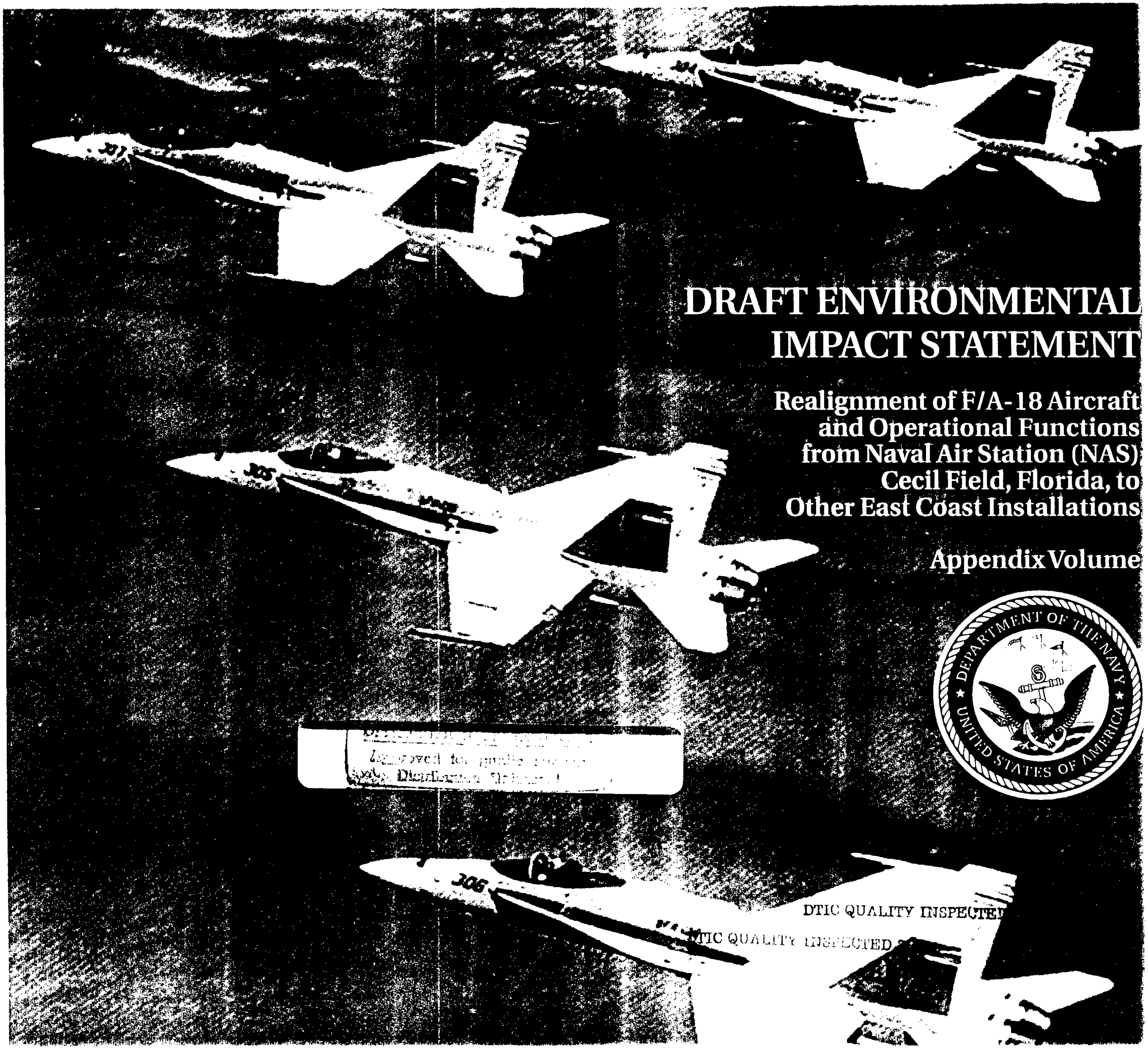
DRAFT ENVIRONMENTAL IMPACT STATEMENT

Realignment of F/A-18 Aircraft and Operational Functions from Naval Air Station (NAS) Cecil Field, Florida, to Other East Coast Installations

Appendix Volume



A Scoping Notices and Public Advertisements/Media Coverage

PAGE A-2 WAS INTENTIONALLY LEFT OUT

PER: PAMELA ANDERSON

(757) 322-4887

NAVAL FACILITIES ENGINEERING COMMAND

ATLANTIC DIVISION

NORFOLK, VA.

that any Tug-N-Turns in use are still capable of turning.

22. J.B.I. shall not contest a United States government subpoena for J.B.I. representatives to testify at a trial related to the Tug-N-Turn in any court in the United States. The government will provide fees and allowances to any subpoenaed witness in accordance with 28 U.S.C. 1821.

23. Upon provisional acceptance of this Settlement Agreement and Order by the Commission, the Commission shall place this Agreement and Order on the public record and publish it in the Federal Register in accordance with the procedures set forth in 16 CFR 1118.20(e)-(h). If the Commission does not to accept the Settlement Agreement and Order within 15 days of such publication, the Agreement and Order shall be deemed finally accepted and the Final Order shall issue on the 16th day.

24. Upon final acceptance of this Settlement Agreement and Order, the Commission shall issue the attached Order.

25. A violation of the Order shall subject the parties to appropriate legal action.

J.B.I. Inc.

Jay Buchbinder,

President, J.B.I., Inc.

The Consumer Product Safety Commission

Eric A. Rubel,

General Counsel.

David Schmeltzer,

Associate Executive Director, Office of Compliance and Enforcement.

Eric L. Stone,

Acting Director, Division of Administrative Litigation, Office of Compliance and Enforcement.

Dated: February 1, 1995.

Ronald G. Yelenik,

Trial Attorney, Division of Administrative Litigation, Office of Compliance and Enforcement.

Dated: February 1, 1995.

Jayme Rizzolo Epstein,

Attorney, Office of General Counsel.

Order

Upon consideration of the Settlement Agreement between the staff and Respondent, and it appearing the Settlement Agreement is in the public interest, it is

Ordered, that the Settlement Agreement be and hereby is accepted, as indicated below; and it is

Further ordered, that Respondent upon final acceptance of the Settlement Agreement, shall pay to the U.S. Treasury a civil penalty in the amount of two hundred twenty five thousand dollars ($225,000), within twenty (20) days after service of this Final Order.

Provisionally accepted and Provisional Order issued on the 8th day of November, 1995.

By Order of the Commission.

Sadye E. Dunn,

Secretary, Consumer Product Safety Commission.

[FR Doc. 95-28347 Filed 11-15-95; 8:45 am]

BILLING CODE 6355-01-M

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Intent To Prepare an Environmental Impact Statement for Construction and Operational Changes Associated With Realignment of F/A-18 Aircraft to Naval Air Station Oceana, Virginia Beach, VA From Naval Air Station, Cecil Field, FL

Pursuant to Section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969, as implemented by the Council on Environmental Quality regulations (40 CFR Parts 1500–1508), the Department of the Navy announces its intent to prepare an Environmental Impact Statement (EIS) to evaluate the potential environmental consequences of the realignment of F/A–18 aircraft and their associated personnel to Naval Air Station (NAS) Oceana, located in Virginia Beach, Virginia. This action is being conducted in accordance with the Defense Base Closure and Realignment Act of 1990 (Pub. L. 101–510), as implemented during 1995.

In accordance with congressional direction implementing the 1995 recommendations of the Defense Base Closure and Realignment Commission (BRAC 95), the Navy will close NAS Cecil Field, Florida, and realign F/A–18 aircraft, personnel, and ancillary activities associated with the existing F/A–18 aircraft, personnel, and ancillary activities associated with the existing F/A–18 missions. F/A–18 assets from NAS Cecil Field will be distributed to support the Navy's operational mission by use of existing infrastructure and capacity, elimination of substantial new construction, and maintenance of operational flexibility for deployment. For BRAC 95, two F/A–18 reserve squadrons are proposed to be sent to NAS Atlanta for integration with Naval Reserve Forces and two operational squadrons are proposed to be sent to MCAS Beaufort to establish joint operations capability with existing Marine Corps F/A–18 assets. These two moves will be addressed in separate NEPA documentation. The remainder of F/A–18 assets (up to ten squadrons) are proposed to be sent to NAS Oceana and is the subject of this EIS. The move to NAS Oceana includes approximately 175 aircraft, 3,600 military personnel, and 200 civilians. In order to accommodate this realignment, approximately 200,000 square feet of new/existing facilities will be constructed or modified. In addition, the realignment will result in a greater level of aircraft operations at NAS Oceana, at Naval Auxiliary Landing Field (NALF) Fentress, located in Chesapeake, Virginia, and within various aircraft training ranges and warning areas in and adjacent to Virginia and eastern North Carolina, including Dare County, BT–9 (Brant Island Shoal), and BT–11 (Piney Island).

The Navy intends to analyze the potential impacts of the realignment on the natural environment, including but not limited to air quality, plant and animal habitats, and water resources, such as streams and wetlands. It will also evaluate potential effects to the built environment, including land use patterns, cultural resources, transportation, housing, community services, and the regional economy. Further, the Navy will be preparing analyses of the projected operations of the incoming F/A–18 aircraft on the existing airspace range structure in Virginia and eastern North Carolina, and on aircraft noise exposure levels in and around NAS Oceana and NALF, Fentress, and training areas in Virginia and North Carolina.

In accordance with the Clean Air Act, as amended in 1990 (42 U.S.C. 7401–7661q), as implemented by the Environmental Protection Agency Regulations on Determining Conformity of General Federal Actions to Federal or State Implementation Plans (40 CFR Parts 6, 53, and 93), the Navy will conduct a conformity review, assessing whether total direct and indirect air emissions associated with the realignment are consistent or in compliance with all relevant requirements and milestones contained in the relevant State Implementation Plan (SIP). All required public comment periods, hearings and notices associated with the conformity review will be conducted concurrently with those associated with the EIS.

The Navy will initiate a scoping process for the purpose of determining the scope of significant issues to be addressed in the EIS related to the proposed action. The Navy will hold five public scoping meetings on the following dates: December 5, 1995 beginning at 7 p.m. at the Carteret County Courthouse, Courthouse Square, U.S. Route 70, Beaufort, North Carolina 28516; December 6, 1995 beginning at 7 p.m. at the Pamlico County Courthouse, NC Highway 55 (near NC Highway 304), Bayboro, North Carolina 28515; December 7, 1995 beginning at 7 p.m. at the North Carolina Aquarium and Marine Resources Center, Main Auditorium, Airport Road (adjacent to the Dare County Airport), Manteo, North Carolina 27954; December 12, 1995 beginning at 7 p.m. at the Seatack Elementary School, Main Auditorium, 411 Birdneck Circle, Virginia Beach, Virginia 23454; and December 13, 1995 beginning at 7 p.m. at the Butts Road Intermediate School Gymnatorium, 1571 Mount Pleasant Road, Chesapeake, Virginia 23322.

Following a presentation on the EIS process and the Navy's proposed action, Navy representatives will be available at these meetings to receive comments from agencies and the public regarding issues of concern. It is important that federal, state, and local agencies and interested persons take this opportunity to identify environmental concerns that should be addressed in the EIS. In order to ensure adequate time for those wishing to make public comments, speakers will be limited to five minutes.

Agencies and the public are also invited and encouraged to provide written comments in addition to, or in lieu of, oral comments at the scoping meeting. To be most helpful, scoping comments should clearly describe the specific issues or topics that the commenter believes the EIS should address. Please mail written comments no later than January 5, 1996 to: Commander, Atlantic Division, Naval Facilities Engineering Command, 1510 Gilbert Street, Norfolk, Virginia 23511, Attn: Code 2032DC (Mr. Dan Cecchini), telephone (804) 322–4891, fax (804) 322–4894.

Dated: November 13, 1995.

M.A. Waters,

LCDR, JAGC, USN, Federal Register Liaison Officer.

[FR Doc. 95–28299 Filed 11–15–95; 8:45 am]

BILLING CODE 3810–77–M

DEPARTMENT OF EDUCATION

National Educational Research Policy and Priorities Board; Meeting

AGENCY: National Educational Research Policy and Priorities Board; Education.

ACTION: Notice of closed meeting by teleconference.

SUMMARY: This notice sets forth the schedule and proposed agenda of a forthcoming meeting of the Executive Committee of the National Educational Research Policy and Priorities Board. Notice of this meeting is required under Section 10(a)(2) of the Federal Advisory Committee Act. This document is intended to notify the general public of the meeting.

DATE: November 21, 1995.

TIMES: 11 a.m. to noon.

LOCATION: Room 604e, 555 New Jersey Ave., NW., Washington, DC.

FOR FURTHER INFORMATION CONTACT: John Christensen, Designated Federal Official, Office of Educational Research and Improvement, 555 New Jersey Ave., NW., Washington, DC 20208–7579. Telephone: (202) 219–2065. Internet: john-christensen@ed.gov.

SUPPLEMENTARY INFORMATION: The National Educational Research Policy and Priorities Board is authorized by Section 921 of the Educational Research, Development, Dissemination, and Improvement Act of 1994. The Board works collaboratively with the Assistant Secretary for the Office of Educational Research and Improvement to forge a national consensus with respect to a long-term agenda for educational research, development, and dissemination, and to provide advice and assistance to the Assistant Secretary in administering the duties of the Office.

The meeting of the Executive Committee is closed to the public under the authority of Section 10(d) of the Federal Advisory Committee Act (Pub. L. 92–463; 5 U.S.C. Appendix 2) and under exemption (6) of Section 552b(c) of the Government in the Sunshine Act (Pub. L 94–409; 5 U.S.C. 552b(c)(6)). The committee will discuss candidates for the position of executive director and touch upon matters that would disclose information of a personal nature where disclosure would constitute a clearly unwarranted invasion of personal privacy if conducted in open session. The meeting will be closed under the authority of Section 10(d) of the Federal Advisory Committee Act (Pub. L. 92–463; 5 U.S.C. Appendix 2) and under exemptions (2) and (6) of Section 552b(c) of the Government in the Sunshine Act Pub. L. 94–409; 5 U.S.C. 552b(c). The Executive Committee will consider matters that relate solely to the internal rules and practices of the Board and personal qualifications and experience of potential candidates for the position of executive director, matters that would disclose information of a personal nature where disclosure would constitute a clearly unwarranted invasion of personal privacy if conducted in open session.

A summary of the activities at the closed session and related matters which are informative to the public consistent with the policy of Title 5 U.S.C. 552b(c) will be available to the public within 14 days of the meeting.

The public is being given less than the required 15 days' notice because of the difficulty in accommodating the schedules of all members of the Executive Committee, which must complete its recommendations prior to the next full Board meeting on November 30.

Records are kept of all Board proceedings, and are available for public inspection at the office of the National Educational Research Policy and Priorities Board, 555 New Jersey Ave., NW., Washington, DC 20208–7564.

Dated: November 9, 1995.

Sharon P. Robinson,

Assistant Secretary.

[FR Doc. 95–28252 Filed 11–15–95; 8:45 am]

BILLING CODE 4000–01–M

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

[FERC Docket No. CP95–35–000 and PRPB Docket No. 94–62–1219–JPM]

EcoEléctrica, L.P., Notice of Availability of the Draft Environmental Impact Statement/Preliminary Environmental Impact Statement for the Proposed EcoEléctrica LNG Import Terminal and Cogeneration Project in Guayanilla, Puerto Rico

November 9, 1995.

The staff of the Federal Energy Regulatory Commission (FERC) and the Puerto Rico Planning Board (PRPB) have prepared this joint draft environmental impact statement/preliminary environmental impact statement (DEIS/PEIS) on the natural gas facilities proposed by EcoEléctrica, L.P. (EcoEléctrica) in the above dockets.

The joint EIS was prepared to satisfy the requirements of the National Environmental Policy Act and Puerto Rico's law requiring an EIS under the Puerto Rico Environmental Quality Board Regulations (Article 4[c] of law No. 9). The FERC and PRPB believe, subject to public comment, that approval of the proposed project, with appropriate mitigation measures including receipt of necessary permits and approvals, would have limited adverse environmental impact. The joint EIS evaluates alternatives to the proposal.

recording participation in spiritual activities.

ROUTINE USES OF RECORDS MAINTAINED IN THE SYSTEM, INCLUDING CATEGORIES OF USERS AND THE PURPOSES OF SUCH USES:

In addition to those disclosures generally permitted under 5 U.S.C. 553a(b) of the Privacy Act, these records and information contained therein may specifically be disclosed outside DoD as a routine use pursuant to 5 U.S.C. 55a(b)(3) as follows:

The 'Blanket Routine Uses' set forth at the beginning DLA's compilation of systems of records notices *do not* apply to this system.

POLICIES AND PRACTICES FOR STORING, RETRIEVING, ACCESSING, RETAINING, AND DISPOSING OF RECORDS IN THE SYSTEM:

STORAGE:

Records are stored in paper and computerized form.

RETRIEVABILITY:

Records are retrieved by name or Social Security Number.

SAFEGUARDS:

Records are stored in locked cabinets or rooms and are controlled by personnel screening and computer software.

RETENTION AND DISPOSAL:

Information is retained in the system until superseded or no longer needed.

SYSTEM MANAGER(S) AND ADDRESS:

Office of the Command Chaplain, Defense Logistics Agency, ATTN: DDAC, 8725 John J. Kingman Road, Suite 2533, Fort Belvoir, VA 22060–6221.

NOTIFICATION PROCEDURES:

Individuals seeking to determine whether this system of records contains information about themselves should address written inquiries to the Privacy Act Officer, HQ DLA-CAAV, 8725 John J. Kingman Road, Suite 2533, Fort Belvoir, VA 22060–6221.

RECORD ACCESS PROCEDURES:

Individuals seeking access to records about themselves contained in this system of records should address written inquiries to the Privacy Act Officer, HQ DLA-CAAV, 8725 John J. Kingman Road, Suite 2533, Fort Belvoir, VA 22060–6221.

CONTESTING RECORD PROCEDURES:

The DLA rules for accessing records, and for contesting contents and appealing initial agency determinations are contained in DLA Regulation 5400.21; 32 CFR part 323; or may be obtained from the system manager.

RECORD SOURCE CATEGORIES:

Information is provided by the record subject or subject's family members.

EXEMPTIONS CLAIMED FOR THE SYSTEM:

None.

[FR Doc. 96–21550 Filed 8–22–96; 8:45 am]
BILLING CODE 5000–04–F

Department of the Navy

Amended Notice of Intent To Prepare an Environmental Impact Statement and Public Scoping Meeting Notice for Realignment of F/A–18 Aircraft and Operational Functions From Naval Air Station, Cecil Field, FL

SUMMARY: Pursuant to Section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969, as implemented by the Council on Environmental Quality regulations (40 CFR Parts 1500–1508), the Department of the Navy announced its intent to prepare an Environmental Impact Statement (EIS) to evaluate the potential environmental consequences of the realignment of F/A–18 aircraft and their associated personnel to Naval Air Station (NAS) Oceana, Virginia Beach, Virginia on November 16, 1995.

In accordance with the 1993 mandates of the Defense Base Closure and Realignment Commission (BRAC 93), the Navy will close NAS Cecil Field, Florida, and realign its F/A–18 and S–3 aircraft, personnel, and other ancillary activities. The 1995 Defense Base Closure and Realignment Commission (BRAC 95) changed the receiving sites for NAS Cecil Field assets to "other naval air stations, primarily NAS Oceana, Virginia; MCAS Beaufort, South Carolina; NAS Jacksonville, Florida; and NAS Atlanta, Georgia; or other Navy or Marine Corps Air Stations with the necessary capacity and support infrastructure." This change was made to support the Navy's operational mission by maximizing the use of existing infrastructure and capacity, eliminating the need for substantial new construction to support the realignment, and maintaining operational flexibility for deployment.

The Navy's November 16, 1995 notice of intent indicated that for BRAC 95, two F/A–18 reserve squadrons are proposed to be transferred to NAS Atlanta for integration with Naval Reserve Forces and would be the subject of separate NEPA documentation. This action has not been revised by this amended notice of intent. The Navy's previous notice of intent also stated that two F/A–18 operational squadrons would be transferred to MCAS Beaufort and be addressed in a separate NEPA environmental assessment. The remainder of the F/A–18 assets (9 operational squadrons and the Fleet Replacement Squadron [FRS]), were to be transferred to NAS Oceana and be the subject of an EIS.

In recognition of non-specific language contained within the mandates of BRAC 95, the Navy has conducted preliminary planning analysis to determine a range of reasonable alternatives for the basing of F/A–18 operational aircraft. This included identifying east coast air stations with necessary capacity, compatible missions and appropriate facilities to support F/A–18 operations.

The Navy's preliminary analysis indicated that the following stations have compatible missions, necessary capacity, and could support F/A–18 aircraft: NAS Oceana, Virginia Beach, VA; MCAS Cherry Point, Havelock, NC; and MCAS Beaufort, SC. Based on this preliminary analysis, the Navy is in the process of developing F/A–18 alternative realignment scenarios for inclusion in the EIS.

No preferred alternative for the realignment has been identified by the Navy. Because several reasonable alternatives may be identified for the realignment of F/A–18 operational aircraft, the Navy now plans to prepare one EIS addressing the transfer of all 11 operational squadrons and the FRS from NAS Cecil Field.

This move includes approximately 200 aircraft, 5000 military personnel, and 200 civilians. In order to accommodate this realignment, depending on the alternative, new/existing facilities will be constructed or modified at NAS Oceana, MCAS Cherry Point, and/or MCAS Beaufort. In addition, this realignment will result in a greater level of aircraft operations at each of the respective stations and their associated training ranges, depending on the alternative selected.

The Navy intends to analyze the potential impacts of each alternative on the natural environment, including but not limited to air quality, plant and animal habitats, and water resources, such as streams and wetlands. It will also evaluate potential effects to the built environment, including land use patterns, cultural resources, transportation, housing, community services, and the regional economy. Further, the Navy will be preparing analyses of the projected operations of the incoming F/A–18 aircraft on the existing airspace range structure in Virginia, North Carolina, and South Carolina and on aircraft noise exposure levels in and around NAS Oceana, MCAS Cherry Point and MCAS

Beaufort, associated outlying landing fields, and training areas.

ADDRESSES: The Navy has initiated a scoping process for the purpose of determining the scope of significant issues to be addressed in the EIS related to the proposed action. The Navy will hold two additional Public Scoping Meetings on the following dates: September 10, 1996, beginning at 7:00 p.m. at Havelock City Hall, Council Chambers, 1 Hatteras Avenue (at Route 70), Havelock, NC; and on September 11, 1996, beginning at 7:00 p.m. at the Technical College of the Low Country, Learning Resource Center, Main Auditorium, Building 12, 921 Ribaut Road, Beaufort, SC.

In order to ensure adequate time for those wishing to make public comments at the meetings, speakers will be limited to five minutes. Agencies and the public are also invited and encouraged to provide written comments on the scope of the EIS. Please mail written comments no later than October 5, 1996 to: Commander, Atlantic Division, Naval Facilities Engineering Command, 1510 Gilbert Street, Norfolk, Virginia 23511, Attn: Code 2032DC (Mr. Dan Cecchini), telephone (757) 322–4891, fax: (757) 322–4859.

D. E. Koenig,

LCDR, JAGC, USN, Federal Register Liaison Officer.

[FR Doc. 96–21551 Filed 8–22–96; 8:45 am]

BILLING CODE 3810–FF–P

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

[Recommendation 96–1]

In-Tank Precipitation System at the Savannah River Site

AGENCY: Defense Nuclear Facilities Safety Board.

ACTION: Notice; recommendation.

SUMMARY: The Defense Nuclear Facilities Safety Board has made a recommendation to the Secretary of Energy pursuant to 42 U.S.C. 2286a concerning the In-Tank Precipitation System at the Savannah River Site. The Board requests public comments on this recommendation.

DATES: Comments, data, views, or arguments concerning this recommendation are due on September 23, 1996.

ADDRESSES: Send comments, data, views, or arguments concerning this recommendation to: Defense Nuclear Facilities Safety Board, 625 Indiana Avenue, NW, Suite 700, Washington, DC 20004–2901.

FOR FURTHER INFORMATION CONTACT: Kenneth M. Pusateri or Andrew L. Thibadeau at the address above or telephone (202) 208–6400.

Dated: August 19, 1996.

John T. Conway,

Chairman.

August 14, 1996.

The Defense Nuclear Facilities Safety Board (Board) has devoted substantial attention to the planned use of the In-Tank Precipitation (ITP) System at the Savannah River Site, because of its importance to removal of high-level radioactive waste from storage tanks at that Site, and because certain unique hazards are associated with the ITP process.

The hazards are a consequence of the volatile and flammable organic compound benzene that is released during the process in amounts that must not exceed safe limits. The benzene is generated through decomposition of tetraphenylborate (TPB) compounds. These compounds are added in the process with the objective to precipitate and remove radioactive cesium from solution in the waste water destined for the saltstone process. The concentrated slurry containing the precipitated cesium constitutes a much smaller volume than the original waste, and its feed to the vitrification process leads to production of a correspondingly smaller amount of glass ultimately to be disposed of in a repository.

The proposed treatment process calls for addition of a quantity of TPB in excess of that theoretically required to precipitate the cesium as cesium TPB. That excess is required partly because the significant amount of potassium present is also precipitated as potassium TPB, and partly because an excess of TPB in solution ensures more effective scrubbing of the radioactive cesium through precipitation. However, the benefit of effective scrubbing is accompanied by the generation of the benzene, which presents hazards of a different sort, and which also requires safety controls.

Westinghouse Savannah River Company is the Department of Energy contractor in charge of ITP. The Westinghouse staff at the Savannah River Site believed until recently that the principal cause of decomposition of TPB and generation of benzene is exposure of the TPB to the high level of radiation in the waste. That belief was based on results of full-scale tests conducted in 1983 that may have been misinterpreted, and on a decade of subsequent bench-scale tests using non-radioactive stimulants (almost exclusively) rather than actual waste. The first large-scale operations with actual waste since 1983 were conducted recently in Tank 48, and they showed that the generation and release of benzene did not follow predictions. The generation of benzene in the waste under treatment in Tank 48 was unexpectedly rapid. A surprisingly large amount of the benzene remained captured in the waste, and that benzene was released through action of mixing pumps in the tank.

The current view of the contractor staff is that benzene is produced principally through catalytic decomposition of TPB ions in solution. They believe the catalysts are potentially both soluble and insoluble species, one of which is soluble copper known to be present in the waste. They also believe that the cesium TPB precipitate and the potassium TPB precipitate are relatively immune to catalytic decomposition. The contractor proposes to conduct two Process Verification Tests (PVT), PVT–1 and PVT–2, to further establish the validity of these views and to demonstrate the accuracy of the model it has developed to predict the rate at which the captured benzene is released from solution. PVT–1 would be performed on the homogenized nuclear waste not in Tank 48, which has already been treated with TPB that subsequently has partly decomposed with the result that some cesium has returned to solution. Additional TPB would be added to this material to reprecipitate that cesium. The amount of TPB to be added would be strictly limited to a small amount as needed to reduce the concentration of cesium remaining in solution to a low radiation level acceptable for processing as low level waste in the saltstone process, and a large part of that solution would be sent to saltstone. The subsequent proposed experiment, PVT–2, will involve adding to the slurry remaining in Tank 48 a large amount of additional untreated waste and a substantial quantity of TPB as needed to precipitate the cesium in this new waste.

The Board has been informed that the primary safety precaution for the proposed cesium removal activities is to maintain an inert atmosphere in the headspace of Tank 48. This is to be done through establishing a sufficient flow of nitrogen to the tank. Two nitrogen feed systems are available, a normal system and a supplemental emergency system. The nitrogen systems are present to keep the concentration of oxygen below the level that would support combustion of the benzene. Westinghouse staff members have

ARTERET COUNTY,
ORTH CAROLINA.

AFFIDAVIT OF PUBLICATION

Before the undersigned, a Notary Public of said County and State, duly commissioned, qualified, and authorized by law to administer oaths,

personally appeared ....

Patti J. Lyerly who being

first duly sworn, deposes and says: that he (she) is Clerk

....

(Owner, partner, publisher, or other officer or employee authorized to make this affidavit)

of THE CARTERET PUBLISHING CO., INC., engaged in the publication of a newspaper known as CARTERET COUNTY NEWS-TIMES, published, issued, and entered as second class mail in the Town of Morehead City, in said County and State; that he (she) is authorized to make this affidavit and sworn statement; that the notice or other legal advertisement, a true copy of which is attached hereto, was published in CARTERET COUNTY

NEWS-TIMES on the following dates:

September 1, 4, 6, 1996

and that the said newspaper in which such notice, paper, document, or legal advertisement was published was, at the time of each and every such publication, a newspaper meeting all of the requirements and qualifications of Section 1-597 of the General Statutes of North Carolina and was a qualified newspaper within the meaning of Section 1-597 of the General Statutes of North Carolina.

This 9th day of September, 1996

Patti J. Lyerly
(Signature of person making affidavit)

Sworn to and subscribed before me, this ninth

day of September, 1996

Rosa E. Harner
Notary Public.

My Commission expires: July 16, 2001

PUBLIC NOTICE

U.S. DEPARTMENT OF THE NAVY PUBLIC SCOPING MEETINGS ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR TRANSFER OF F/A-18 AIRCRAFT FROM NAVAL AIR STATION (NAS) CECIL FIELD, FLORIDA TO OTHER EAST COAST INSTALLATIONS

The Navy will conduct two public scoping meetings to identify significant issues to be included in an EIS evaluating the environmental effects of the transfer of approximately 200 F/A-18 operational aircraft and 5,200 associated personnel form NAS Cecil Field to other installations, including Marine Corps Air Station (MCAS) Cherry Point, North Carolina, MCAS Beaufort, South Carolina and NAS Oceana, Virginia. This action is being conducted pursuant to the 1995 recommendations of the Defense Base Closure and Realignment Commission. The Navy is formulating alternative realignment scenarios that would involve transferring F/A-18 aircraft to one or more of these installations. Depending on the alternative, this transfer will require the construction/modification of new/existing facilities and will affect the level of aircraft activity at each installation and within various aircraft training ranges in Virginia, North Carolina, South Carolina and Georgia. The scoping meetings will be held on: September 10, 1996, beginning at 7:00 p.m. at Havelock City Hall, Council Chambers, 1 Hatteras Avenue (at Route 70), Havelock, N.C., and on September 11, 1996, beginning at 7:00 p.m. at the Technical College of the Low Country, Main Auditorium, Building 12, 921 Ribaut Road, Beaufort, S.C.

In order to ensure adequate time for those wishing to make public comments at the meetings, speakers will be limited to five minutes. Agencies and the public are also invited and encouraged to provide written comments on the scope of the EIS. Please mail written comments no later than October 5, 1996 to: Commander, Atlantic Division, Naval Facilities Engineering Command, 1510 Gilbert Street, Norfolk, Virginia 23511, Attn: Code 2032DC (Mr. Dan Cecchini), fax: (757)322-4894, internet address; cecchijd@efdlant.navfac.navy.mil

Public notice appearing in the *New Bern Sun Journal* on September 1, 1996; September 2, 1996; and September 3, 1996.

PUBLIC NOTICE
US DEPARTMENT OF THE NAVY
PUBLIC SCOPING MEETINGS
ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR TRANSFER OF F/A-18 AIRCRAFT FROM NAVAL AIR STATION (NAS) CECIL FIELD, FLORIDA TO OTHER EAST COAST INSTALLATIONS

The Navy will conduct two public scoping meetings to identify significant issues to be included in an EIS evaluating the environmental effects of the transfer of approximately 200 F/A - 18 operational aircraft and 5200 associated personnel from NAS Cecil Field to other installations, including Marine Corps Air Station (MCAS) Cherry Point, North Carolina, MCAS Beaufort, South Carolina and NAS Oceana, Virginia. This action is being conducted pursuant to the 1995 recommendations of the Defense Base Closure and Realignment Commission. The Navy is formulating alternative realignment scenarios that would involve transferring F/A - 18 aircraft to one or more of these installations. Depending on the alternative, this transfer will require the construction/modification of new/existing facilities and will affect the level of aircraft activity at each installation and within various aircraft training ranges in Virginia, North Carolina, South Carolina, and Georgia. The scoping meetings will be held on: September 10, 1996, beginning at 7:00 p.m. at Havelock City Hall, Council Chambers, 1 Hatteras Avenue (at Route 70), Havelock, NC and on September 11, 1996 beginning at 7:00 p.m. at the Technical College of the Low Country, Main Auditorium, Building 12, 921 Ribaut Road, Beaufort, SC.

In order to ensure adequate time for those wishing to make public comments at the meetings, speakers will be limited to five minutes. Agencies and the public are also invited and encouraged to provide written comments on the scope of the EIS. Please mail written comments no later than October 5, 1996 to: Commander, Atlantic Division, Naval Facilities Engineering Command, 1510 Gilbert Street, Norfolk, Virginia 23511, Attn: Code 2032 DC (Mr. Dan Cecchini), fax: (757)322-4894, internet address:cecchijd@efdlant.navfac.navy.mil

The Beaufort Gazette

State of South Carolina
COUNTY OF BEAUFORT

Personally appeared before me

Pam V. Jenkins

of The Beaufort Gazette, a newspaper published in the City of Beaufort, County and State aforesaid, who, being duly sworn, says that the advertisement of

US Department of the Navy/Public Scoping Meetings/Environment Impact Statement(EIS) for Transfer of F/A 18 Aircraft from Naval Air Station(NAS) Cecil Field, Florida to other East Coast Installations.

appeared in the issues of said newspaper on the following

day(s): September 1, 2, & 3, 1996

Subscribed and sworn to

before me this 3rd day

of September

A. D. 19 96

Pam V. Jenkins

NOTARY PUBLIC

My commission expires 11-18-96

PUBLIC NOTICE
US DEPARTMENT OF THE NAVY
PUBLIC SCOPING MEETINGS
ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR TRANSFER OF F/A-18 AIRCRAFT FROM NAVAL AIR STATION (NAS) CECIL FIELD, FLORIDA TO OTHER EAST COAST INSTALLATIONS

The Navy will conduct two pubic scoping meetings to identify significant issues to be included in an EIS evaluating the environmental effects of the transfer of approximately 200 F/A-18 operational aircraft and 5200 associated personnel from NAS Cecil Field to other installations, including Marine Corps Air Station (CMAS) Cherry Point, North Carolina, MCAS Beaufort, South Carolina and NAS Oceana, Virginia. This action is being conducted pursuant to the 1995 recommendations of the Defense Base Closure and Realignment Commission. The Navy is formulating alternative realignment scenarios that would involve transferring F/A-18 aircraft to one or more of these installations. Depending on the alternative, this transfer will require the construction/modification of new/existing facilities and will affect the level of aircraft activity at each installation and within various aircraft training ranges in Virginia, North Carolina, South Carolina, and Georgia. The scoping meetings will be held on: September 10, 1996, beginning at 7:00 p.m. at Havelock City Hall, Council Chambers, 1 Hatteras Avenue (at Route 70), Havelock, NC, and on September 11, 1996, beginning at 7:00 p.m. at the Technical College of the Low Country, Main Auditorium, Building 12, 921 Ribaut Road, Beaufort, SC. In order to ensure adequate time for those wishing to make public comments at the meetings, speakers will be limited to five minutes. Agencies and the public are also invited and encouraged to provide written comments on the scope of the EIS. Please mail written comments no later than October 5, 1996 to: Commander, Atlantic Division, Naval Facilities Engineering Command, 1510 Gilbert Street, Norfolk, Virginia 23511, Attn: Code 2032DC (Mr. Dan Cecchini), fax: (757)322-4894, internet address:cecchijd@efdlant.navfac.navy.mil

State of Virginia
City of Norfolk   to-wit:

AFFIDAVIT

This day Diane Curry personally appeared before me and after being duly sworn made oath that:
(1) (He) (She) is affidavit clerk of The Virginian-Pilot a newspaper published by Landmark Communications Inc., in the cities of Norfolk, Portsmouth, Chesapeake, Suffolk, and Virginia Beach, State of Virginia;
(2) That the advertisement hereto annexed at NAVY has been published in said newspaper during the following dates: 11/26/95 - 11/28/95

Diane Curry
Affiant

Subscribed and sworn to before me in my city and state aforesaid this 4TH day of DECEMBER 1995

My commission expires DECEMBER 31, 1995

Louise J. Obenshain
Notary Publi

PUBLIC NOTICE
US DEPARTMENT OF THE NAVY
PUBLIC SCOPING MEETINGS
ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR TRANSFER OF F/A-18 AIRCRAFT TO NAVAL AIR STATION (NAS) OCEANA, VIRGINIA BEACH, VIRGINIA

The Navy will conduct five public scoping meetings to identify significant issues to be included in an EIS evaluating the environmental effects of the transfer of 175 F/A-18 aircraft and 3800 associated personnel to NAS Oceana, pursuant to the 1995 recommendations of the Defense Base Closure and Realignment Commission. This transfer will require approximately 200,000 square feet new construction and modification of existing facilities and will affect the level of aircraft activity at NAS Oceana, Naval Auxiliary Landing Field (NALF) Fentress, in Chesapeake, VA and within various aircraft ranges in and adjacent to Virginia and eastern North Carolina. The scoping meetings will be held on: December 5, 1995, 7:00 P.M., at the Carteret County Courthouse, Courthouse Square, US Route 70, Beaufort, NC; December 6, 1995, 7:00 P.M. at the Pamlico County Courthouse, NC Highway 55 (near NC Highway 304), Bayboro, NC; December 7, 1995, 7:00 P.M. at the North Carolina Aquarium and Marine Resources Center, Main Auditorium, Airport Road (adjacent to the Dare County Airport), Manteo, NC; December 12, 1995, 7:00 P.M. at the Seatack Elementary School Main Auditorium, 411 Birdneck Road, Virginia Beach, VA; and December 13, 1995, 7:00 P.M. at the Butts Road Intermediate School Gymnatorium, 1571 Mount Pleasant Road, Chesapeake, VA.

In order to ensure adequate time for those wishing to make public comments at the meetings, speakers will be limited to five minutes. Agencies and the public are also invited and encouraged to provide written comments on the scope of the EIS. Please mail written comments no later than January 5, 1996 to: Commander, Atlantic Division, Naval Facilities Engineering Command, 1510 Gilbert Street, Norfolk, Virginia 23511, Attn: Code 2032DC (Mr. Dan Cecchini), telephone: (804) 322-4891, fax: (804) 322-4894.

PUBLIC NOTICE
US DEPARTMENT OF THE NAVY
PUBLIC SCOPING MEETINGS
ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR TRANSFER OF F/A-18 AIRCRAFT TO NAVAL AIR STATION (NAS) OCEANA, VIRGINIA BEACH, VIRGINIA

The Navy will conduct five public scoping meetings to identify significant issues to be included in an EIS evaluating the environmental effects of the transfer of approximately 175 F/A-18 aircraft and 3800 associated personnel to NAS Oceana, pursuant to the 1995 recommendations of the Defense Base Closure and Realignment Commission. This transfer will require approximately 200,000 square feet of new construction and modification of existing facilities, and will affect the level of aircraft activity at NAS Oceana, Naval Auxiliary Landing Field (NALF) Fentress, in Chesapeake, VA and within various aircraft training ranges in and adjacent to Virginia and eastern North Carolina. The scoping meetings will be held on: December 5, 7:00 P.M., at the Carteret County Courthouse, Courthouse Square, US Route 70, Beaufort, NC; December 6, 1995, 7:00 P.M. at the Pamlico County Courthouse, NC Highway 55 (near NC Highway 304), Bayboro, NC; December 7, 1995, 7:00 P.M. at the North Carolina Aquarium and Marine Resources Center, Main Auditorium, Airport Road (adjacent to the Dare County Airport), Manteo, NC; December 12, 1995, 7:00 P.M. at the Seatack Elementary School Main Auditorium, 411 Birdneck Road, Virginia Beach, VA; and December 13, 1995, 7:00 P.M. at the Butts Road Intermediate School Gymatorium, 1571 Mount Pleasant Road, Chesapeake, VA.

In order to ensure adequate time for those wishing to make public comments at the meetings, speakers will be limited to five minutes. Agencies and the public are also invited and encouraged to provide written comments on the scope of the EIS. Please mail written comments no later than January 5, 1996 to: Commander, Atlantic Division, Naval Facilities Engineering Command, 1510 Gilbert Street, Norfolk, Virginia 23511, Attn: Code 2032DC (Mr. Dan Cechini), telephone: (804) 322-4891, fax: (804) 322-4894.

Affidavit of Publication
SUN-JOURNAL
New Bern, N.C.

Personally appeared before me, a Notary Public of the County of Craven, State of North Carolina,

on this the 5th day of December 1995

[signature]

of the Sun Journal, who, being duly sworn, states that the notice entitled

PUBLIC NOTICE

a true copy of which is attached hereto, appeared in the Sun Journal, a newspaper published in the City of New Bern, County of Craven, State of North Carolina,

THREE TIMES a week for

ONE weeks, on the following dates:

NOVEMBER 26, 1995

NOVEMBER 27, 1995

NOVEMBER 28, 1995

19

19

19

19

19

The New Bern Sun Journal

Subscribed and sworn to this 5th

day of December 1995

[signature]

Notary Public

MY COMMISSION EXPIRES FEB. 20, 1999

Public notice appearing in the *Carteret County News-Times* on November 26, 1995; November 29, 1995; and December 1, 1995.

PUBLIC NOTICE
US DEPARTMENT OF THE NAVY
PUBLIC SCOPING MEETINGS
ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR TRANSFER OF F/A-18 AIRCRAFT TO NAVAL AIR STATION (NAS) OCEANA, VIRGINIA BEACH, VIRGINIA

The Navy will conduct five public scoping meetings to identify significant issues to be included in an EIS evaluating the environmental effects of the transfer of approximately 175 F/A-18 aircraft and 3800 associated personnel to NAS Oceana, pursuant to the 1995 recommendations of the Defense Base Closure and Realignment Commission. This transfer will require approximately 200,000 square feet of new construction and modification of existing facilities, and will affect the level of aircraft activity at NAS Oceana, Naval Auxiliary Landing Field (NALF) Fentress, in Chesapeake, VA, and within various aircraft training ranges in and adjacent to Virginia and eastern North Carolina. The scoping meetings will be held on: **December 5, 7:00 P.M., at the Carteret County Courthouse, Courthouse Square, US Route 70, Beaufort, NC; December 6, 1995 7:00 P.M. at the Pamlico County Courthouse, NC Highway 55 (near NC Highway 304), Bayboro, NC; December 7, 1995, 7:00 P.M/ at the North Carolina Aquarium and Marine Resources Center, Main Auditorium, Airport Road (adjacent to the Dare County Airport), Manteo, NC; December 12, 1995, 7:00 P.M. at the Seatack Elementary School Main Auditorium, 411 Birdneck Road, Virginia Beach, VA; and December 13, 1995 , 7:00 P.M./ at the Butts Road Intermediate School Gymatorium, 1571 Mount Pleasant Road, Chesapeake, VA.**

In order to ensure adequate time for those wishing to make public comments at the meetings, speakers will be limited to five minutes. Agencies and the public are also invited and encouraged to provide written comments on the scope of the EIS. Please mail written comments no later than January 5, 1996 to: Commander, Atlantic Division, Naval Facilities Engineering Command, 1510 Gilbert Street, Norfolk,, Virginia 23511, Attn: Code 2032DC (Mr. Dan Cecchini), telephone: (804)322-4891, fax: (804) 322-4894.

SUN JOURNAL

REGION

Briefs

From staff reports

Navy's scoping meeting on Hornets slated tonight

■ Havelock

The Navy will hold a public scoping meeting today in Havelock to discuss the environmental impact of transferring 200 F/A Hornets to bases along the East Coast.

The meeting is scheduled for 7 p.m. today in Havelock City Hall.

The Navy had intended to study the environmental impact of moving nine squadrons of Hornets from Cecil Field Naval Air Station, Fla., to Oceana Naval Air Station in Virginia Beach, Va., following base realignments in 1995.

However, the 1995 decision has been amended and a study on the transfer of 200 aircraft, 5,000 military personnel and 200 civilians will include Cherry Point Marine Corps Air Station, according to the Naval Facilities Engineering Command.

In 1993, a Base Closure and Realignment Commission (BRAC) decided to close Cecil Field and transfer the jets to Cherry Point.

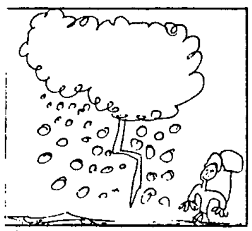
This decision was changed by the 1995 BRAC hearings, which chose to send the aircraft to other stations, "primarily" Oceana, Beaufort (S.C.) Marine Corps Air Station, Jacksonville Naval Air Station, Fla., Atlanta Naval Air Station, "or other Navy or Marine Corps Air Stations with the necessary capacity and support infrastructure."

Cherry Point, Oceana and Beaufort will be included in the new environmental impact statement, which is slated for completion in August 1997.

THE HAVELOCK TIMES

VOL. 2 • NO. 25 HAVELOCK, NC TEL. 444-8210 SEPTEMBER 4, 1996 25 CENTS

WEEKEND WEATHER



Please watch TV hurricane weather advisories on Fran

Weekend— Chance of storms and thundershowers

Highs: 80 to 85
Lows: near 70
Source: National Weather Service, Newport

Our weather picture was drawn by **Tony Lopes**, a student in Ms. Cullom and Mrs. Cameron's first grade class at Arthur W. Edwards Elementary School.

WEEK AHEAD

THURSDAY

- **9 a.m. — Ribbon cutting,** Clip N Dip, #8 East Plaza
- **Noon** — Rotary Club meeting, Shoney's
- **6 - 7 p.m. — Low impact**

Navy schedules meeting on Hornet impact

Sept. 10 meeting could be 'déja vu all over again'

By Zack Hamlett
TIMES STAFF WRITER

The 1993 round of Department of Defense base closings and realignments started local officials on a planning roller coaster ride that will apparently continue well into 1997.

An Aug. 23 announcement that the Navy will conduct a Sept. 10 public meeting in Havelock on the environmental impact of pursuing one of several "alternative realignment scenarios" — one of which includes Marine Corps Air Station Cherry Point — only adds to local speculation that some of the F/A-18 Hornets originally destined for Cherry Point may end up here after all.

The worst fears in 1993 were that Cherry Point might actually be on the list for closure. The installation not only survived the cut, but was selected as the receiving site for approximately 200 Navy Hornets — accompanied by support personnel and dependents — when a decision was made to close Naval Air Station Cecil Field in Florida.

Business and government leaders began planning for what would clearly be a mixed blessing for Havelock and eastern North Carolina. The new military mission would bring with it an influx of thousands of people; presenting environmental, housing and educational challenges along with clear economic benefits.

Then, early in 1995, Secretary of

(see HORNETS, page 2)

Hornets

(From page 1)

Defense William Perry surprised local leaders by announcing his opposition to basing the Hornets at Cherry Point. Naval Air Station Oceana in Virginia Beach, Va. was now seen as the preferred location. An opinion that many feel was rubber-stamped by the 1995 Base Closure and Realignment Commission, which came to the same conclusion. All the planning seemed to have been in vain.

However rumors persisted that, somehow, an unspecified number of Hornets would still end up at Cherry Point.

Local officials say privately that they have been advised not to scrap any plans made for receiving at least some of the aircraft.

Dave Jones, military liaison to Gov. Jim Hunt, said Friday that Cherry Point could easily accommodate three squadrons. That could translate into an influx of well over 1,000 people.

He noted that no specific numbers of aircraft are being talked about by the Navy and that a decision could be more than a year down the road.

"If the Navy is planning to bring aircraft to Cherry Point, we need to know it so we can plan," Jones said. "... you don't just arrive."

In fact, Navy Commander Morgan Smith of the U.S. Atlantic Fleet Public Affairs Office in Norfolk, Va. said yesterday, no final decision has been made as to where the 11 operational squadrons and one replacement squadron will finally be based.

"Nor can one be made until all the data is gathered," Smith said.

However the latest notice of intent is an amended version of a November notice which made no mention of any alternatives involving Cherry Point.

That difference suggests to some that the potential exists for a determination that could once again make Cherry Point a site.

Third District State Representative John Nichols, R-Craven, said yesterday that the door seems to be open.

"The door may open wider, but it's too soon to tell what that means for Cherry Point," Nichols said.

Nichols was part of a state delegation that testified in support of the 1993 BRAC decision during the 1995 process. That delegation, led by Gov. Hunt, argued that comparisons between Oceana and Cherry Point were unfairly — and politically — drawn.

They also pointed out problems with the choice of Oceana that included air and water quality standards, congestion and noise standards in the Virginia Beach area.

"I think the Navy has had to admit that those problems are there," Nichols said. "It may not totally be a done deal."

Jack Dorsey, a senior military reporter for the Virginia-Pilot newspaper said yesterday that people in Virginia Beach see it differently.

"That decision was made last summer, it's an accepted fact that they're coming," Dorsey said. He added that he's seen the amended notices, but his take on the process is that nothing has materially changed.

"It looks like they're just going through the motions," Dorsey said.

Whether or not that is the case, the Navy says it wants public input on a study evaluating the environmental impact of moving the Hornets.

"This move includes approximately 200 aircraft, 5,000 military personnel, and 200 civilians," the Aug. 23 notice of intent says. "In order to accommodate this realignment, depending on the alternative, new/existing facilities will be constructed or modified at NAS Oceana, MCAS Cherry Point, and/or MCAS Beaufort."

The notice goes on to say that the Navy will study the impact of each alternative on such environmental concerns as air quality, plant and animal habitats, water resources and aircraft noise exposure levels. The Navy statement adds that further analysis will be done on the potential impact of realignment on land use patterns, housing, community services and the regional economy.

"Sounds like déja vu all over again," one area official observed.

The public meeting will be held at Havelock City Hall on Tuesday, Sept. 10 at 7 p.m.

Bratton. "Each one calls for different responses in some areas."

The other types of disasters he has plans for are aircraft crashes, winter ... more training with the Marine Corp Air Station Cherry Point rescue personnel to ensure their capability o handling this type of emergency as joint team.

PUBLIC NOTICE

U.S. DEPARTMENT OF THE NAVY PUBLIC SCOPING MEETINGS ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR TRANSFER OF F/A-18 AIRCRAFT FROM NAVAL AIR STATION (NAS) CECIL FIELD, FLORIDA TO OTHER EAST COAST INSTALLATIONS

The Navy will conduct two public scoping meetings to identify significant issues to be included in an EIS evaluating the environmental effects of the transfer of approximately 200 F/A-18 operational aircraft and 5,200 associated personnel from NAS Cecil Field to other installations, including Marine Corps Air Station (MCAS) Cherry Point, N. C., MCAS Beaufort, S. C. and NAS Oceana, Va. This action is being conducted pursuant to the 1995 recommendations of the Defense Base Closure and Realignment Commission. The Navy is formulating alternative realignment scenarios that would involve transferring F/A-18 aircraft to one or more of these installations. Depending on the alternative, this transfer will require the construction/modification of new/existing facilities and will affect the level of aircraft activity at each installation and within various aircraft training ranges in Virginia, North Carolina, South Carolina and Georgia. The scoping meetings will be held on: Sept. 10, 1996, beginning at 7:00 p.m at Havelock City Hall, Council Chambers, 1 Hatteras Avenue (at Route 70), Havelock, N.C., and on Sept. 11, 1996, beginning at 7:00 p.m. at the Technical College of the Low Country, Main Auditorium, Building 12, 921 Ribaut Road, Beaufort, S.C.

In order to ensure adequate time for those wishing to make public comments at the meetings, speakers will be limited to five minutes. Agencies and the public are also invited and encouraged to provide written comments on the scope of the EIS. Please mail written comments no later than Oct. 5, 1996 to: Commander, Atlantic Division, Naval Facilities Engineering Command, 1510 Gilbert St., Norfolk, Va. 23511, Attn: Code 2032DC (Mr. Dan Cecchini), fax: (757) 322-4894, internet address: cecchijd@efdlant.navfac.navy.mil

The Havelock News
230 Stonebridge Square, Havelock, N.C. 28532 Phone: 1-919-444-1999 Fax: 1-919-447-0897

Vol. 11, No. 48 Havelock's Newspaper of Record for a Decade Wednesday, Sept. 4, 1996 50c

F-18's coming to Havelock?

Navy study looking at Cherry Point again

William Saunders
Havelock News

The possibility of 200 F/A-18 Hornets and their support personnel coming to Havelock has been raised once again, this time by the U.S. Department of the Navy. The Navy has scheduled a public scoping meeting at Havelock City Hall on September 10 at 7 p.m. to discuss issues concerning the transfer of the Hornets to MCAS Cherry Point.

The base had been looked at during BRAC '95 (Base Realignment and Closure Committee) as a possible site for the nine squadrons of fighter jets and the 5,200 personnel needed to support the aircraft. The committee later decided to send the planes elsewhere, but now have discovered the base they chose to receive the planes, Naval Air Station Oceana in Virginia, may not be able to handle the planes on an environmental level.

"The reality is exactly what the North Carolina delegation, led by

See F-18's, page 3

F-18's

Continued from page 1

the Governor, told BRAC," said Troy Smith, whose law firm was hired by the state to help them prepare their argument to BRAC for putting the planes in Cherry Point. With word that the Navy is looking at Cherry Point again, Smith was guardedly optimistic. "We're a long way from getting there, but it's consistent with what we told them."

The intent of the meeting, as stated by the Navy, is to identify significant issues that will be included in an environmental impact statement evaluating the effects caused by the transfer of the 200 Hornets and the needed support personnel.

However, Cherry Point does not stand alone in this study. A second scoping meeting will be conducted on September 11 in Beaufort, SC to look at the impact transferring some or all of the planes to MCAS Beaufort. NAS Oceana remains in the study pursuant to recommendations of BRAC.

"The Navy is formulating alternative realignment scenarios that would involve transferring F/A-18 aircraft to one or more of the installations," states a notice from the Navy. "

Depending on the alternative, this transfer will require the construction/modification of new/existing facilities and will affect the area of aircraft activity at each installation and within various aircraft training ranges in Virginia, North Carolina, South Carolina and Georgia."

In order to ensure adequate time for those wishing to make public comments at the meeting, speakers will be limited to five minutes. Agencies and the public are also invited and encouraged to provide written comments on the scope of the environmental impact statements.

Please mail written comments no later than October 5 to:

Commander, Atlantic Division, Naval Facilities Engineering Command, 1510 Gilbert Street, Norfolk, VA 23511, Attn: 2032 DC (Mr. Dan Cecchini), or fax (757) 322-4894, or the internet address: cecchijd@efdlant.navfac.navy.mil.

Questioning the questions

Havelock Survey on growth raises temperature at meeting.

SUN JOURNAL

New Bern, North Carolina — Tuesday, July 23, 1996

■ Marine jets

Getting jets depends on Oceana EIS

By Steve Jones
Senior Writer

North Carolina's renewed efforts to land at least some U.S. Navy F/A-18 Hornets at Cherry Point Marine Corps Air Station could crash and burn if an environmental impact statement (EIS) goes Virginia's way.

"If the state of Virginia can show mitigation within the state that keeps them in compliance," said retired Marine colonel Dave Jones, Gov. Jim Hunt's military liaison, "then the whole thing becomes moot."

But efforts recently begun by Hunt and by U.S. Sen. Lauch Faircloth, R-N.C., are based on the belief that the air around Oceana (Va.) Naval Air Station already has too much ozone.

The presence of so many diesel-burning aircraft would only make that situation worse, they infer.

Faircloth, according to defense issues aide Geddings Roche, wrote a letter to the Navy and the Environmental Protection Agency June 13 requesting information on the environmental impact of sending 150 Hornets to the Norfolk metropolitan area.

They were told the information would be contained in the EIS, which Jones said could be finished in August or September.

If the EIS finds the Tidewater's air quality is too bad to handle the additional aircraft, the Tar Heel state plans to suggest that some of the squadrons be sent to Cherry Point instead.

The Hornet squadrons were slated by the 1993 Base Closure and Realignment Commission (BRAC) to be based at Cherry Point. But that order was reversed by BRAC '95.

"(Faircloth) thinks that (Cherry Point) could certainly accommodate additional squadrons," said Roche.

"We don't have any compliance problems," added Jones, "so that gives us a leg up."

Jones, who called Faircloth North Carolina's "ace in the hole" in the current effort, said Cherry Point could easily house three to five squadrons and associated personnel without any major construction.

Jones said he thinks each Navy squadron has 12 aircraft and between 160 and 180 people assigned to it. From a personnel housing standpoint, he noted that Cherry Point has relatively new barracks for 13,000 personnel and only 8,500 stationed there now.

He said that if the EIS were to mandate the relocation of some aircraft ordered to Oceana by the 1995

See JETS/A2

Jets

Base Closure and Realignment Commission (BRAC), it could set a precedent.

"I don't know that it's ever come out this way," he said.

One factor not in Cherry Point's favor: the base does not have the maintenance personnel the Hornets would need, he said.

"How this will play out," he said, "I don't know."

State and federal officials are awaiting the release of the EIS before deciding their next moves.

Jones said the Navy is particularly interested in having the bulk of the aircraft go to Oceana, as that air station is currently operating at well below capacity. Such a situation, he explained, could work against the base in a future round of closings.

MetroNews

Preservationists work to save Alexander House in Columbia, N.C. /B3

THE VIRGINIAN-PILOT

FRIDAY, NOVEMBER 24, 1995

Navy to study Hornets' impact

GUY FRIDDELL

At a Friddell Thanksgiving, two turkeys get a basting

Everybody says Thanksgiving is such an easygoing holiday, lots to eat and no pressure.

So I invited the three families, including eight [illegible] to come eat. Leave it all to me, I said. And bought a country ham (cooked); and a turkey dinner (cooked) and a beef tenderloin roast (no sale).

And got caught up in a fascinating conversation on the phone, which left me with an hour to pull the meal together

After the '33 storm, many Hog Island residents put their homes on barges and moved to the mainland. Now they are coming together to let the region's unique history live on.

Before Oceana gets 175 new jets, Navy will ask public about move.

BY JACK DORSEY
STAFF WRITER

VIRGINIA BEACH — The Navy, preparing to bring up to 175 new F/A-18 Hornet jets to Oceana, is asking the public from coastal North Carolina to southeast Virginia to say what environmental issues it should study in relation to the move.

Before the Hornets can come to Oceana, the Navy must complete a full Environmental Impact Statement in the next year that details the planes' impact on air quality, plant and animal habitats and water resources.

The new aircraft are scheduled to come to Oceana as a result of

IMPACT STUDY

WHAT: Five public hearings on F/A-18 Hornets' impact on the local environment. Speakers are asked to limit comments to 5 minutes.

WHERE:

- Dec. 5, 7 p.m. Carteret County Courthouse in Beaufort, N.C.
- Dec. 6, 7 p.m. Pamlico County Courthouse in Bayboro, N.C.
- Dec. 7, 7 p.m. North Car-

the brothers, taught by his grandfather to carve, bows the knife as if playing a Strad and waits onto the platter a rosette of slices you could enter in an art show.

To warm the turkey, I bent the flexible roasting pan close around it and jammed it and the roast into the oven. Rereading the directions, I learned the turkey should be placed "in a cook-bag."

COOK-BAG! Ye gods, they never give you the whole story!

Pulling the turkey from the oven, I called a daughter-in-law who said, Never fear, wrap it in foil.

That done, I wedged the turkey back into oven when it occurred to me I had wrapped the shiny side of the aluminum foil around it.

I retrieved it again. Put in another call; the line was busy. Called my sister in Richmond who said, Never fear, either side will do.

Back into the oven it went in highly mobile way. Smoke began pouring out. Both lines were busy. Talking to each other, probably, marveling at my ineptitude.

Sounds from the beef on the grill were those of surf breaking. A friend, an affable cook, said the beef was fat dropping into the pan. Never fear, she said, just grease the roast with some olive oil.

The grill and the pan were interlocked. Couldn't budge either one.

I grabbed a towel, reached in the oven and lifted the roast from the grill — WHOO-O-O-O BOY! THAT'S HOT! — and, cradling the roast in my hands, pulling back from the fiery furnace slipped on grease, fell flat on my back, still clutching the steaming hot roast.

Primal instinct took over. Raising my arms, still grasping the infernal roast, without even consciously taking aim, I flung it in the direction of the kitchen sink.

And, even as I heaved it, I was scrambling to my knees, hearing the boys' grandfather, the best basketball coach ever they believed as do I, yelling at them years ago as they threw the ball at the hoop: FOLLOW IT UP! DON'T JUST STAND THERE! FOLLOW IT UP!

The roast hit the edge of the sink — YE GODS! WHAT NEXT! — I extended my right hand far as I could, and just as the roast rolled on the edge, I tipped it into the sink.

Had it been Michael Jordan, the arena would have roared.

Instead, the three daughters-in-law flew in, a fluttering flock of goldfinches. They bore salads and melons and pies and they shooed me outside to watch the children.

There's no holiday to beat an easy Thanksgiving.

TAMARA VOWINKEL/The Virginian-Pilot

Mae Bowen, 82, can tell you the names of half the people in the Barrier Island Center photo exhibit. One, Tom Dougherty — an old man with a bushy white beard — proposed to her when she was 11. "I was a good housekeeper," said Bowen of his reasons for proposing.

RELICS *of a* SIMPLE LIFE

The isolated island had no theaters, doctors or restaurants. Residents didn't know anything else.

BY KAREN JOLLY DAVIS
STAFF WRITER

WILLIS WHARF — Before the Atlantic washed away her town, Mae Bowen lived in Broadwater, a thriving community on Hog Island.

Then came the big storms of the '30s, when the sea moved in to claim the island. Bowen and her neighbors picked up their homes, put them on barges and took them to the mainland. She never returned.

"I want to remember it as it was," Bowen said.

But remembering life on the barrier islands is becoming more difficult. As former residents pass away, their possessions are being snatched up by private collectors.

Artifacts are disappearing so quickly that some of the Eastern Shore's most respected citizens have united to form the Barrier Island Center, an organization for gathering, preserving and sharing a vital part of the region's history.

For now, the Barrier Island Center doesn't have a building of its own. But Center members have put together their first exhibit, which is being shown at Kerr Place, a museum in Onancock, until Dec. 22. The pieces range from photos, decoys, guns, quilts and waterman's tools to a harp from the Cobb Island Hotel. They were lent to the center by local collectors. Thelma Peterson, one of the founders of the Barrier Island Center, hopes many others will follow their example.

"We want people to recognize what we're trying to do in preserving that part of our heritage," Peterson said.

Mae Bowen can tell you the names of half the people in the exhibit's photographs. She said one of them, Tom Dougherty — an old man with a bushy white beard — proposed to her when she was 11 years old.

"I was a good housekeeper," Bowen said of his reasons for proposing. Dougherty gave her an ornate handkerchief that she still has in her home at Willis Wharf. But Bowen didn't marry him. He was too old and "ugly," she said.

"I had better sense (than) to get mixed up with him," she said, more vibrant at 82 than many teens.

Bowen's stories, and those of the family dwindling number of former Hog Islanders, are part of the

Please see Island, Page B11

Suffolk teenager killed in hunting accident

The teen's gun discharged when he tumbled from a tree.

BY STEVE STONE
STAFF WRITER

SUFFOLK — It should have been a good holiday.

Two teenage buddies hiked into the woods near Whaleyville shortly after dawn Thursday. Leaves crackled underfoot; the sky was bright and sunny; the air was crisp with a slight, chilly breeze. It was a great day to hunt deer before returning home for the Thanksgiving repast.

Timothy Lee Russell, who would turn 16 in a week, climbed eight feet to a tree stand — a hunter's perch built on limbs — and scanned the area for a target while his 15-year-old buddy found a spot nearby.

Shortly after 7 a.m., the 15-year-old heard a shot — nothing unusual when you're several days into deer season. About a half-hour later, he made his way back to where Russell had been only to find his friend on the ground. He was dead.

Exactly what went wrong may never be known, but police said Russell fell from the tree stand and

Timothy Lee Russell

that when he and the shotgun he was carrying hit the ground, the weapon fired. The boy was struck in the abdomen.

"There's no way to tell why he fell," said Mike Simpkins, a police spokesman. "He may have lost his balance on the stand or slipped climbing the ladder."

The teenagers — whose families are longtime friends — were hunting only a short distance from Russell's home in the 500 block of Little Fork Road.

The 15-year-old, whose name was withheld at the request of his family, told police he heard the shot but thought nothing of it.

"He waited 30 minutes and went toward where Russell was supposed to be," Simpkins said. He found the boy on the ground, his gun nearby.

Given the nature of his wounds, police said the delay between the time Russell was shot and when he was found was not significant. "It wouldn't have made any difference," Simpkins said.

Russell was a sophomore at Lakeland High School.

...rium in Moyock, N.C.

- Dec. 12, 7 p.m. main auditorium of Seatack Elementary School in Virginia Beach
- Dec. 13, 7 p.m. Butts Road Intermediate School in Chesapeake

base closings elsewhere.

Ten squadrons of F/A-18s are to leave Cecil Field, Fla., which has been ordered closed, and move to Oceana between 1997 and the early spring of 1999.

In addition, five squadrons of F-14 Tomcat fighters — about 70 planes — are moving to Oceana from Miramar Naval Air Station near San Diego, beginning in May. Miramar has been ordered transferred to the Marine Corps.

Although the F-14s have an impact on the total number of planes at Oceana, they are not the subject of the hearings the Navy is holding next month. Their presence has been surveyed in an "environmental assessment" that does not require such hearings, according to the Navy.

Oceana has had more F-14s in the past and is not exceeding the number it had at its peak in 1989, therefore a full environmental

Please see Hornets, Page B4

METRO NEWS

Hornets: Navy hopes to submit impact statement by Dec. 1996

Continued from Page B1

impact statement is not required, according to officials.

In all, if the moves come about as expected, Oceana will be home to 23 aircraft squadrons, 374 aircraft and 13,000 personnel. At its peak in 1989, it had 363 aircraft and 12,473 personnel. It currently is at 181 aircraft and 8,069 personnel because of drawdowns mandated by Congress since 1990.

While studying the F/A-18 impact at Oceana, the Navy also plans to evaluate potential effects on land use patterns, cultural resources, transportation, housing, community services, the local tax base and the regional economy.

It also wants to know from the community what additional items it should evaluate, said John Peters, a spokesman for the Naval Facilities Engineering Command in Norfolk which is coordinating the study.

Between Dec. 5 and 13, the Navy will hold five "public scoping meetings," three in North Carolina and two in Virginia.

"We are getting input from the public on what they want us to look at when we do the EIS," said Peters.

"It is not a comment period. But we are interested if there are concerns about transportation, the loading of highways, noises, the effect on public utilities."

The Navy is going to the North Carolina communities because it conducts aircraft operations at three bombing ranges in that part of the state: two of them located on the Pamlico Sound near the mouth of the Neuse River and a third located east of the Alligator River, operated by the Air Force.

In Virginia, the hearings are being held because Oceana occupies 5,650 acres in Virginia Beach and also operates the Fentress Naval Auxiliary Landing Field in Chesapeake.

The Navy wants to submit its final environmental impact statement by December 1996 and will issue a draft statement earlier.

At its "scoping" meetings, it asks speakers to limit comments to five minutes and encourages agencies and the public to submit written comments as well.

Written comments should be mailed no later than Jan. 5 to: Commander, Atlantic Division, Naval Facilities Engineering Command, 1510 Gilbert Street, Norfolk, Va., 23511, Attn: Code 2032DC (Dean Cecchini), telephone 322-4891, fax 322-4894.

MILITARY BRIEFS

MONDAY

The **Hampton Roads Council of Veterans Organizations** will meet at 7:30 p.m. at the Disabled American Veterans, Chapter 21, 1018 W. Little Creek Road, Norfolk.

MISCELLANEOUS

Nauticus, the National Maritime Center, needs volunteers 18 to 80 to serve as exhibit interpreters for Naval history and technology, shipbuilding ecology, aquatic life, the weather and more. Nauticus opens for tour groups at 9 a.m., opens to the public at 10 a.m. and remains open until 5 p.m. Tuesday through Sunday. Validated parking for volunteers is provided. Anyone interested may call Sharon Smith, volunteer manager, at 664-1000, Ext. 3104.

Navy Family Services Center, Little Creek, will offer the following:

■ Navy Family Services Center, Little Creek is honoring **Military Family Recognition Day, Nov. 27,** with various activities... will appear in *The Gator*. Call 464-7563 for information on where to pick up flyers.

■ "Strengthening Stepfamilies" 7 to 9 p.m. Tuesday. Call 464-7563 for location.

Navy Family Services Center, Oceana, will offer the following:

■ "Building Effective Anger Management Skills" 3 to 5 p.m. Tuesday at the Oceana Counseling and Assistance Center. Call 433-2912 to register.

Navy Family Services Center, Norfolk Annex, 8910 Hampton Blvd., will offer the following:

■ "Adults Molested as Children" 4 to 5:30 p.m. Wednesdays at Navy Family Services Center, Norfolk Annex. Call 444-2102 to register.

REUNIONS

JOHN PAUL JONES, 1996, Myrtle Beach, S.C. Contact Charles Wyler, 9 New Gate Road, Oxford, Conn. 06478, or 203-888-0008.

USS CANISTEO, February, Orlando...

SERVICE (U.S. Army), Feb. 15-18, 1996. Norfolk. Contact Forrest Passer, Route 3, Box 74, Wells, Minn. 56097, or 507-553-3421.

USS CEREMONIAL GUARD ALUMNI ASSN, Spring 1996, Washington, D.C. Contact Hal Gardner, 80 Burgoyne Ave., Fort Edward, N.Y. 12828, or 518-747-3896.

USS WILLIAM M. WOOD, summer 1996, Hampton Roads. Contact Chuck Traub, 784 Glasgow Court, Virginia Beach, Va. 23452, or call 340-9056.

Military Brief notices should be addressed to: Military Briefs, The Virginian-Pilot, 150 W. Brambleton Ave., Norfolk, 23510, Attn: Cheryl Ball, and arrive by noon on Thursday of the week before publication. Please include date, time, place and a telephone number where information may be obtained. For details, call Cheryl Ball at 446-2259.

Public meetings set on jets' impact

Carteret County meeting is Dec. 5

In the coming month, the Navy will hold three public meetings in North Carolina and two in Virginia to hear what neighbors think of a plan to bring 175 new jets to Oceana Naval Air Station.

The first of the five meetings, to be held Thursday, Dec. 5, will begin at 5 p.m. at the Carteret County Courthouse, Beaufort.

The Virginia air station uses three bombing ranges in North Carolina: Piney Island in Carteret County, Brant Island Shoals in Pamlico County, both on Pamlico Sound near the mouth of the Neuse River. The third, east of the Alligator River, is operated by the Air Force.

Before the F/A-18 Hornets can come to Oceana, the Navy must complete a full environmental impact statement in the next year. The statement will detail the planes' effect on air quality, plant and animal habitats and water resources.

The jets were originally slated to come to Cherry Point Marine Corps Air Station, but the 1995 Defense Base Closure and Realignment Commission redirected the jets to Oceana. The commission ruling, which overturned a 1993 BRAC decision, cited lower cost estimates to house the jets at the Virginia base.

When that decision was announced, North Carolina leaders complained that Virginia would be getting all of the positive economic impacts, while North Carolina would only get the noise associated with training.

While studying the environmental impact, the Navy also plans to evaluate the jets' potential effects on land use, cultural resources, transportation, housing, community services, the tax base and the economy.

It wants to know from the community what additional items it should evaluate, said spokesman John Peters of the Naval Facilities Engineering Command in Norfolk, which is coordinating the study.

The five public meetings will be held between Dec. 5 and Dec. 13.

"We are getting input from the public on what they want us to look at when we do the EIS," Peters said. "It is not a comment period. But we are interested if there are concerns about transportation, the loading of highways, noises, the effect on public utilities."

In Virginia, Oceana occupies 5,650 acres in Virginia Beach and also operates the Fentress Naval Auxiliary Landing Field in Chesapeake.

The new aircraft are scheduled to come to Oceana as a result of base closings elsewhere.

Ten squadrons of F/A-18s from Cecil Field Naval Air Station in Florida, which is closing, will move to Oceana between 1997 and the spring of 1999.

In addition, five squadrons of F-14 Tomcat fighters — about 70 planes — are moving to Oceana from Miramar Naval Air Station near San Diego beginning in May. Miramar has been ordered transferred to the Marine Corps.

If all of the moves come about as expected, Oceana will be home to 23 aircraft squadrons, 374 aircraft and 13,000 personnel. At its peak in 1989, it had 363 aircraft and 12,473 personnel. It currently is at 181 aircraft and 8,069 personnel because of reductions mandated by Congress since 1990.

The Navy wants to submit its final environmental impact statement by December 1996 and will issue a draft statement earlier.

B List of Preparers

LIST OF PREPARERS

U.S. DEPARTMENT OF NAVY

Anderson, Pamela - Head, NAVFACENGCOM LANTDIV, NEPA Documents Section

Cecchini, Dan - NAVFACENGCOM LANTDIV, Project Manager

ECOLOGY AND ENVIRONMENT, INC.

Farrell, Margaret J., QEP, CHMM - Project Coordinator/Quality Control
M.S., 1990, Environmental Studies/Natural Sciences, State University of New York at Buffalo
B.A., 1979, Environmental Studies/Biology, Binghamton University

Aungst, Nancy J. - Technical Advisor
B.A., 1979, Economics, State University of New York at Buffalo

Tronolone, Paul, J., PP, AICP - Project Manager
M.C.R.P., 1989, City and Regional Planning, Rutgers University
B.A., 1985, Environmental Design and Planning, State University of New York at Buffalo

Guerin, Jone - Assistant Project Manager
M.S., 1988, Natural Resource Management/Policy, University of Michigan
B.A., 1984, Political Science, Northwestern University

Shmookler, Leonid, SOPA - Cultural Resources
M.A., 1983, Anthropology, Columbia University
B.A., 1979, Anthropology, Columbia University
Certificate, Department of History, Leningrad University, USSR

Hendrickson, John D. II - Transportation
M.S., 1994, Urban and Regional Planning, Florida State University
B.S., 1991, Geography, Florida State University

Myers, Sean - Community Planner/GIS Specialist
M.S., 1992, Resource Administration/Management, University of New Hampshire
B.S., 1986, Environmental Studies, Syracuse University College of Environmental Science and Forestry

Wattle, Bruce - Air Quality
B.S., 1979, Atmospheric Science, University of Michigan

Kim, Robin - Terrestrial and Water Resources
B.S., 1987, Agriculture and Wildlife Science, Purdue University

Kim, Matthew - Air Quality
B.S., 1989, Biological Science, University of Colorado in Boulder

Ghosen, Joseph - GIS Mapping
M.S., 1995, Social Science/Public Administration, State University of New York at Buffalo
B.S., 1992, Business Administration, State University of New York at Buffalo

Shelly, Kirsten - Socioeconomics
M.S., 1991, Environmental/Resource Economics, University of London, University College, London, England
B.A., 1989, Economics, Colgate University

Helter, David, AICP - Land Use, Utilities/Infrastructure
M.S., 1991, Urban and Regional Planning, Florida State University
B.S., 1985, Geology, Bowling Green University

Comer, Chris - Terrestrial and Water Resources
M.S., 1996, Environmental Pollution Control, Pennsylvania State University
B.A., 1991, Biology, Carleton College
B.A., 1991, Economics, Carleton College

Mach, Carl - Terrestrial and Water Resources
Ph.D., 1992, Civil Engineering, University of Minnesota at Minneapolis
M.S., 1984, Biology, University of Minnesota at Duluth
B.S., 1980, Forest Ecology, Syracuse University College of Environmental Science and Forestry

Donnelly, Michael, PWS - Wetlands
M.E.M., 1988, Environmental Management, Duke University
B.S., 1987, Applied Biology, Xavier University

Phillips, Marie - Editor
B.A., 1990, History, Syracuse University

WYLE LABORATORIES, WYLE RESEARCH

Czech, Joseph J. - Noise and Accident Potential Zone Analyses
B.S., 1988, Aerospace Engineering, California State Polytechnic University

ATAC CORPORATION

Huber, Derek - Airfield Operations
B.S., 1993, Aeronautical Sciences and Engineering, University of California, Davis
B.S., 1993, Mechanical Engineering, University of California, Davis

Boyajian, Eric G. - Airfield Operations
M.B.A., 1993, Management Sciences, California State University, Hayward
B.S., 1988, Mechanical Engineering, University of California, Davis

Martin, Joseph E. - Airfield Operations
M.S., 1996, Industrial and Systems Engineering, University of California, San Jose
B.S., 1985, Fermentation Science, University of California, Davis

C Airfield and Airspace Analysis

Derived from ATAC Corporation *NAS Oceana, Airfield and Airspace Operational Study of the 1995 BRAC Realignment of Navy F/A-18 Squadrons*, August 1997. MCAS Beaufort was not subject to the Naval Aviation Simulation Model (NASMOD) analysis.

Airfield and Airspace Operational Study for the 1995 BRAC Realignment of Navy F/A-18 Aircraft

August 22, 1997

Submitted under contract
N68925-93-D-A093

Naval Facilities Engineering Command
Department of the Navy
Alexandria, Virginia

ATAC
ATAC Corporation
Sunnyvale, California

CONTENTS

LIST OF FIGURES

LIST OF TABLES

PREFACE

The Airfield and Airspace Study for the 1995 BRAC Realignment of Navy F/A-18 Aircraft was conducted by ATAC Corporation under Work Order Number 13 of Contract Number N68925–93–D–A093. The Naval Aviation Simulation Model, NASMOD, the primary tool used to produce this study, was developed by ATAC for the Naval Facilities Engineering Command (NAVFAC).

The ATAC analysts for this study, and the authors of this report, are Derek Huber, Eric Boyajian, and Joe Martin. Michael Abkin is overall project manager. The authors acknowledge the indispensable contributions throughout this study of other members of ATAC's NASMOD team and of our Navy, Marine Corps, and Air Force points of contact.

NASMOD

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

This study examines the capability of NAS Oceana and MCAS Cherry Point, including NALF Fentress, MCALF Bogue, and the local airspace and ranges, to accommodate the prospective levels of operations resulting from the implementation of BRAC 95-related decisions. This analysis is accomplished through the use of a fast-time computer simulation model, NASMOD.

Five alternative relocation scenarios (ARS) were identified by the Navy for analysis. Each scenario represents an alternative base-loading squadron mix in a future year (i.e., FY99) following the relocation and realignment of the modeled squadrons. A baseline scenario was analyzed with which to compare the alternatives.

The tenant mix for the Baseline Scenario is as follows:

NAS Oceana	MCAS Cherry Point
7 F-14 Atlantic fleet squadrons 4 F-14 Pacific fleet squadrons 1 F-14 FRS 1 F/A-18 adversary squadron	3 AV-8 fleet squadrons 1 AV-8 FRS 4 EA-6B squadrons 1 KC-130 fleet squadron 1 KC-130 FRS

The alternative scenarios specify the location of the Atlantic F/A-18 squadrons as follows:

	ARS-1	ARS-2	ARS-3	ARS-4	ARS-5
NAS Oceana	11 + FRS	9 + FRS	8 + FRS	6 + FRS	6 + FRS
MCAS Cherry Point			3		5
MCAS Beaufort		2		5	

The impacts of Navy squadron realignment alternatives on MCAS Beaufort and that air station's surrounding training areas is not examined in the study.

On an annual basis, the increase in flight operations from the realignment of the Navy F/A-18 squadrons does not affect the ability of the squadrons to complete their overall flight requirements. Although increases for most aircraft groups in adjusted and postponed flights do occur in the alternative scenarios, no significant postponements in flight scheduling are experienced. Some adjustments are made to alternative or less-preferred training areas for most squadrons. Also, shifting of flight launch times due to adjusted training area selections affect squadron aircraft allocation and overall scheduling efficiency.

The impacts to airfield operations at NAS Oceana by a comparison between the Baseline Scenario and ARS-1 are as follows:

- Operations increase by about 120 percent.
- NALF Fentress experiences an increase of 51 percent in operations.
- Taxi delay rises from an average of 1.0 minute to 1.9 minutes per sortie.

- Completion of desired return-to-base pattern operations drops from 98.0 percent (average over all aircraft groups) to 92.8 percent.

The impacts to airfield operations at MCAS Cherry Point relative to the Baseline Scenario are as follows:

- Operations increase 18 percent (ARS-3) and 26 percent (ARS-5).
- Night (2200 to 0700) operations increase by 85 percent (ARS-3) and 113 percent (ARS-5).
- Average taxi delay increases by about six seconds per sortie in ARS-3 and eight seconds per sortie in ARS-5.
- Pattern event completion rate drops from 96.8 percent to 94.2 percent (ARS-3) and 94.4 percent (ARS-5).

The realigned Navy F/A-18 squadrons have a significant impact on local training area operations. The W-72 TACTS range and Navy Dare County Range approach capacity limits.

- The W-72 TACTS range is utilized about 83 percent of its published hours on average over the simulated year in ARS-1. Scheduling inefficiencies and demand peaking from among the squadrons preclude the possibility of scheduling 100 percent of the available hours for the whole year, and annual average utilization rates of 80 percent to 85 percent may be a practical upper limit given the current scheduling procedures and requirements.
- The Navy Dare County Range utilization rate is about 65 percent. Results suggest that as Navy Dare's utilization rate approaches 70 percent, the range approaches "capacity," or saturation.

From a schedule capacity point-of-view, BT-11 and BT-9 have the ability to accommodate increased operations after the realignment of the Navy F/A-18 squadrons (in any scenario).

- The BT-11 utilization rate is approximately 50 percent on average during the year for all the alternative scenarios (42 percent in the Baseline Scenario).
- BT-9 is utilized about 20 percent of its available hours during the year.

No significant impact on civilian traffic is caused by the additional R-5314 operations resulting from the realignment of Navy F/A-18 squadrons to the region.

NASMOD

INTRODUCTION

1 INTRODUCTION

This study examines the capability of Naval Air Station (NAS) Oceana and Marine Corps Air Station (MCAS) Cherry Point, including Naval Auxiliary Landing Field (NALF) Fentress and Marine Corps Auxiliary Landing Field (MCALF) Bogue Field, and the related ranges, military operations areas (MOAs), warning areas, and restricted areas, to accommodate prospective levels of operations resulting from 1995 Base Realignment and Closure (BRAC 95)-related decisions. Figure 1-1 depicts the general study region. This section describes the issues and objectives of the study, the methodology followed, data sources, and the contents of this report.

1.1 Issues and Study Objectives

The Navy has identified several issues associated with the BRAC 95-related decisions to single site the F-14 squadrons at NAS Oceana and to relocate NAS Cecil Field-based F/A-18 squadrons. These issues include:

- The sufficiency of airfield, airspace, and range capacity to accommodate the projected activity in the NAS Oceana and MCAS Cherry Point region;
- The ability of squadrons to meet their training requirements; and
- The environmental impacts on the military facilities, training areas, routes, and ranges, as well as the communities surrounding them.

Fiscal Year 1999 (FY99) is the simulation period; the proposed relocations of the F-14 fleet squadrons from NAS Miramar and the F/A-18 fleet squadrons and F/A-18 fleet replacement squadron (FRS) from NAS Cecil Field are assumed to be completed by this year.

The principal study objective is to provide the Navy with an analysis of operations within the study region under alternative base loading conditions that address these issues. The results presented are inputs to noise and environmental impact studies.

1.2 Study Methodology

The study methodology employs a general simulation model for naval aviation operations, the Naval Aviation Simulation Model (NASMOD). Using data and information supplied by the Navy, Marine Corps, and Air Force, ATAC configured NASMOD to represent the aviation activities at NAS Oceana and MCAS Cherry Point with the existing and proposed tenants. These simulation inputs reflect the anticipated operations at the modeled airfields and airspace including several associated bombing ranges, MOAs, and warning and restricted areas.

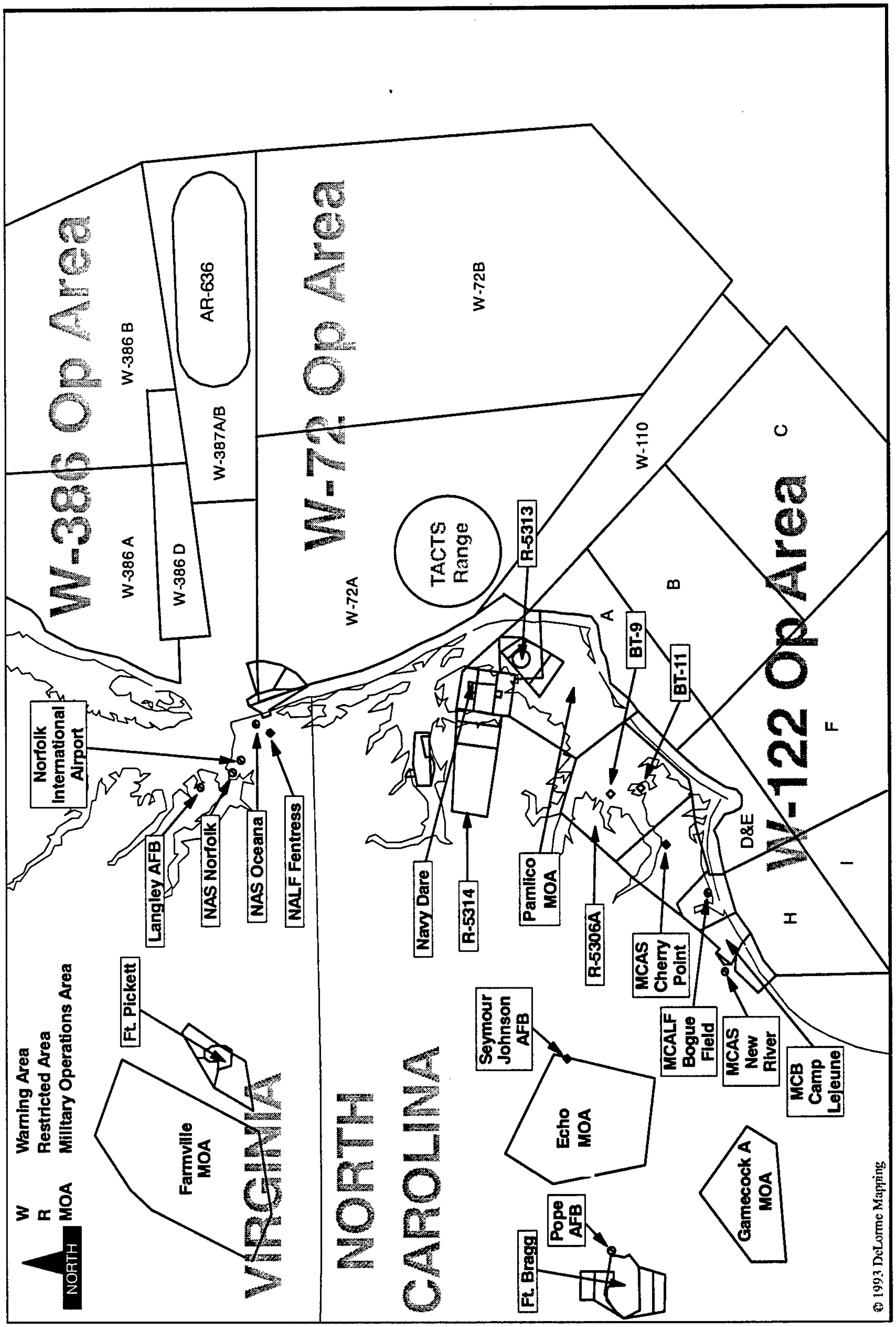


Figure 1-1: Airspace Study Region

1.3 NASMOD Background

The development of NASMOD was motivated by a need within the Navy for a technically credible tool to objectively and efficiently analyze options in a number of critical naval aviation decision areas. For example:

- Base closings and realignments. Is there sufficient airfield and airspace capacity at selected sites to accommodate the training requirements of both existing and realigned military users? What operational alternatives are there that could potentially mitigate capacity constraints? What are the potential impacts on civilian traffic in the area?
- Changes in special use airspace. What operational efficiencies are attainable from proposed modifications to MOAs, warning areas, and other military special use airspace areas (SUAs); or from proposed changes in operating schedules and configurations of such areas? What would be the training and cost impacts to the military of restrictions on the availability or use of such areas? What impacts might there be on civilian traffic?
- Interactions between civilian and military air traffic. What are the cost and operational impacts on military and civilian users of shared airspace due to: projected growth in levels of activity, changes in instrument flight rule (IFR) routes and/or air traffic control (ATC) procedures, or changes in the operational requirements of the users?
- New aircraft types. What are the airfield and airspace impacts associated with the introduction of a new aircraft type and its affiliated training requirements? What procedural or operational changes in airfield and airspace management, schedules, and configurations are feasible to mitigate identified constraints?
- Changes in training and resource requirements. What airfield and airspace modifications may be required due to changes in mission (e.g., the addition of night bombing to the F-14 mission), pilot training requirements (e.g., increased flight hours in the Training and Readiness Matrix for certain training events), or training resource requirements (e.g., instructors, adversary aircraft, target facilities)? What operational changes in airfield and airspace management, schedules, and configurations are feasible?
- Environmental assessments and environmental impact statements. What are the potential impacts on airfield operations and utilization of ranges and SUAs, which in turn have noise and other environmental impacts, due to changes in operations?

NASMOD is derived directly from two other general simulation models: the Navy Air Training System Model (NATS) and the Airfield and Airspace Capacity Model (SIMMOD). NATS was developed in the mid-1980s for analysis of special use airspace and other resource impacts on basic flight training at NAS Whiting Field, Florida. The design of the model was specialized for that particular application. SIMMOD, conversely, is the official simulation model of the Federal Aviation

Administration (FAA) and is used in terminal and en route airspace environments for analysis of airfield and airspace capacity issues. It has been validated and used in numerous studies for the analysis of airport layouts, runway and taxiway procedures, sectorization plans, air traffic control procedures, traffic management strategies, and traffic routing. NASMOD incorporates the functionality of NATS, the simulation and analytical capabilities of SIMMOD, and also includes advanced database and analytical capabilities necessary to model complex tactical military training operations.

NASMOD is a fast-time computer simulation model composed of:

- A graphical user interface (GUI) for data entry, including database table editing and graphical tools for building airfields, routes, and mission profiles; simulation control; and results analysis, including a database querying tool;
- A traffic animator, which replays a simulated day of air traffic and training operations as an animated, graphical approximation of the events simulated by the NASMOD mathematical model;
- Relational databases of input and output data, wherein the input data control the model assumptions and parameters, and the output data contain the results for the simulation period;
- Simulation modules that model squadron mission scheduling, central scheduling of airspace areas, and the evolution of military missions and their interactions with other modeled traffic; and
- A performance calculator that computes selected measures of performance for squadrons and their training activities, airfield operations, and airspace and range area scheduling and utilization.

Appendix D provides an overview of the NASMOD simulation model components.

1.4 Study Process

A NASMOD study consists of four basic phases: study design, data collection, model development, and scenario simulation and analysis. Each study is a highly iterative and interactive process requiring extensive coordination between the analysts and the data sources during all phases. Often, information learned and insights gained during a later phase of the study necessitate revisiting earlier phases before proceeding. Occasionally, assumptions are adjusted, data collection is revised, or the scenario design is modified.

1.4.1 Study Design

During the design phase of a study, analysts and military personnel meet and determine the baseline and operating alternatives, including the assumptions governing each. Occasionally, modifications or updates are required to reflect results of the analysis in progress, particularly when the need for a more detailed analysis is recognized or an area of interest changes due to a dynamic decision.

1.4.2 Data Collection Requirements and Sources

During the data collection phase of the study, analysts collect the large volume of data required for model construction and analysis. These data describe current and proposed operations. For this study, there are three general categories of data sources: publications; personal interviews and observations of operations; and records of actual airfield and airspace operations. The References section lists all of the documents, publications, and other direct and indirect sources used. Examples of the published information include: letters of agreement, maps and charts of airspace structures and airfield facilities, approach plates, computer-aided design (CAD) and other engineering drawings, the air operations manual, and range regulations. Examples of information gathered through interviews and direct observations include: ATC procedures, flight profiles, flight scheduling requirements, and squadron deployment specifications. Actual operations records include: ATC facility logs, traffic analyzer data, and squadron flight schedules.

1.4.3 Model Development

Preparation of the NASMOD input database involves analyzing the collected data and extracting and assembling the essential information. Analysts convert this information into the format required by the model, enter the data, and then test various parameters for accuracy.

1.4.4 Simulation and Analysis of Alternative Scenarios

Each alternative scenario requires a separate database with parameters set to reflect the appropriate assumptions. The model simulates the air traffic and training operations associated with those assumptions. For this study, ATAC uses a one-year simulation period. Results from the one-year period account for the seasonal variation in operations and the impact of unit deployment schedules. Simulation results are used in the analysis to identify, quantify, and compare the differences between the baseline and operating alternatives.

1.5 Report Contents

This report documents the process, assumptions, results and analyses of the Airfield and Airspace Operational Study for the 1995 BRAC Realignment of Navy F/A-18 Aircraft (hereinafter refered to as the Navy F/A-18 Realignment Study). The report contains four additional sections. These sections describe the model building process with a description of the alternative scenarios and their associated assumptions, the comparative analysis among the alternatives based on simulation results, and the summary and conclusions. The appendices contain a description of the model and selected detailed results. A glossary of terms and lists of references and acronyms are also provided.

NASMOD

SCENARIO SPECIFICATION AND MODEL DEVELOPMENT

2 SCENARIO SPECIFICATION AND MODEL DEVELOPMENT

This section describes the model development process and provides detailed information about the baseline and five alternative base-loading scenarios studied. It provides an overview of the key logical and data assumptions that comprise the Navy F/A-18 Realignment Study, including airfield and airspace data, training area descriptions, and user operations characteristics.

2.1 Scenario Specifications

The five alternative scenarios for this study are unique base-loading possibilities involving Navy F/A-18 squadrons from NAS Cecil Field. All assumptions governing the baseline scenario also apply to each alternative scenario unless specifically stated otherwise in the following discussions. Table 2-1 summarizes the Navy F/A-18 squadron base loading for each alternative scenario. Note that, although two scenarios assume F/A-18 assets are relocated to MCAS Beaufort, analysis of the impacts on the MCAS Beaufort area of this relocation is outside the scope of this study.

The alternative realignment scenario (ARS) designation reflects the numbering of the scenarios in the environmental impact statement (EIS) for which this study is a data source.

Table 2-1: Alternative Relocation Scenarios of the Navy F/A-18 Squadrons

	ARS-1	ARS-2	ARS-3	ARS-4	ARS-5
NAS Oceana	11 + FRS	9 + FRS	8 + FRS	6 + FRS	6 + FRS
MCAS Cherry Point			3		5
MCAS Beaufort		2		5	

The Baseline Scenario against which the above alternatives are compared assumes that four Pacific Fleet F-14 squadrons are based at NAS Oceana along with seven Atlantic Fleet F-14 squadrons, one F-14 fleet replacement squadron (FRS), and one Navy F/A-18 adversary squadron. Based at MCAS Cherry Point are three AV-8 fleet squadrons, one AV-8 FRS, four EA-6B squadrons, one KC-130 fleet squadron, and one KC-130 FRS. In the Baseline Scenario, all Navy A-6 squadrons at NAS Oceana are decommissioned, and the base loading at MCAS Cherry Point reflects current conditions.

The EIS specification of ARS-5 includes the addition of a new runway parallel to Runway 23R at MCAS Cherry Point. This study does not address the quantitative impacts of the parallel runway. However, descriptions of the location and specifications of the parallel runway (that are currently known) and changes that will be made to the air station's patterns and operations are provided in Section 2.3.4.1. A qualitative assessment of the impacts of the parallel runway is presented in Section 3.

2.2 Airfield Operations

NAS Oceana and MCAS Cherry Point are master Navy and Marine Corps air stations in Virginia and North Carolina, respectively. Other Navy/Marine Corps airfields in the region include NAS Patuxent River, NAS Norfolk, and MCAS New River; these three air stations are not under consideration as sites for basing Navy F/A-18 squadrons.

2.2.1 NAS Oceana Operations

The NAS Oceana airfield is located approximately 3½ miles west of the Atlantic coast in Virginia Beach, Virginia, as shown in Figure 2-1. NALF Fentress, an outlying airfield used primarily for field carrier landing practice (FCLP) operations, is located about 8½ miles southwest of NAS Oceana. This region has experienced substantial commercial and residential growth in recent years with significant development occurring just outside the confines of the air station.

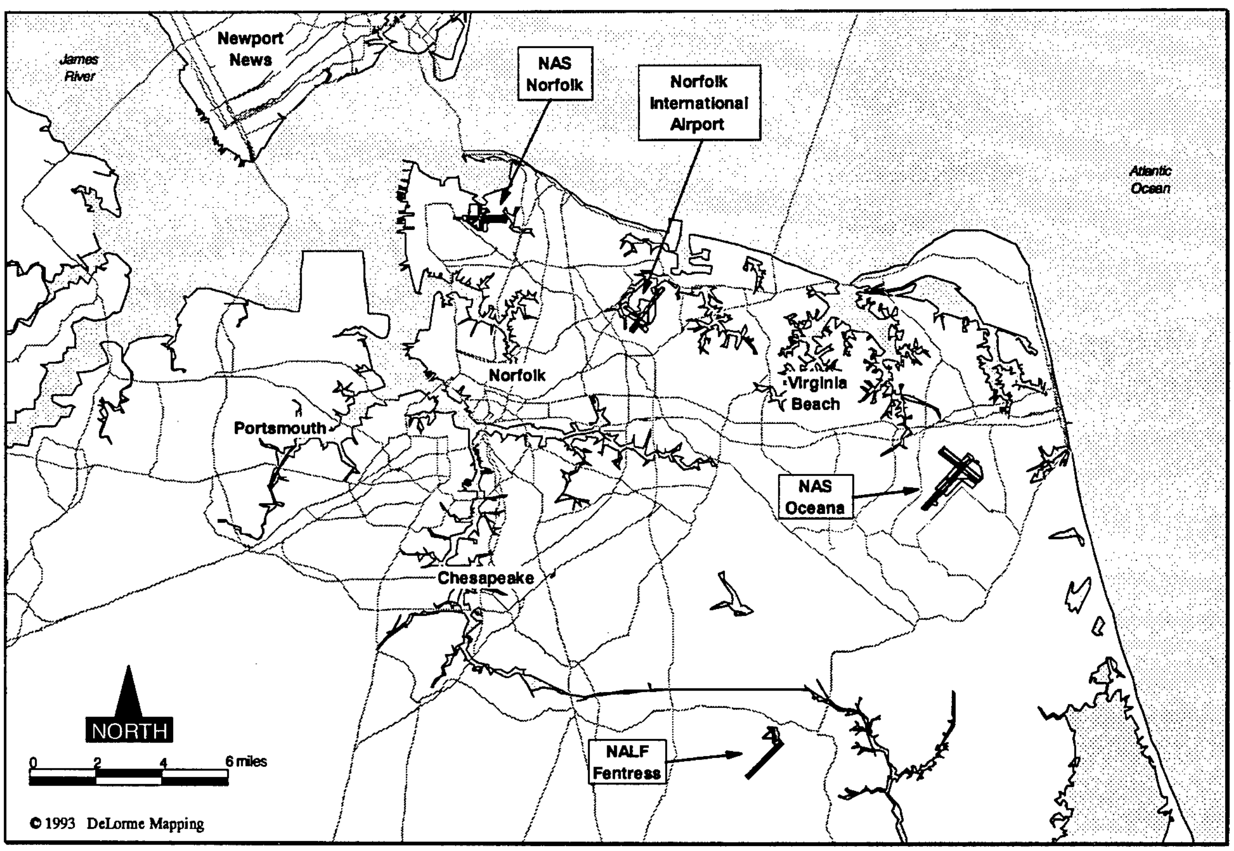


Figure 2-1: Vicinity of NAS Oceana

NAS Oceana has two sets of dual runways for arrival and departure traffic. Runways 5L/R (left/right) and 23L/R are the "calm wind" runways. These runways are preferred at times when wind is not a constraining factor (typically less than 3 knots) due to their length, orientation with respect to arrival and departure routings, and proximity to desired ground features such as high speed exits and fuel pits. Figure 2-2 depicts the proposed NAS Oceana airfield layout after the proposed realignment of the F-14 and F/A-18 squadrons.

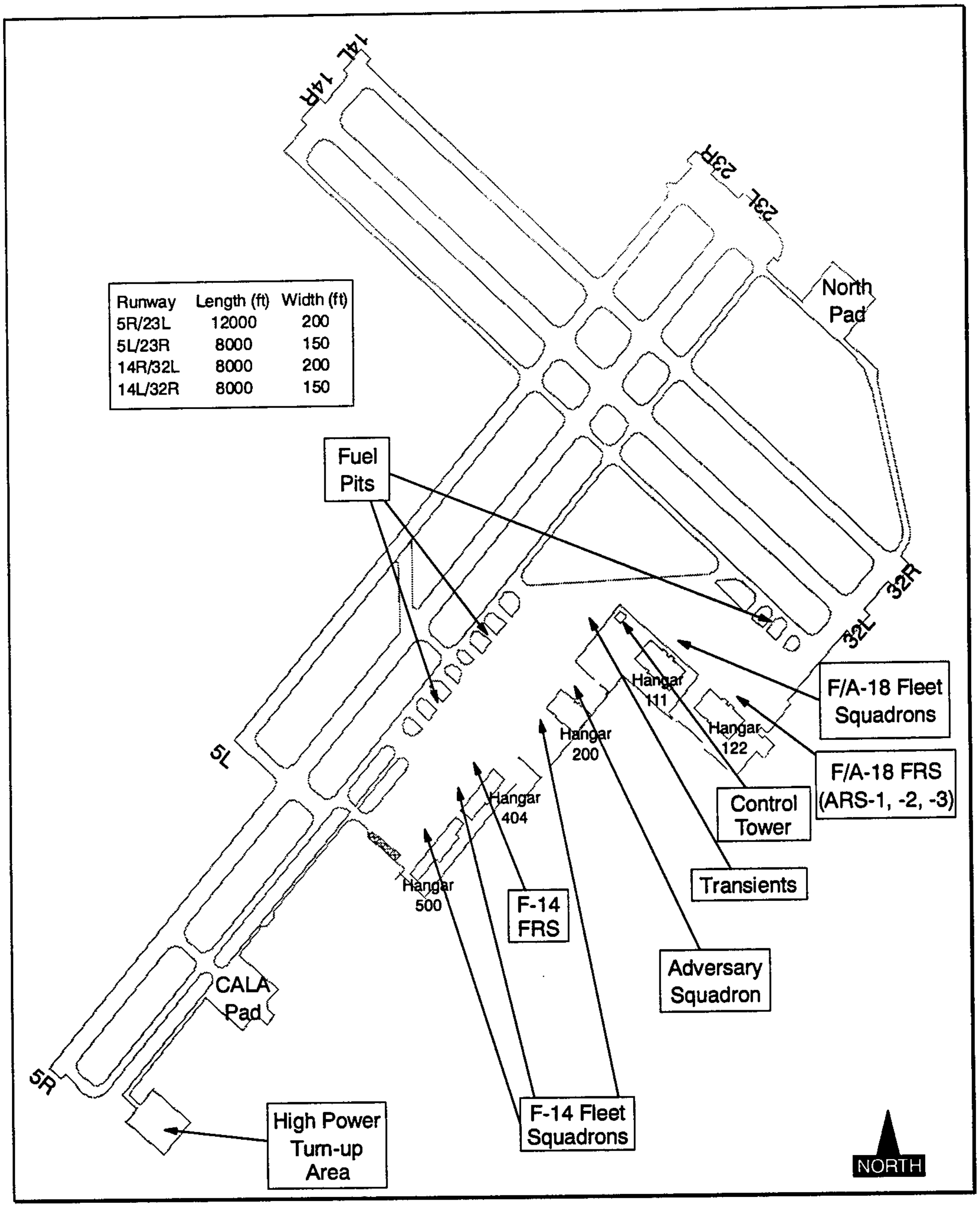


Figure 2-2: NAS Oceana Airfield Layout

In general, airfield operations for all scenarios modeled in NASMOD are in accordance with published ATC procedures and consistent with the current NAS Oceana Air Operations Manual. However, to facilitate timely development of the NAS Oceana airfield model, all the airfield operations are "mapped" to one duty runway plan (Runways 5R and 5L). This greatly reduces the modeling effort while achieving the desired results with no significant loss of accuracy. NAVFAC and NAS Oceana base operations representatives concurred with this approach. Therefore, results related to specific runways are not addressed in this study; however, such statistics can be derived by distributing the total operations among the runways based on their historical proportion of total usage.

This approach is supported by several NAS Oceana airfield characteristics, including:

1. The airfield consists of two pairs of dual runways (5/23 and 14/32) aligned about 90 degrees from each other. Historically, total airfield operations have been distributed by runway pair as follows:

Runway Pair	Operations Distribution
5	50%
14	2%
23	34%
32	14%

2. There is no significant difference between the duty runways in the total time required by aircraft to taxi for takeoff and return to the ramp after landing. There is somewhat less room for aircraft holding for departures on Runway 32.
3. Overhead break approaches and precision approach landing system (PALS) approaches are available to all four runway pairs. Standard departures can be made from all the runways. Instrument carrier landing system (ICLS) services are available on Runway 5R.
4. Each of the runway pairs has a visual pattern and a GCA box pattern. The capacities of the patterns are the same for each runway pair.
5. Field carrier landing practice (FCLP) can be performed on each of the four runway pairs.

The airfield facilities and ground activities (i.e., aircraft parking areas, refueling pits, and taxiways) are modeled according to the current airfield layout and operating procedures. A node/link network in NASMOD represents the runway/taxiway/parking area. Airfield nodes are placed at physical positions where aircraft interact or where significant events (in terms of aircraft movements) occur, including the ends of runways, runway exits, runway/taxiway crossing points, taxiway/taxiway crossing points, refueling pits, and parking areas. A link is the travel path between two nodes. Figure 2-3 depicts the node/link network constructed for NAS Oceana.

The direction in which links can be traversed and the type of operation that can use a link (that is, arrivals only, departures only, or both arrivals and departures) are inputs to the model. In traveling between two ground nodes (e.g., fuel pit and hangar), the taxipath to be used by an individual aircraft can be either pre-specified in the NASMOD input or determined by the model logic to achieve the minimum-time routing. The minimum-time routing logic is implemented as much as possible except in cases where specific directionality is required, such as when aircraft pass through the fuel pits.

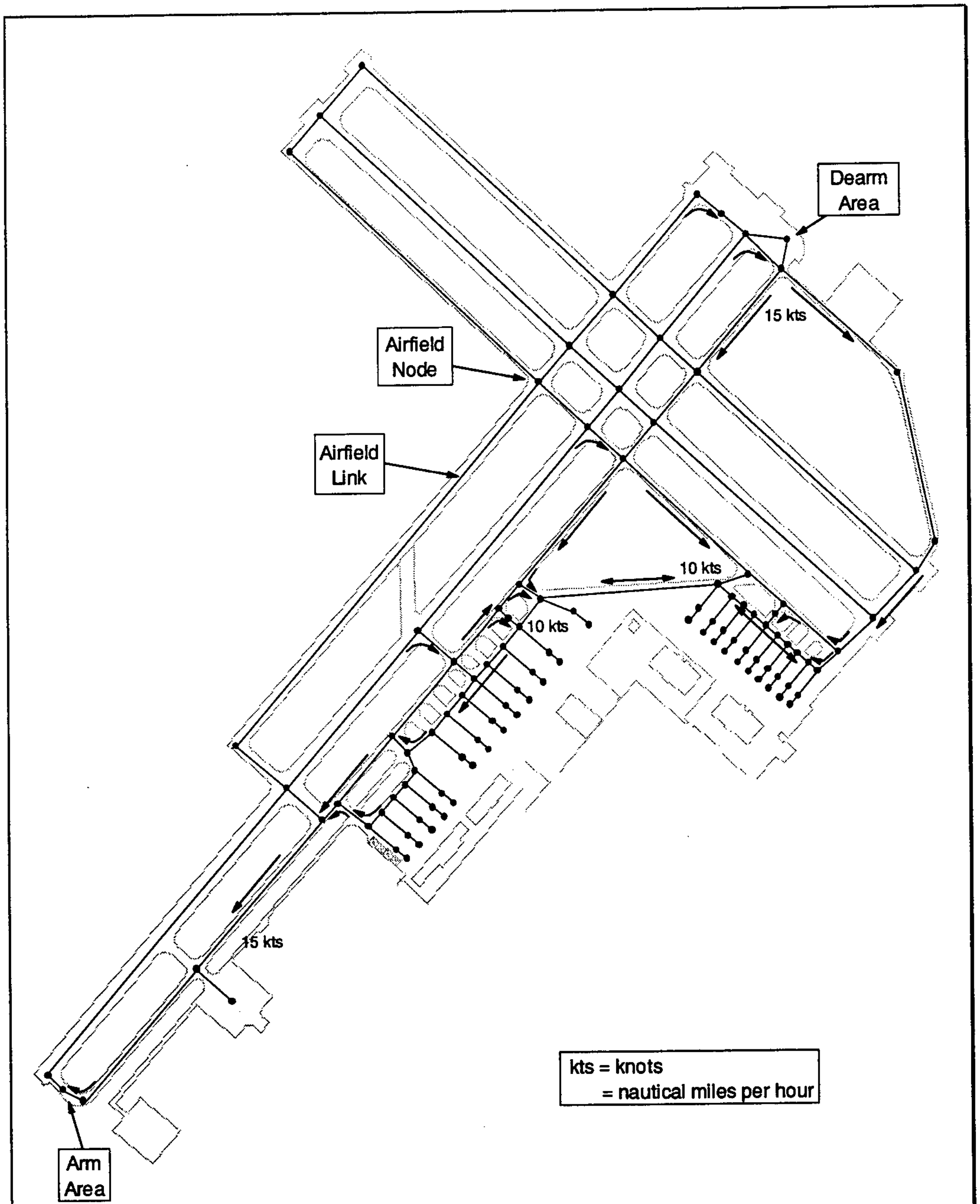


Figure 2-3: NAS Oceana NASMOD Airfield Network for the Runway 5 Plan

Operations at the aircraft parking areas are not modeled in detail. Squadron parking areas, in which a specific squadron or squadrons park, are defined instead of parking spaces for individual aircraft. The capacity of a squadron parking area is defined as the total number of individual aircraft capable of being parked there. The squadron parking area allocation is based primarily on the actual squadron areas utilized during FY95. This is adjusted to accommodate the newly based F/A-18 aircraft. The parking area links shown in Figure 2-3 are not intended to depict actual aircraft parking rows. Modeling of activity within an individual squadron — that is, the interaction of aircraft in the parking area and maneuvering on the ramp area — is beyond the scope of this study.

The nominal taxi speed for aircraft is assumed to be 10-15 knots; however, taxi speeds along selected segments differ in order to reflect those areas of the airfield where aircraft tend to move faster or slower than this nominal speed (e.g., inner or outer taxiway). Traffic congestion that occurs during the simulation results in longer taxi times. These statistics are collected during the simulation analysis. The predominant directions of travel as well as nominal taxi speeds are indicated in Figure 2-3.

Fuel pit availability is generally determined by funding and staffing limitations, as well as squadron demand. Such constraints are modeled within NASMOD by specifying the maximum number of aircraft that can be simultaneously refueled in the pits. After consultation with base operations personnel, fuel pit availability for the F/A-18 realignment scenarios is assumed to permit simultaneous refueling of up to four aircraft in the fuel pits along the west ramp area and up to four aircraft along the east ramp. This level of fuel pit staffing is speculative yet reasonable in view of the historical levels of fuel pit staffing by the proposed future NAS Oceana tenant squadrons. Figure 2-2 shows the locations of the fuel pits.

The time required for hot refueling depends on the amount of fuel consumed during the previous flight. Refueling time is typically about eight minutes for F-14 and F/A-18 aircraft.

A decision to use the fuel pits is based primarily on an estimation by the aircrew as to whether or not refueling in the pits is faster than on the ramp. When the pits are full, aircraft must wait on the outer taxiways. When these get full, tower controllers direct aircraft to wait on the inner taxiways. This does not occur frequently since most aircrews will opt to refuel back at their line when the fuel pits are so congested. When FCLP or other missions requiring a fast turn-around of aircraft are being conducted, a squadron may staff extra fuel pits or give these missions priority when refueling. For the NASMOD simulations, it is assumed that all aircraft that can physically fit in the fuel pits (e.g., military jets, smaller turboprops) will try to refuel this way. Another assumption is that a maximum of twelve aircraft, six on the west ramp and six on the east, will wait for an available fuel pit; beyond these amounts, it is assumed that the aircraft is refueled on its line. Aircraft returning from FCLP sorties are an exception in that they are assumed to be able to refuel in the pits immediately after landing, entering the fuel pit area without waiting in the queue.

2.2.2 NALF Fentress Operations

NALF Fentress is used primarily by Navy fixed-wing aircraft from NAS Oceana and NAS Norfolk for FCLP operations. NALF Fentress is used infrequently for other military training purposes, such as parachute and towed-banner drops. This usage is of lower priority, is scheduled not to conflict with FCLP operations, and is thus considered negligible for purposes of this study. Due to foreign object damage hazard, only E-2/C-2 aircraft are permitted to make full-stop landings for crew changes. No more than five aircraft are permitted simultaneously in the pattern.

The airfield has one runway (5/23) equipped to simulate an aircraft carrier flight deck and is available for FCLP training 24 hours a day except for the following times:

1115–1230 and 1630–1730 Monday, Tuesday, Wednesday, Friday, and Saturday;
0600–1400 and 1630–1730 Thursday; and
0600–1300, 1630–1730, and 1900–2100 Sunday.

2.2.3 MCAS Cherry Point Operations

MCAS Cherry Point is located midway along the Atlantic Coast of North Carolina, southeast of New Bern on the south bank of the Neuse River (see Figure 2-4).

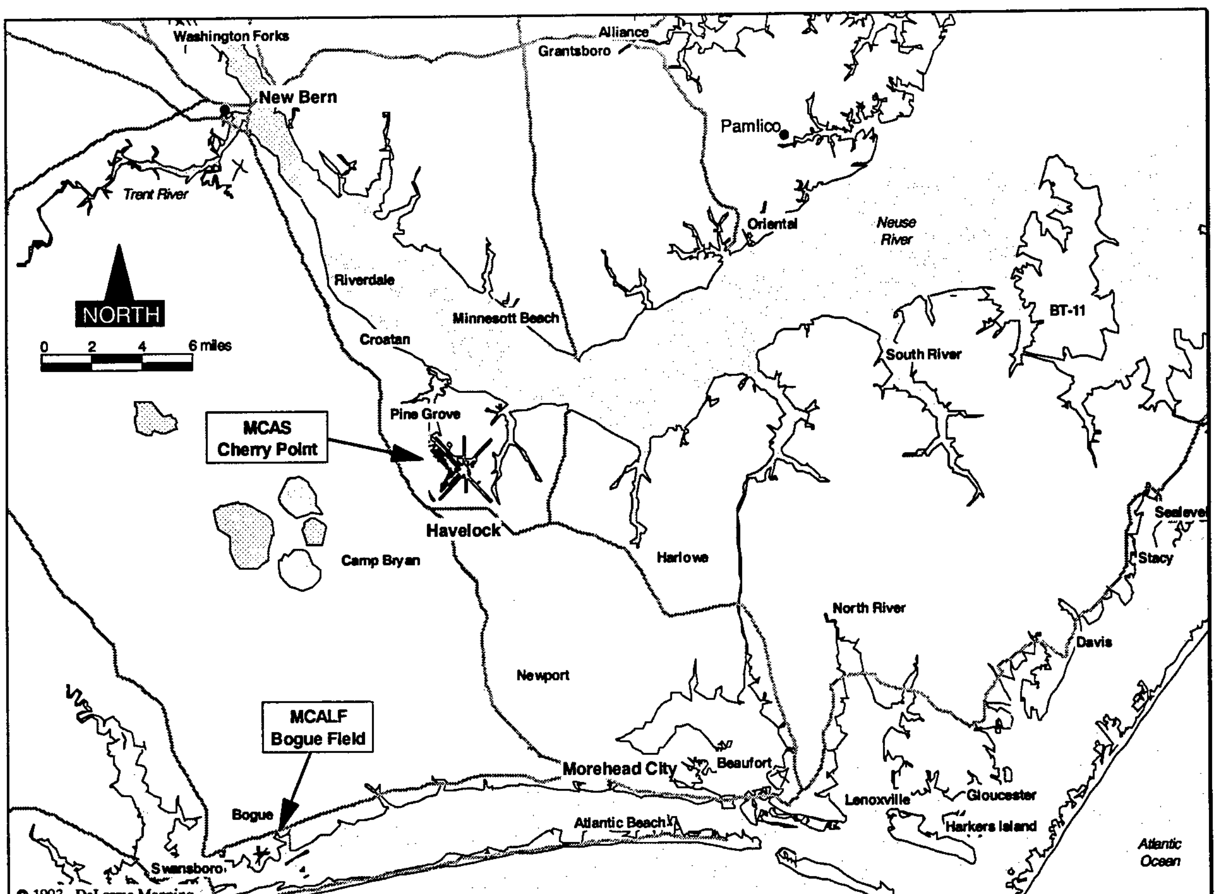
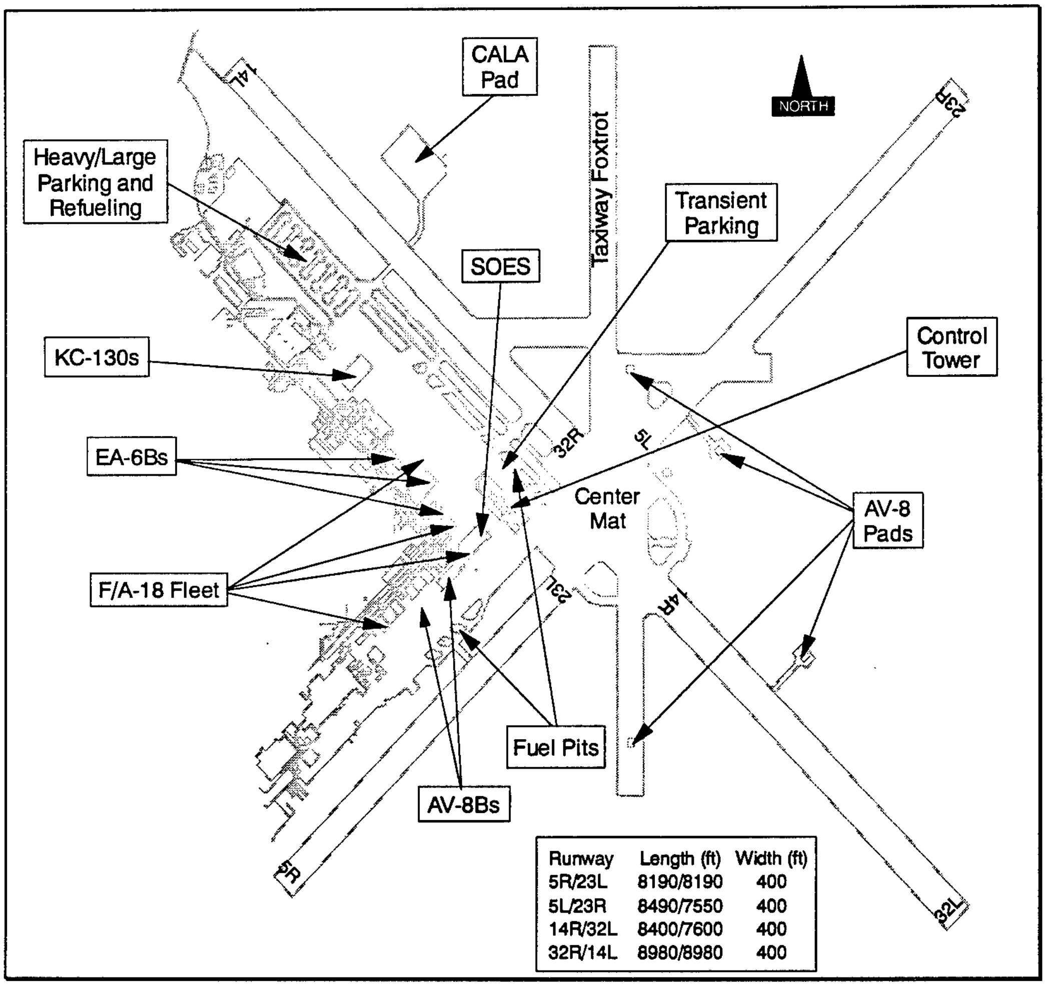


Figure 2-4: Vicinity of MCAS Cherry Point

MCAS Cherry Point utilizes two pairs of offset runways for arrival and departure traffic and several pads for AV-8 and helicopter operations as shown in Figure 2-5. The main landing area consists of runways, which are offset to form a common centermat area. Takeoffs are made from the center of the airfield and landings are made toward the center of the airfield. Four AV-8 pads are available for vertical takeoffs and landings: North, South, Northeast, and Southeast pads. Precision approach radar (PAR) services are available to all arrival runways (32L, 23R, 14L, 05R). Carrier deck lighting is available on Runway 23R.



Runway	Length (ft)	Width (ft)
5R/23L	8190/8190	400
5L/23R	8490/7550	400
14R/32L	8400/7600	400
32R/14L	8980/8980	400

Figure 2-5: MCAS Cherry Point Airfield Layout

In general, airfield operations for all scenarios modeled in NASMOD are in accordance with published ATC procedures and consistent with the current MCAS Cherry Point Air Operations Manual. However, to facilitate timely development of the MCAS Cherry Point airfield model, most runway operations, with the exception of FCLPs, are "mapped" to one duty runway plan (Runways 32L and 32R). This greatly reduces the modeling effort while achieving the desired results with no significant loss of accuracy. NAVFAC and MCAS Cherry Point air traffic representatives concurred with this approach. The GCA box pattern, instrument approaches, and the visual touch-and-go pattern in the model are associated with Runway 32L. The primary departure runway is Runway 32R.

To reflect the flexibility and capacity of the MCAS Cherry Point airfield, Runway 23L is also used for IFR (instrument flight rules) and VFR (visual flight rules) departures and Runway 23R for straight-in VFR arrivals to a full-stop landing, in order to expedite traffic during high tempo operations or when requested by pilots.

Navy aircraft are modeled in a similar manner to those based at NAS Oceana and adjusted to conform with MCAS Cherry Point procedures and operations. Hangar assignments for all squadrons currently based at MCAS Cherry Point are the same in all scenarios. The F/A-18 fleet squadrons are assigned hangar locations in ARS-3 that include them (see Figure 2-5). The NASMOD node/link network representing the MCAS Cherry Point runways, taxiways, and parking areas is shown in Figure 2-6.

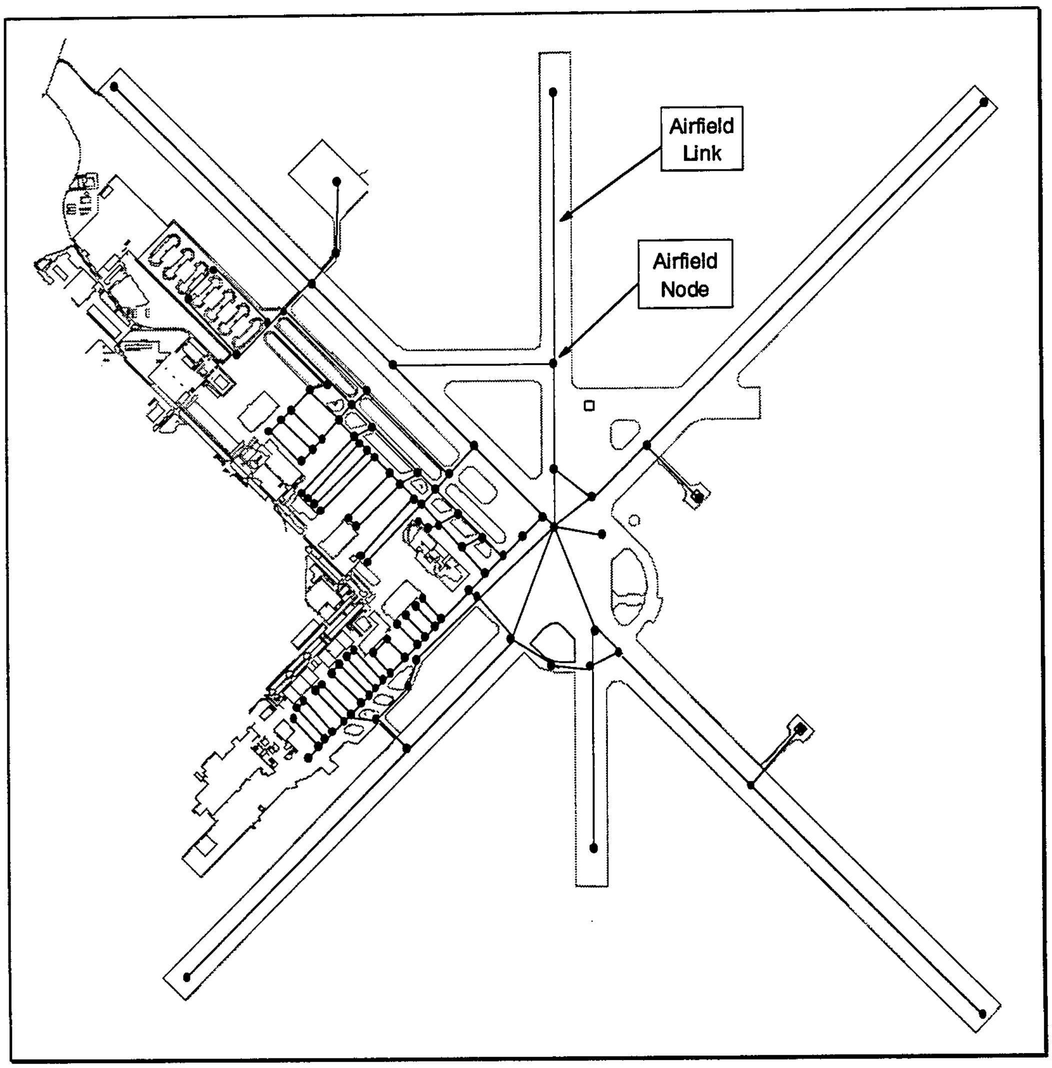


Figure 2-6: MCAS Cherry Point NASMOD Airfield Network

On the airfield, the nominal aircraft taxi speed is assumed to be 15 kts; however, taxi speeds along selected segments differ in order to reflect those areas of the airfield where aircraft tend to move faster or slower than this nominal speed (e.g., refueling pits). Departing aircraft maneuvering in the departure staging area, the centermat, are assumed to move slower than the nominal taxi speed; therefore, speeds in this area are also adjusted to lower than the nominal.

The airfield is open 24 hours per day, but overhead break arrivals and touch-and-go operations are limited to the hours between 0700 and 2300 (all times are local). Navy FCLP operations, however, can be scheduled after 2300; by modeling no restriction on the scheduling times for FCLPs, a better understanding of the extent of potential impacts could be attained for analysis purposes. MCAS Cherry Point ATC personnel supported this modeling approach, which in fact reflects current operating procedures that allow squadrons to request extended airfield hours. The airfield is closed on all federal holidays.

Aircraft are separated based on standard FAA and military operating procedures for aircraft separation. When the weather condition changes at the air station, departure and arrival procedures change. Aircraft are released at greater intervals when the weather is below basic VMC. Aircraft operating under IFR are always separated by at least 3 NM from other traffic.

Future operations by VMU-2, an unmanned aerial vehicle (UAV) squadron of about four aircraft, will be infrequent and are assumed to have little impact on existing operations.

2.2.4 MCALF Bogue Field Operations

MCALF Bogue Field is the primary location for AV-8 forward base operations training and field carrier landing practice. The AV-8 training squadron is the primary user of this airfield; however, along with normal AV-8 fleet squadron usage, one large exercise per year is conducted at Bogue Field, and various smaller exercises with different services are performed throughout the year.

Bogue Field is open 10 hours per day Monday through Thursday with opening times as early as 0600. The field is open 0900–1200 Friday, and closed on the weekends. However, the field will open for weekends and after-hours during special exercises. Most operations are scheduled between 0900 and 2200, with only a few instances of after-hours and weekend operations during the year. The field is closed when MCAS Cherry Point is closed for holidays.

All operations are scheduled, and closed-field operations are not permitted. Priority for scheduling is equal among MCAS Cherry Point-based squadrons, except for Navy and Marine Corps exercises which have the highest scheduling priority. All other Marine Corps aircraft have third priority, all other Navy aircraft have fourth priority, and all other military aircraft have the lowest priority.

2.3 Airspace Operations

Air routes associated with NAS Oceana and MCAS Cherry Point operations are modeled within NASMOD as a node/link network similar to the one representing the airfield. These routes are modeled using descriptions from flight publications and information collected during interviews with pilots and ATC personnel. Airspace nodes are placed at physical positions where aircraft interact or where significant events in terms of aircraft movements occur (e.g., crossing points, altitude restrictions, route mergers).

NASMOD routes for airport traffic areas represent the nominal radar vector and VFR flight paths used in controlling aircraft in the airspace for ground controlled approaches (GCAs), carrier controlled approaches (CCAs), visual and instrument patterns, and VFR traffic within a five-statute-mile radius of the airport. Flights arriving, departing, and operating within the studied airspace on published IFR routings are modeled in accordance with current en route and terminal separation standards. Routings within the airspace that are normally utilized for VFR operations are modeled as published and as described by pilots and ATC personnel.

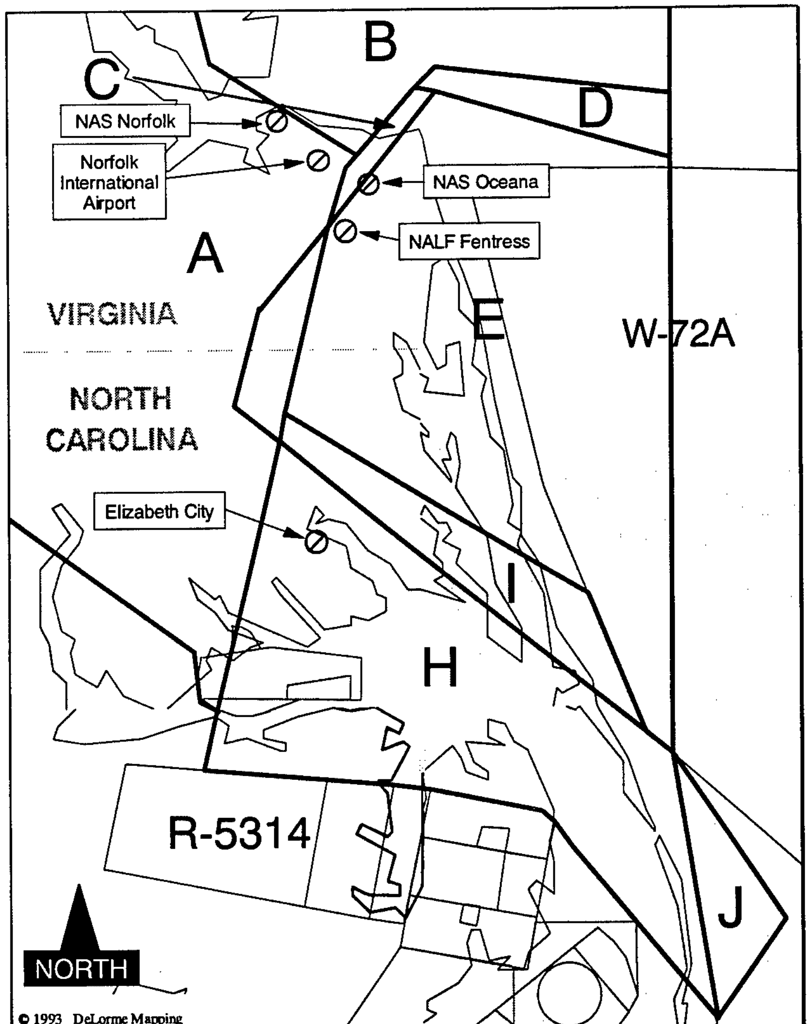
Aircraft speeds are modeled in accordance with Federal Air Regulations and pilot descriptions of aircraft performance characteristics for profiled activities. The definition of links and associated speed data accounts for speed variations based on aircraft type, the state of flight, and local procedures. Maximum, minimum, and nominal flight speeds for a link are based upon operating characteristics of specific groups of aircraft (i.e., heavy jet, large jet, military jet, military prop, and helicopter) and are used in simulating traffic movements, including allowable controller speed control and spacing actions. Standard rates of climb and descent for the general categories of aircraft are also incorporated into the routings. NASMOD in-trail spacing requirements are consistent with actual air traffic procedures. Wake turbulence spacing is applied as necessary between aircraft of different weight classes.

2.3.1 NAS Oceana Airspace Description

The NAS Oceana Radar Air Traffic Control Facility (RATCF) provides radar air traffic control services for all controlled airspace delegated to NAS Oceana RATCF by the FAA's Washington Air Route Traffic Control Center and Norfolk Approach Control as defined by letters of agreement. While this serves primarily NAS Oceana and NALF Fentress, several other small, uncontrolled general aviation and military airfields are located within the RATCF's airspace. This region encompasses much of the Atlantic coast from the mouth of the Chesapeake Bay to the northern end of Pamlico Sound. See Figure 2-7 for approach control boundary depiction and stratification descriptions.

Washington Air Route Traffic Control Center (ARTCC), Fleet Area Control and Surveillance Facility, Virginia Capes (FACSFAC VACAPES), and MCAS Cherry

Point Approach Control also have air traffic control responsibilities in close proximity to the region.



Sub-Area	Norfolk Approach Control	NAS Oceana Approach Control	FACSFAC VACAPES
A	surface to FL230	—	—
B	surface to FL230	—	—
C	4000 to FL230	surface to 3,000	—
D	11,000 to FL230	surface to 10,000	—
E	—	surface to FL230	—
H	surface to 10,000	11,000 to FL230	—
I	surface to 4,000	5,000 to FL230	—
J	surface to 10,000	—	11,000 to FL230

Figure 2-7: Norfolk/NAS Oceana Approach Control Airspace

2.3.2 NAS Oceana and NALF Fentress Routes and Patterns

The NASMOD airspace network is constructed to permit the analyst to accurately model distances between key spatial locations at which interactions between aircraft may occur. The distances defined by the airspace network correspond to actual flight track lengths. Figure 2-8 shows a geographic depiction of the modeled flight tracks associated with the Runway 5 plan at NAS Oceana and NALF Fentress.

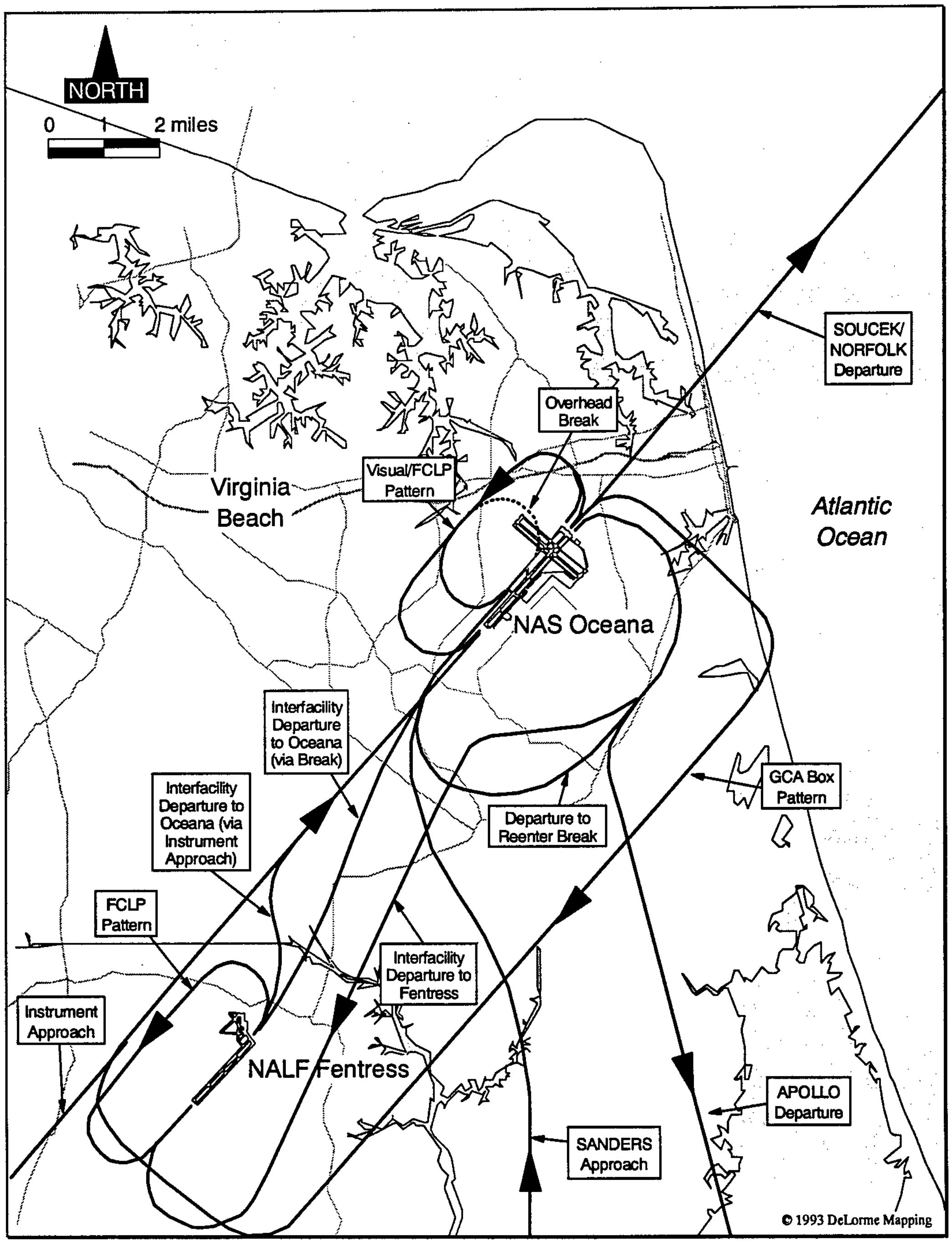


Figure 2-8: NAS Oceana Flight Tracks Modeled for Runway 5 Operations

The frequently used, published routes are:

APOLLO Departure: This standard departure follows the 175° NTU (NAS Oceana) Tactical Air Navigation (TACAN) radial. Aircraft departing the field climb to 1000 feet (altitudes in MSL) and maintain until clear of the VFR pattern. Aircraft then execute a right turn from Runways 5 and 14 and a left turn from Runways 23 and 32 to intercept the radial within four nautical miles (NM) of the TACAN. The left turn from Runway 32 should be made within two NM. Aircraft should climb above 11,000 feet within 38 miles along the radial. There are a number of transitions along this route for entry into W-72, the W-72 Tactical Aircrew Combat Training System (TACTS) range, R-5314 and the Navy Dare County Bombing Range, R-5313, Stumpy Point MOA, Pamlico MOA, and W-122.

SOUCEK Departure: Aircraft on this standard departure climb straight from Runway 5 or execute left turns above 3500 feet from Runways 14, 23, and 32 to intercept the 95° radial of the Norfolk International Airport Very High Frequency Omnidirectional Range Tactical Air Navigation (VORTAC) transmitter. Transitions take aircraft into W-386 and W-72.

NORFOLK Departure: Aircraft on this standard departure climb to 1500 feet while maintaining their runway heading. They are then given radar vectors to their appropriate transition or fix. A flight track to the SCHOL fix has been modeled for missions using the military training routes (MTRs) to the west.

SANDERS Approach: Aircraft on this standard approach intercept the 193° NTU TACAN radial within 29 NM at altitudes between 4500 feet and 6500 feet. When three NM from the airfield, they turn to fly the three-NM arc until they intercept the duty runway extended center-line, at which point they turn to enter the break or land.

LIGHTSHIP Approach: This standard approach is available only to runways 23 and 32. Aircraft on this approach intercept the 83° NTU TACAN radial within 16 NM at altitudes between 4500 feet and 6500 feet. When three NM from the airfield, they turn to fly the three-NM-radius arc until they intercept the duty runway extended center-line, at which point they turn to enter the break or land.

Two patterns are used at the NAS Oceana airfield for visual and instrument approach training. The visual pattern, also called the tower pattern, is a left-hand pattern in which aircraft conduct touch-and-go operations to Runway 5L. FCLP operations also use this pattern. Aircraft operate at 1000 feet AGL (above ground level) on the downwind leg of this pattern. ATC limits five aircraft to the tower pattern. Aircraft enter the visual pattern from the overhead break approach (most common), a straight-in visual approach, a transition from an instrument approach to Runway 5R, or directly after take-off. The instrument pattern, or GCA box pattern, is a right-hand pattern to Runway 5R. Instrument approaches involve shallower approach angles, hence a larger distance from an initial point to the runway, than visual approaches. For modeling purposes, ATC personnel stated that a reasonable maximum number of aircraft in the GCA pattern at one time is eight aircraft.

The NALF Fentress pattern is designated as the airspace below 1000 feet and within 1¾ nautical miles from the center of the airfield. This auxiliary field is used only under VFR or Special VFR (SVFR) conditions. Interfacility departures from NAS Oceana to NALF Fentress use the following procedures:

NALF Fentress duty runway is 5: NAS Oceana Runway 5 and 14 departures execute right turns within 3 nautical miles to intercept the 201° (VFR) or 213° (SVFR) NTU TACAN radial. They follow the radial at or below 1500 feet (VFR) or as assigned (SVFR) to 11 nautical miles from the TACAN at which they execute a right hand turn and enter NALF Fentress pattern via the break at 1000 feet. NAS Oceana Runway 32 departures execute left turns within 3 nautical miles to intercept the 233° (VFR) or 213° (SVFR) NTU TACAN radial. They follow the radial at or below 1500 feet (VFR) or as assigned (SVFR) to 11 nautical miles from the TACAN at which they execute a left (VFR) or right (SVFR) hand turn and enter NALF Fentress pattern via the break at 1000 feet.

NALF Fentress duty runway is 23: All NAS Oceana departures execute turns within 3 nautical miles to intercept the 223° NTU TACAN radial. They follow the radial at or below 1500 feet (VFR) or as assigned (SVFR) and directly enter NALF Fentress pattern via the break at 1000 feet.

Interfacility departures from NALF Fentress to NAS Oceana use the following procedures:

NAS Oceana duty runway is 5: NALF Fentress departures proceed directly to NAS Oceana for a straight-in approach.

NAS Oceana duty runway is 14: NALF Fentress Runway 5 departures proceed directly to NAS Oceana and enter the downwind leg of the tower pattern. NALF Fentress Runway 23 departures turn left and proceed to NAS Oceana via the STUMPY LAKE fix and enter the base leg of the tower pattern.

NAS Oceana duty runway is 23: NALF Fentress departures turn right and proceed to NAS Oceana via the PUNGO fix and enter the downwind leg of the tower pattern.

NAS Oceana duty runway is 32: NALF Fentress Runway 5 departures turn right and proceed to NAS Oceana via the PUNGO fix and enter the base leg of the tower pattern. NALF Fentress Runway 23 departures turn left and proceed to NAS Oceana via the PUNGO fix and enter the downwind leg of the tower pattern.

The upwind leg of NALF Fentress visual or FCLP pattern is a maximum of 1.5 miles for Runway 5 and a minimum of 1.7 miles for Runway 23. The pattern altitude is 800 feet. Coordination by a landing signal officer (LSO) is required when more than one aircraft is in the pattern.

2.3.3 MCAS Cherry Point Airspace Description

The MCAS Cherry Point RATCF provides radar air traffic control services for airports and air traffic operations within Alert Area 530 (A-530), the Restricted Area 5306 complex (R-5306A, C, D, and E), and portions of Warning Area 122 (W-122) at-or-below 17,000 feet, and in other areas where altitudes and airspace structures are specified by letters of agreement. Figure 2-9 depicts the modeled approach control airspace boundaries and stratification. Air traffic control responsibilities for R-5313 and R-5314 are delegated by Washington ARTCC to FACSFAC VACAPES when these areas are in use by military units.

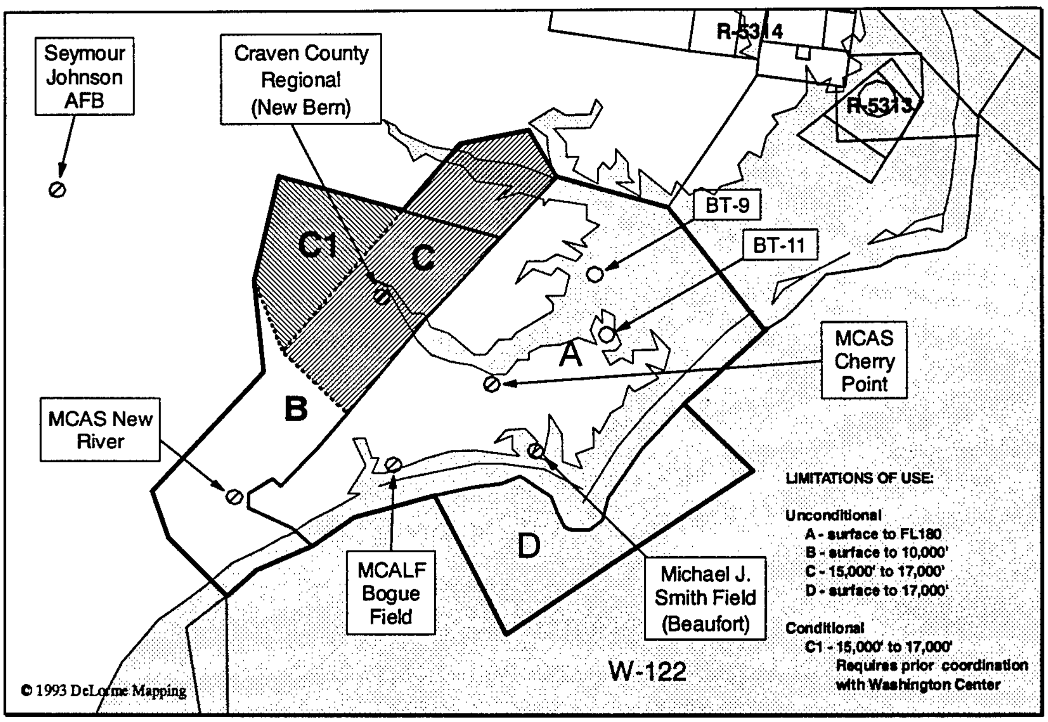


Figure 2-9: MCAS Cherry Point Approach Control Airspace

Since the commissioning of this study, a proposal has been made to modify the boundaries of the MCAS Cherry Point Approach Control Airspace by increasing the volume of airspace under the MCAS Cherry Point RATCF's control by approximately 300 percent, with lateral boundaries stretching to R-5314. Personnel at MCAS Cherry Point RATCF stated that the change will increase the quality of services (e.g., improved radar and radio coverage for several airports, improved traffic flow efficiency due to new airspace sectorization) provided to aircraft operating in the new airspace but will not have significant impacts on military and civilian traffic routings.

2.3.4 MCAS Cherry Point Routes and Patterns

The route and pattern structure at MCAS Cherry Point has similar elements as that of NAS Oceana. GCA, visual touch-and-go, and FCLP patterns, depart-and-reenter to the overhead break, overhead arrival, straight-in arrival, and departure routes exist. In addition, arrival routes to the AV-8 pads are modeled. The MCAS Cherry Point flight tracks are shown in Figure 2-10.

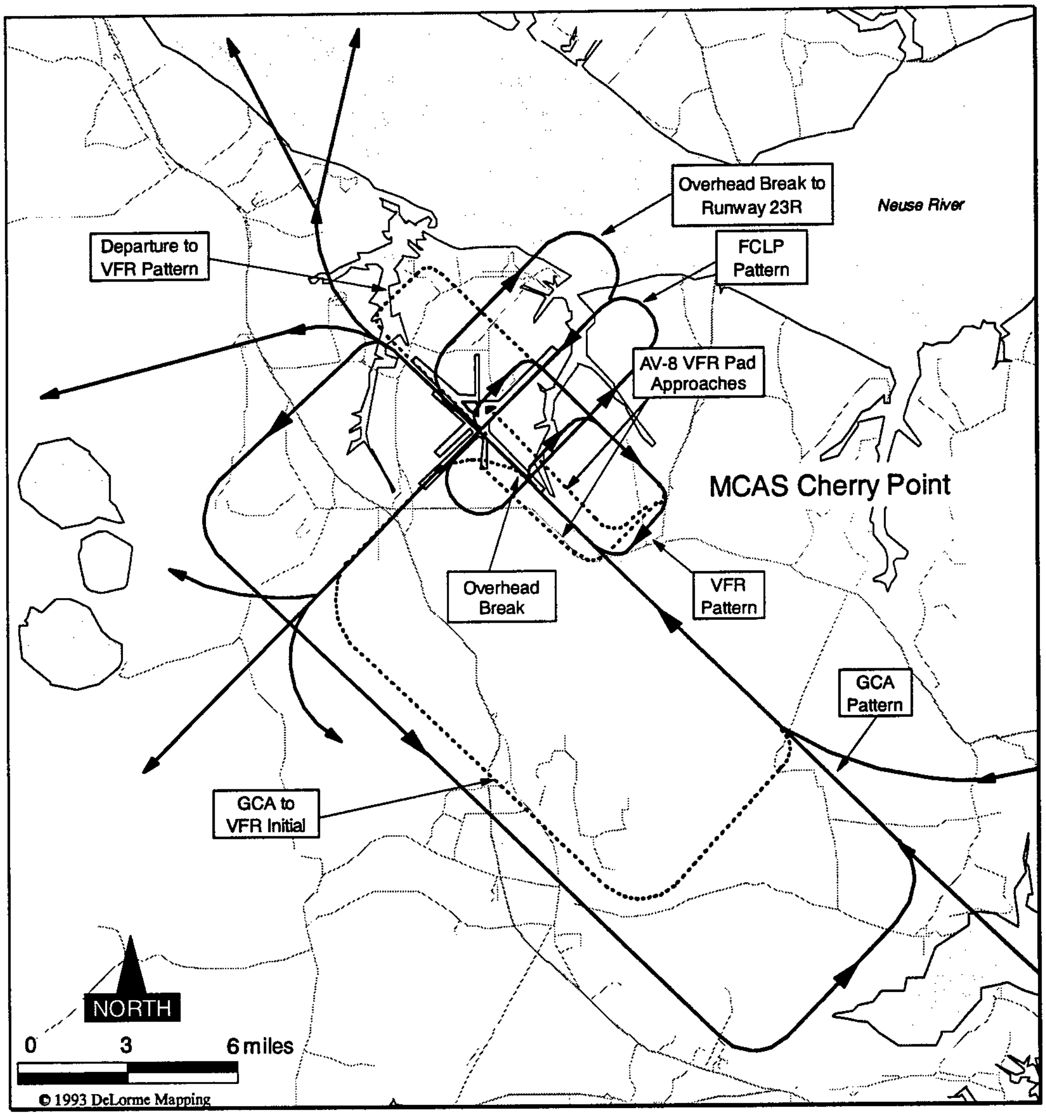


Figure 2-10: MCAS Cherry Point Flight Tracks Modeled for Runway 32 as the Primary Duty Runway

Analysts relied on data provided by MCAS Cherry Point-based ATC personnel and pilots to develop routes, speeds and altitude profiles to build representative profiles of arrival and departure flight paths, including nominal radar vector paths, within the terminal area. Flights arriving, departing, and operating within the studied airspace on published IFR routings are modeled in accordance with current en route and terminal separation standards. Unlike NAS Oceana, MCAS Cherry Point does not have published standard departure routes. Routings within the airspace that normally utilize VFR are modeled as published and as described by pilots and ATC personnel. The flight paths to and from the air station and local training areas are direct routings to fixes and transfer control points, which are established by MCAS Cherry Point ATC and other ATC facilities in the area. Several stereo routes are also available.

The tower traffic pattern for Runway 32L/R is right-handed at 1000 feet AGL. Overhead breaks are made at 1500 feet AGL. The GCA pattern is left-handed at 1500 feet AGL. For modeling purposes, nominal capacities for the tower and GCA patterns have been designated as six and nine aircraft, respectively. A maximum of six aircraft conducting touch-and-go operations in the tower pattern was determined by ATC personnel as a reasonable (average) maximum to be used in the model. In this runway plan, it is assumed that three pads for AV-8 V/STOL operations are utilized: north, south, and northeast pads.

When the tower pattern is busy (i.e., six aircraft are conducting visual touch-and-go operations), aircraft returning to base via the overhead break do so over Runway 32R to a right downwind leg for a full-stop, straight-in arrival to Runway 23R.

Carrier FCLP operations are performed on Runway 23R in a left-hand pattern at 600 feet AGL. No other operations at the airfield except departures and full-stop arrivals are permitted during the FCLP period. A maximum of six aircraft in the FCLP pattern is allowed, and up to four aircraft can operate in the automated carrier landing system (ACLS) pattern. Aircraft arriving at the airfield when FCLPs are in progress perform a straight-in full stop landing. Note that Navy F/A-18 FCLP operations are performed exclusively at MCAS Cherry Point and not at MCAS Bogue Field.

AV-8 squadrons also perform FCLP operations, but these operations consist of vertical landings on a painted carrier deck at MCALF Bogue Field, which has heat-resistant, aluminum matting for runway surfaces and can sustain the intense heat from an AV-8 aircraft's downward thrust during a vertical landing and departure. Occasionally, AV-8 fleet squadrons will conduct forward base operations (FBO) qualifications at MCAS Cherry Point instead of at MCALF Bogue Field. FBOs consist of rolling vertical landings and short field take-offs and, at MCAS Cherry Point, are performed on Taxiway Foxtrot. The FBOs on Taxiway Foxtrot prohibit FCLPs on Runway 23R.

2.3.4.1 Description of the Proposed Parallel Runway at MCAS Cherry Point

The following descriptions of the parallel runway and its potential effects on pattern operations and runway usage are preliminary. The parallel runway is proposed only in conjunction with the realignment of five Navy F/A-18 fleet squadrons to MCAS Cherry Point (ARS-5). The impetus for the addition of this runway is threefold: decrease the impact of carrier FCLP operations, decrease the interactions between aircraft arriving and departing the airfield and those conducting pattern operations (resulting in reduced delays), and increase the capacity and efficiency of the airfield. The presentation of operational descriptions of the parallel runway focus on details necessary for the potential future implementation of the runway in the NASMOD model.

Runway 23L, the designation of the new runway, is (at least) 8000 feet in length and 400 feet wide with its centerline 1000 feet from Runway 23R. The current Runway 23L is renamed to Runway 23C and is still used for departures. Runway 23 (L/R/C) becomes the duty runway as well as the calm wind runway, which is currently Runway 32. Runway 32 remains the primary instrument runway. (Note that the approach weather minimums are low for Runway 23, but the lowest minimums are for approaches to Runway 32. Runway 32 also has better lighting, and its instrument approach path does not interfere with the restricted area (R-5306A) as does for the approach corridor for instrument arrivals to Runway 23.)

Taxiways connect Runways 23R and 23L at the approach end, midway, and at the centermat end of the runways. The Northeast Harrier pad (located east of Runway 23R) is no longer available. This pad will be replaced, but the exact location has yet to be determined. ATC personnel suggest that the new pad will be located to the west of Runway 23R such that the approach to this new pad will not interfere with the approaches to the North Harrier pad nor with operations at the rifle range.

During the Runway 23 plan, VFR touch-and-go operations are conducted on the new Runway 23L in a left-hand pattern. Approaches to the Harrier pads are performed from this pattern. Instrument approaches are made to Runway 23R. VFR full-stop arrivals from the tower pattern can be made to either Runway 23R or 23L, depending on traffic conditions. Full-stop arrivals from the tower pattern with mixed traffic (e.g., AV-8s with EA-6s or F/A-18s) are typically performed to Runway 23R.

FCLP operations are performed on Runway 23L in a left-hand pattern at 600 feet AGL (for F/A-18s). During FCLP operations, the tower pattern operations are shifted to Runway 23R in an "up and out" left-hand pattern that is at least 1100 feet AGL and wider and longer than the FCLP pattern. Instrument arrivals remain to Runway 23R. The South and Southeast Harrier pads are not available during FCLPs.

In the current model and under the Runway 32 plan in the parallel runway scenario, FCLP flights are centrally scheduled such that non-FCLP flights that desire to conduct pattern operations have their launch times adjusted in order to "avoid" returning to base during a FCLP period. Note that FCLP flights do not have a higher priority than flights that conduct normal pattern operations; FCLP and non-FCLP flights that have potentially overlapping pattern times are adjusted to avoid conflict. (It is a random selection for missions with equal priority for scheduling.) During the Runway 23 plan, on the other hand, FCLPs can occur on Runway 23L without taking away the ability for tower and instrument pattern operations. FCLP missions do not need to be scheduled centrally such that the launch times of non-FCLP flights might be adjusted. Also, FCLP missions will not be affected by normal pattern operations. As a consequence, we can expect the simulation to show that nighttime FCLPs will be scheduled earlier on average during the Runway 23 plan than during the other plans.

With the introduction of the parallel runway, runway utilization will be altered. Currently, Runway 32 is designated the calm wind runway, but after the addition of the new runway, Runway 23 becomes the calm wind runway. The calm wind condition, during which the wind is three knots or less, occurs about 15 percent of the time at MCAS Cherry Point. Table 2-2 shows the percentage of time that each runway is designated as the duty runway for the current airfield layout (from historical data) and for the parallel runway scenario (estimated).

Table 2-2: Percentage of Time Runways at MCAS Cherry Point Designated as Duty Runway

Runway	Current airfield layout	With parallel runway (est.)
23	33%	48%
32	43%	28%
14	9%	9%
5	15%	15%

2.4 Training Areas

The training areas analyzed in this study are those used primarily by military units in the MCAS Cherry Point and NAS Oceana region. Table 2-3 lists the training areas in which demand from all users is modeled.

Table 2-3: Training Areas with Fully Modeled Demand

Training Area	Scheduling Notes and Comments
W-72 TACTS range	Scheduled exclusive-use for activities requiring TACTS instrumentation.
R-5314/ Navy Dare County	Primarily scheduled for exclusive-use activities.
Phelps MOA	Located above R-5314. Scheduled in conjunction with high-altitude air-to-ground missions at R-5314. (Not yet approved special use airspace)
BT-11	Target scheduled exclusive-use.
BT-9	Target scheduled exclusive-use.
R-5306A	Operations conducted exclusively outside of BT-9 and BT-11. Can be scheduled exclusive-use for exercises.
W-72	Primarily scheduled for concurrent-use activities. W-72 statistics do not include TACTS range activity.
W-386A/B	Concurrent-use airspace. Primarily used by Langly AFB units in exclusive-use sub-areas.
W–386D	Primarily used as an air-to-air gunnery range.
W-122	Concurrent-use airspace MCAS Cherry Point, Seymour Johnson AFB, and Pope AFB units.

The training areas analyzed with the demands of only NAS Oceana and MCAS Cherry Point tenant squadrons include R-5306D, military training routes, the Fort Picket range, and the Stumpy Point Range (R-5313). The reported annual utilization for each area is categorized by user.

The internal boundaries of the warning areas administered by FACSFAC VACAPES (i.e., W-122, W-386, W-72, W-108) were modified to incorporate special operating areas (SOAs) after the design of this study. Subareas A, B, and D of W-386 no longer exist. The SOAs provide users the ability to schedule subareas within the warning areas exclusively. The alteration to operations, capacity, and utilization of these warning areas is not addressed in this study but may be studied in future analyses.

The following sections give key scheduling and operational assumptions for the training areas.

2.4.1 W-72 TACTS Range

The W-72 Tactical Aircrew Combat Training System (TACTS) range lies in the southwest region of W-72A and has published operating hours on weekdays of 0700–1800 during the summer and 0700–1700 during the winter. At other times and during weekends, the TACTS range can be scheduled on an overtime basis. This system permits the tracking and recording of the position and attitude of aircraft equipped with TACTS instrumentation while on the range. The system is primarily used to enhance the effectiveness of air-to-air combat training. Normally, only one event at a time is scheduled in the TACTS range due to limited airspace. Several aircraft can participate in the event (up to 36 aircraft at one time). The range can also be scheduled as "area only" for events that do not employ the TACTS instrumentation.

This range is scheduled in 30-minute blocks by the Navy Fighter Wing One, Atlantic.

2.4.2 Navy Dare County Range and Phelps MOA

The Navy Dare County Range is situated within the northern half of R-5314 and is scheduled on an exclusive-use basis for a variety of mission types, most of which are related to air-to-ground training. The southern half of R-5314 contains a similar range administered by the Air Force. This analysis addresses only the Navy Dare Range (i.e., northern half of R-5314). This range is available 0800–2400 Monday through Thursday and 0800–1600 Friday and Saturday. It is available at other times and on Sunday with special prior scheduling. Priority is given to Navy units Monday through Friday and Virginia Air National Guard units on Saturday.

The Phelps MOA is designed to be utilized in conjunction with high-altitude air-to-ground missions at R-5314, providing ingress airspace. The MOA, along with an Air Traffic Control Assigned Airspace (ATCAA) extension, "fills in" the airspace between Hatteras B ATCAA and R-5314, as depicted in Figure 2-11. By letter of agreement with FAA, the MOA can only be used as part of high-altitude bombing exercises in R-5314. Military aircraft avoid using the area for training that does not require a high-altitude ingress to the Dare County Range. The Phelps MOA is currently not an approved special use airspace (SUA), but for the purposes of this study, the airspace is assumed to be designated SUA.

This range is scheduled in 15-minute blocks by FACSFAC VACAPES.

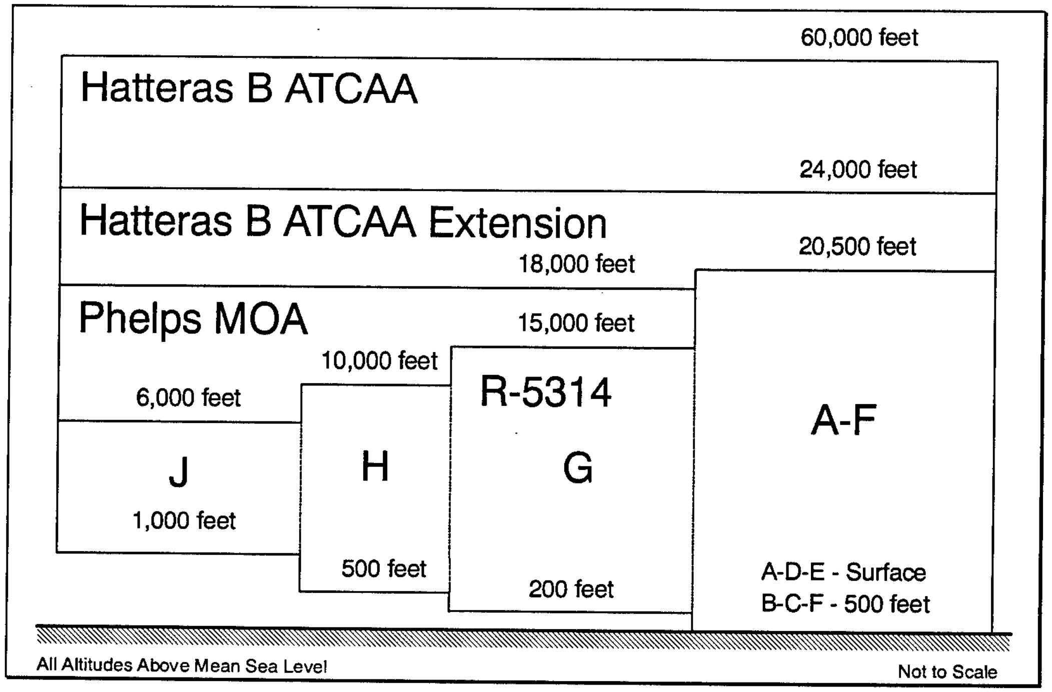


Figure 2-11: Schematic of Dare County Airspace (looking to the north)

2.4.3 BT-9 and BT-11

The BT-9 Brant Shoals Target and the BT-11 Piney Island Range are located within R-5306A. These targets are manned 0800–2300 Monday through Thursday and 0800–1500 Friday and are used for air-to-ground training. After-hours and weekend utilization is not modeled, except during special exercises such as JTFEX. These targets are scheduled in 20-minute blocks by MCAS Cherry Point Central Scheduling. Exercises have first priority, and all other users have equal scheduling priority.

2.4.4 R-5306A

Located to the north of MCAS Cherry Point, this restricted airspace is approximately 30 NM by 30 NM in size with altitudes surface to 17,999 feet MSL and contains bombing targets BT-9 and BT-11. Many of the flights that enter R-5306A are ultimately destined for these targets.

Other users of R-5306A conduct a wide variety of missions within the airspace. Missions utilizing the Cherry Point TACTS and Mid-Atlantic Electronic Warfare Range (MAEWR) that are not scheduling BT-9 or BT-11 have increased in number over the last few years. Also, various aircraft perform low-altitude training (LAT) along a course within the restricted airspace, and helicopters train at OLF Atlantic, an unmanned airfield in the southeast corner of R-5306A.

Currently, airspace managers place no restriction to the number of flights, each of which can contain any number of aircraft, allowed into R-5306A at one time. The capacity of BT-11 and BT-9 is more clearly defined since those training areas are scheduled exclusive-use. The capacity of concurrent-use airspace is based upon the pilots' comfort levels, which are directly related to the type of flights that are being conducted within the restricted airspace. Pilots suggested that a realistic limit to the number of flights inside R-5306A, exclusive of BT-11 or BT-9, is four, including aircraft on the LAT course but not including helicopters at OLF Atlantic. This assumption is not applied to exercises that schedule R-5306A exclusively.

R-5306A is scheduled by MCAS Cherry Point Central Scheduling.

2.4.5 R-5306D

Located within the Marine Corps Base (MCB) Camp Lejeune Complex and approximately 25 nautical miles to the south of MCAS Cherry Point, R-5306D is utilized by fixed-wing squadrons during close-air-support missions at Golf 10 (G-10) impact area, forward base operations at Lyman Road, and other missions involving troop support.

This restricted area is scheduled by MCB Camp Lejeune Range Control.

2.4.6 W-72

For the purpose of this analysis, W-72 is considered as the entire region of W-72A/B excluding the area associated with the TACTS range. This is because the W-72 airspace outside the TACTS range is used primarily on a concurrent-use basis while the TACTS range is scheduled on an exclusive-use basis. Most missions use W-72 concurrently, and during such times there is no limit imposed on the number of simultaneous missions or sorties. FACSFAC VACAPES informs missions wishing to use W-72 of the current state of the airspace (e.g., number of aircraft currently present) and can suggest possible available blocks of unused airspace within W-72. The airspace can be scheduled exclusive-use for special events (e.g., live missile fire). During such activities, the entire airspace, including the TACTS range, is reserved exclusively for the aircraft participating in the event.

2.4.7 W-386A/B

These two subareas of W-386 are situated to the northeast of NAS Oceana. Air Force and Air National Guard units have a higher priority for exclusive-use utilization of this airspace than the Navy. Missile launches from NASA Wallops Flight Facility have highest priority.

This airspace is administered by FACSFAC VACAPES and is scheduled by the Air Force Air Combat Command, First Fighter Wing.

2.4.8 W-386D

This subarea of W-386 is situated along the southeast edge of W-386A. While the Air Force has a higher scheduling priority for this airspace, they do not use this area due to its limited size. The Navy uses this airspace primarily for air-to-air gunnery training.

This airspace is administered and scheduled by FACSFAC VACAPES.

2.4.9 W-122

Like W-72, most missions use W-122 concurrently, and there is no limit imposed on the number of simultaneous missions or sorties. FACSFAC VACAPES performs the same services for W-122 users as for W-72 users. Portions of this large airspace can also be scheduled for exclusive-use for special events (e.g., live missile fire).

2.4.10 Military Training Routes

These are a collection of visual (VR) and instrument routes (IR) that are used by NAS Oceana and MCAS Cherry Point-based squadrons. Historically, the most commonly used routes at NAS Oceana have been VRs 1752, 1753, 1754, 1755, and 1758. Cherry Point Central Scheduling provides scheduling of four VR routes and one IR route: VRs 1040, 1041, 1043, 1046, and IR 23. VRs 1043 and 1046 terminate at R-5306A, and all of these routes lie to the south and east of MCAS Cherry Point. Combined historical utilization of the four Cherry Point VR routes is approximately 1400 sorties annually.

The MTRs are administered by a variety of agencies. This study only addresses the demand on the MTRs by NAS Oceana and MCAS Cherry Point squadrons.

2.4.11 Fort Pickett Range

The U.S. Army's Fort Pickett Range is adjacent to Fort Pickett, Virginia, and is about 90 nautical miles to the west of NAS Oceana. The range is composed of three restricted areas, R-6602A/B/C, and three MOAs, Pickett 1, Pickett 2, and Pickett 3, and is utilized by the Navy for F-14 and F/A-18 squadrons' close-air-support missions.

This range is scheduled by the Fort Pickett Directorate of Plans, Training, and Mobilization. Only NAS Oceana demand on this range is addressed in this study.

2.4.12 Stumpy Point Range

The Stumpy Point Range is located about 80 nautical miles south of NAS Oceana (75 miles north of MCAS Cherry Point) in Pamlico Sound. The range is composed of R-5313A/B and a target, which consists of a sunken landing ship tank that once measured 315 feet by 50-feet, but now is broken in several pieces. The target is scored, and only inert bombs and training rockets are authorized.

This range is scheduled by FACSFAC VACAPES.

2.4.13 The Proposed Core and Cherry 1 MOAs

This description of the Core and Cherry 1 MOAs is presented to inform the reader about the proposed MOAs, but these training areas are not included in this NASMOD study.

First proposed by the Marine Corps in 1985, the Core and Cherry 1 MOAs are adjacent to the southeast and northwest sides of R-5306A, respectively, as shown in Figure 2-12.

The establishment of the Core MOA will enable realistic tactical ingresses to R-5306A from the ocean (W-122) by permitting AV-8, F-14, F/A-18, and other military aircraft conducting strike, close-air-support, and other air-to-ground missions to operate at speeds in excess of 250 knots at altitudes below 10,000 feet MSL.

The establishment of the Cherry 1 MOA will significantly increase the overland training area in proximity to the BT-11, BT-9, and the MAEWR, which will provide flexibility in training locations and extend training opportunities. This MOA will provide protected airspace for tactical ingress and egress of overland strikes to targets within R-5306A. When not utilized for tactical training, the Cherry 1 MOA can relieve R-5306A demand of missions not requiring designated restricted airspace, such as familiarization flights.

The Core and Cherry 1 MOAs' descriptions, location process, and impacts on the local communities and environment are presented in the 1987 *Draft Environmental Impact Statement for Establishment of Cherry 1 and Core Military Operating Areas.*

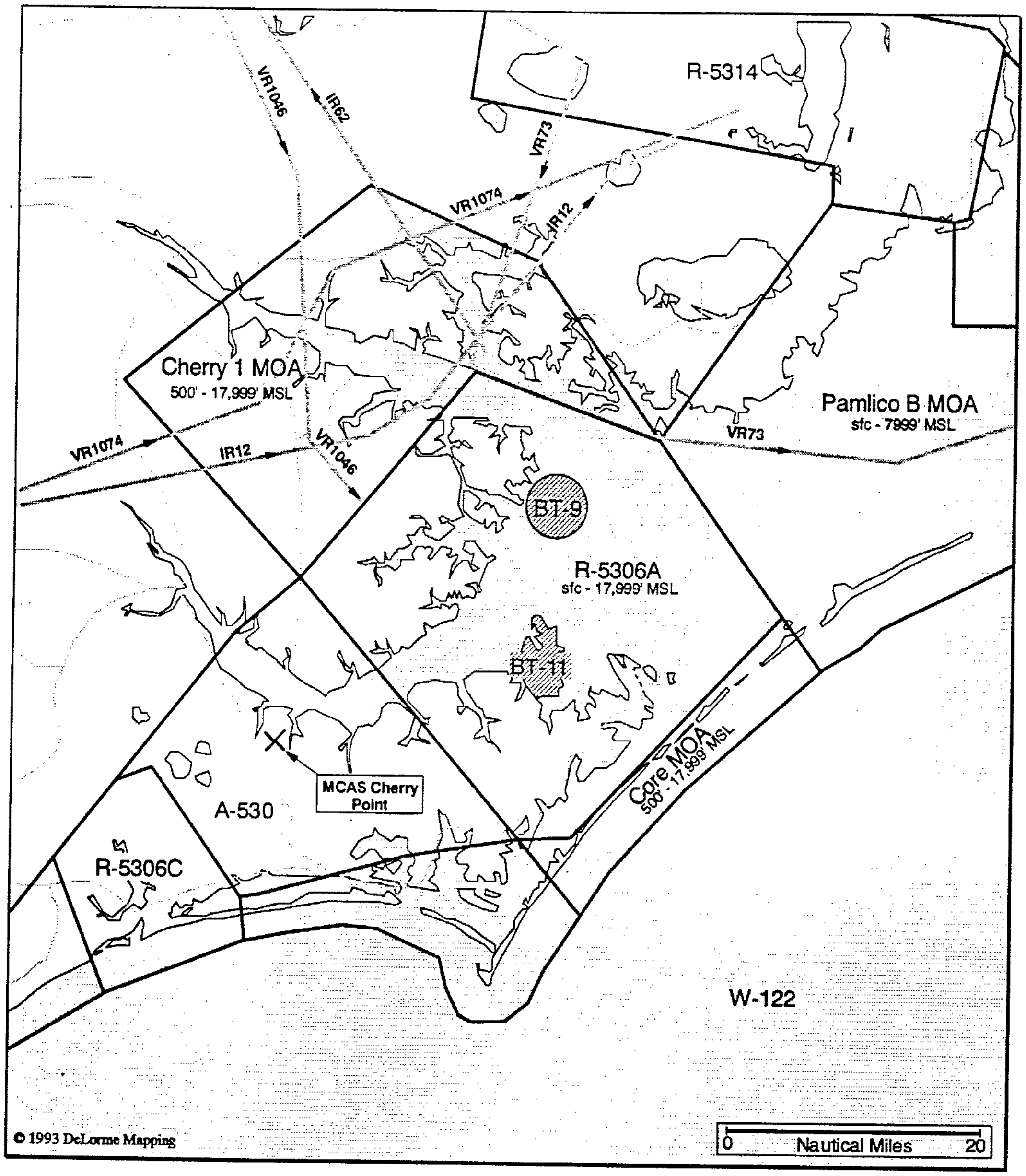


Figure 2-12: Proposed Core and Cherry 1 MOAs

2.5 Squadron Operations

Squadrons and their training operations are modeled using a diverse set of variables and characteristics. These include the number and type of units expected to reside at NAS Oceana and MCAS Cherry Point following the implementation of the BRAC 95 decisions, definition of the deployment and training cycles each unit follows, and descriptions of the types of missions and number of activities and operations performed during the defined training cycles.

2.5.1 Navy Fleet Squadron Operations

For the purpose of this study, Navy fleet squadrons are operational squadrons that deploy as part of a carrier airwing (CVW). This nomenclature distinguishes such Navy squadrons from other operational units, such as training and adversary squadrons, which do not perform carrier deployments. In this study, three types of Navy fleet squadrons are modeled: F-14 Fleet (Atlantic), F-14 Fleet (Pacific), and F/A-18 Fleet (Atlantic).

2.5.1.1 Workup Cycle Description

All of the fleet squadrons perform a sequence of training exercises to prepare for carrier deployment. These workups follow the pattern shown in Figure 2-13. There are approximately eighteen months of training prior to deployment followed by six months of deployed carrier operations. After a squadron returns from deployment, it recommences workups for its next deployment. These nominal cycles were developed in consultation with personnel from Naval Air Forces, Atlantic (AIRLANT), and Naval Air Forces, Pacific (AIRPAC), and are idealized schedules of milestones. In practice, squadrons rarely follow precisely these cycle since many of the factors that govern the schedule of carrier deployments, particularly overseas political and military commitments, can change rapidly.

During the eighteen-month workup period, a typical fleet squadron trains at its home air station and away on temporary detachments or at-sea exercises. The first month after return from deployment is generally a standdown period during which little flying is done and many squadron personnel take leave. A few aircraft may be reassigned to other squadrons that are closer to their deployment dates.

For the first six months of the workup, the training activities tend to be at the unit level. New and replacement aircrews are assigned to squadrons during these months or as early in the workup as possible. A strike/fighter detachment (S/F Det) may occur around the third month, consisting of approximately five aircraft and ten aircrews. A period of carrier qualifications (CQ) often occurs during the fifth month with an emphasis on getting the newer aircrews qualified. Another detachment, called Orange Air for Atlantic fleet squadrons, occurs during the sixth month. This may involve about 80 percent of the squadron in air-to-ground (A/G) training or as aggressors in training exercises with other, embarked squadrons.

AIRLANT Workup

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Event	POST DEPLOYMENT		S/F Det		C	Orange Air/AG			Sea Trials	SFARP		TSTA I/II	CVW DET		TSTA III/ C2X (Phase 1 & 2)		JTFEX	POM
Days	home		7 away		4 away	17 away			3 away	16 hom 12 away		16 away	21 away		52 away		20 away	home

AIRPAC Workup

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Event	POST DEPLOYMENT		S/F Det		C	AG Det			Sea Trials	SFARP		TSTA I/II	CVW DET		TSTA III/ C2X (Ph 1)		C2X (Ph 2)/ JTFEX	POM
Days	home		7 away		4 away	10 away			3 away	16 home 12 away		16 away	21 away		34 away		32 away	home

A/G Det	Air-to-Ground detachment
CQ	Carrier Qualifications (embarked)
CVW Det	Carrier air wing detachment at NAS Fallon
JTFEX	Joint Training Fleet Exercise, carrier air wing exercises (embarked)
Orange Air A/G Det	Air-to-Ground detachment, adversarial support for carrier-based exercises (variety of locations, e.g., NAS Roosevelt Roads)
S/F Det	Strike fighter detachment
SFARP	Strike fighter advanced readiness program detachment (dashed portion of box indicates that squadrons perform first part of this training at home)
TSTA	Tailored Ship Training Availability, three parts, carrier air wing exercise (embarked)
C2X	Competitive Training Unit Exercise, two phases, carrier air wing exercises (embarked)

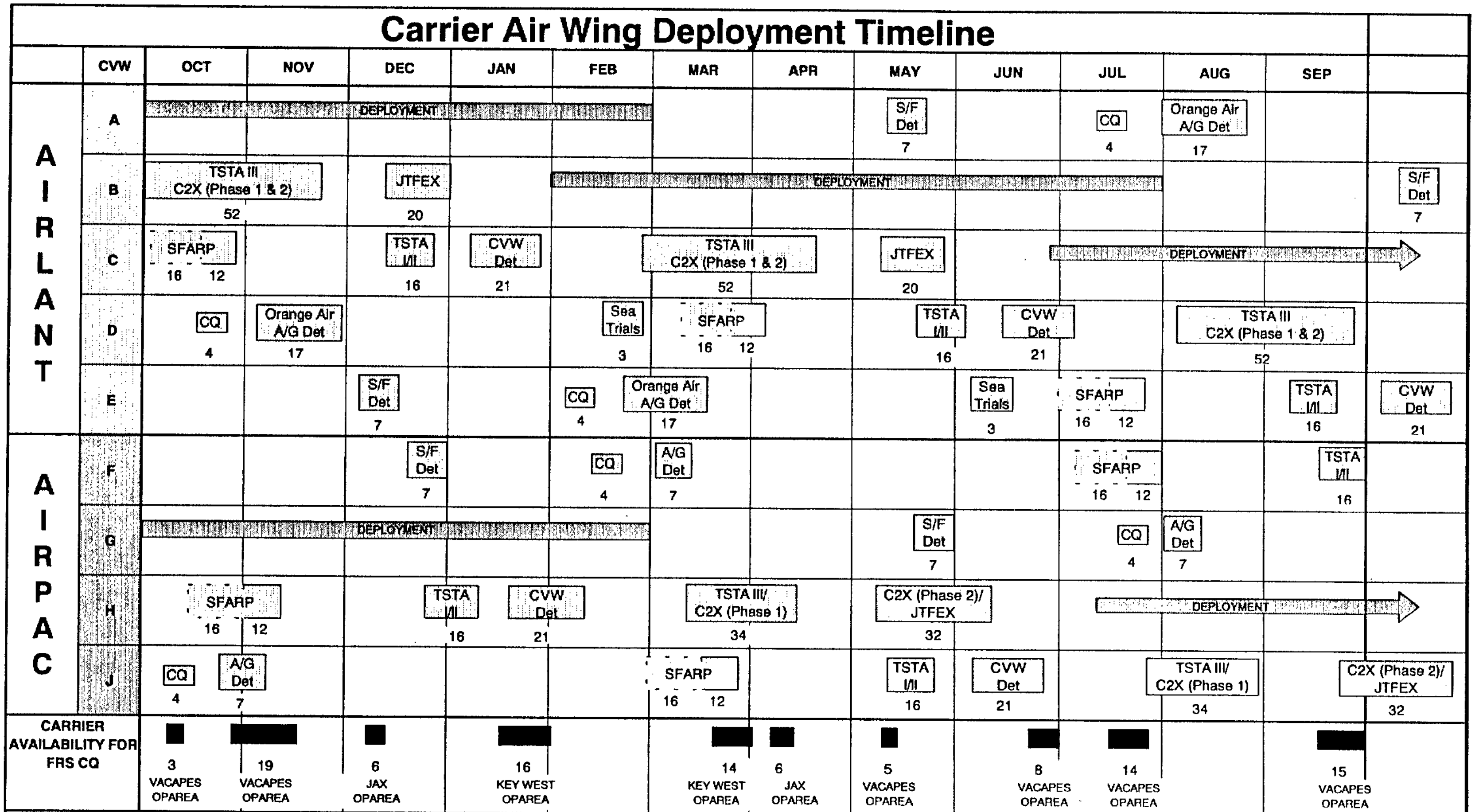
Figure 2-13: Navy Fleet Nominal Workup Cycles

Squadron operations through the next six months tend to incorporate greater levels of joint training with sister squadrons (i.e., other squadrons assigned to the same airwing). Squadrons may send some aircrews to support sea trials, which are dedicated primarily for the training of aircraft carrier and other ship-based personnel. Typically performed close to the first airwing exercise, SFARP is an intensive period of air combat training supported by adversary squadrons. For the first two and one-half weeks, Atlantic and Pacific fleet squadrons perform the air-to-air portion of SFARP locally in the TACTS range. The final week, the air-to-ground phase, is performed on detachment, frequently at NAS Fallon. Around the twelfth month, the entire airwing embarks for a series of Tailored Ship Training Availability (TSTA), during which they conduct joint training operations and coordinated activities at sea.

The remaining six months consist of increasing amounts of wing-level training during three large exercises. The carrier airwing detachment to NAS Fallon is three weeks long, consisting primarily of air-to-air and air-to-ground training. The TSTA III and Competitive Training Unit Exercise (C2X) are more at-sea exercises, which culminate with the Joint Training Fleet Exercise (JTFEX). Following successful completion of JTFEX, the carrier battlegroup is ready for deployment. During the final month before deployment, the squadrons' aircrews conduct local flights in the core mission types, perform maintenance flights and FCLP training, and take personal leave.

2.5.1.2 Airwing Deployment Cycles

Figure 2-14 depicts the workup, detachment, and deployment timeline assumed for NAS Oceana-based squadrons during a hypothetical future year after implementation of the BRAC 95-related decisions. The timeline is based on data provided by AIRLANT and AIRPAC. As discussed in the previous section, each carrier airwing participates in six-month deployments that are preceded (i.e., separated) by eighteen-month workup intervals. The carrier airwing deployments are staggered by about five months. A fifth Pacific fleet carrier airwing is based in Japan and does not have a significant effect on the operations at NAS Oceana and MCAS Cherry Point; consequently, it is not shown in the figure. This fifth airwing is on deployment from February to July.



Note: **Boxed events are performed away from NAS Oceana. The numbers under each box denote the durations of the detachments.**

A/G Det	Air-to-Ground detachment
CQ	Carrier Qualifications (embarked)
CVW Det	Carrier air wing detachment at NAS Fallon
JTFEX	Joint Training Fleet Exercise, carrier air wing exercises (embarked)
Orange Air A/G Det	Air-to-Ground detachment, adversarial support for carrier-based exercises (variety of locations, e.g., NAS Roosevelt Roads)
S/F Det	Strike fighter detachment
SFARP	Strike fighter advanced readiness program detachment (dashed portion of box indicates that squadrons perform first part of this training at home)
TSTA	Tailored Ship Training Availability, three parts, carrier air wing exercise (embarked)
TSTA III C2X (Phase 1 & 2)	Competitive Training Unit Exercise, two phases, carrier air wing exercises (embarked)

JAX	Jacksonville
VACAPES	Virginia Capes

Figure 2-14: Deployment Timeline for NAS Oceana-based Squadrons

The NASMOD simulation for this study is performed for a twelve-month period chosen such that the overlap of the deployment schedules results in an average loading of local flights at NAS Oceana. The contribution of local operations by different airwings varies considerably; however, simulating twelve months permits an analysis of the aggregate affects of the overlap of the deployment cycles. An additional benefit of simulating a full twelve months is that the effects of weather and other calendar-dependent events (e.g., holidays, sunrise/sunset time variation) can be observed.

2.5.1.3 Navy Fleet Squadron Training Requirements

Training requirements are the NASMOD data inputs for modeling the varying levels of training that each squadron type performs during its workup cycle. The training and readiness (T&R) matrices for each type of aircraft (e.g., F-14, F/A-18) were reviewed and the various flights were aggregated into mission types. The analysts and pilots then arranged the mission types into a frequency matrix. Using T&R currency and Navy flight hour funding guidelines, determinations were made as to the frequency of individual mission types during each month of the workup cycle. Each squadron's monthly mission allocations were adjusted across the turnaround cycle to ensure that an appropriate number of missions of each type are being flown during the workup cycle. The total number of monthly sorties and flight hours were also calculated to verify the month-by-month training levels. Finally, the portion of the total hours that is flown locally (i.e., to/from NAS Oceana or MCAS Cherry Point and excluding detachments and at-sea training) for each mission type was determined. Examples of monthly allocations of at-home Atlantic F-14 and F/A-18 fleet squadron sorties during a workup cycle are shown in Table 2-4 and Table 2-5, respectively.

For most mission types, a fleet squadron attempts to complete the allocated number of sorties for that type on any day during the month. However, FCLP training is designed to prepare pilots for carrier landings and, consequently, are performed as late as possible before an at-sea period to ensure that pilots' skills are current. For this study, all FCLPs allocated for a specific month of workup are restricted to the two-week period starting sixteen days prior to the next at-sea period. During this time, FCLP flights have scheduling priority within the squadron. With this plan, two free days after the last FCLP is performed provide time for the squadron to embark the carrier.

Table 2-4: Monthly Squadron Local Sortie Allocations by Mission Type during a Nominal F-14 Fleet Squadron Workup

				S/F Det ↓		CQ ↓	Orange Air A/G Det ←→			Sea Trials ↓	SFARP ←→		TSTA I/II ←→	CVW Det ←→		TSTA III/ C2X (Phase 1 & 2) ←→		JTFEX ←→	Deploy ↓	
MISSION TYPE	Hours per Flight / Month of Workup	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	TOTAL
Air Combat Maneuvers 1 v 1	1.0	6	6		12	8	4	16	6	15	18	12	4		18		6	5	5	141
Air Combat Maneuvers 2 v 2	1.2	6	6	4	8		7	16	20	18	20	18	5		18		7	5	30	188
Air Combat Maneuvers 2 v X	1.5	4	8	3	4		8		15	12	22	18	2		14		2	5	10	127
Air Combat Maneuvers 4 v X	1.5	4	8		4			4	5	2	18	4	2		10		2		8	71
Air Combat Tactics	1.5	12	12	18	12					4	16	4								78
Air Intercept Combat	1.8	6	6	6	6	24	8	16	10	6	18	10	2		7		8	10	10	153
Close Air Support	1.5		14	2			10	2	20	2			4	10				5		69
Carrier Qualification	1.0																			
Electronic Warfare	1.5		4	4	4	4		4	20		4	8	12	5						69
Forward Air Control	1.7		4	4	6	4	12	2	9	15	8	4	12		2			5		87
Functional Check Flight	1.2	8	10	4	10	4	6	12	19	15	15	15			10				15	143
Field Carrier Landing Practice	1.0					48				80			100		90			72	80	470
Bombing, Live	1.5							4												4
Bombing, Inert	1.5		12	8						25	4	12	5		15		4	4	20	109
Air-to-Air Gunnery	1.8				10				5				5		10					30
Air-to-Ground Strafe	1.4		2	3	6	4	5	10	5	5	5		5	2	4		2	4		62
Low Altitude Training	1.4				6	8	10			20		4			2					50
Low Level Navigation	2.0	8	6			6	30	15	10	15	2	6			8			5		111
Low Level Reconnaissance	1.8	12			6			6		5					10				6	45
Missile Shot	1.4						6					12								18
Strike	1.8	8	18	8	12			8				4			16			2		76
Weapons Air-to-Ground	1.5	20	12				10	16	5	10		8		2				2	10	95
Cross Country	2.4	2	12		6			6	4			6			6		2	2	8	54
Other Overhead	varies					12				20			16			8	8	8	20	92
TOTAL LOCAL SORTIES		96	140	64	112	122	116	137	153	269	150	145	174	19	240	0	41	134	222	2334

Table 2-5: Monthly Squadron Local Sortie Allocations by Mission Type during a Nominal F/A-18 Fleet Squadron Workup

				S/F Det ↓		CQ ↓	Orange Air A/G Det ←→			Sea Trials ↓	SFARP ←→		TSTA I/II ←→	CVW Det ←→		TSTA III/ C2X (Phase 1 & 2) ←→		JTFEX ←→	Deploy ↓	
MISSION TYPE	**Hours per Flight \ Month of Workup**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**TOTAL**
Similar Air Combat Training 1 v 1	1.1	17	34		17			10	10	17	8	8	12	6	18		8	10	20	195
Similar Air Combat Training 2 v 2	1.1	10	20	12	24	10	18	10	20	16	4	24	10	6	18		4	10	20	236
Dissimilar Air Combat Training 1 v 1	1.2				26	10		16	8		30	8			10				6	114
Dissimilar Air Combat Training 2 v X	1.2	10	17		16	14		8	18	10	30	6			20				6	155
Dissimilar Air Combat Training 4 v X	1.2		17					8	8		40	4			18					95
Dissimilar Air Combat Training 8 v X	1.1										34									34
Air Intercept Combat, Night Vision Goggles	1.4		21	17	14	16	14	8	12	12	8	8	8	8	18			10	20	194
Close Air Support	1.5		17		10	14		8	8			10			20					87
Multi-Sensor Integration	1.4		17	17	14	10	16	8	10	12	8	18	8	10	18			10	20	196
Precision Guided Munitions	1.6					10		12	12			10			16					60
Functional Check Flight	1.5					60				76			95		85			55	70	441
Field Carrier Landing Practice	1.2				17	17														34
Bombing, High-High	1.6	4	6	4	8	6	2	10	6	8		8	4		10		2		4	82
Bombing, Live Heavy Drop	1.6		9			15			8			10								42
Air-to-Air Gunnery	1.5								16											16
Air-to-Air Competitive Exercise	1.4											30								30
Mining Exercise	1.6					10														10
Low Level / Bombing, Day	1.6	10	8	4	12	6	4	10	10	12	4	14	2		4		2	4	2	108
Low Level / Bombing, Night Vision Goggles	1.6	4	4		8	4		8	4			4			4		2		4	46
Missile Shot	1.5											12								12
Strike	1.4			4	4	4	4	8	6	8			4		16			4	16	78
Air-to-Ground Competitive Exercise	1.6								14											14
Cross Country, Other Overhead	2.0																			
TOTAL LOCAL SORTIES		55	170	58	170	206	58	124	170	171	166	174	143	30	275	0	18	103	188	2279

2.5.1.4 F-14 Fleet Squadrons

There are eleven F-14 fleet squadrons based at NAS Oceana in the baseline scenario. These are composed of seven Atlantic fleet and four Pacific fleet squadrons. Squadron compositions are shown in Table 2-6. Many squadrons begin their workup with fewer than their full complement of aircrews and aircraft; however, as their deployment date gets closer, the squadrons are usually brought up to full strength. Typically, only ten aircraft per squadron are mission capable on a given day.

Table 2-6: F-14 Fleet Squadron Compositions

Squadron Type	Number of Squadrons	Aircraft per Squadron	Aircrew per Squadron
F-14 Fleet (Atlantic)	3	14	18
F-14 Fleet (Atlantic)	4	13	17
F-14 Fleet (Pacific)	4	14	18

The squadrons typically work Monday through Friday; however, weekends are utilized to catch up on incomplete training due to unforeseen events, such as bad weather and equipment failures. Cross-country flights and detachment transits are often (or primarily) flown during the weekend. The F-14 fleet squadrons occupy Hangars 500, 404, and 200 in the western-facing ramp area at NAS Oceana.

2.5.1.5 F/A-18 Fleet

All F/A-18 squadrons are assumed to be similar in composition and workup schedule. Each squadron is assumed to have 17 aircrews and 12 aircraft; however, on average only nine aircraft are mission capable on a given day.

Like the F-14 squadrons, the F/A-18 squadrons typically work Monday through Friday with "catch-up" training, cross-country flights, and detachment transits flown primarily on weekends. The F/A-18 fleet squadrons occupy Hangars 111 and 122 in the eastern-facing ramp area at NAS Oceana. At MCAS Cherry Point, they occupy Hangars 1665W, 131S, and 1700E as well as additional ramp space adjacent to Hangar 130 for ARS-5.

2.5.1.6 Navy Squadron Airwing Assignments

An important component of a squadron's impact over the course of a year on its home air station and the local training areas is its airwing assignment. After proposed carrier deployment cycles were determined by AIRLANT personnel and ATAC analysts, the composition of each airwing for each scenario was carefully selected in order to have an *average* impact over the year on NAS Oceana, MCAS Cherry Point, and the local training areas. Table 2-7 presents the Atlantic Fleet airwings' composition of Navy F-14 and F/A-18 squadrons for the alternative scenarios. Since the model is capturing a one-year "snapshot" of operations, some wings have a greater influence on local operations than others. To maintain an average impact on NAS Oceana and to introduce an average Navy F/A-18 impact on MCAS Cherry Point, it was necessary to modify the F/A-18 squadron contribution to Wing C and Wing E for ARS-3. Appendix C contains further discussion of this modeling approach.

Table 2-7: Atlantic Fleet Airwing Assignments for F-14 and F/A-18 Squadrons for the Alternative Scenarios

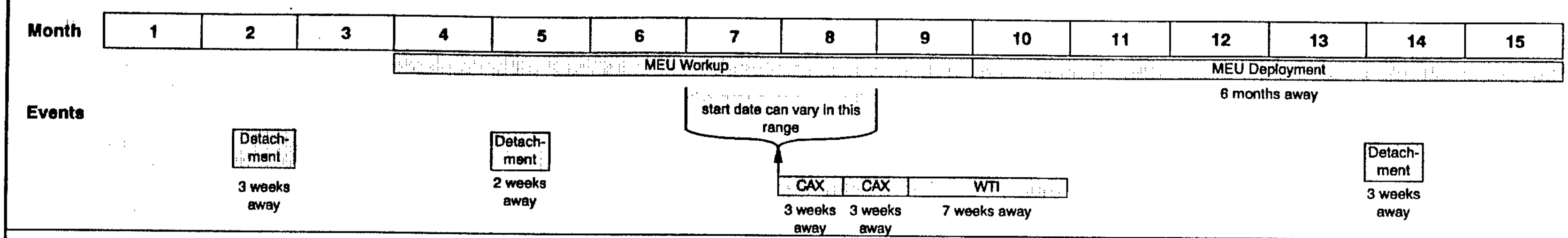
	Squadron Location	Wing A		Wing B		Wing C		Wing D		Wing E		Total	
		F/A-18	F-14	F/A-18	F-14	F/A-18	F-14	F/A-18	F-14	F/A-18	F-14	F/A-18	F-14
ARS-1	NAS Oceana	2	2	2	1	2	1	2	2	3	1	11	7
	MCAS Cherry Point											0	
	MCAS Beaufort											0	
ARS-2	NAS Oceana	2	2	2	1		1	2	2	3	1	9	7
	MCAS Cherry Point											0	
	MCAS Beaufort					2						2	
ARS-3	NAS Oceana	2	2	2	1		1	2	2	2	1	8	7
	MCAS Cherry Point					3						3	
	MCAS Beaufort											0	
ARS-4	NAS Oceana	2	2	2	1		1	2	2		1	6	7
	MCAS Cherry Point											0	
	MCAS Beaufort					3				2		5	
ARS-5	NAS Oceana	2	2	2	1		1	2	2		1	6	7
	MCAS Cherry Point					3				2		5	
	MCAS Beaufort											0	

2.5.2 Marine Corps Fleet Squadron Operations

There are three distinct types of Marine Corps fleet squadrons based at MCAS Cherry Point: AV-8, EA-6B, and KC-130. Each type follows a very different timeline or work cycle, which is described in the following subsections.

2.5.2.1 AV-8 Fleet Squadrons

There are three AV-8 fleet (or "gun") squadrons with 20 aircraft and 28 pilots each. These squadrons follow a repeating, 15-month cycle, as shown in Figure 2-15. Like a Navy fleet squadron, AV-8 fleet squadrons participate in a number of detachments and exercises. In addition, each squadron supports a Marine Expeditionary Unit (MEU) deployment with six aircraft and ten pilots. AV-8 sortie allocations were developed following the method described for the Navy fleet squadrons. The simulated calendar year timeline is given in Figure 2-16 and shows the overlap of each AV-8 squadron's work cycle. The squadrons typically work Monday through Friday; however, weekends are utilized to catch up on incomplete training due to unforeseen events, such as bad weather and equipment failures.



Detachment	Each detachment has a specific training focus such as air-to-ground, night systems, air interdiction. Approximately 12 aircraft and all pilots particpate.
CAX	Combined arms exercise. Primarily close air support training.
WTI	Weapons tactics instructor. 2 - 4 aircraft and 1 -2 pilots participate.
MEU Workup	Marine Expeditionary Unit workup period. 10 pilots train for future deployment.
MEU Deployment	Marine Expeditionary Unit deployment. 6 aircraft and 10 pilots participate.

Figure 2-15: AV-8 Fleet Squadron Nominal Workup Cycle

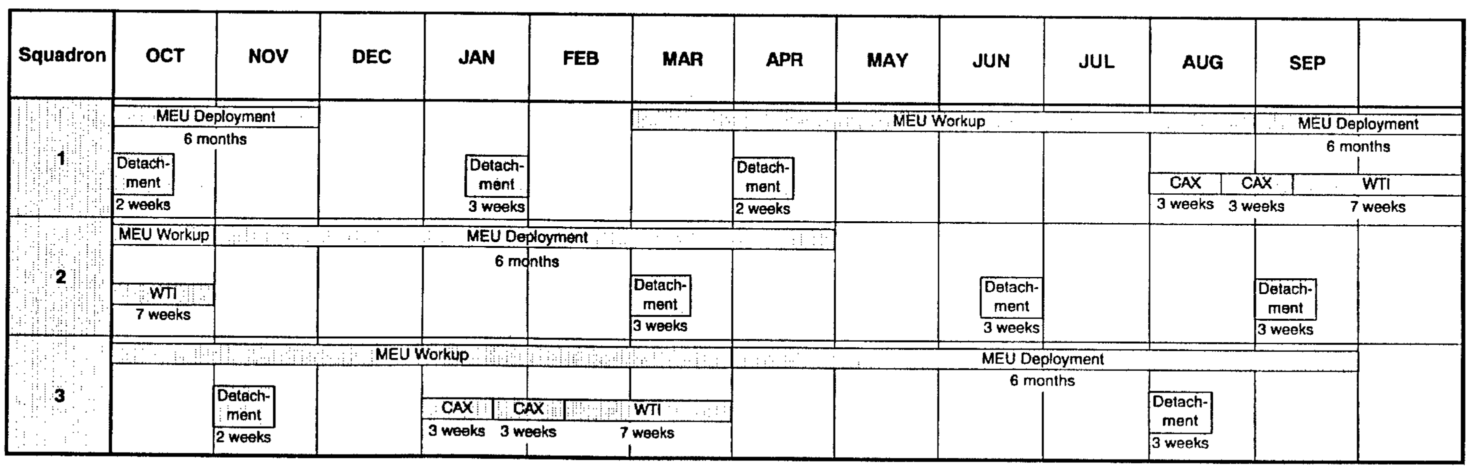


Figure 2-16: AV-8 Fleet Squadrons' Timeline

The AV-8 fleet squadrons occupy Hangars 1666N, 1666S, and 1664N. They primarily use the fuel pits located to the east of their hangars, along Taxiway Bravo.

2.5.2.2 EA-6B Fleet Squadrons

There are four EA-6B fleet squadrons with five aircraft and eight aircrews each. These squadrons follow a repeating 24-month cycle as shown in Figure 2-17. Like the other fleet squadron types, EA-6B squadrons deploy overseas as part of a unit deployment program (UDP). Each deployment is preceded by an 18-month workup period. EA-6B sortie allocations were developed following the method described for the Navy fleet squadrons. The simulated calendar year timeline for the four MCAS Cherry Point EA-6B squadrons is shown in Figure 2-18. The squadrons typically work Monday through Friday; however, weekends are utilized to catch up on incomplete training due to unforeseen events, such as bad weather and equipment failures.

The EA-6B fleet squadrons utilize Hangars 1700, 130, and 1701. They conduct refueling operations in the fuel pits located along Taxiway Hotel near Taxiway Golf.

2.5.2.3 KC-130 Fleet Squadrons

The KC-130 fleet squadron has 14 aircraft and 14 aircrews. Unlike the other fleet squadrons, the KC-130s do not follow a regularly recurring cycle of operations. Because of this, the KC-130 squadron was modeled as conducting a fairly constant level of training for each of its mission types during the simulated year. Approximately 75 percent of all sorties are flown away from the study region, with a typical mission originating from MCAS Cherry Point and visiting other airfields prior to returning. Most sorties originating or terminating at MCAS Cherry Point occur Monday through Friday; however, many of the “away” sorties are flown on weekends.

The KC-130 fleet squadron occupies Hangar 250, with many of its aircraft on the ramp adjacent to the hangar. Typically, the KC-130 aircraft are refueled by a truck on its ramp.

2.5.3 Fleet Replacement Squadron Operations

Fleet replacement squadrons (FRS) are units whose purpose is to train aircrews in a particular fleet airframe. After completing the FRS syllabus, a pilot or crew member is assigned to a fleet squadron.

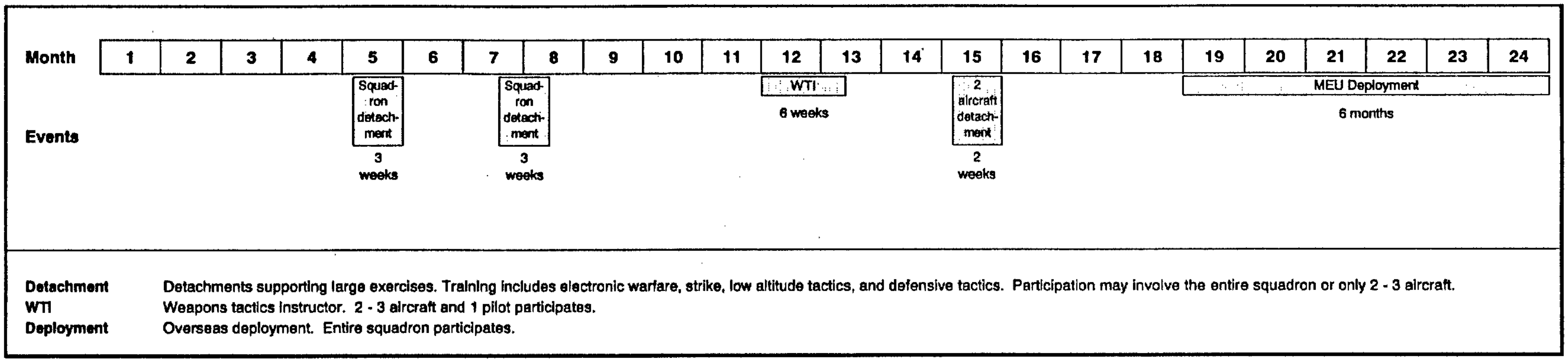


Figure 2-17: EA-6B Fleet Squadron Nominal Workup Cycle

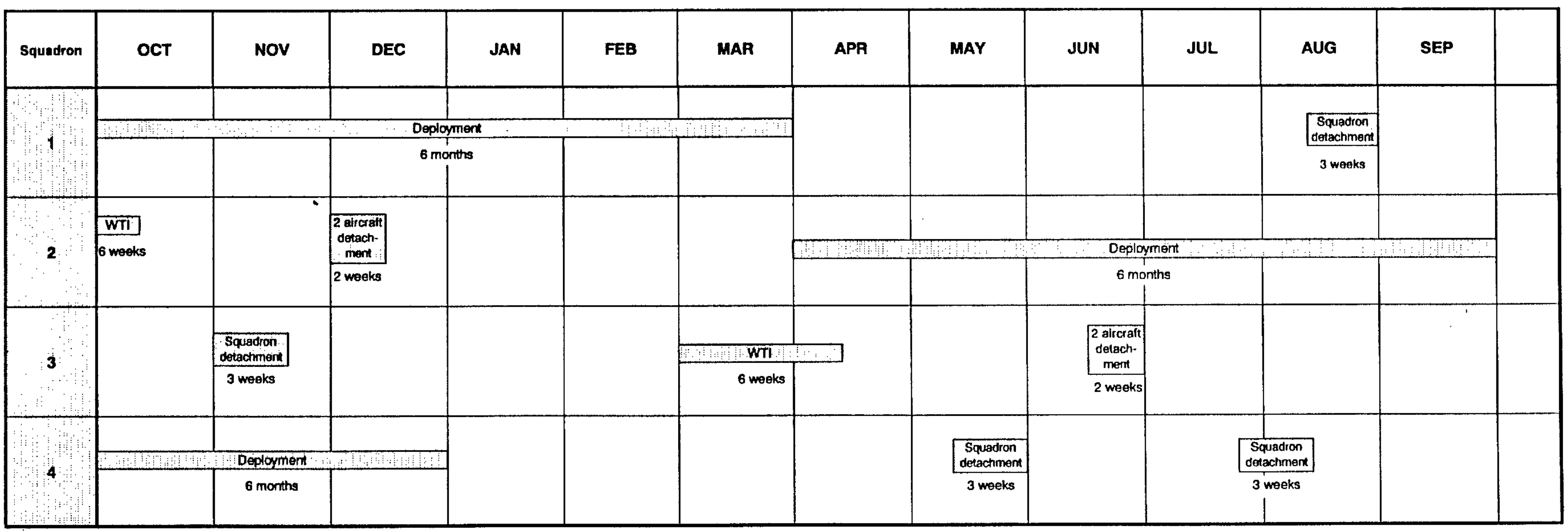


Figure 2-18: EA-6B Fleet Squadrons' Timeline

2.5.3.1 Fleet Replacement Squadron Training Requirements

The methods for creating the NASMOD FRS training requirement inputs are similar to those described in Section 2.5.1.3 for the fleet squadrons. The class training syllabus is synonymous to the fleet workup cycle. Typically, students are grouped into classes that proceed through various phases of instruction, beginning with aircraft familiarization. The commencement of each class is staggered chronologically such that, during any given week, the FRS may be working on a limited set of mission types. Figure 2-19 shows a hypothetical annual timeline of classes for the F-14 FRS.

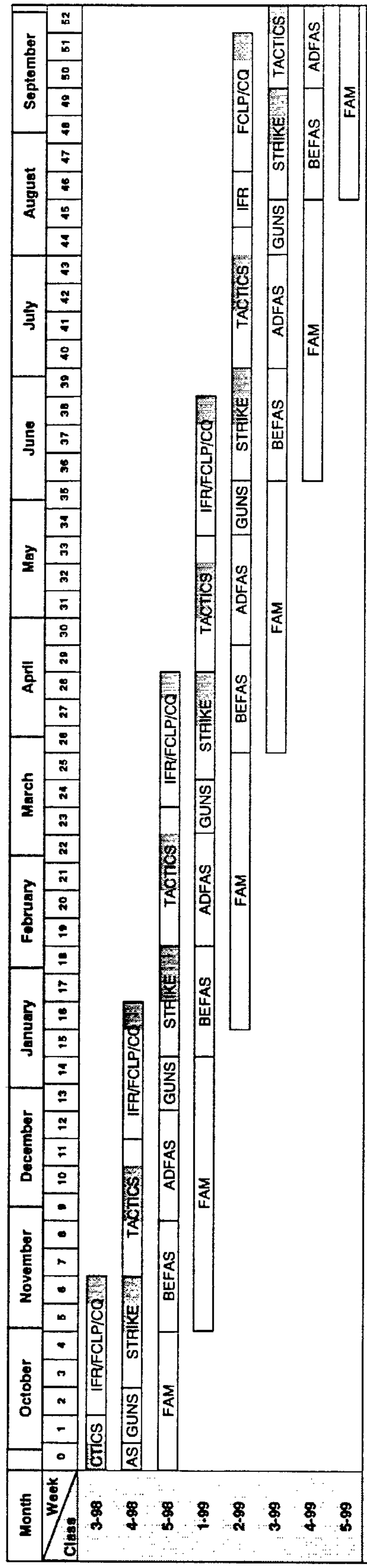
2.5.3.2 F-14 FRS

The F-14 FRS trains aircrews for both the Atlantic and Pacific F-14 fleet squadrons through a 34-week program. Table 2-8 shows the number of pilots and Naval flight officers (NFOs) — radar intercept officers (RIOs) for the F-14 — that the F-14 FRS completes each year. These students are grouped into five classes. Within each class are different categories of students. Category I are new students that have not previously flown in the fleet. Categories II through IV are students that have experience in other airframes or need refresher training. Category V students learn exclusively Tactical Air Reconnaissance Pod System (TARPS) mission techniques. An IUT is an "instructor under training" and is a future FRS instructor. Each student category requires a different number of flight hours to complete its syllabus, with the "Cat" I pilot requiring the most hours. The total flight hours required to complete the 100 Cat II–V pilots is equivalent to the syllabus flight hours of 29 Cat I pilots; consequently, a total of 69 Cat I "equivalent" pilots complete F-14 FRS training each year. Likewise, the F-14 FRS annually completes 53 Cat I equivalent RIOs.

Table 2-8: F-14 FRS Annual Pilot Loading

	Category					
	I	II	III	IV	V	IUT
Pilots	40	5	32	33	30	12
NFOs	24	10	36	24	32	12

In FY99, the F-14 FRS is expected to have approximately 38 F-14A/B and 10 F-14D model aircraft. Of these 48 aircraft, an average of 38 are expected to be mission capable on any given day, with the rest undergoing maintenance. The squadron utilizes Hangar 404, which is located midway along the western-facing ramp area and can service aircraft between missions in approximately two hours, exclusive of refueling time. The F-14 FRS prefers to operate Monday through Friday, with first daytime takeoffs at about 0730. Preferred first nighttime takeoffs are about 30 minutes after sunset. The F-14 FRS may fly during weekends and any time of the day, as needed in order to meet training requirement goals.



Shaded bars indicate training performed on detachment away from NAS Oceana.

LEGEND:

FAM	Familiarization phase	STRIKE	Strike (A/G) Phase
BEFAS	Basic Employment Phase	TACTICS	Tactics (ACM) Phase
ADFAS	Advanced Fleet Air Superiority Phase	IFR	In-flight Refueling Phase
GUNS	Air-to-Air Gunnery Phase	FCLP/CQ	Carrier Qualification Phase

Figure 2-19: Hypothetical F-14 FRS Class Timeline for FY99

2.5.3.3 F/A-18 FRS

The F/A-18 FRS trains pilots for the Navy and Marine Corps fleet squadrons and occasionally instructs foreign military pilots. The F/A-18 FRS training syllabus is very similar to the F-14 FRS but shorter in duration. Like the F-14 FRS, the F/A-18 student pilots participate in three detachments: strike, fighter weapons training, and carrier qualifications. The F/A-18 FRS is expected to complete ten 31-week classes each year, with a total number of students as shown in Table 2-9. Category I through Category IV students are like those described in the previous section on the F-14 FRS. The 120 Category I through IV pilots are equivalent to 86 Category I pilots in terms of flight hours required. The CQ category consists of students that only require carrier qualification. The NVG students are current fleet squadron pilots that need training in the newly developed night vision goggle missions. The IUT students are the instructors under training.

Table 2-9: F/A-18 FRS Annual Pilot Loading

	Category						
	I	II	III	IV	CQ	NVG	IUT
Pilots	55	24	21	20	7	45	13

In FY99, the F/A-18 FRS is expected to have approximately 48 aircraft, with an average of 29 expected to be mission capable on any given day. The squadron prefers to operate Monday through Friday, with first daytime takeoffs at about 0800. Like the F-14 FRS, the F/A-18 FRS may fly during weekends and after-hours in order to meet training requirement objectives.

Each class conducts one strike (air-to-ground) detachment and one fighter weapons tactics (FWT, air-to-air) detachment. The strike detachments are currently held at the Fallon Range Training Complex, and the FWT detachments are located NAS Key West. The first few syllabus flights for each of these training phases are performed locally. The class concludes with four weeks of FCLP training and one week of carrier qualifications.

The F/A-18 FRS occupies 122 in the eastern-facing ramp area at NAS Oceana.

2.5.3.4 AV-8 FRS

The AV-8 FRS trains pilots for the MCAS Cherry Point AV-8 fleet squadrons and groups its students into five classes per year. There are four categories of students as shown in Table 2-10. The basic, refresher, and modified refresher are similar to the F-14 FRS Categories I, II, and III students. The annual replacement aircrew (RAC) rate is approximately 52, where the number of hours flown by a basic student generates the equivalent of one RAC.

Table 2-10: AV-8 FRS Annual Pilot Loading

	Category			
	Basic	Refresher	Modified Refresher	IUT
Pilots	43	27	13	12

The squadron has 14 AV-8B and 14 AV-8T aircraft; however, usually about ten on average are readied each work day. The preferred work week is Monday through Friday with weekends available for catching up with incomplete training. Nighttime missions are the focus of training one week each month. The AV-8 FRS is located in Hangar 3998 at MCAS Cherry Point.

2.5.3.5 KC-130 FRS

Unlike the other FRSs, the KC-130 FRS does not group students into classes but works them into the squadron flight schedule as they enter the FRS. The basic/transition pilot can complete syllabus flights in any order after completing the first five familiarization flights. The number of each category of student is given in Table 2-11. The KC-130 FRS squadron is similar to the KC-130 fleet squadron in that many of its sorties are flown outside the study region on events extending over multiple days.

Table 2-11: KC-130 FRS Annual Student Loading

	Category		
	Basic/ Transition	Refresher	IUT
Pilots	43	27	12
Navigators	16 (all categories)		

The KC-130 FRS has seven aircraft of which five or six are typically mission capable on any given day. The preferred work week is Monday through Friday with about two or three sorties flown per day. The first flights of the day generally takeoff around 0900 to 1000. The FRS occupies Hangar 250 with the KC-130 fleet squadron.

2.5.4 Adversary

VFC-12 is the only adversary squadron permanently based at NAS Oceana. This squadron is a component of the Navy Reserve Airwing 20 (CVWR-20), which has the task of maintaining adversary squadrons. Navy adversary support resources are undergoing realignment, and the information contained in this section may not be current. The discussion contained herein describes the information available for this study, unresolved issues, and offers a rationale for the resulting assumptions.

In FY98, CVWR-20 is expected to include the following squadrons:

VFC-12	12 F/A-18 aircraft, based at NAS Oceana
VFC-13	F-5 aircraft, based at NAS Fallon
VF-201	F-14 aircraft, based at NAS JRB Fort Worth
VFA-203	F/A-18 aircraft, based at NAS Atlanta
VFA-204	F/A-18 aircraft (new squadron), NAS New Orleans

(CVWR-20 also consists of EA-6B, S-3, and E-2 squadrons. However, these aircraft do not perform local support functions and do not impact this study.)

In FY96, two CVWR-20 squadrons — VFA-127, based at NAS Fallon, Nevada, and VF-45, based at NAS Key West, Florida — were decommissioned. VF-45, in recent years (e.g., FY95), was the primary supporter of the F/A-18 FRS at NAS Cecil Field for fighter weapons training (FWT). With VF-45 unavailable in FY99 and the F/A-18 FRS relocated to NAS Oceana, AIRLANT personnel estimate that any of the CVWR-20 squadrons may provide FWT support to the NAS Oceana-based F/A-18 FRS.

The adversary squadrons' impacts at NAS Oceana will depend upon which training programs conducted by CVWR-20 squadrons will be performed locally. The F-14 FRS will continue to conduct a portion (about 20 percent) of its ACM flights at NAS Oceana. Similarly, the F/A-18 FRS will perform approximately 40 percent of its FWT phases at NAS Oceana and the rest on detachment. Atlantic fleet squadrons will perform two weeks of their SFARP at NAS Oceana and one week of the air-to-ground phase of SFARP on detachment. Tactics missions, requiring dissimilar aircraft, will be performed during the local phases of SFARP, and a combination of adversary squadrons will typically support this training. Pacific fleet F-14 squadrons will detach for the entire SFARP, most likely to the west coast.

In light of the issues concerning a reduced CVWR-20, it is assumed for the purposes of this study that adequate adversary support will be available in the future for FRS and SFARP training at NAS Oceana. For each of the five F-14 FRS classes during the year, VFC-12 will provide primary support for the F-14 FRS's ACM training, locally and on detachment. For other squadrons, the identity of an adversary squadron cannot be forecast with certainty within the scope of this study, particularly for F/A-18 FRS and local SFARP missions. Operations by adversary aircraft at the airfield or in training areas are identified as "Adversary" with no aircraft type specified. AIRLANT personnel did, however, provide a rough estimate of the adversary aircraft-type proportions for NAS Oceana-based sorties: 70 percent to 75 percent F/A-18A, 10 percent to 20 percent F-14, and 5 percent to 15 percent F-5.

2.5.5 Non-NAS Oceana- or MCAS Cherry Point-based Squadrons and Units

Units based at locations other than NAS Oceana or MCAS Cherry Point are modeled in less detail than those based at these study airfields. Data collection was limited to the information necessary to sufficiently model their activities at the airfield and in the training areas.

For purposes of this study and in discussions with ATC personnel, it was determined that non-participating flights should not be modeled beyond direct interaction with the study airfield traffic. In the context of this report, non-participating flights include military, commercial, and general aviation aircraft flying on airways or direct routings.

2.5.5.1 NAS Oceana and MCAS Cherry Point Airfield Transients

Both NAS Oceana and MCAS Cherry Point have a number of aircraft that are assigned directly to the air stations. For example, MCAS Cherry Point supports a Station Operations and Engineering Squadron (SOES), which is composed of two C-9B and two C-12 fixed-wing aircraft and three HH-46A helicopters. These "station" aircraft contribute few operations compared to the total number of operations performed annually at the air stations. In addition, a number of airfield operations is generated annually by aircraft not permanently based at the two air stations of this study. These two types of "background" traffic are grouped into the category of transient aircraft (although the station aircraft are not technically transient). Many of the non-station-based aircraft belong to units participating in various exercises conducted in the local airspace. The air stations host many of these visitors for the duration of the exercise. Other transients include various military logistics and support flights, as well as aircraft that may perform practice approaches. Future levels of transient operations are generally difficult to predict since they are not necessarily related to the future level of based-unit operations. Consequently, FY95 monthly airport traffic reports are used to forecast future levels of transient operations.

Tower air traffic analyzer data are used to predict the proportions of instrument and visual takeoffs, approaches, touch-and-go operations, and landings. Due to the lack of specificity in the traffic analyzer data, the identity of transient aircraft cannot be determined beyond a general grouping of Navy/Marine Corps and other military. Consequently, the transients are categorized into the following two groups:

Transient Jets	A wide variety military aircraft such as F-14, F-15, F-16, F/A-18, and S-3 jets.
Transient Props	Primarily C-2, C-12, C-130, E-2, and T-34 aircraft.
Transient Heavy	Primarily C-5, C-141, and KC-10 aircraft.
Transient Large	Primarily C-9 aircraft.
Transient Helicopter	Includes AH-1, H-46, H-53, OH-58, AH-64, and UH-1 aircraft.

2.5.5.2 NAS Norfolk-based E-2/C-2

There are five E-2 fleet squadrons, one C-2 fleet squadron, and one E-2/C-2 FRS based at NAS Norfolk, which is located approximately 16 miles to the northwest of NAS Oceana. These squadrons generate a significant amount of FCLP operations at NALF Fentress throughout the year. One E-2 fleet squadron is attached to each Atlantic airwing, and each squadron follows a FCLP work-up schedule very similar to the F/A-18 and F-14 fleet squadrons' schedules. The C-2 fleet squadron supports each Atlantic airwing with a 2-aircraft/6-aircrew detachment; C-2 fleet FCLP operations are conducted on a regular basis throughout the year. The E-2/C-2 FRS normally has five classes of pilots per year; each class conducts six weeks of FCLP training, of which one week is spent at NAS Key West.

Note that the E-2/C-2, F-14, and F/A-18 FRSs have scheduling priority at NALF Fentress, except for two weeks prior to a fleet carrier detachment or deployment, during which the E-2, C-2, F-14, and F/A-18 fleet squadrons have scheduling priority.

E-2/C-2 operations (pattern work) conducted at NAS Oceana are captured in the *Transient Props* category described above, and E-2/C-2 flights in W-72 are included in *Other Navy*, as described in the following section.

2.5.5.3 Other Navy

This category denotes Navy aircraft that are not based at NAS Oceana but use local training areas. The majority of these are E-2, C-2, P-3, and helicopters operating out of other airfields (e.g., NAS Norfolk) and jets operating from carriers located off the coast. A small number of these aircraft may be visiting NAS Oceana in order to perform joint training with the local squadrons. In this case, their airfield operations are included in the airfield *Transient* categories.

2.5.5.4 Other Marine Corps

The Marine Corps generates a significant number of operations in the training areas examined by this study. MCAS New River, North Carolina, is home to two AH-1W/UH-1N, six CH-46E, and two CH-53E Fleet Marine Force (FMF) helicopter squadrons, one CH-46E FRS, and one CH-53E FRS. All of these squadrons are significant users of the R-5306A complex, including BT-11 and BT-9. The AV-8B squadrons also use Navy Dare on a regular basis.

Another source of Marine Corps sorties is MCAS Beaufort, South Carolina. F/A-18 squadrons based there participate in joint training with MCAS Cherry Point and NAS Oceana squadrons, and they generate a number of sorties on the bombing targets and in the warning areas.

2.5.5.5 Air Force

The Air Force and Navy have historically favored different airspace and, to some degree, have operated independently of each other. This is evidenced by the north-south partition of R-5314 and the existence of two, separately managed bombing ranges in Dare County: Navy Dare in the northern half and Air Force Dare in the south. Nevertheless, most of the training areas examined in this study are used, to a greater or lesser extent, by all the branches of the military, and the Air Force presence is substantial.

Langley Air Force Base (AFB), Virginia, is home to the 1st Fighter Wing, which consists of three F-15C squadrons. Their demand is primarily on W-386; however, they also use W-72 and R-5314. The 4th Wing at Seymour Johnson AFB, North Carolina, is home to four F-15E squadrons — two fighter units (FUs) and two fighter training units (FTUs). These squadrons are significant users of Dare County, Navy Dare as well as Air Force Dare. They also use W-72, W-122, BT-11, and BT-9. Pope AFB, North Carolina, is home to F-16 and A-10 squadrons. The F-16 squadrons prefer W-122 for air-to-air missions due to its close proximity; however, they sometimes use W-72. The F-16 and A-10 squadrons use the Dare County ranges, BT-11, and BT-9 extensively for air-to-ground missions. Shaw AFB, South Carolina, is also home to F-16 and A-10 squadrons, but at a distance of over 240 NM from R-5314, these squadrons have a much smaller impact on the ranges studied. The Virginia Air National Guard (F-16 aircraft), Richmond, performs a significant amount of operations during the weekend. It uses Dare County for air-to-ground training and primarily W-386 for air-to-air training. It also uses W-72 and the TACTS range.

Air Force Dare range is the primary air-to-ground training area for aircraft units based at Seymour Johnson AFB and Pope AFB. Due to the overall volume of missions conducted during the year as well as during "surge" training, these units utilize other ranges to meet training milestones. These squadrons use Navy Dare, BT-11, and BT-9 when available to complete the training that cannot be accommodated by Air Force Dare and to provide a variety of training environments (e.g., different types of targets, different run-in views, and the electronic range at BT-11).

The proposed operations of the units listed above are based upon FY95 historical operations and estimations by Air Force personnel. Note that the only squadron realignment proposed to occur between FY95 and FY99 at the Air Force bases discussed above is at Seymour Johnson AFB, where one FU is converted to a FTU in the FY95–FY96 time frame.

2.5.5.6 Coast Guard

The Coast Guard generates a relatively small number of flights in the warning areas. These are predominantly helicopter and C-130 aircraft based at the Coast Guard Air Station, Elizabeth City, North Carolina.

2.5.5.7 Contractor

Contractors are employed by the military for various aerial support services, such as banner towing for air-to-air gunnery practice, and fly a number of different aircraft such as Lear jet and Mitsubishi aircraft for these tasks. Many of these contractor sorties originate from Newport News/Williamsburg International Airport, Virginia.

2.5.5.8 Civilian

These users operate a wide range of aircraft types, both commercial and private (e.g., Boeing 747, Cessna 172). These users are observed in the warning areas and are usually transiting the airspace. The primary flows of civilian air traffic are routed around or above the NAS Oceana and MCAS Cherry Point airspace and nearby warning areas, MOAs, and Dare County range, and do not impact or interact with military aircraft.

The military and civilian operations near R-5314 and Dare County Regional Airport at Manteo (on Roanoke Island in northeastern North Carolina) has been studied by ATAC analysts, and a summary of the analysis is included in Section 4.

2.6 Other Modeling Issues

The realism of a NASMOD simulation is obtained through the consideration of the many "real-world" conditions, events, and procedures that are designed into the model.

2.6.1 Mission Profiles

Mission profiles are used to describe the ways in which a given mission type is performed. During the process of developing training requirements, all aspects of individual mission evolutions were discussed with pilots from the various aircraft communities located at NAS Oceana, MCAS Cherry Point, and NAS Norfolk. Profile information includes, for example, mission-specific resource requirements and availability; range and special use airspace requirements and capabilities, including preferred and alternate training areas for conducting activities; routings to and from the activity areas; volume of airspace required for each activity; duration of an activity; return-to-base activities (e.g., GCAs, touch-and-go practice); meteorological restrictions; historical operating practices (e.g., scheduled exercises); squadron operating practices (e.g., sequence of training missions); and additional factors that may influence where, when, and how a mission is flown.

The mission profile elements for each flight type may vary in any number of ways from those of other flights in the same or similar type grouping. As an example, there may be two familiarization flights of equal duration, using the same training area, but each with significantly different return-to-base activity profile elements. Therefore, each has a unique profile, yet both achieve a common training requirement. Such diversity of requirements dictated that approximately 1470 individual profiles be created for this study, consisting of over 20,100 steps.

With the exception of NAS Norfolk-based E-2/C-2 squadrons and Seymour Johnson-based F-15s, units not based at NAS Oceana or MCAS Cherry Point are modeled using mission profile parameters derived from historical demand recorded by range control organizations. In the case of several of the ranges, it is not feasible to break down historical hours and operations by aircraft type because the total hours of reported utilization are not delineated by aircraft type, only by hours per service organization (e.g., Navy, Marine Corps, Air Force).

Due to the scope of the study, detailed flight traffic is only modeled for the portion of sorties completed within the local training area. Thus, for cross-country and detachment transit flights, only the pertinent local air traffic elements are modeled in detail. The model assumes the associated training requirements are completed away from the study region.

2.6.2 Mission Scheduling

In NASMOD, the flight frequency for each type of mission is established by the training requirements, which are in the form of the number of missions that the squadron would like to fly during a given time period. (Refer to the discussion on sortie allocations in Section 2.5.) Based on the number of missions desired and the number of working days in the time period, the NASMOD scheduler calculates a daily desired rate for each mission type. If this daily desired rate is not flown, the squadron will accumulate a backlog of missions that were desired and not flown. For most missions the daily desired rate will continue to increase as this backlog accumulates. This continues until the backlog of desired missions has been eliminated (flown).

NASMOD schedules FCLPs in a different manner. FCLP training requirements will only accumulate backlog during the two week window in which the FCLPs have been scheduled. Once the two week FCLP window is over, any remaining backlog is eliminated and counted as unmet requirements. For fleet squadrons, FCLPs have the highest priority of any mission that the squadron schedules.

2.6.3 Weather

The area weather is based upon historical data observed at the respective air stations, and this weather is applied in the model in the form of occurrences of various conditions of reduced visibility and ceiling. Four basic types of weather conditions are modeled:

- Clear weather: This weather type is default, with the ceiling at or higher than 3000 feet (AGL) and the visibility at or greater than 3 NM. All airfield arrival paths and patterns are available.
- Clear Weather to Basic VMC: The visual tower pattern and overhead break are available. FCLP operations can still occur under this weather condition.
- Instrument meteorological conditions (IMC). IMC conditions prevail at the airfield; the ceiling is less than 1000 feet and/or the visibility is less than 3 NM. Missions that must be performed under VFR (i.e., familiarization flights, FCLP training) are canceled. Missions that can (or must) be performed under IFR or above the cloud layers (i.e., air combat

maneuvers) can be completed. This weather condition is above departure minimums.

- Approximate Departure Minimums: During this weather condition, with the ceiling less than 200 feet and/or the visibility less than 0.75 NM, airfield operations are basically suspended. This weather condition may include severe weather, such as excessive ground fog or a hurricane, that also suspends operations or closes the airfield.

NASMOD applies the weather randomly such that the proportion with which each of these weather conditions is in effect varies by month according to historical meteorological records. A ceiling/visibility weather event can occur up to two time periods in the day at both MCAS Cherry Point and NAS Oceana: 0000 to 0900 and/or 0900 to 2400. The probability of a particular weather event occurring is based upon data that is averaged over the last 49 years. This data is provided by the air stations' meteorological units.

Each mission has weather requirements, and at the time of departure, if a weather event that is below a mission's requirements is active, the mission is canceled. FCLP and visual touch-and-go pattern operations do not occur in the model when the weather is at basic VMC or below. Practice GCAs or any type of departures do not occur when the weather is below departure minimums.

NASMOD

SCENARIOS RESULTS ANALYSIS

3 SCENARIO RESULTS ANALYSIS

This section presents an analysis and comparison of the alternative scenarios. The analysis examines the quantitative and qualitative results of the NASMOD simulation in three major areas: squadron operations, airfield operations, and training area operations.

Each of the alternative realignment scenarios inherits the fundamental modeling assumptions of the baseline scenario. In the following discussions, an emphasis is placed on the relative rather than the absolute differences among the scenarios.

3.1 Squadron Operations

Squadron operations are evaluated primarily in terms of annual local sorties and flight hours, which are compared among the realignment scenarios. In addition, the efficiency with which the various aircraft communities complete their training provides a measure of the merits of a given scenario.

3.1.1 Squadron Sorties and Flight Hours

A local sortie is one in which the aircraft either departs or arrives (or both) at NAS Oceana or MCAS Cherry Point. Many of the modeled squadrons are deployed or detached away from their home base for periods of time during the simulated year. (Refer to the squadron modeling assumptions in Section 2.5.) Such "away" sorties, in which the entire sortie occurs away from the modeled airfield, are excluded from the annual sorties and flight hour statistics. The F/A-18 fleet squadron annual sorties and flight hours vary among the scenarios due to the various basing alternatives. In ARS-4 and -5, six F/A-18 fleet squadrons are located at NAS Oceana. Consequently, these two scenarios share consistent F/A-18 fleet sortie and flight hour statistics.

Table 3-1 presents the annual local sortie and flight hours for the NAS Oceana and MCAS Cherry Point tenant squadrons for each of the scenarios.

Note that there is very little fluctuation in the number of annual local sorties and flight hours for the squadron communities (F-14s, AV-8s, EA-6Bs, and KC-130s) that have a fixed basing for all the scenarios. This indicates that the various basing alternatives for the F/A-18 fleet squadrons do not affect the ability of other squadrons to complete their desired amount of annual local training. What little variation exists among the scenarios is due to the effects of randomness in the simulation. There are differences among the scenarios in the sorties and flight hours for the F/A-18 squadrons, however.

The F/A-18 fleet squadron annual sorties and flight hours vary among the scenarios due to the various basing alternatives. In ARS-4 and -5, six F/A-18 fleet squadrons are located at NAS Oceana. Consequently, these two scenarios share consistent F/A-18 fleet sortie and flight hour statistics.

Table 3-1: Annual Sorties and Flight Hours of NAS Oceana and MCAS Cherry Point Tenant Aircraft

	Baseline		ARS-1		ARS-2	
Aircraft Groups	**Sorties**	**Hours**	**Sorties**	**Hours**	**Sorties**	**Hours**
NAS Oceana						
F-14 (Fleet)	12,580	16,620	12,704	16,706	12,604	16,487
F-14 (FRS)	6,912	9,992	6,929	10,049	6,920	10,027
F/A-18 (Fleet)	—	—	14,449	17,959	12,092	15,170
F/A-18 (FRS)	—	—	8,401	10,410	8,416	10,408
Adversary	418	440	585	658	536	594
Total	19,910	27,053	43,068	55,782	40,568	52,686
MCAS Cherry Point						
AV-8 (Fleet)	7,188	8,533	7,176	8,498	7,183	8,504
AV-8 (FRS)	5,993	6,231	5,992	6,221	5,996	6,224
EA-6B	2,070	3,800	2,071	3,801	2,070	3,797
F/A-18 (Fleet)	—	—	—	—	—	—
KC-130 (Fleet)	401	1,303	401	1,304	401	1,297
KC-130 (FRS)	622	2,458	622	2,463	622	2,464
Total	16,274	22,326	16,262	22,287	16,272	22,286

	ARS-3		ARS-4		ARS-5	
Aircraft Groups	**Sorties**	**Hours**	**Sorties**	**Hours**	**Sorties**	**Hours**
NAS Oceana						
F-14 (Fleet)	12,636	16,629	12,630	16,533	12,627	16,654
F-14 (FRS)	6,949	10,067	6,931	10,044	6,959	10,087
F/A-18 (Fleet)	10,205	12,775	8,350	10,332	8,299	10,278
F/A-18 (FRS)	8,402	10,403	8,397	10,391	8,398	10,389
Adversary	585	683	511	558	594	687
Total	38,777	50,557	36,819	47,859	36,877	48,096
MCAS Cherry Point						
AV-8 (Fleet)	7,158	8,513	7,181	8,504	7,185	8,539
AV-8 (FRS)	5,987	6,217	5,996	6,216	5,992	6,220
EA-6B	2,071	3,807	2,070	3,797	2,071	3,813
F/A-18 (Fleet)	3,528	4,077	—	—	5,467	6,715
KC-130 (Fleet)	400	1,294	401	1,301	401	1,297
KC-130 (FRS)	625	2,461	622	2,460	624	2,467
Total	19,769	26,371	16,270	22,278	21,740	29,051

Although ARS-1 , -3, and -5 represent alternatives in which all 11 F/A-18 fleet squadrons are based at the modeled airfields, the number of annual fleet F/A-18 sorties in ARS-1 differs from the sum of the annual sorties for NAS Oceana and MCAS Cherry Point fleet F/A-18s of ARS-3 and ARS-5 by about five percent. This is a result of the modeling technique used to assign F/A-18 fleet squadrons to airwings as described in Section 2.5.1.6 and Appendix C. In ARS-1, Airwing C has two F/A-18 fleet squadrons, and Airwing E has three. In ARS-3 and ARS-5, this is reversed with Airwing C having three F/A-18 squadrons, and Airwing E having two. Since Airwing C spends a much greater portion of the simulated year away from the local area than Airwing E, ARS-3 and ARS-5 generate a lower number of local sorties than ARS-1.

The annual sorties and flight hours attributable to the adversary squadron vary considerably among the scenarios. This primarily reflects the assumption that the adversary squadron supports the fleet SFARP. Consequently, adversary operations are lowest for the Baseline Scenario (no local F/A-18 support), slightly increased in ARS-4 (six local F/A-18 Squadrons), greater for ARS-2 (nine local F/A-18 squadrons), and greatest for ARS-1, -3, and -5 (eleven local F/A-18 squadrons).

3.1.2 Squadron Training Completion

For each scenario, all NAS Oceana and MCAS Cherry Point tenant squadrons are able to complete all training requirements during the appropriate simulated months. That is, no mission requirements are significantly postponed nor are any training requirements left incomplete at the end of the simulated year.

One reason for the postponement of a mission is a scheduling conflict with another squadron for a training area. Every simulated day, each squadron prepares a list of missions it wishes to fly; however, some of these missions may not ultimately appear on that day's flight schedule because of conflicts with other squadrons for training areas. Usually, the mission can be successfully scheduled if it uses a less-preferred training area or changes the takeoff time of the flight. Section 2.6.2 and Appendix D.1.2 describe the methodology used by NASMOD to determine the flight schedule for each day of the simulation.

Table 3-2 provides the percentage of all missions being considered for the next day's flight schedule that must either: a) adjust the takeoff time or training area location, or b) postpone the mission to a later date. Notice that the F-14 and F/A-18 FRS squadrons more frequently postpone rather than adjust a mission that is under consideration for the next day's schedule. This is primarily because a FRS syllabus flight typically has a profile with specific training areas and day/night requirements. Consequently, the FRS is less likely to modify a mission in order to include it on the schedule if a preferred training area or takeoff time will be unavailable.

The Navy fleet squadrons show the opposite behavior. Fleet squadrons are more flexible than FRS squadrons when determining their daily flight schedule. They can often adjust a mission in several ways, such as using a secondary training area or performing unit level training when supporting aircraft from other squadrons cancel. An exception to this behavior is for MCAS Cherry Point based F/A-18s. The results for ARS-3 and ARS-5 indicate that approximately 25 percent of all missions under consideration for a flight schedule are postponed. Three quarters of these postponed missions are FCLPs. FCLPs are difficult to schedule because the Navy F/A-18 fleet squadrons do not have an outlying landing field and must perform this training at MCAS Cherry Point, unlike the NAS Oceana-based F/A-18 squadrons which use NALF Fentress. In addition, the F/A-18 fleet squadrons do not receive scheduling priority when planning their FCLP periods but must work with the other MCAS Cherry Point squadrons when devising a schedule.

Table 3-2: Percentage of Missions Affected by Scheduling Constraints

Aircraft Groups	Baseline		ARS-1		ARS-2	
	Adjusted	Postponed	Adjusted	Postponed	Adjusted	Postponed
NAS Oceana						
F-14 (Fleet)	12.2%	2.9%	19.0%	5.4%	18.6%	4.9%
F-14 (FRS)	1.6%	12.2%	1.9%	14.8%	1.7%	15.3%
F/A-18 (Fleet)	—	—	15.8%	8.6%	14.3%	7.6%
F/A-18 (FRS)	—	—	2.3%	6.0%	2.1%	6.5%
Adversary	1.5%	1.4%	17.1%	5.8%	14.9%	3.0%
MCAS Cherry Point						
AV-8 (Fleet)	2.8%	2.1%	3.6%	2.6%	3.2%	2.3%
AV-8 (FRS)	0.9%	2.7%	1.9%	3.5%	1.6%	3.4%
EA-6B	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%
F/A-18 (Fleet)	—	—	—	—	—	—
KC-130 (Fleet)	0.3%	0.0%	0.3%	0.0%	0.3%	0.0%
KC-130 (FRS)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Aircraft Groups	ARS-3		ARS-4		ARS-5	
	Adjusted	Postponed	Adjusted	Postponed	Adjusted	Postponed
NAS Oceana						
F-14 (Fleet)	17.8%	4.9%	17.0%	3.4%	17.0%	5.2%
F-14 (FRS)	2.0%	14.1%	1.7%	14.4%	2.1%	13.4%
F/A-18 (Fleet)	12.7%	13.1%	12.8%	5.3%	13.8%	6.0%
F/A-18 (FRS)	2.5%	6.1%	2.2%	5.0%	2.6%	5.6%
Adversary	10.3%	5.9%	10.1%	2.8%	9.8%	6.6%
MCAS Cherry Point						
AV-8 (Fleet)	4.3%	2.1%	2.9%	2.2%	4.0%	2.2%
AV-8 (FRS)	2.3%	3.6%	1.1%	3.6%	2.3%	5.3%
EA-6B	0.1%	4.7%	0.0%	0.0%	0.0%	5.3%
F/A-18 (Fleet)	6.4%	24.7%	—	—	5.8%	25.4%
KC-130 (Fleet)	0.1%	1.7%	0.3%	0.0%	0.2%	2.1%
KC-130 (FRS)	1.7%	3.3%	0.0%	0.0%	0.9%	3.8%

While this does not hinder the ability of the MCAS Cherry Point F/A-18 fleet squadrons to complete their FCLP training, they must expend a greater amount of effort in planning the FCLP workup.

A comparison between the Baseline Scenario and ARS-1 for the mission adjustment/postponement percentages for the Marine Corps squadrons reveals that only the AV-8 squadrons would experience a perceptible increase in scheduling difficulties if all the F/A-18 squadrons were based at NAS Oceana, due primarily to competition for time at BT-11. For either scenario, these percentages are low, however. The AV-8 mission postponement percentage is fairly constant for all the scenarios, despite the fact that ARS-3 involves basing F/A-18 squadrons at MCAS Cherry Point. For these scenarios, the AV-8 mission adjustment percentage is somewhat higher, reflecting a slightly greater need for the AV-8 squadrons to use alternate training areas and takeoff times.

While the mission adjustment/postponement percentages for the Marine Corps squadrons for ARS-3 and ARS-5 are low, they may be perceived to be much greater. That is, in the Baseline and ARS-1,-2, and -4, in which *no* Navy squadrons are based at MCAS Cherry Point, the EA-6B and KC-130 squadrons experience almost no difficulties scheduling their missions. Under ARS-3 and ARS-5, in which F/A-18 squadrons *are* based at MCAS Cherry Point, the EA-6B and KC-130 squadrons experience a small yet consistent level of difficulty in mission scheduling. EA-6B and KC-130 squadron personnel who experience a transition from the Baseline Scenario to ARS-3 or ARS-5 may *perceive* the increase in scheduling difficulty to be significant.

3.2 Airfield Operations

The airfield operations data are presented in detail in Appendix A, and the discussions in this section refer to these data. An examination of these data yields informative comparisons between the alternative realignment scenarios of the levels of activity that can be expected with the different F/A-18 basing options. Comparisons of the various types of airfield delay and pattern congestion are examined, as well.

Figure 3-1 shows the annual airfield operations at NAS Oceana, NALF Fentress, MCAS Cherry Point, and MCALF Bogue Field for the baseline and five alternative scenarios. The F/A-18 squadrons are not expected to use MCALF Bogue Field even if based at MCAS Cherry Point; consequently, the level of MCALF Bogue Field operations is fairly constant across all the scenarios.

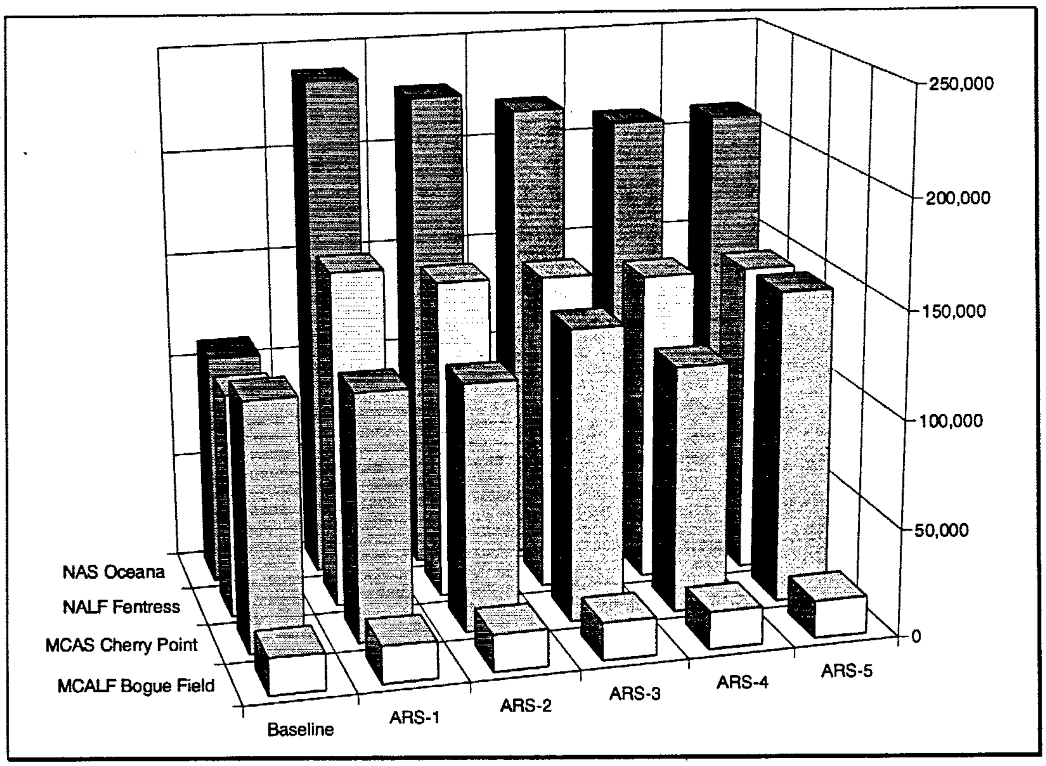


Figure 3-1: Summary of Annual Airfield Operations

3.2.1 NAS Oceana Operations

All of the alternative scenarios involve the relocation of F/A-18 squadrons to NAS Oceana, resulting in a significantly greater number of annual operations than are observed for the Baseline Scenario. Figure 3-2 illustrates the proportion of day (defined as 0700–2200) versus night (2200–0700) operations. The percentage of night operations for the alternative scenarios ranges from 8.1 percent (ARS-3) to 8.5 percent (ARS-1) of total operations while it is 6.5 percent for the Baseline Scenario. This reflects the heavier emphasis on nighttime operations by the F/A-18 squadrons.

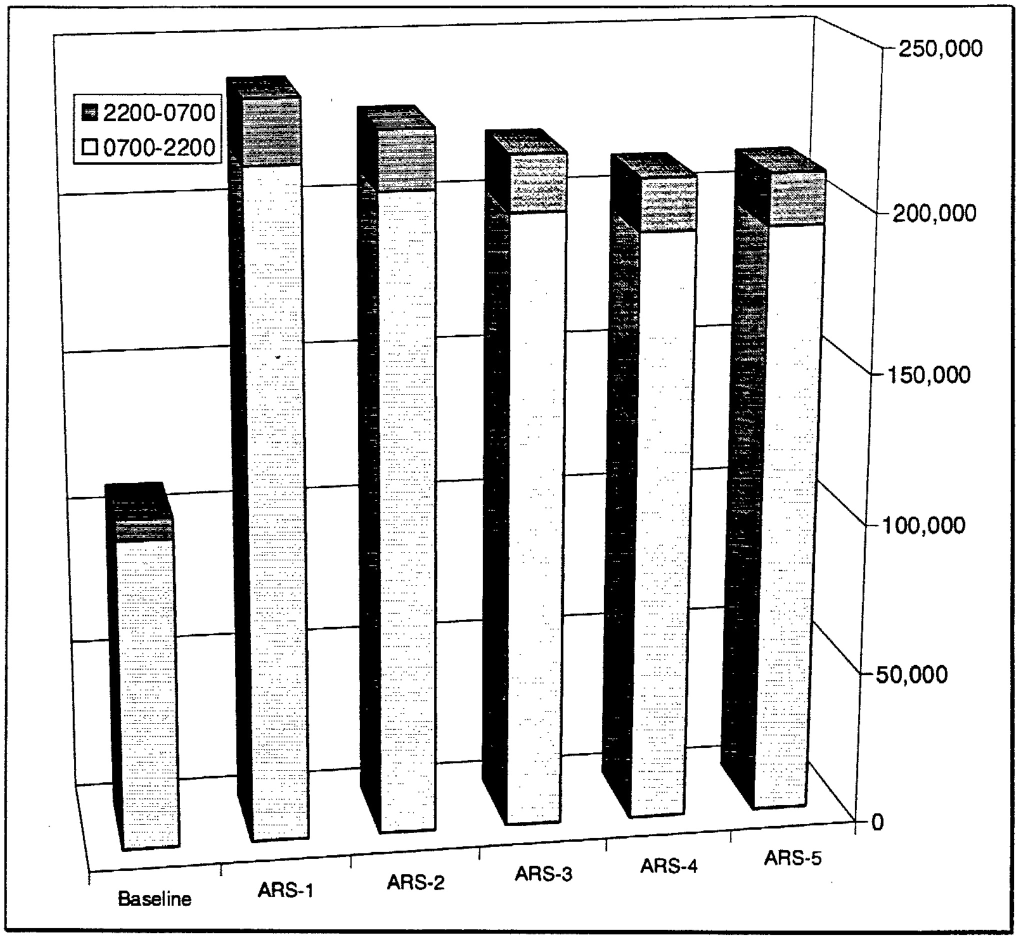


Figure 3-2: NAS Oceana Annual Airfield Operations

With the greatest number of squadrons based at NAS Oceana (25 squadrons) of the analyzed scenarios, ARS-1 generates the greatest increase in annual operations over the Baseline Scenario, as shown in Table 3-3. The F/A-18 FRS generates 47 percent (over 60,000) of the additional operations in ARS-1; if only the FRS

Table 3-3: Percentage Increase in Annual NAS Oceana Operations over the Baseline

ARS-1	118.1%
ARS-2	108.6%
ARS-3	100.6%
ARS-4	92.6%
ARS-5	92.9%

is realigned to NAS Oceana, airfield operations would increase by 56 percent over the Baseline Scenario. The increase over the baseline is significantly less for ARS-4 and ARS-5 which have six (vice 11) F/A-18 Fleet squadrons based at NAS Oceana.

Pattern operations at NAS Oceana significantly increase with the realignment of the F/A-18 squadrons in each of the alternative scenarios. Table 3-4 shows the number of annual operations conducted in the VFR pattern, the FCLP pattern, and the instrument pattern for each scenario. Table 3-5 presents the percentage increase over the Baseline Scenario in each pattern type at NAS Oceana for the alternative realignment scenarios. The VFR touch-and-go operations are more than doubled in all scenarios, with the F/A-18 FRS alone contributing over 38,000 operations. NAS Oceana-based squadrons prefer to conduct FCLP operations at NALF Fentress and utilize NAS Oceana only when NALF Fentress is unavailable. In the Baseline Scenario, squadrons are able to complete their FCLP training without utilizing NAS Oceana; however, in each of the alternative scenarios, NAS Oceana is utilized for FCLP training. This "off-load" of operations represents about three percent of the total FCLP operations conducted by NAS Oceana-based squadrons in ARS-1. Note that the amount of exclusive-use pattern time utilized at NAS Oceana (on Runway 5L) in ARS-1 is approximately 25 hours for the year.

Table 3-4: Annual Pattern Operations at NAS Oceana

	Baseline	ARS-1	ARS-2	ARS-3	ARS-4	ARS-5
VFR Touch-and-Go Operations	52,300	117,800	114,200	110,800	106,700	106,500
NAS Oceana FCLP Operations	0	3,500	2,900	1,400	2,300	1,800
Instrument Touch-and-Go Operations	9,400	17,300	17,000	16,600	16,100	16,200

Note: Operations rounded to the nearest 100.

Table 3-5: Percentage Increase in Annual Pattern Operations at NAS Oceana over the Baseline

	ARS-1	ARS-2	ARS-3	ARS-4	ARS-5
VFR Touch-and-Go Operations	125%	119%	112%	104%	104%
Instrument Touch-and-Go Operations	84%	80%	77%	71%	72%

One measure of potential airfield congestion is the average amount of taxi time required per sortie. For this calculation, taxi time is considered to be the time an aircraft spends moving from one point to another on the airfield before and after a flight. Time spent arming, de-arming, pit refueling, or waiting for an available fuel pit, while modeled, is not included in the taxi time delay analysis since not all sorties perform these activities. Consequently, the only taxi times considered are the time spent in motion and the delays imposed by pilot and controller action, such as holding short for takeoff and waiting to cross active runways or busy taxiways. All sorties are subject to these types of delays, regardless of their mission. As can be seen from Table 3-6, the average taxi delay for ARS-1 is almost double that for the Baseline Scenario, generating about a 15 percent increase in the total average sortie taxi time.

Table 3-6: Average "Per Sortie" Taxi Times (in minutes) for NAS Oceana

Per Sortie (sum of pre-takeoff and post-landing)		
	Taxi Duration	**Taxi Delay**
Baseline	15.1	1.0
ARS-1	17.3	1.9
ARS-2	17.1	1.8
ARS-3	17.0	1.7
ARS-4	16.8	1.6
ARS-5	16.8	1.6

The amount of delay a sortie experiences while refueling in the pits is another indicator of airfield congestion. Section 2.2.1 notes that the fuel pits are modeled to accommodate the simultaneous refueling of up to four aircraft on the western-facing ramp and four aircraft on the eastern-facing ramp, with queues of up to six aircraft allowed for each ramp area. The six-aircraft-per-queue limit is the threshold used by the model to determine the point at which additional aircraft taxi directly to their line without waiting to refuel at the pits.

Table 3-7 lists some noteworthy fuel pit statistics for selected scenarios. The **Total Aircraft Requesting Pit Refueling** is a count of all the annual sorties that will use the fuel pits if they can. The **Aircraft that Must Wait** is the number of aircraft that want to use the fuel pits but find them all occupied upon arrival. Note that this value is 141 percent higher for ARS-1 than it is for the baseline while the number of aircraft requesting pit refueling is only 112 percent higher. This difference in the relative comparisons of the two statistics indicates that the fuel pit capacity adversely affects the level of operations for ARS-1. This condition is not the case for ARS-3. The **Aircraft that Must Wait** statistic is given as a proportion of **Total Aircraft Requesting Pit Refueling** in the row labeled **Percentage of Total Aircraft that Must Wait**. This percentage can also be interpreted as the probability that the desired fuel pit is occupied when an aircraft wishes to enter. The **Percentage of Aircraft that Cannot Enter Queue** is a subset of the **Percentage of Total Aircraft that Must Wait**. This is the proportion or probability that not only are the four fuel pit slots in a given ramp area full, but there are already six aircraft waiting when another aircraft arrives. The queues for the western-ramp and eastern-ramp fuel pits are assumed to be independent; however, these statistics aggregate the fuel pits of both ramps. The **Average Wait Prior to Refueling** is virtually the same in all scenarios. This is the amount of time that an aircraft, once it has entered the queue, will actually spend waiting for a fuel pit slot.

Table 3-7: NAS Oceana Annual Fuel Pit Usage and Delay

	Baseline	ARS-1	ARS-2	ARS-3	ARS-4	ARS-5
Total Aircraft Requesting Pit Refueling	22,981	48,812 112% higher than Baseline	45,858 100% higher than Baseline	44,176 92% higher than Baseline	41,644 81% higher than Baseline	42,103 83% higher than Baseline
Aircraft that Must Wait	4,080	9,825 141% higher than Baseline	8,555 110% higher than Baseline	7,945 95% higher than Baseline	7,142 75% higher than Baseline	7,418 82% higher than Baseline
Percentage of Total Aircraft that Must Wait	17.8%	20.1%	18.7%	18.0%	17.2%	17.6%
Percentage of Aircraft that Cannot Enter Queue	0.8%	1.0%	0.8%	0.9%	0.7%	0.8%
Average Wait Prior to Refueling (in minutes)	4.4	4.5	4.4	4.4	4.4	4.4

Some aircraft returning to base desire to conduct pattern operations but are unable to access the patterns due to several factors. As mentioned in Section 2.3.2, NAS Oceana ATC places a limit of five aircraft in the VFR touch-and-go (or tower) pattern. This five-aircraft limit is specified as a firm constraint in NASMOD. If an aircraft arrives at a time when five other aircraft are in the pattern or if FCLP operations are underway, it cannot enter the visual pattern and must proceed to the next action specified in its profile (e.g., perform a full stop landing). (Note that for modeling purposes, an aircraft conducting an overhead break arrival directly to a full-stop landing is not holding a pattern position or "slot".) Similarly, if an aircraft returns to base when the weather precludes VFR pattern operations, it will either conduct an instrument approach to a full-stop landing or conduct practice instrument approaches if the weather permits. Even though non-FCLP missions are scheduled to avoid FCLP periods on the flight schedule, some aircraft return to the base for pattern work while other aircraft are active in the FCLP pattern or when the tower pattern is full. When this occurs, the desired pattern operations are considered to be "lost". Table 3-8 presents a summary of the NAS Oceana pattern events desired and not performed in each scenario. In the Baseline Scenario, almost all desired pattern events are performed. In ARS-1, the busiest scenario at NAS Oceana, about seven percent of the desired events cannot be not performed, with the F-14 fleet squadrons the most affected group. The "lost" operations total only 4.6 percent of the total operations conducted, however. With six F/A-18 fleet squadrons based at NAS Oceana (ARS-4 and ARS-5), the pattern event completion rate increases to 93.7 percent. Note that almost all of the desired pattern events that are not performed are VFR pattern events.

Table 3-8: Annual Pattern Event Completions at NAS Oceana

Aircraft Group	Desired Pattern Events* not Performed					
	Baseline	ARS-1	ARS-2	ARS-3	ARS-4	ARS-5
F/A-18 Fleet	—	1,386	1,249	931	770	741
F/A-18 FRS	—	1,576	1,753	1,607	1,341	1,432
F-14 Fleet	308	1,368	1,269	1,256	1,226	1,115
F-14 FRS	269	937	857	767	805	846
Adversary/Transient	99	251	187	226	196	200
Total Events	676	5,518	5,315	4,787	4,338	4,334
Aircraft Group	**Percent of Desired Pattern Events* Performed**					
	Baseline	ARS-1	ARS-2	ARS-3	ARS-4	ARS-5
F/A-18 Fleet	—	91.8%	91.5%	92.4%	92.2%	92.3%
F/A-18 FRS	—	93.5%	92.8%	93.4%	94.5%	94.1%
F-14 Fleet	97.2%	89.3%	89.9%	90.0%	89.9%	90.8%
F-14 FRS	98.4%	94.6%	95.0%	95.6%	95.3%	95.1%
Adversary/Transient	97.9%	95.4%	96.6%	95.8%	96.4%	96.3%
Total Percentage	98.0%	92.8%	92.9%	93.3%	93.7%	93.7%

*One Event = Two Operations; excludes FCLP operations

3.2.2 NALF Fentress Operations

Figure 3-3 provides the number of annual operations at NALF Fentress for each of the scenarios, and Table 3-9 presents a comparison of the percentage increase of NALF Fentress operations from the Baseline Scenario. The impacts of the F/A-18 squadrons' realignment is significant: a 51 percent increase in operations (about 53,500 operations) in ARS-1 over the baseline and a 40 percent increase in ARS-4 and -5.

Table 3-9: Scenario Comparisons of NALF Fentress Operations

	Percent Greater than Baseline	Daytime Operations	Nighttime Operations
Baseline	—	38,056	66,612
ARS-1	51.1%	59,602	98,592
ARS-2	43.3%	56,008	94,032
ARS-3	42.1%	55,164	93,592
ARS-4	39.2%	53,408	92,252
ARS-5	39.6%	54,008	92,132

FCLP training is grouped into daytime and nighttime periods, with the first nighttime period occurring no earlier than thirty minutes after sunset. Table 3-9 provides a comparison of the daytime and nighttime (based on sunrise and sunset times) operations for NALF Fentress. For all the scenarios, about 63 percent of the FCLPs are conducted under nighttime conditions. However, only about 38 percent (33 percent for Baseline) are conducted after 2200. Of course, during the summer months, a greater number of FCLPs are flown after 2200 than during the winter months, simply due to the shifts in the sunset time.

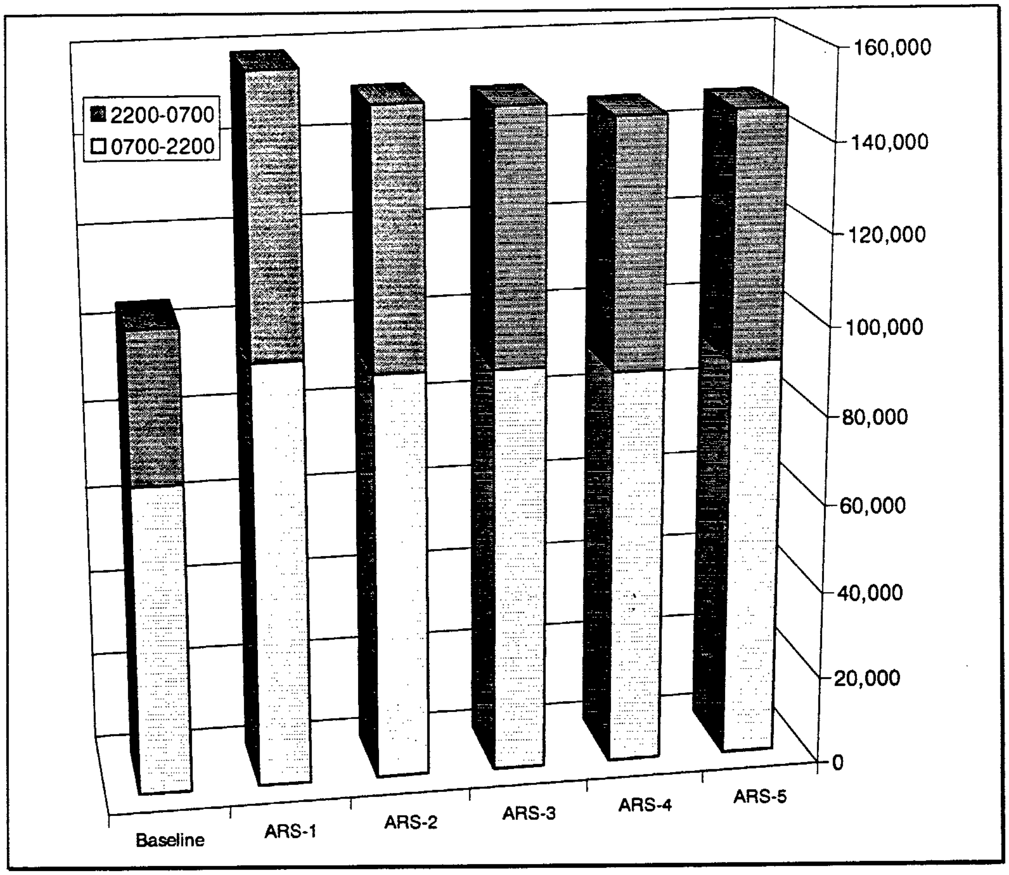


Figure 3-3: NALF Fentress Annual Airfield Operations

Constraints on simulated daytime and nighttime FCLP scheduling at NALF Fentress exist due to airfield closure periods, the shifting of sunrise and sunset times during the year, and rigid block scheduling of Fentress time in NASMOD. The operating hours of NALF Fentress for a normal week are illustrated in Figure 3-4. The shaded regions denote the times that NALF Fentress is closed. Notice that the number of daytime and nighttime hours is dependent on the sunrise and sunset times. As modeled, NALF Fentress is scheduled in 45-minute time blocks; however, some of the open time periods, such as 1230–1630, do not divide evenly into 45-minute blocks and, consequently, fifteen minutes will be unused. During certain periods of the year, up to thirty minutes of nighttime hours are technically "unschedulable" each night. This limitation may not be entirely realistic since squadrons can slide the times at which they arrive at NALF Fentress, can mix with sister squadrons, or can simply use a time block less than 45 minutes. While the

NASMOD scheduling algorithm attempts to emulate squadron scheduling personnel by searching for available schedule blocks, it cannot dynamically change the duration of schedule blocks during a simulation nor can it deliberately slide a schedule forward (i.e., creating more schedule blocks) to take advantage of free time available due to missions that complete their FCLP period early. These factors tend to place a greater constraint on the number of missions that may use NALF Fentress during the course of a simulated day.

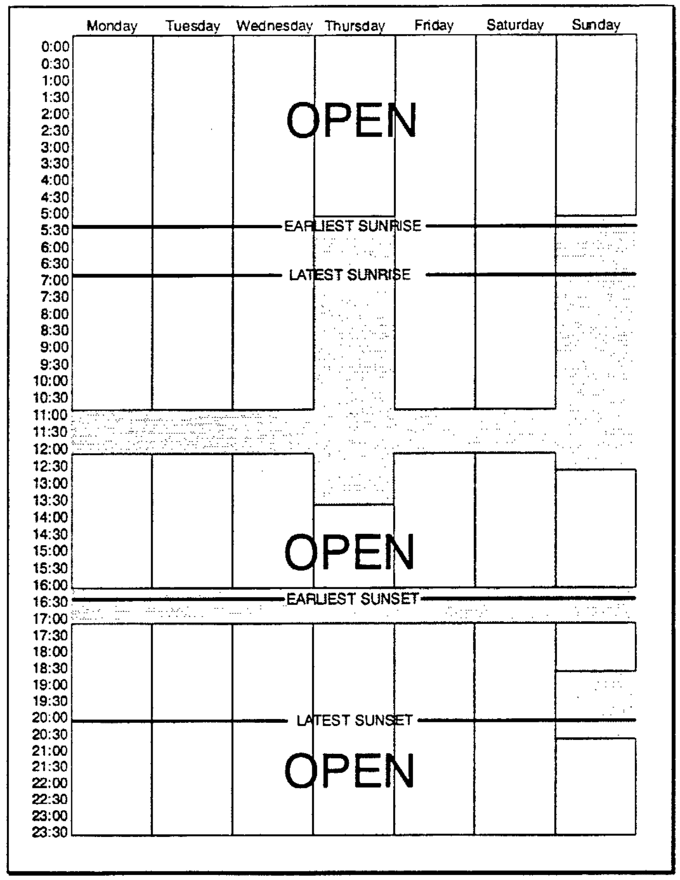


Figure 3-4: NALF Fentress Hours of Operation

3.2.3 MCAS Cherry Point Operations

With respect to their effect on MCAS Cherry Point operations, the scenarios can be aggregated into the following three groups:

No Navy F/A-18 squadrons	Baseline, ARS-1, -2, and -4
Three Navy F/A-18 fleet squadrons	ARS-3
Five Navy F/A-18 fleet squadrons	ARS-5

Within each group, the resulting airfield operations are fairly constant among the scenarios. Consequently, the appendix excludes the tabulations for ARS-1, -2, and -4 since their results closely match the Baseline Scenario. Figure 3-5 offers a graphical comparison of the scenarios. Notice that the addition of three F/A-18 fleet squadrons increases the annual operations by about 18 percent while the addition of five F/A-18 fleet squadrons results in a 26 percent increase in annual operations over the Baseline Scenario. The number of night (2200–0700) operations for ARS-3 increases by about 85 percent (3184) over the baseline count, and for ARS-5, the night operations climb by 113 percent (4253 operations). Recall that pattern operations are unavailable after 2300, except for FCLP operations that can extend beyond 2300 as needed.

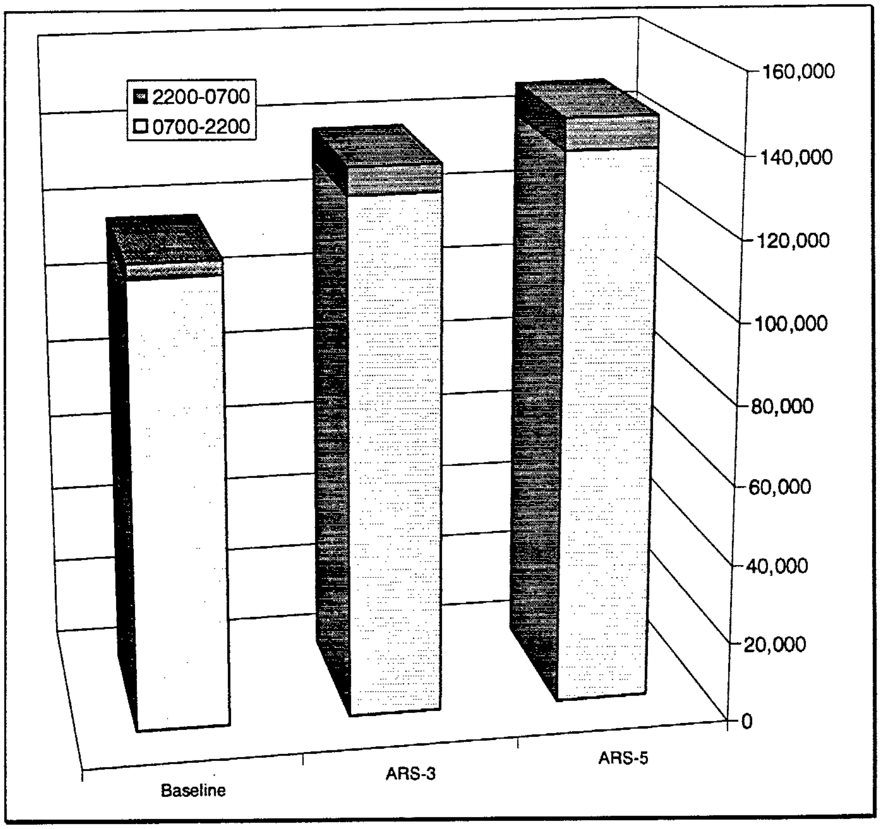


Figure 3-5: MCAS Cherry Point Annual Airfield Operations

Pattern operations at MCAS Cherry Point moderately increase over baseline levels with the realignment of Navy F/A-18 fleet squadrons to this air station in ARS-3 and ARS-5. As shown in Table 3-10 and in Table 3-11, VFR pattern operations increase by 3600 (15 percent) in ARS-3 and about 7000 (29 percent) in ARS-5 over the Baseline Scenario. AV-8B pad operations are only slightly affected, with about 2 percent of the baseline operations "lost" in each of the alternative scenarios due to interactions with FCLP periods and pattern capacity constraints.

Table 3-10: Annual Pattern and Pad Operations at MCAS Cherry Point

	Baseline	ARS-3	ARS-5
VFR Touch-and-Go Operations*	24,200	27,800	31,100
Pad Operations**	18,900	18,500	18,500
Navy FCLP Operations	0	10,700	12,200
Instrument Touch-and-Go Operations	16,400	16,700	17,000

Note: Operations rounded to the nearest 100.
* Includes pad landings from tower pattern
** Includes press-ups and pad VTO/Decel/VL

The greatest impact the F/A-18 squadrons on the airfield is from their FCLP pattern operations; these operations represent about 45 percent of the total annual F/A-18 airfield operations in ARS-3 and 37 percent in ARS-5.

Table 3-11: Percentage Increase in Annual Pattern and Pad Operations at MCAS Cherry Point over the Baseline

	ARS-3	ARS-5
VFR Touch-and-Go Operations	15%	29%
Pad Operations	-2%	-2%
Instrument Touch-and-Go Operations	2%	3%

Table 3-12 provides the average total taxi duration and delay per sortie. ARS-3 (three Navy F/A-18 fleet squadrons at MCAS Cherry Point) has slightly higher duration and delays, yet these values are minimal (about 30 seconds of additional taxi time, of which about six seconds are delay). These are greater primarily because most of the F/A-18s attempt to refuel at the fuel pits rather than return directly to their ramp (unlike the KC-130s). This refueling strategy raises the overall airfield average taxi duration.

Table 3-12: Average "Per Sortie" Taxi Times (in minutes) for MCAS Cherry Point

Per Sortie (sum of pre-takeoff and post-landing)		
	Taxi Duration	Taxi Delay
Baseline	8.0	0.14
ARS-3	8.4	0.24
ARS-5	8.6	0.27

This heavy usage of the fuel pits by the F/A-18 squadrons is readily apparent from the data provided in Table 3-13. Unlike NAS Oceana, all aircraft that want to use the fuel pits *will* use them. That is, they are modeled as willing to wait indefinitely. Note that the actual amount of delay is small, just a few minutes; however, in ARS-5, almost one-fifth of all aircraft must wait. These fuel pit usage statistics are highly dependent on the location of the various tenant squadrons' parking locations on the airfield. In none of the scenarios is the actual magnitude of the delay large; however, the impact on taxi operations is an important consideration in deciding where to locate additional squadrons.

Table 3-13: MCAS Cherry Point Annual Fuel Pit Usage and Delay

	Baseline	ARS-3	ARS-5
Total Aircraft Requesting Pit Refueling	15,155	18,962 25% higher than Baseline	21,089 39% higher than Baseline
Aircraft that Must Wait	393	2,785 609% higher than Baseline	3,935 901% higher than Baseline
Percentage of Total Aircraft that Must Wait	2.6%	14.7%	18.7%
Average Wait Prior to Refueling (in minutes)	4.0	6.6	6.9

An aircraft may not able to complete desired airfield pattern or pad operations when it returns to base and one of three conditions exist: (1) the weather (ceiling and/or visibility) precludes VFR pattern operations, (2) the VFR pattern or instrument pattern is at "capacity", or (3) FCLP operations are underway (preclusion depends on the location of the FCLP pattern). Airfield pattern operations are not performed at MCAS Cherry Point due to the same causes as at NAS Oceana. However, the situations that "block" pattern operations and resulting actions that aircraft must take are different at the two bases. Without a parallel runway at MCAS Cherry Point, the instrument and VFR patterns exist on the same runway, and FCLP operations preclude both VFR and instrument pattern operations as well as most pad operations (restrictions on arrivals to and press-ups on certain pads exist during FCLPs).

Table 3-14 shows the pattern operations at MCAS Cherry Point that are desired but not performed in the Baseline, ARS-3, and ARS-5. In the Baseline Scenario just under 97 percent of all desired pattern events are completed. This rate is comparable to that at NAS Oceana in the Baseline Scenario, during which 98.0 percent of all desired pattern events are completed. The introduction of the Navy F/A-18 squadrons to MCAS Cherry Point does not have a dramatic impact on the existing tenant squadrons, which lose approximately 1350 and 1900 events in ARS-3 and ARS-5, respectively. The F/A-18 squadrons at MCAS Cherry Point have a pattern event completion rate about 8 percent lower on average than at NAS Oceana.

Table 3-14: Annual Pattern Event Completions at MCAS Cherry Point

Aircraft Group	Desired Pattern Events* not Performed			Percent of Desired Pattern Events* Performed		
	Baseline	ARS-3	ARS-5	Baseline	ARS-3	ARS-5
AV-8 Fleet	724	1,021	1,042	94.8%	92.6%	92.5%
AV-8 FRS	323	799	792	98.2%	95.6%	95.7%
EA-6B	258	281	282	91.4%	90.7%	90.6%
F/A-18 Fleet	—	437	988	—	85.6%	82.6%
KC-130 Fleet	100	94	117	95.0%	95.3%	94.1%
KC-130 FRS	49	99	46	98.9%	97.7%	98.9%
Transient Traffic	4	70	101	99.9%	98.2%	97.4%
Total Events/ Percentage	1,458	2,801	3,368	96.8%	94.2%	93.4%

*One Event = Two Operations; excludes FCLP operations.

3.2.3.1 Qualitative Assessment of the Potential Impacts of a Parallel Runway at MCAS Cherry Point

The NASMOD ARS-5 scenario does not incorporate a parallel runway (Runway 23R), and a quantitative assessment of the impacts of this runway cannot be provided at this time. However, qualitative inference about operational costs and benefits of the parallel runway can be made and are presented below:

- Airfield operations "lost" due to conflicts with local FCLP missions will be reduced. With a parallel runway, the tower and instrument patterns as well as approaches to two pads are available during FCLP operations on Runway 23R.
- Fewer missions will have their launch times altered as a result of a reduced need for FCLP scheduling deconfliction. Efficiency of scheduling will increase.
- Airfield operations will increase only moderately due to the gain of lost operations. Also, fewer night (after 2200) operations will occur since FCLPs and other missions that conduct pattern operations will not interfere with each other. Consequently, these flights can be scheduled earlier in the evening during the Runway 23 plan versus other plans.
- Interactions between aircraft in the tower and the instrument patterns and aircraft arriving for a full-stop arrival will be reduced during the Runway 23 plan. Mission delay time will decrease as a result. (Recall that the calm wind runway becomes Runway 23 after the parallel runway is added, thereby increasing the time that Runway 23 is the primary runway by about 15 percent).
- The ability of the air station to accommodate higher flows of arriving and departing (Runway 05 plan) aircraft is gained with the parallel runway.
- The only potential cost that can be assessed at this time is the possible loss of the Northeast Harrier pad. If this pad is not relocated, the AV-8 aircraft will have only three pads. It is not certain if operations would be lost without this pad, but some delay may be incurred if the pads are busy.

3.2.4 MCALF Bogue Field Operations

The annual number of operations at MCALF Bogue Field are not affected by the relocation of F/A-18 squadrons. The tables in Appendix A offer the annual operations for the Baseline Scenario only. Annually, about 17,300 operations are performed at MCALF Bogue Field, with the AV-8 squadrons conducting about 15,200 (88 percent) of these operations.

3.3 Training Area Utilization

The availability of airspace, ranges, and targets is a significant constraint on the ability of the modeled squadrons to complete their training; as greater numbers of military aviation units compete for a fixed amount of airspace, the utilization must increase. As utilization increases, the ability of squadrons to complete their training requirements in a timely manner is highly dependent on their flexibility to use other ranges or airspace. The training areas are categorized as either exclusive-use or concurrent-use areas, and the discussion of the training areas is presented in these two categories.

Appendix B offers a comprehensive tabulation of the sorties that each training area receives by scenario. Usage in terms of hours is also tabulated for the exclusive-use areas W-72 TACTS range, Navy Dare County Range, BT-11, and BT-9.

3.3.1 Exclusive-Use Training Areas

This section addresses the utilization of the training areas analyzed in this study that are scheduled on an exclusive-use basis: the W-72 TACTS range, the Navy Dare County range, BT-11, BT-9, W-386D, and W-386A/B. The Fort Pickett and Stumpy Point Ranges are also scheduled on an exclusive-use basis, but these areas are modeled with only the NAS Oceana and MCAS Cherry Point demand.

Several of these areas have official ("published") operating hours that are divided into discrete scheduling blocks. Because of the limited operating hours, they have a theoretical maximum number of users/missions that can be accommodated. The range managers for these areas report utilization statistics using a variety of methods. This section does not attempt to duplicate such methods but, instead, offers a single approach for all the areas to facilitate a comparison between scenarios. The formulae used to calculate percentage utilization are as follows:

$$\text{Scheduled Hours} = (\text{Used Hours}) + (\text{Short-Notice Canceled Hours})$$

$$\text{Percentage Utilization} = \frac{(\text{Scheduled Hours})}{(\text{Published Hours})} = \frac{(\text{Used Hours}) + (\text{Short-Notice Canceled Hours})}{(\text{Published Hours})}$$

where:

- Used Hours — schedule (block) hours actually flown
- Short-Notice Canceled Hours — schedule (block) hours canceled on too short (late) notification to allow another user to take advantage of the available blocks

Published Hours — the official open hours for the area as specified by the area/range manager

Missions may be canceled on short-notice for reasons such as aircraft mechanical problems, bad weather, or last-minute changes to a squadron flight schedule. While mechanical problems and bad weather are unavoidable by the user, some last minute cancellations reflect inefficiencies in squadron operations planning. NASMOD has the capability to generate random weather events that correspond to actual NAS Oceana region weather patterns and to impose probabilities of mechanical problems for missions. These parameters are used to model the "act-of-God" cancellations of missions that truly wanted to use their schedule area block time. However, this study does not attempt to address or model short-notice cancellations due to squadron planning inefficiencies. Because of this modeling approach, a higher efficiency of the usage of scheduled blocks is reflected in the utilization data.

By the above definition of utilization, when an area is reported as having 100 percent utilization for a specific day (or month, year), the interpretation is that every block of time of that area's schedule is reserved. If a mission results in a "no-show", its schedule blocks are unavailable to other users; consequently, these blocks are considered to have been "used" by the squadron that reserved them.

3.3.1.1 W-72 TACTS Range

The F-14 and F/A-18 fleet squadrons are the primary users of the TACTS range. For example, SFARP training is performed exclusively in the TACTS range; consequently, the addition of the F/A-18 squadrons can effectively double the demand for range time for SFARP missions alone. This is apparent by an examination of Table B-1 as well as Table 3-15, which gives the increase over the Baseline Scenario that can be expected in the number of sorties to the TACTS range for each of the alternatives. The usage of the W-72 TACTS range for the Navy fleet squadrons is highly dependent on the mission preferences and secondary training areas utilization. For example, the introduction of Navy F/A-18 fleet squadrons, which brings about 3200 annual area sorties in ARS-1, displaces both F-14 fleet squadrons and Air Force sorties to secondary areas. Except for the FRSs, the aircraft group mix utilizing the TACTS range is highly dependent on the number of F/A-18 squadrons based in the region. Note that the F-14 and F/A-18 FRSs use the TACTS range for local portions of their ACM and FWT syllabi, and most of the associated flight profiles have no secondary training areas. As a result, the FRSs' utilization is relatively constant across the alternative scenarios.

Table 3-15: Percentage Increase in Annual TACTS Range Sorties over the Baseline

ARS-1	67%
ARS-2	58%
ARS-3	58%
ARS-4	46%
ARS-5	54%

The published TACTS range hours indicate that the range is available 50 hours per week when standard time is in effect and 55 hours per week when daylight savings time is in effect. This suggests that there are a maximum of approximately 2730 hours (5460 30-minute schedule blocks) available each year to users. However, the TACTS range can operate on an overtime basis. In particular, the recently updated training and readiness matrix for the F-14 community includes night air combat training. During the data collection for this study, the F-14 community expressed a desire to use the TACTS range as the preferred location for these missions. Such missions would occur outside the current published range hours and would require that the range be available after dark 113 hours on weeknights during the year for the Baseline Scenario and 35 to 45 hours for the alternative scenarios. Other missions, too, extend beyond published hours during the weekdays; the total hours of range time utilized for the Baseline Scenario is 146 hours, and it ranges from 223 hours to 274 hours for the alternative scenarios.

Squadrons require weekend range time during the simulated year for a total of about six hours for the Baseline Scenario and 15.5 hours to 47.5 hours for the alternative scenarios. This weekend demand typically occurs soon after holiday periods and days of bad weather, indicating that the squadrons need the overtime to "catch-up" rather than a fundamental shortage of available hours on weekdays.

Table 3-16 presents the percent utilization of the TACTS range for each scenario. ARS-1, which has the all F/A-18 squadrons realigned to NAS Oceana, has the greatest utilization rate, with just over 2275 hours of published range hours scheduled. Total annual scheduled hours in ARS-1 is 2590 hours, which includes hours scheduled on an overtime basis. Interestingly, although the TACTS range in the Baseline is scheduled during normal published hours for more hours than in ARS-4, it is actually scheduled for 25 fewer hours over all than in ARS-4.

Table 3-16: Annual Percentage Utilization of the W-72 TACTS Range

Baseline	78%
ARS-1	83%
ARS-2	80%
ARS-3	77%
ARS-4	76%
ARS-5	76%

Note that the utilization percentages for the alternative scenarios are about the same as for the Baseline although the number of sorties is substantially higher. This implies that, as more Navy squadrons are based in the region, the average number of aircraft participating in each TACTS range event will increase. Also, scheduling inefficiencies and demand peaking from among the squadrons preclude the possibility of scheduling 100 percent of the available hours, and utilization rates of 80 percent to 85 percent may be an upper limit given the current scheduling procedures and requirements.

3.3.1.2 Navy Dare County Range

The percentage increase in annual sorties with respect to the Baseline Scenario for the Navy Dare County Range is given in Table 3-17. A comparison of the utilization percentages among Tables B-21 through B-26 shows a similar trend. The Navy Dare range is available approximately 3600 hours on weekdays and 400 hours on weekends (excluding holidays/closures). This results in about 16,000 available 15-minute schedule blocks during the year. However, the range is used infrequently on Sundays, except for special events such as carrier exercises. Navy Dare is open on Saturdays from 0800–1600, during which it is used primarily by the Virginia Air National Guard. NAS Oceana- and MCAS Cherry point-based units and other Navy, Air Force, and Marine Corps units are less frequent weekend users. Most Saturdays are used at a rate of 10 percent to 20 percent of the available hours. There is very little difference between the scenarios on this frequency. Some weekend work is inevitable for squadrons as they try to achieve their training cycle milestones, and this weekend utilization does not indicate a substantial shortage of weekday range hours.

Table 3-17: Percentage Increase in Annual Navy Dare County Range Sorties over the Baseline

ARS-1	37%
ARS-2	33%
ARS-3	33%
ARS-4	25%
ARS-5	33%

In all scenarios, the F-14 fleet squadrons are the major users of the range, with sorties varying from 3024 sorties (57 percent of the annual total) in the Baseline Scenario to 2674 sorties in ARS-2 (38 percent of the total). The F/A-18 fleet squadrons usage varies from 1652 sorties in ARS-1 to 960 sorties in ARS-4. The Air Force annual sorties range from about 1050 in the Baseline and ARS-5 to about 975 in ARS-1 and ARS-3. The Marine Corps sends the fewest sorties to Navy Dare range, with about 70 annual sorties on average.

Some range time outside of the published open range hours is required by the users. These "overtime" hours are primarily the result of demand by carrier-based exercises and training. This demand varies among the alternatives from 18 hours per year (ARS-1) to 26 hours (ARS-3).

Table 3-18 shows the percent utilization of the annual available hours of the Navy Dare County Range for all scenarios. The range hours scheduled jumps by 10 percent (about 410 hours during published available hours) from the Baseline to ARS-1, and Navy Dare range experiences very little change in percentage utilization from ARS-1 to the other scenarios. With five F/A-18 fleet squadrons based out of the region in ARS-4, the annual utilization is about 3 percent less (about 130 hours) than it is in ARS-1. These observations suggest that utilization of this range is reaching a saturation point for specific blocks of those available from the schedule. That is, there are occurrences in

Table 3-18: Annual Percentage Utilization of the Navy Dare County Range

Baseline	57%
ARS-1	67%
ARS-2	66%
ARS-3	66%
ARS-4	64%
ARS-5	65%

which two or more users request the same range schedule blocks. Often the request for specific range times is dictated by the availability of aircraft within the requesting squadron, which in turn is governed by such factors as squadron maintenance staff and procedures. Consequently, the squadron will attempt to alter the mission launch time first, but if no acceptable alternate times are found, the training area location is altered. The Navy fleet squadrons and Air Force fighter units are much more likely to do this than the FRS or training units. This results in squadrons "flexing" to an alternate training area. For example, Seymour Johnson AFB F-15 fighter unit representatives indicated that if they cannot obtain a Dare County range reservation (either Air Force Dare, which is not modeled, or Navy Dare), they will opt for BT-11. If BT-11 is unavailable, BT-9 is a third choice for some profiles about 10 percent of the time. Table 3-19 gives the percentage of missions that wish to reserve time at Navy Dare but ended up using BT-11 and BT-9. Note that the "flex" percentages for the alternative scenarios are slightly higher than for the baseline.

Table 3-19: Percentage of Missions that "Flex" from Navy Dare County to BT-11 and BT-9

User	Baseline		ARS-1		ARS-2		ARS-3		ARS-4		ARS-5	
	BT-11	BT-9	BT-11	BT-9	BT-11	BT-9	BT-11	BT-9	BT-11	BT-9	BT-11	BT-9
Navy	11%	2%	13%	2%	14%	2%	13%	2%	13%	2%	12%	2%
Air Force	18%	9%	19%	15%	22%	12%	18%	13%	20%	9%	15%	14%

User group utilization of the Navy Dare range is complex due to joint training missions, training area flexibility, and Navy F/A-18 fleet squadron basing scenario. The Navy fleet squadrons, the AV-8 fleet squadrons, and the F-15 units from Seymour Johnson AFB can schedule alternative training areas if the Navy Dare range is unavailable. These aircraft groups have the ability to "flex" to areas, such as BT-11 and BT-9. With a greater number of F/A-18 fleet squadrons based in the region, the flexing of F-14 fleet and F-15 missions from Navy Dare range (compared to the Baseline and ARS-4, for example) to alternative areas is also greater.

3.3.1.3 Phelps MOA

The Phelps MOA is designed to allow high-altitude bombing on the Dare County ranges. Per a letter of agreement with the Federal Aviation Administration incorporating this MOA, missions may use the MOA only in conjunction with training activities using Dare County, which is officially exclusive-use. Consequently, only one mission should be using the Phelps MOA (northern-half) at a time for training purposes, and that mission should be performing high-altitude ingress. All non-high-altitude bombing missions avoid using this airspace for other types of training.

Annually, 146 F/A-18 high-altitude bombing missions (ARS-4) to 276 missions (ARS-1) are performed at the Navy Dare County range. The F-14 squadrons do not perform high-altitude bombing training locally. These high-altitude bombing missions typically involve two to four aircraft reserving the range for one hour for each mission. Phelps MOA is activated annually between 48 hours (ARS-4) and 83 hours (ARS-1) for the alternative scenarios.

3.3.1.4 BT-9 and BT-11

Prior to the realignment of the Navy F/A-18 squadrons, Marine Corps AV-8 and F/A-18 squadrons are the primary users of BT-11. These squadrons, along with Air Force F-16 and A-10 units, have also dominated the usage of BT-9. After realignment, especially in ARS-1, the Navy F/A-18 squadrons have a tremendous impact at BT-11, becoming the single greatest user community in that scenario.

BT-9 tends to be a flex point rather than a primary objective for many bombing missions due to the poor state of this target, its location on a shoal in Pamlico Sound, and the attractive features of other local targets. BT-9 was originally composed of three ship hulks but currently offers only the remains of these hulks. When training over the water at BT-9, pilots may have a difficult time establishing a horizon reference, and close-air-support and forward-air-control missions cannot be supported there. Also, electronic warfare emitters are located at BT-11 along with 16 different targets. Hence, BT-11 and Dare County ranges are generally preferred for most locally performed air-to-ground missions.

Army helicopters from Fort Bragg use BT-9 and BT-11 but at levels much lower than those of the Navy, Marine Corps, and Air Force. For example, the Army utilized only 2.7 hours of range time at BT-11 in FY94 and 33 hours at BT-9. For purposes of this study, Army usage of these targets is considered negligible and is not modeled.

Multi-aircraft strike missions that require an exclusive-use reservation of R-5306A are assumed to be using both BT-9 and BT-11 regardless of whether they actually make runs over the targets. When such missions are in progress, the bombing targets are unavailable to other users and are, consequently, considered as being utilized by the strike mission.

For each alternative scenario, the percentage increase in annual sorties with respect to the Baseline Scenario for BT-9 and BT-11 is shown in Table 3-20. Note that the increase in the usage of BT-11 is about the same for all the scenarios, with the exception of ARS-4 in which five F/A-18 fleet squadrons are based out of the region. BT-9 experiences greater increases for ARS-1 and -5 because the F/A-18 fleet squadrons are willing to "flex" missions to this target in the event that Navy Dare County or BT-11 are unavailable.

Table 3-20: Percentage Increase in Annual BT-11 and BT-9 Sorties over the Baseline

	BT-11	BT-9
ARS-1	34%	41%
ARS-2	31%	29%
ARS-3	32%	33%
ARS-4	19%	16%
ARS-5	32%	37%

It is important to note that the Marine Corps is the major user of BT-9 and BT-11 in terms of range hours for all the scenarios but that it is almost equal with the

Navy in terms of sorties scheduled at BT-11 in ARS-1 and -5, as shown in Table 3-21 and Table 3-22. With the relocation of the F/A-18 squadrons, the proportion of the range sorties flown by Navy aircraft increases; however, they primarily add to the total number of sorties flown in the area and do not significantly displace Marine Corps or Air Force sorties as is evident by an examination of Tables B-4 and B-5. Also, Navy F/A-18 air-to-ground missions tend to involve more aircraft (sorties) per mission than do AV-8 missions.

Table 3-21: Percentage of BT-11 and BT-9 Sorties Generated by User Community

User	Baseline		ARS-1		ARS-2		ARS-3		ARS-4		ARS-5	
	BT-11	BT-9	BT-11	BT-9	BT-11	BT-9	BT-11	BT-9	BT-11	BT-9	BT-11	BT-9
Navy	17%	21%	40%	38%	38%	33%	40%	36%	31%	30%	41%	33%
Marine Corps	56%	39%	40%	32%	41%	34%	40%	32%	46%	35%	40%	33%
Air Force	24%	32%	18%	24%	19%	26%	18%	26%	21%	28%	17%	27%
Army/Other	3%	8%	2%	6%	2%	7%	2%	6%	2%	7%	2%	7%

Table 3-22: Percentage of BT-11 and BT-9 Hours Sceduled by User Community

User	Baseline		ARS-1		ARS-2		ARS-3		ARS-4		ARS-5	
	BT-11	BT-9	BT-11	BT-9	BT-11	BT-9	BT-11	BT-9	BT-11	BT-9	BT-11	BT-9
Navy	17%	20%	34%	26%	32%	25%	35%	25%	27%	21%	38%	24%
Marine Corps	54%	42%	42%	39%	43%	40%	42%	38%	47%	39%	41%	39%
Air Force	22%	24%	18%	23%	19%	23%	18%	25%	20%	26%	16%	25%
Army/Other	7%	14%	5%	12%	6%	12%	5%	12%	6%	12%	5%	12%

BT-9 and BT-11 are each available approximately 3350 hours on weekdays during the year, excluding holidays and other closures. This results in about 10,050 available 20-minute schedule blocks for each range. Tables B-27 through B-32 provide the utilization statistics for BT-11, and Tables B-33 through B-38 for BT-9. Neither of these two targets exhibits symptoms of reaching its capacity. The BT-11 utilization for the Baseline Scenario is 42 percent and varies from 46 percent to 51 percent for the alternatives, as shown in Table 3-23. The BT-9 utilization for the Baseline Scenario is 17 percent and varies from 16 percent to 20 percent for the alternatives. These increases from baseline reflect the "flexing" of missions from the Navy Dare County range to these targets as well as a greater demand for the bombing targets.

Table 3-23: Annual Percentage Utilization of BT-11 and BT-9

	BT-11	BT-9
Baseline	42%	17%
ARS-1	51%	20%
ARS-2	49%	18%
ARS-3	49%	18%
ARS-4	46%	16%
ARS-5	51%	19%

3.3.1.5 W-386A/B and W-386D

Air Force units, specifically the 1st Fighter Wing units at Langley AFB and the Virginia Air National Guard, use W-386A/B as their primary air-to-air training area. The Air Force schedules its warning area missions into exclusive-use subareas. Depending on the activities scheduled, Air Force scheduling personnel send flights to different areas of W-386A/B; some flights require the entire area, while other flights have smaller airspace requirements and use subareas of the warning area. Rocket launches and other flight activities by NASA Wallops Flight Facility have the highest scheduling priority in W-386. Over the year, NASA conducts 183 flight activities requiring about 549 hours of W-386A/B and W-386D schedule time.

The Navy conducts air combat maneuvers and air intercept training in W-386A/B and air-to-air gunnery training in W-386D. W-386A/B is primarily a secondary mission training area to W-72 for NAS Oceana-based squadrons. Note that the Navy performs concurrent-use operations in W-386A/B areas not being used by the Air Force. W-386D is scheduled on an exclusive-use basis by all users.

Other aircraft groups utilize W-386A/B, including flights from NAS Norfolk, NAS Patuxent River, other Air Force and Navy bases, and civilian flights that perform support missions. Commercial traffic transits portions of the airspace when they are not in use by the military.

Table 3-24 provides the percentage increase in baseline W-386 sorties resulting from the implementation of the alternative scenarios. The relocation of the F/A-18 squadrons to NAS Oceana results in an increase in the amount of joint training among the Navy fleet squadrons and, to a lesser degree, with the Air Force. The absolute increases are modest for W-386A/B (on the order of 500 sorties) since the Air Force, whose demand does not vary significantly among the scenarios, accounts for the majority of all the sorties (78 percent for baseline and 72 percent to 75 percent for the alternative scenarios).

Table 3-24: Percentage Increase in Annual W-386A/B and W-386D Sorties over the Baseline

	W-386A/B	W-386D
ARS-1	12%	27%
ARS-2	11%	22%
ARS-3	14%	21%
ARS-4	9%	18%
ARS-5	12%	22%

The absolute increases are modest for W-386D, as well (on the order of 300 sorties), although the percentage increases are greater. This area is used primarily by F-14 squadrons.

3.3.1.6 Fort Pickett Range

The Fort Pickett range is used as an alternative site for close-air-support (CAS) and forward-air-control (FAC) training by the Navy fleet squadrons. Such training is usually performed (or preferred) at Navy Dare and BT-11 due to their closer proximity, and the Fort Pickett range is designated as a flex point because the distance to Fort Pickett reduces the amount of flight time the mission can spend on the target. Occasionally, however, CAS and FAC missions at Fort Pickett are conducted as coordinated training with Army ground units and, at such times, the

Fort Pickett range is selected by the scheduling algorithm as the primary training site.

Table B-13 provides the number of sorties to the Fort Pickett range generated by Navy squadrons based at NAS Oceana and MCAS Cherry Point. Table 3-25 provides the percentage increase in baseline Fort Pickett sorties by NAS Oceana/MCAS Cherry Point-based Navy fleet squadrons resulting from the implementation of the alternative scenarios. Note that the Navy demand on this range varies from 222 sorties in ARS-3 to 72 sorties in the Baseline Scenario. While the total annual number of sorties at the Fort Pickett range was not assessed as part of this study, range managers can expect the Navy demand to approximately triple as a result of the relocation of the F/A-18 squadrons.

Table 3-25: Percentage Increase in Annual Fort Pickett Range Sorties over the Baseline

NAS Oceana/MCAS Cherry Point Demand Only	
ARS-1	194%
ARS-2	133%
ARS-3	208%
ARS-4	167%
ARS-5	183%

ARS-3 generates more sorties than ARS-1 to the Fort Pickett range because although the total number of Navy squadrons based in the combined NAS Oceana/MCAS Cherry Point region is the same for these two scenarios, the squadron/airwing assignments are different such that there are more Navy squadrons performing Fort Pickett CAS and FAC missions.

3.3.1.7 Stumpy Point Range

The Stumpy Point target in R-5313 consists of a sunken hulk similar to that of BT-9; however, there are no land targets in R-5313. The condition of this target has been very poor the past few years, and is used as a tertiary target for some strike missions by Navy squadrons. There are only 56 Navy sorties (all by F-14 fleet aircraft) to Stumpy Point for the Baseline Scenario. In the alternative scenarios, the usage at Stumpy Point is reduced due to the increase in joint strike missions, which have profiles that do not use this range as an alternative. The Navy demand for Stumpy Point for each scenario is presented in Table B-14.

3.3.2 Concurrent-Use Training Areas

This section addresses the utilization of the training areas analyzed in this study that are scheduled on a concurrent-use basis: W-72, W-122, and the military training routes. As discussed in Section 2-4, W-72 and W-122 were subdivided into SOAs after this study was designed. These SOAs may limit the number of simultaneous missions that may use a given warning area; however, for the purpose of this study, no such limits are imposed on the concurrent-use training areas.

3.3.2.1 W-72

W-72 is a primary training area for NAS Oceana-based squadrons. About one-third of all local F-14 sorties enter W-72, not counting the missions using only the W-72 TACTS range. As shown in Table 3-26, relocating all the F/A-18 squadrons to NAS Oceana (ARS-1) nearly doubles the number of sorties in W-72. The F/A-18 squadrons conduct about 9900 sorties in ARS-1. About 50 percent of the increase (about 4600 sorties on average) is due to the F/A-18 FRS. ARS-2 and -3 generate increases proportional to the number of F/A-18 fleet squadrons located at NAS Oceana. Those F/A-18 fleet squadrons based at MCAS Cherry Point for ARS-3 and ARS-5 use W-122 as their primary over-water training area. Since W-72 is modeled as concurrent-use, an increase by one user community does not affect the availability of the area to other users, consequently the number of sorties generated by other communities does not vary among the scenarios.

Table 3-26: Percentage Increase in Annual W-72 (exclusive of TACTS range) Sorties over the Baseline

ARS-1	101%
ARS-2	91%
ARS-3	85%
ARS-4	75%
ARS-5	77%

3.3.2.2 W-122

Navy aircraft account for only six to eight percent of the total sorties to W-122, except for ARS-3 and ARS-5 in which Navy sorties account for 17 percent and 23 percent of the total, respectively.. The percentage increase in annual sorties with respect to the Baseline Scenario is given in Table 3-27. The additional sorties in ARS-3 and ARS-5 are generated by the Navy F/A-18 fleet squadrons based at MCAS Cherry Point. Note that about 97 percent of the sorties generated by the MCAS Cherry Point-based F/A-18 squadrons are performed during the daytime. Table B-11 provides the W-122 sortie statistics for each scenario.

Table 3-27: Percentage Increase in Annual W-122 Sorties over the Baseline

ARS-1	2%
ARS-2	1%
ARS-3	13%
ARS-4	0%
ARS-5	21%

Like W-72, the number of sorties generated by other user communities does not vary among the scenarios. The Air Force jets (primarily F-15E aircraft from Seymour Johnson AFB) and Marine Corps squadrons from MCAS Cherry Point generate about 5430 sorties and 5800 sorties, respectively. These two aircraft groups represent about 79 percent of the annual sorties in the Baseline Scenario and 65 percent in ARS-5.

3.3.2.3 Military Training Routes

Table B-12 provides the number of annual sorties by NAS Oceana and MCAS Cherry Point squadrons on local MTRs. A number of sorties are allocated to the Other Visual Routes and Other Instrument Routes categories. These categories aggregate MTR sorties for which it is impossible to identify specific MTR usage; most squadrons try to use a variety of MTRs to provide different low-level mission profiles.

While the MTRs are considered to be concurrent-use areas, there is a theoretical limit to the number of missions that can use an MTR in any period of time because each mission is given an entry time by the scheduling agency for the route to provide for adequate spacing between missions. However, the demand generated by NAS Oceana and MCAS Cherry Point squadrons is far below these limits. For example, VR-1753, the most heavily used MTR by the modeled squadrons, experiences an average of five to six sorties per day. Since many low-level missions are flown as a section (two aircraft), this level of demand equates to an average of two to three missions per day.

3.4 Operations Flow Analysis

One purpose for simulating a twelve-month period is to capture the manner in which the level of operations varies or "flows" over the year. The flight schedule for a given squadron can differ significantly from one day to the next. Base loading may change month-to-month as squadrons depart or return from deployments or detachments. The operations discussed in Sections 3.2 and 3.3 provide a summary of the annual effects but do not give an insight as to how these totals are distributed over the twelve months (or 52 weeks), why certain parts of the simulated year are busier (or less busy) than others, and what the busiest day of the year is like. The following sections discuss a variety of operations flow issues.

Note that since flows are highly dependent upon the assumed workup and deployment cycles described in Section 2, changes to those assumptions would result in significant changes to the results presented in this section.

3.4.1 Airfield Operations by Month

Figure 3-6 displays the number of monthly airfield operations at NAS Oceana for ARS-1. This scenario was chosen for this analysis because it represents the greatest NAS Oceana-tenant loading condition among the alternative scenarios. The busiest month is April with 22,226 operations, and the least busy month is May with 17,513 operations. The average is 19,784 operations per month, so there is about a 12 percent variation from the average. This emphasizes the fact that no one-month period can give a complete representation of the long-term tempo of operations at the airfield.

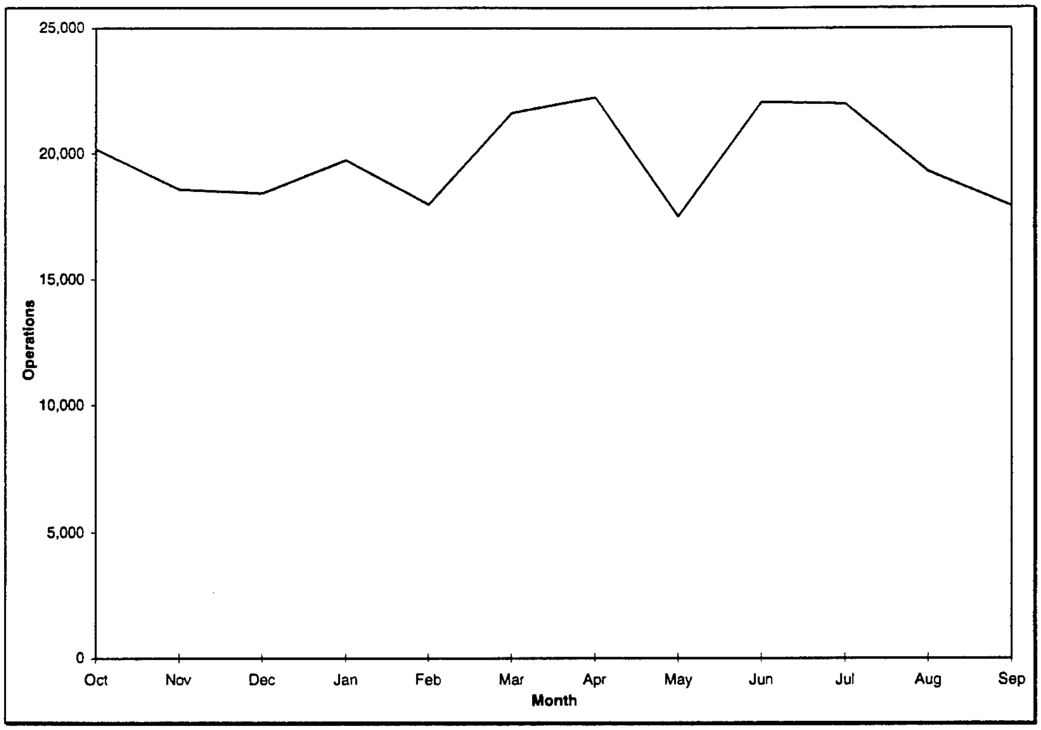


Figure 3-6: Total Monthly NAS Oceana Operations (ARS-1)

March, April, June, and July are busy months for a number of reasons. The primary factor is that there are more squadrons based at home during these periods. As shown in Figure 2-14, all airwings except Atlantic Airwing B are at home during these months (Pacific Airwing H deploys in mid-July). During the peak month of April, Airwing B is deployed and Airwings C and H are embarked during the first half of the month, performing their TSTA III/COMPTUEX exercises. All other airwings are at their home air stations, thereby resulting in a high level of local operations. Operations are low for the month of May, on the other hand, because all but two of the airwings spend part of the month away on detachments or at-sea exercises. FCLPs add a high number of operations, so that months that contain the two weeks prior to at-sea exercises tend to be somewhat higher than average. February and December are low months primarily because they have fewer working days.

Figure 3-7 categorizes the monthly NAS Oceana operations by user/aircraft category. The F/A-18 fleet community generates the most operations six months of the year, the F/A-18 FRS five months, and the F-14 FRS squadron only one month. This figure illustrates the amount of monthly fluctuation that can be expected. For the F-14 and F/A-18 user communities, the monthly operations can vary by 20–35 percent of their averages, the transients can vary by 35–45 percent, and the adversaries by 70–140 percent of their average. These fluctuations emphasize the limitation of calculating an average number of monthly operations.

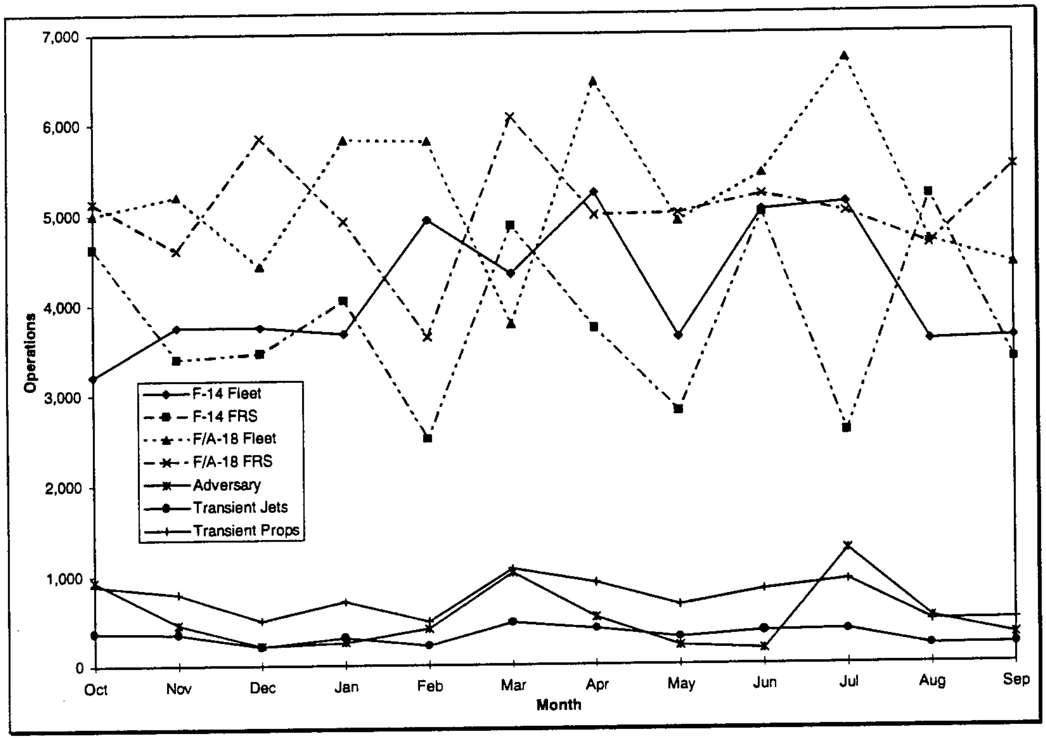


Figure 3-7: Monthly NAS Oceana Operations by Aircraft Category (ARS-1)

It is interesting to note that each of the four categories of major NAS Oceana tenant squadrons — F-14 fleet, F-14 FRS, F/A-18 fleet, and F/A-18 FRS — generates about the same magnitude of operations. The F/A-18 aircraft conduct only a few more operations than the F-14s; however, no single community dominates NAS Oceana operations.

The monthly variation of operations at NALF Fentress is much greater than for NAS Oceana due to the fact that NALF Fentress is used primarily for FCLP training. For fleet squadrons, FCLP training is performed just prior to an at-sea period as required by a given squadron's workup cycle. For fleet replacement squadrons, FCLP training is dictated by class sizes, carrier schedules, and class training phases. Figure 3-8 shows the monthly operations for NALF Fentress for ARS-1. June is the peak month because Airwings C and H are preparing for deployments at the end of the month and the beginning of July. Airwing E is also participating in Sea Trials during June. In addition, the F-14 and E-2 FRSs have student pilots in the FCLP phase of their training. The contributions by each of the aircraft categories are shown in Figure 3-9. July is actually the busiest month for the fleet squadrons because, while Airwing H is finishing its FCLPs in preparation for deployment, Airwings A and G are performing carrier qualifications and Airwing J is preparing for TSTA III. The F-14 and E-2 FRSs are not performing a large number of operations this month. The curves for the three fleet squadron communities (F-14, F/A-18, and E-2/C-2) tend to have the same shape since each of the communities supports the same airwing deployments and have the same at-sea exercise timeline.

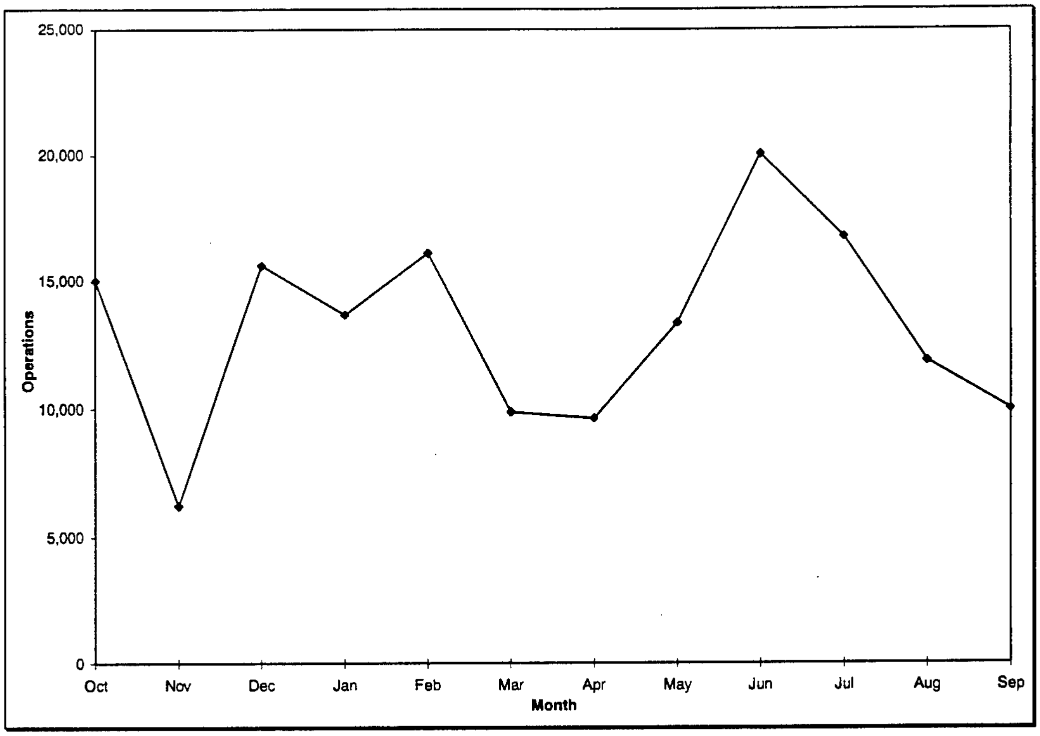


Figure 3-8: Total Monthly NALF Fentress Operations (ARS-1)

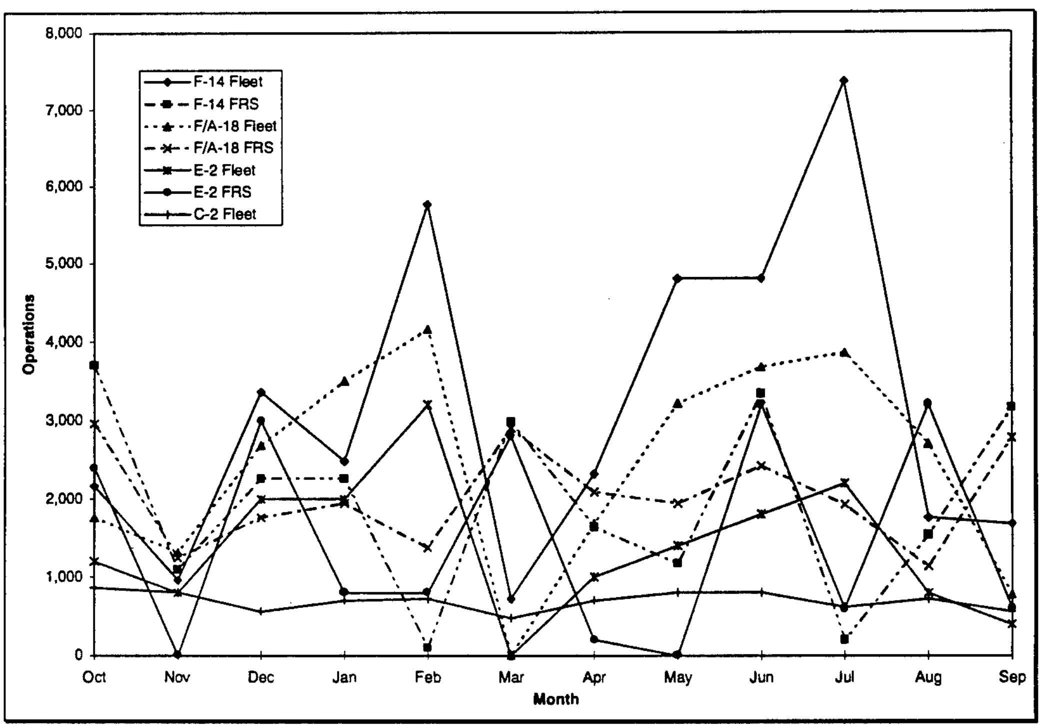


Figure 3-9: Monthly NALF Fentress Operations by Aircraft Category (ARS-1)

The F-14 fleet usage of NALF Fentress diverges somewhat from the other two fleet communities because of the presence of Pacific fleet squadrons, which creates a demand beyond those by the Atlantic airwings.

ARS-5 was chosen for the flow analysis for MCAS Cherry Point since this scenario captures the greatest loading with five Navy F/A-18 squadrons based there. Figure 3-10 displays the number of monthly airfield operations at MCAS Cherry Point for ARS-5. This figure shows two curves. The upper curve reflects the sum of the monthly operations for all the users based at MCAS Cherry Point while the lower curve excludes the operations generated by the five F/A-18 fleet squadrons based there for this scenario.

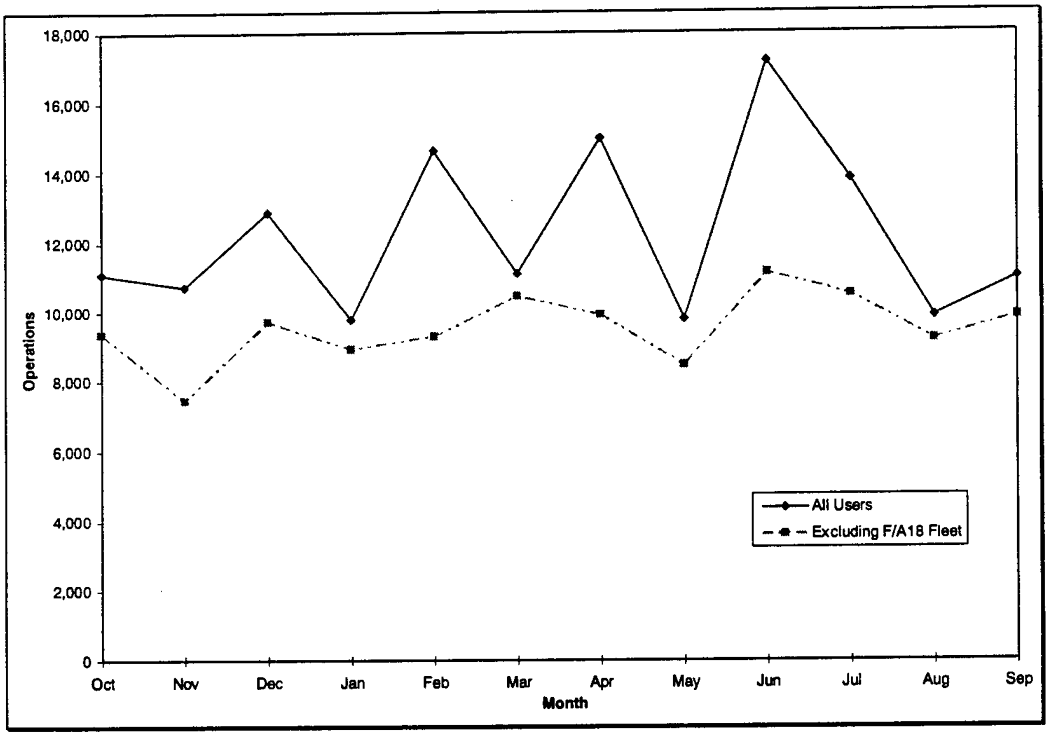


Figure 3-10: Total Monthly MCAS Cherry Point Operations (ARS-5)

The spike in operations for the months of February, April, and June are due, in large part, to F/A-18 FCLP periods. The F/A-18 fleet squadrons for ARS-5 are assigned to Airwings C and A, as shown in Table 2-6. Figure 2-14 shows that Airwing C departs for TSTA III at the end of February, for JTFEX in early May, and for deployment at the end of June. Thereafter, they no longer generate operations at their home base for the remainder of the simulation period. These FCLP cycles result in large monthly variations in airfield operations. Airwing A is on deployment for the first six months and conducts FCLPs one time in the year, in July for preparation for carrier qualifications. May and June are the lowest and highest months, respectively, at 20 percent below and almost 40 percent above the average. These months also represent the greatest monthly change at about 60 percent of the average.

The flow of operations generated by the Marine Corps squadrons does not vary as much as for the Navy squadrons. Only the EA-6Bs deploy as an entire squadron. The AV-8 fleet squadrons support detachments and deployments with usually only a subset of the squadron, so large variations in airfield operations do not occur as deployments begin or end. Even with the exclusion of the F/A-18 squadrons, the greatest monthly change in operations is from May to June. However, this change represents only 28 percent of the average number of monthly operations.

3.4.2 Airfield Operations by Hour

The number of hourly airfield operations varies during a typical weekday as squadrons perform their training missions. For this analysis, non-holiday weekday operation counts are averaged hour-by-hour over the day for the entire simulated year and for the peak month. The annual averages tend to smooth out the daily and monthly variation; consequently, the hour-by-hour variation for the annual average is less than for a given day.

Figure 3-11 compares the number of hourly operations for NAS Oceana averaged over the simulated year and the peak month of April for ARS-1. Most of the operations occur between 0700 and 2400 with prominent daytime surge between 0800 and 1800. During this surge period, there is an average of 68 operations per hour. During this same period in the Baseline Scenario, there is an average of 33 operations per hour. In the late afternoon/early evening there is a lull as daytime missions are completed but nighttime missions have not yet begun. This lull period shifts during the year with sunset, resulting in a somewhat flat average after the 1800 hour on the annual graph. The evening lull is more apparent in the peak-month average since sunset does not vary greatly during this 30-day window. Most of the nighttime flying occurs in the three-hour period following sunset. The peak-month also exhibits a significant "mid-day dip". This is not unusual in that many squadrons typically schedule a morning and an afternoon flight for a given aircraft. The mid-day period allows maintenance crews to prepare the aircraft for its second flight of the day. This mid-day dip also shifts about somewhat based on the sunrise and sunset times, resulting in a fairly flat curve for the annual average.

Figure 3-12 compares the number of hourly operations for MCAS Cherry Point averaged over the simulated year and the peak month of June for ARS-5. Between the hours of 0800 and 1800, inclusive, there is and average of 41 operations per hour. During this same period in the Baseline Scenario, there is an average of 34 operations per hour. As discussed in the previous section, Airwing C, of which three F/A-18 fleet squadrons are based at MCAS Cherry Point, is preparing for deployment at the end of this month. Consequently, these three squadrons all perform two weeks of FCLPs during this period. Approximately two thirds of FCLPs are conducted under nighttime conditions; the squadrons schedule their first nighttime FCLP period of the day about 30 minutes after sunset, which ranges from 2015 to 2030 during this month. Therefore, the first nighttime FCLP period typically commences at about 2045 or 2100. While the squadrons attempt to

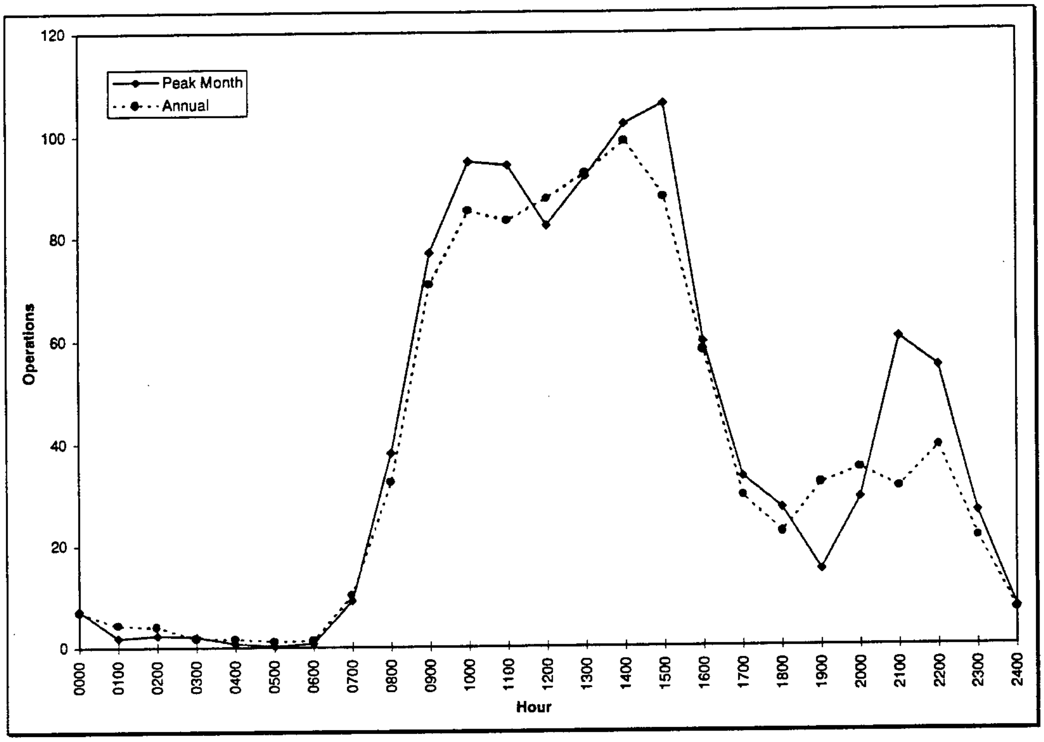


Figure 3-11: Average Hourly NAS Oceana Operations (ARS-1)

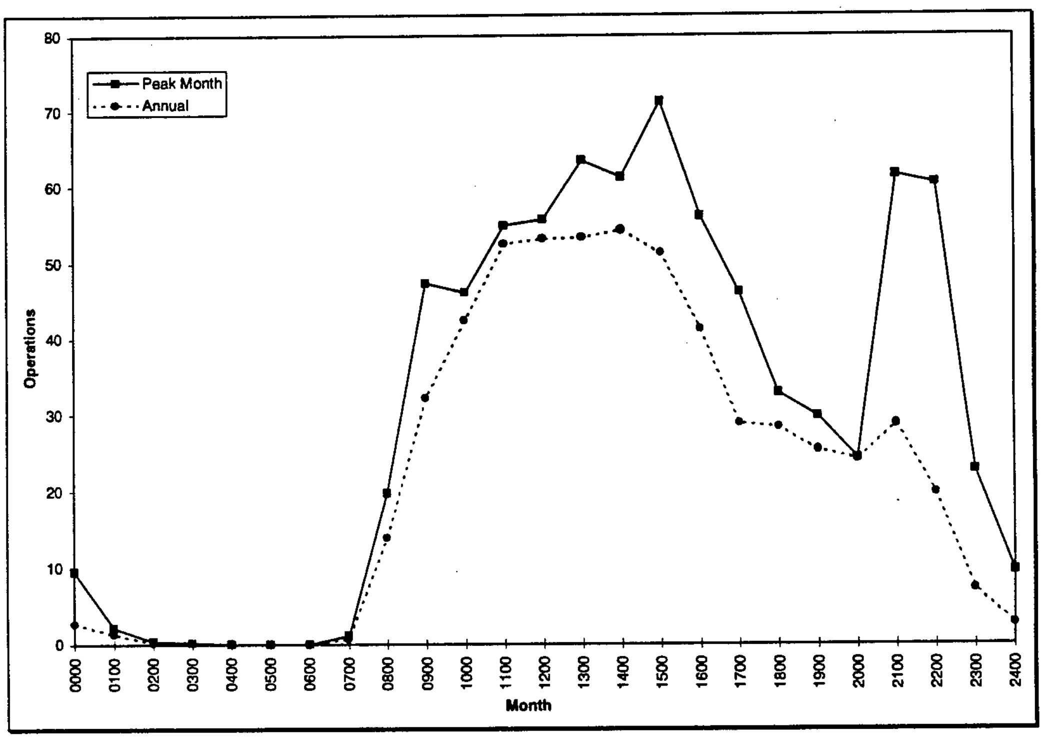


Figure 3-12: Average Hourly MCAS Cherry Point Operations (ARS-5)

complete their FCLPs as soon as possible on a given night, the training can be expected to extend past the 2300 tower pattern close time. This occurs on 22 days during the simulated year; these days are clustered into five two-week periods. On only four days do the FCLPs extend past 0100; however, the FCLPs never exceed 0200. As stated in Section 2.2.3, no restriction is placed on the scheduling of FCLPs past the 2300 tower pattern close time. On days when nighttime FCLPs are scheduled, the F/A-18 squadrons attempt to shift the entire workday later to minimize the staffing demand on the maintenance crews. While no deliberate effort is made to shift the workday in NASMOD, a variety of modeling parameters do limit the rate at which aircraft can be "turned around" by the maintenance crews and be launched by the squadron. This does result in a shift to later hours as is evident in Figure 3-12 for the peak month. As described earlier, it also accounts for the mid-day dip. As with the graph for NAS Oceana, the annual average smoothes out spikes that would result from a plot of a single day's (or single month's) operations.

3.4.3 Training Area Sorties by Month

The monthly sortie flows in the five primary training areas of this study for the simulated year are shown in Figure 3-13. The black lines indicate ARS-1 and the grey lines indicate ARS-5. The monthly variations are due to changes in demand by the users as they progress through their training workups. W-72 flow data includes the sorties to the W-72 TACTS range. Note that W-72 experiences a greater amount of variation than W-122; this is because the predominant users of

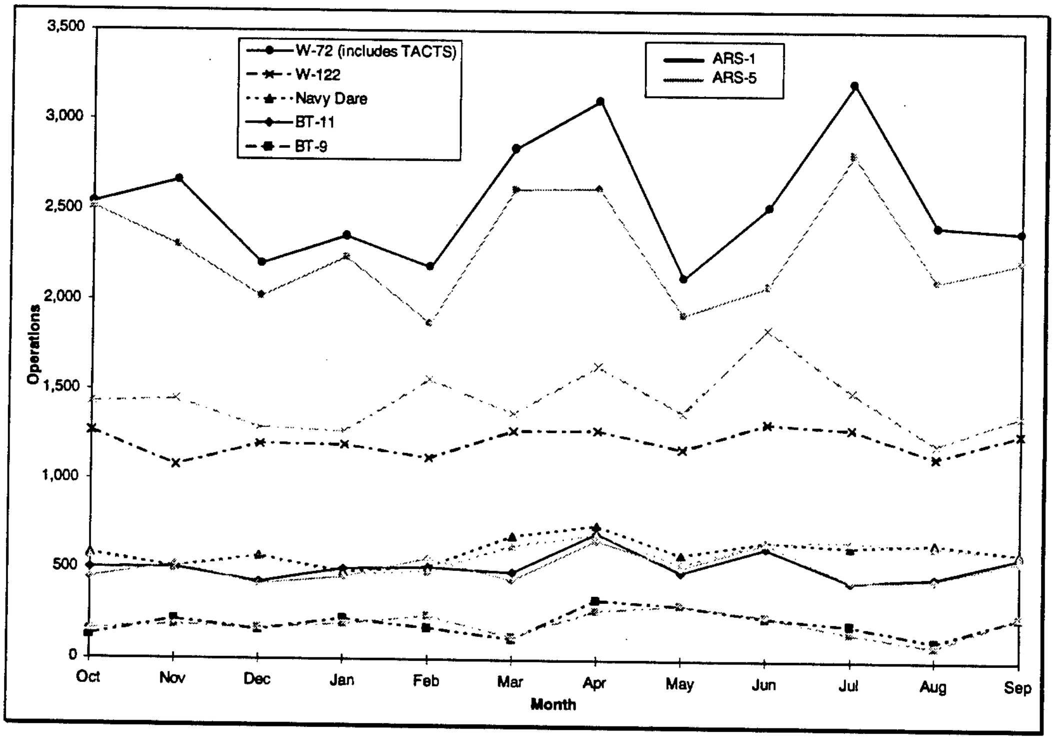


Figure 3-13: Primary Training Area Sorties by Month (ARS-1 and -5)

W-72 are NAS Oceana-based squadrons that are subject to workup fluctuations. Navy generated sorties account for a smaller percentage of the total sorties for W-122, thereby imposing a smaller amount of variation.

There is not a significant difference in the usage of Navy Dare, BT-11, and BT-9 between ARS-1 and ARS-5. The usage of W-72 is slightly lower and W-122 slightly higher for ARS-5 as compared with ARS-1. This results from the preference of performing basic over-water training in the closest warning area by the relocated F/A-18 fleet squadrons. All three squadrons in Airwing C and both squadrons in Airwing A are "in phase" in terms of the times of year for which they make demands on each of the training areas. This has the effect of amplifying the additional number of over-water (W-122) sorties for ARS-5 in June and April, for example.

The average number of monthly sorties for W-72 (including the TACTS range sorties) is about 2550 in ARS-1 and 2280 in ARS-5; however, the lowest month is 16 percent below the average for both ARS-1 and ARS-5 while the highest month is 26 percent above the average for ARS-1 and 24 percent above the average for ARS-5. The variation for W-122 is only about 10 percent above or below its average of 1220 monthly sorties. For ARS-5, the averages is about 1450 sorties per month, with the maximum month of June at 28 percent above average and the lowest month of August at 16 percent below average. The variation for Navy Dare is about 20 percent of its average of 600 monthly sorties for both scenarios. The bombing targets experience a significant amount of monthly variation. BT-11 and BT-9 sortie counts can differ from their monthly average by up to 36 percent and 63 percent, respectively, for ARS-1 and 28 percent and 58 percent, respectively, for ARS-5.

NASMOD

AIR TRAFFIC IN THE DARE COUNTY REGION

4 AIR TRAFFIC IN THE DARE COUNTY REGION

This section presents an examination of military and civilian air traffic in the Dare County region, including military operations in R-5314, existing procedures for instrument arrivals to the Manteo/Dare County Regional Airport, the impacts of relocated Navy F/A-18 aircraft, and the potential benefits of enhanced radar coverage in the area.

4.1 Traffic Description

The air traffic in the Dare County/R-5314 region below 23,000 feet MSL is composed of military aircraft transiting to and from operating areas, such as R-5314, civilian aircraft on Victor airways, and civilian aircraft operating under visual flight rules (VFR). Civilian airports in the greater area include Norfolk International Airport, Craven County Regional Airport, Manteo/Dare County Regional Airport, Elizabeth City Coast Guard Air Station/Municipal Airport, and First Flight Airport at Kitty Hawk, North Carolina. Figure 4-1 depicts the location of civilian airports and military airfields in the vicinity of Dare County and R-5314.

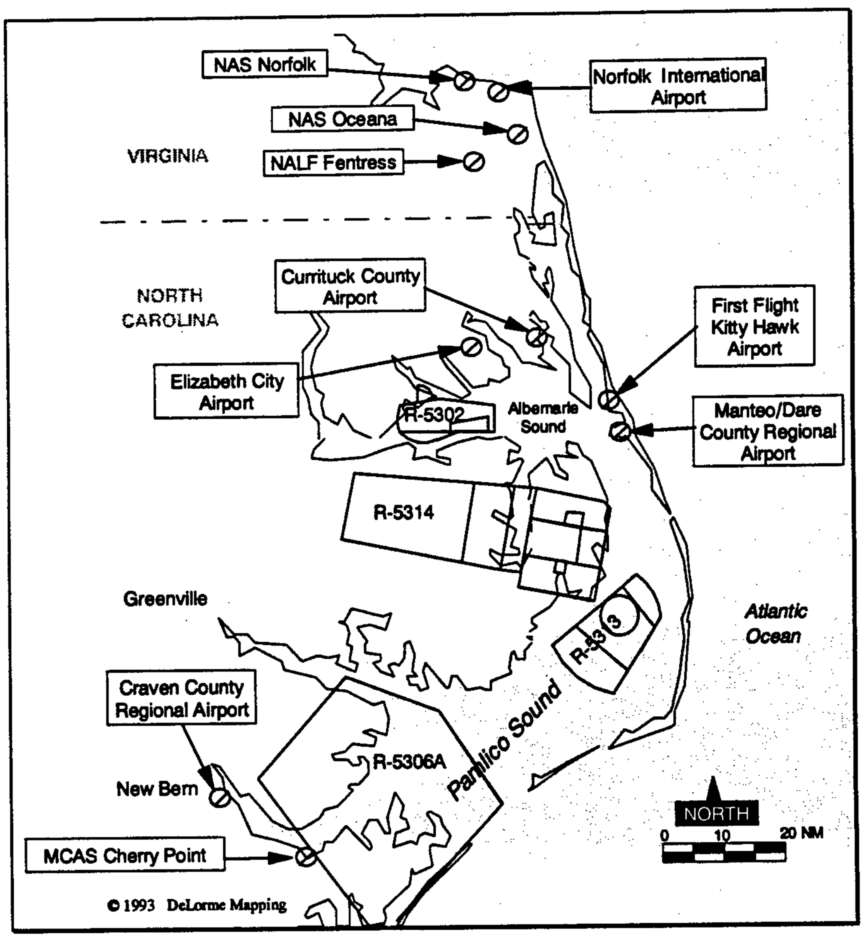


Figure 4-1: Airports/Airfields in the Vicinity of Dare County

R-5314, located 70 nautical miles to the south of NAS Oceana, is 40 miles by 15 miles in size, with ceilings ranging from 6,000 feet to 20,500 feet MSL. Military aircraft from NAS Oceana and Seymour Johnson AFB are the primary users of R-5314. Other sources of military operations include Pope AFB, MCAS Cherry Point, various Air National Guard units, Shaw AFB, MCAS Beaufort, and naval aircraft carriers operating offshore. The restricted airspace is administered by the Air Force 4th Wing, Seymour Johnson AFB. This restricted use airspace contains two ranges to the east of the Alligator River; the northern half, called the Navy Dare County Range, is scheduled and operated by the Navy's Fleet Area Control and Surveillance Facility, Virginia Capes, and the southern half, named the Air Force Dare County Range, is scheduled and operated by the Air Force 4th Wing. R-5314 is the primary air-to-ground training area for squadrons and units based at NAS Oceana and Seymour Johnson AFB.

Figure 4-2 and Figure 2-11 show R-5314 from planform and side views, respectively.

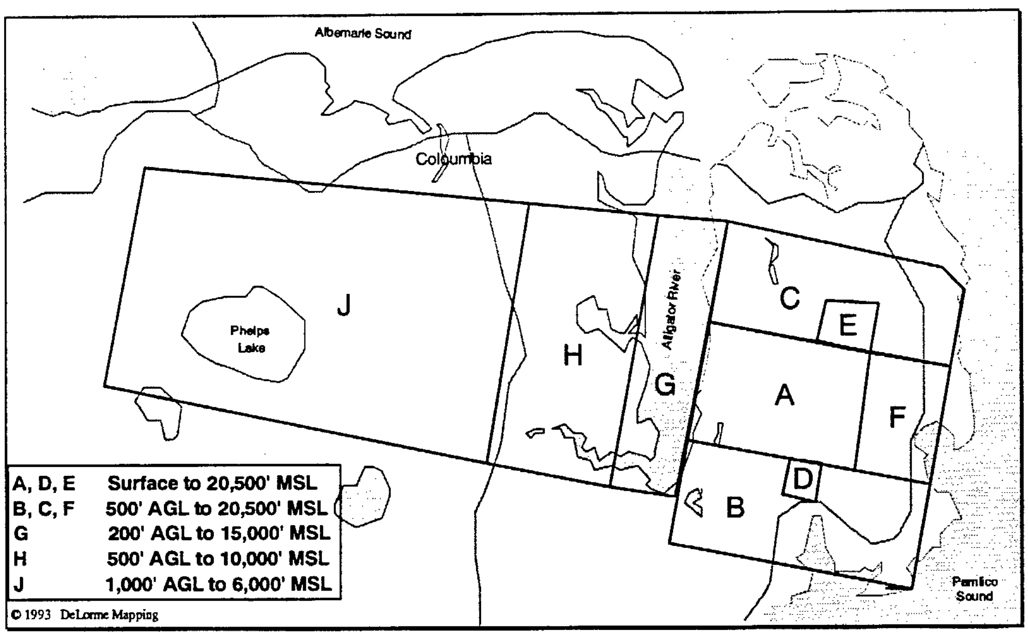


Figure 4-2: Planform View of R-5314

Norfolk Approach Control and NAS Oceana Approach Control provide the primary air traffic control service to aircraft operating in the area. Washington Air Route Traffic Control Center (ARTCC), FACSFAC VACAPES, and MCAS Cherry Point Approach Control also have air traffic control responsibilities in close proximity to the region. The Norfolk/NAS Oceana approach control airspace is depicted in Figure 2-7.

Military aircraft enter R-5314 west of the Alligator River during most flights, as the flight tracks Figure 4-3 indicate. NAS Oceana-based aircraft normally enter and depart R-5314 from the north at 4,000 to 7,000 feet. Note that seven visual

MTRs and two instrument MTRs terminate at or near the edge of R-5314. Many of the aircraft on these routes enter R-5314 to spend time on the ranges at the completion of their training route activity.

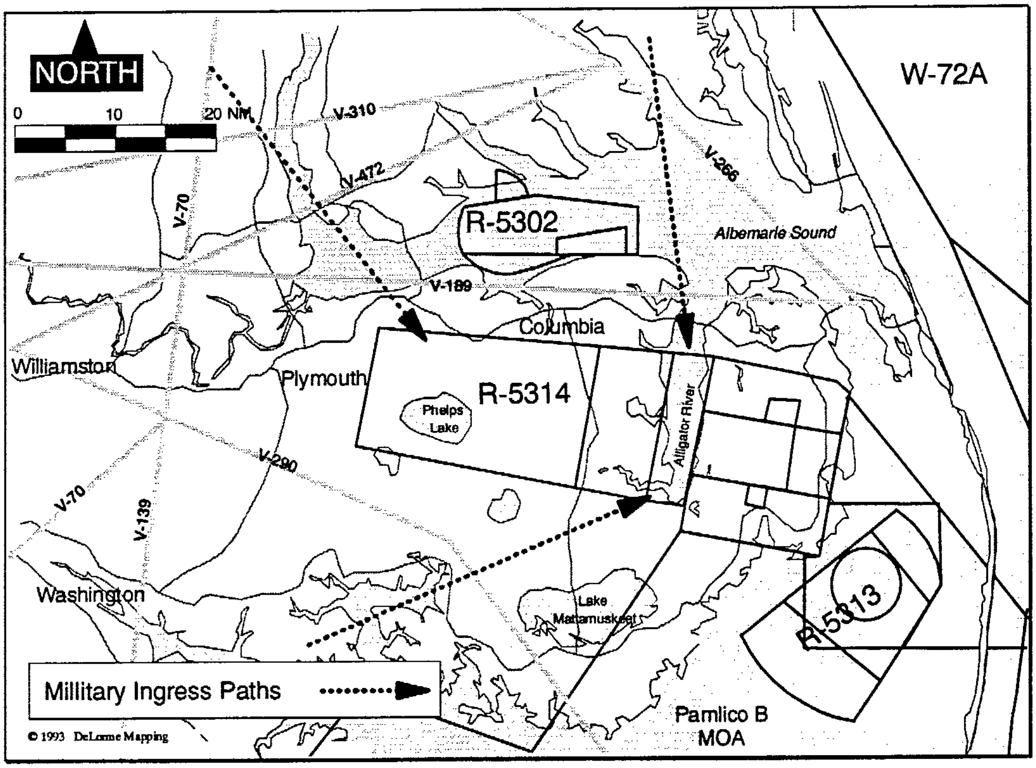


Figure 4-3: Normal R-5314 Ingress Flight Paths

The primary civilian air traffic in the region is composed of general aviation aircraft operating under VFR, with the majority flying below 5,000 feet AGL. Several Victor airways (routes that are part of the low altitude federal airway structure below 18,000 feet MSL) exist in the vicinity of R-5314 and include V-189, V-266, V-472, V-310, V-70, and V-290 (see Figure 4-3). Aircraft utilize the Victor airways under VFR and IFR at all altitudes below 18,000 feet to appropriate floors as determined by air navigation aids and/or terrain restrictions. In addition, civilian traffic must maintain 3 NM lateral separation from restricted airspace boundaries.

4.2 Military Operations in the Dare County Ranges and R-5314

As discussed in the previous section, the primary users of R-5314 are units based at NAS Oceana and Seymour Johnson AFB. With the last Navy A-6 squadron at NAS Oceana decommissioning in 1997, the only NAS Oceana-based aircraft utilizing R-5314 will be F-14 aircraft (fleet and FRS) and an occasional F/A-18 aircraft (from the adversary squadron). The two F-15E fighter units and two F-15E fighter training units based at Seymour Johnson AFB heavily utilize R-5314.

Presently, Navy aircraft rarely use the Air Force range, but Air Force aircraft frequently operate on the Navy range.

Other aircraft that schedule the Navy Dare County Range include F-16 aircraft from the Virginia Air National Guard and Shaw AFB, F/A-18 aircraft from MCAS Beaufort and aircraft carriers during special exercises, AV-8 aircraft from MCAS Cherry Point, and A-10 aircraft from Pope AFB (see Table 4-22). The Air Force Dare County Range also experiences operations from these aircraft types. Scheduling of the ranges is conducted through the appropriate agency as described in the previous section. Most flights, which are normally composed of two or four aircraft, schedule range time in 15- to 60-minute periods.

R-5314 and the Navy and Air Force Dare County ranges are reserved for air-to-ground missions. Specific missions conducted in the area include close-air support, forward-air control, strike, delivery practice, and reconnaissance mapping. During these activities, the pilots are operating under VFR and are responsible for staying within the boundaries of the airspace. According to the airspace and range management personnel of the Air Force 4th Wing, no airspace spillouts, near-misses, or accidents with civilian aircraft have been reported in at least the last five years.

Activation of the restricted airspace is based upon the first and last scheduled missions of the day at either the Air Force or Navy Dare County Range. In general, the restricted airspace is activated (becomes "hot") between 0700 to 0800 in the morning, and is returned to Washington ARTCC at 2400.

4.3 Manteo Airport

The Manteo/Dare County Regional Airport is a small, municipal airport located in the northern portion of Roanoke Island. The majority of the airport's traffic includes helicopters and small fixed-wing aircraft arriving and departing with air tours and advertisement banners and other general aviation traffic. The uncontrolled (no manned control tower) airport has two runways, Runway 04/22 and Runway 16/34. Runway 22 is the longest at 3,300 feet. The approach end of Runway 04 is about 6.5 NM (runway heading) from the edge of R-5314. The airport has three published instrument approaches — two to Runway 16 and one to Runway 04.

Due to its close proximity to R-5314, aircraft conducting IFR approaches to Runway 04 interact with the northeastern portion of the restricted airspace. Figure 4-4 presents the current, published NDB/GPS RWY 4 approach plate for the Manteo Airport; note that the outer edge of the procedure turn to final is within the 10 NM radius circle shown. This figure shows the relationship between the airport, the instrument arrival flight track to Runway 04, and R-5314, and includes a basic diagram of the airport in the lower right-hand corner. Note that VFR arrivals to Runway 04 and IFR and VFR departures and arrivals to the other three runways do not interact with R-5314.

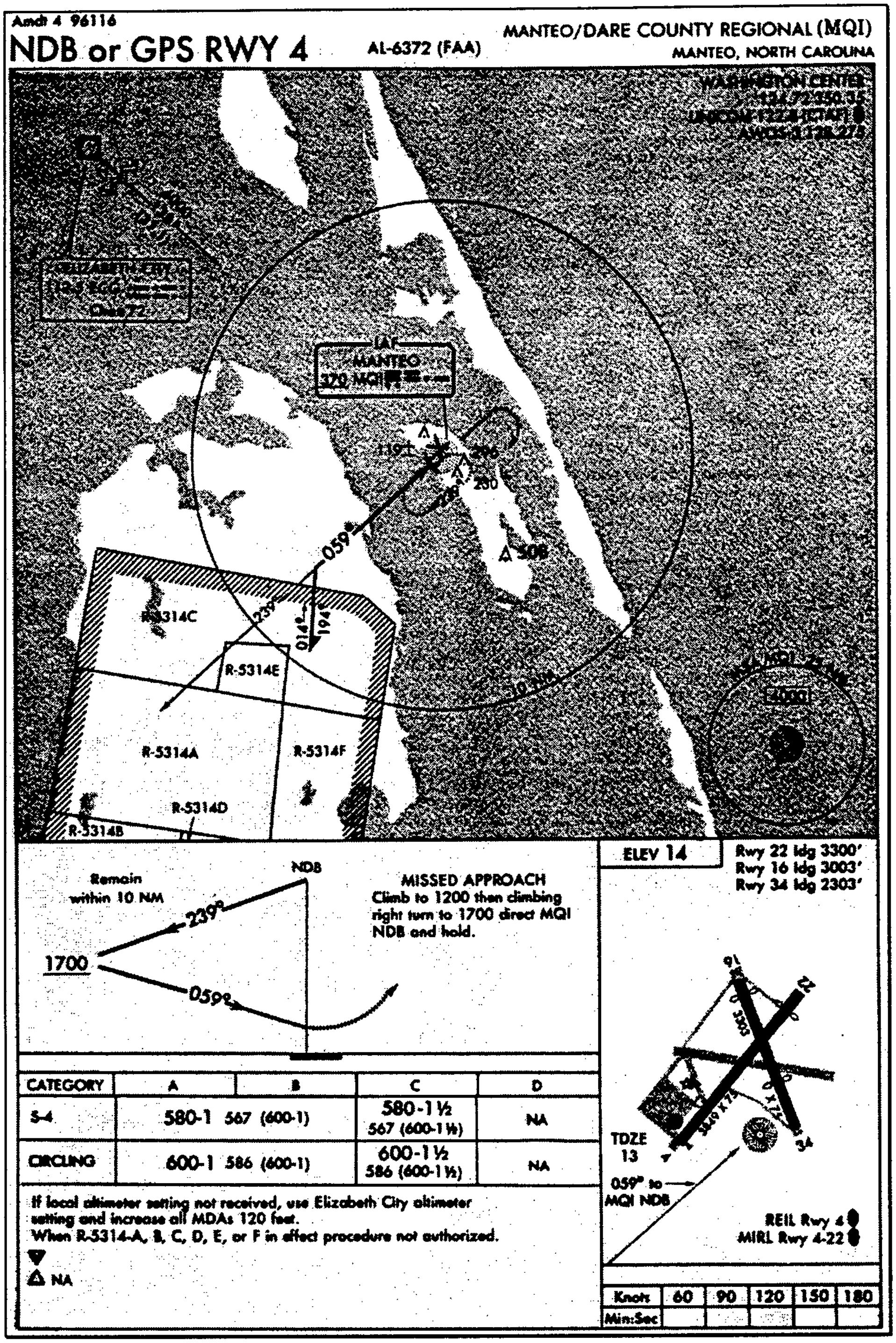


Figure 4-4: Runway 04 Approach Plate for Manteo Airport

Radar-monitored instrument approaches to Manteo Airport are currently not available since Norfolk Approach Control cannot provide radar services in the area due to lack of radar coverage. Published approach procedures provide aviators with a safe means to arrive at an airport during inclement weather using air navigation aids, such as a nondirectional beacon (NDB) or the global positioning system (GPS). In the case of Runway 04 instrument arrivals, the approach procedure dictates that aircraft make a procedural turn within 10 NM of the Manteo NDB. Federal Air Regulations mandate that all aircraft maintain a 3 NM lateral separation (unless otherwise indicated) from active restricted airspace and that military and civilian nonparticipating aircraft operating under IFR or VFR are not permitted within active restricted airspace boundaries. Therefore, if wind conditions require landing on Runway 04, one of two actions may be taken: (a) R-5314 must be inactive (i.e., released back to the controlling agency, Washington ARTCC in this situation) prior to the commencement of a straight-in instrument approach to Runway 04; or (b) the pilot performs a circling NDB approach to Runway 16 or a circling VOR/GPS approach to Runway 16 with a landing on Runway 04.

Currently, no procedures exist to allow for instrument approaches to Runway 04 when R-5314 is active. Pilots must exercise option (b) in the situation described above. A procedure is currently being developed by the Air Force, Navy, and FAA to facilitate the release of R-5314 back to the FAA to accommodate instrument approaches to Runway 04. If both the Air Force and Navy ranges are clear, then the FAA is notified, R-5314 becomes "cold", and aircraft are cleared to enter the restricted airspace during the approach to Runway 04. If, at the time of request for an instrument approach to Runway 04, one of the ranges is not clear, the civilian aircraft must delay its approach until the activity at the range is complete, all military aircraft have cleared the airspace, and R-5314 is released back to the FAA.

This procedure is not ideal due to potential aircraft delay time, but it does accommodate both Manteo Airport traffic and Dare County Range military operations in a safe manner. Potential coordination conflicts between the Manteo Airport and the Dare County Range under instrument meteorological conditions are expected to decrease after the Navy A-6 aircraft, which have all-weather mission capabilities, are retired from service.

4.4 Effect of the Relocation of Navy F/A-18 Squadrons

The arrival of Navy F/A-18 squadrons to NAS Oceana (and/or MCAS Cherry Point) will result in, at most, a 30 percent increase of Navy Dare County Range utilization but with minimal impacts to the length of time each day that R-5314 is active and, accordingly, to civilian aircraft transiting in the vicinity of R-5314.

The Navy F/A-18 mission is part fighter and part attack, a role that borrows elements from the Navy F-14 and A-6 communities. The F/A-18 aircraft's operating speeds are similar to the F-14, and the Navy F/A-18 squadrons will transit to and from most training areas as do the Navy F-14 squadrons. Unlike the A-6 squadrons, Navy F/A-18 squadrons currently do not conduct all-weather missions. Additionally, the F/A-18 squadrons perform low-level missions (flights utilizing visual MTRs) with a much lower frequency than the A-6 squadrons did.

At this time, no new operating or scheduling procedures have been identified as necessary to accommodate the F/A-18 mission and activities at R-5314.

The relocation of the Navy F/A-18 squadrons to NAS Oceana will have a moderate impact on the Navy Dare County Range utilization. In the Baseline Scenario, the average number of sorties per day (weekday) conducting operations in the northern half of R-5314 is 19 . In ARS-1, the introduction of 11 F/A-18 fleet squadrons and one F/A-18 FRS to NAS Oceana results in a seven-sortie per day *net* increase (37 percent) to an average rate of 26 sorties per day at the Navy Dare County Range.

4.5 Benefits of Enhanced Radar Coverage

The Navy is in the process of determining a site for an air surveillance radar system in northeastern North Carolina. At this time, the Elizabeth City Coast Guard Air Station is the proposed site for installation of this radar. The radar system is proposed to be installed and operational by the end of 1997 with data feeds to FACSFAC VACAPES and Norfolk Approach Control, with Norfolk Approach Control providing the radar services. Radar coverage in this area will offer significant benefits to all civilian and military users. The implementation of a new radar site will provide all airspace users with better service and a safer flying environment while enhancing military training. The primary benefits to the flying community will include:

Increased Flight Safety. Improved radar coverage will allow air traffic controllers to provide more efficient positive control of flights on instrument flight plans and offer more effective VFR traffic advisory service.

Enhanced Services to Civil Airfields. With improved radar coverage, at least five additional civil airfields will be able to receive VFR and IFR services below 5,000 feet, including radar separation from other aircraft and vectoring to initial approach fixes for the final approach.

Improved Traffic Flow and Services to Dare County/Manteo Airport. With improved radar coverage, a new instrument approach to Runway 04 at the Dare County/Manteo Airport can be designed and implemented, meeting all current restricted airspace separation criteria.

NASMOD

SUMMARY AND CONCLUSIONS

5 SUMMARY AND CONCLUSIONS

This study examines the capability of NAS Oceana and MCAS Cherry Point, including NALF Fentress, MCALF Bogue, and the local airspace and ranges, to accommodate the prospective levels of operations resulting from the implementation of BRAC 95-related decisions. This analysis is accomplished through the use of a fast-time computer simulation model, NASMOD, by modeling the proposed tenant squadrons and other airspace and range users with their training requirements over a simulated year. This study also examines the issues related to the proximity of the Manteo/Dare County Regional Airport to R-5314.

The NASMOD model of NAS Oceana and MCAS Cherry Point was developed with extensive coordination between the analysts and military personnel and encompasses all the relevant airfield, airspace, and squadron attributes required to characterize the elements under the scope of this study.

Five alternative relocation scenarios (ARS) were identified by the Navy for analysis. Each scenario represents an alternative base-loading squadron mix in a future year (i.e., FY99) following the relocation and realignment of the modeled squadrons. A baseline scenario was analyzed with which to compare the alternatives.

The tenant mix for the Baseline Scenario is as follows:

NAS Oceana	MCAS Cherry Point
7 F-14 Atlantic fleet squadrons	3 AV-8 fleet squadrons
4 F-14 Pacific fleet squadrons	1 AV-8 FRS
1 F-14 FRS	4 EA-6B squadrons
1 F/A-18 adversary squadron	1 KC-130 fleet squadron
	1 KC-130 FRS

The alternative scenarios specify the location of the Atlantic F/A-18 squadrons as follows:

	ARS-1	ARS-2	ARS-3	ARS-4	ARS-5
NAS Oceana	11 + FRS	9 + FRS	8 + FRS	6 + FRS	6 + FRS
MCAS Cherry Point			3		5
MCAS Beaufort		2		5	

The impacts of Navy squadron realignment alternatives on MCAS Beaufort and that air station's surrounding training areas is not examined in the study.

In the Baseline Scenario, each modeled squadron and unit is able to complete its training with very little difficulty. Delays, scheduling adjustments and postponements, and incomplete airfield operations are minimal. The training areas, although significantly utilized, are able to accommodate users' demand adequately; however, some missions occasionally "flex" to alternate training areas due to scheduling conflicts.

With the realignment of the Navy F/A-18 squadrons from NAS Cecil Field to NAS Oceana and MCAS Cherry Point (ARS-3 and -5), operation levels at airfield and local training areas increase significantly. With the increases in operations comes a cost to existing tenant squadrons (as well as the realigned squadrons) in terms of "lost" airfield operations (i.e., desired return-to-base pattern operations not performed due to full patterns, weather, or FCLP periods underway), more frequent usage of secondary and alternate training areas, an increase in adjusted and postponed missions, and flight launch times more frequently "pushed" later in the day or later in the evening. With more users in the region and more demand placed on limited training area resources, the scheduling of flight operations becomes more complex. These impacts of the increase in operations are costs to the users, air traffic control, and range schedulers in the area.

On an annual basis, the increase in flight operations from the realignment of the Navy F/A-18 squadrons does not affect the ability of the squadrons to complete their overall flight requirements. Although increases for most aircraft groups in adjusted and postponed flights do occur in the alternative scenarios, no significant postponements in flight scheduling are experienced. Some adjustments are made to alternative or less-preferred training areas for most squadrons. Also, shifting of flight launch times due to adjusted training area selections affect squadron aircraft allocation and overall scheduling efficiency.

Significant increases of airfield operations at NAS Oceana occur with the realignment of the F/A-18 squadrons. In ARS-1, airfield operations increase by about 120 percent (about 128,600 operations) above baseline levels. The F/A-18 FRS contributes 47 percent of the increase. NALF Fentress experiences an increase of 51 percent in airfield operations. As a result of increased operations, taxi delay, a component of the mission delay, increases by 90 percent, rising from 1.0 minute in the Baseline to 1.9 minutes per sortie on average for ARS-1. Due to increased interactions and pattern congestion, completion of desired return-to-base pattern operations drops from 98.0 percent (average over all aircraft groups) in the Baseline Scenario to 92.8 percent in ARS-1. The F-14 fleet squadrons experience the largest decrease, from 97.2 percent in the Baseline Scenario to 89.3 percent in ARS-1.

Airfield operations at MCAS Cherry Point increase moderately in ARS-3 and -5 (18 percent and 26 percent, respectively) as a result of relocation of Navy F/A-18 fleet squadrons. Night (2200 to 0700) operations increase sharply — by 85 percent in ARS-3 and 113 percent in ARS-5. The F/A-18 fleet squadrons conduct about 10,700 FCLP operations annually in ARS-3 at MCAS Cherry Point. Note that MCALF Bogue Field operations, which total about 17, 300 annually, are not affected by Navy F/A-18 squadron operations.

Interactions increase only slightly from baseline levels with the F/A-18 squadrons at MCAS Cherry Point. The average taxi delay increases from the Baseline Scenario by about six seconds per sorties in ARS-3 and eight seconds in ARS-5. Taxi delay at MCAS Cherry Point is much lower on average (0.14 minutes in the Baseline) than at NAS Oceana (60 seconds). The pattern event completion rate drops from 96.8 percent to 94.2 percent and 94.4 percent in ARS-3 and ARS-5, respectively. Compared to the number of "lost" operations at NAS Oceana, the operations "lost" at MCAS Cherry Point are much lower (about 70 percent lower for ARS-3).

Navy F/A-18 squadrons have a significant impact on local training area operations, especially in W-72, the W-72 TACTS range, Navy Dare County Range, and BT-11. The F/A-18 squadrons utilize almost all of the local areas currently used by the aircraft communities at NAS Oceana and MCAS Cherry Point. In W-72, annual sorties double after the realignment of F/A-18s to NAS Oceana, increasing from about 11,400 in the Baseline Scenario to 22,800 in ARS-1. Even in ARS-4 (the scenario with the fewest Navy F/A-18 squadrons in the region), W-72 sorties increase by 44 percent to 20,200 for the simulated year.

The W-72 TACTS range and Navy Dare County Range approach capacity limits with the realignment of F/A-18 squadrons. The TACTS range in ARS-1 is utilized 83 percent (of its published available hours), with over 8000 sorties using the area annually. In the Baseline Scenario, the TACTS range experiences 4000 annual sorties and has a utilization rate of 78 percent. The number of sorties utilizing the TACTS range increases by 67 percent in ARS-1 (the greatest increase from the baseline of any alternative scenario) to 46 percent in ARS-4 (the smallest increase).

Note that the utilization percentages for the alternative scenarios are about the same as for the Baseline although the number of sorties is substantially higher. This implies that, as more Navy squadrons are based in the region, the average number of aircraft participating in each TACTS range event will increase. Also, scheduling inefficiencies and demand peaking from among the squadrons preclude the possibility of scheduling 100 percent of the available hours, and utilization rates of 80 percent to 85 percent may be a practical upper limit given the current scheduling procedures and requirements.

Navy Dare County Range also experiences high levels of utilization after the realignment. The annual sorties at Navy Dare increase by 37 percent in ARS-1, 33 percent in ARS-2, -3, and -5, and 25 percent in ARS-4. The variation of Navy Dare's utilization rate in the alternative scenarios is very small: 67 percent in ARS-1 and 64 percent in ARS-4. As demand for the area is reduced (e.g., ARS-1 to ARS-4 or ARS-5), the utilization rate does not decrease by a proportional amount. This observation, coupled with the fact that the training area selection "flexing" from Navy Dare increases in the alternative scenarios, suggests that as Navy Dare's utilization rate approaches 70 percent, the range approaches "capacity," or saturation.

The increases in annual sortie rates at BT-9 and BT-11 are on the same order in all scenarios as those experienced at Navy Dare range. BT-11 sorties increase by 34 percent in ARS-1 and only 19 percent in ARS-4 from baseline levels. Similarly, BT-9 annual sorties increase by 41 percent in ARS-1 and 16 percent in ARS-4 from the Baseline Scenario. From a schedule capacity point-of-view, BT-11 has the ability to accommodate increased operations after the realignment of the Navy F/A-18 squadrons (in any scenario). BT-11's utilization rate is approximately 50 percent for all scenarios (42 percent in the Baseline Scenario). On average, BT-9 is only utilized about 20 percent of its available hours.

W-122 is significantly affected only in ARS-3 and -5, in which F/A-18 fleet squadrons are based at MCAS Cherry Point. Annual sorties increase by 13 percent and 21 percent in ARS-3 and ARS-5, respectively. Air Force jets (primarily F-15E aircraft from Seymour Johnson AFB) and Marine Corps squadrons from MCAS Cherry Point dominate the usage of W-122, annually generating about 5430 sorties and 5800 sorties, respectively. These two user groups represent about 79 percent of the annual sorties in the Baseline Scenario and 65 percent in ARS-5.

The local MTRs are modeled with MCAS Cherry Point and NAS Oceana squadrons' demand only. These routes are scheduled only to avoid multiple flights from beginning a route at the same time. Capacity of the local route system is not a constraint on squadron operations. The local MTRs experience about 3530 sorties annual in the Baseline Scenario. In ARS-1, about 5060 aircraft — an increase of 43 percent — perform operations on the MTRs, and in ARS-4, about 4680 sorties conduct flights on MTRs, representing a 32 percent increase in operations. The most utilized MTR in the area in ARS-1 experiences 5 to 6 sorties per day on average.

Monthly and hourly operation flows are examined at MCAS Cherry Point (ARS-5), NAS Oceana (ARS-1), and at five training areas (ARS-1 and ARS-5). The busiest month at NAS Oceana is April with about 22,200 operations. At NALF Fentress, the peak month is June with about 20,000 operations performed; during the least busy month at Fentress, about 6000 operations are conducted. The variation in monthly operations is extreme compared to the monthly operations at NAS Oceana, which reflects the FCLP schedule.

At MCAS Cherry Point, airfield operations in ARS-5 vary from a low of 9800 in January to a peak of over 17,100 operations June. With the realignment of F/A-18 fleet squadrons, the month-to-month variations in ARS-5 are much greater than in the Baseline Scenario.

Annual hourly airfield operations between 0800 to 1900, representing the average day's "surge" period, average 33 operations per hour at NAS Oceana in the Baseline Scenario and 68 operations per hour in ARS-1. Similarly, operations during this same period at MCAS Cherry Point average 34 operations per hour in the Baseline Scenario and 41 operations per hour in ARS-5.

An analysis of military and civilian traffic in the Dare County region of the potential impacts due to the increase in operations from the realignment of the Navy F/A-18 squadrons on the civilian traffic in the area was performed. Although the number of sorties to and from R-5314 increases by 37 percent in ARS-1 and 25 percent in ARS-4 over the baseline levels, the amount of hours that the range is utilized increases by at most 10 percent in any of the alternative scenarios. In ARS-1, the introduction of 11 F/A-18 fleet squadrons and one F/A-18 FRS to NAS Oceana results in a seven-sortie-per-day *net* increase (37 percent) to an average rate of 26 sorties per day at the Navy Dare County Range. Furthermore, the amount of time that the range is "open" per day will only slightly increase in order to accommodate special operations. No significant impact on civilian traffic is caused by the additional R-5314 operations resulting from the realignment of Navy F/A-18 squadrons to the region.

The Navy is in the process of determining a site for an air surveillance radar system in northeastern North Carolina. Radar coverage in this area will offer significant benefits to all civilian and military users. The implementation of a new radar site will provide all airspace users with better service and a safer flying environment while enhancing military training. The primary benefits to the flying community will include: increased flight safety, enhanced services to civil airfields, and improved traffic flow and services to Dare County/Manteo Airport.

APPENDIX A:
AIRFIELD UTILIZATION

APPENDIX A: AIRFIELD UTILIZATION

This section contains tables of airfield operations, flight track operations, and NAS Oceana Lightship approach data for selected scenarios. MCAS Cherry Point and MCALF Bogue Field airfield operation tables are not included for ARS-1, -2, and -4. The operation levels and type distributions of these scenarios do not differ significantly from the scenarios with the same base loading at MCAS Cherry Point. To determine the MCAS Cherry Point and MCALF Bogue Field airfield operations for ARS-1, -2, and -4, see the Baseline tables.

In reviewing and comparing quantitative results, note that, unless otherwise discussed in the text (Section 3), each of the alternatives should be compared against the baseline scenario. Since the results are dependent upon airwing compositions as well as base loading, comparisons between the alternative scenarios may result in misleading conclusions. Some variation is to be expected due to random behavior designed into the model.

A.1 Basic Airfield Operations

Two types of airfield operations tables are presented: basic and flight track. The basic airfield operations are those commonly used by ATC personnel in counting the number of actions during each airfield event. They are defined as follows:

Departure	One aircraft taking off from a runway from a full stop. *One operation.*
Full Stop Visual Landing	One aircraft performing a full-stop landing under VFR from either the visual touch-and-go pattern, or a straight-in approach. *One operation.*
Full Stop Instrument Landing	One aircraft performing a full-stop landing using a GCA or other instrument landing system. *One operation.*
Pad Landing	One aircraft performing an approach to a vertical landing on a pad. *One operation.*
Visual Touch-and-Go/ Low Approach	One aircraft performing a visual approach followed by either a takeoff (in a touch-and-go) or a missed approach. *Two operations.*
Instrument Touch-and-Go/ Low Approach	One aircraft performing an instrument approach followed by either a takeoff (in a touch-and-go) or a missed approach. *Two operations.*
Field Carrier Landing Practice	Similar to a visual touch-and go event. *Two operations.*

Press-Up	A vertical takeoff from a pad followed by hovering maneuvers and a vertical pad landing. *Two operations.*
Pad Vertical Takeoff to Pad Landing Circuit	One aircraft performs a vertical takeoff from a pad, accelerates to forward flight speed around a pattern, and conducts an approach to a vertical pad landing. *Two operations.*

Specific operations at MCALF Bogue Field include:

Field Carrier Landing Practice	Pattern operations with approaches to a simulated ship deck. *Two operations.*
Forward Base Operations	Pattern operations with approaches to the runway. *Two operations.*
Expeditionary Airfield Operations	Arrivals, departures, and pattern operations during expeditionary airfield demonstrations and exercises.

Transient aircraft airfield operations are performed by aircraft not based at the specific air station. The transient aircraft may perform a full-stop landing and remain at the base for several hours or several days. Some transients conduct approaches and depart out of the local operating area. The sources of these transient aircraft are as diverse as the number of military bases throughout the United States, but certain aircraft types perform the majority of operations in each transient group. The transient aircraft groups are described below:

NAS Oceana

Transient Jet	Primarily Navy jets such as F-14, S-3, and F/A-18 aircraft, but includes Lear jets and transports.
Transient Prop	Primarily E-2, C-2, T-34, and C-130 aircraft.

MCAS Cherry Point

Transient Jet	Includes a wide variety of military jets such as F-15, F-16, and F/A-18 aircraft.
Transient Prop	Includes C-12, E-2, and C-130 aircraft.
Transient Heavy	Primarily C-141, C-5, and KC-10, aircraft.
Transient Large	Primarily C-9 aircraft.
Transient Helicopter	Includes H-46, H-53, UH-1, AH-1, AH-64, and OH-58 helicopters.

MCALF Bogue Field

Marine Corps Helicopter	Primarily MCAS New River-based CH-46, CH-53, UH-1, and AH-1 helicopters.

Other Military Jet	Primarily Marine Corps F/A-18 aircraft.
Other Military Helicopter	Includes a variety of Army and foreign military helicopters.

Table A-1: Annual Basic Operations at NAS Oceana and NALF Fentress for the Baseline Scenario

		Airfield Operations		
Aircraft Category	**Operation Type**	**Day** 0700-2200	**Night** 2200-0700	**Total**
F-14 Fleet	Departure	12,358	867	13,225
	Full Stop Visual Landing	11,360	1,340	12,700
	Full Stop Instrument Landing	399	115	514
	Visual Touch-and-Go/Low Approach	19,320	1,076	20,396
	Instrument Touch-and-Go/Low Approach	526	44	570
	Field Carrier Landing Practice	0	0	0
	TOTAL	43,963	3,442	47,405
F-14 FRS	Departure	6,627	320	6,947
	Full Stop Visual Landing	5,953	355	6,308
	Full Stop Instrument Landing	309	330	639
	Visual Touch-and-Go/Low Approach	26,502	954	27,456
	Instrument Touch-and-Go/Low Approach	3,774	1,460	5,234
	Field Carrier Landing Practice	0	0	0
	TOTAL	43,165	3,419	46,584
Adversary	Departure	826	13	839
	Full Stop Visual Landing	826	2	828
	Full Stop Instrument Landing	5	0	5
	Visual Touch-and-Go/Low Approach	436	0	436
	Instrument Touch-and-Go/Low Approach	168	0	168
	TOTAL	2,261	15	2,276
Transient Jet	Departure	947	20	967
	Full Stop Visual Landing	710	14	724
	Full Stop Instrument Landing	241	2	243
	Visual Touch-and-Go/Low Approach	1,050	28	1,078
	Instrument Touch-and-Go/Low Approach	806	30	836
	TOTAL	3,754	94	3,848
Transient Prop	Departure	1,611	31	1,642
	Full Stop Visual Landing	1,155	16	1,171
	Full Stop Instrument Landing	463	8	471
	Visual Touch-and-Go/Low Approach	2,838	52	2,890
	Instrument Touch-and-Go/Low Approach	2,568	42	2,610
	TOTAL	8,635	149	8,784
	AIRFIELD TOTAL	101,778	7,119	**108,897**

NALF Fentress

		Airfield Operations		
Aircraft Category	**Operation Type**	**Day** 0700-2200	**Night** 2200-0700	**Total**
F-14 Fleet	Field Carrier Landing Practice	25,074	13,566	38,640
F-14 FRS	Field Carrier Landing Practice	15,946	7,334	23,280
E-2 Fleet	Field Carrier Landing Practice	9,743	7,057	16,800
E-2 FRS	Field Carrier Landing Practice	11,641	5,959	17,600
C-2 Fleet	Field Carrier Landing Practice	7,772	576	8,348
	AIRFIELD TOTAL	70,176	34,492	**104,668**

Table A-2 Annual Basic Operations at NAS Oceana and NALF Fentress for ARS-1

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Departure	12,181	1,169	13,350
	Full Stop Visual Landing	11,302	1,502	12,804
	Full Stop Instrument Landing	365	171	536
	Visual Touch-and-Go/Low Approach	20,772	994	21,766
	Instrument Touch-and-Go/Low Approach	456	56	512
	Field Carrier Landing Practice	640	240	880
	TOTAL	45,716	4,132	49,848
F-14 FRS	Departure	6,539	425	6,964
	Full Stop Visual Landing	5,921	393	6,314
	Full Stop Instrument Landing	265	385	650
	Visual Touch-and-Go/Low Approach	25,274	918	26,192
	Instrument Touch-and-Go/Low Approach	3,732	1,500	5,232
	Field Carrier Landing Practice	0	180	180
	TOTAL	41,731	3,801	45,532
F/A-18 Fleet	Departure	14,330	1,298	15,628
	Full Stop Visual Landing	12,556	1,891	14,447
	Full Stop Instrument Landing	851	342	1,193
	Visual Touch-and-Go/Low Approach	24,342	1,914	26,256
	Instrument Touch-and-Go/Low Approach	2,124	800	2,924
	Field Carrier Landing Practice	1,180	1,080	2,260
	TOTAL	55,383	7,325	62,708
F/A-18 FRS	Departure	8,059	479	8,538
	Full Stop Visual Landing	6,838	667	7,505
	Full Stop Instrument Landing	689	344	1,033
	Visual Touch-and-Go/Low Approach	35,822	2,412	38,234
	Instrument Touch-and-Go/Low Approach	4,406	654	5,060
	Field Carrier Landing Practice	160	0	160
	TOTAL	55,974	4,556	60,530
Adversary	Departure	2,262	71	2,333
	Full Stop Visual Landing	2,316	0	2,316
	Full Stop Instrument Landing	16	1	17
	Visual Touch-and-Go/Low Approach	1,476	0	1,476
	Instrument Touch-and-Go/Low Approach	166	0	166
	TOTAL	6,236	72	6,308
Transient Jet	Departure	947	20	967
	Full Stop Visual Landing	709	14	723
	Full Stop Instrument Landing	242	2	244
	Visual Touch-and-Go/Low Approach	1,004	22	1,026
	Instrument Touch-and-Go/Low Approach	804	30	834
	TOTAL	3,706	88	3,794
Transient Prop	Departure	1,634	30	1,664
	Full Stop Visual Landing	1,173	16	1,189
	Full Stop Instrument Landing	467	8	475
	Visual Touch-and-Go/Low Approach	2,778	52	2,830
	Instrument Touch-and-Go/Low Approach	2,572	42	2,614
	TOTAL	8,624	148	8,772
	AIRFIELD TOTAL	217,370	20,122	237,492

NALF Fentress

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Field Carrier Landing Practice	20,508	17,652	38,160
F-14 FRS	Field Carrier Landing Practice	14,802	8,658	23,460
F/A-18 Fleet	Field Carrier Landing Practice	17,629	11,711	29,340
F/A-18 FRS	Field Carrier Landing Practice	17,187	7,299	24,486
E-2 Fleet	Field Carrier Landing Practice	7,873	8,927	16,800
E-2 FRS	Field Carrier Landing Practice	10,291	7,309	17,600
C-2 Fleet	Field Carrier Landing Practice	7,860	488	8,348
	AIRFIELD TOTAL	96,150	62,044	158,194

Table A-3: Annual Basic Operations at NAS Oceana and NALF Fentress for ARS-2

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Departure	12,087	1,164	13,251
	Full Stop Visual Landing	11,257	1,450	12,707
	Full Stop Instrument Landing	357	177	534
	Visual Touch-and-Go/Low Approach	20,568	940	21,508
	Instrument Touch-and-Go/Low Approach	474	64	538
	Field Carrier Landing Practice	976	320	1,296
	TOTAL	45,719	4,115	49,834
F-14 FRS	Departure	6,495	460	6,955
	Full Stop Visual Landing	5,895	418	6,313
	Full Stop Instrument Landing	282	360	642
	Visual Touch-and-Go/Low Approach	25,470	890	26,360
	Instrument Touch-and-Go/Low Approach	3,682	1,538	5,220
	Field Carrier Landing Practice	50	130	180
	TOTAL	41,874	3,796	45,670
F/A-18 Fleet	Departure	12,048	1,024	13,072
	Full Stop Visual Landing	10,592	1,478	12,070
	Full Stop Instrument Landing	700	315	1,015
	Visual Touch-and-Go/Low Approach	20,996	1,760	22,756
	Instrument Touch-and-Go/Low Approach	1,854	658	2,512
	Field Carrier Landing Practice	140	924	1,064
	TOTAL	46,330	6,159	52,489
F/A-18 FRS	Departure	8,137	416	8,553
	Full Stop Visual Landing	6,907	652	7,559
	Full Stop Instrument Landing	686	308	994
	Visual Touch-and-Go/Low Approach	35,902	2,190	38,092
	Instrument Touch-and-Go/Low Approach	4,520	570	5,090
	Field Carrier Landing Practice	320	80	400
	TOTAL	56,472	4,216	60,688
Adversary	Departure	1,962	55	2,017
	Full Stop Visual Landing	2,006	0	2,006
	Full Stop Instrument Landing	10	1	11
	Visual Touch-and-Go/Low Approach	1,530	0	1,530
	Instrument Touch-and-Go/Low Approach	168	0	168
	TOTAL	5,676	56	5,732
Transient Jet	Departure	946	21	967
	Full Stop Visual Landing	710	14	724
	Full Stop Instrument Landing	241	2	243
	Visual Touch-and-Go/Low Approach	1,020	22	1,042
	Instrument Touch-and-Go/Low Approach	804	30	834
	TOTAL	3,721	89	3,810
Transient Prop	Departure	1,638	31	1,669
	Full Stop Visual Landing	1,183	16	1,199
	Full Stop Instrument Landing	462	8	470
	Visual Touch-and-Go/Low Approach	2,878	52	2,930
	Instrument Touch-and-Go/Low Approach	2,572	42	2,614
	TOTAL	8,733	149	8,882
	AIRFIELD TOTAL	208,525	18,580	**227,105**

NALF Fentress

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Field Carrier Landing Practice	20,274	17,326	37,600
F-14 FRS	Field Carrier Landing Practice	13,972	9,308	23,280
F/A-18 Fleet	Field Carrier Landing Practice	13,570	8,650	22,220
F/A-18 FRS	Field Carrier Landing Practice	17,695	6,497	24,192
E-2 Fleet	Field Carrier Landing Practice	8,520	8,280	16,800
E-2 FRS	Field Carrier Landing Practice	10,499	7,101	17,600
C-2 Fleet	Field Carrier Landing Practice	7,704	644	8,348
	AIRFIELD TOTAL	92,234	57,806	**150,040**

Table A-4: Annual Basic Operations at NAS Oceana and NALF Fentress for ARS-3

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Departure	12,176	1,105	13,281
	Full Stop Visual Landing	11,295	1,465	12,760
	Full Stop Instrument Landing	354	157	511
	Visual Touch-and-Go/Low Approach	20,402	994	21,396
	Instrument Touch-and-Go/Low Approach	472	56	528
	Field Carrier Landing Practice	176	80	256
	TOTAL	44,875	3,857	48,732
F-14 FRS	Departure	6,534	450	6,984
	Full Stop Visual Landing	5,924	399	6,323
	Full Stop Instrument Landing	270	391	661
	Visual Touch-and-Go/Low Approach	25,502	904	26,406
	Instrument Touch-and-Go/Low Approach	3,698	1,612	5,310
	Field Carrier Landing Practice	0	0	0
	TOTAL	41,928	3,756	45,684
F/A-18 Fleet	Departure	10,222	827	11,049
	Full Stop Visual Landing	8,977	1,281	10,258
	Full Stop Instrument Landing	590	213	803
	Visual Touch-and-Go/Low Approach	17,786	1,512	19,298
	Instrument Touch-and-Go/Low Approach	1,590	528	2,118
	Field Carrier Landing Practice	220	660	880
	TOTAL	39,385	5,021	44,406
F/A-18 FRS	Departure	8,066	473	8,539
	Full Stop Visual Landing	6,900	674	7,574
	Full Stop Instrument Landing	621	344	965
	Visual Touch-and-Go/Low Approach	35,738	2,490	38,228
	Instrument Touch-and-Go/Low Approach	4,484	616	5,100
	Field Carrier Landing Practice	160	80	240
	TOTAL	55,969	4,677	60,646
Adversary	Departure	2,272	56	2,328
	Full Stop Visual Landing	2,316	0	2,316
	Full Stop Instrument Landing	11	1	12
	Visual Touch-and-Go/Low Approach	1,522	0	1,522
	Instrument Touch-and-Go/Low Approach	164	0	164
	TOTAL	6,285	57	6,342
Transient Jet	Departure	946	21	967
	Full Stop Visual Landing	708	14	722
	Full Stop Instrument Landing	243	2	245
	Visual Touch-and-Go/Low Approach	1,042	22	1,064
	Instrument Touch-and-Go/Low Approach	792	30	822
	TOTAL	3,731	89	3,820
Transient Prop	Departure	1,639	30	1,669
	Full Stop Visual Landing	1,175	17	1,192
	Full Stop Instrument Landing	469	8	477
	Visual Touch-and-Go/Low Approach	2,792	52	2,844
	Instrument Touch-and-Go/Low Approach	2,556	42	2,598
	TOTAL	8,631	149	8,780
	AIRFIELD TOTAL	200,804	17,606	**218,410**

NALF Fentress

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Field Carrier Landing Practice	21,508	16,972	38,480
F-14 FRS	Field Carrier Landing Practice	14,575	9,425	24,000
F/A-18 Fleet	Field Carrier Landing Practice	11,829	7,391	19,220
F/A-18 FRS	Field Carrier Landing Practice	17,006	7,302	24,308
E-2 Fleet	Field Carrier Landing Practice	8,641	8,159	16,800
E-2 FRS	Field Carrier Landing Practice	10,514	7,086	17,600
C-2 Fleet	Field Carrier Landing Practice	7,795	553	8,348
	AIRFIELD TOTAL	91,868	56,888	**148,756**

Table A-5: Annual Basic Operations at NAS Oceana and NALF Fentress for ARS-4

Aircraft Category	Operation Type	Airfield Operations: Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Departure	12,155	1,123	13,278
	Full Stop Visual Landing	11,279	1,456	12,735
	Full Stop Instrument Landing	383	150	533
	Visual Touch-and-Go/Low Approach	19,656	996	20,652
	Instrument Touch-and-Go/Low Approach	522	44	566
	Field Carrier Landing Practice	480	160	640
	TOTAL	44,475	3,929	48,404
F-14 FRS	Departure	6,511	455	6,966
	Full Stop Visual Landing	5,896	428	6,324
	Full Stop Instrument Landing	260	382	642
	Visual Touch-and-Go/Low Approach	25,420	964	26,384
	Instrument Touch-and-Go/Low Approach	3,670	1,598	5,268
	Field Carrier Landing Practice	360	0	360
	TOTAL	42,117	3,827	45,944
F/A-18 Fleet	Departure	8,285	719	9,004
	Full Stop Visual Landing	7,424	988	8,412
	Full Stop Instrument Landing	453	151	604
	Visual Touch-and-Go/Low Approach	14,538	876	15,414
	Instrument Touch-and-Go/Low Approach	1,314	316	1,630
	Field Carrier Landing Practice	380	600	980
	TOTAL	32,394	3,650	36,044
F/A-18 FRS	Departure	8,113	421	8,534
	Full Stop Visual Landing	6,910	679	7,589
	Full Stop Instrument Landing	666	279	945
	Visual Touch-and-Go/Low Approach	36,446	2,344	38,790
	Instrument Touch-and-Go/Low Approach	4,498	570	5,068
	Field Carrier Landing Practice	240	80	320
	TOTAL	56,873	4,373	61,246
Adversary	Departure	1,799	51	1,850
	Full Stop Visual Landing	1,837	0	1,837
	Full Stop Instrument Landing	11	2	13
	Visual Touch-and-Go/Low Approach	1,514	0	1,514
	Instrument Touch-and-Go/Low Approach	168	0	168
	TOTAL	5,329	53	5,382
Transient Jet	Departure	947	20	967
	Full Stop Visual Landing	708	14	722
	Full Stop Instrument Landing	243	2	245
	Visual Touch-and-Go/Low Approach	1,024	28	1,052
	Instrument Touch-and-Go/Low Approach	800	30	830
	TOTAL	3,722	94	3,816
Transient Prop	Departure	1,645	32	1,677
	Full Stop Visual Landing	1,186	16	1,202
	Full Stop Instrument Landing	467	8	475
	Visual Touch-and-Go/Low Approach	2,858	52	2,910
	Instrument Touch-and-Go/Low Approach	2,566	42	2,608
	TOTAL	8,722	150	8,872
	AIRFIELD TOTAL	193,632	16,076	209,708

NALF Fentress

Aircraft Category	Operation Type	Airfield Operations: Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Field Carrier Landing Practice	21,027	17,053	38,080
F-14 FRS	Field Carrier Landing Practice	13,679	9,601	23,280
F/A-18 Fleet	Field Carrier Landing Practice	10,740	6,540	17,280
F/A-18 FRS	Field Carrier Landing Practice	17,848	6,424	24,272
E-2 Fleet	Field Carrier Landing Practice	8,472	8,328	16,800
E-2 FRS	Field Carrier Landing Practice	10,307	7,293	17,600
C-2 Fleet	Field Carrier Landing Practice	7,795	553	8,348
	AIRFIELD TOTAL	89,868	55,792	145,660

Table A-6: Annual Basic Operations at NAS Oceana and NALF Fentress for ARS-5

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Departure	12,178	1,097	13,275
	Full Stop Visual Landing	11,308	1,429	12,737
	Full Stop Instrument Landing	376	151	527
	Visual Touch-and-Go/Low Approach	19,794	1,010	20,804
	Instrument Touch-and-Go/Low Approach	488	60	548
	Field Carrier Landing Practice	576	160	736
	TOTAL	44,720	3,907	48,627
F-14 FRS	Departure	6,574	420	6,994
	Full Stop Visual Landing	5,938	404	6,342
	Full Stop Instrument Landing	268	384	652
	Visual Touch-and-Go/Low Approach	25,680	904	26,584
	Instrument Touch-and-Go/Low Approach	3,670	1,596	5,266
	Field Carrier Landing Practice	0	0	0
	TOTAL	42,130	3,708	45,838
F/A-18 Fleet	Departure	8,224	729	8,953
	Full Stop Visual Landing	7,374	997	8,371
	Full Stop Instrument Landing	455	139	594
	Visual Touch-and-Go/Low Approach	14,170	936	15,106
	Instrument Touch-and-Go/Low Approach	1,288	356	1,644
	Field Carrier Landing Practice	220	480	700
	TOTAL	31,731	3,637	35,368
F/A-18 FRS	Departure	8,062	473	8,535
	Full Stop Visual Landing	6,918	700	7,618
	Full Stop Instrument Landing	623	294	917
	Visual Touch-and-Go/Low Approach	36,272	2,330	38,602
	Instrument Touch-and-Go/Low Approach	4,476	640	5,116
	Field Carrier Landing Practice	240	160	400
	TOTAL	56,591	4,597	61,188
Adversary	Departure	2,289	59	2,348
	Full Stop Visual Landing	2,325	0	2,325
	Full Stop Instrument Landing	23	0	23
	Visual Touch-and-Go/Low Approach	1,496	0	1,496
	Instrument Touch-and-Go/Low Approach	164	0	164
	TOTAL	6,297	59	6,356
Transient Jet	Departure	947	20	967
	Full Stop Visual Landing	708	14	722
	Full Stop Instrument Landing	243	2	245
	Visual Touch-and-Go/Low Approach	1,006	22	1,028
	Instrument Touch-and-Go/Low Approach	804	30	834
	TOTAL	3,708	88	3,796
Transient Prop	Departure	1,633	31	1,664
	Full Stop Visual Landing	1,177	16	1,193
	Full Stop Instrument Landing	463	8	471
	Visual Touch-and-Go/Low Approach	2,858	52	2,910
	Instrument Touch-and-Go/Low Approach	2,582	42	2,624
	TOTAL	8,713	149	8,862
	AIRFIELD TOTAL	193,890	16,145	**210,035**

NALF Fentress

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Field Carrier Landing Practice	21,345	16,655	38,000
F-14 FRS	Field Carrier Landing Practice	14,628	9,012	23,640
F/A-18 Fleet	Field Carrier Landing Practice	10,826	6,734	17,560
F/A-18 FRS	Field Carrier Landing Practice	17,356	6,836	24,192
E-2 Fleet	Field Carrier Landing Practice	8,558	8,242	16,800
E-2 FRS	Field Carrier Landing Practice	10,307	7,293	17,600
C-2 Fleet	Field Carrier Landing Practice	7,772	576	8,348
	AIRFIELD TOTAL	90,792	55,348	**146,140**

Table A-7: Annual Basic Operations at MCAS Cherry Point for the Baseline Scenario

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
AV-8 Fleet	Departure	9,996	127	10,123
	Full Stop Visual Landing	8,062	307	8,369
	Full Stop Instrument Landing	529	29	558
	Pad Landing	1,129	80	1,209
	Visual Touch-and-Go/Low Approach	4,238	374	4,612
	Instrument Touch-and-Go/Low Approach	2,346	24	2,370
	Press-Up	6,666	20	6,686
	Pad Vertical Take-off to Pad Landing Circuit	2,804	182	2,986
	TOTAL	35,770	1,143	36,913
AV-8 FRS	Departure	11,404	166	11,570
	Full Stop Visual Landing	8,191	174	8,365
	Full Stop Instrument Landing	491	0	491
	Pad Landing	2,651	63	2,714
	Visual Touch-and-Go/Low Approach	772	6	778
	Instrument Touch-and-Go/Low Approach	4,062	66	4,128
	Press-Up	6,476	70	6,546
	Pad Vertical Take-off to Pad Landing Circuit	2,518	122	2,640
	TOTAL	36,565	667	37,232
EA-6B	Departure	2,119	7	2,126
	Full Stop Visual Landing	1,753	136	1,889
	Full Stop Instrument Landing	220	18	238
	Visual Touch-and-Go/Low Approach	5,188	314	5,502
	Instrument Touch-and-Go/Low Approach	1,720	250	1,970
	TOTAL	11,000	725	11,725
KC-130 Fleet	Departure	632	0	632
	Full Stop Visual Landing	251	31	282
	Full Stop Instrument Landing	328	22	350
	Visual Touch-and-Go/Low Approach	1,358	126	1,484
	Instrument Touch-and-Go/Low Approach	1,582	24	1,606
	TOTAL	4,151	203	4,354
KC-130 FRS	Departure	803	0	803
	Full Stop Visual Landing	275	9	284
	Full Stop Instrument Landing	482	37	519
	Visual Touch-and-Go/Low Approach	3,772	170	3,942
	Instrument Touch-and-Go/Low Approach	3,296	60	3,356
	TOTAL	8,628	276	8,904
Transient Jet	Departure	1,750	48	1,798
	Full Stop Visual Landing	1,328	0	1,328
	Full Stop Instrument Landing	470	0	470
	Visual Touch-and-Go/Low Approach	1,336	0	1,336
	Instrument Touch-and-Go/Low Approach	1,050	2	1,052
	TOTAL	5,934	50	5,984
Transient Prop	Departure	658	0	658
	Full Stop Visual Landing	219	0	219
	Full Stop Instrument Landing	439	0	439
	Visual Touch-and-Go/Low Approach	2,628	0	2,628
	Instrument Touch-and-Go/Low Approach	360	2	362
	TOTAL	4,304	2	4,306
Transient Heavy	Departure	116	67	183
	Full Stop Instrument Landing	181	2	183
	Instrument Touch-and-Go/Low Approach	340	0	340
	TOTAL	637	69	706
Transient Large	Departure	535	159	694
	Full Stop Visual Landing	146	0	146
	Full Stop Instrument Landing	541	7	548
	Instrument Touch-and-Go/Low Approach	938	6	944
	TOTAL	2,160	172	2,332
Transient Helicopter	Departure	1,360	405	1,765
	Full Stop Visual Landing	1,732	33	1,765
	Instrument Touch-and-Go/Low Approach	268	0	268
	TOTAL	3,360	438	3,798
	AIRFIELD TOTAL	112,509	3,745	116,254

Table A-8: Annual Basic Operations at MCAS Cherry Point for ARS-3

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
AV-8 Fleet	Departure	9,801	158	9,959
	Full Stop Visual Landing	7,923	304	8,227
	Full Stop Instrument Landing	514	50	564
	Pad Landing	1,082	98	1,180
	Visual Touch-and-Go/Low Approach	3,846	374	4,220
	Instrument Touch-and-Go/Low Approach	2,314	12	2,326
	Press-Up	6,648	10	6,658
	Pad Vertical Take-off to Pad Landing Circuit	2,674	218	2,892
	TOTAL	34,802	1,224	36,026
AV-8 FRS	Departure	11,139	140	11,279
	Full Stop Visual Landing	7,969	138	8,107
	Full Stop Instrument Landing	517	6	523
	Pad Landing	2,597	52	2,649
	Visual Touch-and-Go/Low Approach	764	4	768
	Instrument Touch-and-Go/Low Approach	3,972	44	4,016
	Press-Up	6,352	62	6,414
	Pad Vertical Take-off to Pad Landing Circuit	2,438	94	2,532
	TOTAL	35,748	540	36,288
EA-6B	Departure	2,116	11	2,127
	Full Stop Visual Landing	1,736	154	1,890
	Full Stop Instrument Landing	222	16	238
	Visual Touch-and-Go/Low Approach	5,114	348	5,462
	Instrument Touch-and-Go/Low Approach	1,698	266	1,964
	TOTAL	10,886	795	11,681
F/A-18 Fleet	Departure	3,575	271	3,846
	Full Stop Visual Landing	3,068	346	3,414
	Full Stop Instrument Landing	348	80	428
	Visual Touch-and-Go/Low Approach	4,018	140	4,158
	Instrument Touch-and-Go/Low Approach	480	72	552
	Field Carrier Landing Practice	8,368	2,298	10,666
	TOTAL	19,857	3,207	23,064
KC-130 Fleet	Departure	631	0	631
	Full Stop Visual Landing	251	32	283
	Full Stop Instrument Landing	328	20	348
	Visual Touch-and-Go/Low Approach	1,354	138	1,492
	Instrument Touch-and-Go/Low Approach	1,572	40	1,612
	TOTAL	4,136	230	4,366
KC-130 FRS	Departure	802	0	802
	Full Stop Visual Landing	286	5	291
	Full Stop Instrument Landing	471	40	511
	Visual Touch-and-Go/Low Approach	3,834	90	3,924
	Instrument Touch-and-Go/Low Approach	3,234	60	3,294
	TOTAL	8,627	195	8,822
Transient Jet	Departure	1,756	40	1,796
	Full Stop Visual Landing	1,326	0	1,326
	Full Stop Instrument Landing	470	0	470
	Visual Touch-and-Go/Low Approach	1,304	0	1,304
	Instrument Touch-and-Go/Low Approach	1,030	2	1,032
	TOTAL	5,886	42	5,928
Transient Prop	Departure	658	0	658
	Full Stop Visual Landing	219	0	219
	Full Stop Instrument Landing	439	0	439
	Visual Touch-and-Go/Low Approach	2,594	0	2,594
	Instrument Touch-and-Go/Low Approach	354	2	356
	TOTAL	4,264	2	4,266
Transient Heavy	Departure	110	73	183
	Full Stop Instrument Landing	181	2	183
	Instrument Touch-and-Go/Low Approach	328	0	328
	TOTAL	619	75	694
Transient Large	Departure	539	155	694
	Full Stop Visual Landing	146	0	146
	Full Stop Instrument Landing	540	8	548
	Instrument Touch-and-Go/Low Approach	914	6	920
	TOTAL	2,139	169	2,308
Transient Helicopter	Departure	1,348	417	1,765
	Full Stop Visual Landing	1,732	33	1,765
	Instrument Touch-and-Go/Low Approach	266	0	266
	TOTAL	3,346	450	3,796
	AIRFIELD TOTAL	130,310	6,929	137,239

Table A-9: Annual Basic Operations at MCAS Cherry Point for ARS-5

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
AV-8 Fleet	Departure	9,882	162	10,044
	Full Stop Visual Landing	7,991	326	8,317
	Full Stop Instrument Landing	526	42	568
	Pad Landing	1,096	74	1,170
	Visual Touch-and-Go/Low Approach	3,986	328	4,314
	Instrument Touch-and-Go/Low Approach	2,328	18	2,346
	Press-Up	6,604	10	6,614
	Pad Vertical Take-off to Pad Landing Circuit	2,708	204	2,912
	TOTAL	35,121	1,164	36,285
AV-8 FRS	Departure	11,207	155	11,362
	Full Stop Visual Landing	8,038	157	8,195
	Full Stop Instrument Landing	518	8	526
	Pad Landing	2,596	45	2,641
	Visual Touch-and-Go/Low Approach	732	12	744
	Instrument Touch-and-Go/Low Approach	3,924	52	3,976
	Press-Up	6,396	58	6,454
	Pad Vertical Take-off to Pad Landing Circuit	2,438	96	2,534
	TOTAL	35,849	583	36,432
EA-6B	Departure	2,115	14	2,129
	Full Stop Visual Landing	1,729	151	1,880
	Full Stop Instrument Landing	224	24	248
	Visual Touch-and-Go/Low Approach	5,110	348	5,458
	Instrument Touch-and-Go/Low Approach	1,682	258	1,940
	TOTAL	10,860	795	11,655
F/A-18 Fleet	Departure	5,602	378	5,980
	Full Stop Visual Landing	4,660	549	5,209
	Full Stop Instrument Landing	546	225	771
	Visual Touch-and-Go/Low Approach	7,148	468	7,616
	Instrument Touch-and-Go/Low Approach	712	160	872
	Field Carrier Landing Practice	9,686	2,554	12,240
	TOTAL	28,354	4,334	32,688
KC-130 Fleet	Departure	632	0	632
	Full Stop Visual Landing	254	29	283
	Full Stop Instrument Landing	329	20	349
	Visual Touch-and-Go/Low Approach	1,362	104	1,466
	Instrument Touch-and-Go/Low Approach	1,556	34	1,590
	TOTAL	4,133	187	4,320
KC-130 FRS	Departure	805	0	805
	Full Stop Visual Landing	283	6	289
	Full Stop Instrument Landing	474	42	516
	Visual Touch-and-Go/Low Approach	3,842	128	3,970
	Instrument Touch-and-Go/Low Approach	3,282	44	3,326
	TOTAL	8,686	220	8,906
Transient Jet	Departure	1,658	35	1,693
	Full Stop Visual Landing	1,221	0	1,221
	Full Stop Instrument Landing	472	0	472
	Visual Touch-and-Go/Low Approach	1,184	0	1,184
	Instrument Touch-and-Go/Low Approach	1,054	2	1,056
	TOTAL	5,589	37	5,626
Transient Prop	Departure	661	0	661
	Full Stop Visual Landing	219	0	219
	Full Stop Instrument Landing	442	0	442
	Visual Touch-and-Go/Low Approach	2,570	0	2,570
	Instrument Touch-and-Go/Low Approach	346	2	348
	TOTAL	4,238	2	4,240
Transient Heavy	Departure	118	65	183
	Full Stop Instrument Landing	181	2	183
	Instrument Touch-and-Go/Low Approach	324	0	324
	TOTAL	623	67	690
Transient Large	Departure	530	164	694
	Full Stop Visual Landing	146	0	146
	Full Stop Instrument Landing	540	8	548
	Instrument Touch-and-Go/Low Approach	910	6	916
	TOTAL	2,126	178	2,304
Transient Helicopter	Departure	1,367	398	1,765
	Full Stop Visual Landing	1,732	33	1,765
	Instrument Touch-and-Go/Low Approach	268	0	268
	TOTAL	3,367	431	3,798
	AIRFIELD TOTAL	138,946	7,998	146,944

Table A-10 Annual Basic Operations at MCALF Bogue Field for the Baseline Scenario

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
AV-8 Fleet	Field Carrier Landing Practice	3,240	0	3,240
	Forward Base Operations	2,736	0	2,736
	TOTAL	5,976	0	5,976
AV-8 FRS	Field Carrier Landing Practice	3,960	0	3,960
	Forward Base Operations	5,280	0	5,280
	TOTAL	9,240	0	9,240
EA-6B	Expeditionary Airfield Operations	36	0	36
KC-130 Fleet	Normal Pattern Operations	20	0	20
Marine Corps Helicopters	Arrivals/Departures/Pattern Operations	960	50	1,010
Other Military Jet	Arrivals/Departures/Pattern Operations	790	135	925
Other Military Helicopters	Arrivals/Departures/Pattern Operations	110	20	130
	AIRFIELD TOTAL	17,132	205	**17,337**

A.2 Flight Track Airfield Operations

Flight track airfield operations are those commonly used to assess the frequency by which specific flight tracks are used and are provided to support noise assessment efforts. For NAS Oceana and NALF Fentress, they are defined as follows:

NAS Oceana

Southeasterly Departure	One aircraft leaving the airfield traffic pattern to the southeast (e.g., APOLLO Departure). *One operation.*
Northeasterly Departure	One aircraft leaving the airfield traffic pattern to the northeast (e.g., SOUCEK/NORFOLK Departure). *One operation.*
Interfacility Departure to Fentress	One aircraft leaving the NAS Oceana airfield and arriving at NALF Fentress. *One operation.*
Straight-In/Full Stop Arrival	One aircraft approaching the NAS Oceana directly to a runway (including instrument and visual straight-in approaches) to either a full-stop landing, touch-and-go, or low approach (excluding arrivals from NALF Fentress). *One operation.*
Overhead Arrival at Oceana	One aircraft arriving at the airfield through the overhead approach (excluding arrivals from NALF Fentress). *One operation.*
Visual Touch-and-Go	One full circuit of the visual (tower) pattern. *Two operations.*
GCA Pattern	One full circuit of the GCA box pattern. *Two operations.*
Depart and Reenter to Overhead	One aircraft conducting an overhead approach immediately after leaving the airfield traffic pattern. *One operation.*
FCLP Pattern	One full circuit of the FCLP pattern at NAS Oceana. *Two operations.*
Interfacility Arrival from Fentress (w/ overhead approach)	One aircraft leaving NALF Fentress and arriving at NAS Oceana via the overhead approach. *One operation.*
Interfacility Arrival from Fentress (w/ straight-in approach)	One aircraft leaving NALF Fentress and conducting a straight-in approach at NAS Oceana. *One operation.*

NALF Fentress

Interfacility Arrival from Oceana(w/ overhead approach)	One aircraft leaving NAS Oceana and arriving at NALF Fentress via the overhead approach. *One operation.*
FCLP Pattern	One full circuit of the FCLP pattern at NALF Fentress. *Two operations.*
Interfacility Departure to Oceana	One aircraft leaving the NALF Fentress airfield and arriving at NAS Oceana. *One operation.*

For MCAS Cherry Point and MCALF Bogue Field, the flight track descriptions are as follows:

MCAS Cherry Point

Departure	One aircraft leaving the airfield traffic pattern. *One operation.*
Interfacility Departure to Bogue Field	One aircraft leaving the MCAS Cherry Point airfield and arriving at MCALF Bogue Field. *One operation.*
Straight-In/Full Stop Arrival	One aircraft approaching MCAS Cherry Point directly to a runway (including instrument and visual straight-in approaches) to either a full-stop landing, touch-and-go, or low approach (excluding arrivals from MCALF Bogue Field). *One operation.*
Overhead Arrival at Cherry Point to Runway	One aircraft arriving at the airfield through the overhead approach to a runway (excluding arrivals from MCALF Bogue Field). *One operation.*
Overhead Arrival at Cherry Point to Pad	One AV-8 aircraft arriving at the airfield through the overhead approach to a pad (excluding arrivals from MCALF Bogue Field). *One operation.*
Visual Touch-and-Go	One full circuit of the visual (tower) pattern. *Two operations.*
FCLP Pattern	One full circuit of the FCLP pattern at MCAS Cherry Point. *Two operations.*
Full Circuit to Runway	One AV-8 aircraft entering the tower pattern for an arrival to a runway immediately after departing. *Two operations.*
Full Circuit to Pad	One AV-8 aircraft entering the tower pattern for an arrival to a pad immediately after departing. *Two operations.*

GCA Pattern	One full circuit of the GCA box pattern. *Two operations.*
Depart and Reenter to Overhead	One aircraft conducting an overhead approach immediately after leaving the airfield traffic pattern. *One operation.*
Press-Up	A vertical takeoff from a pad followed by hovering maneuvers and a vertical pad landing. *Two operations.*
Pad Vertical Takeoff to Pad Landing Circuit	One aircraft performs a vertical takeoff from a pad, accelerates to forward flight speed around a pattern, and conducts an approach to a vertical pad landing. *Two operations.*
Interfacility Arrival from Bogue Field (w/ overhead approach)	One aircraft leaving MCALF Bogue Field and arriving at MCAS Cherry Point via the overhead approach. *One operation.*
Interfacility Arrival from Bogue Field (w/ straight-in approach)	One aircraft leaving MCALF Bogue Field and conducting a straight-in approach at MCAS Cherry Point. *One operation.*

MCALF Bogue Field

Interfacility Arrival from Cherry Point	One aircraft leaving MCAS Cherry Point and arriving at MCALF Bogue Field. *One operation.*
Arrival	One aircraft arriving at MCALF Bogue Field (excluding arrivals from MCAS Cherry Point). *One operation.*
FCLP Pattern	One full circuit of the FCLP pattern at MCALF Bogue Field. *Two operations.*
Forward Base Operations Pattern	One full circuit of the FBO pattern at MCALF Bogue Field. *Two operations.*
Interfacility Departure to Cherry Point	One aircraft leaving MCALF Bogue Field and arriving at MCAS Cherry Point. *One operation.*

Table A-11: Annual Flight Track Operations at NAS Oceana for the Baseline Scenario

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Southeasterly Departure	5,879	111	5,990
	Northeasterly Departure	4,729	91	4,820
	Interfacility Departure to Fentress	1,750	665	2,415
	Interfacility Arrival from Fentress (w/ overhead approach)	1,365	900	2,265
	Interfacility Arrival from Fentress (w/ straight-in approach)	60	90	150
	Straight-In/Full stop Arrival (non-interfacility)	450	25	475
	Overhead Arrival at Oceana (non-interfacility)	9,938	386	10,324
	Depart and Reenter to Overhead	111	0	111
	Visual Touch-and-Go	19,377	1,130	20,507
	GCA Box	304	44	348
	FCLP Pattern	0	0	0
	TOTAL	43,963	3,442	47,405
F-14 FRS	Southeasterly Departure	1,661	0	1,661
	Northeasterly Departure	3,976	0	3,976
	Interfacility Departure to Fentress	965	320	1,285
	Interfacility Arrival from Fentress (w/ overhead approach)	520	160	680
	Interfacility Arrival from Fentress (w/ straight-in approach)	295	310	605
	Straight-In/Full stop Arrival (non-interfacility)	1,689	86	1,775
	Overhead Arrival at Oceana (non-interfacility)	3,764	98	3,862
	Depart and Reenter to Overhead	689	0	689
	Visual Touch-and-Go	27,390	1,117	28,507
	GCA Box	2,216	1,328	3,544
	FCLP Pattern	0	0	0
	TOTAL	43,165	3,419	46,584
Adversary	Southeasterly Departure	673	13	686
	Northeasterly Departure	153	0	153
	Straight-In/Full stop Arrival (non-interfacility)	89	0	89
	Overhead Arrival at Oceana (non-interfacility)	742	2	744
	Visual Touch-and-Go	604	0	604
	TOTAL	2,261	15	2,276
Transient Jet	Southeasterly Departure	46	2	48
	Northeasterly Departure	901	18	919
	Straight-In/Full stop Arrival (non-interfacility)	283	6	289
	Overhead Arrival at Oceana (non-interfacility)	670	8	678
	Visual Touch-and-Go	1,132	38	1,170
	GCA Box	722	22	744
	TOTAL	3,754	94	3,848
Transient Prop	Southeasterly Departure	174	3	177
	Northeasterly Departure	1,437	28	1,465
	Straight-In/Full stop Arrival (non-interfacility)	665	11	676
	Overhead Arrival at Oceana (non-interfacility)	956	10	966
	Visual Touch-and-Go	3,239	61	3,300
	GCA Box	2,164	36	2,200
	TOTAL	8,635	149	8,784
	AIRFIELD TOTAL	101,778	7,119	**108,897**

Table A-12: Annual Flight Track Operations at NAS Oceana for ARS-1

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Southeasterly Departure	4,798	60	4,858
	Northeasterly Departure	5,953	99	6,052
	Interfacility Departure to Fentress	1,390	995	2,385
	Interfacility Arrival from Fentress (w/ overhead approach)	1,130	1,045	2,175
	Interfacility Arrival from Fentress (w/ straight-in approach)	70	140	210
	Straight-In/Full stop Arrival (non-interfacility)	464	41	505
	Overhead Arrival at Oceana (non-interfacility)	10,015	380	10,395
	Depart and Reenter to Overhead	108	0	108
	Visual Touch-and-Go	20,908	1,076	21,984
	GCA Box	240	56	296
	FCLP Pattern	640	240	880
	TOTAL	45,716	4,132	49,848
F-14 FRS	Southeasterly Departure	1,593	0	1,593
	Northeasterly Departure	4,041	0	4,041
	Interfacility Departure to Fentress	880	415	1,295
	Interfacility Arrival from Fentress (w/ overhead approach)	485	190	675
	Interfacility Arrival from Fentress (w/ straight-in approach)	290	330	620
	Straight-In/Full stop Arrival (non-interfacility)	1,674	132	1,806
	Overhead Arrival at Oceana (non-interfacility)	3,740	88	3,828
	Depart and Reenter to Overhead	692	0	692
	Visual Touch-and-Go	26,158	1,100	27,258
	GCA Box	2,178	1,366	3,544
	FCLP Pattern	0	180	180
	TOTAL	41,731	3,801	45,532
F/A-18 Fleet	Southeasterly Departure	6,211	232	6,443
	Northeasterly Departure	6,729	96	6,825
	Interfacility Departure to Fentress	1,305	880	2,185
	Interfacility Arrival from Fentress (w/ overhead approach)	1,065	933	1,998
	Interfacility Arrival from Fentress (w/ straight-in approach)	80	107	187
	Straight-In/Full stop Arrival (non-interfacility)	1,693	617	2,310
	Overhead Arrival at Oceana (non-interfacility)	10,546	424	10,970
	Depart and Reenter to Overhead	326	0	326
	Visual Touch-and-Go	25,840	2,884	28,724
	GCA Box	408	72	480
	FCLP Pattern	1,180	1,080	2,260
	TOTAL	55,383	7,325	62,708
F/A-18 FRS	Southeasterly Departure	385	0	385
	Northeasterly Departure	6,542	84	6,626
	Interfacility Departure to Fentress	1,122	395	1,517
	Interfacility Arrival from Fentress (w/ overhead approach)	672	193	865
	Interfacility Arrival from Fentress (w/ straight-in approach)	345	307	652
	Straight-In/Full stop Arrival (non-interfacility)	1,977	280	2,257
	Overhead Arrival at Oceana (non-interfacility)	4,560	194	4,754
	Depart and Reenter to Overhead	1,165	181	1,346
	Visual Touch-and-Go	37,548	2,704	40,252
	GCA Box	1,498	218	1,716
	FCLP Pattern	160	0	160
	TOTAL	55,974	4,556	60,530
Adversary	Southeasterly Departure	1,715	71	1,786
	Northeasterly Departure	547	0	547
	Straight-In/Full stop Arrival (non-interfacility)	116	1	117
	Overhead Arrival at Oceana (non-interfacility)	2,216	0	2,216
	Visual Touch-and-Go	1,642	0	1,642
	TOTAL	6,236	72	6,308
Transient Jet	Southeasterly Departure	46	2	48
	Northeasterly Departure	901	18	919
	Straight-In/Full stop Arrival (non-interfacility)	285	8	293
	Overhead Arrival at Oceana (non-interfacility)	668	6	674
	Visual Touch-and-Go	1,084	32	1,116
	GCA Box	722	22	744
	TOTAL	3,706	88	3,794
Transient Prop	Southeasterly Departure	174	3	177
	Northeasterly Departure	1,460	27	1,487
	Straight-In/Full stop Arrival (non-interfacility)	670	12	682
	Overhead Arrival at Oceana (non-interfacility)	973	9	982
	Visual Touch-and-Go	3,171	61	3,232
	GCA Box	2,176	36	2,212
	TOTAL	8,624	148	8,772
	AIRFIELD TOTAL	217,370	20,122	237,492

Table A-13: Annual Flight Track Operations at NAS Oceana for ARS-2

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Southeasterly Departure	4,912	67	4,979
	Northeasterly Departure	5,739	102	5,841
	Interfacility Departure to Fentress	1,375	975	2,350
	Interfacility Arrival from Fentress (w/ overhead approach)	1,140	1,025	2,165
	Interfacility Arrival from Fentress (w/ straight-in approach)	45	140	185
	Straight-In/Full stop Arrival (non-interfacility)	472	51	523
	Overhead Arrival at Oceana (non-interfacility)	9,943	344	10,287
	Depart and Reenter to Overhead	105	0	105
	Visual Touch-and-Go	20,748	1,027	21,775
	GCA Box	264	64	328
	FCLP Pattern	976	320	1,296
	TOTAL	45,719	4,115	49,834
F-14 FRS	Southeasterly Departure	1,623	0	1,623
	Northeasterly Departure	4,012	0	4,012
	Interfacility Departure to Fentress	830	455	1,285
	Interfacility Arrival from Fentress (w/ overhead approach)	450	220	670
	Interfacility Arrival from Fentress (w/ straight-in approach)	280	335	615
	Straight-In/Full stop Arrival (non-interfacility)	1,702	93	1,795
	Overhead Arrival at Oceana (non-interfacility)	3,752	88	3,840
	Depart and Reenter to Overhead	690	0	690
	Visual Touch-and-Go	26,363	1,063	27,426
	GCA Box	2,122	1,412	3,534
	FCLP Pattern	50	130	180
	TOTAL	41,874	3,796	45,670
F/A-18 Fleet	Southeasterly Departure	5,427	212	5,639
	Northeasterly Departure	5,616	80	5,696
	Interfacility Departure to Fentress	995	655	1,650
	Interfacility Arrival from Fentress (w/ overhead approach)	830	641	1,471
	Interfacility Arrival from Fentress (w/ straight-in approach)	55	124	179
	Straight-In/Full stop Arrival (non-interfacility)	1,453	525	1,978
	Overhead Arrival at Oceana (non-interfacility)	8,990	380	9,370
	Depart and Reenter to Overhead	275	0	275
	Visual Touch-and-Go	22,223	2,592	24,815
	GCA Box	326	26	352
	FCLP Pattern	140	924	1,064
	TOTAL	46,330	6,159	52,489
F/A-18 FRS	Southeasterly Departure	406	0	406
	Northeasterly Departure	6,522	101	6,623
	Interfacility Departure to Fentress	1,189	310	1,499
	Interfacility Arrival from Fentress (w/ overhead approach)	664	190	854
	Interfacility Arrival from Fentress (w/ straight-in approach)	365	280	645
	Straight-In/Full stop Arrival (non-interfacility)	1,927	269	2,196
	Overhead Arrival at Oceana (non-interfacility)	4,655	178	4,833
	Depart and Reenter to Overhead	1,179	165	1,344
	Visual Touch-and-Go	37,685	2,483	40,168
	GCA Box	1,560	160	1,720
	FCLP Pattern	320	80	400
	TOTAL	56,472	4,216	60,688
Adversary	Southeasterly Departure	1,433	55	1,488
	Northeasterly Departure	529	0	529
	Straight-In/Full stop Arrival (non-interfacility)	94	1	95
	Overhead Arrival at Oceana (non-interfacility)	1,922	0	1,922
	Visual Touch-and-Go	1,698	0	1,698
	TOTAL	5,676	56	5,732
Transient Jet	Southeasterly Departure	46	2	48
	Northeasterly Departure	900	19	919
	Straight-In/Full stop Arrival (non-interfacility)	285	8	293
	Overhead Arrival at Oceana (non-interfacility)	668	6	674
	Visual Touch-and-Go	1,102	32	1,134
	GCA Box	720	22	742
	TOTAL	3,721	89	3,810
Transient Prop	Southeasterly Departure	174	3	177
	Northeasterly Departure	1,464	28	1,492
	Straight-In/Full stop Arrival (non-interfacility)	669	12	681
	Overhead Arrival at Oceana (non-interfacility)	979	9	988
	Visual Touch-and-Go	3,281	61	3,342
	GCA Box	2,166	36	2,202
	TOTAL	8,733	149	8,882
	AIRFIELD TOTAL	208,525	18,580	227,105

Table A-14: Annual Flight Track Operations at NAS Oceana for ARS-3

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Southeasterly Departure	5,000	79	5,079
	Northeasterly Departure	5,695	86	5,781
	Interfacility Departure to Fentress	1,470	935	2,405
	Interfacility Arrival from Fentress (w/ overhead approach)	1,205	1,027	2,232
	Interfacility Arrival from Fentress (w/ straight-in approach)	45	128	173
	Straight-In/Full stop Arrival (non-interfacility)	440	41	481
	Overhead Arrival at Oceana (non-interfacility)	9,979	390	10,369
	Depart and Reenter to Overhead	110	0	110
	Visual Touch-and-Go	20,503	1,035	21,538
	GCA Box	252	56	308
	FCLP Pattern	176	80	256
	TOTAL	44,875	3,857	48,732
F-14 FRS	Southeasterly Departure	1,621	0	1,621
	Northeasterly Departure	4,013	0	4,013
	Interfacility Departure to Fentress	875	450	1,325
	Interfacility Arrival from Fentress (w/ overhead approach)	475	220	695
	Interfacility Arrival from Fentress (w/ straight-in approach)	280	350	630
	Straight-In/Full stop Arrival (non-interfacility)	1,682	104	1,786
	Overhead Arrival at Oceana (non-interfacility)	3,768	80	3,848
	Depart and Reenter to Overhead	690	0	690
	Visual Touch-and-Go	26,388	1,066	27,454
	GCA Box	2,136	1,486	3,622
	FCLP Pattern	0	0	0
	TOTAL	41,928	3,756	45,684
F/A-18 Fleet	Southeasterly Departure	4,490	146	4,636
	Northeasterly Departure	4,854	59	4,913
	Interfacility Departure to Fentress	865	565	1,430
	Interfacility Arrival from Fentress (w/ overhead approach)	745	591	1,336
	Interfacility Arrival from Fentress (w/ straight-in approach)	35	59	94
	Straight-In/Full stop Arrival (non-interfacility)	1,222	400	1,622
	Overhead Arrival at Oceana (non-interfacility)	7,607	332	7,939
	Depart and Reenter to Overhead	231	0	231
	Visual Touch-and-Go	18,854	2,167	21,021
	GCA Box	264	40	304
	FCLP Pattern	220	660	880
	TOTAL	39,387	5,019	44,406
F/A-18 FRS	Southeasterly Departure	360	0	360
	Northeasterly Departure	6,570	88	6,658
	Interfacility Departure to Fentress	1,126	380	1,506
	Interfacility Arrival from Fentress (w/ overhead approach)	691	195	886
	Interfacility Arrival from Fentress (w/ straight-in approach)	305	315	620
	Straight-In/Full stop Arrival (non-interfacility)	1,958	269	2,227
	Overhead Arrival at Oceana (non-interfacility)	4,589	202	4,791
	Depart and Reenter to Overhead	1,170	182	1,352
	Visual Touch-and-Go	37,490	2,796	40,286
	GCA Box	1,550	170	1,720
	FCLP Pattern	160	80	240
	TOTAL	55,969	4,677	60,646
Adversary	Southeasterly Departure	1,773	56	1,829
	Northeasterly Departure	499	0	499
	Straight-In/Full stop Arrival (non-interfacility)	95	1	96
	Overhead Arrival at Oceana (non-interfacility)	2,232	0	2,232
	Visual Touch-and-Go	1,686	0	1,686
	TOTAL	6,285	57	6,342
Transient Jet	Southeasterly Departure	46	2	48
	Northeasterly Departure	900	19	919
	Straight-In/Full stop Arrival (non-interfacility)	284	9	293
	Overhead Arrival at Oceana (non-interfacility)	669	5	674
	Visual Touch-and-Go	1,120	32	1,152
	GCA Box	712	22	734
	TOTAL	3,731	89	3,820
Transient Prop	Southeasterly Departure	170	3	173
	Northeasterly Departure	1,469	27	1,496
	Straight-In/Full stop Arrival (non-interfacility)	665	12	677
	Overhead Arrival at Oceana (non-interfacility)	983	9	992
	Visual Touch-and-Go	3,180	62	3,242
	GCA Box	2,164	36	2,200
	TOTAL	8,631	149	8,780
	AIRFIELD TOTAL	200,806	17,604	218,410

Table A-15: Annual Flight Track Operations at NAS Oceana for ARS-4

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Southeasterly Departure	5,111	67	5,178
	Northeasterly Departure	5,579	101	5,680
	Interfacility Departure to Fentress	1,435	945	2,380
	Interfacility Arrival from Fentress (w/ overhead approach)	1,170	1,030	2,200
	Interfacility Arrival from Fentress (w/ straight-in approach)	55	125	180
	Straight-In/Full stop Arrival (non-interfacility)	486	31	517
	Overhead Arrival at Oceana (non-interfacility)	9,965	366	10,331
	Depart and Reenter to Overhead	117	0	117
	Visual Touch-and-Go	19,789	1,060	20,849
	GCA Box	288	44	332
	FCLP Pattern	480	160	640
	TOTAL	44,475	3,929	48,404
F-14 FRS	Southeasterly Departure	1,612	0	1,612
	Northeasterly Departure	4,024	0	4,024
	Interfacility Departure to Fentress	830	455	1,285
	Interfacility Arrival from Fentress (w/ overhead approach)	440	240	680
	Interfacility Arrival from Fentress (w/ straight-in approach)	260	345	605
	Straight-In/Full stop Arrival (non-interfacility)	1,699	108	1,807
	Overhead Arrival at Oceana (non-interfacility)	3,755	74	3,829
	Depart and Reenter to Overhead	688	0	688
	Visual Touch-and-Go	26,335	1,137	27,472
	GCA Box	2,114	1,468	3,582
	FCLP Pattern	360	0	360
	TOTAL	42,117	3,827	45,944
F/A-18 Fleet	Southeasterly Departure	3,825	111	3,936
	Northeasterly Departure	3,650	53	3,703
	Interfacility Departure to Fentress	785	505	1,290
	Interfacility Arrival from Fentress (w/ overhead approach)	695	535	1,230
	Interfacility Arrival from Fentress (w/ straight-in approach)	25	35	60
	Straight-In/Full stop Arrival (non-interfacility)	1,021	268	1,289
	Overhead Arrival at Oceana (non-interfacility)	6,151	211	6,362
	Depart and Reenter to Overhead	183	0	183
	Visual Touch-and-Go	15,471	1,316	16,787
	GCA Box	208	16	224
	FCLP Pattern	380	600	980
	TOTAL	32,394	3,650	36,044
F/A-18 FRS	Southeasterly Departure	412	0	412
	Northeasterly Departure	6,507	91	6,598
	Interfacility Departure to Fentress	1,179	325	1,504
	Interfacility Arrival from Fentress (w/ overhead approach)	714	205	919
	Interfacility Arrival from Fentress (w/ straight-in approach)	335	250	585
	Straight-In/Full stop Arrival (non-interfacility)	1,984	248	2,232
	Overhead Arrival at Oceana (non-interfacility)	4,580	198	4,778
	Depart and Reenter to Overhead	1,176	162	1,338
	Visual Touch-and-Go	38,200	2,644	40,844
	GCA Box	1,546	170	1,716
	FCLP Pattern	240	80	320
	TOTAL	56,873	4,373	61,246
Adversary	Southeasterly Departure	1,305	51	1,356
	Northeasterly Departure	494	0	494
	Straight-In/Full stop Arrival (non-interfacility)	98	2	100
	Overhead Arrival at Oceana (non-interfacility)	1,750	0	1,750
	Visual Touch-and-Go	1,682	0	1,682
	TOTAL	5,329	53	5,382
Transient Jet	Southeasterly Departure	46	2	48
	Northeasterly Departure	901	18	919
	Straight-In/Full stop Arrival (non-interfacility)	286	7	293
	Overhead Arrival at Oceana (non-interfacility)	667	7	674
	Visual Touch-and-Go	1,102	38	1,140
	GCA Box	720	22	742
	TOTAL	3,722	94	3,816
Transient Prop	Southeasterly Departure	174	3	177
	Northeasterly Departure	1,471	29	1,500
	Straight-In/Full stop Arrival (non-interfacility)	667	12	679
	Overhead Arrival at Oceana (non-interfacility)	989	9	998
	Visual Touch-and-Go	3,251	61	3,312
	GCA Box	2,170	36	2,206
	TOTAL	8,722	150	8,872
	AIRFIELD TOTAL	193,632	16,076	209,708

Table A-16: Annual Flight Track Operations at NAS Oceana for ARS-5

		Airfield Operations		
Aircraft Category	Operation Type	Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Southeasterly Departure	5,133	73	5,206
	Northeasterly Departure	5,559	89	5,648
	Interfacility Departure to Fentress	1,450	925	2,375
	Interfacility Arrival from Fentress (w/ overhead approach)	1,190	1,010	2,200
	Interfacility Arrival from Fentress (w/ straight-in approach)	55	120	175
	Straight-In/Full stop Arrival (non-interfacility)	474	35	509
	Overhead Arrival at Oceana (non-interfacility)	9,960	374	10,334
	Depart and Reenter to Overhead	106	0	106
	Visual Touch-and-Go	19,941	1,061	21,002
	GCA Box	276	60	336
	FCLP Pattern	576	160	736
	TOTAL	44,720	3,907	48,627
F-14 FRS	Southeasterly Departure	1,645	0	1,645
	Northeasterly Departure	4,019	0	4,019
	Interfacility Departure to Fentress	885	420	1,305
	Interfacility Arrival from Fentress (w/ overhead approach)	475	210	685
	Interfacility Arrival from Fentress (w/ straight-in approach)	275	345	620
	Straight-In/Full stop Arrival (non-interfacility)	1,691	103	1,794
	Overhead Arrival at Oceana (non-interfacility)	3,776	94	3,870
	Depart and Reenter to Overhead	692	0	692
	Visual Touch-and-Go	26,564	1,068	27,632
	GCA Box	2,108	1,468	3,576
	FCLP Pattern	0	0	0
	TOTAL	42,130	3,708	45,838
F/A-18 Fleet	Southeasterly Departure	3,634	128	3,762
	Northeasterly Departure	3,775	51	3,826
	Interfacility Departure to Fentress	800	510	1,310
	Interfacility Arrival from Fentress (w/ overhead approach)	694	550	1,244
	Interfacility Arrival from Fentress (w/ straight-in approach)	21	45	66
	Straight-In/Full stop Arrival (non-interfacility)	1,006	264	1,270
	Overhead Arrival at Oceana (non-interfacility)	6,132	198	6,330
	Depart and Reenter to Overhead	183	0	183
	Visual Touch-and-Go	15,082	1,387	16,469
	GCA Box	184	24	208
	FCLP Pattern	220	480	700
	TOTAL	31,731	3,637	35,368
F/A-18 FRS	Southeasterly Departure	403	5	408
	Northeasterly Departure	6,490	113	6,603
	Interfacility Departure to Fentress	1,154	345	1,499
	Interfacility Arrival from Fentress (w/ overhead approach)	709	225	934
	Interfacility Arrival from Fentress (w/ straight-in approach)	305	260	565
	Straight-In/Full stop Arrival (non-interfacility)	1,961	268	2,229
	Overhead Arrival at Oceana (non-interfacility)	4,579	203	4,782
	Depart and Reenter to Overhead	1,184	172	1,356
	Visual Touch-and-Go	38,066	2,626	40,692
	GCA Box	1,500	220	1,720
	FCLP Pattern	240	160	400
	TOTAL	56,591	4,597	61,188
Adversary	Southeasterly Departure	1,790	59	1,849
	Northeasterly Departure	499	0	499
	Straight-In/Full stop Arrival (non-interfacility)	109	0	109
	Overhead Arrival at Oceana (non-interfacility)	2,239	0	2,239
	Visual Touch-and-Go	1,660	0	1,660
	TOTAL	6,297	59	6,356
Transient Jet	Southeasterly Departure	46	2	48
	Northeasterly Departure	901	18	919
	Straight-In/Full stop Arrival (non-interfacility)	284	9	293
	Overhead Arrival at Oceana (non-interfacility)	669	5	674
	Visual Touch-and-Go	1,084	32	1,116
	GCA Box	724	22	746
	TOTAL	3,708	88	3,796
Transient Prop	Southeasterly Departure	174	3	177
	Northeasterly Departure	1,459	28	1,487
	Straight-In/Full stop Arrival (non-interfacility)	665	12	677
	Overhead Arrival at Oceana (non-interfacility)	978	9	987
	Visual Touch-and-Go	3,259	61	3,320
	GCA Box	2,178	36	2,214
	TOTAL	8,713	149	8,862
	AIRFIELD TOTAL	193,890	16,145	210,035

Table A-17: Annual Flight Track Operations at NALF Fentress for the Baseline Scenario

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Interfacility Arrival from Oceana (w/ overhead approach)	1,750	665	2,415
	FCLP Pattern	21,899	11,911	33,810
	Interfacility Departure to Oceana	1,425	990	2,415
	TOTAL	25,074	13,566	38,640
F-14 FRS	Interfacility Arrival from Oceana (w/ overhead approach)	965	320	1,285
	FCLP Pattern	14,166	6,544	20,710
	Interfacility Departure to Oceana	815	470	1,285
	TOTAL	15,946	7,334	23,280
E-2 Fleet	Arrival (w/ overhead approach)	112	56	168
	FCLP Pattern	9,543	6,921	16,464
	Departure	88	80	168
	TOTAL	9,743	7,057	16,800
E-2 FRS	Arrival (w/ overhead approach)	459	157	616
	FCLP Pattern	10,833	5,535	16,368
	Departure	349	267	616
	TOTAL	11,641	5,959	17,600
C-2 Fleet	Arrival (w/ overhead approach)	106	6	112
	FCLP Pattern	7,566	558	8,124
	Departure	100	12	112
	TOTAL	7,772	576	8,348
	AIRFIELD TOTAL	70,176	34,492	104,668

Table A-18: Annual Flight Track Operations at NALF Fentress for ARS-1

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Interfacility Arrival from Oceana (w/ overhead approach)	1,390	995	2,385
	FCLP Pattern	17,918	15,472	33,390
	Interfacility Departure to Oceana	1,200	1,185	2,385
	TOTAL	20,508	17,652	38,160
F-14 FRS	Interfacility Arrival from Oceana (w/ overhead approach)	880	415	1,295
	FCLP Pattern	13,147	7,723	20,870
	Interfacility Departure to Oceana	775	520	1,295
	TOTAL	14,802	8,658	23,460
F/A-18 Fleet	Interfacility Arrival from Oceana (w/ overhead approach)	1,305	880	2,185
	FCLP Pattern	15,179	9,791	24,970
	Interfacility Departure to Oceana	1,145	1,040	2,185
	TOTAL	17,629	11,711	29,340
F/A-18 FRS	Interfacility Arrival from Oceana (w/ overhead approach)	1,122	395	1,517
	FCLP Pattern	15,048	6,404	21,452
	Interfacility Departure to Oceana	1,017	500	1,517
	TOTAL	17,187	7,299	24,486
E-2 Fleet	Arrival (w/ overhead approach)	94	74	168
	FCLP Pattern	7,713	8,751	16,464
	Departure	66	102	168
	TOTAL	7,873	8,927	16,800
E-2 FRS	Arrival (w/ overhead approach)	444	172	616
	FCLP Pattern	9,558	6,810	16,368
	Departure	289	327	616
	TOTAL	10,291	7,309	17,600
C-2 Fleet	Arrival (w/ overhead approach)	108	4	112
	FCLP Pattern	7,654	470	8,124
	Departure	98	14	112
	TOTAL	7,860	488	8,348
	AIRFIELD TOTAL	96,150	62,044	158,194

Table A-19: Annual Flight Track Operations at NALF Fentress for ARS-2

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Interfacility Arrival from Oceana (w/ overhead approach)	1,375	975	2,350
	FCLP Pattern	17,714	15,186	32,900
	Interfacility Departure to Oceana	1,185	1,165	2,350
	TOTAL	20,274	17,326	37,600
F-14 FRS	Interfacility Arrival from Oceana (w/ overhead approach)	830	455	1,285
	FCLP Pattern	12,412	8,298	20,710
	Interfacility Departure to Oceana	730	555	1,285
	TOTAL	13,972	9,308	23,280
F/A-18 Fleet	Interfacility Arrival from Oceana (w/ overhead approach)	995	655	1,650
	FCLP Pattern	11,690	7,230	18,920
	Interfacility Departure to Oceana	885	765	1,650
	TOTAL	13,570	8,650	22,220
F/A-18 FRS	Interfacility Arrival from Oceana (w/ overhead approach)	1,189	310	1,499
	FCLP Pattern	15,482	5,712	21,194
	Interfacility Departure to Oceana	1,029	470	1,499
	TOTAL	17,700	6,492	24,192
E-2 Fleet	Arrival (w/ overhead approach)	98	70	168
	FCLP Pattern	8,350	8,114	16,464
	Departure	72	96	168
	TOTAL	8,520	8,280	16,800
E-2 FRS	Arrival (w/ overhead approach)	446	170	616
	FCLP Pattern	9,752	6,616	16,368
	Departure	301	315	616
	TOTAL	10,499	7,101	17,600
C-2 Fleet	Arrival (w/ overhead approach)	106	6	112
	FCLP Pattern	7,500	624	8,124
	Departure	98	14	112
	TOTAL	7,704	644	8,348
	AIRFIELD TOTAL	92,239	57,801	150,040

Table A-20: Annual Flight Track Operations at NALF Fentress for ARS-3

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Interfacility Arrival from Oceana (w/ overhead approach)	1,470	935	2,405
	FCLP Pattern	18,788	14,882	33,670
	Interfacility Departure to Oceana	1,250	1,155	2,405
	TOTAL	21,508	16,972	38,480
F-14 FRS	Interfacility Arrival from Oceana (w/ overhead approach)	875	450	1,325
	FCLP Pattern	12,945	8,405	21,350
	Interfacility Departure to Oceana	755	570	1,325
	TOTAL	14,575	9,425	24,000
F/A-18 Fleet	Interfacility Arrival from Oceana (w/ overhead approach)	865	565	1,430
	FCLP Pattern	10,184	6,176	16,360
	Interfacility Departure to Oceana	780	650	1,430
	TOTAL	11,829	7,391	19,220
F/A-18 FRS	Interfacility Arrival from Oceana (w/ overhead approach)	1,126	380	1,506
	FCLP Pattern	14,884	6,412	21,296
	Interfacility Departure to Oceana	996	510	1,506
	TOTAL	17,006	7,302	24,308
E-2 Fleet	Arrival (w/ overhead approach)	102	66	168
	FCLP Pattern	8,467	7,997	16,464
	Departure	72	96	168
	TOTAL	8,641	8,159	16,800
E-2 FRS	Arrival (w/ overhead approach)	437	179	616
	FCLP Pattern	9,775	6,593	16,368
	Departure	302	314	616
	TOTAL	10,514	7,086	17,600
C-2 Fleet	Arrival (w/ overhead approach)	106	6	112
	FCLP Pattern	7,591	533	8,124
	Departure	98	14	112
	TOTAL	7,795	553	8,348
	AIRFIELD TOTAL	91,868	56,888	148,756

Table A-21: Annual Flight Track Operations at NALF Fentress for ARS-4

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Interfacility Arrival from Oceana (w/ overhead approach)	1,435	945	2,380
	FCLP Pattern	18,367	14,953	33,320
	Interfacility Departure to Oceana	1,225	1,155	2,380
	TOTAL	21,027	17,053	38,080
F-14 FRS	Interfacility Arrival from Oceana (w/ overhead approach)	830	455	1,285
	FCLP Pattern	12,149	8,561	20,710
	Interfacility Departure to Oceana	700	585	1,285
	TOTAL	13,679	9,601	23,280
F/A-18 Fleet	Interfacility Arrival from Oceana (w/ overhead approach)	785	505	1,290
	FCLP Pattern	9,235	5,465	14,700
	Interfacility Departure to Oceana	720	570	1,290
	TOTAL	10,740	6,540	17,280
F/A-18 FRS	Interfacility Arrival from Oceana (w/ overhead approach)	1,179	325	1,504
	FCLP Pattern	15,620	5,644	21,264
	Interfacility Departure to Oceana	1,049	455	1,504
	TOTAL	17,848	6,424	24,272
E-2 Fleet	Arrival (w/ overhead approach)	102	66	168
	FCLP Pattern	8,304	8,160	16,464
	Departure	66	102	168
	TOTAL	8,472	8,328	16,800
E-2 FRS	Arrival (w/ overhead approach)	434	182	616
	FCLP Pattern	9,574	6,794	16,368
	Departure	299	317	616
	TOTAL	10,307	7,293	17,600
C-2 Fleet	Arrival (w/ overhead approach)	106	6	112
	FCLP Pattern	7,591	533	8,124
	Departure	98	14	112
	TOTAL	7,795	553	8,348
	AIRFIELD TOTAL	89,868	55,792	145,660

Table A-22: Annual Flight Track Operations at NALF Fentress for ARS-5

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Interfacility Arrival from Oceana (w/ overhead approach)	1,450	925	2,375
	FCLP Pattern	18,650	14,600	33,250
	Interfacility Departure to Oceana	1,245	1,130	2,375
	TOTAL	21,345	16,655	38,000
F-14 FRS	Interfacility Arrival from Oceana (w/ overhead approach)	885	420	1,305
	FCLP Pattern	12,993	8,037	21,030
	Interfacility Departure to Oceana	750	555	1,305
	TOTAL	14,628	9,012	23,640
F/A-18 Fleet	Interfacility Arrival from Oceana (w/ overhead approach)	800	510	1,310
	FCLP Pattern	9,311	5,629	14,940
	Interfacility Departure to Oceana	715	595	1,310
	TOTAL	10,826	6,734	17,560
F/A-18 FRS	Interfacility Arrival from Oceana (w/ overhead approach)	1,154	345	1,499
	FCLP Pattern	15,188	6,006	21,194
	Interfacility Departure to Oceana	1,014	485	1,499
	TOTAL	17,356	6,836	24,192
E-2 Fleet	Arrival (w/ overhead approach)	98	70	168
	FCLP Pattern	8,390	8,074	16,464
	Departure	70	98	168
	TOTAL	8,558	8,242	16,800
E-2 FRS	Arrival (w/ overhead approach)	434	182	616
	FCLP Pattern	9,574	6,794	16,368
	Departure	299	317	616
	TOTAL	10,307	7,293	17,600
C-2 Fleet	Arrival (w/ overhead approach)	106	6	112
	FCLP Pattern	7,566	558	8,124
	Departure	100	12	112
	TOTAL	7,772	576	8,348
	AIRFIELD TOTAL	90,792	55,348	146,140

Table A-23: Annual Flight Track Operations at MCAS Cherry Point for the Baseline Scenario

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
AV-8 Fleet	Departure	6,564	28	6,592
	Interfacility Departure to Bogue Field	312	0	312
	Interfacility Arrival from Bogue Field (w/ overhead approach)	90	0	90
	Interfacility Arrival from Bogue Field (w/ straight-in approach)	222	0	222
	Straight-In/Full stop Arrival (non-interfacility)	748	67	815
	Overhead Arrival at Cherry Point to Runway (non-interfacility)	5,570	198	5,768
	Overhead Arrival at Cherry Point to Pad (non-interfacility)	20	2	22
	Depart and Reenter to Overhead	138	0	138
	Visual Touch-and-Go	4,874	448	5,322
	Full Circuit to Runway	5,000	172	5,172
	Full Circuit to Pad	1,034	16	1,050
	GCA Box	1,728	10	1,738
	Press-Up	6,666	20	6,686
	Pad Vertical Take-off to Pad Landing Circuit	2,804	182	2,986
	TOTAL	35,770	1,143	36,913
AV-8 FRS	Departure	4,421	0	4,421
	Interfacility Departure to Bogue Field	352	0	352
	Interfacility Arrival from Bogue Field (w/ overhead approach)	348	0	348
	Interfacility Arrival from Bogue Field (w/ straight-in approach)	4	0	4
	Straight-In/Full stop Arrival (non-interfacility)	1,606	25	1,631
	Overhead Arrival at Cherry Point to Runway (non-interfacility)	1,454	0	1,454
	Overhead Arrival at Cherry Point to Pad (non-interfacility)	1,332	4	1,336
	Depart and Reenter to Overhead	407	0	407
	Visual Touch-and-Go	2,381	98	2,479
	Full Circuit to Runway	10,624	214	10,838
	Full Circuit to Pad	2,638	118	2,756
	GCA Box	2,004	16	2,020
	Press-Up	6,476	70	6,546
	Pad Vertical Take-off to Pad Landing Circuit	2,518	122	2,640
	TOTAL	36,565	667	37,232
EA-6B	Departure	2,119	7	2,126
	Interfacility Arrival from Bogue Field (w/ straight-in approach)	6	0	6
	Straight-In/Full stop Arrival (non-interfacility)	798	117	915
	Overhead Arrival at Cherry Point to Runway (non-interfacility)	1,189	17	1,206
	Depart and Reenter to Overhead	332	78	410
	Visual Touch-and-Go	5,990	456	6,446
	GCA Box	564	52	616
	TOTAL	10,998	727	11,725
KC-130 Fleet	Departure	632	0	632
	Interfacility Arrival from Bogue Field (w/ straight-in approach)	5	0	5
	Straight-In/Full stop Arrival (non-interfacility)	552	36	588
	Overhead Arrival at Cherry Point to Runway (non-interfacility)	33	6	39
	Visual Touch-and-Go	1,709	159	1,868
	GCA Box	1,220	2	1,222
	TOTAL	4,151	203	4,354
KC-130 FRS	Departure	691	0	691
	Straight-In/Full stop Arrival (non-interfacility)	651	40	691
	Visual Touch-and-Go	3,602	182	3,784
	GCA Box	3,220	54	3,274
	Depart and Reenter to Overhead	464	0	464
	TOTAL	8,628	276	8,904
Transient Jet	Departure	1,785	49	1,834
	Straight-In/Full stop Arrival (non-interfacility)	1,252	1	1,253
	Overhead Arrival at Cherry Point to Runway (non-interfacility)	581	0	581
	Visual Touch-and-Go	1,336	0	1,336
	GCA Box	980	0	980
	TOTAL	5,934	50	5,984
Transient Prop	Departure	755	1	756
	Straight-In/Full stop Arrival (non-interfacility)	755	1	756
	Visual Touch-and-Go	2,628	0	2,628
	GCA Box	166	0	166
	TOTAL	4,304	2	4,306
Transient Heavy	Departure	116	67	183
	Straight-In/Full stop Arrival (non-interfacility)	181	2	183
	GCA Box	340	0	340
	TOTAL	637	69	706
Transient Large	Departure	535	159	694
	Straight-In/Full stop Arrival (non-interfacility)	687	7	694
	GCA Box	938	6	944
	TOTAL	2,160	172	2,332
Transient Helicopter	Departure	1,494	405	1,899
	Straight-In/Full stop Arrival (non-interfacility)	1,866	33	1,899
	TOTAL	3,360	438	3,798
	AIRFIELD TOTAL	112,507	3,747	116,254

Table A-24: Annual Flight Track Operations at MCAS Cherry Point for ARS-3

		Airfield Operations		
Aircraft Category	Operation Type	Day 0700-2200	Night 2200-0700	Total
AV-8 Fleet	Departure	6,509	54	6,563
	Interfacility Departure to Bogue Field	324	0	324
	Interfacility Arrival from Bogue Field (w/ overhead approach)	90	0	90
	Interfacility Arrival from Bogue Field (w/ straight-in approach)	234	0	234
	Straight-In/Full stop Arrival (non-interfacility)	762	89	851
	Overhead Arrival at Cherry Point to Runway (non-interfacility)	5,496	206	5,702
	Overhead Arrival at Cherry Point to Pad (non-interfacility)	20	2	22
	Depart and Reenter to Overhead	130	0	130
	Visual Touch-and-Go	4,417	435	4,852
	Full Circuit to Runway	4,766	162	4,928
	Full Circuit to Pad	1,028	44	1,072
	GCA Box	1,704	4	1,708
	Press-Up	6,648	10	6,658
	Pad Vertical Take-off to Pad Landing Circuit	2,674	218	2,892
	TOTAL	34,802	1,224	36,026
AV-8 FRS	Departure	4,404	1	4,405
	Interfacility Departure to Bogue Field	355	0	355
	Interfacility Arrival from Bogue Field (w/ overhead approach)	351	0	351
	Interfacility Arrival from Bogue Field (w/ straight-in approach)	4	0	4
	Straight-In/Full stop Arrival (non-interfacility)	1,625	24	1,649
	Overhead Arrival at Cherry Point to Runway (non-interfacility)	1,433	0	1,433
	Overhead Arrival at Cherry Point to Pad (non-interfacility)	1,319	4	1,323
	Depart and Reenter to Overhead	403	0	403
	Visual Touch-and-Go	2,362	69	2,431
	Full Circuit to Runway	10,204	182	10,386
	Full Circuit to Pad	2,556	96	2,652
	GCA Box	1,942	8	1,950
	Press-Up	6,352	62	6,414
	Pad Vertical Take-off to Pad Landing Circuit	2,438	94	2,532
	TOTAL	35,748	540	36,288
EA-6B	Departure	2,116	11	2,127
	Interfacility Arrival from Bogue Field (w/ straight-in approach)	6	0	6
	Straight-In/Full stop Arrival (non-interfacility)	803	126	929
	Overhead Arrival at Cherry Point to Runway (non-interfacility)	1,173	20	1,193
	Depart and Reenter to Overhead	328	86	414
	Visual Touch-and-Go	5,919	497	6,416
	GCA Box	540	56	596
	TOTAL	10,885	796	11,681
F/A-18 Fleet	Departure	2,851	58	2,909
	Straight-In/Full stop Arrival (non-interfacility)	556	130	686
	Overhead Arrival at Cherry Point to Runway (non-interfacility)	2,175	44	2,219
	Depart and Reenter to Overhead	75	0	75
	Visual Touch-and-Go	5,059	433	5,492
	FCLP Pattern	9,061	2,542	11,603
	GCA Box	80	0	80
		19,857	3,207	23,064
KC-130 Fleet	Departure	631	0	631
	Interfacility Arrival from Bogue Field (w/ straight-in approach)	6	0	6
	Straight-In/Full stop Arrival (non-interfacility)	549	38	587
	Overhead Arrival at Cherry Point to Runway (non-interfacility)	32	6	38
	Visual Touch-and-Go	1,704	176	1,880
	GCA Box	1,214	10	1,224
	TOTAL	4,136	230	4,366
KC-130 FRS	Departure	690	0	690
	Straight-In/Full stop Arrival (non-interfacility)	647	43	690
	Visual Touch-and-Go	3,664	98	3,762
	GCA Box	3,150	54	3,204
	Depart and Reenter to Overhead	476	0	476
	TOTAL	8,627	195	8,822
Transient Jet	Departure	1,791	41	1,832
	Straight-In/Full stop Arrival (non-interfacility)	1,250	1	1,251
	Overhead Arrival at Cherry Point to Runway (non-interfacility)	581	0	581
	Visual Touch-and-Go	1,304	0	1,304
	GCA Box	960	0	960
	TOTAL	5,886	42	5,928
Transient Prop	Departure	753	1	754
	Straight-In/Full stop Arrival (non-interfacility)	753	1	754
	Visual Touch-and-Go	2,594	0	2,594
	GCA Box	164	0	164
	TOTAL	4,264	2	4,266
Transient Heavy	Departure	110	73	183
	Straight-In/Full stop Arrival (non-interfacility)	181	2	183
	GCA Box	328	0	328
	TOTAL	619	75	694
Transient Large	Departure	539	155	694
	Straight-In/Full stop Arrival (non-interfacility)	686	8	694
	GCA Box	914	6	920
	TOTAL	2,139	169	2,308
Transient Helicopter	Departure	1,481	417	1,898
	Straight-In/Full stop Arrival (non-interfacility)	1,865	33	1,898
	TOTAL	3,346	450	3,796
	AIRFIELD TOTAL	130,309	6,930	137,239

Table A-25: Annual Flight Track Operations at MCAS Cherry Point for ARS-5

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
AV-8 Fleet	Departure	6,536	56	6,592
	Interfacility Departure to Bogue Field	318	0	318
	Interfacility Arrival from Bogue Field (w/ overhead approach)	84	0	84
	Interfacility Arrival from Bogue Field (w/ straight-in approach)	234	0	234
	Straight-In/Full stop Arrival (non-interfacility)	780	94	874
	Overhead Arrival at Cherry Point to Runway (non-interfacility)	5,510	199	5,709
	Overhead Arrival at Cherry Point to Pad (non-interfacility)	18	2	20
	Depart and Reenter to Overhead	135	0	135
	Visual Touch-and-Go	4,598	389	4,987
	Full Circuit to Runway	4,852	178	5,030
	Full Circuit to Pad	1,034	24	1,058
	GCA Box	1,710	8	1,718
	Press-Up	6,604	10	6,614
	Pad Vertical Take-off to Pad Landing Circuit	2,708	204	2,912
	TOTAL	35,121	1,164	36,285
AV-8 FRS	Departure	4,416	3	4,419
	Interfacility Departure to Bogue Field	352	0	352
	Interfacility Arrival from Bogue Field (w/ overhead approach)	344	0	344
	Interfacility Arrival from Bogue Field (w/ straight-in approach)	0	0	0
	Straight-In/Full stop Arrival (non-interfacility)	1,626	30	1,656
	Overhead Arrival at Cherry Point to Runway (non-interfacility)	1,462	0	1,462
	Overhead Arrival at Cherry Point to Pad (non-interfacility)	1,309	0	1,309
	Depart and Reenter to Overhead	402	0	402
	Visual Touch-and-Go	2,314	80	2,394
	Full Circuit to Runway	10,304	214	10,518
	Full Circuit to Pad	2,574	90	2,664
	GCA Box	1,912	12	1,924
	Press-Up	6,396	58	6,454
	Pad Vertical Take-off to Pad Landing Circuit	2,438	96	2,534
	TOTAL	35,849	583	36,432
EA-6B	Departure	2,115	14	2,129
	Interfacility Arrival from Bogue Field (w/ straight-in approach)	0	0	0
	Straight-In/Full stop Arrival (non-interfacility)	792	132	924
	Overhead Arrival at Cherry Point to Runway (non-interfacility)	1,187	17	1,204
	Depart and Reenter to Overhead	325	83	408
	Visual Touch-and-Go	5,878	504	6,382
	GCA Box	560	48	608
	TOTAL	10,857	798	11,655
F/A-18 Fleet	Departure	4,766	141	4,907
	Straight-In/Full stop Arrival (non-interfacility)	858	356	1,214
	Overhead Arrival at Cherry Point to Runway (non-interfacility)	3,573	120	3,693
	Depart and Reenter to Overhead	124	0	124
	Visual Touch-and-Go	8,429	896	9,325
	FCLP Pattern	10,492	2,821	13,313
	GCA Box	112	0	112
		28,354	4,334	32,688
KC-130 Fleet	Departure	632	0	632
	Interfacility Arrival from Bogue Field (w/ straight-in approach)	20	0	20
	Straight-In/Full stop Arrival (non-interfacility)	536	38	574
	Overhead Arrival at Cherry Point to Runway (non-interfacility)	34	4	38
	Visual Touch-and-Go	1,713	137	1,850
	GCA Box	1,198	8	1,206
	TOTAL	4,133	187	4,320
KC-130 FRS	Departure	691	0	691
	Straight-In/Full stop Arrival (non-interfacility)	646	45	691
	Visual Touch-and-Go	3,673	137	3,810
	GCA Box	3,200	38	3,238
	Depart and Reenter to Overhead	476	0	476
	TOTAL	8,686	220	8,906
Transient Jet	Departure	1,691	36	1,727
	Straight-In/Full stop Arrival (non-interfacility)	1,145	1	1,146
	Overhead Arrival at Cherry Point to Runway (non-interfacility)	581	0	581
	Visual Touch-and-Go	1,184	0	1,184
	GCA Box	988	0	988
	TOTAL	5,589	37	5,626
Transient Prop	Departure	755	1	756
	Straight-In/Full stop Arrival (non-interfacility)	755	1	756
	Visual Touch-and-Go	2,570	0	2,570
	GCA Box	158	0	158
	TOTAL	4,238	2	4,240
Transient Heavy	Departure	118	65	183
	Straight-In/Full stop Arrival (non-interfacility)	181	2	183
	GCA Box	324	0	324
	TOTAL	623	67	690
Transient Large	Departure	530	164	694
	Straight-In/Full stop Arrival (non-interfacility)	686	8	694
	GCA Box	910	6	916
	TOTAL	2,126	178	2,304
Transient Helicopter	Departure	1,501	398	1,899
	Straight-In/Full stop Arrival (non-interfacility)	1,866	33	1,899
	TOTAL	3,367	431	3,798
	AIRFIELD TOTAL	138,943	8,001	146,944

Table A-26: Annual Flight Track Operations at MCALF Bogue Field for the Baseline Scenario

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
AV-8 Fleet	Interfacility Arrival from Cherry Point	312	0	312
	FCLP Pattern	2,880	0	2,880
	Forward Base Operations Pattern	2,472	0	2,472
	Interfacility Departure to Cherry Point	312	0	312
	TOTAL	5,976	0	5,976
AV-8 FRS	Interfacility Arrival from Cherry Point	352	0	352
	FCLP Pattern	3,696	0	3,696
	Forward Base Operations Pattern	4,840	0	4,840
	Interfacility Departure to Cherry Point	352	0	352
	TOTAL	9,240	0	9,240
EA-6B	Arrival (non-interfacility)	6	0	6
	Expeditionary Airfield Operations	24	0	24
	Interfacility Departure to Cherry Point	6	0	6
	TOTAL	36	0	36
KC-130 Fleet	Arrival (non-interfacility)	5	0	5
	Normal Pattern Operations	10	0	10
	Interfacility Departure to Cherry Point	5	0	5
	TOTAL	20	0	20
Marine Corps Helicopter	Arrivals/Departures/Pattern Operations	960	50	1,010
Other Military Jet	Arrivals/Departures/Pattern Operations	790	135	925
Other Military Helicopter	Arrivals/Departures/Pattern Operations	110	20	130
	AIRFIELD TOTAL	17,132	205	**17,337**

A.3 Lightship and Sanders Approach Data for NAS Oceana

Table A-27: Lightship and Sanders Approaches for Baseline Scenario

		F-14 Fleet		F-14 FRS		Adversary	
		Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700
Sanders	Overhead Arrival	8,712	326	2,873	83	685	2
	Visual Straight-in Arrival	0	0	613	0	0	0
Lightship	Overhead Arrival	1,226	60	891	15	57	0
	Visual Straight-in Arrival	0	0	283	0	0	0
	Instrument Arrivals	450	25	793	86	89	0
Total Overhead Arrivals (ni)		9,938	386	3,764	98	742	2
Total Straight-In Arrivals (ni)		450	25	1,689	86	89	0

Table A-28: Lightship and Sanders Approaches for ARS-1

		F-14 Fleet		F-14 FRS		F/A-18 Fleet		F/A-18 FRS		Adversary	
		Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700
Sanders	Overhead Arrival	8,270	320	2,850	72	8,706	330	3,127	191	1,982	0
	Visual Straight-in Arrival	48	9	618	0	49	18	166	25	15	0
Lightship	Overhead Arrival	1,745	60	890	16	1,840	94	1,433	3	234	0
	Visual Straight-in Arrival	13	1	304	0	15	0	8	0	2	0
	Instrument Arrivals	403	31	752	132	1,629	599	1,803	255	99	1
Total Overhead Arrivals (ni)		10,015	380	3,740	88	10,546	424	4,560	194	2,216	0
Total Straight-In Arrivals (ni)		464	41	1,674	132	1,693	617	1,977	280	116	1

Table A-29: Lightship and Sanders Approaches for ARS-2

		F-14 Fleet		F-14 FRS		F/A-18 Fleet		F/A-18 FRS		Adversary	
		Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700
Sanders	Overhead Arrival	8,286	290	2,859	72	7,466	303	3,211	175	1,693	0
	Visual Straight-in Arrival	45	11	619	0	34	15	122	36	0	0
Lightship	Overhead Arrival	1,657	54	893	16	1,524	77	1,444	3	229	0
	Visual Straight-in Arrival	10	3	296	0	10	3	4	0	0	0
	Instrument Arrivals	417	37	787	93	1,409	507	1,801	233	94	1
Total Overhead Arrivals (ni)		9,943	344	3,752	88	8,990	380	4,655	178	1,922	0
Total Straight-In Arrivals (ni)		472	51	1,702	93	1,453	525	1,927	269	94	1

Table A-30: Lightship and Sanders Approaches for ARS-3

		F-14 Fleet		F-14 FRS		F/A-18 Fleet		F/A-18 FRS		Adversary	
		Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700
Sanders	Overhead Arrival	8,346	324	2,872	65	6,277	265	3,125	198	2,017	0
	Visual Straight-in Arrival	18	8	613	0	4	1	175	17	2	0
Lightship	Overhead Arrival	1,633	66	896	15	1,330	67	1,464	4	215	0
	Visual Straight-in Arrival	3	4	293	0	0	1	0	0	0	0
	Instrument Arrivals	419	29	776	104	1,218	398	1,783	252	93	1
Total Overhead Arrivals (ni)		9,979	390	3,768	80	7,607	332	4,589	202	2,232	0
Total Straight-In Arrivals (ni)		440	41	1,682	104	1,222	400	1,958	269	95	1

Table A-31: Lightship and Sanders Approaches for ARS-4

		F-14 Fleet		F-14 FRS		F/A-18 Fleet		F/A-18 FRS		Adversary	
		Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700
Sanders	Overhead Arrival	8,398	299	2,861	64	5,181	164	3,151	194	1,537	0
	Visual Straight-in Arrival	36	4	620	5	33	1	172	19	3	0
Lightship	Overhead Arrival	1,567	67	894	10	970	47	1,429	4	213	0
	Visual Straight-in Arrival	5	2	301	1	7	1	5	0	0	0
	Instrument Arrivals	445	25	778	102	981	266	1,807	229	95	2
Total Overhead Arrivals (ni)		9,965	366	3,755	74	6,151	211	4,580	198	1,750	0
Total Straight-In Arrivals (ni)		486	31	1,699	108	1,021	268	1,984	248	98	2

Table A-32: Lightship and Sanders Approaches for ARS-5

		F-14 Fleet		F-14 FRS		F/A-18 Fleet		F/A-18 FRS		Adversary	
		Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700	Day 0700 - 2200	Night 2200 - 0700
Sanders	Overhead Arrival	8,394	312	2,879	78	5,095	154	3,139	197	2,024	0
	Visual Straight-in Arrival	41	2	622	0	16	2	151	24	3	0
Lightship	Overhead Arrival	1,566	62	897	16	1,037	44	1,440	6	215	0
	Visual Straight-in Arrival	6	2	290	0	4	2	4	0	1	0
	Instrument Arrivals	427	31	779	103	986	260	1,806	244	105	0
Total Overhead Arrivals (ni)		9,960	374	3,776	94	6,132	198	4,579	203	2,239	0
Total Straight-In Arrivals (ni)		474	35	1,691	103	1,006	264	1,961	268	109	0

NASMOD

APPENDIX B: TRAINING AREA UTILIZATION

APPENDIX B: TRAINING AREA UTILIZATION

This section contains tables of training area sorties and exclusive-use training area utilization data for each of the scenarios.

In reviewing and comparing quantitative results, note that, unless otherwise discussed in the text (Section 3), each of the alternatives should be compared against the baseline scenario. Since the results are dependent upon airwing compositions as well as base loading, comparisons between the alternative scenarios may result in misleading conclusions. Some variation is to be expected due to random behavior designed into the model.

B.1 Training Area Sorties

An area sortie represents one aircraft entering a region of airspace, operating there for a period of time, and leaving. Note that for reporting purposes, W-72 TACTS range sorties are not included in W-72 totals, and BT-9 and BT-11 sorties are not included in R-5306A totals.

The aircraft categories given in the tables comprise the significant service users for the training areas. For the overland areas, BT-9, BT-11, Navy Dare, Fort Pickett (R-6602), Stumpy Point (R-5313A), and the MTRs, each aircraft category is defined by a type of airframe (e.g., F-14, F-16) and type of squadron (e.g., Fleet, FRS). For example, while the majority of the F-14 sorties to BT-11 originate from NAS Oceana, a number of these sorties originate from aircraft carriers positioned off the Atlantic coast and are categorized, therefore, as F-14 (Other Navy).

Because of the nature of historical utilization reports, it is more difficult to compile a comprehensive list of airframes for the more commonly used over-water areas. In this case, aggregate categories are defined in the model by type of user/service. These users are described below.

Adversary	Naval adversary squadron aircraft including F-14, F/A-18, and F-5 aircraft.
Navy Other	Naval aircraft from non-NAS Oceana points of origin including C-2/E-2, S-3, P-3 aircraft, as well as Navy helicopters.
Air Force Jets	Primarily F-15 and F-16 aircraft.
Air Force Other	Primarily large Air Force aircraft such as C-141, C-5, and KC-135.
Marine Corps	Includes a wide variety of aircraft such as jets, tankers, and helicopters.
Coast Guard	Primarily C-130 and helicopter aircraft.

NASA	This category indicates the number of NASA operations that require exclusive use of the airspace. These operations are primarily missile launches from NASA Wallops Flight Facility.
Contractor	Primarily Learjet and Mitsubishi aircraft flown in support of military operations.
Civilian	Primarily commercial carriers.
Army Helicopters	Includes AH-64, OH-58, and UH-60 helicopters.

Table B-1: Annual W-72 TACTS Range Sorties

User/Service Category	Baseline Day 0700-2200	Baseline Night 2200-0700	Baseline Total	ARS-1 Day 0700-2200	ARS-1 Night 2200-0700	ARS-1 Total	ARS-2 Day 0700-2200	ARS-2 Night 2200-0700	ARS-2 Total
F-14 (NAS Oceana Fleet)	2,869	47	2,916	1,877	21	1,898	2,048	26	2,074
F-14 (NAS Oceana FRS)	543	0	543	546	0	546	543	0	543
F/A-18 (NAS Oceana Fleet)	—	—	—	3,198	31	3,229	2,812	34	2,846
F/A-18 (MCAS Cherry Point Fleet)	—	—	—	—	—	—	—	—	—
F/A-18 (NAS Oceana FRS)	—	—	—	138	0	138	157	0	157
Adversary	612	14	626	1,718	25	1,743	1,433	19	1,452
Air Force Jets	704	11	715	459	16	475	479	20	499
TOTAL	4,728	72	**4,800**	7,936	93	**8,029**	7,472	99	**7,571**

User/Service Category	ARS-3 Day 0700-2200	ARS-3 Night 2200-0700	ARS-3 Total	ARS-4 Day 0700-2200	ARS-4 Night 2200-0700	ARS-4 Total	ARS-5 Day 0700-2200	ARS-5 Night 2200-0700	ARS-5 Total
F-14 (NAS Oceana Fleet)	1,990	21	2,011	2,238	33	2,271	1,942	31	1,973
F-14 (NAS Oceana FRS)	548	0	548	546	0	546	551	0	551
F/A-18 (NAS Oceana Fleet)	2,286	28	2,314	2,153	11	2,164	1,992	25	2,017
F/A-18 (MCAS Cherry Point Fleet)	457	0	457	—	—	—	536	0	536
F/A-18 (NAS Oceana FRS)	113	0	113	165	0	165	153	0	153
Adversary	1,706	19	1,725	1,311	15	1,326	1,724	19	1,743
Air Force Jets	406	23	429	498	22	520	421	14	435
TOTAL	7,506	91	**7,597**	6,911	81	**6,992**	7,319	89	**7,408**

Table B-2: Annual Phelps MOA Sorties

Aircraft Category	Baseline Day 0700-2200	Baseline Night 2200-0700	Baseline Total	ARS-1 Day 0700-2200	ARS-1 Night 2200-0700	ARS-1 Total	ARS-2 Day 0700-2200	ARS-2 Night 2200-0700	ARS-2 Total
F/A-18 (NAS Oceana Fleet)	—	—	—	276	0	276	242	0	242
F/A-18 (MCAS Cherry Point Fleet)	—	—	—	—	—	—	—	—	—
TOTAL	0	0	**0**	276	0	**276**	242	0	**242**

Aircraft Category	ARS-3 Day 0700-2200	ARS-3 Night 2200-0700	ARS-3 Total	ARS-4 Day 0700-2200	ARS-4 Night 2200-0700	ARS-4 Total	ARS-5 Day 0700-2200	ARS-5 Night 2200-0700	ARS-5 Total
F/A-18 (NAS Oceana Fleet)	204	0	204	146	0	146	130	0	130
F/A-18 (MCAS Cherry Point Fleet)	10	0	10	—	—	—	42	0	42
TOTAL	214	0	**214**	146	0	**146**	172	0	**172**

Table B-3: Annual Navy Dare Sorties

	Baseline			ARS-1			ARS-2		
Aircraft Category	**Day** 0700-2200	**Night** 2200-0700	**Total**	**Day** 0700-2200	**Night** 2200-0700	**Total**	**Day** 0700-2200	**Night** 2200-0700	**Total**
F-14 (NAS Oceana Fleet)	2,986	38	3,024	2,684	72	2,756	2,618	56	2,674
F-14 (NAS Oceana FRS)	1,027	0	1,027	972	0	972	997	0	997
F-14 (Other Navy)	9	0	9	9	0	9	9	0	9
F/A-18 (NAS Oceana Fleet)	—	—	—	1,454	198	1,652	1,346	160	1,506
F/A-18 (MCAS Cherry Point Fleet)	—	—	—	—	—	—	—	—	—
F/A-18 (NAS Oceana FRS)	—	—	—	573	91	664	557	106	663
F/A-18 (Adversary)	12	0	12	27	0	27	24	0	24
F/A-18 (Other Navy)	53	0	53	53	0	53	53	0	53
F/A-18 (Marine Corps)	26	6	32	26	2	28	18	2	20
T-34	0	0	0	22	0	22	27	0	27
AV-8 (Fleet)	68	0	68	54	4	58	38	0	38
AV-8 (FRS)	10	0	10	6	0	6	8	0	8
EA-6B	5	0	5	5	0	5	5	0	5
A-10	14	0	14	16	0	16	20	0	20
F-15	156	4	160	106	2	108	130	10	140
F-16	346	4	350	326	2	328	312	6	318
F-16 (Air National Guard)	498	26	524	504	16	520	490	20	510
TOTAL	5,210	78	**5,288**	6,837	387	**7,224**	6,652	360	**7,012**

	ARS-3			ARS-4			ARS-5		
Aircraft Category	**Day** 0700-2200	**Night** 2200-0700	**Total**	**Day** 0700-2200	**Night** 2200-0700	**Total**	**Day** 0700-2200	**Night** 2200-0700	**Total**
F-14 (NAS Oceana Fleet)	2,684	80	2,764	2,700	54	2,754	2,762	48	2,810
F-14 (NAS Oceana FRS)	998	0	998	995	0	995	1,010	0	1,010
F-14 (Other Navy)	9	0	9	9	0	9	9	0	9
F/A-18 (NAS Oceana Fleet)	1,176	116	1,292	874	86	960	864	94	958
F/A-18 (MCAS Cherry Point Fleet)	86	10	96	—	—	—	257	68	325
F/A-18 (NAS Oceana FRS)	567	98	665	550	106	656	558	103	661
F/A-18 (Adversary)	30	0	30	19	0	19	22	0	22
F/A-18 (Other Navy)	53	0	53	53	0	53	53	0	53
F/A-18 (Marine Corps)	20	2	22	24	8	32	20	2	22
T-34	26	0	26	35	0	35	22	0	22
AV-8 (Fleet)	62	0	62	62	0	62	46	2	48
AV-8 (FRS)	12	0	12	8	0	8	10	2	12
EA-6B	5	0	5	5	0	5	5	0	5
A-10	6	0	6	10	0	10	8	4	12
F-15	104	4	108	140	8	148	146	4	150
F-16	338	2	340	366	2	368	318	2	320
F-16 (Air National Guard)	526	20	546	488	6	494	548	20	568
TOTAL	6,702	332	**7,034**	6,338	270	**6,608**	6,658	349	**7,007**

Table B-4: Annual BT-11 Sorties

Aircraft Category	Baseline			ARS-1			ARS-2		
	Day 0700-2200	Night 2200-0700	Total	Day 0700-2200	Night 2200-0700	Total	Day 0700-2200	Night 2200-0700	Total
F-14 (NAS Oceana Fleet)	494	2	496	688	34	722	708	28	736
F-14 (Other Navy)	30	0	30	30	0	30	30	0	30
F/A-18 (NAS Oceana Fleet)	—	—	—	1,394	72	1,466	1,188	74	1,262
F/A-18 (MCAS Cherry Point Fleet)	—	—	—	—	—	—	—	—	—
F/A-18 (Other Navy)	237	28	265	237	28	265	237	28	265
F/A-18 (Marine Corps)	362	22	384	354	14	368	364	26	390
AV-8 (Fleet)	1,162	36	1,198	1,082	42	1,124	1,110	30	1,140
AV-8 (FRS)	720	0	720	685	0	685	693	0	693
EA-6B	13	0	13	13	0	13	13	0	13
KC-130 (MCAS Cherry Point Fleet)	18	0	18	18	0	18	18	0	18
A-10	120	0	120	120	0	120	104	2	106
F-15	400	6	406	418	10	428	406	12	418
F-16	388	0	388	392	0	392	402	0	402
F-16 (Air National Guard)	198	0	198	202	4	206	212	0	212
AH-1	107	0	107	97	0	97	103	0	103
UH-1	43	0	43	43	0	43	40	0	40
CH-46	123	0	123	113	0	113	112	0	112
CH-53	13	2	15	11	2	13	11	2	13
Army Helicopters	80	8	88	72	0	72	72	0	72
Other Jets	14	3	17	21	3	24	22	2	24
Other Props	17	0	17	18	0	18	18	0	18
TOTAL	4,539	107	**4,646**	6,008	209	**6,217**	5,863	204	**6,067**

Aircraft Category	ARS-3			ARS-4			ARS-5		
	Day 0700-2200	Night 2200-0700	Total	Day 0700-2200	Night 2200-0700	Total	Day 0700-2200	Night 2200-0700	Total
F-14 (NAS Oceana Fleet)	686	16	702	626	4	630	640	18	658
F-14 (Other Navy)	30	0	30	30	0	30	30	0	30
F/A-18 (NAS Oceana Fleet)	974	50	1,024	794	16	810	754	18	772
F/A-18 (MCAS Cherry Point Fleet)	380	20	400	—	—	—	773	34	807
F/A-18 (Other Navy)	237	28	265	237	28	265	237	28	265
F/A-18 (Marine Corps)	360	16	376	340	24	364	354	22	376
AV-8 (Fleet)	1,074	42	1,116	1,106	28	1,134	1,092	42	1,134
AV-8 (FRS)	666	2	668	713	0	713	679	0	679
EA-6B	13	0	13	13	0	13	13	0	13
KC-130 (MCAS Cherry Point Fleet)	18	0	18	18	0	18	18	0	18
A-10	102	2	104	126	0	126	86	0	86
F-15	420	10	430	374	12	386	376	6	382
F-16	400	4	404	390	0	390	392	0	392
F-16 (Air National Guard)	172	4	176	218	12	230	152	2	154
AH-1	105	0	105	99	0	99	101	0	101
UH-1	43	0	43	41	0	41	40	0	40
CH-46	114	0	114	123	0	123	102	0	102
CH-53	11	0	11	11	4	15	13	2	15
Army Helicopters	80	0	80	80	0	80	70	0	70
Other Jets	16	1	17	23	0	23	21	2	23
Other Props	15	0	15	18	0	18	17	0	17
TOTAL	5,916	195	**6,111**	5,380	128	**5,508**	5,960	174	**6,134**

Table B-5: Annual BT-9 Sorties

Aircraft Category	Baseline Day 0700-2200	Baseline Night 2200-0700	Baseline Total	ARS-1 Day 0700-2200	ARS-1 Night 2200-0700	ARS-1 Total	ARS-2 Day 0700-2200	ARS-2 Night 2200-0700	ARS-2 Total
F-14 (NAS Oceana Fleet)	68	0	68	254	30	284	192	22	214
F-14 (Other Navy)	30	0	30	30	0	30	30	0	30
F/A-18 (NAS Oceana Fleet)	—	—	—	308	32	340	204	24	228
F/A-18 (MCAS Cherry Point Fleet)	—	—	—	—	—	—	—	—	—
F/A-18 (Other Navy)	237	28	265	237	28	265	237	28	265
F/A-18 (Marine Corps)	190	10	200	200	20	220	194	14	208
AV-8 (Fleet)	246	6	252	256	14	270	270	10	280
AV-8 (FRS)	25	0	25	60	0	60	49	0	49
EA-6B	13	0	13	13	0	13	13	0	13
A-10	110	0	110	108	0	108	114	4	118
F-15	52	0	52	84	2	86	62	2	64
F-16	380	8	388	402	4	406	408	0	408
AH-1	78	0	78	88	0	88	82	0	82
UH-1	29	0	29	29	0	29	32	0	32
CH-46	75	0	75	85	0	85	86	0	86
CH-53	9	2	11	11	2	13	13	0	13
Army Helicopters	74	8	82	90	8	98	90	8	98
Other Jets	43	0	43	36	0	36	36	0	36
Other Props	20	0	20	19	0	19	19	0	19
TOTAL	1,679	62	**1,741**	2,310	140	**2,450**	2,131	112	**2,243**

Aircraft Category	ARS-3 Day 0700-2200	ARS-3 Night 2200-0700	ARS-3 Total	ARS-4 Day 0700-2200	ARS-4 Night 2200-0700	ARS-4 Total	ARS-5 Day 0700-2200	ARS-5 Night 2200-0700	ARS-5 Total
F-14 (NAS Oceana Fleet)	232	16	248	170	4	174	216	12	228
F-14 (Other Navy)	30	0	30	30	0	30	30	0	30
F/A-18 (NAS Oceana Fleet)	184	10	194	138	4	142	160	4	164
F/A-18 (MCAS Cherry Point Fleet)	84	8	92	—	—	—	104	8	112
F/A-18 (Other Navy)	237	28	265	237	28	265	237	28	265
F/A-18 (Marine Corps)	202	16	218	212	8	220	210	8	218
AV-8 (Fleet)	226	12	238	214	18	232	260	10	270
AV-8 (FRS)	61	0	61	33	0	33	63	0	63
EA-6B	13	0	13	13	0	13	13	0	13
A-10	134	0	134	108	0	108	146	0	146
F-15	74	8	82	80	4	84	84	2	86
F-16	384	0	384	360	8	368	410	6	416
AH-1	80	0	80	86	0	86	84	0	84
UH-1	29	0	29	31	0	31	32	0	32
CH-46	84	0	84	75	0	75	96	0	96
CH-53	15	0	15	11	0	11	9	2	11
Army Helicopters	82	8	90	82	8	90	92	8	100
Other Jets	43	0	43	37	0	37	37	0	37
Other Props	22	0	22	19	0	19	20	0	20
TOTAL	2,216	106	**2,322**	1,936	82	**2,018**	2,303	88	**2,391**

Table B-6: Annual R-5306A Sorties (exclusive of BT-9 and BT-11)

Aircraft Category	Baseline Day 0700-2200	Baseline Night 2200-0700	Baseline Total	ARS-1 Day 0700-2200	ARS-1 Night 2200-0700	ARS-1 Total	ARS-2 Day 0700-2200	ARS-2 Night 2200-0700	ARS-2 Total
F/A-18 (Marine Corps)	91	0	91	89	0	89	91	0	91
AV-8 (Fleet)	1,003	18	1,021	1,039	10	1,049	1,046	8	1,054
AV-8 (FRS)	1,553	0	1,553	1,552	2	1,554	1,551	2	1,553
EA-6B	279	9	288	282	9	291	279	9	288
A-10	30	0	30	29	0	29	31	0	31
F-15	56	0	56	60	0	60	58	0	58
F-16	208	4	212	208	4	212	206	4	210
F-16 (Air National Guard)	26	0	26	26	0	26	26	0	26
AH-1	136	0	136	136	0	136	136	0	136
Other Jets	35	0	35	35	0	35	35	0	35
Other Props	90	0	90	90	0	90	90	0	90
TOTAL	3,507	31	**3,538**	3,546	25	**3,571**	3,549	23	**3,572**

Aircraft Category	ARS-3 Day 0700-2200	ARS-3 Night 2200-0700	ARS-3 Total	ARS-4 Day 0700-2200	ARS-4 Night 2200-0700	ARS-4 Total	ARS-5 Day 0700-2200	ARS-5 Night 2200-0700	ARS-5 Total
F/A-18 (Marine Corps)	91	0	91	91	0	91	95	0	95
AV-8 (Fleet)	1,053	16	1,069	1,052	32	1,084	1,035	28	1,063
AV-8 (FRS)	1,550	0	1,550	1,552	2	1,554	1,554	0	1,554
EA-6B	287	10	297	278	10	288	280	11	291
A-10	30	0	30	30	0	30	30	0	30
F-15	54	0	54	56	0	56	52	4	56
F-16	208	4	212	208	4	212	202	8	210
F-16 (Air National Guard)	26	0	26	26	0	26	26	0	26
AH-1	136	0	136	136	0	136	136	0	136
Other Jets	35	0	35	35	0	35	35	0	35
Other Props	90	0	90	90	0	90	90	0	90
TOTAL	3,560	30	**3,590**	3,554	48	**3,602**	3,535	51	**3,586**

Table B-7: Annual R-5306D Sorties (MCAS Cherry Point demand only)

Aircraft Category	Baseline Day 0700-2200	Baseline Night 2200-0700	Baseline Total	ARS-1 Day 0700-2200	ARS-1 Night 2200-0700	ARS-1 Total	ARS-2 Day 0700-2200	ARS-2 Night 2200-0700	ARS-2 Total
AV-8 (Fleet)	560	2	562	582	0	582	568	4	572
KC-130 (MCAS Cherry Point Fleet)	22	0	22	22	0	22	22	0	22
KC-130 (MCAS Cherry Point FRS)	34	0	34	34	0	34	34	0	34
TOTAL	616	2	**618**	638	0	**638**	624	4	**628**

Aircraft Category	ARS-3 Day 0700-2200	ARS-3 Night 2200-0700	ARS-3 Total	ARS-4 Day 0700-2200	ARS-4 Night 2200-0700	ARS-4 Total	ARS-5 Day 0700-2200	ARS-5 Night 2200-0700	ARS-5 Total
AV-8 (Fleet)	580	0	580	572	4	576	584	4	588
KC-130 (MCAS Cherry Point Fleet)	22	0	22	22	0	22	22	0	22
KC-130 (MCAS Cherry Point FRS)	34	0	34	34	0	34	34	0	34
TOTAL	636	0	**636**	628	4	**632**	640	4	**644**

Table B-8: Annual W-72 Sorties (exclusive of W-72 TACTS range)

	Baseline			ARS-1			ARS-2		
User/Service Category	**Day** 0700-2200	**Night** 2200-0700	**Total**	**Day** 0700-2200	**Night** 2200-0700	**Total**	**Day** 0700-2200	**Night** 2200-0700	**Total**
F-14 (NAS Oceana Fleet)	2,942	58	3,000	4,002	42	4,044	3,809	61	3,870
F-14 (NAS Oceana FRS)	2,739	0	2,739	2,808	0	2,808	2,783	0	2,783
F/A-18 (NAS Oceana Fleet)	—	—	—	5,158	156	5,314	4,286	149	4,435
F/A-18 (MCAS Cherry Point Fleet)	—	—	—	—	—	—	—	—	—
F/A-18 (NAS Oceana FRS)	—	—	—	4,535	61	4,596	4,537	58	4,595
F/A-18 (Marine Corps)	75	0	75	75	0	75	75	0	75
KC-130 (MCAS Cherry Point FRS)	4	0	4	4	0	4	4	0	4
Adversary	121	0	121	544	0	544	522	0	522
Navy Other	2,771	204	2,975	2,773	202	2,975	2,769	206	2,975
Air Force Jets	1,323	0	1,323	1,329	0	1,329	1,328	0	1,328
Air Force Other	69	41	110	70	40	110	70	40	110
Coast Guard	46	33	79	46	33	79	46	33	79
Contractor	876	0	876	876	0	876	876	0	876
Civilian	34	37	71	34	37	71	34	37	71
TOTAL	11,000	373	**11,373**	22,254	571	**22,825**	21,139	584	**21,723**

	ARS-3			ARS-4			ARS-5		
User/Service Category	**Day** 0700-2200	**Night** 2200-0700	**Total**	**Day** 0700-2200	**Night** 2200-0700	**Total**	**Day** 0700-2200	**Night** 2200-0700	**Total**
F-14 (NAS Oceana Fleet)	3,723	60	3,783	3,536	65	3,601	3,588	56	3,644
F-14 (NAS Oceana FRS)	2,757	0	2,757	2,796	0	2,796	2,762	0	2,762
F/A-18 (NAS Oceana Fleet)	3,680	102	3,782	2,810	64	2,874	2,830	83	2,913
F/A-18 (MCAS Cherry Point Fleet)	134	16	150	—	—	—	262	40	302
F/A-18 (NAS Oceana FRS)	4,522	60	4,582	4,518	61	4,579	4,472	76	4,548
F/A-18 (Marine Corps)	75	0	75	75	0	75	75	0	75
KC-130 (MCAS Cherry Point FRS)	4	0	4	4	0	4	6	0	6
Adversary	491	0	491	494	0	494	489	0	489
Navy Other	2,764	210	2,974	2,771	204	2,975	2,772	203	2,975
Air Force Jets	1,326	0	1,326	1,327	0	1,327	1,330	0	1,330
Air Force Other	70	40	110	69	41	110	70	40	110
Coast Guard	46	33	79	46	33	79	46	33	79
Contractor	875	0	875	876	0	876	876	0	876
Civilian	35	36	71	34	37	71	33	38	71
TOTAL	20,502	557	**21,059**	19,356	505	**19,861**	19,611	569	**20,180**

Table B-9: Annual W-386A/B Sorties

User/Service Category	Baseline			ARS-1			ARS-2		
	Day 0700-2200	Night 2200-0700	Total	Day 0700-2200	Night 2200-0700	Total	Day 0700-2200	Night 2200-0700	Total
F-14 (NAS Oceana Fleet)	0	0	0	98	0	98	88	0	88
F-14 (NAS Oceana FRS)	14	0	14	17	0	17	15	0	15
F/A-18 (NAS Oceana Fleet)	—	—	—	276	4	280	206	0	206
F/A-18 (NAS Oceana FRS)	—	—	—	22	0	22	18	0	18
F/A-18 (Marine Corps)	15	0	15	15	0	15	15	0	15
Navy Other	360	199	559	362	199	561	363	199	562
Air Force Jets	3,308	0	3,308	3,424	0	3,424	3,452	0	3,452
Air Force Other	75	24	99	75	24	99	75	24	99
Coast Guard	17	2	19	17	2	19	17	2	19
NASA (Missle Launches)	183	0	183	183	0	183	183	0	183
Contractor	7	4	11	7	4	11	7	4	11
Civilian	129	27	156	129	27	156	129	27	156
TOTAL	4,108	256	**4,364**	4,625	260	**4,885**	4,568	256	**4,824**

User/Service Category	ARS-3			ARS-4			ARS-5		
	Day 0700-2200	Night 2200-0700	Total	Day 0700-2200	Night 2200-0700	Total	Day 0700-2200	Night 2200-0700	Total
F-14 (NAS Oceana Fleet)	94	0	94	148	0	148	100	0	100
F-14 (NAS Oceana FRS)	34	0	34	7	0	7	36	0	36
F/A-18 (NAS Oceana Fleet)	206	4	210	86	0	86	150	0	150
F/A-18 (NAS Oceana FRS)	69	0	69	18	0	18	65	0	65
F/A-18 (Marine Corps)	15	0	15	15	0	15	15	0	15
Navy Other	362	198	560	360	199	559	366	199	565
Air Force Jets	3,518	0	3,518	3,442	0	3,442	3,484	0	3,484
Air Force Other	75	24	99	75	24	99	75	24	99
Coast Guard	17	2	19	17	2	19	17	2	19
NASA (Missle Launches)	183	0	183	183	0	183	183	0	183
Contractor	7	4	11	7	4	11	7	4	11
Civilian	130	25	155	129	27	156	129	27	156
TOTAL	4,710	257	**4,967**	4,487	256	**4,743**	4,627	256	**4,883**

Table B-10: Annual W-386D Sorties

User/Service Category	Baseline Day 0700-2200	Baseline Night 2200-0700	Baseline Total	ARS-1 Day 0700-2200	ARS-1 Night 2200-0700	ARS-1 Total	ARS-2 Day 0700-2200	ARS-2 Night 2200-0700	ARS-2 Total
F-14 (NAS Oceana Fleet)	275	5	280	325	5	330	317	0	317
F-14 (NAS Oceana FRS)	684	0	684	684	0	684	684	0	684
F/A-18 (NAS Oceana Fleet)	—	—	—	179	0	179	159	0	159
Adversary	0	0	0	0	0	0	0	0	0
Air Force Jets	3	0	3	83	0	83	60	0	60
NASA (Missle Launches)	183	0	183	183	0	183	183	0	183
TOTAL	1,145	5	**1,150**	1,454	5	**1,459**	1,403	0	**1,403**

User/Service Category	ARS-3 Day 0700-2200	ARS-3 Night 2200-0700	ARS-3 Total	ARS-4 Day 0700-2200	ARS-4 Night 2200-0700	ARS-4 Total	ARS-5 Day 0700-2200	ARS-5 Night 2200-0700	ARS-5 Total
F-14 (NAS Oceana Fleet)	341	0	341	325	4	329	325	0	325
F-14 (NAS Oceana FRS)	684	0	684	684	0	684	684	0	684
F/A-18 (NAS Oceana Fleet)	133	0	133	111	0	111	139	0	139
Adversary	2	0	2	0	0	0	0	0	0
Air Force Jets	47	0	47	54	0	54	67	0	67
NASA (Missle Launches)	183	0	183	183	0	183	183	0	183
TOTAL	1,390	0	**1,390**	1,357	4	**1,361**	1,398	0	**1,398**

Table B-11: Annual W-122 Sorties

User/Service Category	Baseline Day 0700-2200	Baseline Night 2200-0700	Baseline Total	ARS-1 Day 0700-2200	ARS-1 Night 2200-0700	ARS-1 Total	ARS-2 Day 0700-2200	ARS-2 Night 2200-0700	ARS-2 Total
F-14 (NAS Oceana Fleet)	718	44	762	474	56	530	377	56	433
F-14 (NAS Oceana FRS)	123	0	123	104	0	104	108	0	108
F/A-18 (NAS Oceana Fleet)	—	—	—	565	16	581	397	20	417
F/A-18 (MCAS Cherry Point Fleet)	—	—	—	—	—	—	—	—	—
Adversary	0	0	0	0	0	0	0	0	0
F/A-18 (Marine Corps)	551	68	619	546	73	619	550	72	622
AV-8 (Fleet)	2,130	32	2,162	2,126	35	2,161	2,129	35	2,164
AV-8 (FRS)	1,316	0	1,316	1,311	0	1,311	1,311	0	1,311
EA-6B	1,606	15	1,621	1,610	15	1,625	1,606	15	1,621
KC-130 (MCAS Cherry Point Fleet)	144	0	144	144	0	144	144	0	144
KC-130 (MCAS Cherry Point FRS)	231	0	231	231	0	231	231	0	231
Navy Other	452	184	636	454	182	636	453	183	636
Air Force Jets	4,852	573	5,425	4,849	580	5,429	4,844	584	5,428
Air Force Other	270	60	330	270	60	330	270	60	330
Coast Guard	40	4	44	40	4	44	40	4	44
Contractor	34	9	43	34	9	43	33	10	43
Civilian	774	63	837	774	63	837	774	63	837
TOTAL	13,241	1,052	**14,293**	13,532	1,093	**14,625**	13,267	1,102	**14,369**

User/Service Category	ARS-3 Day 0700-2200	ARS-3 Night 2200-0700	ARS-3 Total	ARS-4 Day 0700-2200	ARS-4 Night 2200-0700	ARS-4 Total	ARS-5 Day 0700-2200	ARS-5 Night 2200-0700	ARS-5 Total
F-14 (NAS Oceana Fleet)	553	48	601	485	30	515	721	40	761
F-14 (NAS Oceana FRS)	112	0	112	107	0	107	117	0	117
F/A-18 (NAS Oceana Fleet)	328	12	340	279	4	283	257	4	261
F/A-18 (MCAS Cherry Point Fleet)	1,635	52	1,687	—	—	—	2,715	98	2,813
Adversary	72	0	72	0	0	0	70	0	70
F/A-18 (Marine Corps)	540	77	617	548	69	617	543	74	617
AV-8 (Fleet)	2,054	38	2,092	2,123	33	2,156	2,069	40	2,109
AV-8 (FRS)	1,305	0	1,305	1,314	0	1,314	1,276	0	1,276
EA-6B	1,610	21	1,631	1,605	16	1,621	1,602	23	1,625
KC-130 (MCAS Cherry Point Fleet)	143	0	143	144	0	144	144	0	144
KC-130 (MCAS Cherry Point FRS)	220	0	220	231	0	231	226	0	226
Navy Other	460	177	637	451	185	636	454	182	636
Air Force Jets	4,879	542	5,421	4,865	563	5,428	4,873	555	5,428
Air Force Other	269	61	330	270	60	330	270	60	330
Coast Guard	40	4	44	40	4	44	40	4	44
Contractor	33	10	43	34	9	43	34	9	43
Civilian	776	61	837	774	63	837	775	62	837
TOTAL	15,029	1,103	**16,132**	13,270	1,036	**14,306**	16,186	1,151	**17,337**

Table B-12: Annual Military Training Route Sorties (NAS Oceana and MCAS Cherry Point demand only)

	Baseline			ARS-1			ARS-2		
Aircraft Category	**Day** 0700-2200	**Night** 2200-0700	**Total**	**Day** 0700-2200	**Night** 2200-0700	**Total**	**Day** 0700-2200	**Night** 2200-0700	**Total**
VR-1043									
AV-8 (FRS)	22	0	**22**	35	0	**35**	24	0	**24**
VR-1046									
F/A-18 (NAS Oceana Fleet)	—	—	—	350	16	366	308	20	328
AV-8 (Fleet)	210	0	210	196	0	196	182	2	184
AV-8 (FRS)	82	0	82	85	0	85	60	0	60
VR-1046 Total	292	0	**292**	631	16	**647**	550	22	**572**
VR-1074									
AV-8 (Fleet)	250	0	250	246	2	248	260	2	262
AV-8 (FRS)	74	0	74	61	0	61	70	0	70
VR-1074 Total	324	0	**324**	307	2	**309**	330	2	**332**
VR-1753									
F-14 (NAS Oceana Fleet)	200	0	200	194	6	200	184	0	184
F-14 (NAS Oceana FRS)	548	0	548	553	0	553	550	0	550
F/A-18 (NAS Oceana Fleet)	—	—	—	526	30	556	480	22	502
F/A-18 (MCAS Cherry Point Fleet)	—	—	—	—	—	—	—	—	—
F/A-18 (NAS Oceana FRS)	—	—	—	104	40	144	91	50	141
VR-1753 Total	748	0	**748**	1,377	76	**1,453**	1,305	72	**1,377**
VR-073									
F-14 (NAS Oceana FRS)	28	0	28	28	0	28	28	0	28
AV-8 (Fleet)	232	4	236	278	6	284	258	4	262
AV-8 (FRS)	214	0	214	214	0	214	238	0	238
VR-073 Total	474	4	**478**	520	6	**526**	524	4	**528**
Other Visual Routes									
F-14 (NAS Oceana Fleet)	760	0	760	760	0	760	774	0	774
F/A-18 (NAS Oceana FRS)	—	—	—	350	0	350	350	0	350
F/A-18 (MCAS Cherry Point Fleet)	—	—	—	—	—	—	—	—	—
AV-8 (Fleet)	160	2	162	124	2	126	146	4	150
AV-8 (FRS)	61	0	61	57	0	57	62	0	62
EA-6B	495	0	495	495	0	495	495	0	495
KC-130 (MCAS Cherry Point Fleet)	18	0	18	18	0	18	18	0	18
KC-130 (MCAS Cherry Point FRS)	174	0	174	174	0	174	174	0	174
Other Visual Routes Total	1,668	2	**1,670**	1,978	2	**1,980**	2,019	4	**2,023**
Other Instrument Routes									
F/A-18 (NAS Oceana FRS)	—	—	—	110	5	115	115	5	120
TOTAL ALL ROUTES	3,528	6	**3,534**	4,958	107	**5,065**	4,867	109	**4,976**

Table B-12 (cont.): Annual Military Training Route Sorties (NAS Oceana and MCAS Cherry Point demand only)

Aircraft Category	ARS-3 Day 0700-2200	ARS-3 Night 2200-0700	ARS-3 Total	ARS-4 Day 0700-2200	ARS-4 Night 2200-0700	ARS-4 Total	ARS-5 Day 0700-2200	ARS-5 Night 2200-0700	ARS-5 Total
VR-1043									
AV-8 (FRS)	23	0	**23**	21	0	**21**	23	0	**23**
VR-1046									
F/A-18 (NAS Oceana Fleet)	272	8	280	184	2	186	190	2	192
AV-8 (Fleet)	186	0	186	180	4	184	168	4	172
AV-8 (FRS)	85	0	85	87	0	87	75	0	75
VR-1046 Total	543	8	**551**	451	6	**457**	433	6	**439**
VR-1074									
AV-8 (Fleet)	240	4	244	250	0	250	284	14	298
AV-8 (FRS)	73	0	73	67	0	67	77	0	77
VR-1074 Total	313	4	**317**	317	0	**317**	361	14	**375**
VR-1753									
F-14 (NAS Oceana Fleet)	198	2	200	190	2	192	202	0	202
F-14 (NAS Oceana FRS)	551	0	551	552	0	552	551	0	551
F/A-18 (NAS Oceana Fleet)	408	8	416	332	10	342	326	8	334
F/A-18 (MCAS Cherry Point Fleet)	0	0	0	—	—	—	0	0	0
F/A-18 (NAS Oceana FRS)	88	53	141	101	41	142	96	45	141
VR-1753 Total	1,245	63	**1,308**	1,175	53	**1,228**	1,175	53	**1,228**
VR-073									
F-14 (NAS Oceana FRS)	28	0	28	28	0	28	28	0	28
AV-8 (Fleet)	288	4	292	288	14	302	250	2	252
AV-8 (FRS)	221	0	221	223	0	223	225	0	225
VR-073 Total	537	4	**541**	539	14	**553**	503	2	**505**
Other Visual Routes									
F-14 (NAS Oceana Fleet)	760	0	760	766	0	766	756	0	756
F/A-18 (NAS Oceana FRS)	350	0	350	350	0	350	350	0	350
F/A-18 (MCAS Cherry Point Fleet)	132	2	134	—	—	—	296	16	312
AV-8 (Fleet)	128	4	132	124	2	126	128	4	132
AV-8 (FRS)	50	0	50	54	0	54	52	0	52
EA-6B	494	0	494	495	0	495	495	0	495
KC-130 (MCAS Cherry Point Fleet)	18	0	18	18	0	18	18	0	18
KC-130 (MCAS Cherry Point FRS)	174	0	174	174	0	174	174	0	174
Other Visual Routes Total	2,106	6	**2,112**	1,981	2	**1,983**	2,269	20	**2,289**
Other Instrument Routes									
F/A-18 (NAS Oceana FRS)	105	9	114	112	7	119	110	4	114
TOTAL ALL ROUTES	4,872	94	**4,966**	4,596	82	**4,678**	4,874	99	**4,973**

Table B-13: Annual Fort Pickett Range Sorties (NAS Oceana and MCAS Cherry Point demand only)

Aircraft Category	Baseline Day 0700-2200	Baseline Night 2200-0700	Baseline Total	ARS-1 Day 0700-2200	ARS-1 Night 2200-0700	ARS-1 Total	ARS-2 Day 0700-2200	ARS-2 Night 2200-0700	ARS-2 Total
F-14 (NAS Oceana Fleet)	72	0	72	116	0	116	102	0	102
F/A-18 (NAS Oceana Fleet)	—	—	—	92	4	96	62	4	66
F/A-18 (MCAS Cherry Point Fleet)	—	—	—	—	—	—	—	—	—
TOTAL	72	0	**72**	208	4	**212**	164	4	**168**

Aircraft Category	ARS-3 Day 0700-2200	ARS-3 Night 2200-0700	ARS-3 Total	ARS-4 Day 0700-2200	ARS-4 Night 2200-0700	ARS-4 Total	ARS-5 Day 0700-2200	ARS-5 Night 2200-0700	ARS-5 Total
F-14 (NAS Oceana Fleet)	98	0	98	142	0	142	112	0	112
F/A-18 (NAS Oceana Fleet)	78	0	78	50	0	50	44	0	44
F/A-18 (MCAS Cherry Point Fleet)	46	0	46	—	—	—	48	0	48
TOTAL	222	0	**222**	192	0	**192**	204	0	**204**

Table B-14: Annual Stumpy Point Range Sorties (NAS Oceana demand only)

Aircraft Category	Baseline Day 0700-2200	Baseline Night 2200-0700	Baseline Total	ARS-1 Day 0700-2200	ARS-1 Night 2200-0700	ARS-1 Total	ARS-2 Day 0700-2200	ARS-2 Night 2200-0700	ARS-2 Total
F-14 (NAS Oceana Fleet)	50	6	56	26	0	26	24	0	24
F/A-18 (NAS Oceana Fleet)	—	—	—	8	0	8	12	0	12
TOTAL	50	6	**56**	34	0	**34**	36	0	**36**

Aircraft Category	ARS-3 Day 0700-2200	ARS-3 Night 2200-0700	ARS-3 Total	ARS-4 Day 0700-2200	ARS-4 Night 2200-0700	ARS-4 Total	ARS-5 Day 0700-2200	ARS-5 Night 2200-0700	ARS-5 Total
F-14 (NAS Oceana Fleet)	20	0	20	44	2	46	20	0	20
F/A-18 (NAS Oceana Fleet)	8	0	8	12	0	12	4	0	4
TOTAL	28	0	**28**	56	2	**58**	24	0	**24**

B.2 Exclusive-Use Training Area Utilization

This section provides utilization statistics for the four primary exclusive-use training areas in the study: W-72 TACTS range, Navy Dare, BT-11, and BT-9. Each of these areas requires users to reserve blocks of area/range time. These tables quantify the number of Scheduled Hours and Used Hours. The Scheduled Hours and Used Hours data are presented in daytime (daylight needed for mission) and nighttime (darkness needed for mission) categories.

In order to better observe the impact of Navy squadrons and other military units on these areas, hours are allocated to the User/Service Group that schedules the time block. For events that consist of joint training between NAS Oceana- or MCAS Cherry point-based units and other units (e.g., Navy F-14 and Air Force Jets), the hours are allocated to the Navy members of the event (e.g., Navy F-14). For events that consist of joint training between one or more NAS Oceana- or MCAS Cherry point-based Navy units (e.g., Navy F-14 and Navy F/A-18), the hours are divided evenly among the Navy participants. Consequently, the hours allocated to non-Navy units consist of area/range time during which the non-Navy units perform training without the involvement of NAS Oceana- or MCAS Cherry Point squadrons.

The W-72 TACTS range utilization statistics includes time scheduled for activities requiring the TACTS range instrumentation and for activities using the area only.

Four summary statistics for each area are presented in the following tables and are defined as follows:

Overtime Hours	The range hours scheduled beyond the normal operating hours (see Section 2.4).
Non-Overtime Scheduled Hours	The range hours scheduled during the normal operating hours.
Published Hours	The annual number of hours the range is available according to the published (normal) operating hours.
Percentage Utilization	The percentage of published range hours scheduled (Non-Overtime Scheduled Hours/Published Hours).

Table B-15: Annual TACTS Range Utilization (Baseline Scenario)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
F-14 (NAS Oceana Fleet)	1,659.5	114.0	1,773.5	1,628.5	112.5	1,741.0
F-14 (NAS Oceana FRS)	378.0	0.0	378.0	344.5	0.0	344.5
Adversary	100.5	0.0	100.5	85.0	0.0	85.0
Air Force Jets	29.0	0.0	29.0	23.5	0.0	23.5
TOTAL	2,167.0	114.0	2,281.0	2,081.5	112.5	2,194.0
Overtime Hours			**151.5**			
Non-Overtime Scheduled Hours			**2,129.5**			
Published Hours			**2,730.0**			
Percentage Utilization			**78%**			

Table B-16: Annual TACTS Range Utilization (ARS-1)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
F-14 (NAS Oceana Fleet)	840.0	36.0	876.0	827.5	34.5	862.0
F-14 (NAS Oceana FRS)	329.0	0.0	329.0	285.5	0.0	285.5
F/A-18 (NAS Oceana Fleet)	1,214.0	0.0	1,214.0	1,197.5	0.0	1,197.5
F/A-18 (NAS Oceana FRS)	70.5	0.0	70.5	60.0	0.0	60.0
Adversary	64.0	0.0	64.0	58.0	0.0	58.0
Air Force Jets	33.5	0.0	33.5	31.5	0.0	31.5
TOTAL	2,551.0	36.0	2,587.0	2,460.0	34.5	2,494.5
Overtime Hours			**310.5**			
Non-Overtime Scheduled Hours			**2,276.5**			
Published Hours			**2,730.0**			
Percentage Utilization			**83%**			

Table B-17: Annual TACTS Range Utilization (ARS-2)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
F-14 (NAS Oceana Fleet)	893.5	43.5	937.0	868.0	40.5	908.5
F-14 (NAS Oceana FRS)	330.5	0.0	330.5	286.0	0.0	286.0
F/A-18 (NAS Oceana Fleet)	1,043.0	0.0	1,043.0	1,025.5	0.0	1,025.5
F/A-18 (NAS Oceana FRS)	78.0	0.0	78.0	70.5	0.0	70.5
Adversary	67.0	0.0	67.0	61.0	0.0	61.0
Air Force Jets	36.5	0.0	36.5	35.5	0.0	35.5
TOTAL	2,448.5	43.5	2,492.0	2,346.5	40.5	2,387.0
Overtime Hours			**294.5**			
Non-Overtime Scheduled Hours			**2,197.5**			
Published Hours			**2,730.0**			
Percentage Utilization			**80%**			

Table B-18: Annual TACTS Range Utilization (ARS-3)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
F-14 (NAS Oceana Fleet)	826.5	40.5	867.0	814.0	39.0	853.0
F-14 (NAS Oceana FRS)	332.0	0.0	332.0	285.0	0.0	285.0
F/A-18 (NAS Oceana Fleet)	861.0	0.0	861.0	850.0	0.0	850.0
F/A-18 (MCAS Cherry Point Fleet)	195.0	0.0	195.0	195.0	0.0	195.0
F/A-18 (NAS Oceana FRS)	60.0	0.0	60.0	49.5	0.0	49.5
Adversary	58.0	0.0	58.0	55.0	0.0	55.0
Air Force Jets	37.5	0.0	37.5	37.0	0.0	37.0
TOTAL	2,370.0	40.5	2,410.5	2,285.5	39.0	2,324.5
Overtime Hours			**319.5**			
Non-Overtime Scheduled Hours			**2,091.0**			
Published Hours			**2,730.0**			
Percentage Utilization			**77%**			

Table B-19: Annual TACTS Range Utilization (ARS-4)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
F-14 (NAS Oceana Fleet)	920.0	45.0	965.0	902.0	45.0	947.0
F-14 (NAS Oceana FRS)	323.5	0.0	323.5	285.0	0.0	285.0
F/A-18 (NAS Oceana Fleet)	827.5	0.0	827.5	808.0	0.0	808.0
F/A-18 (NAS Oceana FRS)	85.5	0.0	85.5	73.5	0.0	73.5
Adversary	74.0	0.0	74.0	66.0	0.0	66.0
Air Force Jets	31.0	0.0	31.0	31.0	0.0	31.0
TOTAL	2,261.5	45.0	2,306.5	2,165.5	45.0	2,210.5
Overtime Hours			**238.5**			
Non-Overtime Scheduled Hours			**2,068.0**			
Published Hours			**2,730.0**			
Percentage Utilization			**76%**			

Table B-20: Annual TACTS Range Utilization (ARS-5)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
F-14 (NAS Oceana Fleet)	753.0	37.5	790.5	735.5	36.0	771.5
F-14 (NAS Oceana FRS)	330.5	0.0	330.5	289.0	0.0	289.0
F/A-18 (NAS Oceana Fleet)	831.5	0.0	831.5	818.0	0.0	818.0
F/A-18 (MCAS Cherry Point Fleet)	239.5	0.0	239.5	239.0	0.0	239.0
F/A-18 (NAS Oceana FRS)	69.0	0.0	69.0	66.0	0.0	66.0
Adversary	68.0	0.0	68.0	63.0	0.0	63.0
Air Force Jets	36.0	0.0	36.0	35.5	0.0	35.5
TOTAL	2,327.5	37.5	2,365.0	2,246.0	36.0	2,282.0
Overtime Hours			**301.0**			
Non-Overtime Scheduled Hours			**2,064.0**			
Published Hours			**2,730.0**			
Percentage Utilization			**76%**			

Table B-21: Annual Navy Dare Utilization (Baseline Scenario)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
Navy Total	1,798.3	193.3	1,991.5	1,535.5	169.3	1,704.8
F-14 (NAS Oceana Fleet)	1,198.0	193.3	1,391.3	998.0	169.3	1,167.3
F-14 (NAS Oceana FRS)	574.0	0.0	574.0	512.0	0.0	512.0
Adversary	9.0	0.0	9.0	9.0	0.0	9.0
Navy Exercise	17.3	0.0	17.3	16.5	0.0	16.5
Marine Corps Total	15.3	14.3	29.5	15.3	13.5	28.8
AV-8 (Fleet)	7.5	9.8	17.3	7.5	9.8	17.3
AV-8 (FRS)	3.0	0.8	3.8	3.0	0.8	3.8
F/A-18	4.8	3.8	8.5	4.8	3.0	7.8
Air Force Total	218.0	27.0	245.0	184.3	21.8	206.0
F-15	35.3	9.0	44.3	30.5	7.0	37.5
F-16	85.8	1.8	87.5	69.8	1.8	71.5
F-16 (Air National Guard)	94.5	15.0	109.5	81.5	12.5	94.0
A-10	2.5	1.3	3.8	2.5	0.5	3.0
TOTAL	2,031.5	234.5	2,266.0	1,735.0	204.5	1,939.5
Overtime Hours			0.0			
Non-Overtime Scheduled Hours			2,266.0			
Published Hours			4,000.0			
Percentage Utilization			57%			

Table B-22: Annual Navy Dare Utilization (ARS-1)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
Navy Total	2,050.8	401.5	2,452.3	1,760.0	342.5	2,102.5
F-14 (NAS Oceana Fleet)	1,038.6	169.4	1,208.0	886.5	142.4	1,028.9
F-14 (NAS Oceana FRS)	555.3	0.0	555.3	481.0	0.0	481.0
F/A-18 (NAS Oceana Fleet)	324.9	118.1	443.0	276.3	101.9	378.1
F/A-18 (NAS Oceana FRS)	93.0	114.0	207.0	79.5	98.3	177.8
Adversary	21.8	0.0	21.8	20.3	0.0	20.3
Navy Exercise	17.3	0.0	17.3	16.5	0.0	16.5
Marine Corps Total	11.0	10.5	21.5	11.0	10.5	21.5
AV-8 (Fleet)	5.3	8.3	13.5	5.3	8.3	13.5
AV-8 (FRS)	2.3	0.0	2.3	2.3	0.0	2.3
F/A-18	3.5	2.3	5.8	3.5	2.3	5.8
Air Force Total	195.0	24.3	219.3	169.3	21.5	190.8
F-15	23.3	7.5	30.8	19.5	6.3	25.8
F-16	74.5	1.8	76.3	65.0	1.8	66.8
F-16 (Air National Guard)	95.5	13.5	109.0	83.0	12.0	95.0
A-10	1.8	1.5	3.3	1.8	1.5	3.3
TOTAL	2,256.8	436.3	2,693.0	1,940.3	374.5	2,314.8
Overtime Hours			18.0			
Non Overtime Scheduled Hours			2,675.0			
Published Hours			4,000.0			
Percentage Utilization			67%			

Table B-23: Annual Navy Dare Utilization (ARS-2)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
Navy Total	2,032.3	378.3	2,410.5	1,734.5	328.8	2,063.3
F-14 (NAS Oceana Fleet)	1,023.4	164.5	1,187.9	866.3	143.5	1,009.8
F-14 (NAS Oceana FRS)	569.0	0.0	569.0	490.8	0.0	490.8
F/A-18 (NAS Oceana Fleet)	305.6	101.0	406.6	262.0	87.8	349.8
F/A-18 (NAS Oceana FRS)	96.8	112.8	209.5	81.0	97.5	178.5
Adversary	20.3	0.0	20.3	18.0	0.0	18.0
Navy Exercise	17.3	0.0	17.3	16.5	0.0	16.5
Marine Corps Total	9.3	9.0	18.3	9.3	9.0	18.3
AV-8 (Fleet)	3.8	6.8	10.5	3.8	6.8	10.5
AV-8 (FRS)	2.3	0.8	3.0	2.3	0.8	3.0
F/A-18	3.3	1.5	4.8	3.3	1.5	4.8
Air Force Total	199.8	30.8	230.5	168.0	27.3	195.3
F-15	26.8	11.8	38.5	21.0	11.3	32.3
F-16	74.3	3.3	77.5	61.3	3.3	64.5
F-16 (Air National Guard)	95.5	14.5	110.0	82.5	11.5	94.0
A-10	3.3	1.3	4.5	3.3	1.3	4.5
TOTAL	2,241.3	418.0	2,659.3	1,911.8	365.0	2,276.8
Overtime Hours			**19.8**			
Non-Overtime Scheduled Hours			**2,639.5**			
Published Hours			**4,000.0**			
Percentage Utilization			**66%**			

Table B-24: Annual Navy Dare Utilization (ARS-3)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
Navy Total	2,025.3	367.3	2,392.5	1,742.0	321.0	2,063.0
F-14 (NAS Oceana Fleet)	1,054.6	154.5	1,209.1	903.6	135.8	1,039.4
F-14 (NAS Oceana FRS)	566.8	0.0	566.8	500.0	0.0	500.0
F/A-18 (NAS Oceana Fleet)	251.0	92.0	343.0	209.6	80.3	289.9
F/A-18 (MCAS Cherry Point Fleet)	8.9	7.5	16.4	8.8	7.5	16.3
F/A-18 (NAS Oceana FRS)	102.0	113.3	215.3	81.0	97.5	178.5
Adversary	24.8	0.0	24.8	22.5	0.0	22.5
Navy Exercise	17.3	0.0	17.3	16.5	0.0	16.5
Marine Corps Total	16.0	10.8	26.8	16.0	10.0	26.0
AV-8 (Fleet)	6.8	9.0	15.8	6.8	9.0	15.8
AV-8 (FRS)	4.5	0.0	4.5	4.5	0.0	4.5
F/A-18	4.8	1.8	6.5	4.8	1.0	5.8
Air Force Total	206.8	24.3	231.0	174.3	21.3	195.5
F-15	26.5	6.5	33.0	19.8	5.5	25.3
F-16	77.3	2.8	80.0	66.0	2.8	68.8
F-16 (Air National Guard)	103.0	13.5	116.5	88.5	11.5	100.0
A-10	0.0	1.5	1.5	0.0	1.5	1.5
TOTAL	2,248.0	402.3	2,650.3	1,932.3	352.3	2,284.5
Overtime Hours			**26.0**			
Non-Overtime Scheduled Hours			**2,624.3**			
Published Hours			**4,000.0**			
Percentage Utilization			**66%**			

Table B-25: Annual Navy Dare Utilization (ARS-4)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
Navy Total	1,946.3	347.5	2,293.8	1,669.0	299.8	1,968.8
F-14 (NAS Oceana Fleet)	1,098.0	173.8	1,271.8	924.3	147.1	1,071.4
F-14 (NAS Oceana FRS)	557.5	0.0	557.5	492.3	0.0	492.3
F/A-18 (NAS Oceana Fleet)	158.8	61.5	220.3	140.8	54.6	195.4
F/A-18 (NAS Oceana FRS)	98.3	112.3	210.5	79.5	98.0	177.5
Adversary	16.5	0.0	16.5	15.8	0.0	15.8
Navy Exercise	17.3	0.0	17.3	16.5	0.0	16.5
Marine Corps Total	15.3	17.5	32.8	15.3	17.5	32.8
AV-8 (Fleet)	7.5	11.3	18.8	7.5	11.3	18.8
AV-8 (FRS)	3.0	2.3	5.3	3.0	2.3	5.3
F/A-18	4.8	4.0	8.8	4.8	4.0	8.8
Air Force Total	209.5	24.3	233.8	180.3	20.8	201.0
F-15	29.5	7.8	37.3	25.3	6.8	32.0
F-16	77.8	2.5	80.3	67.3	2.5	69.8
F-16 (Air National Guard)	99.5	13.5	113.0	85.0	11.0	96.0
A-10	2.8	0.5	3.3	2.8	0.5	3.3
TOTAL	2,171.0	389.3	2,560.3	1,864.5	338.0	2,202.5
Overtime Hours			**18.5**			
Non-Overtime Scheduled Hours			**2,541.8**			
Published Hours			**4,000.0**			
Percentage Utilization			**64%**			

Table B-26: Annual Navy Dare Utilization (ARS-5)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
Navy Total	1,983.0	367.3	2,350.3	1,721.5	322.0	2,043.5
F-14 (NAS Oceana Fleet)	1,074.0	157.9	1,231.9	920.1	137.9	1,058.0
F-14 (NAS Oceana FRS)	553.0	0.0	553.0	493.0	0.0	493.0
F/A-18 (NAS Oceana Fleet)	176.3	68.0	244.3	154.3	61.5	215.8
F/A-18 (MCAS Cherry Point Fleet)	41.8	25.9	67.6	41.6	25.9	67.5
F/A-18 (NAS Oceana FRS)	100.5	115.5	216.0	79.5	96.8	176.3
Adversary	20.3	0.0	20.3	16.5	0.0	16.5
Navy Exercise	17.3	0.0	17.3	16.5	0.0	16.5
Marine Corps Total	12.8	10.0	22.8	12.8	10.0	22.8
AV-8 (Fleet)	5.3	7.5	12.8	5.3	7.5	12.8
AV-8 (FRS)	3.8	0.8	4.5	3.8	0.8	4.5
F/A-18	3.8	1.8	5.5	3.8	1.8	5.5
Air Force Total	210.3	28.0	238.3	182.8	22.5	205.3
F-15	31.8	8.0	39.8	27.8	6.8	34.5
F-16	71.0	3.3	74.3	62.0	2.5	64.5
F-16 (Air National Guard)	105.5	16.0	121.5	91.0	12.5	103.5
A-10	2.0	0.8	2.8	2.0	0.8	2.8
TOTAL	2,206.0	405.3	2,611.3	1,917.0	354.5	2,271.5
Overtime Hours			**22.8**			
Non-Overtime Scheduled Hours			**2,588.5**			
Published Hours			**4,000.0**			
Percentage Utilization			**65%**			

Table B-27: Annual BT-11 Utilization (Baseline Scenario)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
Navy Total	189.7	42.0	231.7	155.3	34.7	190.0
F-14 (NAS Oceana Fleet)	133.3	3.3	136.7	105.0	3.3	108.3
Navy Exercise	56.3	38.7	95.0	50.3	31.3	81.7
Marine Corps Total	640.3	123.0	763.3	621.3	120.7	742.0
AV-8 (Fleet)	177.3	94.0	271.3	177.3	94.0	271.3
AV-8 (FRS)	223.3	8.0	231.3	223.3	8.0	231.3
F/A-18	98.3	17.7	116.0	89.3	16.0	105.3
KC-130 (MCAS Cherry Point Fleet)	24.0	0.0	24.0	24.0	0.0	24.0
AH-1	40.7	0.0	40.7	36.7	0.0	36.7
CH-46	56.0	0.0	56.0	51.3	0.0	51.3
CH-53	1.3	3.3	4.7	1.3	2.7	4.0
UH-1	19.3	0.0	19.3	18.0	0.0	18.0
Air Force Total	276.7	36.7	313.3	243.3	29.3	272.7
F-15	108.0	27.3	135.3	96.0	22.0	118.0
F-16	91.3	0.7	92.0	78.0	0.7	78.7
F-16 (Air National Guard)	52.7	2.0	54.7	46.7	1.3	48.0
A-10	24.7	6.7	31.3	22.7	5.3	28.0
Army Total	31.0	4.0	35.0	30.0	4.0	34.0
Army Helicopters	31.0	4.0	35.0	30.0	4.0	34.0
Other Total	55.7	2.3	58.0	52.0	2.3	54.3
Other Jets	24.3	2.3	26.7	20.7	2.3	23.0
Other Props	31.3	0.0	31.3	31.3	0.0	31.3
TOTAL	1,193.3	208.0	1,401.3	1,102.0	191.0	1,293.0
Overtime Hours			**40.3**			
Non-Overtime Scheduled Hours			**1,361.0**			
Published Hours			**3,350.0**			
Percentage Utilization			**42%**			

Table B-28: Annual BT-11 Utilization (ARS-1)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
Navy Total	476.3	110.0	586.3	409.0	96.3	505.3
F-14 (NAS Oceana Fleet)	139.7	8.7	148.3	115.3	8.0	123.3
F/A-18 (NAS Oceana Fleet)	283.3	66.3	349.7	243.3	57.0	300.3
Navy Exercise	53.3	35.0	88.3	50.3	31.3	81.7
Marine Corps Total	601.7	125.3	727.0	580.7	122.0	702.7
AV-8 (Fleet)	162.3	99.7	262.0	162.3	99.7	262.0
AV-8 (FRS)	210.0	8.7	218.7	210.0	8.7	218.7
F/A-18	97.3	14.3	111.7	86.3	11.7	98.0
KC-130 (MCAS Cherry Point Fleet)	24.0	0.0	24.0	24.0	0.0	24.0
AH-1	37.3	0.0	37.3	33.3	0.0	33.3
CH-46	50.0	0.0	50.0	45.3	0.0	45.3
CH-53	1.3	2.7	4.0	1.3	2.0	3.3
UH-1	19.3	0.0	19.3	18.0	0.0	18.0
Air Force Total	276.7	35.3	312.0	246.7	32.0	278.7
F-15	110.0	26.0	136.0	99.3	23.3	122.7
F-16	90.0	2.7	92.7	77.3	2.7	80.0
F-16 (Air National Guard)	51.3	2.7	54.0	46.7	2.7	49.3
A-10	25.3	4.0	29.3	23.3	3.3	26.7
Army Total	31.0	1.0	32.0	30.0	1.0	31.0
Army Helicopters	31.0	1.0	32.0	30.0	1.0	31.0
Other Total	55.0	2.3	57.3	54.0	2.3	56.3
Other Jets	23.0	2.3	25.3	22.0	2.3	24.3
Other Props	32.0	0.0	32.0	32.0	0.0	32.0
TOTAL	1,440.7	274.0	1,714.7	1,320.3	253.7	1,574.0
Overtime Hours			**51.7**			
Non-Overtime Scheduled Hours			**1,663.0**			
Published Hours			**3,350.0**			
Percentage Utilization			**51%**			

Table B-29: Annual BT-11 Utilization (ARS-2)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
Navy Total	449.7	98.3	548.0	390.7	90.0	480.7
F-14 (NAS Oceana Fleet)	148.0	10.7	158.7	126.0	9.7	135.7
F/A-18 (NAS Oceana Fleet)	248.3	54.0	302.3	214.3	49.0	263.3
Navy Exercise	53.3	33.7	87.0	50.3	31.3	81.7
Marine Corps Total	609.0	124.0	733.0	589.7	119.7	709.3
AV-8 (Fleet)	162.7	95.3	258.0	162.7	95.3	258.0
AV-8 (FRS)	215.0	7.3	222.3	215.0	7.3	222.3
F/A-18	96.7	18.7	115.3	88.0	15.0	103.0
KC-130 (MCAS Cherry Point Fleet)	24.0	0.0	24.0	24.0	0.0	24.0
AH-1	40.0	0.0	40.0	35.3	0.0	35.3
CH-46	51.3	0.0	51.3	46.7	0.0	46.7
CH-53	1.3	2.7	4.0	1.3	2.0	3.3
UH-1	18.0	0.0	18.0	16.7	0.0	16.7
Air Force Total	280.7	32.7	313.3	248.7	30.7	279.3
F-15	110.0	23.3	133.3	98.0	22.0	120.0
F-16	94.7	1.3	96.0	81.3	1.3	82.7
F-16 (Air National Guard)	52.0	2.7	54.7	47.3	2.7	50.0
A-10	24.0	5.3	29.3	22.0	4.7	26.7
Army Total	31.0	1.0	32.0	30.0	1.0	31.0
Army Helicopters	31.0	1.0	32.0	30.0	1.0	31.0
Other Total	57.7	4.7	62.3	54.7	4.7	59.3
Other Jets	26.7	4.7	31.3	23.7	4.7	28.3
Other Props	31.0	0.0	31.0	31.0	0.0	31.0
TOTAL	1,428.0	260.7	1,688.7	1,313.7	246.0	1,559.7
Overtime Hours			**46.3**			
Non-Overtime Scheduled Hours			**1,642.3**			
Published Hours			**3,350.0**			
Percentage Utilization			**49%**			

Table B-30: Annual BT-11 Utilization (ARS-3)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
Navy Total	486.7	109.7	596.3	442.3	97.3	539.7
F-14 (NAS Oceana Fleet)	128.0	7.0	135.0	112.0	6.7	118.7
F/A-18 (NAS Oceana Fleet)	201.7	48.0	249.7	177.0	39.7	216.7
F/A-18 (MCAS Cherry Point Fleet)	103.7	19.7	123.3	103.0	19.7	122.7
Navy Exercise	53.3	35.0	88.3	50.3	31.3	81.7
Marine Corps Total	601.0	117.7	718.7	578.0	114.7	692.7
AV-8 (Fleet)	158.7	91.3	250.0	158.7	91.3	250.0
AV-8 (FRS)	206.7	8.7	215.3	206.7	8.7	215.3
F/A-18	99.7	15.7	115.3	86.7	13.3	100.0
KC-130 (MCAS Cherry Point Fleet)	24.0	0.0	24.0	24.0	0.0	24.0
AH-1	40.0	0.0	40.0	36.0	0.0	36.0
CH-46	51.3	0.0	51.3	46.7	0.0	46.7
CH-53	1.3	2.0	3.3	1.3	1.3	2.7
UH-1	19.3	0.0	19.3	18.0	0.0	18.0
Air Force Total	267.3	36.0	303.3	242.7	34.7	277.3
F-15	109.3	26.7	136.0	102.0	26.0	128.0
F-16	90.0	1.3	91.3	80.7	1.3	82.0
F-16 (Air National Guard)	46.0	3.3	49.3	40.7	2.7	43.3
A-10	22.0	4.7	26.7	19.3	4.7	24.0
Army Total	31.0	2.0	33.0	30.0	2.0	32.0
Army Helicopters	31.0	2.0	33.0	30.0	2.0	32.0
Other Total	46.7	3.3	50.0	45.7	2.7	48.3
Other Jets	21.7	3.3	25.0	20.7	2.7	23.3
Other Props.	25.0	0.0	25.0	25.0	0.0	25.0
TOTAL	1,432.7	268.7	1,701.3	1,338.7	251.3	1,590.0
Overtime Hours			**45.0**			
Non-Overtime Scheduled Hours			**1,656.3**			
Published Hours			**3,350.0**			
Percentage Utilization			**49%**			

Table B-31: Annual BT-11 Utilization (ARS-4)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
Navy Total	362.3	70.0	432.3	310.7	63.7	374.3
F-14 (NAS Oceana Fleet)	141.7	5.0	146.7	118.7	4.7	123.3
F/A-18 (NAS Oceana Fleet)	167.3	30.0	197.3	141.7	27.7	169.3
Navy Exercise	53.3	35.0	88.3	50.3	31.3	81.7
Marine Corps Total	621.0	122.0	743.0	602.3	118.3	720.7
AV-8 (Fleet)	168.7	94.0	262.7	168.7	94.0	262.7
AV-8 (FRS)	220.3	7.3	227.7	220.3	7.3	227.7
F/A-18	93.3	17.3	110.7	84.0	14.3	98.3
KC-130 (MCAS Cherry Point Fleet)	24.0	0.0	24.0	24.0	0.0	24.0
AH-1	38.0	0.0	38.0	34.0	0.0	34.0
CH-46	56.7	0.0	56.7	52.7	0.0	52.7
CH-53	1.3	3.3	4.7	1.3	2.7	4.0
UH-1	18.7	0.0	18.7	17.3	0.0	17.3
Air Force Total	269.3	37.3	306.7	236.7	32.7	269.3
F-15	94.0	25.3	119.3	84.0	22.0	106.0
F-16	93.3	0.7	94.0	80.0	0.7	80.7
F-16 (Air National Guard)	56.0	5.3	61.3	49.3	4.7	54.0
A-10	26.0	6.0	32.0	23.3	5.3	28.7
Army Total	31.0	2.0	33.0	30.0	2.0	32.0
Army Helicopters	31.0	2.0	33.0	30.0	2.0	32.0
Other Total	55.3	2.7	58.0	54.3	1.7	56.0
Other Jets	24.3	2.7	27.0	23.3	1.7	25.0
Other Props	31.0	0.0	31.0	31.0	0.0	31.0
TOTAL	1,339.0	234.0	1,573.0	1,234.0	218.3	1,452.3
Overtime Hours			**43.0**			
Non-Overtime Scheduled Hours			**1,530.0**			
Published Hours			**3,350.0**			
Percentage Utilization			**46%**			

Table B-32: Annual BT-11 Utilization (ARS-5)

User/Sevice Group	Scheduled Hours			Used Hours		
	Daytime	Nighttime	Total	Daytime	Nighttime	Total
Navy Total	553.7	107.3	661.0	506.7	97.7	604.3
F-14 (NAS Oceana Fleet)	122.7	8.0	130.7	103.3	7.3	110.7
F/A-18 (NAS Oceana Fleet)	161.0	29.3	190.3	137.3	24.7	162.0
F/A-18 (MCAS Cherry Point Fleet)	217.0	35.0	252.0	216.0	34.3	250.3
Navy Exercise	53.0	35.0	88.0	50.0	31.3	81.3
Marine Corps Total	588.7	124.3	713.0	572.0	121.0	693.0
AV-8 (Fleet)	155.7	96.7	252.3	155.7	96.7	252.3
AV-8 (FRS)	212.0	8.0	220.0	212.0	8.0	220.0
F/A-18	92.3	16.3	108.7	85.0	13.7	98.7
KC-130 (MCAS Cherry Point Fleet)	24.0	0.0	24.0	24.0	0.0	24.0
AH-1	38.7	0.0	38.7	34.7	0.0	34.7
CH-46	46.7	0.0	46.7	42.7	0.0	42.7
CH-53	1.3	3.3	4.7	1.3	2.7	4.0
UH-1	18.0	0.0	18.0	16.7	0.0	16.7
Air Force Total	252.7	26.7	279.3	228.7	23.3	252.0
F-15	98.0	20.7	118.7	89.3	18.7	108.0
F-16	92.7	0.7	93.3	82.0	0.7	82.7
F-16 (Air National Guard)	43.3	1.3	44.7	39.3	1.3	40.7
A-10	18.7	4.0	22.7	18.0	2.7	20.7
Army Total	29.0	1.0	30.0	28.0	1.0	29.0
Army Helicopters	29.0	1.0	30.0	28.0	1.0	29.0
Other Total	53.7	2.7	56.3	52.7	2.7	55.3
Other Jets	24.3	2.7	27.0	23.3	2.7	26.0
Other Props	29.3	0.0	29.3	29.3	0.0	29.3
TOTAL	1,477.7	262.0	1,739.7	1,388.0	245.7	1,633.7
Overtime Hours			**45.0**			
Non-Overtime Scheduled Hours			**1,694.7**			
Published Hours			**3,350.0**			
Percentage Utilization			**51%**			

Table B-33: Annual BT-9 Utilization (Baseline Scenario)

User/Sevice Group	Scheduled Hours			Used Hours		
	Daytime	Nighttime	Total	Daytime	Nighttime	Total
Navy Total	70.3	38.7	109.0	61.7	31.3	93.0
F-14 (NAS Oceana Fleet)	14.0	0.0	14.0	11.3	0.0	11.3
Navy Exercise	56.3	38.7	95.0	50.3	31.3	81.7
Marine Corps Total	203.7	30.0	233.7	181.3	29.0	210.3
AV-8 (Fleet)	41.3	20.3	61.7	41.3	20.3	61.7
AV-8 (FRS)	8.0	0.0	8.0	8.0	0.0	8.0
F/A-18	70.3	8.0	78.3	58.0	7.0	65.0
AH-1	30.7	0.0	30.7	26.0	0.0	26.0
CH-46	37.3	0.0	37.3	32.7	0.0	32.7
CH-53	1.3	1.7	3.0	1.3	1.7	3.0
UH-1	14.7	0.0	14.7	14.0	0.0	14.0
Air Force Total	119.3	14.0	133.3	106.0	13.3	119.3
F-15	8.7	6.0	14.7	8.0	6.0	14.0
F-16	84.7	4.7	89.3	75.3	4.7	80.0
A-10	26.0	3.3	29.3	22.7	2.7	25.3
Army Total	8.0	1.0	9.0	7.0	1.0	8.0
Army Helicopters	8.0	1.0	9.0	7.0	1.0	8.0
Other Total	59.3	12.3	71.7	49.7	10.3	60.0
Other Jets	18.0	12.3	30.3	17.3	10.3	27.7
Other Props	41.3	0.0	41.3	32.3	0.0	32.3
TOTAL	460.7	96.0	556.7	405.7	85.0	490.7
Overtime Hours			**40.3**			
Non-Overtime Scheduled Hours			**516.3**			
Published Hours			**3,350.0**			
Percentage Utilization			**17%**			

Table B-34: Annual BT-9 Utilization (ARS-1)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
Navy Total	131.3	48.3	179.7	113.7	43.3	157.0
F-14 (NAS Oceana Fleet)	31.3	6.0	37.3	25.3	5.3	30.7
F/A-18 (NAS Oceana Fleet)	46.7	7.3	54.0	38.0	6.7	44.7
Navy Exercise	53.3	35.0	88.3	50.3	31.3	81.7
Marine Corps Total	233.3	32.0	265.3	214.3	31.0	245.3
AV-8 (Fleet)	49.0	18.0	67.0	49.0	18.0	67.0
AV-8 (FRS)	19.3	0.0	19.3	19.3	0.0	19.3
F/A-18	71.7	11.7	83.3	62.0	10.7	72.7
AH-1	34.0	0.0	34.0	30.0	0.0	30.0
CH-46	43.3	0.0	43.3	38.7	0.0	38.7
CH-53	1.3	2.3	3.7	1.3	2.3	3.7
UH-1	14.7	0.0	14.7	14.0	0.0	14.0
Air Force Total	140.0	14.0	154.0	123.3	11.3	134.7
F-15	17.3	7.3	24.7	16.0	6.7	22.7
F-16	94.7	3.3	98.0	82.7	2.0	84.7
A-10	28.0	3.3	31.3	24.7	2.7	27.3
Army Total	8.0	3.0	11.0	7.0	3.0	10.0
Army Helicopters	8.0	3.0	11.0	7.0	3.0	10.0
Other Total	56.0	11.3	67.3	46.3	10.3	56.7
Other Jets	15.3	11.3	26.7	14.7	10.3	25.0
Other Props	40.7	0.0	40.7	31.7	0.0	31.7
TOTAL	568.7	108.7	677.3	504.7	99.0	603.7
Overtime Hours			**51.7**			
Non-Overtime Scheduled Hours			**625.7**			
Published Hours			**3,350.0**			
Percentage Utilization			**20%**			

ATAC

Table B-35: Annual BT-9 Utilization (ARS-2)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
Navy Total	112.0	46.3	158.3	96.3	42.0	138.3
F-14 (NAS Oceana Fleet)	26.3	5.3	31.7	21.3	4.3	25.7
F/A-18 (NAS Oceana Fleet)	32.3	7.3	39.7	24.7	6.3	31.0
Navy Exercise	53.3	33.7	87.0	50.3	31.3	81.7
Marine Corps Total	216.3	40.3	256.7	200.3	40.0	240.3
AV-8 (Fleet)	44.7	28.3	73.0	44.7	28.3	73.0
AV-8 (FRS)	15.3	0.0	15.3	15.3	0.0	15.3
F/A-18	66.3	9.7	76.0	58.3	9.3	67.7
AH-1	31.3	0.0	31.3	28.0	0.0	28.0
CH-46	41.3	0.0	41.3	37.3	0.0	37.3
CH-53	1.3	2.3	3.7	1.3	2.3	3.7
UH-1	16.0	0.0	16.0	15.3	0.0	15.3
Air Force Total	136.0	10.7	146.7	121.3	8.0	129.3
F-15	16.0	5.3	21.3	15.3	4.0	19.3
F-16	93.3	2.7	96.0	82.7	2.0	84.7
A-10	26.7	2.7	29.3	23.3	2.0	25.3
Army Total	8.0	3.0	11.0	7.0	3.0	10.0
Army Helicopters	8.0	3.0	11.0	7.0	3.0	10.0
Other Total	56.7	9.3	66.0	46.3	7.7	54.0
Other Jets	18.0	9.3	27.3	16.7	7.7	24.3
Other Props	38.7	0.0	38.7	29.7	0.0	29.7
TOTAL	529.0	109.7	638.7	471.3	100.7	572.0
Overtime Hours			**46.3**			
Non-Overtime Scheduled Hours			**592.3**			
Published Hours			**3,350.0**			
Percentage Utilization			**18%**			

Table B-36: Annual BT-9 Utilization (ARS-3)

User/Sevice Group	Scheduled Hours			Used Hours		
	Daytime	Nighttime	Total	Daytime	Nighttime	Total
Navy Total	115.7	46.3	162.0	106.0	42.0	148.0
F-14 (NAS Oceana Fleet)	26.3	4.3	30.7	22.3	4.0	26.3
F/A-18 (NAS Oceana Fleet)	24.3	5.0	29.3	22.3	4.7	27.0
F/A-18 (MCAS Cherry Point Fleet)	11.7	2.0	13.7	11.0	2.0	13.0
Navy Exercise	53.3	35.0	88.3	50.3	31.3	81.7
Marine Corps Total	214.7	32.7	247.3	199.3	30.7	230.0
AV-8 (Fleet)	42.0	16.3	58.3	42.0	16.3	58.3
AV-8 (FRS)	19.3	0.0	19.3	19.3	0.0	19.3
F/A-18	64.0	13.3	77.3	58.0	11.3	69.3
AH-1	32.7	0.0	32.7	27.3	0.0	27.3
CH-46	40.0	0.0	40.0	37.3	0.0	37.3
CH-53	1.3	3.0	4.3	1.3	3.0	4.3
UH-1	15.3	0.0	15.3	14.0	0.0	14.0
Air Force Total	148.7	15.3	164.0	125.3	12.0	137.3
F-15	24.7	8.7	33.3	16.7	7.3	24.0
F-16	93.3	4.0	97.3	80.0	2.7	82.7
A-10	30.7	2.7	33.3	28.7	2.0	30.7
Army Total	8.0	2.0	10.0	7.0	2.0	9.0
Army Helicopters	8.0	2.0	10.0	7.0	2.0	9.0
Other Total	62.3	11.3	73.7	52.0	10.3	62.3
Other Jets	18.7	11.3	30.0	17.3	10.3	27.7
Other Props	43.7	0.0	43.7	34.7	0.0	34.7
TOTAL	549.3	107.7	657.0	489.7	97.0	586.7
Overtime Hours			**45.0**			
Non-Overtime Scheduled Hours			**612.0**			
Published Hours			**3,350.0**			
Percentage Utilization			**18%**			

Table B-37: Annual BT-9 Utilization (ARS-4)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
Navy Total	87.0	38.3	125.3	80.0	34.0	114.0
F-14 (NAS Oceana Fleet)	19.3	1.7	21.0	17.3	1.3	18.7
F/A-18 (NAS Oceana Fleet)	14.7	1.7	16.3	12.7	1.3	14.0
Navy Exercise	53.0	35.0	88.0	50.0	31.3	81.3
Marine Corps Total	202.7	28.3	231.0	185.3	28.0	213.3
AV-8 (Fleet)	36.7	18.3	55.0	36.7	18.3	55.0
AV-8 (FRS)	12.0	0.0	12.0	12.0	0.0	12.0
F/A-18	69.3	7.7	77.0	61.3	7.3	68.7
AH-1	30.7	0.0	30.7	26.7	0.0	26.7
CH-46	37.3	0.0	37.3	33.3	0.0	33.3
CH-53	1.3	2.3	3.7	1.3	2.3	3.7
UH-1	15.3	0.0	15.3	14.0	0.0	14.0
Air Force Total	138.0	16.0	154.0	122.0	12.7	134.7
F-15	16.7	6.7	23.3	15.3	6.0	21.3
F-16	94.0	4.0	98.0	82.0	3.3	85.3
A-10	27.3	5.3	32.7	24.7	3.3	28.0
Army Total	8.0	3.0	11.0	7.0	3.0	10.0
Army Helicopters	8.0	3.0	11.0	7.0	3.0	10.0
Other Total	55.7	12.3	68.0	46.0	10.3	56.3
Other Jets	14.3	12.3	26.7	13.7	10.3	24.0
Other Props	41.3	0.0	41.3	32.3	0.0	32.3
TOTAL	491.3	98.0	589.3	440.3	88.0	528.3
Overtime Hours			**43.0**			
Non-Overtime Scheduled Hours			**546.3**			
Published Hours			**3,350.0**			
Percentage Utilization			**16%**			

Table B-38: Annual BT-9 Utilization (ARS-5)

User/Sevice Group	Scheduled Hours Daytime	Scheduled Hours Nighttime	Scheduled Hours Total	Used Hours Daytime	Used Hours Nighttime	Used Hours Total
Navy Total	111.7	46.3	158.0	102.0	41.3	143.3
F-14 (NAS Oceana Fleet)	22.3	4.7	27.0	19.0	4.0	23.0
F/A-18 (NAS Oceana Fleet)	25.3	2.0	27.3	23.0	2.0	25.0
F/A-18 (MCAS Cherry Point Fleet)	11.0	4.7	15.7	10.0	4.0	14.0
Navy Exercise	53.0	35.0	88.0	50.0	31.3	81.3
Marine Corps Total	230.3	33.0	263.3	211.7	31.3	243.0
AV-8 (Fleet)	44.3	19.0	63.3	44.3	19.0	63.3
AV-8 (FRS)	20.0	0.0	20.0	20.0	0.0	20.0
F/A-18	70.0	12.3	82.3	60.7	10.7	71.3
AH-1	32.7	0.0	32.7	28.7	0.0	28.7
CH-46	46.0	0.0	46.0	41.3	0.0	41.3
CH-53	1.3	1.7	3.0	1.3	1.7	3.0
UH-1	16.0	0.0	16.0	15.3	0.0	15.3
Air Force Total	146.7	18.7	165.3	128.7	15.3	144.0
F-15	18.7	7.3	26.0	16.0	6.0	22.0
F-16	96.0	4.0	100.0	84.7	4.0	88.7
A-10	32.0	7.3	39.3	28.0	5.3	33.3
Army Total	9.0	3.0	12.0	8.0	3.0	11.0
Army Helicopters	9.0	3.0	12.0	8.0	3.0	11.0
Other Total	57.3	12.0	69.3	47.0	10.0	57.0
Other Jets	16.0	12.0	28.0	14.7	10.0	24.7
Other Props	41.3	0.0	41.3	32.3	0.0	32.3
TOTAL	555.0	113.0	668.0	497.3	101.0	598.3
Overtime Hours			**45.0**			
Non-Overtime Scheduled Hours			**623.0**			
Published Hours			**3,350.0**			
Percentage Utilization			**19%**			

NASMOD

APPENDIX C: DISCUSSION OF NAVY F/A-18 SQUADRON ASSIGNMENTS TO CARRIER AIRWINGS

APPENDIX C: DISCUSSION OF NAVY F/A-18 SQUADRON ASSIGNMENTS TO CARRIER AIRWINGS

The relationship between the year "snapshot" of all airwing workup cycles and the squadron assignment mix in each airwing is very important in determining the local impact of squadron operations. For example, in the case of MCAS Cherry Point, the more F/A-18 fleet squadrons performing FCLPs in the weeks prior to deployment, the more potential there is for competition for airfield pattern slots and thus for inability of other squadrons to perform routine return-to-base pattern work. Similarly, competition for schedule periods at Navy Dare County Range will be keener, and hence, off-load to BT-11 will be greater, if several squadrons from multiple airwings are attempting to perform required air-to-ground work at the same time.

The objective for EIS purposes, therefore, is to come up with a deployment schedule and airwing assignments (i.e., how many squadrons of each type are assigned to each airwing) that will result in a representative, or *average* year of operations. Several constants are assumed given in determining squadron airwing assignments. First, the stagger between airwing deployment dates is fixed. Second, the lengths of deployments and workup periods are set at a nominal six months and 18 months, respectively. Finally, the F-14 squadron airwing assignments are based upon those made in the previous NAS Oceana study and are static for this analysis.

Working within the limitations of using the simulation of a *particular* year to represent an *average* year of future operations, analysts determined that it was necessary to adjust the squadron airwing assignments for each unique base loading scenario in order to maintain the goal of providing an average year of operations.

The task at hand reduces down to determining the working definition of "average impact" and then making F/A-18 squadron airwing assignments accordingly. A squadron impacts training area operations and airfield operations, both on the ground and in the pattern and route structures. Certain portions of a squadron's workup cycle are more intense in one particular type of training than the others, such as FCLPs or air-to-ground missions. Therefore, a definition of average impact on the system should not be biased toward or away from a particular period in the workup cycle nor a particular type of mission.

An appropriate measure of the overall impact is annual local sorties conducted by an aircraft group, which in this case is either NAS Oceana-based or MCAS Cherry Point-based Navy F/A-18 fleet squadrons. The squadron average over one year is defined by summing the local sorties over a complete, 24-month workup-deployment cycle and dividing by two. The average impact (local sorties) at a specific air station for the Navy F/A-18 fleet squadrons equals the number of based squadrons multiplied by the overall squadron average.

The first action to achieve an average impact of F/A-18 squadrons at NAS Oceana is to design a year period that captures a normal flow of squadron exercises, detachments, and deployments. Then, for each alternative loading scenario, the wing assignments chosen (see Table 2-6 in Section 2.5.1.6) reflect the best possible configuration at NAS Oceana and MCAS Cherry Point to achieve an *estimated* average impact of Navy F/A-18 fleet squadrons. This was a process of calculation, compromise, and judgment on the part of analysts in making airwing assignments to achieve a balance across all types of activities (i.e., air-to-air, FCLP, air-to-ground, total airfield operations) at both NAS Oceana and MCAS Cherry Point. It was not feasible to include MCAS Beaufort in this "averaging" process.

Another, more accurate approach would be to run the simulation for a full two-year period so all airwings would go through a complete cycle and take the average year as half the two-year results. With this approach, each squadron will theoretically conduct the same number and mix of flights, and the shuffling of wing assignments would not be necessary. Technical limitations of the current NASMOD system, however, prevented taking this approach at this time. Nevertheless, with this understanding, the results reported here are a fair picture of a representative year of operations at the studied air stations and training areas.

APPENDIX D:
NASMOD OVERVIEW

APPENDIX D: NASMOD OVERVIEW

The Department of the Navy has developed a simulation model for use in analyzing problems and issues related to airfield and special use airspace operations. The Navy Aviation Simulation Model (NASMOD) provides the Department of the Navy with the capability to conduct simulation analyses that:

1. Quantitatively assess airfield and airspace capacity in support of proposed operational alternatives.
2. Calculate the impacts of changes in special use airspace on both military and civilian operations.
3. Analyze the operational impacts of interaction between military and civilian aircraft.
4. Analyze pilot training system resource requirements including airfields, airspace, instructors, syllabus, aircraft type, maintenance, fuel, and operating costs.
5. Analyze the impacts of using alternative aircraft types to meet training and operational objectives.

NASMOD merges the capabilities of the Federal Aviation Administration's (FAA) SIMMOD model with enhancements to the Navy's Naval Aviation Training System (NATS) model developed in 1986. SIMMOD, an advanced state-of-the-art model that simulates both airfield and airspace traffic operations, has been used extensively by the FAA in studies and analyses aimed at planning for operational changes in the National Airspace System. The model has proven to be extremely valuable as a tool for analyzing airport and airspace problems, identifying potential solutions, and quantitatively assessing the delay, capacity, traffic loading, and operating cost impacts of potential operational alternatives. Recently, the Navy and the FAA incorporated several key improvements into SIMMOD, including the capability to model dynamic runway plan changes and touch-and-go, FCLP, and GCA operations.

SIMMOD was designed to address enroute or IFR traffic. The Navy's NATS model was developed to address VFR traffic in the training environment. NASMOD combines these capabilities and includes other features necessary to model military aviation operations, such as special ground operations (hover and taxi to ordnance loading areas, high power run-up areas, and hot refueling pits) and the unique vertical and short takeoff and landing (V/STOL) characteristics and operating procedures of the AV-8B aircraft. The new capabilities introduced in NASMOD permit analysis of all Navy and Marine Corps aviation training operations—in the training command, in the fleet replacement squadrons, in the fleet and operating squadrons—and management and utilization of special use airspace areas.

Thus, NASMOD provides the Navy with a tool to evaluate a wide array of proposed special use airspace alternatives and training requirements, the capability to quantify impacts on other users of the National Airspace System (commercial and general aviation), and the ability to work with the FAA to mutually resolve critical special use airspace issues. In addition, the Navy now has the capability to evaluate various base closure and realignment alternatives by addressing impacts of airfield and airspace capacity, training requirements, and operational alternatives.

The NASMOD system has three primary components:

1. *A Graphical User Interface.* The Graphical User Interface facilitates data entry and management. NASMOD operates on a SUN workstation in the UNIX operating system. The user interface is window-based and mouse-driven. The system provides tools for building the airfield and airspace network, including routes and runways, for building the profiles of training missions that are used to complete Navy training requirements or syllabus objectives, for entering flight schedule data from the Official Airline Guides (OAG), for digitizing airfield and airspace charts, and for editing the database.

2. *A Simulation Processor.* The simulation processor simulates mission scheduling and operations, based on user input. Users may simulate multiple day periods. There are three major components of the simulation processor that are executed for each simulated day:

   a. The Scheduler, which selects the missions to be performed each simulated day and devises a conflict-free schedule of missions for that day. This component simulates scheduling performed by squadrons and by airspace and range scheduling authorities, such as a fleet area control and scheduling facility (FACSFAC).

   b. The Operations and Traffic Simulator, which simulates the day's flight and mission operations, including the utilization of special use airspace areas and interactions between civilian and military traffic.

   c. The Performance Calculator, which computes detailed and summary measures of daily squadron, airfield, and airspace operations and utilization performance, based on simulated results of the Scheduler and the Operations and Traffic Simulator.

3. *Results Analysis Tools.* NASMOD includes all of SIMMOD's tabular and graphical report generation capabilities, including a flight animation that visually replays simulated aircraft movements on the ground and through the airspace. NASMOD also provides database query tools to assist the analyst in extracting information from the system's output database and setting up reports.

This appendix discusses the Simulation Processor, focusing on the Scheduler and the Operations and Traffic Simulator, and includes an example of the graphical animation capabilities is in the form of computer display snapshots with corresponding descriptions.

D.1 Simulation Processor

The Simulation Processor components work in tandem: the Scheduler processes the inputs to derive a mission schedule, which serves as input for the Operations and Traffic Simulator. Typically, analysts use NASMOD to study military operations for a multiple-day period, such as one year. A one-year simulation period provides results that account for seasonal variations in activity and the impacts of airwing deployment schedules. During a multiple-day simulation period, the Scheduler considers the dynamic output of the previous day from the Operations and Traffic Simulator in addition to the static database inputs.

D.1.1 The Scheduler

NASMOD's Scheduler generates the schedule of missions that is the input for the Operations and Traffic Simulator. Based on the input data, the schedule of missions reflects squadrons' requirements and preferences, as well as airspace limits. In fact, the Scheduler is a two-step process. During the first step, the Scheduler determines the events squadrons desire to perform, and devises a schedule to accomplish those events; during this step NASMOD's Scheduler performs the functions of a squadron scheduler. During the second step, the Scheduler considers all squadrons' schedules and the resulting requests for airspace, and resolves any conflicts; during this step, NASMOD's Scheduler performs the functions of a scheduling authority or central scheduler.

D.1.1.1 Squadron Scheduler

A squadron has a set of events that it is required to perform; those events must be performed at a certain frequency. The frequency at which those events are performed may vary, depending on the squadron's deployment cycle. On each simulated date, the Scheduler computes the average number of each event that the squadron must do. Next, the Scheduler selects a target number of the event to schedule; that target number reflects the amount performed on previous days. When a squadron has not performed a certain event for several days, it builds a backlog in that event; as a result, on subsequent days the target number of that event increases.

For each event the Scheduler targets for scheduling, it selects a profile that completes that event. The profile contains the sequence of requests the mission makes. A profile may contain several paths—several different sets of requests that the mission might make. Each set might request different activity areas, for example. The Scheduler selects one path, which contains one set of requests. Based on the selected path and the expected transit times, the Scheduler projects a mission length.

Every profile is associated with a range of starting times—times at which missions may begin performing the profile. In addition, a squadron has a specific number of aircraft available and a maximum rate at which it launches those aircraft, such as ten per hour. The Scheduler attempts to schedule all targeted events, subject to the limits imposed by the launch rate, aircraft availability, mission lengths, and profile starting times.

The resulting schedule represents the missions the squadron would like to accomplish that day, subject to internal aircraft availability and launch rate constraints but with no consideration to requests made by other squadrons or to airspace constraints.

D.1.1.2 Central Scheduler

During this second step of the scheduling process, the Scheduler resolves conflicts for airspace usage. As a result of the squadron scheduling process, multiple missions may be scheduled to use the same airspace simultaneously; in fact, the number of missions scheduled to use an airspace may exceed capacity or safety limits that airspace operators impose. To resolve these conflicts, the Scheduler ranks all missions, scheduling higher-priority missions first. (Users may create any number of mission ranks in terms of several criteria, including event, aircraft type, and days until deployment.) When the Scheduler determines that the squadrons are requesting that more missions use an airspace or other activity area than are permitted at any one time, it attempts to reschedule the surplus missions. First, the Scheduler attempts to schedule such a mission at that same activity area at a later time. If that is not possible, the Scheduler attempts to schedule the mission along a different path in its profile, if any are specified. If the mission cannot be scheduled at a later time or at an alternate area, the Scheduler cancels the mission; that event is added to the squadron's backlog, increasing the likelihood that the event will be scheduled on a subsequent day.

The resulting schedule becomes the input for the Operations and Traffic Simulator. Note that this schedule created by the central scheduling process may violate squadron launch requirements or aircraft availability. These violations, variations in travel time, and the interactive effects of non-centrally scheduled missions can lead to simulated activity area usage that differs from scheduled usage.

D.1.1.3 Other Capabilities

In addition to the basic two-step algorithm for scheduling missions, the Scheduler offers users many capabilities to influence the schedule. When devising the squadrons preferred scheduled, the Scheduler considers many special types of events. For instance, the Scheduler can schedule detachments on pre-specified dates or on dates when the squadron's backlog reaches a pre-determined level. The events during a detachment may be pre-specified or determined by the Scheduler. In addition to detachments, the Scheduler may schedule multiple-day events that possibly occur away from the squadron's home base, such as events performed during cross-country missions. The Scheduler may also limit the dates on which events are performed. For example, the Scheduler might schedule carrier qualification missions only during the two-week period prior to the date on which a carrier is available.

Similarly, during the central scheduling process, the Scheduler considers various types of area usage. Missions may request the area for exclusive use, in which case only missions with which it is coordinated are permitted in the area, or missions may request the area for co-use, in which case either a pre-specified number of aircraft is permitted in the area or a pre-specified volume of the area may be used. (The scheduler permits missions to act as an equivalent number of aircraft, which may differ from the actual number of aircraft; a two-plane Formation flight, for instance, may act as one aircraft.) The Scheduler can also require that certain squadrons use areas during pre-specified time periods, even blocking other squadrons from using the area during those periods.

Finally, the Scheduler determines the sunrise and sunset times, and selects the weather conditions for each activity area on the simulated day. The Scheduler calculates the sunrise and sunset times based on the area's latitude and longitude and the day of the year. The Scheduler selects the weather intensities for each of the three weather types, based on the probabilistic data input by NASMOD analysts. Specifically, analysts enter the probability that each weather condition occurs at an area throughout the day during various seasons of the year.

D.1.2 The Operations and Traffic Simulator

NASMOD's Operations and Traffic Simulator (Simulator) is an extension of the SIMMOD simulation program; NASMOD includes additional capabilities to reflect military operations.

SIMMOD (and hence NASMOD) is a fast-time, Monte-Carlo computer simulation model. Users create operational scenarios, including a node-link network that represents the airfield structure and the airspace route system, and a flight schedule. The model tracks movements of individual aircraft traveling through the node-link network. As it tracks aircraft, the model detects potential violations of separation standards, flow constraints, or operating procedures, and takes air traffic control actions to resolve these potential conflicts and to ensure that all procedural rules are met. The model maintains various statistics relating to travel and delay times, airspace sector occupancy levels, and airport usage. See the *SIMMOD Version 2.0 Reference Manual* for further discussion of the logic and structure of flight simulation in SIMMOD.

NASMOD adds capabilities to monitor the usage and availability of scarce resources — such as aircraft, instructors, and TACTS pods—and activity areas—such as military operating areas and special use airspace. To make use of these features, NASMOD introduces the concept of a "mission." Missions can fly routes, can acquire and prepare a specific number of a scarce resources, and can use a certain volume of an activity area for a specific amount of time. While flying a route, a mission is called a "flight;" thus, a mission may be composed of a sequence of flights. Missions are scheduled in the model by NASMOD's Scheduler. Some flights are pre-defined outside the model in the database (e.g., to represent commercial traffic). The Simulator then "plays out" each day's schedule of missions and flights.

During the simulation, missions make requests. There are four types of requests:

1. Requests to obtain or release scarce or tangible resources, such as aircraft, instructors, or TACTS pods. A mission requests a specific number of units, and takes a certain amount of time to prepare the resource units once they are acquired (or the mission takes a certain amount of time to return the resource units and prepare them for the next mission).
2. Requests to use an activity area, such as a military operating area, warning area, target range, or fuel pit. A mission requests a specific volume of airspace (or other unit of capacity) in the activity area and uses that volume for a certain amount of time. The volume and the amount of time are dependent upon the activity conducted. The maneuvers associated with a FAM activity, for instance, may take longer than those associated with a FORM activity.
3. Requests to fly an airspace route. The model handles the mission as a flight on an airspace route. The mission's flight interacts with other flights, which may also be missions, and the model imposes appropriate air traffic control actions.
4. Requests to taxi between two ground activity areas, such as a fuel pit and a pad. The model creates a special ground movement "flight" when a mission wishes to taxi between two ground nodes at a modeled airfield. The mission interacts with other aircraft taxiing at the airfield.

Any of these requests may be coordinated. At coordinated requests, two or more missions join to complete the request together. A coordinated airspace route request, for example, can represent a section flight. The sequence of requests that a mission makes is pre-defined in its mission profile.

The Simulator monitors each mission's progress as it proceeds through its mission profile, taking corrective action as necessary. At requests for tangible resources, for example, the Simulator checks that the resource is available before allowing the mission to acquire and prepare the resource; missions will be delayed in a queue if there is not enough available. Similarly, although the Scheduler devises a schedule that should avoid airspace conflicts, delayed and unscheduled missions may impose unexpected demand for airspace resources; thus, missions might be forced to wait for entry into an activity area.

Furthermore, the Simulator evaluates several constraints at each profile step. These constraints include accumulated mission delay (representing remaining fuel reserve), the amount of daylight remaining (if daylight is required for a mission activity), equipment failure, and weather conditions that affect the ability of the mission to be completed. When a constraint is violated the mission aborts its current request. For some violated constraints, the mission may enter permanent abort mode, in which case it makes no new requests to acquire resources or use activity areas. Alternatively, a particular step can specify an abort profile; missions in abort mode transition to the abort profile and execute that profile's sequence of requests.

For example, NASMOD allows users to specify three weather types. A weather condition is modeled as a distinct intensity of each of the three weather types. At each mission profile step requesting a resource or activity, the mission checks the current intensities of each weather type; if the current intensity of any one weather type exceeds the mission's threshold intensity for that type, the mission aborts the request. Because each mission may have a unique profile, with different weather threshold intensities, users can easily create one or more missions that are more weather sensitive than other missions.

Thus, by combining resource and activity requests that are constrained in various ways and by using abort profiles, analysts can use NASMOD to model a variety of scenarios, including simple training missions or complex fleet training exercises with alternative return-to-base maneuvers.

For example, NASMOD is fully capable of modeling an AV–8B rolling vertical landing and hot refueling. During such a landing, the aircraft approaches the runway at a slower-than-normal speed, requiring greater separation with following aircraft than during a regular landing. A NASMOD analyst would separate that landing flight into two flight segment requests: during the initial segment the mission acts as a regular aircraft, and during the final approach segment, the mission acts as a special aircraft type that has longer runway occupancy times and for which the model imposes greater separations with other aircraft. After the landing, the aircraft taxis to the ground activity area associated with the fuel pit, where it requests another activity representing refueling. Following completion of that activity, the mission makes a request to taxi to a pad, another ground activity area, where it departs to perform further activities.

The Operations and Traffic Simulator produces several output files. One of these contains step-by-step information about the execution of each mission. Figure D-1 shows a hypothetical mission profile that might be produced by the Scheduler and read by the Simulator. During the simulation, each step in the profile, or each mission request, is executed sequentially. Table D-1 translates that mission profile, explaining how the series of steps might correspond to an actual military training mission.

```
   VFA-1.FAM_PROF     #17
1  01 0 0 0 MOA.WXCHECK.NAS NONE 0 0 0 0 20 0 0
2  01 1 0 0 VFA-1.AIRCRAFT.FA18.NAS NONE 0 -1080 0 0
3  00 26 ? ? NAS 0 -1080 0      NAS_MOA_V
4  01 100 2940 3240 MOA NONE 3240 -1080 0 0 20 0 0
5  00 15 ? ? XXX 0 -1080 0      MOA_NAS_INI_V
6  01 0 0 0 NASFCLPPAT_RES ABORT_NASRTGPAT_1TNG_PROF
      0 -1080 0 1 50 0 0
7  01 1 0 0 NASLTGPAT_RES ABORT_NASRTGPAT_1TNG_PROF
      0 -1080 0 99 50 0 0
8  00 53 ? ? XXX 0 -1080 0      NAS_INI_LBRK
9  01 10 0 0 NASLTGPAT NONE 0 -600 0 0
      50 0 0
10 00 20 ? ? XXX 0 -600 0      NAS_LBRK_NASLTGPAT
11 01 -1 0 0 NASLTGPAT_RES NONE 0 -1080 0 0 50 0 0
12 00 24 ? ? NAS 0 -1080 0      NASLTGPAT_LAND
13 01 -1 4800 4800 VFA-1.AIRCRAFT.FA18.NAS NONE 0 -1080 0 0
```

Figure D-1: Sample Profile

Table D-1: Profile Description

Profile Step	Step Description
1	Check weather at activity area; if the weather exceeds a specified intensity (20), cancel the mission.
2	Request a F/A-18 aircraft from squadron VFA-1. If none is immediately available, wait up to 1080 seconds (18 minutes), and then cancel the mission.
3	Fly the route NAS_MOA_V from NAS to MOA.
4	Perform an activity at the MOA that requires 100 volume units. The activity takes between 2940 and 3240 seconds (49 to 54 minutes). Before commencing the activity, check the amount of daylight remaining; if there is not at least 54 minutes of day remaining, do not perform the activity (go to the next profile step). If the area is not immediately available, wait up to 18 minutes for it to become available, and then go to the next profile step. If the weather intensity at the activity area exceeds 20, do not perform the activity; instead, go to the next profile step.
5	Fly the route MOA_NAS_INI_V from the MOA to the initial point at NAS.
6	Check the pattern for FCLPs. If FCLPs are being conducted, go ("abort") to the right pattern to do touch-and-go landings.
7	Try to enter the left touch-and-go pattern. If full, abort to the right pattern to do touch-and-go landings.
8	Fly the route NAS_INI_LBRK from the initial through the left break.
9	Request the touch-and-go activity.
10	Fly the route NAS_LBRK_NASLTGPAT from the break through the first replication of the pattern.
11	Check out of the pattern, allowing others to enter.
12	Fly the route NASLTGPAT_LAND, which brings the aircraft to a full-stop landing.
13	Return the F/A-18 aircraft to VFA-1. Take 80 minutes to do maintenance on the aircraft before returning it to service for other missions to use.

D.1.3 The Performance Calculator

The data files generated by the Operations and Traffic Simulator are in a highly detailed yet "raw" format. The Performance Calculator processes these files to produce an extensive database with tables that summarize travel actions (both on the ground and in the air), area usage, resource usage, and squadron satisfaction of training requirements. This database can subsequently be searched using formal database querying techniques in order to extract the desired results. Further data processing is generally required in order to render the results into a readable format.

D.2 Animation Snapshots

Much of the information that describes how the airspace, airfield, and squadrons function is non-visual; requirements, rules, and procedures are textual database entries. However, the software user interface provides graphical depictions of the spatial relationships between the airfield, airspace, aircraft in flight, and the operating areas. In addition, the software can generate an animation replay of a simulated day on the computer display. This tool is important for visual verification of the accuracy of modeled operations.

Figure D-2 is a NASMOD animation snapshot of the computer display that shows the NAS Oceana airfield. It is interesting to note that the simulation time of the snapshot is 24:42:23 (local) which indicates that the day's flight operations are extending past midnight. This is useful for distinguishing between missions that launch early on a given day with those that are continuing from a previous day. Note the positions of the various aircraft. The symbology conveys information about each aircraft. The attitude of an aircraft icon shows the general direction of travel. A number of labels may be displayed for each icon as described in the following example:

F18O_L5	Squadron—the Atlantic F/A-18 fleet squadron 5
10	Altitude—10 hundred feet (i.e., 1000 feet)
152 kt	Speed—152 nautical miles per hour, true airspeed

The animation can also identify the nature of the aircraft behavior by a user-selected color. In Figure D-2, blue denotes arriving or enroute aircraft, green denotes departing aircraft, and red denotes holding aircraft. Note that the icons are not intended to reflect the actual size of the aircraft.

Four F/A-18s are arriving via the overhead break and landing on Runway 5L. One F/A-18 (the northernmost) is in the midst of its break at 1300 feet and approximately 257 knots; a second F/A-18 is on the downwind leg at 1000 feet and 152 knots; a third F/A-18 is on the base leg at 500 feet and 152 knots; and a fourth F/A-18 is landing on the runway and is at 90 knots in its deceleration. These F/A-18s are blue to denote their status as "arrival" aircraft.

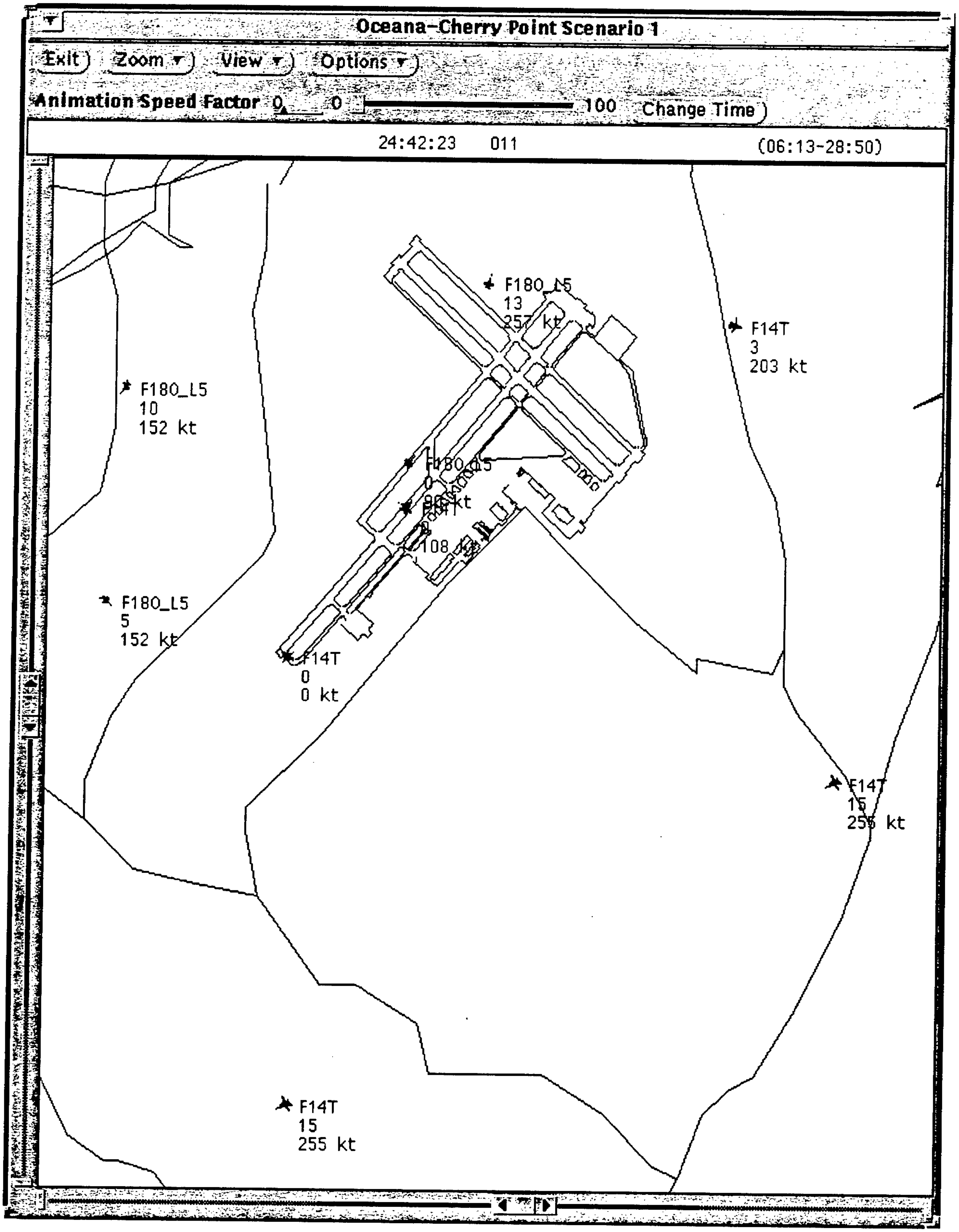


Figure D-2: Animation Snapshot of NAS Oceana Airfield Operations

Meanwhile, five F-14s from the FRS are departing Runway 5R to transit to NALF Fentress. The two southernmost F-14s have already reached 1500 feet and 255 knots; a third F-14 has reached 300 feet and 203 knots as it is executing is right-hand turning climbout; and a fourth F-14 is accelerating down Runway 5R in its takeoff roll and has reached about 108 knots. All four of these F-14s are green to denote their "departure" status. The fifth F-14 is waiting for clearance to depart at the end of the Runway 5R. It is red to alert the analyst that it is holding.

Figure D-3 presents an animation snapshot of the airspace and training areas close to NAS Oceana for ARS-1. NASMOD does not attempt to model the actual flight tracks of aircraft while they are within the various training areas but, instead, logs the time every aircraft enters and departs such areas. The analyst can then choose to display area labels when viewing an animation. When an aircraft enters a modeled area, the counter associated with an area label is incremented. The counter simply lets the analyst know how many aircraft are within the specific training area at that instant. The counter is decremented when an aircraft leaves an area. Such labels and counters are shown in Figure D-3. At the instant of the snapshot (14:18:00 local), there are nine aircraft within W-72 and an additional four within the TACTS range specifically. There is also one aircraft at the Navy Dare bombing range. Two aircraft icons are seen in close proximity to W-72; an aircraft from Atlantic F/A-18 fleet squadron 8 is about to enter W-72 while an aircraft from Atlantic F-14 fleet squadron 5 has just departed W-72. These aircraft are on the outer extremities of the modeled NAS Oceana airfield/pattern structure. A number of aircraft are located at the airfield (either on the ground or in the pattern) and, consequently, their icons overlay one another in the figure due to the lower magnification of this view.

In addition to the area labels, the animation can display a listing of all activities occurring within training areas. A portion of this listing is shown in the inset titled Current Area-Activity Information in the figure. The items in red are activities that are occurring at that instant during the animated replay of the simulation. Some areas cannot be adequately displayed on the main animation screen because they do not have geographic boundaries. For example, the first line in the list indicates to the analyst that two aircraft are currently performing a twenty-minute offensive air support (air interdiction) activity on VR73. The listing further indicates that five aircraft are using NALF Fentress for FCLP training and one aircraft is currently using the Navy Dare range. This can be verified on the main animation display by observing the corresponding area labels and counters.

Figure D-4 shows an animation snapshot of MCAS Cherry Point taken from ARS-5. (This corresponds to ATAC Scenario 11 as indicated in the window title.) The animation software can import computer-aided design (CAD) drawings to the display; consequently, the figure shows a current drawing obtained from the MCAS Cherry Point facilities department. While the CAD drawings used for the animation snapshots may not reflect the airfield configuration of the scenario, the underlying model structure governing the movement of aircraft does incorporate the assumptions pertinent to the given scenario.

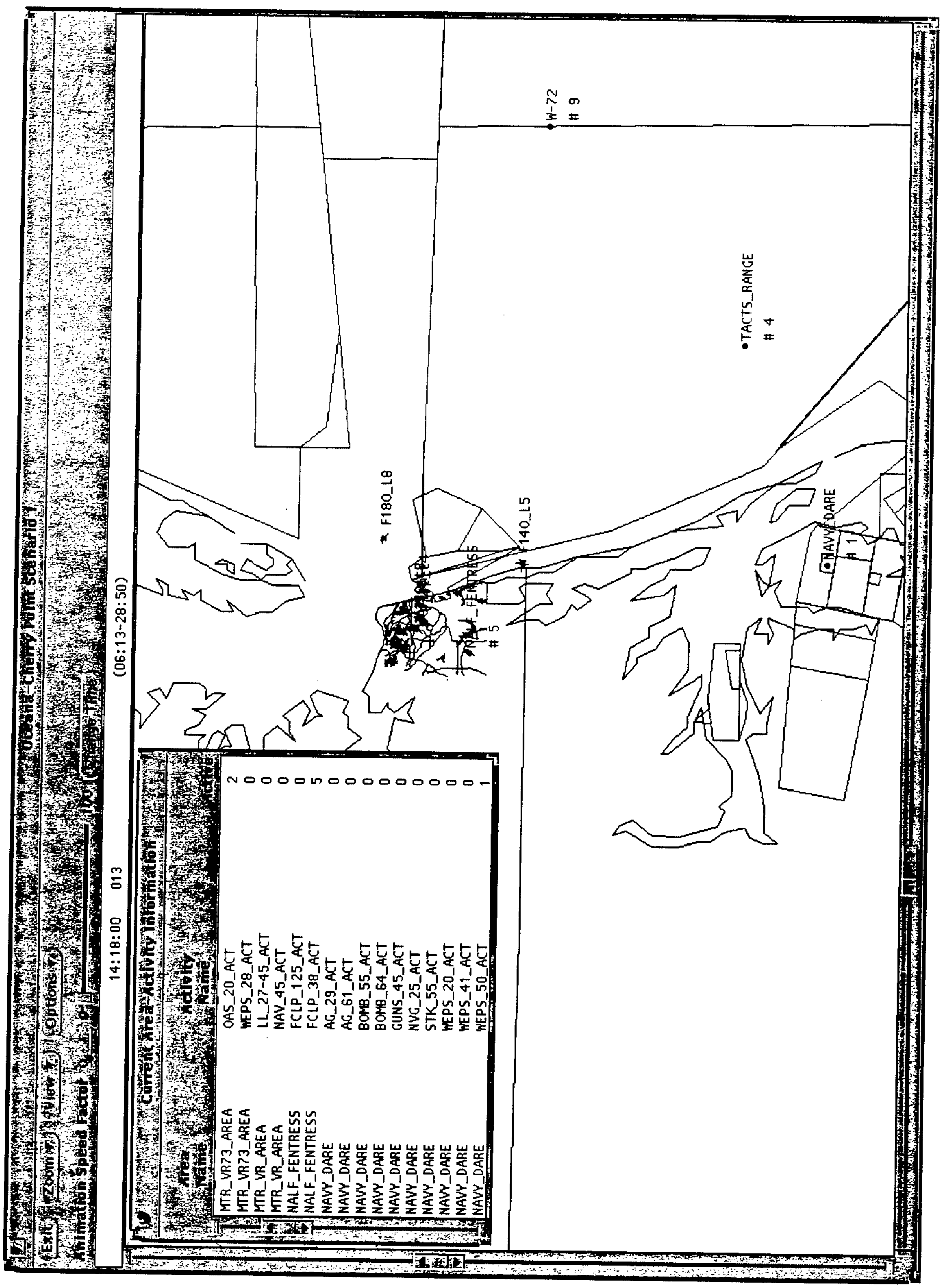


Figure D-3: Animation Snapshot of NAS Oceana Region Airspace Operations

ATAC

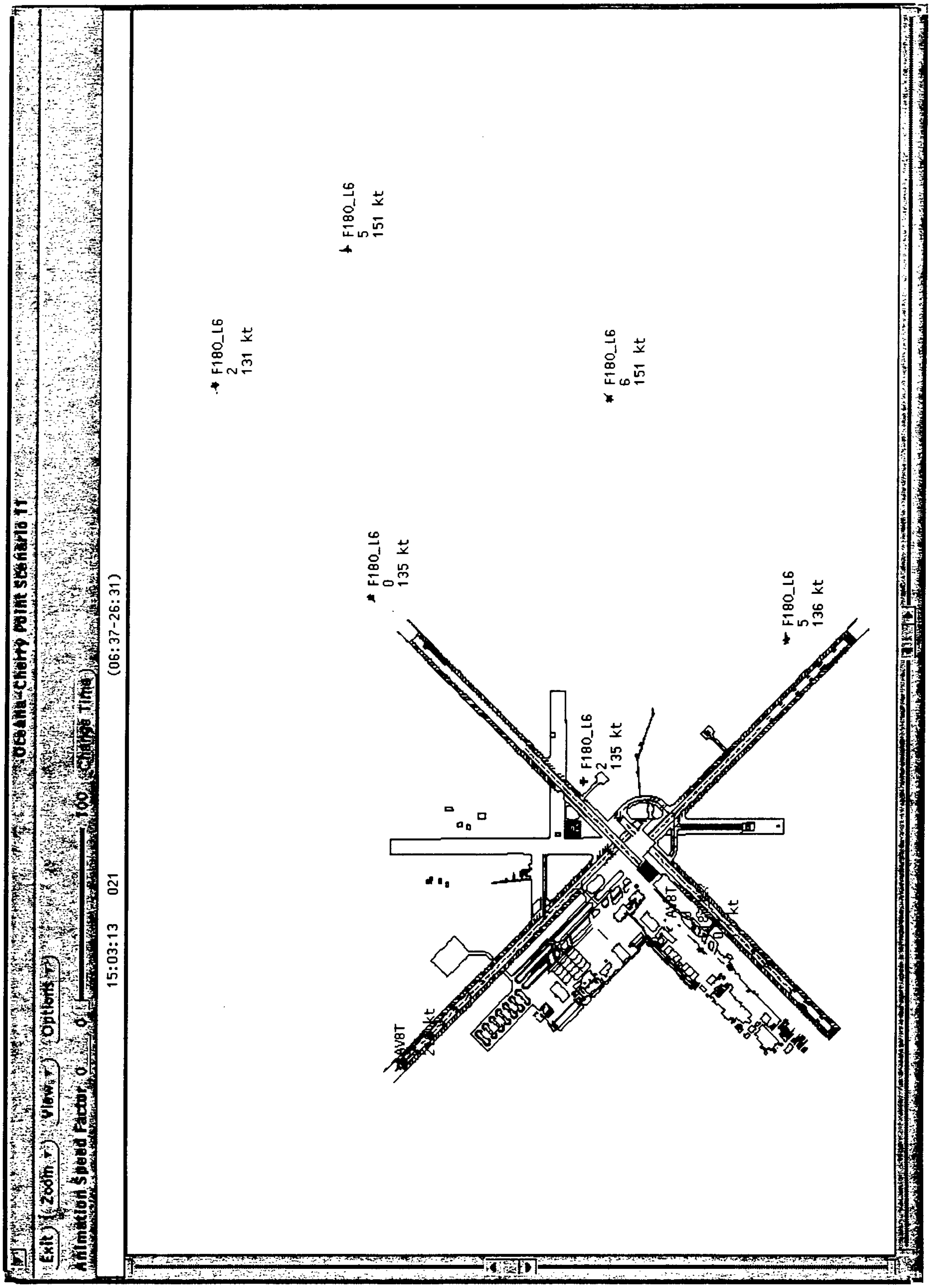


Figure D-4: Animation Snapshot of MCAS Cherry Point Airfield Operations

This figure captures a moment at which FCLP operations are underway. The aircraft are from Atlantic F/A-18 fleet squadron 6. Six aircraft are in the FCLP pattern on Runway 23R. As with Figure D-2, the approximate attitude, altitude, and speed of the aircraft can be discerned. At the same time, an AV-8B from the FRS is departing from Runway 32R. Another AV-8B and F/A-18 are taxiing on the southwest ramp area.

Figure D-5 is similar to Figure D-3 in that it displays some of the training areas with labels and counters in a lower magnification. Likewise, it provides the current activity list. As stated earlier, aircraft icons are displayed only when the aircraft are in close proximity to the airfield. In the figure, two F/A-18s have recently departed W-122 and are returning to MCAS Cherry Point. An EA-6B is on the final approach to Runway 32L. A transient jet aircraft is approaching from the northwest. The blue icon color designates these aircraft as "arrivals". A number of other aircraft are either in the pattern or taxiing at the airfield and their overlaying icons are green. The visible portion of the activity list shows that activities are in progress at BT-11 and BT-9. These activities are approximately 30-minute air-to-ground training exercises consisting of two aircraft each. Other missions are currently in R-5306D, W-122, the W-72 TACTS range, the Navy Dare range, and possibly other regions not visible on the displayed portion of the map.

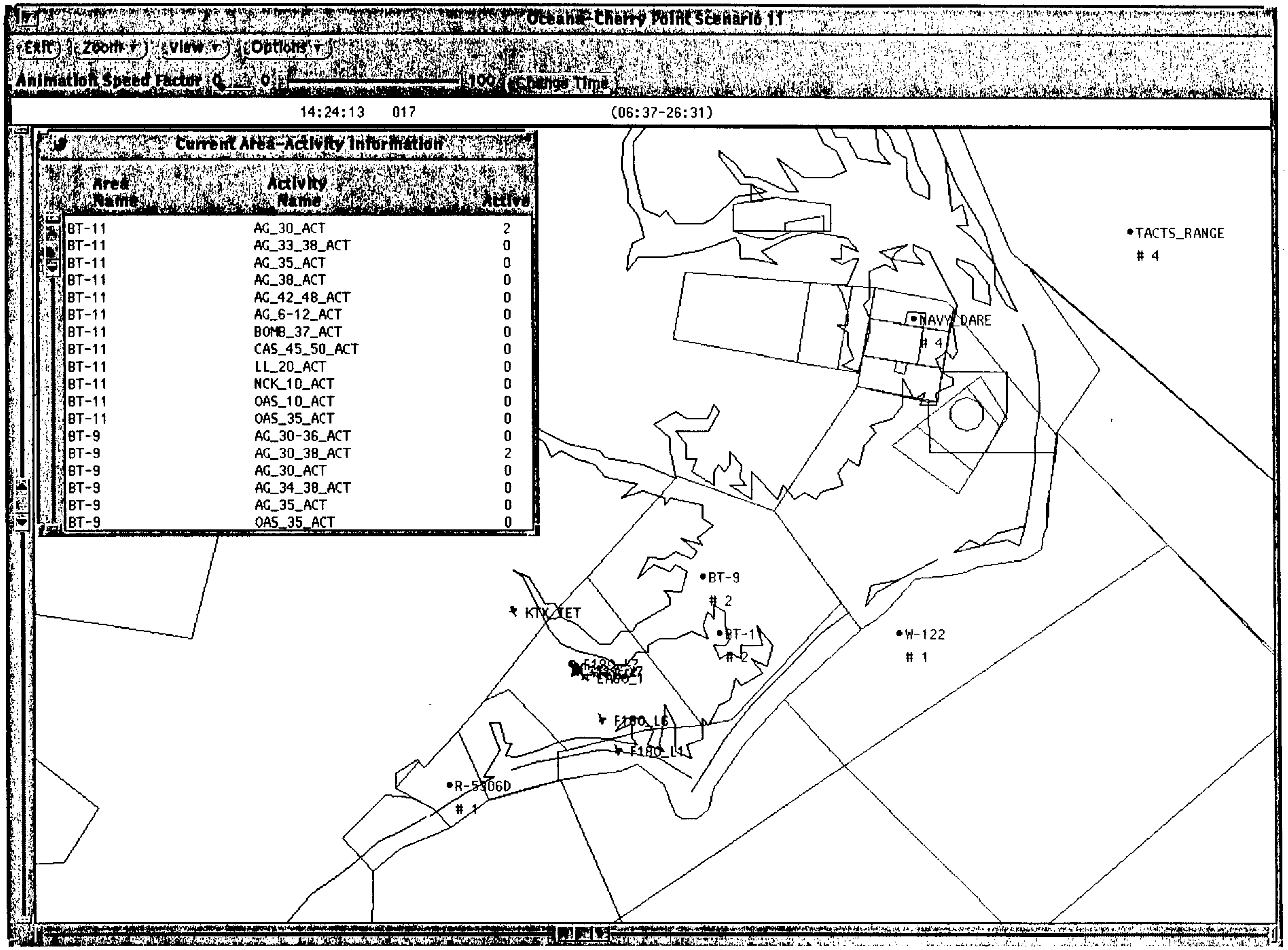


Figure D-5: Animation Snapshot of MCAS Cherry Point Region Airspace Operations

NASMOD

GLOSSARY, ACRONYMS AND ABBREVIATIONS, AND REFERENCES

GLOSSARY

Term	Acronym	Definition
		(* = adapted from FAA, 7110.65H Air Traffic Control, "Glossary")
Air traffic control assigned airspace	ATCAA	*Airspace of defined vertical/lateral limits, assigned by ATC, for the purpose of providing air traffic segregation between the specified activities being conducted within the assigned airspace and other IFR air traffic.
Airfield event		An aircraft operation on the surface or in the vicinity of an airfield. Examples include a departure, an arrival, a touch-and-go pass, an FCLP pass, an overhead break, a pad landing, a low approach.
Airfield operation		An airfield event that is a landing or a takeoff. Examples include a departure, an arrival, a pad landing. Touch-and-go landings, FCLPs, and low approaches count as two airfield operations each (e.g., the "touch" and the "go").
Alert area	A-	*A type of special use airspace that may contain a high volume of pilot training activities or an unusual type of aerial activity, neither of which is hazardous to aircraft.
Arrival		An aircraft landing out of non-local traffic or from local training areas. The landing may be to a full stop or may continue without stopping into, for example, a touch-and-go or low approach airfield event.
Break		See *Overhead break*
Controlled airspace		*An airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification.
Cross-country		A type of flight that normally spans more than one day from time of departure from base to time of return to base.
Departure		An aircraft taking off to non-local traffic or to local training areas. The takeoff may be after taxi from the flight line or after completing, for example, a touch-and-go or low approach airfield event.
Detachment		The movement of all or part of a squadron from the normal home base to another location for a temporary period of time in order to conduct a prescribed set of training exercises.
Division flight		A flight of three or four aircraft.
Field carrier landing practice	FCLP	A training event that uses the airfield to practice landings on an aircraft carrier.

Final approach		*A component of an airfield's traffic pattern: a flight path in the direction of landing along the extended runway centerline, normally extending from the base leg to the approach end of the runway.
Fleet replacement squadron	FRS	A squadron whose mission is to train new and returning Navy and Marine aviators in the operation of a particular type of aircraft.
Flight		One or more aircraft departing a base airfield, conducting one or more missions, possibly including landings and takeoffs at other airfields, and returning to base.
Flight hour		An hour of airborne flight time, including air taxi but excluding ground taxi and other ground operations.
Flight level	FL	*A level of constant atmospheric pressure related to a reference datum of 29.92 inches of mercury; stated in three digits that represent hundreds of feet, e.g., flight level 250 (FL250) represents a barometric altimeter indication of 25,000 feet.
Ground controlled approach	GCA	*A radar approach system operated from the ground by air traffic control personnel transmitting instructions to the pilot by radio.
Instrument approach		*Also "instrument approach procedure." A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing or to a point from which a landing may be made visually.
Instrument flight rules	IFR	*Rules governing the procedures for conducting instrument flight.
Instrument meteorological conditions	IMC	*Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling less than the minima specified for visual meteorological conditions.
Landing		An aircraft approach to and touch down on the airfield surface.
Local traffic		*Aircraft operating in the traffic pattern or within sight of the tower, or aircraft departing to or arriving from flight in local training areas, or aircraft executing practice instrument approaches at the airfield.
Low approach		*An approach over an airfield or runway where the pilot intentionally does not make contact with the surface.
Military operations area	MOA	*A type of special use airspace of defined vertical and lateral dimensions established outside Class A airspace (i.e., below 18,000 feet MSL) to separate/segregate certain military activities from IFR traffic and to identify for VFR traffic where these activities are conducted.
Military training route	MTR	*Airspace of defined vertical and lateral dimensions established for the conduct of military flight training at airspeeds in excess of 250 knots.
Mission		A flight or part of a flight that accomplishes a specific purpose. Often used interchangeably with "flight."

Out-and-in flight		A flight that leaves the base airfield, operates in one or more training areas, lands at a second airfield for refueling and layover, departs the second airfield, operates in one or more training areas, and returns to the base airfield.
Overhead break		*Also "overhead maneuver" or "break." A series of predetermined maneuvers prescribed for aircraft (often in formation) for entry into the VFR traffic pattern and to proceed to a landing. A break usually includes the following components: (1) an initial approach three to five miles in length; (2) an elliptical pattern consisting of two 180-degree turns; (3) a break point at which the first 180-degree turn is started; and (4) altitude at least 500 feet above the conventional pattern.
Profile		Also "flight profile" or "mission profile." A sequence of steps that specifies the ordered elements of a flight, such as resources requested and returned, routes flown, training areas worked in and time spent there, and weather and other conditions that may abort or otherwise change the steps accomplished.
Resource		An asset whose supply is fixed and accounted for as flights request it in order to carry out their missions. If a resource is not available when requested, the mission is either delayed or aborted. Examples include aircraft, instructors, TACTS pods, and bomb racks.
Restricted area	R-	*A type of special use airspace within which the flight of aircraft, while not wholly prohibited, is subject to restriction.
Section flight		A flight of two aircraft.
Sortie		(1) In the context of squadron operations: one aircraft making one departure and one arrival. (2) In the context of training area operations: one aircraft entering a region of airspace, operating there for a period of time, and leaving.
Special use airspace	SUA	*Airspace of defined dimensions identified by an area on the surface of the earth wherein activities must be confined because of their nature and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities.
Standdown		The period of time, typically about one month, immediately after a return from a carrier deployment during which a fleet squadron performs a minimal level of flight operations.
Stereo route		*Also "coded route." A routinely used and officially established route of flight, identified by a coded name in order to minimize flight plan handling and communications.
Tactical air navigation	TACAN	*An ultra-high frequency electronic air navigation aid that provides suitably equipped aircraft a continuous indication of bearing and distance to the TACAN station.
Takeoff		An aircraft lifting off the airfield surface.

Taxi		*The movement of an airplane or wheeled helicopter under its own power on the surface of an airfield.
Touch-and-go landing		*An operation by an aircraft that lands and takes off on a runway without stopping or exiting the runway.
Traffic pattern		*The traffic flow that is prescribed for aircraft landing at, taxiing on, or taking off from an airport.
Training area		A ground or airspace area where squadron flight operations take place, e.g., a range, outlying landing field, or special use airspace.
Training event		A type of mission that accomplishes a specific training requirement.
Turnaround cycle		The period prior to deployment that a squadron spends training at its base airfield or on detachment.
Visual approach		*An approach conducted on an IFR flight plan that authorizes the pilot to proceed visually and clear of clouds to the airfield., always with the airfield or the preceding aircraft in sight.
Visual flight rules	VFR	*Rules that govern the procedures for conducting flight under visual conditions.
Visual meteorological conditions	VMC	*Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling equal to or better than specified minima.
Warning area	W-	* A type of special use airspace that may contain hazards to nonparticipating aircraft in international airspace.
Workup		The training performed by fleet squadrons between two carrier deployments.

ACRONYMS AND ABBREVIATIONS

AA	air-to-air
ACLS	automated carrier landing system
ACM	air combat maneuvers
AFB	Air Force Base
AG	air-to-ground
AGL	above ground level
AIRLANT	Naval Air Forces, Atlantic
AIRPAC	Naval Air Forces, Pacific
ARS	Alternative Realignment Scenario
ARTCC	air route traffic contol center
ATC	air traffic control
ATCAA	air traffic control assigned airspace
BRAC	Base Realignment and Closure
BT	bombing target
C2X	Competitive Training Unit Exercise
CAD	computer-aided design
CAX	Combined Arms Exercise
CCA	carrier controlled approach
CINCLANTFLT	Commander-in-Chief, Atlantic Fleet
CQ	carrier qualification
CVW	carrier airwing
FAA	Federal Aviation Administration
FACSFAC	Fleet Area Control and Surveillance Facility
FBO	forward base operations
FCLP	field carrier landing practice
FL	flight level
FMF	Fleet Marine Force
FRS	fleet replacement squadron
FTU	fighter training unit
FU	fighter unit
FWT	fighter weapons training
FY	fiscal year
GCA	ground controlled approach
GUI	graphical user interface
ICLS	instrument Carrier Landing System
IFR	Instrument Flight Rules
IMC	instrument meteorological conditions
IR	instrument route
IUT	instructor under training
JRB	Joint Reserve Base
JTFEX	Joint Training Fleet Exercise
KTS	knots (nautical miles per hour)
LAT	low altitude training
MAEWR	Mid-Atlantic Electronic Warfare Range
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCOLF	Marine Corps outlying landing field
MEU	Marine Expeditionary Unit
MOA	military operations area
MSL	mean sea level
MTR	military training route

NALF	Naval Auxiliary Landing Field
NAS	Naval Air Station
NASMOD	Naval Aviation Simulation Model
NATS	Navy Air Training System Model
NAVFAC	Naval Facilities Engineering Command
NFE	Naval Auxiliary Landing Field Fentress
NFO	Naval flight officer
NM	nautical miles
NTU	Naval Air Station Oceana
NVG	night vision goggles
OLF	outlying landing field
PALS	precision approach landing system
PAR	precision approach radar
RAC	replacement aircrew
RATCF	Radar Air Traffic Control Facility
RIO	radar intercept officer
S/F	strike/fighter
SFARP	Strike Fighter Advanced Readiness Program
SIMMOD	FAA Airfield and Airspace Capacity Model
SOA	special operating area
SOES	Station Operations and Engineering Squadron
SUA	Special Use Airspace
T&R	Training & Readiness
TACAN	Tactical Air Navigation
TACTS	Tactical Aircrew Combat Training System
TARPS	Tactical Air Reconnaissance Pod System
TSTA	Tailored Ship Training Availability
UAV	unmanned aerial vehicle
UDP	Unit Deployment Program
VACAPES	Virginia Capes
VFR	visual flight rules
VMC	visual meteorological conditions
VORTAC	Very High Frequency Omnidirectional Range Tactical Air Navigation
VR	visual route

REFERENCES

The data required for this study was collected from a wide variety of sources over a three and half year period and consists of both titled/prepared documentation (e.g., reports, letters, faxes, memos, manuals, maps) and untitled materials (e.g., computer printouts, interview notes). This section provides a listing of the significant sources that were consulting during the construction of the model.

Document Sources

Air Operations Manual, NAS Oceana, Instruction 3710.1N, 22 February 1993.

Air Operations Manual, MCAS Cherry Point, ASO P3710.5F, 5 September 1995.

Air Traffic Control Facility Manual, MCALF Bogue Field, 2 May 1996.

Air Traffic Control Training Manual, FACSFAC VACAPES Instruction 3722.2B.

Air Station Order 3570.2L – Target Facilities and Operation Areas, MCAS Cherry Point, NC – Operating Procedures for ranges within R–5306A and R–5306C.

Atlantic Fleet Manual of Fleet Operating Areas and Warning Areas, CINCLANTFLT Instruction 3120.26E.

DOD Flight Information Publication (Terminal), High Altitude United States, Instrument Approach Procedures, Airport Diagrams, Radar Instrument Approach Minimums for the Northeast United States.

Environmental Impact Statement for the Establishment of Cherry 1 and Core Military Operating Areas (MOAs) (DRAFT), January 1987.

Environmental Impact Statement for the Establishment of Cherry 1 and Core Military Operating Areas (MOAs) (FINAL), 1987.

Fleet Area Control and Surveillance Facility, Virginia Capes, FACSFACVACAPESINST 3120.1G, 7 December 1992.

Fleet Training Area/Range Directory, February 1996.

FRS Flight Syllabus Guides for the following aircraft communities:

Navy	F-14 (Summer 1995)
Marine Corps	AV-8B (June 1996)

In Flight Guide/MCAS Cherry Pt, Special Use Airspace (R–5306A) (VFR Concurrent Use) (Except BT–9/BT–11), December 1992.

Letter of Agreement, Joint Use Restricted Area Letter of Procedure, Subject: Joint Use Letter of Procedure for use of Restricted Area R–5306, June 15, 1979.

Letter of Agreement, MCAS Cherry Point RATCF and Oceana RATCF, Subject: Tower Enroute Control, 21 June 1991.

Letter of Agreement, Washington ARTCC, 2nd Marine Aircraft Wing, MCAS Cherry Point RATCF, Subject: HATTERAS F – Military Operations Area (MOA), 1 May 1989.

Letter of Agreement, Washington ARTCC, FACSFAC VACAPES, MCAS Cherry Point, and NAS Oceana ATCF, Subject: Pamlico A–B/Stumpy Point – Military Operations Areas, February 26, 1981.

Letter of Agreement, Washington Center, Marine Aircraft Group-14, and Cherry Point RATCF, Subject: Stereotyped Flight Plans for Marine Aircraft Group–14, May 1, 1993.

Letter of Agreement, Washington Center, Medium Attack Wing One, FACSFAC VACAPES, Norfolk Tower, Subject: Military Training Routes (IR), October 13, 1988.

Letter of Agreement, Washington Center and Cherry Point RATCF, Subject: Approach Control Service, September 14, 1993.

Letter of Agreement, Washington Center and MCAS Cherry Point Approach control Facility, Subject: Coordination and Use of NEUSE ATCAA, June 16, 1980.

MCAS New River Airfield and Airspace Operational Study Report, December 27, 1995.

MCAS Cherry Point Airfield and Airspace Operational Study Report (DRAFT), April 24, 1995.

NAS Oceana Local Area Forecaster's Handbook, NAVLANTMETOCDETOCEANAINST 3140.2C, 03 March 1995.

NAS Oceana RATCF Procedures, 12 May 1993 with proposed changes to reflect new routings and procedures.

Range Users Manual – Cherry Point Mid-Atlantic Electronic Warfare Range Complex (MAEWR) – Revised October 1992.

Selective Guide to Climatic Data Sources, December 1988.

Standard Operating Procedures (samples) for the following aircraft communities:

Navy	F-14
	F/A-18
Marine Corps	AV-8B

Tactical Air User's Quick-Look Guide for the MAEWR and Mid-Atlantic TACTS, May 1996.

Target Facilities and Operation Areas, MCAS Cherry Point, NC, ASO P3570.2M, 22 December 1995.

T & R Manuals for the following aircraft communities:

Navy	F-14
	F/A-18
Marine Corps	AV-8B
	EA-6B
	KC-130

Data Sources

Daily warning area usage (W-386, W-72, W-108, W-122) by Air Force 1st Fighter Wing, June 1994 to June 3 1995.

Interviews with Navy, Marine Corps, and Air Force personnel regarding pilot training, flight scheduling, mission planning, and airspace utilization.

Monthly data for FY93 from NAS Oceana-based squadrons.

Monthly operations count for NAS Oceana and NALF Fentress for FY93-FY95.

Monthly usage data for R–5301, R–5302 (A–C), R–5306 (A, C, BT–9, BT–11), R–5313 (A–D), R–5314, R–6609, Hatteras F MOA, Pamlico (A–B) MOAs, Stumpy Point MOA, W–110, W–72 (A–B), and W–122 (A–J) for October 1992 to June 1995.

NAS Oceana TACTS Utilization Summary, October 1992 – June 1995.

Navy Dare County Bombing Range quarterly summaries for July 1992 – June 1995, monthly summaries for April 1993 –June 1993, and daily schedules for October 1994 – February 1995.

Palmetto Point MOA, and Stumpy Point MOA monthly activity summaries for the period October 1992 – September 1993 and daily schedules for October 1994 – February 1995.

BT-9 and BT-11 Utilization Summaries, FY93 – FY95.

International Station Meteorological Summary, Oceana NAS, VA, NCDC Asheville NC, July 1995.

Personnel Sources

The most important sources of information for this study are the personnel who have expert knowledge of operations being simulated. Most of the information entered into the model are derived directly through interviews with these individuals. Any data obtained through document sources were verified by appropriate personnel.

The following list is a compilation of those whose input has directly supported the effort to complete this study. The ranks, rates, and roles listed below were current at the time that individual contributed to the study.

LT	R.	Bates	Airspace Liaison Officer, FACSFAC VACAPES
MAJ	R.	Baxter	S-3, EA-6B, MAG-14, MCAS Cherry Point
ACC	R.	Bernier	Assistant Airspace Liaison Officer, FACSFAC VACAPES
MAJ		Bigelow	S-3, AV-8B, MAG-14, MCAS Cherry Point
LT	C.	Bolt	Scheduling Officer, VAW-120, NAS Norfolk
LCDR		Bowman	VFA-106, NAS Cecil Field
CAPT	L.	Brock	Schedules, 23OSS/OSOSF, Pope AFB
	C.	Brown	Range Schedules, FACSFAC VACAPES

	D.	Brown	Air Operations, MCAS Cherry Point
LCDR	M.	Cartier	Readiness Officer, COMNAVAIRLANT
	D.	Cecchini	Environmental Planning, NAVFACLANTDIV
MAJ	R.	Claypool	Maintenance Officer, VMAT-203, MCAS Cherry Point
CDR	R.	D'Adiomoff	Executive Officer, VFC-12, NAS Oceana
CDR	D.	Dervay	Readiness Officer, FITWINGLANT, NAS Oceana
LT	B.	Dickerson	Landing Signal Officer, VAW-120, NAS Norfolk
LTCOL		Dobson	Operations Officer, MAG-31
	D.	Donata	FAA Representative, NAS Oceana
CAPT	D.	Drew	Safety Officer, VMA-542, MCAS Cherry Point
LCDR	V.	Drouillard	F-14 Training Readiness, COMNAVAIRPAC, NAS North Island
CAPT	R.	Eason	COMNAVAIRLANT
MAJ	D.	Garnish	Aircrew Programs, HQMC ASM
CAPT		Greer	VMA-231, MCAS Cherry Point
CWO4	E.	Grigalis	VMGR-252, MCAS Cherry Point
LCDR	D.	Hafer	FITWINGPAC
CDR	D.	Handforth	Comptroller, NAS Oceana
ACCS	J.	Heard	Radar, FACSFAC VACAPES
LCDR	E.	Hinger	Operations Officer, VAW-120, NAS Norfolk
LT	W.	Hitchcock	Landing Signal Officer, VRC-40, NAS Norfolk
LT	B.	Hoffmann	Landing Signal Officer, VAW-125, NAS Norfolk
MAJ	P.	Hogan	Future Operations Officer, G-3, 2d MAW, MCAS Cherry Point
	J.	Hughes	ATC Supervisor, MCAS Cherry Point
LTCOL	A.	Johnson	Navy Representative to the FAA, Southeast Region
LCDR	K.	Johnson	Executive Officer, VFA-106, NAS Cecil Field
	K.	Johnson	ATC Supervisor, MCAS Cherry Point
MAJ	C.	Jones	Operations Officer, VMAT-203, MCAS Cherry Point
LTCOL	K.	Kachmar	Operations Officer, MAG-14, MCAS Cherry Point
CAPT		Keeler	VMGRT-253, MCAS Cherry Point
	J.	Kooderings-Clemens	Airspace Management, 1OSS/OSO, Langley AFB
CAPT	R.	Kucuck	Schedules, VMAT-203, MCAS Cherry Point
	A.	Ladd	Airspace Management, 23OSS/OSR, Seymour Johnson AFB
CAPT	D.	Law	Carrier Schedules, COMNAVAIRLANT
COL		Lloyd	Directorate of Operations, MCAS Cherry Point
LCDR	G.	Luttrell	F-14 Training Readiness, COMNAVAIRLANT
LCDR	G.	Magill	Operations Officer, FITWINGLANT
CDR	G.	Mayer	Commanding Officer, VFA-106, NAS Cecil Field
LCDR	J.	Mazanowski	Operations Officer, FITWINGLANT
ACC	M.	McCarthy	ATC Tower, NAS Oceana
MAJ	M.	Micucci	MWSS-271, MCAS Cherry Point
CDR	E.	Miller	Comptroller, NAS Oceana
ACC	M.	Moon	ATC Radar, NAS Oceana
LCDR	J.	Moynihan	VFA-106, NAS Cecil Field
MAJ	L.	Muhlenberg	ATC Facility Officer, MCAS Cherry Point
LCDR	P.	Norris	Airspace, COMNAVAIRLANT
MAJ	G.	Nysven	Air Operations Officer, MCALF Bogue Field
	L.	Pickett	Airspace and Range Management, 4OSS/OSTR, Seymour Johnson AFB
MAJ	R.	Pomarico	Operations Officer, VMA-542, MCAS Cherry Point

CAPT	L.	Reading	VMGRT-253, MCAS Cherry Point
	J.	Reilly	COMCAB BRAC, MCAS Cherry Point
	J.	Reuther	BRAC Coordinator, NAVFACLANTDIV
	D.	Savage	TACTS/MAEWR Operations, MCAS Cherry Point
	R.	Schenck	Airspace Management, HQ ACC/DOS
CDR	B.	Schnabel	Operations Officer, STKFITWINGLANT
	T.	Sears	Range Schedules, MCAS Cherry Point
LCDR	M.	Seelenbinder	Strike Operations, CVW-1
CAPT		Simmons	G-3, 2d MAW, MCAS Cherry Point
LCDR	L.	Spradlin	Airspace, COMNAVAIRLANT
AC1		Stahl	ATC Radar, NAS Oceana
CAPT	S.	Taylor	FRAGS Officer, G-3, 2d MAW, MCAS Cherry Point
LCDR	K.	Thompson	F/A-18 Training Readiness, COMNAVAIRLANT
MAJ	D.	Tracy	Schedules, 4OSS/OSOT, Seymour Johnson AFB
LCDR	J.	Tibbels	Operations Officer, VF-101, NAS Oceana
CAPT	C.	Tjark	VMAT-203, MCAS Cherry Point
	D.	Walczak	FAA Representative, MCAS Cherry Point
	O.	Wood	Target Schedules, MCAS Cherry Point
MAJ	M.	Wright	TEEPS Officer, G-3, 2d MAW, MCAS Cherry Point
CAPT		York	Schedules, 4OSS/OSOT, Seymour Johnson AFB

D Suggested Compatible Land Uses in Noise and Accident Potential Zones

Derived from Chief of Naval Operations Instruction (OPNAVINST) 11010.36A, *AICUZ Program Procedures and Guidelines for Department of the Navy Air Installations*.

AICUZ PROGRAM PROCEDURES AND GUIDELINES FOR DEPARTMENT OF THE NAVY AIR INSTALLATIONS

TABLE 1. SUGGESTED LAND USE COMPATIBILITY IN NOISE ZONES

LAND USE		NOISE ZONES/DNL Levels in L_{dn}						
		1		2		3		
SLUCM NO.	NAME	0-55	55-65	65-70	70-75	75-80	80-85	85+
10	Residential							
11	Household units							
11.11	Single units; detached	Y	Y*	25[1]	30[1]	N	N	N
11.12	Single units; semidetached	Y	Y*	25[1]	30[1]	N	N	N
11.13	Single units; attached row	Y	Y*	25[1]	30[1]	N	N	N
11.21	Two units; side-by-side	Y	Y*	25[1]	30[1]	N	N	N
11.22	Two units; one above the other	Y	Y*	25[1]	30[1]	N	N	N
11.31	Apartments; walk up	Y	Y*	25[1]	30[1]	N	N	N
11.32	Apartments; elevator	Y	Y*	25[1]	30[1]	N	N	N
12	Group quarters	Y	Y*	25[1]	30[1]	N	N	N
13	Residential hotels	Y	Y*	25[1]	30[1]	N	N	N
14	Mobile home parks or courts	Y	Y*	N	N	N	N	N
15	Transient lodgings	Y	Y*	25[1]	30[1]	35[1]	N	N
16	Other residential	Y	Y*	25[1]	30[1]	N	N	N
20	Manufacturing							
21	Food & kindred products; manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
22	Textile mill products; manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
23	Apparel and other finished products made from fabrics, leather, and similar materials; manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
24	Lumber and wood products (except furniture); manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
25	Furniture and fixtures; manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
26	Paper & allied products; manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
27	Printing, publishing, and allied industries	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
28	Chemicals and allied products; manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
29	Petroleum refining and related industries	Y	Y	Y	Y[2]	Y[3]	Y[4]	N

*The designation of these uses as "compatible" in this zone reflects individual Federal agencies' consideration of general cost and feasibility factors as well as past community experiences and program objectives. Localities, when evaluating the application of these guidelines to specific situations, may have different concerns or goals to consider (Guidelines for Considering Noise in Land Use Planning and Control, June 1980).

TABLE 1. SUGGESTED LAND USE COMPATIBILITY IN NOISE ZONES

LAND USE		NOISE ZONES/DNL Levels in L_{dn}						
SLUCM		1		2		3		
NO.	NAME	0-55	55-65	65-70	70-75	75-80	80-85	85+
30	Manufacturing (cont'd)							
31	Rubber and misc. plastic products; manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
32	Stone, clay and glass products; manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
33	Primary metal industries	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
34	Fabricated metal products; manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
35	Professional, scientific, and controlling instruments; photographic and optical goods; watches and clocks - manufacturing	Y	Y	Y	25	30	N	N
39	Miscellaneous manufacturing	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
40	Transportation, communication and utilities							
41	Railroad, rapid rail transit and street railway transportation	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
42	Motor vehicle transportation	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
43	Aircraft transportation	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
44	Marine craft transportation	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
45	Highway & street right-of-way	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
46	Automobile parking	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
47	Communication	Y	Y	Y	25[5]	30[5]	N	N
48	Utilities	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
49	Other transportation, communication and utilities	Y	Y	Y	25[5]	30[5]	N	N
50	Trade							
51	Wholesale trade	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
52	Retail trade - building materials, hardware and farm equipment	Y	Y	Y	Y[2]	Y[3]	Y[4]	N
53	Retail trade - general merchandise	Y	Y	Y	25	30	N	N
54	Retail trade - food	Y	Y	Y	25	30	N	N
55	Retail trade - automotive, marine craft, aircraft and accessories	Y	Y	Y	25	30	N	N
56	Retail trade - apparel and accessories	Y	Y	Y	25	30	N	N
57	Retail trade - furniture, home furnishings and equipment	Y	Y	Y	25	30	N	N
58	Retail trade - eating and drinking establishments	Y	Y	Y	25	30	N	N
59	Other retail trade	Y	Y	Y	25	30	N	N

TABLE 1. SUGGESTED LAND USE COMPATIBILITY IN NOISE ZONES

LAND USE		NOISE ZONES/DNL Levels in L_{dn}						
		1		2		3		
SLUCM NO.	NAME	0-55	55-65	65-70	70-75	75-80	80-85	85+
60	Services							
61	Finance, insurance and real estate services	Y	Y	Y	25	30	N	N
62	Personal services	Y	Y	Y	25	30	N	N
62.4	Cemeteries	Y	Y	Y	Y2	Y3	Y4,11	Y6,11
63	Business services	Y	Y	Y	25	30	N	N
64	Repair services	Y	Y	Y	Y2	Y3	Y4	N
65	Professional services	Y	Y	Y	25	30	N	N
65.1	Hospitals, nursing homes	Y	Y*	25*	30*	N	N	N
65.1	Other medical facilities	Y	Y	Y	25	30	N	N
66	Contract construction services	Y	Y	Y	25	30	N	N
67	Governmental services	Y	Y*	Y*	25*	30*	N	N
68	Educational services	Y	Y*	25*	30*	N	N	N
69	Miscellaneous services	Y	Y	Y	25	30	N	N
70	Cultural, entertainment and recreational							
71	Cultural activities (including churches)	Y	Y*	25*	30*	N	N	N
71.2	Nature exhibits	Y	Y*	Y*	N	N	N	N
72	Public assembly	Y	Y	Y	N	N	N	N
72.1	Auditoriums, concert halls	Y	Y	25	30	N	N	N
72.11	Outdoor music shells, amphitheaters	Y	Y*	N	N	N	N	N
72.2	Outdoor sports arenas, spectator sports	Y	Y	Y7	Y7	N	N	N
73	Amusements	Y	Y	Y	Y	N	N	N
74	Recreational activities (incl. golf courses, riding stables, water recreation)	Y	Y*	Y*	25*	30*	N	N
75	Resorts and group camps	Y	Y*	Y*	Y*	N	N	N
76	Parks	Y	Y*	Y*	Y*	N	N	N
79	Other cultural, entertainment and recreation	Y	Y*	Y*	Y*	N	N	N
80	Resource production and extraction.							
81	Agriculture (except livestock)	Y	Y	Y8	Y9	Y10	Y10,11	Y10,11
81.5 81.7	Livestock farming and animal breeding	Y	Y	Y8	Y9	N	N	N
82	Agricultural related activities	Y	Y	Y8	Y9	Y10	Y10,11	Y10,11
83	Forestry activities and related services	Y	Y	Y8	Y9	Y10	Y10,11	Y10,11
84	Fishing activities and related services	Y	Y	Y	Y	Y	Y	Y
85	Mining activities and related services	Y	Y	Y	Y	Y	Y	Y
89	Other resource production and extraction	Y	Y	Y	Y	Y	Y	Y

NOTES FOR TABLE 1

1. a) Although local conditions regarding the need for housing may require residential use in these zones, residential use is discouraged in DNL 65-70 and strongly discouraged in DNL 70-75. The absence of viable alternative development options should be determined and an evaluation should be conducted prior to approvals indicating that a demonstrated community need for the residential use would not be met if development were prohibited in these zones.

   b) Where the community determines that residential uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25 dB (DNL 65-70) and 30 dB (DNL 70-75) should be incorporated into building codes and be considered in individual approvals. Normal construction can be expected to provide a NLR of 20 dB, thus the reduction requirements are often stated as 5, 10 or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. Additional consideration should be given to modifying NLR levels based on peak noise levels or vibrations.

   c) NLR criteria will not eliminate outdoor noise problems. However, building location and site planning, design and use of berms and barriers can help mitigate outdoor noise exposure particularly from ground level sources. Measures that reduce noise at a site should be used wherever practical in preference to measures which only protect interior spaces.

2. Measures to achieve NLR of 25 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

3. Measures to achieve NLR of 30 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low

4. Measures to achieve NLR of 35 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low

5. If project or proposed development is noise sensitive, use indicated NLR; if not, land use is compatible without NLR.

6. No buildings.

7. Land use compatible provided special sound reinforcement systems are installed.

8. Residential buildings require a NLR of 25.

9. Residential buildings require a NLR of 30.

10. Residential buildings not permitted.

11. Land use not recommended, but if community decides use is necessary, hearing protection devices should be worn by personnel.

KEY TO TABLE 1

SLUCM	Standard Land Use Coding Manual
Y (Yes)	Land Use and related structures compatible without restrictions.
N (No)	Land Use and related structures are not compatible and should be prohibited.
NLR (Noise Level Reduction)	Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.
Y^{X} (Yes with restrictions)	Land Use and related structures generally compatible; see notes 2 through 4.
25, 30, or 35	Land Use and related structures generally compatible; measures to achieve NLR of 25, 30 or 35 must be incorporated into design and construction of structure.
25*, 30* or 35*	Land Use generally compatible with NLR; however, measures to achieve an overall noise reduction do not necessarily solve noise difficulties and additional evaluation is warranted.
DNL	Day-Night Average Sound Level.
L_{dn}	Mathematical symbol for DNL.

TABLE 4. SUGGESTED LAND USE COMPATIBILITY IN ACCIDENT POTENTIAL ZONES

LAND USE: SLUCM NO.	LAND USE: NAME	CLEAR ZONE	APZ-1	APZ-2
10	Residential			
11	Household units			
11.11	Single units: detached	N	N	Y[1]
11.12	Single units: semidetached	N	N	N
11.13	Single units: attached row	N	N	N
11.21	Two units: side-by-side	N	N	N
11.22	Two units: one above the other	N	N	N
11.31	Apartments: walk up	N	N	N
11.32	Apartments: elevator	N	N	N
12	Group quarters	N	N	N
13	Residential hotels	N	N	N
14	Mobile home parks or courts	N	N	N
15	Transient lodgings	N	N	N
16	Other residential	N	N	N[1]
20	Manufacturing			
21	Food & kindred products; manufacturing	N	N[2]	Y
22	Textile mill products; manufacturing	N	N[2]	Y
23	Apparel and other finished products made from fabrics, leather, and similar materials: manufacturing	N	N	N[2]
24	Lumber and wood products (except furniture); manufacturing	N	Y[2]	Y
25	Furniture and fixtures; manufacturing	N	Y[2]	Y
26	Paper & allied products: manufacturing	N	Y[2]	Y
27	Printing, publishing, and allied industries	N	Y[2]	Y
28	Chemicals and allied products; manufacturing	N	N	N[2]
29	Petroleum refining and related industries	N	N	N

TABLE 4. SUGGESTED LAND USE COMPATIBILITY IN ACCIDENT POTENTIAL ZONES

LAND USE		CLEAR ZONE	APZ-1	APZ-2
SLUCM NO.	NAME			
30	Manufacturing (cont'd)			
31	Rubber and misc. plastic products; manufacturing	N	N[2]	N[2]
32	Stone. clay and glass products; manufacturing	N	N[2]	Y
33	Primary metal industries	N	N[2]	Y
34	Fabricated metal products; manufacturing	N	N[2]	Y
35	Professional. scientific. and controlling instruments; photographic and optical goods; watches and clocks - manufacturing	N	N	N[2]
39	Miscellaneous manufacturing	N	Y[2]	Y[2]
40	Transportation. communi- and utilities			
41	Railroad. rapid rail transit and street railway transportation	N[3]	Y[4]	Y
12	Motor vehicle transportation	N[3]	Y	Y
43	Aircraft transportation	N[3]	Y[4]	Y
44	Marine craft transportation	N[3]	Y[4]	Y
45	Highway & street right-of-way	N[3]	Y	Y
46	Automobile parking	N[3]	Y[4]	Y
47	Communication	N[3]	Y[4]	Y
48	Utilities	N[3]	Y[4]	Y
49	Other transportation. communication and utilities	N[3]	Y[4]	Y
50	Trade			
51	Wholesale trade	N	Y[2]	Y
52	Retail trade - building materials. hardware and farm equipment	N	Y[2]	Y
53	Retail trade - general merchandise	N	N[2]	Y[2]
54	Retail trade - food	N	N[2]	Y[2]
55	Retail trade - automotive. marine craft. aircraft and accessories	N	Y[2]	Y
56	Retail trade - apparel and accessories	N	N[2]	Y[2]
57	Retail trade - furniture. home furnishings and equipment	N	N[2]	Y[2]
58	Retail trade - eating and drinking establishments	N	N	N[2]
59	Other retail trade	N	N[2]	Y[2]

TABLE 4. SUGGESTED LAND USE COMPATIBILITY IN ACCIDENT POTENTIAL ZONES

LAND USE SLUCM NO.	LAND USE NAME	CLEAR ZONE	APZ-1	APZ-2
60	Services			
61	Finance, insurance and real estate services	N	N	Y^6
62	Personal services	N	N	Y^6
62.4	Cemeteries	N	Y^7	Y^7
63	Business services	N	Y^8	Y^8
64	Repair services	N	Y^2	Y
65	Professional services	N	N	Y^6
65.1	Hospitals, nursing homes	N	N	N
65.1	Other medical facilities	N	N	N
66	Contract construction services	N	Y^6	Y
67	Governmental services	N	N	Y^6
68	Educational services	N	N	N
69	Miscellaneous services	N	N^2	Y^2
70	Cultural, entertainment and recreational			
71	Cultural activities (including churches)	N	N	N^2
71.2	Nature exhibits	N	Y^2	Y
72	Public assembly	N	N	N
72.1	Auditoriums, concert halls	N	N	N
72.11	Outdoor music shells, amphitheaters	N	N	N
72.2	Outdoor sports arenas, spectator sports	N	N	N
73	Amusements	N	N	Y^8
74	Recreational activities (incl. golf courses, riding stables, water recreation)	N	$Y^{8,9,10}$	Y
75	Resorts and group camps	N	N	N
76	Parks	N	Y^8	Y^8
79	Other cultural, entertainment and recreation	N	Y^9	Y^9
80	Resource production and extraction			
81	Agriculture (except livestock)	Y	Y	Y
81.5) 81.7)	Livestock farming and animal breeding	N	Y	Y
82	Agricultural related activities	N	Y^5	Y
83	Forestry activities and related services	N^5	Y	Y
4	Fishing activities and related services	N^5	Y^5	Y
85	Mining activities and related services	N	Y^5	Y
89	Other resource production and extraction	N	Y^5	Y

NOTES TO TABLE 4

1. Suggested maximum density 1-2 dwelling units per acre, possibly increased under a Planned Unit Development (PUD) where maximum lot coverage is less than 20 percent.

2. Within each land use category, uses exist where further evaluation may be needed due to the variation of densities of people and structures. For example, where a small neighborhood retail store may be compatible in APZ-II, a shopping center or strip shopping mall would be incompatible due to the density of development and concentration of people.

3. The placing of structures, buildings or above-ground utility lines in the clear zone is subject to severe restrictions. In a majority of the clear zones, these items are prohibited. See NAVFAC P-80.3 (NOTAL) for specific guidance.

4. No passenger terminals and no major above-ground transmission lines in APZ-I.

5. Factors to be considered: labor intensity, structural coverage, explosive characteristics, air pollution.

6. Low-intensity office uses only. Meeting places, auditoriums, etc., not recommended.

7. Excludes chapels.

8. Facilities must be low intensity.

9. Clubhouse not recommended.

10. Large classes not recommended.

E Air Conformity Determination Report

Draft Clean Air Act Conformity Determination Realignment of F/A-18 Aircraft and Operational Functions to Naval Air Station Oceana, Virginia

August 1997

Prepared by:

DEPARTMENT OF THE NAVY

Executive Summary

Implementation of the 1995 mandates of the Base Closure and Realignment Commission will result in transferring 11 F/A-18 operational squadrons and the F/A-18 Fleet Replacement Squadron (FRS) (180 aircraft) from Naval Air Station (NAS) Cecil Field to other east coast installations. The Navy is currently considering alternative realignment scenarios that would involve transferring these aircraft to one or more installations. One of these scenarios may result in 11 operational squadrons and the FRS of F/A-18 aircraft (180 aircraft) being realigned to NAS Oceana, Virginia Beach, Virginia. This action, if implemented, would include the transfer of approximately 4,100 military and 100 civilian personnel to the station. To accommodate the realignment, some existing facilities would require construction/modification. In addition, this action would affect the level of aircraft operations (e.g., landings, takeoffs, touch-and-go operations, and interfacility flights) at both NAS Oceana and Naval Auxiliary Landing Field (NALF) Fentress, the station's outlying landing field. The purpose of this study is to determine whether this federal action (i.e., this alternative) resulting from the 1995 mandates is subject to the requirements of the Clean Air Act (CAA) General Conformity Rule. The site of this federal action is within a marginal ozone nonattainment area called the Hampton Roads Ozone Nonattainment Area in Virginia. This nonattainment designation is current as of August 15, 1997.

In addition to the proposed F/A-18 realignment, the Navy is currently undertaking other actions that will affect aircraft loadings at NAS Oceana. These actions include a planned decommissioning of all A-6 aircraft, changes in the number of F-14 aircraft, and other Base Closure and Realignment (BRAC) actions. The net effects of these actions and the proposed F/A-18 realignment to NAS Oceana are assessed in this document.

Emissions of volatile organic compounds (VOCs) and oxides of nitrogen (NO_x), both ozone precursor compounds, are the focus of this conformity determination. Total annual emissions of ozone precursors include emissions from aircraft flight operations at both NAS Oceana and NALF Fentress, stationary source emissions at NAS Oceana including out-of-aircraft engine testing, other mobile source emissions such as in-aircraft engine testing, ground support equipment, and construction-related emissions. The Navy's initial projection of net annual VOC emissions caused by this alternative realignment scenario (i.e., in the full buildout year—1999) is 105 tons per year, which exceeds the *de minimis* exemption levels specified under the General Conformity Rule (i.e., 100 tons per year) by 5 tons. Initial projections of reasonably foreseeable net annual emissions of NO_x total approximately 396 tons per year in 1999, exceeding the *de minimis* exemption levels by approximately 296 tons. Exceeding the *de minimis* exemption levels of nonattainment pollutants requires a formal determination that the federal action conforms with the Commonwealth of Virginia's State Implementation Plan (SIP).

The Commonwealth of Virginia has submitted an ozone maintenance plan to the United States Environmental Protection Agency (EPA) in accordance with the CAA. The Navy has coordinated with the Virginia Department of Environmental Quality to incorporate the projected net emissions associated with the proposed action into the maintenance plan to demonstrate conformity with the Virginia SIP.

1 Introduction

As a result of the 1995 Base Closure and Realignment Commission (Commission) mandates, Naval Air Station (NAS) Cecil Field in Jacksonville, Florida, will be closed, and its critical functions and assets will be transferred to other installations. F/A-18 operational aircraft includes 11 operational squadrons and the F/A-18 Fleet Replacement Squadron (FRS), or a total of 180 aircraft. The Navy is currently considering alternative realignment scenarios involving transferring these aircraft to one or more installations along the east coast. Under one of these alternatives, 11 operational squadrons of F/A-18 aircraft and the F/A-18 FRS may be realigned from NAS Cecil Field, Florida, to NAS Oceana, Virginia Beach, Virginia. The purpose of this conformity review is to demonstrate that direct and indirect air pollutant emissions associated with the proposed construction and operational changes necessary to facilitate the alternative realignment scenario at NAS Oceana are in accordance with the requirements of the 1990 amendments to the Clean Air Act (CAA) as implemented through 40 Code of Federal Regulations (CFR) Parts 6, 51, and 93, *Determining Conformity of General Federal Actions to State or Federal Implementation Plans*, which is also known as the "General Conformity Rule."

A comprehensive analysis of the environmental consequences of this realignment is being conducted in compliance with the National Environmental Policy Act (NEPA), and the results will be presented in an Environmental Impact Statement (EIS). This conformity review has been conducted in compliance with the CAA as amended (42 United States Code [USC] 7476[c]), the General Conformity Rule, and the *Draft Chief of Naval Operations Interim Guidance on Compliance with the Clean Air Act General Conformity Rule*.

The federal action, as defined in 40 CFR 93.152, consists of two components: new construction and renovation of existing facilities to support the realignment; and operational changes at and between NAS Oceana and its outlying landing field, Naval Auxiliary Landing Field (NALF) Fentress (i.e., changes in the level of aircraft operations such as landings, takeoffs, touch-and-go operations, and interfacility flights).

1.1 Site Location

NAS Oceana occupies 5,650 acres (2,288 hectares) in southeastern Virginia, within the corporate limits of the City of Virginia Beach, approximately 10 miles (16.1 kilometers) east of the City of Norfolk, Virginia (see Figures 1-1 and 1-2). The commanding officer of NAS Oceana also is in charge of NALF Fentress, which is located in Chesapeake, Virginia. This facility is used for training operations associated with aircraft at the station (U.S. Navy 1985).

NAS Oceana and NALF Fentress are located in the Hampton Roads Air Quality Region, which includes the counties of James City, York, Isle of Wight, Accomack, Northampton and Southampton, and the cities of Virginia Beach, Chesapeake, Norfolk, Portsmouth, Suffolk, Newport News, Hampton, Williamsburg, and Poquoson (see Figure 1-3) (VDEQ 1994). With the exception of Isle of Wight, Accomack, Northampton and Southampton counties, this area is currently designated as a marginal nonattainment area for ozone (VDEQ 1994).

1.2 Defense Base Closure and Realignment Act

As the U.S. Congress reduced defense spending after the end of the Cold War, it sought to establish a process to close and realign military installations in the United States to achieve long-term cost savings. In 1990, Congress enacted the Defense Base Closure and Realignment Act (hereafter referred to as BRAC). Under this statute, the U.S. Secretary of Defense is required to prepare a Force Structure Plan, and evaluate and submit a list of base closures and realignments to an independent commission. The commission is to convene public hearings, review selected installations according to the Force Structure Plan and selection criteria, amend the list as necessary, and then submit the list to the President and Congress for approval. Once the list is approved, the Secretary of Defense is required to proceed with the specified closures and realignments. This process was conducted in 1991, 1993, and 1995.

Under the Commission's 1993 mandates, NAS Cecil Field in Jacksonville, Florida will be closed. Aircraft currently stationed at NAS Cecil Field will be realigned to "other naval air stations, primarily NAS Oceana; Marine Corps Air Station (MCAS) Beaufort, South Carolina; NAS Jacksonville, Florida; and NAS Atlanta, Georgia, or other Navy or Marine Corps air stations with the necessary capacity and support infrastructure." Because of the non-specific language of the 1995 BRAC mandates, the Navy is formulating alternative realignment scenarios for transferring NAS Cecil Field aircraft to other east coast installations. Under one of these alternatives, 11 Atlantic Fleet F/A-18 Operational Squadrons, each consisting of 12 aircraft, and one F/A-18 Fleet Replacement Squadron (FRS), consisting of 48 aircraft, or a total of 180 aircraft, may be realigned to NAS Oceana by 1999 (U.S. Navy 1995a).

1.3 Other Issues Affecting Realignment at NAS Oceana

The Navy is currently undertaking additional actions that will affect future aircraft loadings at NAS Oceana. These actions involve changes in the population of F-14 and A-6 aircraft at NAS Oceana, and other BRAC actions at the station.

As of 1993, 86 A-6 aircraft were stationed at NAS Oceana. The Navy has taken steps to gradually phase out all A-6 aircraft (and associated support and training activities) by the middle of fiscal year (FY) 1997 (U.S. Navy 1994). In FY 1996, 14 A-6 aircraft remained at NAS Oceana (U.S. Navy 1995a).

In addition, as a result of the 1993 BRAC recommendations, one F-14 FRS Detachment, consisting of eight F-14 aircraft, were relocated from the West Coast to NAS Oceana in October 1996 (i.e., first month of FY 1997).

Under a separate 1995 BRAC mandate, Pacific Fleet F-14 aircraft stationed at NAS Miramar, California, and their associated military and civilian personnel have been transferred to NAS Oceana. This move capitalizes on existing F-14 support and takes advantage of excess capacity at NAS Oceana (BRAC 1995). This 1995 F-14 realignment involves the relocation of four Pacific Fleet operational squadrons, each containing 14 F-14 aircraft, or a total of 56 aircraft, to the station by 1997 (U.S. Navy 1995a). These squadrons joined the existing six Atlantic Fleet F-14 operational squadrons and the F-14 FRS currently stationed at NAS Oceana.

Finally, under a separate action unrelated to BRAC, one F-14A squadron, consisting of 14 aircraft, has been transferred to the station from NAS Miramar and would have the same operating mission as Atlantic Fleet F/A-18 aircraft. This squadron would fulfill this mission until additional F/A-18 aircraft are added to the Navy's inventory.

These other actions were the subject of separate NEPA documentation and air conformity reviews. The 1993 and 1995 BRAC actions involving F-14 aircraft were exempted from the General Conformity Rule since the net air emissions were below *de minimis* levels established under the rule (see Section 2.2 for discussion of *de minimis* levels). The movement of the single squadron of F-14A aircraft to fulfill F/A-18 mission requirements was also exempted from the General Conformity Rule since emissions were below *de minimis*. However, the net impacts on air quality of these other actions at Oceana are considered in the analysis for this action.

As presented in Table 1-1, these separate actions will result in an increase of 129 total aircraft from 1993 levels at the station. In 1999, 402 aircraft will be based at NAS Oceana. As a result, personnel loadings at NAS Oceana will increase during this from approximately 10,500 military and civilian personnel in 1993 to approximately 13,700 personnel in 1999 (U.S. Navy 1995a).

Table 1-1

HISTORIC AND PROJECTED AIRCRAFT LOADING AT NAS OCEANA[a]

Aircraft Type	1993 Total	1995	1996	1997	1998	1999
A-6	86	29[b]	14[b]	0[b]	0	0
F-14A	80	79[b]	93[c]	121[d]	115[b]	115[b]
F-14B	55	55	55	55	55	55
F-14D	0	0	14[e]	36[f]	36	36
A-4E	3	0[b]	0	0	0	0
A-4F	15	0[b]	0	0	0	0
F-5E	4	0[b]	0	0	0	0
F-5F	1	0[b]	0	0	0	0
F-16N	5	0[b]	0	0	0	0
F/A-18	0	12[g]	12	12	132[h]	192[h]
UH-3H	2	2	2	0[b]	0	0
TA-4J	9	0[b]	0	0	0	0
TC-4C	4	0[b]	0	0	0	0
TF-16N	1	0[b]	0	0	0	0
C-12	1	1	1	1	1	1
T-2C	4	0[b]	0	0	0	0
T-34	3	3	3	3	3	3
Total	273	181	194	228	342	402

[a] Figures as of the last day of each fiscal year (September 30).
[b] Decrease in aircraft resulting from decommissioning activities.
[c] Increase of 14 F-14A aircraft associated with 1995 F-14 BRAC realignment from NAS Miramar.
[d] Increase of 28 F-14A aircraft associated with 1995 F-14 BRAC realignment from NAS Miramar (14 aircraft) and separate transfer of 1 F-14A squadron (14 aircraft) to fulfill F/A-18 mission requirements.
[e] Increase in 14 F-14D aircraft associated with 1995 F-14 BRAC realignment from NAS Miramar.
[f] Increase in 22 F-14D aircraft associated with 1995 F-14 BRAC realignment from NAS Miramar (14 aircraft) and 1993 BRAC realignment of F-14 FRS detachment (8 aircraft).
[g] Increase in 12 F/A-18 associated with commissioning new adversarial squadron at NAS Oceana.
[h] Increase in F/A-18 aircraft associated with proposed action.

Source: U.S. Navy 1995a.

1.4 Components of the Proposed Realignment

1.4.1 Proposed F/A-18 Construction Projects

F/A-18 Parking Apron Alterations

This project would include two separate components:

- The installation of 6-foot by 6-foot steel (2-meter by 2-meter) plates along the flight line in the proposed F/A-18 parking area; and
- Installation of apron 400-hertz (Hz) converters (i.e., fixed-point utility systems [FPUSs]).

Because exhaust from F/A-18 auxiliary power units projects downward, plates must be installed on top of the existing concrete flight line in the proposed F/A-18 parking area to protect the pavement from damage during aircraft engine start-ups. The Hz converters are used to provide power to aircraft parked on the apron (U.S. Navy 1995b).

F/A-18 Flight Simulator Facility

This project would consist of the construction of a two-story, 53,916-square-foot (6,726-square-meter) addition to Building 140 to accommodate F/A-18 flight simulators. Currently, NAS Oceana operates F-14 flight simulators only. Excess simulator space created by the recent decommissioning of A-6 aircraft at the station is being filled by F-14D simulators which are being relocated to NAS Oceana to support 1993 BRAC directives. Additional space is required to house the incoming F/A-18 flight simulators.

The addition would wrap around the northwest and southwest sides of the existing building onto existing lawn areas and a portion of an underutilized parking area. The project also involves interior modifications to Building 140 (U.S. Navy 1995b).

Naval Maintenance Training Group Detachment (NAMTRAGRUDET) Training Facility

This project would include interior modifications and the construction of a one-story, 40,359-square-foot (3,749-square-meter) addition to Building 240 to house classroom and training space, and interior modifications to Building 223. Currently, NAMTRAGRUDET facilities at NAS Oceana are used to instruct students in the maintenance of fighter and attack aircraft. Excess space created by the recent decommissioning of A-6 aircraft at the station is not large enough to satisfy F/A-18 training requirements.

The Building 240 addition would create a new wing off the southeast portion of the building, currently a maintained lawn area.

Strike Fighter Weapons School Facilities and Parking

Three additions to Building 137, totaling 26,722 square feet (2,483 square meters), would be constructed under this project, including:

- A one-story addition to the northwest corner of the building (currently maintained lawn and parking) for inert weapons storage;
- A two-story addition to the southeast corner of the building (currently maintained lawn) for classroom space, offices, and rest rooms; and
- A one-story addition to the southwest corner of the building (currently maintained lawn) for a new 120-seat lecture hall.

The project would also involve the construction of a new 23,940-square-foot (2,224-square-meter), 76-space parking lot in an adjoining maintained lawn area. The construction additions and the additional parking spaces are required to alleviate projected training space shortfalls for F/A-18 aircraft (U.S. Navy 1995b).

F/A-18 Aviation Maintenance Facilities and Parking

This project would involve a series of small additions and freestanding construction projects to augment facilities along the flight line. These projects include:

- Construction of a one-story, 2,820-square-foot (262-square-meter) addition to the northeast side of Building 301 (currently maintained lawn) for storage;
- Construction of two one-story additions, totaling 3,143 square feet (362 square meters) on the northeast side of Building 401 (currently a combination of maintained lawn and pavement), for a ground support equipment (GSE) shop and battery shop;
- Construction of a canopy extending from the southeast side of Building 401 for parking of GSE vehicles;
- Construction of a 4,700-square-foot (437-square-meter) freestanding shed southeast of Building 401 (currently a wooded area) for storage of "Yellow Gear" (e.g., aircraft tugs); and

- Construction of a 3,000-square-foot (279-square-meter), one-story addition to Building 513 (on maintained lawn) for a composite shop (i.e., aircraft body repair); and
- Construction of a freestanding 5,290-square-foot (491-square-meter) building east of Building 513 for armament storage.

The project would also involve construction of two new parking lots, one 40,000-square-foot (3,716-square-meter), 100-space lot that would be located in a wooded area east of Building 401, and one 44,400-square-foot (4,125-square-meter), 78-space parking lot that would be located in a currently maintained lawn area west of Building 513. The construction additions and the additional parking spaces are required to alleviate projected intermediate level maintenance shortfalls for F/A-18 aircraft (U.S. Navy 1995b).

Corrosion Control Hangar

The construction of a new 13,322-square-foot (1,238-square-meter) hangar facility along the paved flight line would be included in this project. This project is required to provide space to wash and strip corrosive material, and paint F/A-18 aircraft at the operational maintenance level.

The proposed site is located southeast of Building 122, a former A-6 aircraft hangar that would be used for F/A-18 aircraft. The project would require the removal of five temporary buildings (Buildings 132, 133, 134, 137A, and 137B) and construction of a 4,135-square-foot (384-square-meter) extension of pavement from the southeastern end of the flight line (U.S. Navy 1995b).

Installation of Secure Vaults

This project would involve the installation of vaults in Buildings 111 and 122 designed to store classified documents for F/A-18 squadrons and secure debriefing spaces with the hangars.

Renovations to Building 122

This project would involve limited interior hangar renovations (e.g., installation of interior walls, utilities, etc.) to Building 122 designed for the specific requirements of F/A-18 squadrons.

Bachelor Enlisted Quarters and Parking

This project would involve the construction of a new 230-module, 173,300-square-foot (16,100-square-meter) BEQ designed to house 460 enlisted personnel (i.e., Grades E-1 through E-4). The facility would be located on a currently wooded site near the intersection of "E" Avenue and 3rd Street. The project would also include a surface parking lot for 357 vehicles.

Jet Engine Testing Cell Replacement

This project would involve the renovation of Building 1100, located at the southwestern end of the flight line, to facilitate testing of aircraft engines. It would include construction and installation of an acoustically-treated engine test enclosure, air intakes with silencers, and a structurally isolated ancillary building to house a test operator control room, fuel room, mechanical room, and rest room facilities. The project would also include demolition of an existing high-temperature exhaust silencing system and replacement through the construction of a new air-cooled augmenter.

Aircraft Acoustical Enclosure (i.e., Hush House)

This project would involve the construction of a new 11,795-square-foot (1,096-square-meter), one-story building to conduct high-powered, in-aircraft engine run-ups. The building would be equipped with acoustical elements to reduce noise emissions associated with these activities.

3-Module Aircraft Hangar

This project would involve the construction of a 116,502-square-foot (10,823-square-meter), 3-module hangar along the former A-6 flight line. The facility would be designed in full compliance with P-80 guidelines and would provide space for three fleet squadrons (i.e., 36 aircraft).

Parking Apron Expansion

This project would involve the construction of a 870,202-square-foot (80,844-square-meter) expansion of the aircraft parking apron along the former A-6 flight line. The expansion would be intended to provide parking space adjacent to the proposed 3-module aircraft hangar.

1.4.2 Aircraft Operations

Realignment to NAS Oceana would result in changes to the level of aircraft operations. Aircraft operations consist of two components:

- Airfield operations composed of landing and takeoff (LTO) cycles, touch-and-go operations, and approach/circling patterns around NAS Oceana and NALF Fentress; and

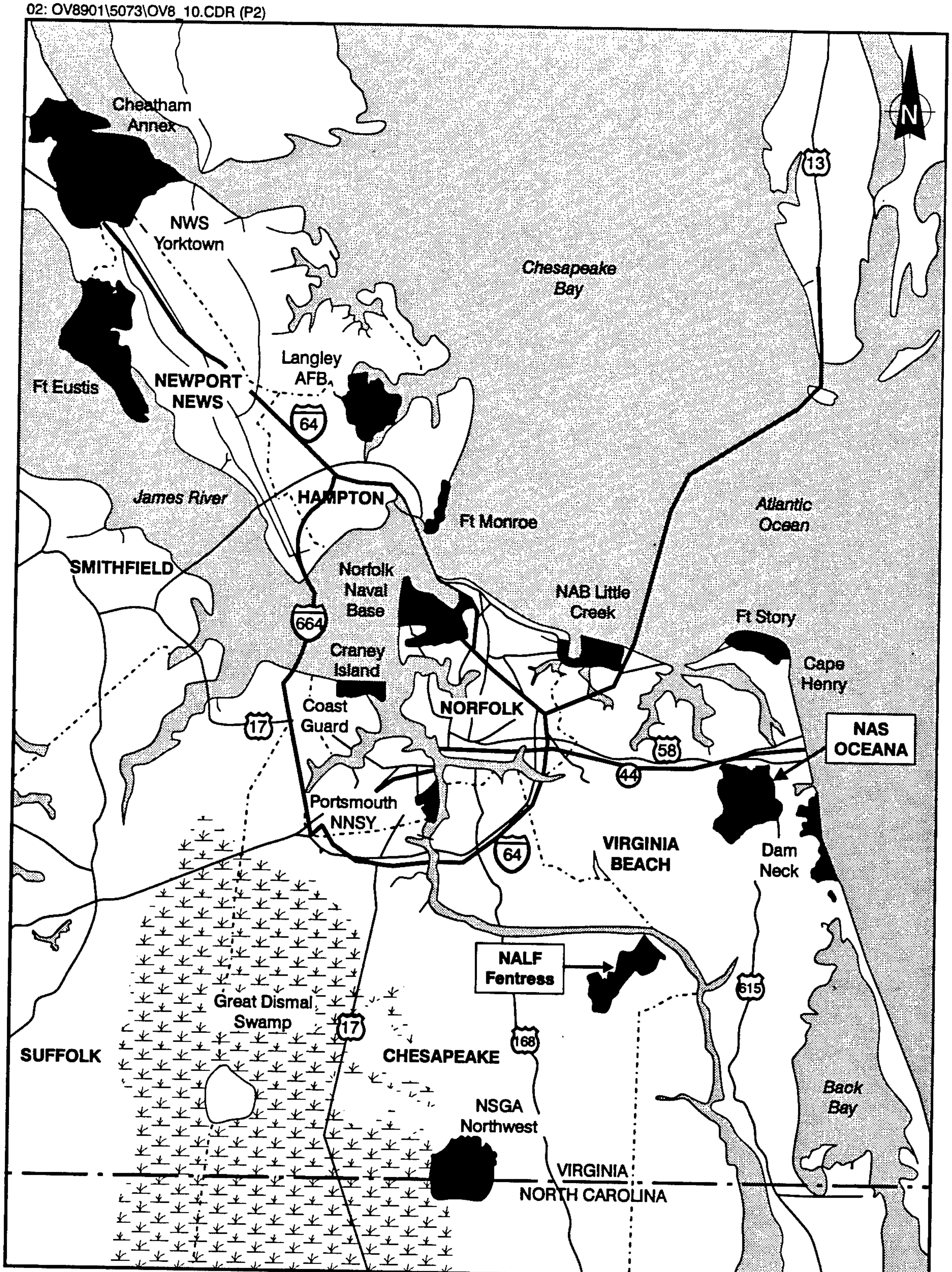
- Airspace operations consisting of training activities along military training routes (MTRs), and within various warning areas, military operating areas (MOAs), inert bombing ranges, and other special use airspace in eastern North Carolina.

The incoming aircraft would use airfield flight tracks and airspace that are similar to those currently used by existing aircraft stationed at NAS Oceana. To determine the projected annual total of aircraft operations, the Navy used the Naval Aviation Simulation Model (NASMOD). NASMOD projects operations of aircraft squadrons over a simulated year, based upon the respective training requirements and deployment cycles of each aircraft squadron examined (ATAC 1997).

The NASMOD analysis encompassed a cumulative 1999 projection of the operations of the incoming Atlantic Fleet F/A-18 squadrons, Pacific Fleet F-14 squadrons (including the single F-14A squadron that will fulfill F/A-18 mission requirements), the F-14 FRS Detachment, as well as other aircraft that typically utilize NAS Oceana and NALF Fentress for aircraft operations. As discussed in Section 1.3, operations of A-6 aircraft were excluded from the analysis based on the assumption that all A-6 aircraft deployed in 1996 would be decommissioned by mid-1997 (ATAC 1997).

It should be noted that while all airfield operations at NAS Oceana and NALF Fentress were included in this analysis, projected airspace operations in eastern North Carolina were excluded from this air conformity review. Training areas in North Carolina are designated as attainment areas for all criteria pollutants; therefore, emissions associated with aircraft operations in these areas are not subject to the General Conformity Rule.

02: OV8901\5073\OV8_10.CDR (P2)

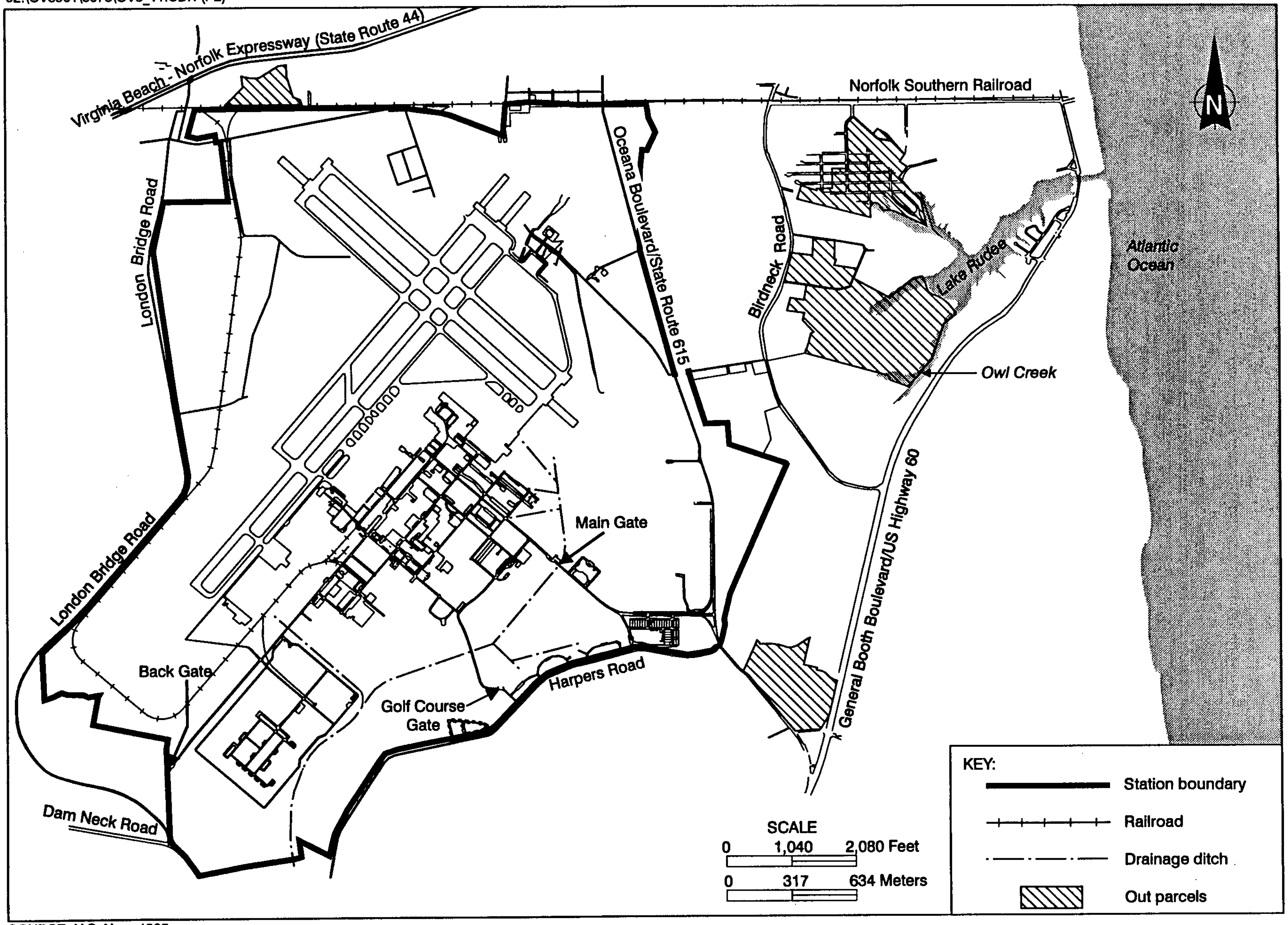


SOURCE: U. S. Navy 1985.

NOT TO SCALE

Figure 1-1 NAS OCEANA REGIONAL LOCATION

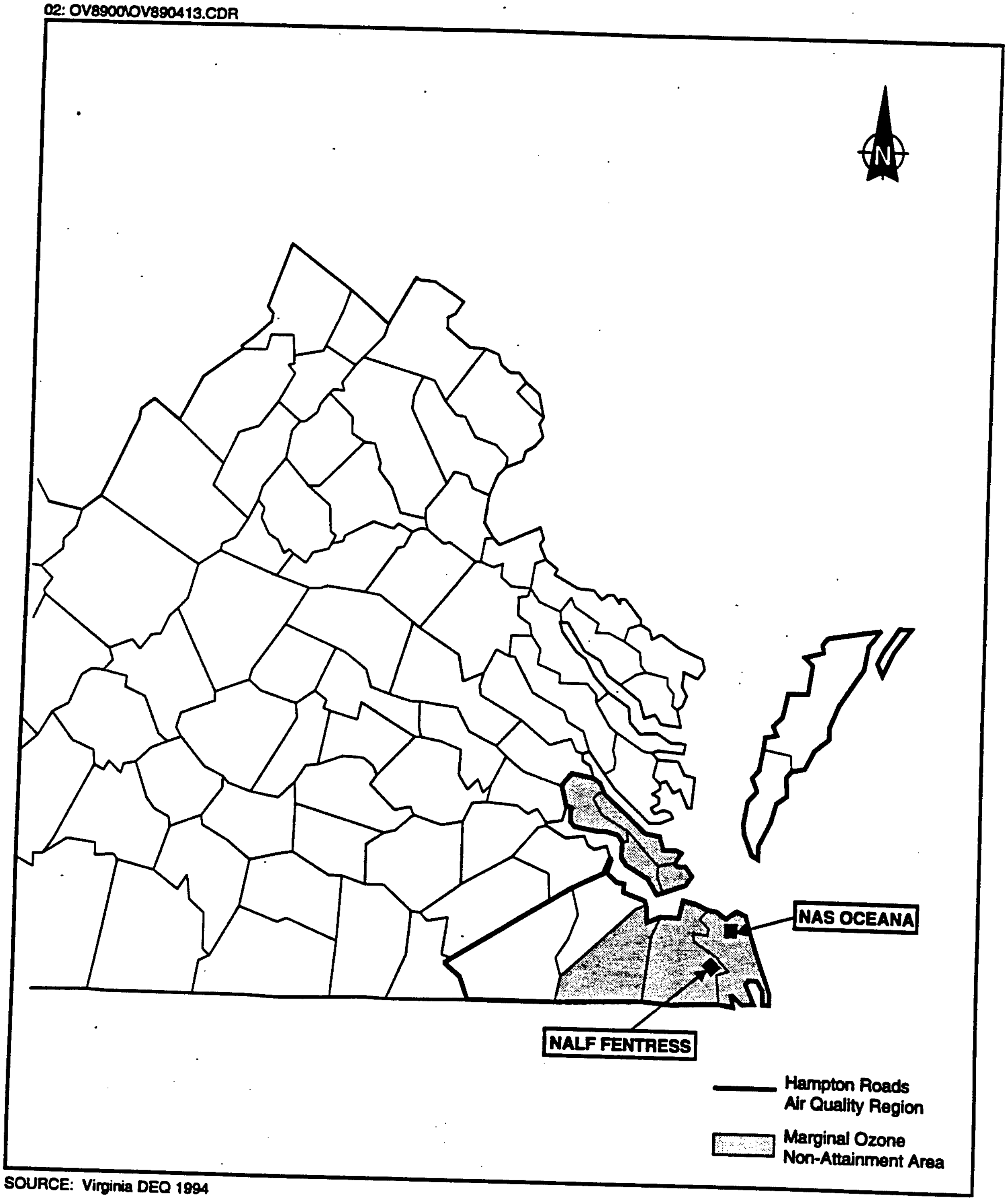
02:\OV8901\5073\OV8_11.CDR (P2)



SOURCE: U.S. Navy 1995c

Figure 1-2 NAS OCEANA MAP

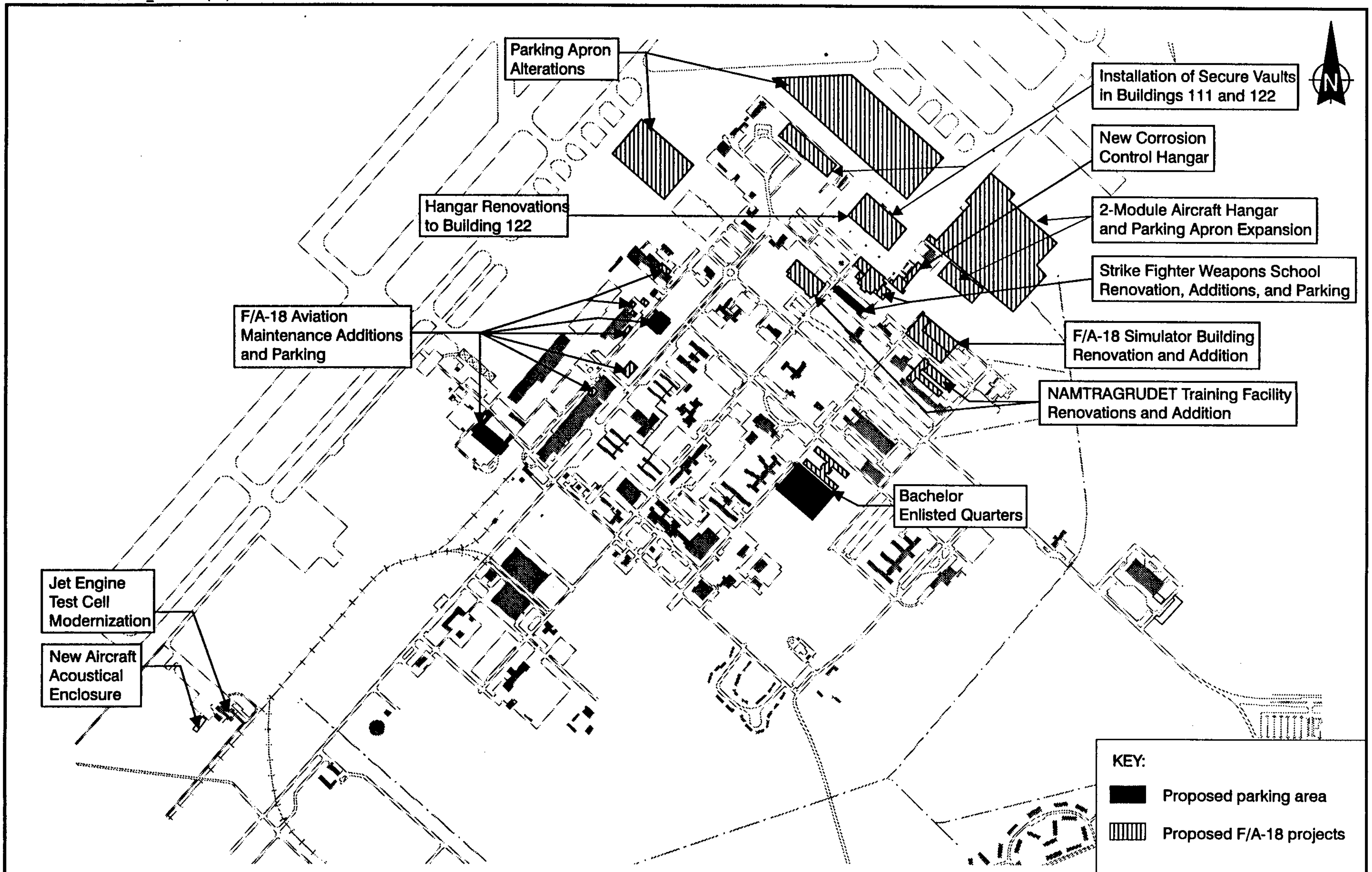
02: OV8900\OV890413.CDR



SOURCE: Virginia DEQ 1994

Figure 1-3 HAMPTON ROADS AIR QUALITY REGION

02: OV8901\5073\OV8_12.CDR (P5)



SOURCE: U. S. Navy 1995

SCALE

0 520 1,040 Feet

0 158.5 317 Meters

Figure 1-4 CONSTRUCTION ASSOCIATED WITH THE PROPOSED ACTION

2 Air Quality Regulations

2.1 Clean Air Act

The CAA of 1970, 42 USC 7401 *et seq.*, amended in 1977 and 1990, is the primary federal statute governing air pollution. The CAA designates six pollutants as criteria pollutants, for which National Ambient Air Quality Standards (NAAQS) have been promulgated to protect public health and welfare. The six criteria pollutants are respirable particulate matter smaller than 10 micrometers in diameter (PM10), carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), lead (Pb), and ozone (O_3). The Commonwealth of Virginia has adopted these federal standards (see Table 2-1).

Federal law requires states or local air quality control agencies to have a State Implementation Plan (SIP) that prescribes measures to eliminate or reduce the severity and number of violations of NAAQS and to achieve expeditious attainment of these standards. Areas that do not meet NAAQSs are designated as "nonattainment" for that criteria pollutant. Nonattainment status is further defined by the extent the standard is exceeded. There are six classifications of ozone nonattainment status: transitional, marginal, moderate, serious, severe, and extreme; and two classifications of CO and PM10 nonattainment status: moderate and serious. The remaining criteria pollutants have designations of either attainment, nonattainment, or unclassifiable.

Although VOCs are not considered criteria pollutants and no ambient standard exists for them, VOCs are a major contributor to urban air pollution because they react in the atmosphere to form ozone. Nitrogen dioxide is the only nitrogen oxide (NO_x) for which an ambient standard exists. However, all NO_x (NO, NO_2, and NO_3) are considered to be ozone precursors. Therefore, VOC and NO_x emission sources are regulated in order to control ozone, especially in ozone nonattainment areas.

NAS Oceana and NALF Fentress are located in the Hampton Roads Ozone Nonattainment area, which has a "marginal" designation. The Hampton Roads area meets all other standards (NAAQS) set for criteria pollutants.

The Commonwealth of Virginia, through the Virginia Department of Environmental Quality (VDEQ), has submitted an ozone redesignation request and two SIP revision requests. The first SIP revision is a maintenance plan to the EPA, in accordance with the CAA. The second SIP revision establishes a mobile emissions budget (also known as a motor vehicle emissions budget). The EPA has indicated its intent to approve the redesignation and SIP revision requests and is currently accepting public comment on their proposed approval (FR, Volume 62, Number 48 and FR, Volume 62, Number 82). The VDEQ used its 1993 emissions inventory as the attainment emissions budget because 1993 was one of three years upon which Virginia based its attainment demonstration. It was also the original deadline year established by EPA for marginal ozone nonattainment areas to reach attainment for ozone.

In their redesignation request and ozone maintenance plan, VDEQ submitted three years (1993-1995) of ambient monitoring data demonstrating attainment of the ozone standard and an air basin-wide attainment emission inventory corresponding to the attainment deadline (1993) established by EPA. The maintenance plan and the attainment emissions budget is presented in a Federal Register announcement (Vol. 62, No. 48, March 12, 1997). An emission allotment is contained in the attainment emissions budget for NAS Oceana's projected future year emissions. Demonstration by NAS Oceana in this conformity analysis that the future year emissions will be less than or equal to the allotment is used to demonstrate conformance with the SIP. By showing emissions to be less than or equal to the allotment, the base will contribute to maintaining attainment with the ozone standard and thus comply with the SIP.

Table 2-1

NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	Primary Standard	Secondary Standard ($\mu g/m^3$)
Respirable Particulate matter	24-hour maximum[b] Annual arithmetic mean	150 $\mu g/m^3$ 50 $\mu g/m^3$	150 50
Sulfur dioxide	24-hour maximum[a] 3-hour maximum[a] Annual arithmetic mean	365 $\mu g/m^3$ None 80 $\mu g/m^3$	None 1,300 None
Carbon monoxide	8-hour maximum[a] 1-hour maximum[a]	9 ppm 35 ppm	None None
Nitrogen dioxide	Annual arithmetic mean	100 $\mu g/m^3$	100
Lead	Quarterly Arithmetic mean[a]	1.5 $\mu g/m^3$	1.5
Ozone	1-hour maximum[b]	235 $\mu g/m^3$	235

[a] Not to be exceeded more than once per year.

[b] Not to be exceeded on more than an average of one day per year for a three-year period.

Key:

ppm = Parts per million.
$\mu g/m^3$ = Micrograms per cubic meter.

Source: Virginia Department of Environmental Quality 1994.

2.2 The General Conformity Rule

The General Conformity Rule has been promulgated by EPA to ensure that the actions of federal departments or agencies conform to the applicable SIP. The rule is a statutory obligation in Section 176(c)(4) of the CAA; it was added to the CAA by the 1990 amendments. USEPA implemented Sec. 176(c)(4) by amending 40 CFR Parts 6, 51, and 93. Part 6 was amended to reference the Conformity Rule under the environmental review and consultation requirements associated with NEPA. Part 51, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans," was amended to require states to revise their implementation plans to include conformity requirements. Part 93 was newly established to require federal agencies to comply with the conformity requirements as of the effective date of the requirements (January 1, 1994) and in the interim period before the states revise their implementation plans. Virginia has submitted to USEPA an SIP revision that, if approved, would incorporate the State's General Conformity Rule into the Virginia SIP. (Virginia published its General Conformity Rule in September 1996 [12 Va. Register 3620]). Because USEPA has not approved the Virginia General Conformity SIP Revision, the conformity requirement citation in this report refers to 40 CFR Part 93.

On April 26, 1994, the Navy provided a guidance document for conducting conformity reviews entitled *Draft Interim Guidance on Compliance with the Clean Air Act General Conformity Rule* (U.S. Navy 1994). This guidance summarizes provisions of the Conformity Rule, provides steps to be followed to determine applicability of the Conformity Rule to Navy actions, and sets forth procedures for making conformity determinations. The Conformity Rule requires using the latest EPA emission estimation techniques and models listed in the most recent version of *Guideline on Air Quality Models* (EPA 1986). The rule also contains reporting, public participation, and mitigation provisions.

The General Conformity Rule covers direct and indirect emissions of criteria pollutants or their precursors that are caused by a federal action, are reasonably foreseeable, and can practically be controlled by the federal agency through its continuing program responsibility.

Conformity is demonstrated if the total net emissions expected to result from a federal action in a nonattainment or maintenance area will not:

- Cause or contribute to any new violation of any NAAQS;
- Interfere with provisions in the applicable SIP for maintenance of any standard;
- Increase the frequency or severity of any existing violation; or

- Delay the timely attainment of a standard, interim emission reduction or milestone, including where applicable, emission levels specified in the applicable SIP for purposes of demonstrating reasonable further progress, attainment, or a maintenance plan.

Mitigation measures that are enforceable may be used to demonstrate conformity. Conformity can also be demonstrated by obtaining emissions offsets; however, the entire emissions increase must be offset such that the action results in no net emissions increase.

A federal action is exempt from applicability of the General Conformity Rule requirements if the action's total net emissions are below the *de minimis* levels shown in Table 2-2 and are not regionally significant (i.e., the emissions represent 10% or less of a nonattainment or maintenance area's total emission inventory of that pollutant) or are otherwise exempt per 40 CFR 93.153. Total net emissions include direct and indirect emissions from all stationary point and area sources, construction sources, and mobile sources caused by the federal action.

If the total net emissions increase of nonattainment pollutants caused by a federal action exceeds *de minimis* levels, then a formal conformity determination is required. Conformance with a SIP can be demonstrated by:

- Fully offsetting the emissions increase (i.e., no net increase); or
- Showing that the emissions of nonattainment pollutants are accounted for in the air basin's emissions budget.

However, there are special considerations regarding indirect emissions, specifically mobile-source emissions. If the action, or a portion of the action, is subject to the transportation conformity rule, then that portion of the action is excluded from the General Conformity Rule.

Table 2-2

***DE MINIMIS* LEVELS FOR NONATTAINMENT AREAS**

Pollutant	Tons/Year
Ozone (volatile organic compounds or nitrogen oxides)	
Serious nonattainment areas	50
Severe nonattainment areas	25
Extreme nonattainment areas	10
Marginal and moderate ozone nonattainment areas outside an ozone transport region	100
Marginal and moderate nonattainment areas inside an ozone transport region	
Volatile organic compounds	50
Nitrogen oxides	100
Carbon monoxide	
All nonattainment areas	100
Sulfur dioxide or nitrogen dioxide	
All nonattainment areas	100
Particulate matter	
Moderate nonattainment areas	100
Serious nonattainment areas	70
Lead	
All nonattainment areas	25

Source: 40 CFR 93.

2.3 Years Requiring Emission Analyses

Emission projections used in air conformity reviews must evaluate the years of maximum direct and indirect emissions, the CAA deadline years for attaining relevant NAAQSs, and other years specifically used by the applicable SIP documents for tracking anticipated progress toward attainment and maintenance of NAAQSs.

VDEQ is using 1993 as the existing (i.e., attainment) year for its ozone maintenance plan (Sydnor 1996) to track maintenance of the ozone NAAQs. The farthest projection year is 2008 (FR, Volume 62, No. 48, Pg. 11,341).

For the conformity determination, emissions analyses were conducted for 1993 (to conform with the attainment year that VDEQ is using for its maintenance plan) and 1999 (the maximum ozone precursor emissions year). In addition, analyses were conducted for 1996, 1997, and 1998, to show the net effects associated with phasing the implementation of the proposed action (i.e., F/A-18 aircraft will be realigned during 1998 and 1999) and to account for cumulative effects of other actions being taken at the station discussed in Section 1 (e.g., other 1993 and 1995 BRAC actions, decommissioning of aircraft, and transfer of F-14A squadron to fulfill F/A-18 mission requirements).

Although some reductions to aircraft and personnel loadings are anticipated after 1999, the Navy anticipates that the emissions generated under ARS 1 in 1999 will remain unchanged until the expiration of the 10-year maintenance period in 2008.

3 Current and Projected Emissions

The total net change in annual emissions of nonattainment pollutants attributable to the proposed action was calculated to determine whether the federal action is exempt from the General Conformity Rule requirements.

For purposes of air conformity, the proposed action is the decommissioning of older aircraft at NAS Oceana with a resulting emission reduction and the utilization of the available emission capacity created from this decommissioning by F/A-18 aircraft realigned from NAS Cecil Field. When considered in the context of historic aircraft and levels of operations, this force restructuring began in 1990 and will continue through 1999. However, as discussed in Section 2, VDEQ is using its 1993 emissions inventory as the attainment emissions budget. The Navy is using 1993 as the existing year for calculating net emissions resulting from the action because: 1) the aircraft and level of operations are representative of typical base operations; and 2) it will allow VDEQ to track emissions corresponding to the years analyzed in its maintenance plan.

Some of the capacity created by decommissioning the older aircraft at NAS Oceana has been utilized by other realignment activities as discussed in Section 1, specifically the transfer of an F-14D FRS detachment (eight aircraft) and the transfer of four F-14 squadrons (56 aircraft) under other 1993 and 1995 actions and the transfer of one F-14A squadron (14 aircraft) to fulfill F/A-18 mission requirements under a separate action. These actions were the subject of separate NEPA documentation and air conformity reviews. The remaining capacity will be utilized for the air emissions impacts associated with realignment of the F/A-18 aircraft from NAS Cecil Field.

3.1 Current Emissions of Nonattainment Pollutants

This section discusses the existing (1993) emissions of VOCs and NO_X from all sources at NAS Oceana and NALF Fentress. A summary of 1993, along with 1996-1999, emissions is presented in Table 3-1.

3.1.1 Aircraft Mobile Sources

Pollutants emitted from aircraft include VOCs and NO_X. Aircraft engine emission data are typically reported as hydrocarbons based on the ratio of hydrogen to carbon in the fuel burned in the engine (AESO 1996). This reporting method is not the same as reporting VOC content of the emissions because not all hydrocarbons are VOCs. However, the reverse is true; that is, all VOCs are hydrocarbons. Data presented in the literature cited for emission factors does not indicate the VOC content of aircraft engine exhaust. Therefore, to avoid an arbitrary division of aircraft engine exhaust into VOC and non-VOC components, all aircraft engine exhaust is assumed to be VOC. This also allows aircraft engine exhaust data to be summed with other sources of VOCs at NAS Oceana for analysis. Aircraft engine emissions were estimated using the methods, emission factors, time-in-mode values, and aircraft/engine model combinations contained in the *Procedures of Emission Inventory Preparation Volume IV: Mobile Sources* (EPA 1992) and data on aircraft emission rates from the Navy's Aircraft Environmental Support Office (AESO 1990, 1997) and Naval Air Warfare Center (NAWC 1994). The primary data source for aircraft engine emissions (EPA 1992) contains Navy aircraft emission data referenced primarily to AESO publications. Data from the EPA document were used unless data were not available for a particular aircraft/engine combination or the data were found to be in error. Some of the data in the EPA document were not transcribed correctly from the AESO reference. In these cases, AESO data were used. Aircraft engine emission factors sources are:

- AESO and NAWC - E-2/C-2 (VOC at approach and idle mode only), F-14B/D (NAWC), F/A-18, T-34, S-3 (idle only), UH-3 (climbout and approach mode only), and F-14A (VOC at idle only); and
- EPA - E-2/C-2 (all pollutant and modes other than above), A-6, A-4, F-16, F-5, S-3 (all modes other than idle), UH-3 (all modes other than climbout and approach), T-2, and F-14A (all other pollutants and modes other than stated above).

Current aircraft operation data at NAS Oceana and NALF Fentress were provided by the NAS Oceana Aircraft Operations Department. Emission rates in pounds per operation were developed for each aircraft type for the following types of aircraft operations:

Table 3-1
EMISSIONS SUMMARY - NAS OCEANA AND NALF FENTRESS - ARS 1
FOR 1993 AND 1996-1999
(tons per year)

	1993					1996					1997				
Source Type	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**
NAS Oceana:															
Mobile Sources:															
Aircraft Operations	272.13	328.88	609.85	18.59	152.58	122.15	223.66	291.74	10.75	121.03	149.42	288.32	357.41	13.81	155.96
Total Aircraft	**272.13**	**328.88**	**609.85**	**18.59**	**152.58**	**122.15**	**223.66**	**291.74**	**10.75**	**121.03**	**149.42**	**288.32**	**357.41**	**13.81**	**155.96**
Other Mobile Sources:															
GSE	5.13	26.43	72.65	1.71	2.00	3.09	27.35	17.03	1.84	2.24	4.57	34.01	18.73	2.20	2.66
Maintenance Run-ups	70.29	177.95	130.69	5.82	47.42	29.40	136.41	61.78	3.90	47.42	38.29	198.30	97.19	5.86	72.28
Generators	0.56	6.89	1.48	0.45	0.48	0.56	6.89	1.48	0.45	0.48	0.56	6.89	1.48	0.45	0.48
Total Other Mobile	**75.97**	**211.27**	**204.82**	**7.98**	**49.90**	**33.05**	**170.65**	**80.29**	**6.18**	**50.14**	**43.42**	**239.20**	**117.40**	**8.51**	**75.42**
Stationary Sources:															
Boilers:	1.13	32.32	8.31	22.09	3.84	0.78	29.13	7.52	23.76	3.63	0.78	29.13	7.52	23.76	3.63
Generators	0.71	8.67	1.87	0.57	0.61	0.71	8.67	1.87	0.57	0.61	2.11	27.87	7.27	3.77	2.21
Engine Test Cells	6.24	37.65	49.39	1.80	4.32	3.95	28.48	39.09	1.31	3.96	5.05	37.03	50.86	1.71	4.62
JP-5 Fuel Handling	0.66	0.00	0.00	0.00	0.00	0.46	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.00	0.00
Service Station	19.35	0.00	0.00	0.00	0.00	4.46	0.00	0.00	0.00	0.00	4.67	0.00	0.00	0.00	0.00
Painting	19.30	0.00	0.00	0.00	0.00	13.29	0.00	0.00	0.00	0.00	24.05	0.00	0.00	0.00	0.00
Construction:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Stationary	**47.39**	**78.64**	**59.57**	**24.46**	**8.77**	**23.65**	**66.28**	**48.48**	**25.64**	**8.20**	**37.20**	**94.03**	**65.65**	**29.24**	**10.46**
Total NASO	**395.49**	**618.78**	**874.24**	**51.04**	**211.24**	**178.84**	**460.58**	**420.50**	**42.58**	**179.37**	**230.04**	**621.55**	**540.46**	**51.56**	**241.85**
NALF Fentress:															
Aircraft	13.48	146.63	37.00	6.81	30.87	11.78	155.58	25.11	6.42	42.23	13.66	189.24	29.30	7.57	55.28
Total Annual:	**408.97**	**765.41**	**911.24**	**57.85**	**242.11**	**190.62**	**616.16**	**445.61**	**49.00**	**221.60**	**243.70**	**810.79**	**569.75**	**59.13**	**297.12**

Table 3-1
EMISSIONS SUMMARY - NAS OCEANA AND NALF FENTRESS - ARS 1
FOR 1993 AND 1996-1999
(tons per year)

	1998					1999				
Source Type	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**
NAS Oceana:										
Mobile Sources:										
Aircraft Operations	299.16	429.89	788.81	19.33	231.61	376.57	503.08	1,010.07	22.26	271.03
Total Aircraft	**299.16**	**429.89**	**788.81**	**19.33**	**231.61**	**376.57**	**503.08**	**1,010.07**	**22.26**	**271.03**
Other Mobile Sources:										
GSE	3.67	34.57	17.17	2.32	2.79	3.69	34.66	17.22	1.73	1.92
Maintenance Run-ups	53.75	224.58	139.20	3.44	83.57	61.59	238.38	160.01	7.02	89.74
Generators	0.56	6.89	1.48	0.45	0.48	0.56	6.89	1.48	0.45	0.48
Total Other Mobile	**57.99**	**266.04**	**157.85**	**6.21**	**86.84**	**65.83**	**279.93**	**178.71**	**9.20**	**92.13**
Stationary Sources:										
Boilers:	0.62	27.13	6.68	22.82	3.38	0.62	27.13	6.68	22.82	3.38
Generators	2.11	27.87	7.27	3.77	2.21	2.11	27.87	7.27	3.77	2.21
Engine Test Cells	9.20	48.99	64.32	2.00	9.31	11.31	55.20	71.48	2.16	11.48
JP-5 Fuel Handling	0.81	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00
Service Station	6.40	0.00	0.00	0.00	0.00	6.72	0.00	0.00	0.00	0.00
Painting	34.12	0.00	0.00	0.00	0.00	34.16	0.00	0.00	0.00	0.00
Construction:	2.55	26.13	8.18	2.41	4.08	0.00	0.00	0.00	0.00	0.00
Total Stationary	**55.81**	**130.12**	**86.45**	**30.99**	**18.97**	**55.82**	**110.20**	**85.43**	**28.75**	**17.07**
Total NASO	**412.95**	**826.05**	**1,033.11**	**56.54**	**337.42**	**498.23**	**893.21**	**1,274.21**	**60.21**	**380.23**
NALF Fentress:										
Aircraft	15.23	242.43	35.97	9.28	78.05	16.08	267.84	39.30	10.10	89.09
Total Annual:	**428.19**	**1,068.48**	**1,069.08**	**65.81**	**415.47**	**514.31**	**1,161.04**	**1,313.51**	**70.31**	**469.32**

Note: Shaded areas indicate nonattainment pollutants of concern.
1993 data and future year estimates based on data current as of June 4 1996.

Key: VOC = volatile organic compounds. SO2 = sulfur dioxide.
NOx = oxides of nitrogen. PM10 = particulate matter. JP-5 = jet fuel.
CO = carbon monoxide. GSE = Ground Support Equipment

- Full LTO cycles, which include taxi-out/idle, a hot refueling idle mode for a percentage of aircraft performing full LTOs, takeoff, climbout, approach, and taxi-in/idle modes;
- Touch-and-go LTOs, which include approach, climbout, and a level mode (i.e., low circling operation as the aircraft re-enters the touch-and-go pattern);
- The ground-controlled-approach (GCA) pattern box, involving a circling level pattern between NAS Oceana and NALF Fentress, without significant altitude changes (i.e., no approach or climbout mode); and
- Interfacility operations between NAS Oceana and NALF Fentress, which include only a level mode.

As shown in Table 3-1, the combined aircraft emissions from both facilities for VOCs and NO_X in 1993 were 286 and 476 tons per year, respectively. A detailed description of the methods used to estimate aircraft emissions is presented in Appendix A.

3.1.2 Other Mobile Sources

A series of other mobile sources at NAS Oceana contribute to air emissions at the station. These include GSE, engine maintenance run-ups (in-frame engine testing), and mobile generators.

GSE, also known as yellow gear, includes various vehicles and equipment used along the flight line to support aircraft and operations, such as tow tractors, jet engine start units, and service vehicles. Existing emissions for GSE were calculated based upon existing operations and fuel logs. The 1993 emissions of VOCs and NO_X from GSE were 5 tons and 26 tons, respectively. In-aircraft engine maintenance run-ups are performed as necessary after engine maintenance events. The tests involve running the engine at various power settings and durations. Maintenance run-ups accounted for 70 tons of VOC emissions and 178 tons of NO_X emissions in 1993.

Mobile generators include portable diesel units used to power essential buildings in cases of emergency electrical outages or other situations when power is not available. Emissions for these units were calculated using data from past operations and fuel logs. Mobile generators emitted 0.6 ton of VOCs and 7 tons of NO_X in 1993.

NAS Oceana employees commuting to and from the base in personally owned vehicles (POVs), as well as government-owned vehicles operating on and off base, are sources of air emissions. However, emissions from POVs and government-owned vehicles are not included in this analysis because they have already been accounted for in the Hampton

Roads Transportation Improvement Program (TIP). A final Transportation Conformity Determination for this TIP was completed in December 1995 (ICF Kaiser 1995). Therefore, this portion of the action is presumed to conform to the Virginia SIP and is not included in this conformity determination.

3.1.3 Stationary Sources

Stationary sources at NAS Oceana include boilers, generators, jet fuel storage tanks, paint spray operations, the Navy Exchange (NEX) service station, and engine test cells (out of frame engine testing). These emissions were calculated through an examination of operations logs and fuel usage data provided by the NAS Oceana Environmental Compliance Division.

The total emissions of VOCs and NO_x from stationary sources for 1993 were estimated to be 47 and 79 tons per year, respectively. The methods and assumptions used to calculate stationary source emissions are shown in Appendix A.

3.2 Projected Emissions of Nonattainment Pollutants

The types of aircraft stationed at NAS Oceana in 1999 (predominantly F-14 and F/A-18) would vary from 1993 (predominantly A-6 and F-14). The number of LTOs at both NAS Oceana and NALF Fentress would also vary. The number of employees at NAS Oceana would increase by approximately 2,500 from 1993 to 1999. Because of the increased number of aircraft and employees, it is anticipated that some of the associated stationary source emissions would also increase slightly due to the operation of newly constructed facilities. These new facilities can be heated by existing boiler plants at slightly increased load. Some facilities, such as a new paint booth, simply add new emissions to the base total. The following paragraphs discuss the projected net change in emissions from all sources as a result of implementation of the proposed action. Emission summaries for the years affected by the proposed action (1996-1999) are presented in Table 3-1.

3.2.1 Aircraft Mobile Sources

Aircraft engine emissions are the primary emissions associated with NAS Oceana and NALF Fentress. The majority of aircraft stationed at NAS Oceana after implementation of the proposed action would be F-14s and F/A-18s. Aircraft engine emissions for 1999 were estimated using the same methods as 1993, except that the number of aircraft operations were calculated using NASMOD (ATAC 1997). NASMOD provided the number of operations per specific operation type for each aircraft type.

The projected emission rates of nonattainment pollutants in 1999 for aircraft are 377 tons per year of VOCs and 503 tons per year of NO_x from NAS Oceana, and 16 tons per year of VOCs and 268 tons per year of NO_x from NALF Fentress. The combined 1999 aircraft emissions from both facilities would be 393 tons per year of VOCs and 771 tons per year of NO_x.

3.2.2 Other Mobile Sources

Other mobile emission sources include GSE, engine maintenance run-ups (in-frame engine testing), and mobile generators. Projected emissions from GSE were based on estimates of fuel used by GSE multiplied by the projected amount of GSE used during a specific year (NAS Oceana 1997). The projected number of maintenance run-up events by aircraft type was taken from the noise study database (Wyle Labs 1997). Mobile electrical generator emissions were projected based on the fuel usage derived from past operations logs. Projected VOC and NO_x emissions from GSE in 1999 would be 4 and 35 tons per year, respectively. Projected VOC and NO_x emissions from engine maintenance run-ups in 1999 would be 62 and 238 tons per year, respectively. Mobile electrical generators are projected to emit 0.6 ton of VOCs and 7 tons of NO_x in 1999.

3.2.3 Stationary Sources

Projected emissions from stationary sources were calculated using data for anticipated changes in the level of use of existing sources and data for any new stationary sources (i.e., the new corrosion control [painting] hangar). These emissions are divided into six primary source categories: boilers, generators, out-of-frame engine test cells, fuel storage tanks, the NEX service station, and painting operations.

The total emissions of nonattainment pollutants from stationary sources in 1999 are projected to be 56 tons per year of VOCs and 110 tons per year of NO_x.

3.2.4 Construction

The construction projects associated with the proposed action would result in the emission of nonattainment pollutants to the atmosphere. The nonattainment emissions consist of exhaust and crankcase emissions from construction machinery. An estimated total of 2.6 tons of VOCs and 26.1 tons of NO_x would be emitted from all construction projects (see Appendix A). These air quality impacts would be limited to the construction phase of the proposed action (1998) and, therefore, would not be cumulative during the maximum (full build-out) year (1999).

3.3 Net Change in Emission of Nonattainment Pollutants

Table 3-2 presents a summary of net emissions from NAS Oceana and NALF Fentress between 1993 and 1999. As shown on Table 3-2, the VOC emissions from NAS Oceana and NALF Fentress would increase from 1993 to 1999. Annual VOC emissions would increase by 105 tons per year. This increase is primarily a result of increased aircraft operations and maintenance run-ups. Annual NO_x emissions would increase by 396 tons per year, primarily resulting from increased aircraft operations, maintenance run-ups, and higher NO_x emission rates for incoming aircraft (i.e., F/A-18 vs. A-6). The increase in VOC and NO_x emissions each exceed the General Conformity Rule *de minimis* exemption levels of 100 tons per year for each pollutant. Therefore, a full conformity determination is required.

Table 3-2
NET EMISSIONS CHANGE - NAS OCEANA AND NALF FENTRESS - ARS 1
(tons per year)

Year	VOCs	NOx	CO	SO2	PM10
NAS Oceana:					
1993	395.49	618.78	874.24	51.04	211.24
1996	178.84	460.58	420.50	42.58	179.37
1997	230.04	621.55	540.46	51.56	241.85
1998	412.95	826.05	1033.11	56.54	337.42
1999	498.23	893.21	1274.21	60.21	380.23
Net Change:					
1993 to 1999	**102.74**	**274.43**	**399.97**	**9.17**	**168.99**
NALF Fentress:					
1993	13.48	146.63	37.00	6.81	30.87
1996	11.78	155.58	25.11	6.42	42.23
1997	13.66	189.24	29.30	7.57	55.28
1998	15.23	242.43	35.97	9.28	78.05
1999	16.08	267.84	39.30	10.10	89.09
Net Change:					
1993 to 1999	**2.60**	**121.20**	**2.30**	**3.30**	**58.22**
Net Change NAS Oceana and NALF Fentress:					
1993 to 1999	**105.33**	**395.63**	**402.28**	**12.47**	**227.21**

Note: Shaded areas indicate nonattainment pollutants of concern.

4 Demonstration of Conformity with the Virginia SIP

Initial estimates of the net emissions of VOC and NO_x associated with the proposed action exceed the *de minimis* exemption levels stipulated in the General Conformity Rule. VOC emissions are projected to increase by 105 tons per year in 1999, exceeding the *de minimis* exemption level by 5 tons. NO_x emissions are projected to increase by 396 tons per year in 1999, exceeding the *de minimis* level by 296 tons per year.

As discussed in Section 2, the Commonwealth of Virginia has submitted an ozone redesignation request, a maintenance plan SIP revision, and a mobile emissions budget (also known as a motor vehicle emissions budget) SIP revision to EPA. To demonstrate conformity with the Virginia SIP as revised by these SIP revision requests, the Navy coordinated with VDEQ to incorporate the projected net emissions associated with the proposed action into Virginia's ozone maintenance plan. The VDEQ emissions budget in the Maintenance Plan SIP revision contains an allotment of 200 tons per year of VOCs and 800 tons per year of NO_x for NAS Oceana/Fentress (FR, Volume 62, No. 48; Sydnor 1996). The projected maximum net emissions in the full build year (1999) of 105 tons per year of VOC and 396 tons per year of NO_x are within the allotments. Therefore, conformity with the SIP is demonstrated. This approach satisfies the criteria for determining conformity of general federal actions as specified in 40 CFR 93.158(a)(1).

5 References

ATAC Corporation 1997, *NAS Oceana Airfield and Airspace Operational Study Report for BRAC 95*, Draft, prepared for Naval Facilities Engineering Command, Sunnyvale, California.

Defense Base Closure and Realignment Commission (BRAC), July 1, 1995 *Report to the President,* Arlington, Virginia.

ICF Kaiser International, 1995, *Conformity Documentation for the Hampton Roads, Virginia Ozone Nonattainment Area,* Fairfax, Virginia.

Miller, Cdr. Edward, 1997, facsimile transmittal of taxi times at NAS Oceana, Virginia.

Naval Air Station Oceana, July 16, 1997, Support Equipment Division, "Updated Emissions Data, NAS Oceana, Support Equipment," memorandum to Commander, Naval Air Atlantic Fleet, BRAC Officer, Washington, D.C.

Sydnor, James E., 1996, Director, VDEQ Office of Nonattainment and Mobile Source Planning, letters to Steve Martin and Dan Cecchini, LANTDIV Air Quality Section, regarding General Conformity Rule and Hampton Roads Maintenance Plan, Richmond, Virginia.

United States Department of the Navy, AESO, 1997, technical memorandum from Aircraft Environmental Support Office regarding updated engine thrust settings for F/A-18 approach-mode flight.

__________, 1995a, personal communication memorandum from CDR Edward Miller, BRAC Officer, NAS Oceana to D. Cecchini, LANTDIV, regarding 1990, current, and projected aircraft loadings and operations; personnel projections; and realignment schedules, Virginia Beach, Virginia.

__________, 1995b, Form 1391, Project Data Sheets for Project Numbers O&M, P-165U, P-164U, P-163U, P-576U, P-166U, P-712U, P-161U, P-160U, P-453, and P-201, Norfolk, Virginia.

__________, NAWC, June 1994, F110-GE-400 Engine Emission Test, Alpha-Gamma Technologies Contract Number N00140-93-C-8D11, Naval Air Warfare Center, Trenton, New Jersey.

__________, April 26, 1994, Chief of Naval Operations, *Draft Interim Guidance on Compliance with the Clean Air Act General Conformity Rule,* Washington, D.C.

__________, AESO, June 1990, Summary Tables of Gaseous and Particulate Emissions from Aircraft Engines, AESO Report No. 6-90, Aircraft Environmental Support Office, Naval Aviation Depot, NAS San Diego.

__________, 1985, *Master Plan, Master Jet Base, Naval Air Station Oceana, Virginia,* Atlantic Division, Naval Facilities Engineering Command Norfolk, Virginia.

United States Environmental Protection Agency (USEPA), 1995, *Compilation of Air Pollutant Emission Factors (AP-42), Volume I: Stationary Point and Area Sources 5th ed.*, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

__________, 1992, *Procedures for Emission Inventory Preparation Volume IV: Mobile Sources*, Office of Mobile Sources, Ann Arbor, Michigan.

__________, 1986, Office of Air Quality Planning and Standards, *Guideline on Air Quality Models* (Revised) Publication Number 450/2-78-027R, Research Triangle Park, North Carolina.

United States Government Printing Office, Federal Register, March 12, 1997, Volume 62, Number 48, pp. 112337-11346.

__________, Federal Register, April 29, 1997, Volume 62, Number 82, pp. 23139-23140 and pp. 23196-23197.

Virginia Department of Environmental Quality (VDEQ), 1995, *Virginia 1990 Base Year Emission Inventory*, Richmond, Virginia.

__________, 1994, *Virginia Ambient Air Monitoring Data Report*, Richmond, Virginia.

Ward, I., 1995, BRAC/Title V Emissions Analysis for NAS Oceana and Emission Estimation Spreadsheets, facsimile transmittal to Bruce Wattle of Ecology and Environment, Inc., on November 9, 1995.

Wyle Laboratories, 1997, *Aircraft Noise Study for Naval Air Station Oceana Associated with BRAC 1995*, Arlington, Virginia.

A Methods of Analysis

A.1 Aircraft Emissions Analysis

This section describes the methods and assumptions used to estimate the air pollutant emissions from aircraft operations at NAS Oceana and NALF Fentress. The aircraft emissions analysis was conducted in two phases: emission rates were developed for each type of aircraft, and the number and type of operations were estimated for each aircraft type.

A.1.1 Developing Emission Rates

An aircraft engine emits air pollutants during all phases of operation, whether idling on the ground, or in flight. However, only those pollutants emitted in the atmospheric layer known as the mixing layer, affect the ground-level ambient concentrations of those pollutants. The mixing layer is generally referred to as the air layer between the ground and a height where vertical mixing of pollutants decreases significantly.

Aircraft operations which emit pollutants within the mixing layer include:

- Full LTO cycles, which include taxi out/idle, takeoff, climbout, approach, taxi in/idle modes, and a period of idling during refueling known as "hot refueling". The taxi out/idle and taxi in/idle modes include engine RPM increases typically performed prior to flight;
- Touch-and-go operations (T&G), which include only approach, climbout, and touch-and-go level modes of CLP operations were considered the same as T&G operations in this analysis since aircraft modes are similar to T&G;
- GCA box operations, which involve low-altitude circling patterns and include only a level mode; and
- Interfacility operations between NAS Oceana and NALF Fentress, which include only a level mode.

Specific pollutant emission rates are associated with each operating mode. To calculate total emissions for operation of a specific aircraft, emission rates for each operating mode must be used. Total emissions per aircraft, pollutant and operating cycle were calculated using the following equation contained in the *Procedures of Emission Inventory Preparation Volume IV: Mobile Sources* (EPA 1992):

$$E_{ij} = \sum (TIM_{jk}) \; x \; (FF_{jk}/1000) \; x \; (EI_{ijk}) \; x \; (NE_j) \qquad \text{(Eq. A-1)}$$

where:

E_{ij} = total emissions of pollutant i produced by aircraft type j per LTO (or T&G/FCLP) cycle (lbs).
TIM_{jk} = time in mode for mode k for aircraft type j (minutes).
FF_{jk} = fuel flow for mode k for each engine used on aircraft type j (lbs fuel/minute).
EI_{ijk} = emission index for pollutant i in mode k for aircraft type j (lb/10^3 lbs fuel).
NE_j = number of engines used on aircraft j.

Modal emission rates for most of the military aircraft engine types used at NAS Oceana were available in the aforementioned document. However, the F-14 data in this document were based on the F-14A engine (TF30-P-412A). Modal emission rate data for the F-14B and D engines (F110-GE-400) were provided by the Aircraft Environmental Support Office (AESO). AESO also provided emission rates for the level portions of touch-and-go, GCA Box, and interfacility flight operations for F-14A, B, and D, A-6, F/A-18, and E-2/C-2 aircraft. For all other aircraft that perform touch-and-go operations, it was assumed that emission rates for the level mode were equivalent to the emission rates during approach for each particular aircraft. Actual flight data were provided by AESO for F/A-18 approach-mode engine thrust settings. In addition, AESO provided errata for the emission rate data prepared by EPA (EPA 1992), specifically involving emission factors for Navy aircraft incorrectly transcribed in EPA publications.

Emission factors for aircraft engines are usually reported as hydrocarbons (HC) in the form $CH_{y/x}$, where y/x is the ratio of carbon to hydrogen in exhaust refuel to the same ratio in jet fuel. This way of reporting emissions presents complications when attempting to add aircraft engine emissions with other emissions from sources on base reported as VOCs. Only limited data exists to allow determination of which VOC species are in the exhaust. Therefore, to simplify the analysis while remaining conservative, all aircraft engine emissions are assumed composed of VOCs.

Time-in-mode (TIM) data for aircraft operations at NAS Oceana and NALF Fentress were based on default values for U.S. Navy Combat Aircraft, transport-turbine aircraft, and military helicopters for all modes except taxi and idle (EPA 1992). These default TIMs for climbout and approach are based on a mixing height of 3,000 feet. The climbout and approach TIMs for NAS Oceana flight operations were modified based on the local-mixing height. Site-specific TIM for taxi out/idle, taxi in/idle, and hot refueling idle were used instead of EPA default values. Site- specific TIMs were provided by NAS Oceana (Miller 1997).

Projected aircraft operations at NAS Oceana and NALF Fentress are presented in Table A-1. Emission rates for each type of aircraft that conducted operations at NAS Oceana or NALF Fentress in 1993 and aircraft projected to conduct operations in 1999 are shown in Table A-2. In addition, emission rates in pounds per mode were tabulated for full cycle LTOs, touch-and-go/FCLP operations, GCA Box operations, and interfacility level-mode operations.

A.1.2 Aircraft Operations

After aircraft emission rates were developed, the number and types of operations which occurred or will occur in the years of interest were determined. Data for the baseline year (1993) were derived from air traffic control records for both NAS Oceana and NALF Fentress. The number of operations projected for 1999 was taken from the Naval Aviation Simulation Model (NASMOD), which provided the number of operations for specific operation types for F-14A, F-14B/D, and F/A-18 (ATAC 1997). Because the number of operations in 1996, 1997, and 1998 were not modeled by NASMOD, they were estimated by proportioning 1999 data according to the number of aircraft stationed at NAS Oceana during those years. For 1996 through 1998, it was assumed that the number of operations for T-34s, S-3s, C-12s, and E-2/C-2s (NALF Fentress only) would be the same as 1999 because the number of these types of aircraft used at NAS Oceana would not change.

NASMOD data for 1999 distinguishes between full-cycle LTOs and touch-and-gos, thus, 1996, 1997, and 1998 data were proportioned accordingly. Only E-2/C-2 aircraft are permitted to conduct full-stop landings at NALF Fentress; A-6, F-14, and F/A-18 aircraft are permitted to perform only touch-and-go operations (FCLPs included) at NALF Fentress. Therefore, all operations at NALF Fentress, with the exception of E-2/C-2s, were assumed to be touch-and-gos.

The NASMOD analysis counts operations differently than required for air pollutant emission analyses. In the air quality analysis, emissions are calculated for a full LTO cycle, which consists of taxiing, takeoff, climbout, and approach. In NASMOD, departures are counted separately from landings; each is counted as one operation. Generally, the number of departures equals the number of landings, therefore, either is indicative of the number of full LTO cycles at the airfield (assuming each aircraft that performs a landing will also perform a departure at a later time). For the emissions analysis, the number of departures was used as the number of LTOs.

Hot refueling is a period of time during which aircraft are refueled while the engines are in idle mode. Only F-14A, F-14B/D, F/A-18, A-6, and S-3 aircraft are capable of hot refueling. Because facilities for hot refueling are limited, only 25% of the full LTO operations perform hot refueling. The remainder (75%) refuel under engine shut-down conditions (Miller 1997).

In the air quality analysis, T&G and FCLP is counted as one operation consisting of an approach and climbout mode. Level modes of flight during the circling pattern to repeat a T&G or FCLP are analyzed separately. In NASMOD, a T&G and FCLP is counted as two operations. Therefore, T&G and FCLP NASMOD data were divided by two to obtain the data required for the air quality analysis.

In 1997 and later years, aircraft population for F-14As increases, although the number of operations remains nearly steady. This characteristic of the data is due to deployment at sea. More aircraft are considered stationed at NAS Oceana but are on duty away from NAS Oceana; therefore, operations at NAS Oceana are limited.

The number of operations per year for each aircraft type was multiplied by the appropriate emission factors to determine an annual emission rate for each aircraft type. A summary of aircraft emissions from NAS Oceana for 1993, 1996, 1997, 1998, and 1999 is presented in Table A-3. A summary of aircraft emissions from NALF Fentress for the same years is presented in Table A-4.

A.1.3 Example Aircraft Emission Calculation

In summary, the procedure used to calculate emissions from aircraft flight operations consists of the following steps:

- Obtain modal emission rate from best available reference.
- Use default TIMs for all modes except climbout and approach. Modify TIMs for climbout and approach using local mixing layer height and equations A-2 and A-3 presented in Section A.1-1.
- Determine total emissions per aircraft, pollutant and operating cycle using equation A-1.
- Determine total emissions of pollutant from aircraft operations using:

$$E_{Ti} = \sum J,C\ E_{ij} * A$$

where:

E_{ti} = total annual emissions from aircraft flight operations of pollutant i.
E_{ij} = total emissions of pollutant; from aircraft types per operating cycle c.
A = number of operations of type c.

For this analysis, a mixing layer height of 2,500 feet was derived from EPA's published isopleth maps of mixing heights across the U.S. (EPA 1992). This revised mixing layer height is used to modify the TIM for the climb out and approach portions of aircraft flight. TIM would decrease if the mixing layer height is below 3,000 ft.

For example, the TIM for SC Approach was adjusted to reflect local mixing height using Equation 5.9, page 189, of EPA-450:

$$TIM_{app-M} = (default\ TIM\ X\ (H/3000) \qquad \text{(Eq. A-2)}$$

where:

TIM_{app-M}	=	is the adjusted time in the approach mode for military aircraft, in minutes.
default TIM	=	is the default time in mode value from EPA-450, Table 5-1, page 141 (example: 1.6 minutes for USN combat aircraft).
H	=	is the mixing height, reflecting local conditions (2,500 feet for NAS Oceana).
3,000	=	is the EPA default value for mixing height, in feet.

Therefore, TIM_{app-M} = (1.6) X (2,500/3,000) = 1.33 minutes for the approach mode for USN Combat aircraft at NAS Oceana.

The TIM for SC Climbout was adjusted to reflect local mixing height using Equation 5.10, page 189, of EPA-450:

$$TIM_{clim-M} = (default\ TIM)\ X\ [(H-500)/2500] \qquad \text{(Eq. A-3)}$$

where:

TIM_{clim-M}	=	is the adjusted time in the climbout mode for military aircraft, in minutes.
default TIM	=	is the default time in mode value from EPA-450, Table 5-1, page 141 (example: 0.5 minutes for USN Combat aircraft).
H	=	is the mixing height, reflecting local conditions (2,500 feet for NAS Oceana).

Therefore, TIM_{clim-M} = (0.5) X [(2,500-500)/2,500] = 0.4 minutes for the approach mode for USN Combat aircraft at NAS Oceana.

Climbout and approach TIMs were adjusted to 2,500 feet by reducing them by 17%. TIMs for level modes of touch-and-go, GCA Box, and interfacility flight operations were estimated from flight track profiles provided by Wyle Laboratories in aircraft noise studies for NAS Oceana.

A.2 Other Mobile Sources

A.2.1 Ground Support Equipment

GSE emissions were calculated by determining the average amount of fuel used for each GSE based on a review of equipment and fuel logs. Data regarding future fuel usage and the projected amount of GSE to be used in a specific year were provided by NAS Oceana (NAS Oceana 1997). Emission factors for uncontrolled gasoline and diesel industrial engines from the *Compilation of Air Pollutant Emission Factors (AP-42), Volume I: Stationary, Point, and Area Sources* (EPA 1995) were applied to the fuel usage data to calculate emissions from GSE.

Emissions factors, fuel consumption data, and annual emission rates for GSE are shown in Table A-5.

A.2.2 In-Aircraft Maintenance Run-ups

In-aircraft (or in-frame) engine testing is performed on a routine basis at NAS Oceana at designated areas. These operations are known as maintenance run-ups because their purpose is to perform routine maintenance checks, evaluate pilot reports of abnormal operation and to test engines prior to and following test cell procedures. During maintenance run-ups, each engine is tested under specific power settings that correspond to typical operating modes (i.e., idle, takeoff, climbout, and approach). Emission rates per run-up power setting were calculated by multiplying the time in each power setting by the appropriate fuel flow and the emission factors found in *Procedures for Emission Inventory Preparation Volume IV: Mobile Sources* (EPA 1992). These emission rates are presented in Table A-6. The emission rates are multiplied by the number of run-ups per year for each power setting for each engine to estimate the annual emissions from maintenance run-ups (see Table A-7). The existing number of single-engine maintenance run-ups, power settings, and duration in each power setting were compiled from squadron and maintenance crew interviews and logs. The projected number of single-engine maintenance run-ups was obtained from noise studies (Wyle Labs 1997). Emissions of VOCs, NO_x, CO, SO_2, and PM10 generated by maintenance run-ups were calculated in the same manner as in-flight aircraft operations, as detailed in Section A.1.

A.2.3 Mobile Generators

Mobile generator emissions were calculated based upon the average maximum hours of usage per unit. The average maximum use was derived from past operations logs and then multiplied by the reported amount of fuel used by each unit (in gallons). The same AP-42 emission factors that were used for GSE were applied to the fuel usage for mobile generators to calculate emissions.

A.3 Stationary Sources

There are six major categories of stationary sources at NAS Oceana: boilers, generators, engine test cells, fuel storage tanks, painting, and the NEX service station (see Figure A-1).

Sources of data used to estimate stationary source emissions included: spreadsheets developed by the NAS Oceana Environmental Compliance Division (Ward 1995) for tracking fuel usage and emissions data for boilers, diesel generators, the engine test cells, fuel storage tanks (based on vehicle and aircraft refueling), and painting operations; emission rates for boilers, generators, and fuel storage tanks published in the *Compilation of Air Pollutant Emission Factors (AP-42), Volume I: Stationary Point and Area Sources* (EPA 1995); the projected number of aircraft stationed at NAS Oceana in the years of interest (ATAC 1997); and the projected number of test cell operations (Wyle Labs 1997). The stationary source emissions are presented in Table A-8.

A.3.1 Boilers

Boiler emissions were estimated by applying the appropriate AP-42 emission factors to fuel usage data. The largest and most widely used boilers at NAS Oceana are those at the main boiler plant, which have maximum rated capacities of 70 MM Btu/hr. These are small industrial boilers that burn No. 4 fuel oil and natural gas. Other boilers at NAS Ocean burn a combination of No. 2 fuel oil and natural gas.

A.3.2 Generators

Stationary generator emissions were calculated according to fuel logs. Projected emissions from these sources were derived from the highest annual emission rates reported in previous years examined. The emission factors were the same as those used for mobile generators.

A.3.3 Fuel Handling

Projected jet fuel (JP-5) storage tank emissions were calculated by deriving data from filling logs and estimating VOCs emitted during fuel transfer to and from tank trucks and aircraft.

To accomplish this, the AP-42 emission factors for submerged and splash loading loss for tank trucks and rail tank cars were applied to the total annual JP-5 throughput associated with fuel transfer operations, estimated through review of fuel logs.

A.3.4 Jet Engine Test Cell Emissions

The four jet engine test cells at NAS Oceana are used to identify the maintenance needs of an engine and to verify that the engine has been restored to proper working condition prior to reinstallation into aircraft. During testing, each engine is operated under various power settings that approximate typical operating modes such as the idle, takeoff, climbout, and approach.

Estimates of power settings and durations for engine tests, as well as the number and type performed each year, were compiled by Wyle Laboratories (Wyle Labs 1997) and are presented in Appendix D. Wyle only provided these data for F-14A, F-14B/D, and F/A-18 aircraft. Engine testing for A-6 aircraft was assumed to be performed in power settings analogous to those used when testing the F-14A engines and of the same duration.

Using these data, the emissions from engine testing at NAS Oceana were calculated as follows. Emission rates in pounds per test for VOCs, NO_X, CO, SO_2, and PM_{10} were calculated using appropriate fuel flows,the time spent in each power setting, and emission factors. The various power settings were obtained from the *Procedures for Emission Inventory Preparation Volume IV: Mobile Sources* (EPA 1992); AESO Report No. 6-90 (AESO 1990); and an AESO 1997 technical memorandum (AESO 1997). The equation shown in Section A.1.1 for calculating aircraft emission rates was applied to these variables to calculate engine test emission rates. The number of engines (NE) was always one because aircraft engines are tested one at a time. In addition, the fuel used per test cycle was calculated using time in power setting, fuel flow, and fuel density (6.8 lbs/gallon for JP-5). The emission rates and fuel usage per test cycle for aircraft engines are presented in Table A-9. Only the engines used in the F-14A (TF-30-P-412A), F-14B/D (F110-GE-400), A-6 (J-52-P-8B), and F/A-18 (F404-GE-400) were considered because they are the primary aircraft stationed and serviced at NAS Oceana.

A.3.5 Service Stations

NEX service station fuel throughput was calculated based on the number of personal vehicles on station for the years in question. NAS Oceana operates three service stations; two are operated by the Navy Exchange, and one is operated by the Public Works Center. Emission factors from AP-42 for filling and breathing loss from gasoline retail operations and displacement and spillage loss for vehicle gasoline tanks were applied to service stations' throughput to calculate VOC emissions. These calculations also include emission reductions associated with Stage II vapor recovery equipment installed at the service stations in 1995 and 1996.

A.3.6 Painting Operations

Data on the types and quantities of paints used at NAS Oceana, along with the VOC content (pounds per gallon) of each paint, were obtained from base records. The VOC emissions from painting for a given year were calculated by multiplying the total gallons of each type of paint used by the respective VOC content. The primary assumption was that 100% of the VOCs contained in the paint evaporate while the paint is drying. For 1996 through 1999, the quantities of paint used annually were estimated using the number of aircraft projected to be based at NAS Oceana and the painting requirements of each type of aircraft.

A.4 Construction Emissions

Construction projects fall into two general categories: automobile parking lot/aircraft apron and new building/building additions. Emissions are produced in each category from construction equipment exhaust emissions during site preparation and construction/paving activities. Fugitive particulate matter is generated during the disturbance of soil, removal of existing structures/obstructions and construction.

Emissions are estimated for these activities using equipment exhaust emission factors, fugitive dust emission factors, and best engineering estimates of the duration of construction and the number and type of equipment used.

A.4.1 Project Schedule Estimation

Construction duration was based on typical durations for similar types of structures or projects. A work day is assumed to be 8 hours long, during which the equipment operates continuously. All construction projects were assumed to occur in CY 1998.

Since all projects occur in 1998 and only annual emission estimates are required, construction schedule estimates for all individual projects were summed to produce a total estimate of equipment type, quantity, and duration of use. Equipment for construction of the automobile parking lot, aircraft apron, new building, and building addition and the duration of activity estimates are shown in Table A-11.

A.4.2 Truck and Machinery Exhaust Emission Estimates

Heavy equipment is used to prepare a site for construction of parking lots, aircraft parking aprons, new buildings and additions to existing buildings. Activities such as excavation, grading and soil compacting occur during site preparation. Heavy equipment is also used during the construction phase of the project. Pavers, rollers and haul trucks are typically used during parking lot and aircraft apron construction; cranes, hi-lifts, and front-end loaders are typical of heavy equipment used during building construction.

Exhaust and crankcase emissions from heavy-duty construction equipment were estimated by calculating the amount of fuel burned and applying an appropriate emission factor. Emissions from haul trucks (dump trucks and cement mixers) were calculated by estimating the amount of miles driven and hours idling each work day and applying the appropriate emission factors. Emission factors for heavy construction equipment were obtained from *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources (USEPA 1992)* and *Nonroad Engine and Vehicle Emission Study Report (USEPA 1991).*

These emission factors are shown in Table A-11. The analysis assumes each piece of construction equipment burns an average of 50 gallons of diesel fuel per day.

The annual emission estimate is a sum of the individual emissions from each piece of heavy equipment. Equipment emissions were calculated using:

$$\textit{Emissions (tons/year)} = \frac{((\textit{Daily fuel use} * \textit{days used})/1{,}000) * \textit{Equip quantity} * \textit{EFactor}}{2{,}000\ \textit{lb/ton}}$$

Similarly, engine exhaust emissions from haul truck activity were calculated using the following equation, assuming each truck is driven 100 miles/day and idled 2 hours/day:

$$\textit{Emissions (tons/year)} = \frac{(\textit{Daily miles driven} * \textit{days used} * \textit{number of trucks} * \textit{EFactor})}{(454\ \textit{g/lb} * 2{,}000\ \textit{lb/ton})}$$

$$+ \frac{(\textit{Daily hours idled} * \textit{days used} * \textit{number of trucks} * \textit{EFactor})}{(454\ \textit{g/lb} * 2{,}000\ \textit{lb/ton})}$$

A.4.3 Fugitive Dust (Particulate) Emissions

Fugitive dust is emitted from mechanical disturbance of soil during site preparation and mechanical disturbance of other particulate producing materials such as construction debris during demolition.

Emission of fugitive dust due to demolition was calculated using an estimate of floor space demolished multiplied by an appropriate particulate emission factor. The amount of floor space demolished in preparation for all construction projects under each ARS was estimated to be 10% of total floor space constructed from all projects. Emission of fugitive dust due to site preparation was calculated using an estimate of the total construction projects' "footprint" plus additional disturbed area for equipment use. A project's footprint was determined by dividing the total floor space constructed by the number of floors. A multiplication factor of 2 was used to estimated the additional disturbed area for equipment use. Emission factors for fugitive dust were obtained from the *Fugitive Dust Background and*

Technical Information Document For Best Available Control Measures Document (USEPA 1992).

During the demolition phase, dust is emitted from structure and debris removal and vehicle activity. For demolition activity, the following equation was used to calculate annual emissions:

Emissions (tons/year) = (Floor space * EFactor for structure removal)
+(Floor space * EFactor for debris removal)
+(Floor space * EFactor for on-site vehicle activity)

Annual demolition particulate emissions are shown in Table A-12.

During site preparation, dust is emitted during bulldozing, soil removal and earth-moving activity. The following equation was used to calculate annual emissions:

Emissions (tons/year) = (Hours bulldozing per day * days active * EFactor)
+(Miles travelled during soil removal per acre * Acres * EFactor)
+(Miles travelled during soil removal * 3 (distance factor) * EFactor)

Assumptions for the analysis of site preparation dust are: 8 hours per day of bulldozing activity, 0.79 miles travelled per acre of soil removal (based on an average pan scraper speed of 5 MPH, pan width of 10 feet and length of one side of a square acre of 209 feet), and earthmoving miles travelled of three times soil removal miles to account for transport of soil to and from a holding area.

Annual site preparation particulate emissions are shown in Table A-12.

Total annual emissions for each pollutant emitted from each construction project were summed were summed to produce the results presented in Table A-13.

Table A-1
ARS 1
TOTAL AIRCRAFT OPERATIONS AT NAS OCEANA AND NALF FENTRESS
FOR 1993 AND 1996-1999

Aircraft Type	Operation type	1993	1996	1997	1998	1999
F-14A	Full LTO	12,465	9,171	11,932	11,340	11,340
	Touch&Go NASO	15,236	12,361	16,083	15,286	15,286
	GCA Box	2,178	867	1,128	1,072	1,072
	Interfacility	2,164	1,661	2,162	2,054	2,054
	Touch&Go NALF	10,511	13,909	18,097	17,200	17,200
F-14B/D	Full LTO	8,551	6,804	8,974	8,974	8,974
	Touch&Go NASO	10,452	9,171	12,095	12,095	12,095
	GCA Box	1,494	643	848	848	848
	Interfacility	1,485	1,233	1,626	1,626	1,626
	Touch&Go NALF	7,226	10,320	13,610	13,610	13,610
A-6	Full LTO	13,401	0	0	0	0
	Touch&Go NASO	16,380	0	0	0	0
	GCA Box	2,341	0	0	0	0
	Interfacility	2,326	0	0	0	0
	Touch&Go NALF	11,086	0	0	0	0
F/A-18	Full LTO	0	1,656	1,656	18,218	26,499
	Touch&Go NASO	0	2,392	2,392	26,309	38,268
	GCA Box	0	0	0	755	1,098
	Interfacility	0	0	0	2,545	3,702
	Touch&Go NALF	0	0	0	18,503	26,913
A-4	Full LTO	4,169	0	0	0	0
	Touch&Go	5,096	0	0	0	0
F-16	Full LTO	936	0	0	0	0
	Touch&Go	1,144	0	0	0	0
F-5	Full LTO	808	0	0	0	0
	Touch&Go	988	0	0	0	0
TC-4C	Full LTO	638	0	0	0	0
	Touch&Go	780	0	0	0	0
UH-3H	Full LTO	662	0	0	0	0
C-12	Full LTO	261	1,664	1,664	1,664	1,664
	Touch&Go	445	2,722	2,722	2,722	2,722
	GCA Box	0	1,106	1,106	1,106	1,106
S-3	Full LTO	1,741	967	967	967	967
	Touch&Go	1,295	930	930	930	930
	GCA Box	1,323	372	372	372	372
T-2C	Full LTO	1,418	0	0	0	0
T-34	Full LTO	1,040	1,040	1,040	1,040	1,040
E-2/C-2	Full LTO NALF	1,074	896	896	896	896
	Touch&Go NALF	25,058	20,478	20,478	20,478	20,478
Total		**166,172**	**100,364**	**120,778**	**180,610**	**210,760**

Notes:
(1) F-14 operations divided between F-14As and F-14B/Ds using 1993 aircraft population data.
Number of GCAs and interfacility flights were proportioned from 1997 data based on the number of aircraft.
(2) 1996-1998 operations proportioned from 1999 data using NAS Oceana aircraft population data
A-6s assumed decommissioned by mid-1997.
(3) 1999 and Transient aircraft operations derived from NASMOD analysis (ATAC 1997).
(4) GCA box and interfacility flights include only the level portion of those operations.
Takeoff and landings for these operations are accounted for under full LTO or T&G.

Key:
LTO = Landing and takeoff cycle
GCA = Ground Control Approach
NASO = Naval Air Station Oceana
NALF = Naval Auxiliary Landing Field

Table A-2
ARS 1
MODAL EMISSION RATES FOR AIRCRAFT AT NAS OCEANA

Aircraft (Engine Model)	Mode	Time in Mode (minutes)	Fuel Flow ((lb/min)/eng)	Engines	Emission Factor ([lb /1000 lb fuel]/eng)					Modal Emission Rates (lb/mode)				
					VOC (1)	NOx	CO	SO2	PM10 (2)	VOC (1)	NOx	CO	SO2	PM10 (2)
	Taxi Out/Idle	7.0	15.33	2	31.42	3.22	55.51	0.54	8.96	6.74	0.69	11.91	0.12	1.92
(TF30-P-412A)	Hot Refueling Idle	16.0	15.33	2	31.42	3.22	55.51	0.54	8.96	15.41	1.58	27.23	0.26	4.40
	Take Off	0.4	796.67	2	0.20	4.79	10.77	0.54	0.00	0.13	3.05	6.86	0.34	0.00
	Climbout	0.4	117.50	2	0.77	19.60	1.38	0.54	2.98	0.07	1.84	0.13	0.05	0.28
	Approach	1.3	71.67	2	1.48	10.74	3.43	0.54	7.98	0.28	2.00	0.64	0.10	1.49
	Taxi In/Idle	5.3	15.33	2	31.42	3.22	55.51	0.54	8.96	5.11	0.52	9.02	0.09	1.46
	T&G Level	1.4	71.67	2	1.48	10.74	3.43	0.54	7.98	0.30	2.16	0.69	0.11	1.60
	GCA Box	9.7	71.67	2	1.48	10.74	3.43	0.54	7.98	2.06	14.93	4.77	0.75	11.10
	Interfacility	1.6	71.67	2	1.48	10.74	3.43	0.54	7.98	0.34	2.46	0.79	0.12	1.83
									Touch and Go	**0.65**	**6.00**	**1.46**	**0.26**	**3.37**
									Full LTO w/hot ref.	**27.74**	**9.69**	**55.80**	**0.96**	**9.54**
									Full LTO w/o hot ref.	**12.32**	**8.11**	**28.57**	**0.70**	**5.15**
									Interfacility	**0.34**	**2.46**	**0.79**	**0.12**	**1.83**
									GCA Box	**2.06**	**14.93**	**4.77**	**0.75**	**11.10**
F-14B/D	Taxi Out/Idle	7.0	19.52	2	3.65	2.77	16.60	0.54	12.38	1.00	0.76	4.54	0.15	3.38
(F110-GE-400)	Hot Refueling Idle	16.0	19.52	2	3.65	2.77	16.60	0.54	12.38	2.28	1.73	10.37	0.34	7.73
	Take Off	0.4	195.32	2	0.40	28.63	0.84	0.54	2.81	0.06	4.47	0.13	0.08	0.44
	Climbout	0.4	195.32	2	0.40	28.63	0.84	0.54	2.81	0.06	4.47	0.13	0.08	0.44
	Approach	1.3	133.03	2	0.26	19.61	0.76	0.54	6.10	0.09	6.78	0.26	0.19	2.11
	Taxi In/Idle	5.3	19.52	2	3.65	2.77	16.60	0.54	12.38	0.76	0.57	3.43	0.11	2.56
	T&G Level	1.4	64.10	2	0.95	8.75	1.64	0.54	6.10	0.17	1.57	0.29	0.10	1.09
	GCA Box	9.7	64.10	2	0.95	8.75	1.64	0.54	6.10	1.18	10.88	2.04	0.67	7.59
	Interfacility	1.6	64.10	2	0.95	8.75	1.64	0.54	6.10	0.19	1.79	0.34	0.11	1.25
									Touch and Go	**0.32**	**12.83**	**0.69**	**0.37**	**3.64**
									Full LTO w/ hot ref.	**4.25**	**18.79**	**18.87**	**0.95**	**16.67**
									Full LTO w/o hot ref.	**1.97**	**17.06**	**8.50**	**0.61**	**8.93**
									Interfacility	**0.19**	**1.79**	**0.34**	**0.11**	**1.25**
									GCA Box	**1.18**	**10.88**	**2.04**	**0.67**	**7.59**
A-6	Taxi Out/Idle	7.0	11.33	2	42.20	1.79	63.78	0.54	0.00	6.69	0.28	10.12	0.09	0.00
(J-52-P-8B)	Hot Refueling Idle	20.0	11.33	2	42.20	1.79	63.78	0.54	0.00	19.13	0.81	28.91	0.24	0.00
	Take Off	0.4	122.83	2	0.93	13.05	0.71	0.54	0.00	0.09	1.28	0.07	0.05	0.00
	Climbout	0.4	72.00	2	0.58	10.10	3.00	0.54	0.00	0.03	0.58	0.17	0.03	0.00
	Approach	1.3	38.33	2	1.72	6.34	10.54	0.54	0.00	0.17	0.63	1.05	0.05	0.00
	Taxi In/Idle	5.3	11.33	2	42.20	1.79	63.78	0.54	0.00	5.07	0.21	7.66	0.06	0.00
	T&G Level	1.4	38.33	2	1.72	6.34	10.54	0.54	0.00	0.18	0.68	1.13	0.06	0.00
	GCA Box	9.7	38.33	2	1.72	6.34	10.54	0.54	0.00	1.28	4.71	7.84	0.40	0.00
	Interfacility	1.6	38.33	2	1.72	6.34	10.54	0.54	0.00	0.21	0.78	1.29	0.07	0.00
									Touch and Go	**0.39**	**1.89**	**2.35**	**0.14**	**0.00**
									Full LTO w/ hot ref.	**31.18**	**3.81**	**47.97**	**0.53**	**0.00**
									Full LTO w/o hot ref.	**12.06**	**2.99**	**19.07**	**0.29**	**0.00**
									Interfacility	**0.21**	**0.78**	**1.29**	**0.07**	**0.00**
									GCA Box	**1.28**	**4.71**	**7.84**	**0.40**	**0.00**

Table A-2
ARS 1
MODAL EMISSION RATES FOR AIRCRAFT AT NAS OCEANA

Aircraft (Engine Model)	Mode	Time in Mode (minutes)	Fuel Flow ((lb/min)/eng)	Engines	Emission Factor ([lb /1000 lb fuel]/eng)					Modal Emission Rates (lb/mode)				
					VOC (1)	NOx	CO	SO2	PM10 (2)	VOC (1)	NOx	CO	SO2	PM10 (2)
A-4	Taxi Out/Idle	6.5	11.33	1	42.20	1.79	63.78	0.54	0.00	3.11	0.13	4.70	0.04	0.00
(J-52-P-8B)	Take Off	0.4	122.83	1	0.93	13.05	0.71	0.54	0.00	0.05	0.64	0.03	0.03	0.00
	Climbout	0.4	72.00	1	0.58	10.10	3.00	0.54	0.00	0.02	0.29	0.09	0.02	0.00
	Approach	1.3	38.33	1	1.72	6.34	10.54	0.54	0.00	0.09	0.32	0.53	0.03	0.00
	Taxi In/Idle	6.5	11.33	1	42.20	1.79	63.78	0.54	0.00	3.11	0.13	4.70	0.04	0.00
	T&G Level	1.4	38.33	1	1.72	6.34	10.54	0.54	0.00	0.09	0.34	0.57	0.03	0.00
									Touch and Go	**0.19**	**0.95**	**1.18**	**0.07**	**0.00**
									Full LTO w/o hot ref.	**6.36**	**1.51**	**10.04**	**0.15**	**0.00**
F-16	Taxi Out/Idle	6.5	17.67	1	2.26	3.96	19.34	0.54	0.09	0.26	0.45	2.22	0.06	0.01
(F100-PW-100)	Take Off	0.4	736.67	1	0.10	16.50	55.10	0.54	0.00	0.03	4.86	16.24	0.16	0.00
	Climbout	0.4	173.33	1	0.05	44.00	1.80	0.54	0.83	0.00	3.05	0.12	0.04	0.06
	Approach	1.3	50.00	1	0.60	11.00	3.00	0.54	0.33	0.04	0.72	0.20	0.04	0.01
	Taxi In/Idle	6.5	17.67	1	2.26	3.96	19.34	0.54	0.09	0.26	0.45	2.22	0.06	0.01
	T&G Level	1.4	50.00	1	0.60	11.00	3.00	0.54	0.33	0.04	0.77	0.21	0.04	0.02
									Touch and Go	**0.08**	**4.54**	**0.53**	**0.11**	**0.09**
									Full LTO w/o hot ref.	**0.59**	**9.54**	**21.00**	**0.36**	**0.088**
F-5	Taxi Out/Idle	6.5	6.67	2	24.25	1.25	159.00	0.54	0.00	2.10	0.11	13.79	0.05	0.00
(J85-GE-21)	Take Off	0.4	177.50	2	0.10	5.60	36.40	0.54	0.00	0.01	0.80	5.17	0.08	0.00
	Climbout	0.4	53.33	2	0.25	5.00	21.56	0.54	0.00	0.01	0.21	0.92	0.02	0.00
	Approach	1.3	20.00	2	2.58	2.92	46.25	0.54	0.00	0.13	0.15	2.41	0.03	0.00
	Taxi In/Idle	6.5	6.67	2	24.45	1.25	159.00	0.54	0.00	2.12	0.11	13.79	0.05	0.00
	T&G Level	1.4	20.00	2	2.58	2.92	46.25	0.54	0.00	0.14	0.16	2.59	0.03	0.00
									Touch and Go	**0.29**	**0.53**	**5.91**	**0.08**	**0.00**
									Full LTO w/o hot ref.	**4.38**	**1.38**	**36.07**	**0.22**	**0.00**
F/A-18	Taxi Out/Idle	7.0	10.40	2	58.18	1.16	137.34	0.40	12.38	8.47	0.17	20.00	0.06	1.80
(F404-GE-400)	Hot Refueling Idle	11.0	10.40	2	58.18	1.16	137.34	0.40	12.38	13.31	0.27	31.42	0.09	2.83
	Take Off	0.4	473.28	2	0.13	9.22	23.12	0.40	0.00	0.05	3.49	8.75	0.15	0.00
	Climbout	0.4	143.12	2	0.31	25.16	1.05	0.40	2.81	0.04	2.88	0.12	0.05	0.32
	Approach	1.3	66.75	2	0.44	8.37	1.78	0.40	6.10	0.08	1.45	0.31	0.07	1.06
	Taxi In/Idle	5.3	10.40	2	58.18	1.16	137.34	0.40	12.38	6.41	0.13	15.14	0.04	1.36
	T&G Level	1.7	60.00	2	0.44	8.37	1.78	0.40	6.10	0.09	1.71	0.36	0.08	1.24
	GCA Box	9.0	60.00	2	0.44	8.37	1.78	0.40	6.10	0.48	9.04	1.92	0.43	6.59
	Interfacility	1.4	85.00	2	0.38	11.78	1.16	0.40	6.10	0.09	2.80	0.28	0.10	1.45
									Touch and Go	**0.20**	**6.04**	**0.79**	**0.20**	**2.62**
									Full LTO w/ hot ref.	**28.36**	**8.39**	**75.74**	**0.46**	**7.38**
									Full LTO w/o hot ref.	**15.05**	**8.12**	**44.32**	**0.37**	**4.55**
									Interfacility	**0.09**	**2.80**	**0.28**	**0.10**	**1.45**
									GCA Box	**0.48**	**9.04**	**1.92**	**0.43**	**6.59**

Table A-2
ARS 1
MODAL EMISSION RATES FOR AIRCRAFT AT NAS OCEANA

Aircraft (Engine Model)	Mode	Time in Mode (minutes)	Fuel Flow ((lb/min)/eng)	Engines	Emission Factor ([lb /1000 lb fuel]/eng)					Modal Emission Rates (lb/mode)				
					VOC (1)	NOx	CO	SO2	PM10 (2)	VOC (1)	NOx	CO	SO2	PM10 (2)
S-3	Taxi Out/Idle	6.5	7.63	2	14.99	1.69	90.98	0.54	3.26	1.49	0.17	9.02	0.05	0.32
(TF34-GE-400)	Hot Refueling Idle	8.0	7.63	2	14.99	1.69	90.98	0.54	3.26	1.83	0.21	11.11	0.07	0.40
	Take Off	0.4	63.33	2	0.39	7.51	5.95	0.54	2.11	0.02	0.38	0.30	0.03	0.11
	Climbout	0.4	7.67	2	2.63	3.42	33.57	0.54	6.85	0.02	0.02	0.21	0.00	0.04
	Approach	1.3	7.67	2	2.63	3.42	33.57	0.54	6.85	0.05	0.07	0.67	0.01	0.14
	Taxi In/Idle	6.5	7.63	2	14.99	1.69	90.98	0.54	3.26	1.49	0.17	9.02	0.05	0.32
	T&G Level	1.8	7.67	2	2.63	3.42	33.57	0.54	6.85	0.07	0.09	0.93	0.01	0.19
	GCA Box	7.5	7.67	2	2.63	3.42	33.57	0.54	6.85	0.30	0.39	3.86	0.06	0.79
									Touch and Go	**0.14**	**0.18**	**1.80**	**0.03**	**0.37**
									Full LTO w/ hot ref.	**4.89**	**1.01**	**30.33**	**0.21**	**1.33**
									Full LTO w/o hot ref.	**3.06**	**0.80**	**19.23**	**0.15**	**0.93**
									GCA Box	**0.30**	**0.39**	**3.86**	**0.06**	**0.79**
C-12/TC-4	Taxi Out/Idle	19.0	2.45	2	101.63	1.97	115.31	0.54	0.00	9.46	0.18	10.74	0.05	0.00
(PT6A-41)	Take Off	0.5	8.50	2	1.75	7.98	5.10	0.54	0.00	0.01	0.07	0.04	0.00	0.00
	Climbout	2.1	7.88	2	2.03	7.57	6.49	0.54	0.00	0.07	0.25	0.21	0.02	0.00
	Approach	3.7	4.55	2	22.71	4.65	34.80	0.54	0.00	0.76	0.16	1.17	0.02	0.00
	Taxi In/Idle	7.0	2.45	2	101.63	1.97	115.31	0.54	0.00	3.49	0.07	3.96	0.02	0.00
	T&G Level	2.0	4.55	2	22.71	4.65	34.80	0.54	0.00	0.41	0.08	0.63	0.01	0.00
	GCA Box	7.5	4.55	2	22.71	4.65	34.80	0.54	0.00	1.55	0.32	2.38	0.04	0.00
									Touch and Go	**1.25**	**0.49**	**2.02**	**0.05**	**0.00**
									Full LTO w/o hot ref.	**13.79**	**0.73**	**16.12**	**0.11**	**0.00**
									GCA Box	**1.55**	**0.32**	**2.38**	**0.04**	**0.00**
UH-3H	Taxi Out/Idle	8.0	2.20	2	130.42	1.43	178.44	0.54	0.00	4.59	0.05	6.28	0.02	0.00
(T58-GE-8F)	Take Off	0.0	13.10	2	0.40	5.47	9.03	0.54	0.00	0.00	0.00	0.00	0.00	0.00
	Climbout	5.7	10.45	2	0.80	4.68	14.13	0.54	0.00	0.10	0.08	0.11	0.03	0.00
	Approach	5.7	9.68	2	1.12	4.47	17.28	0.54	0.00	0.13	0.53	2.06	0.06	0.00
	Taxi In/Idle	7.0	2.20	2	130.42	1.43	178.44	0.54	0.00	4.02	0.04	5.50	0.02	0.00
									Full LTO w/o hot ref.	**8.84**	**0.71**	**13.94**	**0.13**	**0.00**
T-34	Taxi Out/Idle	6.5	1.92	1	50.17	2.43	64.00	0.54	0.00	0.63	0.03	0.80	0.01	0.00
(PT6A-25)	Take Off	0.4	7.08	1	0.00	7.81	1.01	0.54	0.00	0.00	0.02	0.00	0.00	0.00
	Climbout	0.4	6.67	1	0.00	7.00	1.20	0.54	0.00	0.00	0.02	0.00	0.00	0.00
	Approach	1.3	3.58	1	2.19	8.37	23.02	0.54	0.00	0.01	0.04	0.11	0.00	0.00
	Taxi In/Idle	6.5	1.92	1	50.17	2.43	64.00	0.54	0.00	0.63	0.03	0.80	0.01	0.00
									Full LTO w/o hot ref.	**1.26**	**0.14**	**1.71**	**0.02**	**0.00**

Table A-2
ARS 1
MODAL EMISSION RATES FOR AIRCRAFT AT NAS OCEANA

Aircraft (Engine Model)	Mode	Time in Mode (minutes)	Fuel Flow ((lb/min)/eng)	Engines	Emission Factor ([lb /1000 lb fuel]/eng)					Modal Emission Rates (lb/mode)				
					VOC (1)	NOx	CO	SO2	PM10 (2)	VOC (1)	NOx	CO	SO2	PM10 (2)
T-2 (J85-GE-2)	Taxi Out/Idle	6.5	9.33	2	11.86	3.68	111.86	0.54	0.00	1.44	0.45	13.57	0.07	0.00
	Take Off	0.4	48.17	2	0.45	6.40	21.56	0.54	0.00	0.02	0.25	0.83	0.02	0.00
	Climbout	0.4	35.92	2	0.64	5.67	28.38	0.54	0.00	0.02	0.16	0.82	0.02	0.00
	Approach	1.3	17.42	2	2.40	4.02	63.53	0.54	0.00	0.11	0.18	2.88	0.02	0.00
	Taxi In/Idle	6.5	9.33	2	11.86	3.68	111.86	0.54	0.00	1.44	0.45	13.57	0.07	0.00
									Full LTO w/o hot ref.	**3.02**	**1.48**	**31.66**	**0.19**	**0.00**
E-2/C-2 (T56-A-16)	Taxi Out/Idle	19.0	9.98	2	19.24	3.53	30.11	0.54	0.00	7.30	1.34	11.42	0.20	0.00
	Take Off	0.5	36.98	2	0.14	10.45	0.65	0.54	0.00	0.01	0.39	0.02	0.02	0.00
	Climbout	2.1	36.98	2	0.14	10.45	0.65	0.54	0.00	0.02	1.62	0.10	0.08	0.00
	Approach	3.7	33.27	2	0.17	9.93	0.42	0.54	0.00	0.04	2.44	0.10	0.13	0.00
	Taxi In/Idle	7.0	9.98	2	19.24	3.53	30.11	0.54	0.00	2.69	0.49	4.21	0.08	0.00
	T&G Level	1.6	15.00	2	0.95	6.52	4.54	0.54	0.00	0.05	0.31	0.22	0.03	0.00
									Touch and Go	**0.11**	**4.38**	**0.42**	**0.24**	**0.00**
									Full LTO w/o hot ref.	**10.05**	**6.29**	**15.85**	**0.52**	**0.00**

Notes:

1) Aircraft VOC reported as HC in the form CHy/x

2) Emission factors equal to 0.00 for PM10 indicate that no factor has been determined (AESO 1996).

Emission factors from AESO Report Number 6-90 and USEPA AP-42.

Shaded areas indicate the nonattainment pollutants of concern.

Modal emission rates calculated from data provided by AESO, except for time in modes for T&G, GCA Box, and interfacility level modes from flight track profiles.

Level mode TIMs estimated from flight track profiles for F-14, E-2/C-2, F/A-18, and S-3 aircraft. Level TIMs for C-12s and TC-4s were assumed to be the same as E-2/C-2

All other aircraft are assumed to have the same level TIMs as F-14s.

Emission rates for T&G operations include approach, climbout, and T&G level modes only.

GCA box and interfacility mode emission rates are presented only for aircraft that conduct low-altitude operations between NAS Oceana and NALF Fentress.

F-14B and F-14D have the same engine types, and therefore, have identical emission rates.

TC-4s are assumed to have the same emission rates as C-12s.

FCLP mode is included in T&G

Key:

VOC = volatile organic compounds	LTO w/ hot ref. = landing and takeoff cycle with hot refueling idle
NOx = oxides of nitrogen	LTO w/o hot ref. = landing and takeoff cycle without hot refueling idle
CO = carbon monoxide	T&G = touch and go
SO2 = sulfur dioxide	GCA = ground control approach
PM10 = particulate matter	Interfacility = low altitude operations between NAS Oceana and NALF Fentress
	TIM = time in mode

Table A-3
ARS 1
AIRCRAFT EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e) per operation (lb)	VOC (e) Total (TPY)	NOx per operation (lb)	NOx Total (TPY)	CO per operation (lb)	CO Total (TPY)	SO2 per operation (lb)	SO2 Total (TPY)	PM10 per operation (lb)	PM10 Total (TPY)
1993	F-14A	Full LTO w/ hot ref.	3,116	27.74	43.22	9.69	15.10	55.80	86.94	0.96	1.50	9.54	14.87
		Full LTO w/o hot ref.	9,349	12.32	57.61	8.11	37.91	28.57	133.54	0.70	3.27	5.15	24.06
		Touch&Go	15,236	0.65	4.91	6.00	45.70	1.46	11.10	0.26	1.98	3.37	25.66
		GCA Box	2,178	2.06	2.24	14.93	16.26	4.77	5.19	0.75	0.82	11.10	12.08
		Interfacility	2,164	0.34	0.37	2.46	2.67	0.79	0.85	0.12	0.13	1.83	1.98
	F-14B	Full LTO w/ hot ref.	2,138	4.25	4.54	18.79	20.09	18.87	20.17	0.95	1.02	16.67	17.81
		Full LTO w/o hot ref.	6,414	1.97	6.31	17.06	54.71	8.50	27.25	0.61	1.97	8.93	28.65
		Touch&Go	10,452	0.32	1.69	12.83	67.03	0.69	3.60	0.37	1.92	3.64	19.04
		GCA Box	1,494	1.18	0.88	10.88	8.13	2.04	1.52	0.67	0.50	7.59	5.67
		Interfacility	1,485	0.19	0.14	1.79	1.33	0.34	0.25	0.11	0.08	1.25	0.93
	A-6	Full LTO w/ hot ref.	3,350	31.18	52.24	3.81	6.38	47.97	80.37	0.53	0.89	0.00	0.00
		Full LTO w/o hot ref.	10,051	12.06	60.60	2.99	15.05	19.07	95.84	0.29	1.45	0.00	0.00
		Touch&Go	16,380	0.39	3.19	1.89	15.51	2.35	19.28	0.14	1.17	0.00	0.00
		GCA Box	2,341	1.28	1.50	4.71	5.52	7.84	9.17	0.40	0.47	0.00	0.00
		Interfacility	2,326	0.21	0.25	0.78	0.90	1.29	1.50	0.07	0.08	0.00	0.00
	A-4	Full LTO w/o hot ref.	4,169	6.36	13.27	1.51	3.15	10.04	20.93	0.15	0.31	0.00	0.00
		Touch&Go	5,096	0.19	0.50	0.95	2.41	1.18	3.00	0.07	0.18	0.00	0.00
	F-16	Full LTO w/o hot ref.	936	0.59	0.28	9.54	4.46	21.00	9.83	0.36	0.17	0.09	0.04
		Touch&Go	1,144	0.08	0.05	4.54	2.59	0.53	0.30	0.11	0.06	0.09	0.05
	F-5	Full LTO w/o hot ref.	808	4.38	1.77	1.38	0.56	36.07	14.57	0.22	0.09	0.00	0.00
		Touch&Go	988	0.29	0.14	0.53	0.26	5.91	2.92	0.08	0.04	0.00	0.00
	TC-4	Full LTO w/o hot ref.	638	13.79	4.40	0.73	0.23	16.12	5.14	0.11	0.03	0.00	0.00
		Touch&Go	780	1.25	0.49	0.49	0.19	2.02	0.79	0.05	0.02	0.00	0.00
	UH-3H	Full LTO w/o hot ref.	662	8.84	2.92	0.71	0.23	13.94	4.61	0.13	0.04	0.00	0.00
	C-12	Full LTO w/o hot ref.	261	13.79	1.80	0.73	0.09	16.12	2.10	0.11	0.01	0.00	0.00
		Touch&Go	445	1.25	0.28	0.49	0.11	2.02	0.45	0.05	0.01	0.00	0.00
	S-3	Full LTO w/ hot ref.	870	4.89	2.13	1.01	0.44	30.33	13.20	0.21	0.09	1.33	0.58
		Full LTO w/o hot ref.	870	3.06	1.33	0.80	0.35	19.23	8.37	0.15	0.06	0.93	0.41
		Touch&Go	1,295	0.14	0.09	0.18	0.12	1.80	1.17	0.03	0.02	0.37	0.24
		GCA Box	1,323	0.30	0.20	0.39	0.26	3.86	2.55	0.06	0.04	0.79	0.52
	T-2C	Full LTO w/o hot ref.	1,418	3.02	2.14	1.48	1.05	31.66	22.45	0.19	0.14	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**111,217**		**272.13**		**328.88**		**609.85**		**18.59**		**152.58**

Table A-3
ARS 1
AIRCRAFT EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1996(b)	F-14A	Full LTO w/ hot ref.	2,293	27.74	31.80	9.69	11.11	55.80	63.96	0.96	1.11	9.54	10.94
		Full LTO w/o hot ref.	6,878	12.32	42.39	8.11	27.89	28.57	98.24	0.70	2.40	5.15	17.70
		Touch&Go	12,361	0.65	3.99	6.00	37.08	1.46	9.01	0.26	1.61	3.37	20.82
		GCA Box	867	2.06	0.89	14.93	6.47	4.77	2.07	0.75	0.33	11.10	4.81
		Interfacility	1,661	0.34	0.28	2.46	2.05	0.79	0.65	0.12	0.10	1.83	1.52
	F-14B/D	Full LTO w/ hot ref.	1,701	4.25	3.61	18.79	15.98	18.87	16.05	0.95	0.81	16.67	14.17
		Full LTO w/o hot ref.	5,103	1.97	5.02	17.06	43.53	8.50	21.68	0.61	1.57	8.93	22.79
		Touch&Go	9,171	0.32	1.48	12.83	58.82	0.69	3.16	0.37	1.69	3.64	16.71
		GCA Box	643	1.18	0.38	10.88	3.50	2.04	0.66	0.67	0.22	7.59	2.44
		Interfacility	1,233	0.19	0.12	1.79	1.11	0.34	0.21	0.11	0.07	1.25	0.77
	A-6	Full LTO w/ hot ref.	0	31.18	0.00	3.81	0.00	47.97	0.00	0.53	0.00	0.00	0.00
		Full LTO w/o hot ref.	0	12.06	0.00	2.99	0.00	19.07	0.00	0.29	0.00	0.00	0.00
		Touch&Go	0	0.39	0.00	1.89	0.00	2.35	0.00	0.14	0.00	0.00	0.00
		GCA Box	0	1.28	0.00	4.71	0.00	7.84	0.00	0.40	0.00	0.00	0.00
		Interfacility	0	0.21	0.00	0.78	0.00	1.29	0.00	0.07	0.00	0.00	0.00
	F/A-18	Full LTO w/ hot ref.	414	28.36	5.87	8.39	1.74	75.74	15.68	0.46	0.10	7.38	1.53
		Full LTO w/o hot ref.	1,242	15.05	9.34	8.12	5.04	44.32	27.53	0.37	0.23	4.55	2.82
		Touch&Go	2,392	0.20	0.24	6.04	7.22	0.79	0.95	0.20	0.24	2.62	3.14
	S-3(c)	Full LTO w/ hot ref.	484	4.89	1.18	1.01	0.24	30.33	7.33	0.21	0.05	1.33	0.32
		Full LTO w/o hot ref.	484	3.06	0.74	0.80	0.19	19.23	4.65	0.15	0.04	0.93	0.23
		Touch&Go	930	0.14	0.07	0.18	0.09	1.80	0.84	0.03	0.01	0.37	0.17
		GCA Box	372	0.30	0.06	0.39	0.07	3.86	0.72	0.06	0.01	0.79	0.15
	UH-3H	Full LTO w/o hot ref.	0	8.84	0.00	0.71	0.00	13.94	0.00	0.13	0.00	0.00	0.00
	C-12	Full LTO w/o hot ref.	1,664	13.79	11.48	0.73	0.60	16.12	13.41	0.11	0.09	0.00	0.00
		Touch&Go	2,722	1.25	1.69	0.49	0.67	2.02	2.75	0.05	0.06	0.00	0.00
		GCA Box	1,106	1.55	0.86	0.32	0.18	2.38	1.31	0.04	0.02	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**54,761**		**122.15**		**223.66**		**291.74**		**10.75**		**121.03**

Table A-3
ARS 1
AIRCRAFT EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1997(b)	F-14A	Full LTO w/ hot ref.	2,983	27.74	41.37	9.69	14.45	55.80	83.22	0.96	1.44	9.54	14.23
		Full LTO w/o hot ref.	8,949	12.32	55.15	8.11	36.29	28.57	127.82	0.70	3.13	5.15	23.03
		Touch&Go	16,083	0.65	5.19	6.00	48.24	1.46	11.72	0.26	2.09	3.37	27.09
		GCA Box	1,128	2.06	1.16	14.93	8.42	4.77	2.69	0.75	0.42	11.10	6.26
		Interfacility	2,162	0.34	0.37	2.46	2.66	0.79	0.85	0.12	0.13	1.83	1.98
	F-14B/D	Full LTO w/ hot ref.	2,243	4.25	4.76	18.79	21.08	18.87	21.16	0.95	1.07	16.67	18.69
		Full LTO w/o hot ref.	6,730	1.97	6.62	17.06	57.41	8.50	28.59	0.61	2.07	8.93	30.06
		Touch&Go	12,095	0.32	1.95	12.83	77.57	0.69	4.16	0.37	2.23	3.64	22.04
		GCA Box	848	1.18	0.50	10.88	4.61	2.04	0.86	0.67	0.28	7.59	3.22
		Interfacility	1,626	0.19	0.16	1.79	1.46	0.34	0.27	0.11	0.09	1.25	1.02
	F/A-18	Full LTO w/ hot ref.	414	28.36	5.87	8.39	1.74	75.74	15.68	0.46	0.10	7.38	1.53
		Full LTO w/o hot ref.	1,242	15.05	9.34	8.12	5.04	44.32	27.53	0.37	0.23	4.55	2.82
		Touch&Go	2,392	0.20	0.24	6.04	7.22	0.79	0.95	0.20	0.24	2.62	3.14
	S-3	Full LTO w/ hot ref.	484	4.89	1.18	1.01	0.24	30.33	7.33	0.21	0.05	1.33	0.32
		Full LTO w/o hot ref.	484	3.06	0.74	0.80	0.19	19.23	4.65	0.15	0.04	0.93	0.23
		Touch&Go	930	0.14	0.07	0.18	0.09	1.80	0.84	0.03	0.01	0.37	0.17
		GCA Box	372	0.30	0.06	0.39	0.07	3.86	0.72	0.06	0.01	0.79	0.15
	C-12	Full LTO w/o hot ref.	1,664	13.79	11.48	0.73	0.60	16.12	13.41	0.11	0.09	0.00	0.00
		Touch&Go	2,722	1.25	1.69	0.49	0.67	2.02	2.75	0.05	0.06	0.00	0.00
		GCA Box	1,106	1.55	0.86	0.32	0.18	2.38	1.31	0.04	0.02	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**67,696**		**149.42**		**288.32**		**357.41**		**13.81**		**155.96**

Table A-3
ARS 1
AIRCRAFT EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1998	F-14A	Full LTO w/ hot ref.	2,835	27.74	39.32	9.69	13.74	55.80	79.10	0.96	1.37	9.54	13.53
		Full LTO w/o hot ref.	8,505	12.32	52.41	8.11	34.49	28.57	121.48	0.70	2.97	5.15	21.88
		Touch&Go	15,286	0.65	4.93	6.00	45.85	1.46	11.14	0.26	1.99	3.37	25.74
		GCA Box	1,072	2.06	1.10	14.93	8.00	4.77	2.56	0.75	0.40	11.10	5.95
		Interfacility	2,054	0.34	0.35	2.46	2.53	0.79	0.81	0.12	0.13	1.83	1.88
	F-14B/D	Full LTO w/ hot ref.	2,243	4.25	4.76	18.79	21.08	18.87	21.16	0.95	1.07	16.67	18.69
		Full LTO w/o hot ref.	6,730	1.97	6.62	17.06	57.41	8.50	28.59	0.61	2.07	8.93	30.06
		Touch&Go	12,095	0.32	1.95	12.83	77.57	0.69	4.16	0.37	2.23	3.64	22.04
		GCA Box	848	1.18	0.50	10.88	4.61	2.04	0.86	0.67	0.28	7.59	3.22
		Interfacility	1,626	0.19	0.16	1.79	1.46	0.34	0.27	0.11	0.09	1.25	1.02
	F/A-18	Full LTO w/ hot ref.	4,555	28.36	64.58	8.39	19.10	75.74	172.49	0.46	1.05	7.38	16.81
		Full LTO w/o hot ref.	13,664	15.05	102.79	8.12	55.48	44.32	302.78	0.37	2.52	4.55	31.07
		Touch&Go	26,309	0.20	2.65	6.04	79.46	0.79	10.42	0.20	2.59	2.62	34.53
		GCA Box	755	0.48	0.18	9.04	3.41	1.92	0.73	0.43	0.16	6.59	2.49
		Interfacility	2,545	0.09	0.12	2.80	3.57	0.28	0.35	0.10	0.12	1.45	1.85
	S-3	Full LTO w/ hot ref.	484	4.89	1.18	1.01	0.24	30.33	7.33	0.21	0.05	1.33	0.32
		Full LTO w/o hot ref.	484	3.06	0.74	0.80	0.19	19.23	4.65	0.15	0.04	0.93	0.23
		Touch&Go	930	0.14	0.07	0.18	0.09	1.80	0.84	0.03	0.01	0.37	0.17
		GCA Box	372	0.30	0.06	0.39	0.07	3.86	0.72	0.06	0.01	0.79	0.15
	C-12	Full LTO w/o hot ref.	1,664	13.79	11.48	0.73	0.60	16.12	13.41	0.11	0.09	0.00	0.00
		Touch&Go	2,722	1.25	1.69	0.49	0.67	2.02	2.75	0.05	0.06	0.00	0.00
		GCA Box	1,106	1.55	0.86	0.32	0.18	2.38	1.31	0.04	0.02	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**109,923**		**299.16**		**429.89**		**788.81**		**19.33**		**231.61**

Table A-3
ARS 1
AIRCRAFT EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e) per operation (lb)	VOC (e) Total (TPY)	NOx per operation (lb)	NOx Total (TPY)	CO per operation (lb)	CO Total (TPY)	SO2 per operation (lb)	SO2 Total (TPY)	PM10 per operation (lb)	PM10 Total (TPY)
1999	F-14A	Full LTO w/ hot ref.	2,835	27.74	39.32	9.69	13.74	55.80	79.10	0.96	1.37	9.54	13.53
		Full LTO w/o hot ref.	8,505	12.32	52.41	8.11	34.49	28.57	121.48	0.70	2.97	6.15	21.88
		Touch&Go	15,286	0.65	4.93	6.00	45.85	1.46	11.14	0.26	1.99	3.37	25.74
		GCA Box	1,072	2.06	1.10	14.93	8.00	4.77	2.56	0.75	0.40	11.10	5.95
		Interfacility	2,054	0.34	0.35	2.46	2.53	0.79	0.81	0.12	0.13	1.83	1.88
	F-14B/D	Full LTO w/ hot ref.	2,243	4.25	4.76	18.79	21.08	18.87	21.16	0.95	1.07	16.67	18.69
		Full LTO w/o hot ref.	6,730	1.97	6.62	17.06	57.41	8.50	28.59	0.61	2.07	8.93	30.06
		Touch&Go	12,095	0.32	1.95	12.83	77.57	0.69	4.16	0.37	2.23	3.64	22.04
		GCA Box	848	1.18	0.50	10.88	4.61	2.04	0.86	0.67	0.28	7.59	3.22
		Interfacility	1,626	0.19	0.16	1.79	1.46	0.34	0.27	0.11	0.09	1.25	1.02
	F/A-18	Full LTO w/ hot ref.	6,625	28.36	93.93	8.39	27.78	75.74	250.89	0.46	1.53	7.38	24.45
		Full LTO w/o hot ref.	19,874	15.05	149.51	8.12	80.70	44.32	440.41	0.37	3.67	4.55	45.19
		Touch&Go	38,268	0.20	3.86	6.04	115.58	0.79	15.16	0.20	3.77	2.62	50.22
		GCA Box	1,098	0.48	0.26	9.04	4.96	1.92	1.06	0.43	0.24	6.59	3.62
		Interfacility	3,702	0.09	0.17	2.80	5.19	0.28	0.51	0.10	0.18	1.45	2.69
	S-3	Full LTO w/ hot ref.	484	4.89	1.18	1.01	0.24	30.33	7.33	0.21	0.05	1.33	0.32
		Full LTO w/o hot ref.	484	3.06	0.74	0.80	0.19	19.23	4.65	0.15	0.04	0.93	0.23
		Touch&Go	930	0.14	0.07	0.18	0.09	1.80	0.84	0.03	0.01	0.37	0.17
		GCA Box	372	0.30	0.06	0.39	0.07	3.86	0.72	0.06	0.01	0.79	0.15
	C-12	Full LTO w/o hot ref.	1,664	13.79	11.48	0.73	0.60	16.12	13.41	0.11	0.09	0.00	0.00
		Touch&Go	2,722	1.25	1.69	0.49	0.67	2.02	2.75	0.05	0.06	0.00	0.00
		GCA Box	1,106	1.55	0.86	0.32	0.18	2.38	1.31	0.04	0.02	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**131,663**		**376.57**		**503.08**		**1010.07**		**22.26**		**271.03**

Notes:
(a) F-14 operations were divided between F-14As and F-14Bs based on the number of aircraft present in 1993. Number of GCAs and interfacility flights were proportioned from 1997 data based on the number of aircraft.
(b) 1996-1998 operations were proportioned from 1999 data based upon the numbers of aircraft based at NAS Oceana during those years. A-6s assumed to be deployed in 1996 and decommissioned by mid-1997.
(c) Transient aircraft operations, derived from NASMOD analysis (ATAC 1997).
(d) 1999 operations were derived from NASMOD analysis(ATAC 1997).
(e) Aircraft VOC reported as HC in the form CHy/x
Shaded areas indicate nonattainment pollutants of concern.
The LTOs listed for GCA box and interfacility flights include only the level portion of those operations. Takeoff and landings for these operations are accounted for under full LTO or T&G.

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter
LTO w/ hot ref. = landing and takeoff cycle with hot refueling idle
LTO w/o hot ref. = landing and takeoff cycle without hot refueling idle
interfacility = low altitude operations between NAS Oceana and NALF Fentress
GCA = ground control approach
lb = pounds
TPY = tons per year

Table A-4
ARS 1
AIRCRAFT EMISSIONS AT NALF FENTRESS
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation Type	Number of Operations/Year	VOC (d)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1993(a)	F-14A	Touch&Go	10,511	0.65	3.39	6.00	31.53	1.46	7.66	0.26	1.37	3.37	17.70
	F-14B	Touch&Go	7,226	0.32	1.17	12.83	46.34	0.69	2.49	0.37	1.33	3.64	13.17
	E-2/C-2	Full LTO	1,074	10.05	5.40	6.29	3.38	15.85	8.51	0.52	0.28	0.00	0.00
		Touch&Go	25,058	0.11	1.37	4.38	54.89	0.42	5.29	0.24	3.04	0.00	0.00
	A-6	Touch&Go	11,086	0.39	2.16	1.89	10.50	2.35	13.05	0.14	0.79	0.00	0.00
	Total		**54,955**		**13.48**		**146.63**		**37.00**		**6.81**		**30.87**
1996(c)	F-14A	Touch&Go	13,909	0.65	4.49	6.00	41.72	1.46	10.13	0.26	1.81	3.37	23.43
	F-14B/D	Touch&Go	10,320	0.32	1.67	12.83	66.18	0.69	3.55	0.37	1.90	3.64	18.80
	E-2/C-2	Full LTO	896	10.05	4.50	6.29	2.82	15.85	7.10	0.52	0.23	0.00	0.00
		Touch&Go	20,478	0.11	1.12	4.38	44.85	0.42	4.32	0.24	2.49	0.00	0.00
	A-6	Touch&Go	0	0.39	0.00	1.89	0.00	2.35	0.00	0.14	0.00	0.00	0.00
	Total		**45,603**		**11.78**		**155.58**		**25.11**		**6.42**		**42.23**
1997(c)	F-14A	Touch&Go	18,097	0.65	5.84	6.00	54.28	1.46	13.19	0.26	2.35	3.37	30.48
	F-14B/D	Touch&Go	13,610	0.32	2.20	12.83	87.29	0.69	4.69	0.37	2.50	3.64	24.80
	E-2/C-2	Full LTO	896	10.05	4.50	6.29	2.82	15.85	7.10	0.52	0.23	0.00	0.00
		Touch&Go	20,478	0.11	1.12	4.38	44.85	0.42	4.32	0.24	2.49	0.00	0.00
	Total		**53,081**		**13.66**		**189.24**		**29.30**		**7.57**		**55.28**

Table A-4
ARS 1
AIRCRAFT EMISSIONS AT NALF FENTRESS
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation Type	Number of Operations/Year	VOC (d) per operation (lb)	VOC (d) Total (TPY)	NOx per operation (lb)	NOx Total (TPY)	CO per operation (lb)	CO Total (TPY)	SO2 per operation (lb)	SO2 Total (TPY)	PM10 per operation (lb)	PM10 Total (TPY)
1998	F-14A	Touch&Go	17,200	0.65	5.55	6.00	51.59	1.46	12.53	0.26	2.23	3.37	28.97
	F-14B/D	Touch&Go	13,610	0.32	2.20	12.83	87.29	0.69	4.69	0.37	2.50	3.64	24.80
	F/A-18	Touch&Go	18,503	0.20	1.87	6.04	55.89	0.79	7.33	0.20	1.82	2.62	24.28
	E-2/C-2	Full LTO	896	10.05	4.50	6.29	2.82	15.85	7.10	0.52	0.23	0.00	0.00
		Touch&Go	20,478	0.11	1.12	4.38	44.85	0.42	4.32	0.24	2.49	0.00	0.00
	Total		**70,687**		**15.23**		**242.43**		**35.97**		**9.28**		**78.05**
1999	F-14A	Touch&Go	17,200	0.65	5.55	6.00	51.59	1.46	12.53	0.26	2.23	3.37	28.97
	F-14B/D	Touch&Go	13,610	0.32	2.20	12.83	87.29	0.69	4.69	0.37	2.50	3.64	24.80
	F/A-18	Touch&Go	26,913	0.20	2.71	6.04	81.29	0.79	10.66	0.20	2.65	2.62	35.32
	E-2/C-2	Full LTO	896	10.05	4.50	6.29	2.82	15.85	7.10	0.52	0.23	0.00	0.00
		Touch&Go	20,478	0.11	1.12	4.38	44.85	0.42	4.32	0.24	2.49	0.00	0.00
	Total		**79,097**		**16.08**		**267.84**		**39.30**		**10.10**		**89.09**

Notes:
(a) F-14 operations were divided between F-14As and F-14Bs based on the number of aircraft present in 1993.
(b) 1996-1998 operations for F-14s were proporationed from 1999 data based upon the numbers of F-14 squadrons based at NAS Oceana, A-6s assumed to be deployed in 1996 and decommissioned by mid-1997, 1996-1998 E-2/C-2 operations assumed to the same as 1999.
(c) 1997 operations derived from NASMOD analysis (ATAC 1997).
(d) Aircraft VOC reported as HC in the form CHy/x
Shaded areas indicate nonattainment pollutants of concern.

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter
LTO = landing and takeoff cycle
interfacility = low altitude operations between NAS Oceana and NALF Fentress
GCA = ground control approach
lb = pounds
TPY = tons per year

Table A-5
ARS 1
Emissions from Ground Support Equipment at NAS Oceana

		Fuel Consumption (gal/yr)	VOC		NOx		CO		SO2		PM-10	
			lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)
1997	*Tow Tractors: (a)*											
	A/S32A-30A	22000	64.60	0.71	436.67	4.80	268.50	2.95	31.10	0.34	46.50	0.51
	A/S32A-30	3500	122.00	0.21	146.00	0.26	3250.00	5.69	5.20	0.01	8.27	0.01
	TA-35	600	64.60	0.02	436.67	0.13	268.50	0.08	31.10	0.01	46.50	0.01
	A/S32A-42	23000	64.60	0.74	436.67	5.02	268.50	3.09	31.10	0.36	46.50	0.53
	TA-75	1200	122.00	1.04	146.00	1.25	3250.00	1.95	5.20	0.00	8.27	0.00
	Flight Line Electric Power Units											
	NC8A (b)	16000	49.23	0.39	604.17	4.83	130.15	1.04	39.73	0.32	42.47	0.34
	NC10C (b)	6000	49.23	0.15	604.17	1.81	130.15	0.39	39.73	0.12	42.47	0.13
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	45000	49.23	1.11	604.17	13.59	130.15	2.93	39.73	0.89	42.47	0.96
	GTC-85 (c)	3500	0.13	0.00	3.88	0.01	14.83	0.03	0.54	0.00	0.00	0.00
	Miscellaneous: (b)											
	A/M32C-17	3000	49.23	0.07	604.17	0.91	130.15	0.20	39.73	0.06	42.47	0.06
	A/M27T-5	3000	49.23	0.07	604.17	0.91	130.15	0.20	39.73	0.06	42.47	0.06
	A/M42M-2	1600	49.23	0.04	604.17	0.48	130.15	0.10	39.73	0.03	42.47	0.03
	HLU-196	20	415.11	0.00	223.31	0.00	8589.90	0.09	11.51	0.00	13.70	0.00
		Total		**4.57**		**34.01**		**18.73**		**2.20**		**2.66**
1998	*Tow Tractors: (a)*											
	A/S32A-30A (MOGAS)	22000	64.60	0.71	436.67	4.80	268.50	2.95	31.10	0.34	46.50	0.51
	A/S32A-30	3500	122.00	0.21	146.00	0.26	3250.00	5.69	5.20	0.01	8.27	0.01
	TA-35	600	64.60	0.02	436.67	0.13	268.50	0.08	31.10	0.01	46.50	0.01
	A/S32A-42	23000	64.60	0.74	436.67	5.02	268.50	3.09	31.10	0.36	46.50	0.53
	Flight Line Electric Power Units											
	NC8A (b)	16000	49.23	0.39	604.17	4.83	130.15	1.04	39.73	0.32	42.47	0.34
	NC10C (b)	8000	49.23	0.20	604.17	2.42	130.15	0.52	39.73	0.16	42.47	0.17
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	47000	49.23	1.16	604.17	14.20	130.15	3.06	39.73	0.93	42.47	1.00
	GTC-85 (c)	3500	0.13	0.00	3.88	0.01	14.83	0.03	0.54	0.00	0.00	0.00
	Miscellaneous: (b)											
	A/M32C-17	4000	49.23	0.10	604.17	1.21	130.15	0.26	39.73	0.08	42.47	0.08
	A/M27T-5	4000	49.23	0.10	604.17	1.21	130.15	0.26	39.73	0.08	42.47	0.08
	A/M42M-2	1600	49.23	0.04	604.17	0.48	130.15	0.10	39.73	0.03	42.47	0.03
	HLU-196	20	415.11	0.00	223.31	0.00	8589.90	0.09	11.51	0.00	13.70	0.00
		Total		**3.67**		**34.57**		**17.17**		**2.32**		**2.79**

Table A-5
ARS 1
Emissions from Ground Support Equipment at NAS Oceana

		Fuel Consumption (gal/yr)	VOC lb/1000 gal	VOC Total (TPY)	NOx lb/1000 gal	NOx Total (TPY)	CO lb/1000 gal	CO Total (TPY)	SO2 lb/1000 gal	SO2 Total (TPY)	PM-10 lb/1000 gal	PM-10 Total (TPY)
1999	*Tow Tractors: (a)*											
	A/S32A-30A (JP-5)	22400	64.60	0.72	436.67	4.89	268.50	3.01	5.20	0.06	8.27	0.09
	A/S32A-30	3500	122.00	0.21	146.00	0.26	3250.00	5.69	5.20	0.01	8.27	0.01
	TA-35	600	64.60	0.02	436.67	0.13	268.50	0.08	5.20	0.00	8.27	0.00
	A/S32A-42	23000	64.60	0.74	436.67	5.02	268.50	3.09	5.20	0.06	8.27	0.10
	Flight Line Electric Power Units											
	NC8A (b)	16000	49.23	0.39	604.17	4.83	130.15	1.04	39.73	0.32	42.47	0.34
	NC10C (b)	8000	49.23	0.20	604.17	2.42	130.15	0.52	39.73	0.16	42.47	0.17
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	47000	49.23	1.16	604.17	14.20	130.15	3.06	39.73	0.93	42.47	1.00
	GTC-85 (c)	3500	0.13	0.00	3.88	0.01	14.83	0.03	0.54	0.00	0.00	0.00
	Miscellaneous: (b)											
	A/M32C-17	4000	49.23	0.10	604.17	1.21	130.15	0.26	39.73	0.08	42.47	0.08
	A/M27T-5	4000	49.23	0.10	604.17	1.21	130.15	0.26	39.73	0.08	42.47	0.08
	A/M42M-2	1600	49.23	0.04	604.17	0.48	130.15	0.10	39.73	0.03	42.47	0.03
	HLU-196	20	415.11	0.00	223.31	0.00	8589.90	0.09	11.51	0.00	13.70	0.00
		Total		**3.69**		**34.66**		**17.22**		**1.73**		**1.92**

(a) Emission factors from AP-42 Volume II for gasoline-powered wheeled tractor for TA-75, JG-75, & A/S32A-30 and diesel-powered wheeled tractors for all others.
(b) Emission factors from AP-42 Volume I for Uncontrolled gasoline and diesel industrial engines SCC 20200102, 20300101, and 2300301..
Converted from lb/MMBtu assuming heating value for JP-5 of 137,000 Btu/gallon.
(c) Emission factors from USEPA 1992 for aircraft auxilliary power units used because specific emission factors for individual equipment types not available.

Table A-6
ARS 1
EMISSION RATES FOR SINGLE ENGINE MAINTENANCE RUN-UPS AT NAS OCEANA
(IN-FRAME ENGINE TESTING)

Engine (Aircraft)	Power Setting (a)	Time in Power Setting (a) (minutes)	Fuel Flow (lb/min)	Emission Factor ([lb /1000 lb fuel]/eng)					Emission Rates (lb/single engine run-up)				
				VOC (b)	NOx	CO	SO2	PM10	VOC	NOx	CO	SO2	PM10
TF30-P-412A (F-14A)	**Low Power**												
	Idle	7.00	15.3	31.42	3.22	55.51	0.40	8.96	3.37	0.35	5.96	0.04	0.96
	75%	12.00	71.7	1.48	10.74	3.43	0.40	5.70	1.27	9.24	2.95	0.34	4.90
	Total								**4.65**	**9.59**	**8.91**	**0.39**	**5.87**
	High Power												
	Idle	10.00	15.3	31.42	3.22	55.51	0.40	8.96	4.81	0.49	8.49	0.06	1.37
	75%	25.00	71.7	1.48	10.74	3.43	0.40	5.70	2.65	19.25	6.15	0.72	10.22
	100% (Mil)	10.00	117.5	0.77	19.60	1.38	0.40	2.98	0.90	23.03	1.62	0.47	3.50
	A/B (Z5)	4.00	796.7	0.20	4.79	10.77	0.40	0.00	0.64	15.26	34.32	1.27	0.00
	Total								**9.00**	**58.04**	**50.58**	**2.52**	**15.09**
F110-GE-400 (F-14B/D)	**Low Power**												
	Idle	5.00	19.5	3.65	2.77	16.60	0.40	12.38	0.36	0.27	1.62	0.04	1.21
	75%	12.50	133.0	0.26	19.61	0.76	0.40	4.30	0.43	32.60	1.26	0.67	7.15
	Total								**0.79**	**32.87**	**2.88**	**0.70**	**8.36**
	High Power												
	Idle	10.00	19.5	3.65	2.77	16.60	0.40	12.38	0.71	0.54	3.24	0.08	2.41
	75%	20.00	133.0	0.26	19.61	0.76	0.40	4.30	0.69	52.16	2.02	1.06	11.44
	IRP	15.00	195.3	0.40	28.63	0.84	0.40	2.81	1.17	83.87	2.46	1.17	8.23
	A/B(Max)	4.00	945.0	0.13	9.22	23.12	0.40	0.00	0.49	34.85	87.39	1.51	0.00
	Total								**3.07**	**171.43**	**95.11**	**3.83**	**22.08**
J-52-P-8B (A-6)	**Low Power**												
	Idle	15.00	11.3	48.96	1.79	63.78	0.40	0.00	8.32	0.30	10.84	0.07	0.00
	78-82%	10.00	72.0	0.67	10.10	3.00	0.40	0.00	0.48	7.27	2.16	0.29	0.00
	Total								**8.80**	**7.58**	**13.00**	**0.36**	**0.00**
	High Power												
	Idle	15.00	11.3	48.96	1.79	63.78	0.40	0.00	8.30	0.30	10.81	0.07	0.00
	78-82%	5.00	72.0	0.67	10.10	3.00	0.40	0.00	0.24	3.64	1.08	0.14	0.00
	94-100%	8.00	122.8	0.93	13.05	0.71	0.40	0.00	0.91	12.82	0.70	0.39	0.00
	Total								**9.45**	**16.76**	**12.59**	**0.60**	**0.00**
F404-GE-400 (F/A-18)	**Low Power**												
	Idle	6.50	10.4	58.18	1.16	137.34	0.40	12.38	3.93	0.08	9.28	0.03	0.84
	76%	3.50	109.0	0.35	14.80	1.09	0.40	6.10	0.13	5.65	0.42	0.15	2.33
	Total								**4.07**	**5.72**	**9.70**	**0.18**	**3.16**
	High Power												
	Idle	13.00	10.4	58.18	1.16	137.34	0.40	12.38	7.87	0.16	18.57	0.05	1.67
	76%	8.50	109.0	0.35	14.80	1.09	0.40	4.00	0.32	13.71	1.01	0.37	3.71
	IRP	5.00	143.1	0.31	25.16	1.05	0.40	2.81	0.22	18.00	0.75	0.29	2.01
	A/B	2.00	473.3	0.13	9.22	23.12	0.40	0.00	0.12	8.73	21.89	0.38	0.00
	Total								**8.54**	**40.60**	**42.21**	**1.09**	**7.39**

Notes:
(a) Power setting and time in power setting for F-14 A, F-14B/D, F/A-18 aircraft,and A-6 provided by AESO and COMNAVAIRLANT.
(b) Aircraft VOC reported as HC in the form CHy/x

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter
A/B = afterburner operating
Idle = typically 57% throttle setting
75% = 75% throttle setting
IRP = intermediate rated power

Table A-7
ARS 1
EMISSIONS FROM SINGLE ENGINE IN-FRAME MAINTENANCE RUN-UPS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft (Engine) and Number of Aircraft	Run-up mode	Number of Single Engine Run-ups/yr	VOC (b)		NOx		CO		SO2		PM10	
				Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)
1993	F-14A (TF30-P-412A)	Low Power	8,776	4.65	20.38	9.59	42.06	8.91	39.09	0.39	1.70	5.87	25.74
	80	High Power	250	9.00	1.13	58.04	7.25	50.58	6.32	2.52	0.32	15.09	1.89
	F-14B/D (F110-GE-400)	Low Power	4,162	0.79	1.64	32.87	68.41	2.88	6.00	0.70	1.47	8.36	17.39
	55	High Power	218	3.07	0.33	171.43	18.69	95.11	10.37	3.83	0.42	22.08	2.41
	A-6 (J-52-P-8B)	Low Power	10,320	8.80	45.42	7.58	39.09	13.00	67.08	0.36	1.84	0.00	0.00
	86	High Power	292	9.45	1.38	16.76	2.45	12.59	1.84	0.60	0.09	0.00	0.00
				Total	**70.29**		**177.95**		**130.69**		**5.82**		**47.42**
1996	F-14A (TF30-P-412A)	Low Power	11,179	4.65	25.96	9.59	42.06	8.91	39.09	0.39	1.70	5.87	25.74
	93	High Power	319	9.00	1.44	58.04	7.25	50.58	6.32	2.52	0.32	15.09	1.89
	F-14B/D (F110-GE-400)	Low Power	4,222	0.79	1.66	32.87	68.41	2.88	6.00	0.70	1.47	8.36	17.39
	69	High Power	221	3.07	0.34	171.43	18.69	95.11	10.37	3.83	0.42	22.08	2.41
				Total	**29.40**		**136.41**		**61.78**		**3.90**		**47.42**
1997	F-14A (TF30-P-412A)	Low Power	14,545	4.65	33.78	9.59	69.72	8.91	64.78	0.39	2.82	5.87	42.66
	121	High Power	415	9.00	1.87	58.04	12.04	50.58	10.50	2.52	0.52	15.09	3.13
	F-14B/D (F110-GE-400)	Low Power	5,568	0.79	2.19	32.87	91.51	2.88	8.02	0.70	1.96	8.36	23.26
	91	High Power	292	3.07	0.45	171.43	25.03	95.11	13.89	3.83	0.56	22.08	3.22
				Total	**38.29**		**198.30**		**97.19**		**5.86**		**72.28**

Table A-7
ARS 1
EMISSIONS FROM SINGLE ENGINE IN-FRAME MAINTENANCE RUN-UPS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft (Engine) and Number of Aircraft	Run-up mode	Number of Single Engine Run-ups/yr	VOC (b)		NOx		CO		SO2		PM10	
				Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)
1998	F-14A (TF30-P-412A)	Low Power	13824	4.65	32.11	9.59	66.26	8.91	61.57	0.39	0.01	5.87	40.54
	115	High Power	394	9.00	1.77	58.04	11.43	50.58	9.97	2.52	0.00	15.09	2.97
	F-14B/D (F110-GE-400)	Low Power	5,568	0.79	2.19	32.87	91.51	2.88	8.02	0.70	1.96	8.36	23.26
	91	High Power	292	3.07	0.45	171.43	25.03	95.11	13.89	3.83	0.56	22.08	3.22
	F/A-18 (F404-GE-400)	Low Power	7,580	4.07	15.41	5.72	21.70	9.70	36.76	0.18	0.68	3.16	11.99
	132	High Power	426	8.54	1.82	40.60	8.65	42.21	8.99	1.09	0.23	7.39	1.57
				Total	**53.75**		**224.58**		**139.20**		**3.44**		**83.57**
1999	F-14A (TF30-P-412A)	Low Power	13824	4.65	32.11	9.59	66.26	8.91	61.57	0.39	2.68	5.87	40.54
	115	High Power	394	9.00	1.77	58.04	11.43	50.58	9.97	2.52	0.50	15.09	2.97
	F-14B/D (F110-GE-400)	Low Power	5568	0.79	2.19	32.87	91.51	2.88	8.02	0.70	1.96	8.36	23.26
	91	High Power	292	3.07	0.45	171.43	25.03	95.11	13.89	3.83	0.56	22.08	3.22
	F/A-18 (F404-GE-400)	Low Power	11026	4.07	22.42	5.72	31.56	9.70	53.48	0.18	0.99	3.16	17.44
	192	High Power	620	8.54	2.65	40.60	12.59	42.21	13.09	1.09	0.34	7.39	2.29
				Total	**61.59**		**238.38**		**160.01**		**7.02**		**89.74**

Notes:
(a) Number of maintenance run-ups for F-14A, F-14B/D, and F/A-18 aircraft in 1993 and 1999 are from Wyle (1997) 1996-1998 maintenance run-ups were scaled from 1993 based on number of aircraft stationed at NAS Oceana.
(b) Aircraft VOC reported as HC in the form CHy/x

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table A-8
STATIONARY SOURCE EMISSIONS AT NAS OCEANA - ARS 1
FOR 1993 AND 1996-1999

	1993					1996					1997				
	VOC	**NOx**	**CO**	**SO2**	**PM10**	**VOC**	**NOx**	**CO**	**SO2**	**PM10**	**VOC**	**NOx**	**CO**	**SO2**	**PM10**
Stationary Sources:															
Boilers:	1.13	32.32	8.31	22.09	3.84	0.78	29.13	7.52	23.76	3.63	0.78	29.13	7.52	23.76	3.63
Generators	0.71	8.67	1.87	0.57	0.61	0.71	8.67	1.87	0.57	0.61	2.11	27.87	7.27	3.77	2.21
Engine Testing	6.24	37.65	49.39	1.80	4.32	3.95	28.48	39.09	1.31	3.96	5.05	37.03	50.86	1.71	4.62
JP-5 Fuel Handling	0.66	0.00	0.00	0.00	0.00	0.46	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.00	0.00
Service Station	19.35	0.00	0.00	0.00	0.00	4.46	0.00	0.00	0.00	0.00	4.67	0.00	0.00	0.00	0.00
Painting	19.30	0.00	0.00	0.00	0.00	13.29	0.00	0.00	0.00	0.00	24.05	0.00	0.00	0.00	0.00
Construction:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	47.39	78.64	59.57	24.46	8.77	23.65	66.28	48.48	25.64	8.20	37.20	94.03	65.65	29.24	10.46

Table A-8
STATIONARY SOURCE EMISSIONS AT NAS OCEANA - ARS 1
FOR 1993 AND 1996-1999

	1998					1999				
	VOC	**NOx**	**CO**	**SO2**	**PM10**	**VOC**	**NOx**	**CO**	**SO2**	**PM10**
Stationary Sources:										
Boilers:	0.62	27.13	6.68	22.82	3.38	0.62	27.13	6.68	22.82	3.38
Generators	2.11	27.87	7.27	3.77	2.21	2.11	27.87	7.27	3.77	2.21
Engine Testing	9.20	48.99	64.32	2.00	9.31	11.31	55.20	71.48	2.16	11.48
JP-5 Fuel Handling	0.81	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00
Service Station	6.40	0.00	0.00	0.00	0.00	6.72	0.00	0.00	0.00	0.00
Painting	34.12	0.00	0.00	0.00	0.00	34.16	0.00	0.00	0.00	0.00
Construction:	2.55	26.13	8.18	2.41	4.08	0.00	0.00	0.00	0.00	0.00
Total	55.81	130.12	86.45	30.99	18.97	55.82	110.20	85.43	28.75	17.07

Note: Shaded areas indicate nonattainment pollutants of concern.

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table A-9
EMISSION RATES FOR AIRCRAFT ENGINE TESTS AT NAS OCEANA - ARS 1
(SINGLE ENGINE IN TEST CELLS)

Engine (Aircraft)	Power Setting	Time in Power Setting (a) (minutes)	Fuel Flow (lb/min)	Calculated Fuel Usage (b) (gallons/test)	Emission Factor (c) ([lb /1000 lb fuel]/eng)					Single Engine Test Emissions (pounds)				
					VOC (d)	NOx	CO	SO2	PM10	VOC (d)	NOx	CO	SO2	PM10
TF30-P-412A (F-14A)	Idle	28.00	15.33	63.12	31.42	3.22	55.51	0.54	8.96	13.49	1.38	23.83	0.23	3.85
	75%	5.00	71.67	52.70	1.48	10.74	3.43	0.54	7.98	0.53	3.85	1.23	0.19	2.86
	81%	23.00	77.40	261.79	1.20	16.02	1.62	0.54	7.98	2.14	28.52	2.88	0.96	14.21
	A/B	22.00	796.67	2577.46	0.20	4.79	10.77	0.54	0.00	3.51	83.95	188.76	9.46	0.00
	Total	**78.00**		**2955.08**					**Per Test**	**19.66**	**117.70**	**216.70**	**10.85**	**20.91**
F110-GE-400 (F-14B/D)	Idle	54.00	19.50	154.85	3.97	2.74	15.75	0.54	12.38	4.18	2.89	16.58	0.57	13.04
	81%	44.00	143.70	929.82	0.26	19.61	0.76	0.54	2.81	1.64	123.99	4.81	3.41	17.77
	93%	25.00	198.22	728.75	0.31	28.53	1.08	0.54	2.81	1.54	141.38	5.35	2.68	13.92
	A/B	11.00	945.05	1528.76	3.75	12.64	44.21	0.54	0.00	38.98	131.40	459.59	5.61	0.00
	Total	**134.00**		**3342.18**					**Per Test**	**46.34**	**399.66**	**486.33**	**12.27**	**44.73**
J-52-P-8B (A-6)	Ground Idle	32.00	11.33	53.32	48.96	1.79	63.78	0.54	0.00	17.75	0.65	23.12	0.20	0.00
	IRP	18.00	122.83	325.14	1.08	13.05	0.71	0.54	0.00	2.39	28.85	1.57	1.19	0.00
	75% Thrust	24.00	72.00	254.12	0.87	10.10	3.00	0.54	0.00	1.50	17.45	5.18	0.93	0.00
	3k Lbs Thrust	25.00	38.33	140.92	1.99	6.34	10.54	0.54	0.00	1.91	6.08	10.10	0.52	0.00
	Total	**99.00**		**773.49**					**Per Test**	**23.55**	**53.03**	**39.98**	**2.84**	**0.00**
F404-GE-400 (F/A-18)	Idle	10.00	10.40	15.29	58.18	1.16	137.34	0.54	12.38	6.05	0.12	14.28	0.06	1.29
	80%	8.00	131.60	154.82	0.33	18.71	1.17	0.54	6.10	0.35	19.70	1.23	0.57	6.42
	A/B	2.00	473.28	139.20	0.13	9.22	23.12	0.54	0.00	0.12	8.73	21.88	0.51	0.00
	Total	**20.00**		**309.32**					**Per Test**	**6.52**	**28.55**	**37.40**	**1.14**	**7.71**

(a) Power setting and time in power setting taken from Wyle (1997) for F-14A, F-14B/D, and F/A-18 aircraft. A-6 data provided by COMNAVAIRLANT (Cdr. Vandenberg, Dec. 1996).
(b) Assumes a product density of 6.8 lb/gallon for JP-5.
(c) Data for calculating modal emission rates provided by the Navy Aircraft Environmental Support Office.
(d) Aircraft VOC reported as HC in the form CHy/x

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

A/B Max. = maximum afterburner
IRP = intermediate rated power (same as military)
75% = 75% throttle setting

Table A-10
EMISSIONS FROM AIRCRAFT ENGINE TESTING AT NAS OCEANA - ARS 1
FOR 1993 AND 1996-1999
(SINGLE ENGINE IN TEST CELLS)

Year	Engine Model	Number of Aircraft	Number of Tests/Year (a)	VOC (b)		NOx		CO		SO2		PM10	
				per test (lb)	Total (TPY)	per test (lb)	Total (TPY)	per test (lb)	Total (TPY)	per test (lb)	Total (TPY)	per test (lb)	Total (TPY)
1993	TF30-P-412A	80	152	19.66	1.49	117.70	8.95	216.70	16.47	10.85	0.82	20.91	1.59
	F110-GE-400	55	122	46.34	2.83	399.66	24.38	486.33	29.67	12.27	0.75	44.73	2.73
	J-52-P-8B	86	163	23.55	1.92	53.03	4.32	39.98	3.26	2.84	0.23	0.00	0.00
				Total	**6.24**		**37.65**		**49.39**		**1.80**		**4.32**
1996	TF30-P-412A	93	123	19.66	1.21	117.70	7.23	216.70	13.32	10.85	0.67	20.91	1.29
	F110-GE-400	69	100	46.34	2.32	399.66	20.00	486.33	24.34	12.27	0.61	44.73	2.24
	F404-GE-400	12	26	33.12	0.42	97.43	1.24	112.34	1.43	2.57	0.03	33.99	0.43
				Total	**3.95**		**28.48**		**39.09**		**1.31**		**3.96**
1997	TF30-P-412A	121	160	19.66	1.57	117.70	9.41	216.70	17.33	10.85	0.87	20.91	1.67
	F110-GE-400	91	132	46.34	3.06	399.66	26.38	486.33	32.10	12.27	0.81	44.73	2.95
	F404-GE-400	12	26	33.12	0.42	97.43	1.24	112.34	1.43	2.57	0.03	0.00	0.00
				Total	**5.05**		**37.03**		**50.86**		**1.71**		**4.62**
1998	TF30-P-412A	115	152	19.66	1.49	117.70	8.95	216.70	16.47	10.85	0.82	20.91	1.59
	F110-GE-400	91	132	46.34	3.06	399.66	26.38	486.33	32.10	12.27	0.81	44.73	2.95
	F404-GE-400	132	281	33.12	4.65	97.43	13.67	112.34	15.76	2.57	0.36	33.99	4.77
				Total	**9.20**		**48.99**		**64.32**		**2.00**		**9.31**
1999	TF30-P-412A	115	152	19.66	1.49	117.70	8.95	216.70	16.47	10.85	0.82	20.91	1.59
	F110-GE-400	91	132	46.34	3.06	399.66	26.38	486.33	32.10	12.27	0.81	44.73	2.95
	F404-GE-400	192	408	33.12	6.76	97.43	19.88	112.34	22.92	2.57	0.53	33.99	6.93
				Total	**11.31**		**55.20**		**71.48**		**2.16**		**11.48**

Notes:
(a) Number of engine tests per F-14A, F-14B/D, and F/A-18 aircraft from Wyle 1997. Number of A-6 engine tests per aircraft assumed to be the same as F-14A engine tests per aircraft.
(b) Aircraft VOC reported as HC in the form CHy/x
Shaded areas indicate the nonattainment pollutants of concern.

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table A-11
PARKING LOT CONSTRUCTION (4 LOTS) AND AIRCRAFT APRON - ARS 1
Equipment Exhaust Emissions

	Equipment	Days	Emission Factors (lb/1000 gal)					EMISSIONS (lbs)				
Equipment List	quantity	Used	**NOx**	**VOC**	**CO**	**SO2**	**PM10**	**NOx**	**VOC**	**CO**	**SO2**	**PM10**
Crane	0	0	403	35.0	82.0	31.2	27	0.0	0.0	0.0	0.0	0.0
Backhoe Loader	2	60	395	39.0	133.0	31.2	27	2370.0	234.0	798.0	187.2	162.0
Pan Scraper	1	20	340	19.6	97.7	31.2	27	340.0	19.6	97.7	31.2	27.0
Hi-Lift	0	0	364	31.0	121.0	31.2	25	0.0	0.0	0.0	0.0	0.0
Front-end Loader, wheels	1	60	403	23.5	94.0	31.2	29	1209.0	70.5	282.0	93.6	87.0
Pile Driver	0	0	403	35.0	82.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Track loader	1	0	391	23.5	94.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Grader	2	60	375	43.0	74.3	31.2	22	2250.0	258.0	445.8	187.2	132.0
Bulldozer	2	60	375	43.0	74.3	31.2	25	2250.0	258.0	445.8	187.2	150.0
Compactor	3	60	364	31.0	121.0	31.2	24	3276.0	279.0	1089.0	280.8	216.0
Roller	3	60	364	31.0	121.0	31.2	24	3276.0	279.0	1089.0	280.8	216.0
Paver	1	60	403	23.5	125.0	31.2	29	1209.0	70.5	375.0	93.6	87.0
haul trk/cement mixer, mob(gm/	4	60	8.0	2.1	9.93	2.8	2.15	422.9	111.0	524.9	148.0	113.7
haul trk/cement mixer, idl(gm/hr	4	60	13.2	16.2	40.2	0	0	14.0	17.1	42.5	0.0	0.0
							Total, lb/yr	16616.9	1596.7	5189.7	1489.6	1190.7
							Total TPY	**8.31**	**0.80**	**2.59**	**0.74**	**0.60**

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table A-11
NEW BUILDING/ADDITION CONSTRUCTION - ARS 1
Equipment Exhaust Emissions

EQUIPMENT LIST	Equipment quantity	Days Used	Emission Factors (lb/1000 gal)					EMISSIONS (lbs)				
			NOx	**VOC**	**CO**	**SO2**	**PM10**	**NOx**	**VOC**	**CO**	**SO2**	**PM10**
Crane	3	120	403	35.0	82.0	31.2	27	7254.0	630.0	1476.0	561.6	486.0
Backhoe Loader	2	120	395	39.0	133.0	31.2	27	4740.0	468.0	1596.0	374.4	324.0
Pan Scraper	1	120	340	19.6	97.7	31.2	27	2040.0	117.6	586.2	187.2	162.0
Hi-Lift	4	120	364	31.0	121.0	31.2	25	8736.0	744.0	2904.0	748.8	600.0
Front-end Loader, wheels	1	120	403	23.5	94.0	31.2	29	2418.0	141.0	564.0	187.2	174.0
Pile Driver	0	0	403	35.0	82.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Track loader	0	0	391	23.5	94.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Grader	1	120	375	43.0	74.3	31.2	22	2250.0	258.0	445.8	187.2	132.0
Bulldozer	2	120	375	43.0	74.3	31.2	25	4500.0	516.0	891.6	374.4	300.0
Compactor	1	120	364	31.0	121.0	31.2	24	2184.0	186.0	726.0	187.2	144.0
Roller	0	0	364	31.0	121.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Paver	0	0	403	23.5	125.0	31.2	29	0.0	0.0	0.0	0.0	0.0
haul trk, mob(gm/mi)	7	120	8.0	2.1	9.93	2.8	2.15	1480.2	388.5	1837.3	518.1	397.8
haul trk, idl(gm/hr)	7	120	13.2	16.2	40.2	0	0	48.8	59.9	148.8	0.0	0.0
							Total Lb/yr	**35651.0**	**3509.1**	**11175.6**	**3326.1**	**2719.8**
							Total TPY	**17.83**	**1.75**	**5.59**	**1.66**	**1.36**

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table A-12
ANNUAL DEMOLITION PARTICULATE EMISSIONS - ARS 1

Floor Space (SQ FT)	STRUCTURE REMOVAL (LBS)	DEBRIS REMOVAL (LBS)	VEHICLE ACTIVITY (LBS)	EMISSIONS LBS/YR	EMISSIONS TPY
199,381	10.2	187.4	2122.4	2320.0	1.16

Notes:
Demolition square ft assumed = 10 % of new construction sq ft
PM emission from structure takedown based on sq ft *EF
PM emission from debris removal based on sq ft *EF
PM emission from on-site vehicle activity based on sq ft *EF
Pushing (bulldozing) PM emission put under site prep spreadsheet
Reference EPA-450/2-92-004 (Fugitive Dust document)
(all EF's in EPA document converted to english units)

Table A-12

ANNUAL SITE PREPARATION PARTICULATE EMISSIONS FOR CONSTRUCTION AT NAS OCEANA - ARS 1

ACRES	ACTIVITY DAYS	BULLDOZIN (LBS)	PAN SCRAPING SOIL REMOV(LBS)	PAN SCRAPING ETHMOVING (LBS)	EMISSIONS	
					LBS/YR	TPY
46	120	720	736	464	1920	0.96

Notes:
Acreage estimate based on building sq ft*2
Estimate activity days for preferred, develop ratio days:acres
Apply ratio to ARS acreages to get activity days
Bulldozing pm emissions based on 8hr/activity day * EF (EPA 1992)
Soil removal emiss based on VMT/acre *acres*EF (EPA 1992)
Earthmoving emiss based on soil removal miles *3 (BEE)*EF
EPA 1992 is Fugitive Dust BG document (EPA-450/2-92-004)

Table A-13
Total Construction Emissions (Exhaust and Dust) - ARS 1

Project/Source	**Emissions (tons/yr)**				
Engine Exhaust Emissions	**VOC**	**NOx**	**CO**	**SOx**	**PM10**
Parking Lot Construction	0.80	8.31	2.59	0.74	0.60
Building/Addition Const. (total)	1.75	17.83	5.59	1.66	1.36
Demolition/Construction Activity					
Mechanical dust Generation	0.00	0.00	0.00	0.00	2.12
Total	**2.55**	**26.13**	**8.18**	**2.41**	**4.08**

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table A-14
EMISSIONS SUMMARY - NAS OCEANA AND NALF FENTRESS - ARS 1
FOR 1993 AND 1996-1999
(tons per year)

	1993					1996					1997				
Source Type	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**
NAS Oceana:															
Mobile Sources:															
Aircraft Operations	272.13	328.88	609.85	18.59	152.58	122.15	223.66	291.74	10.75	121.03	149.42	288.32	357.41	13.81	155.96
Total Aircraft	**272.13**	**328.88**	**609.85**	**18.59**	**152.58**	**122.15**	**223.66**	**291.74**	**10.75**	**121.03**	**149.42**	**288.32**	**357.41**	**13.81**	**155.96**
Other Mobile Sources:															
GSE	5.13	26.43	72.65	1.71	2.00	3.09	27.35	17.03	1.84	2.24	4.57	34.01	18.73	2.20	2.66
Maintenance Run-ups	70.29	177.95	130.69	5.82	47.42	29.40	136.41	61.78	3.90	47.42	38.29	198.30	97.19	5.86	72.28
Generators	0.56	6.89	1.48	0.45	0.48	0.56	6.89	1.48	0.45	0.48	0.56	6.89	1.48	0.45	0.48
Total Other Mobile	**75.97**	**211.27**	**204.82**	**7.98**	**49.90**	**33.05**	**170.65**	**80.29**	**6.18**	**50.14**	**43.42**	**239.20**	**117.40**	**8.51**	**75.42**
Stationary Sources:															
Boilers:	1.13	32.32	8.31	22.09	3.84	0.78	29.13	7.52	23.76	3.63	0.78	29.13	7.52	23.76	3.63
Generators	0.71	8.67	1.87	0.57	0.61	0.71	8.67	1.87	0.57	0.61	2.11	27.87	7.27	3.77	2.21
Engine Test Cells	6.24	37.65	49.39	1.80	4.32	3.95	28.48	39.09	1.31	3.96	5.05	37.03	50.86	1.71	4.62
JP-5 Fuel Handling	0.66	0.00	0.00	0.00	0.00	0.46	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.00	0.00
Service Station	19.35	0.00	0.00	0.00	0.00	4.46	0.00	0.00	0.00	0.00	4.67	0.00	0.00	0.00	0.00
Painting	19.30	0.00	0.00	0.00	0.00	13.29	0.00	0.00	0.00	0.00	24.05	0.00	0.00	0.00	0.00
Construction:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Stationary	**47.39**	**78.64**	**59.57**	**24.46**	**8.77**	**23.65**	**66.28**	**48.48**	**25.64**	**8.20**	**37.20**	**94.03**	**65.65**	**29.24**	**10.46**
Total NASO	**395.49**	**618.78**	**874.24**	**51.04**	**211.24**	**178.84**	**460.58**	**420.50**	**42.58**	**179.37**	**230.04**	**621.55**	**540.46**	**51.56**	**241.85**
NALF Fentress:															
Aircraft	13.48	146.63	37.00	6.81	30.87	11.78	155.58	25.11	6.42	42.23	13.66	189.24	29.30	7.57	55.28
Total Annual:	**408.97**	**765.41**	**911.24**	**57.85**	**242.11**	**190.62**	**616.16**	**445.61**	**49.00**	**221.60**	**243.70**	**810.79**	**569.75**	**59.13**	**297.12**

Table A-14
EMISSIONS SUMMARY - NAS OCEANA AND NALF FENTRESS - ARS 1
FOR 1993 AND 1996-1999
(tons per year)

	1998					1999				
Source Type	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**
NAS Oceana:										
Mobile Sources:										
Aircraft Operations	299.16	429.89	788.81	19.33	231.61	376.57	503.08	1,010.07	22.26	271.03
Total Aircraft	**299.16**	**429.89**	**788.81**	**19.33**	**231.61**	**376.57**	**503.08**	**1,010.07**	**22.26**	**271.03**
Other Mobile Sources:										
GSE	3.67	34.57	17.17	2.32	2.79	3.69	34.66	17.22	1.73	1.92
Maintenance Run-ups	53.75	224.58	139.20	3.44	83.57	61.59	238.38	160.01	7.02	89.74
Generators	0.56	6.89	1.48	0.45	0.48	0.56	6.89	1.48	0.45	0.48
Total Other Mobile	**57.99**	**266.04**	**157.85**	**6.21**	**86.84**	**65.83**	**279.93**	**178.71**	**9.20**	**92.13**
Stationary Sources:										
Boilers:	0.62	27.13	6.68	22.82	3.38	0.62	27.13	6.68	22.82	3.38
Generators	2.11	27.87	7.27	3.77	2.21	2.11	27.87	7.27	3.77	2.21
Engine Test Cells	9.20	48.99	64.32	2.00	9.31	11.31	55.20	71.48	2.16	11.48
JP-5 Fuel Handling	0.81	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00
Service Station	6.40	0.00	0.00	0.00	0.00	6.72	0.00	0.00	0.00	0.00
Painting	34.12	0.00	0.00	0.00	0.00	34.16	0.00	0.00	0.00	0.00
Construction:	2.55	26.13	8.18	2.41	4.08	0.00	0.00	0.00	0.00	0.00
Total Stationary	**55.81**	**130.12**	**86.45**	**30.99**	**18.97**	**55.82**	**110.20**	**85.43**	**28.75**	**17.07**
Total NASO	**412.95**	**826.05**	**1,033.11**	**56.54**	**337.42**	**498.23**	**893.21**	**1,274.21**	**60.21**	**380.23**
NALF Fentress:										
Aircraft	15.23	242.43	35.97	9.28	78.05	16.08	267.84	39.30	10.10	89.09
Total Annual:	**428.19**	**1,068.48**	**1,069.08**	**65.81**	**415.47**	**514.31**	**1,161.04**	**1,313.51**	**70.31**	**469.32**

Note: Shaded areas indicate nonattainment pollutants of concern.
1993 data and future year estimates based on data current as of June 4 1996.

Key: VOC = volatile organic compounds. SO2 = sulfur dioxide.
NOx = oxides of nitrogen. PM10 = particulate matter. JP-5 = jet fuel.
CO = carbon monoxide. GSE = Ground Support Equipment

Table A-15
NET EMISSIONS CHANGE - NAS OCEANA AND NALF FENTRESS - ARS 1
(tons per year)

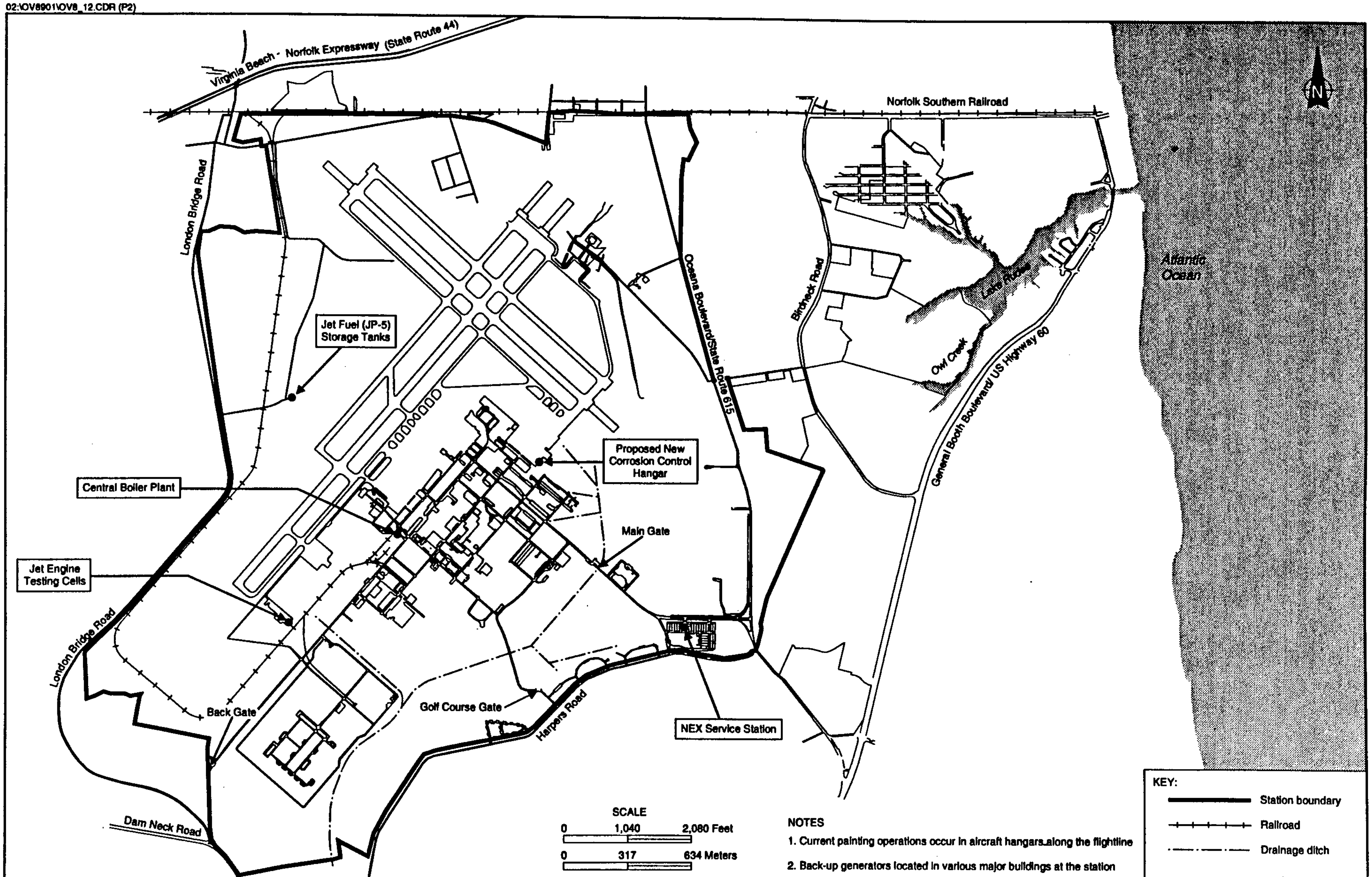
Year	VOCs	NOx	CO	SO2	PM10
NAS Oceana:					
1993	395.49	618.78	874.24	51.04	211.24
1996	180.59	464.33	475.16	42.75	180.14
1997	229.61	622.32	565.04	51.64	242.81
1998	410.91	876.96	1051.10	59.85	345.44
1999	494.88	968.61	1288.12	65.30	392.35
Net Change:					
1993 to 1999	**99.39**	**349.83**	**413.88**	**14.26**	**181.10**
NALF Fentress:					
1993	13.48	146.63	37.00	6.81	30.87
1996	11.78	155.58	25.11	6.42	42.23
1997	13.66	189.24	29.30	7.57	55.28
1998	15.44	267.81	35.97	10.46	84.25
1999	16.39	304.74	39.30	11.83	98.11
Net Change:					
1993 to 1999	**2.91**	**158.11**	**2.30**	**5.02**	67.24
Net Change NAS Oceana and NALF Fentress:					
1993 to 1999	**102.30**	**507.94**	**416.19**	**19.29**	**248.34**

Note: Shaded areas indicate nonattainment pollutants of concern. Emission estimates based on data current as of 4 June 1996.

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

02:\OV8901\OV8_12.CDR (P2)



SOURCE: U.S. Navy 1985; 1995b

Figure A-1 EXISTING AND PROPOSED STATIONARY AIR EMISSION SOURCES

B Airfield and Airspace Operational Study for the 1995 BRAC Realignment of Navy F/A-18 Aircraft

Excerpted from *Airfield and Airspace Operational Study Report for the 1995 BRAC Realignment of Navy F/A-18 Aircraft*, ATAC Corporation, 1997.

AIRFIELD UTILIZATION

This section contains tables of airfield operations, flight track operations, and NAS Oceana Lightship approach data for selected scenarios. MCAS Cherry Point and MCALF Bogue Field airfield operation tables are not included for ARS-1, -2, and -4. The operation levels and type distributions of these scenarios do not differ significantly from the scenarios with the same base loading at MCAS Cherry Point. To determine the MCAS Cherry Point and MCALF Bogue Field airfield operations for ARS-1, -2, and -4, see the Baseline tables.

In reviewing and comparing quantitative results, note that, unless otherwise discussed in the text (Section 3), each of the alternatives should be compared against the baseline scenario. Since the results are dependent upon airwing compositions as well as base loading, comparisons between the alternative scenarios may result in misleading conclusions. Some variation is to be expected due to random behavior designed into the model.

Basic Airfield Operations

Two types of airfield operations tables are presented: basic and flight track. The basic airfield operations are those commonly used by ATC personnel in counting the number of actions during each airfield event. They are defined as follows:

Departure	One aircraft taking off from a runway from a full stop. *One operation.*
Full Stop Visual Landing	One aircraft performing a full-stop landing under VFR from either the visual touch-and-go pattern, or a straight-in approach. *One operation.*
Full Stop Instrument Landing	One aircraft performing a full-stop landing using a GCA or other instrument landing system. *One operation.*
Pad Landing	One aircraft performing an approach to a vertical landing on a pad. *One operation.*
Visual Touch-and-Go/ Low Approach	One aircraft performing a visual approach followed by either a takeoff (in a touch-and-go) or a missed approach. *Two operations.*
Instrument Touch-and-Go/ Low Approach	One aircraft performing an instrument approach followed by either a takeoff (in a touch-and-go) or a missed approach. *Two operations.*
Field Carrier Landing Practice	Similar to a visual touch-and go event. *Two operations.*

Press-Up	A vertical takeoff from a pad followed by hovering maneuvers and a vertical pad landing. *Two operations.*
Pad Vertical Takeoff to Pad Landing Circuit	One aircraft performs a vertical takeoff from a pad, accelerates to forward flight speed around a pattern, and conducts an approach to a vertical pad landing. *Two operations.*

Specific operations at MCALF Bogue Field include:

Field Carrier Landing Practice	Pattern operations with approaches to a simulated ship deck. *Two operations.*
Forward Base Operations	Pattern operations with approaches to the runway. *Two operations.*
Expeditionary Airfield Operations	Arrivals, departures, and pattern operations during expeditionary airfield demonstrations and exercises.

Transient aircraft airfield operations are performed by aircraft not based at the specific air station. The transient aircraft may perform a full-stop landing and remain at the base for several hours or several days. Some transients conduct approaches and depart out of the local operating area. The sources of these transient aircraft are as diverse as the number of military bases throughout the United States, but certain aircraft types perform the majority of operations in each transient group. The transient aircraft groups are described below:

NAS Oceana

Transient Jet	Primarily Navy jets such as F-14, S-3, and F/A-18 aircraft, but includes Lear jets and transports.
Transient Prop	Primarily E-2, C-2, T-34, and C-130 aircraft.

MCAS Cherry Point

Transient Jet	Includes a wide variety of military jets such as F-15, F-16, and F/A-18 aircraft.
Transient Prop	Includes C-12, E-2, and C-130 aircraft.
Transient Heavy	Primarily C-141, C-5, and KC-10, aircraft.
Transient Large	Primarily C-9 aircraft.
Transient Helicopter	Includes H-46, H-53, UH-1, AH-1, AH-64, and OH-58 helicopters.

MCALF Bogue Field

Marine Corps Helicopter	Primarily MCAS New River-based CH-46, CH-53, UH-1, and AH-1 helicopters.

Annual Basic Operations at NAS Oceana and NALF Fentress for ARS-1

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Departure	12,181	1,169	13,350
	Full Stop Visual Landing	11,302	1,502	12,804
	Full Stop Instrument Landing	365	171	536
	Visual Touch-and-Go/Low Approach	20,772	994	21,766
	Instrument Touch-and-Go/Low Approach	456	56	512
	Field Carrier Landing Practice	640	240	880
	TOTAL	45,716	4,132	49,848
F-14 FRS	Departure	6,539	425	6,964
	Full Stop Visual Landing	5,921	393	6,314
	Full Stop Instrument Landing	265	385	650
	Visual Touch-and-Go/Low Approach	25,274	918	26,192
	Instrument Touch-and-Go/Low Approach	3,732	1,500	5,232
	Field Carrier Landing Practice	0	180	180
	TOTAL	41,731	3,801	45,532
F/A-18 Fleet	Departure	14,330	1,298	15,628
	Full Stop Visual Landing	12,556	1,891	14,447
	Full Stop Instrument Landing	851	342	1,193
	Visual Touch-and-Go/Low Approach	24,342	1,914	26,256
	Instrument Touch-and-Go/Low Approach	2,124	800	2,924
	Field Carrier Landing Practice	1,180	1,080	2,260
	TOTAL	55,383	7,325	62,708
F/A-18 FRS	Departure	8,059	479	8,538
	Full Stop Visual Landing	6,838	667	7,505
	Full Stop Instrument Landing	689	344	1,033
	Visual Touch-and-Go/Low Approach	35,822	2,412	38,234
	Instrument Touch-and-Go/Low Approach	4,406	654	5,060
	Field Carrier Landing Practice	160	0	160
	TOTAL	55,974	4,556	60,530
Adversary	Departure	2,262	71	2,333
	Full Stop Visual Landing	2,316	0	2,316
	Full Stop Instrument Landing	16	1	17
	Visual Touch-and-Go/Low Approach	1,476	0	1,476
	Instrument Touch-and-Go/Low Approach	166	0	166
	TOTAL	6,236	72	6,308
Transient Jet	Departure	947	20	967
	Full Stop Visual Landing	709	14	723
	Full Stop Instrument Landing	242	2	244
	Visual Touch-and-Go/Low Approach	1,004	22	1,026
	Instrument Touch-and-Go/Low Approach	804	30	834
	TOTAL	3,706	88	3,794
Transient Prop	Departure	1,634	30	1,664
	Full Stop Visual Landing	1,173	16	1,189
	Full Stop Instrument Landing	467	8	475
	Visual Touch-and-Go/Low Approach	2,778	52	2,830
	Instrument Touch-and-Go/Low Approach	2,572	42	2,614
	TOTAL	8,624	148	8,772
	AIRFIELD TOTAL	217,370	20,122	**237,492**

NALF Fentress

Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Field Carrier Landing Practice	20,508	17,652	38,160
F-14 FRS	Field Carrier Landing Practice	14,802	8,658	23,460
F/A-18 Fleet	Field Carrier Landing Practice	17,629	11,711	29,340
F/A-18 FRS	Field Carrier Landing Practice	17,187	7,299	24,486
E-2 Fleet	Field Carrier Landing Practice	7,873	8,927	16,800
E-2 FRS	Field Carrier Landing Practice	10,291	7,309	17,600
C-2 Fleet	Field Carrier Landing Practice	7,860	488	8,348
	AIRFIELD TOTAL	96,150	62,044	**158,194**

Flight Track Airfield Operations

Flight track airfield operations are those commonly used to assess the frequency by which specific flight tracks are used and are provided to support noise assessment efforts. For NAS Oceana and NALF Fentress, they are defined as follows:

NAS Oceana

Southeasterly Departure	One aircraft leaving the airfield traffic pattern to the southeast (e.g., APOLLO Departure). *One operation.*
Northeasterly Departure	One aircraft leaving the airfield traffic pattern to the northeast (e.g., SOUCEK/NORFOLK Departure). *One operation.*
Interfacility Departure to Fentress	One aircraft leaving the NAS Oceana airfield and arriving at NALF Fentress. *One operation.*
Straight-In/Full Stop Arrival	One aircraft approaching the NAS Oceana directly to a runway (including instrument and visual straight-in approaches) to either a full-stop landing, touch-and-go, or low approach (excluding arrivals from NALF Fentress). *One operation.*
Overhead Arrival at Oceana	One aircraft arriving at the airfield through the overhead approach (excluding arrivals from NALF Fentress). *One operation.*
Visual Touch-and-Go	One full circuit of the visual (tower) pattern. *Two operations.*
GCA Pattern	One full circuit of the GCA box pattern. *Two operations.*
Depart and Reenter to Overhead	One aircraft conducting an overhead approach immediately after leaving the airfield traffic pattern. *One operation.*
FCLP Pattern	One full circuit of the FCLP pattern at NAS Oceana. *Two operations.*
Interfacility Arrival from Fentress (w/ overhead approach)	One aircraft leaving NALF Fentress and arriving at NAS Oceana via the overhead approach. *One operation.*
Interfacility Arrival from Fentress (w/ straight-in approach)	One aircraft leaving NALF Fentress and conducting a straight-in approach at NAS Oceana. *One operation.*

NALF Fentress

Interfacility Arrival from Oceana(w/ overhead approach)	One aircraft leaving NAS Oceana and arriving at NALF Fentress via the overhead approach. *One operation.*
FCLP Pattern	One full circuit of the FCLP pattern at NALF Fentress. *Two operations.*
Interfacility Departure to Oceana	One aircraft leaving the NALF Fentress airfield and arriving at NAS Oceana. *One operation.*

For MCAS Cherry Point and MCALF Bogue Field, the flight track descriptions are as follows:

MCAS Cherry Point

Departure	One aircraft leaving the airfield traffic pattern. *One operation.*
Interfacility Departure to Bogue Field	One aircraft leaving the MCAS Cherry Point airfield and arriving at MCALF Bogue Field. *One operation.*
Straight-In/Full Stop Arrival	One aircraft approaching MCAS Cherry Point directly to a runway (including instrument and visual straight-in approaches) to either a full-stop landing, touch-and-go, or low approach (excluding arrivals from MCALF Bogue Field). *One operation.*
Overhead Arrival at Cherry Point to Runway	One aircraft arriving at the airfield through the overhead approach to a runway (excluding arrivals from MCALF Bogue Field). *One operation.*
Overhead Arrival at Cherry Point to Pad	One AV-8 aircraft arriving at the airfield through the overhead approach to a pad (excluding arrivals from MCALF Bogue Field). *One operation.*
Visual Touch-and-Go	One full circuit of the visual (tower) pattern. *Two operations.*
FCLP Pattern	One full circuit of the FCLP pattern at MCAS Cherry Point. *Two operations.*
Full Circuit to Runway	One AV-8 aircraft entering the tower pattern for an arrival to a runway immediately after departing. *Two operations.*
Full Circuit to Pad	One AV-8 aircraft entering the tower pattern for an arrival to a pad immediately after departing. *Two operations.*

GCA Pattern	One full circuit of the GCA box pattern. *Two operations.*
Depart and Reenter to Overhead	One aircraft conducting an overhead approach immediately after leaving the airfield traffic pattern. *One operation.*
Press-Up	A vertical takeoff from a pad followed by hovering maneuvers and a vertical pad landing. *Two operations.*
Pad Vertical Takeoff to Pad Landing Circuit	One aircraft performs a vertical takeoff from a pad, accelerates to forward flight speed around a pattern, and conducts an approach to a vertical pad landing. *Two operations.*
Interfacility Arrival from Bogue Field (w/ overhead approach)	One aircraft leaving MCALF Bogue Field and arriving at MCAS Cherry Point via the overhead approach. *One operation.*
Interfacility Arrival from Bogue Field (w/ straight-in approach)	One aircraft leaving MCALF Bogue Field and conducting a straight-in approach at MCAS Cherry Point. *One operation.*

MCALF Bogue Field

Interfacility Arrival from Cherry Point	One aircraft leaving MCAS Cherry Point and arriving at MCALF Bogue Field. *One operation.*
Arrival	One aircraft arriving at MCALF Bogue Field (excluding arrivals from MCAS Cherry Point). *One operation.*
FCLP Pattern	One full circuit of the FCLP pattern at MCALF Bogue Field. *Two operations.*
Forward Base Operations Pattern	One full circuit of the FBO pattern at MCALF Bogue Field. *Two operations.*
Interfacility Departure to Cherry Point	One aircraft leaving MCALF Bogue Field and arriving at MCAS Cherry Point. *One operation.*

Annual Flight Track Operations at NAS Oceana for ARS-1

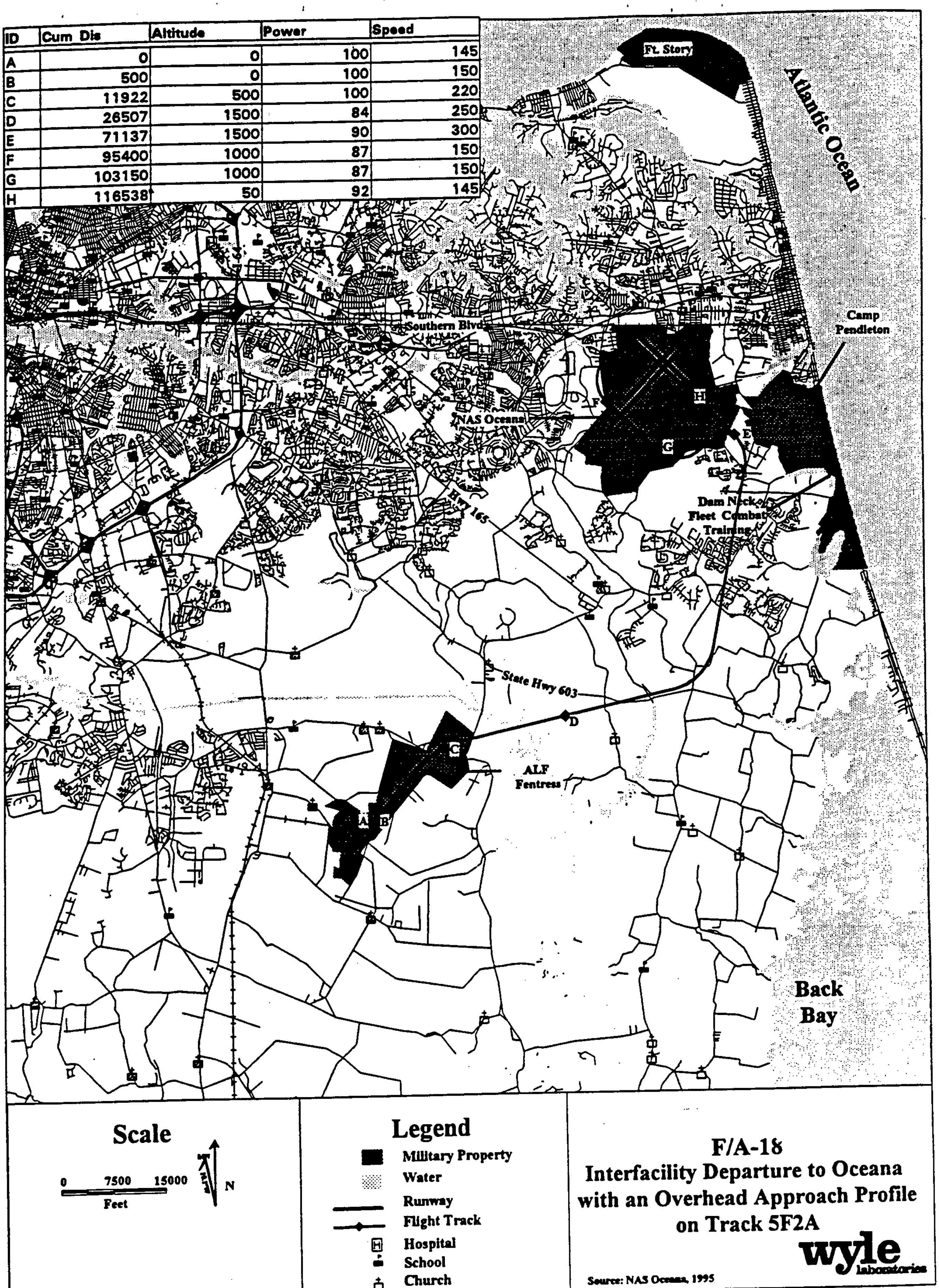
Aircraft Category	Operation Type	Airfield Operations Day 0700-2200	Night 2200-0700	Total
F-14 Fleet	Southeasterly Departure	4,798	60	4,858
	Northeasterly Departure	5,953	99	6,052
	Interfacility Departure to Fentress	1,390	995	2,385
	Interfacility Arrival from Fentress (w/ overhead approach)	1,130	1,045	2,175
	Interfacility Arrival from Fentress (w/ straight-in approach)	70	140	210
	Straight-In/Full stop Arrival (non-interfacility)	464	41	505
	Overhead Arrival at Oceana (non-interfacility)	10,015	380	10,395
	Depart and Reenter to Overhead	108	0	108
	Visual Touch-and-Go	20,908	1,076	21,984
	GCA Box	240	56	296
	FCLP Pattern	640	240	880
	TOTAL	45,716	4,132	49,848
F-14 FRS	Southeasterly Departure	1,593	0	1,593
	Northeasterly Departure	4,041	0	4,041
	Interfacility Departure to Fentress	880	415	1,295
	Interfacility Arrival from Fentress (w/ overhead approach)	485	190	675
	Interfacility Arrival from Fentress (w/ straight-in approach)	290	330	620
	Straight-In/Full stop Arrival (non-interfacility)	1,674	132	1,806
	Overhead Arrival at Oceana (non-interfacility)	3,740	88	3,828
	Depart and Reenter to Overhead	692	0	692
	Visual Touch-and-Go	26,158	1,100	27,258
	GCA Box	2,178	1,366	3,544
	FCLP Pattern	0	180	180
	TOTAL	41,731	3,801	45,532
F/A-18 Fleet	Southeasterly Departure	6,211	232	6,443
	Northeasterly Departure	6,729	96	6,825
	Interfacility Departure to Fentress	1,305	880	2,185
	Interfacility Arrival from Fentress (w/ overhead approach)	1,065	933	1,998
	Interfacility Arrival from Fentress (w/ straight-in approach)	80	107	187
	Straight-In/Full stop Arrival (non-interfacility)	1,693	617	2,310
	Overhead Arrival at Oceana (non-interfacility)	10,546	424	10,970
	Depart and Reenter to Overhead	326	0	326
	Visual Touch-and-Go	25,840	2,884	28,724
	GCA Box	408	72	480
	FCLP Pattern	1,180	1,080	2,260
	TOTAL	55,383	7,325	62,708
F/A-18 FRS	Southeasterly Departure	385	0	385
	Northeasterly Departure	6,542	84	6,626
	Interfacility Departure to Fentress	1,122	395	1,517
	Interfacility Arrival from Fentress (w/ overhead approach)	672	193	865
	Interfacility Arrival from Fentress (w/ straight-in approach)	345	307	652
	Straight-In/Full stop Arrival (non-interfacility)	1,977	280	2,257
	Overhead Arrival at Oceana (non-interfacility)	4,560	194	4,754
	Depart and Reenter to Overhead	1,165	181	1,346
	Visual Touch-and-Go	37,548	2,704	40,252
	GCA Box	1,498	218	1,716
	FCLP Pattern	160	0	160
	TOTAL	55,974	4,556	60,530
Adversary	Southeasterly Departure	1,715	71	1,786
	Northeasterly Departure	547	0	547
	Straight-In/Full stop Arrival (non-interfacility)	116	1	117
	Overhead Arrival at Oceana (non-interfacility)	2,216	0	2,216
	Visual Touch-and-Go	1,642	0	1,642
	TOTAL	6,236	72	6,308
Transient Jet	Southeasterly Departure	46	2	48
	Northeasterly Departure	901	18	919
	Straight-In/Full stop Arrival (non-interfacility)	285	8	293
	Overhead Arrival at Oceana (non-interfacility)	668	6	674
	Visual Touch-and-Go	1,084	32	1,116
	GCA Box	722	22	744
	TOTAL	3,706	88	3,794
Transient Prop	Southeasterly Departure	174	3	177
	Northeasterly Departure	1,460	27	1,487
	Straight-In/Full stop Arrival (non-interfacility)	670	12	682
	Overhead Arrival at Oceana (non-interfacility)	973	9	982
	Visual Touch-and-Go	3,171	61	3,232
	GCA Box	2,176	36	2,212
	TOTAL	8,624	148	8,772
	AIRFIELD TOTAL	217,370	20,122	237,492

ATAC

C NAS Oceana Flight Tracks

Derived from *Aircraft Noise Study for Naval Air Station Oceana and Auxiliary Landing Field Fentress, Virginia, and Related Airspaces, Draft*, 1997 by Wyle Laboratories.

ID	Cum Dis	Altitude	Power	Speed
A	0	0	100	145
B	500	0	100	150
C	11922	500	100	220
D	26507	1500	84	250
E	71137	1500	90	300
F	95400	1000	87	150
G	103150	1000	87	150
H	116538	50	92	145

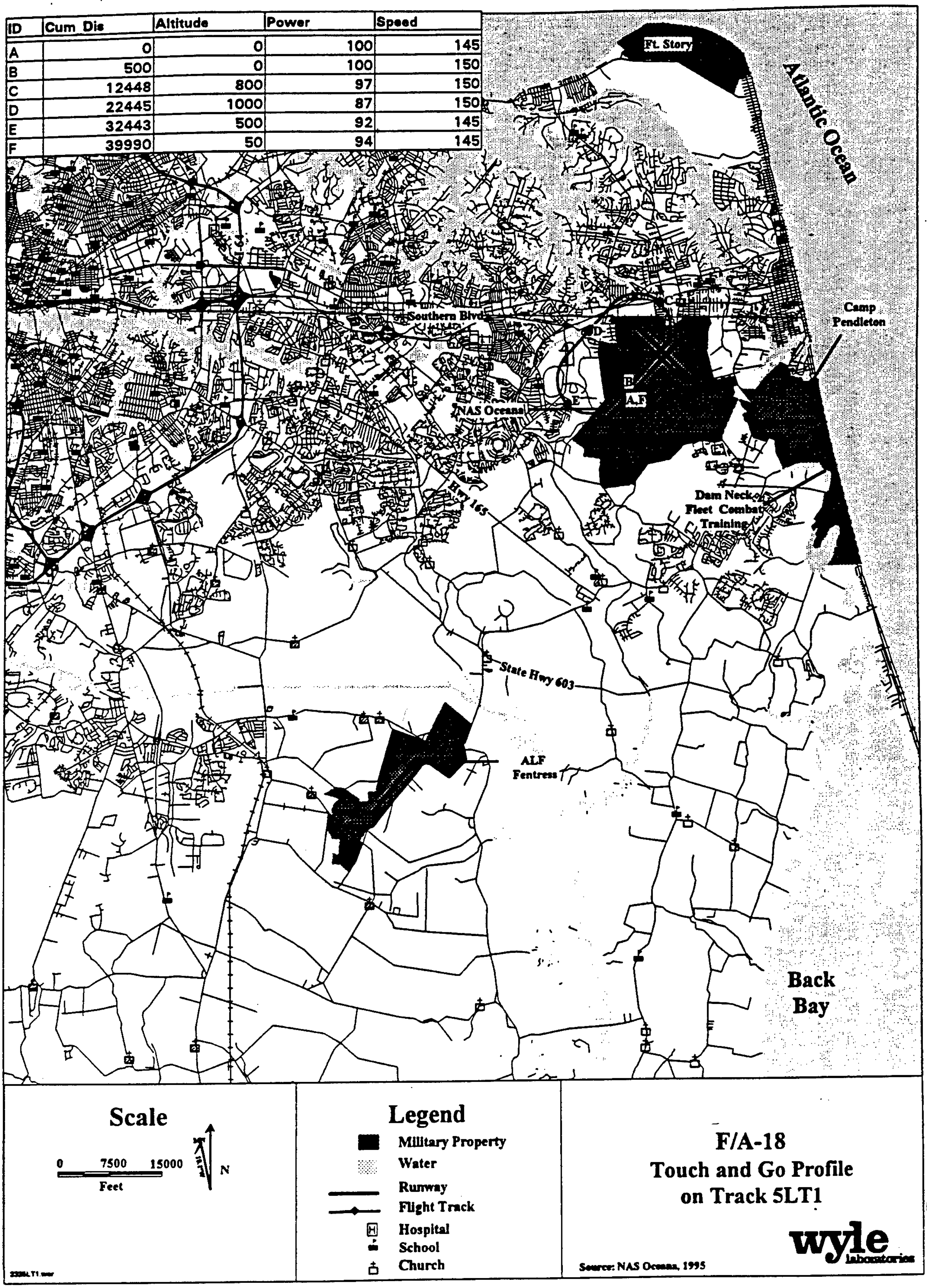


F/A-18 Interfacility Departure to Oceana with an Overhead Approach Profile on Track 5F2A

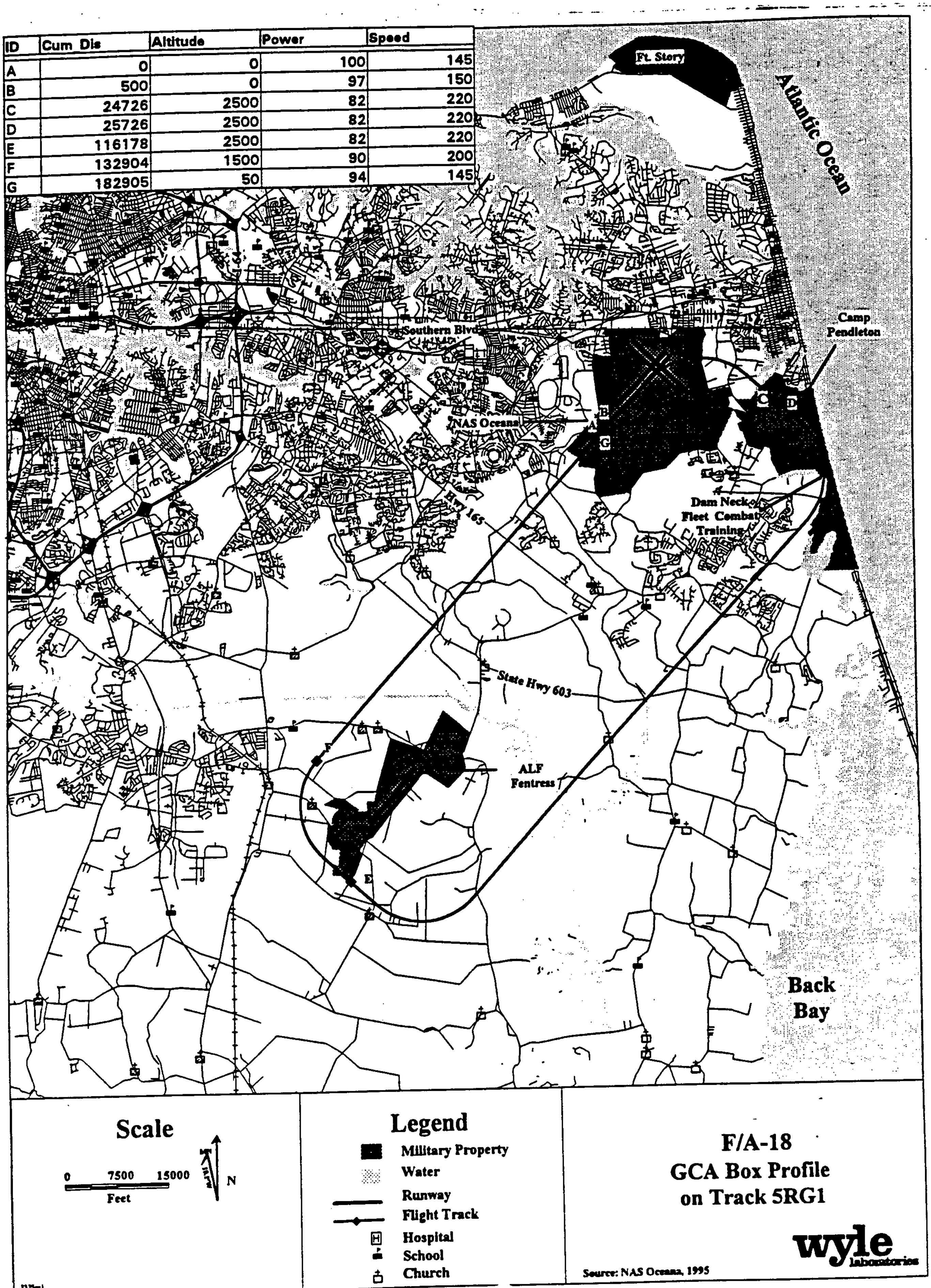
wyle laboratories

Source: NAS Oceana, 1995

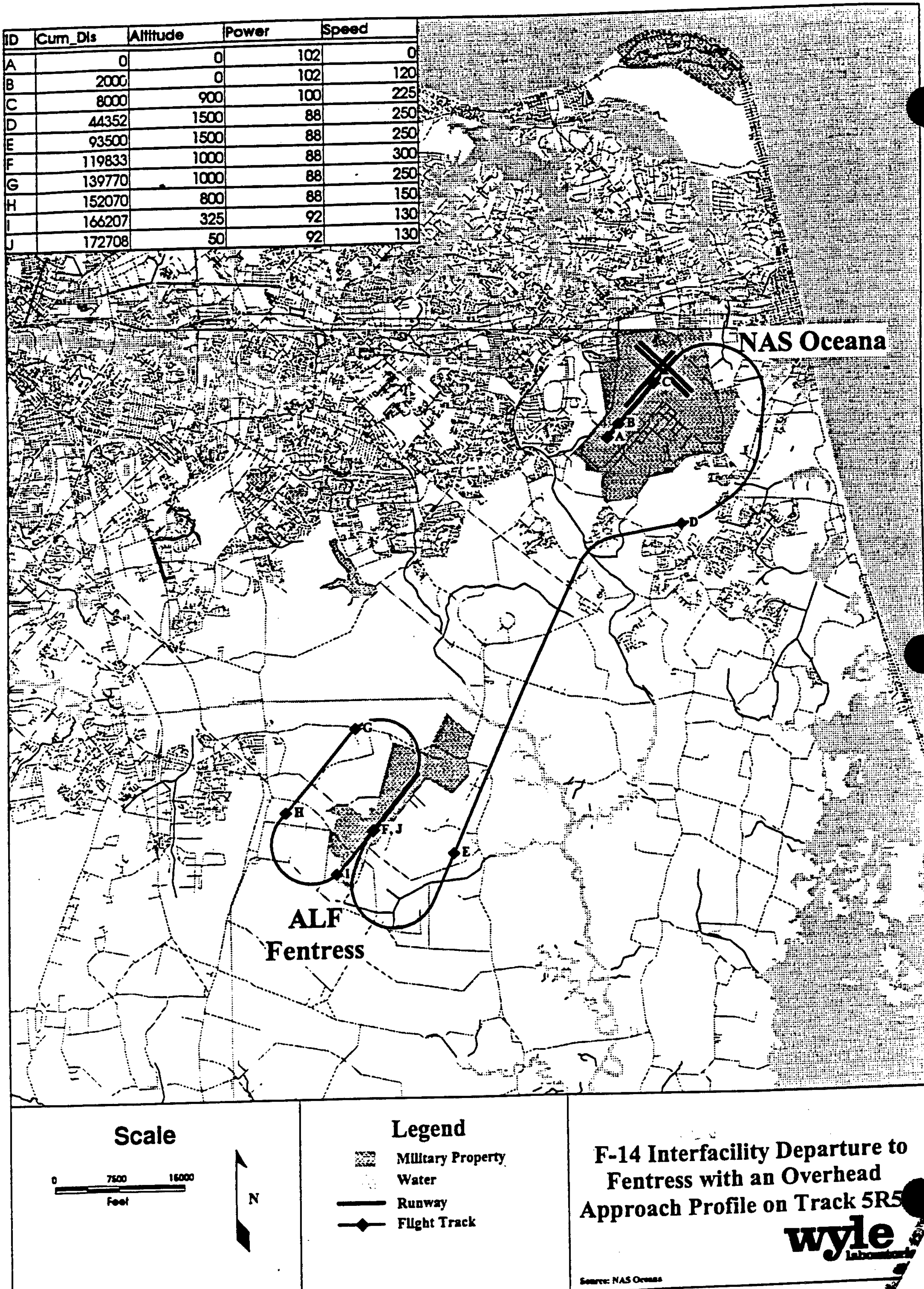
ID	Cum Dis	Altitude	Power	Speed
A	0	0	100	145
B	500	0	100	150
C	12448	800	97	150
D	22445	1000	87	150
E	32443	500	92	145
F	39990	50	94	145



ID	Cum Dis	Altitude	Power	Speed
A	0	0	100	145
B	500	0	97	150
C	24726	2500	82	220
D	25726	2500	82	220
E	116178	2500	82	220
F	132904	1500	90	200
G	182905	50	94	145



ID	Cum_Dis	Altitude	Power	Speed
A	0	0	102	0
B	2000	0	102	120
C	8000	900	100	225
D	44352	1500	88	250
E	93500	1500	88	250
F	119833	1000	88	300
G	139770	1000	88	250
H	152070	800	88	150
I	166207	325	92	130
J	172708	50	92	130

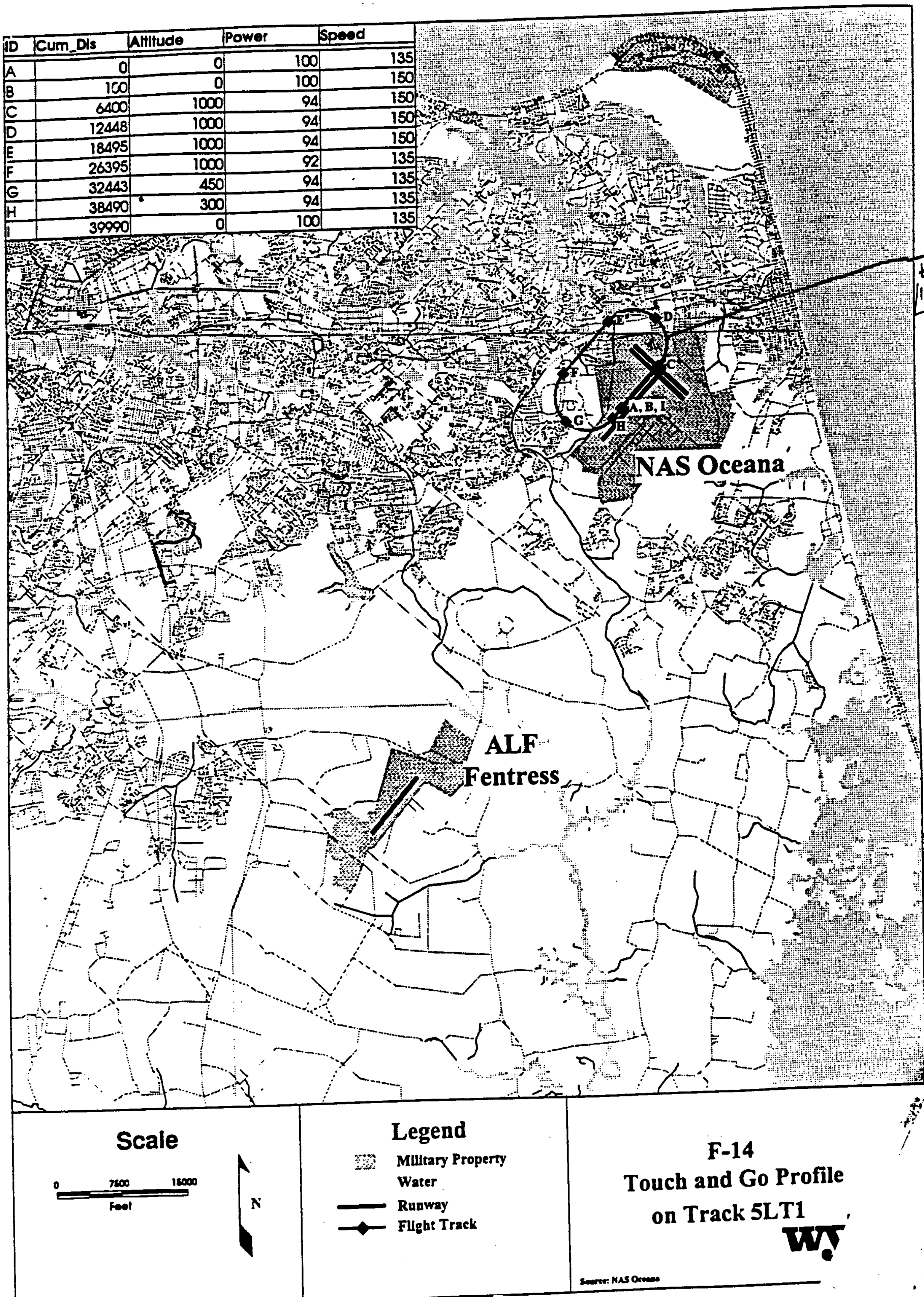


F-14 Interfacility Departure to Fentress with an Overhead Approach Profile on Track 5R5

wyle laboratories

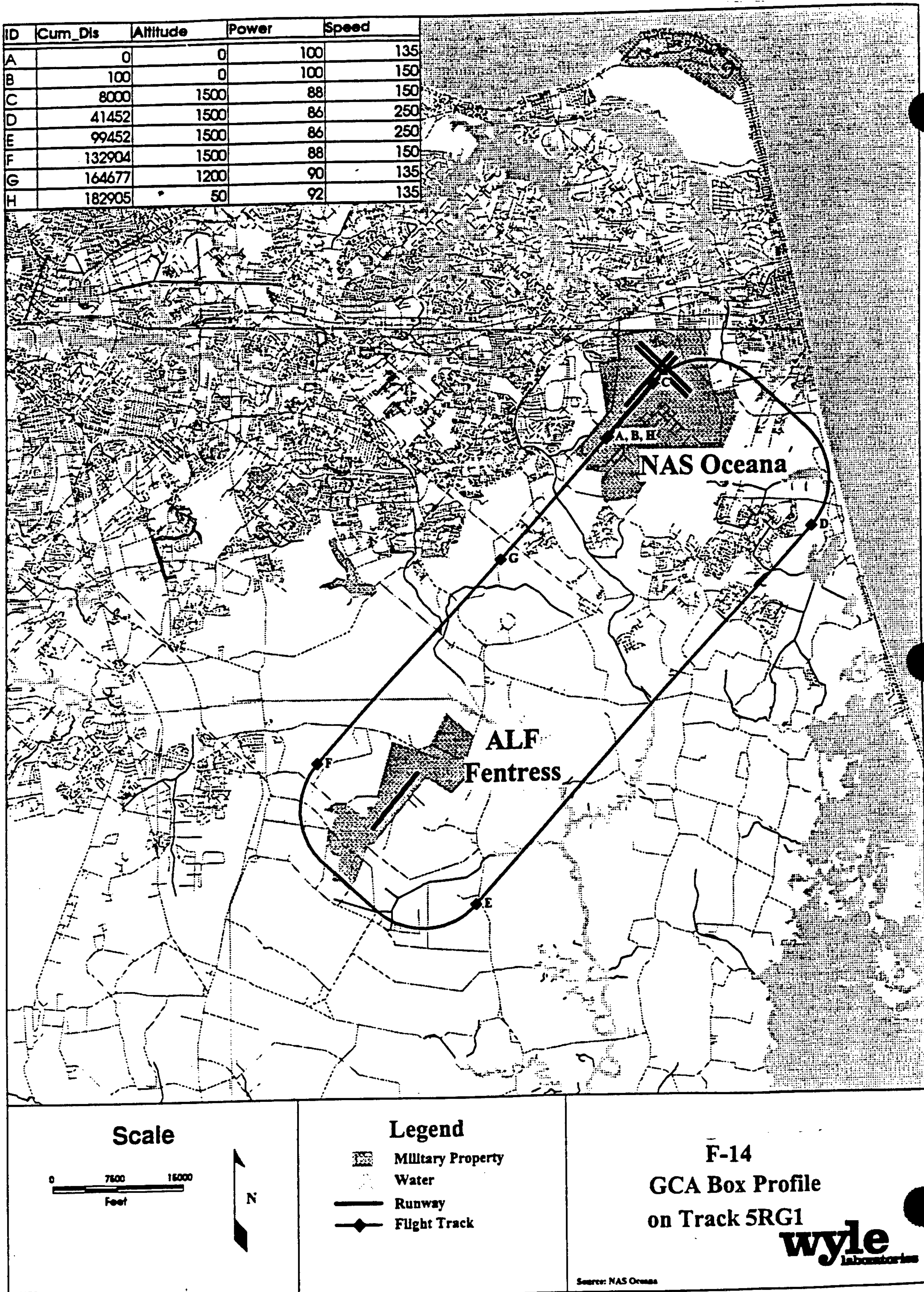
Source: NAS Oceana

ID	Cum_Dis	Altitude	Power	Speed
A	0	0	100	135
B	100	0	100	150
C	6400	1000	94	150
D	12448	1000	94	150
E	18495	1000	94	150
F	26395	1000	92	135
G	32443	450	94	135
H	38490	300	94	135
I	39990	0	100	135



F-14
Touch and Go Profile
on Track 5LT1

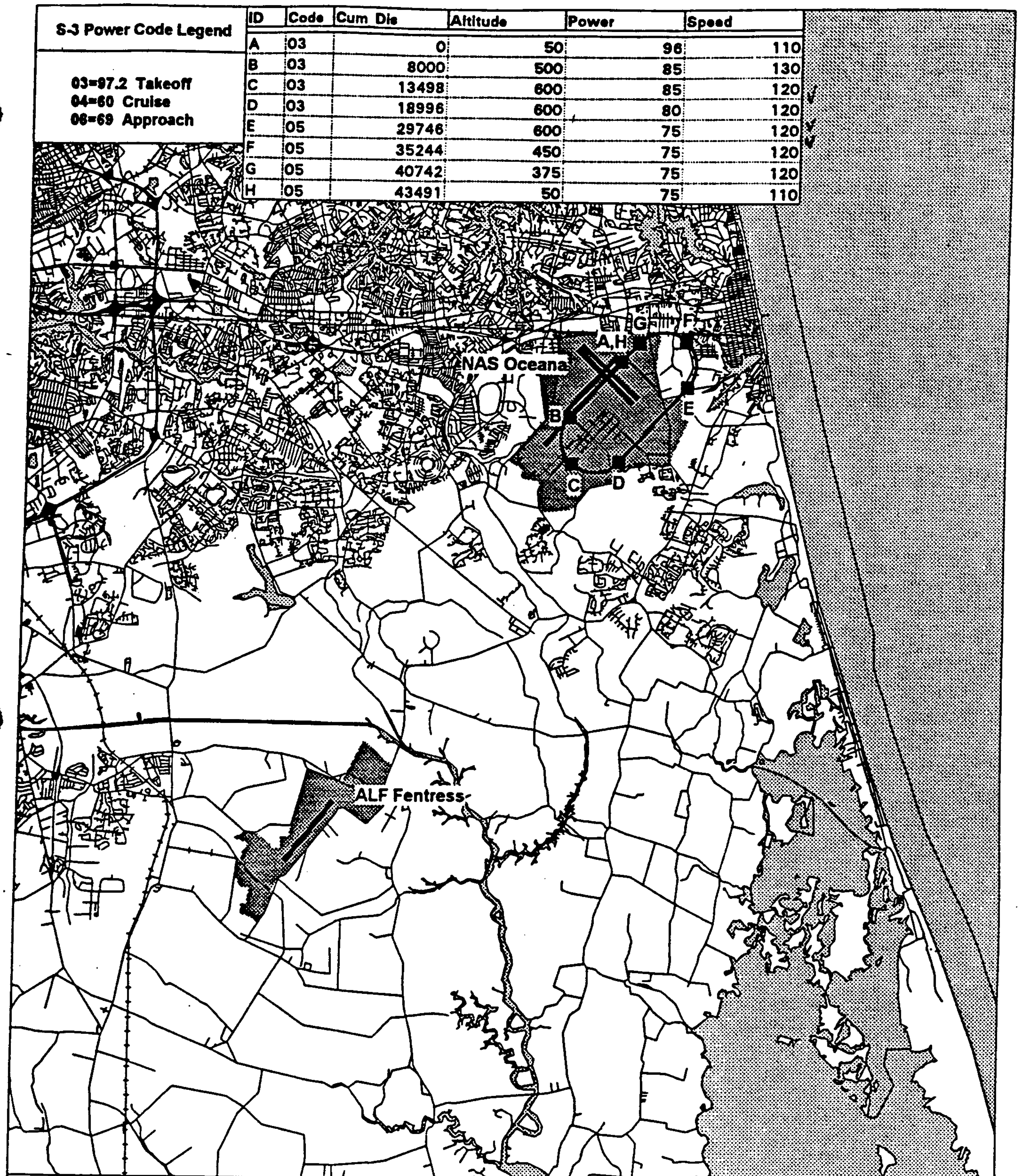
ID	Cum_Dis	Altitude	Power	Speed
A	0	0	100	135
B	100	0	100	150
C	8000	1500	88	150
D	41452	1500	86	250
E	99452	1500	86	250
F	132904	1500	88	150
G	164677	1200	90	135
H	182905	50	92	135



F-14
GCA Box Profile
on Track 5RG1

S-3 Power Code Legend
03=97.2 Takeoff 04=60 Cruise 05=69 Approach

ID	Code	Cum Dis	Altitude	Power	Speed
A	03	0	50	96	110
B	03	8000	500	85	130
C	03	13498	600	85	120
D	03	18996	600	80	120
E	05	29746	600	75	120
F	05	35244	450	75	120
G	05	40742	375	75	120
H	05	43491	50	75	110



0 7500 15000
Feet

N

Legend

NAS Oceana / ALF Fentress

Water

Flight Track

Cum_Dis (ft)
Altitude (ft)
Power (%nc)
Speed (kts)

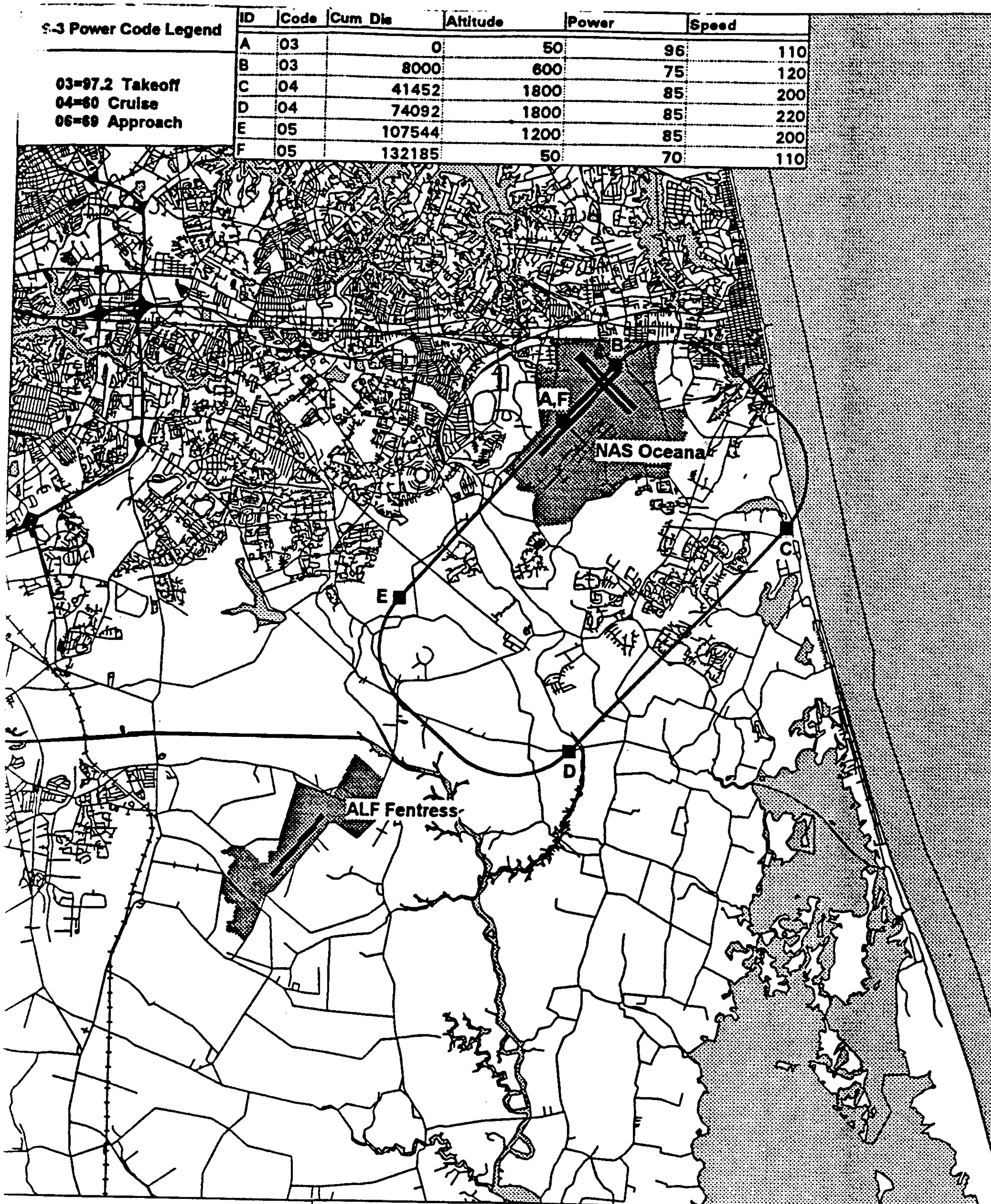
S-3 Flight Profile on Track 3LF1

Source: NAS Cecil Field
Prepared by Wyle Laboratories, 1994

S-3 Power Code Legend

03=97.2 Takeoff
04=60 Cruise
05=69 Approach

ID	Code	Cum Dis	Altitude	Power	Speed
A	03	0	50	96	110
B	03	8000	600	75	120
C	04	41452	1800	85	200
D	04	74092	1800	85	220
E	05	107544	1200	85	200
F	05	132185	50	70	110



0 7500 15000
Feet

N

Legend

NAS Oceana / ALF Fentress
Water
Flight Track
Cum_Dis (ft)
Altitude (ft)
Power (%nc)
Speed (kts)

S-3 Flight Profile on Track 5LG1

Source: NAS Cecil Field
Prepared by Wyle Laboratories, 1994

ID	Cum_Dis	Altitude	Power	Speed
A	0	50	4650	120
B	5800	800	3500	125
C	19937	800	2500	130
D	26087	800	2500	120
E	39306	800	2500	120
F	52874	50	1000	120

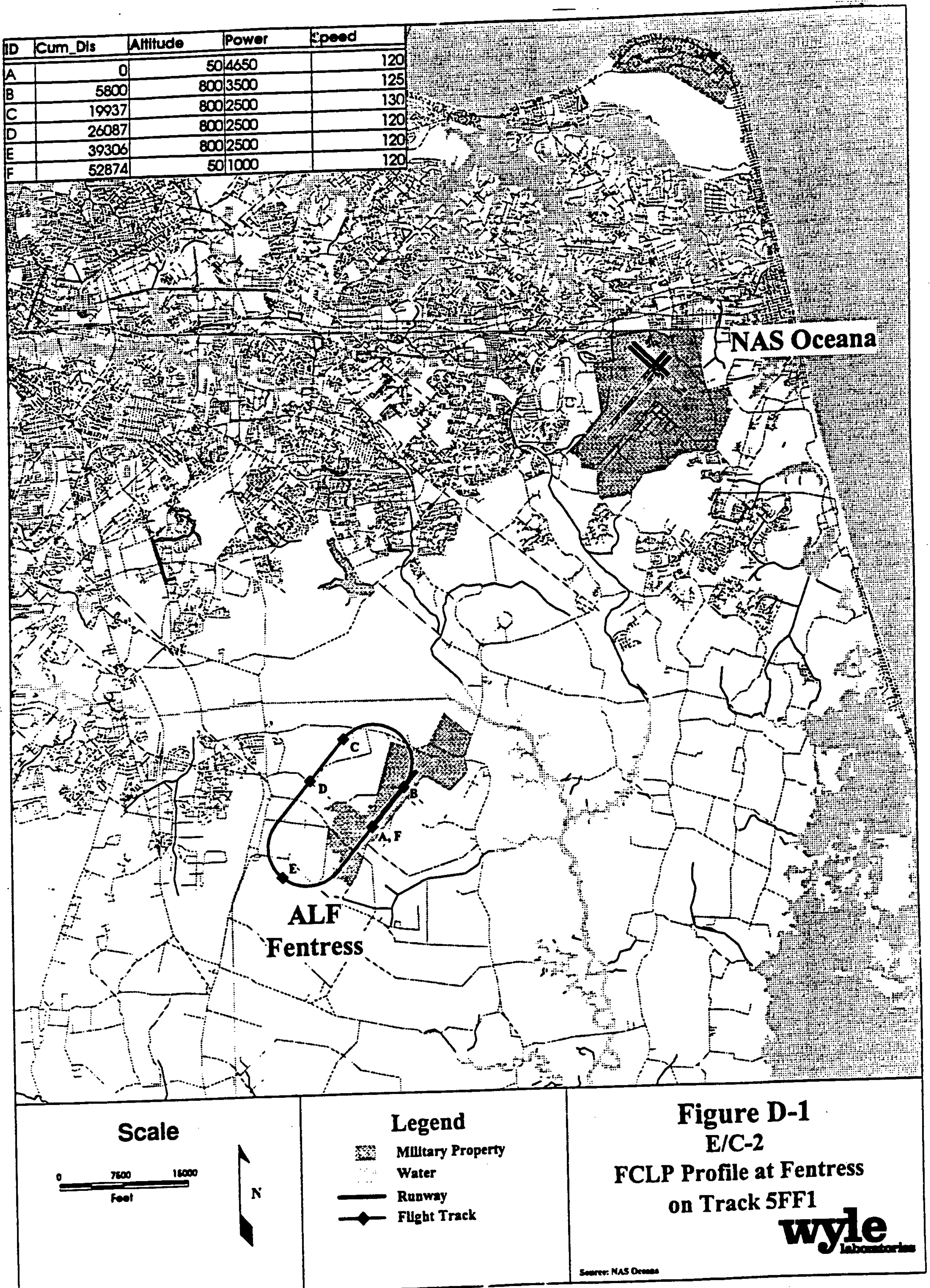


Figure D-1
E/C-2
FCLP Profile at Fentress
on Track 5FF1

wyle laboratories

F

Air Conformity Analyses for ARSs 2, 3, 4, and 5

The following tables present air quality calculations for ARSs 2, 3, 4, and 5. These same calculations are presented for ARS 1 in Appendix E (Air Conformity Determination). The primary differences among the ARSs with regard to these calculations are the total number of aircraft operations under each ARS, the number of in-aircraft engine maintenance run-ups and the number of engine tests in test cells.

Table F-1
ARS 2
TOTAL AIRCRAFT OPERATIONS AT NAS OCEANA AND NALF FENTRESS FOR 1993 AND 1996-1999

Aircraft Type	Operation type	1993	1996	1997	1998	1999
F-14A	Full LTO	12,465	9,122	11,869	11,280	11,280
	Touch&Go NASO	15,236	12,438	16,183	15,380	15,380
	GCA Box	2,178	872	1,134	1,078	1,078
	Interfacility	2,164	1,641	2,135	2,029	2,029
	Touch&Go NALF	10,511	13,742	17,880	16,993	16,993
F-14B/D	Full LTO	8,551	6,768	8,926	8,926	8,926
	Touch&Go NASO	10,452	9,228	12,171	12,171	12,171
	GCA Box	1,494	647	853	853	853
	Interfacility	1,485	1,218	1,606	1,606	1,606
	Touch&Go NALF	7,226	10,196	13,447	13,447	13,447
A-6	Full LTO	13,401	0	0	0	0
	Touch&Go NASO	16,380	0	0	0	0
	GCA Box	2,341	0	0	0	0
	Interfacility	2,326	0	0	0	0
	Touch&Go NALF	11,086	0	0	0	0
F/A-18	Full LTO	0	1,689	1,689	18,576	23,642
	Touch&Go NASO	0	2,558	2,558	28,133	35,806
	GCA Box	0	0	0	814	1,036
	Interfacility	0	0	0	2,474	3,149
	Touch&Go NALF	0	0	0	18,233	23,206
A-4	Full LTO	4,169	0	0	0	0
	Touch&Go	5,096	0	0	0	0
F-16	Full LTO	936	0	0	0	0
	Touch&Go	1,144	0	0	0	0
F-5	Full LTO	808	0	0	0	0
	Touch&Go	988	0	0	0	0
TC-4C	Full LTO	638	0	0	0	0
	Touch&Go	780	0	0	0	0
UH-3H	Full LTO	662	0	0	0	0
C-12	Full LTO	261	1,669	1,669	1,669	1,669
	Touch&Go	445	2,772	2,772	2,772	2,772
	GCA Box	0	1,101	1,101	1,101	1,101
S-3	Full LTO	1,741	967	967	967	967
	Touch&Go	1,295	938	938	938	938
	GCA Box	1,323	371	371	371	371
T-2C	Full LTO	1,418	0	0	0	0
T-34	Full LTO	1,040	1,040	1,040	1,040	1,040
E-2/C-2	Full LTO NALF	1,074	896	896	896	896
	Touch&Go NALF	25,058	20,478	20,478	20,478	20,478
Total		**166,172**	**100,350**	**120,681**	**182,226**	**200,834**

Notes:

(1) F-14 operations divided between F-14As and F-14B/Ds using 1993 aircraft population data.
Number of GCAs and interfacility flights were proportioned from 1997 data based on the number of aircraft.

(2) 1996-1998 operations proportioned from 1999 data using NAS Oceana aircraft population data
A-6s assumed decommissioned by mid-1997.

(3) 1999 and Transient aircraft operations derived from NASMOD analysis (ATAC 1997).

(4) GCA box and interfacility flights include only the level portion of those operations.
Takeoff and landings for these operations are accounted for under full LTO or T&G.

Key:

LTO = Landing and takeoff cycle
GCA = Ground Control Approach
NASO = Naval Air Station Oceana
NALF = Naval Auxiliary Landing Field

Table F-2
ARS 2
MODAL EMISSION RATES FOR AIRCRAFT AT NAS OCEANA

Aircraft (Engine Model)	Mode	Time in Mode (minutes)	Fuel Flow ((lb/min)/eng)	Engines	Emission Factor ([lb /1000 lb fuel]/eng)					Modal Emission Rates (lb/mode)				
					VOC (1)	NOx	CO	SO2	PM10 (2)	VOC (1)	NOx	CO	SO2	PM10 (2)
F-14A (TF30-P-412A)	Taxi Out/Idle	7.0	15.33	2	31.42	3.22	55.51	0.54	8.96	6.74	0.69	11.91	0.12	1.92
	Hot Refueling Idle	16.0	15.33	2	31.42	3.22	55.51	0.54	8.96	15.41	1.58	27.23	0.26	4.40
	Take Off	0.4	796.67	2	0.20	4.79	10.77	0.54	0.00	0.13	3.05	6.86	0.34	0.00
	Climbout	0.4	117.50	2	0.77	19.60	1.38	0.54	2.98	0.07	1.84	0.13	0.05	0.28
	Approach	1.3	71.67	2	1.48	10.74	3.43	0.54	7.98	0.28	2.00	0.64	0.10	1.49
	Taxi In/Idle	5.3	15.33	2	31.42	3.22	55.51	0.54	8.96	5.11	0.52	9.02	0.09	1.46
	T&G Level	1.4	71.67	2	1.48	10.74	3.43	0.54	7.98	0.30	2.16	0.69	0.11	1.60
	GCA Box	9.7	71.67	2	1.48	10.74	3.43	0.54	7.98	2.06	14.93	4.77	0.75	11.10
	Interfacility	1.6	71.67	2	1.48	10.74	3.43	0.54	7.98	0.34	2.46	0.79	0.12	1.83
									Touch and Go	**0.65**	**6.00**	**1.46**	**0.26**	**3.37**
									Full LTO w/hot ref.	**27.74**	**9.69**	**55.80**	**0.96**	**9.54**
									Full LTO w/o hot ref.	**12.32**	**8.11**	**28.57**	**0.70**	**5.15**
									Interfacility	**0.34**	**2.46**	**0.79**	**0.12**	**1.83**
									GCA Box	**2.06**	**14.93**	**4.77**	**0.75**	**11.10**
F-14B/D (F110-GE-400)	Taxi Out/Idle	7.0	19.52	2	3.65	2.77	16.60	0.54	12.38	1.00	0.76	4.54	0.15	3.38
	Hot Refueling Idle	16.0	19.52	2	3.65	2.77	16.60	0.54	12.38	2.28	1.73	10.37	0.34	7.73
	Take Off	0.4	195.32	2	0.40	28.63	0.84	0.54	2.81	0.06	4.47	0.13	0.08	0.44
	Climbout	0.4	195.32	2	0.40	28.63	0.84	0.54	2.81	0.06	4.47	0.13	0.08	0.44
	Approach	1.3	133.03	2	0.26	19.61	0.76	0.54	6.10	0.09	6.78	0.26	0.19	2.11
	Taxi In/Idle	5.3	19.52	2	3.65	2.77	16.60	0.54	12.38	0.76	0.57	3.43	0.11	2.56
	T&G Level	1.4	64.10	2	0.95	8.75	1.64	0.54	6.10	0.17	1.57	0.29	0.10	1.09
	GCA Box	9.7	64.10	2	0.95	8.75	1.64	0.54	6.10	1.18	10.88	2.04	0.67	7.59
	Interfacility	1.6	64.10	2	0.95	8.75	1.64	0.54	6.10	0.19	1.79	0.34	0.11	1.25
									Touch and Go	**0.32**	**12.83**	**0.69**	**0.37**	**3.64**
									Full LTO w/ hot ref.	**4.25**	**18.79**	**18.87**	**0.95**	**16.67**
									Full LTO w/o hot ref.	**1.97**	**17.06**	**8.50**	**0.61**	**8.93**
									Interfacility	**0.19**	**1.79**	**0.34**	**0.11**	**1.25**
									GCA Box	**1.18**	**10.88**	**2.04**	**0.67**	**7.59**
A-6 (J-52-P-8B)	Taxi Out/Idle	7.0	11.33	2	42.20	1.79	63.78	0.54	0.00	6.69	0.28	10.12	0.09	0.00
	Hot Refueling Idle	20.0	11.33	2	42.20	1.79	63.78	0.54	0.00	19.13	0.81	28.91	0.24	0.00
	Take Off	0.4	122.83	2	0.93	13.05	0.71	0.54	0.00	0.09	1.28	0.07	0.05	0.00
	Climbout	0.4	72.00	2	0.58	10.10	3.00	0.54	0.00	0.03	0.58	0.17	0.03	0.00
	Approach	1.3	38.33	2	1.72	6.34	10.54	0.54	0.00	0.17	0.63	1.05	0.05	0.00
	Taxi In/Idle	5.3	11.33	2	42.20	1.79	63.78	0.54	0.00	5.07	0.21	7.66	0.06	0.00
	T&G Level	1.4	38.33	2	1.72	6.34	10.54	0.54	0.00	0.18	0.68	1.13	0.06	0.00
	GCA Box	9.7	38.33	2	1.72	6.34	10.54	0.54	0.00	1.28	4.71	7.84	0.40	0.00
	Interfacility	1.6	38.33	2	1.72	6.34	10.54	0.54	0.00	0.21	0.78	1.29	0.07	0.00
									Touch and Go	**0.39**	**1.89**	**2.35**	**0.14**	**0.00**
									Full LTO w/ hot ref.	**31.18**	**3.81**	**47.97**	**0.53**	**0.00**
									Full LTO w/o hot ref.	**12.06**	**2.99**	**19.07**	**0.29**	**0.00**
									Interfacility	**0.21**	**0.78**	**1.29**	**0.07**	**0.00**
									GCA Box	**1.28**	**4.71**	**7.84**	**0.40**	**0.00**

Table F-2
ARS 2
MODAL EMISSION RATES FOR AIRCRAFT AT NAS OCEANA

Aircraft (Engine Model)	Mode	Time in Mode (minutes)	Fuel Flow ((lb/min)/eng)	Engines	Emission Factor ([lb /1000 lb fuel]/eng)					Modal Emission Rates (lb/mode)				
					VOC (1)	NOx	CO	SO2	PM10 (2)	VOC (1)	NOx	CO	SO2	PM10 (2)
A-4 (J-52-P-8B)	Taxi Out/Idle	6.5	11.33	1	42.20	1.79	63.78	0.54	0.00	3.11	0.13	4.70	0.04	0.00
	Take Off	0.4	122.83	1	0.93	13.05	0.71	0.54	0.00	0.05	0.64	0.03	0.03	0.00
	Climbout	0.4	72.00	1	0.58	10.10	3.00	0.54	0.00	0.02	0.29	0.09	0.02	0.00
	Approach	1.3	38.33	1	1.72	6.34	10.54	0.54	0.00	0.09	0.32	0.53	0.03	0.00
	Taxi In/Idle	6.5	11.33	1	42.20	1.79	63.78	0.54	0.00	3.11	0.13	4.70	0.04	0.00
	T&G Level	1.4	38.33	1	1.72	6.34	10.54	0.54	0.00	0.09	0.34	0.57	0.03	0.00
									Touch and Go	**0.19**	**0.95**	**1.18**	**0.07**	**0.00**
									Full LTO w/o hot ref.	**6.36**	**1.51**	**10.04**	**0.15**	**0.00**
F-16 (F100-PW-100)	Taxi Out/Idle	6.5	17.67	1	2.26	3.96	19.34	0.54	0.09	0.26	0.45	2.22	0.06	0.01
	Take Off	0.4	736.67	1	0.10	16.50	55.10	0.54	0.00	0.03	4.86	16.24	0.16	0.00
	Climbout	0.4	173.33	1	0.05	44.00	1.80	0.54	0.83	0.00	3.05	0.12	0.04	0.06
	Approach	1.3	50.00	1	0.60	11.00	3.00	0.54	0.33	0.04	0.72	0.20	0.04	0.01
	Taxi In/Idle	6.5	17.67	1	2.26	3.96	19.34	0.54	0.09	0.26	0.45	2.22	0.06	0.01
	T&G Level	1.4	50.00	1	0.60	11.00	3.00	0.54	0.33	0.04	0.77	0.21	0.04	0.02
									Touch and Go	**0.08**	**4.54**	**0.53**	**0.11**	**0.09**
									Full LTO w/o hot ref.	**0.59**	**9.54**	**21.00**	**0.36**	**0.088**
F-5 (J85-GE-21)	Taxi Out/Idle	6.5	6.67	2	24.25	1.25	159.00	0.54	0.00	2.10	0.11	13.79	0.05	0.00
	Take Off	0.4	177.50	2	0.10	5.60	36.40	0.54	0.00	0.01	0.80	5.17	0.08	0.00
	Climbout	0.4	53.33	2	0.25	5.00	21.56	0.54	0.00	0.01	0.21	0.92	0.02	0.00
	Approach	1.3	20.00	2	2.58	2.92	46.25	0.54	0.00	0.13	0.15	2.41	0.03	0.00
	Taxi In/Idle	6.5	6.67	2	24.45	1.25	159.00	0.54	0.00	2.12	0.11	13.79	0.05	0.00
	T&G Level	1.4	20.00	2	2.58	2.92	46.25	0.54	0.00	0.14	0.16	2.59	0.03	0.00
									Touch and Go	**0.29**	**0.53**	**5.91**	**0.08**	**0.00**
									Full LTO w/o hot ref.	**4.38**	**1.38**	**36.07**	**0.22**	**0.00**
F/A-18 (F404-GE-400)	Taxi Out/Idle	7.0	10.40	2	58.18	1.16	137.34	0.40	12.38	8.47	0.17	20.00	0.06	1.80
	Hot Refueling Idle	11.0	10.40	2	58.18	1.16	137.34	0.40	12.38	13.31	0.27	31.42	0.09	2.83
	Take Off	0.4	473.28	2	0.13	9.22	23.12	0.40	0.00	0.05	3.49	8.75	0.15	0.00
	Climbout	0.4	143.12	2	0.31	25.16	1.05	0.40	2.81	0.04	2.88	0.12	0.05	0.32
	Approach	1.3	66.75	2	0.44	8.37	1.78	0.40	6.10	0.08	1.45	0.31	0.07	1.06
	Taxi In/Idle	5.3	10.40	2	58.18	1.16	137.34	0.40	12.38	6.41	0.13	15.14	0.04	1.36
	T&G Level	1.7	60.00	2	0.44	8.37	1.78	0.40	6.10	0.09	1.71	0.36	0.08	1.24
	GCA Box	9.0	60.00	2	0.44	8.37	1.78	0.40	6.10	0.48	9.04	1.92	0.43	6.59
	Interfacility	1.4	85.00	2	0.38	11.78	1.16	0.40	6.10	0.09	2.80	0.28	0.10	1.45
									Touch and Go	**0.20**	**6.04**	**0.79**	**0.20**	**2.62**
									Full LTO w/ hot ref.	**28.36**	**8.39**	**75.74**	**0.46**	**7.38**
									Full LTO w/o hot ref.	**15.05**	**8.12**	**44.32**	**0.37**	**4.55**
									Interfacility	**0.09**	**2.80**	**0.28**	**0.10**	**1.45**
									GCA Box	**0.48**	**9.04**	**1.92**	**0.43**	**6.59**

Table F-2
ARS 2
MODAL EMISSION RATES FOR AIRCRAFT AT NAS OCEANA

Aircraft (Engine Model)	Mode	Time in Mode (minutes)	Fuel Flow ((lb/min)/eng)	Engines	Emission Factor ([lb /1000 lb fuel]/eng)					Modal Emission Rates (lb/mode)				
					VOC (1)	NOx	CO	SO2	PM10 (2)	VOC (1)	NOx	CO	SO2	PM10 (2)
S-3	Taxi Out/Idle	6.5	7.63	2	14.99	1.69	90.98	0.54	3.26	1.49	0.17	9.02	0.05	0.32
(TF34-GE-400)	Hot Refueling Idle	8.0	7.63	2	14.99	1.69	90.98	0.54	3.26	1.83	0.21	11.11	0.07	0.40
	Take Off	0.4	63.33	2	0.39	7.51	5.95	0.54	2.11	0.02	0.38	0.30	0.03	0.11
	Climbout	0.4	7.67	2	2.63	3.42	33.57	0.54	6.85	0.02	0.02	0.21	0.00	0.04
	Approach	1.3	7.67	2	2.63	3.42	33.57	0.54	6.85	0.05	0.07	0.67	0.01	0.14
	Taxi In/Idle	6.5	7.63	2	14.99	1.69	90.98	0.54	3.26	1.49	0.17	9.02	0.05	0.32
	T&G Level	1.8	7.67	2	2.63	3.42	33.57	0.54	6.85	0.07	0.09	0.93	0.01	0.19
	GCA Box	7.5	7.67	2	2.63	3.42	33.57	0.54	6.85	0.30	0.39	3.86	0.06	0.79
									Touch and Go	**0.14**	**0.18**	**1.80**	**0.03**	**0.37**
									Full LTO w/ hot ref.	**4.89**	**1.01**	**30.33**	**0.21**	**1.33**
									Full LTO w/o hot ref.	**3.06**	**0.80**	**19.23**	**0.15**	**0.93**
									GCA Box	**0.30**	**0.39**	**3.86**	**0.06**	**0.79**
C-12/TC-4	Taxi Out/Idle	19.0	2.45	2	101.63	1.97	115.31	0.54	0.00	9.46	0.18	10.74	0.05	0.00
(PT6A-41)	Take Off	0.5	8.50	2	1.75	7.98	5.10	0.54	0.00	0.01	0.07	0.04	0.00	0.00
	Climbout	2.1	7.88	2	2.03	7.57	6.49	0.54	0.00	0.07	0.25	0.21	0.02	0.00
	Approach	3.7	4.55	2	22.71	4.65	34.80	0.54	0.00	0.76	0.16	1.17	0.02	0.00
	Taxi In/Idle	7.0	2.45	2	101.63	1.97	115.31	0.54	0.00	3.49	0.07	3.96	0.02	0.00
	T&G Level	2.0	4.55	2	22.71	4.65	34.80	0.54	0.00	0.41	0.08	0.63	0.01	0.00
	GCA Box	7.5	4.55	2	22.71	4.65	34.80	0.54	0.00	1.55	0.32	2.38	0.04	0.00
									Touch and Go	**1.25**	**0.49**	**2.02**	**0.05**	**0.00**
									Full LTO w/o hot ref.	**13.79**	**0.73**	**16.12**	**0.11**	**0.00**
									GCA Box	**1.55**	**0.32**	**2.38**	**0.04**	**0.00**
UH-3H	Taxi Out/Idle	8.0	2.20	2	130.42	1.43	178.44	0.54	0.00	4.59	0.05	6.28	0.02	0.00
(T58-GE-8F)	Take Off	0.0	13.10	2	0.40	5.47	9.03	0.54	0.00	0.00	0.00	0.00	0.00	0.00
	Climbout	5.7	10.45	2	0.80	4.68	14.13	0.54	0.00	0.10	0.08	0.11	0.03	0.00
	Approach	5.7	9.68	2	1.12	4.47	17.28	0.54	0.00	0.13	0.53	2.06	0.06	0.00
	Taxi In/Idle	7.0	2.20	2	130.42	1.43	178.44	0.54	0.00	4.02	0.04	5.50	0.02	0.00
									Full LTO w/o hot ref.	**8.84**	**0.71**	**13.94**	**0.13**	**0.00**
T-34	Taxi Out/Idle	6.5	1.92	1	50.17	2.43	64.00	0.54	0.00	0.63	0.03	0.80	0.01	0.00
(PT6A-25)	Take Off	0.4	7.08	1	0.00	7.81	1.01	0.54	0.00	0.00	0.02	0.00	0.00	0.00
	Climbout	0.4	6.67	1	0.00	7.00	1.20	0.54	0.00	0.00	0.02	0.00	0.00	0.00
	Approach	1.3	3.58	1	2.19	8.37	23.02	0.54	0.00	0.01	0.04	0.11	0.00	0.00
	Taxi In/Idle	6.5	1.92	1	50.17	2.43	64.00	0.54	0.00	0.63	0.03	0.80	0.01	0.00
									Full LTO w/o hot ref.	**1.26**	**0.14**	**1.71**	**0.02**	**0.00**

Table F-2
ARS 2
MODAL EMISSION RATES FOR AIRCRAFT AT NAS OCEANA

Aircraft (Engine Model)	Mode	Time in Mode (minutes)	Fuel Flow ((lb/min)/eng)	Engines	Emission Factor ([lb /1000 lb fuel]/eng)					Modal Emission Rates (lb/mode)				
					VOC (1)	NOx	CO	SO2	PM10 (2)	VOC (1)	NOx	CO	SO2	PM10 (2)
T-2	Taxi Out/Idle	6.5	9.33	2	11.86	3.68	111.86	0.54	0.00	1.44	0.45	13.57	0.07	0.00
(J85-GE-2)	Take Off	0.4	48.17	2	0.45	6.40	21.56	0.54	0.00	0.02	0.25	0.83	0.02	0.00
	Climbout	0.4	35.92	2	0.64	5.67	28.38	0.54	0.00	0.02	0.16	0.82	0.02	0.00
	Approach	1.3	17.42	2	2.40	4.02	63.53	0.54	0.00	0.11	0.18	2.88	0.02	0.00
	Taxi In/Idle	6.5	9.33	2	11.86	3.68	111.86	0.54	0.00	1.44	0.45	13.57	0.07	0.00
									Full LTO w/o hot ref.	**3.02**	**1.48**	**31.66**	**0.19**	**0.00**
E-2/C-2	Taxi Out/Idle	19.0	9.98	2	19.24	3.53	30.11	0.54	0.00	7.30	1.34	11.42	0.20	0.00
(T56-A-16)	Take Off	0.5	36.98	2	0.14	10.45	0.65	0.54	0.00	0.01	0.39	0.02	0.02	0.00
	Climbout	2.1	36.98	2	0.14	10.45	0.65	0.54	0.00	0.02	1.62	0.10	0.08	0.00
	Approach	3.7	33.27	2	0.17	9.93	0.42	0.54	0.00	0.04	2.44	0.10	0.13	0.00
	Taxi In/Idle	7.0	9.98	2	19.24	3.53	30.11	0.54	0.00	2.69	0.49	4.21	0.08	0.00
	T&G Level	1.6	15.00	2	0.95	6.52	4.54	0.54	0.00	0.05	0.31	0.22	0.03	0.00
									Touch and Go	**0.11**	**4.38**	**0.42**	**0.24**	**0.00**
									Full LTO w/o hot ref.	**10.05**	**6.29**	**15.85**	**0.52**	**0.00**

Notes:

1) Aircraft VOC reported as HC in the form CHy/x

2) Emission factors equal to 0.00 for PM10 indicate that no factor has been determined (AESO 1996).

Emission factors from AESO Report Number 6-90 and USEPA AP-42.

Shaded areas indicate the nonattainment pollutants of concern.

Modal emission rates calculated from data provided by AESO, except for time in modes for T&G, GCA Box, and interfacility level modes from flight track profiles.

Level mode TIMs estimated from flight track profiles for F-14, E-2/C-2, F/A-18, and S-3 aircraft. Level TIMs for C-12s and TC-4s were assumed to be the same as E-2/C-2

All other aircraft are assumed to have the same level TIMs as F-14s.

Emission rates for T&G operations include approach, climbout, and T&G level modes only.

GCA box and interfacility mode emission rates are presented only for aircraft that conduct low-altitude operations between NAS Oceana and NALF Fentress.

F-14B and F-14D have the same engine types, and therefore, have identical emission rates.

TC-4s are assumed to have the same emission rates as C-12s.

FCLP mode is included in T&G

Key:

VOC = volatile organic compounds	LTO w/ hot ref. = landing and takeoff cycle with hot refueling idle
NOx = oxides of nitrogen	LTO w/o hot ref. = landing and takeoff cycle without hot refueling idle
CO = carbon monoxide	T&G = touch and go
SO2 = sulfur dioxide	GCA = ground control approach
PM10 = particulate matter	Interfacility = low altitude operations between NAS Oceana and NALF Fentress
	TIM = time in mode

Table F-3
ARS 2
AIRCRAFT EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1993	F-14A	Full LTO w/ hot ref.	3,116	27.74	43.22	9.69	15.10	55.80	86.94	0.96	1.50	9.54	14.87
		Full LTO w/o hot ref.	9,349	12.32	57.61	8.11	37.91	28.57	133.54	0.70	3.27	5.15	24.06
		Touch&Go	15,236	0.65	4.91	6.00	45.70	1.46	11.10	0.26	1.98	3.37	25.66
		GCA Box	2,178	2.06	2.24	14.93	16.26	4.77	5.19	0.75	0.82	11.10	12.08
		Interfacility	2,164	0.34	0.37	2.46	2.67	0.79	0.85	0.12	0.13	1.83	1.98
	F-14B	Full LTO w/ hot ref.	2,138	4.25	4.54	18.79	20.09	18.87	20.17	0.95	1.02	16.67	17.81
		Full LTO w/o hot ref.	6,414	1.97	6.31	17.06	54.71	8.50	27.25	0.61	1.97	8.93	28.65
		Touch&Go	10,452	0.32	1.69	12.83	67.03	0.69	3.60	0.37	1.92	3.64	19.04
		GCA Box	1,494	1.18	0.88	10.88	8.13	2.04	1.52	0.67	0.50	7.59	5.67
		Interfacility	1,485	0.19	0.14	1.79	1.33	0.34	0.25	0.11	0.08	1.25	0.93
	A-6	Full LTO w/ hot ref.	3,350	31.18	52.24	3.81	6.38	47.97	80.37	0.53	0.89	0.00	0.00
		Full LTO w/o hot ref.	10,051	12.06	60.60	2.99	15.05	19.07	95.84	0.29	1.45	0.00	0.00
		Touch&Go	16,380	0.39	3.19	1.89	15.51	2.35	19.28	0.14	1.17	0.00	0.00
		GCA Box	2,341	1.28	1.50	4.71	5.52	7.84	9.17	0.40	0.47	0.00	0.00
		Interfacility	2,326	0.21	0.25	0.78	0.90	1.29	1.50	0.07	0.08	0.00	0.00
	A-4	Full LTO w/o hot ref.	4,169	6.36	13.27	1.51	3.15	10.04	20.93	0.15	0.31	0.00	0.00
		Touch&Go	5,096	0.19	0.50	0.95	2.41	1.18	3.00	0.07	0.18	0.00	0.00
	F-16	Full LTO w/o hot ref.	936	0.59	0.28	9.54	4.46	21.00	9.83	0.36	0.17	0.09	0.04
		Touch&Go	1,144	0.08	0.05	4.54	2.59	0.53	0.30	0.11	0.06	0.09	0.05
	F-5	Full LTO w/o hot ref.	808	4.38	1.77	1.38	0.56	36.07	14.57	0.22	0.09	0.00	0.00
		Touch&Go	988	0.29	0.14	0.53	0.26	5.91	2.92	0.08	0.04	0.00	0.00
	TC-4	Full LTO w/o hot ref.	638	13.79	4.40	0.73	0.23	16.12	5.14	0.11	0.03	0.00	0.00
		Touch&Go	780	1.25	0.49	0.49	0.19	2.02	0.79	0.05	0.02	0.00	0.00
	UH-3H	Full LTO w/o hot ref.	662	8.84	2.92	0.71	0.23	13.94	4.61	0.13	0.04	0.00	0.00
	C-12	Full LTO w/o hot ref.	261	13.79	1.80	0.73	0.09	16.12	2.10	0.11	0.01	0.00	0.00
		Touch&Go	445	1.25	0.28	0.49	0.11	2.02	0.45	0.05	0.01	0.00	0.00
	S-3	Full LTO w/ hot ref.	870	4.89	2.13	1.01	0.44	30.33	13.20	0.21	0.09	1.33	0.58
		Full LTO w/o hot ref.	870	3.06	1.33	0.80	0.35	19.23	8.37	0.15	0.06	0.93	0.41
		Touch&Go	1,295	0.14	0.09	0.18	0.12	1.80	1.17	0.03	0.02	0.37	0.24
		GCA Box	1,323	0.30	0.20	0.39	0.26	3.86	2.55	0.06	0.04	0.79	0.52
	T-2C	Full LTO w/o hot ref.	1,418	3.02	2.14	1.48	1.05	31.66	22.45	0.19	0.14	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**111,217**		**272.13**		**328.88**		**609.85**		**18.59**		**152.58**

Table F-3
ARS 2
AIRCRAFT EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1996(b)	F-14A	Full LTO w/ hot ref.	2,281	27.74	31.63	9.69	11.05	55.80	63.62	0.96	1.10	9.54	10.88
		Full LTO w/o hot ref.	6,842	12.32	42.16	8.11	27.75	28.57	97.72	0.70	2.39	5.15	17.60
		Touch&Go	12,438	0.65	4.01	6.00	37.31	1.46	9.06	0.26	1.62	3.37	20.95
		GCA Box	872	2.06	0.90	14.93	6.51	4.77	2.08	0.75	0.33	11.10	4.84
		Interfacility	1,641	0.34	0.28	2.46	2.02	0.79	0.65	0.12	0.10	1.83	1.50
	F-14B/D	Full LTO w/ hot ref.	1,692	4.25	3.59	18.79	15.90	18.87	15.96	0.95	0.81	16.67	14.10
		Full LTO w/o hot ref.	5,076	1.97	4.99	17.06	43.30	8.50	21.56	0.61	1.56	8.93	22.67
		Touch&Go	9,228	0.32	1.49	12.83	59.18	0.69	3.18	0.37	1.70	3.64	16.81
		GCA Box	647	1.18	0.38	10.88	3.52	2.04	0.66	0.67	0.22	7.59	2.45
		Interfacility	1,218	0.19	0.12	1.79	1.09	0.34	0.20	0.11	0.07	1.25	0.76
	A-6	Full LTO w/ hot ref.	0	31.18	0.00	3.81	0.00	47.97	0.00	0.53	0.00	0.00	0.00
		Full LTO w/o hot ref.	0	12.06	0.00	2.99	0.00	19.07	0.00	0.29	0.00	0.00	0.00
		Touch&Go	0	0.39	0.00	1.89	0.00	2.35	0.00	0.14	0.00	0.00	0.00
		GCA Box	0	1.28	0.00	4.71	0.00	7.84	0.00	0.40	0.00	0.00	0.00
		Interfacility	0	0.21	0.00	0.78	0.00	1.29	0.00	0.07	0.00	0.00	0.00
	F/A-18	Full LTO w/ hot ref.	422	28.36	5.99	8.39	1.77	75.74	15.99	0.46	0.10	7.38	1.56
		Full LTO w/o hot ref.	1,267	15.05	9.53	8.12	5.14	44.32	28.07	·0.37	0.23	4.55	2.88
		Touch&Go	2,558	0.20	0.26	6.04	7.72	0.79	1.01	0.20	0.25	2.62	3.36
	S-3(c)	Full LTO w/ hot ref.	484	4.89	1.18	1.01	0.24	30.33	7.33	0.21	0.05	1.33	0.32
		Full LTO w/o hot ref.	484	3.06	0.74	0.80	0.19	19.23	4.65	0.15	0.04	0.93	0.23
		Touch&Go	938	0.14	0.07	0.18	0.09	1.80	0.85	0.03	0.01	0.37	0.17
		GCA Box	371	0.30	0.06	0.39	0.07	3.86	0.72	0.06	0.01	0.79	0.15
	UH-3H	Full LTO w/o hot ref.	0	8.84	0.00	0.71	0.00	13.94	0.00	0.13	0.00	0.00	0.00
	C-12	Full LTO w/o hot ref.	1,669	13.79	11.51	0.73	0.61	16.12	13.45	0.11	0.09	0.00	0.00
		Touch&Go	2,772	1.25	1.73	0.49	0.68	2.02	2.80	0.05	0.06	0.00	0.00
		GCA Box	1,101	1.55	0.85	0.32	0.17	2.38	1.31	0.04	0.02	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**55,038**		**122.12**		**224.40**		**291.76**		**10.76**		**121.23**

Table F-3
ARS 2
AIRCRAFT EMISSIONS AT NAS OCEANA FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1997(b)	F-14A	Full LTO w/ hot ref.	2,967	27.74	41.15	9.69	14.38	55.80	82.78	0.96	1.43	9.54	14.16
		Full LTO w/o hot ref.	8,901	12.32	54.85	8.11	36.10	28.57	127.14	0.70	3.11	5.15	22.90
		Touch&Go	16,183	0.65	5.22	6.00	48.54	1.46	11.79	0.26	2.10	3.37	27.26
		GCA Box	1,134	2.06	1.17	14.93	8.47	4.77	2.70	0.75	0.43	11.10	6.29
		Interfacility	2,135	0.34	0.36	2.46	2.63	0.79	0.84	0.12	0.13	1.83	1.95
	F-14B/D	Full LTO w/ hot ref.	2,231	4.25	4.74	18.79	20.97	18.87	21.05	0.95	1.06	16.67	18.59
		Full LTO w/o hot ref.	6,694	1.97	6.59	17.06	57.10	8.50	28.44	0.61	2.06	8.93	29.90
		Touch&Go	12,171	0.32	1.97	12.83	78.05	0.69	4.19	0.37	2.24	3.64	22.17
		GCA Box	853	1.18	0.50	10.88	4.64	2.04	0.87	0.67	0.29	7.59	3.24
		Interfacility	1,606	0.19	0.16	1.79	1.44	0.34	0.27	0.11	0.09	1.25	1.00
	F/A-18	Full LTO w/ hot ref.	422	28.36	5.99	8.39	1.77	75.74	15.99	0.46	0.10	7.38	1.56
		Full LTO w/o hot ref.	1,267	15.05	9.53	8.12	5.14	44.32	28.07	0.37	0.23	4.55	2.88
		Touch&Go	2,558	0.20	0.26	6.04	7.72	0.79	1.01	0.20	0.25	2.62	3.36
	S-3	Full LTO w/ hot ref.	484	4.89	1.18	1.01	0.24	30.33	7.33	0.21	0.05	1.33	0.32
		Full LTO w/o hot ref.	484	3.06	0.74	0.80	0.19	19.23	4.65	0.15	0.04	0.93	0.23
		Touch&Go	938	0.14	0.07	0.18	0.09	1.80	0.85	0.03	0.01	0.37	0.17
		GCA Box	371	0.30	0.06	0.39	0.07	3.86	0.72	0.06	0.01	0.79	0.15
	C-12	Full LTO w/o hot ref.	1,669	13.79	11.51	0.73	0.61	16.12	13.45	0.11	0.09	0.00	0.00
		Touch&Go	2,772	1.25	1.73	0.49	0.68	2.02	2.80	0.05	0.06	0.00	0.00
		GCA Box	1,101	1.55	0.85	0.32	0.17	2.38	1.31	0.04	0.02	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**67,980**		**149.27**		**289.09**		**357.14**		**13.82**		**156.13**

Table F-3
ARS 2
AIRCRAFT EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1998	F-14A	Full LTO w/ hot ref.	2,820	27.74	39.11	9.69	13.66	55.80	78.68	0.96	1.36	9.54	13.45
		Full LTO w/o hot ref.	8,460	12.32	52.13	8.11	34.31	28.57	120.84	0.70	2.96	5.15	21.77
		Touch&Go	15,380	0.65	4.96	6.00	46.13	1.46	11.21	0.26	2.00	3.37	25.90
		GCA Box	1,078	2.06	1.11	14.93	8.05	4.77	2.57	0.75	0.40	11.10	5.98
		Interfacility	2,029	0.34	0.34	2.46	2.50	0.79	0.80	0.12	0.13	1.83	1.86
	F-14B/D	Full LTO w/ hot ref.	2,231	4.25	4.74	18.79	20.97	18.87	21.05	0.95	1.06	16.67	18.59
		Full LTO w/o hot ref.	6,694	1.97	6.59	17.06	57.10	8.50	28.44	0.61	2.06	8.93	29.90
		Touch&Go	12,171	0.32	1.97	12.83	78.05	0.69	4.19	0.37	2.24	3.64	22.17
		GCA Box	853	1.18	0.50	10.88	4.64	2.04	0.87	0.67	0.29	7.59	3.24
		Interfacility	1,606	0.19	0.16	1.79	1.44	0.34	0.27	0.11	0.09	1.25	1.00
	F/A-18	Full LTO w/ hot ref.	4,644	28.36	65.85	8.39	19.47	75.74	175.87	0.46	1.07	7.38	17.14
		Full LTO w/o hot ref.	13,932	15.05	104.81	8.12	56.57	44.32	308.73	0.37	2.57	4.55	31.68
		Touch&Go	28,133	0.20	2.84	6.04	84.97	0.79	11.14	0.20	2.77	2.62	36.92
		GCA Box	814	0.48	0.19	9.04	3.68	1.92	0.78	0.43	0.18	6.59	2.68
		Interfacility	2,474	0.09	0.11	2.80	3.47	0.28	0.34	0.10	0.12	1.45	1.80
	S-3	Full LTO w/ hot ref.	484	4.89	1.18	1.01	0.24	30.33	7.33	0.21	0.05	1.33	0.32
		Full LTO w/o hot ref.	484	3.06	0.74	0.80	0.19	19.23	4.65	0.15	0.04	0.93	0.23
		Touch&Go	938	0.14	0.07	0.18	0.09	1.80	0.85	0.03	0.01	0.37	0.17
		GCA Box	371	0.30	0.06	0.39	0.07	3.86	0.72	0.06	0.01	0.79	0.15
	C-12	Full LTO w/o hot ref.	1,669	13.79	11.51	0.73	0.61	16.12	13.45	0.11	0.09	0.00	0.00
		Touch&Go	2,772	1.25	1.73	0.49	0.68	2.02	2.80	0.05	0.06	0.00	0.00
		GCA Box	1,101	1.55	0.85	0.32	0.17	2.38	1.31	0.04	0.02	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**112,178**		**302.20**		**437.16**		**797.77**		**19.58**		**234.95**

Table F-3
ARS 2
AIRCRAFT EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1999	F-14A	Full LTO w/ hot ref.	2,820	27.74	39.11	9.69	13.66	55.80	78.68	0.96	1.36	9.54	13.45
		Full LTO w/o hot ref.	8,460	12.32	52.13	8.11	34.31	28.57	120.84	0.70	2.96	5.15	21.77
		Touch&Go	15,380	0.65	4.96	6.00	46.13	1.46	11.21	0.26	2.00	3.37	25.90
		GCA Box	1,078	2.06	1.11	14.93	8.05	4.77	2.57	0.75	0.40	11.10	5.98
		Interfacility	2,029	0.34	0.34	2.46	2.50	0.79	0.80	0.12	0.13	1.83	1.86
	F-14B/D	Full LTO w/ hot ref.	2,231	4.25	4.74	18.79	20.97	18.87	21.05	0.95	1.06	16.67	18.59
		Full LTO w/o hot ref.	6,694	1.97	6.59	17.06	57.10	8.50	28.44	0.61	2.06	8.93	29.90
		Touch&Go	12,171	0.32	1.97	12.83	78.05	0.69	4.19	0.37	2.24	3.64	22.17
		GCA Box	853	1.18	0.50	10.88	4.64	2.04	0.87	0.67	0.29	7.59	3.24
		Interfacility	1,606	0.19	0.16	1.79	1.44	0.34	0.27	0.11	0.09	1.25	1.00
	F/A-18	Full LTO w/ hot ref.	5,911	28.36	83.80	8.39	24.78	75.74	223.84	0.46	1.36	7.38	21.81
		Full LTO w/o hot ref.	17,732	15.05	133.39	8.12	72.00	44.32	392.93	0.37	3.27	4.55	40.32
		Touch&Go	35,806	0.20	3.61	6.04	108.15	0.79	14.18	0.20	3.52	2.62	46.99
		GCA Box	1,036	0.48	0.25	9.04	4.68	1.92	1.00	0.43	0.22	6.59	3.41
		Interfacility	3,149	0.09	0.14	2.80	4.41	0.28	0.43	0.10	0.15	1.45	2.29
	S-3	Full LTO w/ hot ref.	484	4.89	1.18	1.01	0.24	30.33	7.33	0.21	0.05	1.33	0.32
		Full LTO w/o hot ref.	484	3.06	0.74	0.80	0.19	19.23	4.65	0.15	0.04	0.93	0.23
		Touch&Go	938	0.14	0.07	0.18	0.09	1.80	0.85	0.03	0.01	0.37	0.17
		GCA Box	371	0.30	0.06	0.39	0.07	3.86	0.72	0.06	0.01	0.79	0.15
	C-12	Full LTO w/o hot ref.	1,669	13.79	11.51	0.73	0.61	16.12	13.45	0.11	0.09	0.00	0.00
		Touch&Go	2,772	1.25	1.73	0.49	0.68	2.02	2.80	0.05	0.06	0.00	0.00
		GCA Box	1,101	1.55	0.85	0.32	0.17	2.38	1.31	0.04	0.02	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**125,814**		**349.60**		**483.02**		**933.28**		**21.41**		**259.56**

Notes:

(a) F-14 operations were divided between F-14As and F-14Bs based on the number of aircraft present in 1993. Number of GCAs and interfacility flights were proportioned from 1997 data based on the number of aircraft.

(b) 1996-1998 operations were proportioned from 1999 data based upon the numbers of aircraft based at NAS Oceana during those years. A-6s assumed to be deployed in 1996 and decommissioned by mid-1997.

(c) Transient aircraft operations, derived from NASMOD analysis (ATAC 1997).

(d) 1999 operations were derived from NASMOD analysis(ATAC 1997).

(e) Aircraft VOC reported as HC in the form CHy/x

Shaded areas indicate nonattainment pollutants of concern.

The LTOs listed for GCA box and interfacility flights include only the level portion of those operations. Takeoff and landings for these operations are accounted for under full LTO or T&G.

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

LTO w/ hot ref. = landing and takeoff cycle with hot refueling idle
LTO w/o hot ref. = landing and takeoff cycle without hot refueling idle
interfacility = low altitude operations between NAS Oceana and NALF Fentress
GCA = ground control approach
lb = pounds
TPY = tons per year

Table F-4
ARS 2
AIRCRAFT EMISSIONS AT NALF FENTRESS
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation Type	Number of Operations/Year	VOC (d)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1993(a)	F-14A	Touch&Go	10,511	0.65	3.39	6.00	31.53	1.46	7.66	0.26	1.37	3.37	17.70
	F-14B	Touch&Go	7,226	0.32	1.17	12.83	46.34	0.69	2.49	0.37	1.33	3.64	13.17
	E-2/C-2	Full LTO	1,074	10.05	5.40	6.29	3.38	15.85	8.51	0.52	0.28	0.00	0.00
		Touch&Go	25,058	0.11	1.37	4.38	54.89	0.42	5.29	0.24	3.04	0.00	0.00
	A-6	Touch&Go	11,086	0.39	2.16	1.89	10.50	2.35	13.05	0.14	0.79	0.00	0.00
	Total		**54,955**		**13.48**		**146.63**		**37.00**		**6.81**		**30.87**
1996(c)	F-14A	Touch&Go	13,742	0.65	4.43	6.00	41.22	1.46	10.01	0.26	1.78	3.37	23.15
	F-14B/D	Touch&Go	10,196	0.32	1.65	12.83	65.39	0.69	3.51	0.37	1.88	3.64	18.58
	E-2/C-2	Full LTO	896	10.05	4.50	6.29	2.82	15.85	7.10	0.52	0.23	0.00	0.00
		Touch&Go	20,478	0.11	1.12	4.38	44.85	0.42	4.32	0.24	2.49	0.00	0.00
	A-6	Touch&Go	0	0.39	0.00	1.89	0.00	2.35	0.00	0.14	0.00	0.00	0.00
	Total		**45,312**		**11.70**		**154.28**		**24.95**		**6.38**		**41.72**
1997(c)	F-14A	Touch&Go	17,880	0.65	5.77	6.00	53.63	1.46	13.03	0.26	2.32	3.37	30.11
	F-14B/D	Touch&Go	13,447	0.32	2.17	12.83	86.24	0.69	4.63	0.37	2.47	3.64	24.50
	E-2/C-2	Full LTO	896	10.05	4.50	6.29	2.82	15.85	7.10	0.52	0.23	0.00	0.00
		Touch&Go	20,478	0.11	1.12	4.38	44.85	0.42	4.32	0.24	2.49	0.00	0.00
	Total		**52,701**		**13.56**		**187.54**		**29.08**		**7.51**		**54.61**

Table F-4
ARS 2
AIRCRAFT EMISSIONS AT NALF FENTRESS
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation Type	Number of Operations/Year	VOC (d)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1998	F-14A	Touch&Go	16,993	0.65	5.48	6.00	50.97	1.46	12.38	0.26	2.21	3.37	28.62
	F-14B/D	Touch&Go	13,447	0.32	2.17	12.83	86.24	0.69	4.63	0.37	2.47	3.64	24.50
	F/A-18	Touch&Go	18,233	0.20	1.84	6.04	55.07	0.79	7.22	0.20	1.79	2.62	23.93
	E-2/C-2	Full LTO	896	10.05	4.50	6.29	2.82	15.85	7.10	0.52	0.23	0.00	0.00
		Touch&Go	20,478	0.11	1.12	4.38	44.85	0.42	4.32	0.24	2.49	0.00	0.00
	Total		**70,047**		**15.11**		**239.95**		**35.66**		**9.19**		**77.05**
1999	F-14A	Touch&Go	16,993	0.65	5.48	6.00	50.97	1.46	12.38	0.26	2.21	3.37	28.62
	F-14B/D	Touch&Go	13,447	0.32	2.17	12.83	86.24	0.69	4.63	0.37	2.47	3.64	24.50
	F/A-18	Touch&Go	23,206	0.20	2.34	6.04	70.09	0.79	9.19	0.20	2.28	2.62	30.46
	E-2/C-2	Full LTO	896	10.05	4.50	6.29	2.82	15.85	7.10	0.52	0.23	0.00	0.00
		Touch&Go	20,478	0.11	1.12	4.38	44.85	0.42	4.32	0.24	2.49	0.00	0.00
	Total		**75,020**		**15.61**		**254.97**		**37.63**		**9.68**		**83.57**

Notes:
(a) F-14 operations were divided between F-14As and F-14Bs based on the number of aircraft present in 1993.
(b) 1996-1998 operations for F-14s were proporationed from 1999 data based upon the numbers of F-14 squadrons based at NAS Oceana, A-6s assumed to be deployed in 1996 and decommissioned by mid-1997, 1996-1998 E-2/C-2 operations assumed to the same as 1999.
(c) 1997 operations derived from NASMOD analysis (ATAC 1997).
(d) Aircraft VOC reported as HC in the form CHy/x
Shaded areas indicate nonattainment pollutants of concern.

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter
LTO = landing and takeoff cycle
interfacility = low altitude operations between NAS Oceana and NALF Fentress
GCA = ground control approach
lb = pounds
TPY = tons per year

Table F-5
ARS 2
Emissions from Ground Support Equipment at NAS Oceana

		Fuel Consumption (gal/yr)	VOC		NOx		CO		SO2		PM-10	
			lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)
1993	*Tow Tractors: (a)*											
	A/S32A-30A	8960	64.60	0.29	436.67	1.96	268.50	1.20	31.10	0.14	46.50	0.21
	TA-35	254	64.60	0.01	436.67	0.06	268.50	0.03	31.10	0.00	46.50	0.01
	MD-3/A/S32A-31A	4843	64.60	0.16	436.67	1.06	268.50	0.65	31.10	0.08	46.50	0.11
	TA-75	17115	122.00	1.04	146.00	1.25	3250.00	27.81	5.20	0.04	8.27	0.07
	A/S32A-42	7200	64.60	0.23	436.67	1.57	268.50	0.97	31.10	0.11	46.50	0.17
	JG-75	104	122.00	0.01	146.00	0.01	3250.00	0.17	5.20	0.00	8.27	0.00
	A/S32A-30	897	122.00	0.05	146.00	0.07	3250.00	1.46	5.20	0.00	8.27	0.00
	Flight Line Electric Power Units											
	NC8A (b)	14926	49.23	0.37	604.17	4.51	130.15	0.97	39.73	0.30	42.47	0.32
	NC10C (b)	3180	49.23	0.08	604.17	0.96	130.15	0.21	39.73	0.06	42.47	0.07
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	41932	49.23	1.03	604.17	12.67	130.15	2.73	39.73	0.83	42.47	0.89
	A/S47A-1 (b)	712	49.23	0.02	604.17	0.22	130.15	0.05	39.73	0.01	42.47	0.02
	GTC-85 (c)	10101	0.13	0.00	3.88	0.02	14.83	0.07	0.54	0.00	0.00	0.00
	Miscellaneous: (c)											
	A/M32C-17	2105	49.23	0.05	604.17	0.64	130.15	0.14	39.73	0.04	42.47	0.04
	A/M27T-5	990	49.23	0.02	604.17	0.30	130.15	0.06	39.73	0.02	42.47	0.02
	A/M42M-2	720	49.23	0.02	604.17	0.22	130.15	0.05	39.73	0.01	42.47	0.02
	HLU-196	8400	415.11	1.74	223.31	0.94	8589.90	36.08	11.51	0.05	13.70	0.06
		Total		**5.13**		**26.43**		**72.65**		**1.71**		**2.00**
1996	*Tow Tractors: (a)*											
	A/S32A-30A	19000	64.60	0.61	436.67	4.15	268.50	2.55	31.10	0.30	46.50	0.44
	TA-35	450	64.60	0.01	436.67	0.10	268.50	0.06	31.10	0.01	46.50	0.01
	MD-3/A/S32A-31A	4843	64.60	0.16	436.67	1.06	268.50	0.65	31.10	0.08	46.50	0.11
	TA-75 (MOGAS)	1600	122.00	0.10	146.00	0.12	3250.00	2.60	5.20	0.00	8.27	0.01
	A/S32A-42	17000	64.60	0.55	436.67	3.71	268.50	2.28	31.10	0.26	46.50	0.40
	JG-75	104	122.00	0.01	146.00	0.01	3250.00	0.17	5.20	0.00	8.27	0.00
	A/S32A-30	2900	122.00	0.18	146.00	0.21	3250.00	4.71	5.20	0.01	8.27	0.01
	Flight Line Electric Power Units											
	NC8A (b)	12800	49.23	0.32	604.17	3.87	130.15	0.83	39.73	0.25	42.47	0.27
	NC10C (b)	3500	49.23	0.09	604.17	1.06	130.15	0.23	39.73	0.07	42.47	0.07
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	37000	49.23	0.91	604.17	11.18	130.15	2.41	39.73	0.74	42.47	0.79
	GTC-85 (c)	3000	0.13	0.00	3.88	0.01	14.83	0.02	0.54	0.00	0.00	0.00
	Miscellaneous: (b)											
	A/M32C-17	2400	49.23	0.06	604.17	0.73	130.15	0.16	39.73	0.05	42.47	0.05
	A/M27T-5 (air cond.)	2350	49.23	0.06	604.17	0.71	130.15	0.15	39.73	0.05	42.47	0.05
	A/M42M-2 (power)	1500	49.23	0.04	604.17	0.45	130.15	0.10	39.73	0.03	42.47	0.03
	HLU-196	25	415.11	0.01	223.31	0.00	8589.90	0.11	11.51	0.00	13.70	0.00
		Total		**3.09**		**27.35**		**17.03**		**1.84**		**2.24**

Table F-5
ARS 2
Emissions from Ground Support Equipment at NAS Oceana

		Fuel Consumption (gal/yr)	VOC lb/1000 gal	VOC Total (TPY)	NOx lb/1000 gal	NOx Total (TPY)	CO lb/1000 gal	CO Total (TPY)	SO2 lb/1000 gal	SO2 Total (TPY)	PM-10 lb/1000 gal	PM-10 Total (TPY)
1997	*Tow Tractors: (a)*											
	A/S32A-30A	22000	64.60	0.71	436.67	4.80	268.50	2.95	31.10	0.34	46.50	0.51
	A/S32A-30	3500	122.00	0.21	146.00	0.26	3250.00	5.69	5.20	0.01	8.27	0.01
	TA-35	600	64.60	0.02	436.67	0.13	268.50	0.08	31.10	0.01	46.50	0.01
	A/S32A-42	23000	64.60	0.74	436.67	5.02	268.50	3.09	31.10	0.36	46.50	0.53
	TA-75	1200	122.00	1.04	146.00	1.25	3250.00	1.95	5.20	0.00	8.27	0.00
	Flight Line Electric Power Units											
	NC8A (b)	16000	49.23	0.39	604.17	4.83	130.15	1.04	39.73	0.32	42.47	0.34
	NC10C (b)	6000	49.23	0.15	604.17	1.81	130.15	0.39	39.73	0.12	42.47	0.13
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	45000	49.23	1.11	604.17	13.59	130.15	2.93	39.73	0.89	42.47	0.96
	GTC-85 (c)	3500	0.13	0.00	3.88	0.01	14.83	0.03	0.54	0.00	0.00	0.00
	Miscellaneous: (b)											
	A/M32C-17	3000	49.23	0.07	604.17	0.91	130.15	0.20	39.73	0.06	42.47	0.06
	A/M27T-5	3000	49.23	0.07	604.17	0.91	130.15	0.20	39.73	0.06	42.47	0.06
	A/M42M-2	1600	49.23	0.04	604.17	0.48	130.15	0.10	39.73	0.03	42.47	0.03
	HLU-196	20	415.11	0.00	223.31	0.00	8589.90	0.09	11.51	0.00	13.70	0.00
		Total		**4.57**		**34.01**		**18.73**		**2.20**		**2.66**
1998	*Tow Tractors: (a)*											
	A/S32A-30A (MOGAS)	22000	64.60	0.71	436.67	4.80	268.50	2.95	31.10	0.34	46.50	0.51
	A/S32A-30	3500	122.00	0.21	146.00	0.26	3250.00	5.69	5.20	0.01	8.27	0.01
	TA-35	600	64.60	0.02	436.67	0.13	268.50	0.08	31.10	0.01	46.50	0.01
	A/S32A-42	23000	64.60	0.74	436.67	5.02	268.50	3.09	31.10	0.36	46.50	0.53
	Flight Line Electric Power Units											
	NC8A (b)	16000	49.23	0.39	604.17	4.83	130.15	1.04	39.73	0.32	42.47	0.34
	NC10C (b)	8000	49.23	0.20	604.17	2.42	130.15	0.52	39.73	0.16	42.47	0.17
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	47000	49.23	1.16	604.17	14.20	130.15	3.06	39.73	0.93	42.47	1.00
	GTC-85 (c)	3500	0.13	0.00	3.88	0.01	14.83	0.03	0.54	0.00	0.00	0.00
	Miscellaneous: (b)											
	A/M32C-17	4000	49.23	0.10	604.17	1.21	130.15	0.26	39.73	0.08	42.47	0.08
	A/M27T-5	4000	49.23	0.10	604.17	1.21	130.15	0.26	39.73	0.08	42.47	0.08
	A/M42M-2	1600	49.23	0.04	604.17	0.48	130.15	0.10	39.73	0.03	42.47	0.03
	HLU-196	20	415.11	0.00	223.31	0.00	8589.90	0.09	11.51	0.00	13.70	0.00
		Total		**3.67**		**34.57**		**17.17**		**2.32**		**2.79**

Table F-5
ARS 2
Emissions from Ground Support Equipment at NAS Oceana

		Fuel Consumption (gal/yr)	VOC		NOx		CO		SO2		PM-10	
			lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)
1999	*Tow Tractors: (a)*											
	A/S32A-30A (JP-5)	22400	64.60	0.72	436.67	4.89	268.50	3.01	5.20	0.06	8.27	0.09
	A/S32A-30	3500	122.00	0.21	146.00	0.26	3250.00	5.69	5.20	0.01	8.27	0.01
	TA-35	600	64.60	0.02	436.67	0.13	268.50	0.08	5.20	0.00	8.27	0.00
	A/S32A-42	23000	64.60	0.74	436.67	5.02	268.50	3.09	5.20	0.06	8.27	0.10
	Flight Line Electric Power Units											
	NC8A (b)	16000	49.23	0.39	604.17	4.83	130.15	1.04	39.73	0.32	42.47	0.34
	NC10C (b)	8000	49.23	0.20	604.17	2.42	130.15	0.52	39.73	0.16	42.47	0.17
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	47000	49.23	1.16	604.17	14.20	130.15	3.06	39.73	0.93	42.47	1.00
	GTC-85 (c)	3500	0.13	0.00	3.88	0.01	14.83	0.03	0.54	0.00	0.00	0.00
	Miscellaneous: (b)											
	A/M32C-17	4000	49.23	0.10	604.17	1.21	130.15	0.26	39.73	0.08	42.47	0.08
	A/M27T-5	4000	49.23	0.10	604.17	1.21	130.15	0.26	39.73	0.08	42.47	0.08
	A/M42M-2	1600	49.23	0.04	604.17	0.48	130.15	0.10	39.73	0.03	42.47	0.03
	HLU-196	20	415.11	0.00	223.31	0.00	8589.90	0.09	11.51	0.00	13.70	0.00
		Total		**3.69**		**34.66**		**17.22**		**1.73**		**1.92**

(a) Emission factors from AP-42 Volume II for gasoline-powered wheeled tractor for TA-75, JG-75, & A/S32A-30 and diesel-powered wheeled tractors for all others.
(b) Emission factors from AP-42 Volume I for Uncontrolled gasoline and diesel industrial engines SCC 20200102, 20300101, and 2300301..
Converted from lb/MMBtu assuming heating value for JP-5 of 137,000 Btu/gallon.
(c) Emission factors from USEPA 1992 for aircraft auxilliary power units used because specific emission factors for individual equipment types not available.

Table F-6
ARS 2
EMISSION RATES FOR SINGLE ENGINE MAINTENANCE RUN-UPS AT NAS OCEANA
(IN-FRAME ENGINE TESTING)

Engine (Aircraft)	Power Setting (a)	Time in Power Setting (a) (minutes)	Fuel Flow (lb/min)	Emission Factor ([lb /1000 lb fuel]/eng)					Emission Rates (lb/single engine run-up)				
				VOC (b)	NOx	CO	SO2	PM10	VOC	NOx	CO	SO2	PM10
TF30-P-412A (F-14A)	**Low Power**												
	Idle	7.00	15.3	31.42	3.22	55.51	0.40	8.96	3.37	0.35	5.96	0.04	0.96
	75%	12.00	71.7	1.48	10.74	3.43	0.40	5.70	1.27	9.24	2.95	0.34	4.90
	Total								**4.65**	**9.59**	**8.91**	**0.39**	**5.87**
	High Power												
	Idle	10.00	15.3	31.42	3.22	55.51	0.40	8.96	4.81	0.49	8.49	0.06	1.37
	75%	25.00	71.7	1.48	10.74	3.43	0.40	5.70	2.65	19.25	6.15	0.72	10.22
	100% (Mil)	10.00	117.5	0.77	19.60	1.38	0.40	2.98	0.90	23.03	1.62	0.47	3.50
	A/B (Z5)	4.00	796.7	0.20	4.79	10.77	0.40	0.00	0.64	15.26	34.32	1.27	0.00
	Total								**9.00**	**58.04**	**50.58**	**2.52**	**15.09**
F110-GE-400 (F-14B/D)	**Low Power**												
	Idle	5.00	19.5	3.65	2.77	16.60	0.40	12.38	0.36	0.27	1.62	0.04	1.21
	75%	12.50	133.0	0.26	19.61	0.76	0.40	4.30	0.43	32.60	1.26	0.67	7.15
	Total								**0.79**	**32.87**	**2.88**	**0.70**	**8.36**
	High Power												
	Idle	10.00	19.5	3.65	2.77	16.60	0.40	12.38	0.71	0.54	3.24	0.08	2.41
	75%	20.00	133.0	0.26	19.61	0.76	0.40	4.30	0.69	52.16	2.02	1.06	11.44
	IRP	15.00	195.3	0.40	28.63	0.84	0.40	2.81	1.17	83.87	2.46	1.17	8.23
	A/B(Max)	4.00	945.0	0.13	9.22	23.12	0.40	0.00	0.49	34.85	87.39	1.51	0.00
	Total								**3.07**	**171.43**	**95.11**	**3.83**	**22.08**
J-52-P-8B (A-6)	**Low Power**												
	Idle	15.00	11.3	48.96	1.79	63.78	0.40	0.00	8.32	0.30	10.84	0.07	0.00
	78-82%	10.00	72.0	0.67	10.10	3.00	0.40	0.00	0.48	7.27	2.16	0.29	0.00
	Total								**8.80**	**7.58**	**13.00**	**0.36**	**0.00**
	High Power												
	Idle	15.00	11.3	48.96	1.79	63.78	0.40	0.00	8.30	0.30	10.81	0.07	0.00
	78-82%	5.00	72.0	0.67	10.10	3.00	0.40	0.00	0.24	3.64	1.08	0.14	0.00
	94-100%	8.00	122.8	0.93	13.05	0.71	0.40	0.00	0.91	12.82	0.70	0.39	0.00
	Total								**9.45**	**16.76**	**12.59**	**0.60**	**0.00**
F404-GE-400 (F/A-18)	**Low Power**												
	Idle	6.50	10.4	58.18	1.16	137.34	0.40	12.38	3.93	0.08	9.28	0.03	0.84
	76%	3.50	109.0	0.35	14.80	1.09	0.40	6.10	0.13	5.65	0.42	0.15	2.33
	Total								**4.07**	**5.72**	**9.70**	**0.18**	**3.16**
	High Power												
	Idle	13.00	10.4	58.18	1.16	137.34	0.40	12.38	7.87	0.16	18.57	0.05	1.67
	76%	8.50	109.0	0.35	14.80	1.09	0.40	6.10	0.32	13.71	1.01	0.37	5.65
	IRP	5.00	143.1	0.31	25.16	1.05	0.40	2.81	0.22	18.00	0.75	0.29	2.01
	A/B	2.00	473.3	0.13	9.22	23.12	0.40	0.00	0.12	8.73	21.89	0.38	0.00
	Total								**8.54**	**40.60**	**42.21**	**1.09**	**9.34**

Notes:
(a) Power setting and time in power setting for F-14 A, F-14B/D, F/A-18 aircraft,and A-6 provided by AESO and COMNAVAIRLANT.
(b) Aircraft VOC reported as HC in the form CHy/x

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter
A/B = afterburner operating
Idle = typically 57% throttle setting
75% = 75% throttle setting
IRP = intermediate rated power

Table F-7
ARS 2
EMISSIONS FROM SINGLE ENGINE IN-FRAME MAINTENANCE RUN-UPS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft (Engine) and Number of Aircraft	Run-up mode	Number of Single Engine Run-ups/yr	VOC (b)		NOx		CO		SO2		PM10	
				Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)
1993	F-14A (TF30-P-412A)	Low Power	8,776	4.65	20.38	9.59	42.06	8.91	39.09	0.39	1.70	5.87	25.74
	80	High Power	250	9.00	1.13	58.04	7.25	50.58	6.32	2.52	0.32	15.09	1.89
	F-14B/D (F110-GE-400)	Low Power	4,162	0.79	1.64	32.87	68.41	2.88	6.00	0.70	1.47	8.36	17.39
	55	High Power	218	3.07	0.33	171.43	18.69	95.11	10.37	3.83	0.42	22.08	2.41
	A-6 (J-52-P-8B)	Low Power	10,320	8.80	45.42	7.58	39.09	13.00	67.08	0.36	1.84	0.00	0.00
	86	High Power	292	9.45	1.38	16.76	2.45	12.59	1.84	0.60	0.09	0.00	0.00
				Total	**70.29**		**177.95**		**130.69**		**5.82**		**47.42**
1996	F-14A (TF30-P-412A)	Low Power	11,179	4.65	25.96	9.59	42.06	8.91	39.09	0.39	1.70	5.87	25.74
	93	High Power	319	9.00	1.44	58.04	7.25	50.58	6.32	2.52	0.32	15.09	1.89
	F-14B/D (F110-GE-400)	Low Power	4,222	0.79	1.66	32.87	68.41	2.88	6.00	0.70	1.47	8.36	17.39
	69	High Power	221	3.07	0.34	171.43	18.69	95.11	10.37	3.83	0.42	22.08	2.41
				Total	**29.40**		**136.41**		**61.78**		**3.90**		**47.42**
1997	F-14A (TF30-P-412A)	Low Power	14,545	4.65	33.78	9.59	69.72	8.91	64.78	0.39	2.82	5.87	42.66
	121	High Power	415	9.00	1.87	58.04	12.04	50.58	10.50	2.52	0.52	15.09	3.13
	F-14B/D (F110-GE-400)	Low Power	5,568	0.79	2.19	32.87	91.51	2.88	8.02	0.70	1.96	8.36	23.26
	91	High Power	292	3.07	0.45	171.43	25.03	95.11	13.89	3.83	0.56	22.08	3.22
				Total	**38.29**		**198.30**		**97.19**		**5.86**		**72.28**

Table F-7
ARS 2
EMISSIONS FROM SINGLE ENGINE IN-FRAME MAINTENANCE RUN-UPS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft (Engine) and Number of Aircraft	Run-up mode	Number of Single Engine Run-ups/yr	VOC (b)		NOx		CO		SO2		PM10	
				Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)
1998	F-14A (TF30-P-412A)	Low Power	13824	4.65	32.11	9.59	66.26	8.91	61.57	0.39	0.01	5.87	40.54
	115	High Power	394	9.00	1.77	58.04	11.43	50.58	9.97	2.52	0.00	15.09	2.97
	F-14B/D (F110-GE-400)	Low Power	5,568	0.79	2.19	32.87	91.51	2.88	8.02	0.70	1.96	8.36	23.26
	91	High Power	292	3.07	0.45	171.43	25.03	95.11	13.89	3.83	0.56	22.08	3.22
	F/A-18 (F404-GE-400)	Low Power	7,508	4.07	15.27	5.72	21.49	9.70	36.41	0.18	0.67	3.16	11.88
	132	High Power	422	8.54	1.80	40.60	8.57	42.21	8.91	1.09	0.23	9.34	1.97
				Total	**53.59**		**224.29**		**138.77**		**3.43**		**83.85**
1999	F-14A (TF30-P-412A)	Low Power	13824	4.65	32.11	9.59	66.26	8.91	61.57	0.39	2.68	5.87	40.54
	115	High Power	394	9.00	1.77	58.04	11.43	50.58	9.97	2.52	0.50	15.09	2.97
	F-14B/D (F110-GE-400)	Low Power	5568	0.79	2.19	32.87	91.51	2.88	8.02	0.70	1.96	8.36	23.26
	91	High Power	292	3.07	0.45	171.43	25.03	95.11	13.89	3.83	0.56	22.08	3.22
	F/A-18 (F404-GE-400)	Low Power	9556	4.07	19.43	5.72	27.35	9.70	46.35	0.18	0.86	3.16	15.12
	168	High Power	537	8.54	2.29	40.60	10.90	42.21	11.33	1.09	0.29	9.34	2.51
				Total	**58.24**		**232.49**		**151.13**		**6.84**		**87.63**

Notes:
(a) In-frame maintenance run-ups for F-14A, F-14B/D, and F/A-18 aircraft in 1993 and 1999 from Wyle (1997) 1996-1998 maintenance run-ups were scaled from 1993 based on number of aircraft stationed at NAS Oceana.
(b) Aircraft VOC reported as HC in the form CHy/x

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-8
STATIONARY SOURCE EMISSIONS AT NAS OCEANA - ARS 2
FOR 1993 AND 1996-1999

	1993					1996					1997				
	VOC	NOx	CO	SO2	PM10	VOC	NOx	CO	SO2	PM10	VOC	NOx	CO	SO2	PM10
Stationary Sources:															
Boilers:	1.13	32.32	8.31	22.09	3.84	0.78	29.13	7.52	23.76	3.63	0.78	29.13	7.52	23.76	3.63
Generators	0.71	8.67	1.87	0.57	0.61	0.71	8.67	1.87	0.57	0.61	2.11	27.87	7.27	3.77	2.21
Engine Test Cells	6.24	37.65	49.39	1.80	4.32	3.95	28.47	39.08	1.31	3.95	5.05	37.02	50.85	1.71	4.62
JP-5 Fuel Handling	0.66	0.00	0.00	0.00	0.00	0.46	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.00	0.00
Service Station	19.35	0.00	0.00	0.00	0.00	4.46	0.00	0.00	0.00	0.00	4.67	0.00	0.00	0.00	0.00
Painting	19.30	0.00	0.00	0.00	0.00	13.29	0.00	0.00	0.00	0.00	24.05	0.00	0.00	0.00	0.00
Construction:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	47.39	78.64	59.57	24.46	8.77	23.65	66.27	48.47	25.64	8.19	37.20	94.02	65.64	29.24	10.46

Table F-8
ARS 2
STATIONARY SOURCE EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	1998					1999				
	VOC	NOx	CO	SO2	PM10	VOC	NOx	CO	SO2	PM10
Stationary Sources:										
Boilers:	0.62	27.13	6.68	22.82	3.38	0.62	27.13	6.68	22.82	3.38
Generators	2.11	27.87	7.27	3.77	2.21	2.11	27.87	7.27	3.77	2.21
Engine Test Cells	9.16	48.87	64.19	1.99	9.27	10.42	52.57	68.45	2.09	10.56
JP-5 Fuel Handling	0.81	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00
Service Station	6.40	0.00	0.00	0.00	0.00	6.72	0.00	0.00	0.00	0.00
Painting	34.12	0.00	0.00	0.00	0.00	34.16	0.00	0.00	0.00	0.00
Construction:	2.55	26.13	8.18	2.41	4.04	0.00	0.00	0.00	0.00	0.00
Total	55.77	130.01	86.32	30.99	18.90	54.93	107.57	82.40	28.68	16.15

Note: 1993 data and future year estimates based data current as of 4 June 1996

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-9
ARS 2
EMISSION RATES FOR AIRCRAFT ENGINE TESTS AT NAS OCEANA (SINGLE ENGINE IN TEST CELLS)

Engine (Aircraft)	Power Setting	Time in Power Setting (a) (minutes)	Fuel Flow (lb/min)	Calculated Fuel Usage (b) (gallons/test)	Emission Factor (c) ([lb /1000 lb fuel]/eng)					Single Engine Test Emissions (pounds)				
					VOC (d)	NOx	CO	SO2	PM10	VOC (d)	NOx	CO	SO2	PM10
TF30-P-412A (F-14A)	Idle	28.00	15.33	63.12	31.42	3.22	55.51	0.54	8.96	13.49	1.38	23.83	0.23	3.85
	75%	5.00	71.67	52.70	1.48	10.74	3.43	0.54	7.98	0.53	3.85	1.23	0.19	2.86
	81%	23.00	77.40	261.79	1.20	16.02	1.62	0.54	7.98	2.14	28.52	2.88	0.96	14.21
	A/B	22.00	796.67	2577.46	0.20	4.79	10.77	0.54	0.00	3.51	83.95	188.76	9.46	0.00
	Total	**78.00**		**2955.08**					**Per Test**	**19.66**	**117.70**	**216.70**	**10.85**	**20.91**
F110-GE-400 (F-14B/D)	Idle	54.00	19.50	154.85	3.97	2.74	15.75	0.54	12.38	4.18	2.89	16.58	0.57	13.04
	81%	44.00	143.70	929.82	0.26	19.61	0.76	0.54	2.81	1.64	123.99	4.81	3.41	17.77
	93%	25.00	198.22	728.75	0.31	28.53	1.08	0.54	2.81	1.54	141.38	5.35	2.68	13.92
	A/B	11.00	945.05	1528.76	3.75	12.64	44.21	0.54	0.00	38.98	131.40	459.59	5.61	0.00
	Total	**134.00**		**3342.18**					**Per Test**	**46.34**	**399.66**	**486.33**	**12.27**	**44.73**
J-52-P-8B (A-6)	Ground Idle	32.00	11.33	53.32	48.96	1.79	63.78	0.54	0.00	17.75	0.65	23.12	0.20	0.00
	IRP	18.00	122.83	325.14	1.08	13.05	0.71	0.54	0.00	2.39	28.85	1.57	1.19	0.00
	75% Thrust	24.00	72.00	254.12	0.87	10.10	3.00	0.54	0.00	1.50	17.45	5.18	0.93	0.00
	3k Lbs Thrust	25.00	38.33	140.92	1.99	6.34	10.54	0.54	0.00	1.91	6.08	10.10	0.52	0.00
	Total	**99.00**		**773.49**					**Per Test**	**23.55**	**53.03**	**39.98**	**2.84**	**0.00**
F404-GE-400 (F/A-18)	Idle	52.00	10.40	79.53	58.18	1.16	137.34	0.40	12.38	31.46	0.63	74.27	0.22	6.70
	80%	34.00	131.60	658.00	0.33	18.71	1.17	0.40	6.10	1.48	83.72	5.24	1.79	27.29
	A/B	3.00	473.28	208.80	0.13	9.22	23.12	0.40	0.00	0.18	13.09	32.83	0.57	0.00
	Total	**89.00**		**946.33**					**Per Test**	**33.12**	**97.43**	**112.34**	**2.57**	**33.99**

(a) Power setting and time in power setting taken from Wyle (1997) for F-14A, F-14B/D, and F/A-18 aircraft. A-6 data provided by COMNAVAIRLANT (Cdr. Vandenberg, Dec. 1996).
(b) Assumes a product density of 6.8 lb/gallon for JP-5.
(c) Data for calculating modal emission rates provided by the Navy Aircraft Environmental Support Office.
(d) Aircraft VOC reported as HC in the form CHy/x

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

A/B Max. = maximum afterburner
IRP = intermediate rated power (same as military)
75% = 75% throttle setting

Table F-10
ARS 2
EMISSIONS FROM AIRCRAFT ENGINE TEST CELLS AT NAS OCEANA
FOR 1993 AND 1996-1999

Year	Engine Model	Number of Aircraft	Number of Tests/Year (a)	VOC (b) per test (lb)	VOC (b) Total (TPY)	NOx per test (lb)	NOx Total (TPY)	CO per test (lb)	CO Total (TPY)	SO2 per test (lb)	SO2 Total (TPY)	PM10 per test (lb)	PM10 Total (TPY)
1993	TF30-P-412A	80	152	19.66	1.49	117.70	8.95	216.70	16.47	10.85	0.82	20.91	1.59
	F110-GE-400	55	122	46.34	2.83	399.66	24.38	486.33	29.67	12.27	0.75	44.73	2.73
	J-52-P-8B	86	163	23.55	1.92	53.03	4.32	39.98	3.26	2.84	0.23	0.00	0.00
				Total	**6.24**		**37.65**		**49.39**		**1.80**		**4.32**
1996	TF30-P-412A	93	123	19.66	1.21	117.70	7.23	216.70	13.32	10.85	0.67	20.91	1.29
	F110-GE-400	69	100	46.34	2.32	399.66	20.00	486.33	24.34	12.27	0.61	44.73	2.24
	F404-GE-400	12	25	33.12	0.42	97.43	1.23	112.34	1.42	2.57	0.03	33.99	0.43
				Total	**3.95**		**28.47**		**39.08**		**1.31**		**3.95**
1997	TF30-P-412A	121	160	19.66	1.57	117.70	9.41	216.70	17.33	10.85	0.87	20.91	1.67
	F110-GE-400	91	132	46.34	3.06	399.66	26.38	486.33	32.10	12.27	0.81	44.73	2.95
	F404-GE-400	12	25	33.12	0.42	97.43	1.23	112.34	1.42	2.57	0.03	0.00	0.00
				Total	**5.05**		**37.02**		**50.85**		**1.71**		**4.62**
1998	TF30-P-412A	115	152	19.66	1.49	117.70	8.95	216.70	16.47	10.85	0.82	20.91	1.59
	F110-GE-400	91	132	46.34	3.06	399.66	26.38	486.33	32.10	12.27	0.81	44.73	2.95
	F404-GE-400	132	278	33.12	4.61	97.43	13.55	112.34	15.62	2.57	0.36	33.99	4.73
				Total	**9.16**		**48.87**		**64.19**		**1.99**		**9.27**
1999	TF30-P-412A	115	152	19.66	1.49	117.70	8.95	216.70	16.47	10.85	0.82	20.91	1.59
	F110-GE-400	91	132	46.34	3.06	399.66	26.38	486.33	32.10	12.27	0.81	44.73	2.95
	F404-GE-400	168	354	33.12	5.86	97.43	17.25	112.34	19.88	2.57	0.46	33.99	6.02
				Total	**10.42**		**52.57**		**68.45**		**2.09**		**10.56**

Notes:
(a) Number of engine tests per F-14A, F-14B/D, and F/A-18 aircraft from Wyle 1997. Number of A-6 engine tests per aircraft assumed to be the same as F-14A engine tests per aircraft.
(b) Aircraft VOC reported as HC in the form CHy/x
Shaded areas indicate the nonattainment pollutants of concern.

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-11
PARKING LOT CONSTRUCTION (4 LOTS) AND AIRCRAFT APRON - ARS 2
Equipment Exhaust Emissions

Equipment List	Equipment quantity	Days Used	Emission Factors (lb/1000 gal)					EMISSIONS (lbs)				
			NOx	**VOC**	**CO**	**SO2**	**PM10**	**NOx**	**VOC**	**CO**	**SO2**	**PM10**
Crane	0	0	403	35.0	82.0	31.2	27	0.0	0.0	0.0	0.0	0.0
Backhoe Loader	2	60	395	39.0	133.0	31.2	27	2370.0	234.0	798.0	187.2	162.0
Pan Scraper	1	20	340	19.6	97.7	31.2	27	340.0	19.6	97.7	31.2	27.0
Hi-Lift	0	0	364	31.0	121.0	31.2	25	0.0	0.0	0.0	0.0	0.0
Front-end Loader, wheels	1	60	403	23.5	94.0	31.2	29	1209.0	70.5	282.0	93.6	87.0
Pile Driver	0	0	403	35.0	82.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Track loader	1	0	391	23.5	94.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Grader	2	60	375	43.0	74.3	31.2	22	2250.0	258.0	445.8	187.2	132.0
Bulldozer	2	60	375	43.0	74.3	31.2	25	2250.0	258.0	445.8	187.2	150.0
Compactor	3	60	364	31.0	121.0	31.2	24	3276.0	279.0	1089.0	280.8	216.0
Roller	3	60	364	31.0	121.0	31.2	24	3276.0	279.0	1089.0	280.8	216.0
Paver	1	60	403	23.5	125.0	31.2	29	1209.0	70.5	375.0	93.6	87.0
haul trk/cement mixer, mob(gm/	4	60	8.0	2.1	9.93	2.8	2.15	422.9	111.0	524.9	148.0	113.7
haul trk/cement mixer, idl(gm/hr	4	60	13.2	16.2	40.2	0	0	14.0	17.1	42.5	0.0	0.0
							Total, lb/yr	16616.9	1596.7	5189.7	1489.6	1190.7
							Total TPY	**8.31**	**0.80**	**2.59**	**0.74**	**0.60**

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-11
NEW BUILDING/ADDITION CONSTRUCTION - ARS 2
Equipment Exhaust Emissions

EQUIPMENT LIST	Equipment quantity	Days Used	Emission Factors (lb/1000 gal)					EMISSIONS (lbs)				
			NOx	**VOC**	**CO**	**SO2**	**PM10**	**NOx**	**VOC**	**CO**	**SO2**	**PM10**
Crane	3	120	403	35.0	82.0	31.2	27	7254.0	630.0	1476.0	561.6	486.0
Backhoe Loader	2	120	395	39.0	133.0	31.2	27	4740.0	468.0	1596.0	374.4	324.0
Pan Scraper	1	120	340	19.6	97.7	31.2	27	2040.0	117.6	586.2	187.2	162.0
Hi-Lift	4	120	364	31.0	121.0	31.2	25	8736.0	744.0	2904.0	748.8	600.0
Front-end Loader, wheels	1	120	403	23.5	94.0	31.2	29	2418.0	141.0	564.0	187.2	174.0
Pile Driver	0	0	403	35.0	82.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Track loader	0	0	391	23.5	94.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Grader	1	120	375	43.0	74.3	31.2	22	2250.0	258.0	445.8	187.2	132.0
Bulldozer	2	120	375	43.0	74.3	31.2	25	4500.0	516.0	891.6	374.4	300.0
Compactor	1	120	364	31.0	121.0	31.2	24	2184.0	186.0	726.0	187.2	144.0
Roller	0	0	364	31.0	121.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Paver	0	0	403	23.5	125.0	31.2	29	0.0	0.0	0.0	0.0	0.0
haul trk, mob(gm/mi)	7	120	8.0	2.1	9.93	2.8	2.15	1480.2	388.5	1837.3	518.1	397.8
haul trk, idl(gm/hr)	7	120	13.2	16.2	40.2	0	0	48.8	59.9	148.8	0.0	0.0
							Total Lb/yr	**35651.0**	**3509.1**	**11175.6**	**3326.1**	**2719.8**
							Total TPY	**17.83**	**1.75**	**5.59**	**1.66**	**1.36**

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-12

ANNUAL DEMOLITION PARTICULATE EMISSIONS - ARS 2

Floor Space (SQ FT)	STRUCTURE REMOVAL (LBS)	DEBRIS REMOVAL (LBS)	VEHICLE ACTIVITY (LBS)	EMISSIONS SUM	
				LBS/YR	TPY
199,381	10.0	184.3	2087.5	2281.8	1.14

Notes:

Demolition square ft assumed = 10 % of new construction sq ft

PM emission from structure takedown based on sq ft *EF

PM emission from debris removal based on sq ft *EF

PM emission from on-site vehicle activity based on sq ft *EF

Pushing (bulldozing) PM emission put under site prep spreadsheet

Reference EPA-450/2-92-004 (Fugitive Dust document)

(all EF's in EPA document converted to english units)

Table F-12

ANNUAL SITE PREPARATION PARTICULATE EMISSIONS FOR CONSTRUCTION AT NAS OCEANA - ARS 2

ACRES	ACTIVITY DAYS	BULLDOZIN (LBS)	PAN SCRAPING SOIL REMOV(LBS)	PAN SCRAPING ETHMOVING (LBS)	EMISSIONS SUM	
					LBS/YR	TPY
46	120	720	720	454	1894	0.95

Notes:

Acreage estimate based on building sq ft*2

Estimate activity days for preferred, develop ratio days:acres

Apply ratio to ARS acreages to get activity days

Bulldozing pm emissions based on 8hr/activity day * EF (EPA 1992)

Soil removal emiss based on VMT/acre *acres*EF (EPA 1992)

Earthmoving emiss based on soil removal miles *3 (BEE)*EF

EPA 1992 is Fugitive Dust BG document (EPA-450/2-92-004)

Table F-13
Total Construction Emissions (Exhaust and Dust) - ARS 2

Project/Source	**Emissions (tons/yr)**				
Engine Exhaust Emissions	**VOC**	**NOx**	**CO**	**SOx**	**PM10**
Parking Lot Construction	0.80	8.31	2.59	0.74	0.60
Building/Addition Const. (total)	1.75	17.83	5.59	1.66	1.36
Demolition/Construction Activity					
Mechanical dust Generation	0.00	0.00	0.00	0.00	2.09
Total	**2.55**	**26.13**	**8.18**	**2.41**	**4.04**

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-14
AIR EMISSIONS SUMMARY - NAS OCEANA AND NALF FENTRESS - ARS 2
FOR 1993 AND 1996-1999
(tons per year)

	1993					1996					1997				
Source Type	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**
NAS Oceana:															
Mobile Sources:															
Aircraft Operations	272.13	328.88	609.85	18.59	152.58	122.12	224.40	291.76	10.76	121.23	149.27	289.09	357.14	13.82	156.13
Total Aircraft	**272.13**	**328.88**	**609.85**	**18.59**	**152.58**	**122.12**	**224.40**	**291.76**	**10.76**	**121.23**	**149.27**	**289.09**	**357.14**	**13.82**	**156.13**
Other Mobile Sources:															
GSE	5.13	26.43	72.65	1.71	2.00	0.00	0.00	0.00	0.00	0.00	4.57	34.01	18.73	2.20	2.66
Maintenance Run-ups	70.29	177.95	130.69	5.82	47.42	29.40	136.41	61.78	3.90	47.42	38.29	198.30	97.19	5.86	72.28
Generators	0.56	6.89	1.48	0.45	0.48	0.56	6.89	1.48	0.45	0.48	0.56	6.89	1.48	0.45	0.48
Total Other Mobile	**75.97**	**211.27**	**204.82**	**7.98**	**49.90**	**29.96**	**143.30**	**63.26**	**4.35**	**47.90**	**43.42**	**239.20**	**117.40**	**8.51**	**75.42**
Stationary Sources:															
Boilers:	1.13	32.32	8.31	22.09	3.84	0.78	29.13	7.52	23.76	3.63	0.78	29.13	7.52	23.76	3.63
Generators	0.71	8.67	1.87	0.57	0.61	0.71	8.67	1.87	0.57	0.61	2.11	27.87	7.27	3.77	2.21
Engine Test Cells	6.24	37.65	49.39	1.80	4.32	3.95	28.47	39.08	1.31	3.95	5.05	37.02	50.85	1.71	4.62
JP-5 Fuel Handling	0.66	0.00	0.00	0.00	0.00	0.46	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.00	0.00
Service Station	19.35	0.00	0.00	0.00	0.00	4.46	0.00	0.00	0.00	0.00	4.67	0.00	0.00	0.00	0.00
Painting	19.30	0.00	0.00	0.00	0.00	13.29	0.00	0.00	0.00	0.00	24.05	0.00	0.00	0.00	0.00
Construction:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Stationary	**47.39**	**78.64**	**59.57**	**24.46**	**8.77**	**23.65**	**66.27**	**48.47**	**25.64**	**8.19**	**37.20**	**94.02**	**65.64**	**29.24**	**10.46**
Total NASO	**395.49**	**618.78**	**874.24**	**51.04**	**211.24**	**175.73**	**433.96**	**403.48**	**40.75**	**177.32**	**229.89**	**622.31**	**540.17**	**51.57**	**242.01**
NALF Fentress:															
Aircraft	13.48	146.63	37.00	6.81	30.87	11.70	154.28	24.95	6.38	41.72	13.56	187.54	29.08	7.51	54.61
Total Annual:	**408.97**	**765.41**	**911.24**	**57.85**	**242.11**	**187.43**	**588.24**	**428.43**	**47.13**	**219.04**	**243.45**	**809.85**	**569.25**	**59.08**	**296.63**

Table F-14
AIR EMISSIONS SUMMARY - NAS OCEANA AND NALF FENTRESS - ARS 2
FOR 1993 AND 1996-1999
(tons per year)

	1998					1999				
Source Type	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**
NAS Oceana:										
Mobile Sources:										
Aircraft Operations	302.20	437.16	797.77	19.58	234.95	349.60	483.02	933.28	21.41	259.56
Total Aircraft	**302.20**	**437.16**	**797.77**	**19.58**	**234.95**	**349.60**	**483.02**	**933.28**	**21.41**	**259.56**
Other Mobile Sources:										
GSE	0.10	1.21	0.26	0.08	0.08	0.00	0.00	0.00	0.00	0.00
Maintenance Run-ups	53.59	224.29	138.77	3.43	83.85	58.24	232.49	151.13	6.84	87.63
Generators	0.56	6.89	1.48	0.45	0.48	0.56	6.89	1.48	0.45	0.48
Total Other Mobile	**54.25**	**232.39**	**140.51**	**3.96**	**84.42**	**58.80**	**239.38**	**152.61**	**7.29**	**88.11**
Stationary Sources:										
Boilers:	0.62	27.13	6.68	22.82	3.38	0.62	27.13	6.68	22.82	3.38
Generators	2.11	27.87	7.27	3.77	2.21	2.11	27.87	7.27	3.77	2.21
Engine Test Cells	9.16	48.87	64.19	1.99	9.27	10.42	52.57	68.45	2.09	10.56
JP-5 Fuel Handling	0.81	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00
Service Station	6.40	0.00	0.00	0.00	0.00	6.72	0.00	0.00	0.00	0.00
Painting	34.12	0.00	0.00	0.00	0.00	34.16	0.00	0.00	0.00	0.00
Construction:	2.55	26.13	8.18	2.41	4.04	0.00	0.00	0.00	0.00	0.00
Total Stationary	**55.77**	**130.01**	**86.32**	**30.99**	**18.90**	**54.93**	**107.57**	**82.40**	**28.68**	**16.15**
Total NASO	**412.22**	**799.56**	**1024.60**	**54.53**	**338.27**	**463.33**	**829.97**	**1168.29**	**57.38**	**363.81**
NALF Fentress:										
Aircraft	15.11	239.95	35.66	9.19	77.05	15.61	254.97	37.63	9.68	83.57
Total Annual:	**427.33**	**1,039.51**	**1,060.26**	**63.72**	**415.32**	**478.94**	**1,084.94**	**1,205.92**	**67.06**	**447.39**

Note: Shaded areas indicate nonattainment pollutants of concern.

Key: VOC = volatile organic compounds. NOx = oxides of nitrogen. CO = carbon monoxide. SO2 = sulfur dioxide. PM10 = particulate matter. GSE = Ground Support Equipment JP-5 = jet fuel.

Table F-15
ARS 2
NET EMISSIONS CHANGE - NAS OCEANA AND NALF FENTRESS - ARS 2
(tons per year)

Year	VOCs	NOx	CO	SO2	PM10
NAS Oceana:					
1993	395.49	618.78	874.24	51.04	211.24
1996	175.73	433.96	403.48	40.75	177.32
1997	229.89	622.31	540.17	51.57	242.01
1998	412.22	799.56	1024.60	54.53	338.27
1999	463.33	829.97	1168.29	57.38	363.81
Net Change:					
1993 to 1999	**67.84**	**211.19**	**294.05**	**6.34**	**152.57**
NALF Fentress:					
1993	13.48	146.63	37.00	6.81	30.87
1996	11.70	154.28	24.95	6.38	41.72
1997	13.56	187.54	29.08	7.51	54.61
1998	15.11	239.95	35.66	9.19	77.05
1999	15.61	254.97	37.63	9.68	83.57
Net Change:					
1993 to 1999	**2.13**	**108.34**	**0.63**	**2.88**	**52.71**
Net Change NAS Oceana and NALF Fentress:					
1993 to 1999	**69.97**	**319.53**	**294.68**	**9.22**	**205.27**

Note: Shaded areas indicate nonattainment pollutants of concern.

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-16
ARS 3
TOTAL AIRCRAFT OPERATIONS AT NAS OCEANA AND NALF FENTRESS FOR 1993 AND 1996-1999

Aircraft Type	Operation type	1993	1996	1997	1998	1999
F-14A	Full LTO	12,465	9,149	11,903	11,313	11,313
	Touch&Go NASO	15,236	12,166	15,829	15,044	15,044
	GCA Box	2,178	887	1,154	1,097	1,097
	Interfacility	2,164	1,684	2,191	2,082	2,082
	Touch&Go NALF	10,511	14,103	18,350	17,440	17,440
F-14B/D	Full LTO	8,551	6,788	8,952	8,952	8,952
	Touch&Go NASO	10,452	9,026	11,904	11,904	11,904
	GCA Box	1,494	658	868	868	868
	Interfacility	1,485	1,249	1,648	1,648	1,648
	Touch&Go NALF	7,226	10,464	13,800	13,800	13,800
A-6	Full LTO	13,401	0	0	0	0
	Touch&Go NASO	16,380	0	0	0	0
	GCA Box	2,341	0	0	0	0
	Interfacility	2,326	0	0	0	0
	Touch&Go NALF	11,086	0	0	0	0
F/A-18	Full LTO	0	1,686	1,686	18,544	21,916
	Touch&Go NASO	0	2,598	2,598	28,579	33,775
	GCA Box	0	0	0	856	1,012
	Interfacility	0	0	0	2,484	2,936
	Touch&Go NALF	0	0	0	18,416	21,764
A-4	Full LTO	4,169	0	0	0	0
	Touch&Go	5,096	0	0	0	0
F-16	Full LTO	936	0	0	0	0
	Touch&Go	1,144	0	0	0	0
F-5	Full LTO	808	0	0	0	0
	Touch&Go	988	0	0	0	0
TC-4C	Full LTO	638	0	0	0	0
	Touch&Go	780	0	0	0	0
UH-3H	Full LTO	662	0	0	0	0
C-12	Full LTO	261	1,669	1,669	1,669	1,669
	Touch&Go	445	2,721	2,721	2,721	2,721
	GCA Box	0	1,100	1,100	1,100	1,100
S-3	Full LTO	1,741	967	967	967	967
	Touch&Go	1,295	943	943	943	943
	GCA Box	1,323	367	367	367	367
T-2C	Full LTO	1,418	0	0	0	0
T-34	Full LTO	1,040	1,040	1,040	1,040	1,040
E-2/C-2	Full LTO NALF	1,074	896	896	896	896
	Touch&Go NALF	25,058	20,478	20,478	20,478	20,478
Total		**166,172**	**100,640**	**121,064**	**183,208**	**195,732**

Notes:

(1) F-14 operations divided between F-14As and F-14B/Ds using 1993 aircraft population data.
Number of GCAs and interfacility flights were proportioned from 1997 data based on the number of aircraft.

(2) 1996-1998 operations proportioned from 1999 data using NAS Oceana aircraft population data
A-6s assumed decommissioned by mid-1997.

(3) 1999 and Transient aircraft operations derived from NASMOD analysis (ATAC 1997).

(4) GCA box and interfacility flights include only the level portion of those operations.
Takeoff and landings for these operations are accounted for under full LTO or T&G.

Key:
LTO = Landing and takeoff cycle
GCA = Ground Control Approach
NASO = Naval Air Station Oceana
NALF = Naval Auxiliary Landing Field

Table F-17
ARS 3
MODAL EMISSION RATES FOR AIRCRAFT AT NAS OCEANA

Aircraft (Engine Model)	Mode	Time in Mode (minutes)	Fuel Flow ((lb/min)/eng)	Engines	Emission Factor ([lb /1000 lb fuel]/eng)					Modal Emission Rates (lb/mode)				
					VOC (1)	NOx	CO	SO2	PM10 (2)	VOC (1)	NOx	CO	SO2	PM10 (2)
F-14A (TF30-P-412A)	Taxi Out/Idle	7.0	15.33	2	31.42	3.22	55.51	0.54	8.96	6.74	0.69	11.91	0.12	1.92
	Hot Refueling Idle	16.0	15.33	2	31.42	3.22	55.51	0.54	8.96	15.41	1.58	27.23	0.26	4.40
	Take Off	0.4	796.67	2	0.20	4.79	10.77	0.54	0.00	0.13	3.05	6.86	0.34	0.00
	Climbout	0.4	117.50	2	0.77	19.60	1.38	0.54	2.98	0.07	1.84	0.13	0.05	0.28
	Approach	1.3	71.67	2	1.48	10.74	3.43	0.54	7.98	0.28	2.00	0.64	0.10	1.49
	Taxi In/Idle	5.3	15.33	2	31.42	3.22	55.51	0.54	8.96	5.11	0.52	9.02	0.09	1.46
	T&G Level	1.4	71.67	2	1.48	10.74	3.43	0.54	7.98	0.30	2.16	0.69	0.11	1.60
	GCA Box	9.7	71.67	2	1.48	10.74	3.43	0.54	7.98	2.06	14.93	4.77	0.75	11.10
	Interfacility	1.6	71.67	2	1.48	10.74	3.43	0.54	7.98	0.34	2.46	0.79	0.12	1.83
									Touch and Go	**0.65**	**6.00**	**1.46**	**0.26**	**3.37**
									Full LTO w/hot ref.	**27.74**	**9.69**	**55.80**	**0.96**	**9.54**
									Full LTO w/o hot ref.	**12.32**	**8.11**	**28.57**	**0.70**	**5.15**
									Interfacility	**0.34**	**2.46**	**0.79**	**0.12**	**1.83**
									GCA Box	**2.06**	**14.93**	**4.77**	**0.75**	**11.10**
F-14B/D (F110-GE-400)	Taxi Out/Idle	7.0	19.52	2	3.65	2.77	16.60	0.54	12.38	1.00	0.76	4.54	0.15	3.38
	Hot Refueling Idle	16.0	19.52	2	3.65	2.77	16.60	0.54	12.38	2.28	1.73	10.37	0.34	7.73
	Take Off	0.4	195.32	2	0.40	28.63	0.84	0.54	2.81	0.06	4.47	0.13	0.08	0.44
	Climbout	0.4	195.32	2	0.40	28.63	0.84	0.54	2.81	0.06	4.47	0.13	0.08	0.44
	Approach	1.3	133.03	2	0.26	19.61	0.76	0.54	6.10	0.09	6.78	0.26	0.19	2.11
	Taxi In/Idle	5.3	19.52	2	3.65	2.77	16.60	0.54	12.38	0.76	0.57	3.43	0.11	2.56
	T&G Level	1.4	64.10	2	0.95	8.75	1.64	0.54	6.10	0.17	1.57	0.29	0.10	1.09
	GCA Box	9.7	64.10	2	0.95	8.75	1.64	0.54	6.10	1.18	10.88	2.04	0.67	7.59
	Interfacility	1.6	64.10	2	0.95	8.75	1.64	0.54	6.10	0.19	1.79	0.34	0.11	1.25
									Touch and Go	**0.32**	**12.83**	**0.69**	**0.37**	**3.64**
									Full LTO w/ hot ref.	**4.25**	**18.79**	**18.87**	**0.95**	**16.67**
									Full LTO w/o hot ref.	**1.97**	**17.06**	**8.50**	**0.61**	**8.93**
									Interfacility	**0.19**	**1.79**	**0.34**	**0.11**	**1.25**
									GCA Box	**1.18**	**10.88**	**2.04**	**0.67**	**7.59**
A-6 (J-52-P-8B)	Taxi Out/Idle	7.0	11.33	2	42.20	1.79	63.78	0.54	0.00	6.69	0.28	10.12	0.09	0.00
	Hot Refueling Idle	20.0	11.33	2	42.20	1.79	63.78	0.54	0.00	19.13	0.81	28.91	0.24	0.00
	Take Off	0.4	122.83	2	0.93	13.05	0.71	0.54	0.00	0.09	1.28	0.07	0.05	0.00
	Climbout	0.4	72.00	2	0.58	10.10	3.00	0.54	0.00	0.03	0.58	0.17	0.03	0.00
	Approach	1.3	38.33	2	1.72	6.34	10.54	0.54	0.00	0.17	0.63	1.05	0.05	0.00
	Taxi In/Idle	5.3	11.33	2	42.20	1.79	63.78	0.54	0.00	5.07	0.21	7.66	0.06	0.00
	T&G Level	1.4	38.33	2	1.72	6.34	10.54	0.54	0.00	0.18	0.68	1.13	0.06	0.00
	GCA Box	9.7	38.33	2	1.72	6.34	10.54	0.54	0.00	1.28	4.71	7.84	0.40	0.00
	Interfacility	1.6	38.33	2	1.72	6.34	10.54	0.54	0.00	0.21	0.78	1.29	0.07	0.00
									Touch and Go	**0.39**	**1.89**	**2.35**	**0.14**	**0.00**
									Full LTO w/ hot ref.	**31.18**	**3.81**	**47.97**	**0.53**	**0.00**
									Full LTO w/o hot ref.	**12.06**	**2.99**	**19.07**	**0.29**	**0.00**
									Interfacility	**0.21**	**0.78**	**1.29**	**0.07**	**0.00**
									GCA Box	**1.28**	**4.71**	**7.84**	**0.40**	**0.00**

Table F-17
ARS 3
MODAL EMISSION RATES FOR AIRCRAFT AT NAS OCEANA

Aircraft (Engine Model)	Mode	Time in Mode (minutes)	Fuel Flow ((lb/min)/eng)	Engines	Emission Factor ([lb /1000 lb fuel]/eng)					Modal Emission Rates (lb/mode)				
					VOC (1)	NOx	CO	SO2	PM10 (2)	VOC (1)	NOx	CO	SO2	PM10 (2)
A-4 (J-52-P-8B)	Taxi Out/Idle	6.5	11.33	1	42.20	1.79	63.78	0.54	0.00	3.11	0.13	4.70	0.04	0.00
	Take Off	0.4	122.83	1	0.93	13.05	0.71	0.54	0.00	0.05	0.64	0.03	0.03	0.00
	Climbout	0.4	72.00	1	0.58	10.10	3.00	0.54	0.00	0.02	0.29	0.09	0.02	0.00
	Approach	1.3	38.33	1	1.72	6.34	10.54	0.54	0.00	0.09	0.32	0.53	0.03	0.00
	Taxi In/Idle	6.5	11.33	1	42.20	1.79	63.78	0.54	0.00	3.11	0.13	4.70	0.04	0.00
	T&G Level	1.4	38.33	1	1.72	6.34	10.54	0.54	0.00	0.09	0.34	0.57	0.03	0.00
									Touch and Go	**0.19**	**0.95**	**1.18**	**0.07**	**0.00**
									Full LTO w/o hot ref.	**6.36**	**1.51**	**10.04**	**0.15**	**0.00**
F-16 (F100-PW-100)	Taxi Out/Idle	6.5	17.67	1	2.26	3.96	19.34	0.54	0.09	0.26	0.45	2.22	0.06	0.01
	Take Off	0.4	736.67	1	0.10	16.50	55.10	0.54	0.00	0.03	4.86	16.24	0.16	0.00
	Climbout	0.4	173.33	1	0.05	44.00	1.80	0.54	0.83	0.00	3.05	0.12	0.04	0.06
	Approach	1.3	50.00	1	0.60	11.00	3.00	0.54	0.33	0.04	0.72	0.20	0.04	0.01
	Taxi In/Idle	6.5	17.67	1	2.26	3.96	19.34	0.54	0.09	0.26	0.45	2.22	0.06	0.01
	T&G Level	1.4	50.00	1	0.60	11.00	3.00	0.54	0.33	0.04	0.77	0.21	0.04	0.02
									Touch and Go	**0.08**	**4.54**	**0.53**	**0.11**	**0.09**
									Full LTO w/o hot ref.	**0.59**	**9.54**	**21.00**	**0.36**	**0.088**
F-5 (J85-GE-21)	Taxi Out/Idle	6.5	6.67	2	24.25	1.25	159.00	0.54	0.00	2.10	0.11	13.79	0.05	0.00
	Take Off	0.4	177.50	2	0.10	5.60	36.40	0.54	0.00	0.01	0.80	5.17	0.08	0.00
	Climbout	0.4	53.33	2	0.25	5.00	21.56	0.54	0.00	0.01	0.21	0.92	0.02	0.00
	Approach	1.3	20.00	2	2.58	2.92	46.25	0.54	0.00	0.13	0.15	2.41	0.03	0.00
	Taxi In/Idle	6.5	6.67	2	24.45	1.25	159.00	0.54	0.00	2.12	0.11	13.79	0.05	0.00
	T&G Level	1.4	20.00	2	2.58	2.92	46.25	0.54	0.00	0.14	0.16	2.59	0.03	0.00
									Touch and Go	**0.29**	**0.53**	**5.91**	**0.08**	**0.00**
									Full LTO w/o hot ref.	**4.38**	**1.38**	**36.07**	**0.22**	**0.00**
F/A-18 (F404-GE-400)	Taxi Out/Idle	7.0	10.40	2	58.18	1.16	137.34	0.40	12.38	8.47	0.17	20.00	0.06	1.80
	Hot Refueling Idle	11.0	10.40	2	58.18	1.16	137.34	0.40	12.38	13.31	0.27	31.42	0.09	2.83
	Take Off	0.4	473.28	2	0.13	9.22	23.12	0.40	0.00	0.05	3.49	8.75	0.15	0.00
	Climbout	0.4	143.12	2	0.31	25.16	1.05	0.40	2.81	0.04	2.88	0.12	0.05	0.32
	Approach	1.3	66.75	2	0.44	8.37	1.78	0.40	6.10	0.08	1.45	0.31	0.07	1.06
	Taxi In/Idle	5.3	10.40	2	58.18	1.16	137.34	0.40	12.38	6.41	0.13	15.14	0.04	1.36
	T&G Level	1.7	60.00	2	0.44	8.37	1.78	0.40	6.10	0.09	1.71	0.36	0.08	1.24
	GCA Box	9.0	60.00	2	0.44	8.37	1.78	0.40	6.10	0.48	9.04	1.92	0.43	6.59
	Interfacility	1.4	85.00	2	0.38	11.78	1.16	0.40	6.10	0.09	2.80	0.28	0.10	1.45
									Touch and Go	**0.20**	**6.04**	**0.79**	**0.20**	**2.62**
									Full LTO w/ hot ref.	**28.36**	**8.39**	**75.74**	**0.46**	**7.38**
									Full LTO w/o hot ref.	**15.05**	**8.12**	**44.32**	**0.37**	**4.55**
									Interfacility	**0.09**	**2.80**	**0.28**	**0.10**	**1.45**
									GCA Box	**0.48**	**9.04**	**1.92**	**0.43**	**6.59**

Table F-17
ARS 3
MODAL EMISSION RATES FOR AIRCRAFT AT NAS OCEANA

Aircraft (Engine Model)	Mode	Time in Mode (minutes)	Fuel Flow ((lb/min)/eng)	Engines	Emission Factor ([lb /1000 lb fuel]/eng)					Modal Emission Rates (lb/mode)				
					VOC (1)	NOx	CO	SO2	PM10 (2)	VOC (1)	NOx	CO	SO2	PM10 (2)
S-3	Taxi Out/Idle	6.5	7.63	2	14.99	1.69	90.98	0.54	3.26	1.49	0.17	9.02	0.05	0.32
(TF34-GE-400)	Hot Refueling Idle	8.0	7.63	2	14.99	1.69	90.98	0.54	3.26	1.83	0.21	11.11	0.07	0.40
	Take Off	0.4	63.33	2	0.39	7.51	5.95	0.54	2.11	0.02	0.38	0.30	0.03	0.11
	Climbout	0.4	7.67	2	2.63	3.42	33.57	0.54	6.85	0.02	0.02	0.21	0.00	0.04
	Approach	1.3	7.67	2	2.63	3.42	33.57	0.54	6.85	0.05	0.07	0.67	0.01	0.14
	Taxi In/Idle	6.5	7.63	2	14.99	1.69	90.98	0.54	3.26	1.49	0.17	9.02	0.05	0.32
	T&G Level	1.8	7.67	2	2.63	3.42	33.57	0.54	6.85	0.07	0.09	0.93	0.01	0.19
	GCA Box	7.5	7.67	2	2.63	3.42	33.57	0.54	6.85	0.30	0.39	3.86	0.06	0.79
									Touch and Go	**0.14**	**0.18**	**1.80**	**0.03**	**0.37**
									Full LTO w/ hot ref.	**4.89**	**1.01**	**30.33**	**0.21**	**1.33**
									Full LTO w/o hot ref.	**3.06**	**0.80**	**19.23**	**0.15**	**0.93**
									GCA Box	**0.30**	**0.39**	**3.86**	**0.06**	**0.79**
C-12/TC-4	Taxi Out/Idle	19.0	2.45	2	101.63	1.97	115.31	0.54	0.00	9.46	0.18	10.74	0.05	0.00
(PT6A-41)	Take Off	0.5	8.50	2	1.75	7.98	5.10	0.54	0.00	0.01	0.07	0.04	0.00	0.00
	Climbout	2.1	7.88	2	2.03	7.57	6.49	0.54	0.00	0.07	0.25	0.21	0.02	0.00
	Approach	3.7	4.55	2	22.71	4.65	34.80	0.54	0.00	0.76	0.16	1.17	0.02	0.00
	Taxi In/Idle	7.0	2.45	2	101.63	1.97	115.31	0.54	0.00	3.49	0.07	3.96	0.02	0.00
	T&G Level	2.0	4.55	2	22.71	4.65	34.80	0.54	0.00	0.41	0.08	0.63	0.01	0.00
	GCA Box	7.5	4.55	2	22.71	4.65	34.80	0.54	0.00	1.55	0.32	2.38	0.04	0.00
									Touch and Go	**1.25**	**0.49**	**2.02**	**0.05**	**0.00**
									Full LTO w/o hot ref.	**13.79**	**0.73**	**16.12**	**0.11**	**0.00**
									GCA Box	**1.55**	**0.32**	**2.38**	**0.04**	**0.00**
UH-3H	Taxi Out/Idle	8.0	2.20	2	130.42	1.43	178.44	0.54	0.00	4.59	0.05	6.28	0.02	0.00
(T58-GE-8F)	Take Off	0.0	13.10	2	0.40	5.47	9.03	0.54	0.00	0.00	0.00	0.00	0.00	0.00
	Climbout	5.7	10.45	2	0.80	4.68	14.13	0.54	0.00	0.10	0.08	0.11	0.03	0.00
	Approach	5.7	9.68	2	1.12	4.47	17.28	0.54	0.00	0.13	0.53	2.06	0.06	0.00
	Taxi In/Idle	7.0	2.20	2	130.42	1.43	178.44	0.54	0.00	4.02	0.04	5.50	0.02	0.00
									Full LTO w/o hot ref.	**8.84**	**0.71**	**13.94**	**0.13**	**0.00**
T-34	Taxi Out/Idle	6.5	1.92	1	50.17	2.43	64.00	0.54	0.00	0.63	0.03	0.80	0.01	0.00
(PT6A-25)	Take Off	0.4	7.08	1	0.00	7.81	1.01	0.54	0.00	0.00	0.02	0.00	0.00	0.00
	Climbout	0.4	6.67	1	0.00	7.00	1.20	0.54	0.00	0.00	0.02	0.00	0.00	0.00
	Approach	1.3	3.58	1	2.19	8.37	23.02	0.54	0.00	0.01	0.04	0.11	0.00	0.00
	Taxi In/Idle	6.5	1.92	1	50.17	2.43	64.00	0.54	0.00	0.63	0.03	0.80	0.01	0.00
									Full LTO w/o hot ref.	**1.26**	**0.14**	**1.71**	**0.02**	**0.00**

Table F-17
ARS 3
MODAL EMISSION RATES FOR AIRCRAFT AT NAS OCEANA

Aircraft (Engine Model)	Mode	Time in Mode (minutes)	Fuel Flow ((lb/min)/eng)	Engines	Emission Factor ([lb /1000 lb fuel]/eng)					Modal Emission Rates (lb/mode)				
					VOC (1)	NOx	CO	SO2	PM10 (2)	VOC (1)	NOx	CO	SO2	PM10 (2)
T-2 (J85-GE-2)	Taxi Out/Idle	6.5	9.33	2	11.86	3.68	111.86	0.54	0.00	1.44	0.45	13.57	0.07	0.00
	Take Off	0.4	48.17	2	0.45	6.40	21.56	0.54	0.00	0.02	0.25	0.83	0.02	0.00
	Climbout	0.4	35.92	2	0.64	5.67	28.38	0.54	0.00	0.02	0.16	0.82	0.02	0.00
	Approach	1.3	17.42	2	2.40	4.02	63.53	0.54	0.00	0.11	0.18	2.88	0.02	0.00
	Taxi In/Idle	6.5	9.33	2	11.86	3.68	111.86	0.54	0.00	1.44	0.45	13.57	0.07	0.00
									Full LTO w/o hot ref.	**3.02**	**1.48**	**31.66**	**0.19**	**0.00**
E-2/C-2 (T56-A-16)	Taxi Out/Idle	19.0	9.98	2	19.24	3.53	30.11	0.54	0.00	7.30	1.34	11.42	0.20	0.00
	Take Off	0.5	36.98	2	0.14	10.45	0.65	0.54	0.00	0.01	0.39	0.02	0.02	0.00
	Climbout	2.1	36.98	2	0.14	10.45	0.65	0.54	0.00	0.02	1.62	0.10	0.08	0.00
	Approach	3.7	33.27	2	0.17	9.93	0.42	0.54	0.00	0.04	2.44	0.10	0.13	0.00
	Taxi In/Idle	7.0	9.98	2	19.24	3.53	30.11	0.54	0.00	2.69	0.49	4.21	0.08	0.00
	T&G Level	1.6	15.00	2	0.95	6.52	4.54	0.54	0.00	0.05	0.31	0.22	0.03	0.00
									Touch and Go	**0.11**	**4.38**	**0.42**	**0.24**	**0.00**
									Full LTO w/o hot ref.	**10.05**	**6.29**	**15.85**	**0.52**	**0.00**

Notes:

1) Aircraft VOC reported as HC in the form CHy/x
2) Emission factors equal to 0.00 for PM10 indicate that no factor has been determined (AESO 1996).
Emission factors from AESO Report Number 6-90 and USEPA AP-42.
Shaded areas indicate the nonattainment pollutants of concern.
Modal emission rates calculated from data provided by AESO, except for time in modes for T&G, GCA Box, and interfacility level modes from flight track profiles.
Level mode TIMs estimated from flight track profiles for F-14, E-2/C-2, F/A-18, and S-3 aircraft. Level TIMs for C-12s and TC-4s were assumed to be the same as E-2/C-2
All other aircraft are assumed to have the same level TIMs as F-14s.
Emission rates for T&G operations include approach, climbout, and T&G level modes only.
GCA box and interfacility mode emission rates are presented only for aircraft that conduct low-altitude operations between NAS Oceana and NALF Fentress.
F-14B and F-14D have the same engine types, and therefore, have identical emission rates.
TC-4s are assumed to have the same emission rates as C-12s.
FCLP mode is included in T&G

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

LTO w/ hot ref. = landing and takeoff cycle with hot refueling idle
LTO w/o hot ref. = landing and takeoff cycle without hot refueling idle
T&G = touch and go
GCA = ground control approach
Interfacility = low altitude operations between NAS Oceana and NALF Fentress
TIM = time in mode

Table F-18
ARS 3
AIRCRAFT EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e) per operation (lb)	VOC (e) Total (TPY)	NOx per operation (lb)	NOx Total (TPY)	CO per operation (lb)	CO Total (TPY)	SO2 per operation (lb)	SO2 Total (TPY)	PM10 per operation (lb)	PM10 Total (TPY)
1993	F-14A	Full LTO w/ hot ref.	3,116	27.74	43.22	9.69	15.10	55.80	86.94	0.96	1.50	9.54	14.87
		Full LTO w/o hot ref.	9,349	12.32	57.61	8.11	37.91	28.57	133.54	0.70	3.27	5.15	24.06
		Touch&Go	15,236	0.65	4.91	6.00	45.70	1.46	11.10	0.26	1.98	3.37	25.66
		GCA Box	2,178	2.06	2.24	14.93	16.26	4.77	5.19	0.75	0.82	11.10	12.08
		Interfacility	2,164	0.34	0.37	2.46	2.67	0.79	0.85	0.12	0.13	1.83	1.98
	F-14B	Full LTO w/ hot ref.	2,138	4.25	4.54	18.79	20.09	18.87	20.17	0.95	1.02	16.67	17.81
		Full LTO w/o hot ref.	6,414	1.97	6.31	17.06	54.71	8.50	27.25	0.61	1.97	8.93	28.65
		Touch&Go	10,452	0.32	1.69	12.83	67.03	0.69	3.60	0.37	1.92	3.64	19.04
		GCA Box	1,494	1.18	0.88	10.88	8.13	2.04	1.52	0.67	0.50	7.59	5.67
		Interfacility	1,485	0.19	0.14	1.79	1.33	0.34	0.25	0.11	0.08	1.25	0.93
	A-6	Full LTO w/ hot ref.	3,350	31.18	52.24	3.81	6.38	47.97	80.37	0.53	0.89	0.00	0.00
		Full LTO w/o hot ref.	10,051	12.06	60.60	2.99	15.05	19.07	95.84	0.29	1.45	0.00	0.00
		Touch&Go	16,380	0.39	3.19	1.89	15.51	2.35	19.28	0.14	1.17	0.00	0.00
		GCA Box	2,341	1.28	1.50	4.71	5.52	7.84	9.17	0.40	0.47	0.00	0.00
		Interfacility	2,326	0.21	0.25	0.78	0.90	1.29	1.50	0.07	0.08	0.00	0.00
	A-4	Full LTO w/o hot ref.	4,169	6.36	13.27	1.51	3.15	10.04	20.93	0.15	0.31	0.00	0.00
		Touch&Go	5,096	0.19	0.50	0.95	2.41	1.18	3.00	0.07	0.18	0.00	0.00
	F-16	Full LTO w/o hot ref.	936	0.59	0.28	9.54	4.46	21.00	9.83	0.36	0.17	0.09	0.04
		Touch&Go	1,144	0.08	0.05	4.54	2.59	0.53	0.30	0.11	0.06	0.09	0.05
	F-5	Full LTO w/o hot ref.	808	4.38	1.77	1.38	0.56	36.07	14.57	0.22	0.09	0.00	0.00
		Touch&Go	988	0.29	0.14	0.53	0.26	5.91	2.92	0.08	0.04	0.00	0.00
	TC-4	Full LTO w/o hot ref.	638	13.79	4.40	0.73	0.23	16.12	5.14	0.11	0.03	0.00	0.00
		Touch&Go	780	1.25	0.49	0.49	0.19	2.02	0.79	0.05	0.02	0.00	0.00
	UH-3H	Full LTO w/o hot ref.	662	8.84	2.92	0.71	0.23	13.94	4.61	0.13	0.04	0.00	0.00
	C-12	Full LTO w/o hot ref.	261	13.79	1.80	0.73	0.09	16.12	2.10	0.11	0.01	0.00	0.00
		Touch&Go	445	1.25	0.28	0.49	0.11	2.02	0.45	0.05	0.01	0.00	0.00
	S-3	Full LTO w/ hot ref.	870	4.89	2.13	1.01	0.44	30.33	13.20	0.21	0.09	1.33	0.58
		Full LTO w/o hot ref.	870	3.06	1.33	0.80	0.35	19.23	8.37	0.15	0.06	0.93	0.41
		Touch&Go	1,295	0.14	0.09	0.18	0.12	1.80	1.17	0.03	0.02	0.37	0.24
		GCA Box	1,323	0.30	0.20	0.39	0.26	3.86	2.55	0.06	0.04	0.79	0.52
	T-2C	Full LTO w/o hot ref.	1,418	3.02	2.14	1.48	1.05	31.66	22.45	0.19	0.14	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**111,217**		**272.13**		**328.88**		**609.85**		**18.59**		**152.58**

Table F-18
ARS 3
AIRCRAFT EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1996(b)	F-14A	Full LTO w/ hot ref.	2,287	27.74	31.72	9.69	11.08	55.80	63.81	0.96	1.10	9.54	10.91
		Full LTO w/o hot ref.	6,862	12.32	42.28	8.11	27.83	28.57	98.01	0.70	2.40	5.15	17.66
		Touch&Go	12,166	0.65	3.92	6.00	36.49	1.46	8.86	0.26	1.58	3.37	20.49
		GCA Box	887	2.06	0.91	14.93	6.62	4.77	2.12	0.75	0.33	11.10	4.92
		Interfacility	1,684	0.34	0.29	2.46	2.07	0.79	0.66	0.12	0.10	1.83	1.54
	F-14B/D	Full LTO w/ hot ref.	1,697	4.25	3.60	18.79	15.94	18.87	16.01	0.95	0.81	16.67	14.14
		Full LTO w/o hot ref.	5,091	1.97	5.01	17.06	43.42	8.50	21.63	0.61	1.57	8.93	22.74
		Touch&Go	9,026	0.32	1.46	12.83	57.89	0.69	3.11	0.37	1.66	3.64	16.44
		GCA Box	658	1.18	0.39	10.88	3.58	2.04	0.67	0.67	0.22	7.59	2.50
		Interfacility	1,249	0.19	0.12	1.79	1.12	0.34	0.21	0.11	0.07	1.25	0.78
	A-6	Full LTO w/ hot ref.	0	31.18	0.00	3.81	0.00	47.97	0.00	0.53	0.00	0.00	0.00
		Full LTO w/o hot ref.	0	12.06	0.00	2.99	0.00	19.07	0.00	0.29	0.00	0.00	0.00
		Touch&Go	0	0.39	0.00	1.89	0.00	2.35	0.00	0.14	0.00	0.00	0.00
		GCA Box	0	1.28	0.00	4.71	0.00	7.84	0.00	0.40	0.00	0.00	0.00
		Interfacility	0	0.21	0.00	0.78	0.00	1.29	0.00	0.07	0.00	0.00	0.00
	F/A-18	Full LTO w/ hot ref.	421	28.36	5.98	8.39	1.77	75.74	15.96	0.46	0.10	7.38	1.56
		Full LTO w/o hot ref.	1,264	15.05	9.51	8.12	5.13	44.32	28.02	0.37	0.23	4.55	2.88
		Touch&Go	2,598	0.20	0.26	6.04	7.85	0.79	1.03	0.20	0.26	2.62	3.41
	S-3(c)	Full LTO w/ hot ref.	484	4.89	1.18	1.01	0.24	30.33	7.33	0.21	0.05	1.33	0.32
		Full LTO w/o hot ref.	484	3.06	0.74	0.80	0.19	19.23	4.65	0.15	0.04	0.93	0.23
		Touch&Go	943	0.14	0.07	0.18	0.09	1.80	0.85	0.03	0.01	0.37	0.17
		GCA Box	367	0.30	0.06	0.39	0.07	3.86	0.71	0.06	0.01	0.79	0.14
	UH-3H	Full LTO w/o hot ref	0	8.84	0.00	0.71	0.00	13.94	0.00	0.13	0.00	0.00	0.00
	C-12	Full LTO w/o hot ref.	1,669	13.79	11.51	0.73	0.61	16.12	13.45	0.11	0.09	0.00	0.00
		Touch&Go	2,721	1.25	1.69	0.49	0.67	2.02	2.75	0.05	0.06	0.00	0.00
		GCA Box	1,100	1.55	0.85	0.32	0.17	2.38	1.31	0.04	0.02	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**54,698**		**122.22**		**222.92**		**292.03**		**10.73**		**120.83**

Table F-18
ARS 3
AIRCRAFT EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1997(b)	F-14A	Full LTO w/ hot ref.	2,976	27.74	41.27	9.69	14.42	55.80	83.02	0.96	1.43	9.54	14.20
		Full LTO w/o hot ref.	8,927	12.32	55.01	8.11	36.20	28.57	127.51	0.70	3.12	5.15	22.97
		Touch&Go	15,829	0.65	5.11	6.00	47.48	1.46	11.53	0.26	2.06	3.37	26.66
		GCA Box	1,154	2.06	1.19	14.93	8.62	4.77	2.75	0.75	0.43	11.10	6.40
		Interfacility	2,191	0.34	0.37	2.46	2.70	0.79	0.86	0.12	0.14	1.83	2.00
	F-14B/D	Full LTO w/ hot ref.	2,238	4.25	4.75	18.79	21.03	18.87	21.11	0.95	1.07	16.67	18.65
		Full LTO w/o hot ref.	6,714	1.97	6.61	17.06	57.27	8.50	28.52	0.61	2.06	8.93	29.99
		Touch&Go	11,904	0.32	1.92	12.83	76.35	0.69	4.10	0.37	2.19	3.64	21.69
		GCA Box	868	1.18	0.51	10.88	4.72	2.04	0.89	0.67	0.29	7.59	3.29
		Interfacility	1,648	0.19	0.16	1.79	1.48	0.34	0.28	0.11	0.09	1.25	1.03
	F/A-18	Full LTO w/ hot ref.	421	28.36	5.98	8.39	1.77	75.74	15.96	0.46	0.10	7.38	1.56
		Full LTO w/o hot ref.	1,264	15.05	9.51	8.12	5.13	44.32	28.02	0.37	0.23	4.55	2.88
		Touch&Go	2,598	0.20	0.26	6.04	7.85	0.79	1.03	0.20	0.26	2.62	3.41
	S-3	Full LTO w/ hot ref.	484	4.89	1.18	1.01	0.24	30.33	7.33	0.21	0.05	1.33	0.32
		Full LTO w/o hot ref.	484	3.06	0.74	0.80	0.19	19.23	4.65	0.15	0.04	0.93	0.23
		Touch&Go	943	0.14	0.07	0.18	0.09	1.80	0.85	0.03	0.01	0.37	0.17
		GCA Box	367	0.30	0.06	0.39	0.07	3.86	0.71	0.06	0.01	0.79	0.14
	C-12	Full LTO w/o hot ref.	1,669	13.79	11.51	0.73	0.61	16.12	13.45	0.11	0.09	0.00	0.00
		Touch&Go	2,721	1.25	1.69	0.49	0.67	2.02	2.75	0.05	0.06	0.00	0.00
		GCA Box	1,100	1.55	0.85	0.32	0.17	2.38	1.31	0.04	0.02	0.00	0.00
	T-34	Full LTO w/o hot ref	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**67,540**		**149.41**		**287.13**		**357.52**		**13.77**		**155.59**

Table F-18
ARS 3
AIRCRAFT EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1998	F-14A	Full LTO w/ hot ref.	2,828	27.74	39.23	9.69	13.70	55.80	78.90	0.96	1.36	9.54	13.49
		Full LTO w/o hot ref.	8,485	12.32	52.29	8.11	34.41	28.57	121.19	0.70	2.97	5.15	21.83
		Touch&Go	15,044	0.65	4.85	6.00	45.12	1.46	10.96	0.26	1.95	3.37	25.34
		GCA Box	1,097	2.06	1.13	14.93	8.19	4.77	2.62	0.75	0.41	11.10	6.09
		Interfacility	2,082	0.34	0.35	2.46	2.56	0.79	0.82	0.12	0.13	1.83	1.91
	F-14B/D	Full LTO w/ hot ref.	2,238	4.25	4.75	18.79	21.03	18.87	21.11	0.95	1.07	16.67	18.65
		Full LTO w/o hot ref.	6,714	1.97	6.61	17.06	57.27	8.50	28.52	0.61	2.06	8.93	29.99
		Touch&Go	11,904	0.32	1.92	12.83	76.35	0.69	4.10	0.37	2.19	3.64	21.69
		GCA Box	868	1.18	0.51	10.88	4.72	2.04	0.89	0.67	0.29	7.59	3.29
		Interfacility	1,648	0.19	0.16	1.79	1.48	0.34	0.28	0.11	0.09	1.25	1.03
	F/A-18	Full LTO w/ hot ref.	4,636	28.36	65.73	8.39	19.44	75.74	175.58	0.46	1.07	7.38	17.11
		Full LTO w/o hot ref.	13,908	15.05	104.63	8.12	56.47	44.32	308.21	0.37	2.57	4.55	31.63
		Touch&Go	28,579	0.20	2.88	6.04	86.32	0.79	11.32	0.20	2.81	2.62	37.51
		GCA Box	856	0.48	0.20	9.04	3.87	1.92	0.82	0.43	0.18	6.59	2.82
		Interfacility	2,484	0.09	0.11	2.80	3.48	0.28	0.34	0.10	0.12	1.45	1.80
	S-3	Full LTO w/ hot ref.	484	4.89	1.18	1.01	0.24	30.33	7.33	0.21	0.05	1.33	0.32
		Full LTO w/o hot ref.	484	3.06	0.74	0.80	0.19	19.23	4.65	0.15	0.04	0.93	0.23
		Touch&Go	943	0.14	0.07	0.18	0.09	1.80	0.85	0.03	0.01	0.37	0.17
		GCA Box	367	0.30	0.06	0.39	0.07	3.86	0.71	0.06	0.01	0.79	0.14
	C-12	Full LTO w/o hot ref.	1,669	13.79	11.51	0.73	0.61	16.12	13.45	0.11	0.09	0.00	0.00
		Touch&Go	2,721	1.25	1.69	0.49	0.67	2.02	2.75	0.05	0.06	0.00	0.00
		GCA Box	1,100	1.55	0.85	0.32	0.17	2.38	1.31	0.04	0.02	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**112,179**		**302.12**		**436.54**		**797.59**		**19.57**		**235.03**

Table F-18
ARS 3
AIRCRAFT EMISSIONS AT NAS OCEANA FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e) per operation (lb)	VOC (e) Total (TPY)	NOx per operation (lb)	NOx Total (TPY)	CO per operation (lb)	CO Total (TPY)	SO2 per operation (lb)	SO2 Total (TPY)	PM10 per operation (lb)	PM10 Total (TPY)
1999	F-14A	Full LTO w/ hot ref.	2,828	27.74	39.23	9.69	13.70	55.80	78.90	0.96	1.36	9.54	13.49
		Full LTO w/o hot ref.	8,485	12.32	52.29	8.11	34.41	28.57	121.19	0.70	2.97	5.15	21.83
		Touch&Go	15,044	0.65	4.85	6.00	45.12	1.46	10.96	0.26	1.95	3.37	25.34
		GCA Box	1,097	2.06	1.13	14.93	8.19	4.77	2.62	0.75	0.41	11.10	6.09
		Interfacility	2,082	0.34	0.35	2.46	2.56	0.79	0.82	0.12	0.13	1.83	1.91
	F-14B/D	Full LTO w/ hot ref.	2,238	4.25	4.75	18.79	21.03	18.87	21.11	0.95	1.07	16.67	18.65
		Full LTO w/o hot ref.	6,714	1.97	6.61	17.06	57.27	8.50	28.52	0.61	2.06	8.93	29.99
		Touch&Go	11,904	0.32	1.92	12.83	76.35	0.69	4.10	0.37	2.19	3.64	21.69
		GCA Box	868	1.18	0.51	10.88	4.72	2.04	0.89	0.67	0.29	7.59	3.29
		Interfacility	1,648	0.19	0.16	1.79	1.48	0.34	0.28	0.11	0.09	1.25	1.03
	F/A-18	Full LTO w/ hot ref.	5,479	28.36	77.69	8.39	22.97	75.74	207.50	0.46	1.26	7.38	20.22
		Full LTO w/o hot ref.	16,437	15.05	123.65	8.12	66.74	44.32	364.24	0.37	3.03	4.55	37.38
		Touch&Go	33,775	0.20	3.40	6.04	102.01	0.79	13.38	0.20	3.32	2.62	44.33
		GCA Box	1,012	0.48	0.24	9.04	4.57	1.92	0.97	0.43	0.22	6.59	3.33
		Interfacility	2,936	0.09	0.13	2.80	4.12	0.28	0.41	0.10	0.14	1.45	2.13
	S-3	Full LTO w/ hot ref.	484	4.89	1.18	1.01	0.24	30.33	7.33	0.21	0.05	1.33	0.32
		Full LTO w/o hot ref.	484	3.06	0.74	0.80	0.19	19.23	4.65	0.15	0.04	0.93	0.23
		Touch&Go	943	0.14	0.07	0.18	0.09	1.80	0.85	0.03	0.01	0.37	0.17
		GCA Box	367	0.30	0.06	0.39	0.07	3.86	0.71	0.06	0.01	0.79	0.14
	C-12	Full LTO w/o hot ref.	1,669	13.79	11.51	0.73	0.61	16.12	13.45	0.11	0.09	0.00	0.00
		Touch&Go	2,721	1.25	1.69	0.49	0.67	2.02	2.75	0.05	0.06	0.00	0.00
		GCA Box	1,100	1.55	0.85	0.32	0.17	2.38	1.31	0.04	0.02	0.00	0.00
	T-34	Full LTO w/o hot ref	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		121,354		333.68		467.38		887.82		20.80		251.55

Notes:

(a) F-14 operations were divided between F-14As and F-14Bs based on the number of aircraft present in 1993. Number of GCAs and interfacility flights were proportioned from 1997 data based on the number of aircraft.

(b) 1996-1998 operations were proportioned from 1999 data based upon the numbers of aircraft based at NAS Oceana during those years. A-6s assumed to be deployed in 1996 and decommissioned by mid-1997.

(c) Transient aircraft operations, derived from NASMOD analysis (ATAC 1997).

(d) 1999 operations were derived from NASMOD analysis(ATAC 1997).

(e) Aircraft VOC reported as HC in the form CHy/x

Shaded areas indicate nonattainment pollutants of concern.

The LTOs listed for GCA box and interfacility flights include only the level portion of those operations. Takeoff and landings for these operations are accounted for under full LTO or T&G.

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

LTO w/ hot ref. = landing and takeoff cycle with hot refueling idle
LTO w/o hot ref. = landing and takeoff cycle without hot refueling idle
interfacility = low altitude operations between NAS Oceana and NALF Fentress
GCA = ground control approach
lb = pounds TPY = tons per year

Table F-19
ARS 3
AIRCRAFT EMISSIONS AT NALF FENTRESS
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation Type	Number of Operations/Year	VOC (d) per operation (lb)	VOC (d) Total (TPY)	NOx per operation (lb)	NOx Total (TPY)	CO per operation (lb)	CO Total (TPY)	SO2 per operation (lb)	SO2 Total (TPY)	PM10 per operation (lb)	PM10 Total (TPY)
1993(a)	F-14A	Touch&Go	10,511	0.65	3.39	6.00	31.53	1.46	7.66	0.26	1.37	3.37	17.70
	F-14B	Touch&Go	7,226	0.32	1.17	12.83	46.34	0.69	2.49	0.37	1.33	3.64	13.17
	E-2/C-2	Full LTO	1,074	10.05	5.40	6.29	3.38	15.85	8.51	0.52	0.28	0.00	0.00
		Touch&Go	25,058	0.11	1.37	4.38	54.89	0.42	5.29	0.24	3.04	0.00	0.00
	A-6	Touch&Go	11,086	0.39	2.16	1.89	10.50	2.35	13.05	0.14	0.79	0.00	0.00
	Total		**54,955**		**13.48**		**146.63**		**37.00**		**6.81**		**30.87**
1996(c)	F-14A	Touch&Go	14,103	0.65	4.55	6.00	42.30	1.46	10.28	0.26	1.83	3.37	23.75
	F-14B/D	Touch&Go	10,464	0.32	1.69	12.83	67.11	0.69	3.60	0.37	1.93	3.64	19.06
	E-2/C-2	Full LTO	896	10.05	4.50	6.29	2.82	15.85	7.10	0.52	0.23	0.00	0.00
		Touch&Go	20,478	0.11	1.12	4.38	44.85	0.42	4.32	0.24	2.49	0.00	0.00
	A-6	Touch&Go	0	0.39	0.00	1.89	0.00	2.35	0.00	0.14	0.00	0.00	0.00
	Total		**45,941**		**11.86**		**157.08**		**25.30**		**6.47**		**42.82**
1997(c)	F-14A	Touch&Go	18,350	0.65	5.92	6.00	55.04	1.46	13.37	0.26	2.38	3.37	30.91
	F-14B/D	Touch&Go	13,800	0.32	2.23	12.83	88.51	0.69	4.75	0.37	2.54	3.64	25.14
	E-2/C-2	Full LTO	896	10.05	4.50	6.29	2.82	15.85	7.10	0.52	0.23	0.00	0.00
		Touch&Go	20,478	0.11	1.12	4.38	44.85	0.42	4.32	0.24	2.49	0.00	0.00
	Total		**53,524**		**13.77**		**191.22**		**29.55**		**7.64**		**56.05**

Table F-19
ARS 3
AIRCRAFT EMISSIONS AT NALF FENTRESS
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation Type	Number of Operations/Year	VOC (d)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1998	F-14A	Touch&Go	17,440	0.65	5.63	6.00	52.31	1.46	12.71	0.26	2.26	3.37	29.37
	F-14B/D	Touch&Go	13,800	0.32	2.23	12.83	88.51	0.69	4.75	0.37	2.54	3.64	25.14
	F/A-18	Touch&Go	18,416	0.20	1.86	6.04	55.62	0.79	7.30	0.20	1.81	2.62	24.17
	E-2/C-2	Full LTO	896	10.05	4.50	6.29	2.82	15.85	7.10	0.52	0.23	0.00	0.00
		Touch&Go	20,478	0.11	1.12	4.38	44.85	0.42	4.32	0.24	2.49	0.00	0.00
	Total		**71,030**		**15.33**		**244.11**		**36.18**		**9.33**		**78.68**
1999	F-14A	Touch&Go	17,440	0.65	5.63	6.00	52.31	1.46	12.71	0.26	2.26	3.37	29.37
	F-14B/D	Touch&Go	13,800	0.32	2.23	12.83	88.51	0.69	4.75	0.37	2.54	3.64	25.14
	F/A-18	Touch&Go	21,764	0.20	2.19	6.04	65.74	0.79	8.62	0.20	2.14	2.62	28.56
	E-2/C-2	Full LTO	896	10.05	4.50	6.29	2.82	15.85	7.10	0.52	0.23	0.00	0.00
		Touch&Go	20,478	0.11	1.12	4.38	44.85	0.42	4.32	0.24	2.49	0.00	0.00
	Total		**74,378**		**15.67**		**254.22**		**37.50**		**9.66**		**83.08**

Notes:
(a) F-14 operations were divided between F-14As and F-14Bs based on the number of aircraft present in 1993.
(b) 1996-1998 operations for F-14s were proporationed from 1999 data based upon the numbers of F-14 squadrons based at NAS Oceana, A-6s assumed to be deployed in 1996 and decommissioned by mid-1997, 1996-1998 E-2/C-2 operations assumed to the same as 1999.
(c) 1997 operations derived from NASMOD analysis (ATAC 1997).
(d) Aircraft VOC reported as HC in the form CHy/x
Shaded areas indicate nonattainment pollutants of concern.

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter
LTO = landing and takeoff cycle
interfacility = low altitude operations between NAS Oceana and NALF Fentress
GCA = ground control approach
lb = pounds
TPY = tons per year

Table F-20
ARS 3
Emissions from Ground Support Equipment at NAS Oceana

		Fuel Consumption (gal/yr)	VOC lb/1000 gal	VOC Total (TPY)	NOx lb/1000 gal	NOx Total (TPY)	CO lb/1000 gal	CO Total (TPY)	SO2 lb/1000 gal	SO2 Total (TPY)	PM-10 lb/1000 gal	PM-10 Total (TPY)
1993	*Tow Tractors: (a)*											
	A/S32A-30A	8960	64.60	0.29	436.67	1.96	268.50	1.20	31.10	0.14	46.50	0.21
	TA-35	254	64.60	0.01	436.67	0.06	268.50	0.03	31.10	0.00	46.50	0.01
	MD-3/A/S32A-31A	4843	64.60	0.16	436.67	1.06	268.50	0.65	31.10	0.08	46.50	0.11
	TA-75	17115	122.00	1.04	146.00	1.25	3250.00	27.81	5.20	0.04	8.27	0.07
	A/S32A-42	7200	64.60	0.23	436.67	1.57	268.50	0.97	31.10	0.11	46.50	0.17
	JG-75	104	122.00	0.01	146.00	0.01	3250.00	0.17	5.20	0.00	8.27	0.00
	A/S32A-30	897	122.00	0.05	146.00	0.07	3250.00	1.46	5.20	0.00	8.27	0.00
	Flight Line Electric Power Units											
	NC8A (b)	14926	49.23	0.37	604.17	4.51	130.15	0.97	39.73	0.30	42.47	0.32
	NC10C (b)	3180	49.23	0.08	604.17	0.96	130.15	0.21	39.73	0.06	42.47	0.07
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	41932	49.23	1.03	604.17	12.67	130.15	2.73	39.73	0.83	42.47	0.89
	A/S47A-1 (b)	712	49.23	0.02	604.17	0.22	130.15	0.05	39.73	0.01	42.47	0.02
	GTC-85 (c)	10101	0.13	0.00	3.88	0.02	14.83	0.07	0.54	0.00	0.00	0.00
	Miscellaneous: (c)											
	A/M32C-17	2105	49.23	0.05	604.17	0.64	130.15	0.14	39.73	0.04	42.47	0.04
	A/M27T-5	990	49.23	0.02	604.17	0.30	130.15	0.06	39.73	0.02	42.47	0.02
	A/M42M-2	720	49.23	0.02	604.17	0.22	130.15	0.05	39.73	0.01	42.47	0.02
	HLU-196	8400	415.11	1.74	223.31	0.94	8589.90	36.08	11.51	0.05	13.70	0.06
		Total		**5.13**		**26.43**		**72.65**		**1.71**		**2.00**
1996	*Tow Tractors: (a)*											
	A/S32A-30A	19000	64.60	0.61	436.67	4.15	268.50	2.55	31.10	0.30	46.50	0.44
	TA-35	450	64.60	0.01	436.67	0.10	268.50	0.06	31.10	0.01	46.50	0.01
	MD-3/A/S32A-31A	4843	64.60	0.16	436.67	1.06	268.50	0.65	31.10	0.08	46.50	0.11
	TA-75 (MOGAS)	1600	122.00	0.10	146.00	0.12	3250.00	2.60	5.20	0.00	8.27	0.01
	A/S32A-42	17000	64.60	0.55	436.67	3.71	268.50	2.28	31.10	0.26	46.50	0.40
	JG-75	104	122.00	0.01	146.00	0.01	3250.00	0.17	5.20	0.00	8.27	0.00
	A/S32A-30	2900	122.00	0.18	146.00	0.21	3250.00	4.71	5.20	0.01	8.27	0.01
	Flight Line Electric Power Units											
	NC8A (b)	12800	49.23	0.32	604.17	3.87	130.15	0.83	39.73	0.25	42.47	0.27
	NC10C (b)	3500	49.23	0.09	604.17	1.06	130.15	0.23	39.73	0.07	42.47	0.07
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	37000	49.23	0.91	604.17	11.18	130.15	2.41	39.73	0.74	42.47	0.79
	GTC-85 (c)	3000	0.13	0.00	3.88	0.01	14.83	0.02	0.54	0.00	0.00	0.00
	Miscellaneous: (b)											
	A/M32C-17	2400	49.23	0.06	604.17	0.73	130.15	0.16	39.73	0.05	42.47	0.05
	A/M27T-5 (air cond.)	2350	49.23	0.06	604.17	0.71	130.15	0.15	39.73	0.05	42.47	0.05
	A/M42M-2 (power)	1500	49.23	0.04	604.17	0.45	130.15	0.10	39.73	0.03	42.47	0.03
	HLU-196	25	415.11	0.01	223.31	0.00	8589.90	0.11	11.51	0.00	13.70	0.00
		Total		**3.09**		**27.35**		**17.03**		**1.84**		**2.24**

Table F-20
ARS 3
Emissions from Ground Support Equipment at NAS Oceana

		Fuel Consumption (gal/yr)	VOC		NOx		CO		SO2		PM-10	
			lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)
1997	*Tow Tractors: (a)*											
	A/S32A-30A	22000	64.60	0.71	436.67	4.80	268.50	2.95	31.10	0.34	46.50	0.51
	A/S32A-30	3500	122.00	0.21	146.00	0.26	3250.00	5.69	5.20	.0.01	8.27	0.01
	TA-35	600	64.60	0.02	436.67	0.13	268.50	0.08	31.10	0.01	46.50	0.01
	A/S32A-42	23000	64.60	0.74	436.67	5.02	268.50	3.09	31.10	0.36	46.50	0.53
	TA-75	1200	122.00	1.04	146.00	1.25	3250.00	1.95	5.20	0.00	8.27	0.00
	Flight Line Electric Power Units											
	NC8A (b)	16000	49.23	0.39	604.17	4.83	130.15	1.04	39.73	0.32	42.47	0.34
	NC10C (b)	6000	49.23	0.15	604.17	1.81	130.15	0.39	39.73	0.12	42.47	0.13
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	45000	49.23	1.11	604.17	13.59	130.15	2.93	39.73	0.89	42.47	0.96
	GTC-85 (c)	3500	0.13	0.00	3.88	0.01	14.83	0.03	0.54	0.00	0.00	0.00
	Miscellaneous: (b)											
	A/M32C-17	3000	49.23	0.07	604.17	0.91	130.15	0.20	39.73	0.06	42.47	0.06
	A/M27T-5	3000	49.23	0.07	604.17	0.91	130.15	0.20	39.73	0.06	42.47	0.06
	A/M42M-2	1600	49.23	0.04	604.17	0.48	130.15	0.10	39.73	0.03	42.47	0.03
	HLU-196	20	415.11	0.00	223.31	0.00	8589.90	0.09	11.51	0.00	13.70	0.00
		Total		**4.57**		**34.01**		**18.73**		**2.20**		**2.66**
1998	*Tow Tractors: (a)*											
	A/S32A-30A (MOGAS)	22000	64.60	0.71	436.67	4.80	268.50	2.95	31.10	0.34	46.50	0.51
	A/S32A-30	3500	122.00	0.21	146.00	0.26	3250.00	5.69	5.20	0.01	8.27	0.01
	TA-35	600	64.60	0.02	436.67	0.13	268.50	0.08	31.10	0.01	46.50	0.01
	A/S32A-42	23000	64.60	0.74	436.67	5.02	268.50	3.09	31.10	0.36	46.50	0.53
	Flight Line Electric Power Units											
	NC8A (b)	16000	49.23	0.39	604.17	4.83	130.15	1.04	39.73	0.32	42.47	0.34
	NC10C (b)	8000	49.23	0.20	604.17	2.42	130.15	0.52	39.73	0.16	42.47	0.17
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	47000	49.23	1.16	604.17	14.20	130.15	3.06	39.73	0.93	42.47	1.00
	GTC-85 (c)	3500	0.13	0.00	3.88	0.01	14.83	0.03	0.54	0.00	0.00	0.00
	Miscellaneous: (b)											
	A/M32C-17	4000	49.23	0.10	604.17	1.21	130.15	0.26	39.73	0.08	42.47	0.08
	A/M27T-5	4000	49.23	0.10	604.17	1.21	130.15	0.26	39.73	0.08	42.47	0.08
	A/M42M-2	1600	49.23	0.04	604.17	0.48	130.15	0.10	39.73	0.03	42.47	0.03
	HLU-196	20	415.11	0.00	223.31	0.00	8589.90	0.09	11.51	0.00	13.70	0.00
		Total		**3.67**		**34.57**		**17.17**		**2.32**		**2.79**

Table F-20
ARS 3
Emissions from Ground Support Equipment at NAS Oceana

		Fuel Consumption (gal/yr)	VOC		NOx		CO		SO2		PM-10	
			lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)
1999	*Tow Tractors: (a)*											
	A/S32A-30A (JP-5)	22400	64.60	0.72	436.67	4.89	268.50	3.01	5.20	0.06	8.27	0.09
	A/S32A-30	3500	122.00	0.21	146.00	0.26	3250.00	5.69	5.20	0.01	8.27	0.01
	TA-35	600	64.60	0.02	436.67	0.13	268.50	0.08	5.20	0.00	8.27	0.00
	A/S32A-42	23000	64.60	0.74	436.67	5.02	268.50	3.09	5.20	0.06	8.27	0.10
	Flight Line Electric Power Units											
	NC8A (b)	16000	49.23	0.39	604.17	4.83	130.15	1.04	39.73	0.32	42.47	0.34
	NC10C (b)	8000	49.23	0.20	604.17	2.42	130.15	0.52	39.73	0.16	42.47	0.17
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	47000	49.23	1.16	604.17	14.20	130.15	3.06	39.73	0.93	42.47	1.00
	GTC-85 (c)	3500	0.13	0.00	3.88	0.01	14.83	0.03	0.54	0.00	0.00	0.00
	Miscellaneous: (b)											
	A/M32C-17	4000	49.23	0.10	604.17	1.21	130.15	0.26	39.73	0.08	42.47	0.08
	A/M27T-5	4000	49.23	0.10	604.17	1.21	130.15	0.26	39.73	0.08	42.47	0.08
	A/M42M-2	1600	49.23	0.04	604.17	0.48	130.15	0.10	39.73	0.03	42.47	0.03
	HLU-196	20	415.11	0.00	223.31	0.00	8589.90	0.09	11.51	0.00	13.70	0.00
		Total		**3.69**		**34.66**		**17.22**		**1.73**		**1.92**

(a) Emission factors from AP-42 Volume II for gasoline-powered wheeled tractor for TA-75, JG-75, & A/S32A-30 and diesel-powered wheeled tractors for all others.
(b) Emission factors from AP-42 Volume I for Uncontrolled gasoline and diesel industrial engines SCC 20200102, 20300101, and 2300301..
Converted from lb/MMBtu assuming heating value for JP-5 of 137,000 Btu/gallon.
(c) Emission factors from USEPA 1992 for aircraft auxilliary power units used because specific emission factors for individual equipment types not available.

Table F-21
ARS 3
EMISSION RATES FOR SINGLE ENGINE MAINTENANCE RUN-UPS AT NAS OCEANA
(IN-FRAME ENGINE TESTING)

Engine (Aircraft)	Power Setting (a)	Time in Power Setting (a) (minutes)	Fuel Flow (lb/min)	Emission Factor ([lb /1000 lb fuel]/eng)					Emission Rates (lb/single engine run-up)				
				VOC (b)	NOx	CO	SO2	PM10	VOC	NOx	CO	SO2	PM10
TF30-P-412A (F-14A)	**Low Power**												
	Idle	7.00	15.3	31.42	3.22	55.51	0.40	8.96	3.37	0.35	5.96	0.04	0.96
	75%	12.00	71.7	1.48	10.74	3.43	0.40	5.70	1.27	9.24	2.95	0.34	4.90
	Total								**4.65**	**9.59**	**8.91**	**0.39**	**5.87**
	High Power												
	Idle	10.00	15.3	31.42	3.22	55.51	0.40	8.96	4.81	0.49	8.49	0.06	1.37
	75%	25.00	71.7	1.48	10.74	3.43	0.40	5.70	2.65	19.25	6.15	0.72	10.22
	100% (Mil)	10.00	117.5	0.77	19.60	1.38	0.40	2.98	0.90	23.03	1.62	0.47	3.50
	A/B (Z5)	4.00	796.7	0.20	4.79	10.77	0.40	0.00	0.64	15.26	34.32	1.27	0.00
	Total								**9.00**	**58.04**	**50.58**	**2.52**	**15.09**
F110-GE-400 (F-14B/D)	**Low Power**												
	Idle	5.00	19.5	3.65	2.77	16.60	0.40	12.38	0.36	0.27	1.62	0.04	1.21
	75%	12.50	133.0	0.26	19.61	0.76	0.40	4.30	0.43	32.60	1.26	0.67	7.15
	Total								**0.79**	**32.87**	**2.88**	**0.70**	**8.36**
	High Power												
	Idle	10.00	19.5	3.65	2.77	16.60	0.40	12.38	0.71	0.54	3.24	0.08	2.41
	75%	20.00	133.0	0.26	19.61	0.76	0.40	4.30	0.69	52.16	2.02	1.06	11.44
	IRP	15.00	195.3	0.40	28.63	0.84	0.40	2.81	1.17	83.87	2.46	1.17	8.23
	A/B(Max)	4.00	945.0	0.13	9.22	23.12	0.40	0.00	0.49	34.85	87.39	1.51	0.00
	Total								**3.07**	**171.43**	**95.11**	**3.83**	**22.08**
J-52-P-8B (A-6)	**Low Power**												
	Idle	15.00	11.3	48.96	1.79	63.78	0.40	0.00	8.32	0.30	10.84	0.07	0.00
	78-82%	10.00	72.0	0.67	10.10	3.00	0.40	0.00	0.48	7.27	2.16	0.29	0.00
	Total								**8.80**	**7.58**	**13.00**	**0.36**	**0.00**
	High Power												
	Idle	15.00	11.3	48.96	1.79	63.78	0.40	0.00	8.30	0.30	10.81	0.07	0.00
	78-82%	5.00	72.0	0.67	10.10	3.00	0.40	0.00	0.24	3.64	1.08	0.14	0.00
	94-100%	8.00	122.8	0.93	13.05	0.71	0.40	0.00	0.91	12.82	0.70	0.39	0.00
	Total								**9.45**	**16.76**	**12.59**	**0.60**	**0.00**
F404-GE-400 (F/A-18)	**Low Power**												
	Idle	6.50	10.4	58.18	1.16	137.34	0.40	12.38	3.93	0.08	9.28	0.03	0.84
	76%	3.50	109.0	0.35	14.80	1.09	0.40	6.10	0.13	5.65	0.42	0.15	2.33
	Total								**4.07**	**5.72**	**9.70**	**0.18**	**3.16**
	High Power												
	Idle	13.00	10.4	58.18	1.16	137.34	0.40	12.38	7.87	0.16	18.57	0.05	1.67
	76%	8.50	109.0	0.35	14.80	1.09	0.40	6.10	0.32	13.71	1.01	0.37	5.65
	IRP	5.00	143.1	0.31	25.16	1.05	0.40	2.81	0.22	18.00	0.75	0.29	2.01
	A/B	2.00	473.3	0.13	9.22	23.12	0.40	0.00	0.12	8.73	21.89	0.38	0.00
	Total								**8.54**	**40.60**	**42.21**	**1.09**	**9.34**

Notes:
(a) Power setting and time in power setting for F-14 A, F-14B/D, F/A-18 aircraft,and A-6 provided by AESO and COMNAVAIRLANT.
(b) Aircraft VOC reported as HC in the form CHy/x

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter
A/B = afterburner operating
Idle = typically 57% throttle setting
75% = 75% throttle setting
IRP = intermediate rated power

Table F-22
ARS 3
EMISSIONS FROM SINGLE ENGINE IN-FRAME MAINTENANCE RUN-UPS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft (Engine) and Number of Aircraft	Run-up mode	Number of Single Engine Run-ups/yr	VOC (b)		NOx		CO		SO2		PM10	
				Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)
1993	F-14A (TF30-P-412A)	Low Power	8,776	4.65	20.38	9.59	42.06	8.91	39.09	0.39	1.70	5.87	25.74
	80	High Power	250	9.00	1.13	58.04	7.25	50.58	6.32	2.52	0.32	15.09	1.89
	F-14B/D (F110-GE-400)	Low Power	4,162	0.79	1.64	32.87	68.41	2.88	6.00	0.70	1.47	8.36	17.39
	55	High Power	218	3.07	0.33	171.43	18.69	95.11	10.37	3.83	0.42	22.08	2.41
	A-6 (J-52-P-8B)	Low Power	10,320	8.80	45.42	7.58	39.09	13.00	67.08	0.36	1.84	0.00	0.00
	86	High Power	292	9.45	1.38	16.76	2.45	12.59	1.84	0.60	0.09	0.00	0.00
				Total	**70.29**		**177.95**		**130.69**		**5.82**		**47.42**
1996	F-14A (TF30-P-412A)	Low Power	11,179	4.65	25.96	9.59	42.06	8.91	39.09	0.39	1.70	5.87	25.74
	93	High Power	319	9.00	1.44	58.04	7.25	50.58	6.32	2.52	0.32	15.09	1.89
	F-14B/D (F110-GE-400)	Low Power	4,222	0.79	1.66	32.87	68.41	2.88	6.00	0.70	1.47	8.36	17.39
	69	High Power	221	3.07	0.34	171.43	18.69	95.11	10.37	3.83	0.42	22.08	2.41
				Total	**29.40**		**136.41**		**61.78**		**3.90**		**47.42**
1997	F-14A (TF30-P-412A)	Low Power	14,545	4.65	33.78	9.59	69.72	8.91	64.78	0.39	2.82	5.87	42.66
	121	High Power	415	9.00	1.87	58.04	12.04	50.58	10.50	2.52	0.52	15.09	3.13
	F-14B/D (F110-GE-400)	Low Power	5,568	0.79	2.19	32.87	91.51	2.88	8.02	0.70	1.96	8.36	23.26
	91	High Power	292	3.07	0.45	171.43	25.03	95.11	13.89	3.83	0.56	22.08	3.22
				Total	**38.29**		**198.30**		**97.19**		**5.86**		**72.28**

Table F-22
ARS 3
EMISSIONS FROM SINGLE ENGINE IN-FRAME MAINTENANCE RUN-UPS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft (Engine) and Number of Aircraft	Run-up mode	Number of Single Engine Run-ups/yr	VOC (b) Lb per Single Engine Run-up	VOC (b) Total (TPY)	NOx Lb per Single Engine Run-up	NOx Total (TPY)	CO Lb per Single Engine Run-up	CO Total (TPY)	SO2 Lb per Single Engine Run-up	SO2 Total (TPY)	PM10 Lb per Single Engine Run-up	PM10 Total (TPY)
1998	F-14A (TF30-P-412A)	Low Power	13824	4.65	32.11	9.59	66.26	8.91	61.57	0.39	0.01	5.87	40.54
	115	High Power	394	9.00	1.77	58.04	11.43	50.58	9.97	2.52	0.00	15.09	2.97
	F-14B/D (F110-GE-400)	Low Power	5,568	0.79	2.19	32.87	91.51	2.88	8.02	0.70	1.96	8.36	23.26
	91	High Power	292	3.07	0.45	171.43	25.03	95.11	13.89	3.83	0.56	22.08	3.22
	F/A-18 (F404-GE-400)	Low Power	7,883	4.07	16.03	5.72	22.56	9.70	38.23	0.18	0.71	3.16	12.47
	132	High Power	420	8.54	1.79	40.60	8.53	42.21	8.87	1.09	0.23	9.34	1.96
				Total	**54.34**		**225.33**		**140.54**		**3.46**		**84.44**
1999	F-14A (TF30-P-412A)	Low Power	13824	4.65	32.11	9.59	66.26	8.91	61.57	0.39	2.68	5.87	40.54
	115	High Power	394	9.00	1.77	58.04	11.43	50.58	9.97	2.52	0.50	15.09	2.97
	F-14B/D (F110-GE-400)	Low Power	5568	0.79	2.19	32.87	91.51	2.88	8.02	0.70	1.96	8.36	23.26
	91	High Power	292	3.07	0.45	171.43	25.03	95.11	13.89	3.83	0.56	22.08	3.22
	F/A-18 (F404-GE-400)	Low Power	8820	4.07	17.93	5.72	25.25	9.70	42.78	0.18	0.79	3.16	13.95
	156	High Power	496	8.54	2.12	40.60	10.07	42.21	10.47	1.09	0.27	9.34	2.32
				Total	**56.57**		**229.55**		**146.69**		**6.75**		**86.27**

Notes:
(a) In-frame maintenance run-ups for F-14A, F-14B/D, and F/A-18 aircraft in 1993 and 1999 from Wyle (1997) 1996-1998 maintenance run-ups were scaled from 1993 based on number of aircraft stationed at NAS Oceana.
(b) Aircraft VOC reported as HC in the form CHy/x

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-23
ARS 3
STATIONARY SOURCE EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	1993					1996					1997				
	VOC	NOx	CO	SO2	PM10	VOC	NOx	CO	SO2	PM10	VOC	NOx	CO	SO2	PM10
Stationary Sources:															
Boilers:	1.13	32.32	8.31	22.09	3.84	0.78	29.13	7.52	23.76	3.63	0.78	29.13	7.52	23.76	3.63
Generators	0.71	8.67	1.87	0.57	0.61	0.71	8.67	1.87	0.57	0.61	2.11	27.87	7.27	3.77	2.21
Engine Test Cells	6.24	37.65	49.39	1.80	4.32	3.94	28.46	39.07	1.31	3.95	5.05	37.01	50.83	1.71	4.62
JP-5 Fuel Handling	0.66	0.00	0.00	0.00	0.00	0.46	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.00	0.00
Service Station	19.35	0.00	0.00	0.00	0.00	4.46	0.00	0.00	0.00	0.00	4.67	0.00	0.00	0.00	0.00
Painting	19.30	0.00	0.00	0.00	0.00	13.29	0.00	0.00	0.00	0.00	24.05	0.00	0.00	0.00	0.00
Construction:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	47.39	78.64	59.57	24.46	8.77	23.64	66.26	48.46	25.64	8.19	37.20	94.01	65.62	29.24	10.46

Table F-23
ARS 3
STATIONARY SOURCE EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	1998					1999				
	VOC	**NOx**	**CO**	**SO2**	**PM10**	**VOC**	**NOx**	**CO**	**SO2**	**PM10**
Stationary Sources:										
Boilers:	0.62	27.13	6.68	22.82	3.38	0.62	27.13	6.68	22.82	3.38
Generators	2.11	27.87	7.27	3.77	2.21	2.11	27.87	7.27	3.77	2.21
Engine Test Cells	9.12	48.76	64.06	1.99	9.23	9.95	51.20	66.88	2.05	10.08
JP-5 Fuel Handling	0.81	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00
Service Station	6.40	0.00	0.00	0.00	0.00	6.72	0.00	0.00	0.00	0.00
Painting	34.12	0.00	0.00	0.00	0.00	34.16	0.00	0.00	0.00	0.00
Construction:	2.42	24.74	7.75	2.28	3.65	0.00	0.00	0.00	0.00	0.00
Total	55.60	128.50	85.76	30.86	18.47	54.46	106.20	80.83	28.64	15.67

Note: Shaded areas indicate nonattainment pollutants of concern.

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-24
ARS 3
EMISSION RATES FOR AIRCRAFT ENGINE TESTS AT NAS OCEANA
(SINGLE ENGINE IN TEST CELLS)

Engine (Aircraft)	Power Setting	Time in Power Setting (a) (minutes)	Fuel Flow (lb/min)	Calculated Fuel Usage (b) (gallons/test)	Emission Factor (c) ([lb /1000 lb fuel]/eng)					Single Engine Test Emissions (pounds)				
					VOC (d)	NOx	CO	SO2	PM10	VOC (d)	NOx	CO	SO2	PM10
TF30-P-412A (F-14A)	Idle	28.00	15.33	63.12	31.42	3.22	55.51	0.54	8.96	13.49	1.38	23.83	0.23	3.85
	75%	5.00	71.67	52.70	1.48	10.74	3.43	0.54	7.98	0.53	3.85	1.23	0.19	2.86
	81%	23.00	77.40	261.79	1.20	16.02	1.62	0.54	7.98	2.14	28.52	2.88	0.96	14.21
	A/B	22.00	796.67	2577.46	0.20	4.79	10.77	0.54	0.00	3.51	83.95	188.76	9.46	0.00
	Total	**78.00**		**2955.08**					**Per Test**	**19.66**	**117.70**	**216.70**	**10.85**	**20.91**
F110-GE-400 (F-14B/D)	Idle	54.00	19.50	154.85	3.97	2.74	15.75	0.54	12.38	4.18	2.89	16.58	0.57	13.04
	81%	44.00	143.70	929.82	0.26	19.61	0.76	0.54	2.81	1.64	123.99	4.81	3.41	17.77
	93%	25.00	198.22	728.75	0.31	28.53	1.08	0.54	2.81	1.54	141.38	5.35	2.68	13.92
	A/B	11.00	945.05	1528.76	3.75	12.64	44.21	0.54	0.00	38.98	131.40	459.59	5.61	0.00
	Total	**134.00**		**3342.18**					**Per Test**	**46.34**	**399.66**	**486.33**	**12.27**	**44.73**
J-52-P-8B (A-6)	Ground Idle	32.00	11.33	53.32	48.96	1.79	63.78	0.54	0.00	17.75	0.65	23.12	0.20	0.00
	IRP	18.00	122.83	325.14	1.08	13.05	0.71	0.54	0.00	2.39	28.85	1.57	1.19	0.00
	75% Thrust	24.00	72.00	254.12	0.87	10.10	3.00	0.54	0.00	1.50	17.45	5.18	0.93	0.00
	3k Lbs Thrust	25.00	38.33	140.92	1.99	6.34	10.54	0.54	0.00	1.91	6.08	10.10	0.52	0.00
	Total	**99.00**		**773.49**					**Per Test**	**23.55**	**53.03**	**39.98**	**2.84**	**0.00**
F404-GE-400 (F/A-18)	Idle	52.00	10.40	79.53	58.18	1.16	137.34	0.40	12.38	31.46	0.63	74.27	0.22	6.70
	80%	34.00	131.60	658.00	0.33	18.71	1.17	0.40	6.10	1.48	83.72	5.24	1.79	27.29
	A/B	3.00	473.28	208.80	0.13	9.22	23.12	0.40	0.00	0.18	13.09	32.83	0.57	0.00
	Total	**89.00**		**946.33**					**Per Test**	**33.12**	**97.43**	**112.34**	**2.57**	**33.99**

(a) Power setting and time in power setting taken from Wyle (1997) for F-14A, F-14B/D, and F/A-18 aircraft. A-6 data provided by COMNAVAIRLANT (Cdr. Vandenberg, Dec. 1996).
(b) Assumes a product density of 6.8 lb/gallon for JP-5.
(c) Data for calculating modal emission rates provided by the Navy Aircraft Environmental Support Office.
(d) Aircraft VOC reported as HC in the form CHy/x

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

A/B Max. = maximum afterburner
IRP = intermediate rated power (same as military)
75% = 75% throttle setting

Table F-25
ARS 3
EMISSIONS FROM AIRCRAFT ENGINE TESTING AT NAS OCEANA
FOR 1993 AND 1996-1999

Year	Engine Model	Number of Aircraft	Number of Tests/Year (a)	VOC (b)		NOx		CO		SO2		PM10	
				per test (lb)	Total (TPY)	per test (lb)	Total (TPY)	per test (lb)	Total (TPY)	per test	Total (TPY)	per test (lb)	Total (TPY)
1993	TF30-P-412A	80	152	19.66	1.49	117.70	8.95	216.70	16.47	10.[illegible]	0.82	20.91	1.59
	F110-GE-400	55	122	46.34	2.83	399.66	24.38	486.33	29.67	12.27	0.75	44.73	2.73
	J-52-P-8B	86	163	23.55	1.92	53.03	4.32	39.98	3.26	2.84	0.23	0.00	0.00
				Total	**6.24**		**37.65**		**49.39**		**1.80**		**4.32**
1996	TF30-P-412A	93	123	19.66	1.21	117.70	7.23	216.70	13.32	10.85	0.67	20.91	1.29
	F110-GE-400	69	100	46.34	2.32	399.66	20.00	486.33	24.34	12.27	0.61	44.73	2.24
	F404-GE-400	12	25	33.12	0.42	97.43	1.22	112.34	1.41	2.57	0.03	33.99	0.43
				Total	**3.94**		**28.46**		**39.07**		**1.31**		**3.95**
1997	TF30-P-412A	121	160	19.66	1.57	117.70	9.41	216.70	17.33	10.85	0.87	20.91	1.67
	F110-GE-400	91	132	46.34	3.06	399.66	26.38	486.33	32.10	12.27	0.81	44.73	2.95
	F404-GE-400	12	25	33.12	0.42	97.43	1.22	112.34	1.41	2.57	0.03	0.00	0.00
				Total	**5.05**		**37.01**		**50.83**		**1.71**		**4.62**
1998	TF30-P-412A	115	152	19.66	1.49	117.70	8.95	216.70	16.47	10.85	0.82	20.91	1.59
	F110-GE-400	91	132	46.34	3.06	399.66	26.38	486.33	32.10	12.27	0.81	44.73	2.95
	F404-GE-400	132	276	33.12	4.57	97.43	13.44	112.34	15.49	2.57	0.36	33.99	4.69
				Total	**9.12**		**48.76**		**64.06**		**1.99**		**9.23**
1999	TF30-P-412A	115	152	19.66	1.49	117.70	8.95	216.70	16.47	10.85	0.82	20.91	1.59
	F110-GE-400	91	132	46.34	3.06	399.66	26.38	486.33	32.10	12.27	0.81	44.73	2.95
	F404-GE-400	156	326	33.12	5.40	97.43	15.88	112.34	18.31	2.57	0.42	33.99	5.54
				Total	**9.95**		**51.20**		**66.88**		**2.05**		**10.08**

Notes:
(a) Number of engine tests per F-14A, F-14B/D, and F/A-18 aircraft from Wyle 1997. Number of A-6 engine tests per aircraft assumed to be the same as F-14A engine tests per aircraft.
(b) Aircraft VOC reported as HC in the form CHy/x
Shaded areas indicate the nonattainment pollutants of concern.

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-26
PARKING LOT CONSTRUCTION (4 LOTS) AND AIRCRAFT APRON - ARS 3
Equipment Exhaust Emissions

	Equipment	Days	Emission Factors (lb/1000 gal)					EMISSIONS (lbs)				
Equipment List	quantity	Used	**NOx**	**VOC**	**CO**	**SO2**	**PM10**	**NOx**	**VOC**	**CO**	**SO2**	**PM10**
Crane	0	0	403	35.0	82.0	31.2	27	0.0	0.0	0.0	0.0	0.0
Backhoe Loader	2	50	395	39.0	133.0	31.2	27	1975.0	195.0	665.0	156.0	135.0
Pan Scraper	1	16	340	19.6	97.7	31.2	27	272.0	15.7	78.2	25.0	21.6
Hi-Lift	0	0	364	31.0	121.0	31.2	25	0.0	0.0	0.0	0.0	0.0
Front-end Loader, wheels	1	50	403	23.5	94.0	31.2	29	1007.5	58.8	235.0	78.0	72.5
Pile Driver	0	0	403	35.0	82.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Track loader	1	0	391	23.5	94.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Grader	2	50	375	43.0	74.3	31.2	22	1875.0	215.0	371.5	156.0	110.0
Bulldozer	2	50	375	43.0	74.3	31.2	25	1875.0	215.0	371.5	156.0	125.0
Compactor	3	50	364	31.0	121.0	31.2	24	2730.0	232.5	907.5	234.0	180.0
Roller	3	50	364	31.0	121.0	31.2	24	2730.0	232.5	907.5	234.0	180.0
Paver	1	50	403	23.5	125.0	31.2	29	1007.5	58.8	312.5	78.0	72.5
haul trk/cement mixer, mob(gm/mi	4	50	8.0	2.1	9.93	2.8	2.15	352.4	92.5	437.4	123.3	94.7
haul trk/cement mixer, idl(gm/hr)	4	50	13.2	16.2	40.2	0	0	11.6	14.3	35.4	0.0	0.0
							Total, lb/yr	13836.1	1330.0	4321.5	1240.3	991.3
							Total TPY	**6.92**	**0.66**	**2.16**	**0.62**	**0.50**

Key:
- VOC = volatile organic compounds
- NOx = oxides of nitrogen
- CO = carbon monoxide
- SO2 = sulfur dioxide
- PM10 = particulate matter

Table F-26
NEW BUILDING/ADDITION CONSTRUCTION - ARS 3
Equipment Exhaust Emissions

EQUIPMENT LIST	Equipment quantity	Days Used	Emission Factors (lb/1000 gal) NOx	VOC	CO	SO2	PM10	EMISSIONS (lbs) NOx	VOC	CO	SO2	PM10
Crane	3	120	403	35.0	82.0	31.2	27	7254.0	630.0	1476.0	561.6	486.0
Backhoe Loader	2	120	395	39.0	133.0	31.2	27	4740.0	468.0	1596.0	374.4	324.0
Pan Scraper	1	120	340	19.6	97.7	31.2	27	2040.0	117.6	586.2	187.2	162.0
Hi-Lift	4	120	364	31.0	121.0	31.2	25	8736.0	744.0	2904.0	748.8	600.0
Front-end Loader, wheels	1	120	403	23.5	94.0	31.2	29	2418.0	141.0	564.0	187.2	174.0
Pile Driver	0	0	403	35.0	82.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Track loader	0	0	391	23.5	94.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Grader	1	120	375	43.0	74.3	31.2	22	2250.0	258.0	445.8	187.2	132.0
Bulldozer	2	120	375	43.0	74.3	31.2	25	4500.0	516.0	891.6	374.4	300.0
Compactor	1	120	364	31.0	121.0	31.2	24	2184.0	186.0	726.0	187.2	144.0
Roller	0	0	364	31.0	121.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Paver	0	0	403	23.5	125.0	31.2	29	0.0	0.0	0.0	0.0	0.0
haul trk, mob(gm/mi)	7	120	8.0	2.1	9.93	2.8	2.15	1480.2	388.5	1837.3	518.1	397.8
haul trk, idl(gm/hr)	7	120	13.2	16.2	40.2	0	0	48.8	59.9	148.8	0.0	0.0
							Total Lb/yr	**35651.0**	**3509.1**	**11175.6**	**3326.1**	**2719.8**
							Total TPY	**17.83**	**1.75**	**5.59**	**1.66**	**1.36**

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-27
ANNUAL DEMOLITION PARTICULATE EMISSIONS - ARS 3

Floor Space (SQ FT)	STRUCTURE REMOVAL (LBS)	DEBRIS REMOVAL (LBS)	VEHICLE ACTIVITY (LBS)	EMISSIONS SUM	
				LBS/YR	TPY
169,025	8.6	158.9	1799.3	1966.8	0.98

Notes:
Demolition square ft assumed = 10 % of new construction sq ft
PM emission from structure takedown based on sq ft *EF
PM emission from debris removal based on sq ft *EF
PM emission from on-site vehicle activity based on sq ft *EF
Pushing (bulldozing) PM emission put under site prep spreadsheet
Reference EPA-450/2-92-004 (Fugitive Dust document)
(all EF's in EPA document converted to english units)

Table F-27

ANNUAL SITE PREPARATION PARTICULATE EMISSIONS FOR CONSTRUCTION AT NAS OCEANA - ARS 3

ACRES	ACTIVITY DAYS	BULLDOZIN (LBS)	PAN SCRAPING SOIL REMOV(LBS)	PAN SCRAPING ETHMOVING (LBS)	EMISSIONS SUM	
					LBS/YR	TPY
39	100	600	624	394	1618	0.81

Notes:
Acreage estimate based on building sq ft*2
Estimate activity days for preferred, develop ratio days:acres
Apply ratio to ARS acreages to get activity days
Bulldozing pm emissions based on 8hr/activity day * EF (EPA 1992)
Soil removal emiss based on VMT/acre *acres*EF (EPA 1992)
Earthmoving emiss based on soil removal miles *3 (BEE)*EF
EPA 1992 is Fugitive Dust BG document (EPA-450/2-92-004)

Table F-28
Total Construction Emissions (Exhaust and Dust) - ARS 3

Project/Source	**Emissions (tons/yr)**				
Engine Exhaust Emissions	**VOC**	**NOx**	**CO**	**SOx**	**PM10**
Parking Lot Construction	0.66	6.92	2.16	0.62	0.50
Building/Addition Const. (total)	1.75	17.83	5.59	1.66	1.36
Demolition/Construction Activity					
Mechanical dust Generation	0.00	0.00	0.00	0.00	1.79
Total	**2.42**	**24.74**	**7.75**	**2.28**	**3.65**

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-29
AIR EMISSIONS SUMMARY - NAS OCEANA AND NALF FENTRESS - ARS 3
(tons per year)

	1993					1996					1997				
Source Type	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**
NAS Oceana:															
Mobile Sources:															
Aircraft Operations	272.13	328.88	609.85	18.59	152.58	122.22	222.92	292.03	10.73	120.83	149.41	287.13	357.52	13.77	155.59
Total Aircraft:	**272.13**	**328.88**	**609.85**	**18.59**	**152.58**	**122.22**	**222.92**	**292.03**	**10.73**	**120.83**	**149.41**	**287.13**	**357.52**	**13.77**	**155.59**
Other Mobile Sources:															
GSE	5.13	26.43	72.65	1.71	2.00	0.00	0.00	0.00	0.00	0.00	4.57	34.01	18.73	2.20	2.66
Maintenance Run-ups	70.29	177.95	130.69	5.82	47.42	29.40	136.41	61.78	3.90	47.42	38.29	198.30	97.19	5.86	72.28
Generators	0.56	6.89	1.48	0.45	0.48	0.56	6.89	1.48	0.45	0.48	0.56	6.89	1.48	0.45	0.48
Total Other Mobile:	**75.97**	**211.27**	**204.82**	**7.98**	**49.90**	**29.96**	**143.30**	**63.26**	**4.35**	**47.90**	**43.42**	**239.20**	**117.40**	**8.51**	**75.42**
Stationary Sources:															
Boilers:	1.13	32.32	8.31	22.09	3.84	0.78	29.13	7.52	23.76	3.63	0.78	29.13	7.52	23.76	3.63
Generators	0.71	8.67	1.87	0.57	0.61	0.71	8.67	1.87	0.57	0.61	2.11	27.87	7.27	3.77	2.21
Engine Test Cells	6.24	37.65	49.39	1.80	4.32	3.94	28.46	39.07	1.31	3.95	5.05	37.01	50.83	1.71	4.62
JP-5 Fuel Handling	0.66	0.00	0.00	0.00	0.00	0.46	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.00	0.00
Service Station	19.35	0.00	0.00	0.00	0.00	4.46	0.00	0.00	0.00	0.00	4.67	0.00	0.00	0.00	0.00
Painting	19.30	0.00	0.00	0.00	0.00	13.29	0.00	0.00	0.00	0.00	24.05	0.00	0.00	0.00	0.00
Construction:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Stationary:	**47.39**	**78.64**	**59.57**	**24.46**	**8.77**	**23.64**	**66.26**	**48.46**	**25.64**	**8.19**	**37.20**	**94.01**	**65.62**	**29.24**	**10.46**
Total NASO:	**395.49**	**618.78**	**874.24**	**51.04**	**211.24**	**175.82**	**432.48**	**403.74**	**40.71**	**176.92**	**230.03**	**620.34**	**540.54**	**51.52**	**241.47**
NALF Fentress:															
Aircraft	13.48	146.63	37.00	6.81	30.87	11.86	157.08	25.30	6.47	42.82	13.77	191.22	29.55	7.64	56.05
Total Annual:	**408.97**	**765.41**	**911.24**	**57.85**	**242.11**	**187.68**	**589.56**	**429.04**	**47.19**	**219.73**	**243.80**	**811.56**	**570.09**	**59.16**	**297.52**

Table F-29
AIR EMISSIONS SUMMARY - NAS OCEANA AND NALF FENTRESS - ARS 3
(tons per year)

	1998					1999				
Source Type	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**
NAS Oceana:										
Mobile Sources:										
Aircraft Operations	302.12	436.54	797.59	19.57	235.03	333.68	467.38	887.82	20.80	251.55
Total Aircraft:	**302.12**	**436.54**	**797.59**	**19.57**	**235.03**	**333.68**	**467.38**	**887.82**	**20.80**	**251.55**
Other Mobile Sources:										
GSE	0.10	1.21	0.26	0.08	0.08	0.00	0.00	0.00	0.00	0.00
Maintenance Run-ups	54.34	225.33	140.54	3.46	84.44	56.57	229.55	146.69	6.75	86.27
Generators	0.56	6.89	1.48	0.45	0.48	0.56	6.89	1.48	0.45	0.48
Total Other Mobile:	**55.00**	**233.42**	**142.28**	**3.99**	**85.00**	**57.13**	**236.44**	**148.17**	**7.20**	**86.75**
Stationary Sources:										
Boilers:	0.62	27.13	6.68	22.82	3.38	0.62	27.13	6.68	22.82	3.38
Generators	2.11	27.87	7.27	3.77	2.21	2.11	27.87	7.27	3.77	2.21
Engine Test Cells	9.12	48.76	64.06	1.99	9.23	9.95	51.20	66.88	2.05	10.08
JP-5 Fuel Handling	0.81	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00
Service Station	6.40	0.00	0.00	0.00	0.00	6.72	0.00	0.00	0.00	0.00
Painting	34.12	0.00	0.00	0.00	0.00	34.16	0.00	0.00	0.00	0.00
Construction:	2.42	24.74	7.75	2.28	3.65	0.00	0.00	0.00	0.00	0.00
Total Stationary:	**55.60**	**128.50**	**85.76**	**30.86**	**18.47**	**54.46**	**106.20**	**80.83**	**28.64**	**15.67**
Total NASO:	**412.72**	**798.47**	**1,025.63**	**54.43**	**338.50**	**445.27**	**810.02**	**1,116.82**	**56.65**	**353.97**
NALF Fentress:										
Aircraft	15.33	244.11	36.18	9.33	78.68	15.67	254.22	37.50	9.66	83.08
Total Annual:	**428.05**	**1,042.58**	**1,061.81**	**63.76**	**417.18**	**460.94**	**1,064.25**	**1,154.33**	**66.31**	**437.05**

Note: Shaded areas indicate nonattainment pollutants of concern.

Key: VOC = volatile organic compounds. SO2 = sulfur dioxide.
NOx = oxides of nitrogen. PM10 = particulate matter. JP-5 = jet fuel.
CO = carbon monoxide. GSE = Ground Support Equipment

Table F-30
NET EMISSIONS CHANGE - NAS OCEANA AND NALF FENTRESS - ARS 3
(tons per year)

Year	VOCs	NOx	CO	SO2	PM10
NAS Oceana:					
1993	395.49	618.78	874.24	51.04	211.24
1996	175.82	432.48	403.74	40.71	176.92
1997	230.03	620.34	540.54	51.52	241.47
1998	412.72	798.47	1025.63	54.43	338.50
1999	445.27	810.02	1116.82	56.65	353.97
Net Change:					
1993 to 1999	**49.78**	**191.24**	**242.58**	**5.61**	**142.73**
NALF Fentress:					
1993	13.48	146.63	37.00	6.81	30.87
1996	11.86	157.08	25.30	6.47	42.82
1997	13.77	191.22	29.55	7.64	56.05
1998	15.33	244.11	36.18	9.33	78.68
1999	15.67	254.22	37.50	9.66	83.08
Net Change:					
1993 to 1999	**2.19**	**107.59**	**0.50**	**2.86**	**52.21**
Net Change NAS Oceana and NALF Fentress:					
1993 to 1999	**51.97**	**298.83**	**243.09**	**8.47**	**194.94**

Note: Shaded areas indicate nonattainment pollutants of concern.

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-31
ARS 4
TOTAL AIRCRAFT OPERATIONS AT NAS OCEANA AND NALF FENTRESS
FOR 1993 AND 1996-1999

Aircraft Type	Operation type	1993	1996	1997	1998	1999
F-14A	Full LTO	12,465	9,139	11,891	11,301	11,301
	Touch&Go NASO	15,236	12,160	15,821	15,037	15,037
	GCA Box	2,178	884	1,150	1,093	1,093
	Interfacility	2,164	1,655	2,153	2,046	2,046
	Touch&Go NALF	10,511	13,851	18,021	17,127	17,127
F-14B/D	Full LTO	8,551	6,781	8,943	8,943	8,943
	Touch&Go NASO	10,452	9,022	11,898	11,898	11,898
	GCA Box	1,494	656	865	865	865
	Interfacility	1,485	1,228	1,619	1,619	1,619
	Touch&Go NALF	7,226	10,276	13,553	13,553	13,553
A-6	Full LTO	13,401	0	0	0	0
	Touch&Go NASO	16,380	0	0	0	0
	GCA Box	2,341	0	0	0	0
	Interfacility	2,326	0	0	0	0
	Touch&Go NALF	11,086	0	0	0	0
F/A-18	Full LTO	0	1,763	1,763	12,338	19,388
	Touch&Go NASO	0	2,904	2,904	20,327	31,942
	GCA Box	0	0	0	617	970
	Interfacility	0	0	0	1,778	2,794
	Touch&Go NALF	0	0	0	13,221	20,776
A-4	Full LTO	4,169	0	0	0	0
	Touch&Go	5,096	0	0	0	0
F-16	Full LTO	936	0	0	0	0
	Touch&Go	1,144	0	0	0	0
F-5	Full LTO	808	0	0	0	0
	Touch&Go	988	0	0	0	0
TC-4C	Full LTO	638	0	0	0	0
	Touch&Go	780	0	0	0	0
UH-3H	Full LTO	662	0	0	0	0
C-12	Full LTO	261	1,677	1,677	1,677	1,677
	Touch&Go	445	2,759	2,759	2,759	2,759
	GCA Box	0	1,103	1,103	1,103	1,103
S-3	Full LTO	1,741	967	967	967	967
	Touch&Go	1,295	941	941	941	941
	GCA Box	1,323	371	371	371	371
T-2C	Full LTO	1,418	0	0	0	0
T-34	Full LTO	1,040	1,040	1,040	1,040	1,040
E-2/C-2	Full LTO NALF	1,074	0	0	0	0
	Touch&Go NALF	25,058	21,374	21,374	21,374	21,374
Total		**166,172**	**100,549**	**120,812**	**161,995**	**189,584**

Notes:
(1) F-14 operations divided between F-14As and F-14B/Ds using 1993 aircraft population data.
Number of GCAs and interfacility flights were proportioned from 1997 data based on the number of aircraft.
(2) 1996-1998 operations proportioned from 1999 data using NAS Oceana aircraft population data
A-6s assumed decommissioned by mid-1997.
(3) 1999 and Transient aircraft operations derived from NASMOD analysis (ATAC 1997).
(4) GCA box and interfacility flights include only the level portion of those operations.
Takeoff and landings for these operations are accounted for under full LTO or T&G.

Key:
LTO = Landing and takeoff cycle
GCA = Ground Control Approach
NASO = Naval Air Station Oceana
NALF = Naval Auxiliary Landing Field

Table F-32
ARS 4
MODAL EMISSION RATES FOR AIRCRAFT AT NAS OCEANA

Aircraft (Engine Model)	Mode	Time in Mode (minutes)	Fuel Flow ((lb/min)/eng)	Engines	Emission Factor ([lb /1000 lb fuel]/eng)					Modal Emission Rates (lb/mode)				
					VOC (1)	NOx	CO	SO2	PM10 (2)	VOC (1)	NOx	CO	SO2	PM10 (2)
F-14A	Taxi Out/Idle	7.0	15.33	2	31.42	3.22	55.51	0.54	8.96	6.74	0.69	11.91	0.12	1.92
(TF30-P-412A)	Hot Refueling Idle	16.0	15.33	2	31.42	3.22	55.51	0.54	8.96	15.41	1.58	27.23	0.26	4.40
	Take Off	0.4	796.67	2	0.20	4.79	10.77	0.54	0.00	0.13	3.05	6.86	0.34	0.00
	Climbout	0.4	117.50	2	0.77	19.60	1.38	0.54	2.98	0.07	1.84	0.13	0.05	0.28
	Approach	1.3	71.67	2	1.48	10.74	3.43	0.54	7.98	0.28	2.00	0.64	0.10	1.49
	Taxi In/Idle	5.3	15.33	2	31.42	3.22	55.51	0.54	8.96	5.11	0.52	9.02	0.09	1.46
	T&G Level	1.4	71.67	2	1.48	10.74	3.43	0.54	7.98	0.30	2.16	0.69	0.11	1.60
	GCA Box	9.7	71.67	2	1.48	10.74	3.43	0.54	7.98	2.06	14.93	4.77	0.75	11.10
	Interfacility	1.6	71.67	2	1.48	10.74	3.43	0.54	7.98	0.34	2.46	0.79	0.12	1.83
									Touch and Go	**0.65**	**6.00**	**1.46**	**0.26**	**3.37**
									Full LTO w/hot ref.	**27.74**	**9.69**	**55.80**	**0.96**	**9.54**
									Full LTO w/o hot ref.	**12.32**	**8.11**	**28.57**	**0.70**	**5.15**
									Interfacility	**0.34**	**2.46**	**0.79**	**0.12**	**1.83**
									GCA Box	**2.06**	**14.93**	**4.77**	**0.75**	**11.10**
F-14B/D	Taxi Out/Idle	7.0	19.52	2	3.65	2.77	16.60	0.54	12.38	1.00	0.76	4.54	0.15	3.38
(F110-GE-400)	Hot Refueling Idle	16.0	19.52	2	3.65	2.77	16.60	0.54	12.38	2.28	1.73	10.37	0.34	7.73
	Take Off	0.4	195.32	2	0.40	28.63	0.84	0.54	2.81	0.06	4.47	0.13	0.08	0.44
	Climbout	0.4	195.32	2	0.40	28.63	0.84	0.54	2.81	0.06	4.47	0.13	0.08	0.44
	Approach	1.3	133.03	2	0.26	19.61	0.76	0.54	6.10	0.09	6.78	0.26	0.19	2.11
	Taxi In/Idle	5.3	19.52	2	3.65	2.77	16.60	0.54	12.38	0.76	0.57	3.43	0.11	2.56
	T&G Level	1.4	64.10	2	0.95	8.75	1.64	0.54	6.10	0.17	1.57	0.29	0.10	1.09
	GCA Box	9.7	64.10	2	0.95	8.75	1.64	0.54	6.10	1.18	10.88	2.04	0.67	7.59
	Interfacility	1.6	64.10	2	0.95	8.75	1.64	0.54	6.10	0.19	1.79	0.34	0.11	1.25
									Touch and Go	**0.32**	**12.83**	**0.69**	**0.37**	**3.64**
									Full LTO w/hot ref.	**4.25**	**18.79**	**18.87**	**0.95**	**16.67**
									Full LTO w/o hot ref.	**1.97**	**17.06**	**8.50**	**0.61**	**8.93**
									Interfacility	**0.19**	**1.79**	**0.34**	**0.11**	**1.25**
									GCA Box	**1.18**	**10.88**	**2.04**	**0.67**	**7.59**
A-6	Taxi Out/Idle	7.0	11.33	2	42.20	1.79	63.78	0.54	0.00	6.69	0.28	10.12	0.09	0.00
(J-52-P-8B)	Hot Refueling Idle	20.0	11.33	2	42.20	1.79	63.78	0.54	0.00	19.13	0.81	28.91	0.24	0.00
	Take Off	0.4	122.83	2	0.93	13.05	0.71	0.54	0.00	0.09	1.28	0.07	0.05	0.00
	Climbout	0.4	72.00	2	0.58	10.10	3.00	0.54	0.00	0.03	0.58	0.17	0.03	0.00
	Approach	1.3	38.33	2	1.72	6.34	10.54	0.54	0.00	0.17	0.63	1.05	0.05	0.00
	Taxi In/Idle	5.3	11.33	2	42.20	1.79	63.78	0.54	0.00	5.07	0.21	7.66	0.06	0.00
	T&G Level	1.4	38.33	2	1.72	6.34	10.54	0.54	0.00	0.18	0.68	1.13	0.06	0.00
	GCA Box	9.7	38.33	2	1.72	6.34	10.54	0.54	0.00	1.28	4.71	7.84	0.40	0.00
	Interfacility	1.6	38.33	2	1.72	6.34	10.54	0.54	0.00	0.21	0.78	1.29	0.07	0.00
									Touch and Go	**0.39**	**1.89**	**2.35**	**0.14**	**0.00**
									Full LTO w/hot ref.	**31.18**	**3.81**	**47.97**	**0.53**	**0.00**
									Full LTO w/o hot ref.	**12.06**	**2.99**	**19.07**	**0.29**	**0.00**
									Interfacility	**0.21**	**0.78**	**1.29**	**0.07**	**0.00**
									GCA Box	**1.28**	**4.71**	**7.84**	**0.40**	**0.00**

Table F-32
ARS 4
MODAL EMISSION RATES FOR AIRCRAFT AT NAS OCEANA

Aircraft (Engine Model)	Mode	Time in Mode (minutes)	Fuel Flow ((lb/min)/eng)	Engines	Emission Factor ([lb /1000 lb fuel]/eng)					Modal Emission Rates (lb/mode)				
					VOC (1)	NOx	CO	SO2	PM10 (2)	VOC (1)	NOx	CO	SO2	PM10 (2)
A-4	Taxi Out/Idle	6.5	11.33	1	42.20	1.79	63.78	0.54	0.00	3.11	0.13	4.70	0.04	0.00
(J-52-P-8B)	Take Off	0.4	122.83	1	0.93	13.05	0.71	0.54	0.00	0.05	0.64	0.03	0.03	0.00
	Climbout	0.4	72.00	1	0.58	10.10	3.00	0.54	0.00	0.02	0.29	0.09	0.02	0.00
	Approach	1.3	38.33	1	1.72	6.34	10.54	0.54	0.00	0.09	0.32	0.53	0.03	0.00
	Taxi In/Idle	6.5	11.33	1	42.20	1.79	63.78	0.54	0.00	3.11	0.13	4.70	0.04	0.00
	T&G Level	1.4	38.33	1	1.72	6.34	10.54	0.54	0.00	0.09	0.34	0.57	0.03	0.00
									Touch and Go	**0.19**	**0.95**	**1.18**	**0.07**	**0.00**
									Full LTO w/o hot ref.	**6.36**	**1.51**	**10.04**	**0.15**	**0.00**
F-16	Taxi Out/Idle	6.5	17.67	1	2.26	3.96	19.34	0.54	0.09	0.26	0.45	2.22	0.06	0.01
(F100-PW-100)	Take Off	0.4	736.67	1	0.10	16.50	55.10	0.54	0.00	0.03	4.86	16.24	0.16	0.00
	Climbout	0.4	173.33	1	0.05	44.00	1.80	0.54	0.83	0.00	3.05	0.12	0.04	0.06
	Approach	1.3	50.00	1	0.60	11.00	3.00	0.54	0.33	0.04	0.72	0.20	0.04	0.01
	Taxi In/Idle	6.5	17.67	1	2.26	3.96	19.34	0.54	0.09	0.26	0.45	2.22	0.06	0.01
	T&G Level	1.4	50.00	1	0.60	11.00	3.00	0.54	0.33	0.04	0.77	0.21	0.04	0.02
									Touch and Go	**0.08**	**4.54**	**0.53**	**0.11**	**0.09**
									Full LTO w/o hot ref.	**0.59**	**9.54**	**21.00**	**0.36**	**0.088**
F-5	Taxi Out/Idle	6.5	6.67	2	24.25	1.25	159.00	0.54	0.00	2.10	0.11	13.79	0.05	0.00
(J85-GE-21)	Take Off	0.4	177.50	2	0.10	5.60	36.40	0.54	0.00	0.01	0.80	5.17	0.08	0.00
	Climbout	0.4	53.33	2	0.25	5.00	21.56	0.54	0.00	0.01	0.21	0.92	0.02	0.00
	Approach	1.3	20.00	2	2.58	2.92	46.25	0.54	0.00	0.13	0.15	2.41	0.03	0.00
	Taxi In/Idle	6.5	6.67	2	24.45	1.25	159.00	0.54	0.00	2.12	0.11	13.79	0.05	0.00
	T&G Level	1.4	20.00	2	2.58	2.92	46.25	0.54	0.00	0.14	0.16	2.59	0.03	0.00
									Touch and Go	**0.29**	**0.53**	**5.91**	**0.08**	**0.00**
									Full LTO w/o hot ref.	**4.38**	**1.38**	**36.07**	**0.22**	**0.00**
F/A-18	Taxi Out/Idle	7.0	10.40	2	58.18	1.16	137.34	0.40	12.38	8.47	0.17	20.00	0.06	1.80
(F404-GE-400)	Hot Refueling Idle	11.0	10.40	2	58.18	1.16	137.34	0.40	12.38	13.31	0.27	31.42	0.09	2.83
	Take Off	0.4	473.28	2	0.13	9.22	23.12	0.40	0.00	0.05	3.49	8.75	0.15	0.00
	Climbout	0.4	143.12	2	0.31	25.16	1.05	0.40	2.81	0.04	2.88	0.12	0.05	0.32
	Approach	1.3	66.75	2	0.44	8.37	1.78	0.40	6.10	0.08	1.45	0.31	0.07	1.06
	Taxi In/Idle	5.3	10.40	2	58.18	1.16	137.34	0.40	12.38	6.41	0.13	15.14	0.04	1.36
	T&G Level	1.7	60.00	2	0.44	8.37	1.78	0.40	6.10	0.09	1.71	0.36	0.08	1.24
	GCA Box	9.0	60.00	2	0.44	8.37	1.78	0.40	6.10	0.48	9.04	1.92	0.43	6.59
	Interfacility	1.4	85.00	2	0.38	11.78	1.16	0.40	6.10	0.09	2.80	0.28	0.10	1.45
									Touch and Go	**0.20**	**6.04**	**0.79**	**0.20**	**2.62**
									Full LTO w/hot ref.	**28.36**	**8.39**	**75.74**	**0.46**	**7.38**
									Full LTO w/o hot ref.	**15.05**	**8.12**	**44.32**	**0.37**	**4.55**
									Interfacility	**0.09**	**2.80**	**0.28**	**0.10**	**1.45**
									GCA Box	**0.48**	**9.04**	**1.92**	**0.43**	**6.59**

Table F-32
ARS 4
MODAL EMISSION RATES FOR AIRCRAFT AT NAS OCEANA

Aircraft (Engine Model)	Mode	Time in Mode (minutes)	Fuel Flow ((lb/min)/eng)	Engines	Emission Factor ([lb /1000 lb fuel]/eng)					Modal Emission Rates (lb/mode)				
					VOC (1)	NOx	CO	SO2	PM10 (2)	VOC (1)	NOx	CO	SO2	PM10 (2)
S-3	Taxi Out/Idle	6.5	7.63	2	14.99	1.69	90.98	0.54	3.26	1.49	0.17	9.02	0.05	0.32
(TF34-GE-400)	Hot Refueling Idle	8.0	7.63	2	14.99	1.69	90.98	0.54	3.26	1.83	0.21	11.11	0.07	0.40
	Take Off	0.4	63.33	2	0.39	7.51	5.95	0.54	2.11	0.02	0.38	0.30	0.03	0.11
	Climbout	0.4	7.67	2	2.63	3.42	33.57	0.54	6.85	0.02	0.02	0.21	0.00	0.04
	Approach	1.3	7.67	2	2.63	3.42	33.57	0.54	6.85	0.05	0.07	0.67	0.01	0.14
	Taxi In/Idle	6.5	7.63	2	14.99	1.69	90.98	0.54	3.26	1.49	0.17	9.02	0.05	0.32
	T&G Level	1.8	7.67	2	2.63	3.42	33.57	0.54	6.85	0.07	0.09	0.93	0.01	0.19
	GCA Box	7.5	7.67	2	2.63	3.42	33.57	0.54	6.85	0.30	0.39	3.86	0.06	0.79
									Touch and Go	**0.14**	**0.18**	**1.80**	**0.03**	**0.37**
									Full LTO w/hot ref.	**4.89**	**1.01**	**30.33**	**0.21**	**1.33**
									Full LTO w/o hot ref	**3.06**	**0.80**	**19.23**	**0.15**	**0.93**
									GCA Box	**0.30**	**0.39**	**3.86**	**0.06**	**0.79**
C-12/TC-4	Taxi Out/Idle	19.0	2.45	2	101.63	1.97	115.31	0.54	0.00	9.46	0.18	10.74	0.05	0.00
(PTGA-41)	Take Off	0.5	8.50	2	1.75	7.98	5.10	0.54	0.00	0.01	0.07	0.04	0.00	0.00
	Climbout	2.1	7.88	2	2.03	7.57	6.49	0.54	0.00	0.07	0.25	0.21	0.02	0.00
	Approach	3.7	4.55	2	22.71	4.65	34.80	0.54	0.00	0.76	0.16	1.17	0.02	0.00
	Taxi In/Idle	7.0	2.45	2	101.63	1.97	115.31	0.54	0.00	3.49	0.07	3.96	0.02	0.00
	T&G Level	2.0	4.55	2	22.71	4.65	34.80	0.54	0.00	0.41	0.08	0.63	0.01	0.00
	GCA Box	7.5	4.55	2	22.71	4.65	34.80	0.54	0.00	1.55	0.32	2.38	0.04	0.00
									Touch and Go	**1.25**	**0.49**	**2.02**	**0.05**	**0.00**
									Full LTO w/o hot ref	**13.79**	**0.73**	**16.12**	**0.11**	**0.00**
									GCA Box	**1.55**	**0.32**	**2.38**	**0.04**	**0.00**
UH-3H	Taxi Out/Idle	8.0	2.20	2	130.42	1.43	178.44	0.54	0.00	4.59	0.05	6.28	0.02	0.00
(T58-GE-8F)	Take Off	0.0	13.10	2	0.40	5.47	9.03	0.54	0.00	0.00	0.00	0.00	0.00	0.00
	Climbout	5.7	10.45	2	0.80	4.68	14.13	0.54	0.00	0.10	0.08	0.11	0.03	0.00
	Approach	5.7	9.68	2	1.12	4.47	17.28	0.54	0.00	0.13	0.53	2.06	0.06	0.00
	Taxi In/Idle	7.0	2.20	2	130.42	1.43	178.44	0.54	0.00	4.02	0.04	5.50	0.02	0.00
									Full LTO w/o hot ref	**8.84**	**0.71**	**13.94**	**0.13**	**0.00**
T-34	Taxi Out/Idle	6.5	1.92	1	50.17	2.43	64.00	0.54	0.00	0.63	0.03	0.80	0.01	0.00
(PTGA-25)	Take Off	0.4	7.08	1	0.00	7.81	1.01	0.54	0.00	0.00	0.02	0.00	0.00	0.00
	Climbout	0.4	6.67	1	0.00	7.00	1.20	0.54	0.00	0.00	0.02	0.00	0.00	0.00
	Approach	1.3	3.58	1	2.19	8.37	23.02	0.54	0.00	0.01	0.04	0.11	0.00	0.00
	Taxi In/Idle	6.5	1.92	1	50.17	2.43	64.00	0.54	0.00	0.63	0.03	0.80	0.01	0.00
									Full LTO w/o hot ref	**1.26**	**0.14**	**1.71**	**0.02**	**0.00**

Table F-32
ARS 4
MODAL EMISSION RATES FOR AIRCRAFT AT NAS OCEANA

Aircraft (Engine Model)	Mode	Time in Mode (minutes)	Fuel Flow ((lb/min)/eng)	Engines	Emission Factor ([lb /1000 lb fuel]/eng)					Modal Emission Rates (lb/mode)				
					VOC (1)	NOx	CO	SO2	PM10 (2)	VOC (1)	NOx	CO	SO2	PM10 (2)
T-2	Taxi Out/Idle	6.5	9.33	2	11.86	3.68	111.86	0.54	0.00	1.44	0.45	13.57	0.07	0.00
(J85-GE-2)	Take Off	0.4	48.17	2	0.45	6.40	21.56	0.54	0.00	0.02	0.25	0.83	0.02	0.00
	Climbout	0.4	35.92	2	0.64	5.67	28.38	0.54	0.00	0.02	0.16	0.82	0.02	0.00
	Approach	1.3	17.42	2	2.40	4.02	63.53	0.54	0.00	0.11	0.18	2.88	0.02	0.00
	Taxi In/Idle	6.5	9.33	2	11.86	3.68	111.86	0.54	0.00	1.44	0.45	13.57	0.07	0.00
									Full LTO w/o hot ref	**3.02**	**1.48**	**31.66**	**0.19**	**0.00**
E-2/C-2	Taxi Out/Idle	19.0	9.98	2	19.24	3.53	30.11	0.54	0.00	7.30	1.34	11.42	0.20	0.00
(T56-A-16)	Take Off	0.5	36.98	2	0.14	10.45	0.65	0.54	0.00	0.01	0.39	0.02	0.02	0.00
	Climbout	2.1	36.98	2	0.14	10.45	0.65	0.54	0.00	0.02	1.62	0.10	0.08	0.00
	Approach	3.7	33.27	2	0.17	9.93	0.42	0.54	0.00	0.04	2.44	0.10	0.13	0.00
	Taxi In/Idle	7.0	9.98	2	19.24	3.53	30.11	0.54	0.00	2.69	0.49	4.21	0.08	0.00
	T&G Level	1.6	15.00	2	0.95	6.52	4.54	0.54	0.00	0.05	0.31	0.22	0.03	0.00
									Touch and Go	**0.11**	**4.38**	**0.42**	**0.24**	**0.00**
									Full LTO w/o hot ref	**10.05**	**6.29**	**15.85**	**0.52**	**0.00**

Notes:

(a) F-14 operations were divided between F-14As and F-14Bs based on the number of aircraft present in 1993. Number of GCAs and interfacility flights were proportioned from 1997 data based on the number of aircraft.

(b) 1996-1998 operations were proportioned from 1999 data based upon the numbers of aircraft based at NAS Oceana during those years. A-6s assumed to be deployed in 1996 and decommissioned by mid-1997.

(c) Transient aircraft operations, derived from NASMOD analysis (ATAC 1997).

(d) 1999 operations were derived from NASMOD analysis(ATAC 1997).

(e) Aircraft VOC reported as HC in the form CHy/x

Shaded areas indicate nonattainment pollutants of concern.

The LTOs listed for GCA box and interfacility flights include only the level portion of those operations. Takeoff and landings for these operations are accounted for under full LTO or T&G.

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

LTO w/ hot ref. = landing and takeoff cycle with hot refueling idle
LTO w/o hot ref. = landing and takeoff cycle without hot refueling idle
interfacility = low altitude operations between NAS Oceana and NALF Fentress
GCA = ground control approach
lb = pounds TPY = tons per year

Table F-33
ARS 4
AIRCRAFT EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Yea	VOC (e)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1993	F-14A	Full LTO w/hot ref.	3,116	27.74	43.22	9.69	15.10	55.80	86.94	0.96	1.50	9.54	14.87
		Full LTO w/o hot ref.	9,349	12.32	57.61	8.11	37.91	28.57	133.54	0.70	3.27	5.15	24.06
		Touch&Go	15,236	0.65	4.91	6.00	45.70	1.46	11.10	0.26	1.98	3.37	25.66
		GCA Box	2,178	2.06	2.24	14.93	16.26	4.77	5.19	0.75	0.82	11.10	12.08
		Interfacility	2,164	0.34	0.37	2.46	2.67	0.79	0.85	0.12	0.13	1.83	1.98
	F-14B	Full LTO w/hot ref.	2,138	4.25	4.54	18.79	20.09	18.87	20.17	0.95	1.02	16.67	17.81
		Full LTO w/o hot ref.	6,414	1.97	6.31	17.06	54.71	8.50	27.25	0.61	1.97	8.93	28.65
		Touch&Go	10,452	0.32	1.69	12.83	67.03	0.69	3.60	0.37	1.92	3.64	19.04
		GCA Box	1,494	1.18	0.88	10.88	8.13	2.04	1.52	0.67	0.50	7.59	5.67
		Interfacility	1,485	0.19	0.14	1.79	1.33	0.34	0.25	0.11	0.08	1.25	0.93
	A-6	Full LTO w/hot ref.	3,350	31.18	52.24	3.81	6.38	47.97	80.37	0.53	0.89	0.00	0.00
		Full LTO w/o hot ref.	10,051	12.06	60.60	2.99	15.05	19.07	95.84	0.29	1.45	0.00	0.00
		Touch&Go	16,380	0.39	3.19	1.89	15.51	2.35	19.28	0.14	1.17	0.00	0.00
		GCA Box	2,341	1.28	1.50	4.71	5.52	7.84	9.17	0.40	0.47	0.00	0.00
		Interfacility	2,326	0.21	0.25	0.78	0.90	1.29	1.50	0.07	0.08	0.00	0.00
	A-4	Full LTO w/o hot ref.	4,169	6.36	13.27	1.51	3.15	10.04	20.93	0.15	0.31	0.00	0.00
		Touch&Go	5,096	0.19	0.50	0.95	2.41	1.18	3.00	0.07	0.18	0.00	0.00
	F-16	Full LTO w/o hot ref.	936	0.59	0.28	9.54	4.46	21.00	9.83	0.36	0.17	0.09	0.04
		Touch&Go	1,144	0.08	0.05	4.54	2.59	0.53	0.30	0.11	0.06	0.09	0.05
	F-5	Full LTO w/o hot ref.	808	4.38	1.77	1.38	0.56	36.07	14.57	0.22	0.09	0.00	0.00
		Touch&Go	988	0.29	0.14	0.53	0.26	5.91	2.92	0.08	0.04	0.00	0.00
	TC-4	Full LTO w/o hot ref.	638	13.79	4.40	0.73	[illegible]	16.12	5.14	0.11	0.03	0.00	0.00
		Touch&Go	780	1.25	0.49	0.49	0.19	2.02	0.79	0.05	0.02	0.00	0.00
	UH-3H	Full LTO w/o hot ref.	662	8.84	2.92	0.71	0.23	13.94	4.61	0.13	0.04	0.00	0.00
	C-12	Full LTO w/o hot ref.	261	13.79	1.80	0.73	0.09	16.12	2.10	0.11	0.01	0.00	0.00
		Touch&Go	445	1.25	0.28	0.49	0.11	2.02	0.45	0.05	0.01	0.00	0.00
	S-3	Full LTO w/hot ref.	870	4.89	2.13	1.01	0.44	30.33	13.20	0.21	0.09	1.33	0.58
		Full LTO w/o hot ref.	870	3.06	1.33	0.80	0.35	19.23	8.37	0.15	0.06	0.93	0.41
		Touch&Go	1,295	0.14	0.09	0.18	0.12	1.80	1.17	0.03	0.02	0.37	0.24
		GCA Box	1,323	0.30	0.20	0.39	0.26	3.86	2.55	0.06	0.04	0.79	0.52
	T-2C	Full LTO w/o hot ref.	1,418	3.02	2.14	1.48	1.05	31.66	22.45	0.19	0.14	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**111,217**		**272.13**		**328.88**		**609.85**		**18.59**		**152.58**

Table F-33
ARS 4
AIRCRAFT EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1996(b)	F-14A	Full LTO w/hot ref.	2,285	27.74	31.69	9.69	11.07	55.80	63.74	0.96	1.10	9.54	10.90
		Full LTO w/o hot ref.	6,854	12.32	42.24	8.11	27.80	28.57	97.91	0.70	2.40	5.15	17.64
		Touch&Go	12,160	0.65	3.92	6.00	36.47	1.46	8.86	0.26	1.58	3.37	20.48
		GCA Box	884	2.06	0.91	14.93	6.60	4.77	2.11	0.75	0.33	11.10	4.90
		Interfacility	1,655	0.34	0.28	2.46	2.04	0.79	0.65	0.12	0.10	1.83	1.51
	F-14B/D	Full LTO w/hot ref.	1,695	4.25	3.60	18.79	15.93	18.87	15.99	0.95	0.81	16.67	14.13
		Full LTO w/o hot ref.	5,086	1.97	5.00	17.06	43.38	8.50	21.60	0.61	1.56	8.93	22.71
		Touch&Go	9,022	0.32	1.46	12.83	57.86	0.69	3.11	0.37	1.66	3.64	16.44
		GCA Box	656	1.18	0.39	10.88	3.57	2.04	0.67	0.67	0.22	7.59	2.49
		Interfacility	1,228	0.19	0.12	1.79	1.10	0.34	0.21	0.11	0.07	1.25	0.77
	A-6	Full LTO w/hot ref.	0	31.18	0.00	3.81	0.00	47.97	0.00	0.53	0.00	0.00	0.00
		Full LTO w/o hot ref.	0	12.06	0.00	2.99	0.00	19.07	0.00	0.29	0.00	0.00	0.00
		Touch&Go	0	0.39	0.00	1.89	0.00	2.35	0.00	0.14	0.00	0.00	0.00
		GCA Box	0	1.28	0.00	4.71	0.00	7.84	0.00	0.40	0.00	0.00	0.00
		Interfacility	0	0.21	0.00	0.78	0.00	1.29	0.00	0.07	0.00	0.00	0.00
	F/A-18	Full LTO w/hot ref.	441	28.36	6.25	8.39	1.85	75.74	16.69	0.46	0.10	7.38	1.63
		Full LTO w/o hot ref.	1,322	15.05	9.94	8.12	5.37	44.32	29.29	0.37	0.24	4.55	3.01
		Touch&Go	2,904	0.20	0.29	6.04	8.77	0.79	1.15	0.20	0.29	2.62	3.81
	S-3(c)	Full LTO w/hot ref.	484	4.89	1.18	1.01	0.24	30.33	7.33	0.21	0.05	1.33	0.32
		Full LTO w/o hot ref.	484	3.06	0.74	0.80	0.19	19.23	4.65	0.15	0.04	0.93	0.23
		Touch&Go	941	0.14	0.07	0.18	0.09	1.80	0.85	0.03	0.01	0.37	0.17
		GCA Box	371	0.30	0.06	0.39	0.07	3.86	0.72	0.06	0.01	0.79	0.15
	UH-3H	Full LTO w/o hot ref.	0	8.84	0.00	0.71	0.00	13.94	0.00	0.13	0.00	0.00	0.00
	C-12	Full LTO w/o hot ref.	1,677	13.79	11.57	0.73	0.61	16.12	13.52	0.11	0.09	0.00	0.00
		Touch&Go	2,759	1.25	1.72	0.49	0.68	2.02	2.79	0.05	0.06	0.00	0.00
		GCA Box	1,103	1.55	0.85	0.32	0.18	2.38	1.31	0.04	0.02	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**55,048**		**122.93**		**223.94**		**294.02**		**10.76**		**121.28**

Table F-33
ARS 4
AIRCRAFT EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e) per operation (lb)	VOC (e) Total (TPY)	NOx per operation (lb)	NOx Total (TPY)	CO per operation (lb)	CO Total (TPY)	SO2 per operation (lb)	SO2 Total (TPY)	PM10 per operation (lb)	PM10 Total (TPY)
1997(b)	F-14A	Full LTO w/hot ref.	2,973	27.74	41.23	9.69	14.40	55.80	82.94	0.96	1.43	9.54	14.18
		Full LTO w/o hot ref.	8,918	12.32	54.96	8.11	36.17	28.57	127.38	0.70	3.12	5.15	22.95
		Touch&Go	15,821	0.65	5.10	6.00	47.46	1.46	11.53	0.26	2.05	3.37	26.65
		GCA Box	1,150	2.06	1.18	14.93	8.59	4.77	2.74	0.75	0.43	11.10	6.38
		Interfacility	2,153	0.34	0.37	2.46	2.65	0.79	0.85	0.12	0.13	1.83	1.97
	F-14B/D	Full LTO w/hot ref.	2,236	4.25	4.75	18.79	21.00	18.87	21.09	0.95	1.06	16.67	18.63
		Full LTO w/o hot ref.	6,707	1.97	6.60	17.06	57.21	8.50	28.49	0.61	2.06	8.93	29.96
		Touch&Go	11,898	0.32	1.92	12.83	76.31	0.69	4.10	0.37	2.19	3.64	21.68
		GCA Box	865	1.18	0.51	10.88	4.71	2.04	0.88	0.67	0.29	7.59	3.28
		Interfacility	1,619	0.19	0.16	1.79	1.45	0.34	0.27	0.11	0.09	1.25	1.01
	F/A-18	Full LTO w/hot ref.	441	28.36	6.25	8.39	1.85	75.74	16.69	0.46	0.10	7.38	1.63
		Full LTO w/o hot ref.	1,322	15.05	9.94	8.12	5.37	44.32	29.29	0.37	0.24	4.55	3.01
		Touch&Go	2,904	0.20	0.29	6.04	8.77	0.79	1.15	0.20	0.29	2.62	3.81
	S-3	Full LTO w/hot ref.	484	4.89	1.18	1.01	0.24	30.33	7.33	0.21	0.05	1.33	0.32
		Full LTO w/o hot ref.	484	3.06	0.74	0.80	0.19	19.23	4.65	0.15	0.04	0.93	0.23
		Touch&Go	941	0.14	0.07	0.18	0.09	1.80	0.85	0.03	0.01	0.37	0.17
		GCA Box	371	0.30	0.06	0.39	0.07	3.86	0.72	0.06	0.01	0.79	0.15
	C-12	Full LTO w/o hot ref.	1,677	13.79	11.57	0.73	0.61	16.12	13.52	0.11	0.09	0.00	0.00
		Touch&Go	2,759	1.25	1.72	0.49	0.68	2.02	2.79	0.05	0.06	0.00	0.00
		GCA Box	1,103	1.55	0.85	0.32	0.18	2.38	1.31	0.04	0.02	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**67,864**		**150.10**		**288.07**		**359.45**		**13.80**		**155.99**

Table F-33
ARS 4
AIRCRAFT EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1998	F-14A	Full LTO w/hot ref.	2,825	27.74	39.18	9.69	13.69	55.80	78.82	0.96	1.36	9.54	13.48
		Full LTO w/o hot ref.	8,476	12.32	52.23	8.11	34.37	28.57	121.07	0.70	2.96	5.15	21.81
		Touch&Go	15,037	0.65	4.85	6.00	45.10	1.46	10.96	0.26	1.95	3.37	25.33
		GCA Box	1,093	2.06	1.12	14.93	8.16	4.77	2.61	0.75	0.41	11.10	6.06
		Interfacility	2,046	0.34	0.35	2.46	2.52	0.79	0.80	0.12	0.13	1.83	1.87
	F-14B/D	Full LTO w/hot ref.	2,236	4.25	4.75	18.79	21.00	18.87	21.09	0.95	1.06	16.67	18.63
		Full LTO w/o hot ref.	6,707	1.97	6.60	17.06	57.21	8.50	28.49	0.61	2.06	8.93	29.96
		Touch&Go	11,898	0.32	1.92	12.83	76.31	0.69	4.10	0.37	2.19	3.64	21.68
		GCA Box	865	1.18	0.51	10.88	4.71	2.04	0.88	0.67	0.29	7.59	3.28
		Interfacility	1,619	0.19	0.16	1.79	1.45	0.34	0.27	0.11	0.09	1.25	1.01
	F/A-18	Full LTO w/hot ref.	3,084	28.36	43.73	8.39	12.93	75.74	116.81	0.46	0.71	7.38	11.38
		Full LTO w/o hot ref.	9,253	15.05	69.61	8.12	37.57	44.32	205.05	0.37	1.71	4.55	21.04
		Touch&Go	20,327	0.20	2.05	6.04	61.39	0.79	8.05	0.20	2.00	2.62	26.68
		GCA Box	617	0.48	0.15	9.04	2.79	1.92	0.59	0.43	0.13	6.59	2.03
		Interfacility	1,778	0.09	0.08	2.80	2.49	0.28	0.25	0.10	0.08	1.45	1.29
	S-3	Full LTO w/hot ref.	484	4.89	1.18	1.01	0.24	30.33	7.33	0.21	0.05	1.33	0.32
		Full LTO w/o hot ref.	484	3.06	0.74	0.80	0.19	19.23	4.65	0.15	0.04	0.93	0.23
		Touch&Go	941	0.14	0.07	0.18	0.09	1.80	0.85	0.03	0.01	0.37	0.17
		GCA Box	371	0.30	0.06	0.39	0.07	3.86	0.72	0.06	0.01	0.79	0.15
	C-12	Full LTO w/o hot ref.	1,677	13.79	11.57	0.73	0.61	16.12	13.52	0.11	0.09	0.00	0.00
		Touch&Go	2,759	1.25	1.72	0.49	0.68	2.02	2.79	0.05	0.06	0.00	0.00
		GCA Box	1,103	1.55	0.85	0.32	0.18	2.38	1.31	0.04	0.02	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**96,720**		**244.14**		**383.85**		**631.89**		**17.44**		**206.40**

Table F-33
ARS 4
AIRCRAFT EMISSIONS AT NAS OCEANA FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e) per operation (lb)	VOC (e) Total (TPY)	NOx per operation (lb)	NOx Total (TPY)	CO per operation (lb)	CO Total (TPY)	SO2 per operation (lb)	SO2 Total (TPY)	PM10 per operation (lb)	PM10 Total (TPY)
1999	F-14A	Full LTO w/hot ref.	2,825	27.74	39.18	9.69	13.69	55.80	78.82	0.96	1.36	9.54	13.48
		Full LTO w/o hot ref.	8,476	12.32	52.23	8.11	34.37	28.57	121.07	0.70	2.96	5.15	21.81
		Touch&Go	15,037	0.65	4.85	6.00	45.10	1.46	10.96	0.26	1.95	3.37	25.33
		GCA Box	1,093	2.06	1.12	14.93	8.16	4.77	2.61	0.75	0.41	11.10	6.06
		Interfacility	2,046	0.34	0.35	2.46	2.52	0.79	0.80	0.12	0.13	1.83	1.87
	F-14B/D	Full LTO w/hot ref.	2,236	4.25	4.75	18.79	21.00	18.87	21.09	0.95	1.06	16.67	18.63
		Full LTO w/o hot ref.	6,707	1.97	6.60	17.06	57.21	8.50	28.49	0.61	2.06	8.93	29.96
		Touch&Go	11,898	0.32	1.92	12.83	76.31	0.69	4.10	0.37	2.19	3.64	21.68
		GCA Box	865	1.18	0.51	10.88	4.71	2.04	0.88	0.67	0.29	7.59	3.28
		Interfacility	1,619	0.19	0.16	1.79	1.45	0.34	0.27	0.11	0.09	1.25	1.01
	F/A-18	Full LTO w/hot ref.	4,847	28.36	68.72	8.39	20.32	75.74	183.56	0.46	1.12	7.38	17.89
		Full LTO w/o hot ref.	14,541	15.05	109.39	8.12	59.04	44.32	322.23	0.37	2.68	4.55	33.06
		Touch&Go	31,942	0.20	3.22	6.04	96.48	0.79	12.65	0.20	3.14	2.62	41.92
		GCA Box	970	0.48	0.23	9.04	4.38	1.92	0.93	0.43	0.21	6.59	3.20
		Interfacility	2,794	0.09	0.13	2.80	3.92	0.28	0.39	0.10	0.13	1.45	2.03
	S-3	Full LTO w/hot ref.	484	4.89	1.18	1.01	0.24	30.33	7.33	0.21	0.05	1.33	0.32
		Full LTO w/o hot ref.	484	3.06	0.74	0.80	0.19	19.23	4.65	0.15	0.04	0.93	0.23
		Touch&Go	941	0.14	0.07	0.18	0.09	1.80	0.85	0.03	0.01	0.37	0.17
		GCA Box	371	0.30	0.06	0.39	0.07	3.86	0.72	0.06	0.01	0.79	0.15
	C-12	Full LTO w/o hot ref.	1,677	13.79	11.57	0.73	0.61	16.12	13.52	0.11	0.09	0.00	0.00
		Touch&Go	2,759	1.25	1.72	0.49	0.68	2.02	2.79	0.05	0.06	0.00	0.00
		GCA Box	1,103	1.55	0.85	0.32	0.18	2.38	1.31	0.04	0.02	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**116,754**		**310.21**		**450.81**		**820.90**		**20.09**		**242.07**

Notes:
(a) F-14 operations were divided between F-14As and F-14Bs based on the number of aircraft present in 1993. Number of GCAs and interfacility flights were proportioned from 1997 data based on the number of aircraft.
(b) 1996-1998 operations were proportioned from 1999 data based upon the numbers of aircraft based at NAS Oceana during those years. A-6s assumed to be deployed in 1996 and decommissioned by mid-1997.
(c) Transient aircraft operations, derived from NASMOD analysis (ATAC 1997).
(d) 1999 operations were derived from NASMOD analysis(ATAC 1997).
(e) Aircraft VOC reported as HC in the form CHy/x

Shaded areas indicate nonattainment pollutants of concern.
The LTOs listed for GCA box and interfacility flights include only the level portion of those operations. Takeoff and landings for these operations are accounted for under full LTO or T&G.

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter
LTO w/ hot ref. = landing and takeoff cycle with hot refueling idle
LTO w/o hot ref. = landing and takeoff cycle without hot refueling idle
interfacility = low altitude operations between NAS Oceana and NALF Fentress
GCA = ground control approach
lb = pounds
TPY = tons per year

Table F-34
ARS 4
AIRCRAFT EMISSIONS AT NALF FENTRESS
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation Type	Number of perations/Yea	VOC (d) per operation (lb)	VOC (d) Total (TPY)	NOx per operation (lb)	NOx Total (TPY)	CO per operation (lb)	CO Total (TPY)	SO2 per operation (lb)	SO2 Total (TPY)	PM10 per operation (lb)	PM10 Total (TPY)
1993(a)	F-14A	Touch&Go	10,511	0.65	3.39	6.00	31.53	1.46	7.66	0.26	1.37	3.37	17.70
	F-14B	Touch&Go	7,226	0.32	1.17	12.83	46.34	0.69	2.49	0.37	1.33	3.64	13.17
	E-2/C-2	Full LTO	1,074	10.05	5.40	6.29	3.38	15.85	8.51	0.52	0.28	0.00	0.00
		Touch&Go	25,058	0.11	1.37	4.38	54.89	0.42	5.29	0.24	3.04	0.00	0.00
	A-6	Touch&Go	11,086	0.39	2.16	1.89	10.50	2.35	13.05	0.14	0.79	0.00	0.00
	Total		**54,955**		**13.48**		**146.63**		**37.00**		**6.81**		**30.87**
1996(c)	F-14A	Touch&Go	13,851	0.65	4.47	6.00	41.54	1.46	10.09	0.26	1.80	3.37	23.33
	F-14B/D	Touch&Go	10,276	0.32	1.66	12.83	65.91	0.69	3.54	0.37	1.89	3.64	18.72
	E-2/C-2	Full LTO	0	10.05	0.00	6.29	0.00	15.85	0.00	0.52	0.00	0.00	0.00
		Touch&Go	21,374	0.11	1.17	4.38	46.82	0.42	4.51	0.24	2.59	0.00	0.00
	A-6	Touch&Go	0	0.39	0.00	1.89	0.00	2.35	0.00	0.14	0.00	0.00	0.00
	Total		**45,501**		**7.29**		**154.27**		**18.14**		**6.28**		**42.05**
1997(c)	F-14A	Touch&Go	18,021	0.65	5.81	6.00	54.05	1.46	13.13	0.26	2.34	3.37	30.35
	F-14B/D	Touch&Go	13,553	0.32	2.19	12.83	86.92	0.69	4.67	0.37	2.49	3.64	24.69
	E-2/C-2	Full LTO	0	10.05	0.00	6.29	0.00	15.85	0.00	0.52	0.00	0.00	0.00
		Touch&Go	21,374	0.11	1.17	4.38	46.82	0.42	4.51	0.24	2.59	0.00	0.00
	Total		**52,948**		**9.17**		**187.79**		**22.31**		**7.43**		**55.04**

Table F-34
ARS 4
AIRCRAFT EMISSIONS AT NALF FENTRESS
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation Type	Number of perations/Yea	VOC (d) per operation (lb)	VOC (d) Total (TPY)	NOx per operation (lb)	NOx Total (TPY)	CO per operation (lb)	CO Total (TPY)	SO2 per operation (lb)	SO2 Total (TPY)	PM10 per operation (lb)	PM10 Total (TPY)
1998	F-14A	Touch&Go	17,127	0.65	5.52	6.00	51.37	1.46	12.48	0.26	2.22	3.37	28.85
	F-14B/D	Touch&Go	13,553	0.32	2.19	12.83	86.92	0.69	4.67	0.37	2.49	3.64	24.69
	F/A-18	Touch&Go	13,221	0.20	1.33	6.04	39.93	0.79	5.24	0.20	1.30	2.62	17.35
	E-2/C-2	Full LTO	0	10.05	0.00	6.29	0.00	15.85	0.00	0.52	0.00	0.00	0.00
		Touch&Go	21,374	0.11	1.17	4.38	46.82	0.42	4.51	0.24	2.59	0.00	0.00
	Total		**65,275**		**10.21**		**225.04**		**26.89**		**8.61**		**70.89**
1999	F-14A	Touch&Go	17,127	0.65	5.52	6.00	51.37	1.46	12.48	0.26	2.22	3.37	28.85
	F-14B/D	Touch&Go	13,553	0.32	2.19	12.83	86.92	0.69	4.67	0.37	2.49	3.64	24.69
	F/A-18	Touch&Go	20,776	0.20	2.09	6.04	62.75	0.79	8.23	0.20	2.04	2.62	27.27
	E-2/C-2	Full LTO	0	10.05	0.00	6.29	0.00	15.85	0.00	0.52	0.00	0.00	0.00
		Touch&Go	21,374	0.11	1.17	4.38	46.82	0.42	4.51	0.24	2.59	0.00	0.00
	Total		**72,830**		**10.97**		**247.86**		**29.89**		**9.36**		**80.80**

Notes:
(a) F-14 operations were divided between F-14As and F-14Bs based on the number of aircraft present in 1993.
(b) 1996-1998 operations for F-14s were proporationed from 1999 data based upon the numbers of F-14 squadrons based at NAS Oceana, A-6s assumed to be deployed in 1996 and decommissioned by mid-1997. 1996-1998 E-2/C-2 operations assumed to the same as 1999.
(c) 1997 operations derived from NASMOD analysis (ATAC 1997).
(d) Aircraft VOC reported as HC in the form CHy/x
Shaded areas indicate nonattainment pollutants of concern.

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

LTO = landing and takeoff cycle
interfacility = low altitude operations between NAS Oceana and NALF Fentress
GCA = ground control approach
lb = pounds
TPY = tons per year

Table F-35
ARS 4
Emissions from Ground Support Equipment at NAS Oceana

		Fuel Consumption (gal/yr)	VOC		NOx		CO		SO2		PM-10	
			lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)
1993	*Tow Tractors: (a)*											
	A/S32A-30A	8960	64.60	0.29	436.67	1.96	268.50	1.20	31.10	0.14	46.50	0.21
	TA-35	254	64.60	0.01	436.67	0.06	268.50	0.03	31.10	0.00	46.50	0.01
	MD-3/A/S32A-31A	4843	64.60	0.16	436.67	1.06	268.50	0.65	31.10	0.08	46.50	0.11
	TA-75	17115	122.00	1.04	146.00	1.25	3250.00	27.81	5.20	0.04	8.27	0.07
	A/S32A-42	7200	64.60	0.23	436.67	1.57	268.50	0.97	31.10	0.11	46.50	0.17
	JG-75	104	122.00	0.01	146.00	0.01	3250.00	0.17	5.20	0.00	8.27	0.00
	A/S32A-30	897	122.00	0.05	146.00	0.07	3250.00	1.46	5.20	0.00	8.27	0.00
	Flight Line Electric Power Units											
	NC8A (b)	14926	49.23	0.37	604.17	4.51	130.15	0.97	39.73	0.30	42.47	0.32
	NC10C (b)	3180	49.23	0.08	604.17	0.96	130.15	0.21	39.73	0.06	42.47	0.07
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	41932	49.23	1.03	604.17	12.67	130.15	2.73	39.73	0.83	42.47	0.89
	A/S47A-1 (b)	712	49.23	0.02	604.17	0.22	130.15	0.05	39.73	0.01	42.47	0.02
	GTC-85 (c)	10101	0.13	0.00	3.88	0.02	14.83	0.07	0.54	0.00	0.00	0.00
	Miscellaneous: (c)											
	A/M32C-17	2105	49.23	0.05	604.17	0.64	130.15	0.14	39.73	0.04	42.47	0.04
	A/M27T-5	990	49.23	0.02	604.17	0.30	130.15	0.06	39.73	0.02	42.47	0.02
	A/M42M-2	720	49.23	0.02	604.17	0.22	130.15	0.05	39.73	0.01	42.47	0.02
	HLU-196	8400	415.11	1.74	223.31	0.94	8589.90	36.08	11.51	0.05	13.70	0.06
		Total		**5.13**		**26.43**		**72.65**		**1.71**		**2.00**
1996	*Tow Tractors: (a)*											
	A/S32A-30A	19000	64.60	0.61	436.67	4.15	268.50	2.55	31.10	0.30	46.50	0.44
	TA-35	450	64.60	0.01	436.67	0.10	268.50	0.06	31.10	0.01	46.50	0.01
	MD-3/A/S32A-31A	4843	64.60	0.16	436.67	1.06	268.50	0.65	31.10	0.08	46.50	0.11
	TA-75 (MOGAS)	1600	122.00	0.10	146.00	0.12	3250.00	2.60	5.20	0.00	8.27	0.01
	A/S32A-42	17000	64.60	0.55	436.67	3.71	268.50	2.28	31.10	0.26	46.50	0.40
	JG-75	104	122.00	0.01	146.00	0.01	3250.00	0.17	5.20	0.00	8.27	0.00
	A/S32A-30	2900	122.00	0.18	146.00	0.21	3250.00	4.71	5.20	0.01	8.27	0.01
	Flight Line Electric Power Units											
	NC8A (b)	12800	49.23	0.32	604.17	3.87	130.15	0.83	39.73	0.25	42.47	0.27
	NC10C (b)	3500	49.23	0.09	604.17	1.06	130.15	0.23	39.73	0.07	42.47	0.07
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	37000	49.23	0.91	604.17	11.18	130.15	2.41	39.73	0.74	42.47	0.79
	GTC-85 (c)	3000	0.13	0.00	3.88	0.01	14.83	0.02	0.54	0.00	0.00	0.00
	Miscellaneous: (b)											
	A/M32C-17	2400	49.23	0.06	604.17	0.73	130.15	0.16	39.73	0.05	42.47	0.05
	A/M27T-5 (air cond.)	2350	49.23	0.06	604.17	0.71	130.15	0.15	39.73	0.05	42.47	0.05
	A/M42M-2 (power)	1500	49.23	0.04	604.17	0.45	130.15	0.10	39.73	0.03	42.47	0.03
	HLU-196	25	415.11	0.01	223.31	0.00	8589.90	0.11	11.51	0.00	13.70	0.00
		Total		**3.09**		**27.35**		**17.03**		**1.84**		**2.24**

Table F-35
ARS 4
Emissions from Ground Support Equipment at NAS Oceana

		Fuel Consumption (gal/yr)	VOC		NOx		CO		SO2		PM-10	
			lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)
1997	*Tow Tractors: (a)*											
	A/S32A-30A	22000	64.60	0.71	436.67	4.80	268.50	2.95	31.10	0.34	46.50	0.51
	A/S32A-30	3500	122.00	0.21	146.00	0.26	3250.00	5.69	5.20	0.01	8.27	0.01
	TA-35	600	64.60	0.02	436.67	0.13	268.50	0.08	31.10	0.01	46.50	0.01
	A/S32A-42	23000	64.60	0.74	436.67	5.02	268.50	3.09	31.10	0.36	46.50	0.53
	TA-75	1200	122.00	1.04	146.00	1.25	3250.00	1.95	5.20	0.00	8.27	0.00
	Flight Line Electric Power Units											
	NC8A (b)	16000	49.23	0.39	604.17	4.83	130.15	1.04	39.73	0.32	42.47	0.34
	NC10C (b)	6000	49.23	0.15	604.17	1.81	130.15	0.39	39.73	0.12	42.47	0.13
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	45000	49.23	1.11	604.17	13.59	130.15	2.93	39.73	0.89	42.47	0.96
	GTC-85 (c)	3500	0.13	0.00	3.88	0.01	14.83	0.03	0.54	0.00	0.00	0.00
	Miscellaneous: (b)											
	A/M32C-17	3000	49.23	0.07	604.17	0.91	130.15	0.20	39.73	0.06	42.47	0.06
	A/M27T-5	3000	49.23	0.07	604.17	0.91	130.15	0.20	39.73	0.06	42.47	0.06
	A/M42M-2	1600	49.23	0.04	604.17	0.48	130.15	0.10	39.73	0.03	42.47	0.03
	HLU-196	20	415.11	0.00	223.31	0.00	8589.90	0.09	11.51	0.00	13.70	0.00
		Total		**4.57**		**34.01**		**18.73**		**2.20**		**2.66**
1998	*Tow Tractors: (a)*											
	A/S32A-30A (MOGAS)	22000	64.60	0.71	436.67	4.80	268.50	2.95	31.10	0.34	46.50	0.51
	A/S32A-30	3500	122.00	0.21	146.00	0.26	3250.00	5.69	5.20	0.01	8.27	0.01
	TA-35	600	64.60	0.02	436.67	0.13	268.50	0.08	31.10	0.01	46.50	0.01
	A/S32A-42	23000	64.60	0.74	436.67	5.02	268.50	3.09	31.10	0.36	46.50	0.53
	Flight Line Electric Power Units											
	NC8A (b)	16000	49.23	0.39	604.17	4.83	130.15	1.04	39.73	0.32	42.47	0.34
	NC10C (b)	8000	49.23	0.20	604.17	2.42	130.15	0.52	39.73	0.16	42.47	0.17
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	47000	49.23	1.16	604.17	14.20	130.15	3.06	39.73	0.93	42.47	1.00
	GTC-85 (c)	3500	0.13	0.00	3.88	0.01	14.83	0.03	0.54	0.00	0.00	0.00
	Miscellaneous: (b)											
	A/M32C-17	4000	49.23	0.10	604.17	1.21	130.15	0.26	39.73	0.08	42.47	0.08
	A/M27T-5	4000	49.23	0.10	604.17	1.21	130.15	0.26	39.73	0.08	42.47	0.08
	A/M42M-2	1600	49.23	0.04	604.17	0.48	130.15	0.10	39.73	0.03	42.47	0.03
	HLU-196	20	415.11	0.00	223.31	0.00	8589.90	0.09	11.51	0.00	13.70	0.00
		Total		**3.67**		**34.57**		**17.17**		**2.32**		**2.79**

Table F-35
ARS 4
Emissions from Ground Support Equipment at NAS Oceana

		Fuel Consumption (gal/yr)	VOC		NOx		CO		SO2		PM-10	
			lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)
1999	*Tow Tractors: (a)*											
	A/S32A-30A (JP-5)	22400	64.60	0.72	436.67	4.89	268.50	3.01	5.20	0.06	8.27	0.09
	A/S32A-30	3500	122.00	0.21	146.00	0.26	3250.00	5.69	5.20	0.01	8.27	0.01
	TA-35	600	64.60	0.02	436.67	0.13	268.50	0.08	5.20	0.00	8.27	0.00
	A/S32A-42	23000	64.60	0.74	436.67	5.02	268.50	3.09	5.20	0.06	8.27	0.10
	Flight Line Electric Power Units											
	NC8A (b)	16000	49.23	0.39	604.17	4.83	130.15	1.04	39.73	0.32	42.47	0.34
	NC10C (b)	8000	49.23	0.20	604.17	2.42	130.15	0.52	39.73	0.16	42.47	0.17
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	47000	49.23	1.16	604.17	14.20	130.15	3.06	39.73	0.93	42.47	1.00
	GTC-85 (c)	3500	0.13	0.00	3.88	0.01	14.83	0.03	0.54	0.00	0.00	0.00
	Miscellaneous: (b)											
	A/M32C-17	4000	49.23	0.10	604.17	1.21	130.15	0.26	39.73	0.08	42.47	0.08
	A/M27T-5	4000	49.23	0.10	604.17	1.21	130.15	0.26	39.73	0.08	42.47	0.08
	A/M42M-2	1600	49.23	0.04	604.17	0.48	130.15	0.10	39.73	0.03	42.47	0.03
	HLU-196	20	415.11	0.00	223.31	0.00	8589.90	0.09	11.51	0.00	13.70	0.00
		Total		**3.69**		**34.66**		**17.22**		**1.73**		**1.92**

(a) Emission factors from AP-42 Volume II for gasoline-powered wheeled tractor for TA-75, JG-75, & A/S32A-30 and diesel-powered wheeled tractors for all others.
(b) Emission factors from AP-42 Volume I for Uncontrolled gasoline and diesel industrial engines SCC 20200102, 20300101, and 2300301..
Converted from lb/MMBtu assuming heating value for JP-5 of 137,000 Btu/gallon.
(c) Emission factors from USEPA 1992 for aircraft auxilliary power units used because specific emission factors for individual equipment types not available.

Table F-36
ARS 4
EMISSION RATES FOR SINGLE ENGINE MAINTENANCE RUN-UPS AT NAS OCEANA
(IN-FRAME ENGINE TESTING)

Engine (Aircraft)	Power Setting (a)	Time in Power Setting (a) (minutes)	Fuel Flow (lb/min)	Emission Factor ([lb /1000 lb fuel]/eng)					Emission Rates (lb/single engine run-up)				
				VOC (b)	NOx	CO	SO2	PM10	VOC	NOx	CO	SO2	PM10
TF30-P-412A (F-14A)	**Low Power**												
	Idle	7.00	15.3	31.42	3.22	55.51	0.40	8.96	3.37	0.35	5.96	0.04	0.96
	75%	12.00	71.7	1.48	10.74	3.43	0.40	5.70	1.27	9.24	2.95	0.34	4.90
	Total								**4.65**	**9.59**	**8.91**	**0.39**	**5.87**
	High Power												
	Idle	10.00	15.3	31.42	3.22	55.51	0.40	8.96	4.81	0.49	8.49	0.06	1.37
	75%	25.00	71.7	1.48	10.74	3.43	0.40	5.70	2.65	19.25	6.15	0.72	10.22
	100% (Mil)	10.00	117.5	0.77	19.60	1.38	0.40	2.98	0.90	23.03	1.62	0.47	3.50
	A/B (Z5)	4.00	796.7	0.20	4.79	10.77	0.40	0.00	0.64	15.26	34.32	1.27	0.00
	Total								**9.00**	**58.04**	**50.58**	**2.52**	**15.09**
F110-GE-400 (F-14B/D)	**Low Power**												
	Idle	5.00	19.5	3.65	2.77	16.60	0.40	12.38	0.36	0.27	1.62	0.04	1.21
	75%	12.50	133.0	0.26	19.61	0.76	0.40	4.30	0.43	32.60	1.26	0.67	7.15
	Total								**0.79**	**32.87**	**2.88**	**0.70**	**8.36**
	High Power												
	Idle	10.00	19.5	3.65	2.77	16.60	0.40	12.38	0.71	0.54	3.24	0.08	2.41
	75%	20.00	133.0	0.26	19.61	0.76	0.40	4.30	0.69	52.16	2.02	1.06	11.44
	IRP	15.00	195.3	0.40	28.63	0.84	0.40	2.81	1.17	83.87	2.46	1.17	8.23
	A/B(Max)	4.00	945.0	0.13	9.22	23.12	0.40	0.00	0.49	34.85	87.39	1.51	0.00
	Total								**3.07**	**171.43**	**95.11**	**3.83**	**22.08**
J-52-P-8B (A-6)	**Low Power**												
	Idle	15.00	11.3	48.96	1.79	63.78	0.40	0.00	8.32	0.30	10.84	0.07	0.00
	78-82%	10.00	72.0	0.67	10.10	3.00	0.40	0.00	0.48	7.27	2.16	0.29	0.00
	Total								**8.80**	**7.58**	**13.00**	**0.36**	**0.00**
	High Power												
	Idle	15.00	11.3	48.96	1.79	63.78	0.40	0.00	8.30	0.30	10.81	0.07	0.00
	78-82%	5.00	72.0	0.67	10.10	3.00	0.40	0.00	0.24	3.64	1.08	0.14	0.00
	94-100%	8.00	122.8	0.93	13.05	0.71	0.40	0.00	0.91	12.82	0.70	0.39	0.00
	Total								**9.45**	**16.76**	**12.59**	**0.60**	**0.00**
F404-GE-400 (F/A-18)	**Low Power**												
	Idle	6.50	10.4	58.18	1.16	137.34	0.40	12.38	3.93	0.08	9.28	0.03	0.84
	76%	3.50	109.0	0.35	14.80	1.09	0.40	6.10	0.13	5.65	0.42	0.15	2.33
	Total								**4.07**	**5.72**	**9.70**	**0.18**	**3.16**
	High Power												
	Idle	13.00	10.4	58.18	1.16	137.34	0.40	12.38	7.87	0.16	18.57	0.05	1.67
	76%	8.50	109.0	0.35	14.80	1.09	0.40	6.10	0.32	13.71	1.01	0.37	5.65
	IRP	5.00	143.1	0.31	25.16	1.05	0.40	2.81	0.22	18.00	0.75	0.29	2.01
	A/B	2.00	473.3	0.13	9.22	23.12	0.40	0.00	0.12	8.73	21.89	0.38	0.00
	Total								**8.54**	**40.60**	**42.21**	**1.09**	**9.34**

Notes:
(a) Power setting and time in power setting for F-14 A, F-14B/D, F/A-18 aircraft,and A-6 provided by AESO and COMNAVAIRLANT.
(b) Aircraft VOC reported as HC in the form CHy/x

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

A/B = afterburner operating
Idle = typically 57% throttle setting
75% = 75% throttle setting
IRP = intermediate rated power

Table F-37
ARS 4
EMISSIONS FROM SINGLE ENGINE IN-FRAME MAINTENANCE RUN-UPS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft (Engine) and Number of Aircraft	Run-up mode	Number of Single Engine Run-ups/yr	VOC (b)		NOx		CO		SO2		PM10	
				Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)
1993	F-14A (TF30-P-412A)	Low Power	8,776	4.65	20.38	9.59	42.06	8.91	39.09	0.39	1.70	5.87	25.74
	80	High Power	250	9.00	1.13	58.04	7.25	50.58	6.32	2.52	0.32	15.09	1.89
	F-14B/D (F110-GE-400)	Low Power	4,162	0.79	1.64	32.87	68.41	2.88	6.00	0.70	1.47	8.36	17.39
	55	High Power	218	3.07	0.33	171.43	18.69	95.11	10.37	3.83	0.42	22.08	2.41
	A-6 (J-52-P-8B)	Low Power	10,320	8.80	45.42	7.58	39.09	13.00	67.08	0.36	1.84	0.00	0.00
	86	High Power	292	9.45	1.38	16.76	2.45	12.59	1.84	0.60	0.09	0.00	0.00
				Total	**70.29**		**177.95**		**130.69**		**5.82**		**47.42**
1996	F-14A (TF30-P-412A)	Low Power	11,179	4.65	25.96	9.59	42.06	8.91	39.09	0.39	1.70	5.87	25.74
	93	High Power	319	9.00	1.44	58.04	7.25	50.58	6.32	2.52	0.32	15.09	1.89
	F-14B/D (F110-GE-400)	Low Power	4,222	0.79	1.66	32.87	68.41	2.88	6.00	0.70	1.47	8.36	17.39
	69	High Power	221	3.07	0.34	171.43	18.69	95.11	10.37	3.83	0.42	22.08	2.41
				Total	**29.40**		**136.41**		**61.78**		**3.90**		**47.42**
1997	F-14A (TF30-P-412A)	Low Power	14,545	4.65	33.78	9.59	69.72	8.91	64.78	0.39	2.82	5.87	42.66
	121	High Power	415	9.00	1.87	58.04	12.04	50.58	10.50	2.52	0.52	15.09	3.13
	F-14B/D (F110-GE-400)	Low Power	5,568	0.79	2.19	32.87	91.51	2.88	8.02	0.70	1.96	8.36	23.26
	91	High Power	292	3.07	0.45	171.43	25.03	95.11	13.89	3.83	0.56	22.08	3.22
				Total	**38.29**		**198.30**		**97.19**		**5.86**		**72.28**

Table F-37
ARS 4
EMISSIONS FROM SINGLE ENGINE IN-FRAME MAINTENANCE RUN-UPS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft (Engine) and Number of Aircraft	Run-up mode	Number of Single Engine Run-ups/yr	VOC (b)		NOx		CO		SO2		PM10	
				Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)
1998	F-14A (TF30-P-412A) 115	Low Power	13824	4.65	32.11	9.59	66.26	8.91	61.57	0.39	0.01	5.87	40.54
		High Power	394	9.00	1.77	58.04	11.43	50.58	9.97	2.52	0.00	15.09	2.97
	F-14B/D (F110-GE-400) 91	Low Power	5,568	0.79	2.19	32.87	91.51	2.88	8.02	0.70	1.96	8.36	23.26
		High Power	292	3.07	0.45	171.43	25.03	95.11	13.89	3.83	0.56	22.08	3.22
	F/A-18 (F404-GE-400) 132	Low Power	14700	4.07	29.89	5.72	42.08	9.70	71.30	0.18	1.32	3.16	23.26
		High Power	413	8.54	1.76	40.60	8.38	42.21	8.72	1.09	0.22	9.34	1.93
				Total	**68.17**		**244.70**		**173.46**		**4.07**		**95.19**
1999	F-14A (TF30-P-412A) 115	Low Power	13824	4.65	32.11	9.59	66.26	8.91	61.57	0.39	2.68	5.87	40.54
		High Power	394	9.00	1.77	58.04	11.43	50.58	9.97	2.52	0.50	15.09	2.97
	F-14B/D (F110-GE-400) 91	Low Power	5568	0.79	2.19	32.87	91.51	2.88	8.02	0.70	1.96	8.36	23.26
		High Power	292	3.07	0.45	171.43	25.03	95.11	13.89	3.83	0.56	22.08	3.22
	F/A-18 (F404-GE-400) 132	Low Power	7350	4.07	14.94	5.72	21.04	9.70	35.65	0.18	0.66	3.16	11.63
		High Power	413	8.54	1.76	40.60	8.38	42.21	8.72	1.09	0.22	9.34	1.93
				Total	**53.23**		**223.66**		**137.81**		**6.58**		**83.56**

Notes:
(a) In-frame maintenance run-ups for F-14A, F-14B/D, and F/A-18 aircraft in 1993 and 1999 from Wyle (1997) 1996-1998 maintenance run-ups were scaled from 1993 based on number of aircraft stationed at NAS Oceana.
(b) Aircraft VOC reported as HC in the form CHy/x

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-38
STATIONARY SOURCE EMISSIONS AT NAS OCEANA - ARS 4
FOR 1993 AND 1996-1999

	1993					1996					1997				
	VOC	NOx	CO	SO2	PM10	VOC	NOx	CO	SO2	PM10	VOC	NOx	CO	SO2	PM10
Stationary Sources:															
Boilers:	1.13	32.32	8.31	22.09	3.84	0.78	29.13	7.52	23.76	3.63	0.78	29.13	7.52	23.76	3.63
Generators	0.71	8.67	1.87	0.57	0.61	0.71	8.67	1.87	0.57	0.61	2.11	27.87	7.27	3.77	2.21
Engine Test Cells	6.24	37.65	49.40	1.81	4.32	3.94	28.44	39.05	1.31	3.95	5.04	37.00	50.82	1.71	4.63
JP-5 Fuel Handling	0.66	0.00	0.00	0.00	0.00	0.46	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.00	0.00
Service Station	19.35	0.00	0.00	0.00	0.00	4.46	0.00	0.00	0.00	0.00	4.67	0.00	0.00	0.00	0.00
Painting	19.30	0.00	0.00	0.00	0.00	13.29	0.00	0.00	0.00	0.00	24.05	0.00	0.00	0.00	0.00
Construction:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	47.39	78.64	59.58	24.47	8.77	23.64	66.24	48.44	25.64	8.19	37.19	94.00	65.61	29.24	10.47

Table F-38
STATIONARY SOURCE EMISSIONS AT NAS OCEANA - ARS 5
FOR 1993 AND 1996-1999

	1998					1999				
	VOC	NOx	CO	SO2	PM10	VOC	NOx	CO	SO2	PM10
Stationary Sources:										
Boilers:	0.62	27.13	6.68	22.82	3.38	0.62	27.13	6.68	22.82	3.38
Generators	2.11	27.87	7.27	3.77	2.21	2.11	27.87	7.27	3.77	2.21
Engine Test Cells	9.06	48.58	63.85	1.99	9.17	9.06	48.58	63.85	1.99	9.17
JP-5 Fuel Handling	0.81	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00
Service Station	6.40	0.00	0.00	0.00	0.00	6.72	0.00	0.00	0.00	0.00
Painting	34.12	0.00	0.00	0.00	0.00	34.16	0.00	0.00	0.00	0.00
Construction:	1.96	19.50	6.33	1.85	3.55	0.00	0.00	0.00	0.00	0.00
Total	55.08	123.07	84.13	30.43	18.31	53.57	103.58	77.80	28.58	14.76

Note: Shaded areas indicate nonattainment pollutants of concern.

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-39
EMISSION RATES FOR AIRCRAFT ENGINE TESTS AT NAS OCEANA - ARS 4
(SINGLE ENGINE IN TEST CELLS)

Engine (Aircraft)	Power Setting	Time in Power Setting (a) (minutes)	Fuel Flow (lb/min)	Calculated Fuel Usage (b) (gallons/test)	Emission Factor (c) ([lb /1000 lb fuel]/eng)					Single Engine Test Emissions (pounds)				
					VOC (d)	NOx	CO	SO2	PM10	VOC (d)	NOx	CO	SO2	PM10
TF30-P-412A (F-14A)	Idle	28.00	15.33	63.12	31.42	3.22	55.51	0.54	8.96	13.49	1.38	23.83	0.23	3.85
	75%	5.00	71.67	52.70	1.48	10.74	3.43	0.54	7.98	0.53	3.85	1.23	0.19	2.86
	81%	23.00	77.40	261.79	1.20	16.02	1.62	0.54	7.98	2.14	28.52	2.88	0.96	14.21
	A/B	22.00	796.67	2577.46	0.20	4.79	10.77	0.54	0.00	3.51	83.95	188.76	9.46	0.00
	Total	**78.00**		**2955.08**					**Per Test**	**19.66**	**117.70**	**216.70**	**10.85**	**20.91**
F110-GE-400 (F-14B/D)	Idle	54.00	19.64	155.96	3.97	2.74	15.75	0.54	12.38	4.21	2.91	16.70	0.57	13.13
	81%	44.00	143.70	929.82	0.26	19.61	0.76	0.54	2.81	1.64	123.99	4.81	3.41	17.77
	93%	25.00	198.22	728.75	0.31	28.53	1.08	0.54	2.81	1.54	141.38	5.35	2.68	13.92
	A/B	11.00	945.05	1528.76	3.75	12.64	44.21	0.54	0.00	38.98	131.40	459.59	5.61	0.00
	Total	**134.00**		**3343.30**					**Per Test**	**46.37**	**399.68**	**486.45**	**12.28**	**44.82**
J-52-P-8B (A-6)	Ground Idle	32.00	11.33	53.32	48.96	1.79	63.78	0.54	0.00	17.75	0.65	23.12	0.20	0.00
	IRP	18.00	122.83	325.14	1.08	13.05	0.71	0.54	0.00	2.39	28.85	1.57	1.19	0.00
	75% Thrust	24.00	72.00	254.12	0.87	10.10	3.00	0.54	0.00	1.50	17.45	5.18	0.93	0.00
	3k Lbs Thrust	25.00	38.33	140.92	1.99	6.34	10.54	0.54	0.00	1.91	6.08	10.10	0.52	0.00
	Total	**99.00**		**773.49**					**Per Test**	**23.55**	**53.03**	**39.98**	**2.84**	**0.00**
F404-GE-400 (F/A-18)	Idle	52.00	10.40	79.53	58.18	1.16	137.34	0.40	12.38	31.46	0.63	74.27	0.22	6.70
	80%	34.00	131.60	658.00	0.33	18.71	1.17	0.40	6.10	1.48	83.72	5.24	1.79	27.29
	A/B	3.00	473.28	208.80	0.13	9.22	23.12	0.40	0.00	0.18	13.09	32.83	0.57	0.00
	Total	**89.00**		**946.33**					**Per Test**	**33.12**	**97.43**	**112.34**	**2.57**	**33.99**

(a) Power setting and time in power setting taken from Wyle (1997) for F-14A, F-14B/D, and F/A-18 aircraft. A-6 data provided by COMNAVAIRLANT (Cdr. Vandenberg, Dec. 1996).
(b) Assumes a product density of 6.8 lb/gallon for JP-5.
(c) Data for calculating modal emission rates provided by the Navy Aircraft Environmental Support Office.
(d) Aircraft VOC reported as HC in the form CHy/x

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

A/B Max. = maximum afterburner
IRP = intermediate rated power (same as military)
75% = 75% throttle setting

Table F-40
EMISSIONS FROM AIRCRAFT ENGINE TESTING AT NAS OCEANA - ARS 4
FOR 1993 AND 1996-1999
(SINGLE ENGINE IN TEST CELLS)

Year	Engine Model	Number of Aircraft	Number of Tests/Year (a)	VOC (b) per test (lb)	VOC (b) Total (TPY)	NOx per test (lb)	NOx Total (TPY)	CO per test (lb)	CO Total (TPY)	SO2 per test (lb)	SO2 Total (TPY)	PM10 per test (lb)	PM10 Total (TPY)
1993	TF30-P-412A	80	152	19.66	1.49	117.70	8.95	216.70	16.47	10.85	0.82	20.91	1.59
	F110-GE-400	55	122	46.37	2.83	399.68	24.38	486.45	29.67	12.28	0.75	44.82	2.73
	J-52-P-8B	86	163	23.55	1.92	53.03	4.32	39.98	3.26	2.84	0.23	0.00	0.00
				Total	**6.24**		**37.65**		**49.40**		**1.81**		**4.32**
1996	TF30-P-412A	93	123	19.66	1.21	117.70	7.23	216.70	13.32	10.85	0.67	20.91	1.29
	F110-GE-400	69	100	46.37	2.32	399.68	20.00	486.45	24.34	12.28	0.61	44.82	2.24
	F404-GE-400	12	25	33.12	0.41	97.43	1.20	112.34	1.39	2.57	0.03	33.99	0.42
				Total	**3.94**		**28.44**		**39.05**		**1.31**		**3.95**
1997	TF30-P-412A	121	160	19.66	1.57	117.70	9.41	216.70	17.33	10.85	0.87	20.91	1.67
	F110-GE-400	91	132	46.37	3.06	399.68	26.38	486.45	32.11	12.28	0.81	44.82	2.96
	F404-GE-400	12	25	33.12	0.41	97.43	1.20	112.34	1.39	2.57	0.03	0.00	0.00
				Total	**5.04**		**37.00**		**50.82**		**1.71**		**4.63**
1998	TF30-P-412A	115	152	19.66	1.49	117.70	8.95	216.70	16.47	10.85	0.82	20.91	1.59
	F110-GE-400	91	132	46.37	3.06	399.68	26.38	486.45	32.11	12.28	0.81	44.82	2.96
	F404-GE-400	132	272	33.12	4.50	97.43	13.25	112.34	15.28	2.57	0.35	33.99	4.62
				Total	**9.06**		**48.58**		**63.85**		**1.99**		**9.17**
1999	TF30-P-412A	115	152	19.66	1.49	117.70	8.95	216.70	16.47	10.85	0.82	20.91	1.59
	F110-GE-400	91	132	46.37	3.06	399.68	26.38	486.45	32.11	12.28	0.81	44.82	2.96
	F404-GE-400	132	272	33.12	4.50	97.43	13.25	112.34	15.28	2.57	0.35	33.99	4.62
				Total	**9.06**		**48.58**		**63.85**		**1.99**		**9.17**

Notes:
(a) Number of engine tests per F-14A, F-14B/D, and F/A-18 aircraft from Wyle 1997. Number of A-6 engine tests per aircraft assumed to be the same as F-14A engine tests per aircraft.
(b) Aircraft VOC reported as HC in the form CHy/x
Shaded areas indicate the nonattainment pollutants of concern.

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-41
PARKING LOT CONSTRUCTION (4 LOTS) AND AIRCRAFT APRON - ARS 4
Equipment Exhaust Emissions

	Equipment	Days	Emission Factors (lb/1000 gal)					EMISSIONS (lbs)				
Equipment List	quantity	Used	**NOx**	**VOC**	**CO**	**SO2**	**PM10**	**NOx**	**VOC**	**CO**	**SO2**	**PM10**
Crane	0	0	403	35.0	82.0	31.2	27	0.0	0.0	0.0	0.0	0.0
Backhoe Loader	2	45	395	39.0	133.0	31.2	27	1777.5	175.5	598.5	140.4	121.5
Pan Scraper	1	20	340	19.6	97.7	31.2	27	340.0	19.6	97.7	31.2	27.0
Hi-Lift	0	0	364	31.0	121.0	31.2	25	0.0	0.0	0.0	0.0	0.0
Front-end Loader, wheels	1	45	403	23.5	94.0	31.2	29	906.8	52.9	211.5	70.2	65.3
Pile Driver	0	0	403	35.0	82.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Track loader	1	0	391	23.5	94.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Grader	2	45	375	43.0	74.3	31.2	22	1687.5	193.5	334.4	140.4	99.0
Bulldozer	2	45	375	43.0	74.3	31.2	25	1687.5	193.5	334.4	140.4	112.5
Compactor	3	45	364	31.0	121.0	31.2	24	2457.0	209.3	816.8	210.6	162.0
Roller	3	45	364	31.0	121.0	31.2	24	2457.0	209.3	816.8	210.6	162.0
Paver	1	45	403	23.5	125.0	31.2	29	906.8	52.9	281.3	70.2	65.3
haul trk/cement mixer, mob(gm/	4	45	8.0	2.1	9.93	2.8	2.15	317.2	83.3	393.7	111.0	85.2
haul trk/cement mixer, idl(gm/hr	4	45	13.2	16.2	40.2	0	0	10.5	12.8	31.9	0.0	0.0
							Total, lb/yr	12547.6	1202.5	3916.7	1125.0	899.7
							Total TPY	**6.27**	**0.60**	**1.96**	**0.56**	**0.45**

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-41
NEW BUILDING/ADDITION CONSTRUCTION - ARS 4
Equipment Exhaust Emissions

EQUIPMENT LIST	Equipment quantity	Days Used	Emission Factors (lb/1000 gal)					EMISSIONS (lbs)				
			NOx	**VOC**	**CO**	**SO2**	**PM10**	**NOx**	**VOC**	**CO**	**SO2**	**PM10**
Crane	1	120	403	35.0	82.0	31.2	27	2418.0	210.0	492.0	187.2	162.0
Backhoe Loader	2	120	395	39.0	133.0	31.2	27	4740.0	468.0	1596.0	374.4	324.0
Pan Scraper	1	120	340	19.6	97.7	31.2	27	2040.0	117.6	586.2	187.2	162.0
Hi-Lift	2	120	364	31.0	121.0	31.2	25	4368.0	372.0	1452.0	374.4	300.0
Front-end Loader, wheels	1	120	403	23.5	94.0	31.2	29	2418.0	141.0	564.0	187.2	174.0
Pile Driver	0	0	403	35.0	82.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Track loader	0	0	391	23.5	94.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Grader	1	120	375	43.0	74.3	31.2	22	2250.0	258.0	445.8	187.2	132.0
Bulldozer	2	120	375	43.0	74.3	31.2	25	4500.0	516.0	891.6	374.4	300.0
Compactor	1	120	364	31.0	121.0	31.2	24	2184.0	186.0	726.0	187.2	144.0
Roller	0	0	364	31.0	121.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Paver	0	0	403	23.5	125.0	31.2	29	0.0	0.0	0.0	0.0	0.0
haul trk, mob(gm/mi)	7	120	8.0	2.1	9.93	2.8	2.15	1480.2	388.5	1837.3	518.1	397.8
haul trk, idl(gm/hr)	7	120	13.2	16.2	40.2	0	0	48.8	59.9	148.8	0.0	0.0
							Total Lb/yr	**26447.0**	**2717.1**	**8739.6**	**2577.3**	**2095.8**
							Total TPY	**13.22**	**1.36**	**4.37**	**1.29**	**1.05**

Key:
- VOC = volatile organic compounds
- NOx = oxides of nitrogen
- CO = carbon monoxide
- SO2 = sulfur dioxide
- PM10 = particulate matter

Table F-42

ANNUAL DEMOLITION PARTICULATE EMISSIONS - ARS 4

Floor Space (SQ FT)	STRUCTURE REMOVAL (LBS)	DEBRIS REMOVAL (LBS)	VEHICLE ACTIVITY (LBS)	EMISSIONS SUM	
				LBS/YR	TPY
191,887	9.8	180.4	2042.6	2232.8	1.12

Notes:
Demolition square ft assumed = 10 % of new construction sq ft
PM emission from structure takedown based on sq ft *EF
PM emission from debris removal based on sq ft *EF
PM emission from on-site vehicle activity based on sq ft *EF
Pushing (bulldozing) PM emission put under site prep spreadsheet
Reference EPA-450/2-92-004 (Fugitive Dust document)
(all EF's in EPA document converted to english units)

Table F-42

ANNUAL SITE PREPARATION PARTICULATE EMISSIONS FOR CONSTRUCTION AT NAS OCEANA - ARS 4

ACRES	ACTIVITY DAYS	BULLDOZIN (LBS)	PAN SCRAPING SOIL REMOV(LBS)	PAN SCRAPING ETHMOVING (LBS)	EMISSIONS SUM	
					LBS/YR	TPY
44	120	720	704	444	1868	0.93

Notes:
Acreage estimate based on building sq ft*2
Estimate activity days for preferred, develop ratio days:acres
Apply ratio to ARS acreages to get activity days
Bulldozing pm emissions based on 8hr/activity day * EF (EPA 1992)
Soil removal emiss based on VMT/acre *acres*EF (EPA 1992)
Earthmoving emiss based on soil removal miles *3 (BEE)*EF
EPA 1992 is Fugitive Dust BG document (EPA-450/2-92-004)

Table F-43

Total Construction Emissions (Exhaust and Dust) - ARS 4

Project/Source	**Emissions (tons/yr)**				
Engine Exhaust Emissions	**VOC**	**NOx**	**CO**	**SOx**	**PM10**
Parking Lot Construction	0.60	6.27	1.96	0.56	0.45
Building/Addition Const. (total)	1.36	13.22	4.37	1.29	1.05
Demolition/Construction Activity					
Mechanical dust Generation	0.00	0.00	0.00	0.00	2.05
Total	**1.96**	**19.50**	**6.33**	**1.85**	**3.55**

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-44
EMISSIONS SUMMARY - NAS OCEANA AND NALF FENTRESS - ARS 4
FOR 1993 AND 1996-1999
(tons per year)

	1993					1996					1997				
Source Type	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**
NAS Oceana:															
Mobile Sources:															
Aircraft Operations	272.13	328.88	609.85	18.59	152.58	122.93	223.94	294.02	10.76	121.28	150.10	288.07	359.45	13.80	155.99
Total Aircraft	**272.13**	**328.88**	**609.85**	**18.59**	**152.58**	**122.93**	**223.94**	**294.02**	**10.76**	**121.28**	**150.10**	**288.07**	**359.45**	**13.80**	**155.99**
Other Mobile Sources:															
GSE	5.13	26.43	72.65	1.71	2.00	0.00	0.00	0.00	0.00	0.00	4.57	34.01	18.73	2.20	2.66
Maintenance Run-ups	70.29	177.95	130.69	5.82	47.42	29.40	136.41	61.78	3.90	47.42	38.29	198.30	97.19	5.86	72.28
Generators	0.56	6.89	1.48	0.45	0.48	0.56	6.89	1.48	0.45	0.48	0.56	6.89	1.48	0.45	0.48
Total Other Mobile	**75.97**	**211.27**	**204.82**	**7.98**	**49.90**	**29.96**	**143.30**	**63.26**	**4.35**	**47.90**	**43.42**	**239.20**	**117.40**	**8.51**	**75.42**
Stationary Sources:															
Boilers:	1.13	32.32	8.31	22.09	3.84	0.78	29.13	7.52	23.76	3.63	0.78	29.13	7.52	23.76	3.63
Generators	0.71	8.67	1.87	0.57	0.61	0.71	8.67	1.87	0.57	0.61	2.11	27.87	7.27	3.77	2.21
Engine Test Cells	6.24	37.65	49.40	1.81	4.32	3.94	28.44	39.05	1.31	3.95	5.04	37.00	50.82	1.71	4.63
JP-5 Fuel Handling	0.66	0.00	0.00	0.00	0.00	0.46	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.00	0.00
Service Station	19.35	0.00	0.00	0.00	0.00	4.46	0.00	0.00	0.00	0.00	4.67	0.00	0.00	0.00	0.00
Painting	19.30	0.00	0.00	0.00	0.00	13.29	0.00	0.00	0.00	0.00	24.05	0.00	0.00	0.00	0.00
Construction:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Stationary	**47.39**	**78.64**	**59.58**	**24.47**	**8.77**	**23.64**	**66.24**	**48.44**	**25.64**	**8.19**	**37.19**	**94.00**	**65.61**	**29.24**	**10.47**
Total NASO	**395.49**	**618.78**	**874.24**	**51.04**	**211.25**	**176.54**	**433.48**	**405.72**	**40.75**	**177.37**	**230.71**	**621.26**	**542.45**	**51.55**	**241.88**
NALF Fentress:															
Aircraft	13.48	146.63	37.00	6.81	30.87	7.29	154.27	18.14	6.28	42.05	9.17	187.79	22.31	7.43	55.04
Total Annual:	**408.97**	**765.41**	**911.25**	**57.85**	**242.12**	**183.83**	**587.74**	**423.86**	**47.03**	**219.42**	**239.88**	**809.05**	**564.76**	**58.98**	**296.93**

Table F-44
EMISSIONS SUMMARY - NAS OCEANA AND NALF FENTRESS - ARS 4
FOR 1993 AND 1996-1999
(tons per year)

	1998					1999				
Source Type	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**
NAS Oceana:										
Mobile Sources:										
Aircraft Operations	244.14	383.85	631.89	17.44	206.40	310.21	450.81	820.90	20.09	242.07
Total Aircraft	**244.14**	**383.85**	**631.89**	**17.44**	**206.40**	**310.21**	**450.81**	**820.90**	**20.09**	**242.07**
Other Mobile Sources:										
GSE	0.10	1.21	0.26	0.08	0.08	0.00	0.00	0.00	0.00	0.00
Maintenance Run-ups	68.17	244.70	173.46	4.07	95.19	53.23	223.66	137.81	6.58	83.56
Generators	0.56	6.89	1.48	0.45	0.48	0.56	6.89	1.48	0.45	0.48
Total Other Mobile	**68.83**	**252.79**	**175.20**	**4.60**	**95.75**	**53.79**	**230.55**	**139.29**	**7.03**	**84.04**
Stationary Sources:										
Boilers:	0.62	27.13	6.68	22.82	3.38	0.62	27.13	6.68	22.82	3.38
Generators	2.11	27.87	7.27	3.77	2.21	2.11	27.87	7.27	3.77	2.21
Engine Test Cells	9.06	48.58	63.85	1.99	9.17	9.06	48.58	63.85	1.99	9.17
JP-5 Fuel Handling	0.81	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00
Service Station	6.40	0.00	0.00	0.00	0.00	6.72	0.00	0.00	0.00	0.00
Painting	34.12	0.00	0.00	0.00	0.00	34.16	0.00	0.00	0.00	0.00
Construction:	1.96	19.50	6.33	1.85	3.55	0.00	0.00	0.00	0.00	0.00
Total Stationary	**55.08**	**123.07**	**84.13**	**30.43**	**18.31**	**53.57**	**103.58**	**77.80**	**28.58**	**14.76**
Total NASO	**368.05**	**759.71**	**891.22**	**52.47**	**320.46**	**417.57**	**784.93**	**1,037.99**	**55.70**	**340.87**
NALF Fentress:										
Aircraft	10.21	225.04	26.89	8.61	70.89	10.97	247.86	29.89	9.36	80.80
Total Annual:	**378.26**	**984.76**	**918.12**	**61.09**	**391.35**	**428.54**	**1,032.79**	**1,067.88**	**65.05**	**421.67**

Note: Shaded areas indicate nonattainment pollutants of concern.
1993 data and future year estimates based on data current as of June 4 1996.

Key: VOC = volatile organic compounds. SO2 = sulfur dioxide.
NOx = oxides of nitrogen. PM10 = particulate matter. JP-5 = jet fuel.
CO = carbon monoxide. GSE = Ground Support Equipment

Table F-45
NET EMISSIONS CHANGE - NAS OCEANA AND NALF FENTRESS - ARS 4
(tons per year)

Year	VOCs	NOx	CO	SO2	PM10
NAS Oceana:					
1993	395.49	618.78	874.24	51.04	211.25
1996	176.54	433.48	405.72	40.75	177.37
1997	230.71	621.26	542.45	51.55	241.88
1998	368.05	759.71	891.22	52.47	320.46
1999	417.57	784.93	1037.99	55.70	340.87
Net Change:					
1993 to 1999	**22.07**	**166.15**	**163.75**	**4.66**	**129.62**
NALF Fentress:					
1993	13.48	146.63	37.00	6.81	30.87
1996	7.29	154.27	18.14	6.28	42.05
1997	9.17	187.79	22.31	7.43	55.04
1998	10.21	225.04	26.89	8.61	70.89
1999	10.97	247.86	29.89	9.36	80.80
Net Change:					
1993 to 1999	**-2.51**	**101.23**	**-7.11**	**2.55**	**49.94**
Net Change NAS Oceana and NALF Fentress:					
1993 to 1999	**19.57**	**267.38**	**156.64**	**7.21**	**179.55**

Note: Shaded areas indicate nonattainment pollutants of concern.

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-46
ARS 5
TOTAL AIRCRAFT OPERATIONS AT NAS OCEANA AND NALF FENTRESS
FOR 1993 AND 1996-1999

Aircraft Type	Operation type	1993	1996	1997	1998	1999
F-14A	Full LTO	12,465	9,151	11,906	11,315	11,315
	Touch&Go NASO	15,236	12,175	15,841	15,056	15,056
	GCA Box	2,178	883	1,149	1,092	1,092
	Interfacility	2,164	1,661	2,162	2,054	2,054
	Touch&Go NALF	10,511	13,914	18,103	17,205	17,205
F-14B/D	Full LTO	8,551	6,789	8,954	8,954	8,954
	Touch&Go NASO	10,452	9,033	11,913	11,913	11,913
	GCA Box	1,494	655	864	864	864
	Interfacility	1,485	1,233	1,626	1,626	1,626
	Touch&Go NALF	7,226	10,323	13,615	13,615	13,615
A-6	Full LTO	13,401	0	0	0	0
	Touch&Go NASO	16,380	0	0	0	0
	GCA Box	2,341	0	0	0	0
	Interfacility	2,326	0	0	0	0
	Touch&Go NALF	11,086	0	0	0	0
F/A-18	Full LTO	0	1,803	1,803	12,623	19,836
	Touch&Go NASO	0	2,874	2,874	20,118	31,614
	GCA Box	0	0	0	613	964
	Interfacility	0	0	0	1,788	2,809
	Touch&Go NALF	0	0	0	13,285	20,876
A-4	Full LTO	4,169	0	0	0	0
	Touch&Go	5,096	0	0	0	0
F-16	Full LTO	936	0	0	0	0
	Touch&Go	1,144	0	0	0	0
F-5	Full LTO	808	0	0	0	0
	Touch&Go	988	0	0	0	0
TC-4C	Full LTO	638	0	0	0	0
	Touch&Go	780	0	0	0	0
UH-3H	Full LTO	662	0	0	0	0
C-12	Full LTO	261	1,664	1,664	1,664	1,664
	Touch&Go	445	2,767	2,767	2,767	2,767
	GCA Box	0	1,107	1,107	1,107	1,107
S-3	Full LTO	1,741	967	967	967	967
	Touch&Go	1,295	931	931	931	931
	GCA Box	1,323	373	373	373	373
T-2C	Full LTO	1,418	0	0	0	0
T-34	Full LTO	1,040	1,040	1,040	1,040	1,040
E-2/C-2	Full LTO NALF	1,074	0	0	0	0
	Touch&Go NALF	25,058	21,374	21,374	21,374	21,374
Total		**166,172**	**100,718**	**121,032**	**162,344**	**190,016**

Notes:
(1) F-14 operations divided between F-14As and F-14B/Ds using 1993 aircraft population data.
Number of GCAs and interfacility flights were proportioned from 1997 data based on the number of aircraft.
(2) 1996-1998 operations proportioned from 1999 data using NAS Oceana aircraft population data
A-6s assumed decommissioned by mid-1997.
(3) 1999 and Transient aircraft operations derived from NASMOD analysis (ATAC 1997).
(4) GCA box and interfacility flights include only the level portion of those operations.
Takeoff and landings for these operations are accounted for under full LTO or T&G.

Key:
LTO = Landing and takeoff cycle
GCA = Ground Control Approach
NASO = Naval Air Station Oceana
NALF = Naval Auxiliary Landing Field

Table F-47
ARS 5
MODAL EMISSION RATES FOR AIRCRAFT AT NAS OCEANA

Aircraft (Engine Model)	Mode	Time in Mode (minutes)	Fuel Flow ((lb/min)/eng)	Engines	Emission Factor ([lb /1000 lb fuel]/eng)					Modal Emission Rates (lb/mode)				
					VOC (1)	NOx	CO	SO2	PM10 (2)	VOC (1)	NOx	CO	SO2	PM10 (2)
F-14A	Taxi Out/Idle	7.0	15.33	2	31.42	3.22	55.51	0.54	8.96	6.74	0.69	11.91	0.12	1.92
(TF30-P-412A)	Hot Refueling Idle	16.0	15.33	2	31.42	3.22	55.51	0.54	8.96	15.41	1.58	27.23	0.26	4.40
	Take Off	0.4	796.67	2	0.20	4.79	10.77	0.54	0.00	0.13	3.05	6.86	0.34	0.00
	Climbout	0.4	117.50	2	0.77	19.60	1.38	0.54	2.98	0.07	1.84	0.13	0.05	0.28
	Approach	1.3	71.67	2	1.48	10.74	3.43	0.54	7.98	0.28	2.00	0.64	0.10	1.49
	Taxi In/Idle	5.3	15.33	2	31.42	3.22	55.51	0.54	8.96	5.11	0.52	9.02	0.09	1.46
	T&G Level	1.4	71.67	2	1.48	10.74	3.43	0.54	7.98	0.30	2.16	0.69	0.11	1.60
	GCA Box	9.7	71.67	2	1.48	10.74	3.43	0.54	7.98	2.06	14.93	4.77	0.75	11.10
	Interfacility	1.6	71.67	2	1.48	10.74	3.43	0.54	7.98	0.34	2.46	0.79	0.12	1.83
									Touch and Go	**0.65**	**6.00**	**1.46**	**0.26**	**3.37**
									Full LTO w/hot ref.	**27.74**	**9.69**	**55.80**	**0.96**	**9.54**
									Full LTO w/o hot ref.	**12.32**	**8.11**	**28.57**	**0.70**	**5.15**
									Interfacility	**0.34**	**2.46**	**0.79**	**0.12**	**1.83**
									GCA Box	**2.06**	**14.93**	**4.77**	**0.75**	**11.10**
F-14B/D	Taxi Out/Idle	7.0	19.52	2	3.65	2.77	16.60	0.54	12.38	1.00	0.76	4.54	0.15	3.38
(F110-GE-400)	Hot Refueling Idle	16.0	19.52	2	3.65	2.77	16.60	0.54	12.38	2.28	1.73	10.37	0.34	7.73
	Take Off	0.4	195.32	2	0.40	28.63	0.84	0.54	2.81	0.06	4.47	0.13	0.08	0.44
	Climbout	0.4	195.32	2	0.40	28.63	0.84	0.54	2.81	0.06	4.47	0.13	0.08	0.44
	Approach	1.3	133.03	2	0.26	19.61	0.76	0.54	6.10	0.09	6.78	0.26	0.19	2.11
	Taxi In/Idle	5.3	19.52	2	3.65	2.77	16.60	0.54	12.38	0.76	0.57	3.43	0.11	2.56
	T&G Level	1.4	64.10	2	0.95	8.75	1.64	0.54	6.10	0.17	1.57	0.29	0.10	1.09
	GCA Box	9.7	64.10	2	0.95	8.75	1.64	0.54	6.10	1.18	10.88	2.04	0.67	7.59
	Interfacility	1.6	64.10	2	0.95	8.75	1.64	0.54	6.10	0.19	1.79	0.34	0.11	1.25
									Touch and Go	**0.32**	**12.83**	**0.69**	**0.37**	**3.64**
									Full LTO w/hot ref.	**4.25**	**18.79**	**18.87**	**0.95**	**16.67**
									Full LTO w/o hot ref.	**1.97**	**17.06**	**8.50**	**0.61**	**8.93**
									Interfacility	**0.19**	**1.79**	**0.34**	**0.11**	**1.25**
									GCA Box	**1.18**	**10.88**	**2.04**	**0.67**	**7.59**
A-6	Taxi Out/Idle	7.0	11.33	2	42.20	1.79	63.78	0.54	0.00	6.69	0.28	10.12	0.09	0.00
(J-52-P-8B)	Hot Refueling Idle	20.0	11.33	2	42.20	1.79	63.78	0.54	0.00	19.13	0.81	28.91	0.24	0.00
	Take Off	0.4	122.83	2	0.93	13.05	0.71	0.54	0.00	0.09	1.28	0.07	0.05	0.00
	Climbout	0.4	72.00	2	0.58	10.10	3.00	0.54	0.00	0.03	0.58	0.17	0.03	0.00
	Approach	1.3	38.33	2	1.72	6.34	10.54	0.54	0.00	0.17	0.63	1.05	0.05	0.00
	Taxi In/Idle	5.3	11.33	2	42.20	1.79	63.78	0.54	0.00	5.07	0.21	7.66	0.06	0.00
	T&G Level	1.4	38.33	2	1.72	6.34	10.54	0.54	0.00	0.18	0.68	1.13	0.06	0.00
	GCA Box	9.7	38.33	2	1.72	6.34	10.54	0.54	0.00	1.28	4.71	7.84	0.40	0.00
	Interfacility	1.6	38.33	2	1.72	6.34	10.54	0.54	0.00	0.21	0.78	1.29	0.07	0.00
									Touch and Go	**0.39**	**1.89**	**2.35**	**0.14**	**0.00**
									Full LTO w/hot ref.	**31.18**	**3.81**	**47.97**	**0.53**	**0.00**
									Full LTO w/o hot ref.	**12.06**	**2.99**	**19.07**	**0.29**	**0.00**
									Interfacility	**0.21**	**0.78**	**1.29**	**0.07**	**0.00**
									GCA Box	**1.28**	**4.71**	**7.84**	**0.40**	**0.00**

Table F-47
ARS 5
MODAL EMISSION RATES FOR AIRCRAFT AT NAS OCEANA

Aircraft (Engine Model)	Mode	Time in Mode (minutes)	Fuel Flow ((lb/min)/eng)	Engines	Emission Factor ([lb /1000 lb fuel]/eng)					Modal Emission Rates (lb/mode)				
					VOC (1)	NOx	CO	SO2	PM10 (2)	VOC (1)	NOx	CO	SO2	PM10 (2)
A-4	Taxi Out/Idle	6.5	11.33	1	42.20	1.79	63.78	0.54	0.00	3.11	0.13	4.70	0.04	0.00
(J-52-P-8B)	Take Off	0.4	122.83	1	0.93	13.05	0.71	0.54	0.00	0.05	0.64	0.03	0.03	0.00
	Climbout	0.4	72.00	1	0.58	10.10	3.00	0.54	0.00	0.02	0.29	0.09	0.02	0.00
	Approach	1.3	38.33	1	1.72	6.34	10.54	0.54	0.00	0.09	0.32	0.53	0.03	0.00
	Taxi In/Idle	6.5	11.33	1	42.20	1.79	63.78	0.54	0.00	3.11	0.13	4.70	0.04	0.00
	T&G Level	1.4	38.33	1	1.72	6.34	10.54	0.54	0.00	0.09	0.34	0.57	0.03	0.00
									Touch and Go	**0.19**	**0.95**	**1.18**	**0.07**	**0.00**
									Full LTO w/o hot ref.	**6.36**	**1.51**	**10.04**	**0.15**	**0.00**
F-16	Taxi Out/Idle	6.5	17.67	1	2.26	3.96	19.34	0.54	0.09	0.26	0.45	2.22	0.06	0.01
(F100-PW-100)	Take Off	0.4	736.67	1	0.10	16.50	55.10	0.54	0.00	0.03	4.86	16.24	0.16	0.00
	Climbout	0.4	173.33	1	0.05	44.00	1.80	0.54	0.83	0.00	3.05	0.12	0.04	0.06
	Approach	1.3	50.00	1	0.60	11.00	3.00	0.54	0.33	0.04	0.72	0.20	0.04	0.01
	Taxi In/Idle	6.5	17.67	1	2.26	3.96	19.34	0.54	0.09	0.26	0.45	2.22	0.06	0.01
	T&G Level	1.4	50.00	1	0.60	11.00	3.00	0.54	0.33	0.04	0.77	0.21	0.04	0.02
									Touch and Go	**0.08**	**4.54**	**0.53**	**0.11**	**0.09**
									Full LTO w/o hot ref.	**0.59**	**9.54**	**21.00**	**0.36**	**0.088**
F-5	Taxi Out/Idle	6.5	6.67	2	24.25	1.25	159.00	0.54	0.00	2.10	0.11	13.79	0.05	0.00
(J85-GE-21)	Take Off	0.4	177.50	2	0.10	5.60	36.40	0.54	0.00	0.01	0.80	5.17	0.08	0.00
	Climbout	0.4	53.33	2	0.25	5.00	21.56	0.54	0.00	0.01	0.21	0.92	0.02	0.00
	Approach	1.3	20.00	2	2.58	2.92	46.25	0.54	0.00	0.13	0.15	2.41	0.03	0.00
	Taxi In/Idle	6.5	6.67	2	24.45	1.25	159.00	0.54	0.00	2.12	0.11	13.79	0.05	0.00
	T&G Level	1.4	20.00	2	2.58	2.92	46.25	0.54	0.00	0.14	0.16	2.59	0.03	0.00
									Touch and Go	**0.29**	**0.53**	**5.91**	**0.08**	**0.00**
									Full LTO w/o hot ref.	**4.38**	**1.38**	**36.07**	**0.22**	**0.00**
F/A-18	Taxi Out/Idle	7.0	10.40	2	58.18	1.16	137.34	0.40	12.38	8.47	0.17	20.00	0.06	1.80
(F404-GE-400)	Hot Refueling Idle	11.0	10.40	2	58.18	1.16	137.34	0.40	12.38	13.31	0.27	31.42	0.09	2.83
	Take Off	0.4	473.28	2	0.13	9.22	23.12	0.40	0.00	0.05	3.49	8.75	0.15	0.00
	Climbout	0.4	143.12	2	0.31	25.16	1.05	0.40	2.81	0.04	2.88	0.12	0.05	0.32
	Approach	1.3	66.75	2	0.44	8.37	1.78	0.40	6.10	0.08	1.45	0.31	0.07	1.06
	Taxi In/Idle	5.3	10.40	2	58.18	1.16	137.34	0.40	12.38	6.41	0.13	15.14	0.04	1.36
	T&G Level	1.7	60.00	2	0.44	8.37	1.78	0.40	6.10	0.09	1.71	0.36	0.08	1.24
	GCA Box	9.0	60.00	2	0.44	8.37	1.78	0.40	6.10	0.48	9.04	1.92	0.43	6.59
	Interfacility	1.4	85.00	2	0.38	11.78	1.16	0.40	6.10	0.09	2.80	0.28	0.10	1.45
									Touch and Go	**0.20**	**6.04**	**0.79**	**0.20**	**2.62**
									Full LTO w/hot ref.	**28.36**	**8.39**	**75.74**	**0.46**	**7.38**
									Full LTO w/o hot ref.	**15.05**	**8.12**	**44.32**	**0.37**	**4.55**
									Interfacility	**0.09**	**2.80**	**0.28**	**0.10**	**1.45**
									GCA Box	**0.48**	**9.04**	**1.92**	**0.43**	**6.59**

Table F-47
ARS 5
MODAL EMISSION RATES FOR AIRCRAFT AT NAS OCEANA

Aircraft (Engine Model)	Mode	Time in Mode (minutes)	Fuel Flow ((lb/min)/eng)	Engines	Emission Factor ([lb /1000 lb fuel]/eng)					Modal Emission Rates (lb/mode)				
					VOC (1)	NOx	CO	SO2	PM10 (2)	VOC (1)	NOx	CO	SO2	PM10 (2)
S-3	Taxi Out/Idle	6.5	7.63	2	14.99	1.69	90.98	0.54	3.26	1.49	0.17	9.02	0.05	0.32
(TF34-GE-400)	Hot Refueling Idle	8.0	7.63	2	14.99	1.69	90.98	0.54	3.26	1.83	0.21	11.11	0.07	0.40
	Take Off	0.4	63.33	2	0.39	7.51	5.95	0.54	2.11	0.02	0.38	0.30	0.03	0.11
	Climbout	0.4	7.67	2	2.63	3.42	33.57	0.54	6.85	0.02	0.02	0.21	0.00	0.04
	Approach	1.3	7.67	2	2.63	3.42	33.57	0.54	6.85	0.05	0.07	0.67	0.01	0.14
	Taxi In/Idle	6.5	7.63	2	14.99	1.69	90.98	0.54	3.26	1.49	0.17	9.02	0.05	0.32
	T&G Level	1.8	7.67	2	2.63	3.42	33.57	0.54	6.85	0.07	0.09	0.93	0.01	0.19
	GCA Box	7.5	7.67	2	2.63	3.42	33.57	0.54	6.85	0.30	0.39	3.86	0.06	0.79
									Touch and Go	**0.14**	**0.18**	**1.80**	**0.03**	**0.37**
									Full LTO w/hot ref.	**4.89**	**1.01**	**30.33**	**0.21**	**1.33**
									Full LTO w/o hot ref	**3.06**	**0.80**	**19.23**	**0.15**	**0.93**
									GCA Box	**0.30**	**0.39**	**3.86**	**0.06**	**0.79**
C-12/TC-4	Taxi Out/Idle	19.0	2.45	2	101.63	1.97	115.31	0.54	0.00	9.46	0.18	10.74	0.05	0.00
(PTGA-41)	Take Off	0.5	8.50	2	1.75	7.98	5.10	0.54	0.00	0.01	0.07	0.04	0.00	0.00
	Climbout	2.1	7.88	2	2.03	7.57	6.49	0.54	0.00	0.07	0.25	0.21	0.02	0.00
	Approach	3.7	4.55	2	22.71	4.65	34.80	0.54	0.00	0.76	0.16	1.17	0.02	0.00
	Taxi In/Idle	7.0	2.45	2	101.63	1.97	115.31	0.54	0.00	3.49	0.07	3.96	0.02	0.00
	T&G Level	2.0	4.55	2	22.71	4.65	34.80	0.54	0.00	0.41	0.08	0.63	0.01	0.00
	GCA Box	7.5	4.55	2	22.71	4.65	34.80	0.54	0.00	1.55	0.32	2.38	0.04	0.00
									Touch and Go	**1.25**	**0.49**	**2.02**	**0.05**	**0.00**
									Full LTO w/o hot ref	**13.79**	**0.73**	**16.12**	**0.11**	**0.00**
									GCA Box	**1.55**	**0.32**	**2.38**	**0.04**	**0.00**
UH-3H	Taxi Out/Idle	8.0	2.20	2	130.42	1.43	178.44	0.54	0.00	4.59	0.05	6.28	0.02	0.00
(T58-GE-8F)	Take Off	0.0	13.10	2	0.40	5.47	9.03	0.54	0.00	0.00	0.00	0.00	0.00	0.00
	Climbout	5.7	10.45	2	0.80	4.68	14.13	0.54	0.00	0.10	0.08	0.11	0.03	0.00
	Approach	5.7	9.68	2	1.12	4.47	17.28	0.54	0.00	0.13	0.53	2.06	0.06	0.00
	Taxi In/Idle	7.0	2.20	2	130.42	1.43	178.44	0.54	0.00	4.02	0.04	5.50	0.02	0.00
									Full LTO w/o hot ref	**8.84**	**0.71**	**13.94**	**0.13**	**0.00**
T-34	Taxi Out/Idle	6.5	1.92	1	50.17	2.43	64.00	0.54	0.00	0.63	0.03	0.80	0.01	0.00
(PTGA-25)	Take Off	0.4	7.08	1	0.00	7.81	1.01	0.54	0.00	0.00	0.02	0.00	0.00	0.00
	Climbout	0.4	6.67	1	0.00	7.00	1.20	0.54	0.00	0.00	0.02	0.00	0.00	0.00
	Approach	1.3	3.58	1	2.19	8.37	23.02	0.54	0.00	0.01	0.04	0.11	0.00	0.00
	Taxi In/Idle	6.5	1.92	1	50.17	2.43	64.00	0.54	0.00	0.63	0.03	0.80	0.01	0.00
									Full LTO w/o hot ref	**1.26**	**0.14**	**1.71**	**0.02**	**0.00**

Table F-47
ARS 5
MODAL EMISSION RATES FOR AIRCRAFT AT NAS OCEANA

Aircraft (Engine Model)	Mode	Time in Mode (minutes)	Fuel Flow ((lb/min)/eng)	Engines	Emission Factor ([lb /1000 lb fuel]/eng)					Modal Emission Rates (lb/mode)				
					VOC (1)	NOx	CO	SO2	PM10 (2)	VOC (1)	NOx	CO	SO2	PM10 (2)
T-2	Taxi Out/Idle	6.5	9.33	2	11.86	3.68	111.86	0.54	0.00	1.44	0.45	13.57	0.07	0.00
(J85-GE-2)	Take Off	0.4	48.17	2	0.45	6.40	21.56	0.54	0.00	0.02	0.25	0.83	0.02	0.00
	Climbout	0.4	35.92	2	0.64	5.67	28.38	0.54	0.00	0.02	0.16	0.82	0.02	0.00
	Approach	1.3	17.42	2	2.40	4.02	63.53	0.54	0.00	0.11	0.18	2.88	0.02	0.00
	Taxi In/Idle	6.5	9.33	2	11.86	3.68	111.86	0.54	0.00	1.44	0.45	13.57	0.07	0.00
									Full LTO w/o hot ref	**3.02**	**1.48**	**31.66**	**0.19**	**0.00**
E-2/C-2	Taxi Out/Idle	19.0	9.98	2	19.24	3.53	30.11	0.54	0.00	7.30	1.34	11.42	0.20	0.00
(T56-A-16)	Take Off	0.5	36.98	2	0.14	10.45	0.65	0.54	0.00	0.01	0.39	0.02	0.02	0.00
	Climbout	2.1	36.98	2	0.14	10.45	0.65	0.54	0.00	0.02	1.62	0.10	0.08	0.00
	Approach	3.7	33.27	2	0.17	9.93	0.42	0.54	0.00	0.04	2.44	0.10	0.13	0.00
	Taxi In/Idle	7.0	9.98	2	19.24	3.53	30.11	0.54	0.00	2.69	0.49	4.21	0.08	0.00
	T&G Level	1.6	15.00	2	0.95	6.52	4.54	0.54	0.00	0.05	0.31	0.22	0.03	0.00
									Touch and Go	**0.11**	**4.38**	**0.42**	**0.24**	**0.00**
									Full LTO w/o hot ref	**10.05**	**6.29**	**15.85**	**0.52**	**0.00**

Notes:
(a) F-14 operations were divided between F-14As and F-14Bs based on the number of aircraft present in 1993. Number of GCAs and interfacility flights were proportioned from 1997 data based on the number of aircraft.
(b) 1996-1998 operations were proportioned from 1999 data based upon the numbers of aircraft based at NAS Oceana during those years. A-6s assumed to be deployed in 1996 and decommissioned by mid-1997.
(c) Transient aircraft operations, derived from NASMOD analysis (ATAC 1997).
(d) 1999 operations were derived from NASMOD analysis(ATAC 1997).

Shaded areas indicate nonattainment pollutants of concern.
The LTOs listed for GCA box and interfacility flights include only the level portion of those operations. Takeoff and landings for these operations are accounted for under full LTO or T&G.

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

LTO w/ hot ref. = landing and takeoff cycle with hot refueling idle
LTO w/o hot ref. = landing and takeoff cycle without hot refueling idle
interfacility = low altitude operations between NAS Oceana and NALF Fentress
GCA = ground control approach
lb = pounds TPY = tons per year

Table F-48
ARS 5
AIRCRAFT EMISSIONS AT NAS OCEANA FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Yea	VOC (e) per operation (lb)	VOC (e) Total (TPY)	NOx per operation (lb)	NOx Total (TPY)	CO per operation (lb)	CO Total (TPY)	SO2 per operation (lb)	SO2 Total (TPY)	PM10 per operation (lb)	PM10 Total (TPY)
1993	F-14A	Full LTO w/hot ref.	3,116	27.74	43.22	9.69	15.10	55.80	86.94	0.96	1.50	9.54	14.87
		Full LTO w/o hot ref.	9,349	12.32	57.61	8.11	37.91	28.57	133.54	0.70	3.27	5.15	24.06
		Touch&Go	15,236	0.65	4.91	6.00	45.70	1.46	11.10	0.26	1.98	3.37	25.66
		GCA Box	2,178	2.06	2.24	14.93	16.26	4.77	5.19	0.75	0.82	11.10	12.08
		Interfacility	2,164	0.34	0.37	2.46	2.67	0.79	0.85	0.12	0.13	1.83	1.98
	F-14B	Full LTO w/hot ref.	2,138	4.25	4.54	18.79	20.09	18.87	20.17	0.95	1.02	16.67	17.81
		Full LTO w/o hot ref.	6,414	1.97	6.31	17.06	54.71	8.50	27.25	0.61	1.97	8.93	28.65
		Touch&Go	10,452	0.32	1.69	12.83	67.03	0.69	3.60	0.37	1.92	3.64	19.04
		GCA Box	1,494	1.18	0.88	10.88	8.13	2.04	1.52	0.67	0.50	7.59	5.67
		Interfacility	1,485	0.19	0.14	1.79	1.33	0.34	0.25	0.11	0.08	1.25	0.93
	A-6	Full LTO w/hot ref.	3,350	31.18	52.24	3.81	6.38	47.97	80.37	0.53	0.89	0.00	0.00
		Full LTO w/o hot ref.	10,051	12.06	60.60	2.99	15.05	19.07	95.84	0.29	1.45	0.00	0.00
		Touch&Go	16,380	0.39	3.19	1.89	15.51	2.35	19.28	0.14	1.17	0.00	0.00
		GCA Box	2,341	1.28	1.50	4.71	5.52	7.84	9.17	0.40	0.47	0.00	0.00
		Interfacility	2,326	0.21	0.25	0.78	0.90	1.29	1.50	0.07	0.08	0.00	0.00
	A-4	Full LTO w/o hot ref.	4,169	6.36	13.27	1.51	3.15	10.04	20.93	0.15	0.31	0.00	0.00
		Touch&Go	5,096	0.19	0.50	0.95	2.41	1.18	3.00	0.07	0.18	0.00	0.00
	F-16	Full LTO w/o hot ref.	936	0.59	0.28	9.54	4.46	21.00	9.83	0.36	0.17	0.09	0.04
		Touch&Go	1,144	0.08	0.05	4.54	2.59	0.53	0.30	0.11	0.06	0.09	0.05
	F-5	Full LTO w/o hot ref.	808	4.38	1.77	1.38	0.56	36.07	14.57	0.22	0.09	0.00	0.00
		Touch&Go	988	0.29	0.14	0.53	0.26	5.91	2.92	0.08	0.04	0.00	0.00
	TC-4	Full LTO w/o hot ref.	638	13.79	4.40	0.73	0.23	16.12	5.14	0.11	0.03	0.00	0.00
		Touch&Go	780	1.25	0.49	0.49	0.19	2.02	0.79	0.05	0.02	0.00	0.00
	UH-3H	Full LTO w/o hot ref.	662	8.84	2.92	0.71	0.23	13.94	4.61	0.13	0.04	0.00	0.00
	C-12	Full LTO w/o hot ref.	261	13.79	1.80	0.73	0.09	16.12	2.10	0.11	0.01	0.00	0.00
		Touch&Go	445	1.25	0.28	0.49	0.11	2.02	0.45	0.05	0.01	0.00	0.00
	S-3	Full LTO w/hot ref.	870	4.89	2.13	1.01	0.44	30.33	13.20	0.21	0.09	1.33	0.58
		Full LTO w/o hot ref.	870	3.06	1.33	0.80	0.35	19.23	8.37	0.15	0.06	0.93	0.41
		Touch&Go	1,295	0.14	0.09	0.18	0.12	1.80	1.17	0.03	0.02	0.37	0.24
		GCA Box	1,323	0.30	0.20	0.39	0.26	3.86	2.55	0.06	0.04	0.79	0.52
	T-2C	Full LTO w/o hot ref.	1,418	3.02	2.14	1.48	1.05	31.66	22.45	0.19	0.14	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**111,217**		**272.13**		**328.88**		**609.85**		**18.59**		**152.58**

Table F-48
ARS 5
AIRCRAFT EMISSIONS AT NAS OCEANA FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1996(b)	F-14A	Full LTO w/hot ref.	2,288	27.74	31.73	9.69	11.08	55.80	63.82	0.96	1.10	9.54	10.91
		Full LTO w/o hot ref.	6,863	12.32	42.29	8.11	27.83	28.57	98.03	0.70	2.40	5.15	17.66
		Touch&Go	12,175	0.65	3.93	6.00	36.52	1.46	8.87	0.26	1.58	3.37	20.51
		GCA Box	883	2.06	0.91	14.93	6.59	4.77	2.11	0.75	0.33	11.10	4.90
		Interfacility	1,661	0.34	0.28	2.46	2.05	0.79	0.65	0.12	0.10	1.83	1.52
	F-14B/D	Full LTO w/hot ref.	1,697	4.25	3.60	18.79	15.95	18.87	16.01	0.95	0.81	16.67	14.14
		Full LTO w/o hot ref.	5,092	1.97	5.01	17.06	43.43	8.50	21.63	0.61	1.57	8.93	22.74
		Touch&Go	9,033	0.32	1.46	12.83	57.93	0.69	3.11	0.37	1.66	3.64	16.46
		GCA Box	655	1.18	0.39	10.88	3.56	2.04	0.67	0.67	0.22	7.59	2.48
		Interfacility	1,233	0.19	0.12	1.79	1.11	0.34	0.21	0.11	0.07	1.25	0.77
	A-6	Full LTO w/hot ref.	0	31.18	0.00	3.81	0.00	47.97	0.00	0.53	0.00	0.00	0.00
		Full LTO w/o hot ref.	0	12.06	0.00	2.99	0.00	19.07	0.00	0.29	0.00	0.00	0.00
		Touch&Go	0	0.39	0.00	1.89	0.00	2.35	0.00	0.14	0.00	0.00	0.00
		GCA Box	0	1.28	0.00	4.71	0.00	7.84	0.00	0.40	0.00	0.00	0.00
		Interfacility	0	0.21	0.00	0.78	0.00	1.29	0.00	0.07	0.00	0.00	0.00
	F/A-18	Full LTO w/hot ref.	451	28.36	6.39	8.39	1.89	75.74	17.07	0.46	0.10	7.38	1.66
		Full LTO w/o hot ref.	1,352	15.05	10.17	8.12	5.49	44.32	29.97	0.37	0.25	4.55	3.08
		Touch&Go	2,874	0.20	0.29	6.04	8.68	0.79	1.14	0.20	0.28	2.62	3.77
	S-3(c)	Full LTO w/hot ref.	484	4.89	1.18	1.01	0.24	30.33	7.33	0.21	0.05	1.33	0.32
		Full LTO w/o hot ref.	484	3.06	0.74	0.80	0.19	19.23	4.65	0.15	0.04	0.93	0.23
		Touch&Go	931	0.14	0.07	0.18	0.09	1.80	0.84	0.03	0.01	0.37	0.17
		GCA Box	373	0.30	0.06	0.39	0.07	3.86	0.72	0.06	0.01	0.79	0.15
	UH-3H	Full LTO w/o hot ref.	0	8.84	0.00	0.71	0.00	13.94	0.00	0.13	0.00	0.00	0.00
	C-12	Full LTO w/o hot ref.	1,664	13.79	11.48	0.73	0.60	16.12	13.41	0.11	0.09	0.00	0.00
		Touch&Go	2,767	1.25	1.72	0.49	0.68	2.02	2.79	0.05	0.06	0.00	0.00
		GCA Box	1,107	1.55	0.86	0.32	0.18	2.38	1.31	0.04	0.02	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**55,107**		**123.33**		**224.25**		**295.24**		**10.78**		**121.47**

Table F-48
ARS 5
AIRCRAFT EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1997(b)	F-14A	Full LTO w/hot ref.	2,976	27.74	41.28	9.69	14.42	55.80	83.04	0.96	1.43	9.54	14.20
		Full LTO w/o hot ref.	8,929	12.32	55.02	8.11	36.21	28.57	127.54	0.70	3.12	5.15	22.98
		Touch&Go	15,841	0.65	5.11	6.00	47.51	1.46	11.54	0.26	2.06	3.37	26.68
		GCA Box	1,149	2.06	1.18	14.93	8.58	4.77	2.74	0.75	0.43	11.10	6.37
		Interfacility	2,162	0.34	0.37	2.46	2.66	0.79	0.85	0.12	0.13	1.83	1.98
	F-14B/D	Full LTO w/hot ref.	2,238	4.25	4.75	18.79	21.03	18.87	21.11	0.95	1.07	16.67	18.65
		Full LTO w/o hot ref.	6,715	1.97	6.61	17.06	57.28	8.50	28.53	0.61	2.06	8.93	29.99
		Touch&Go	11,913	0.32	1.92	12.83	76.41	0.69	4.10	0.37	2.19	3.64	21.70
		GCA Box	864	1.18	0.51	10.88	4.70	2.04	0.88	0.67	0.29	7.59	3.28
		Interfacility	1,626	0.19	0.16	1.79	1.46	0.34	0.27	0.11	0.09	1.25	1.02
	F/A-18	Full LTO w/hot ref.	451	28.36	6.39	8.39	1.89	75.74	17.07	0.46	0.10	7.38	1.66
		Full LTO w/o hot ref.	1,352	15.05	10.17	8.12	5.49	44.32	29.97	0.37	0.25	4.55	3.08
		Touch&Go	2,874	0.20	0.29	6.04	8.68	0.79	1.14	0.20	0.28	2.62	3.77
	S-3	Full LTO w/hot ref.	484	4.89	1.18	1.01	0.24	30.33	7.33	0.21	0.05	1.33	0.32
		Full LTO w/o hot ref.	484	3.06	0.74	0.80	0.19	19.23	4.65	0.15	0.04	0.93	0.23
		Touch&Go	931	0.14	0.07	0.18	0.09	1.80	0.84	0.03	0.01	0.37	0.17
		GCA Box	373	0.30	0.06	0.39	0.07	3.86	0.72	0.06	0.01	0.79	0.15
	C-12	Full LTO w/o hot ref.	1,664	13.79	11.48	0.73	0.60	16.12	13.41	0.11	0.09	0.00	0.00
		Touch&Go	2,767	1.25	1.72	0.49	0.68	2.02	2.79	0.05	0.06	0.00	0.00
		GCA Box	1,107	1.55	0.86	0.32	0.18	2.38	1.31	0.04	0.02	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**67,940**		**150.53**		**288.46**		**360.74**		**13.82**		**156.23**

Table F-48
ARS 5
AIRCRAFT EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1998	F-14A	Full LTO w/hot ref.	2,829	27.74	39.23	9.69	13.71	55.80	78.92	0.96	1.36	9.54	13.50
		Full LTO w/o hot ref.	8,486	12.32	52.30	8.11	34.42	28.57	121.21	0.70	2.97	5.15	21.84
		Touch&Go	15,056	0.65	4.86	6.00	45.16	1.46	10.97	0.26	1.96	3.37	25.36
		GCA Box	1,092	2.06	1.12	14.93	8.15	4.77	2.60	0.75	0.41	11.10	6.06
		Interfacility	2,054	0.34	0.35	2.46	2.53	0.79	0.81	0.12	0.13	1.83	1.88
	F-14B/D	Full LTO w/hot ref.	2,238	4.25	4.75	18.79	21.03	18.87	21.11	0.95	1.07	16.67	18.65
		Full LTO w/o hot ref.	6,715	1.97	6.61	17.06	57.28	8.50	28.53	0.61	2.06	8.93	29.99
		Touch&Go	11,913	0.32	1.92	12.83	76.41	0.69	4.10	0.37	2.19	3.64	21.70
		GCA Box	864	1.18	0.51	10.88	4.70	2.04	0.88	0.67	0.29	7.59	3.28
		Interfacility	1,626	0.19	0.16	1.79	1.46	0.34	0.27	0.11	0.09	1.25	1.02
	F/A-18	Full LTO w/hot ref.	3,156	28.36	44.74	8.39	13.23	75.74	119.51	0.46	0.73	7.38	11.64
		Full LTO w/o hot ref.	9,467	15.05	71.22	8.12	38.44	44.32	209.79	0.37	1.75	4.55	21.53
		Touch&Go	20,118	0.20	2.03	6.04	60.76	0.79	7.97	0.20	1.98	2.62	26.40
		GCA Box	613	0.48	0.15	9.04	2.77	1.92	0.59	0.43	0.13	6.59	2.02
		Interfacility	1,788	0.09	0.08	2.80	2.51	0.28	0.25	0.10	0.09	1.45	1.30
	S-3	Full LTO w/hot ref.	484	4.89	1.18	1.01	0.24	30.33	7.33	0.21	0.05	1.33	0.32
		Full LTO w/o hot ref.	484	3.06	0.74	0.80	0.19	19.23	4.65	0.15	0.04	0.93	0.23
		Touch&Go	931	0.14	0.07	0.18	0.09	1.80	0.84	0.03	0.01	0.37	0.17
		GCA Box	373	0.30	0.06	0.39	0.07	3.86	0.72	0.06	0.01	0.79	0.15
	C-12	Full LTO w/o hot ref.	1,664	13.79	11.48	0.73	0.60	16.12	13.41	0.11	0.09	0.00	0.00
		Touch&Go	2,767	1.25	1.72	0.49	0.68	2.02	2.79	0.05	0.06	0.00	0.00
		GCA Box	1,107	1.55	0.86	0.32	0.18	2.38	1.31	0.04	0.02	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		**96,865**		**246.79**		**384.69**		**639.48**		**17.49**		**207.03**

Table F-48
ARS 5
AIRCRAFT EMISSIONS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation	Number of Operations/Year	VOC (e) per operation (lb)	VOC (e) Total (TPY)	NOx per operation (lb)	NOx Total (TPY)	CO per operation (lb)	CO Total (TPY)	SO2 per operation (lb)	SO2 Total (TPY)	PM10 per operation (lb)	PM10 Total (TPY)
1999	F-14A	Full LTO w/hot ref.	2,829	27.74	39.23	9.69	13.71	55.80	78.92	0.96	1.36	9.54	13.50
		Full LTO w/o hot ref.	8,486	12.32	52.30	8.11	34.42	28.57	121.21	0.70	2.97	5.15	21.84
		Touch&Go	15,056	0.65	4.86	6.00	45.16	1.46	10.97	0.26	1.96	3.37	25.36
		GCA Box	1,092	2.06	1.12	14.93	8.15	4.77	2.60	0.75	0.41	11.10	6.06
		Interfacility	2,054	0.34	0.35	2.46	2.53	0.79	0.81	0.12	0.13	1.83	1.88
	F-14B/D	Full LTO w/hot ref.	2,238	4.25	4.75	18.79	21.03	18.87	21.11	0.95	1.07	16.67	18.65
		Full LTO w/o hot ref.	6,715	1.97	6.61	17.06	57.28	8.50	28.53	0.61	2.06	8.93	29.99
		Touch&Go	11,913	0.32	1.92	12.83	76.41	0.69	4.10	0.37	2.19	3.64	21.70
		GCA Box	864	1.18	0.51	10.88	4.70	2.04	0.88	0.67	0.29	7.59	3.28
		Interfacility	1,626	0.19	0.16	1.79	1.46	0.34	0.27	0.11	0.09	1.25	1.02
	F/A-18	Full LTO w/hot ref.	4,959	28.36	70.31	8.39	20.79	75.74	187.81	0.46	1.14	7.38	18.30
		Full LTO w/o hot ref.	14,877	15.05	111.92	8.12	60.41	44.32	329.67	0.37	2.74	4.55	33.83
		Touch&Go	31,614	0.20	3.19	6.04	95.49	0.79	12.52	0.20	3.11	2.62	41.49
		GCA Box	964	0.48	0.23	9.04	4.36	1.92	0.93	0.43	0.21	6.59	3.18
		Interfacility	2,809	0.09	0.13	2.80	3.94	0.28	0.39	0.10	0.13	1.45	2.04
	S-3	Full LTO w/hot ref.	484	4.89	1.18	1.01	0.24	30.33	7.33	0.21	0.05	1.33	0.32
		Full LTO w/o hot ref.	484	3.06	0.74	0.80	0.19	19.23	4.65	0.15	0.04	0.93	0.23
		Touch&Go	931	0.14	0.07	0.18	0.09	1.80	0.84	0.03	0.01	0.37	0.17
		GCA Box	373	0.30	0.06	0.39	0.07	3.86	0.72	0.06	0.01	0.79	0.15
	C-12	Full LTO w/o hot ref.	1,664	13.79	11.48	0.73	0.60	16.12	13.41	0.11	0.09	0.00	0.00
		Touch&Go	2,767	1.25	1.72	0.49	0.68	2.02	2.79	0.05	0.06	0.00	0.00
		GCA Box	1,107	1.55	0.86	0.32	0.18	2.38	1.31	0.04	0.02	0.00	0.00
	T-34	Full LTO w/o hot ref.	1,040	1.26	0.66	0.14	0.07	1.71	0.89	0.02	0.01	0.00	0.00
	Total		116,946		314.34		451.96		832.68		20.16		242.97

Notes:
(a) F-14 operations were divided between F-14As and F-14Bs based on the number of aircraft present in 1993. Number of GCAs and interfacility flights were proportioned from 1997 data based on the number of aircraft.
(b) 1996-1998 operations were proportioned from 1999 data based upon the numbers of aircraft based at NAS Oceana during those years. A-6s assumed to be deployed in 1996 and decommissioned by mid-1997.
(c) Transient aircraft operations, derived from NASMOD analysis (ATAC 1997).
(d) 1999 operations were derived from NASMOD analysis(ATAC 1997).
(e) Aircraft VOC reported as HC in the form CHy/x

Shaded areas indicate nonattainment pollutants of concern.
The LTOs listed for GCA box and interfacility flights include only the level portion of those operations. Takeoff and landings for these operations are accounted for under full LTO or T&G.

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

LTO w/ hot ref. = landing and takeoff cycle with hot refueling idle
LTO w/o hot ref. = landing and takeoff cycle without hot refueling idle
interfacility = low altitude operations between NAS Oceana and NALF Fentress
GCA = ground control approach
lb = pounds
TPY = tons per year

Table F-49
ARS 5
AIRCRAFT EMISSIONS AT NALF FENTRESS
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation Type	Number of perations/Yea	VOC (d)		NOx		CO		SO2		PM10	
				per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)	per operation (lb)	Total (TPY)
1993(a)	F-14A	Touch&Go	10,511	0.65	3.39	6.00	31.53	1.46	7.66	0.26	1.37	3.37	17.70
	F-14B	Touch&Go	7,226	0.32	1.17	12.83	46.34	0.69	2.49	0.37	1.33	3.64	13.17
	E-2/C-2	Full LTO	1,074	10.05	5.40	6.29	3.38	15.85	8.51	0.52	0.28	0.00	0.00
		Touch&Go	25,058	0.11	1.37	4.38	54.89	0.42	5.29	0.24	3.04	0.00	0.00
	A-6	Touch&Go	11,086	0.39	2.16	1.89	10.50	2.35	13.05	0.14	0.79	0.00	0.00
	Total		**54,955**		**13.48**		**146.63**		**37.00**		**6.81**		**30.87**
1996(c)	F-14A	Touch&Go	13,914	0.65	4.49	6.00	41.73	1.46	10.14	0.26	1.81	3.37	23.43
	F-14B/D	Touch&Go	10,323	0.32	1.67	12.83	66.21	0.69	3.55	0.37	1.90	3.64	18.81
	E-2/C-2	Full LTO	0	10.05	0.00	6.29	0.00	15.85	0.00	0.52	0.00	0.00	0.00
		Touch&Go	21,374	0.11	1.17	4.38	46.82	0.42	4.51	0.24	2.59	0.00	0.00
	A-6	Touch&Go	0	0.39	0.00	1.89	0.00	2.35	0.00	0.14	0.00	0.00	0.00
	Total		**45,611**		**7.32**		**154.76**		**18.20**		**6.30**		**42.24**
1997(c)	F-14A	Touch&Go	18,103	0.65	5.84	6.00	54.30	1.46	13.19	0.26	2.35	3.37	30.49
	F-14B/D	Touch&Go	13,615	0.32	2.20	12.83	87.32	0.69	4.69	0.37	2.51	3.64	24.80
	E-2/C-2	Full LTO	0	10.05	0.00	6.29	0.00	15.85	0.00	0.52	0.00	0.00	0.00
		Touch&Go	21,374	0.11	1.17	4.38	46.82	0.42	4.51	0.24	2.59	0.00	0.00
	Total		**53,092**		**9.21**		**188.43**		**22.39**		**7.45**		**55.29**

Table F-49
ARS 5
AIRCRAFT EMISSIONS AT NALF FENTRESS
FOR 1993 AND 1996-1999

	Type of Aircraft	Operation Type	Number of perations/Yea	VOC (d) per operation (lb)	VOC (d) Total (TPY)	NOx per operation (lb)	NOx Total (TPY)	CO per operation (lb)	CO Total (TPY)	SO2 per operation (lb)	SO2 Total (TPY)	PM10 per operation (lb)	PM10 Total (TPY)
1998	F-14A	Touch&Go	17,205	0.65	5.55	6.00	51.61	1.46	12.54	0.26	2.23	3.37	28.98
	F-14B/D	Touch&Go	13,615	0.32	2.20	12.83	87.32	0.69	4.69	0.37	2.51	3.64	24.80
	F/A-18	Touch&Go	13,285	0.20	1.34	6.04	40.13	0.79	5.26	0.20	1.31	2.62	17.43
	E-2/C-2	Full LTO	0	10.05	0.00	6.29	0.00	15.85	0.00	0.52	0.00	0.00	0.00
		Touch&Go	21,374	0.11	1.17	4.38	46.82	0.42	4.51	0.24	2.59	0.00	0.00
	Total		**65,479**		**10.25**		**225.87**		**27.00**		**8.64**		**71.22**
1999	F-14A	Touch&Go	17,205	0.65	5.55	6.00	51.61	1.46	12.54	0.26	2.23	3.37	28.98
	F-14B/D	Touch&Go	13,615	0.32	2.20	12.83	87.32	0.69	4.69	0.37	2.51	3.64	24.80
	F/A-18	Touch&Go	20,876	0.20	2.10	6.04	63.05	0.79	8.27	0.20	2.05	2.62	27.40
	E-2/C-2	Full LTO	0	10.05	0.00	6.29	0.00	15.85	0.00	0.52	0.00	0.00	0.00
		Touch&Go	21,374	0.11	1.17	4.38	46.82	0.42	4.51	0.24	2.59	0.00	0.00
	Total		**73,070**		**11.02**		**248.79**		**30.00**		**9.39**		**81.18**

Notes:
(a) F-14 operations were divided between F-14As and F-14Bs based on the number of aircraft present in 1993.
(b) 1996-1998 operations for F-14s were proporationed from 1999 data based upon the numbers of F-14 squadrons based at NAS Oceana, A-6s assumed to be deployed in 1996 and decommissioned by mid-1997.
1996-1998 E-2/C-2 operations assumed to the same as 1999.
(c) 1997 operations derived from NASMOD analysis (ATAC 1997).
(d) Aircraft VOC reported as HC in the form CHy/x
Shaded areas indicate nonattainment pollutants of concern.

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

LTO = landing and takeoff cycle
interfacility = low altitude operations between NAS Oceana and NALF Fentress
GCA = ground control approach
lb = pounds
TPY = tons per year

Table F-50
ARS 5
Emissions from Ground Support Equipment at NAS Oceana

		Fuel Consumption (gal/yr)	VOC lb/1000 gal	VOC Total (TPY)	NOx lb/1000 gal	NOx Total (TPY)	CO lb/1000 gal	CO Total (TPY)	SO2 lb/1000 gal	SO2 Total (TPY)	PM-10 lb/1000 gal	PM-10 Total (TPY)
1993	*Tow Tractors: (a)*											
	A/S32A-30A	8960	64.60	0.29	436.67	1.96	268.50	1.20	31.10	0.14	46.50	0.21
	TA-35	254	64.60	0.01	436.67	0.06	268.50	0.03	31.10	0.00	46.50	0.01
	MD-3/A/S32A-31A	4843	64.60	0.16	436.67	1.06	268.50	0.65	31.10	0.08	46.50	0.11
	TA-75	17115	122.00	1.04	146.00	1.25	3250.00	27.81	5.20	0.04	8.27	0.07
	A/S32A-42	7200	64.60	0.23	436.67	1.57	268.50	0.97	31.10	0.11	46.50	0.17
	JG-75	104	122.00	0.01	146.00	0.01	3250.00	0.17	5.20	0.00	8.27	0.00
	A/S32A-30	897	122.00	0.05	146.00	0.07	3250.00	1.46	5.20	0.00	8.27	0.00
	Flight Line Electric Power Units											
	NC8A (b)	14926	49.23	0.37	604.17	4.51	130.15	0.97	39.73	0.30	42.47	0.32
	NC10C (b)	3180	49.23	0.08	604.17	0.96	130.15	0.21	39.73	0.06	42.47	0.07
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	41932	49.23	1.03	604.17	12.67	130.15	2.73	39.73	0.83	42.47	0.89
	A/S47A-1 (b)	712	49.23	0.02	604.17	0.22	130.15	0.05	39.73	0.01	42.47	0.02
	GTC-85 (c)	10101	0.13	0.00	3.88	0.02	14.83	0.07	0.54	0.00	0.00	0.00
	Miscellaneous: (c)											
	A/M32C-17	2105	49.23	0.05	604.17	0.64	130.15	0.14	39.73	0.04	42.47	0.04
	A/M27T-5	990	49.23	0.02	604.17	0.30	130.15	0.06	39.73	0.02	42.47	0.02
	A/M42M-2	720	49.23	0.02	604.17	0.22	130.15	0.05	39.73	0.01	42.47	0.02
	HLU-196	8400	415.11	1.74	223.31	0.94	8589.90	36.08	11.51	0.05	13.70	0.06
		Total		**5.13**		**26.43**		**72.65**		**1.71**		**2.00**
1996	*Tow Tractors: (a)*											
	A/S32A-30A	19000	64.60	0.61	436.67	4.15	268.50	2.55	31.10	0.30	46.50	0.44
	TA-35	450	64.60	0.01	436.67	0.10	268.50	0.06	31.10	0.01	46.50	0.01
	MD-3/A/S32A-31A	4843	64.60	0.16	436.67	1.06	268.50	0.65	31.10	0.08	46.50	0.11
	TA-75 (MOGAS)	1600	122.00	0.10	146.00	0.12	3250.00	2.60	5.20	0.00	8.27	0.01
	A/S32A-42	17000	64.60	0.55	436.67	3.71	268.50	2.28	31.10	0.26	46.50	0.40
	JG-75	104	122.00	0.01	146.00	0.01	3250.00	0.17	5.20	0.00	8.27	0.00
	A/S32A-30	2900	122.00	0.18	146.00	0.21	3250.00	4.71	5.20	0.01	8.27	0.01
	Flight Line Electric Power Units											
	NC8A (b)	12800	49.23	0.32	604.17	3.87	130.15	0.83	39.73	0.25	42.47	0.27
	NC10C (b)	3500	49.23	0.09	604.17	1.06	130.15	0.23	39.73	0.07	42.47	0.07
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	37000	49.23	0.91	604.17	11.18	130.15	2.41	39.73	0.74	42.47	0.79
	GTC-85 (c)	3000	0.13	0.00	3.88	0.01	14.83	0.02	0.54	0.00	0.00	0.00
	Miscellaneous: (b)											
	A/M32C-17	2400	49.23	0.06	604.17	0.73	130.15	0.16	39.73	0.05	42.47	0.05
	A/M27T-5 (air cond.)	2350	49.23	0.06	604.17	0.71	130.15	0.15	39.73	0.05	42.47	0.05
	A/M42M-2 (power)	1500	49.23	0.04	604.17	0.45	130.15	0.10	39.73	0.03	42.47	0.03
	HLU-196	25	415.11	0.01	223.31	0.00	8589.90	0.11	11.51	0.00	13.70	0.00
		Total		**3.09**		**27.35**		**17.03**		**1.84**		**2.24**

Table F-50
ARS 5
Emissions from Ground Support Equipment at NAS Oceana

		Fuel Consumption (gal/yr)	VOC		NOx		CO		SO2		PM-10	
			lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)
1997	*Tow Tractors: (a)*											
	A/S32A-30A	22000	64.60	0.71	436.67	4.80	268.50	2.95	31.10	0.34	46.50	0.51
	A/S32A-30	3500	122.00	0.21	146.00	0.26	3250.00	5.69	5.20	0.01	8.27	0.01
	TA-35	600	64.60	0.02	436.67	0.13	268.50	0.08	31.10	0.01	46.50	0.01
	A/S32A-42	23000	64.60	0.74	436.67	5.02	268.50	3.09	31.10	0.36	46.50	0.53
	TA-75	1200	122.00	1.04	146.00	1.25	3250.00	1.95	5.20	0.00	8.27	0.00
	Flight Line Electric Power Units											
	NC8A (b)	16000	49.23	0.39	604.17	4.83	130.15	1.04	39.73	0.32	42.47	0.34
	NC10C (b)	6000	49.23	0.15	604.17	1.81	130.15	0.39	39.73	0.12	42.47	0.13
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	45000	49.23	1.11	604.17	13.59	130.15	2.93	39.73	0.89	42.47	0.96
	GTC-85 (c)	3500	0.13	0.00	3.88	0.01	14.83	0.03	0.54	0.00	0.00	0.00
	Miscellaneous: (b)											
	A/M32C-17	3000	49.23	0.07	604.17	0.91	130.15	0.20	39.73	0.06	42.47	0.06
	A/M27T-5	3000	49.23	0.07	604.17	0.91	130.15	0.20	39.73	0.06	42.47	0.06
	A/M42M-2	1600	49.23	0.04	604.17	0.48	130.15	0.10	39.73	0.03	42.47	0.03
	HLU-196	20	415.11	0.00	223.31	0.00	8589.90	0.09	11.51	0.00	13.70	0.00
		Total		**4.57**		**34.01**		**18.73**		**2.20**		**2.66**
1998	*Tow Tractors: (a)*											
	A/S32A-30A (MOGAS)	22000	64.60	0.71	436.67	4.80	268.50	2.95	31.10	0.34	46.50	0.51
	A/S32A-30	3500	122.00	0.21	146.00	0.26	3250.00	5.69	5.20	0.01	8.27	0.01
	TA-35	600	64.60	0.02	436.67	0.13	268.50	0.08	31.10	0.01	46.50	0.01
	A/S32A-42	23000	64.60	0.74	436.67	5.02	268.50	3.09	31.10	0.36	46.50	0.53
	Flight Line Electric Power Units											
	NC8A (b)	16000	49.23	0.39	604.17	4.83	130.15	1.04	39.73	0.32	42.47	0.34
	NC10C (b)	8000	49.23	0.20	604.17	2.42	130.15	0.52	39.73	0.16	42.47	0.17
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	47000	49.23	1.16	604.17	14.20	130.15	3.06	39.73	0.93	42.47	1.00
	GTC-85 (c)	3500	0.13	0.00	3.88	0.01	14.83	0.03	0.54	0.00	0.00	0.00
	Miscellaneous: (b)											
	A/M32C-17	4000	49.23	0.10	604.17	1.21	130.15	0.26	39.73	0.08	42.47	0.08
	A/M27T-5	4000	49.23	0.10	604.17	1.21	130.15	0.26	39.73	0.08	42.47	0.08
	A/M42M-2	1600	49.23	0.04	604.17	0.48	130.15	0.10	39.73	0.03	42.47	0.03
	HLU-196	20	415.11	0.00	223.31	0.00	8589.90	0.09	11.51	0.00	13.70	0.00
		Total		**3.67**		**34.57**		**17.17**		**2.32**		**2.79**

Table F-50
ARS 5
Emissions from Ground Support Equipment at NAS Oceana

		Fuel Consumption (gal/yr)	VOC		NOx		CO		SO2		PM-10	
			lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)	lb/1000 gal	Total (TPY)
1999	*Tow Tractors: (a)*											
	A/S32A-30A (JP-5)	22400	64.60	0.72	436.67	4.89	268.50	3.01	5.20	0.06	8.27	0.09
	A/S32A-30	3500	122.00	0.21	146.00	0.26	3250.00	5.69	5.20	0.01	8.27	0.01
	TA-35	600	64.60	0.02	436.67	0.13	268.50	0.08	5.20	0.00	8.27	0.00
	A/S32A-42	23000	64.60	0.74	436.67	5.02	268.50	3.09	5.20	0.06	8.27	0.10
	Flight Line Electric Power Units											
	NC8A (b)	16000	49.23	0.39	604.17	4.83	130.15	1.04	39.73	0.32	42.47	0.34
	NC10C (b)	8000	49.23	0.20	604.17	2.42	130.15	0.52	39.73	0.16	42.47	0.17
	Jet Engine Start Units											
	A/M47A-4/NCPP-105 (b)	47000	49.23	1.16	604.17	14.20	130.15	3.06	39.73	0.93	42.47	1.00
	GTC-85 (c)	3500	0.13	0.00	3.88	0.01	14.83	0.03	0.54	0.00	0.00	0.00
	Miscellaneous: (b)											
	A/M32C-17	4000	49.23	0.10	604.17	1.21	130.15	0.26	39.73	0.08	42.47	0.08
	A/M27T-5	4000	49.23	0.10	604.17	1.21	130.15	0.26	39.73	0.08	42.47	0.08
	A/M42M-2	1600	49.23	0.04	604.17	0.48	130.15	0.10	39.73	0.03	42.47	0.03
	HLU-196	20	415.11	0.00	223.31	0.00	8589.90	0.09	11.51	0.00	13.70	0.00
		Total		**3.69**		**34.66**		**17.22**		**1.73**		**1.92**

(a) Emission factors from AP-42 Volume II for gasoline-powered wheeled tractor for TA-75, JG-75, & A/S32A-30 and diesel-powered wheeled tractors for all others.
(b) Emission factors from AP-42 Volume I for Uncontrolled gasoline and diesel industrial engines SCC 20200102, 20300101, and 2300301..
Converted from lb/MMBtu assuming heating value for JP-5 of 137,000 Btu/gallon.
(c) Emission factors from USEPA 1992 for aircraft auxilliary power units used because specific emission factors for individual equipment types not available.

Table F-51
ARS 5
EMISSION RATES FOR SINGLE ENGINE MAINTENANCE RUN-UPS AT NAS OCEANA
(IN-FRAME ENGINE TESTING)

Engine (Aircraft)	Power Setting (a)	Time in Power Setting (a) (minutes)	Fuel Flow (lb/min)	Emission Factor ([lb /1000 lb fuel]/eng)					Emission Rates (lb/single engine run-up)				
				VOC (b)	NOx	CO	SO2	PM10	VOC	NOx	CO	SO2	PM10
TF30-P-412A (F-14A)	**Low Power**												
	Idle	7.00	15.3	31.42	3.22	55.51	0.40	8.96	3.37	0.35	5.96	0.04	0.96
	75%	12.00	71.7	1.48	10.74	3.43	0.40	5.70	1.27	9.24	2.95	0.34	4.90
	Total								**4.65**	**9.59**	**8.91**	**0.39**	**5.87**
	High Power												
	Idle	10.00	15.3	31.42	3.22	55.51	0.40	8.96	4.81	0.49	8.49	0.06	1.37
	75%	25.00	71.7	1.48	10.74	3.43	0.40	5.70	2.65	19.25	6.15	0.72	10.22
	100% (Mil)	10.00	117.5	0.77	19.60	1.38	0.40	2.98	0.90	23.03	1.62	0.47	3.50
	A/B (Z5)	4.00	796.7	0.20	4.79	10.77	0.40	0.00	0.64	15.26	34.32	1.27	0.00
	Total								**9.00**	**58.04**	**50.58**	**2.52**	**15.09**
F110-GE-400 (F-14B/D)	**Low Power**												
	Idle	5.00	19.5	3.65	2.77	16.60	0.40	12.38	0.36	0.27	1.62	0.04	1.21
	75%	12.50	133.0	0.26	19.61	0.76	0.40	4.30	0.43	32.60	1.26	0.67	7.15
	Total								**0.79**	**32.87**	**2.88**	**0.70**	**8.36**
	High Power												
	Idle	10.00	19.5	3.65	2.77	16.60	0.40	12.38	0.71	0.54	3.24	0.08	2.41
	75%	20.00	133.0	0.26	19.61	0.76	0.40	4.30	0.69	52.16	2.02	1.06	11.44
	IRP	15.00	195.3	0.40	28.63	0.84	0.40	2.81	1.17	83.87	2.46	1.17	8.23
	A/B(Max)	4.00	945.0	0.13	9.22	23.12	0.40	0.00	0.49	34.85	87.39	1.51	0.00
	Total								**3.07**	**171.43**	**95.11**	**3.83**	**22.08**
J-52-P-8B (A-6)	**Low Power**												
	Idle	15.00	11.3	48.96	1.79	63.78	0.40	0.00	8.32	0.30	10.84	0.07	0.00
	78-82%	10.00	72.0	0.67	10.10	3.00	0.40	0.00	0.48	7.27	2.16	0.29	0.00
	Total								**8.80**	**7.58**	**13.00**	**0.36**	**0.00**
	High Power												
	Idle	15.00	11.3	48.96	1.79	63.78	0.40	0.00	8.30	0.30	10.81	0.07	0.00
	78-82%	5.00	72.0	0.67	10.10	3.00	0.40	0.00	0.24	3.64	1.08	0.14	0.00
	94-100%	8.00	122.8	0.93	13.05	0.71	0.40	0.00	0.91	12.82	0.70	0.39	0.00
	Total								**9.45**	**16.76**	**12.59**	**0.60**	**0.00**
F404-GE-400 (F/A-18)	**Low Power**												
	Idle	6.50	10.4	58.18	1.16	137.34	0.40	12.38	3.93	0.08	9.28	0.03	0.84
	76%	3.50	109.0	0.35	14.80	1.09	0.40	6.10	0.13	5.65	0.42	0.15	2.33
	Total								**4.07**	**5.72**	**9.70**	**0.18**	**3.16**
	High Power												
	Idle	13.00	10.4	58.18	1.16	137.34	0.40	12.38	7.87	0.16	18.57	0.05	1.67
	76%	8.50	109.0	0.35	14.80	1.09	0.40	6.10	0.32	13.71	1.01	0.37	5.65
	IRP	5.00	143.1	0.31	25.16	1.05	0.40	2.81	0.22	18.00	0.75	0.29	2.01
	A/B	2.00	473.3	0.13	9.22	23.12	0.40	0.00	0.12	8.73	21.89	0.38	0.00
	Total								**8.54**	**40.60**	**42.21**	**1.09**	**9.34**

Notes:
(a) Power setting and time in power setting for F-14 A, F-14B/D, F/A-18 aircraft,and A-6 provided by AESO and COMNAVAIRLANT.
(b) Aircraft VOC reported as HC in the form CHy/x

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

A/B = afterburner operating
Idle = typically 57% throttle setting
75% = 75% throttle setting
IRP = intermediate rated power

Table F-52
ARS 5
EMISSIONS FROM SINGLE ENGINE IN-FRAME MAINTENANCE RUN-UPS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft (Engine) and Number of Aircraft	Run-up mode	Number of Single Engine Run-ups/yr	VOC (b) Lb per Single Engine Run-up	VOC (b) Total (TPY)	NOx Lb per Single Engine Run-up	NOx Total (TPY)	CO Lb per Single Engine Run-up	CO Total (TPY)	SO2 Lb per Single Engine Run-up	SO2 Total (TPY)	PM10 Lb per Single Engine Run-up	PM10 Total (TPY)
1993	F-14A (TF30-P-412A) 80	Low Power	8,776	4.65	20.38	9.59	42.06	8.91	39.09	0.39	1.70	5.87	25.74
		High Power	250	9.00	1.13	58.04	7.25	50.58	6.32	2.52	0.32	15.09	1.89
	F-14B/D (F110-GE-400) 55	Low Power	4,162	0.79	1.64	32.87	68.41	2.88	6.00	0.70	1.47	8.36	17.39
		High Power	218	3.07	0.33	171.43	18.69	95.11	10.37	3.83	0.42	22.08	2.41
	A-6 (J-52-P-8B) 86	Low Power	10,320	8.80	45.42	7.58	39.09	13.00	67.08	0.36	1.84	0.00	0.00
		High Power	292	9.45	1.38	16.76	2.45	12.59	1.84	0.60	0.09	0.00	0.00
				Total	**70.29**		**177.95**		**130.69**		**5.82**		**47.42**
1996	F-14A (TF30-P-412A) 93	Low Power	11,179	4.65	25.96	9.59	42.06	8.91	39.09	0.39	1.70	5.87	25.74
		High Power	319	9.00	1.44	58.04	7.25	50.58	6.32	2.52	0.32	15.09	1.89
	F-14B/D (F110-GE-400) 69	Low Power	4,222	0.79	1.66	32.87	68.41	2.88	6.00	0.70	1.47	8.36	17.39
		High Power	221	3.07	0.34	171.43	18.69	95.11	10.37	3.83	0.42	22.08	2.41
				Total	**29.40**		**136.41**		**61.78**		**3.90**		**47.42**
1997	F-14A (TF30-P-412A) 121	Low Power	14,545	4.65	33.78	9.59	69.72	8.91	64.78	0.39	2.82	5.87	42.66
		High Power	415	9.00	1.87	58.04	12.04	50.58	10.50	2.52	0.52	15.09	3.13
	F-14B/D (F110-GE-400) 91	Low Power	5,568	0.79	2.19	32.87	91.51	2.88	8.02	0.70	1.96	8.36	23.26
		High Power	292	3.07	0.45	171.43	25.03	95.11	13.89	3.83	0.56	22.08	3.22
				Total	**38.29**		**198.30**		**97.19**		**5.86**		**72.28**

Table F-52
ARS 5
EMISSIONS FROM SINGLE ENGINE IN-FRAME MAINTENANCE RUN-UPS AT NAS OCEANA
FOR 1993 AND 1996-1999

	Type of Aircraft (Engine) and Number of Aircraft	Run-up mode	Number of Single Engine Run-ups/yr	VOC (b)		NOx		CO		SO2		PM10	
				Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)	Lb per Single Engine Run-up	Total (TPY)
1998	F-14A (TF30-P-412A) 115	Low Power	13824	4.65	32.11	9.59	66.26	8.91	61.57	0.39	0.01	5.87	40.54
		High Power	394	9.00	1.77	58.04	11.43	50.58	9.97	2.52	0.00	15.09	2.97
	F-14B/D (F110-GE-400) 91	Low Power	5,568	0.79	2.19	32.87	91.51	2.88	8.02	0.70	1.96	8.36	23.26
		High Power	292	3.07	0.45	171.43	25.03	95.11	13.89	3.83	0.56	22.08	3.22
	F/A-18 (F404-GE-400) 132	Low Power	7350	4.07	14.94	5.72	21.04	9.70	35.65	0.18	0.66	3.16	11.63
		High Power	413	8.54	1.76	40.60	8.38	42.21	8.72	1.09	0.22	9.34	1.93
				Total	**53.23**		**223.66**		**137.81**		**3.41**		**83.56**
1999	F-14A (TF30-P-412A) 115	Low Power	13824	4.65	32.11	9.59	66.26	8.91	61.57	0.39	2.68	5.87	40.54
		High Power	394	9.00	1.77	58.04	11.43	50.58	9.97	2.52	0.50	15.09	2.97
	F-14B/D (F110-GE-400) 91	Low Power	5568	0.79	2.19	32.87	91.51	2.88	8.02	0.70	1.96	8.36	23.26
		High Power	292	3.07	0.45	171.43	25.03	95.11	13.89	3.83	0.56	22.08	3.22
	F/A-18 (F404-GE-400) 132	Low Power	7350	4.07	14.94	5.72	21.04	9.70	35.65	0.18	0.66	3.16	11.63
		High Power	413	8.54	1.76	40.60	8.38	42.21	8.72	1.09	0.22	9.34	1.93
				Total	**53.23**		**223.66**		**137.81**		**6.58**		**83.56**

Notes:
(a) In-frame maintenance run-ups for F-14A, F-14B/D, and F/A-18 aircraft in 1993 and 1999 from Wyle (1997) 1996-1998 maintenance run-ups were scaled from 1993 based on number of aircraft stationed at NAS Oceana.
(b) Aircraft VOC reported as HC in the form CHy/x

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-53
STATIONARY SOURCE EMISSIONS AT NAS OCEANA - ARS 5
FOR 1993 AND 1996-1999

	1993					1996					1997				
	VOC	NOx	CO	SO2	PM10	VOC	NOx	CO	SO2	PM10	VOC	NOx	CO	SO2	PM10
Stationary Sources:															
Boilers:	1.13	32.32	8.31	22.09	3.84	0.78	29.13	7.52	23.76	3.63	0.78	29.13	7.52	23.76	3.63
Generators	0.71	8.67	1.87	0.57	0.61	0.71	8.67	1.87	0.57	0.61	2.11	27.87	7.27	3.77	2.21
Engine Test Cells	6.24	37.65	49.40	1.81	4.32	3.94	28.44	39.05	1.31	3.95	5.04	37.00	50.82	1.71	4.63
JP-5 Fuel Handling	0.66	0.00	0.00	0.00	0.00	0.46	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.00	0.00
Service Station	19.35	0.00	0.00	0.00	0.00	4.46	0.00	0.00	0.00	0.00	4.67	0.00	0.00	0.00	0.00
Painting	19.30	0.00	0.00	0.00	0.00	13.29	0.00	0.00	0.00	0.00	24.05	0.00	0.00	0.00	0.00
Construction:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	47.39	78.64	59.58	24.47	8.77	23.64	66.24	48.44	25.64	8.19	37.19	94.00	65.61	29.24	10.47

Table F-53
STATIONARY SOURCE EMISSIONS AT NAS OCEANA - ARS 5
FOR 1993 AND 1996-1999

	1998					1999				
	VOC	**NOx**	**CO**	**SO2**	**PM10**	**VOC**	**NOx**	**CO**	**SO2**	**PM10**
Stationary Sources:										
Boilers:	0.62	27.13	6.68	22.82	3.38	0.62	27.13	6.68	22.82	3.38
Generators	2.11	27.87	7.27	3.77	2.21	2.11	27.87	7.27	3.77	2.21
Engine Test Cells	9.06	48.58	63.85	1.99	9.17	9.06	48.58	63.85	1.99	9.17
JP-5 Fuel Handling	0.81	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00
Service Station	6.40	0.00	0.00	0.00	0.00	6.72	0.00	0.00	0.00	0.00
Painting	34.12	0.00	0.00	0.00	0.00	34.16	0.00	0.00	0.00	0.00
Construction:	1.96	19.50	6.33	1.85	3.55	0.00	0.00	0.00	0.00	0.00
Total	55.08	123.07	84.13	30.43	18.31	53.57	103.58	77.80	28.58	14.76

Note: Shaded areas indicate nonattainment pollutants of concern.

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-54
EMISSION RATES FOR AIRCRAFT ENGINE TESTS AT NAS OCEANA - ARS 5
(SINGLE ENGINE IN TEST CELLS)

Engine (Aircraft)	Power Setting	Time in Power Setting (a) (minutes)	Fuel Flow (lb/min)	Calculated Fuel Usage (b) (gallons/test)	Emission Factor (c) ([lb /1000 lb fuel]/eng)					Single Engine Test Emissions (pounds)				
					VOC (d)	NOx	CO	SO2	PM10	VOC (d)	NOx	CO	SO2	PM10
TF30-P-412A (F-14A)	Idle	28.00	15.33	63.12	31.42	3.22	55.51	0.54	8.96	13.49	1.38	23.83	0.23	3.85
	75%	5.00	71.67	52.70	1.48	10.74	3.43	0.54	7.98	0.53	3.85	1.23	0.19	2.86
	81%	23.00	77.40	261.79	1.20	16.02	1.62	0.54	7.98	2.14	28.52	2.88	0.96	14.21
	A/B	22.00	796.67	2577.46	0.20	4.79	10.77	0.54	0.00	3.51	83.95	188.76	9.46	0.00
	Total	**78.00**		**2955.08**					**Per Test**	**19.66**	**117.70**	**216.70**	**10.85**	**20.91**
F110-GE-400 (F-14B/D)	Idle	54.00	19.64	155.96	3.97	2.74	15.75	0.54	12.38	4.21	2.91	16.70	0.57	13.13
	81%	44.00	143.70	929.82	0.26	19.61	0.76	0.54	2.81	1.64	123.99	4.81	3.41	17.77
	93%	25.00	198.22	728.75	0.31	28.53	1.08	0.54	2.81	1.54	141.38	5.35	2.68	13.92
	A/B	11.00	945.05	1528.76	3.75	12.64	44.21	0.54	0.00	38.98	131.40	459.59	5.61	0.00
	Total	**134.00**		**3343.30**					**Per Test**	**46.37**	**399.68**	**486.45**	**12.28**	**44.82**
J-52-P-8B (A-6)	Ground Idle	32.00	11.33	53.32	48.96	1.79	63.78	0.54	0.00	17.75	0.65	23.12	0.20	0.00
	IRP	18.00	122.83	325.14	1.08	13.05	0.71	0.54	0.00	2.39	28.85	1.57	1.19	0.00
	75% Thrust	24.00	72.00	254.12	0.87	10.10	3.00	0.54	0.00	1.50	17.45	5.18	0.93	0.00
	3k Lbs Thrust	25.00	38.33	140.92	1.99	6.34	10.54	0.54	0.00	1.91	6.08	10.10	0.52	0.00
	Total	**99.00**		**773.49**					**Per Test**	**23.55**	**53.03**	**39.98**	**2.84**	**0.00**
F404-GE-400 (F/A-18)	Idle	52.00	10.40	79.53	58.18	1.16	137.34	0.40	12.38	31.46	0.63	74.27	0.22	6.70
	80%	34.00	131.60	658.00	0.33	18.71	1.17	0.40	6.10	1.48	83.72	5.24	1.79	27.29
	A/B	3.00	473.28	208.80	0.13	9.22	23.12	0.40	0.00	0.18	13.09	32.83	0.57	0.00
	Total	**89.00**		**946.33**					**Per Test**	**33.12**	**97.43**	**112.34**	**2.57**	**33.99**

(a) Power setting and time in power setting taken from Wyle (1997) for F-14A, F-14B/D, and F/A-18 aircraft. A-6 data provided by COMNAVAIRLANT (Cdr. Vandenberg, Dec. 1996).
(b) Assumes a product density of 6.8 lb/gallon for JP-5.
(c) Data for calculating modal emission rates provided by the Navy Aircraft Environmental Support Office.
(d) Aircraft VOC reported as HC in the form CHy/x

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

A/B Max. = maximum afterburner
IRP = intermediate rated power (same as military)
75% = 75% throttle setting

Table F-55
EMISSIONS FROM AIRCRAFT ENGINE TESTING AT NAS OCEANA - ARS 5
FOR 1993 AND 1996-1999
(SINGLE ENGINE IN TEST CELLS)

Year	Engine Model	Number of Aircraft	Number of Tests/Year (a)	VOC (b) per test (lb)	VOC (b) Total (TPY)	NOx per test (lb)	NOx Total (TPY)	CO per test (lb)	CO Total (TPY)	SO2 per test (lb)	SO2 Total (TPY)	PM10 per test (lb)	PM10 Total (TPY)
1993	TF30-P-412A	80	152	19.66	1.49	117.70	8.95	216.70	16.47	10.85	0.82	20.91	1.59
	F110-GE-400	55	122	46.37	2.83	399.68	24.38	486.45	29.67	12.28	0.75	44.82	2.73
	J-52-P-8B	86	163	23.55	1.92	53.03	4.32	39.98	3.26	2.84	0.23	0.00	0.00
				Total	**6.24**		**37.65**		**49.40**		**1.81**		**4.32**
1996	TF30-P-412A	93	123	19.66	1.21	117.70	7.23	216.70	13.32	10.85	0.67	20.91	1.29
	F110-GE-400	69	100	46.37	2.32	399.68	20.00	486.45	24.34	12.28	0.61	44.82	2.24
	F404-GE-400	12	25	33.12	0.41	97.43	1.20	112.34	1.39	2.57	0.03	33.99	0.42
				Total	**3.94**		**28.44**		**39.05**		**1.31**		**3.95**
1997	TF30-P-412A	121	160	19.66	1.57	117.70	9.41	216.70	17.33	10.85	0.87	20.91	1.67
	F110-GE-400	91	132	46.37	3.06	399.68	26.38	486.45	32.11	12.28	0.81	44.82	2.96
	F404-GE-400	12	25	33.12	0.41	97.43	1.20	112.34	1.39	2.57	0.03	0.00	0.00
				Total	**5.04**		**37.00**		**50.82**		**1.71**		**4.63**
1998	TF30-P-412A	115	152	19.66	1.49	117.70	8.95	216.70	16.47	10.85	0.82	20.91	1.59
	F110-GE-400	91	132	46.37	3.06	399.68	26.38	486.45	32.11	12.28	0.81	44.82	2.96
	F404-GE-400	132	272	33.12	4.50	97.43	13.25	112.34	15.28	2.57	0.35	33.99	4.62
				Total	**9.06**		**48.58**		**63.85**		**1.99**		**9.17**
1999	TF30-P-412A	115	152	19.66	1.49	117.70	8.95	216.70	16.47	10.85	0.82	20.91	1.59
	F110-GE-400	91	132	46.37	3.06	399.68	26.38	486.45	32.11	12.28	0.81	44.82	2.96
	F404-GE-400	132	272	33.12	4.50	97.43	13.25	112.34	15.28	2.57	0.35	33.99	4.62
				Total	**9.06**		**48.58**		**63.85**		**1.99**		**9.17**

Notes:
(a) Number of engine tests per F-14A, F-14B/D, and F/A-18 aircraft from Wyle 1997. Number of A-6 engine tests per aircraft assumed to be the same as F-14A engine tests per aircraft.
(b) Aircraft VOC reported as HC in the form CHy/x

Shaded areas indicate the nonattainment pollutants of concern.

Key:
VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-56
PARKING LOT CONSTRUCTION (4 LOTS) AND AIRCRAFT APRON - ARS 5
Equipment Exhaust Emissions

	Equipment	Days	Emission Factors (lb/1000 gal)					EMISSIONS (lbs)				
Equipment List	quantity	Used	NOx	VOC	CO	SO2	PM10	NOx	VOC	CO	SO2	PM10
Crane	0	0	403	35.0	82.0	31.2	27	0.0	0.0	0.0	0.0	0.0
Backhoe Loader	2	45	395	39.0	133.0	31.2	27	1777.5	175.5	598.5	140.4	121.5
Pan Scraper	1	20	340	19.6	97.7	31.2	27	340.0	19.6	97.7	31.2	27.0
Hi-Lift	0	0	364	31.0	121.0	31.2	25	0.0	0.0	0.0	0.0	0.0
Front-end Loader, wheels	1	45	403	23.5	94.0	31.2	29	906.8	52.9	211.5	70.2	65.3
Pile Driver	0	0	403	35.0	82.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Track loader	1	0	391	23.5	94.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Grader	2	45	375	43.0	74.3	31.2	22	1687.5	193.5	334.4	140.4	99.0
Bulldozer	2	45	375	43.0	74.3	31.2	25	1687.5	193.5	334.4	140.4	112.5
Compactor	3	45	364	31.0	121.0	31.2	24	2457.0	209.3	816.8	210.6	162.0
Roller	3	45	364	31.0	121.0	31.2	24	2457.0	209.3	816.8	210.6	162.0
Paver	1	45	403	23.5	125.0	31.2	29	906.8	52.9	281.3	70.2	65.3
haul trk/cement mixer, mob(gm/	4	45	8.0	2.1	9.93	2.8	2.15	317.2	83.3	393.7	111.0	85.2
haul trk/cement mixer, idl(gm/hr	4	45	13.2	16.2	40.2	0	0	10.5	12.8	31.9	0.0	0.0
							Total, lb/yr	12547.6	1202.5	3916.7	1125.0	899.7
							Total TPY	**6.27**	**0.60**	**1.96**	**0.56**	**0.45**

Key:
- VOC = volatile organic compounds
- NOx = oxides of nitrogen
- CO = carbon monoxide
- SO2 = sulfur dioxide
- PM10 = particulate matter

Table F-56
NEW BUILDING/ADDITION CONSTRUCTION - ARS 5
Equipment Exhaust Emissions

	Equipment	Days	Emission Factors (lb/1000 gal)					EMISSIONS (lbs)				
EQUIPMENT LIST	quantity	Used	NOx	VOC	CO	SO2	PM10	NOx	VOC	CO	SO2	PM10
Crane	1	120	403	35.0	82.0	31.2	27	2418.0	210.0	492.0	187.2	162.0
Backhoe Loader	2	120	395	39.0	133.0	31.2	27	4740.0	468.0	1596.0	374.4	324.0
Pan Scraper	1	120	340	19.6	97.7	31.2	27	2040.0	117.6	586.2	187.2	162.0
Hi-Lift	2	120	364	31.0	121.0	31.2	25	4368.0	372.0	1452.0	374.4	300.0
Front-end Loader, wheels	1	120	403	23.5	94.0	31.2	29	2418.0	141.0	564.0	187.2	174.0
Pile Driver	0	0	403	35.0	82.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Track loader	0	0	391	23.5	94.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Grader	1	120	375	43.0	74.3	31.2	22	2250.0	258.0	445.8	187.2	132.0
Bulldozer	2	120	375	43.0	74.3	31.2	25	4500.0	516.0	891.6	374.4	300.0
Compactor	1	120	364	31.0	121.0	31.2	24	2184.0	186.0	726.0	187.2	144.0
Roller	0	0	364	31.0	121.0	31.2	24	0.0	0.0	0.0	0.0	0.0
Paver	0	0	403	23.5	125.0	31.2	29	0.0	0.0	0.0	0.0	0.0
haul trk, mob(gm/mi)	7	120	8.0	2.1	9.93	2.8	2.15	1480.2	388.5	1837.3	518.1	397.8
haul trk, idl(gm/hr)	7	120	13.2	16.2	40.2	0	0	48.8	59.9	148.8	0.0	0.0
							Total Lb/yr	**26447.0**	**2717.1**	**8739.6**	**2577.3**	**2095.8**
							Total TPY	**13.22**	**1.36**	**4.37**	**1.29**	**1.05**

Key:
- VOC = volatile organic compounds
- NOx = oxides of nitrogen
- CO = carbon monoxide
- SO2 = sulfur dioxide
- PM10 = particulate matter

Table F-57

ANNUAL DEMOLITION PARTICULATE EMISSIONS - ARS 5

Floor Space (SQ FT)	STRUCTURE REMOVAL (LBS)	DEBRIS REMOVAL (LBS)	VEHICLE ACTIVITY (LBS)	EMISSIONS SUM LBS/YR	EMISSIONS SUM TPY
191,887	9.8	180.4	2042.6	2232.8	1.12

Notes:
Demolition square ft assumed = 10 % of new construction sq ft
PM emission from structure takedown based on sq ft *EF
PM emission from debris removal based on sq ft *EF
PM emission from on-site vehicle activity based on sq ft *EF
Pushing (bulldozing) PM emission put under site prep spreadsheet
Reference EPA-450/2-92-004 (Fugitive Dust document)
(all EF's in EPA document converted to english units)

Table F-57

ANNUAL SITE PREPARATION PARTICULATE EMISSIONS FOR CONSTRUCTION AT NAS OCEANA - ARS 5

ACRES	ACTIVITY DAYS	BULLDOZIN (LBS)	PAN SCRAPING SOIL REMOV(LBS)	PAN SCRAPING ETHMOVING (LBS)	EMISSIONS SUM	
					LBS/YR	TPY
44	120	720	704	444	1868	0.93

Notes:

Acreage estimate based on building sq ft*2

Estimate activity days for preferred, develop ratio days:acres

Apply ratio to ARS acreages to get activity days

Bulldozing pm emissions based on 8hr/activity day * EF (EPA 1992)

Soil removal emiss based on VMT/acre *acres*EF (EPA 1992)

Earthmoving emiss based on soil removal miles *3 (BEE)*EF

EPA 1992 is Fugitive Dust BG document (EPA-450/2-92-004)

Table F-58

Total Construction Emissions (Exhaust and Dust) - ARS 5

Project/Source	**Emissions (tons/yr)**				
Engine Exhaust Emissions	**VOC**	**NOx**	**CO**	**SOx**	**PM10**
Parking Lot Construction	0.60	6.27	1.96	0.56	0.45
Building/Addition Const. (total)	1.36	13.22	4.37	1.29	1.05
Demolition/Construction Activity					
Mechanical dust Generation	0.00	0.00	0.00	0.00	2.05
Total	**1.96**	**19.50**	**6.33**	**1.85**	**3.55**

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

Table F-59
EMISSIONS SUMMARY - NAS OCEANA AND NALF FENTRESS - ARS 5
FOR 1993 AND 1996-1999
(tons per year)

	1993					1996					1997				
Source Type	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**
NAS Oceana:															
Mobile Sources:															
Aircraft Operations	272.13	328.88	609.85	18.59	152.58	123.33	224.25	295.24	10.78	121.47	150.53	288.46	360.74	13.82	156.23
Total Aircraft	**272.13**	**328.88**	**609.85**	**18.59**	**152.58**	**123.33**	**224.25**	**295.24**	**10.78**	**121.47**	**150.53**	**288.46**	**360.74**	**13.82**	**156.23**
Other Mobile Sources:															
GSE	5.13	26.43	72.65	1.71	2.00	0.00	0.00	0.00	0.00	0.00	4.57	34.01	18.73	2.20	2.66
Maintenance Run-ups	70.29	177.95	130.69	5.82	47.42	29.40	136.41	61.78	3.90	47.42	38.29	198.30	97.19	5.86	72.28
Generators	0.56	6.89	1.48	0.45	0.48	0.56	6.89	1.48	0.45	0.48	0.56	6.89	1.48	0.45	0.48
Total Other Mobile	**75.97**	**211.27**	**204.82**	**7.98**	**49.90**	**29.96**	**143.30**	**63.26**	**4.35**	**47.90**	**43.42**	**239.20**	**117.40**	**8.51**	**75.42**
Stationary Sources:															
Boilers:	1.13	32.32	8.31	22.09	3.84	0.78	29.13	7.52	23.76	3.63	0.78	29.13	7.52	23.76	3.63
Generators	0.71	8.67	1.87	0.57	0.61	0.71	8.67	1.87	0.57	0.61	2.11	27.87	7.27	3.77	2.21
Engine Test Cells	6.24	37.65	49.40	1.81	4.32	3.94	28.44	39.05	1.31	3.95	5.04	37.00	50.82	1.71	4.63
JP-5 Fuel Handling	0.66	0.00	0.00	0.00	0.00	0.46	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.00	0.00
Service Station	19.35	0.00	0.00	0.00	0.00	4.46	0.00	0.00	0.00	0.00	4.67	0.00	0.00	0.00	0.00
Painting	19.30	0.00	0.00	0.00	0.00	13.29	0.00	0.00	0.00	0.00	24.05	0.00	0.00	0.00	0.00
Construction:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Stationary	**47.39**	**78.64**	**59.58**	**24.47**	**8.77**	**23.64**	**66.24**	**48.44**	**25.64**	**8.19**	**37.19**	**94.00**	**65.61**	**29.24**	**10.47**
Total NASO	**395.49**	**618.78**	**874.24**	**51.04**	**211.25**	**176.93**	**433.79**	**406.94**	**40.76**	**177.56**	**231.14**	**621.65**	**543.75**	**51.57**	**242.12**
NALF Fentress:															
Aircraft	13.48	146.63	37.00	6.81	30.87	7.32	154.76	18.20	6.30	42.24	9.21	188.43	22.39	7.45	55.29
Total Annual:	**408.97**	**765.41**	**911.25**	**57.85**	**242.12**	**184.26**	**588.55**	**425.14**	**47.07**	**219.80**	**240.35**	**810.09**	**566.14**	**59.02**	**297.41**

Table F-59
EMISSIONS SUMMARY - NAS OCEANA AND NALF FENTRESS - ARS 5
FOR 1993 AND 1996-1999
(tons per year)

	1998					1999				
Source Type	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**	**VOCs**	**NOx**	**CO**	**SO2**	**PM10**
NAS Oceana:										
Mobile Sources:										
Aircraft Operations	246.79	384.69	639.48	17.49	207.03	314.34	451.96	832.68	20.16	242.97
Total Aircraft	**246.79**	**384.69**	**639.48**	**17.49**	**207.03**	**314.34**	**451.96**	**832.68**	**20.16**	**242.97**
Other Mobile Sources:										
GSE	0.10	1.21	0.26	0.08	0.08	0.00	0.00	0.00	0.00	0.00
Maintenance Run-ups	53.23	223.66	137.81	3.41	83.56	53.23	223.66	137.81	6.58	83.56
Generators	0.56	6.89	1.48	0.45	0.48	0.56	6.89	1.48	0.45	0.48
Total Other Mobile	**53.89**	**231.76**	**139.55**	**3.94**	**84.12**	**53.79**	**230.55**	**139.29**	**7.03**	**84.04**
Stationary Sources:										
Boilers:	0.62	27.13	6.68	22.82	3.38	0.62	27.13	6.68	22.82	3.38
Generators	2.11	27.87	7.27	3.77	2.21	2.11	27.87	7.27	3.77	2.21
Engine Test Cells	9.06	48.58	63.85	1.99	9.17	9.06	48.58	63.85	1.99	9.17
JP-5 Fuel Handling	0.81	0.00	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00
Service Station	6.40	0.00	0.00	0.00	0.00	6.72	0.00	0.00	0.00	0.00
Painting	34.12	0.00	0.00	0.00	0.00	34.16	0.00	0.00	0.00	0.00
Construction:	1.96	19.50	6.33	1.85	3.55	0.00	0.00	0.00	0.00	0.00
Total Stationary	**55.08**	**123.07**	**84.13**	**30.43**	**18.31**	**53.57**	**103.58**	**77.80**	**28.58**	**14.76**
Total NASO	**355.76**	**739.52**	**863.16**	**51.86**	**309.46**	**421.70**	**786.08**	**1,049.78**	**55.76**	**341.77**
NALF Fentress:										
Aircraft	10.25	225.87	27.00	8.64	71.22	11.02	248.79	30.00	9.39	81.18
Total Annual:	**366.01**	**965.38**	**890.16**	**60.50**	**380.68**	**432.72**	**1,034.87**	**1,079.78**	**65.15**	**422.95**

Note: Shaded areas indicate nonattainment pollutants of concern.
1993 data and future year estimates based on data current as of June 4 1996.

Key: VOC = volatile organic compounds. SO2 = sulfur dioxide.
NOx = oxides of nitrogen. PM10 = particulate matter. JP-5 = jet fuel.
CO = carbon monoxide. GSE = Ground Support Equipment

Table F-60
NET EMISSIONS CHANGE - NAS OCEANA AND NALF FENTRESS - ARS 5
(tons per year)

Year	VOCs	NOx	CO	SO2	PM10
NAS Oceana:					
1993	395.49	618.78	874.24	51.04	211.25
1996	176.93	433.79	406.94	40.76	177.56
1997	231.14	621.65	543.75	51.57	242.12
1998	355.76	739.52	863.16	51.86	309.46
1999	421.70	786.08	1049.78	55.76	341.77
Net Change:					
1993 to 1999	**26.21**	**167.30**	**175.53**	**4.72**	**130.52**
NALF Fentress:					
1993	13.48	146.63	37.00	6.81	30.87
1996	7.32	154.76	18.20	6.30	42.24
1997	9.21	188.43	22.39	7.45	55.29
1998	10.25	225.87	27.00	8.64	71.22
1999	11.02	248.79	30.00	9.39	81.18
Net Change:					
1993 to 1999	**-2.46**	**102.16**	-7.00	**2.58**	**50.31**
Net Change NAS Oceana and NALF Fentress:					
1993 to 1999	**23.75**	**269.46**	**168.54**	7.31	**180.83**

Note: Shaded areas indicate nonattainment pollutants of concern.

Key:

VOC = volatile organic compounds
NOx = oxides of nitrogen
CO = carbon monoxide
SO2 = sulfur dioxide
PM10 = particulate matter

G Accident Potential Zones

G.1 Introduction

The stated goals of the Air Installations Compatible Use Zones (AICUZ) Program are to protect the Navy and Marine Corps operational capabilities; to protect health, safety, and welfare of civilian and military personnel by discouraging land uses that are incompatible with aircraft operations; and to inform the public about the AICUZ program and seek cooperative efforts to minimize aircraft accident potential in the vicinity of military air installations.

The accident potential zone (APZ) concept discusses the probable impact area if an accident occurs and not the probability of an accident occurring. In the 1950s, the first attempt to recognize the safety aspects of aircraft operations was identified in a report entitled, "The Airport and Its Neighbors, the Report of the President's Airport Commission." Commonly referred to as the Doolittle Report, this report recommended that an area surrounding an airfield be set aside as a buffer in the event of aircraft accidents and areas beyond the ends of runways be kept free and clear of obstacles to flight. These areas are called clear zones (CZs) and are located immediately off the ends of the runways. These first steps toward controlling the land use close to an airport were designed to protect the pilot and his/her aircraft from obstructions and hazards that could impede the safe flight of the aircraft. Aircraft safety has evolved over the years to include measures to protect the safety of the people and property on the ground.

The AICUZ Program recognized these safety aspects and created the concept of APZs to promote compatible land use for the protection of people under aircraft flight paths. Nearly 25 years ago, the Air Force collected and analyzed tri-service accident data between 1968 and 1972 to determine the geometric characteristics needed for effective CZs and APZs. The objective of this analysis was to identify patterns of accident occurrence; that is, to determine the percent of accidents contained within areas of specified length and width from the end of a runway. This analysis resulted in the definition of zones which exhibited the maximum concentration (percent) of accidents in the smallest area. The resultant zones are shown on Figure G-1. CZs are applied to all active runways and are trapezoidal in shape. Located at the end of the runway, the CZs have the greatest potential for occurrence of aircraft accidents beyond the runway. APZs, located beyond the CZs, have a measurable potential for aircraft accidents and are applied to all flight tracks with a minimum of 5,000 aircraft operations.

02: OV8901\5229\OV8_H1234.CDR

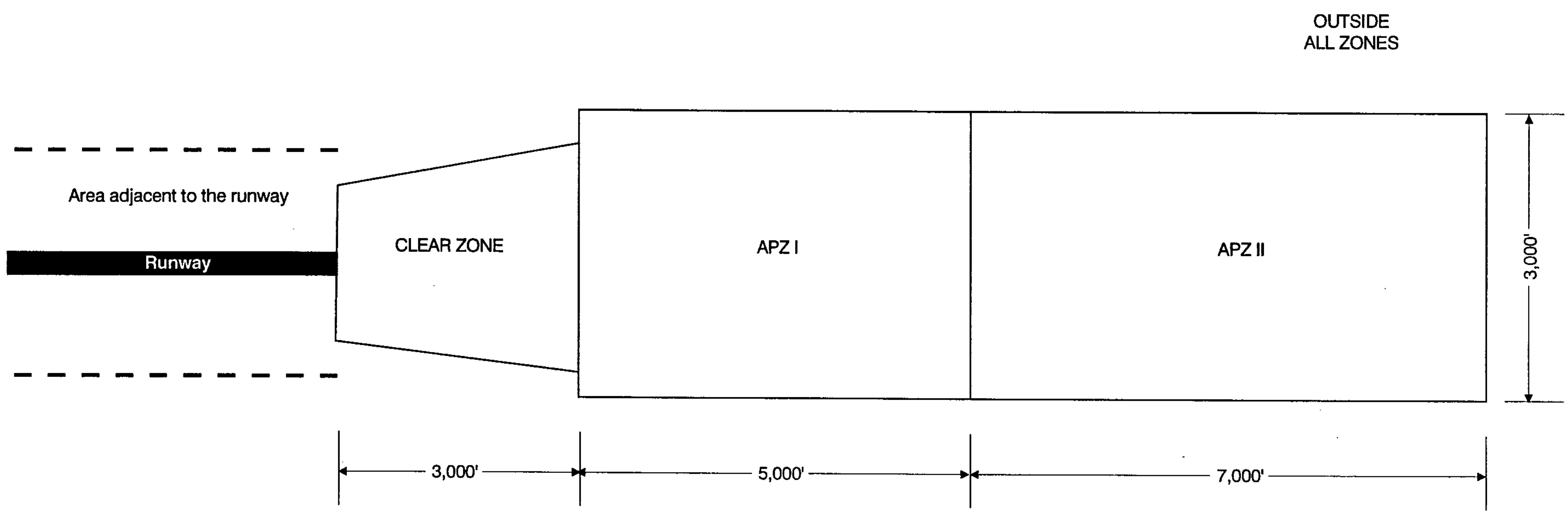


Figure G-1 AICUZ LAYOUT BASED ON TRI-SERVICE ACCIDENT DATA (1968-1972)

G.2 Aircraft Accidents (1968-1982) Update

In 1982, the Navy collected accident data to update the initial tri-service investigation and determine the applicability of the previously defined CZ and APZ configurations to then current aircraft operational procedures and those aircraft in the Naval aviation inventory. Data were collected from every Naval and Marine Corps Air Station to pinpoint the exact location of accidents from a common point of reference at the airfield. Only Class "A" accidents (i.e., those accidents where an aircraft suffered more than 1 million dollars in damage or a fatality occurred) were included in the study.

Fifty-five Naval and Marine Corps Air Stations reported 580 accidents for a 13-year period ending in January 1982. Each accident was categorized by type of operation, aircraft class, and location.

As shown in Table G-1, landing accidents occurred more frequently than takeoff accidents by a factor of three. The majority of accidents involved jet aircraft (7 out of every 10 accidents reported).

Table G-1

ACCIDENTS RECORDED (1968-1982)
(580 Accidents over 13 Years)

Operation Type	Percent of Total Accidents
Takeoffs	19.14
Landings	59.83
Unknown	21.03
Aircraft Type	**Percent of Total Accidents**
Jet	72.07
Turboprop/Piston	12.76
Rotary	15.17

Table G-2 and Figure G-2 provide total accident data by aircraft class and accident location. Unknown accidents (i.e., those accidents where operation and/or type of aircraft was not designated) accounted for more than 21% of all the accidents reported and were not included in Figure G-2. Of those accidents occurring on the runway, turboprop and piston aircraft had the highest percentage (48%) when compared on a relative scale. For accidents occurring adjacent to the runway, there was no predominant trend among the aircraft types.

Table G-2

AICUZ ACCIDENT TABULATION (1968-1982)
(Total Operations)

Location	Total (%)		Jet (%)		Turboprop/Piston (%)		Rotary (%)	
Runway	163	(35.6)	120	(33.6)	27	(48.2)	16	(35.6)
Adjacent Runway	92	(20.1)	72	(20.2)	10	(17.9)	10	(22.2)
Clear Zone	57	(12.4)	47	(13.2)	8	(14.3)	2	(4.4)
APZ I	31	(8.8)	25	(7.0)	4	(7.1)	2	(4.4)
APZ II	13	(2.8)	12	(3.4)	0	(0)	1	(2.3)
Out	102	(22.3)	81	(22.6)	7	(12.5)	14	(31.1)
TOTAL	458	(100)	357	(100)	56	(100)	45	(100)

Key:

Jet = Aircraft including A-4F, TA-4J, F-8J, F-4, T-28C, A-7A, F-14A, etc.

2:OV8901.D5229-08/22/97-D1

02: OV8901\5229\OV8_H1234.CDR (pg2)

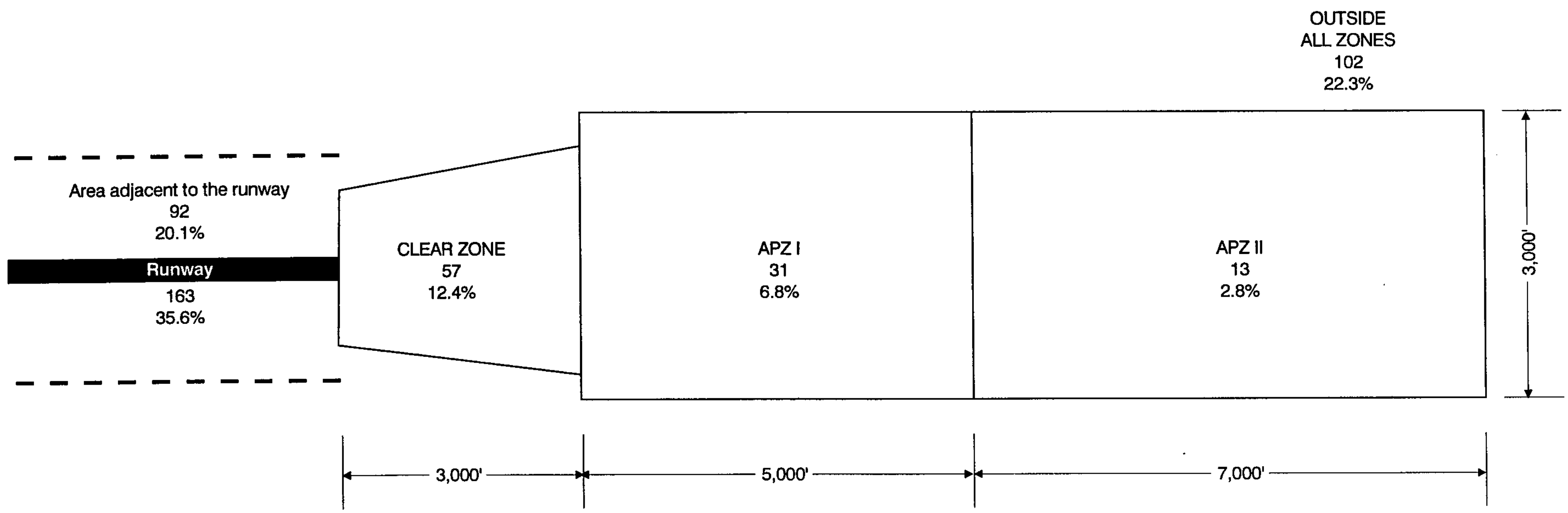


Figure G-2 ACCIDENT DATA (TOTAL OPERATIONS) BASED ON THE NAVY UPDATE OF THE TRI-SERVICE ACCIDENT DATA (1968-1982)

Accident rates in the CZ were similar for jet and turboprop/piston aircraft (±14%) but considerably lower for rotary wing aircraft (4%). Considering such factors as location of the helipad, dissimilar flight tracks, glide slopes, and maneuverability, some deviation between fixed wing aircraft and rotary wing aircraft was expected.

Approximately 7% of all the reported accidents occur in APZ I, and less than 3% occur in APZ II. The majority of accidents were on or adjacent to the runway (56%). The total percent of accidents occurring in the CZ and APZs was approximately equal to accidents occurring outside these zones (22%).

Tables G-3 and G-4 provide a detailed breakdown of accident data for takeoffs and landings, respectively. Figures G-3 and G-4 aggregate the takeoff and landing accident data by APZ.

Figure G-5 illustrates the total percent of accidents for each aircraft class versus distance from the threshold. This information provides the primary means for determining the applicability of the zones identified in the tri-service study to current operations. The total accident data for the three aircraft types is also shown. As expected, because there are more jet accidents than turboprop/piston or rotary wing aircraft accidents, the total operations curve is similar to the jet curve. The majority of accidents occurred within 15,000 feet of the threshold, and nearly 70% occurred within 3,000 feet. As a result, the study identified a CZ that extended to 3,000 feet; an APZ I that extended to 8,000 feet; and an APZ II that extended to 15,000 feet. These data are comparable to the earlier data.

G.3 Aircraft Accidents (1982-1997) Update

Aircraft accident data were updated for 1982 through July 1997. In that period, there were 52 aircraft accidents at Navy and Marine Corps airfields located in the United States and Japan. Accidents were tabulated by the Naval Safety Center as occurring during takeoff, landing, in-flight, or unknown. In-flight accidents involved aircraft that reported a problem within a 5-mile radius of the airfield but not during the takeoff and/or landing phase (e.g., touch-and-go, overhead break, etc.). The accident data are presented in Table G-5. As indicated in Table G-6, the number of F/A-18 accidents in the 15-year period since F/A-18 aircraft became a mainstay in the fleet is comparable to the level of accidents for other tactical aircraft. Hence, the introduction of F/A-18 squadrons is not expected to degrade safety in the environs of the airfield.

Table G-3

AICUZ ACCIDENT TABULATION (1968-1982)
Takeoffs

Location	Total (%)	Jet (%)	Turboprop/Piston (%)	Rotary (%)
Runway	26 (23.4)	21 (22.8)	1 (11.1)	4 (40.0)
Adjacent Runway	18 (16.2)	14 (15.2)	2 (22.2)	2 (20.0)
Clear Zone	15 (13.6)	14 (15.2)	1 (11.1)	0 (0)
APZ I	11 (9.9)	7 (7.6)	3 (33.4)	1 (10.0)
APZ II	2 (1.8)	2 (2.2)	0 (0)	0 (0)
Out	39 (35.1)	34 (37.0)	2 (22.2)	3 (30.0)
TOTAL	111 (100)	92 (100)	9 (100)	10 (100)

Key:

Jet = Aircraft including A-4F, TA-4J, F-8J, F-4, T-28C, A-7A, F-14A, etc.

02: OV8901\5229\OV8_H1234.CDR (pg3)

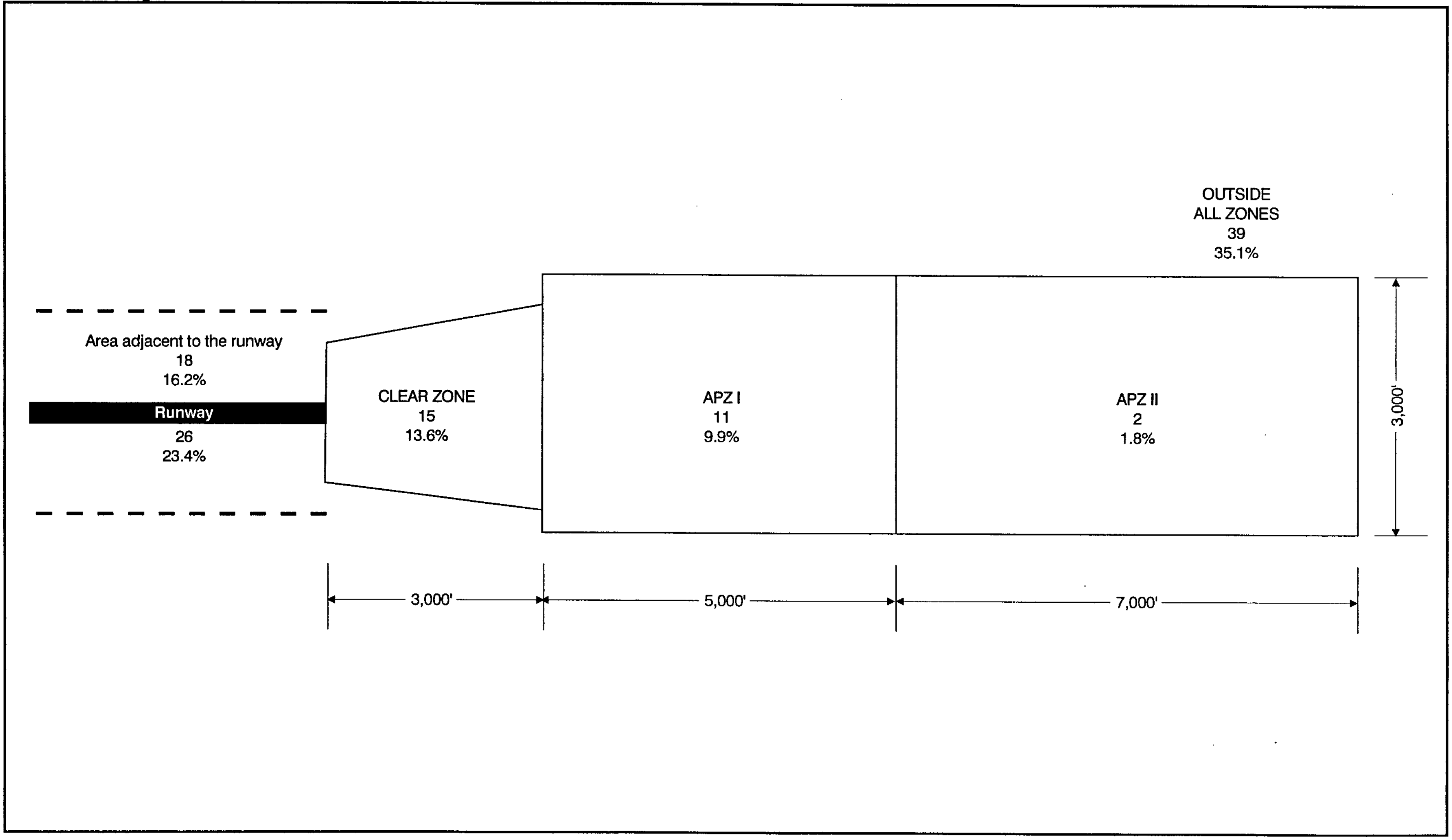


Figure G-3 ACCIDENT DATA FOR TAKEOFFS BASED ON THE NAVY UPDATE OF THE TRI-SERVICE ACCIDENT DATA (1968-1982)

Table G-4

AICUZ ACCIDENT TABULATION (1968-1982)
Landings

Location	Total (%)		Jet (%)		Turboprop/Piston (%)		Rotary (%)	
Runway	137	(39.5)	99	(37.3)	26	(55.4)	12	(34.3)
Adjacent Runway	74	(21.3)	58	(21.9)	8	(17.0)	8	(22.9)
Clear Zone	42	(12.1)	33	(12.5)	7	(14.9)	2	(5.7)
APZ I	20	(5.7)	18	(6.8)	1	(2.1)	1	(2.9)
APZ II	11	(3.2)	10	(3.8)	0	(0)	1	(2.9)
Out	63	(18.2)	47	(17.7)	5	(10.8)	11	(31.3)
TOTAL	347	(100)	265	(100)	47	(100)	35	(100)

Key:

Jet = Aircraft including A-4F, TA-4J, F-8J, F-4, T-28C, A-7A, F-14A, etc.

02:OV8901.D5229-08/22/97-D1

02: OV8901\5229\OV8_H1234.CDR (pg4)

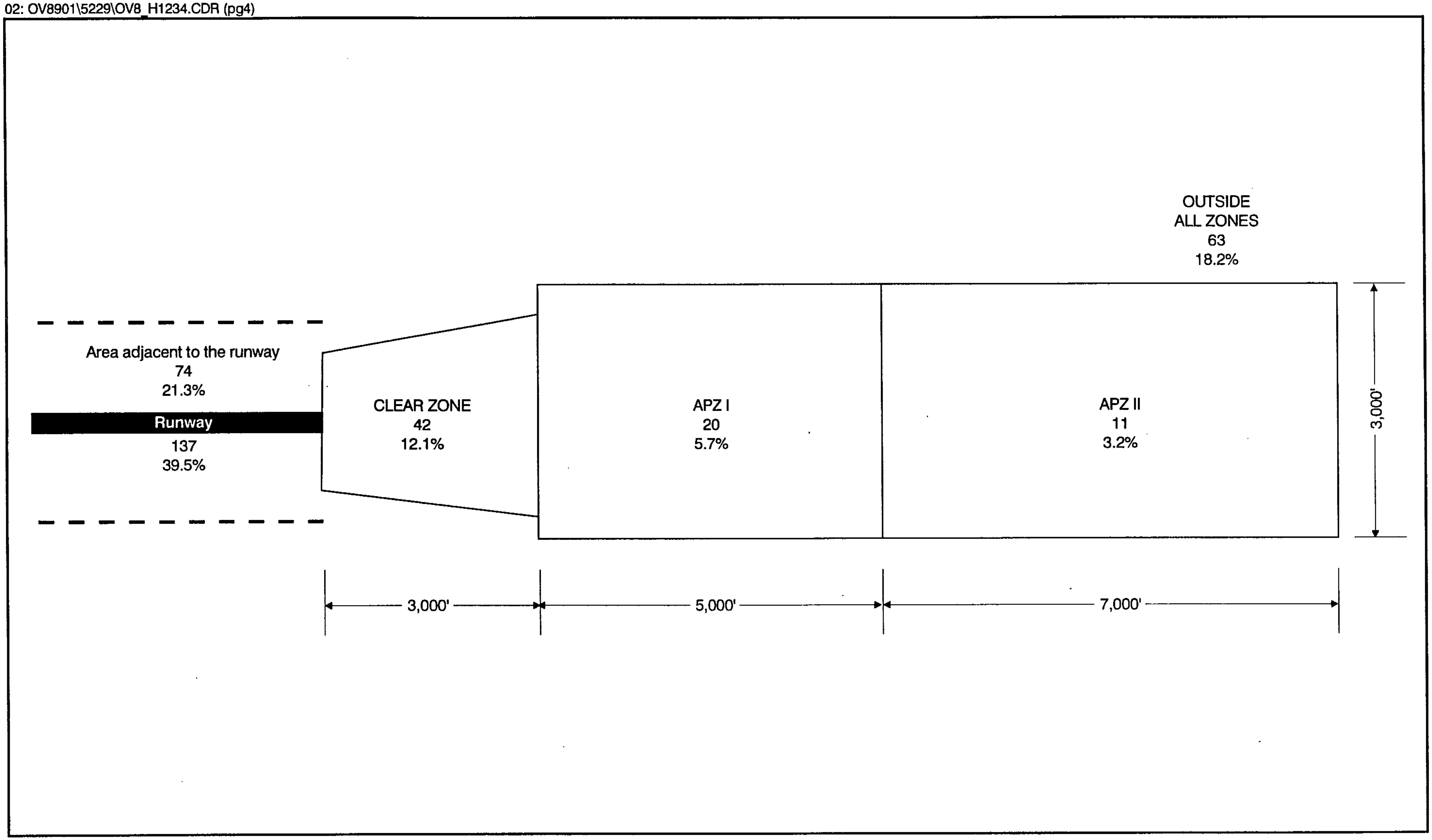


Figure G-4 **ACCIDENT DATA FOR LANDINGS BASED ON THE NAVY UPDATE OF THE TRI-SERVICE ACCIDENT DATA (1968-1982)**

02: OV8901\5229\OV8_5.CDR

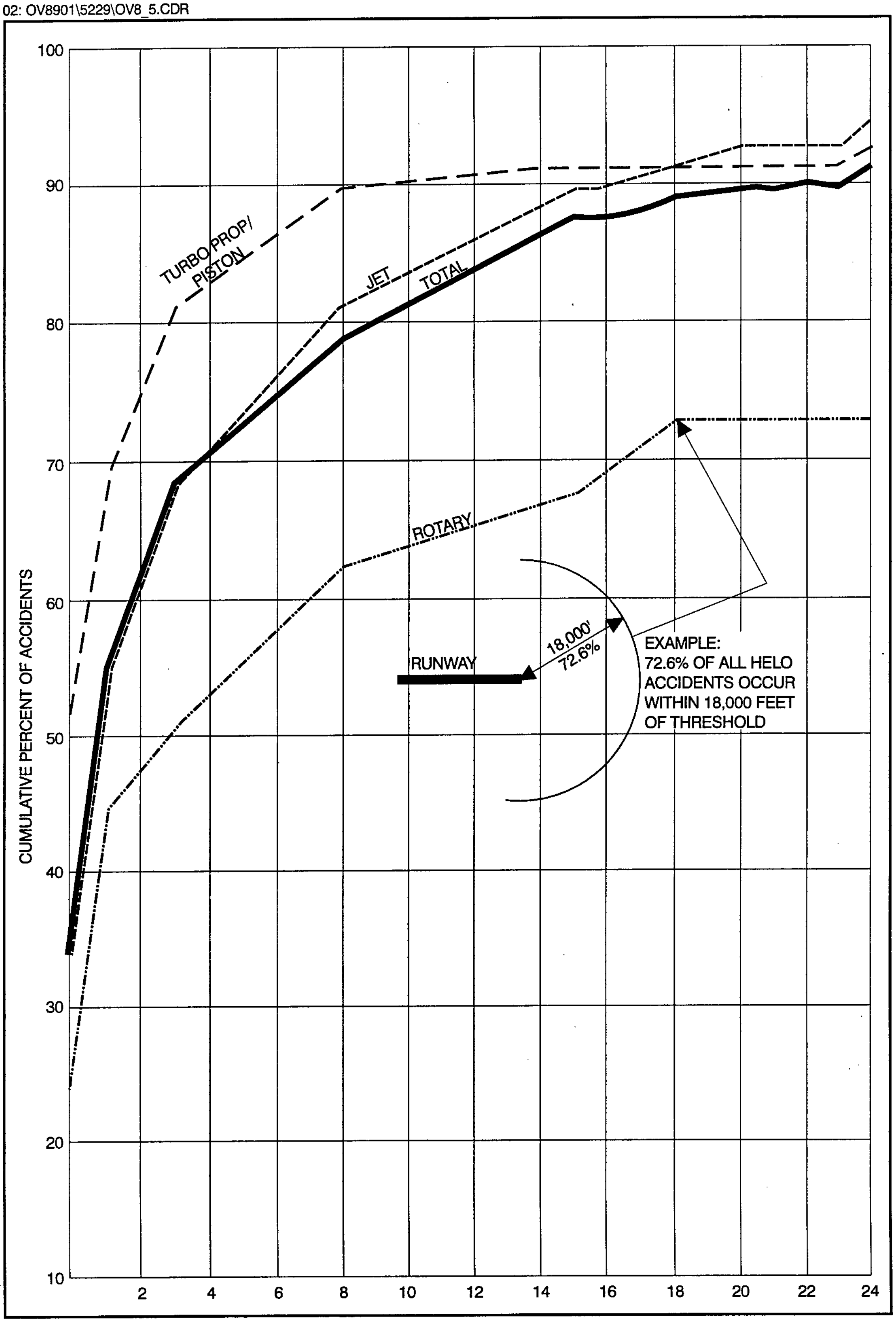


Figure G-5 **PERCENT OF ACCIDENTS FOR EACH AIRCRAFT CLASS VERSUS DISTANCE FROM THRESHOLD (000 FT.)**

Table G-5 AIRCRAFT ACCIDENTS (1982-1997)			
Type	Fixed Wing		Rotary Wing
	Jet	Turboprop	
Takeoff	3	1	—
In-flight	27	6	4
Landing	5	1	4
Unknown	0	1	—

Table G-6 FIXED WING AIRCRAFT ACCIDENTS (1982-1997)	
Aircraft Type	Number of Accidents
A-6	3
EA-6B	1
A-7	4
AV-8	7
A-4	8
F-14	5
F/A-18	3
KC-130	1
T-2	2
T-28	2
T-34	4
T-44	1
OV-10	2

G.4 Conclusion

Based on these studies, aircraft accidents in the vicinity of military airfields show that the areas on/adjacent to the runway and along extended runway centerlines exhibit a greater potential for accidents compared to other areas in the vicinity of the airfield. Accordingly, recommended land use compatibility guidelines for APZs were developed and incorporated in the Navy's AICUZ Program instruction (US Navy 1988) and are presented in Table G-7.

Table G-7

SUGGESTED LAND USE COMPATIBILITY IN ACCIDENT POTENTIAL ZONES

Land Use: SLUCM No.	Land Use: Name	Clear Zone	APZ 1	APZ 2
10	**Residential**			
11	Household units			
11.11	Single units: detached	N	N	Y[a]
11.12	Single units: semidetached	N	N	N
11.13	Single units: attached row	N	N	N
11.21	Two units: side-by-side	N	N	N
11.22	Two units: one above the other	N	N	N
11.31	Apartments: walk up	N	N	N
11.32	Apartments: elevator	N	N	N
12	Group quarters	N	N	N
13	Residential hotels	N	N	N
14	Mobile home parks or courts	N	N	N
15	Transient lodgings	N	N	N
16	Other residential	N	N	N[a]
20	**Manufacturing**			
21	Food and kindred products: manufacturing	N	N[b]	Y
22	Textile mill products: manufacturing	N	N[b]	Y
23	Apparel and other finished products made from fabrics, leather, and similar materials: manufacturing	N	N	N[b]
24	Lumber and wood products (except furniture): manufacturing	N	Y[b]	Y
25	Furniture and fixtures: manufacturing	N	Y[b]	Y
26	Paper and allied products: manufacturing	N	Y[b]	Y

Key at end of table.

Table G-7

SUGGESTED LAND USE COMPATIBILITY IN ACCIDENT POTENTIAL ZONES

Land Use		Clear Zone	APZ 1	APZ 2
SLUCM No.	Name			
30	**Manufacturing (cont'd)**			
27	Printing, publishing, and allied industries	N	Y[b]	Y
28	Chemicals and allied products: manufacturing	N	N	N[b]
29	Petroleum refining and related industries	N	N	N
31	Rubber and misc. plastic products: manufacturing	N	N[b]	N[b]
32	Stone, clay, and glass products: manufacturing	N	N[b]	Y
33	Primary metal industries	N	N[b]	Y
34	Fabricated metal products: manufacturing	N	N[b]	Y
35	Professional, scientific, and controlling instruments; photographic and optical goods; watches and clocks: manufacturing	N	N	N[b]
39	Miscellaneous manufacturing	N	Y[b]	Y[b]
40	**Transportation, communication, and utilities**			
41	Railroad, rapid rail transit, and street railway transportation	N[c]	Y[d]	Y
42	Motor vehicle transportation	N[c]	Y	Y
43	Aircraft transportation	N[c]	Y[d]	Y
44	Marine craft transportation	N[c]	Y[d]	Y
45	Highway and street right-of-way	N[c]	Y	Y
46	Automobile parking	N[c]	Y[d]	Y
47	Communication	N[c]	Y[d]	Y
48	Utilities	N[c]	Y[d]	Y
49	Other transportation, communication, and utilities	N[c]	Y[d]	Y

Key at end of table.

Table G-7

SUGGESTED LAND USE COMPATIBILITY IN ACCIDENT POTENTIAL ZONES

Land Use		Clear Zone	APZ 1	APZ 2
SLUCM No.	Name			
50	**Trade**			
51	Wholesale trade	N	Y^b	Y
52	Retail trade - building materials, hardware, and farm equipment	N	Y^b	Y
53	Retail trade - general merchandise	N	N^b	Y^b
54	Retail trade - food	N	N^b	Y^b
55	Retail trade - automotive, marine craft, aircraft, and accessories	N	Y^b	Y
56	Retail trade - apparel and accessories	N	N^b	Y^b
57	Retail trade - furniture, home furnishings, and equipment	N	N^b	Y^b
58	Retail trade - eating and drinking establishments	N	N	N^b
59	Other retail trade	N	N^b	Y^b
60	**Services**			
61	Finance, insurance, and real estate services	N	N	Y^f
62	Personal services	N	N	Y^f
62.4	Cemeteries	N	Y^g	Y^g
63	Business services	N	Y^h	Y^h
64	Repair services	N	Y^b	Y
65	Professional services	N	N	Y^f
65.1	Hospitals and nursing homes	N	N	N
65.1	Other medical facilities	N	N	N
66	Contract construction services	N	Y^f	Y
67	Governmental services	N	N	Y^f

Key at end of table.

Table G-7

SUGGESTED LAND USE COMPATIBILITY IN ACCIDENT POTENTIAL ZONES

Land Use: SLUCM No.	Land Use: Name	Clear Zone	APZ 1	APZ 2
60	**Services (cont.)**			
68	Educational services (i.e., schools)	N	N	N
69	Miscellaneous services (e.g., religious facilities)	N	N[b]	Y[b]
70	**Cultural, Entertainment, and Recreational**			
71	Cultural activities (including churches)	N	N	N[b]
71.2	Nature exhibits	N	Y[b]	Y
72	Public assembly	N	N	N
72.1	Auditoriums and concert halls	N	N	N
72.11	Outdoor music shells and amphitheaters	N	N	N
72.2	Outdoor sports arenas and spectator sports	N	N	N
73	Amusements	N	N	Y[h]
74	Recreational activities (incl. golf courses, riding stables, water recreation)	N	Y[h,i,j]	Y
75	Resorts and group camps	N	N	N
76	Parks	N	Y[h]	Y[h]
79	Other cultural, entertainment, and recreation	N	Y[i]	Y[i]
80	**Resource Production and Extraction**			
81	Agriculture (except livestock)	Y	Y	Y
81.5 81.7	Livestock farming and animal breeding	N	Y	Y
82	Agricultural-related activities	N	Y[e]	Y
83	Forestry activities and related services	N[e]	Y	Y
84	Fishing activities and related services	N[e]	Y[e]	Y

Key at end of table.

Table G-7

SUGGESTED LAND USE COMPATIBILITY IN ACCIDENT POTENTIAL ZONES

Land Use		Clear Zone	APZ 1	APZ 2
SLUCM No.	**Name**			
80	**Resource Production and Extraction (cont.)**			
85	Mining activities and related services	N	Y[e]	Y
89	Other resource production and extraction	N	Y[e]	Y

[a] Suggested maximum density is one to two dwelling units per acre, possibly increased under a Planned Unit Development (PUD) where maximum lot coverage is less than 20%.
[b] Within each land use category, uses exist where further evaluation may be needed due to the variation of densities of people and structures. For example, where a small neighborhood retail store may be compatible in APZ 2, a shopping center or strip shopping mall would be incompatible because of the density of development and concentration of people.
[c] The placing of structures, buildings, or aboveground utility lines in the clear zone is subject to severe restrictions. In a majority of the clear zones, these items are prohibited. See NAVFAC P-80.3 (NOTAL) for specific guidance.
[d] No passenger terminals and no major aboveground transmission lines in APZ 1.
[e] Factors to be considered: labor intensity, structural coverage, explosive characteristics, air pollution.
[f] Low-intensity office uses only. Meeting places, auditoriums, etc., not recommended.
[g] Excludes chapels.
[h] Facilities must be low in intensity.
[i] Clubhouse not recommended.
[j] Large classes not recommended.

Key:

SLUCM = Standard Land Use Coding Manual.

H Noise

H.1 General

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air, and are sensed by the human ear. Whether that sound is interpreted as pleasant (e.g., music) or unpleasant (e.g., jackhammers) depends largely on the listener's current activity, past experience, and attitude toward the source of that sound.

The measurement and human perception of sound involves three basic physical characteristics - intensity, frequency, and duration. First, intensity is a measure of the acoustic energy of the sound vibrations and is expressed in terms of sound pressure. The higher the sound pressure, the more energy carried by the sound and the louder the perception of that sound. The second important physical characteristic is sound frequency, which is the number of times per second the air vibrates or oscillates. Low-frequency sounds are characterized as rumbles or roars, while high-frequency sounds are typified by sirens or screeches. The third important characteristic of sound is duration or the length of time the sound can be detected.

Aircraft noise consists of two major sound sources: aircraft takeoffs and landings and engine maintenance operations or run-ups. The former can be described as intermittent sounds and the latter as continuous.

The loudest sounds that can be detected comfortably by the human ear have intensities that are a trillion times larger than those of sounds that can just be detected. Because of this vast range, using a linear scale to represent the intensity of sound becomes very unwieldy. As a result, a logarithmic unit known as the decibel (abbreviated dB) is used to represent the intensity of a sound. Such a representation is called a sound level.

A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. Sound levels above 120 dB begin to be felt inside the human ear as discomfort and eventually pain at still higher levels.

Because of the logarithmic nature of the decibel unit, sound levels cannot be arithmetically added or subtracted and are somewhat cumbersome to handle mathematically. However, some simple rules are useful in dealing with sound levels. First, if a sound's intensity is doubled, the sound level increases by 3 dB, regardless of the initial sound level. For example:

- 60 dB + 60 dB = 63 dB, and
- 80 dB + 80 dB = 83 dB.

Second, the total sound level produced by two sounds of different levels is usually only slightly more than the higher of the two. For example:

- 60.0 dB + 70.0 dB = 70.4 dB.

Because the addition of sound levels is different than that of ordinary numbers, such addition is often referred to as "decibel addition" or "energy addition". The latter term arises from the fact that what we are really doing when we add decibel values is first converting each decibel value to its corresponding acoustic energy, then adding the energies using the normal rules of addition, and finally converting the total energy back to its decibel equivalent.

An important facet of decibel addition arises later when the concept of time-average sound levels is introduced to explain day-night average sound level. Because of the logarithmic units, the time-average sound level is dominated by the louder levels that occur during the averaging period. As a simple example, consider a sound level of 100 dB which lasts for 30 seconds, followed by a sound level of 50 dB which also lasts for 30 seconds. The time-average sound level over the total 60-second period is 97 dB, not 75 dB.

The minimum change in the sound level of individual events that an average human ear can detect is about 3 dB. A change in sound level of about 10 dB is usually perceived by the average person as a doubling (or halving) of the sound's loudness, and this relation holds true for loud and quiet sounds. A decrease in sound level of 10 dB actually represents a 90% decrease in sound intensity but only a 50% decrease in perceived loudness because of the nonlinear response of the human ear (similar to most human senses).

Sound frequency is measured in terms of cycles per second (cps), or hertz (Hz), which is the preferred scientific unit for cps. The normal human ear can detect sounds that range in frequency from about 20 Hz to about 15,000 Hz. All sounds in this wide range of frequencies, however, are not heard equally by the human ear, which is most sensitive to frequencies in the 1,000 to 4,000 Hz range. In measuring community noise, this frequency dependence is taken into account by adjusting the very high and very low frequencies to approximate the human ear's lower sensitivity to those frequencies. This is called "A-weighting" and is commonly used in measurements of community environmental noise.

If sound levels are measured using A-weighting, they are called A-weighted sound levels. If sound levels are measured without any frequency weighting, they are called sound levels. Most environmental impact analysis documents deal only with A-weighted sound levels; therefore, the adjective "A-weighted" is often omitted. In this case, A-weighted sound levels are also referred to as sound levels. In some instances, levels that have been

A-weighted are identified by using the abbreviation dBA or dB(A), rather than the abbreviation dB, for decibel. As long as the use of A-weighting is understood to be used, there is no difference implied by the terms "sound level" and "A-weighted sound level" or by the units dB, dBA, and dB(A).

This document presents A-weighted sound levels, but the adjective "A-weighted" has been omitted.

Sound levels do not represent instantaneous measurements but rather averages over short periods of time. Two measurement time periods are most common - one second and one-eighth of a second. A measured sound level averaged over one second is called a slow response sound level; one averaged over one-eighth of a second is called a fast response sound level. Most environmental noise studies use slow response measurements, and the adjective "slow response" is usually omitted. The proper descriptor "slow response A-weighted sound level" is usually shortened to "sound level" in environmental impact analysis documents.

H.2 Noise Metrics

A "metric" is defined as "of, involving, or used in measurement." As used in environmental noise analyses, a metric refers to the unit or quantity that quantitatively measures the <u>effect</u> of noise on the environment. Noise studies have typically involved a confusing proliferation of noise metrics as individual researchers have attempted to understand and represent the effects of noise. As a result, past literature describing environmental noise or environmental noise abatement has included many different metrics.

Recently, however, various federal agencies involved in environmental noise mitigation have agreed on common metrics for environmental impact analysis documents, and both the Department of Defense and the Federal Aviation Administration have specified those which should be used for federal aviation noise assessments. These metrics are as follows.

Maximum Sound Level

The highest A-weighted sound level measured during a single event in which the sound level changes value as time goes on (e.g., an aircraft overflight) is called the maximum A-weighted sound level or maximum sound level. It is usually abbreviated by ALM, L_{max}, or L_{Amax}.

The maximum sound levels of typical events are shown in Figure H-1. The maximum sound level is important in judging the interference caused by a noise event with conversation, TV or radio listening, sleep, or other common activities.

Sound Exposure Level

Individual time-varying noise events have two main characteristics - a sound level that changes throughout the event and a period of time during which the event is heard. Although the maximum sound level, described above, provides some measure of the intrusiveness of the event, it alone does not completely describe the total event. The period of time during which the sound is heard is also significant. The sound exposure level (abbreviated SEL or L_{AE}) combines both of these characteristics into a single metric.

Sound exposure level is a logarithmic measure of the total acoustic energy transmitted to the listener during the event. Mathematically, it represents the sound level of the constant sound that would, in one second, generate the same acoustic energy as did the actual time-varying noise event. Since aircraft overflights usually last longer than one second, the sound exposure level of an overflight is usually greater than the maximum sound level of the overflight.

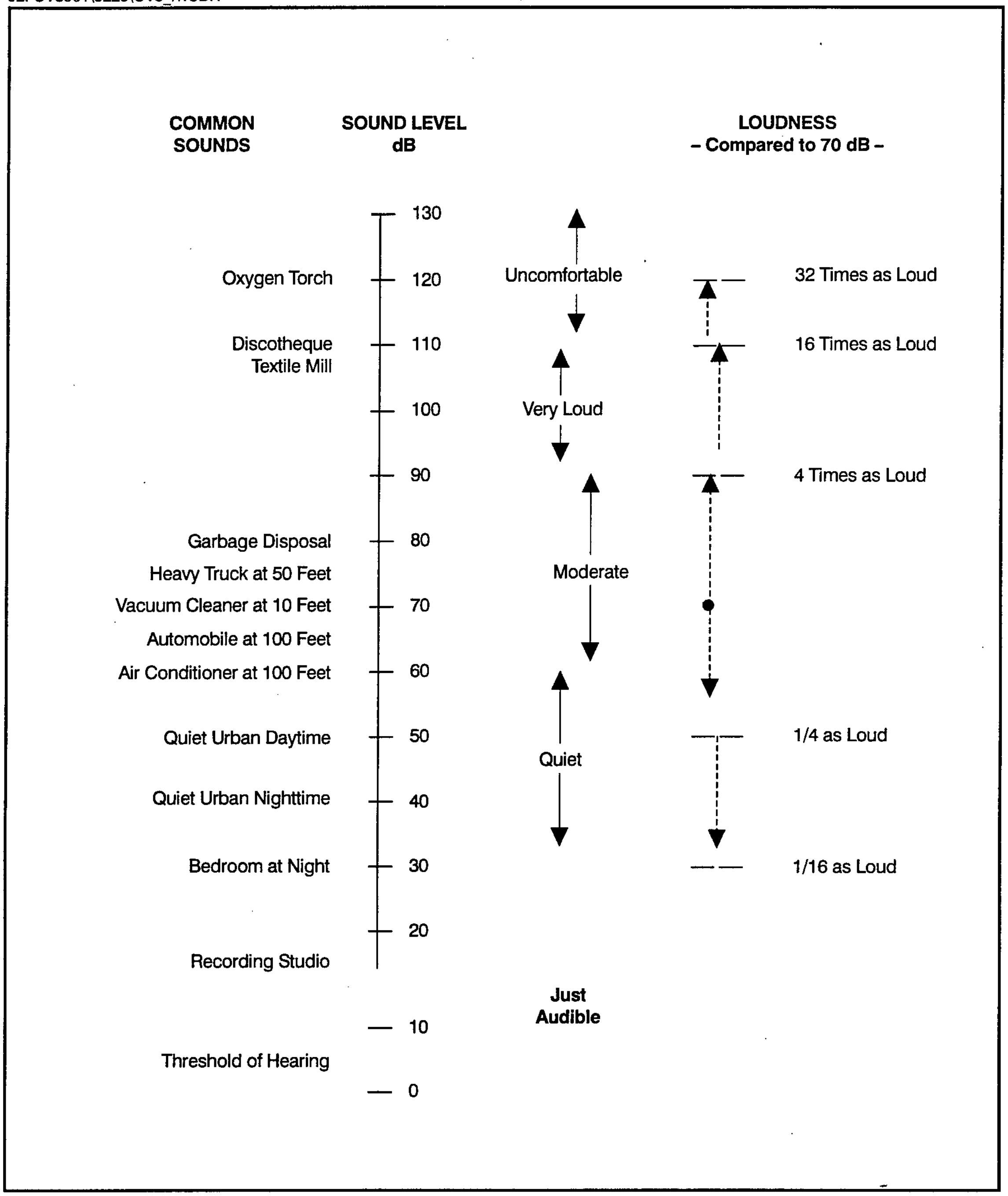
Note that sound exposure level is a composite metric that represents both the intensity of a sound and its duration. It does not directly represent the sound level heard at any given time, but rather provides a measure of the net impact of the entire acoustic event. It has been well established in the scientific community that sound exposure level measures this impact much more reliably than just the maximum sound level.

Day-Night Average Sound Level

Time-average sound levels are measurements of sound levels that are averaged over a specified length of time. These levels provide a measure of the average sound energy during the measurement period.

For the evaluation of community noise effects, and particularly aircraft noise effects, the day-night average sound level (abbreviated DNL or L_{dn}) is used. Day-night average sound level averages aircraft sound levels at a location over a complete 24-hour period, with a 10-decibel adjustment added to those noise events that take place between 10:00 p.m. and 7:00 a.m. the following morning. This 10-decibel "penalty" represents the added intrusiveness of sounds which occur during normal sleeping hours, both because of the increased sensitivity to noise during those hours and because ambient sound levels during nighttime are typically about 10 dB lower than during daytime hours.

02: OV8901\5229\OV8_i1.CDR



SOURCE: *Handbook of Noise Control*, C.M. Harris, Editor, McGraw-Hill Book Co., 1979.

Figure H-1 TYPICAL A-WEIGHTED SOUND LEVELS OF COMMON SOUNDS

Day-night average sound level is the continuous A-weighted sound level that would be present if all of the variations in sound level that occur over a 24-hour period were smoothed out so as to contain the same total sound energy.

Day-night average sound level provides a single measure of overall noise impact, but does not provide specific information on the number of noise events or the individual sound levels that occur during the day. For example, a day-night average sound level of 65 dB could result from a very few noisy events or a large number of quieter events.

As noted earlier for sound exposure level, day-night average sound level does not represent the sound level heard at any particular time but rather represents the total sound exposure. Scientific studies and social surveys conducted to determine community annoyance to all types of environmental noise have found the day-night average sound level to be the best measure of that annoyance. Its use is endorsed by the scientific community (see References H1 through H5).

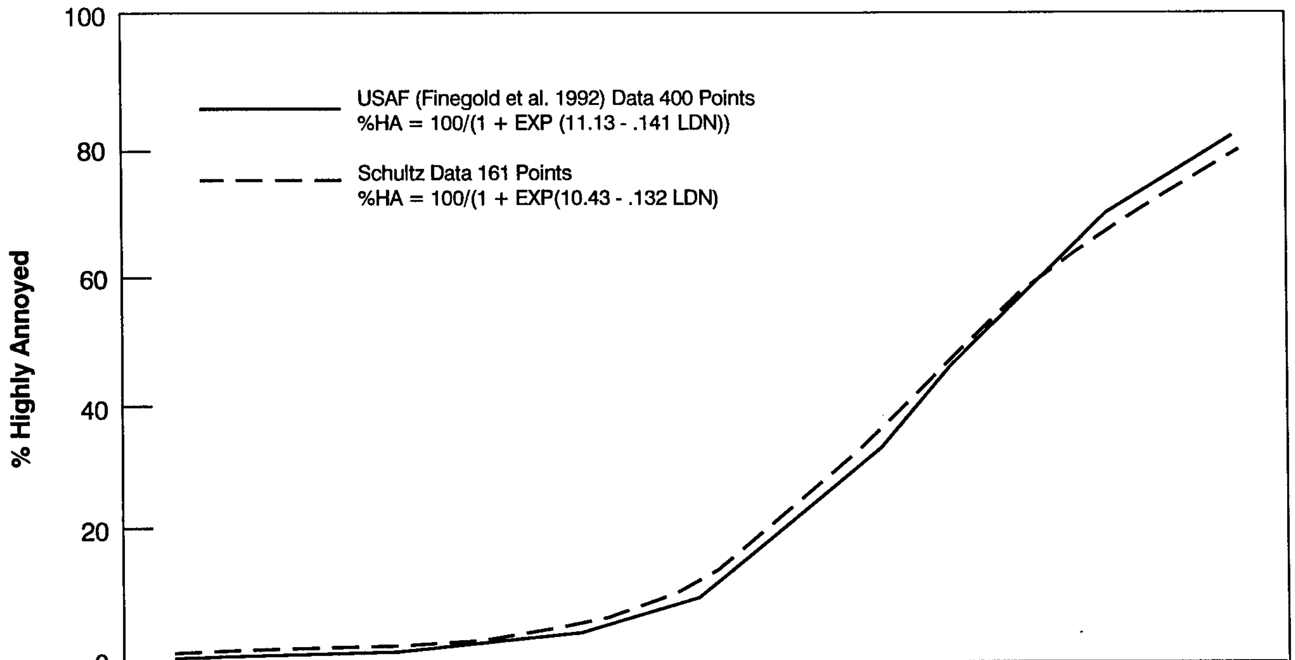
There is, in fact, a remarkable consistency in the results of attitudinal surveys about aircraft noise conducted in different countries to find the percentages of groups of people who express various degrees of annoyance when exposed to different levels of day-night average sound level. This is illustrated in Figure H-2, which summarizes the results of a large number of social surveys relating community responses to various types of noises, measured in day-night average sound level.

Reference H6, the source for Figure H-2, was published in 1978. A more recent study has reaffirmed this relationship (Reference H7). In general, correlation coefficients of 0.85 to 0.95 are found between the percentages of groups of people highly annoyed and the level of average noise exposure. The correlation coefficients for the annoyance of individuals are relatively low (i.e., 0.5 or less). This is not surprising, considering the varying personal factors that influence the manner in which individuals react to noise. Nevertheless, findings substantiate that community annoyance to aircraft noise is represented quite reliably using day-night average sound level.

This relation between community annoyance and time-average sound level has been confirmed, even for infrequent aircraft noise events. Reference H8 reported the reactions of individuals in a community to daily helicopter overflights, ranging from one to 32 per day. The stated reactions to infrequent helicopter overflights correlated quite well with the daily time-average sound levels over this range of numbers of daily noise events.

The use of day-night average sound level has been criticized recently as not accurately representing community annoyance and land-use compatibility with aircraft noise. Much of that criticism stems from a lack of understanding of the basis for the

02:\OV8901\5229\OV8_I2.CDR



Day - Night Average Sound Level in dB		40	45	50	55	60	65	70	75	80	85	90
Calculated %HA Points	USAF	0.41	0.831	1.66	3.31	6.48	12.29	22.1	36.47	53.74	70.16	82.64
	SCHULTZ	0.576	1.11	2.12	4.03	7.52	13.59	23.32	37.05	53.25	68.78	81

SOURCE: FICON 1992.

Figure H-2 **COMPARISON OF LOGISTIC FITS TO ORIGINAL 161 DATA POINTS OF SCHULTZ (1978) AND USAF ANALYSIS WITH 400 POINTS (data provided by USAF Armstrong Laboratory)**

measurement or calculation of L_{dn}. One frequent criticism is based on the inherent feeling that people react more to single noise events and not as much to "meaningless" time-average sound levels.

In fact, a time-average noise metric, such as L_{dn} , takes into account both the noise levels of all individual events that occur during a 24-hour period and the number of times those events occur. As described briefly above, the logarithmic nature of the decibel unit causes the noise levels of the loudest events to control the 24-hour average.

As a simple example of this characteristic, consider a case in which only one aircraft overflight occurs during the daytime over a 24-hour period, creating a sound level of 100 dB for 30 seconds. During the remaining 23 hours, 59 minutes, and 30 seconds of the day, the ambient sound level is 50 dB. The day-night average sound level for this 24-hour period is 65.5 dB. Assume, as a second example, that 10 such 30-second overflights occur during daytime hours during the next 24-hour period, with the same ambient sound level of 50 dB during the remaining 23 hours and 55 minutes of the day. The day-night average sound level for this 24-hour period is 75.4 dB. Clearly, the averaging of noise over a 24-hour period does not ignore the louder single events and tends to emphasize both the sound levels and number of those events.

H.3 Noise Effects

H.3.1 Hearing Loss

Noise-induced hearing loss is probably the best defined of the potential effects of human exposure to excessive noise. Federal workplace standards for protection from hearing loss allow a time-average level of 90 dB over an 8-hour work period or 85 dB over a 16-hour period. Even the most protective criterion (no measurable hearing loss for the most sensitive portion of the population at the ear's most sensitive frequency, 4,000 Hz, after a 40-year exposure) is a time-average sound level of 70 dB over a 24-hour period. Because it is unlikely that airport neighbors will remain outside their homes 24 hours per day for extended periods of time, there is little possibility of hearing loss below a day-night average sound level of 75 dB, and this level is extremely conservative.

H.3.2 Nonauditory Health Effects

Most studies of nonauditory health effects of long-term noise exposure have found that noise exposure levels established for hearing protection will also protect against any potential nonauditory health effects, at least in workplace conditions. One of the best scientific summaries of these findings is contained in the lead paper at the National Institutes of Health Conference on Noise and Hearing Loss, held on 22 to 24 January 1990 in Washington, D.C.:

> "The nonauditory effects of chronic noise exposure, when noise is suspected to act as one of the risk factors in the development of hypertension, cardiovascular disease, and other nervous disorders, have never been proven to occur as chronic manifestations at levels below these criteria (an average of 75 dBA for complete protection against hearing loss for an 8-hour day). At the recent (1988) International Congress on Noise as a Public Health Problem, most studies attempting to clarify such health effects did not find them at levels below the criteria protective of noise-induced hearing loss, and even above these criteria, results regarding such health effects were ambiguous. Consequently, one comes to the conclusion that establishing and enforcing exposure levels protecting against noise-induced hearing loss would not only solve the noise-induced hearing loss problem but also any potential nonauditory health effects in the work place." (Reference H10; parenthetical wording added for clarification.)

Although these findings were specifically directed at noise effects in the workplace, they are equally applicable to aircraft noise effects in the community environment. Research studies regarding the nonauditory health effects of aircraft noise are ambiguous, at best, and often contradictory. Yet, even those studies that purport to find such health effects use time-average noise levels of 75 dB and higher for their research.

For example, in an often-quoted paper, two UCLA researchers apparently found a relationship between aircraft noise levels under the approach path to Los Angeles International Airport (LAX) and increased mortality rates among the exposed residents by using an average noise exposure level greater than 75 dB for the "noise-exposed" population (Reference H11). Nevertheless, three other UCLA professors analyzed those same data and found no relationship between noise exposure and mortality rates (Reference H12).

As a second example, two other UCLA researchers used this same population near LAX to show a higher rate of birth defects for 1970 to 1972 when compared with a control group residing away from the airport (Reference H13). Based on this report, a separate group at the Center for Disease Control performed a more thorough study of populations near Atlanta's Hartsfield International Airport (ATL) for 1970 to 1972 and found no relationship in their study of 17 identified categories of birth defects to aircraft noise levels above 65 dB (Reference H14).

In summary, there is no scientific basis for a claim that potential health effects exist for aircraft time-average sound levels below 75 dB.

H.3.3 Annoyance

The primary effect of aircraft noise on exposed communities is one of annoyance. Noise annoyance is defined by the U.S. Environmental Protection Agency as any negative subjective reaction on the part of an individual or group (Reference H3). As noted in the discussion of day-night average sound level above, community annoyance is best measured by that metric.

H.3.4 Speech Interference

Speech interference associated with aircraft noise is a primary cause of annoyance to individuals on the ground. The disruption of routine activities such as radio or television listening, telephone use, or family conversation gives rise to frustration and irritation. The quality of speech communication is also important in classrooms, offices, and industrial settings and can cause fatigue and vocal strain in those who attempt to communicate over the noise. Research has shown that the use of the sound exposure level metric will successfully measure speech interference and that a sound exposure level exceeding 65 dB will begin to interfere with speech communication.

H.3.5 Sleep Interference

Sleep interference is another source of annoyance associated with aircraft noise. This is especially true because of the intermittent nature and content of aircraft noise, which is more disturbing than continuous noise of equal energy.

Sleep interference may be measured in either of two ways. "Arousal" represents actual awakening from sleep, while a change in "sleep stage" represents a shift from one of four sleep stages to another stage of lighter sleep without actual awakening. In general, arousal requires a somewhat higher noise level than does a change in sleep stage.

A recent analysis sponsored by the U.S. Air Force summarized 21 published studies concerning the effects of noise on sleep (Reference H15). The analysis concluded that a lack of reliable studies in homes, combined with large differences among the results from the various laboratory studies, did not permit development of an acceptably accurate assessment procedure. The noise events used in the laboratory studies and in contrived in-home studies were presented at much higher rates of occurrence than would normally be experienced in the home. None of the laboratory studies were of sufficiently long duration to determine any effects of habituation, such as that which would occur under normal community conditions.

Nevertheless, some guidance is available in judging sleep interference. The U.S. Environmental Protection Agency identified an indoor day-night average sound level of 45 dB as necessary to protect against sleep interference (Reference H3). Assuming a very conservative structural noise insulation of 20 dB for typical dwelling units, this corresponds to an outdoor day-night average sound level of 65 dB minimizing sleep interference.

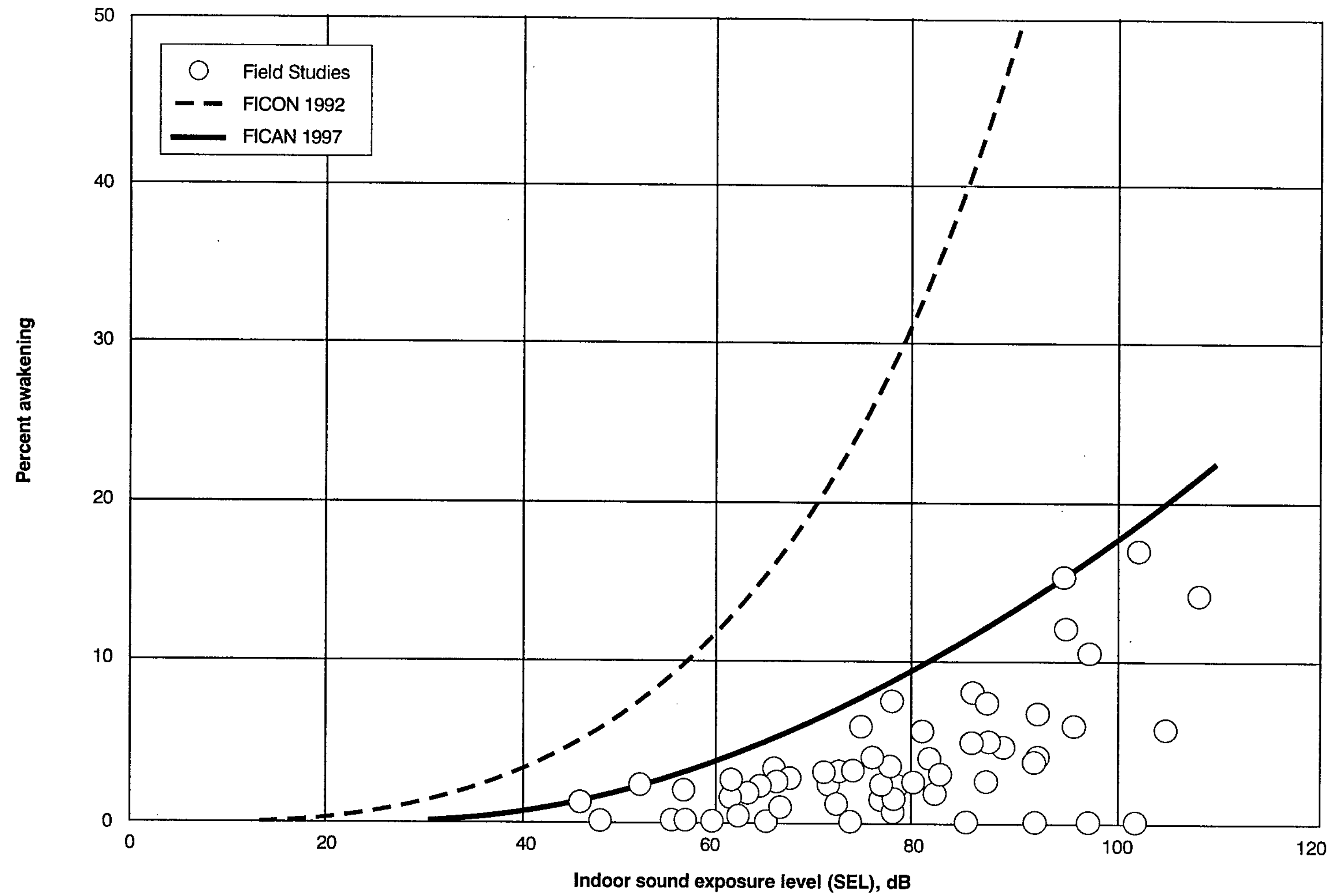
In 1992, the Federal Interagency Committee on Noise (FICON) addressed the issue of sleep disturbance prediction. FICON adopted an interim curve developed by the U.S. Air Force based on available data including home and laboratory studies (Reference H16). Subsequently, in 1997, the Federal Interagency Committee on Aviation Noise (FICAN) amended its earlier position and adopted a new interim guideline for sleep awakening prediction. The new curve, based on recent studies in England and at two U.S. airports (Los Angeles International and Denver International), concluded that the incidence of sleep awakening from aircraft noise was less than previously identified. Using indoor single-event noise levels represented by SELs, potential sleep awakening can be predicted using the curve presented in Figure H-3. For example, maximum sound levels (Lmax) for an F/A-18 conducting touch-and-go or FCLPs is 97 dB (see Table 4.8-5). As noted in Section 3.1.8, the SEL is usually greater than the Lmax because SEL includes the duration of the event. Typical SELs are 10 dB greater than Lmax for flyover events. Therefore, for the F/A-18 touch-and-go or FCLP Lmax of 97 dB, the corresponding outdoor SEL would be 107 dB. Typically, homes in the United States provide 15 dB of sound attenuation with windows open and 25 dB with windows closed and air conditioning operating. Hence, the outdoor SEL of 107 dB would be 92 dB indoors with windows open and 82 dB indoors with windows closed and air conditioning operating. Using Figure H-3, the potential sleep awakening would be 15% with windows open and 10% with windows closed in the above example.

The new FICAN curve does not address habituation over time by sleeping subjects and is applicable only to adult populations. Nevertheless, this curve provides a reasonable guideline for assessing sleep awakening.

H.3.6 Noise Effects on Domestic Animals and Wildlife

Animal species differ greatly in their responses to noise. Each species has adapted, physically and behaviorally, to fill its ecological role in nature, and its hearing ability usually reflects that role. Animals rely on their hearing to avoid predators, obtain food, and communicate with and attract other members of their species. Aircraft noise may mask or interfere with these functions. Secondary effects may include nonauditory effects similar to

02: OV8901\5229\OV8_I3.CDR



SOURCE: Federal Interagency Committee on Aviation Noise (FICAN) 1997

Figure H-3 RECOMMENDED SLEEP DISTURBANCE DOSE–RESPONSE RELATIONSHIP

those exhibited by humans - stress, hypertension, and other nervous disorders. Tertiary effects may include interference with mating and resultant population declines.

Many scientific studies are available regarding the effects of noise on wildlife and some anecdotal reports of wildlife "flight" due to noise. Few of these studies or reports include any reliable measures of the actual noise levels involved.

In the absence of definitive data on the effect of noise on animals, the Committee on Hearing, Bioacoustics, and Biomechanics of the National Research Council has proposed that protective noise criteria for animals be taken to be the same as for humans (Reference H18).

H.3.7 Noise Effects on Structures

Normally, the most sensitive components of a structure to airborne noise are the windows and, infrequently, the plastered walls and ceilings. An evaluation of the peak sound pressures impinging on the structure is normally sufficient to determine the possibility of damage. In general, at sound levels above 130 dB, there is the possibility of the excitation of structural component resonances. While certain frequencies (such as 30 hertz for window breakage) may be of more concern than other frequencies, conservatively, only sounds lasting more than one second above a sound level of 130 dB are potentially damaging to structural components (Reference H19).

Noise-induced structural vibration may also cause annoyance to dwelling occupants because of induced secondary vibrations, or "rattle", of objects within the dwelling - hanging pictures, dishes, plaques, and bric-a-brac. Window panes may also vibrate noticeably when exposed to high levels of airborne noise. In general, such noise-induced vibrations occur at sound levels of 110 dB or greater. Thus, assessments of noise exposure levels for compatible land use should also be protective of noise-induced secondary vibrations.

H.3.8 Noise Effects on Terrain

It has been suggested that noise levels associated with low-flying aircraft may affect the terrain under the flight path by disturbing fragile soil or snow structures, especially in mountainous areas, causing landslides or avalanches. There are no known instances of such effects, and it is considered improbable that such effects will result from routine, subsonic aircraft operations.

H.3.9 Noise Effects on Historical and Archaeological Sites

Because of the potential for increased fragility of structural components of historical buildings and other historical sites, aircraft noise may affect such sites more severely than newer, modern structures. Again, there are few scientific studies of such effects to provide guidance for their assessment.

One study involved the measurements of sound levels and structural vibration levels in a superbly restored plantation house, originally built in 1795, and now situated approximately 1,500 feet from the centerline at the departure end of Runway 19L at Washington Dulles International Airport (IAD). These measurements were made in connection with the proposed scheduled operation of the supersonic Concorde airplane at Dulles (Reference H18). There was special concern for the building's windows, since roughly half of the 324 panes were original. No instances of structural damage were found. Interestingly, despite the high levels of noise during Concorde takeoffs, the induced structural vibration levels were actually less than those induced by touring groups and vacuum cleaning.

As noted above for the noise effects of noise-induced vibrations of normal structures, assessments of noise exposure levels for normally compatible land uses should also be protective of historic and archaeological sites.

H.4 References

This appendix was modified from Wyle 1997.

H1. "Sound Level Descriptors for Determination of Compatible Land Use," American National Standards Institute Standard ANSI S3.23-1980.

H2. "Quantities and Procedures for Description and Measurement of Environmental Sound, Part 1," American National Standards Institute Standard ANSI S12.9-1988.

H3. "Information on Levels of Environmental Noise Requisite to Protect the Public Health and Welfare With an Adequate Margin of Safety," U.S. Environmental Protection Agency Report 550/9-74-004, March 1972.

H4. "Guidelines for Considering Noise in Land-Use Planning and Control," Federal Interagency Committee on Urban Noise, June 1980.

H5. "Federal Agency Review of Selected Airport Noise Analysis Issues," Federal Interagency Committee on Noise, August 1992.

H6. Schultz, T.J., "Synthesis of Social Surveys on Noise Annoyance," *J. Acoust. Soc. Am.*, *64*, 377-405, August 1978.

H7. Fidell, S., Barger, D.S., and Schultz, T.J., "Updating a Dosage-Effect Relationship for the Prevalence of Annoyance Due to General Transportation Noise," *J. Acoust. Soc. Am.*, *89*, 221-233, January 1991.

H8. "Community Reactions to Helicopter Noise: Results From an Experimental Study," *J. Acoust. Soc. Am.*, *82*, 479-492, August 1987.

H9. Plotkin, K.J., Sutherland, L.C., and Molino, J.A., "Environmental Noise Assessment for Military Aircraft Training Routes, Volume II: Recommended Noise Metric," Wyle Research Report WR 86-21, January 1987.

H10. von Gierke, H.R., "The Noise-Induced Hearing Loss Problem", NIH Consensus Development Conference on Noise and Hearing Loss, Washington, D.C., 22–24 January 1990.

H11. Meacham, W.C., and Shaw, N., "Effects of Jet Noise on Mortality Rates," *British Journal of Audiology*, 77-80, August 1979.

H12. Frericks, R.R., *et al.*, "Los Angeles Airport Noise and Mortality: Faulty Analysis and Public Policy," *Am. J. Public Health*, 357-362, April 1980.

H13. Jones, F.N., and Tauscher, J., "Residence Under an Airport Landing Pattern as a Factor in Teratism", *Archives of Environmental Health*, 10-12, January/ February 1978.

H14. Edmonds, L.D., *et al.*, "Airport Noise and Teratogenesis," *Archives of Environmental Health*, 243-247, July/August 1979.

H15. Pearsons, K.S., Barber, D.S., and Tabachick, B.G., "Analyses of the Predictability of Noise-Induced Sleep Disturbance," USAF Report HSD-TR-89-029, October 1989.

H16. Federal Interagency Committee on Noise, "Federal Agency Review of Selected Airport Noise Issues," August 1992

H17. Federal Interagency Committee on Aviation Noise, "Effects of Aviation Noise on Awakenings from Sleep," June 1997

H18. Wesler, J.E., "Concorde Operations At Dulles International Airport," NOIS-EXPO '77, Chicago, IL, March 1977.

H19. "Guidelines for Preparing Environmental Impact Statements on Noise," Committee on Hearing, Bioacoustics and Biomechanics, The National Research Council, National Academy of Sciences, 1977.