Air Force
Environmental Planning Division
(HQ USAF/CEVP)

Room 5B269
1260 Air Force Pentagon
Washington, DC 20330-1260

16 JUL 93

MEMORANDUM FOR DTIC (Acquisition)
(ATTN: Pat Mauby)

SUBJ: Distribution of USAF Planning Documents Forwarded on 1 July 93

All the documents forwarded to your organization on the subject date should be considered Approved for Public Release, distribution is unlimited (Distribution Statement A).

Jack Bush, GM-14

Mr. Jack Bush
Special Projects and Plans
703-697-2928
DSN 227-2928

DRAFT ENVIRONMENTAL STATEMENT
ON
PROPOSED CONTINENTAL OPERATIONS RANGE
(COR)

SUMMARY SHEET

This draft statement was prepared by the Department of the Air Force. For additional information about this proposed action, contact Dr. Billy E. Welch, Special Assistant for Environmental Quality, SAF/ILE, Washington, D.C., 20330, (202) 697-9297.

1. The proposal described is an administrative action.

2. Description:

The proposed COR will be implemented in three time-phases, designated Near-Term, Mid-Term, and Far-Term, by integrating the uses of three existing ranges/test centers. The Near-Term will concentrate on improvements for the ranges associated with the Tactical Fighter Weapons Center at Nellis AFB near Las Vegas, Nevada. The Mid-Term will expand with the additions of the Hill/Wendover/Dugway test ranges near Salt Lake City, Utah. The Far-Term will add the use on a cooperative basis of the ranges associated with the Fallon Naval Air Station near Reno, Nevada.

3. Environmental impact and adverse environmental effects of the proposed action:

The implementation of the proposed COR is expected to have both beneficial and adverse effects. The effects associated with the influx of new personnel for COR activities are considered. COR's increased use of air space with better air traffic control and communications is expected to have the beneficial impact of enhancing the operation and safety of all users. Electromagnetic emanations, constrained by duly prescribed range operations and safety precautions, should pose no undue hazards to people or equipment. The impact of COR generated noise and sonic booms is deemed chiefly noise annoyance to the human and natural environment, which has accommodated to the presence of noise in the area; thus, the impact due to COR activities is not expected to be of significance. Supersonic activity is planned to avoid population areas, known structures, and random activities like known archaeological excavations so that the impact of sonic booms will be minimized. Ordnance expenditures will mostly be confined to the same locale as past activities over the last 30 years. The growth of the civilian population in small communities such as Tonopah and Caliente because of COR should have a favorable impact on the economy of the communities concomitant with the increased demands on their schools and other facilities.

4. Alternatives:

   a. No action.

   b. Existing range improvement.

   c. Methods other than test ranges.

   d. Build a range encompassing existing ranges.

5. Agencies from which comments have been requested:

   a. Department of Agriculture

   b. Department of Health, Education and Welfare

   c. Department of Housing and Urban Development

   d. Department of the Interior

   e. Department of Transportation

   f. Federal Aviation Administration

   g. Environmental Protection Agency

   h. State of Nevada

   i. State of Utah

6. The draft environmental impact statement was made available to the Council on Environmental Quality and the public in June 1974.

CONTENTS

CONTENTS (Cont'd)

CONTENTS (Cont'd)

ILLUSTRATIONS

ILLUSTRATIONS (Cont.)

ILLUSTRATIONS (Cont.)

ILLUSTRATIONS (Cont.)

TABLES

TABLES (Cont.)

TABLES (Cont.)

TABLES (Cont.)

1 INTRODUCTION AND SUMMARY

1.1 SCOPE AND STRUCTURE OF THIS ENVIRONMENTAL STATEMENT

The United States Air Force (USAF) is considering the development of a Continental Operations Range, designed to substantially improve the quality of training for and operational test and evaluation (OT&E) of its weapon systems. Presently, training and OT&E is performed on existing ranges with inadequate means for evaluation or on ranges designed for development testing which are already overcrowded with development tests. As a result, weapon systems, subsystems, and components do not receive appropriate operational evaluation in an environment representative of potential combat situations. Consequently, operational planning for the application of forces is based upon estimates of weapon systems capabilities, often not validated through OT&E. An improvement in quality of present OT&E is necessary to accurately predict the capability of our operational forces while improving the quality of training and state of readiness. The Continental Operations Range is to serve these vital needs to optimize preparedness, to accurately assess capabilities of operational systems and thus better assess needs for new weapon and support systems.

This Environmental Statement (ES) has been prepared pursuant to studies of a Continental Operations Range (COR) proposed for development in the Great Basin region of the United States by combining on-going range activities in the region. More specifically, the proposed COR is to be implemented by coordinating and integrating the uses of three existing test ranges--Nellis bombing and gunnery range (USAF) near Las Vegas, Nevada, Hill (USAF)/Wendover (USAF)/Dugway (Army) test range complex near Salt Lake City, Utah, and the Fallon test range (US Navy) near Reno, Nevada. The proposed implementation and use of COR will accommodate the existing levels of activity on these ranges and will involve moderate increases in use of the airspace in the COR region. No new restrictions are to be requested for lands within this region; however, the proposed COR will necessitate a restructuring of some of the airspace use in the region with one additional restricted airspace proposed for the Nellis range complex. The nature of the proposed COR activities is essentially the same as the testing and training activities presently conducted at these ranges; however, some of these test activities may be redistributed within the area.

The COR is planned to be implemented in three time phases which are designated near-term, mid-term, and far-term. This phased approach is intended to maximize the efficient use of resources in improving and expanding existing range facilities which ultimately will be integrated into a realistic operational test and training complex. Consequently, the near-term COR objectives are to emphasize an immediate improvement and subsequent practical growth in the quality of operational training and test.

While plans for near-term COR have been defined in some detail, mid- and far-term COR plans have been determined only in general terms. Since COR is to serve the needs of future as well as present and programmed weapon systems, it is difficult to establish now all detailed requirements for COR. Accordingly, this ES addresses the potential impacts that may arise from implementing the defined plans for near-term COR as well as the general plans for mid- and far-term COR to the degree that they have been formulated. It should be noted that for some of the near-term activities, detailed definitions are not complete and in these cases the analyses of some impacts are therefore general in nature. As COR planning proceeds and as appropriate detail is available, the COR ES will be updated at timely intervals.

The ES addresses the environmental influences of the past and present use of these government ranges and the projected consequences that may be incurred through the continuing use in that manner and through moderate levels of new uses. The content of the Statement is to fulfill the requirements of the National Environmental Policy Act (NEPA) as detailed in the Council on Environmental Quality guidelines (CEQ), published in the Federal

Register, August 1, 1973. Consequently, this ES addresses the potential impacts on both natural and human environments, including the lands and airspace within the proposed COR region. The development of COR as proposed is to be a United States Air Force action. However, the action is to also require decisions by other agencies including the US Army, US Navy, Atomic Energy Commission, Federal Aviation Administration and the Bureau of Land Management. The potential impacts arising from these associated actions are also addressed insofar as they affect the COR region environment.

The report is organized in general accord with the CEQ guidelines and with a view to facilitating eventual updates. Following Sec. 1, the Introduction and Summary, Sec. 2 describes in detail the previous and existing uses of the test ranges in the COR region, the implementation of the proposed COR, and the existing environment, both human and natural, in the COR region. Section 2 addresses those facets of the proposed COR activities and the environment which may have the greatest potential for impact. Section 3 discusses the relationship of the proposed action to land use plans and policies, and Sec. 4 analyzes and describes the probable impacts of the proposed COR. Section 5 addresses the consequences of alternatives to the proposed COR. Also treated in Sec. 5 are alternative implementations of COR. Sections 6 through 9 deal with unavoidable impacts and mitigative measures, short- and long-term uses of the environment, irretrievable and irreversible commitments of resources, and offsetting considerations. Ten appendices are included which provide primarily the information and analytical bases for the impact assessments. They include information on the enumeration of natural species, species dynamics, jet engine noise and sonic boom generations, airspace considerations, and economic factors.

1.2 DESCRIPTION OF THE PROPOSED ACTION AND EXISTING ENVIRONMENT

1.2.1 Existing Test Range Activities

Three existing test range complexes are involved in the development of the proposed COR--two AF range complexes associated with Nellis and Hill Air Force Bases and a Navy complex at Fallon as shown in Fig. 1.1. The Fallon ranges are used primarily for Navy aircrew training and will be only included as part of COR under mid- and far-term on a cooperative basis between the Air Force and Navy. No increase in activity at Fallon due to COR testing is anticipated; therefore, test range activities at Fallon will not be discussed here.

Existing Nellis range uses center on the activities of the Tactical Fighter Weapons Center (TFWC), which is responsible for developing optimum tactics for Air Force fighter weapon systems and training aircrews in the exercise of such tactics. Upon completion of this training, these aircrews are qualified as instructors to teach tactics to other aircrews at the various Air Force bases. These training activities comprise missions in electronic warfare (EW) against simulated surface-to-air missile and anti-aircraft artillery defense, air-to-air combat, air-to-ground combat, and low level navigation missions.

The Nellis range complex is subdivided into several areas appropriate to each kind of mission. Electronic warfare is accomplished on the Caliente Electronic Warfare (EW) range which lies approximately 100 miles north of Nellis AFB (Las Vegas). This range area is not a restricted area. The Air Force makes use of small isolated sites for locating ground based threat simulators through an arrangement with the Bureau of Land Management (BLM). No ordnance of any kind is expended there. Air-to-air combat training is conducted over the Caliente ranges or over the existing Nellis restricted ranges. All missions with discharge of ordnance are accomplished within the restricted portions of the Nellis range shown as North and South ranges in Fig. 1.1. The number of sorties* of all kinds flown on

*A sortie is defined as one aircraft flight beginning with takeoff and ending with a landing.

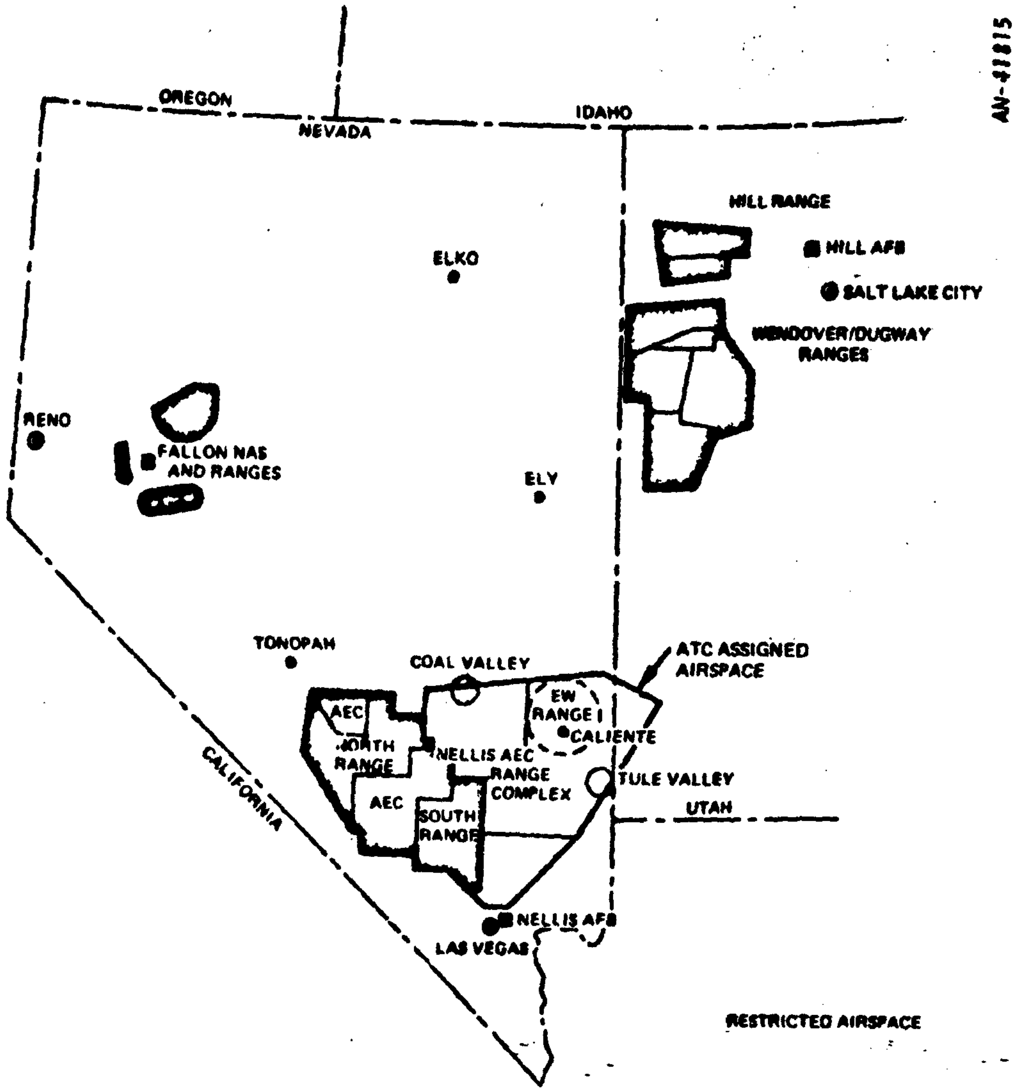


Figure 1.1. Existing Test Ranges in the COR Area

the Nellis range total approximately 33,000 yearly, which includes approximately 5,000 sorties flown by the Navy with Nellis range use. Ordnance (live, inert, and practice) delivered to the test range totals approximately 1,400 tons per year, most of which is delivered to the South range (Fig. 1.1).

The Hill/Wendover/Dugway (H/W/D) range complex (west of Salt Lake) includes the Air Force's Hill and Wendover Test ranges and the Army's Dugway Proving Grounds, which in turn includes Michael Army Air Field. These ranges are used cooperatively by the Air Force and the Army. Existing Air Force uses of the H/W/D complex comprise: air munitions testing (e.g., quality assurance tests, tests to establish munitions safety requirements, etc.), combat crew training, depot flight testing, helicopter training, air-to-air rocketry gunnery and missile firings, and some drone development test and evaluation (DT&E) activities. Live ordnance expended on the range approximates 600 tons per year.

At both Nellis and Hill range complexes, substantial portions of airspace are restricted to provide the necessary freedom for safe air activities. The airspace restrictions include allowance for supersonic activity in support of other vital Air Force training missions. All ordnance missions are tightly controlled to assure that ordnance does not impact out of the designated restricted areas or otherwise cause undue hazards. In particular, at the Nellis South Range, where the major fraction of ordnance has been expended, target sites have been constrained to emplacements on dry lake beds, and these constraints have been embodied in formal agreements with the Department of Interior (Desert Game Refuge) which shares the use of the South Range. Historically, ordnance expenditure on the Nellis ranges extends back 30 years.

1.2.2 Purpose of the Proposed COR

The proposed COR is designed to provide a realistic operational test, training, and evaluation capability that is not now available at existing ranges within the United States. Current activity is constrained and does not provide the realism necessary to assure that the current Air

Force systems are accurately assessed and are utilized with maximum efficiency. Furthermore, no existing range provides adequate land and airspace to adequately train military air warfare elements in a realistic, but simulated, combat environment and to evaluate tactics, performance, and capabilities of these elements. Without the capabilities proposed for COR, aircrews would have to develop tactics in a real combat arena, such as during the Southeast Asian conflict, should such a need arise again. Performing operational test and evaluation on a COR that is to provide near-real battlefield conditions should result in markedly improved air-crew survivability, as well as providing a more accurate basis for deciding upon acquisition of new systems.

1.2.3 Proposed COR Development

The proposed COR is to achieve its purpose and objectives by moderately expanding the capabilities at Nellis ranges and integrating operations with the H/W/D complex and Fallon Range. Substantial improvements in the quality of training and testing are to be provided through the installation of instrumentation to realistically simulated threats and targets for two-sided engagements for participating forces of strike size (flight, squadron and wing in near-, mid- and far-term respectively). Range improvements are to involve additional equipment and operating capabilities for the existing Caliente Range (see Fig. 1.1). This range is to continue to be the primary electronic warfare range until a similar capability can be built on the Nellis North Range (the portion of the restricted range nearest Tonopah, Nevada). Sites for additional threat simulator hardware at the Caliente Range are envisoned. However, threat hardware is to be transportable, such that only one site need have any significant permanent improvements. Similarly, additional sites are to be located on the North Range with one improved site required. To support air combat maneuvering activities, the proposed COR involves a restructuring of existing special use airspaces, with one additional interim restricted area. In addition, the present operations over the Caliente ranges are to be brought under more formal air traffic control procedures to enhance the safety of both participating and non-participating aircraft in the region. A similar airspace action is proposed to extend the boundaries for safe COR operations further north from the existing northern extremity of the existing Nellis airspace. The newly structured Caliente airspace is proposed to be designated COR East and the northern extensions, COR North. The proposed COR is to install additional air traffic control equipments in order to control range operations and COR aircraft. This additional capability would provide improved air traffic services in the region to non-participating users.

The proposed COR forecasts the integration of the H/W/D and Fallon ranges into a large-area facility for selected exercises of many participants. Such integration of some operations would involve increased flight activities between these ranges. It is anticipated that high-speed drone activities as well as other aircraft activity would be undertaken between H/W/D and Nellis during the mid- and far-terms.

Total air activity under COR operations is planned to increase somewhat from the present 33,000 sorties per year at Nellis to about 37,000 on Near-Term COR (Nellis ranges only), about 41,000 on Mid-Term COR (Nellis and H/W/D ranges integrated), and about 71,000 on Far-Term COR (Nellis, H/W/D, and Fallon ranges integrated). The increase in the Far-Term sorties is chiefly due to the integration of Fallon activities into the Far-Term COR with 24,466 Navy sorties, which are representative of the present utilization of Fallon by the Navy. However, the improved instrumentation planned for COR would permit scoring to provide better results. Consequently, overall ordnance expenditures under COR activities are expected to remain at about the same annual rates. The only new ordnance ranges planned for COR are a few target sites to accompany threat simulator sites on the North Range.

The range safety tasks address all aspects of COR activities that may pose risks to participating and non-participating personnel. This activity is to involve the preparation of specific COR range safety procedures and a COR range safety manual.

Approximately 700 additional personnel are planned to operate the fully developed range in the far-term. This buildup in personnel is planned to occur uniformly over the period 1975-1979. The increases are forecast for the Caliente and North ranges and for Nellis AFB, where COR Central is to be located. Modest base improvements are planned at Hill AFB and Nellis AFB for near-term. Additional improvements in mid- and far-term will be covered by separate action as they are programmed.

1.2.4 Description of the Existing Environments in the COR Region

Human Environment

The region underlying the current and proposed military use of this region is a sparsely populated expanse with arid to semi-arid climate. Water is scarce and congregations of people in small towns occur primarily where there is sufficient water to support economic activity. There are three urban areas--Las Vegas, Reno, and Salt Lake City, which are 30 to 45 miles outside the COR operating ranges. The two major air bases, Hill and Nellis, are located near the metropolitan areas of Salt Lake City and Las Vegas, respectively. Significant towns within the proposed COR region are Tonopah, Caliente, Panaca, Pioche, Ely, Austin, and Elko, all in Nevada, and Wendover and Tooele in Utah. These towns all have populations of a few thousand or less. Their support is generally derived from among the following categories: mining, agriculture, centers for cattle operations, recreation, or government activities such as the test range operations. Distances are generally quite far between towns, usually many tens of miles. The towns most likely to be affected by COR operations are Caliente, Panaca, and Pioche because the land and air around them is integrally involved in COR East operations, and Tonopah, Wendover, and Tooele because they are potential locations for basing range and support personnel and their families.

Between these towns are vast open spaces mostly federally owned and managed by the Bureau of Land Management (BLM). Much of the BLM land is leased to ranchers for cattle grazing operations. Several large ranches which utilize BLM leased land underlie COR North and COR East airspaces. Typically, these ranches rely on their privately owned aircraft to support their cattle operations. These ranch air activities involve herd monitoring, cattle buyer surveys, and rustler control, as well as a convenient means to get about. Other airspace users that may be affected by COR airspace are general aviation operations in and near the proposed COR.

There is considerable mining activity within the general COR region, but most of it is outside the COR range complexes.

Recreation is a significant activity in many parts of the COR region, especially where there is water. The Caliente region has a significant complement of developed recreational sites. Also there is a fair amount of game animals distributed throughout Nevada and hunting comprises one of the most significant recreational pursuits. Just north and east of the Caliente area lies one of the more heavily hunted areas in the State.

There are many Indian communities and reservations throughout Nevada comprising a population of approximately 7,000. Also there are more than 150 known archeological sites in southern Nevada of which more than 50 are in or near areas of COR activity.

Natural Environment

The natural environment within the COR region contains significant numbers of plant and animal species, which are adapted to the physiographic and climatic features characterizing the Great Basin. Several distinct plant and animal communities have been identified spanning the conditions from the dry lake beds and surroundings to the montane brush and forest lands of the higher peaks. Communities of concern to COR are the Southern Desert Shrub and Salt Desert Shrub communities which surround ordnance drop areas, and the Piñon-Juniper Woodlands and Mountain Brush communities where important species such as Mule Deer and Desert Bighorn Sheep are resident. Among the important species identified as concerned with COR operations are: 11 species of birds, many of which are raptors such as eagles, 8 species of small mammals, 6 species of rare fishes, and 5 species of large mammals if wild horses and burros are included. In addition, two plant species are considered important, Pygmy Sagebrush and Bristlecone Pine.

Species which have been judged important in this document include those that require special attention by scientists and Federal agencies because they are either endangered, threatened, or of economic or recreational value. The reasons for each species inclusion in this designation are duly noted in the body of the report. Only three of the important species appear on the official Department of Interior's endangered species list (16 USC 668aa).

1.3 RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS AND POLICIES

The land use plans and policies of concern to COR are those of the Bureau of Land Management (BLM), Federal Aviation Administration (FAA) and regional airports, US Fish and Wildlife Service, the Nevada State departments dealing with recreation and air and water quality control and the local and regional plans for the city of Las Vegas, the counties Nye, Lincoln, and Clark, and the communities of Tonopah, Caliente, Panaca, and Pioche, and of course, the Air Force.

The BLM which has charge over all requests for land withdrawals of public domain lands pursues policies designed for multiple uses of these lands. Thus withdrawals for single purposes are scrutinized carefully. Any withdrawals proposed for COR of a semi-permanent nature would undergo such consideration. COR may have needs for additonal very small withdrawals for sites on the Caliente EW range, similar to those currently in use through agreement with the BLM, and possibly some microwave repeater sites for communication systems. Several such sites may be necessary when the H/W/D and Fallon ranges are integrated.

The FAA has established policies and procedures governing the designation of airspace for special uses such as those restricted for Department of Defense entities. Generally, the purpose of such policies is to assure the safety of operation of all aircraft users. For the COR, it is proposed to restructure and redesignate airspace to promote the safety of operation of both participating and non-participating aircraft.

The McCarran International Airport has developed a master plan to guide the development of its facilities into the future and forecasts of aircraft activity are indispensable to such planning. Presently, McCarran activity is at about the same level as it was in 1969, approximately 250,000 movements a year. This activity is expected to double by 1985. Significant growth is also expected at the nearby general aviation airport at North Las Vegas. Nellis AFB is within 10 miles of both of these and the Nellis activity is expected to continue at nearly the present levels in the near-term and gradually increase by 40% in the far-term. Continued use of letters of agreement between these three entities are planned to avoid potential air traffic conflicts.

The US Fish and Wildlife Service has charge over the Desert Game Refuge, half of which is within the boundaries of the Nellis bombing and gunnery range. Part of the Desert Game Refuge has been proposed for a Wilderness designation pursuant to the National Wilderness Act. An ES is in-process on this proposed action and Air Force use of the Refuge is addressed there.

State of Nevada recreation plans call for an expansion in developed recreational sites. The Caliente area is designated as one of the prime areas for expanding recreational facilities. COR activities are planned to continue in this region.

The Nevada Air Quality Implementation Plan forecasts pollutant emissions and establishes objectives for planned reductions in emissions in order to meet federally mandated air quality requirements. The Las Vegas area is expected to grow significantly. Its present air quality hovers around the standards; thus, source reductions in emissions are planned. The plan, without any regard to COR activity, anticipates that Nellis AFB contributions will be in decline. However, contributions from Nellis, both direct and indirect, are negligible when compared to the added potential for emissions from anticipated overall growth.

Local and regional plans of the communities of concern show a variation in their expectations regarding growth. Las Vegas metropolitan area is expected to continue its rapid growth well into the future. In anticipation of such growth significant additions to the system of public facilities are planned and COR-induced growth should easily be accommodated within these plans. The communities of Tonopah and Caliente-Panaca-Pioche anticipate slow to moderate growth. There is some residual capacity in existing facilities but COR-induced growth in those regions is expected to influence planned growth such as school capacities.

1.4 PROBABLE IMPACTS OF THE PROPOSED ACTION

1.4.1 Impacts of COR Airspace Uses

In general, the proposals for COR airspace use will have both beneficial and adverse impacts. Enhanced air traffic control and the restructuring of the airspace should enhance the safety of all users. Also, as COR implements its plans for better low-level communications and control facilities, civilian search and rescue operations should benefit. The COR airspace designations and restructuring may lead to occasional rerouting of some of the general aviation traffic not using the Victor airways. This may cause inconveniences, possible increases in fuel and time for some flights, and possible reduction in business for fixed based operators. In addition, rancher air operations in support of their activities would be affected by the proposed new airspace rules until such a time that the Air Force, through individual agreements, can accommodate each rancher's requirements for airspace use. The COR North and East airspace is to be implemented with unrestricted airspace paths at low altitudes, free from COR flight operations, to accommodate visual flight rule (VFR) operations in transit. These flyways can be made capable of accommodating all required daytime VFR flights.

1.4.2 Impacts from COR Electromagnetic Emanations

Normal operations of threat simulator hardware constrained by duly prescribed range operating procedures and safety precautions should pose no undue hazards to participating or non-participating personnel or equipment. However, threat simulator hardware in the Caliente region is manually operated and from time to time is to continue to be deployed as close as 1-1/2 to 2 miles to the communities of Pioche and Panaca as has been done in the past. As with all tunable electromagnetic emitters, there exists a remote possibility of errors in operations procedures whereby some nonparticipants (as well as participants) could be inadvertently illuminated by main beam radiations. However, at distances of 1-1/2 and 2 miles, the power densities from the threat simulators are significantly below the safe level of exposure (10 nW/cm^2). Considering the ground radiators frequency of operation and peak power level, no significant implanted pacemaker interference is expected, even at a distance of 1000 feet.

COR operations of both ground-based and airborne emitters must continue to be carefully controlled to minimize interference with other participating and non-participating equipments. Errors in operations in violation of prescribed standards for ground-based emitters could potentially produce interferences (mostly of an annoying nature) in receiving equipments up to 50 miles distance. The range of potentially interferring effects from airborne emitters could be as great as 400 miles. The airborne emitters typically operate over much wider frequency bands and consequently are to be subjected to careful scrutiny and control by the COR frequency management authority. COR uses of electronic warfare (EW) equipments will be substantially the same as past and previous uses of EW equipments on Nellis ranges and on several test ranges throughout the US. Thus there is a history of operations and procedures designed to avoid and/or minimize the interferring effects.

1.4.3 Impacts from COR Generated Noise and Sonic Booms

Human Environment. The moderate expansion of COR activities under far-term development at Nellis AFB can be expected to result in some increase in the number of noise complaints received from Las Vegas residents. Circumstances for these situations are expected to arise primarily during periods of adverse wind conditions when Nellis aircraft must reverse their normal takeoff pattern and take off toward Las Vegas. COR-generated noise in the Caliente region will be about the same as in the past. The present accommodation to Nellis activities in the Caliente region indicates that COR activities should receive few if any complaints there. Total supersonic activity will increase slightly as total activity increases. However, in regions where significant supersonic activity is already undertaken, the changes will be slight. There will likely be changes in supersonic activities in the new airspace regions of COR North. Wherever supersonic activity is planned in an area with little history of such activity, procedures will be established to avoid populated areas and known structures. As in the past, low-level subsonic flights may pass over random activities on the ground such as archeological excavations. Although such circumstances are rare, those noise disturbances could have an adverse impact.

Natural Environment. The effects of sonic booms and jet noise on wild animals is virtually unstudied. Consequently, it is difficult to state what, if any, will be the impacts due to COR activities, except that it is not expected to be significantly different from the influences of current activities. Some behavioral responses among nesting waterfowl with known adverse effects have been identified with current operations. In this regard, there is some concern that these effects acting through the reproduction mechanism could produce more significant impacts. Assessments in a total ecosystem context in conjunction with COR usage with particular attention to sensitive links in the ecosystem such as species reproduction could provide conclusive evidence in this regard.

Among the more important species designated in this document, several (primarily Bighorn Sheep and wild horses) have been subjected to the effects of previous and current activities, and based on present evaluations have not suffered adversely. Very little is known regarding the effects of previous and current activities on most of the remaining prime species. However, the Nellis activity has been continuing for a sufficiently long period that in most cases it is expected that accommodations within the natural environment have been achieved and that the present state of the environment reflects that accommodation.

1.4.4 Economic Impacts of COR

COR personnel if stationed at the remote range areas near Tonopah and Caliente would add significantly to the total economies of those areas. Direct plus induced employment due to far-term COR could be expected to increase populations by about 1200 in the Caliente area and 1500 in Tonopah, increases which are significant fractions of the existing levels. It is believed that these two particular communities would welcome the increased employments and concomitant economic growth. However, these increases in population would cause enrollments to exceed existing school capacities during the far-term period by up to 15%. The expected increases in school enrollments will also cause the school budget to increase by 25% above existing levels. However, it is expected that some increases in school tax rates will be necessary though difficult to predict at this time. There are existing sewage treatment problems in both the Tonopah and Caliente areas to which COR induced growth will add. Direct and induced impacts on the Las Vegas economy are estimated to be negligible.

1.4.5 Other COR Impacts

Studies of other potential impacts such as on Utah cities and towns have shown small or regligible impacts.

1.4.6 Unavoidable Adverse Impacts and Mitigative Measures

Unavoidable adverse impact on existing airspace users could result from COR airspace. That the VFR flyways will suffice to provide the same convenience that now exists along the same alignments has not yet been demonstrated, nor can it be taken for granted that COR clearances will always be sought or granted for those users who desire to traverse the COR airspace. Consequently, adverse impacts could result through loss of convenience. However, adjustments in the description of the flyways may do much to mitigate such impacts.

COR ordnance expenditures at new target sites would incur adverse impacts. The only target sites that possibly fall into this category are those accompanying the new threat simulator sites on the North Range. Ordnance expenditures on the South Range will add to the accumulations of the past 30 years but should produce no additional impact on the environment. It is feasible to consider improved methods of range policing to retrieve more spent ordnance and parts, but the degree of mitigation is difficult to establish.

Potential impacts on wearers of heart pacemakers who come in close proximity to radars may be mitigated in the future due to recent efforts initiated by the Food and Drug Administration to define and establish standards for pacemaker sensitivities to electromagnetic radiations. Due to procedural matters and replacement lifetimes for pacemakers, this effort could prove sufficient in 4 to 6 years.

Concer .. expressed for the potential for unavoidable adverse impacts on important species, especially if operations should affect sensitiv links in ecosystems where the ultimate impact could take several more years to develop. Such impacts if they occur, would be essentially unavoidable as, in general, environmental data are insufficient to detect or deduce such effects.

At the planned staffing levels of far-term COR, it appears unavoidable that the existing local school facilities in Tonopah and Caliente area would become overtaxed unless increased capabilities are properly planned and phased.

1.4.7 Short Versus Long Term Uses of the Environment

Most of the land to support COR test range activities is used now for such operations and is needed to assure the safety and security of particular operations. Consequently, the only portions of the environment that are directly used are the land areas where improvements are placed and roads cut and where ordnance expenditures occur. Because desert environments have such slow turnover rates, disruptions of these environments persist for decades and consequently may constitute a long-term appropriation of those portions of the environment depending on the alternative uses that are contemplated for it. Expended live ordnance which are misfires or duds and are not retrieved would continue to render these restricted areas unsafe for most uses until policed (although policing does not guarantee an area is safe). The South Range target areas have already been subjected to extensive ordnance activities and any further effects on these environments will probably be insignificant. New target sites in the North Range will involve these considerations and thus may constitute a long-term use of the environment. Construction or use on remote desert lands could also have persistent effects. However, except for roads and some other excavations, items such as concrete slabs and structures can be removed.

The above considerations also serve to summarize the assessment of the extent to which COR operations constitute an irreversible and irretrievable commitment of resources. Only the new target sites on the North Range fall into this category.

1.5 ALTERNATIVES TO THE PROPOSED ACTION

COR is conceived as an instrument for testing and training air forces in a way which has never been done before: with a realism approaching actual warfare. It will have the capability to provide vitally needed information, which is not now available, and improve new combat effectiveness as much as possible, short of the real experience. Alternatives to this proposed action need to be considered in the context of the needs for such a range. These needs grew out of the deficiencies of our existing ranges to provide for more comprehensive and realistic training of our forces in a simulated threat environment. Familiarization with new weapons systems and their employment is not enough. Realistic training sorties must become a way of life during peace and war. Complementary to this need for realistic training is the need for a range for performing adequate test and evaluation of the weapons systems provided to our air crews. Weapons systems have become increasingly more sophisticated. Without the airspace and ranges for integrating air crews and weapons systems in a simulated combat environment, the real capability of our air crews and weapons effectiveness cannot be determined. As a result, operational testing to evaluate new weapons systems to support procurement decisions is inadequate. The deficiencies of our existing ranges to support realistic training and testing stem from:

1. A lack of an integrated air defense environment that is representative of a network of foreign ground and airborne air defense systems, which includes the air defense detection, identification, tracking, interception, and weapon guidance functions;

2. A lack of airspace and freedom that permits unconstrained employment of penetrator tactics, including electronic warfare to counter the enemy's command, control, and weapon guidance systems.

1.5.1 One Alternative: Improve an Existing Range

To correct these deficiencies, a first consideration is the improvement of an existing range. The following ranges/test centers have been considered and have been found unacceptable as an alternative to COR:

Air Force Eastern Test Range (AFETR)

Space and Missile Test Center/Western Test Range (SAMTEC/WTR)

Armament Development Test Center (ADTC)

Air Force Flight Test Center (AFFTC)

Aerospace Defense Weapons Center (ADWC)

Nevada Tactical Fighter Weapons Center (TFWC)

Hill/Wendover/Dugway Range Complex (H/W/D)

Examples of the new systems for which operational tests now are, or will be, constrained to a significant degree by various range limitations are--

1. Air-to-air and standoff weapons/targets
   - Drone/Remotely Piloted Vehicles
   - AIM-9/AIM-7 Air-to-Air Missiles
   - Modular Guided Glide Bombs
   - Air-Launched Cruise Missiles
2. Aircraft
   - F-15
   - B-1
3. AWACS (Airborne Warning and Control System)

The new weapons systems entering the inventory require larger, not smaller, range air space and associated ground space to accommodate tests of their supersonic capabilities, their electronic warfare capabilities, and to conduct tests involving multiple aircraft, particularly when some may be engaged in free play. Other factors inhibiting training and testing on some existing ranges are poor weather conditions, electromagnetic interference problems relative to public and commercial uses, size of safety footprint areas for missile delivery, and airspace for supersonic testing.

At a time when expansion would be desired, the Air Force finds it difficult to retain existing ranges, and even more difficult to expand range lands for future requirements. The larger problem, then, is created by increased system capability in the face of shrinking ranges. All ranges are feeling the effects of population growth. Another current range constraint is that the FAA has initiated a project to withdraw all restricted air space at and above FL180.

The problem of adequately satisfying the test needs of newer programs cannot be solved by improvement of an existing range. Accommodation of these needs can only be handled with the development of the Continental Operations Range.

1.5.2 Alternatives to Test Ranges

In view of the pressure arising as a natural consequence of population growth, which seem to be relegating the CONUS ranges to sparsely populated land areas of the continental United States, a second alternative might be the development of feasible testing methods which do not depend upon large water and land areas used as ranges.

Alternatives which might reduce the dependence on existing ground ranges are extremely limited at this time. Those available today, those under development, and those under consideration fall into two categories: (1) range equipment alternatives; (2) simulator alternatives. Range equipment alternatives, such as frangible bullets and simulated bomb scoring systems, can free land space below the used air space for grazing, for example. The simulator alternative would be based upon an analytical model.

There are no current alternatives that can fulfill the requirement to simulate (to the maximum extent possible short of wartime risk of life) the current situation. The conclusions are inescapable. Valid data leading to information required by the operations on a COR-type facility cannot be obtained in any other fashion.

1.5.3 Build a Range Encompassing Existing Ranges

This alternative requires that existing non-research and development ranges be improved and integrated to accomplish the desired tests and training objectives. It is the alternative that offers maximum capability with minimum investment and risk. It reduces total investment by making use of a great deal of expensive equipment and facilities currently used for both training and operational testing. Near optimum capability can be achieved at reasonable investment and very low technical risk. Further, the existing missions of the range (training and testing) are enhanced by the creation of a COR-like facility.

In the location, design, and operation of a COR-like facility, prime consideration is given to civil air traffic distribution, population density, climate, topography, existing facilities, existing special-use air space, Government-owned land, and radio frequency interference effects. It was using precisely these criteria that led to the selection of the site now proposed for COR. The Nevada/Utah site is well located with regard to these constraints.

Complete topography requirements cannot be met at any site in the entire CONUS. However, by fragmenting the mission, and using several ranges, it should be possible to train and evaluate the operational air command units with a reasonable degree of confidence. It thus appears that Utah/Nevada area is the best available location.

1.5.4 Alternative Implementations of the Proposed COR

A study was made of possible alternative locations for the electronic warfare (EW) ranges which are to be developed under COR. Expansion of an existing EW range at Caliente was selected as one alternative site. Existing land within the restricted land area of the Nellis North range was selected as a second alternative. Two new areas, at Coal Valley and Tule Valley, were also considered (see Fig. 1.1). Ecological, airspace, and staffing accommodation assessments were made of each alternative. The North range location appears to have the least problems associated with its development. Although both the Tule Valley and Coal Valley locations would entail less potentially adverse ecological impacts than would the Caliente location, substantial alteration of the surrounding airspace structure would be involved in their uses if COR objectives are not to be compromised. Furthermore, the potential impacts involved in COR staffing for these two new locations would be greater than for Caliente.

1.6 OFFSETTING FACTORS AND THE CONSIDERATIONS OF OTHER AGENCIES

The most significant offsetting factor that would result as an effect of COR development is the increased safety of operation that will be made available to all pilots wishing to use COR airspace. In addition, greater protection is offered to the general population. This will be especially true when COR development is completed with respect to the air traffic control instrumentation COR is to install to meet its own needs. The continuing land restrictions of the Nellis range will continue to aid the management of Bighorn Sheep and Wild Horses.

Interests of other agencies in the proposed COR development extend primarily to procedures for airspace rule making and land withdrawals by the Federal Aviation Administration and the Bureau of Land Management, respectively. Each agency will be required to make decisions relative to the COR development.

NOTE: In the detailed discussions which follow in Secs. 2 through the set of appendices, two forms of referencing study material are used. One form uses superscript reference numbers and are sequential through the text. The other form utilizes a reference to the author and year enclosed in brackets. The list for this form of references is alphabetical.

2 DESCRIPTION OF THE PROPOSED ACTION AND RELATED ENVIRONMENT

2.1 BRIEF DESCRIPTION OF THE PROPOSED CONTINENTAL OPERATIONS RANGE (COR)

2.1.1 The COR Concept

The capability of the United States Air Force to meet its world-wide missions must often depend on estimates of weapon systems or force capabilities that have never been operationally validated. In such cases, a call for a rapid deployment of the force or weapon system to a war zone results in unacceptable and unneeded air crew losses. Figure 2.1 depicts Air Force experience of air combat losses during a year in Southeast Asia and substantiates the Air Force conclusion that chances of survivability increase markedly as the aircrews gain experience. The figure also shows that fairly significant decreases in number of losses can be expected after 25 to 30 combat missions.

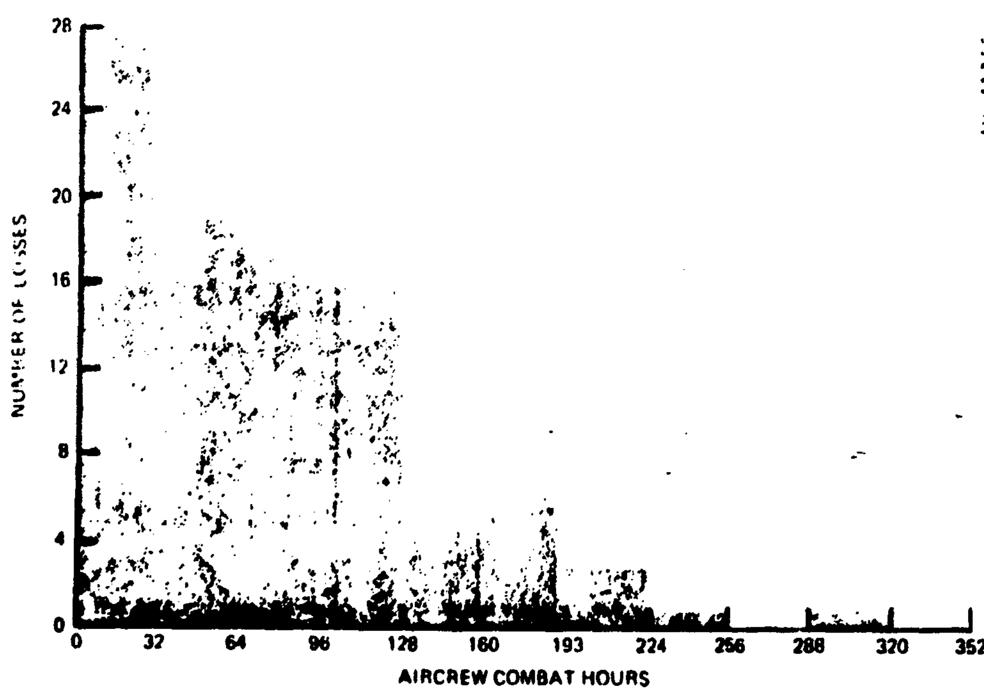


Figure 2.1. 1965 USAF Combat Losses Versus Aircrew Combat Experience

Presently, the US Air Force conducts many aircraft and aircraft system tests at test ranges throughout the United States. Types of tests include Development Test and Evaluation (DT&E), Operational Test and Evaluation (OT&E) and Initial Operational Test and Evaluation (IOT&E), tactics development, training tests, threat validation tests, and full-scale exercises.* In virtually all cases there is considerable lack of realism in simulating hostile combat environments. OT&E and Tactics Development are activities that particularly demand realistic simulation of threat environments, and air crew training should benefit commensurately if more realism is present in the training environment. Testing, to be realistic, should allow for aircraft or systems of aircraft to engage simulated threats in relatively unconstrained, two-sided engagements. Furthermore, to be meaningful such testing must have a high level of instrumentation to measure the outcome and details of the particular tests without allowing the instrumentation setup to interfere with the test.

At present, limited OT&E tests are conducted on ranges set up primarily to perform DT&E. While such test facilities provide excellent instrumentation to relatively uncomplicated tests, physical or environmental

* Development Test and Evaluation (DT&E) is conducted to demonstrate substantial compliance of prototype or developmental systems with engineering design specifications, to establish the feasibility of production with respect to time and costs, and to establish technical and procedural limitations. Operational Test and Evaluation (OT&E) is designed to demonstrate the system's full military utility and operational effectiveness and establishes the system's suitability with respect to reliability, maintainability, logistic and training requirements. OT&E is also used to establish required modifications, and optimum organization, doctrine and tactics for the system's employment. Initial Operational Test and Evaluation (IOT&E), often done in conjunction with DT&E is intended to demonstrate sufficient military utility and operational effectiveness prior to a production decision. Tactics development represents more extensive testing to develop optimum tactics through the integration and employment of multiple systems against simulated or real enemy threats. A substantial amount of additional tests are made up of training, threat validations, and integrated force testing. Also, full scale exercises are run wherein operational units are employed in a realistic combat environment for the purposes of training and evaluating their performance capabilities and effectiveness.

limitations often tend to preclude testing and evaluation of multiple events in two-sided engagements such as air-to-air combat. This deficiency is primarily due to one or more of the following factors: lack of realistic threat resulting from equipment deficiencies; lack of range operating area; lack of suitable range instrumentation; electromagnetic emission limitations; physical encroachment on ground, water, or airspace; limited size of test force that range will accommodate; saturation of existing capability; and lack of adverse weather instrumentation systems.

Recognition of this deficiency has led, through a sequence of planning activities initiated in early 1966, to the concept of a Continental Operations Range (COR) that will provide a realistic operational test, training, and evaluation capability. The primary program objectives for the COR as defined by the Air Force are:

1. Provide a range facility which would permit OT&E of equipment of strike-sized forces (one to 100 aircraft) in a realistic combat environment.

2. Provide large land and airspace areas where exercises could be conducted with a minimum of constraints to train military air warfare elements in a realistic but simulated combat environment, and to evaluate tactics, performance and capabilities of those elements.

3. Provide an operational environment for selected DT&E which cannot be accomplished at other existing ranges.

The concept of COR has evolved to meet requirements for improved OT&E with the dual goal of increasing operational effectiveness and air crew survivability on the one hand and of providing adequate information for making production and acquisition decisions concerning new weapon systems on the other.

The development and acquisition of the COR is conceived as a long-term phased program, both because investment and operating costs are high and because limited experience in the creation of such a range is available. Thus, the COR is to be a three-phased development and acquisition program. The three phases are:

1. Near-term Phase:
   Initial Operating Capability: 1975
   Full Operating Capability: 1977
2. Mid-term Phase: Full Operating Capability: 1979
3. Far-term Phase: Full Operating Capability: 1983

The near-term capability is to be obtained by supplementing and integrating existing resources, including equipment and software, as much as possible.

2.1.2 COR Requirements

The COR site is to provide sufficient ground, airspace, and electromagnetic compatibility to accomplish a variety of air-to-ground and air-to-air operations that may include live or simulated ordnance delivery, electronic countermeasures (ECM), and electronic counter-countermeasures (ECCM). To accommodate these types of operations with a minimum of interference to civilian activities and environmental problems, a large remote and relatively sequestered area within the Continental United States is desirable, preferably one which includes established facilities in which some electronic warfare testing and live ordnance firings are going on at the present time.

In supporting operations in the broad mission areas of the various Air Force combat and support commands, the COR facility must also provide the capability to perform operational tests, training, and evaluations in the context of the Air Force prime missions: close air support, interdiction, air superiority, and airlift. These missions involve air combat maneuvering, drones and remotely piloted vehicles, electronic jamming, combat search and rescue, electronic countermeasures, navigation, reconnaissance, command and control, airlift, and air-to-air or air-to-ground operations including simulated or live ordnance firings.

In the conduct of these operations the participating forces will be subdivided into three groups: blue for friendly forces, red for enemy forces, and white for umpire and evaluation forces. The roles of each of these forces is to be controlled so that combat realism is maintained insofar as information available to any force is concerned. Each of the red and blue forces is to simulate its real-life counterpart to the greatest degree possible, considering operational status of the hardware utilized, tactics employed, and the doctrines observed.

In providing a test range capable of accommodating the desired missions, certain requirements on the availability of land and airspace are desired. A careful study was made of these requirements and the capability to meet them either through establishment of new test areas or improvement and expansion of existing test ranges. It was concluded that improvement and expansion of the Nellis Test Range in southern Nevada, along with eventual integrated and cooperative operations of the Air Force and Army at Hill Air Force Range, Dugway Proving Grounds, and Wendover Air Force Range (all in northwestern Utah), and the Navy at Fallon, Nevada would provide the most feasible opportunity to meet the COR requirements. Figure 1.1 depicts this general region for the proposed COR.

2.1.3 <u>Proposed COR Development</u>

The time-phased approach to COR provides for planning and acquiring improved OT&E and training capability within certain budget constraints by making use of existing resources to the extent possible. The near-term phase will concentrate on improvements to and integration of the existing ranges and range facilities in the Nellis area. Primary emphasis will be placed on instrumentation for the Caliente and North Range with secondary emphasis on South Range. The near-term development establishes the COR command and control center (COR Central) at Nellis AFB. In late 1975, an initial capability to perform integrated tests would be limited to Nellis

AFB ranges and would include the capability for integrated flight-sized operations in air-to-air maneuvering, electronic warfare, and air-to-ground operations. By 1977, the near-term capability would be completed with an Air-Combat Maneuvering (ACM) range capability on the Nellis Ranges with real-time displays at COR Central.

The mid- and far-term phases of COR will be based on total Air Force requirements for COR capabilities. The potential range capability requirements are to be determined by survey of the prospective COR users. Thus, the plans for the mid- and far-term COR are quite general. Improvement of the capability to perform integrated defense suppression and air-to-ground OT&E at Nellis South Range and improvement of drone/RPV test and evaluation facilities at the Hill/Wendover/Dugway complexes is envisioned for the mid-term COR. Also during mid-term, a high-speed remotely piloted vehicle (RPV) track linking Nellis and H/W/D is to be developed. To better serve joint services testing, it is expected that the Navy's Fallon Test range activities will be integrated with the far-term COR operations.

2.2 PREVIOUS AND EXISTING TEST RANGE USES IN THE COR AREA

The COR region is nominally bounded by the region encompassing Fallon, Hill, and Nellis air bases. Although COR may make use of much of the airspace overlying this region from time-to-time, most COR activity will take place within the bounds of the existing test ranges. The extent and nature of previous and existing test activity at these three range complexes is described in this section to provide a basis for understanding the changes in range facilities and activities proposed under COR.

2.2.1 Nellis Air Force Base and Test Range

2.2.1.1 History and Previous Uses

On January 25, 1941, Las Vegas Mayor John L. Russel signed over property eight miles north of Las Vegas to the US Army Quartermaster Corps for the development of a flexible gunnery school for the Army Air Corps.

Mission of the new school was defined as "the training of aerial gunners to a degree of proficiency that will qualify them for combat duty."

Originally known as the Las Vegas Army Air Corps Gunnery School, the base later acquired the name of the Las Vegas Army Air Field. Reasons for locating the school near the town of Las Vegas (population then 8,422) were as follows: flying weather was practically ideal the year around; over 90 percent of the area to the north was public domain wasteland and available at $1 per acre; strategic location was excellent, being well inland; rocky hills approximately twenty miles from the base afforded natural backdrop for cannon and machine gun firing; dry lake beds were available for emergency landing.

From this humble beginning, Las Vegas Army Air Field grew rapidly until, in 1942, the first B-17s arrived giving gunnery students their first chance to train in the gun turret of an actual combat plane and providing aircraft to train co-pilots in ground and transition school. During the height of World War II, there were 600 gunnery students and 215 co-pilots graduated from LVAAF every five weeks.

In March 1945, the base converted from B-17s to the B-29 Gunnery School. An inactivation order closed the base on July 31, 1945, but a new order put the field on standby status until January 31, 1947, when it was inactivated.

The base was reactivated in 1949 as the Las Vegas Air Force Base and became a pilot training wing. With the advent of the Korean War, the mission of Nellis changed from an advanced single-engine school to the training of jet fighter pilots for the Far East Air Force.

The base is named in honor of First Lieutenant William Harrell Nellis, who was killed in action over Luxembourg on December 27, 1944. A fighter pilot with 60 missions to his credit, he was 28 years old when he died.

Nellis Area II (Lake Mead Base). Nellis Air Force Base Area II is an integral part of Nellis AFB, located at the northeast edge of the main base. In September, 1969, the area became part of the Nellis complex. Before then it had served as a weapons storage area for the United States Navy and was known as Lake Mead Base.

There are now three units located in this area: the 57th Munitions Maintenance Squadron, which provides for safe and reliable munitions handling in support of the tactical mission; 3096th Aviation Depot Squadron (AFLC), and the 820th Civil Engineering Squadron (known as "Red Horse"). The 820th is a highly mobile, self-sufficient civil engineering heavy repair unit, capable of worldwide deployment in a short period of time. The squadron provides its own medical and food services, vehicles, maintenance equipment, and can support itself for extended periods of time in the field. Although "Red Horse" units are basically combat-oriented, they are also called upon to handle construction and repair to existing Air Force facilities within the United States.

A unit of the Air Force Logistics Command, the 3096th Avionics Depot Squadron, has the responsibility of maintaining organizational and depot-level weapons maintenance capability. They also provide in transit and permanent storage of weapons, traveling teams to support worldwide requirements, and make technical assistance visits.

Indian Springs Air Force Auxiliary Field. Indian Springs Air Force Auxiliary Field is situated at the southern edge of the Nellis Bombing and Gunnery Range, 45 miles northwest of Nellis on Highway 95.

Indian Springs airfield was founded in the early 1940s as a support facility for the Army Air Corps Gunnery School located at Las Vegas. Thirty years later Indian Springs is still supporting Nellis' mission, but on a larger scale. The men of the 57th Combat Support Squadron maintain more than three million acres of bombing and gunnery ranges.

Specifically, the 57th Combat Support Squadron is charged with maintaining and supporting the range, providing air operational support for various types of aircraft staging from the field, and providing support for personnel from other Department of Defense agencies as required.

Nevada Test Site (AEC). The Nevada Test Site is an Atomic Energy Commission installation that is part of the Nellis/AEC range complex. The selection of this test range followed on a decision in December 1950 to establish a continental testing area for nuclear weapons. At that time, a number of sites throughout the United States and Alaska were considered on the basis of low population density, favorable year-around weather conditions, security, available labor sources, reasonable accessibility and favorable geology. Of all the factors, public safety was considered most important. With due consideration given the known information about fallout, thermal and blast effects from nuclear detonations, an area within what is presently known as the Nellis Air Force Range was selected to be used for relatively low-yield nuclear detonations. Subsequently, the area known as the Nevada Test Site was enlarged to its present area of 1,350 square miles. This Atomic Energy Commission installation is located in Nye County with support and administrative headquarters at Mercury, Nevada, approximately 65 miles northwest of Las Vegas. It is operated by the AEC's Nevada Operations Office at Las Vegas which is charged with the management of all the nation's continental nuclear test programs.

The test site covers approximately 1,350 square miles of land area. It includes the Yucca and Frenchman dry lake basins, Pahute and Ranier Mesas, and the former Camp Desert Rock area which was used by the Sixth Army in the 1950s to house troops participating in atmospheric tests at the test site.

Yucca Flat, a valley roughly 10 miles wide by 20 miles long, and Pahute Mesa, a rugged 7500-foot-high area of 166 square miles at the northwest corner of the site, are the main underground test areas.

Frenchman Flat is the first dry lake basin north of the hills beyond Mercury. It was used for all shots in the first Nevada test series in 1951, but since then has been used primarily for Department of Defense military effects tests.

2.2.1.2 Existing Nellis AFB and Range Activities

The mission of Nellis AFB is twofold. It is the home of the 474th Tactical Fighter Wing (TFW), a combat-ready unit which flies the F-111. It is also the home of the Tactical Fighter Weapons Center (TFWC) of the Tactical Air Command. During the Korean conflict, Nellis AFB served as a center for training fighter pilots--virtually a pilot pipeline to Korea.

Tactical Fighter Weapons Center. The mission of TFWC is to perform operational tests and evaluations of tactical fighter weapons systems (the aircraft and its weapons and related systems). Based on these continuing evaluations, the TFWC is the Air Force's highest authority on how fighter aircraft should be employed in any combat environment. In short it writes and continually updates "the book" on all jet fighter aircraft in the Air Force inventory. The TFWC was characterized by former Secretary of the Air Force Harold Brown as follows: "The Center at Nellis is the Air Force's top authoritative agency on the use of tactical fighter forces worldwide." It also is responsible for training fighter pilots as experts in their particular weapons system. This is not a pilot training activity as it is commonly understood. Only a handful of pilots from each tactical fighter unit in the Air Force go through this course at Nellis to prepare them as instructors in a given fighter weapons system. The TFWC is also responsible for assisting in the definition of future tactical fighter weapon systems requirements.

Nellis was selected for this mission because it is unique among all Air Force bases in the world in having superb flying weather and a test range that is larger than the state of Connecticut.

Even with significant changes in Air Force tactical fighter forces, the TFWC mission will likely remain as essential as it is today. The development of fighter doctrine and employment techniques is a continuing requirement which is relatively insensitive to possible cutbacks in the size of the tactical fighter force for which these methods are being developed. For example, the development of an improved bombing technique for the F-4 aircraft will be pursued whether there are many or few wings of these aircraft.

The 57th Fighter Weapons Wing is the action unit for the Tactical Fighter Weapons Center at Nellis. To accomplish this mission, the 57th Wing flies all of the Air Force's current front-line fighter aircraft: F-105, F-4, F-111 and A-7, as well as the T-38 Talon.

The USAF Fighter Weapons School is an integral function of the wing. As the official Air Force Fighter Weapons School, it offers specialized courses in the field of fighter aircraft tactics and weapons delivery. The school mission is to train fighter weapons instructors in both the F-4 and the A-7 aircraft. The other specialized courses have earned the Fighter Weapons School the reputation of being the graduate school in fighter pilot education.

Diversified training at the school includes teaching radar homing and warning, Wild Weasel training in the F-4 and F-105, and techniques in the delivery of both optical- and laser-guided bombs.

The 57th has five flying units: the 64th, 65th, 66th, 414th, and 422nd Fighter Weapons Squadrons. The 65th, 66th and 414th squadrons perform training roles for the school's mission. The 422nd Fighter Weapons Squadron flies operational tests and evaluations of tactical fighter weapons systems, munitions, and support equipment. The 64th FWS, an "aggressor" squadron, is employed in training fighter pilots throughout the Tactical Air Command in counter-air tactics.

The only non-flying courses taught by the weapons school are the Electronic Warfare Penetration Aids Instructor Course and the Tactical Fighter Doctrine and Tactics Course.

The 57th Tactical Electronic Warfare Training Squadron provides air-crew training support and test support of directed projects in the areas of range instrumentation, engineering, mathematical sciences, radar space positioning and photographic documentation. This unique squadron is the only non-flying squadron in the wing.

474th Tactical Fighter Wing. The 474th TFW moved from Cannon AFB to Nellis in January 1968. It is the first fully equipped F-111 wing in the Air Force. Its mission is to be combat ready and capable of deployment anywhere in the world to destroy enemy forces and facilities.

The Nellis test range complements the Nellis AFB in achieving the missions assigned the Tactical Fighter Weapons Center and the 474th Tactical Fighter Wing. The Nellis range, together with the AEC's Nevad Test site comprises 2.97 million acres within the bounds of areas designated by R-4806, R-4807, R-4808, and R-4809 in Fig. 2.2. Areas R-4806 and R-4807 are the Air Force portions of this site and are specialized and equipped to conduct normal air-to-ground and air-to-air training, electronic warfare training, and operational test and evaluation. The aircraft involved in these activities may be flown at either subsonic or supersonic speeds.

Additional Nellis activity takes place over non-restricted areas to the north and east of Nellis AFB in the special use airspaces designated as Caliente 1, 2, and 3 (Fig. 2.2) and generally referred to as the Caliente range. Because this land area is not restricted, the Caliente range is used only for electronic warfare activities and no live ordnance is expended there.

The complement of aircraft presently stationed at Nellis AFB under the command of the Tactical Fighter Weapons Center (TFWC) and the 474th Tactical Fighter Wing are:

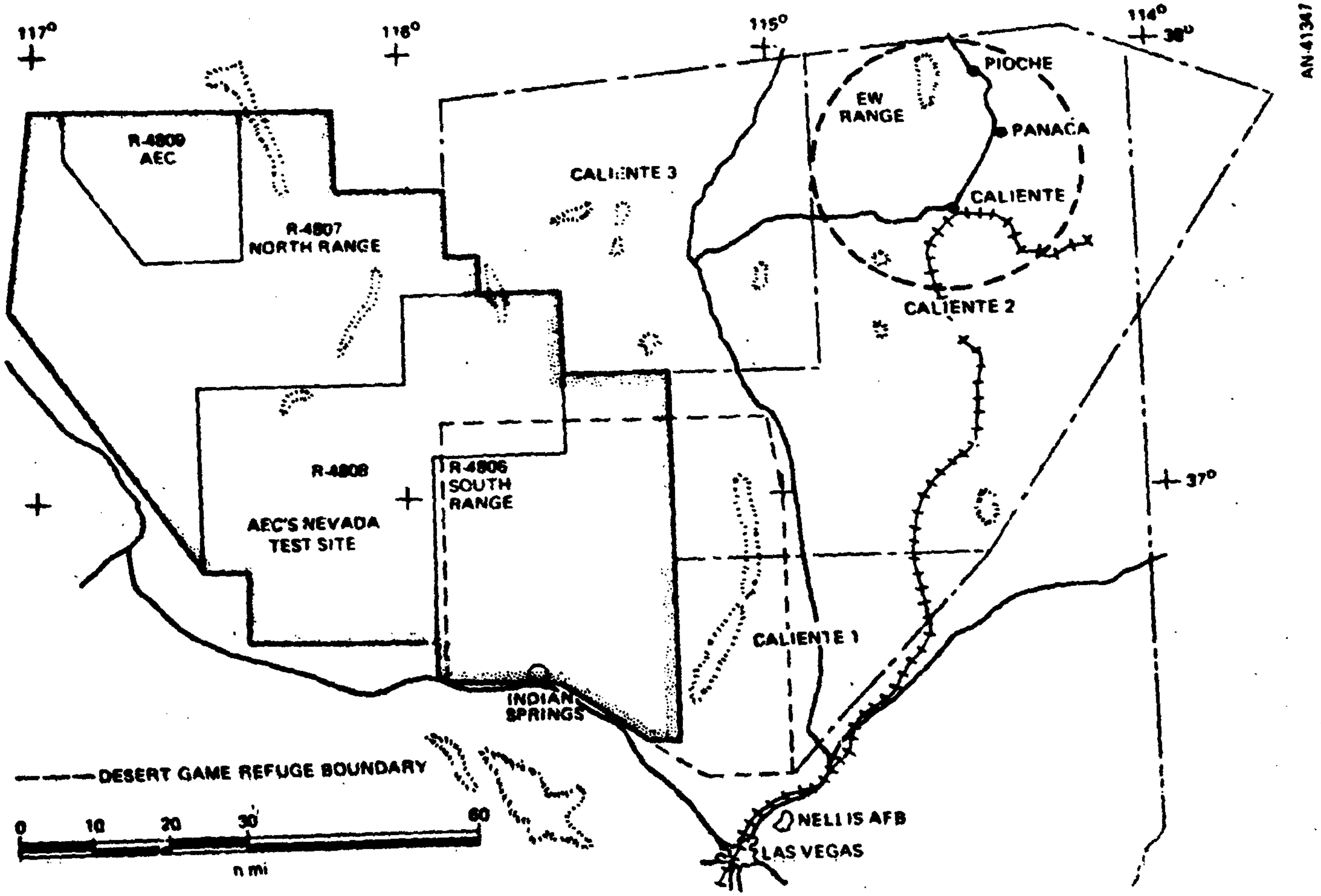


Figure 2.2. Existing Nellis Range Complex

37 F-4 (including all alternative configurations)

69 F-111A

15 F-105

12 A-7

18 T-38

Other minor aircraft

In fulfilling their designated test missions these aircraft generate approximately 33,275 sorties per year divided among the various test categories as shown in Table 2.1. Of this total, approximately 5,000 sorties per year are accounted for by US Navy use of the Nellis test range. As indicated in the table, the majority of sorties are performed as training missions, primarily as part of the Fighter Weapons Instructor Course (FWIC) conducted by the TFWC. Consequently, the training missions conducted as part of the FWIC serve to typify the uses to which the Nellis range are put.

In terms of the training undertaken by each student in the FWIC the following training missions are flown. As part of an integrated attack mission involving (1) a force of strike aircraft, (2) a force of aircraft to suppress surface-to-air missile (SAM) defenses, and (3) a force of combat air patrol aircraft, each student completes 13 air combat maneuvering missions (combat air patrol force) and two air-to-ground missions (strike force). In addition, each student independently completes 11 air-to-ground missions, four air-to-air gunnery missions, three low-level navigation

TABLE 2.1

EXISTING NELLIS RANGE AIR ACTIVITY

(Sorties per Year)

OT&E	2,800
USAF Training	24,100
USN Training	5,000
Exercises	1,175
DT&E and IOT&E	200

missions and two missions in simulated nuclear weapons deliveries. Thus the total number of missions per student is 35. Each type of mission makes use of different range facilities.

In general, missions involving electronic warfare or SAM suppression take place on the Caliente Range. Simulated enemy defenses (radars, etc.), are deployed at the Caliente Electronic Warfare (EW) Range in the vicinity of the towns of Caliente and Panaca (in an area defined by a circle of 20 n mi radius, see Fig. 2.3). The range is used for the purposes of electronic warfare training and is used whenever electronic warfare tactics are a part of a prescribed mission.

In the case of the integrated mission (depicted in Fig. 2.3), the strike force aircraft may carry electronic counter measures (ECM) designed to degrade enemy radars as an aid in penetrating enemy air defenses. The SAM suppression mission, also performed as part of the integrated mission, utilizes specifically designed penetration tactics that are directed against the SAM defenses. The SAM suppression mission is coordinated to just precede the arrival of the strike force so that the strike force can proceed, with the additional aid of its ECM, through the SAM defenses to its prescribed targets. The combat air patrol force of the integrated mission force is directed to accompany the strike force and defend it against enemy air attack. Consequently, in the conduct of the integrated mission the combat air patrol force is generally engaged in mock air-to-air combat by an attacking enemy force. The combat air patrol aircraft normally fly at subsonic speeds to conserve fuel; when attacked they accelerate, with afterburner operation, and in the course of the air combat will most likely achieve supersonic speeds and reasonably high maneuver levels (up to 6.5g). Air combat maneuvers take place as high as 30,000 feet and are broken off within 10,000 feet above ground level and are planned so as to avoid populated areas. The final activity of the integrated mission is the delivery of simulated or inert ordnance by the strike force aircraft to their designated targets; this activity comprises the air-to-ground mission of the integrated mission. Figure 2.3 shows a typical

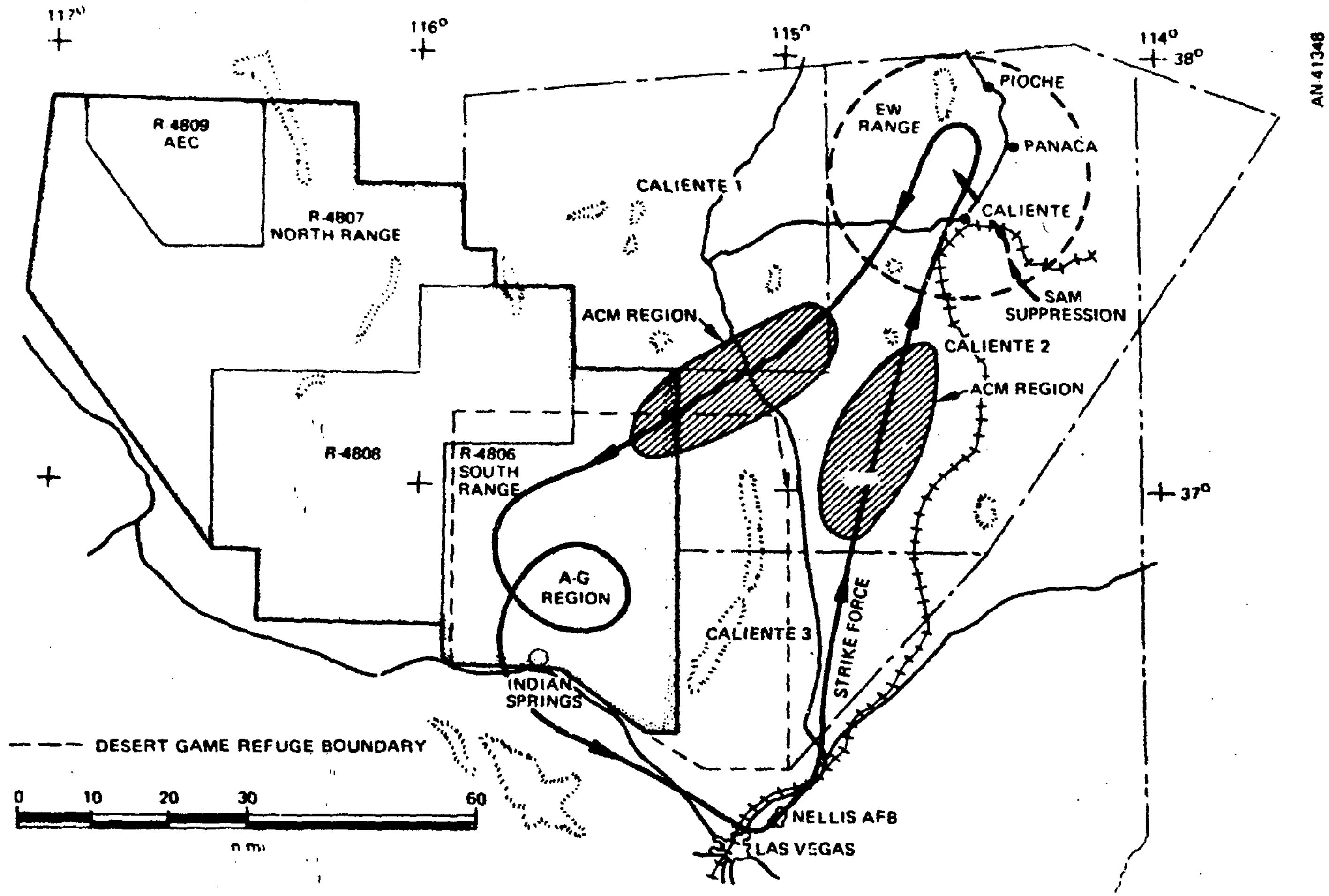


Figure 2.3. Integrated Mission Profile (FWIC)

route flown in the course of an integrated mission which requires an elapsed time of 40 to 55 minutes between takeoff and landing. Of this period, 15 to 20 minutes are spent within the Nellis range. The integrated force mission, including the attacking enemy force, may consist of as many as 13 aircraft.

Each of the activities described as part of the integrated mission may be undertaken as an independent mission at the same or other places on the range. The integrated missions, involving flights near the towns of Panaca and Caliente, are not allowed to carry live, externally stored ordnance; consequently missions with requirements to test such live ordnance must be conducted independently.

Air-to-ground missions may involve delivery of inert, practice, or live ordnance and can take place wherever designated targets have been set up within the restricted areas R-4806 and R-4807. However, R-4806, generally referred to as the south range, is the center of air-to-ground activity.

Air-to-air combat missions without discharge of either live or inert ordnance may take place in either the restricted airspaces, R-4806 and R-4807, or in the special use airspace in Caliente ranges 1, 2, and 3. Air-to-air gunnery practice with live and inert ordnance may take place in either R-4806 or R-4807. However, the south range (R-4806) has a prepared Dart* tow range for air-to-air gunnery practice as well as specific ranges for designated air-to-ground missiles.

The three low-level navigation missions are designed to train the student in flying a low-level combat profile. Low level routes as published in the "FLIP Planning Document" are designated by code number

*Dart is the name given to an aerial gunnery target that is towed at some safe distance behind a piloted aircraft.

and used for these missions. Routes typically used by the 57th FWW and the 474th TFW are listed in Table 2.2 below. The ensemble of all low-level routes in the vicinity of the COR region are depicted in Fig. 2.4. Along these routes the aircraft are flown at altitudes below 1500 feet above ground level. Most of the low-level routes pass over unrestricted lands and flight operations are limited to subsonic speeds. Each low-level route terminates in a restricted airspace where the continuation of the aircraft's operation need not necessarily be constrained in speed and altitude, respecting of course the restricted airspace constraints. Also, when a low-level operation terminates in a restricted area the aircraft may complete its mission with a delivery of practice or inert ordnance to a specified target.

A portion of the south range is prepared for missions in simulated nuclear weapons deliveries. A typical delivery, utilizing practice bombs, will use a high speed (subsonic at approximately 500 knots), low-level approach (approximately 500 feet above ground level) to the target, and a mission will usually involve 12 such passes and deliveries over the target.

TABLE 2.2

LOW LEVEL ROUTES USED BY NELLIS
(As Designated in DoD FLIP Planning Document)

474 TFW Routes		57 FWW Routes	
Las Vegas	340	Las Vegas	329
Blythe	336	Las Vegas	332
Cedar City	339		
Las Vegas	331		
Elko	351		
Elko	356		
Elko	357		
Salt Lake	502		
OB IOA (RBS)			

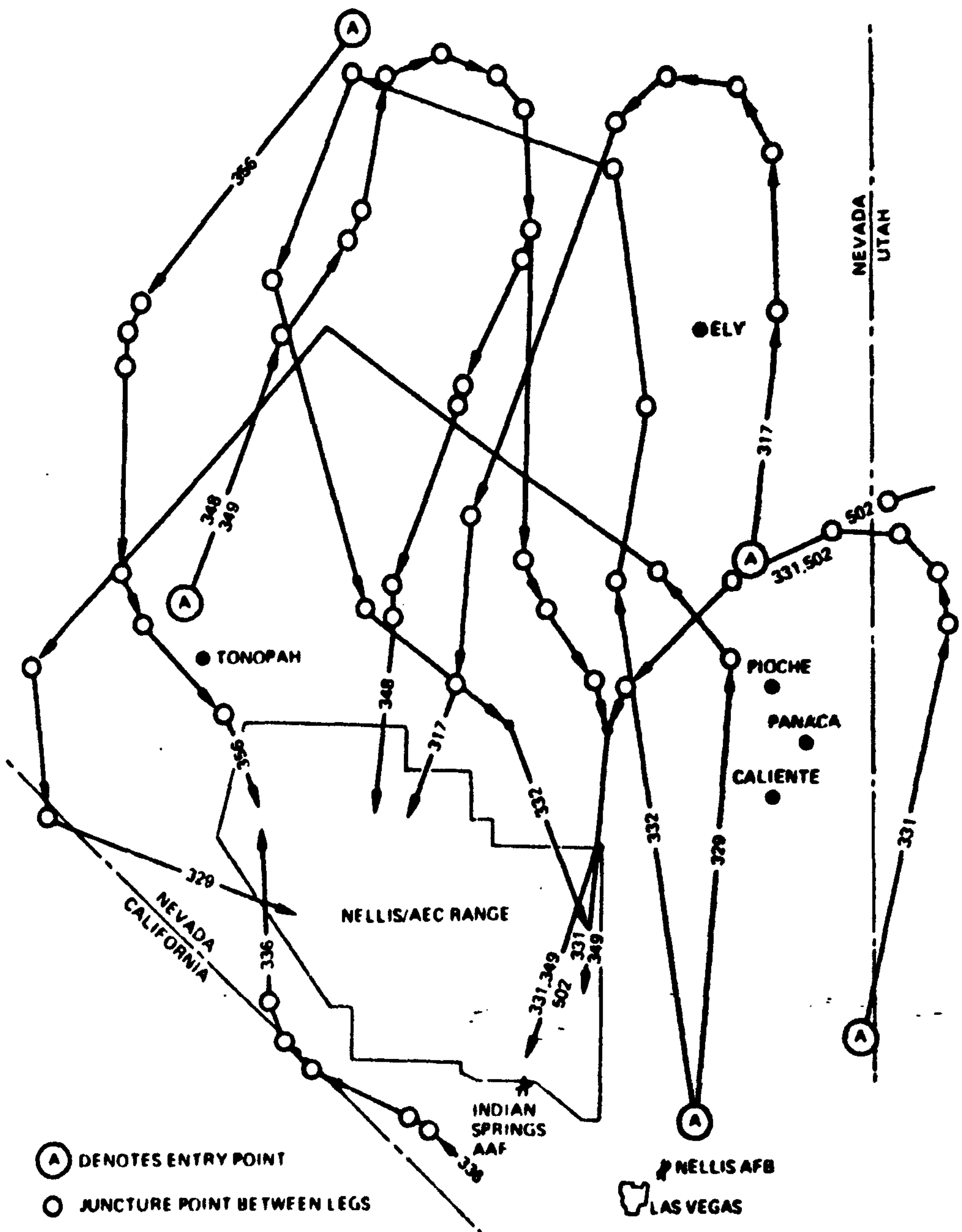


Figure 2.4. Selected Low Level Routes

In the performance of these missions, Nellis range operating procedures require that certain rules and precautions be observed, especially in unrestricted airspaces such as the Caliente ranges 1, 2, and 3. No air activity at speeds greater than Mach 0.85 (approximately 560 knots) is allowed over the 20-n mi-radius circular area designated as the Caliente EW range (see Fig. 2.2). Outside the Caliente EW range and the restricted ranges no supersonic activity is allowed below 5000 feet above ground level. All instances of supersonic flight are recorded by the pilot and eventually logged in a central supersonic activity file maintained by the Air Force according to regulations. Except for designated low-level routes (see Fig. 2.4) all flights in unrestricted airspace are constrained to altitudes equal to or greater than 1500 feet above ground level. Aircraft speeds at altitudes between 1500 and 5000 feet above ground level must be Mach 0.85 or less. However, near centers of population flight activities must be 5000 feet above ground level when approaching to within 2 nautical miles of the periphery of a center of population. Within these constraints the high-altitude areas over the Caliente ranges 1, 2, and 3 are allowed for use as a supersonic training area. Also, there is a high-altitude supersonic corridor designated for use over the Caliente ranges. Within the restricted land areas, sites for range facilities and targets have been chosen such that range ground and air activities do not impinge on wildlife or natural features of interest (e.g., Desert Bighorn Sheep).

Of the total 33,275 sorties generated yearly on the Nellis range, 24,100 are associated with Air Force training missions, 5000 with Navy training missions and the remainder of 4,175 sorties distributed over exercises and various DT&E, OT&E, IOT&E, and tactics development missions. In general, this remaining group of missions will encompass a variety of unique test activities but it is expected that their general characteristics can well be described within the repertoire of missions described above for training activities. The relative frequency of the various missions comprising the FWIC has been used as a guide in allocating the yearly total of sorties to specific missions conducted at specified test areas of the Nellis range. The estimated relative frequencies as percent of total sorties are presented in Table 2.3 for each combination of mission and test area as described for the FWIC.

2.2.1.3 Existing Ordnance Expenditure Activities

Within the bounds of the Nellis range, several ordnance delivery ranges have been set up to test airborne weapons systems and train air crews in their use. Ordnance delivery activiites involve a variety of bombs, rockets, missiles, flares and conventional ammunition. Ordnance may be inert or equipped with live warheads; in some cases simulated ordnance is used. Test sites have been set up for particular usages and these are shown in Fig. 2.5.

TABLE 2.3

ESTIMATED RELATIVE FREQUENCY OF RANGE USE BY MISSION AND RANGE AREA (PERCENT)

4%	Electronic Warfare at Caliente and air-to-ground at South Range (integrated mission)
4%	SAM suppression at Caliente
23%	Air-to-ground at South Range plus North Range
27%	Air-to-air mock combat over Caliente 1, 2, or 3 or North Range
6%	Air-to-air gunnery at South Range
2%	As Dart tow pilot (Dart is A-A gunnery target)
6%	Low-level training on designated routes
4%	Simulated nuclear weapons delivery at South Range
24%	SAM suppression and other air-to-ground at South Range

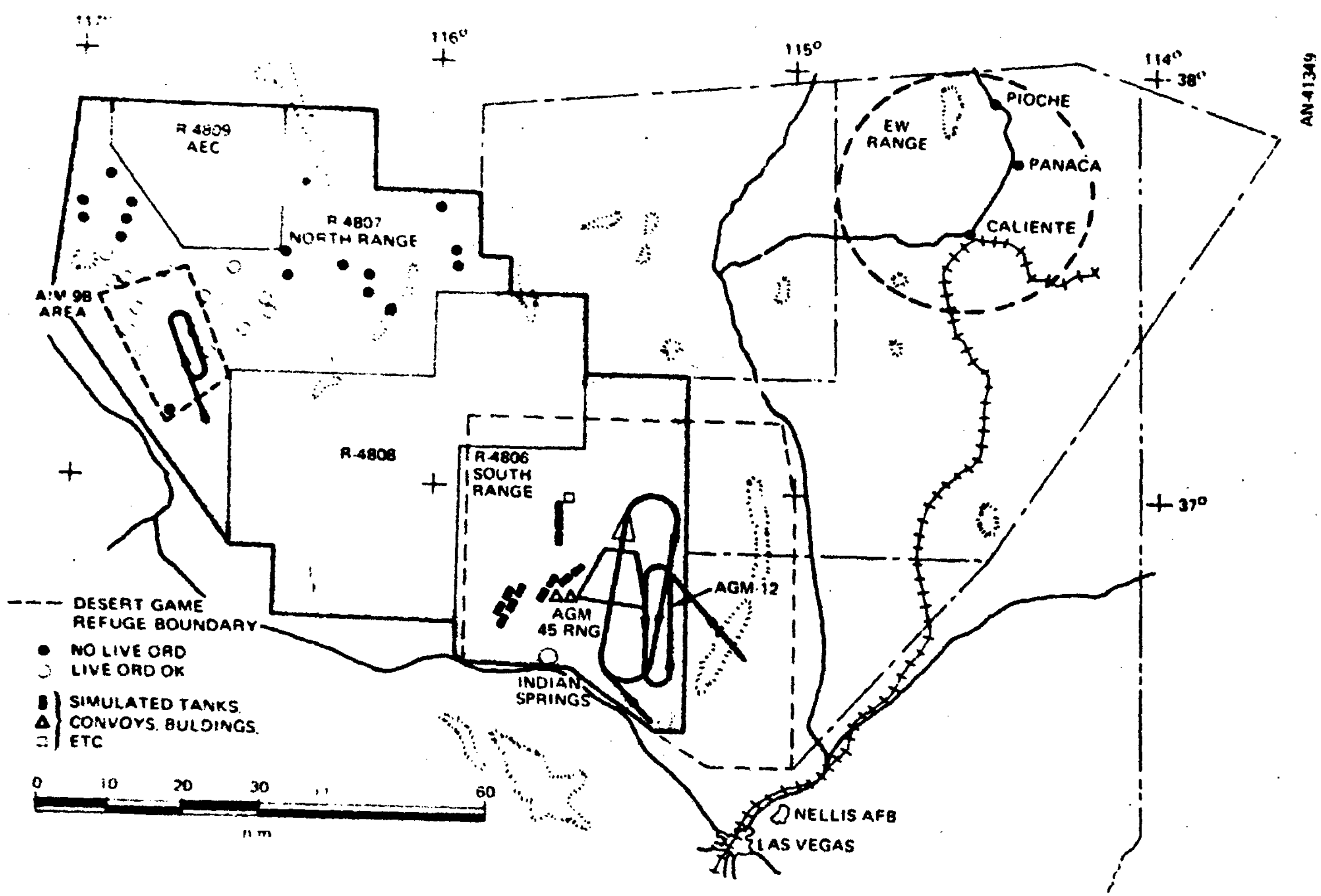


Figure 2.5. Ordnance Delivery Areas

As indicated in Fig. 2.5 both the Nellis North and South ranges are used for ordnance delivery but the South range is used somewhat more than the North range. It is to be noted that although the South range general boundary is within the Desert Game Refuge (dashed lines in Fig. 2.5) a memorandum of understanding, executed between the Air Force and the Department of Interior, allows the Air Force the use of those portions of the Desert Game Refuge within the South range that are below 3600 feet in elevation (above mean sea level). This agreement essentially constrains Air Force activities in the South range to the dry lake beds and the immediate low lying lands surrounding them. Figure 2.6 shows in more detail how air-to-ground gunnery targets are located in the dry lake region known as Indian Springs Valley. For the most part the targets are usually located within the confines of dry lake beds to minimize the effects on the environment and to provide clear unobstructed views for range safety. The same target sites are used over extended periods of time and are seldom changed. Similar circumstances prevail for the North range target sites although fewer of them are located in dry lake beds, primarily because there are fewer dry lake beds.

Table 2.4 presents a list of the kind and number of ordnance expended in a 6-month period on the Nellis range. The total initial live weight of this ordnance was estimated at 700 tons (for the 6 months) exclusive of the discharges of 20mm ammunition. Thus, a year's total may be taken as approximately 1400 tons. Of this, roughly half can be considered inert material which can remain scattered near the target sites. Range policing yields typically about 100 tons per year, most of which is accounted for in the recovery of practice bombs which remain relatively intact after impact. 20mm ammunition is discharged during air-to-air gunnery exercises and so is scattered quite widely.

This general character of ordnance expenditure has prevailed on the Nellis range for the past 30 years with variations from year-to-year in the amounts expended in accordance with national defense needs.

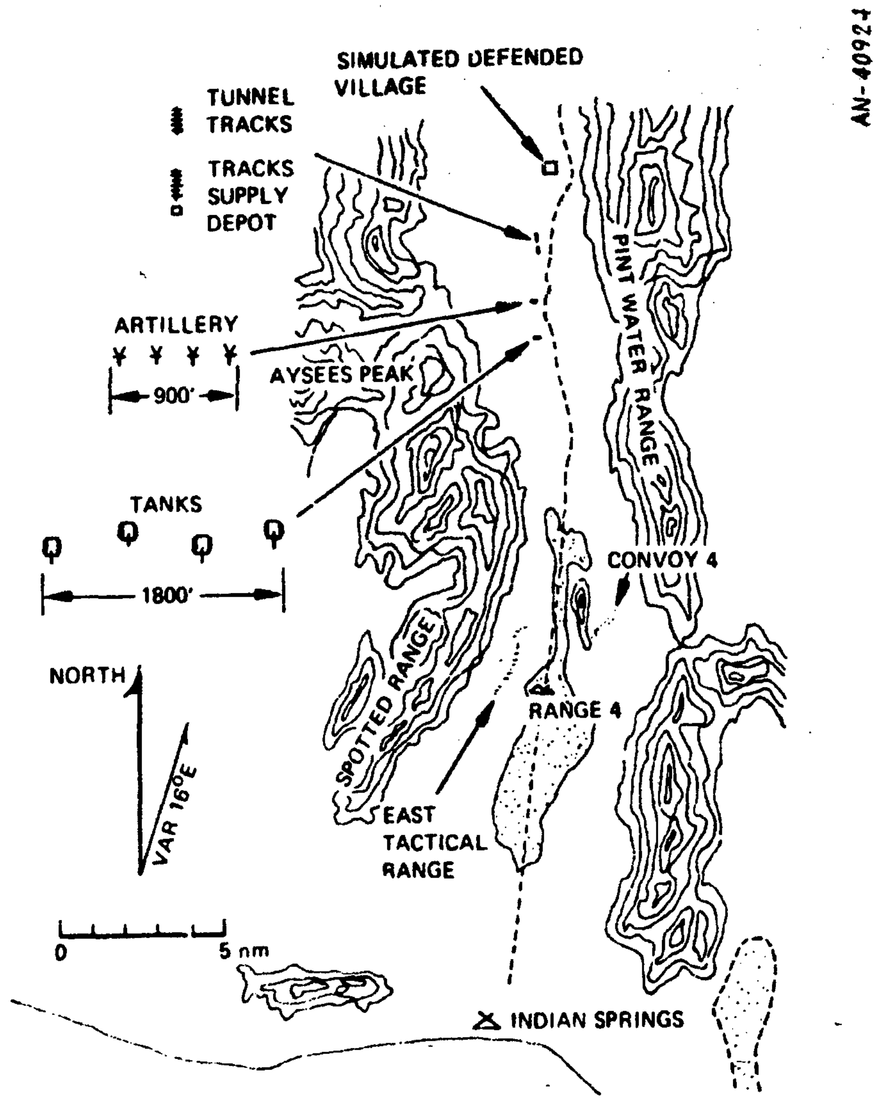


Figure 2.6. Ordnance Range in Indian Springs Valley

TABLE 2.4

ORDNANCE EXPENDITURES AT NELLIS RANGE

(6-month period)

Type Ordnance	No. of Rounds
BOMBS	
BDU-33, practice	13,027
Mk-106, practice	5,500
Mk-82 low-drag, inert	291
Mk-82 low-drag, live	313
Mk-82 hi-drag, inert	191
Mk-82 hi-drag, live	167
M-117, inert	377
BDU-12, practice	35
BDU-27, napalm, inert	7
BDU-27, napalm, live	121
BDU-8, practice	23
CDU-58, cluster, live	90
B-57, inert	3
B-51, inert	2
SUU-51, laser-guided, live	4
MISSILES	
Mk-1 Mod A (Walleye), live	6
Mk-2 Mod 0 (Walleye), live	4
AGM-45 (Shrike), inert	12
AGM-65 (Maverick), live	9
ROCKETS, FLARES AND OTHER	
2.75 in rocket, white phosphorus	387
2.75 in rocket, inert	1,595
Mk-24 and R-119 flares, white phosphorus	1,437
20mm ammunition, tracer and incendiary	31,710
20mm ammunition, all other	88,784

2.2.2 Hill/Wendover/Dugway (HWD) Range Complex

This test range complex comprises five special use airspace areas and two airfields: Hill AFB in the vicinity of Salt Lake City, and Michael Army Air Field located on the Dugway Proving Grounds. Of the five special use airspaces, two--R-6407 and R-6402--overlay the Dugway range, R-6406 is the Wendover range, R-6404 is the Hill Air Force Range, and R-6405 is a special use area. The H/W/D ranges are used cooperatively by both the Air Force and Army. Figure 2.7 is a map of this range complex showing the extent of air and land restrictions.

2.2.2.1 History and Previous Uses

The Air Force Logistics Command (AFLC) Test Range is basically manned to perform testing for the Ogden Air Logistics Center (ALC). Mission tests for which Ogden ALC is responsible include rocket motor testing for both large and small motors, service engineering tests of conventional munitions, and testing of aircraft for malfunction investigation and product improvement. Ogden ALC has service engineering responsibility for the F-4, F-101, and Minuteman Missiles.

Actual start of construction of Hill Air Force Range was 13 May 1963. To be operated at that time by Ogden Air Materiel Area's (OOAMA) 2705th Airmunitions Wing, the remotely located range of over 350,000 acres would be used to conduct airmunitions, explosive, missile, rocket motor and related tests. The associated restricted airspace R-6404 comprises approximately 800,000 acres.

The air and ground space were under control of OOAMA's Commander. The range was available for use by all Air Force commands and Department of Defense agencies when cleared and scheduled through the Weapons Range Control function of OOAMA's Base organization. Range capabilities for all users were: air-to-air ground gunnery; low- and high-altitude skip and toss bombing; precision visual and radar bombing; air-to-surface missile firing; surface-to-surface missile firing; ground testing of special-type

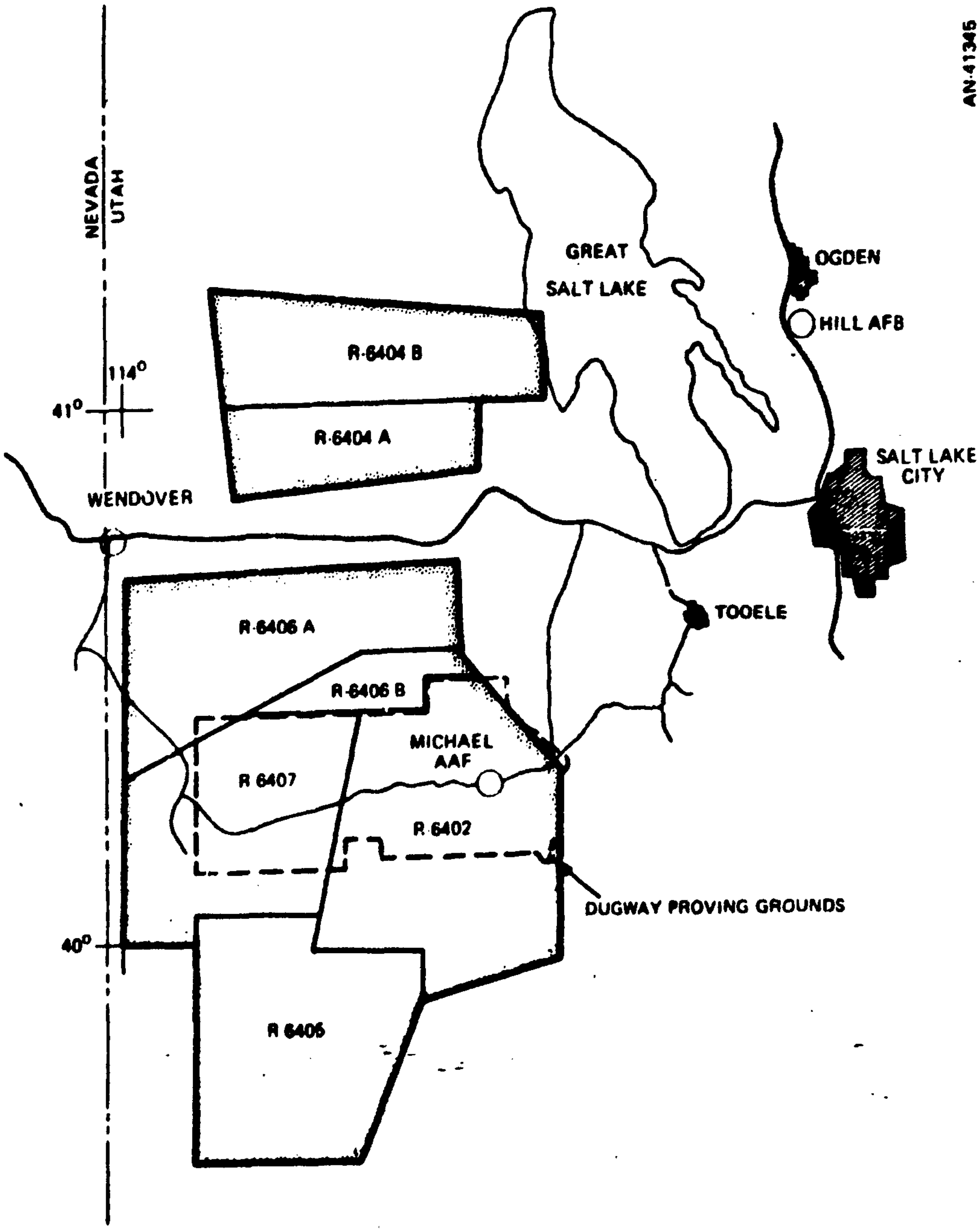


Figure 2.7. Existing Hill/Wendover/Dugway Range Complex

munitions, rockets and missiles, toxic weapons and propellants, etc. Also, the test complex included facilities for static firing of conventional explosives to measure reliability and to acquire data needed for effective airmunitions management for the Air Force.

On 30 June 1967, construction of instrumentation at Hill AF Range for conventional munitions testing began. Storage facilities for excess LGM-30 Minuteman missiles were also under construction. The Range was used for the storage, environmental testing and destruct testing of large rocket motors: Minuteman, Mace, Bomarc, etc., and for aerial flight testing of conventional airmunitions.

An AFLC Test Range Study of the potential use of Wendover/Hill Air Force Base for all of AFLC's test requirements was completed 1[illegible] June 1968 and subsequently approved. By the end of FY 1969, Phase I testing had begun, F-100 aircraft had been received and some equipment was made available.

The Range is unique within AFLC and a valuable asset to Ogden ALC. The potential uses of it are varied and challenging. The expanse of its uninhabited, remote, yet accessible 350,000 acres is adaptable to almost all space-missile-explosive purposes.

Many types of tests are accomplished at the Range. On 21 November 1968 the 100th test firing of a Minuteman Missile Motor occurred. On 1 July 1967 the "Big Papa" Test was initiated to determine the minimum distance between single stacks of Class Seven explosives (125,000 to 500,000 pounds net weight of high explosives) to prevent essentially simultaneous detonation and minimize later propagation; determine the optimum barricade geometry and materials for use in munitions storage barricades construction; obtain data which could be used to verify the criteria used to establish the five-cell-module concept.

Matador and Mace missiles have been flown from Holloman Air Force Base, New Mexico, to the Wendover Complex for operational tests without warheads.

On 9 March 1971 the Air Force announced the establishment of the 1550th Aircrew Training and Testing Wing at Hill Air Force Base. This is an advanced helicopter combat crew training activity. It will be the only Air Force helicopter training school and will train crews for Air Force activities. Firing of ordnance will be conducted on the Hill Air Force Range while refueling and para-drop operations will be conducted on the larger areas of Wendover/Dugway ranges.

2.2.2.2 Hill/Wendover/Dugway Existing Activity

R-6404, Hill Air Force Range Activities. Activities on this test range are undertaken in four main categories: (1) air munitions testing, (2) combat crew training, (3) depot flight testing, and (4) helicopter training.

Under air munitions testing, all types of tests are run to develop safety and surveillance criteria for the storage, burning, or detonation of large solid propellants and high explosive components. Tests are run to establish shelf lives, serviceability, and characteristics for handling, shipping, and storage of propellants and high explosive components. Preproduction lot testing of airmunitions are also performed on this range. Special tests such as "Concrete Sky," which was used to determine the vulnerability of aircraft shelters, are performed from time-to-time. The range is further used to perform static tests of large solid propellant rocket motors to determine environmental sensitivities and the effects of aging. Also, agreements are made with private missile contractors to use the range for reject and destruction tests. The range is also the responsible facility for the salvage and destruction of outdated and unusable Air Force munitions. In general, tests necessary to assure the quality of airmunitions are performed on this range.

The Hill Air Force range is used by Tactical Air Command (TAC) crews undergoing combat crew training at Nellis, Luke, Cannon, and Mountain Home Air Force Bases. Training involves use of routes designed to parallel typical light attack missions and include weapons drops. Routes are planned for nuclear weapon final delivery tactics. Extremely low-level flying across a portion of the restricted area prior to reaching targets provides necessary realism of training. Aircraft used to conduct this training are the F-111, A-7, and F-4.

Under Depot Flight Testing, the Maintenance Directorate, Ogden ALC, uses area R-6404 in conjunction with the Montello Special Operating Area for a flight test area for aircraft which are modified, repaired and overhauled at this depot. Aircraft in the process of Inspection and Repair are disassembled, modified, inspected and reassembled. Experimental flight testing is done in conjunction with the modification of certain segments of the aircraft. Approximately 90 flights are conducted each month. The number of flights is dependent on weather conditions and work flow of the depot repair and modification lines. Special Use Area R-6404 is used for the flight test function in conjunction with other hazardous activities. This is accomplished by having the flight test aircraft operate above the altitude scheduled for other activities. Restricted airspace is used for flight test functions which would be extremely hazardous if performed outside of a controlled restricted area. Hazardous operations include:

- Armament modification tests requiring air-to-ground firing
- Airborne testing of automatic fire control systems while the aircraft is under full instrument control and may not discriminate non-participating aircraft
- Aircraft pitch control system calibrations that involve high-speed turns and potential stall conditions
- Supersonic flight test in general which tend to stress the capability to maintain visual flight safety precautions

Helicopter training requires use of the Hill Air Force Range for air-to-ground gunnery, air-to-ground rocketry from UH-1, H-3, and H-53 aircraft. Munitions to be expended per year in helicopter training are 3,600,000 rounds of 7.62mm, 117,000 rounds 40mm HEI grenades, 8,000 rounds of 2.75 rockets, and 4,200 flares. In addition to gunnery and rocketry training, the Hill Air Force Range will be used for remote site training during periods of inclement weather and for aerial refueling during winter months.

R-6402 and R-6406 Wendover Range Activities. Air-to-Air Rocketry (2.75) and 20mm Gunnery activities are conducted by Idaho, Indiana, Iowa, and Colorado Air National Guard units while holding summer encampments at Hill Air Force Base. On 18 October 1969, the National Guard Bureau informed all units of the Air National Guard west of the Mississippi to consider using Wendover Air Force Auxiliary Field and the Wendover Range (R-6406 A&B) for their summer encampments on a year-round basis. A shared-use agreement has been negotiated with the Army whereby the Air Force uses airspace controlled by the Deseret Test Center for rocketry missions.

Deseret Test Center (Army Materiel Command) has used the Wendover Weapons Range in conjunction with its assigned mission of developing and testing of weapons. A survey conducted by the Army indicates that this is the only area in the United States where they can perform their development missions. The boundaries of R-6402 and R-6407 (Deseret Test Center) are insufficient to contain the magnitude of their operations and use of R-6405 and R-6406 is necessary for safety and security purposes. Testing conducted by the Army includes the use of high angle trajectory weapons including rockets, low-level flights of aircraft, target drops, and low-level bombing. Units of TAC, SAC, and USN utilize R-6404 for high- and low-altitude level bombing, including photo flash. These units fly F-105, B-52, F-4, A-4, A-7, and F-111 aircraft.

Dugway/Wendover Range Activities. The Tactical Air Command (TAC) plans to use this area for high-speed drone launch and recovery (project Combat Angel). Drones are launched and controlled by a DC-130. This mission requires the use of R-6402, R-6405, R-6406, and R-6407 to insure remaining within special use airspace to prevent conflicts with other traffic not participating in the mission. Air Force Systems Command (AFSC) conducts drone/RPV DT&E on these ranges.

Hill/Wendover Ordnance Usage. A variety of ordnance is expended on the Hill range during test operations. Currently the greatest percentage of munitions dropped on Hill Range consists of 750-pound-class dispensers with 600 to 700 baseball-size high-explosive (HE) bomblets. Bomblets vary in means of functioning from impact to exotic random delays or controls. Bomblets may penetrate to depths of 18 inches depending upon terrain, soil moisture, and release altitude. Similar to cluster munitions are aircraft dispensed bomblets which may include high explosive items plus white phosphorus and shaped charges. Napalm may be delivered by aircraft in aluminum containers holding from 100 to 200 pounds of incendiary mix. Other ordnance includes aircraft flares, either for smoke or illumination, general purpose bombs ranging in weight from 100 to 3000 pounds each, 2.75-inch rockets with white phosphorus or high explosive warheads and ammunitions ranging in size from 5.56mm to 40mm. The range is also used to dispose of second and third stage large, solid propellant motors by detonation. Unserviceable munitions are disposed of either by detonation or burning in the same area used for solid-motor disposal.

2.2.3 Fallon Naval Air Station (NAS)

2.2.3.1 History

NAS Fallon began as the Naval Auxiliary Air Station, Fallon, in 1942 when, with sites at Minden, Tonopah, Lovelock, and Winnemucca, Nevada, it was designated by the United States Army for the purpose of inland defense during World War II. NAS Fallon attained the status of an air station on January 1, 1972.

The Army Engineers began work in June 1942, constructing three runways, each 5200 feet in length. The preliminary construction was completed in late 1942 and turned over to the Civil Aeronautics Authority, which held the lease on the land from Churchill County.

The Navy acquired the field in August 1943. The station was commissioned as an auxiliary air station under the command of the Naval Air Center, Alameda, on June 10, 1944. Its mission was to provide training, servicing, and support to air groups deployed there for combat training. At this time, two hangars and supporting facilities were built.

In January 1946 the station was reduced to maintenance status, and then to caretaker status in June 1946, when the facilities were turned over to Churchill County and the Bureau of Indian Affairs. This lasted from June 1946 to October 1953, when the station was re-established.

With the Korean War came a number of new weapons and methods of delivery. Due to NAS Fallon's unique flying weather, approximately 360 days a year, and the sparsely populated area, planning was begun for a new, modern facility.

In 1953, after Congress appropriated five million dollars, work was started to modernize the buildings and equipment and to extend one runway to 10,000 feet. Construction of facilities in the New Area began in 1956 with the construction of four barracks, a mess hall, dispensary, and bachelor officers' quarters. This was also the year the station acquired its major tenant, the 858th Radar Group of the United States Air Force.

In September 1958, the Southern Pacific Pipeline to NAS Fallon from the San Francisco Bay Area was completed, and the first shipment of jet fuel was delivered. During the same year the airfield was named Van Voorhis Field, honoring Lieutenant Commander Bruce Avery Van Voorhis, a native of Fallon and Medal of Honor recipient who lost his life in action in the South Pacific.

During 1959 the runway was extended to 14,000 feet, making it the longest runway in the Navy. This, with the exception of Capehart Housing in 1961, was the last major construction project until 1967 when additional aircraft parking apron and jet fuel storage were added. The year 1968 saw the addition of a new administration building and chapel. Recently an indoor swimming pool and a Chief Petty Officers' Club have been completed. An ambitious housing program is also presently under construction, which includes family housing, bachelor officers' quarters, and enlisted men's housing.

2.2.3.2 Existing Activities at Fallon Naval Air Station (NAS)

The Fallon NAS is used as weapons training base in conducting (primarily) air-to-air gunnery and air-to-ground bombing and gunnery tests. Each fighter squadron pilot must receive air-to-air and air-to-ground ordnance delivery training annually. For this purpose Fallon NAS manages and maintains four primary range areas most easily designated in terms of their restricted airspaces, R-4803, R-4804, R-4810, R-4812, and one composed of R-4813 and R-4802. Controlled land areas under these airspaces comprise about 65,000 acres (~101 square miles) in the aggregate. The Fallon Test Ranges are shown in Fig. 2.8.

The ranges are equipped with a variety of bombing and gunnery targets including target rings on the desert surface, instrumented strafing panels, convoy-type targets comprised of jeeps, automobiles, trucks, and tanks, and targets comprised of artillery pieces and rocket launchers.

Testing activities include ordnance deliveries to these targets which may involve bombs, conventional ammunitions (e.g., cannon), simulated nuclear weapons, some rockets, and napalm. Also air-to-air gunnery tests with towed targets are conducted on the range.

Range facilities include three main control buildings (one each at R-4803, R-4804, and R-4810) with associated power generators, a radar, a maintenance van, a mobile land target tank maintenance building and several spotting towers.

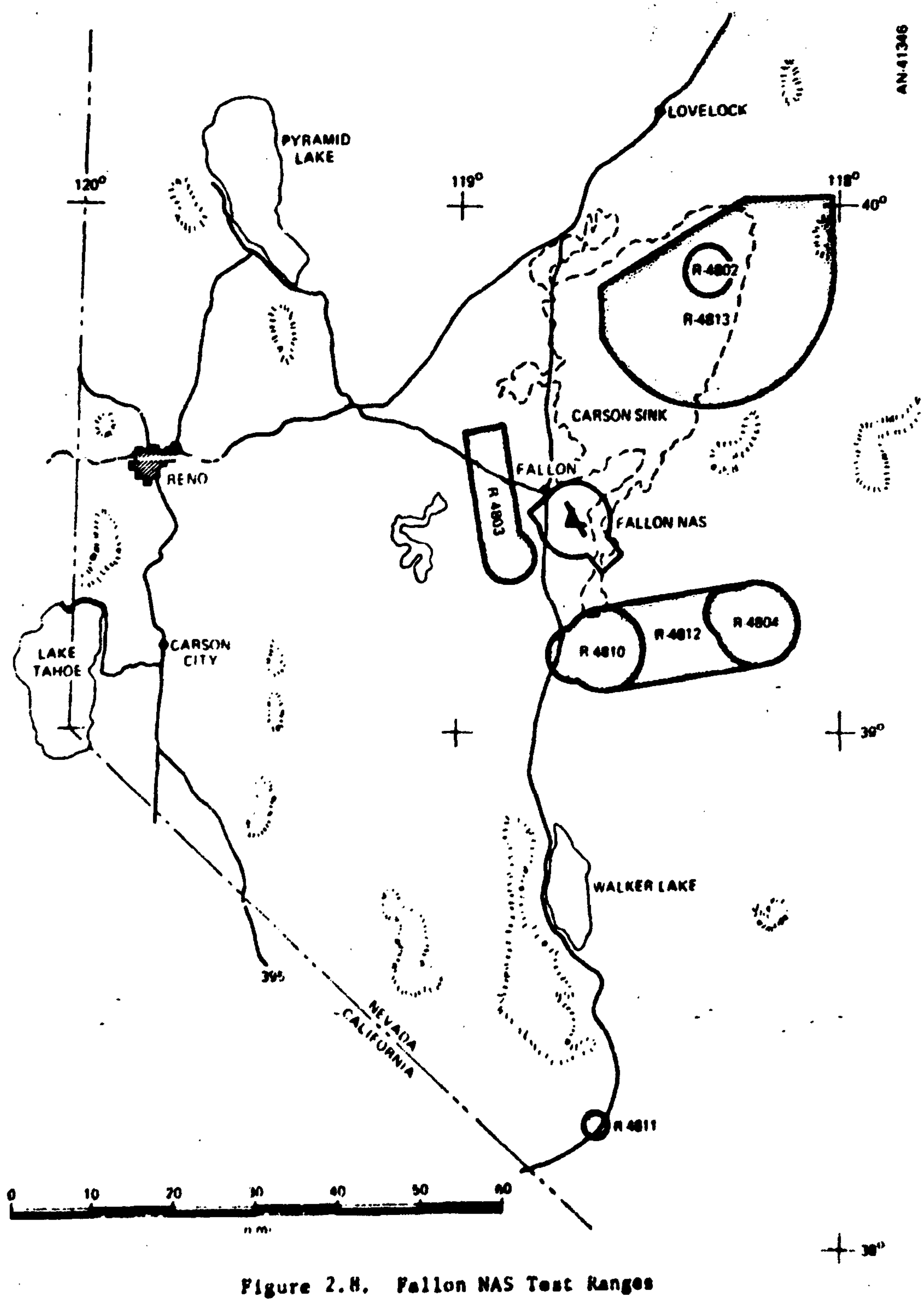


Figure 2.8. Fallon NAS Test Ranges

2.3 PROPOSED COR DEVELOPMENT

As we have previously noted, COR development is to take place in three sequential time phases, nominally referred to as near-term (FY 1975-1977), mid-term (FY 1978-1979), and far-term (FY 1980-1983). Implementation plans for the proposed near-term COR development are based on meeting existing Air Force test needs which are quite well-defined; mid- and far-term COR Plans are to be developed more fully as future test needs become better defined. The development of the proposed COR is described in the next several sections which detail the plans for: new and additional facilities, personnel, airspace adjustments, and likely levels of test activities.

2.3.1 Proposed COR Facilities

The proposed COR, in fulfillment of its objectives, is to make a substantial improvement in the quality of testing, from the standpoints of improved simulation of threat defenses and the comprehensiveness of range measurements. Improved simulation of threat defenses is to be obtained by procuring more threat simulator hardware (primarily radars), and by deploying them in a more realistic defense network which will include the normally expected complement of communication links that an air defense complex would require. Other improved range measurements are to be attained by equipping participating aircraft with a basic instrumentation pod which will be capable of instantaneously providing an aircraft's status, position, and attitude to COR Central. This necessitates the installation of instrumentation data links. Such improvements will take place throughout the three phases of COR development, but certain essential features will be programmed for near-term.

2.3.1.1 Electronic Warfare Range Areas

During near-term, the Caliente EW range is to be improved by increasing the 15 existing sites to 30 accurately surveyed sites as deployment locations for threat hardware. Each site will consist simply of a surveyed monument, a flat surface of perhaps an acre (not necessarily graded), with a road access. One site will be chosen as the center of the simulated threat complex and will have prepared space to accommodate S-530-type barebase military shelters for personnel and equipment. The access roads are to be unimproved and sites are chosen to minimize the cutting of new roads. Figure 2.9 shows the locations of the 30 threat simulator sites at the Caliente Electronic Warfare (EW) range; also shown are proposed site locations at the North Range (R-4809 and R-4807) and the backbone system of communications links.

Of the thirty simulator sites, approximately seventeen are located within one-half mile of either State Highways 7, 93, or 25 and in some of these cases the site is within a few hundred yards of the road. The remaining sites are all within a few hundred yards of other improved or unimproved dirt roads. One site is approximately one and one-half miles from the center of the town of Panaca and another is just over two miles from Panaca. Two more sites are just slightly more than two miles from Pioche.

Threat hardware simulator equipment will be land transportable, mounted in vans the size of a conventional semi-truck trailer. In the beginning of near-term, there will be approximately 19 pieces of equipment. During typical test routines they will be moved from one site to another from time-to-time. (Not all 19 pieces of equipment will be used in every test.) Communications within the simulated defense complex (e.g., between two occupied sites) is proposed to utilize microwave links, telephone lines, or radio; 150 such lines of communication will be required.

Personnel facilities and equipment at site locations are to be trailer or other temporary facilities. Water supply to working crews will be hauled. Similarly, human waste will be accommodated through a system of portable toilets with scheduled pickups and hauling to a central disposal site. Each range area will be equipped with some snow removal equipment to clear site access roads in the winter. Each site will use

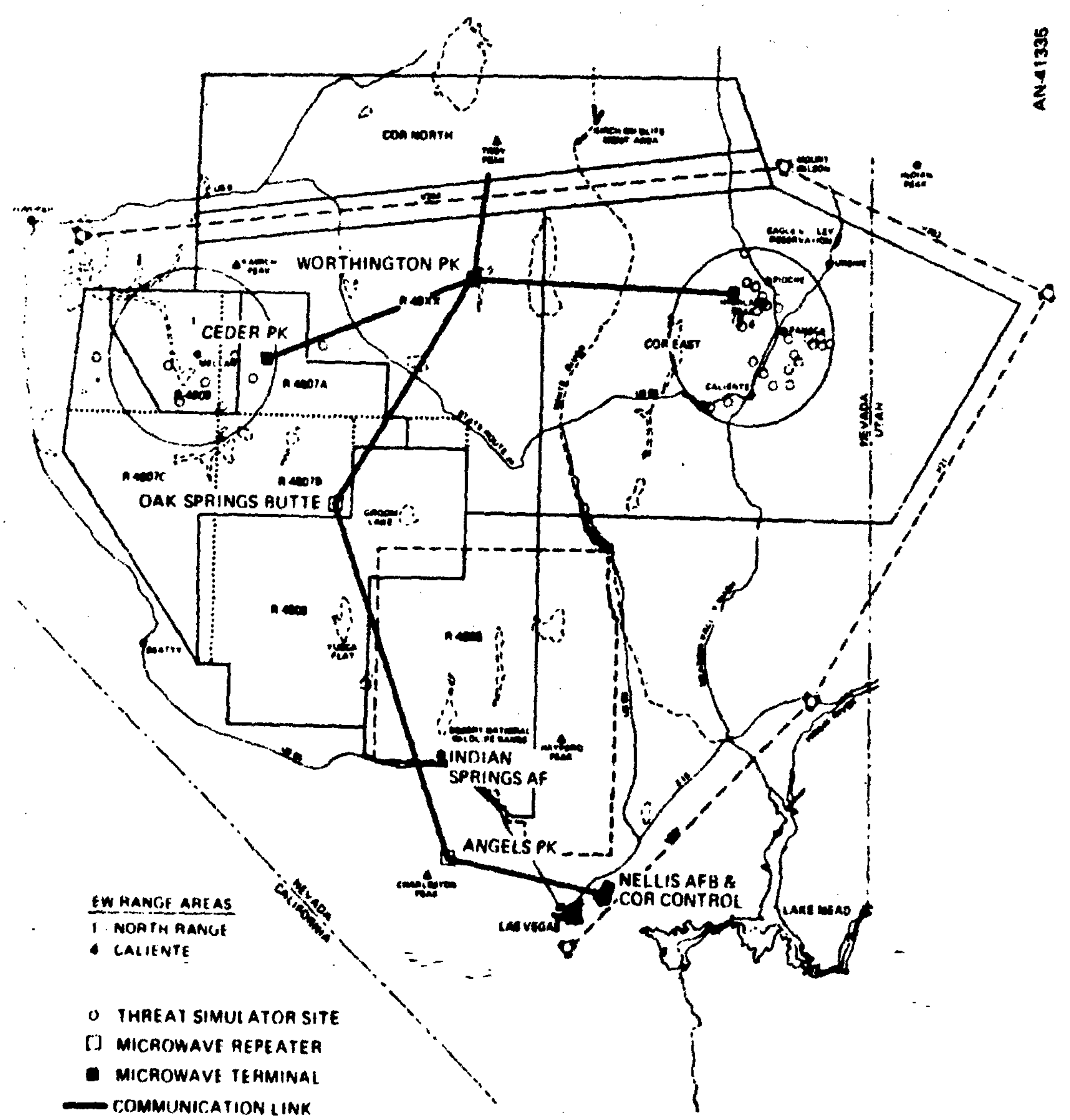


Figure 2.9. Threat Simulator Sites on the COR/Nellis Range

commercial power to the extent it is readily available; otherwise portable power generation equipment will be used to provide heating, cooling, and equipment power. Each threat hardware van will probably have associated mobile motor-generator sets to provide prime or standby power.

The buildup of the North Range as an Electronic Warfare range during near-term is intended to provide the capability to conduct integrated SAM suppression and EW testing with the use of live or inert ordnance, something that cannot be done on the Caliente range. Thus, threat simulator sites will have accompanying target sites where live or inert ordnance may be expended. The target sites have to be sufficiently close to the threat simulators for the purposes of realism but will still be at safe distances so that personnel and equipment at the simulator sites are not exposed to undue hazards. Approximately nine sites are proposed for development and use on the North Range during near term and these are also shown in Fig. 2.9. The requirements for the North Range sites are similar to those described above for the Caliente EW range.

The two threat complexes (Caliente and North Range) are linked to a central control station for COR to be located at Nellis AFB. Figure 2.9 also shows the communications links with repeaters located atop local high points with uninterrupted line-of-sight paths between them. The repeater stations require a minimum of site preparation and infrequent inspection. However, some of the sites may require access roads in order to install or maintain the equipment. Helicopters may be used as well.

As more threat simulator hardware is procured through mid- and far-term, the emphasis will be on building the North Range into a full EW range; the Caliente range will probably continue to operate with the level of development as completed during near term.

2.3.1.2 COR Instrumentation

In accord with COR objectives to immediately improve the quality of operational tests and evaluations, a significant portion of COR expenditures are programmed for range instrumentation. This instrumentation is designed to significantly improve the scoring and evaluation of air-to-air and air-to-ground missions as well as electronic warfare tests.

For the Caliente and North Ranges, instrumentation will include a Time-Space-Position-Information (TSPI) system which will obtain information on each aircraft's position velocity, acceleration and attitude. This data is linked via microwave to COR Central for real-time displays and recording. Furthermore the data from the aircraft instrumentation system will be combined with a tracking instrumentation subsystem and several computer systems to enable COR to accurately monitor and manage flight activities and to perform "electronic" scoring of mission events. When the total scoring system demonstrates sufficient accuracy, the need for use of live or inert ordnances will be reduced for many air-to-air tests. Similarly, instrumentation for air-to-ground scoring will be installed for use on the North Range.

In addition to eliminating the need for live ordnance usage in air-to-air exercises, the fully instrumented COR will provide an unprecedented degree of realism in performance of these exercises. The present practice of towing a DART target, which constrains the maneuver capability of the tow aircraft and DART target, will be supplanted by aircraft engaged in free two-sided encounters wherein the electronics scoring system determines the outcome.

The Nellis Range's capability for conducting air-to-air and air-to-ground tests is to be enhanced by addition of instrumentation to permit electronic scoring of events. Instrumentation will include position, trajectory, and impact measurement equipment. The varied accuracies and requirements to cover both moving and stationary targets dictate the need for a wide variety of scoring systems.

The integration of range instrumentation and measurement systems with COR Central will also require a significant amount of peripheral control equipment plus systems engineering effort to develop the necessary computer software.

2.3.1.3 COR Central Facilities

COR Central will consist of equipment and personnel which, by monitoring red (enemy) and blue (friendly) forces, will provide the capability to white forces (the umpires) to collect, process, and evaluate results from operational and training tests as well as to exercise control to include air traffic control and coordination of all range operations. As such, the COR Central facility will be the nerve center of COR. It will provide capability for positive command and control over the entire test evaluation environment and offensive and defensive forces (i.e., blue and red forces). COR Central must also posses the capability to reconstruct key events after a mission has been completed.

A new building is proposed to be constructed at Nellis AFB to house COR Central. Additional personnel will be required at Nellis AFB to help operate COR Central and expansion and improvement of some of the of the Nellis facilities will be required to accommodate these personnel. Table 2.5 lists the major construction works required at Nellis for the proposed near-term expansion.

The Hill/Wendover/Dugway complex is to be further developed in the mid-term to include a separate integrated communications system. This system is to be linked to the CCR communications system through Caliente. Also some near-term base improvements are proposed at Hill Air Force Base; the major items are noted in Table 2.6.

The COR communications system will also be linked and interfaced with FAA air traffic control personnel and equipment. These links will be established to provide voice and data communications for COR air

TABLE 2.5

NELLIS AFB COR CONSTRUCTION

Item	Quantity	Cost ($ thousands)
Addition to Apron	18,222 sq yd	566
Helicopter Pads	6,667 sq yd	226
Range Central Control	52,000 sq ft	3461
Range Central Control Addition	24,450 sq ft	1700
Maintenance Dock	24,980 sq ft	816
Range Support Maint. Fac (ISAFAF)	14,600 sq ft	567
Dining Hall Amn (ISAFAF)	3,302 sq ft	350
Interim COR Headquarters	6,579 sq ft	275
Comm Elect Maintenance Fac	4,000	270
Range Utility Support (ISAFAF)		205

TABLE 2.6

HILL AFB COR CONSTRUCTION

Item	Quantity	Cost ($ thousands)
Pad, Arm & Disarm	3,250 sq yd	124
Squadron Operations	5,800 sq ft	222
Small Aircraft Maintenance	13,750 sq ft	557

traffic control and electromagnetic interference control from possible effects on commercial aircraft radars, FAA radars and communications systems, and navigation systems. The FAA radars of interest for proposed near-term instrumentation and interface are located at Angel's Peak and Tonopah. Mid- and far-term instrumentation and interface will require acquisition of FAA radar data from Fallon, Battle Mountain, Francis Peak, and Cedar City.

Other COR non-participating entities to be linked to COR Central to promote cooperation in scheduling and minimizing communications interferences are the AEC Nevada Test Site and the AEC Tonopah.

2.3.1.4 COR Operational Safety

The proposed COR has been designated as a Major Test Facility by the Department of Defense (DOD), and under DOD Directive 3200.11 the COR range commander will be required to provide for a variety of range services which include ground and flight safety, range surveillance, and range clearance. Consequently, a significant activity to be undertaken as part of COR implementation is the development of a comprehensive safety program. This program will basically address system safety for the design and operation of the range support equipment and range safety for operational use of the range facilities. System safety requirements are stringent and Air Force policy is carefully prescribed by regulations AFR 127-13, AFR-127-8 and MIL-Std-882. An essential part of the range safety program is the drafting of a range safety manual that defines for range users the requirements that must be met to obtain range safety approval for operations on the Range. The manual will detail the requirements for hazards analysis that are essential in demonstrating to the Range Safety Officer that a test can be run without undue risk to all parties. Range safety considerations will extend to the requirements for safety to the life, health, and property of both participating and non-participating personnel. Range safety analyses will address all potential hazards including but not limited to handling of propellants, fuels and munitions, use of electrical systems, electromagnetic emanations, noise and overpressure.

2.3.2 Proposed COR Staffing

Manpower requirements for COR operations have been estimated and are presented in Table 2.7. The table shows the proposed man-level at the end of each fiscal year. In fiscal year 1975 a significant fraction of COR personnel will be provided by transferring Air Force personnel already stationed at the Nellis Range complex to COR (noted by the numbers in parentheses in Table 2.7). The greatest buildup is planned for the support of the Tactical Electronics Warfare Training Squadron (TEWTS) group. Of the existing 250 personnel now supporting this kind of testing, 200 are at Nellis AFB and 50 are running the Caliente Range. At full development of COR, it is expected that personnel assigned to the TEWTS group will be roughly equally divided between Nellis, Caliente, and Tonopah (North Range). However, TEWTS buildup will occur most rapidly at Caliente and Tonopah in the near term. The overall net addition of personnel due to COR will reach approximately 700 by the year 1979; the staffing level should be nearly constant thereafter.

The mix of personnel in categories of military, in-service civilian, and contract labor which is used to accomplish range operations and maintenance will be determined using a building block approach. This means that all military personnel requirements will be identified first, then in-service civilian requirements (with full cognizance being taken of appropriate Armed Services Procurement Regulations), and finally contract labor services. Military manning will be specifically justified on a position-by-position basis. Military manning will not be based on its cost relative to in-service civilian or contract labor cost; division between in-service civilian and contract labor will be based on guidelines issued by the Offices of Secretary of Defense and Management and Budget (OSD/OMB); the most economical services will be selected.

It is expected that personnel located in the Caliente and Tonopah areas will seek housing within the local communities. Indian Springs personnel will probably be accommodated locally or within the Las Vegas metropolitan area as will the Nellis AFB personnel.

TABLE 2.7

PROPOSED COR STAFF

Group and Facility Where Stationed	1975*	1976	1977	1978	1979
COR Group, Nellis	106 (30)	123	123	123	123
Indian Springs Gunnery Range	178 (150)	185	200	211	215
Tactical Electronic Warfare Training Squadron					
Nellis	(~200)	200	200	241	256
Caliente	(~50)	100	200	240	256
Tonopah	58	100	193	240	255
OLAA					
(Kirtland AFB, New Mexico)	1	2	2	2	2
OLAB					
(Hill AFB)	1	4	4	4	4
OLAC					
(Tonopah)	1	10	10	10	10
TOTALS	590	724	932	1071	1121

*Numbers in parentheses represent existing Air Force personnel now stationed at the Nellis range who are planned to be transferred to COR.

2.3.3 The COR Airspace

The proposed geographical area of COR operations is approximately described by an inverted triangle with apexes at Las Vegas and Reno, Nevada and Salt Lake City, Utah. However, the proposed COR airspace refers to only the lower half of this triangle. No changes as a part of the COR action are proposed for airspace in the vicinity of either the Fallon NAS or the Hill, Wendover, Dugway complex. Figure 2.10 illustrates the area covered by the COR airspace proposal.

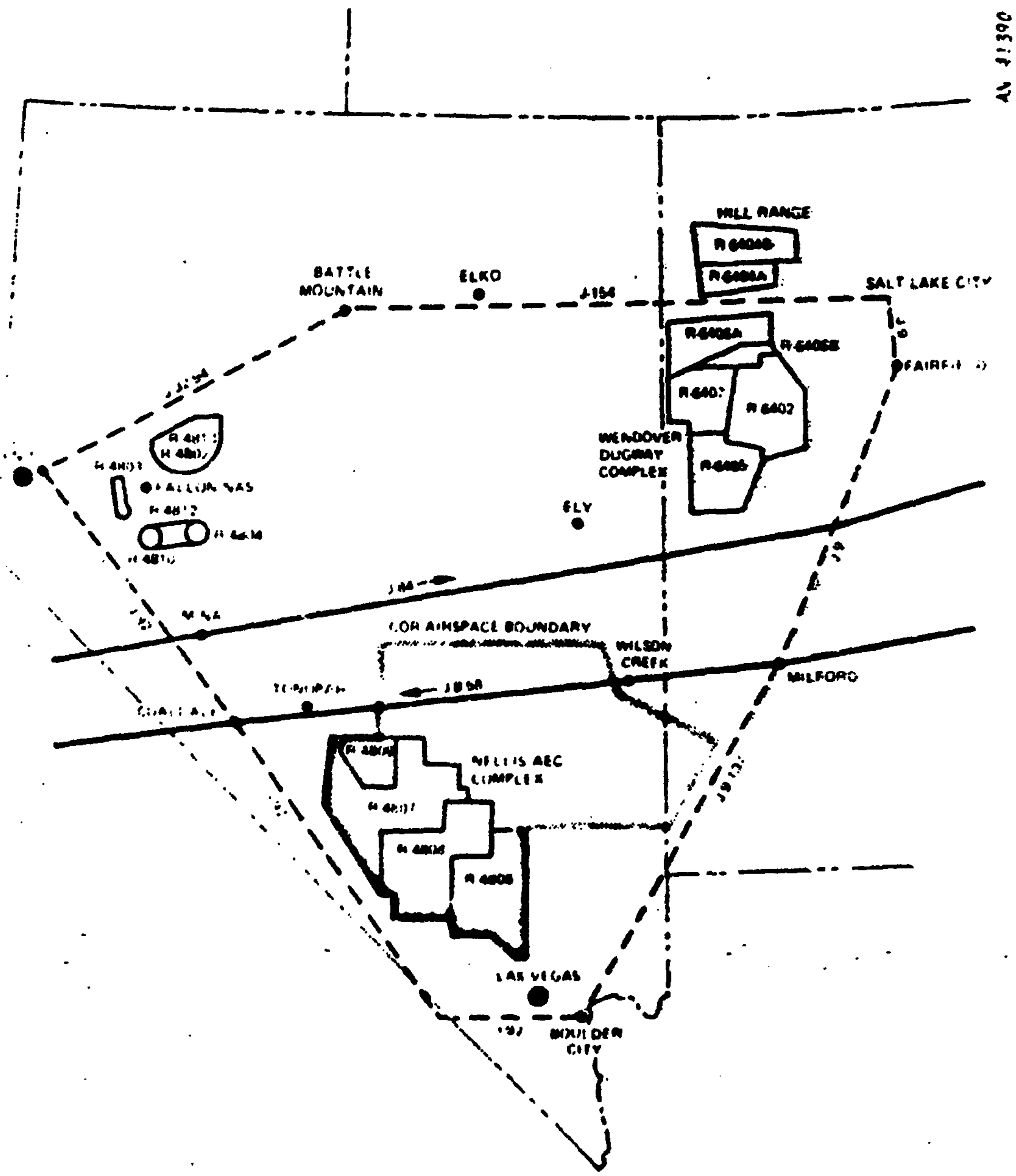
The proposed COR airspace embodies three individual actions. These are:

1. Realignment of the internal boundaries of the extant group of restricted areas to the North of Nellis AFB, and redesignating three of the restricted areas to be joint use.
2. Establishment of a new and interim restricted area currently referred to as R-48XY.
3. Publication of an FAA Special Rule under Part 93 of the Federal Aviation Regulations, designating two Special Use Areas, both requiring an ATC clearance for entrance and transit, except as provided for by unregulated VFR flyways.

Details of the COR Airspace proposal are presented in Appendix G, however a summary of the important issues is presented below.

2.3.3.1 Types of Airspace Mentioned in COR Proporal

The FAA is in charge of all airspace in the US. By the FAA Act of 1958 the FAA Administrator is empowered to grant what is in effect a license to any airspace user who can show need for a special use of airspace. The FAA thereby establishes a volume of special use airepace, in which either the FAA or the military may control the air traffic. The COR proposal refers to several types of special use airspace, each of which is described below.



The COR Area and the COR Airspace Boundary

Restricted Areas. The fundamental requirement for the establishment of a restricted area is an FAA "finding of hazard." Restricted areas are established by FAA rule making and are thus statutory in nature. Restricted areas may be continuous or they may operate only during published periods. They may be restricted to the use of only one user, or they may be joint use (e.g., AF and AEC). The FAA has a policy of designating restricted areas to be joint use wherever possible and the COR proposal takes cognizance of this policy.

Restricted areas are delimited in three dimensions, including upper and lower altitude boundaries. In order for the lower altitude limit to be at ground level, the user must own or control the land beneath the restricted area.

Where unique situations demand peculiar solution to airspace problem, the FAA has authority to establish a special rule calculated to provide for safe and efficient use of airspace. This is done in accordance with FAR Part 93 and results in specific constraints which are procedural in nature and are in lieu of actions which would exclude selected types of operation as in the case with a Restricted Area. In the COR proposal, the unique requirement is "procedural traffic management for safety." Such constraints as would be applicable to COR North and East pertain to aircraft movement only and have no relationship to use or ownership of land beneath the airspace.

VFR Flyways. Although not special use airspace, flyways deserve mention here since they form an integral part of the COR, and because "Flyway" has a specific meaning. Flyways are navigation corridors which are based on reasonable pilotage routes. This means that a Flyway does not require radio communications/navigation or radar coverage. Flyways typically consist of uncontrolled airspace. In the case of COR they are proposed to be 4 statute miles wide and altitude limited at 12,500 feet above mean sea level. No COR flight operations will take place within the flyway airspaces.

2.3.3.2 Realignment of R4807, R4808, and R4809

Figure 2.11 illustrates the proposed realigned restricted areas shown as dotted lines. The full lines indicate the existing boundaries. In addition to realigning R-4807, R-4808, and R-4809, two significant changes are proposed:

1. R-4807 will be split into three independently usable restricted areas R-4807A, B, and C.

2. R-4809 will be redesignated as joint use. Two users are contemplated, the AEC and the US Air Force. This action will formalize an interagency agreement entered into in 1969 by the AEC and the US Air Force. In addition, R-4806 and R-4807 will be redesignated joint use. The designation of R-4808 will remain unchanged.

2.3.3.2 Establishment of a New Interim Restricted Area

Figure 2.12 illustrates where the new restricted area, R48XX, is proposed, and how it dovetails into the outer boundaries of the existing restricted areas. It should be noted that while the existing restricted areas extend from ground up to unlimited altitudes. R-48XX extends from 200 feet above ground level to FL-180. It is anticipated that the Air Force will propose that R-48XX be revoked and the airspace encompassed therein be subject to the lesser constraints of COR East. This will occur as soon as communications capability and radar surveillance will permit. The proposed COR program will provide such a capability in late near or early mid-term, 2 to 3 years after initiation of COR.

2.3.3.3 Part 93 Special Use Airspace

Two special use airspace areas are proposed under FAR Part 93. COR North and COR East are also depicted in Fig. 2.12. It should be stressed that these areas are not restricted--rather access to them is controlled by requiring an ATC clearance to enter and transit them. This clearance will be obtained from or denied by the controlling agency. At the beginning of COR, the controlling agency will be an FAA ARTCC.

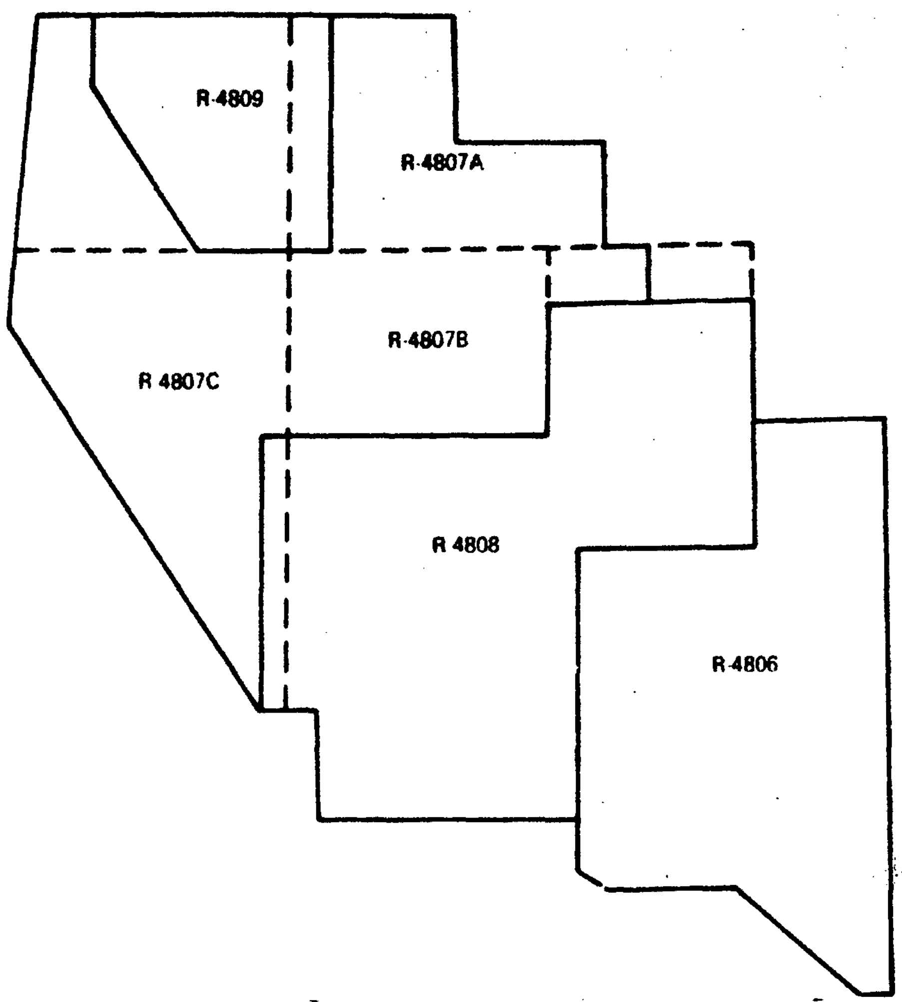


Figure 2.11. Realignment of Existing Restricted Areas of Nellis/AEC Range Complex

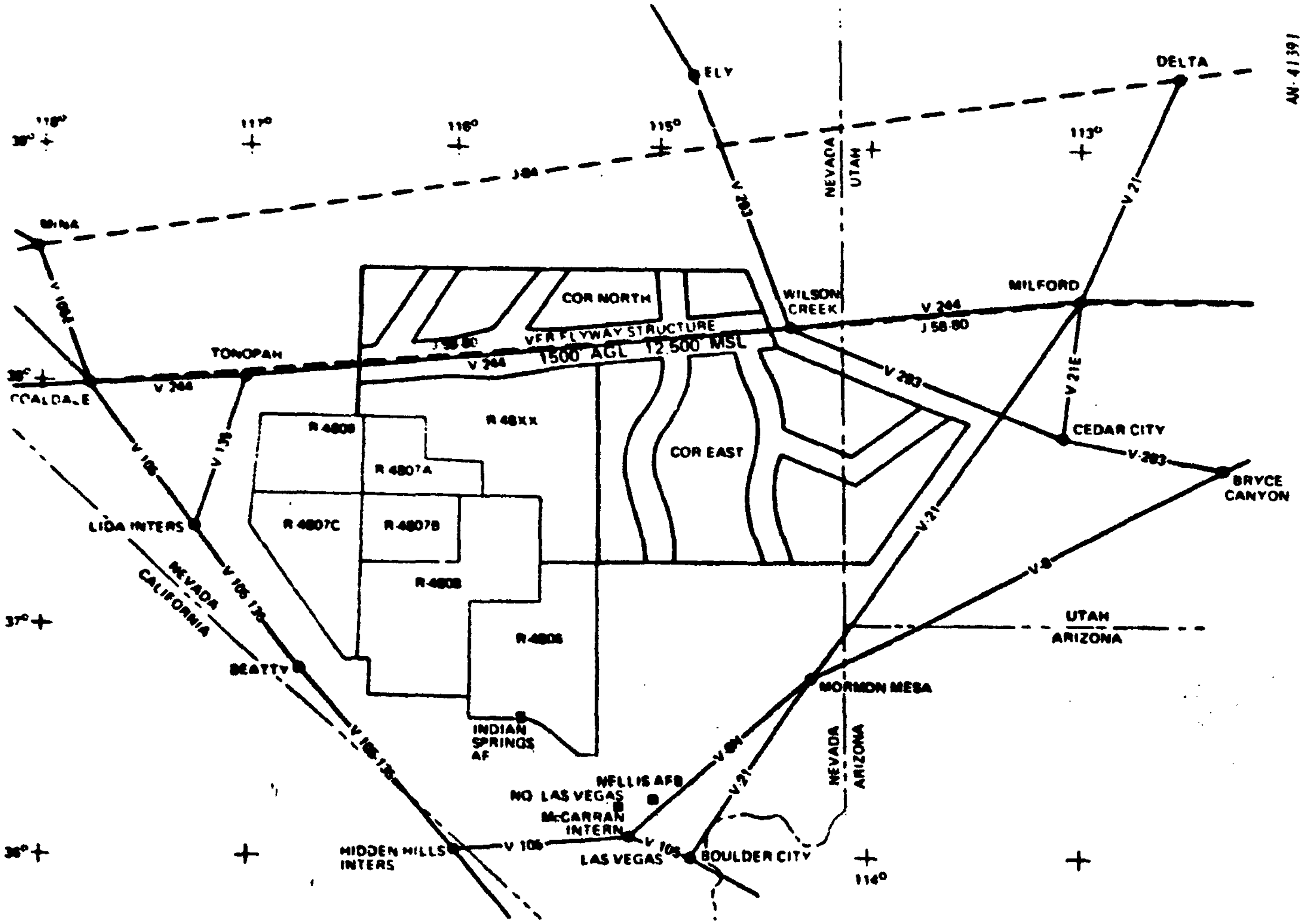


Figure 2.12. Proposed COR Airspace Structure

Preliminary COR plans call for the implementation of the COR Central (CORC), the operational nerve center of COR. When CORC is fully operational, it will be capable of providing ATC services. As a result, CORC would then become the controlling agency.

Included in both COR North and COR East will be flyways which will permit transit through the airspace along prescribed topographically described routes without ATC clearance.

2.3.4 Proposed COR Activities

COR activities will be primarily an outgrowth of existing test range activities. The range improvements to be undertaken by COR will have their greatest impact on the quality of test and evaluation activities. Nonetheless, some of the range improvements will allow increases in overall test activities as indicated in Table 2.8 showing expected COR utilization in terms of sorties per year.

TABLE 2.8

PRESENT AND ESTIMATED COR UTILIZATION (SORTIES PER YEAR)

	Present (Nellis)	Near-Term (Nellis Only)	Mid-Term (Nellis and H/W/D)	Far-Term (Nellis, H/W/D, and Fallon)
OT&E/Tactics	2,800	3,930	5,285	6,440
USAF Training	24,100	25,100	26,100	27,100
USN Training	4,500**	4,500**	4,500**	29,466*
Exercises	1,175	2,350	2,350	5,700
DT&E/IOT&E	200	750	2,400	2,400
Totals	32,775	36,630	40,635	71,106

*Includes 24,466 Navy sorties, representative of present utilizations of Fallon by the Navy.

**Use of Nellis by Navy.

The greatest expansion occurs in the categories of OT&E and Tactics Development, Exercises, DT&E, and IOT&E. Presently, Air Force and Navy training comprise the bulk of activity that would be associated with COR (the activity shown for present utilization is all at the Nellis range). Far-term utilization shows 29,466 Navy training sorties per year, of which 5,000 are part of Nellis range activity. The remaining 24,466 Navy sorties, performed at Fallon, represent the present utilization of Fallon by the Navy; these sorties are included under far term only to show the expected fulfillment of cooperative use of the fully developed COR by Air Force and Navy and imply no expansion of existing Fallon activity under the auspices of COR.

2.3.4.1 Nellis Range Utilization

Of the 33,275 total annual sorties presently conducted, all but 5,000 are generated by Nellis AFB (including Indian Springs). Consequently, it is estimated that Nellis AFB presently averages 100 sorties per day throughout the year. Since there are approximately 150 total aircraft assigned to the various commands at Nellis, a maximum of about 125 sorties per day can be generated at Nellis AFB, allowing for some aircraft to be down for the maintenance or repair.

For the near-term, Nellis AFB activity can be estimated by subtracting the 5,000 USN sorties from the total. Thus, for near-term, Nellis AFB activity will increase by approximately 14 percent and we can expect similar increases in the average daily sortie rate (to 114) and in the number of Nellis assigned aircraft to support this activity. When Fallon sorties are included in the total to represent Nellis Range activity the percentage increase is only 12%.

For the far-term, COR total utilization includes approximately 2,400 sorties due to the integration of Hill/Wendover/Dugway operations. Thus, the total for only Nellis AFB activity is expected to reach 39,260 or an increase of 40 percent over existing levels of activity. The Nellis AFB average daily sortie rate will probably increase to 140 with a concomitant increase in Nellis assigned aircraft. Again by accounting for the Fallon use of the Nellis Range (5000 sorties) the far-term increase in Nellis Range activity will be 34% above existing levels.

2.3.4.2 Range Usage by Mission and Area

Range utilization has been further subdivided by type of test and range location for near-term and far-term cases and these estimated utilization rates are presented in Tables 2.9 and 2.10. The tables show the levels of activity in sorties per year at each of the range areas--Caliente, North, South, H/W/D, and Fallon. In addition, this activity is further divided into categories by test missions of: Electronic Warfare (EW), SAM suppression, air combat maneuvering, (ACM--"mock duels"), air-to-air gunnery (A-A), close air support (CAS), and air-to-ground (A-G). This division by missions is important since each mission type has different potential for impacting the environment. Electronic warfare and SAM suppression involve potential electromagnetic interferences and low-altitude flight activity; air combat maneuvering and air-to-air gunnery involve supersonic flight activity with some of the gunnery involving live ordnance discharges; and close air support and air-to-ground missions involve discharges of inert, practice, or live ordnance as well as low-altitude activities.

Each of these mission activities under near- and far-term COR are not expected to vary much from the manner in which they are conducted at present on the Nellis range. Training flight activities are expected to continue under COR in the same manner as they have been conducted at present as part of the Fighter Weapons Instructor course; only the benefits of improved test range facilities and instrumentation will be apparent. It is also expected that existing Nellis range operating procedures and constraints will continue to be operative under COR except as they are modified by the new airspace designations proposed under COR. Thus, with respect to aircraft activity the most significant changes from present

TABLE 2.9

NEAR-TERM UTILIZATION

Sorties per Year

	Caliente Range			North Range			South Range
	Totals	EW	SAM Suppression	ACM/A-A	EW	A-G/CAS	A-G/CAS
[illegible]							
Tactics Development	4,680	2,000		1,000		840	840
IOT&E							
DT&E							
USAF Training	25,100	2,400	1,400	6,000	1,000	1,400*	12,900
USN Training	5,000**			2,000	1,000	2,000	
Exercises	750	250			250		250

* SAM Suppresion mission

** 5,000 on Nellis range
24,466 on Fallon range

EW = Electronic Warfare Missions
ACM = Air Combat Maneuvering Missions
A-A = Air-to-Air Gunnery Missions
CAS = Close Air Support Missions

TABLE 2.10

FAR-TERM UTILIZATION

Sorties per Year

	Caliente Range			North Range			South Range		
	Totals	EW	SAM Suppression	ACM/A-A	EW	A-G/CAS	A-G/CAS	H/W/D	Fallon
OT&E/Tactics DT&E/IOT&E	8,840	2,000		1,640	?	1,100	1,100	3,000	
USAF Training	27,100	2,400	1,400	6,000	2,300	1,400*	13,600		
USN Training	5,000** 24,466		2,000	1,000	2,000				24,466
Exercises	5,700	1,600		1,700			1,600	400	400

*SAM Suppression missions

**5,000 on Nellis range
24,466 on Fallon range

EW = Electronic Warfare Missions
ACM = Air Combat Maneuvering Missions
A-A = Air-to-Air Gunnery Missions
CAS = Close Air Support Missions

activities that will occur due to implementation of the proposed COR are a slight increase in overall activity (in terms of sorties per year) during the near-term which will increase as COR development proceeds into the far-term. Within the expected levels of overall activity there will occur a redistribution of activity with respect to the range areas utilized. The buildup of the North EW range and its eventual integration with the Caliente EW range will cause the focus of operational test and evaluation activity to occur over those areas. Thus, COR East and COR North will probably experience more air activity than has occurred there in the past. However, once the Caliente area development is essentially completed in the near-term, activity over that region is expected to remain at a more or less constant level throughout the remainder of COR development.

2.3.4.3 COR Ground Activities

Ground activities associated with the daily operations of COR involve primarily the activities of Air Force and Contractor personnel manning the red force threat simulator hardware and the white force instrumentation and data acquisition systems.

Typical use of simulator hardware will require the capability for movement to alternative (prepared) sites on a frequent basis. This may be done to simulate the manner in which an air defense force would utilize mobile radars and missile launchers. When a site is occupied, there will be a crew to operate the simulator equipment. The control site for the defense complex will have additional personnel assigned to perform the command and control functions. At each range area, one site will also be chosen as a range maintenance headquarters which will require a vehicle garage for vehicle repairs, maintenance control vans, and some parking facilities.

A typical range workday will consist of the following routines: First, the crew drives from the maintenance van to the range instrumentation site (i.e., simulator hardware site), an approximate 1/2-hour drive. The instrumentation is warmed up 60 minutes prior to any aircraft arrivals on the range. The equipment is operated for the desired mission time (defined by the departure from the range of the last mission aircraft) and the crew then returns to the maintenance van. The range will be manned for at least five days a week and the typical work day, as defined by the above routines, may average between nine and ten hours. However, from time to time weekend and nighttime activities will be required on the test ranges. Ready access to threat simulator sites is necessary to maximize the mission time on the range. Sites remote from existing roads, and served only by graded but unimproved roads will have minimum mission availability.

2.3.4.4 Bombing and Gunnery Range Activities

Bombing and gunnery activity will take place on the North and South ranges in much the same manner as is presently done on those ranges. This activity involves ordnance deliveries to various simulated stationary and moving ground targets and ordnance usage will generally be similar in types to presently used ordnance. The types of ordnance presently used have already been presented, and it is expected that the annual amount expended on the COR/Nellis ranges will remain in the vicinity of 1400 tons per year.

The full development of electronic scoring systems as proposed for COR will obviate the need for live or even inert ordnance expenditures in many air-to-air and air-to-ground missions. However, there will be a continuing requirement for live ordnance usage whenever it is deemed indispensable to operational realism or essential to pilot and crew training. Offsetting probable reductions in ordnance expenditures under COR is the modest expansion in overall activity anticipated by the time COR is fully developed in the far-term. Consequently, it is expected that overall expenditure of ordnance on the COR ranges will not deviate much in terms of amounts from ordnance expenditures in the past on those ranges programmed to become a part of COR (primarily the Nellis North and South ranges). In all cases of ordnance expenditure it is very unlikely that any new target sites, except those associated with threat simulator sites on the North Range will be adopted for ordnance expenditures.

Ground activity will be associated with the crews assigned to police the range for salvage and expended ordnance fragments as has been done in the past on these ranges.

2.4 EXISTING COR AREA ENVIRONMENT

Environmental impact assessment of the proposed COR must begin by gaining a thorough understanding of the environment, both human and natural, existing in the COR area. Furthermore, descriptions of the environments must be in sufficient detail to allow ready assessment of impacts.

In this subsection detailed descriptions are presented of the human and the natural environment. The human environment is further subdivided into land use, demographic features, economic activities, Indian communities, agricultural and stock grazing activities, mining activities, recreational features, airspace activities, air quality, and archeological sites. Similarly, the natural environmental descriptions are in terms of physiographic and climatic features, major biotic communities, important species, game animals, and migrating species. In each category the descriptions are presented at a level of detail commensurate with the analyses of probable impacts in the sections that follow later.

2.4.1 Human Environment

2.4.1.1 Land Uses

The State of Nevada is easily classed as a "public lands" state in that 86 percent of the total land area is owned by the Federal government and controlled and managed by various of its agencies. Distribution of responsibility for managing the lands depends on the principal purpose for which the land is to be utilized or protected. Thus, the public land is distributed among the agencies listed below with the distribution of these holdings shown in Fig. 2.13.

Bureau of Land Management	47,360,737 acres
Forest Service	5,058,987 acres
Fish and Wildlife Service	2,927,093 acres
National Park Servide	115,880 acres
Bureau of Indian Affairs	7,834 acres
Department of Defense, Atomic Energy Commission,	4,000,000 acres
Bureau of Reclamation	(approx) 466,000 acres

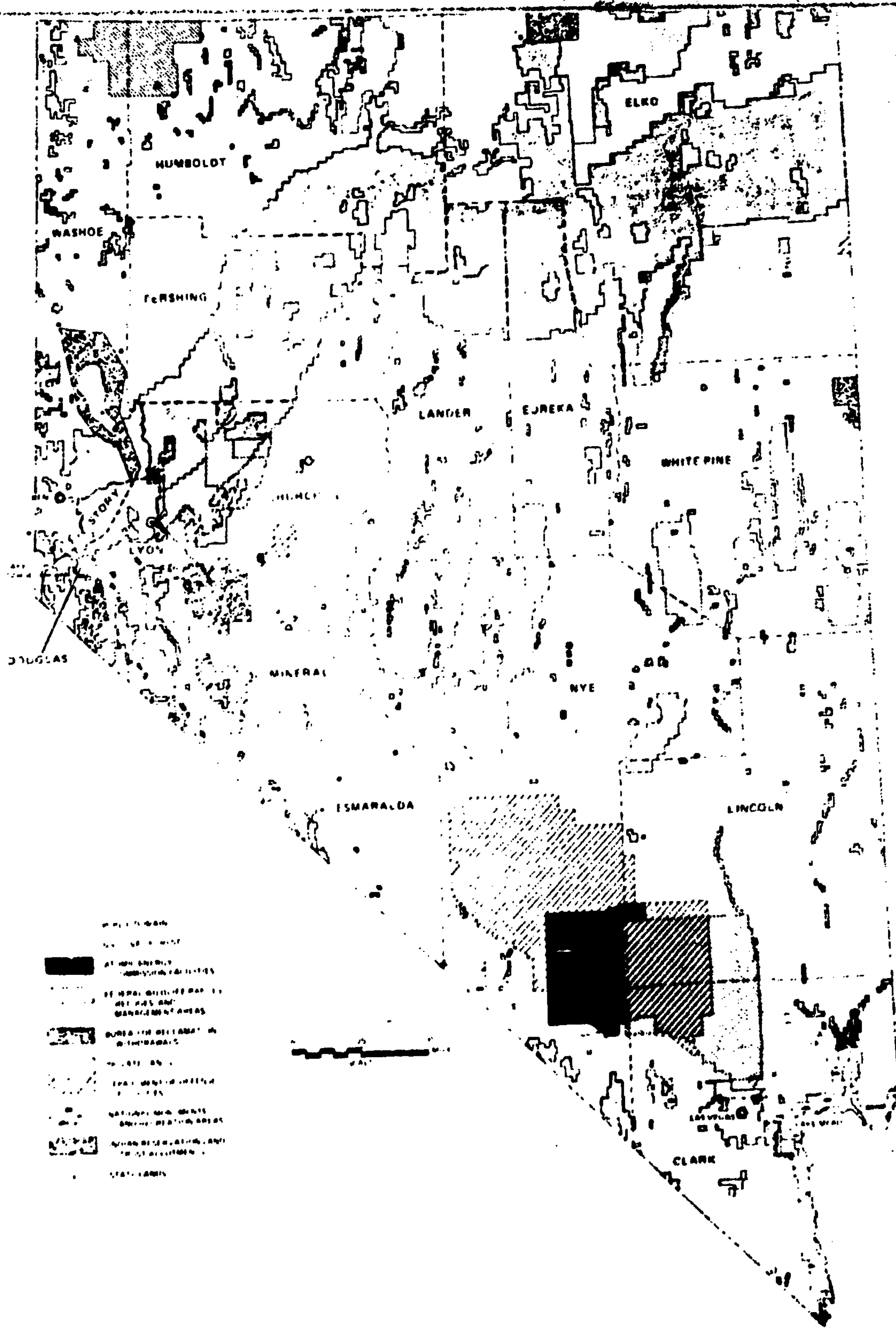


Figure 2.13. Nevada Land Use

The great preponderance of land is in the public domain and is largely unsuitable for agricultural development because of a paucity of water. This land is managed by the Bureau of Land Management (BLM) but it is utilized by ranchers and stockmen for grazing cattle and sheep. They do so under permits granted by the BLM, the permits specifying the number of animals, seasons, and length of time the ranges may be used. These lands may also be utilized for other purposes but are subject to withdrawal for more specific and "higher" purposes; for example, for recreation, wildlife protection, or reclamation.

The remainder of the land under public management was formerly part of the public domain but has been withdrawn for specified purposes. The Forest Service has jurisdiction over a large portion of the timber lands of the State. These are within the Toiyabe and Humboldt National Forests and are located generally across the central and northern sections of the State. The fundamental principle of management guiding the Forest Service is multiple-use, i.e., that these forested areas should serve many public purposes including production of timber, recreation, watershed protection, grazing of stock, and protection of wildlife. Only a minor fraction of land in the national forests is suitable for commercial production of saw timber; the other purposes are paramount.

In contrast with the BLM and Forest Service, other public land tends to be utilized for specific and single purposes. Two of the best examples of this are the Nellis Air Force Base Bombing and Gunnery Range and the Nevada Test Site of the Atomic Energy Commission. Other withdrawals for military or defense purposes are found near Hawthorne and in the Fallon area. The Desert National Wildlife Refuge is located in Southern Nevada adjacent to and overlapping the Nellis Air Force Bombing and Gunnery Range. This facility, as well as several smaller wildlife refuges throughout the State, is managed by the Bureau of Sport Fisheries and Wildlife of the Department of the Interior.

There are two very large Indian reservations in the western part of the State, encompassing or adjacent to the two largest natural water bodies in the State. These are the Pyramid Lake and Walker River Indian Reservations.

Private land is concentrated in the urban areas of Nevada--chiefly around Reno and Las Vegas--and in all areas where irrigation makes agriculture practical. In addition, there is a swath of private land across the northern half of the State, interspersed with public domain land in a checkerboard fashion, the result of land grants to the railroads in the nineteenth century. The Southern Pacific Railroad still owns approximately 1.5 million acres, having sold upwards of 3.5 million acres to other private parties.

Although not shown, the western portion of Utah, which is also part of the COR area, is very similar in land use pattern to that described above for Nevada. Probably among the more significant features of western Utah are the Bonneville Lake bed and the Hill and Wendover Air Force test ranges that partially occupy it. There are no national forest preserves in the portion of western Utah included in the COR area.

Because of its arid climate and the large fraction of the land in government ownership, Nevada is very sparesly populated and will probably continue to be so with the exception of growth at the urban centers of Las Vegas and Reno. The remainder of the State has scattered small communities and many large ranches. These factors combine to provide rural Nevada with unique qualities of solitude and quiet.

Modification of Air Force activities through the development of COR may have impact of a variable nature on the region of Southern Nevada, the communities located in that region, and the people who both live and visit there. Much depends on the intensity, location, and character of the use of the ground and airspace. Much also depends on the values that are associated with the quality of life as it presently exists in the region.

It is difficult to establish an accurate appraisal of the values the residents of Southern Nevada hold and the quality of their lives as perceived by them. However, we may point to some values expressed by historians and commentators on the quality of life in that state.

An early writer noted[1*] the attractions of the State in terms of its spaciousness and solitude and the unsophisticated nature of the people settled there. He further observed that the scarcity of water was largely responsible for Nevada's meager population and was also impressed with how intact its pristine environment was, with the exception of the small but visible excavations of past and present mining explorations and existing farming activities along the drainage bottom lands.

A more contemporary interpreter of the Nevada scene[2] similarly observed its desert beauty and primitive qualities which seemed to give the area a measure of vastness and stillness. He observed how clear the atmosphere is and the cleanliness that it seems to give to the rugged landscape. He noted, however, that because of man's alterations the Nevada desert is no longer a true natural area but that it has retained much of its solitude which he felt is a major attraction of the region.

Whether or not these views and sentiments prevail throughout the communities in Southern Nevada in the region of COR is difficult to establish. We should note that in the cases of Tonopah and the Caliente/Panaca/Pioche area that there is a history of accommodation to local Air Force uses of the environment which appears to be amicable for the most part. Consequently concern with alterations in the existing "quality of life" will deal mostly with any new areas that might become more integrally involved with Air Force operations than they have been in the past. Based on the proposed COR action, these areas would be in COR North or under the potential flight tracks that will link Hill/Wendover/Dugway with the Nellis Range complex. COR North is more sparesely populated than is either the

---

*Superscripted numerals cite materials in Part 1 of the References. In some instances, citations will be by [author, year], and the cited materials will be found in Part 2 of the References.

Tonopah or the Caliente areas, and H/W/D-to-Nellis flight tracks can probably avoid populated areas to a significant degree.

2.4.1.2 Economy and Demography of the COR Area

This section discusses the economic and demographic conditions existing in areas surrounding the proposed COR operation. Information is provided in two levels of detail. General economic and population data are provided for an extensive geographic area surrounding Fallon, Nellis, and H/W/D. More detailed data are provided for those areas which are potentially most affected (e.g., Lincoln, Nye, and Clark Counties). This data is provided so that the potential direct and induced economic impacts may be compared with existing conditions to show the relative importance of these impacts.

Appendix H contains data on the sources and amounts of personal income. In addition, the even numbered tables in Appendix H indicate the dominant "industries" through the use of location quotients.* Table 2.11 summarizes the important data of Appendix H. Where there is more than one industrial sector, they are ranked in order of importance. In general, the area is characterized by economies based upon government activity, mining, farming, and tourism. The service sector is not shown in the tables for Clark and Nye Counties. This is the sector which would reflect the importance of tourism. Data from other sources indicate that tourism is an important industry in both of those counties.[3-5]

Table 2.12 summarizes the employment data which is detailed in Appendix I. The latest year for which complete yearly data are available is 1972.

---

*Location quotients are the regional ratio of "industrial" payroll to total payroll divided by that national ratio. "Industrial" refers here to the economic sector (e.g., mining, military) under consideration rather than some specific industry. Location quotients serve to measure the relative concentration or importance of an industry in an area. Since location quotients are derived from payroll rather than employment figures, they more accurately reflect the total impact (direct and indirect) of an industry.

TABLE 2.11

PRINCIPAL INDUSTRIAL SECTORS (1971)*

Carson City, Nev.	State government
Churchill County, Nev.	Military, federal civilian, farming
Douglas County, Nev.	Services, farming
Elko County, Nev.	Farming, mining
Las Vegas SMSA,** Nev. (Clark County)	Military, construction
Lincoln County, Nev.	State & local government, mining, farming
Lyon County, Nev.	Farming
Nye County, Nev.	Mining, military
Reno SMSA, Nev. (Washoe County)	Services
Storey County, Nev.	Mining, trade, farming
White Pine County, Nev.	Farming, state & local government
Box Elder County, Utah	Farming, manufacturing, federal civilian
Juab County, Utah	Mining, farming
Salt Lake City & Ogden SMSA, Utah (Davis, Salt Lake, & Weber Counties)	Federal civilian
Tooele County, Utah	Federal civilian, mining

*Department of Commerce, Bureau of Economic Analysis, Regional Economics Information System.

**SMSA, Standard Metropolitan Statistical Area.

TABLE 2.12

EMPLOYMENT SUMMARY (1972)*

	Total Work Force	Unemployment Rate	Total Employment
Carson City	10,110	11.6%	8,940
Churchill	3,950	8.5%	3,620
Douglas	11,190	7.3%	10,360
Elko	7,740	5.5%	7,320
Las Vegas	141,100	7.2%	130,700
Lincoln	1,940	10.7%	[illegible]30
Lyon	3,050	9.4%	2,760
Nye	6,580	1.5%	6,490
Reno	76,000	5.8%	71,600
Storey	450	12.3%	3[illegible]0
White Pine	4,560	5.9%	4,290

*Nevada Employment Security Department

Tables 2.13 and 2.14 show population, population growth patterns, and density for the extensive area surrounding the proposed COR operation.

As indicated in Table 2.7, the proposed COR personnel will be primarily located in three areas; Nellis/Indian Springs, Caliente, and Tonopah. Thus we are primarily concerned with the Las Vegas SMSA (Clark County), Caliente/Panaca/Pioche (Lincoln County) and Tonopah (Nye County) areas.

Clark County's economy has two fundamental bases of strength--government spending and recreation. Employment in these two activities enjoyed phenomenal growth in the 1960s. Recreation, which now accounts directly for 25 percent of non-agricultural employment, nearly doubled in that decade. Business services employment, which includes mainly AEC-related activities and represents approximately 5 percent of non-agricultural employment, has multiplied more than 400 percent in the 1960s. In comparison, manufacturing, which accounts for 3.1 percent of Clark County's employment, has increased by only 43 percent in this period.[3]

Currently, the Federal Government and its contractors are by far the largest single employers in Clark County. Total employment is almost equally split between the AEC and the US Air Force. The activities of the AEC are concerned with two major areas--the testing of nuclear weapons and explosives and the test of nuclear engines. The largest activity by far is weapons and nuclear explosives testing. These tests are of two basic types: military weapons and the testing of nuclear devices for peaceful uses (Plowshare Program). Approximately 9,000 persons are employed by the AEC and its contractors. In addition, the AEC spends from $10 to $20 million a year for local goods and services.[3]

As of December 1973, Nellis AFB, situated just north of Las Vegas, employed 7,600 military personnel and 928 civilians. These 8,528 workers had a total of 15,374 dependents (spouses and children) bringing the number of persons depending upon Nellis AFB to 23,902, or roughly

[illegible]

COUNTY POPULATION

	1960*	% Change	1970*	1972**	Density of People Per sq. mi 1970**
Carson City, Nev.	5,163	199.6	15,468	20,000	103.1
Churchill County, Nev.	8,452	24.4	10,513	11,500	2.2
Douglas County, Nev.	3,481	97.7	6,882	8,500	9.8
Elko County, Nev.	12,011	16.2	13,958	14,600	0.8
Las Vegas SMSA, Nev. (Clark County)	127,016	115.2	273,288	295,000	34.7
Lincoln County, Nev.	2,431	5.2	2,557	2,200	0.2
Lyon County, Nev.	6,143	33.8	8,221	9,500	4.0
Nye County, Nev.	4,374	28.0	5,599	4,700	0.3
Reno SMSA, Nev. (Washoe County)	84,743	42.9	121,068	130,500	19.0
Storey County, Nev.	568	22.4	695	700	2.7
White Pine County, Nev.	9,808	3.5	10,150	10,300	1.1
Box Elder County, Utah	25,061	12.2	28,129	---	5.0
Juab County, Utah	4,597	(0.5)	4,574	---	1.3
Salt Lake City & Ogden SMSA, Utah (Davis, Salt Lake, & Weber Counties)	558,379	22.5	683,113	---	416.5
Tooele County, Utah	17,868	20.6	21,545	---	3.1

* US Census of Populations: 1970, "Number of Inhabitants"

** Nevada Department of Economic Development

TABLE 2.14

CITY POPULATION*

	1960	% Change	1970
Caliente, Nev.	792	15.7	916
Henderson, Nev.	12,525	30.9	16,395
Las Vegas, Nev.	64,405	95.3	125,787
North Las Vegas, Nev.	18,422	96.6	36,216
Panaca	458	17.7	539
Pioche, Nev.	696	(7.9)	641
Reno, Nev.	51,470	41.6	72,863
Sparks, Nev.	16,618	45.5	24,187
Tonopah, Nev.	1,679	2.2	1,716
Bountiful, Utah	17,039	63.5	27,853
Brigham City, Utah	11,728	19.4	14,007
Clearfield, Utah	8,333	50.8	13,316
Murray, Utah	16,806	26.2	21,206
Ogden, Utah	70,197	(1.0)	69,478
Roy, Utah	9,239	55.4	14,356
Salt Lake City, Utah	189,454	(7.2)	175,885

* US Census of Populations: 1970, "Number of Inhabitants"

Best Available Copy

8 percent of the 295,000 total population of Clark County. A payroll of approximately $83 million was spent locally for purchased transportation, utilities, maintenance, and services.[3]

Concern has been expressed over being heavily dependent on just two major export industries--particularly since gambling and weapons testing are so heavily influenced by governmental action. The future of government activities in Southern Nevada is a key factor to be considered in evaluating the economic prospects of the area.

While the civilian work force has increased about 9 percent a year over the decade, the unemployment rate has varied between a low of 3.9 percent and a high of 7.2 percent. The relatively high unemployment rate is understandable because of the cyclical nature of the employment pattern, especially in some of the service sectors.[3]

The service sector accounts for approximately 39 percent of all wage and salary employment in Clark County. It includes the important employment groups, hotels and amusements, and business services which includes employment at the AEC test site. This category has grown at an average annual growth rate of 10 percent; this is one of the fastest growing major sectors of the Southern Nevada economy.[3]

Tonopah is an example of a town which owes its beginning to the mining industry. The first discovery of silver in Tonopah occurred in 1900 and it triggered a bonanza that stimulated mining in the West for a decade and awoke Nevada from hard times and declining population. By autumn 1902 the town had 3,000 inhabitants. It became the hub of railroad service for the region, and became the seat of county government. By 1907 Tonopah had become a modern mining town of more than 20,000 inhabitants and possessed "five banks, modern hotels, . . . , cafes, opera house, school, lavish gambling palaces, electric and water companies, and an array of other businesses housed in fine stone edifaces [sic], a few reaching four and five stories." Tonopah became the outfitting point for prospectors and the distribution and supply point for new camps as they developed.[6]

Tonopah reached its peak in 1910-1914 and continued to have many good years until the Depression. Its four principal companies continued operation until World War II. In 1947 the local railroad was abandoned. As one observer put it, "Tonopah as a historic spot has been immortalized--and justly so. Virginia City had put Nevada on the map; Tonopah kept it there."[6]

Tonopah survived the decline of mining for a number of reasons. Situated on the main highway between Reno and Carson City in the north and Las Vegas in the south, it continued as a service center for the nearby ranching and agricultural interests. During World War II the military services constructed an airbase nearby for purposes of tactical instruction. Tonopah also became a headquarters for tourists visiting the mountain deserts.[7]

The 1970 census found Tonopah with a population of 1,716, almost a third of the total population of Nye County. There are six motels and one hotel having a total of 400 rooms; a 40-bed hospital, seven churches, one bank, one weekly newspaper, and radio-TV service from Las Vegas. There are two schools, one elementary and one secondary. Bus, truck and plane service are all available. There is the usual assortment of services; service stations, restaurants, bars and bowling alleys.

Tonopah has continued to benefit as well as to suffer from activities of the federal government. The Central Nevada Atomic Test Site of the Atomic Energy Commission is located nearby as is the Sandia Test Range. The 866th Radar Squadron of the US Air Force was stationed there until 1969 but was transferred to Las Vegas. The combined result was a population loss of 500 people.

Mining continues to be an important activity in the area. The search for mineral wealth has made Nye County the only oil producing area of any importance in Nevada. With rising prices for minerals and therefore renewed interest in exploration and development, it may well be that Tonopah could experience a new mining boom. But the consequences are unlikely to be those of the early twentieth century. Mining operations are highly mechanized and not likely to create the demand for labor that characterized the earlier days.

Tonopah is extremely vulnerable to the changes in the activities and spending policies of the federal government. Ninety percent of Nye County is owned by the federal government. Of that total, 58 percent is managed by the Bureau of Land Management, 15 percent by the Forest Service and 24 percent by "others," largely the Department of Defense.

The dominant industry of Nye County is government, but the leading employer in the County is the service industry, accounting for 28 percent of the employment. A good portion of the service industry directly supports AEC activities, however. Government follows with 20 percent and mining is third with 14 percent. Tourism presumably will figure very strongly in Tonopah's future. A community center has been constructed holding 400 persons and will serve as a convention center for the many state organizations that like Tonopah because of its central location.

Another area that is likely to be impacted by COR operations is the Caliente, Pioche, Panaca area north and east of Nellis Air Force Base in Lincoln County. The three towns together number nearly 2100 of the county's 2,557 total population according to the 1970 census. The largest is Caliente with a population of 916.

The industry of the area consists primarily of mining, agriculture, chiefly livestock raising, and tourism. Pioche enjoyed boom and bust periods from its beginnings in about 1868. After the railroad was extended to the town in 1907, it became "...an attractive camp with several substantial business houses, water system, school, bank and the Pioche Record."[6]

In recent years it has been an outstanding producer of lead and zinc. From 1937 to 1956 the mines prospered but then declined in 1958. Since the mid-1960's there has been increased mining activity again. A recent report in The Nevadan[8] indicates that several big companies are interested in reopening the mines and that work has begun again in nearby communities. More important than mining at the present time is tourism. "High timbered country, fresh cool air, clean uncluttered land and nearby lakes bring more gold these days than buried ore. Wide awake leaders of the community are betting on these factors to hit pay dirt. Both tourists and permanent citizens are needed."[8]

It seems clear that those planning for Pioche's future are emphasizing tourism as a major factor in the economic future of the area. Included in its plans are a series of reservoirs. The area already experiences significant increases in its summer population from tourists and it may be expected that there will be an increased demand for summer recreational homes and trailer sites.

Like the Tonopah area, government plays a crucial role in the lives of residents of Lincoln County. Ninety-nine percent of the land is in public ownership and almost all of that is owned by the federal government. The Bureau of Land Management manages 82 percent of the public land. Government accounts for 38 percent of the employment in the county while trade and services account for only 13 percent and 5 percent, respectively. The latter figures are far lower than for the State of Nevada as a whole.

It seems clear that those planning for Pioche's future are emphasizing its role as a frontier town--restoring the so-called "Million Dollar

Courthouse" with federal assistance, restoring the 1880's look to the buildings from the Depression vintage that they now display. They contemplate reopening the airstrip and adding a lodge, building a rodeo grounds, and developing a park, golf course and facility for travel trailers.

The water system of the two reportedly can handle 15,000 people but there are those who are not anxious to see the town grow much larger, and alter its basic character. In 1970 there were 21 hotel and 12 motel rooms, three churches, a bank, a weekly newspaper, an elementary school, weekly rail freight service, and an airport. It is small, isolated, and perhaps unexciting, but it has other qualities worth retaining: friendliness, and toleration of privacy. "So it is a valid fear that some of these valued traditions will be lost with the influx of newcomers. But the choice appears to be between a severely depressed economy and descent to ghost town status, a status that Pioche has fought vigorously to avoid."[8]

Lincoln County is undoubtedly concerned about its economic well-being since it has the lowest median family income in the state. The county has been designated a redevelopment area by the Department of Commerce's Economic Development Administration. The county is therefore qualified to receive grants and low interest loans from EDA.

Caliente is a somewhat larger town and provides some services not available in Pioche. There is a 27-bed hospital, 3 churches, an elementary school, a newspaper (the Caliente Herald) and a municipal park, swimming pool, library, youth center. There are (or were in 1970) 27 hotel and 38 motel rooms. For banking services, residents of Caliente must go to Pioche. For high school, students of both Pioche and Caliente must go to Panaca.

Panaca was, and presumably remains today, a quiet Mormon town founded by Mormon colonists in the 1860's. Its only church is Mormon. One of its chief economic pursuits is agriculture. It has only one motel with four rooms (in 1970) but it had a high school and a library. The emphasis remains on families and "stable, modest, comfortable homes."[9]

2.4.1.3 Indian Communities

There are three principal tribes in the State of Nevada: Washoe, Paiute, and Shoshone.

The Washoe tribe is located mainly on reservations in the western part of Nevada. They are a small tribe, but are well-known for their famed basketmaker, Dat-So-La-Lee. The Washoe tribal grounds extended into California and some of the tribe still lives there.

The Paiutes are a large tribe extending into many western states. They are excellent craftsmen. In the past, they lived from the land, enjoying fishing from their many fine lakes and hunting the surrounding land. Their two outstanding chiefs were Winnemucca and Captain Truckee.

The Shoshone also extend into many surrounding states, having a reservation even in Death Valley. These people are also good craftsmen, and today they are a progressive people, looking to the future along with their fellow Indians.

Each tribal group has a tribal council composed of five or more members with a chairman and vice-chairman. All of the tribes are members of the Inter-Tribal Council of Nevada, or are eligible for membership. The Inter-Tribal Council is made up of the tribal chairmen of each group and its delegates.

The resident population is small because many live off the reservations. The total Indian population in Nevada is 6,681. The residents and members per reservation are listed in Table 2.15.

TABLE 2.15

INDIAN RESERVATION LANDS AND POPULATIONS

RESERVATION Tribe	Acres	Total Members	Resident Population
DUCK VALLEY			
Shoshone	290,419	1,200	817
DUCKWATER			
Shoshone	3,785	150	63
FALLON			
Paiute-Shoshone	5,480	1,200	127
GOSHUTE			
Shoshone	110,332	200	109
FORT McDERMITT			
Paiute-Shoshone	34,650	500	353
MOAPA			
Paiute	1,174	350	73
PYRAMID LAKE			
Paiute	475,086	900	399
SUMMIT LAKE			
Paiute	10,506	50	1
SOUTH FORK			
Shoshone	18,000	102	102
WALKER RIVER			
Paiute	319,547	1,000	375
YOMBA			
Shoshone	4,682	100	61

The Indian reservations are rich in natural resources and recreation potential. Many large undeveloped mineral deposits are located on reservation lands, and include nickel, copper, iron, silver, gold, some oil, and common varieties of gravel, sand, and limestone. Other resources include livestock and agricultural production. Recreational facilities and potential include Pyramid Lake, 30 miles north of Reno, which has good fishing, water skiing, boating, camping, and hiking areas; Walker Lake (Walker River Reservation), 100 miles from Reno, has good fishing and boating; Fallon Reservation, which is near some of the best duck and goose hunting in the state; Duck Valley Reservation, which has Sheep's Creek Reservoir and Wildhorse Dam, two very good fishing areas; and Goshute, which has great potential as a game ranch, if stocked and expanded. All the reservations have wide open spaces for horseback riding and hiking.

Although some of the reservations enjoy developed industrial parks (e.g., at Fallon and Pyramid Lake), the current unemployment rate is high. The Indian people want to remain in their homes, but as of now there are few jobs available to them. The nearest Indian communities to the COP/Nellis range are the Yomba, Duckwater and Moapa Reservations, all relatively small ones.

2.4.1.4 Agricultural Activities

Agricultural activities are limited to a few specific areas where water is available for irrigation. In and near the vicinity of COP/Nellis, there are only a handful of agricultural areas, as listed in Table 2.16 and shown in Fig. 2.14.

2.4.1.5 Domestic and Feral Livestock Grazing

Horses and Burros. Feral livestock consisting of horses and burros have escaped the close domestic management of man and now graze freely throughout much of the COP Area and may persist scattered throughout the western United States generally. These animals are still escaping into the wild; thus, their populations are made up of animals that have been removed from man's management practices for hundreds of years with long histories of isolation and interbreeding, and those that are essentially domestic but free grazing.

TABLE 2.16

AGRICULTURAL AREAS IN OR NEAR COR, WITH THEIR APPROXIMATE SIZE AND PRINCIPAL CROPS

Agricultural ARea	Principal Crops	Approximate Acreage
Pahrump Valley	Cotton, Alfalfa	10,000
Pahranagat Valley	Alfalfa	8,000
Lower Meadow Valley Wash (several locations)	Alfalfa	800
Sunnyside	Alfalfa, Small Grains	200
Panaca-Caliente	Alfalfa, Small Grains	12,000
Las Vegas Valley	Alfalfa, Sorghum, Raw Crops, Dairy	25,000
Moapa Valley	Alfalfa, Sorghum, Raw Crops, Dairy	3,000
Virgin Valley	Alfalfa, Small Grains, Dairy	2,400
Beaver Dam Area	Alfalfa	300
Enterprise Area	Alfalfa, Small Grains, Potatoes	18,000
Isolated Ranges: Warm Springs, Twin Springs Ranch, Armagosa Valley, Ash Meadows, USAEC Experimental Ranch, Stone Cabin Valley		1,500
TOTAL		88,380

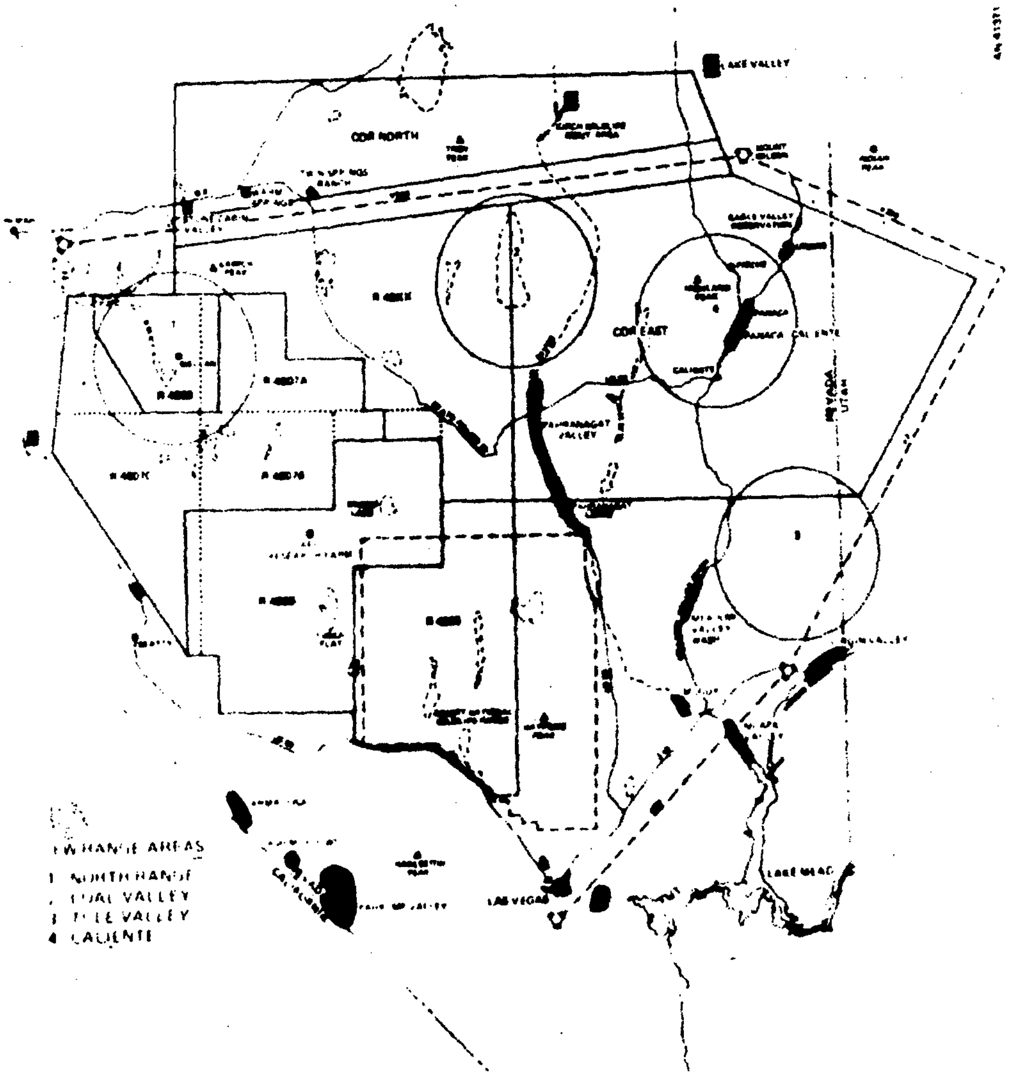


Figure 2.14. Agricultural Areas Within the COR/Nellis Range Area

At the present time there is a very high level of public interest in wild horses for their aesthetic appeal. There has been some concern expressed about wild horse competition with range livestock, but this is not too frequent.

In recent years wild horses particularly and sometimes burros have caught the attention and imagination of many North Americans, so much so that recent legislation has been passed to protect them.

Presently there are an estimated 17,000 wild horses and 190 burros in Nevada, while Utah supports only 500-600 wild horses and five burros. Distributions of animals within COR are shown in Fig. 2.15. About 200-250 (40 to 50 percent) of the wild horses in Utah and all of the burros (Gandy area) are included on ranges that may be covered by proposed operations from H/W/D to either the Caliente EW Range or Tule Valley EW Range area. The principal regions where the wild horses are found are the: Confusion Range with about 100, Crystal Peak area with about 30, Conger Range with 5-10, House Range with about 100, and Northern Hamblin Valley with 5-10.

There are approximately 2,776 wild horses and 123 burros in and near the COR/Nellis area as shown in Fig. 2.15. Since management has not been intense, there is little known about their biology or space requirements. These animals have historically been in and near the Las Vegas Bombing and Gunnery Range, some being associated with the Bureau of Land Management (BLM) lands. Wild Horse Range (now included in the vicinity of North Range) has a fair population where they have had a history of exposure to Air Force activities.

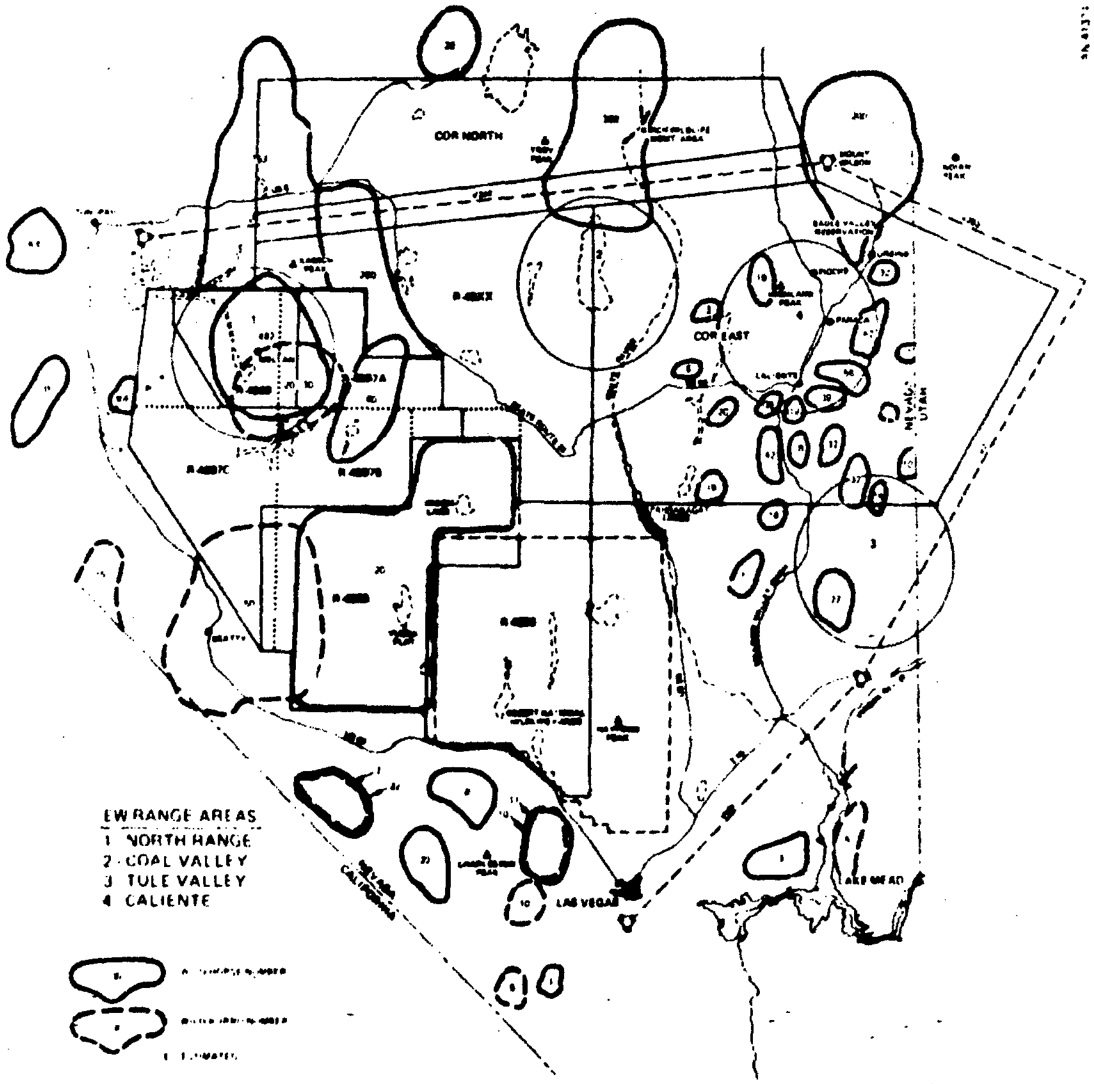


Figure 2.15. Wild Horses and burros Within the COR/Nellis Range Area

Livestock. Ranges in the Great Basin are used as winter ranges, summer ranges, and sometimes as continuous use ranges, depending on the management system. Ranching is carried on throughout the Great Basin and consists primarily of seasonal grazing for cow-calf operations. In the southern portion of the COR Area much of the grazing is year-round where the lands are administered by the Bureau of Land Management. Range is leased on the basis of one Animal Unit Month (AUM) per designated acreage. Figure 2.16 shows the distribution of AUMs permitted within designated management units. For instance, in Nye and Esmeralda counties on Section 15 (Taylor Grazing Act) lands, the AUM is established at one per 52 acres, and grazing is year-round. Currently these areas support 4,429 cattle under permit and harvest about 34,113 AUMs of forage. The AUM is expressed as the forage required by one 1,000-pound cow and her calf, or a 1,000-pound steer or bull for one month. It is generally assumed that the forage consumed in an AUM is approximately 900 pounds of air dry forage. However, forage consumption rates throughout COR and vicinity are probably lower, usually not exceeding 700 pounds and often as low as 500-[illegible]00 pounds of forage consumed per month.

Other lands in Clark County are managed under an Ephemeral Range Classification category where ranchers apply for forage when it becomes available; and grazing occurs anytime during the year. Approximately [illegible] cattle and sheep harvest 35,000 AUMs in the eight grazing units--Charleston, Pahrump, Sandstone, Searchlight, Moapa, Taquop, Key West--Virgin Mountain and Gold Butte Units

Other parts of the Las Vegas BLM Grazing District are administered with grazing rights carefully adjudicated based upon forage requirements, water availability, and base property. Approximately 7,447 cattle graze 75,84[illegible] AUMs on the Sandsprings, Pahranagat, Delamar, Panaca, Clover, and Kane Springs Unit. One additional unit, Tole, has 6,[illegible]54 cattle and sheep harvesting 32,271 AUMs. Mountain allotments are grazed in the summer only, and desert valley allotments year-round.

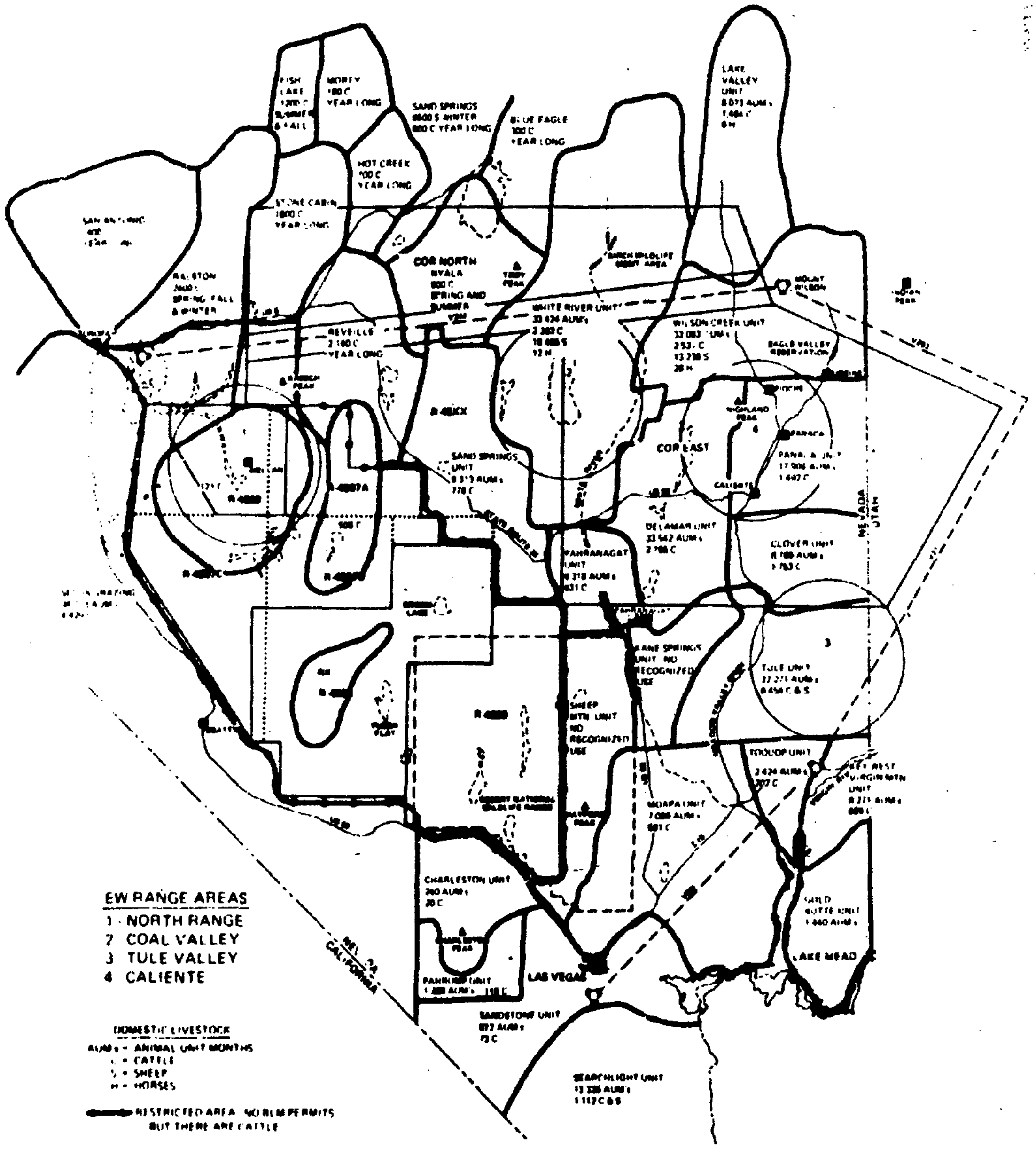


Figure 2.16. Domestic Livestock Within the COR/Nellis Range Area

Adjudicated grazing units in the Ely Grazing District of BLM in the northeast corner of COR and vicinity include White River, Lake Valley, and Wilson Creek. In this area 6,388 cattle, 26 permitted horses, and 31,723 sheep graze 74,560 AUMs of forage. These areas are generally grazed by cattle year-round and by sheep during the winter months from November 1 to April 30.

Grazing units in the Battle Mountain Grazing district of the BLM in the northern part of COR and vicinity include San Antonio, Ralston, Fish Lake, Stone Cabin, Morey, Hat Creek, Reverille, Sand Springs, Blue Eagle, and Nyala. A total of 11,520 cattle are permitted in this area along with 9,500 sheep; the latter are all found within the Sand Springs Unit of the Battle Mountain BLM district.

Sophisticated management programs are being developed by the BLM to include additional fencing, water development, and specific turn-on, turn-off dates for rest-rotation grazing and other grazing management systems. Normally, cattle are not found in the presently restricted areas of COR; however, some do graze in these areas. The Atomic Energy Commission has an experimental herd of about 80 animals on the Nevada Test Site. In R-4809 and proposed R-4807C, southwest of Kawitch Peak, AEC recently counted 121 trespass cattle. In the southern end of Kawitch Valley in proposed R-4807A and R-4807B, 508 cattle were counted in trespass [Brechbill, 1973].

Trespass cattle grazing has been and continues to be a problem in management of the Air Force test ranges. The Air Force in cooperation with the Bureau of Land Management (BLM) and the AEC has attempted several alternative solutions to this problem but as yet it remains unresolved.

Livestock in Utah within potential corridor areas are generally present during winter months from November 1 to April 30. They are not generally scattered but are found in scattered clumps. The area west of Thomas and Dugway ranges contains about 15-20 thousand head of sheep Fewer than 1,000 head of cattle occur there, and the numbers vary considerably annually. The Gold Hill Area contains less than 5,000 sheep and a few hundred cows. The Confusion Range has about 5,000 sheep and 650 cattle. The Buckskin Range-Crystal Peak Area supports about 2,000 sheep and 175 cattle. The Conger Range supports about 15,500 sheep and 160 cattle. The House-Swazey Range area supports about 20,200 sheep. Between Hamblin Valley Wash and Crystal Peak, about 4,300 sheep and 2,400 cattle are wintered. The Garrison area support cattle all year round, but the numbers are not available.

Mining Activities (Fig. 2.17). Mining activities in the COR area are extremely varied, based on the type of ore and the size of the operation, the latter being reflected by numbers of men employed. Also, there are a number of "free lance" prospectors found in many areas of the COR area, but their activities are difficult to assess since most prospect on a part-time basis in the local vicinity of their homes. More important are the explorations in the COR area for minerals, gas, and oil. There seem to be about 200 active firms exploring at the present time, and many oil and gas leases have been requested from the Bureau of Land Management and the US Forest Service. Results of these explorations could alter the mining and drilling activities in a few short years.

Mining activities in Utah of concern to this ES are limited to those underlying potential H/W/D flight corridors near the Utah-Nevada border.

Much of the mining activity in regions around Caliente and Tule Valley ceased around 1965 with the withdrawal of government funding, and few mines remain today (USGS, 1969). The total personnel involved numbers fewer than 50. Scores of registered mining claims exist in this area, but no attempt is made to indicate all of them.

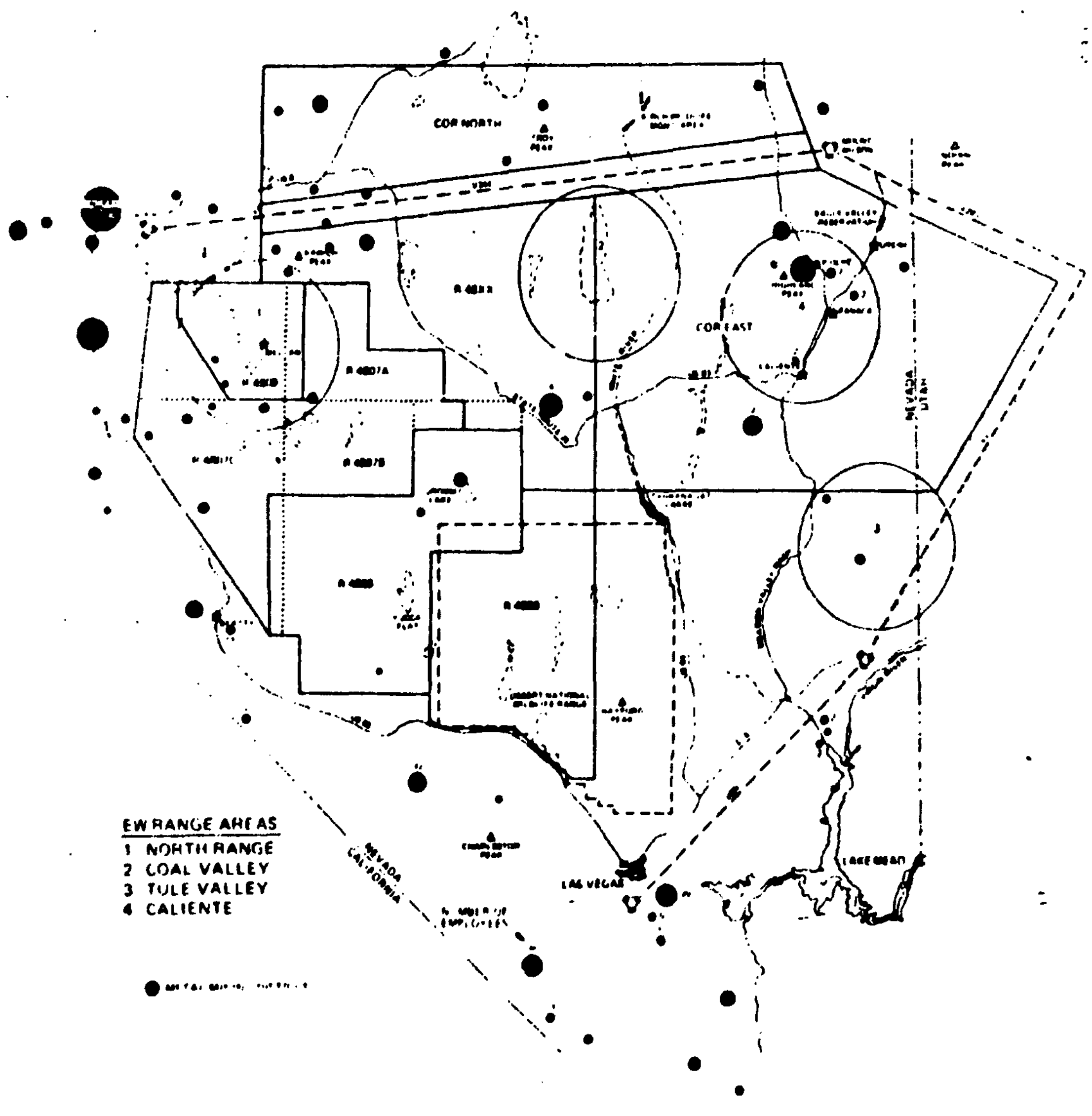


Figure 2.17. Metal Mining Within the COR/Nellis Range Area

Those currently in operation and some of the more significant mines with potential of reopening are mentioned below. Perhaps the most important is the Spor Mountain Area in Juab County. This mine, along with a less important mine near Gold Hill, in Tooele County, contains one of the world's largest known deposits of beryllium [USGS, 1969].

Activities large enough to be considered significant operations are: (1) Gold Hill-Clifton Area at the northern end of the Deep Creek Range. Mining and potential mining activities include vermiculite, tungsten, gold, silver, copper, lead and arsenic. There are presently five to fifteen men employed; (2) Ibapah-Callao Area in the Central part of the Deep Creek Range. The Probert mine in this area produces Mercury. About ten men are employed in the general Callao area. (3) Spor Mountain-Thomas Range Area where the world's largest beryllium deposit is located along with deposits of fluorspar and uranium. There are presently about 15 men employed. (4) Garrick Mine-Fish Springs Range. Mining in this area has recently been suspended, but the primary mineral was barite. (5) House Range-Notch Peak Area produced primarily tungsten, but it is presently inoperative. (6) The San Francisco Mountains Area mine is presently inactive, but recently produced gold and thorium.

Mining activities in Nevada currently include 114 operations employing about 4,409 men [Springer, 1972], most of which are in the COR/Nellis area as shown in Fig. 2.17. There are approximately 16 operations in and around COR in southern Nevada, employing about 310 men. Throughout the total COR area mining activities produce gold, silver, copper, tungsten, mercury, lead, zinc, iron ore, gypsum, diatomoceous earth, silica sand, limestone, opals, barite, turquoise, pozzolan, perlite, gravel, silicon ore, magnesite, volcanic cinder, fluorspar, dolimite, calcined lime, and raw clay. Lithium carbonite is produced from wells near Silver Peak in Esmeralda County.

Active or exploratory mines within or in the close vicinity of the COR/Nellis range produce gypsum, silica sand, limestone, silver, gold, pozzolan, tungsten, perlite, gravel, diatomaceous earth, volcanic cinder, fluorspar, lead, and zinc. Most of these mines are located soutn of COR, although Lincoln County mines in the Caliente EW Range employ about 15 men. Other mining districts in COR are presently inoperative.

Recreation. Developed recreation facilities are numerous throughout the Great Basin where they usually provide substantial economic benefits to the community and state. These activities include hunting for big game, small game and waterfowl, sport fishing, water skiing, camping, swimming, snow skiing, hiking, mountain climbing, rock hounding, outdoor photography, and generally enjoying the out-of-doors. Because of the generally arid environment and possibly a larger number of possible activities, much of the outdoor recreation is centered around water sources, most of which are illustrated in Fig. 2.18 and listed below.

1. Stillwater National Wildlife Refuge
2. Ruby Lakes National Wildlife Refuge
3. Carson Lake Waterfowl Hunting Area
4. Cave Lake Recreation Area
5. Railroad Valley Wildlife Management Area
6. Kirch Wildlife Management Area
7. Eagle Valley Dam
8. Beaver Dam State Park
9. Key Pittman Wildlife Management Area
10. Pahranagat National Wildlife Refuge
11. Overton Wildlife Management Area
12. Lake Mead National Recreation Area
13. Cathedral Gorge State Park
14. Valley of Fire State Park
15. Kershaw Ryan State Park

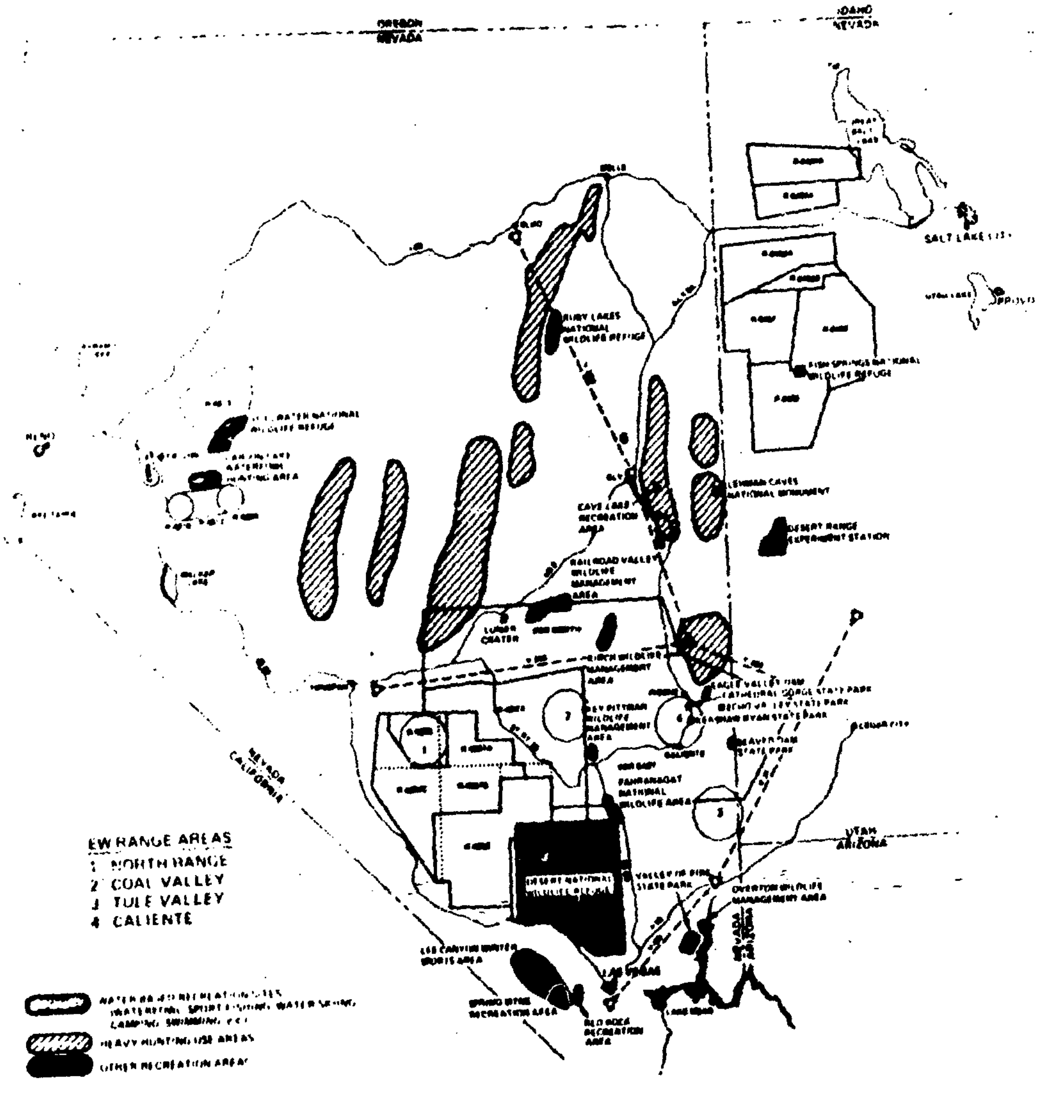


Figure 2.18. Recreational Areas in the COR Region

16. Lee Canyon Winter Sports Area
17. Echo Valley State Park
18. Lunar Crater
19. Fish Springs National Wildlife Refuge
20. Desert Range Experiment Station

All of these areas are presently receiving increased recreational use, as measured by visitor days, hunter days, overnight visitors, etc. As populations increase and urban environments become denser, the use will continue to grow. Table 2.17 presents the 1971 usages of selected areas in the COR/Nellis region.

TABLE 2.17

STATE RECREATION AREAS (1971)

(Source: Nevada Department of Conservation and Natural Resources)

	Users	Fees
Clark		
Valley of Fire	154,088	$3,046
Lincoln		
Beaver Dam	5,931	451
Cathedral Gorge	53,354	1,749
Eagle Valley	76,842	3,218
Kershaw-Ryan	16,246	1,961
Nye		
Berline-Tchthyosaur	7,256	446

In addition to the developed recreational sites, vast areas of open land are used continuously or seasonally by rock hounds, photographers, campers and hunters. This use is also increasing. Most of the areas used heavily for hunting are north of the COR/Nellis range, where they are associated with larger mule deer herds, although the Caliente EW Range includes a portion of the largest mule deer herd in southern Nevada.

2.4.1.6 The Existing Airspace Environment

This section describes the airspace environment as it currently exists in and around the area covered by the special use airspace proposal. The airspace environment is described in two subsections:

- Airspace Structure, relating airways, navigation aids, restrictions to navigation and Air Traffic Control (ATC) operations.
- Air Traffic Activity, describing the types and numbers of user aircraft which populate the airspace described above.

The Airspace Structure. The existing airspace structure described below covers an area that may be described as an inverted triangle. The apex is located at McCarran International Airport in Las Vegas, Nevada, while the base of the triangle links Tonopah and Milford (about 35 n mi north of Cedar City, Utah). Figure 2.19 illustrates this area and the airspace structure within it. This area is a subset of the proposed COR area. The proposed COR airspace applies only to this subset, and it is thus appropriate to describe this airspace only.

The airspace structure consists of airways or air routes, ATC procedures, and certain special use airspace. The airways, known as Victor airways, V-airways, or low-altitude airways, are formed by and defined as radials extending from very-high-frequency omni-directional ranges (VORs). VORs are electronic radio aids to navigation. Airways or segments of airways generally link two VORs in a straight line. Not infrequently, however, an airway segment may consist of a radial from each of two VORs, which meet at an intersection. Victor airways have width, and generally extend 4 n mi to each side of the airway centerline. In some cases, they are widened. The airway may be the extent of controlled airspace. Certain ATC services (such as separation) are provided only in this controlled airspace. The floor of controlled airspace is generally either 700 or 1200 feet above the surface. In mountainous terrain, such as the area covered by the proposed COR airspace, the floor of controlled airspace is established at an

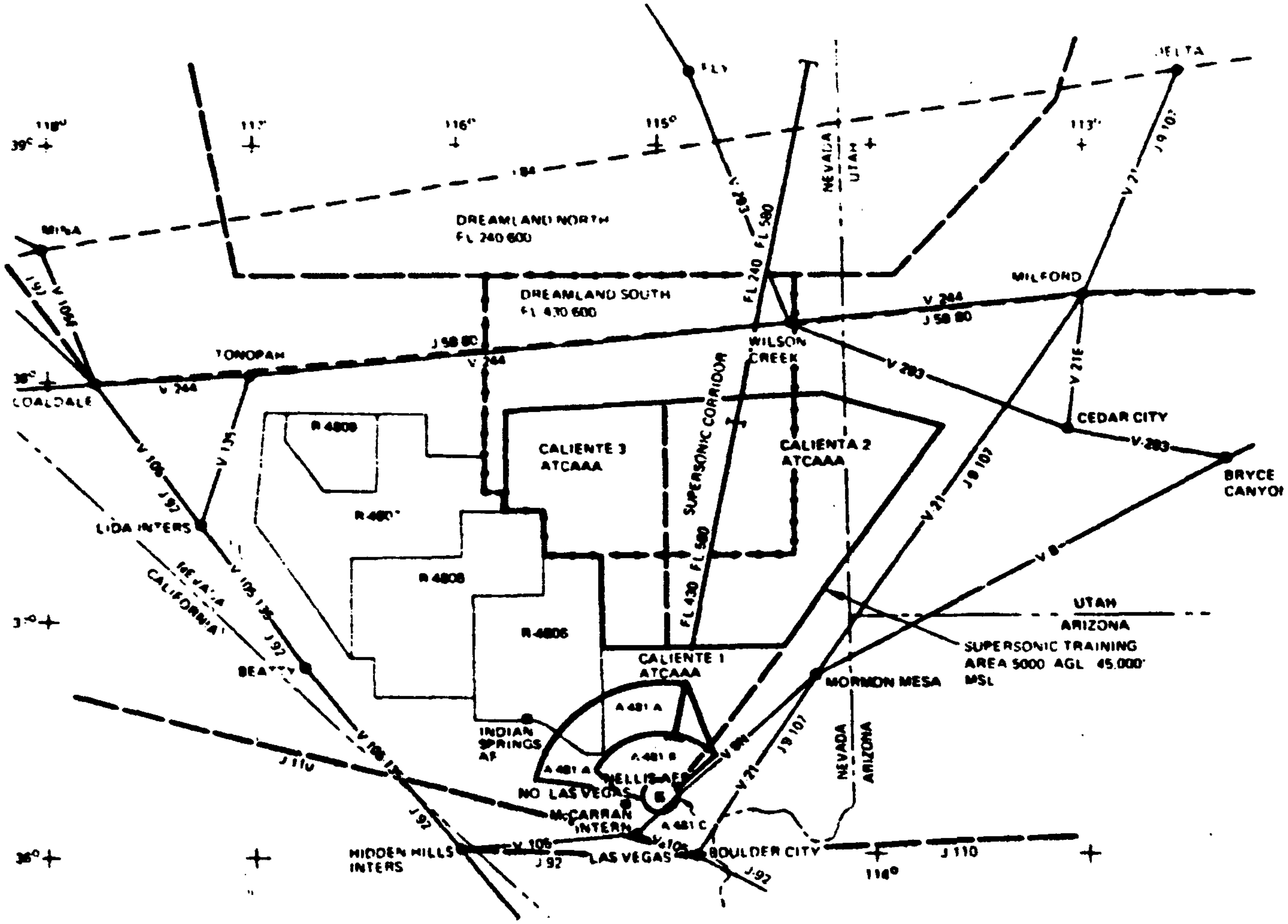


Figure 2.19. Existing COR/Nellis Airspace Structure

altitude, specified in feet above mean sea level (MSL), high enou :o at least clear the highest peak within the airway.*

The Victor airway structure extends up to 18,000 feet (above) MSL. Above this level, the high altitude structure, jet (or J) routes are established. All airspace above 18,000 feet MSL is under positive control. J-routes have no specific width. Above 18,000 feet MSL, all altimeters are referenced to a standard barometric setting (29.92 inches of mercury), and altitudes are referred to as Flight Levels (FL). Thus 24,000 feet MSL is known as FL-240, and 35,000 feet MSL is known as FL-350.

Each side of the lines used here to describe the COR airspace has a Victor airway associated with it; see Fig. 2.19. On the west, V-105 extends from Las Vegas VOR to Hidden Hills Intersection where it joins V-135 and continues to Lida Intersection about 30 n mi south of Tonopah VOR. From Lida, V-135 goes to Tonopah VOR, and V-105 continues to Coaldale VOR.

On the east, V-8N links Las Vegas and Mormon Mesa VORs. Also, V-21 links Boulder City VOR and Milford VOR, via Mormon Mesa VOR. V-237 runs from Las Vegas VOR to V-21 at Lakeview Intersection. In the north, V-244 links Coaldale VOR, Tonopah VOR, Wilson Creek VOR, and Milford VOR. In addition to the above airways, V-293 links Ely, Wilson Creek, and Cedar City VORs by crossing V-21 at Beryl Intersection about 15 miles west of Cedar City.

The jet routes are also depicted on Fig. 2.19. They generally overlay the V-airways; however, there are variations. J-92 links Coaldale and Boulder City VORs in the west. In addition, J-110 is a direct route from Boulder City VOR to Fresno VOR. In the east, J-9 and J-107 together link Boulder City and Milford VORs. J-107 continues to Delta VOR, and J-9 continues on beyond Fairfield VOR (not shown on Fig. 2.19). In the north, J-80 links Milford, Wilson Creek, and Coaldale VORs. J-80 is the major east to west jet route which terminates in the San Francisco Bay area.

*Note that the floor of controlled airspace should not be confused with the IFR Minimum Enroute Altitude (MEA) which is never lower than 2000 feet above the highest peak within the airway.

J-58 links Bryce Canyon and Wilson Creek VORs, and then follows J-80. J-84 links Mina and Delta VORs, and is the major west to east jet route which originates in the San Francisco Bay area.

Four restricted areas currently exist in the subject airspace. R-4809 is used and controlled by the Atomic Energy Commission (AEC). R-4808 is both used and controlled by the AEC. R-4807 and R-4806 are both used and controlled by the US Air Force. All four restricted areas extend from the surface to unlimited altitudes, and are designated to be in continuous use.

Three Air Traffic Control Assigned Airspace Areas (ATCAAA) are a already established in the proposed COR airspace. Known as Caliente 1, 2, and 3 they are shown in Fig. 2.19 and extend from FL-240 through FL-580, FL-180 through FL-580, and FL-240 through FL-580, respectively. They are used by the US Air Force.

Two additional areas, known as Dreamland South and Dreamland North, are already established. They are pertinent to COR only because the use of J-84 and the Caliente Three ATCAAA depend on their status ("hot" or "cold"). The Los Angeles ARTCC coordinates their operations.

Three Alert Areas have been established to warn of high density military operations in the nature of high-performance climbs and descents by training missions based at Nellis Air Force Base. These are known as A-481A, B, and C.

A supersonic corridor has been established to provide a training track for Nellis AFB-based aircraft. The southern section (approximately half) of this track extends from FL-240 through FL-580, while the northern section extends from FL-430 through FL-580. In addition to this supersonic corridor, a supersonic training area is defined. This is also shown in Fig. 2.19 and extends from 5000 feet above ground level (AGL) up to 45,000 feet MSL.

- **Levels of Air Traffic Activity**

No single record of air traffic activity exists. Each operational element of aviation generates its own activity data. These include traffic reported by Air Route Traffic Control Centers (ARTCCs), which consists mainly of Instrument Flight Rule (IFR) operations, traffic reported by Flight Service Stations (FSSs), which consist mainly of Visual Flight Rule (VFR) operations, unfiled or unrecorded operations, airport Fixed Base Operations (FBO), and agriculture and ranchers operations. The data sources for each of these activity elements are listed in Table 2.18

TABLE 2.13

AIR TRAFFIC ACTIVITY SOURCES

ARTCC Traffic	Los Angeles and Salt Lake City ARTCCs
FSS Traffic	Tonopah, Ely, Las Vegas, Cedar City FSSs
Unfiled or Unrecorded	Ranchers, FSSs, and FBOs (estimates only)
Airport Traffic	Tonopah and Ely FSS and airport towers at Nellis AFB, McCarran International, and North Las Vegas airports
Agriculture & Ranchers	Ranchers and FBOs (estimates only)

The military is a significant contributor to the current level of air traffic activity. The Air Force, combined with the Navy, fly approximately 33,000 sorties per year in the Nellis range complex. Most of these missions are conducted within the group of restricted areas, R-4806 through R-4809, or in the associated Air Traffic Control Assigned Airspace Areas (ATCAAA). Typical Air Force missions are described in detail in Sec. 2.2. Except for the airport traffic levels at Nellis AFB and Indian Springs AFB, the subject is not pursued further in this section.

- **ARTCC Traffic Activity**

All controlled IFR operations must maintain two-way radio communications with an air traffic control (ATC) controller. The controller may be in an airport tower, at a terminal control position (approach and departure control), or in an air route traffic control center (ARTCC), generally referred to as a "Center." Tower-derived data is used to define activity classified as "airport operations." Although some IFR operations may be conducted without communicating with a center (by using a "tower-en route" clearance), such operations are infrequent. Thus, IFR operations will be indicated by the record supplied by the appropriate center. Figure 2.20 illustrates that proposed COR airspace is controlled by Los Angeles Center (LAX), which is responsible for Sectors 7 and 8 (low altitude, FL-330 and below) and Sectors 33 and 34 (high altitude, FL-350 and above). In addition, Salt Lake City Center controls some of the COR airspace in Sectors 45 (combined high and low), 44 (low), and 46 (high). The center categorizes traffic into four types: air carrier (AC), air taxi (AT), general aviation (GA), and military (MI). In addition, a small quantity of VFR traffic is handled by centers. The distribution of the daily average air traffic activity among these types is presented in Table 2.19.

Sector totals should not be simply added, since most ARTCC traffic is en route. The en route fraction has been estimated to be as high as 90 percent of reported traffic. However, because of the close proximity of McCarran International, it is probable that the en route fraction of traffic reported by Sectors 7 and 8 (the low-altitude sectors) is less than 90 percent. It is beyond the scope of this study to determine the distribution of center traffic between en route and local operations.

- **FSS Traffic Activity**

In addition to the small number of VFR operations reported by the centers, the major fraction of VFR traffic is recorded by the Flight Service Stations (FSS) at Tonopah, Ely, Cedar City, and Las Vegas. Each FSS maintains a summary of radio contracts made each month. The monthly

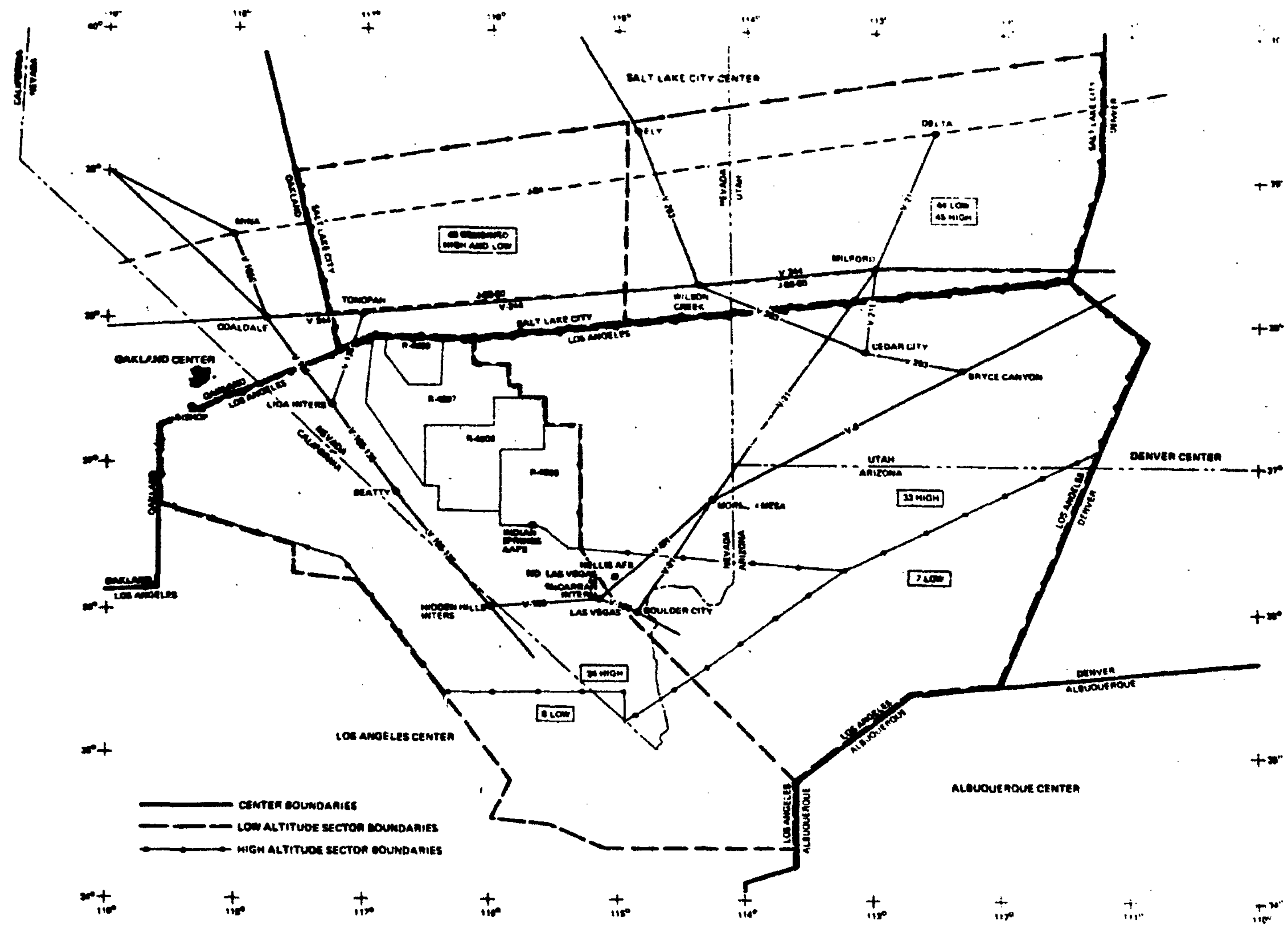


Figure 2.20. Center and Sector Boundaries

TABLE 2.19

AVERAGE DAILY AIR TRAFFIC ACTIVITY

	Los Angeles Center Sectors		Salt Lake City Center Sectors	
	7 + 8	33 + 34	45L + 46	45H
Air Carrier (AC)	125	30	44	180
Air Taxi (AT)	2	0	4	1
General Aviation (GA)	27	3	16	21
Military (MI)	32	22	18	24
VFR Operations	15	0	14	0
TOTALS	221	55	76	226

record is divided into two main segments, IFR and VFR. In each segment, subtotals are recorded for Air Carrier (AC) operations, Air Taxi (AT) services, General Aviation (GA) and Military (MI) flights. Records for calendar year 1973 were obtained and processed to obtain average daily rates in each category. These data are presented in Table 2.20. The resulting average rates are rounded to the nearest whole number of operations.

As in the case of ARTCC traffic, the traffic reported by each FSS should not be simply added because some fraction of this traffic is en route. FSS controllers estimate that approximately 50-percent of FSS reported traffic is en route and 50 percent is local.

Figure 2.21 illustrates the approximate geographic area surrounding each FSS in which a pilot would establish contact with the FSS. In addition to the FSS frequencies, remote communications are made possible

TABLE 2.20

AVERAGE DAILY FSS AIR TRAFFIC ACTIVITY

	Tonopah FSS	Ely FSS	Las Vegas FSS	Cedar City FSS
IFR-AC	<1	2	<1	2
IFR-AT	<1	<1	<1	<1
IFR-GA	2	<1	1	2
IFR-MI	1	<1	3	1
IFR Subtotal	4	3	5	5
VFR-AC	0	2	0	5
VFR-AT	6	3	33	5
VFR-GA	50	16	107	47
VFR-MI	3	<1	3	3
VFR Subtotal	59	21	143	59
IFR-VFR Total	63	24	148	64
Corrected IFR-VFR* Total + 10%	69	26	163	70

*Correction for unrecorded activities.

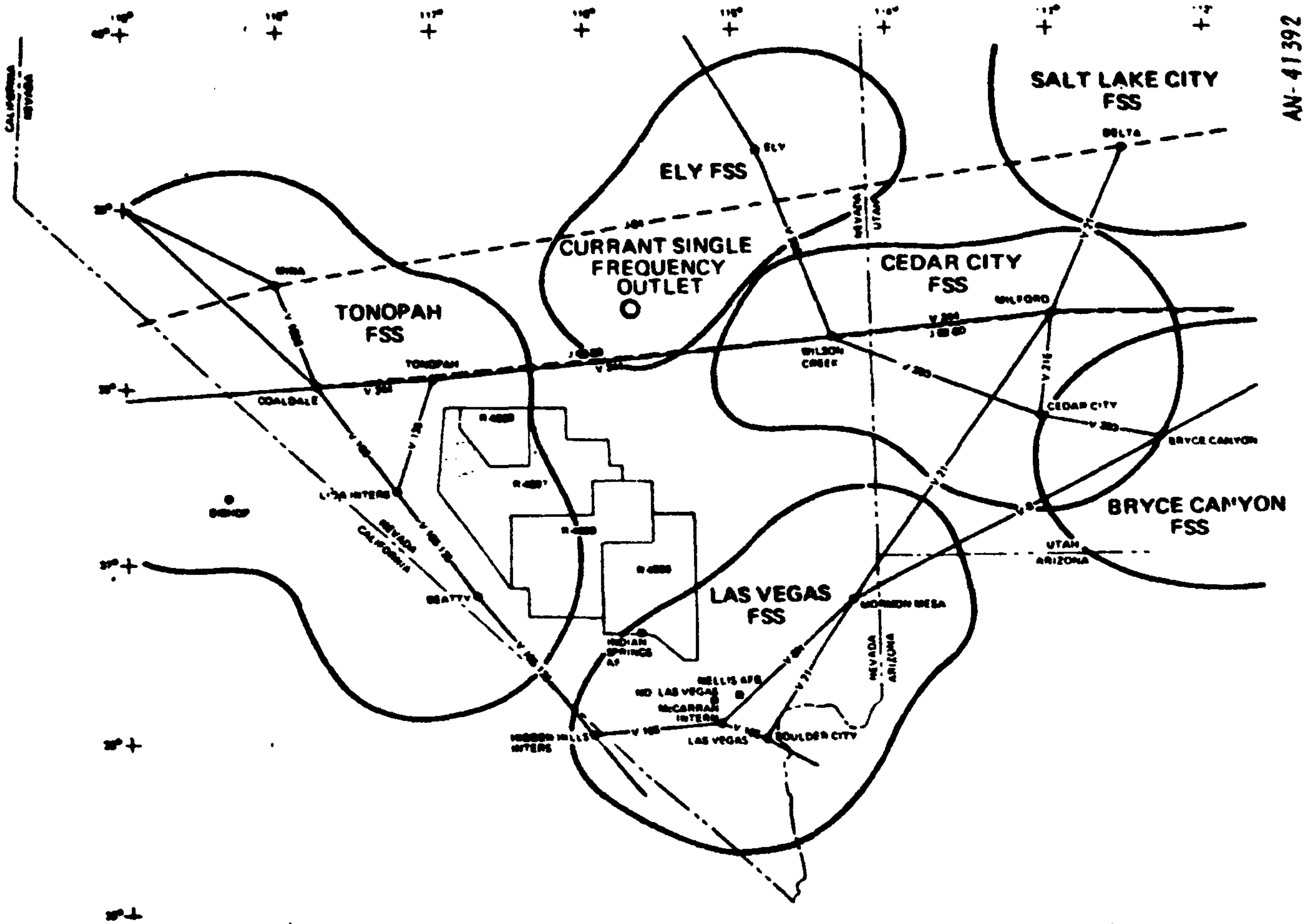


Figure 2.21. Approximate Areas for Contacting Each of Six Flight Service Stations (FSS)

Note: Since altitude is not indicated, coverage is not implied (VHF requires line of sight) via voice channels on VOR frequencies. The Tonopah FSS can communicate via the following VORs

Tonopah	(TPH)
Mina	(MVA)
Beatty	(BTY)
Coaldale	(OAL)
Bishop	(BIH)

The Las Vegas FSS employs communications at the following VORs.

Las Vegas	(LAS)
Boulder City	(BLD)
Monmon Mesa	(MMM)

Ely FSS communicates on its assigned frequencies, via the Ely VOR and via a single frequency outlet at the site of the now decomissioned Currant VOR. Cedar City FSS uses the following VOR communication sites:

Cedar City	(CDC)
Milford	(MLF)
Wilson Creek	(ILC)

Since communcations are <u>not required</u> between VFR aircraft and an FSS, it is reasonable to expect that not all aircraft do establish contact with an FSS. As a result, the above daily averages are low. The correction factor is by necessity an estimate. Controller, FSS personnel, and pilots who are familiar with the behavior of pilots in Southern Nevada, have estimated a correction factor of from +5% to +25%. When the weather is inclement, a larger fraction of pilots contact the FSS than in good weather. We have assumed that the annual correction factor is 10 percent. The resulting estimated totals are presented as "Corrected IFR-VFR Totals" in Table 2.20.

On the basis of estimates made by FSS personnel, the average traffic reported by the Tonopah FSS is distributed as follows:

- Daily East-West traffic following V-244 generally 10 aircraft (San Francisco Bay area to and from Nevada and Colorado)
- Daily North-South traffic following V-105 generally 55 aircraft (Las Vegas and Los Angeles to and from Reno and Salt Lake City)
- Daily off airway traffic (e.g., Ely to Tonopah) four aircraft
- Average daily total: 69 aircraft

Included in the above daily average total aircraft count are approximately eight or nine search and rescue missions per year within 100 n mi of Tonopah. Each mission involves from three to 16 aircraft, and the duration of the search can be extended--searches in excess of 20 days duration are not uncommon.

- Airport Traffic Activity

Accurate records of airport traffic activity are maintained at airports which are served by ATC towers. Activities at uncontrolled airports are generally not recorded. However where FSS are located on an airport, records of airport activity are maintained. Table 2.21 presents average daily aircraft movements at the airports in the general area of interest.

TABLE 2.21

AVERAGE DAILY AIRCRAFT MOVEMENTS

McCarran International	668
North Las Vegas	413
Nellis AFB	384
Indian Springs AAFB	36
Tonopah	13
Ely	20
TOTAL AVERAGE DAILY MOVEMENTS	1534

- **Agriculture and Ranching Air Traffic Operations**

Aviation plays a significant role in the agricultural and ranching operations of the Southern portions of the Great Basin. In addition to aerial application (e.g., crop sprays), Table 2.22 indicates how frequently airplanes are used in the pursuit of ranching.

TABLE 2.22

FREQUENCY OF RANCHING AVIATION OPERATIONS*

Description	Flight Frequency
Stock Buyer Transportation (in season)**	2 per day
Herd Inspection and Survey (in season)**	2 per day
Rancher Transportation - Local	4 per day
Rustling Control (eight per year)	—
Total average daily ranching operations*	8

*Excluding aerial application which, as the Ely FBO reported, last for only one week each year.

**The season extends from about November through July or August, depending on conditions.

These data are estimates made by ranchers, FBOs and FSS personnel. While the number of flights per day is very small compared to IFR and VFR operations, this air traffic activity should not be disregarded, because of its importance to Nevadan ranching enterprises.

Existing Air Quality. Table 2.23 presents the annual totals of air pollutant emissions compiled by the Nevada State Commission of Environmental Protection for the selected counties of Clark, Nye, Lincoln, and Churchill[10] (see Fig. 2.13, p. 2-61). Five categories of pollutant emissions are typically inventoried for a variety of sources; only totals for all sources and the contributions from aircraft are shown in the table.

For particulate and SO_2 emissions in Clark, Nye and Lincoln counties only small contributions from aircraft to the totals are indicated. In Churchill County it appears that aircraft must account for a significant fraction of the totals for these two pollutants. Churchill is a rural county and contains Fallon NAS which accounts for the dominance of aircraft contributions.

Emission data were available only for Clark County on hydrocarbon (HC), carbon monoxide (CO) and nitrogen dioxide (NO_2). These data also indicate that aircraft emissions are a minor contributor to the totals for these pollutants.

The existing air quality which may be taken to reflect these pollutant emissions is summarized in the data presented in Table 2.24. Only data from a few of the air quality monitoring sites were selected (on the basis of interest to COR impact assessment) for presentation in Table 2.24. Primary and secondary standards for air quality are also presented for comparison. All entries are in micrograms per cubic meter ($\mu g/m^2$).

The data show that in the Las Vegas region Sites 01 (city center) and 06 (Nellis AFB) are within the primary standard for particulates concentrations. The airport at McCarran and the Las Vegas Fire Department concentrations of particulates slightly exceed the standards. The sites at Fallon and in Nye County* show significant exceedance of the standard,

*The Nye county site is located at a rural gas station in the town of Gab's and may not be representative due to the nature of the service station activity.

TABLE 2.23

1970 AIR POLLUTANT EMISSIONS
(Tons per Year)

	PARTICULATES		SO_2		HC		CO		NO_2	
	Total	Aircraft	Total	Aircraft	Total	Aircraft	Total	Aircraft	Total	Aircraft
CLARK	89,000	990	55,800	390	47,300	2,450	160,000	6,900	83,400	775
NYE	1,506	3	535	2						
LINCOLN	251	0	193	0						
CHURCHILL	493	138	308	45						

SOURCE: Air Quality Implementation Plan for the State of Nevada, 30 January 1972, Commission of Environmental Protection, State of Nevada

TABLE 2.24

EXISTING AIR QUALITY

Pollutant Concentrations in ($\mu g/m^3$), 1971 Measurements

AIR QUALITY MONITOR SITE	PARTICULATES Annual Mean	PARTICULATES 24 hr Max	SO_2 Annual Mean	SO_2 24 hr Max	OXIDANT Annual Mean	OXIDANT 1 hr Max	CO 3 hr Max	CO 1 hr Max	NO_2 Annual Mean	NO_2 1 hr Max
AQCR 13										
01 Las Vegas (City Center)	73	240				382	25.5	32	38	172
06 Nellis AFB	67	221								
04 Airport (McCarran)	45	291								
05 Las Vegas Fire Dept.	137	333								
AQCR 147										
19 Fallon	105	443								
21 Nye Co.	119	501								
17 Ely	57	100	27	154						
Primary Standard	75	260	80	365		160		40	100	
Secondary Standard	60.	150	60	260						

SOURCE: Air Quality Implementation Plan for the State of Nevada, 30 January 1972, Commission of Environmental Protection, State of Nevada while Ely, which may be more typical of the Great Basin towns, is well within the standard for particulates. Ely is also well under the standards for SO_2 concentrations.

With regard to the set of pollutants, oxidant, CO, and NO_2, data were available only for the Las Vegas site, considering only the set of sites shown in Table 2.24. Data from this site shows exceedance of the oxidant standards while CO and NO_2 concentrations are indicated to be below their respective standards. The emissions data from Table 2.23 suggest that the Las Vegas concentrations of oxidant, CO, and NO_2 are very little affected by aircraft emissions, and most likely are due to auto emissions. HC and NO_2 are important species in the photochemical smog reactions which result in oxidant production. CO, being non-reactive in smog production, is probably a good indicator of the relative contribution of a given source to the consequent air quality.

Archeological Sites. A preliminary survey of information concerning known or surveyed archeological sites in or near the Nellis range and H/W/D range complexes shows some basis for concern regarding archaeological values.

The Utah State Department of Development Services, Division of State History, notes that there are four recorded archeological sites* in the Wendover Bombing and Gunnery Range. There are undoubtedly numerous additional sites in these two areas as no professional survey has been conducted. The known sites are all open campsites. Outside the Wendover/Dugway range, along the Utah-Nevada border in the vicinity of Caliente, 10 sites are recorded. Several of these sites are rock shelters or cave sites.

*Forty-two additional sites have been reported by an amateur on the Dugway Proving Grounds.

The Nevada State Museum has furnished information indicating a fair number of sites in Lincoln, Nye, and Clark counties. As of 1967 there were approximately 72 sites in Clark county, 19 in Lincoln County, and 70 in the eastern half of Nye county. Figure 2.22 shows the locations of these southern Nevada sites. There have been several surveys since 1967 but the results of those surveys are not included in the mapped locations.

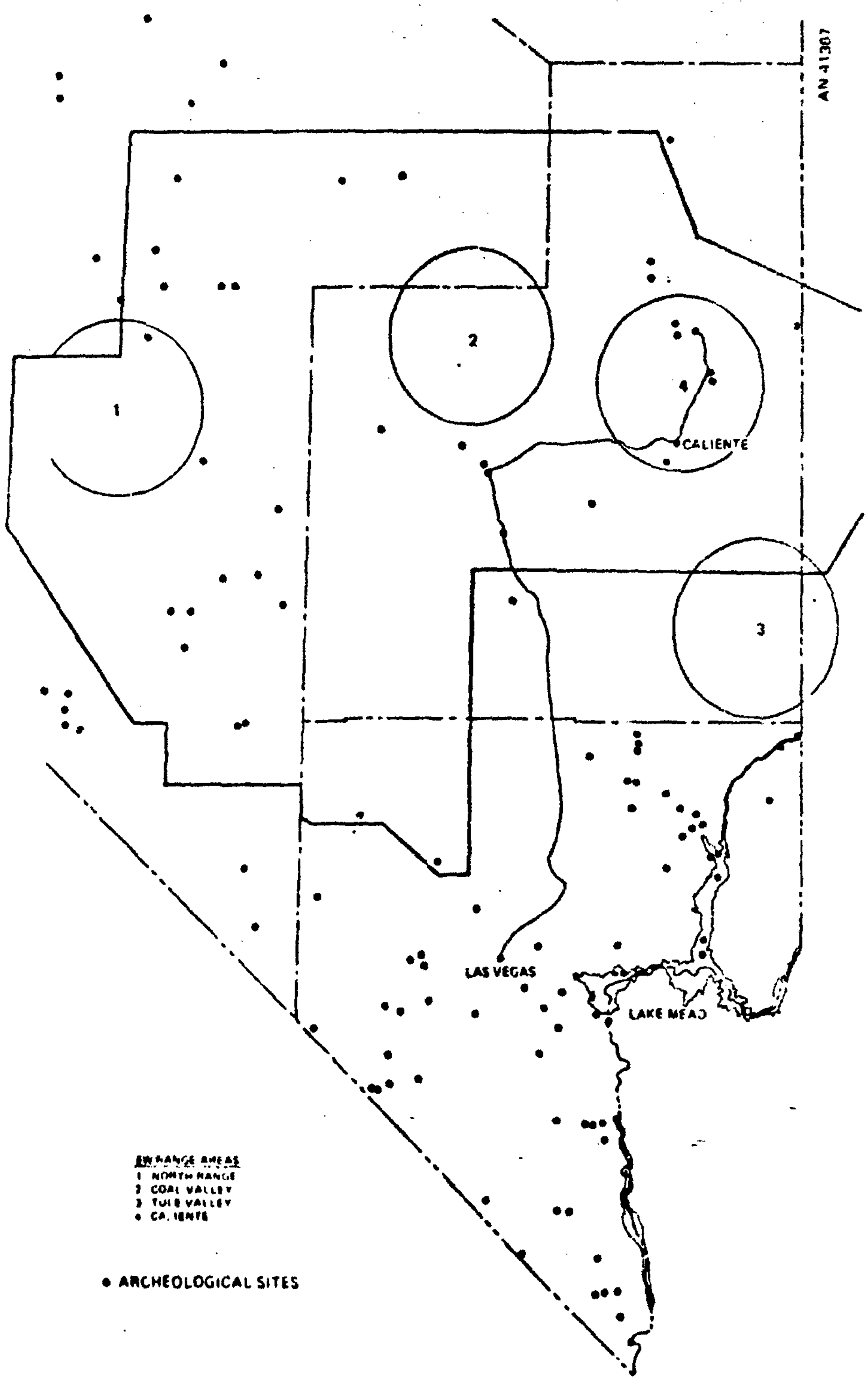


Figure 2.22. Archeological Sites Within the COR/Nellis Range Area

2.4.2 Natural Environment

2.4.2.1 Physiography of the Great Basin

The COR Area lies wholly within the Great Basin Section [Hunt, 1967] of the Basin and Range Physiographic Province [Fenneman, 1931] (Figs. 2.23 and 2.24). The Great Basin consists typically of north-south trending mountain ranges separated by valleys, many of which are basins with internal drainage. Elevations vary from below sea level in Death Valley to over 13,000 feet on Boundary and Wheeler Peaks in Nevada. Basin Floors are found at elevations above 6000 feet, but average nearer 4000 feet. There are more than 200 mountain ranges in the Province, about 21 of which are found in Utah and 52 in Nevada. Approximately 60 per cent of the ranges included in Utah and Nevada are within the general boundaries of COR.

Hunt [1967] divided the great Basin into five subdivisions based on their structure, topography, hydrography and kind of soil and soil substrate (Fig. 2.23):

1. The Central Area of elevated basins and ranges (included in the COR Area).
2. The Bonneville Basin east of the Central Area (included in the COR Area).
3. The Lahontan Basin west of the Central Area (only the southern part is included in the COR Area).
4. The Lava and Lake Area at the northwest corner of the section (in NW Nevada and adjacent California and Oregon, and lies outside the boundaries of the COR Area.
5. The Southern Area in southern Nevada (in the COR Area where current airspace restrictions exist).

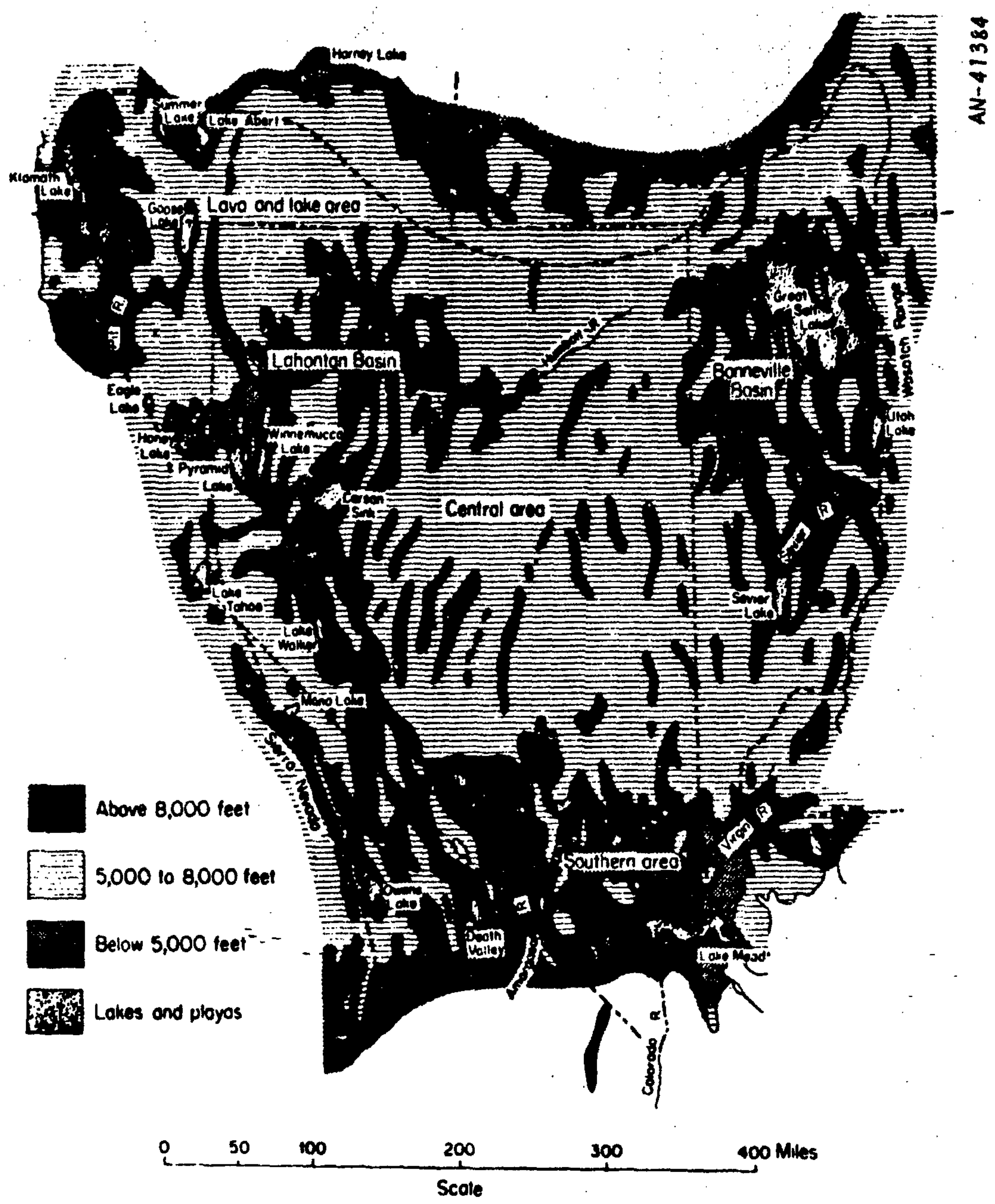


Figure 2.23. Great Basin Section of the Basin and Range Physiographic Province [Hunt, 1967]

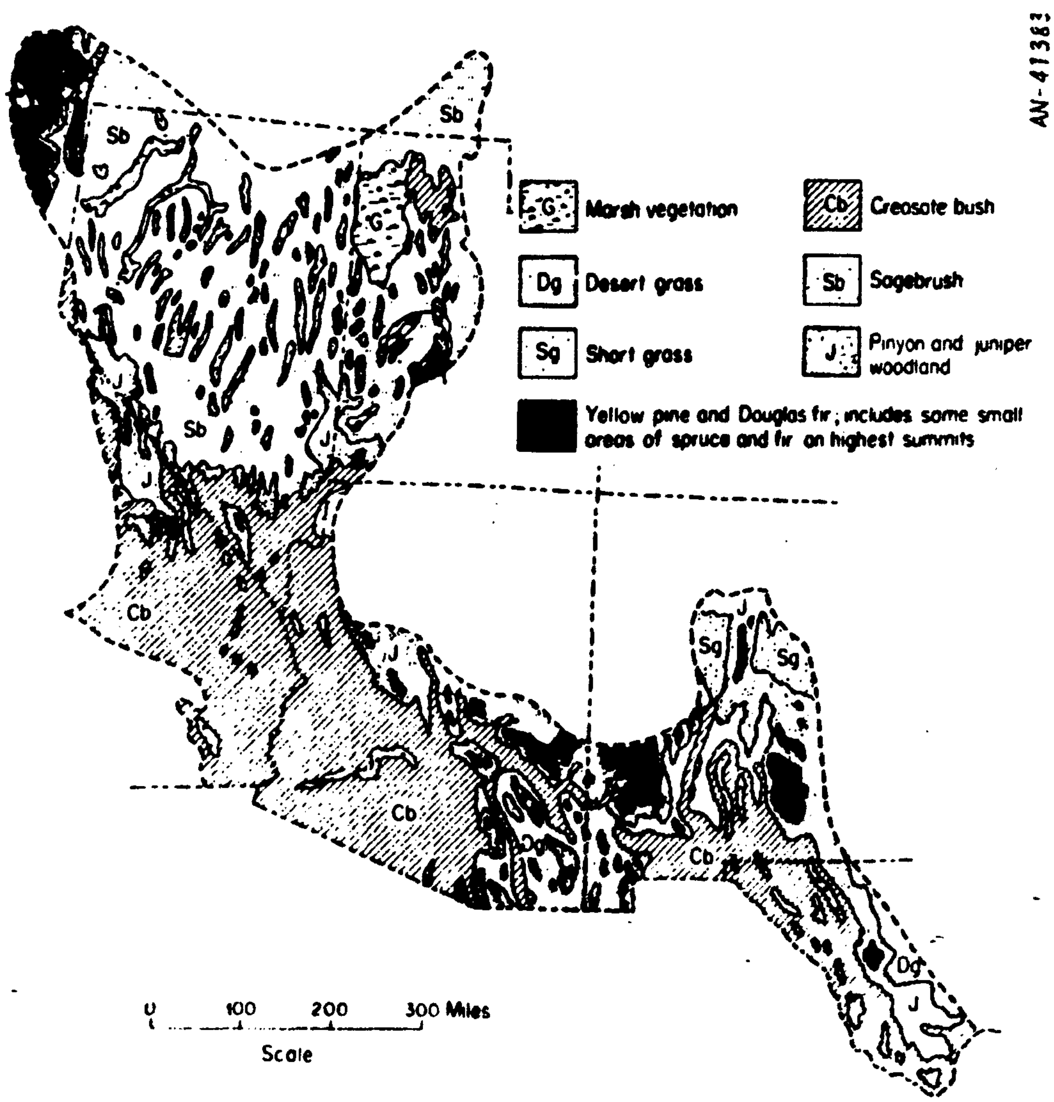


Figure 2.24. Basin and Range Physiographic Province of the Western United States [Hunt, 1967]

The eastern and northern parts of the Central Area contain linear mountain ranges of completely deformed Palezoic rocks consisting in large part of limestone. To the west, the rocks are mostly sandstone, saltstone, and shale derived from volcanic rocks. Block faulting of those folded and faulted rocks produced the basins and ranges. Many small, relatively fresh fault scarps from a few inches to 40 feet in height are found throughout the Great Basin.

In the Bonneville Basin, mountain ranges cover about 25 per cent of the area, while gravel-filled playas and alluvial fans make up the remainder. The ranges are primarily complexly folded and faulted Paleozoic rocks that were later divided into structural blocks by late Tertiary and Quarternary block faulting. To the south, volcanic rocks form some of the mountain ranges. Two major lakes and one playa are found within this basin: Great Salt Lake, Utah Lake, and Sevier Lake, respectively.

The Lahontan Basin is structurally and topographically similar to the Bonneville Basin. The greater part of its area is alluvial fans and playas. It contains some large lakes; such as, Pyramid Lake, Walker Lake, Lake Winnemucca (now dry) and the playa at Carson Sink at the mouth of the Humboldt River. The mountain ranges are fault blocks of Triassic and Jurasic formations, and Tertiary volcanic rocks.

The Southern Area is structurally similar to the Central Area but is lower. Rocks forming the mountain ranges include: complex, folded and faulted Paleozoic and Precambrian rocks, some small masses of equally deformed Triassic and Jurassic rocks, granitic intrusions related to the Sierra Nevada batholith, and a thick series of Tertiary and Quaternary volcanics. This period was preceded by folding and thrust faulting of an original Paleozoic geosyncline in early, middle and late Mesozoic. Middle and late Cenozoic block faulting later produced sediments deposited in the basins leaving the Great Basin as it is today. In some basins, the fill is enormously thick. Death Valley, for example, is estimated to contain 8000 feet of fill having been downfaulted nearly two miles below sea level and then filled with sediment.

The Great Basin is undergoing considerable earth movement (structured deformation) at the present time. Numerous earthquake epicenters are found throughout the Great Basin including the COR areas. There is a concentration of epicenters along the western and eastern parts of the Great Basin, and a few are distributed across its north and south borders, although few epicenters have been recorded in the interior of the Basin. The frequency of recent fault scarps is related to the frequency of earthquake epicenters.

- Climate

The Basin and Range Province, as a whole, is the driest in the United States. Annual precipitation averages less than 20 inches; and in about three-quarters of the province (including the Great Basin), less than 10 inches. The entire Great Basin is arid, such that there is a scarcity of perennial streams (Fig. 2.25) and evaporation rates are high, normally greater than 100 inches per year.

Weather in the Great Basin is the result of three prevailing circulation patterns [Houghton, 1969]: (1) transitory frontal systems moving inland from the Pacific and controlled to a certain extent by the jet stream; (2) continental cyclones developing over the Great Basin; and (3) convection associated with moist air from the Gulf of Mexico. The last two operate year-round, while the first is confined to the summer season. It should be noted that an important feature of the climate in this region is the existence of a semi-permanent high pressure area. It is this feature which primarily accounts for the good flying weather but it also offers significant potential for air pollution. Precipitation comes with great seasonal variation in strength and frequency; thus, reliable precipitation for plant growth and other uses does not occur in the Great Basin. Precipitation is lightest in the low basins of the south

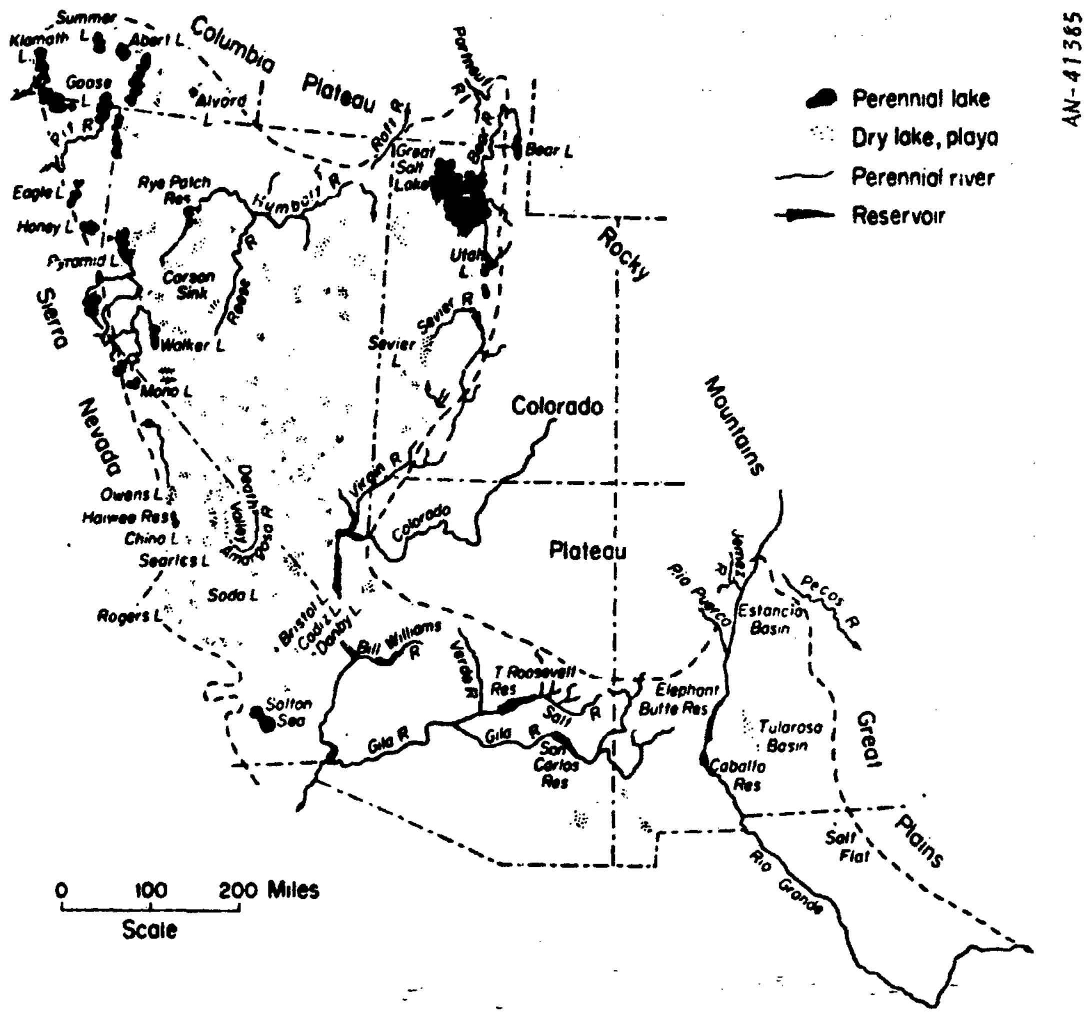


Figure 2.25. Perennial Rivers, Lakes and Playas of the Basin and Range Physiographic Province [Hunt, 1967]

(0.5 to 4.0 inches per year), and in west-central Nevada and western Utah (4 to 6 inches per year). The dry area in the south stems from the rarity of cyclones, while the area to the north occupies rain shadows to the lee of the high mountains. Some mountains of the northern Great Basin receive as much or more than 25 to 50 inches per year. The sagebrush-steppe rangelands of the Northern Desert Shrub vegetation normally receive greater than 10 to 12 inches per year.

In the Pleistocene era, the Great Basin was not desert but rather, as the climate was wet enough, supported lakes hundreds of feet deep. Only a few remnants of these lakes remain, e.g., Great Salt Lake and Pyramid Lake. Other lakes are dry playas or only intermittently wet. The distribution of Pleistocene Lakes [Snyder, et al., 1964] is closely correlated with the contemporary Salt Desert Shrub Vegetation.

Winters are cold in the northern part of the Great Basin, when most of the precipitation falls in the form of snow. Only the extreme southern part of the Great Basin has mild winters, and standing water is scarce and consists only of a very few natural marshlands fed by fresh water springs. Manmade reservoirs add to this and constitute areas characterized by relatively heavy recreation use.

- Major Biotic Communities

The numerous and diverse mountain ranges and their respective valleys have provided for the development of a rather diverse flora and fauna, often [illegible]ging with sharp ecotones as elevations change or from valley to v[illegible]; but generally, the communities can be characterized as: (1) Southern Desert Shrub, (2) Salt Desert Shrub, (3) Northern Desert Shrub, (4) Piñon-Juniper Woodland, (5) Mountain Brush, (6) Forest, (7) Grasslands, (8) Hydrophilous Vegetation, and (9) Croplands. A complete listing of the species considered in this work is found in Appendix A where Plants, Mammals, Birds, Reptiles, Amphibians, and Fishes are listed with their respective common names.

The vertebrates are listed as to whether they are residents of COR; and if so, if it includes all or a part of the species' geographic range. This partitioning is particularly helpful in assessing the possible impact on a species, since the risk increases rapidly as the percentage of a species' range increases in COR. If a species, such as the white-footed mouse, overlaps essentially all of COR, it would not be too serious since it is also found over most of the rest of temperate North America. On the other hand, some risk to say Chipmunk (subspecies nevadensis) exists, since its entire geographic range is restricted to the Sheep Mountains, which are within the boundaries of COR. Plants listed in Appendix A are limited to those species of particular interest to this ES. A comprehensive listing would be too voluminous (approximately 6000 species) to be useful; and also, most species will be impacted only as a secondary response to adjustments by other species in the food chain.

1. Southern Desert Shrub (Fig. 2.26)--These communities are found at low elevations, primarily below 4000 feet in the Southern quarter of Nevada. The following plant species are among those which characterize these communities: Creosote bush, Blackbush, Bursage, Box thorn, Joshua tree, Mojave yucca, Spanish bayonet, Prickly pear cactus, Desert needlegrass, Big galleta. Animal species commonly associated with these communities are: Merriam kangaroo rat, Chisel-toothed kangaroo rat, Least pocket mouse, Long-tailed pocket mouse, White-footed deer mouse, Southern grasshopper mouse, Kit fox, Desert tortoise, Zebra-tailed lizard, Leopard Lizard, Side-blotched lizard, Gopher snake, Sidewinder, Whip-tailed lizard, Black-throated sparrow, Horned lark, Loggerhead shrike, Gray flychatcher, Le Conte's thrasher, sage sparrow, and Raven. As shown in Fig. 2.26, only the south range of Nellis is within the domain of Southern Desert Shrub.

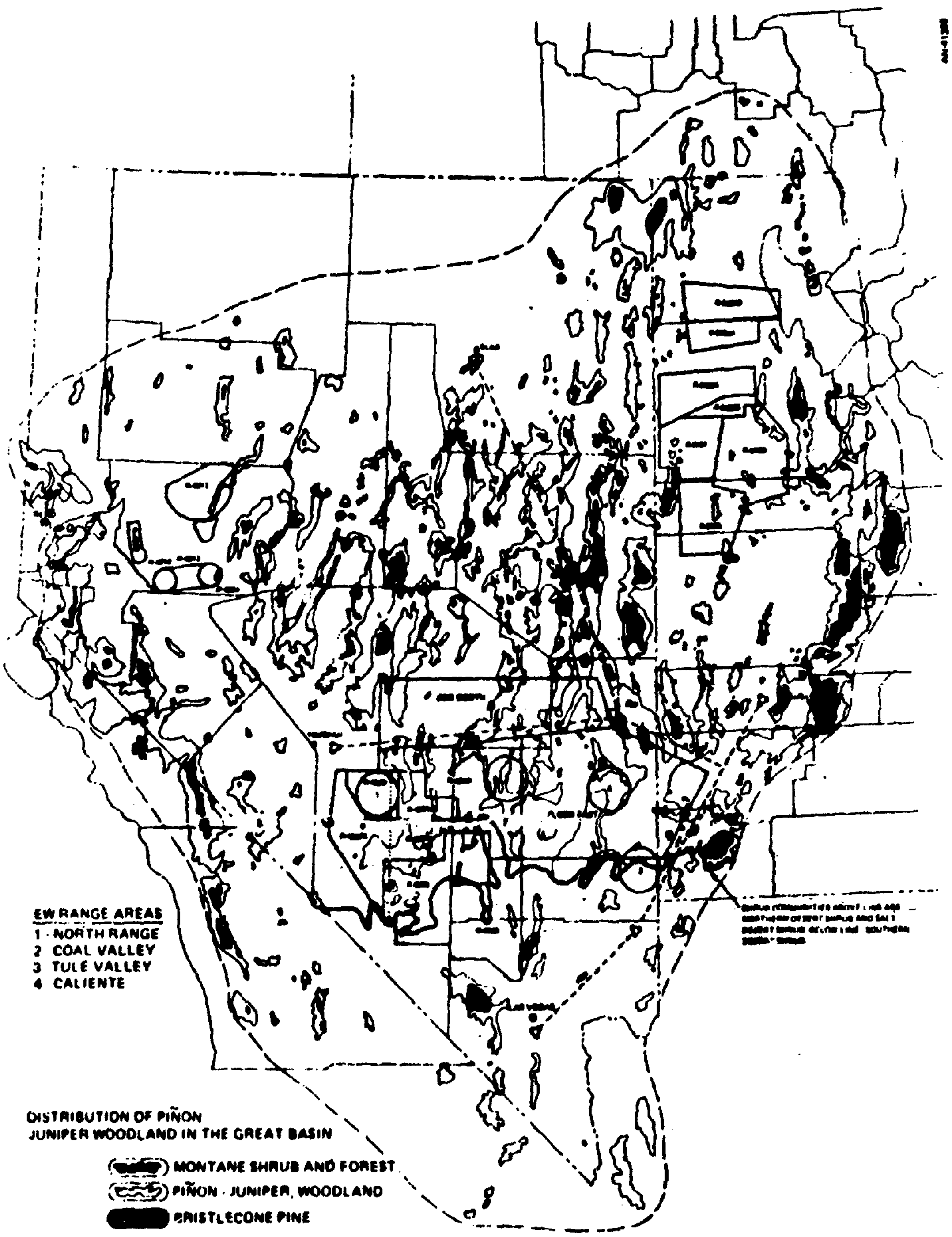


Figure 2.26. Distribution of Piñon-Juniper Woodland in the Great Basin and Demarcation of Northern and Salt Desert Shrub and Southern Desert Shrub

2. Salt Desert Shrub (Fig. 2.27) --These plant communities are found primarily in valley bottoms of central and northern Nevada. The following plant species are common in the communities: White-sage, Shadscale, Four-wing saltbrush, Bailey's greasewood, Greasewood, Spiny hopsage, Russian thistle, Indian ricegrass, Black sagebrush, and Bud sagebrush. Common animal species are: Chisel-toothed kangaroo rat, Ord Kangaroo rat, Least pocket mouse, Dark kangaroo mouse, White-footed deer mouse, Kit fox, Badger, Bobcat, Coyote, Desert-horned lizard, Side-blotched lizard, Whip-tailed lizard, Speckled rattlesnake, Horned lark, Sage thrasher, Brewer's sparrow, Vesper sparrow, and Mourning dove.

3. Northern Desert Shrub (Fig. 2.28)* --These communities are found at intermediate to high elevations throughout Nevada and Utah. In nearly every case, a member of the genus Artemisia is dominant. Important plant species include: Big sagebrush, Rubber rabbitbrush, Green rabbitbrush, Bluebunch wheatgrass, Squirrel tail, and Nevada bluegrass. Common animal species are: Black-tailed jackrabbit, Cliff chipmunk, Great Basin pocket mouse, Ord kangaroo rat, Chisel-toothed Kangaroo rat, Western harvest mouse, White-footed deer mouse, Northern grasshopper mouse, Coyote, Kit fox, Bobcat, American prong-horn, Sagebrush lizard, Side-blotched lizard, Gophersnake, Speckled rattlesnake, Golden eagle, Sage grouse, Horned lark, Raven, Sage thrasher, and Lark sparrow.

4. Piñon-Juniper Woodland (Fig. 2.26)--This community is normally found above the northern desert shrub in a belt around many of the mountain ranges, primarily in central, eastern and south-eastern portions of Nevada. The two principal plant species are Piñon

*The mapping of Salt Desert Shrub and Northern Desert Shrub is the result of very recent high-altitude aerial surveys. Unfortunately, this work has been completed only for Nevada as the maps imply. It is reasonable to assume that these general distributions continue into the western portions of Utah.

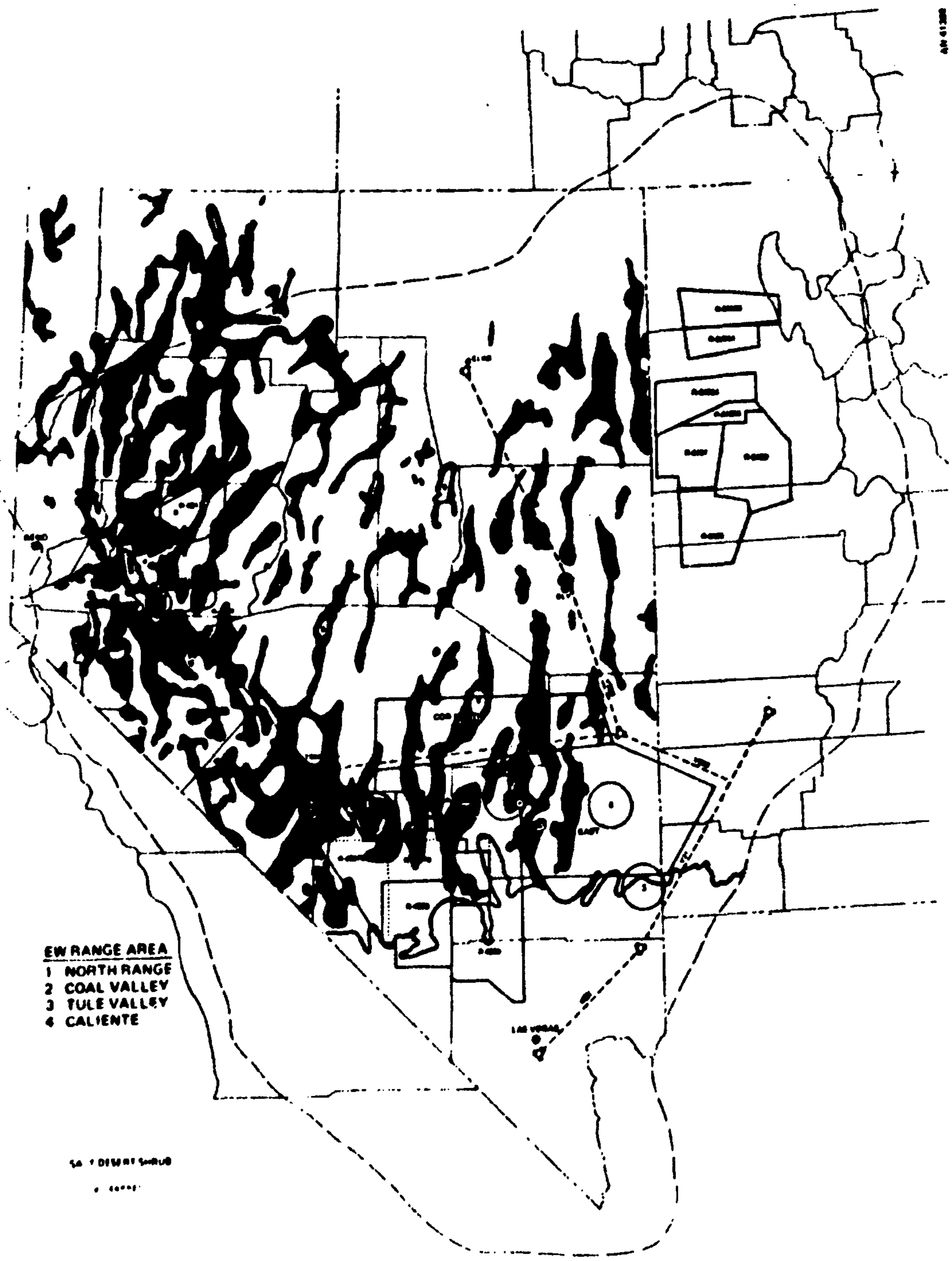


Figure 2.27. Salt Desert Shrub (See footnote, page 2-120)

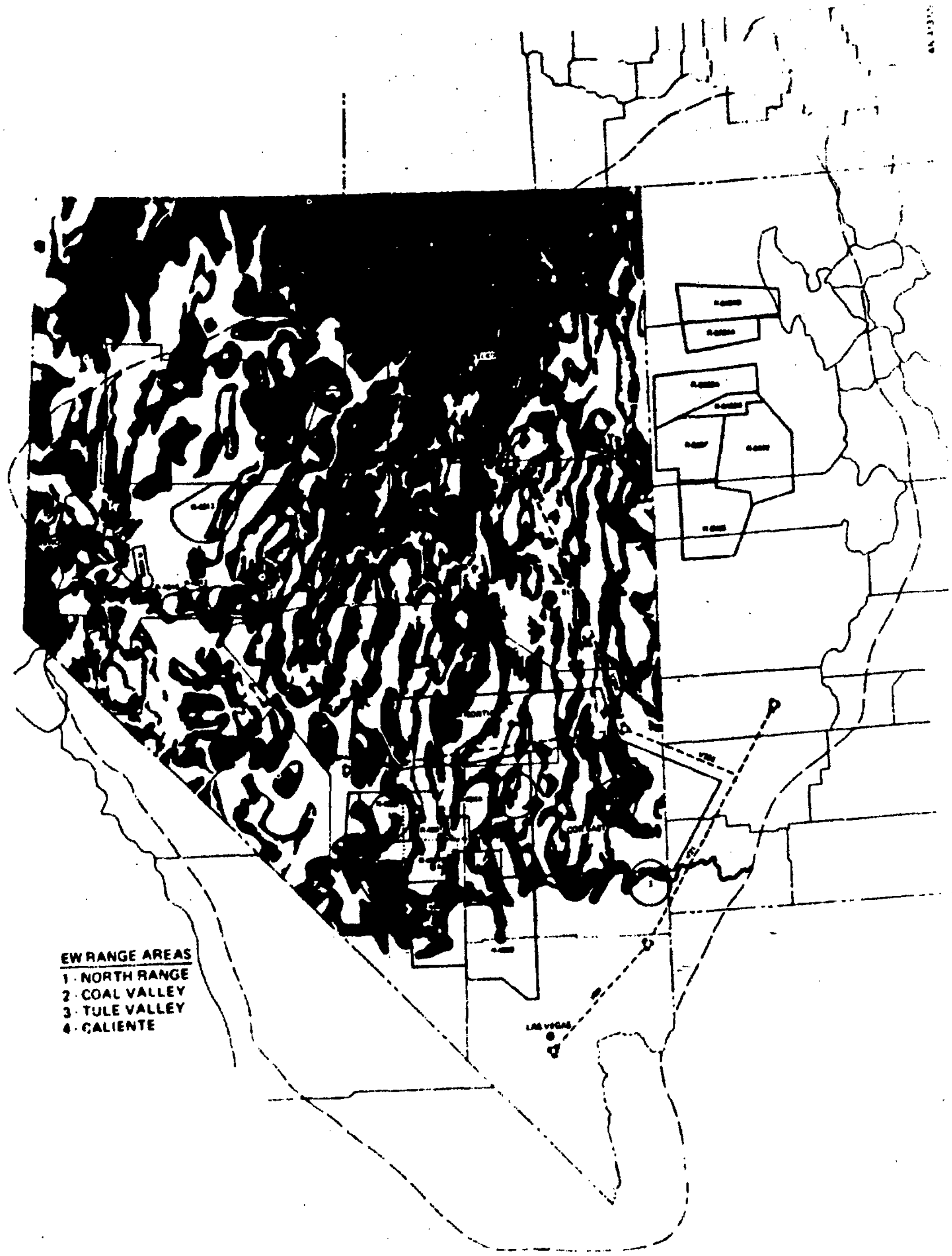


Figure 2.28. Northern Desert Shrub (See footnote, page 2-120)

pine and Utah juniper. Common animal species are: Audubon cottontail, Ord kangaroo rat, Canyon mouse, White-footed deer mouse, Piñon mouse, Desert wood rat, Coyote, Bobcat, Mule deer, Western fence lizard, Side-blotched lizard, Speckled rattlesnake, Mourning dove, Dusky flycatcher, Mountain Chickadee, Bushtit, Gray vireo, Black-throated gray warbler, Black-throated sparrow, White-breasted nuthatch, Bewick's wren, and Poor-will.

5. <u>Mountain Brush</u> (Fig. 2.26)--These communities are found at elevations mostly above the Piñon-Juniper Woodland communities, or often in close association with them. The principal plant species are: Gambel's oak, Scrub oak, Snowberry, Serviceberry, Antelope bitterbrush, Desert bitterbrush, Cliffrose, Pinemat manzanita, Mountain mahoghany, Buckbrush, Sagebrush species, and Quaking aspen. Common animal species are similar to those included in the Piñon-Juniper Woodland; but as yet, they are not specifically characterized.

6. <u>Forest</u> (Fig. 2.26, 2.29)--Truly forested sites, other than Piñon-Juniper Woodlands, are rather uncommon within the "Basin and Range Physiographic Province," but the following plant species do form small, sometimes dense stands in some ranges: Bristlecone pine, Yellow pine, Whitebark pine, White fir, Limber pine, Engleman spruce, and Quaking aspen. Although the animal species associated with these localized forests are not well established, they may be considered rather similar to what would be expected in the Piñon-Juniper Woodland. Some vertebrates are, however, restricted to this plant association, such as, the birds: Pygmy nuthatch and Steller's jay.

7. <u>Grasslands</u>--Grasses are generally present throughout the COR area, but they are seldom found in pure stands. There are, however, some areas of nearly pure stands of: Nevada bluegrass, Big galleta, Needle-and-thread grass, Saltgrass, Great Basin wildrye, Bluebunch wheatgrass, and Indian ricegrass. In addition to the naturally

occurring stands, almost one million acres have been seeded to wheat grasses (Agropyron spp.) for grazing purposes and several hundred thousand acres are covered with Cheatgrass, an exotic fire type. Since these grasslands are generally established locally within other vegetative types, it is not generally possible to characterize the animals associated with them. Generally, the animal species will be similar to those found in the dominant vegetative type that the grass is associated with.

8. Hydrophilous Vegetation--Wherever water surfaces (rivers, lakes, seepages, etc.) or approaches the surface, the vegetation changes dramatically from the surrounding environments. These riparian environments include all of the meadows, marshlands, stream-side and lakeside vegetation, as well as plants growing in soils where the water table is very close to the surface. Because of the local nature of these environments, the animals are difficult to characterize generally, although some species can be expected; such as the Audubon cottontail, Cactus mouse, Montane meadow mouse, Striped skunk, Horse, Burro, varied amphibians, Western Gartersnake, various fishes, various herons and ibises, Common snipe, Yellowthroat, Yellow-headed blackbird, Red-winged blackbird, and Long-billed marsh wren.

9. Croplands (Fig. 2.14)--In addition to the biotic communities briefly characterized, many of which have been altered by man's activities, there are numerous established agricultural operations. These vary in type, although most are related rather closely with cattle industry which uses mostly alfalfa. Ranches of this type are found throughout the "Basin and Range Physiographic Province"; and in each case, the fauna and flora present is a matter of what the rancher will allow to develop.

- **Important Species**

Several species judged to be of primary importance to this assessment have been checklisted. These include those that require special attention by scientists and federal agencies because they are either endangered, threatened, or of economic or recreational value. The reasons for their special consideration are many, namely: (1) ranges are small and thus the population is restricted, perhaps only a few hundred individuals of an entire species in some cases; (2) ranges may be small and although populations may be numerically large, the entire range lies within COR; (3) irrespective of population numbers or range little is known of the current status and in some cases information suggests that populations are declining; (4) species are sensitive to molestation and may potentially be in danger of abnormal declines; (5) species are relict or may have aesthetic and scientific value; (6) economic or recreational importance; and (7) various combinations of the above. The species and why they are considered special are as follows. It to be noted that only three of the species checklisted are actually l on the endangered species list as compiled by the Department of the Interior and published in the Federal Register.

<u>Mammals</u>

1. *Eutamias umbrinus nevadensis* (Say Chipmunk) - restricted range
2. *Thomomys umbrinus nanus* (Botta Pocket Gopher) - restricted range
3. *Thomomys umbrinus phelleoecus* (Botta Pocket Gopher) - restricted range
4. *Microdipodops megacephalus albiventer* (Dark Kangaroo Mouse) - restricted range
5. *Microdipodops megacephalus sabulonis* (Dark Kangaroo Mouse) - restricted range
6. *Microdipodops pallidus ruficollaris* (Pallid Kangaroo Mouse) - restricted range
7. *Microdipodops pallidus purus* (Pallid Kangaroo Mouse) - restricted range
8. *Microtus montanus fucosus* (Montane Meadow Mouse) - restricted range

Birds

1. *Mycteria americana* (Wood Ibis) - population status is undetermined
2. *Plegadis chihi* (White-faced Ibis) - population status is undetermined
3. *Olor buccinator* (Trumpeter Swan) - restricted range
4. *Buteo regalis* (Ferruginous Hawk) - population status is undetermined
5. *Aquila chrysaetos canadensis* (Golden Eagle) - public interest
6. *Haliaestus leucocephalus* (Bald Eagle) - public interest and the population is threatened
7. *Pandion haliaetus* (Osprey) - public interest and the population status is undetermined
8. *Falco mexicanus* (Prairie Falcon) - population status is undetermined and threatened (in part)
9. *Falco peregrinus anatum** (Peregrine Falcon) - population status is undetermined and threatened
10. *Charadrius alexandrinus nivosuse* (Snowy Plover) - population status is undetermined
11. *Numenius americanus* (Long-billed Curlew) - population status is undetermined
12. *Speotyto cunicularia hypogaea* (Burrowing Owl) - population status is undetermined

Fishes

1. *Gila robusta jordani** (White River Gila) - population is threatened and with a restricted range
2. *Moapa coriacea** (Moapa Dace) - population is threatened and with a restricted range
3. *Lepidomeda albivallis* (White River Spinedace) - population status is undetermined

---

*Endangered species, 16 U.S.C. 668aa, Appendix D.

4. *Lepidomeda altivelis* (Pahranagat Spinedace) - restricted range
5. *Crenichthys baileyi* (White River Springfish) - restricted range with local endemic populations
6. *Crenichthys nevadae* (Railroad Valley Springfish) - restricted range

Hooved Mammals

1. *Dama hemionus hemionus* (Mule Deer) - game species
2. *Antilocapra americana americana* (American Pronghorn) - game species with a restricted range and appreciable public interest
3. *Ovis canadensis nelsoni* (Desert Bighorn Sheep) - game species with a restricted range
4. *Cervus canadensis* (Wapiti or Elk) - introduced species with a restricted range
5. Cows - economic importance
6. Horses and Burros - high-level of public interest
7. Domestic sheep - a few lambs graze parts of COR seasonally

Plants

1. *Artemisia pygmaea* (Pygmy Sagebrush) - population status is undetermined
2. *Pinus longaeva* (Bristlecone Pine) - species with a restricted range and a high level of public and scientific interest

The percentage of total geographic range that lies within COR boundaries for the 35 checklisted species is provided in Table 2.25. It is particularly important to identify those species with part of their range in target areas of live ordnance use.

Areas of ordnance use within the COR/Nellis range are located within areas R-4806 (South Range), R-4807A, B, C and R-4809. Within R-4806, ordnance deliveries are restricted to targets located within the bounds of dry lakes (see "Existing Ordnance Expenditure Activities,"

TABLE 2.25

RANGE AND STATUS OF IMPORTANT SPECIES

Species	Percentage of Total Range Within COR	Status[b]
Say Chipmunk	100[a]	B, R
Botta Pocket Gopher (*T. u. nanus*)	100[a]	B, R
Botta Pocket Gopher (*T. u. phelleocus*)	100[a]	B, R
Dark Kangaroo Mouse (*M. m. albiventer*)	100[a]	B, R
Dark Kangaroo Mouse (*M. m. sabulonis*)	75[a]	B, R
Pallid Kangaroo Mouse (*M. p. ruficollaris*)	95[a]	B, R
Pallid Kangaroo Mouse (*M. p. purus*)	100[a]	B, R
Montane Meadow Mouse	100[a]	B, R
Wood Ibis	unknown	M
White-faced Ibis	trace	B, M
Furriginous Hawk	trace	unknown
Golden Eagle	trace	B, R, M
Bald Eagle	unknown	M
Osprey	trace	M
Prairie Falcon	trace	B, R, M
Peregrine Falcon	trace	R, M
Snowy Plover	trace	R, M
Long-billed Curlew	trace	M
Burrowing Owl	trace	B, R
White River Gila	100[a]	B, R
Moapa Dace	100[a]	B, R
White River Spinedace	50[a]	B, R
Pahranagat Spinedace	100[a]	B, R
White River Springfish	90[a]	B, R
Railroad Valley Springfish	50[a]	B, R
Mule Deer	trace	B, R, M
American Pronghorn	trace	B, R
Desert Bighorn Sheep	10-15	B, R
Domestic Cow	trace	----
Wild Horses	unknown	B, R
Wild Burro	unknown	B, R
Domestic Sheep	trace	----
Pygmy Sagebrush	5-10	R
Bristlecone Pine	5-10	R

[a]Species whose range is demonstrated by maps (Figs. 2.29 through 2.35).

[b]Indicates percentage of their total known geographic range that is within the COR/Nellis Range. R = those species that remain within the COR/Nellis Range all year around; B = those species that breed within the COR/Nellis Range; M = those species or populations that pass through or remain in the COR/Nellis Range part of the year, generally spring, fall or winter.

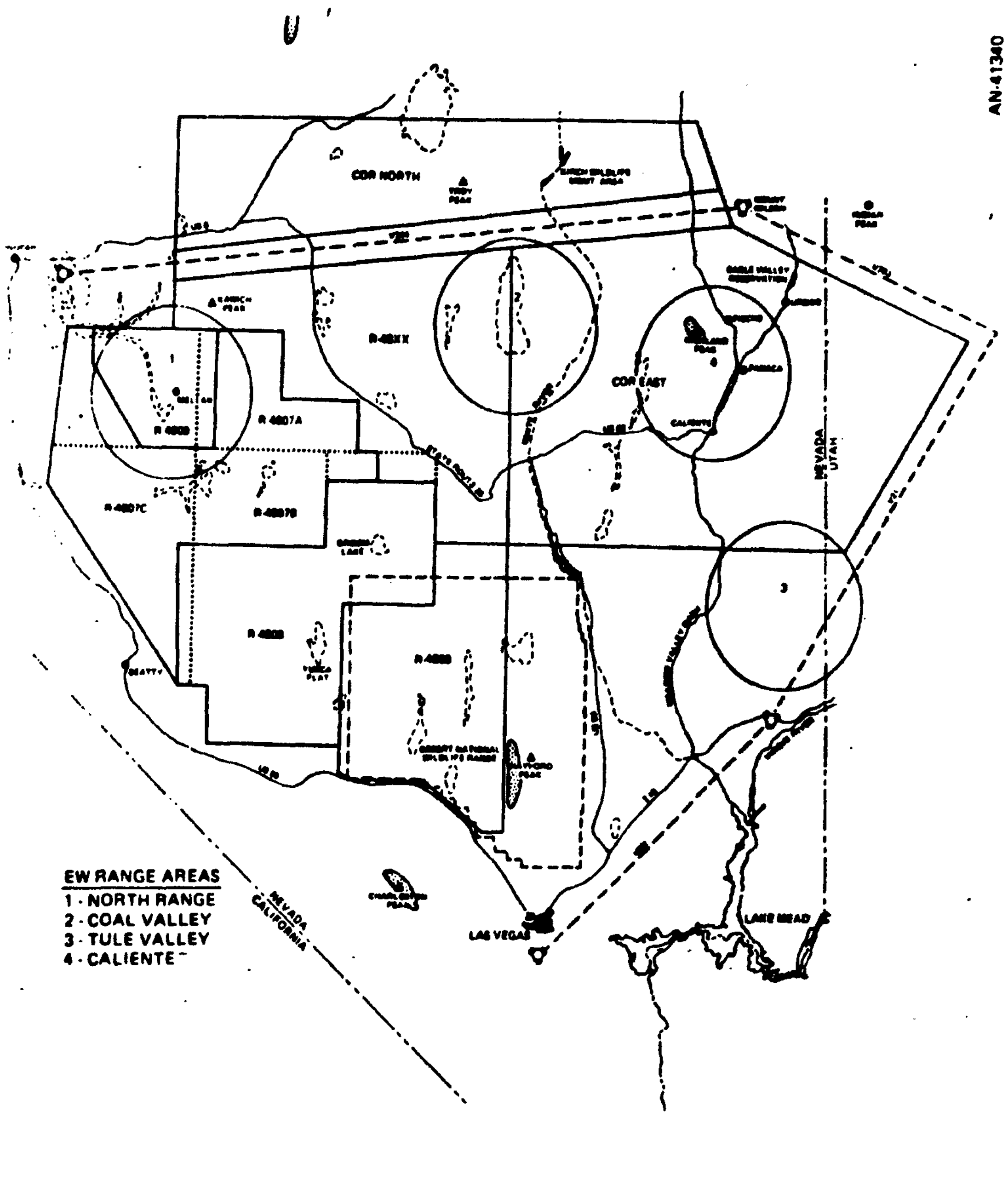


Figure 2.29. Distribution of Bristlecone Pine Within COR

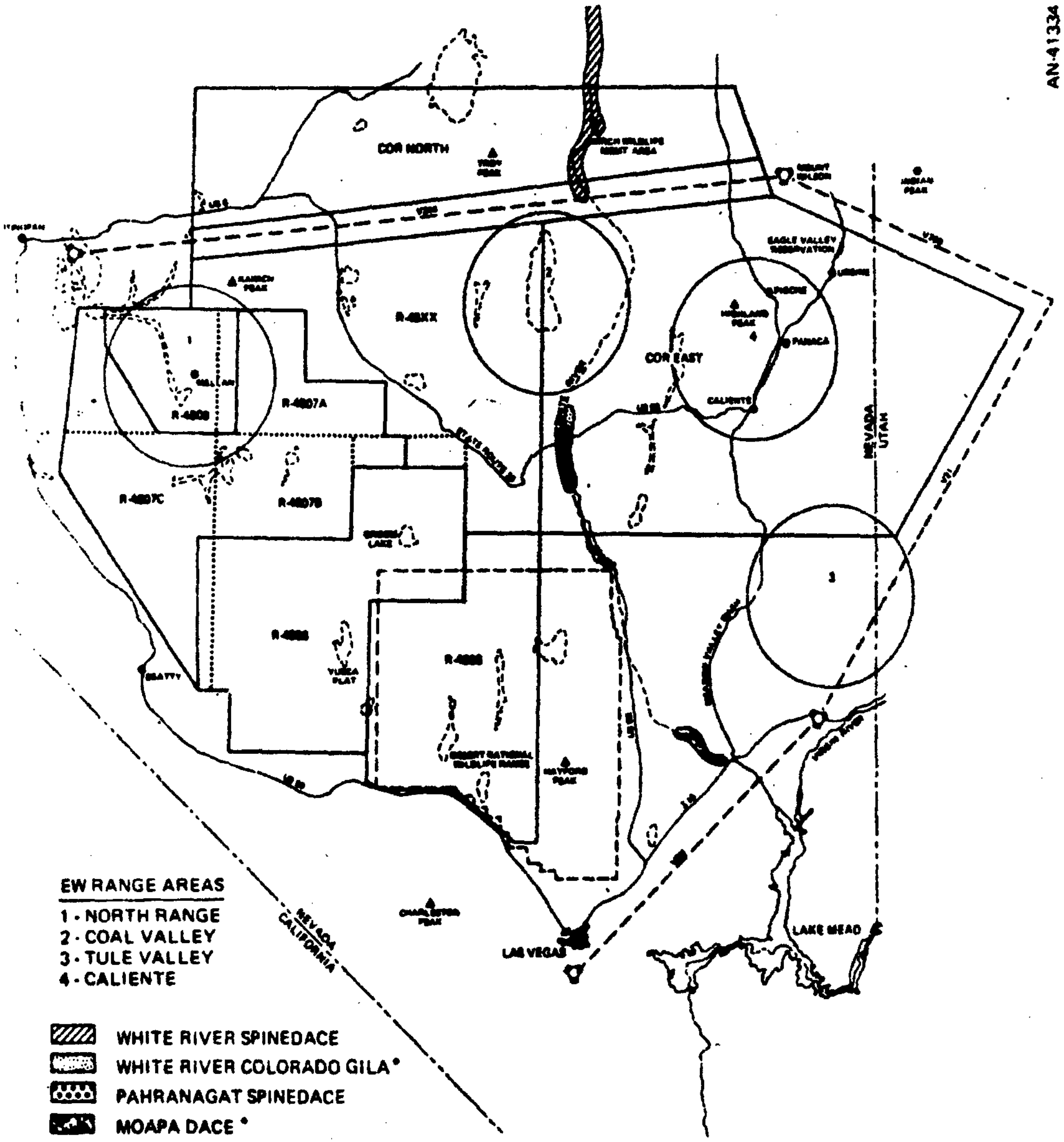


Figure 2.30. Distributions of the White River Spinedace, White River Colorado Gila*, Pahranagat Spinedace, and Moapa Dace* Within COR/Nellis

*Endangered species, 16 U.S. Code 668 aa, Appendix D

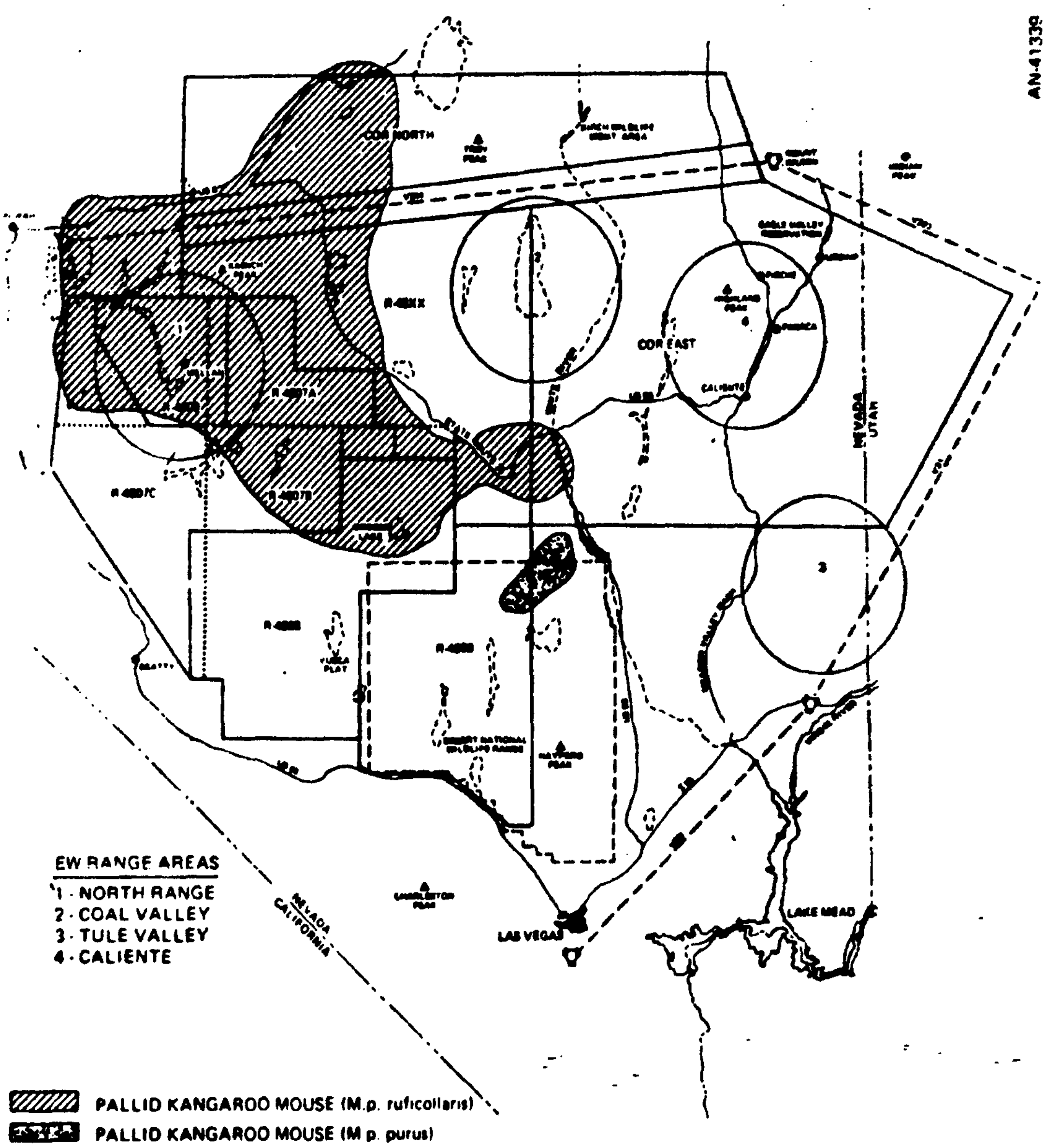


Figure 2.31. Distribution of the Pallid Kangaroo Mice (*M. p. ruficollaris* and *M. p. purus*) Within COR/Nellis

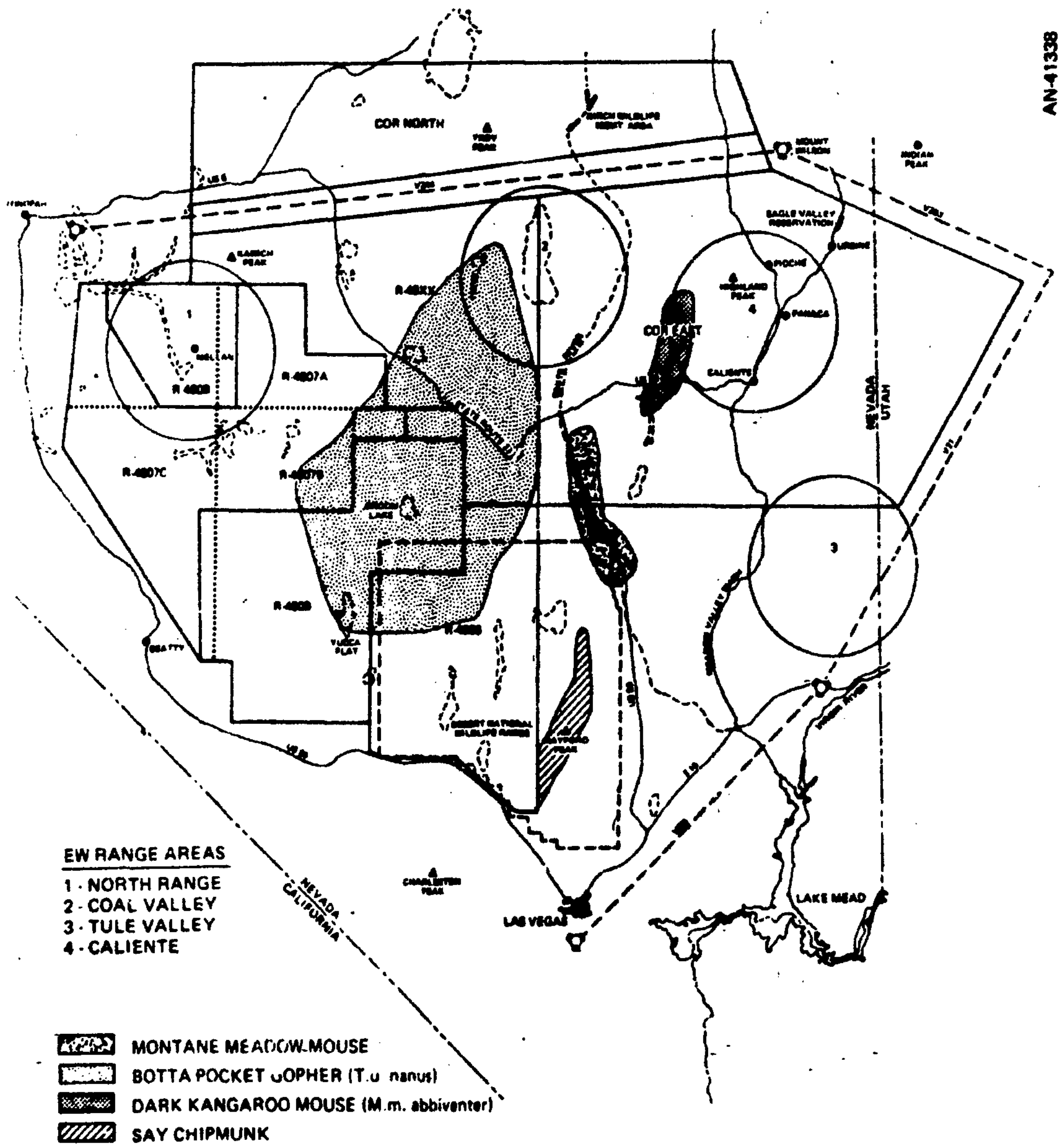


Figure 2.32. Distribution of the Montane Meadow Mouse, Botta Pocket Gopher (*T. u. nanus*), Dark Kangaroo Mouse (*M. m. abbiventer*), and Say Chipmunk Within COR/Nellis

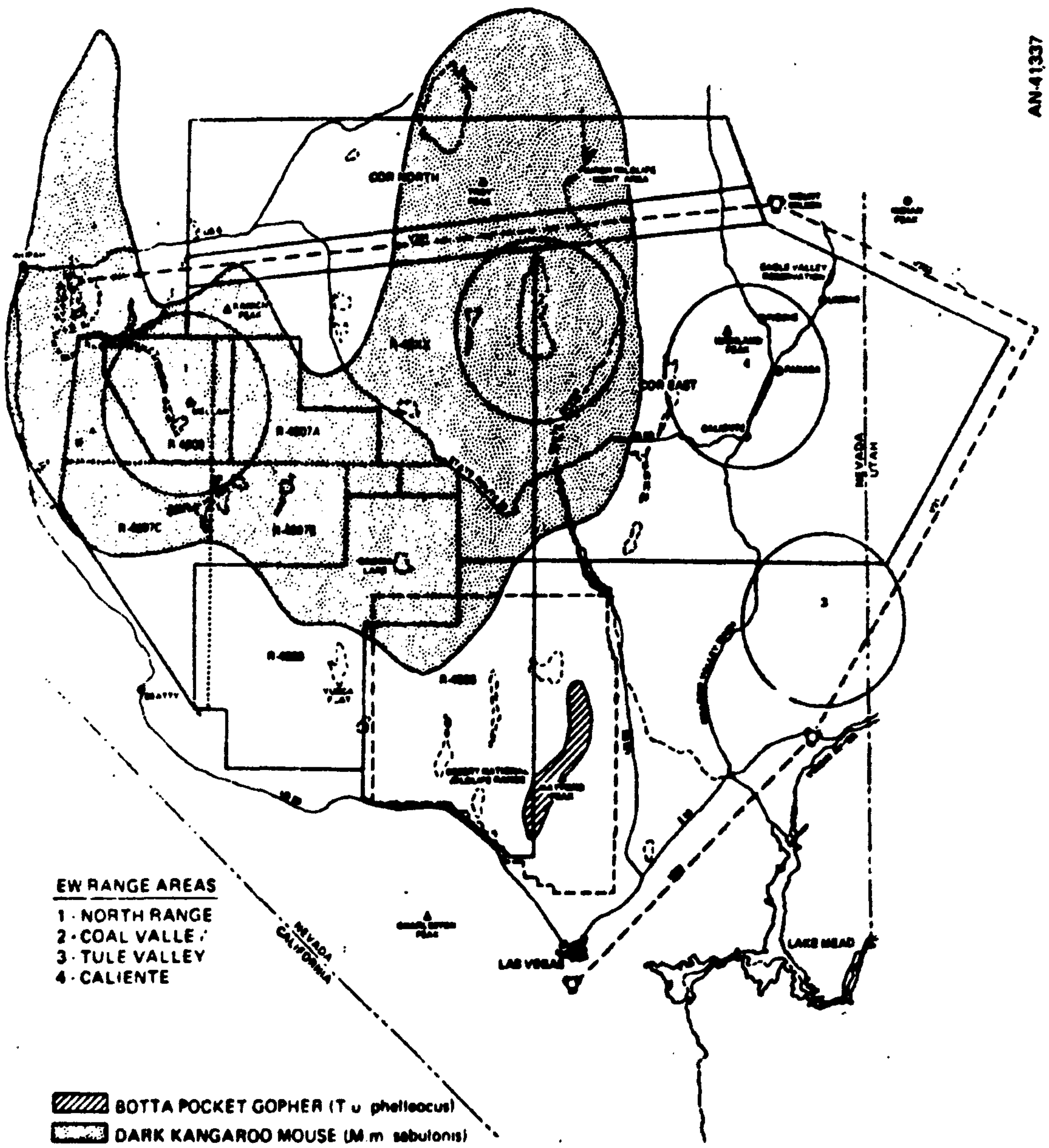


Figure 2.33. Distribution of the Botta Pocket Gopher (*T. u. phelleocus*) and Dark Kangaroo Mouse (*M. m. sabulonis*) Within COR/Nellis

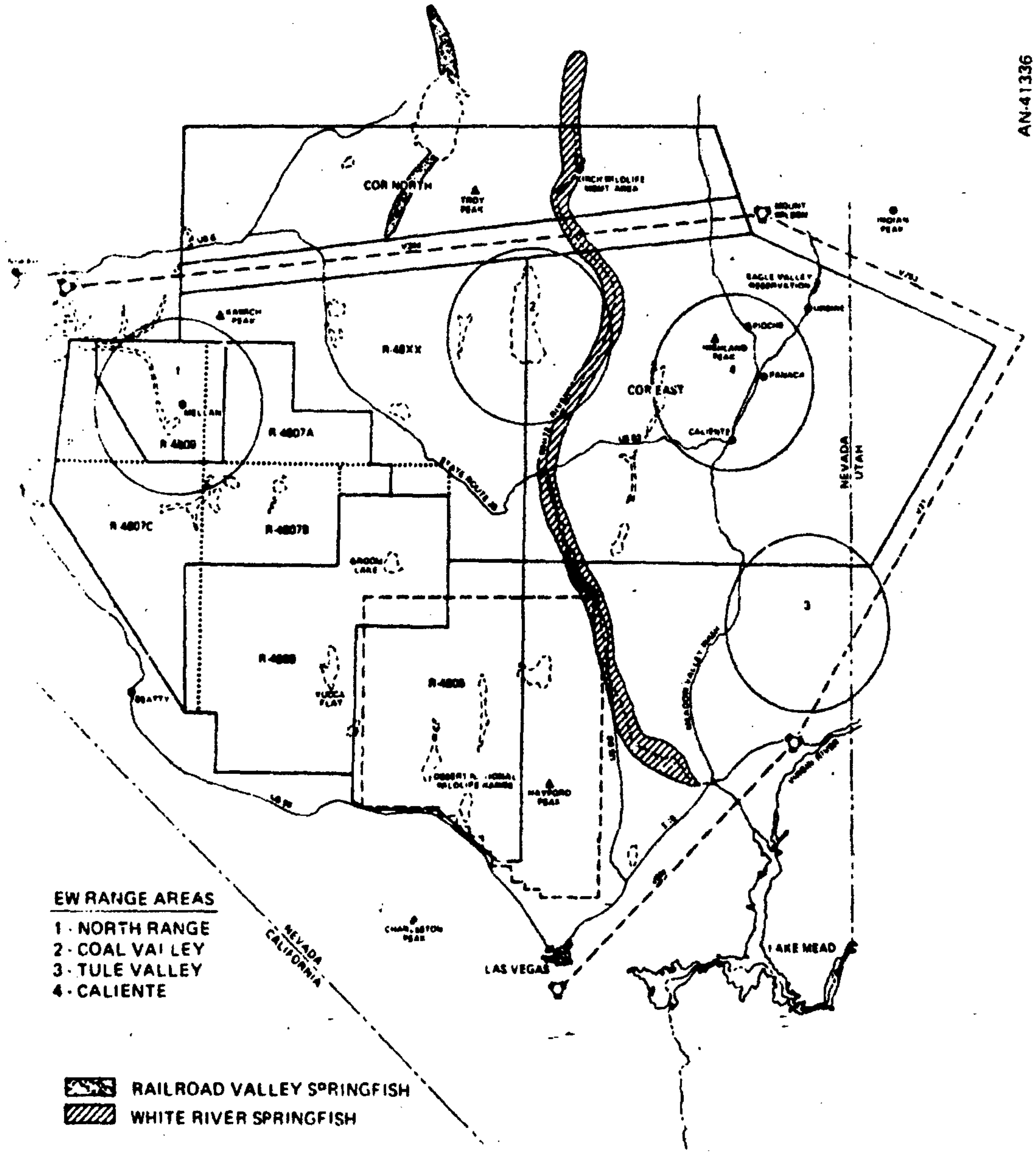


Figure 2.34. Distribution of the Railroad Valley Springfish and White River Springfish Within COR/Nellis

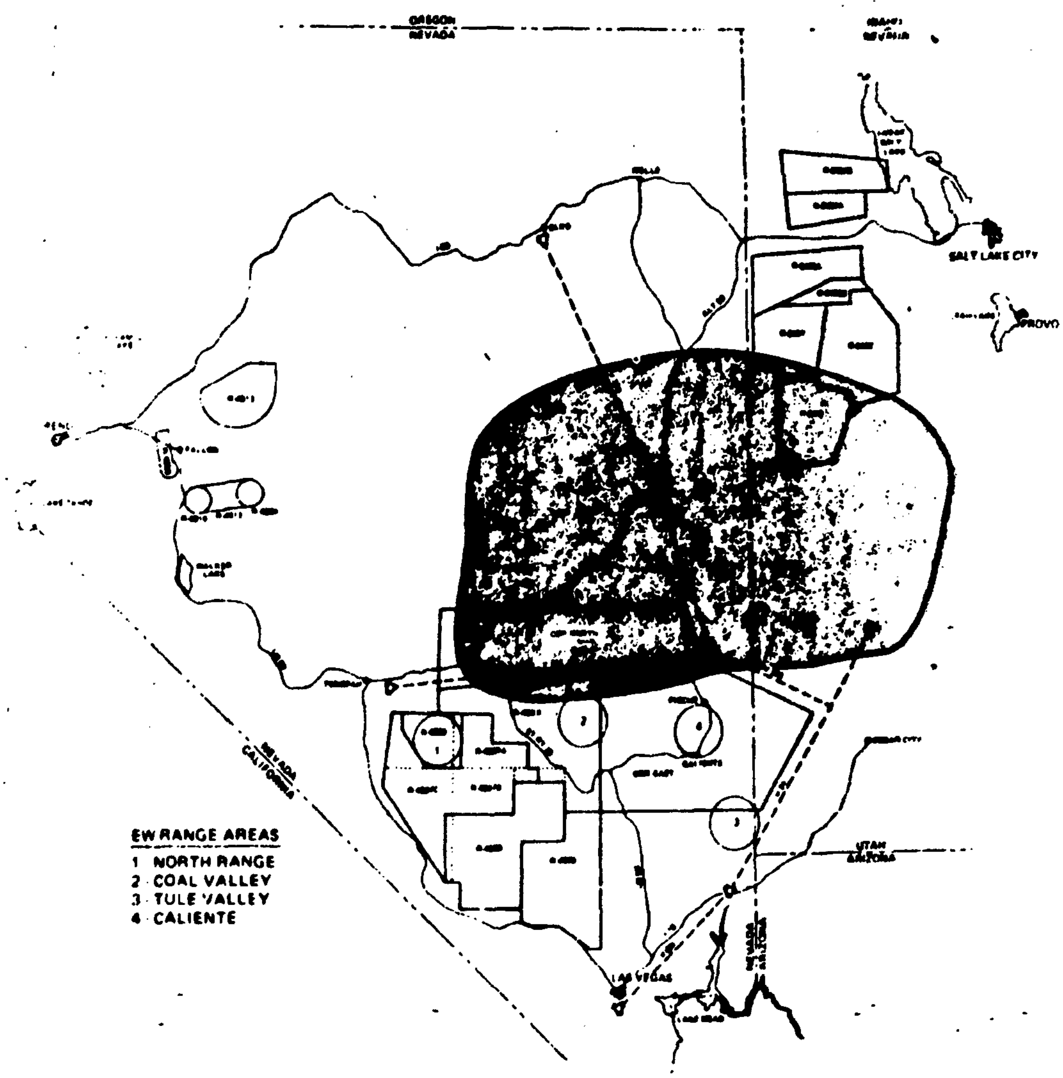


Figure 2.35. Potential Range of Pygmy Sagebrush Within COR Area

Note: Within the area delineated Pygmy Sagebrush will be found primarily in the valleys. Detailed mapping of actual locations of Pygmy Sagebrush has not been completed.

page 2.21) shown by dotted lines on the following maps. It should be generally noted that most species ranges do not extend into the dry lake regions with the exception of the Desert Bighorn Sheep (Fig. 2.36). Within range areas R-4807A, B, and C and R-4809 there are numerous target sites, most of which are shown in Fig. 2.5 depicting existing target sites, and Fig. 2.9, depicting proposed threat simulator sites for the North Range which may have associated live ordnance target sites. Several of the species ranges depicted in the following sets of maps overlap target sites in R-4807A, B, and C and R-4809.

Two species are not in Table 2.25; but still merit special consideration. The Elk is of economic and recreation interest because it will net revenue and public attention from hunting activities. There was an underlying concern with this species because their population in Nevada lies both to the north and south of COR, being found on Charleston Mountain (Spring Range) south of COR (where they have been introduced) and the Shell Creek Mountains north of COR. Aircraft activity associated with flights between H/W/D and COR/Nellis may fly over the Shell Creek Range. Also, there is a possibility of COR ground activity associated with the Angel's Peak (Spring Range) communications site and COR flight activities near the Spring Range. These factors, combined with a high level of public interest, especially where the success of an introduced species is concerned, and the lack of detailed knowledge on Elk responses to aircraft noises, should justify their inclusion in the list of important species.

The second species to merit consideration is the Trumpeter Swan, which at one time was placed on the threatened species list. They have been transported to other parts of their range to encourage survival of the species. Ruby Lakes (see Fig. 2.18) was one such place. Since essentially nothing is known about the effect of sonic disturbances or heavy air traffic on this species, selection of routes that would avoid them is desirable until data are available on this question.

As seen in Table 2.25, some species only have a trace of their total geographic range within COR. This, however, does not indicate that this species should be removed from consideration. An example is the peregrine falcon whose numbers have been reduced by 90 percent within the United States and is virtually extinct in the Eastern US, now existing only in local pockets in the Western US. Notwithstanding the fact that they occur only sporadically in COR, each indivdual of the now-remaining population is of critical importance. Especially important are areas of potential breeding locations such as the Pahranagat Valley (see Fig. 2.14); these areas should be given special consideration.

At least three species of fish (Moapa Dace, Pahranagat Spinedace, White River Colorado Gila) have their entire range within the COR/Nellis Range and occur along only a few miles of stream in isolated ponds (Fig. 2.30). Such small populations are particularly sensitive to disturbance or interference. In part they have been reduced to such low levels because of interference by man by altering their habitats or introducing competitors.

Birds of prey are given special treatment here for at least three reasons: (1) the fact that some tend to be sensitive to disturbance, (2) they are top carnivores and are thus extremely important to ecosystems, and (3) they have seriously declined in many regional areas throughout the US because of the impact of a combination of environmental perturbations.

In general terms, the Pahranagat Valley (see Fig. 2.14) is considered to be one of the "key" wintering areas of buteo hawks in southern Nevada (Robert Oakleaf, Nevada Fish and Game, pers. comm.). However, there are no values available as to the numbers of individuals this involves. More quantitative data should be available by spring 1974. Along with the wintering buteos, "small numbers" of bald eagles also winter in Pahranagat and the White River valleys (both within COR/Nellis) and the Overton Area. Actual numerical values are not available currently on bald eagles. In general, raptors may be considered to winter in areas where high concentrations of prey populations exist; also of considerable importance are localized water sources. Because of the widespread nature of rabbits, a prime food item for large hawks and eagles, raptors might be expected to be thinly spread over broad areas of COR during the winter.

Breeding populations are also poorly known with COR. One might suspect, however, that the breeding densities would be more or less restricted to cliff lines along mountain escarpments or areas of trees. The Shell Creek Range (between H/W/D and COR/Nellis) has some indication of containing rather substanial populations of golden eagles and prairie falcons. Generally, golden eagles and prairie falcons appear to be most highly concentrated in northern Nevada and diminish southward. About 88 nests of breeding golden eagles were located in Elko County in 1972 [Page and Seibert, 1973] and it must be considered that the density is markedly less for Lincoln, Nye, and Clark counties.

Those areas of cliff front that overlook water sources are considered important if for no other reason than the potential they provide should peregrine falcons regain their former numbers. The areas within COR/Nellis that meet these criteria are White River Valley, Pahranagat Valley and the Caliente-Panaca Area.

It is important to remember that those species determined by the Secretary of Interior to be threatened with extinction, and as periodically amended in the Federal Register, are given full benefits by Federal law as provided for by the Endangered Species Conservation Acts of 1969 (16 USC 668aa) and 1966 (80 Stat. 926). Additionally Federal protection is afforded those birds migrating through COR as amended by (16 USC 703-711). Eagles, of both species, are protected through the Bald Eagle Act, as amended (16 USC 668-668d). Wild horses and burros are afforded full federal protection against any form of exploitation or harrassment as provided by Public Law 92-195. COR implementation plans will take full cognizance of the requirements to protect endangered species.

- Game Animals

Mule Deer. Numbers of mule deer (based on hunter records [Popey, 1972]) vary a great deal throughout the COR Area both annually and geographically (Fig. 2.36). Although most of the 8,400 animals estimated for the COR Range are found in the northern and northeastern regions, relatively large numbers are found on the USAEC Nevada Test Site, possibly because they are protected from hunter pressure. Deer herds are found almost entirely in the Piñon-Juniper Woodland or the forests and mountain shrubs associated with them (Fig. 2.36). This habitat provides both the required cover and food, since deer are browsers rather than grazers. In this regard, deer can be expected wherever Piñon-Juniper Woodland occurs, although their population sizes vary appreciably.

Desert Bighorn Sheep. Desert Bighorn Sheep are relatively common in extreme southern Nevada, often south of the COR Range, although about 732 of an estimated 1,025 are within COR itself (Fig. 2.36). The portion of the range for Bighorn Sheep shown in Fig. 2.36 as covering much of the northerly portion of the South range indicates that some sheep may be found in one of the dry lake regions (dotted lines in Fig. 2.36) also used as an air-to-ground range. It should be noted that Bighorn sheep will probably be found here only when in transit from one grazing area to another. Their normal habitat is to stay pretty much in the mountainous terrain except to come down on to the alluvial plains to graze.

American Pronghorn. Although there is a sizeable pronghorn population in northern Nevada, only limited numbers are found in the southern portion

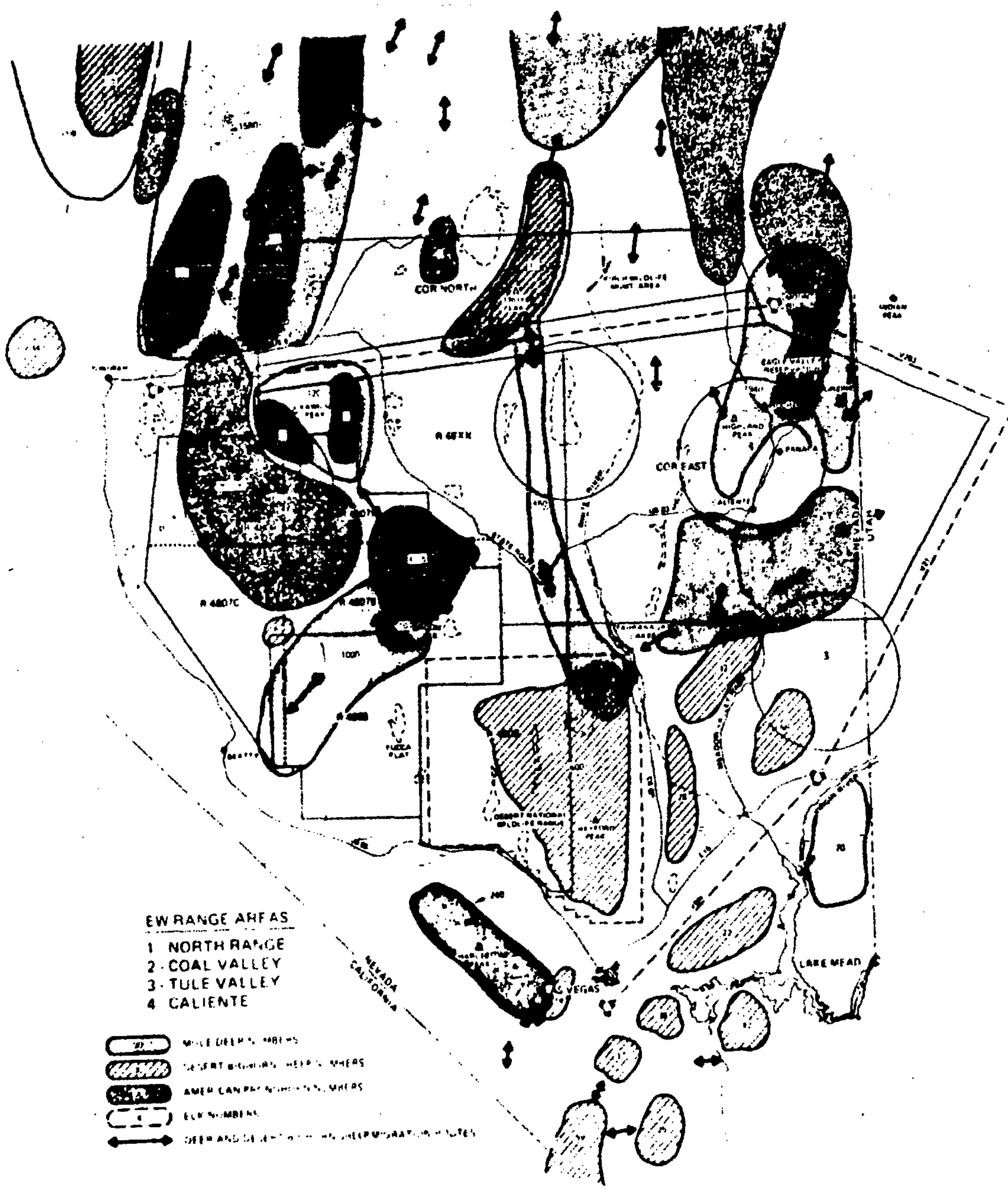


Figure 2.36. Distribution of Large Mammals Within COR/Nellis

of the state. A summary of pronghorn in and near COR reveals that there are approximately 380 animals, most of which are found in the northern portion of the COR/Nellis Range. As far as target areas are concerned, American Pronghorn are found only in the North Range (R4809).

Elk. Elk are found in the Charleston Peak area southwest of COR, where 150 animals are reported. They have been introduced into the area and are intensively managed. The Shell Creek range, situated between the Nellis Range and the H/W/D ranges also contain elk populations.

Small Game. Rabbits form an important source of recreation and judging from the numbers of hunters involved are important to the monetary gain produced in the state by hunting. Over 7,300 hunters sought rabbits in Nevada in 1972. In Clark County 760 hunters took 1,355 rabbits; in Lincoln County 737 hunters took 3,128 rabbits and in Nye County 363 hunters took 1,193 rabbits. Based on the nature of the terrain within these three counties together with the distribution of good rabbit habitat, it may be safe to assume that perhaps one-fourth of the hunts occurred within COR. If this is so, then as many as 465 hunters could have hunted there taking as many as 1,414 animals.

Game Birds. A considerable and significant recreational and monetary resource exists in hunting game birds. These are broken into upland game, such as quail and doves, and waterfowl. There are no reliable estimates of the total numbers of animals involved in the region affected by COR operations. Therefore, about the only indicators that can be used are data on hunter usage and take of animals by counties. Some broad extrapolations may perhaps be inferred from some of these data. Regions of concern to this topic will encompass parts of Lincoln, Clark and Nye counties, and although aircraft will overfly other regions, major consideration will only be given to areas of low-flying aircraft as they approach or are over target areas.

Upland Game. In 1972 Sage Grouse were hunted by 509 hunters in Nye County where 754 birds were taken. Presumably most of the hunting took place in the northern half of Nye County and perhaps most of it outside of COR itself. In 1972, 61 hunters took five Blue Grouse in Nye County. Since this is a montane forest species, they were probably taken outside of COR range boundaries but possibly within potential corridors to COR.

Chukars were heavily hunted in 1972. Clark County had 33 hunters take 761 birds; Lincoln County had 62 hunters take 228 birds; and Nye County had 227 hunters take 424 birds. Along with Chukars, Gambel's Quail was also heavily hunted with 1,083 hunters taking 4,948 birds in Clark County, 598 hunters took 1,792 birds in Lincoln County and 308 hunters took 499 birds in Nye County. Just how many hunters were within COR or potential corridors leading into COR cannot be assessed, but certainly, since Chukars and Quail are arid land birds, the pressure to hunt them in the arid lands making up COR can only increase as the human population in that region increases.

Pheasant was not an important game species in this area since only 323 hunters took 140 birds in Clark County. This species occupies primarily agricultural areas and, therefore, is most likely to be outside of COR except in places like the Pahranagat Valley. The other upland game species of significance is the Mourning Dove. Clark, Lincoln, and Nye Counties combined had a total of 4,043 hunters in the field, and 56,542 birds were taken.

Although no values are available for numbers of hunters within proposed COR/Nellis Range, a safe estimate might be about one-fourth when one considers the type of birds hunted and nature of their habitats. Considering only Chukar, Gambel's Quail and Mourning Doves, perhaps as many as 1,588 hunters were in the field within the COR area taking 16,298 birds. This must be considered speculative, but if this value is a reasonable estimate, then this represents a considerable recreation and economic resource.

Waterfowl. Major areas of waterfowl hunting within COR/Nellis Range or the immediately surrounding area are the Kirch and Key Pittman Wildlife Management Areas. During 1972, about 3,096 ducks, 16 geese, and 63 Coots were taken from these two localities. About 1,500 hunters were involved in these activities.

- Migrating Species

An important feature of many species is their migratory habit. The biology of migration is a complex behavior with a long evolutionary history, resulting in the present behavior essential for species survival. Animals winter in certain areas because they afford protection, food supplies, etc. The areas that are used by migrating species are optimum in the limiting factors, while the areas not frequently used usually lack some of the critically important factors. That is to say, that although unused other areas "look good" to the human eye, they probably are not, or they would be occupied by animals now. If migratory animals are artificially or unnaturally restricted from migrating, serious biological consequences could result, such as greater predator exposure, greater food stress, etc. It should also be mentioned that some of the migratory routes used by animals are "traditions" that have become part of the animals' biology through hundreds of generations. Many times, these traditional behaviors may not be altered and still retain substantial survival. Important migrating species in the COR region are discussed in the next few paragraphs.

Species that are potentially in a position to be affected are Desert Bighorn Sheep, Mule Deer, and about 66 percent of the birds that occur within the COR/Nellis Range which migrate and can be placed in the following groupings: Five species of divers, eight species of heron-like birds; 18 species of waterfowl; six species of raptorial birds; six species of marsh birds; 30 species of shore birds; 16 species of sub-song birds; and

80 species of song birds. This picture is not precisely accurate, however, because in a species like the mallard, which is considered resident, there are populations from northern climes that move into Nevada in the winter to augment the numbers of birds that remain there year around. Because the species can be found year-round, it may be considered a resident, although the individuals that make up the summer population may be from a totally different population than those that comprise the winter population.

Staging grounds are important to a bird's preparation for migration. It is here where they acquire sufficient food to accumulate the necessary energy reserves to make a successful migration. Of special concern are well-established areas of waterfowl wintering and migration that are in areas of high use potential within COR; namely, Pahranagat National Wildlife Refuge, Kirch Wildlife Management Area and Key Pittman Wildlife Management Area.*

In 1971-1972 and 1972-1973, between August and May, there were 41,787 and 30,309 migrating ducks, swans, geese and coots at Pahranagat National Wildlife Refuge. During the 1972-1973 migration season, 67,002 individuals visited Kirch Wildlife Management Area while 34,443 were recorded at Key Pittman Wildlife Management Area; thus, there was a total 1972-1973 usage of about 131,753 individual waterfowl birds of 19+ species:

Mallard	Canvasback
Gadwall	Scaup
Pintail	Goldeneye
Green-wing Teal	Bufflehead
Cinnamon Teal	Ruddy Duck
Widgeon	Canada Goose
Shoveler	Snow Goose
Wood Duck	Whistling Swan
Redhead	Coot
Ringneck	

*These areas are depicted in Fig. 2.14.

Peak months of migration at Pahranagat National Wildlife Region were December and January, while at Kirch and Key Pittman Wildlife Management Areas they were October and November [Borngraver, Malini and Tsukamoto, 1973].

Data are not available on the precise numbers of Mule Deer and Desert Bighorn Sheep migrating in areas of possible impact of low-flying aircraft, but it is probably between 7,000 and 14,000 based on deer harvest data from the Nevada Fish and Game Department. Only the migratory routes could be assessed, and these are not at all clear (Fig. 2.36). Additional assessments of the possible impacts of low-level flights on migration will probably be required if, as COR develops, the characteristics of future paths differ from those of the present activity in these areas.

RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS AND POLICIES

The proposed COR will interact with the activities of several other agencies, and in several cases may require procedural decision-making processes on the part of these agencies. The rule-making process of the FAA in regard to COR airspace proposals is a good example. Similarly, land withdrawals from Bureau of Land Management lands may be sought. Then there is the general category of regional and municipal planning continually in process. Finally, consideration must be paid to State and Federal mandates regarding air quality and the like. In this section, likely areas of COR interactions are discussed from the perspective of the plans and policies pursued by various entities.

3.1 PLANS AND POLICIES OF THE BUREAU OF LAND MANAGEMENT AND US FOREST SERVICE

In undertaking COR activities, the Air Force must locate various land-based facilities and installations on the lands in the range areas. Where these facilities are outside of the land already withdrawn by the Department of Defense, it will be necessary for the Air Force to obtain either a withdrawal of land for the specific purpose for which it will be utilized, or to obtain an easement which will allow the use required by the Air Force--to travel, for example, to a given threat simulator site--or a permit which will allow temporary use of the given site.

The simplest form of site use involves a temporary agreement between the authorized officer of another agency and, for example, the State Director of the Bureau of Land Management. The agreements are for clearly temporary use, other than for a permanent installation or use. It is not clear how long a use may be permitted before some other procedure may be required. And presumably the use will not involve significant disruption of the environment, otherwise a formal environmental impact statement might be requested for the site. There is no definite procedure that must be followed.

The granting of an easement, as for construction of a road or installation of communications equipment, requires far more formal procedures in view of the relatively permanent potential effects on other parties. For roads, for example, there must be submitted a map showing location of right-of-way. If there are mining claims, easements must be obtained. The agency must negotiate location, use, maintenance, environmental concerns, and all other appropriate matters.

Recent experience indicates that the Bureau of Land Management is extremely sensitive to the multiple uses that may be made of land that may have been deemed relatively worthless but a few years ago. Evidence for this is found in documents dealing with a Special Land Use application submitted by Hill Air Force Base for 160 acres in Western Utah, demonstrating the care with which the BLM examines such applications.[11] Included in the documents are analyses of effects on the immediate environment, visual effects, and views of local residents, particularly owners of ranches in the area. Carefully drawn stipulations are included in the proposed ultimate agreement. Moreover, it is clear that the attitude of the BLM might have been considerably different had there been an expectation that the use might extend beyond a single year.

In view of the multiple use of the BLM lands and the already existing rights and investments of others in those lands, the Air Force will undertake to ascertain the impact of its proposed land uses on the physical resources and individuals and communities in the area. Multiple use of BLM lands involving the Air Force as one of the users is not uncommon. A good example is the existing shared use of the Wild Horse Management Area on the Nellis range which is formally circumscribed in letters of agreement between the Air Force and the Department of Interior. These agreements carefully delineate mutually agreed to constraints which allow both agencies to fulfill their responsibilities.

A small portion of the Humboldt National Forest in the Quinn Canyon Range underlies the proposed boundaries of COR North. Any requirement for a land withdrawal of a small parcel of this forest preserve for COR use--say, for a microwave repeater site--will be handled by the Bureau of Land Management (BLM) as are mining claims on national forest lands. Thus the procedures and policies pursued by the BLM as described previously would also apply. However, the US Forest Service does have responsibility for timber resources. The Bristlecone Pine is a species of significant scientific interest, and it is US Forest Service policy

to protect both living trees and dead wood from depredation and scavenging.*
Areas of concern in this respect may arise when detailed plans are formulated to link H/W/D with COR/Nellis with a microwave system. Location of microwave repeaters in US Forest lands will be carefully considered.

3.2 NEVADA STATE RECREATION PLANS AND POLICIES

The Department of Conservation and Natural Resources of the State of Nevada in the mid-1960s concluded that the State's urban and non-urban recreational facilities were "pathetically inadequate to meet public needs."[12] The Department recommended an expansion, modification, and intensification of all recreation programs by all relevant federal, state, and local agencies. It further urged stepped-up spending to acquire land and water resources having outstanding recreation potential. The Department predicted that whatever happened with regard to industrial or agricultural development in Nevada, "The economy of Nevada is expected to remain centered on the tourist industry." With respect to industrial development, it argued that one of the chief attractions that Nevada offered was "uncrowded living." Industrialists, the Department asserted, like Nevada because there is space to live and play.

In 1965, the State projected recreation attendance for various regions of Nevada. It projected an attendance by 1980 of 2.55 million for the North Central and East region in which most of Lincoln County is located. This may be compared with a 1965 attendance of 1.12 million visitors. Sixty percent of all visitor trips come from California, but only 3.6, 2.2, and 1.3 percent of all trips originate in the adjoining states of Utah, Oregon, and Arizona. Thus, the recreation industry is very much tied to the economy of California.

---

*One COR communication site is located atop Highland Peak (near Panaca) which has a significant population of Bristlecone pines. However, this area is not part of a US Forest preserve.

The State has continued its effort toward developing a plan for outdoor recreation. In 1971, the Department published a statewide comprehensive outdoor recreation plan in which it again recommended an aggressive program of land acquisition or land protection and preservation of the limited water resources.[13] It especially urged a substantial increase of funding at all levels of government for acquisition, protection, and operating purposes.

Part of the goal in assessing recreation potential in the State is to preserve open space which is defined as "land or water surface open to the sky" and encompasses land used for livestock range, agriculture, parks, recreation, vistas and views, wildlife conservation, transportation routes, or places of landing. An Ad Hoc Committee on Environmental Quality reported on Nevada's heritage in 1970 to the effect that "many of these lands should be preserved as open spaces, for, in the total environment, the role of open space is to provide a balance between development and non-development. The function of open space is to provide breathing space, recreational outlets, green areas, and retreats of natural beauty and scenic value."

The State has identified numerous potential recreation sites in the various regions of the State. In the northern part of Lincoln County, within the COR EW Range area, 24 such locations have been identified, ranging from 7600 acres of the Fortification Range in the far north of the County to 10 acres at Bristol-Wells. All but one of the sites are under the management of the Bureau of Land Management. Nearly all of these sites would be classified as natural environment areas, or outstanding natural areas, while a few would be classified as historic and cultural sites. The primary objective of natural environment areas is to allow the visitor to enjoy the resource "as is," in its natural setting. Outstanding natural areas are those that are remarkable for their "natural wonder, high scenic splendor, or features of scientific importance."

In addition to identifying such sites, the State has recommended acquisition of nine areas as high priority matters for outdoor recreation. These include Sheldon Game Range, and Sheldon Antelope Refuge, which are outside the COR region, and portions of Highland Peak, Delamar Mountains, Wilson Creek Range, and Gleason Canyon, all within or near the Caliente portion of the COR/Nellis range.

While it is clear that COR overflights at high elevations would probably not significantly disturb activities in these recreation areas, flights at lower levels might have an effect on the quality of the experience in the "open space" of Eastern Nevada. Since tourism and recreation are likely to remain high priority matters for economic development in Eastern Nevada, care will be exercised to ensure that the area remains attractive to tourists and recreationists.

3.3 PLANS FOR PROPOSED WILDERNESS

The existing Nellis Test Range presently makes use of the western half of the Desert Game Refuge, lying just northwest of Las Vegas. Extensive bombing and gunnery is carried on there, often involving live ordnance. These activities are to be continued on that portion of the test range at about the same or slightly higher intensity under the proposed COR.

The Desert Game Refuge is administered by the Fish and Wildlife Service of the United States Department of Interior. The Desert Game Refuge has been proposed for inclusion in the National wilderness system pursuant to the National Wilderness Act of 1964. An environmental impact statement (EIS) has been filed concerning this proposed action and its processing is near completion. However, no legislative bill has yet been drafted.

The portion of the Desert Game Refuge proposed for inclusion as a wilderness comprises most all of the eastern half not now lying in the test range boundaries (with small adjustments in recognition of local developed areas in peripheral portions of the Refuge) plus the higher elevations within the test range portion of the Refuge. Resolution of this proposed wilderness designation has been negotiated with Air Force interests.

Although the wilderness designa- ion does not detract from the original purposes as a game refuge, does provide for other purposes such as a place of solitude where is considered a visitor. However, the present memorandum of understar..ng between the Air Force and the Department of Interior regarding th Desert Game Refuge provides for controls on Air Force ground activities that should render such activities compatible with a possible wilderness designation, provided that protective language is inserted in the enabling legislation for the wilderness area.

3.4 REGIONAL DEMOGRAPHIC PROJECTIONS

The State of Nevada, through its State Engineer's Office, has made projections of population growth through the year 2020. Although such projections frequently lack reliability, they constitute th expectations of the best informed people at the present time. Table 3.1 lists the projected 1980 populations for several Nevada Counties along with the corresponding 1970 census estimates.

3.4.1 Las Vegas Area Plans

The projections show that Clark County, the area around Las Vegas, is expected to grow dramatically during the next several decades, although the rate of growth has alr begun to taper off. Clark County had 273,288 residents in 1970 s expected to reach a population of between 816,000 and 1,000,000 (bas on projected low and high growth rates) by the year 2000. The population he Las Vegas metropolitan area itself is expected to triple in the ime period. The rapid rate of growth began with the constructio of Hoover Dam and the location of the Basic Management, Inc., industrial complex in Henderson. Following were the location of the Nellis Air Force Base and the Nevada Test Site. Gaming

TABLE 3.1

POPULATION PROJECTIONS*

	Existing 1970	1980
Carson City, Nev.	15,468	31,000
Churchill County, Nev.	10,513	13,000
Douglas County, Nev.	6,882	13,000
Elko County, Nev.	13,958	22,000
Las Vegas SMSA, Nev. (Clark County)	273,288	483,000
Lincoln County, Nev.	2,557	2,700
Lyon County, Nev.	8,221	11,000
Nye County, Nev.	5,599	7,000
Reno SMSA, Nev. (Washoe County)	121,068	158,000
Storey County, Nev.	695	800
White Pine County, Nev.	10,150	10,500

*Water for Nevada, Report #5, State Engineer's Office, February 1973.

and tourism generally have been extremely important in explaining this rapid growth. Expansion of government activity and the continued upsurge of tourism and recreation accounts for much of the expected increase in the Las Vegas area. The service industry is expected to grow the fastest with an annual employment increase of 10 percent.

The other areas affected by COR, Nye and Lincoln Counties, are likely to grow much more slowly. Nye is classed as a moderately growing county, expected to reach 10,000 by the year 2000. This is approximately double its present population. Most of this growth will probably occur in the southern area of Nye County in the Pahrump Valley (see Fig. 2.20) where urban development is beginning to occur. This area will probably be little affected by COR activities. Planners project a growth in Tonopah of 250 persons over the next 16 years. It does not appear that there will be a significant increase in the demands for urban public services in Tonopah during the period. Lincoln County is considered an area of slow growth. By the year 2000 it is expected to grow only by 400 people. But such projections could clearly be made erroneous by the opening or closing of an industry. If mining booms, the population growth might be rapid and substantial.

A series of studies commissioned by the Nevada State Planning Board[14] studied the condition of water and waste water facilities in rural Nevada communities. These studies assessed the facilities' capacity to handle current and projected population levels. Recommendations were made regarding improvement of facilities; however, no funds were provided to local governments. Therefore, the implementation of these recommendations is problematical.

3.5 RELATIONSHIP OF PROPOSED COR AIRSPACE AND PROJECTED COR AIR ACTIVITY TO AIRSPACE USE PLANS AND POLICIES

As a result of the Federal Aviation Act of 1958, the FAA Administrator is manager of all airspace in the US and thereby exercises a measure of control of all uses of US airspace. He does not have the jurisdiction to control or regulate activities which take place on the ground. The administrator may determine that a ground activity will or might present a hazard to aviation. A transmitting antenna tower in excess of 200 feet in height, for example, could present a hazard to aviation. Were it to be built despite the FAA finding of hazard, the Federal Communications Commission (FCC) would not issue a license. Beyond such indirect regulation of ground activities, the FAA Administrator has no control.

Thus the proposed COR airspace cannot <u>directly</u> relate to any land use plans or policies. The extent to which land use plans or policies may be affected by implementing the proposed COR airspace is explored in Sec. 4.1.2.

The proposed COR airspace is related to three broad areas of airspace use plans and policies. These are:

1. Relationship to the NEPA
2. Relationship to FAR 73.1
3. Relationship to Compatible Use Zones in the Las Vegas Area.

3.5.1 Relationship of the Proposed COR Airspace to the NEPA

The proposed COR airspace is a key element in the safe and efficient implementation of COR. Accordingly, the US Air Force has decided to include consideration of the airspace as an integral part of the COR ES.

3.5.2 Relationship of the Proposed COR Airspace to FAR 73.1

Federal Aviation Regulation (FAR) Part 73, subpart 1, refers to restricted areas. The user of any restricted airspace is required by 73.1 to notify the FAA in the event that the user's operations are modified so that sole use of the restricted area by a single user can no longer be justified. For example, if a hazardous situation which originally justified sole use no longer prevails continuously (or nearly so), then the FAA is required to redesignate the operational status of the restricted area. The new designation may be in terms of time periods based on a use schedule supplied by the user. Alternatively, FAA may merely redesignate the restricted area to be joint-use, without specifying periods of use.

The US Air Force attaches a specific meaning to the word "joint." Quoting from USAF Manual 55-2, "Joint Special Use Airspace. Special Use Airspace made available for public use (with the FAA as the controlling agency) during periods when USAF operations for which the area was designated are not being conducted." The significant aspect of joint-use is that the airspace may be used by others only during periods when the designated using agency is not using the airspace. "Shared use," on the other hand, is a USAF term meaning simultaneous use of the airspace by the designated user and other user(s). The FAA does not differentiate between joint-use and shared use.

In the case of the proposed COR airspace, three restricted areas are to be redesignated as joint-use. Two of these (R-4806 and R-4807) are currently designated for only USAF use. The intent of the proposal is to make these areas available for public use during periods when they are not required by the USAF. In the correct terminology the USAF will temporarily release the subject airspace. In particular, it is proposed that R-4807 be divided into three independently releasable portions, R-4807A, B, and C. In these areas the public will be permitted to use this airspace when it is released. Naturally, when the USAF again requires use of the airspace, the public will not be permitted access during the time of USAF use.

The case involving R-4809 is slightly different. The AEC is the designated user of R-4809. However, in 1969, the AEC and the USAF entered into agreement which in effect made R-4809 shared use airspace (in USAF definition). The proposed COR airspace seeks to formalize this inter-agency agreement by proposing that the FAA properly designate R-4809 to be joint-use. The intent of this proposal is to permit public access to R-4809 when neither the AEC nor the USAF is using the airspace.

3.5.3 Relationship of the Proposed COR Air Activity to Compatible Use Zones in the Vicinity of Las Vegas

Three airports operate in close proximity to each other in the Las Vegas area; Nellis AFB, North Las Vegas Airport, and McCarran International. These airports form a triangle whose sides measure only 8, 8, and 10 n mi respectively. They cater to the military (Nellis), general aviation (North Las Vegas), and air carriers (McCarran). Their proximity to each other, the relationships of their runways, the diverse types of aircraft using them, and the volume of air traffic that each generates combine to produce the terminal ATC environment. To cope with this issue, letters of agreement between the control towers at each airport establish compatible use zones and ATC procedures which enable safe and efficient air traffic flows. Letters of agreement exist between Nellis tower and McCarran tower, and between North Las Vegas tower and McCarran tower. An example of these letters is to be found in Appendix J.

In addition to the proposed COR, the rate of aircraft operations at McCarran International will expand local air traffic activity. A 1935 Airport Master and Land Use Plan was prepared in October 1970 and is an updated version of a 1966 report. Although it dealt with plans to cover the period to 1985, most of the developments have already been implemented, and a new master plan is being prepared. This subsection deals with the relationships between the levels of air activity proposed by COR, the 1970 McCarran Master Plan and ATC in the general area.

In 1973 Nellis AFB generated an average of 384 aircraft movements daily. Of these, 155 were associated with missions which were the same type as proposed for near term COR missions. The far-term COR projections (for the mid-1980s) would raise this figure to 214. Thus an increase of 59 aircraft movements per average day can be attributed to far-term COR projections.

The McCarran Airport Master Plan tabulates historical and projected scheduled and nonscheduled airline operations, general aviation operations, and military operations. This historical data reports on the years 1965 through 1969 and the forecasts are for 1975, 1980, and 1985. Table 3.2 lists these data and adds the historical data for the years 1970 through 1973.

Defining and determining air traffic flows is also a purpose of letters of agreement and relates to prevailing wind, runway orientation and aircraft performance. It is the opinion of ATC personnel that the projected increases in traffic at Nellis (because of COR far-term plans) would not require changes in the letters of agreement between Nellis and McCarran ATC towers. This is true even in the light of the upper bounds projected for McCarran air traffic activity in the mid-1980s. On the other hand, certain ATC problems which cannot be foreseen at this time, may develop from time to time as a result of increases in air traffic activity. Situations such as these are handled on an individual basis, and generally involve only procedural adjustments.

TABLE 3.2

MCCARRAN AIRPORT OPERATIONS

Year	Annual Total	Daily Average
1965	152,018	418
1966	169,268	464
1967	187,209	512
1968	215,702	591
1969	248,068	680
1970	212,903	584
1971	216,061	592
1972	228,931	627
1973	248,731	681
1975	311,600	851
1980	398,600	1095
1985	488,000	1340

3.6 AIR QUALITY CONTROL PLANS

Large parts of the Nevada and Utah land area are federally owned and consequently the relationship to state and local air quality control plans is of interest. Executive Order 11752 (19 December 1973) requires in essence that federal facilities adhere to local regulations in the area of air and water pollution.

An Air Quality Implementation Plan[10] for the State of Nevada (30 January 1972) has been developed to maintain air quality compliance with federally promulgated standards. In the development of that plan certain assumptions are made with respect to the pollutant emissions in each of several categories. With respect to military aircraft emissions the plan assumes that the number of military aircraft will be in decline at a rate of 1 percent per year and that operating aircraft would be switched to Turbine A fuel. The plan anticipates that total military air pollutant emissions will thereby be reduced from 2033 tons per year in 1970 to 1584 tons per year in 1975 and 1491 tons per year in 1977.

It seems clear that the proposed COR development will increase the number of aircraft, and consequently, proposed COR activities should be the basis for a revision of the air quality implementation plan.

4 PROBABLE IMPACTS OF THE PROPOSED ACTION

4.1 PROBABLE IMPACTS OF PROPOSED COR AIRSPACE

This section outlines the probable impacts that might result from implementation of the proposed COR airspace. In general, these impacts may be classified either as impacts on aviation or impacts on ground based operations.

4.1.1 Aviation Impacts

4.1.1.1 Safety

Paragraph 4 in the proposal for COR airspace* states: "Mission accomplishment with safety is the governing factor in development of the proposed COR and will continue to be the paramount issue in its management when, and if, this proposal becomes a reality." In this context, safety refers to the avoidance of mid-air and near mid-air collisions. By organizing COR airspace, and by providing an increased measure of air traffic control, there can be no doubt that safety should be enhanced.

Military operations will be performed with added safety. In civil aviation, general aviation operations will be the primary beneficiaries of the enhanced safety, since an ATC approval would be required to transit those areas of COR East and COR North in which military and civilian operations are permitted. This clearance would not be granted if the military operations would create a hazard to the civilian operations. Currently, a number of areas exist where uncoordinated mixed (military/civil) operations occur--see Fig. 4.1. While a portion of the supersonic training area will remain outside of COR East, and the alert areas will continue to be available for mixed air traffic, proposed COR airspace will significantly reduce the airspace available for potentially hazardous uncoordinated mixed air traffic.

IFR traffic too will benefit from enhanced safety. For example, Salt Lake City Center's radar at Battle Mountain provides reliable coverage

*Appendix G

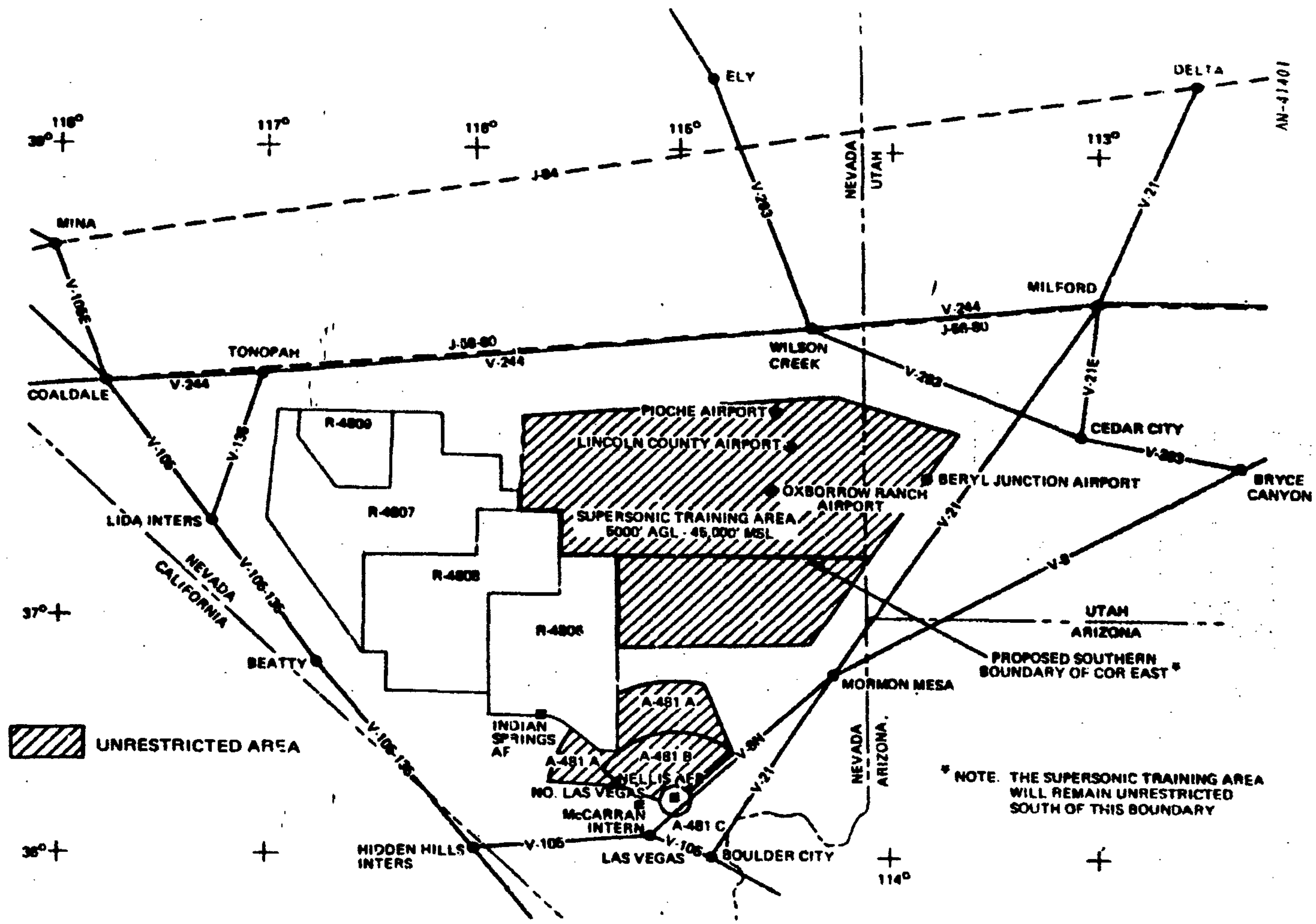


Figure 4.1. Unrestricted Areas of High Performance Military Air Activity in the COR Airspace Area

of V-244 between Tonopah and Wilson Creek above 18,000 feet MSL (17,000 feet MSL if the aircraft is transponder-equipped). Thus radar traffic advisories are available above 17,000 or 18,000 feet. Implementing CORC will provide a valuable addition to the coordination between USAF and FAA ATC activities.

A preponderance of air carrier operations occur above FL-180 and will thus overfly all of the areas described in the proposed COR airspace, except the four extant restricted areas. Air carriers will thus only in general derive enhanced safety because of proposed COR airspace. Air Taxi operations below FL-180 can also expect improved safety.

4.1.1.2 Fuel and Time

Notwithstanding the provision of VFR Flyways, COR airspace may provide an obstacle to some aviation operations. The following is a brief list of potential reasons:

1. The pilot may not wish to fly as low as the VFR Flyways require thus requiring him to obtain an ATC clearance to traverse COR.
2. The pilot may be unaware of the procedure for obtaining the required clearance.
3. The pilot may not be aware that a clearance may be available.
4. The required clearance may not be available.

Even in the case where the pilot understands the procedure for obtaining a COR clearance he may choose among several alternative flight plans. For example, a typical trip which ordinarily might use Victor airway 244 involves flight between Grand Junction, Colorado and the San Francisco Bay area in California. On airways this trip is approximately 710 statute miles. With the COR airspace structure a pilot may wish to avoid the procedure for a COR clearance and file a flight plan from Grand Junction which circumnavigates COR at a slight increase in trip distance. Or the pilot may file a flight plan that tentatively includes a clearance through COR with an alternate flight plan filed in the case, that upon reaching the vicinity of COR airspace, the clearance cannot be immediately obtained. In this case the alternate flight plan using airways to circumnavigate COR could increase the trip distance to 350 statute miles. This increase in mileage (~140 miles) could further require for small aircraft that the trip be broken into segments where it is now feasible to consider it as non-stop.

4.1.1.3 VFR Flyways and Flying Habits

In mountainous terrain, pilots usually elect to fly higher above ground level than they would over lowlands. Two important reasons for this are:

1. Surveillance, communications and navigation coverage may be less than satisfactory at lower altitudes.

2. Additional altitude provides vital extra time and gliding distance for selecting a place to land in emergency.

An East-West Flyway proposed along V-244 between Tonopah and Wilson Creek would restrict users of the flyway to remain at or below 12,500 feet MSL. The following observations pertain to the implementation of the proposed Flyway:

1. It would require operations to be conducted with 2,271 feet of altitude clearance of the main peak in the Quinn Canyon Range (approximately mid-way between Tonopah and Wilson Creek).

2. It would result in two directions of VFR traffic into this clearance layer.

3. It would limit operations to a maximum of 12,500 feet MSL over mountainous terrain where the average terrain is approximately 6,500 feet MSL and where the route crosses eight peaks or ridges in excess of 7,500 feet MSL.

These situations would probably occur regardless of two other offsetting factors:

1. The rule requiring oxygen above 12,000 feet MSL during daylight hours* (10,000 feet MSL at night).

2. A likelihood of a clearance through COR North, even during daylight hours even when it is expected that the USAF will be using the airspace.

However, under COR the flyway airspaces will be free of any COR operations thus providing a measure of safety in their use not now available to VFR operations in the same airspace.

4.1.1.4 Civilian Search and Rescue

Search and rescue (SAR) operations in the vicinity of COR airspace will see a beneficial impact when low-level CORC communications and surveillance capabilities are implemented. SAR activities will not be hampered by the implementation of the COR airspace since COR will accord priority to SAR missions.

4.1.2 Impacts on Ground Based Operations

4.1.2.1 Fixed-Base Operators

The Fixed Base Operator (FBO) at Tonopah (Mustang Air Service) has maintained records of service requests. Records for the past two years indicate an average of six aircraft serviced per day. Fuel sales are the principal source of revenue and records show daily average of 198 gallons pumped, or 32.7 gallons per aircraft.** If the average was represented by a light, single-engined 120-MPH airplane which used about 8 gallons

---

*This rule permits operation in excess of 12,000 feet MSL during daylight for periods not exceeding 30 minutes.

**This does not include fuel used by Mustang Air Service in its own flight operations.

per hour, it would have flown about 500 statute miles before refueling at Tonopah. On the other hand, a light, twin-engined 200-MPH airplane, burning 24 gallons (total) per hour would have traveled about 300 miles before refueling at Tonopah. Therefore, the average aircraft refueling at Tonopah would have traveled between 300 and 500 miles before refueling at Tonopah. San Francisco and Los Angeles, for example, are each approximately 300 miles from Tonopah.

The FBO estimates that 50 percent of his customers fly East and West, and that the proposed COR airspace could reduce his fuel business from these customers.

It is not clear how many pilots would deviate and thus it is impossible to estimate how severely the FBO's business will be affected. It is reasonable, however, to expect that some fraction of the East-West traffic will not refuel at Tonopah as a result of the proposed COR airspace. This fraction cannot be determined in advance, and will probably have to be inferred from a comparison of records of fuel sales prior and subsequent to implementation of the COR.

The Tonopah FBO suggested that the FBO at Ely could also be adversely impacted. The Ely FBO voiced concerns and explained that most of his business is derived from North-South flights to and from the Las Vegas/Boulder City area. These flights are typically off-airways (i.e., they fly direct) and are performed at about 12,000 feet MSL. Again, some reduction in fuel sales may occur, but the data required to support an estimate of this reduction does not exist.

The Ely FBO described two types of operations that could be affected by implementation of the COR.

1. The US Fish and Wildlife service contracts with the Ely FBO for aerial hunting from September through April each year.

This operation is performed at altitudes between 100 and 200 feet AGL and occurs in areas to be covered by COR North, COR East, and R-48XX. In addition to the aerial hunting, the FBO performs aerial application for about 1 week each year in areas covered by the proposed COR airspace.

2. The Forest Service and the BLM conduct fire reconnaissance operations from June through September each year. The Ely FBO performs these flights at approximately 9,000 feet MSL. The flights cover territory from Troy Peak in the Quinn Canyon Range (midway between Tonopah and Wilson Creek) East to the Utah boundary and as far South as Caliente.

The impact that the proposed COR airspace plan could have on these two operations is that if the requested clearance is denied because the USAF is using the airspace, delays will result. These delays could be for only several minutes; however, they could be longer. In the case of operations in R-48XX above 200 feet MSL, the operation could be delayed until the restricted area is released.

4.1.2.2 Ranch Operations and Small Airports

Ranching operations utilize aircraft in several ways. Some examples are herd survey, stock buyer transport, stock inspection, and rustling control. In general, these flights operate in and out of small airstrips. Several of these strips are located in areas covered by, or will be affected by, proposed COR airspace. They are shown on aviation maps and are listed below and charted in Fig. 4.2:*

- Forest Mountain Ranch
- Sunnyside Kirch
- Lake Valley
- Pioche

*The total traffic generated by these airports is not readily available and hence is not included in the data in Table 2.22.

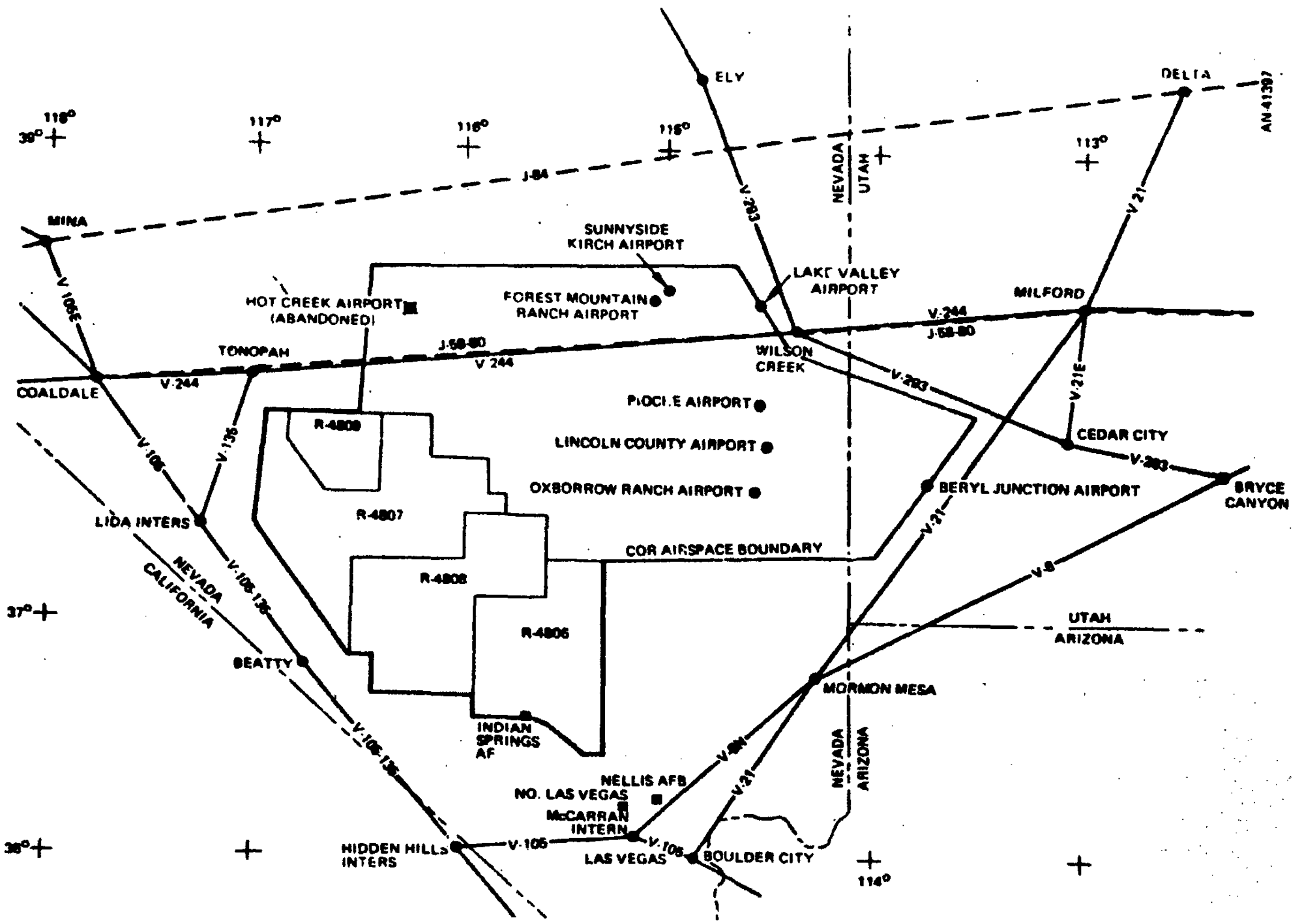


Figure 4.2. Small Charted Airstrips in COR Airspace

- Lincoln County
- Oxborrow Ranch
- Beryl Junction--on the boundary of COR East
- Wilson Creek--1 mile East of the COR North boundary
- Hot Creek--shown X'd on aviation charts

Operations from these strips, as well as operations from any other location in COR North and COR East, will be in conflict with proposed COR airspace procedures unless a clearance is obtained prior to takeoff. In most cases, radio contact is not now possible until an altitude of several thousand feet AGL is reached. Thus, clearances will have to be arranged through procedural agreement by telephone. In some cases, no telephone is available, or, as in the case of a rustling control flight, the rancher has no time to, nor wishes to advertise his intentions. The USAF will accommodate operations such as these as follows:

1. Before COR airspace is implemented, the USAF will survey all aviation interests in the area. The survey will be to learn about the nature and probable frequency of such operations.

2. Operators who advise that operations may be required from time to time, will be requested to advise CORC as soon after the fact as possible. This will enable CORC to coordinate all flights as they are detected by CORC surveillance.

Until significantly improved surveillance is installed by CORC, it appears that USAF permission to operate on the basis of mutual understanding will fall short of COR's goal but may enhance the present level of safety.

4.1.2.3 Air Traffic Control

Several FAA ATC specialists* were questioned in regard to possible impacts which implementation of proposed COR airspace could have on ATC

*These specialists worked at Oakland, Los Angeles, and Salt Lake City Centers, and Flight Service Stations at Tonopah and Ely.

operations. Only one specialist suggested any potential impact on ATC. He felt that ATC controller workload, and communications frequency congestion, would be increased.

4.2 POTENTIAL EFFECTS FROM COR ELECTROMAGNETIC EMANATIONS

The near-term operation of COR will entail the continued use of a number of electromagnetic radiators with some expansion of usage to the Nellis North Range. In the mid- and far-term, electromagnetic radiators will be added to the H/W/D ranges. Some of these radiators will be ground-based mobile equipment, while others will be airborne. The spectrum of operating frequencies will range roughly from 10^8 Hz to 10^{10} Hz. Because a wide range of radiated power levels will be used, over this broad spectrum, it is natural to ask what the impact of these electromagnetic radiations could be on the surrounding environment.

There are several possible levels of severity of potential effect to be examined:

1. Possible human injury due to direct or indirect effects,
2. Injury to domestic and wild life, including flora and fauna,
3. Destruction of property,
4. Disruption of public safety services, including police, fire, and navigation data links, or
5. Disruption of entertainment reception.

Human injury and the direct loss of human life is possible under certain circumstances of irradiation, if appropriate precautions were not taken. Such effects are not anticipated on COR. The conditions under which the possibility exists are similar to the conditions under which damage to other animal life is possible in a vast number of long-standing applications throughout the country. The possibility of destruction of property due to electromagnetic radiation covers a wide field, and although many specific questions remain unanswered, the effects are expected to be very similar to those long accommodated in the COR area. The possibilities of disruption of public safety services, civil and commercial communications, and entertainment reception all pose similar problems involving interference at the receiver site. These effects will need to continue to be avoided through study allocation and authorization as well as through procedures and policy.

4.2.1 Injury

Numerous studies have been undertaken to establish living tissue tolerance levels to electromagnetic radiation. S. Michaelson's survey paper[15] on this subject lists a bibliography of 292 references, of which about 140 are directly concerned with radio frequencies up to the long-wavelength infrared regime.

Electromagnetic radiation is propagated energy, which, if intercepted and absorbed, ultimately results in the generation of heat and elevated temperatures in the absorber. The production of heat in living tissue due to microwave absorption is well established and documented. This mechanism appears to be the dominant effect in the interaction of microwaves with living tissue and is termed the thermal threat.

With respect to thermal effects, the blood stream is important in distributing and dissipating body heat and it can be expected that the regions of the body with a poorly developed vascular system would be especially sensitive to irradiation. The lenses of the eyes are in fact particularly sensitive to thermal damage. Exposure levels of 100 mW/cm^2 for 1 hour to 2450-MHz radiation does indeed cause thermal coagulation of lens protein[16,17] and cataract formation in rabbits. There is also some argument for cumulative effects at somewhat lesser dosages repeatedly applied at short intervals. (Experiments at 50 mW/cm^2, 2450-MHz, 1 hour repeatedly applied [daily] apparently do not cause discernible eye damage.)[18]

It must also be stated that the threshold of warmth sensation (on the forehead) occurs at about 30-50 mW/cm^2 (long time),[19,20] while the threshold for pain (long time) is roughly twice this intensity. Higher intensities produce a pain sensation in correspondingly shorter times (20 seconds for 3.1 W/cm^2 at 3000 MHz).[21]

These types of considerations have formed the basis for setting tolerance limits and standards in the US. The first protection guide used in this country was in 1953, and was set at 10 mW/cm^2, with no time limit set. Subsequent guides have relaxed this guide, allowing higher irradiation levels for short periods (0.1 hour to 10 minutes). In the interest of simplicity, the 10 mW/cm^2 (average power) rule will be adopted in the work herein with no time limit, and regardless of spectral content or modulation.

This criterion for the safe level of exposure is the same as that adopted for Nellis range operations. Nellis procedures also call for posting as hazardous any areas found to experience radiation levels above 10 mW/cm^2.

It should be noted that with this tolerance limit there should be roughly a factor of 10 safety factor for both men and rabbits, and probably for most other animals.

The tolerance limit for flora is more difficult to set, primarily because so little is known either about the absorptivity for plants or their tolerance to heat. It is assumed that the tolerance would be related to a maximum whole volume temperature, and hence is a function of the temperature rise above ambient. The tolerance limit on a hot day may therefore be very much less than on a cold day. Furthermore, tolerance limits would undoubtedly vary widely from species to species for the following reasons:

1. Differences in water content, and concentration
2. Differences in high temperature tolerance
3. Differences in the location, depth and volume of the living portion of the plant
4. Differences in periods of dormancy, reproductive cycle, normal plant lifetime, etc.
5. Other factors such as cooperative shielding among plant neighbors, etc.

In spite of these remarks, and the extreme paucity of data, it would seem that the 10 mW/cm^2 criterion accepted for animal life would not be an unreasonable one for plants as well, especially since these same plants must be capable of withstanding the sun's maximum irradiance level of about 100 mW/cm^2, in a spectral region that is more highly absorbed generally than the microwaves.

The far field average power density level radiated from a transmitter can be approximated by

$$F_{av} = \frac{P_{av} G}{4\pi R^2}$$

where F_{av} = the average flux level
R = the range
P_{av} = the average power level
G = the antenna gain

The near-field average radiated power density can be approximated by

$$F_{av} = \frac{P_{av}}{A}$$

where A is the effective antenna aperture of the radiator.

These two equations combine to give an expression for the average flux intensity in the main beam, or the peak flux intensity when P_p (the peak power) is substituted for P_{av}. In either case, the juncture between near and far fields is essentially defined where the two expressions yield the same flux intensity.

Of all the electromagnetic radiators which will be used on COR, those with the highest average power-gain product by orders of magnitude are of the ground transportable type. A representative of these high power-gain devices has a $P_{av}G$ of just over 10^7 watts. This device can just produce 10 mW/cm^2 (100 W/m^2) in the main beam at a range of 100 meters. It can exceed this radiated value by a factor of more than 5 at shorter ranges. Other radiators produce comparable or less radiated flux.

Since all the antennas are elevated above ground level, it is highly unlikely that the main beam of any of the threat simulators will be directed, under normal operations, at or near points at ground level within one hundred meters distance. However, one simulator to be used, which allows an antenna tilt downwards of 10 degrees below horizontal, has been measured to produce a personnel hazard (10 mW/cm^2) 53 feet from the antenna. Thus continued emphasis will be necessary with regard to this hazard and suitable protective procedures will need to be observed.

The conclusion which can be drawn from these calculations is simply that with proper care in placement, i.e., greater than 100 meters from all non-participating parties, and due indoctrination of operating personnel concerning the health hazards inherent to the operation of these equipments, no hazard to either people or domestic animals will result.

Wildlife within a radius of 100 meters from the equipment may be injured, but this potential is likely to be limited to flying birds which may get into the main beam of the apparatus and then only for very short time periods, an unlikely event.

Where equipment deployment is in close proximity to roads and highways where there may be some concern for hazard to passers-by, operational procedures will be carefully screened to assure safety. In general, all these concerns will be carefully addressed in the preparation of the Range Safety manual. Furthermore, techniques are available, such as the fitting of mechanical stops, to prevent antennas from being directed at nearby ground level locations. Also, simple wire mesh fences of sufficient height can be erected to intercept and scatter any radiation from the antenna that otherwise would be directed at ground levels.

4.2.1.1 Possible Indirect Human Injury Effects

Certain prosthetic devices, notably those intended to electrically stimulate internal organs, the central nervous system, and certain other sensory systems are coming into general usage. Some of these devices are, by their very nature, highly susceptible to radiated electromagnetic fields. Most notable among these devices are the cardiac pacemakers, both because they are more common than the others because any interference with these devices is potentially dangerous to the wearer.

Typically, these devices, together with their associated electrodes, constitute miniature antennas roughly tuned to microwave frequencies. In addition, the internal circuitry of first-generation devices is relatively unshielded. The currents generated in these devices from immersion in a radio frequency field may directly stimulate the organs to which they are attache but more likely, these currents will obstruct the operation of the prosthetic device itself. The demand-type pacemaker in particular is known to be susceptible to this type of interference, changing its pace rate, reverting to a fixed operation or becoming entirely inactive.

The Air Force has conducted extensive studies on the susceptibility of implanted cardiac pacemakers to electromagnetic radiation emitted by radar systems.

A number of investigators have determined that pacemakers in general are susceptible to magnetic fields generated by small motors, electric drills, electric razors, auto ignition systems, diathermy machines, etc.[22,23] Their susceptibility to 2540 MHz radiation has been of great concern because this is the operating frequency of microwave ovens.[24] One documented case of actual interferences from a microwave oven appears in JAMA.[25]

In an unusually well-documented case of the effects of a radar on a pacemaker-controlled hospital patient,[26] premature paced beats or pauses occurring once every 12 seconds were shown to correlate with the revolutions of a large antenna for a radar station one mile from the hospital. This pacemaker was a Medtronic Model 5340, an external unit intended to be placed on the bed.

The recent paper by Mitchell et al[27] evaluated the relative susceptibility of cardiac pacemakers to electromagnetic radiation interference at representative radar sites in the United States. The 21 pacemakers of different types and manufacturers were evaluated in a "free field" configuration, as well as in a saline solution phantom (implantation simulation). Test results were presented for five frequency bands between 200 and 6000 MHz. These data and other referenced material indicate the most critical frequency range for causing pacemaker interference is between 200-500 MHz. Pacemaker patients with the most sensitive pacemakers can experience electromagnetic radiation interference when located within 1000 to 2000 feet of a high powered 200-500 MHz pulsed radar (field strength of 10 V/m). There are no Continental Operations Range (COR) ground radar systems operating in this critical frequency range. The highest power COR radiator operates at a frequency an order of magnitude greater than the critical frequency range, which increases the field strength susceptibility threshold for the most sensitive pacemaker to 1500 V/m. Participating and non-participating personnel are restricted from areas in which field strengths of this magnitude could be experienced. Other COR radiators, like the threat simulators, are not expected to cause any significant pacemaker interference within 1000 feet of the antenna. Range safety procedures will limit the use of the mobile threat simulators so they cannot irradiate any unrestricted area within 1000 feet of the antenna.

4.2.2 Property Damage

Electromagnetic radiation can cause direct damage to certain types of sensitive equipment and materials. These effects are almost exclusively limited to direct electrical degradation and failure of the target material. Thermal heating also occurs, but for even very high radiation intensities, the damage potential due to heat can be almost totally ignored.

Electromagnetic energy has been known to cause deleterious effects on certain electrical equipment. Sensitive radar receiver crystals are normally paced in foil to protect them from damage, for example. Pacemakers, while not damaged, have performed erratically or stopped while being irradiated. Almost any open (unshielded) circuitry containing rectification devices will develop spurious voltages, sometimes large enough to puncture semiconductor devices and destroy the circuitry.

Fluorescent lights are known to light in moderate to strong microwave fields. Even some hearing aids can be expected to reproduce the modulation of a nearby transmitter.

Tin cans, automobile frames, etc., have been known to sing in the presence of strong electromagnetic signals.

While most of these phenomena are not in themselves damaging, they can be highly disconcerting, possibly eliciting fear.

These phenomena all have a common denominator: they are all strong-field effects. Fields sufficiently strong to produce these effects could occur within main beam illuminations of the more powerful COR emitters at distances of one to two miles. As already noted, however, normal location of COR emitters and operation of COR threat simulators are constrained by safety procedures which will not allow the main beams of the emitters to be directed at or near ground levels within such short ranges of areas of potential risk. The COR threat simulators to be used in the Caliente EW range are manually operated and mounted aboard mobile vans. Several of the simulator sites are located within 2 miles of inhabited areas and there is the possibility that error in operation of a simulator in violation of prescribed safety standards could result in main beam illuminations of ground areas although these circumstances are unlikely and will carefully be guarded against.

4.2.3 Interference

The electromagnetic radiators planned for use on COR can be classed under two broad headings-ground-based and airborne equipment. The ground-based equipment in general radiates much stronger signals than the airborne equipment by several orders of magnitude. There are other distinctions. The ground-based equipment is, in general, only capable of radiating over a few, relatively fixed bands, as shown in Fig. 4.3. The airborne equipment, by contrast, has the capability to radiate over the complete 40 MHz to 16 GHz, as shown in Fig. 4.4.

These two figures show a rough upper bound capability to radiate. No one equipment can simultaneously cover any of the bands shown. Furthermore, these figures indicate the power-gain product; since many of the devices have high antenna gains, the radiated power shown will occur only over a very small sector at any one time. Hence, although some small area will be irradiated, most areas will not.

The frequencies shown on the two figures (40 MHz and up) are too high to be refracted or reflected back to earth except on very rare occasions. The frequencies from 40 MHz to perhaps 100 MHz occasionally are bent back, but above about 100 MHz no ionospheric skip effects occur.

Diffraction effects will allow propagation beyond the line-of-sight, but the attenuation in the "shadow" region is so great at these frequencies that these effects could also be neglected. Reflections from mountains and other high objects could produce effects much like the ghosts which sometimes are evidenced in commercial TV.

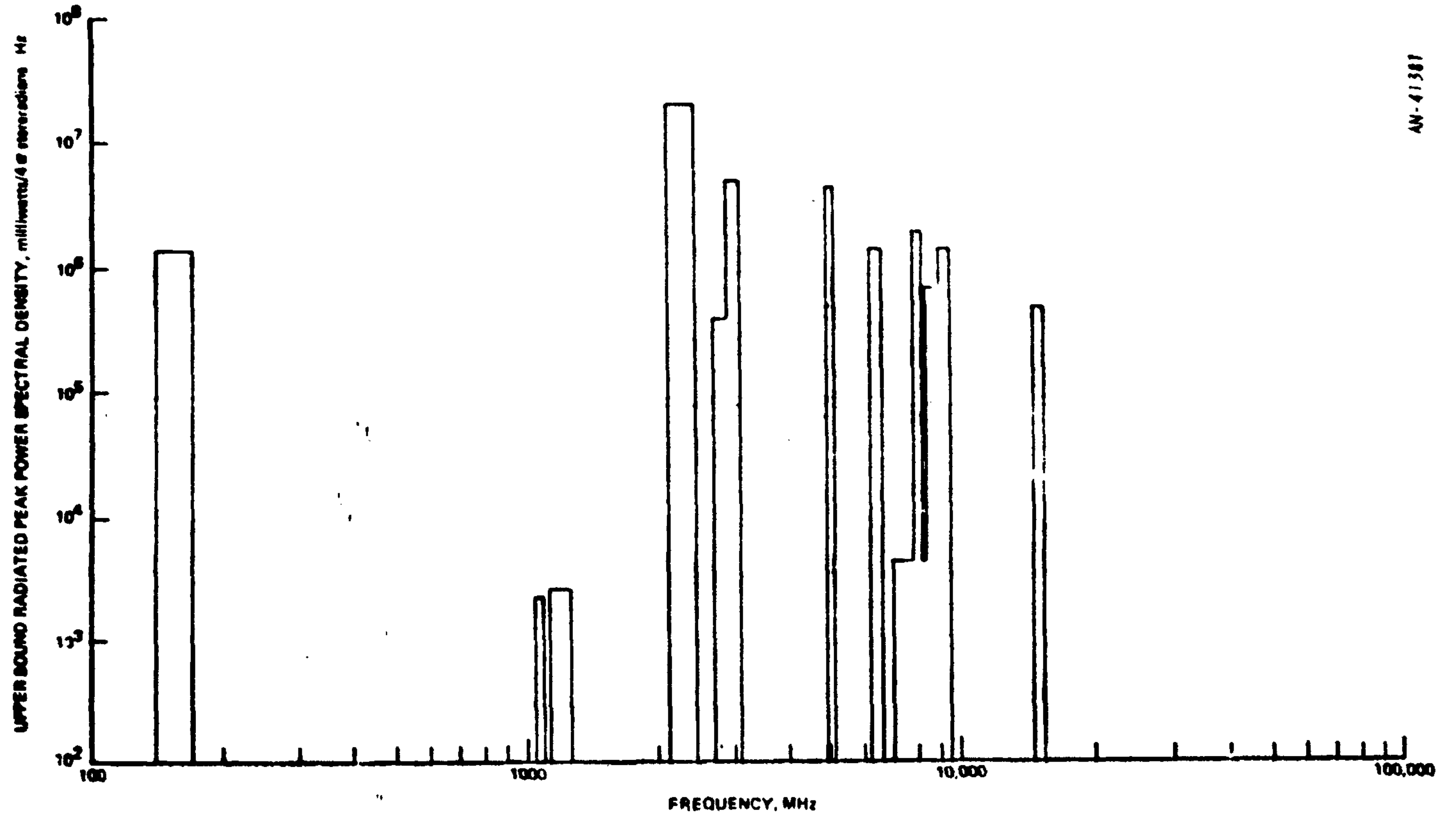


Figure 4.3. Ground Based Emitter Spectral Characteristics

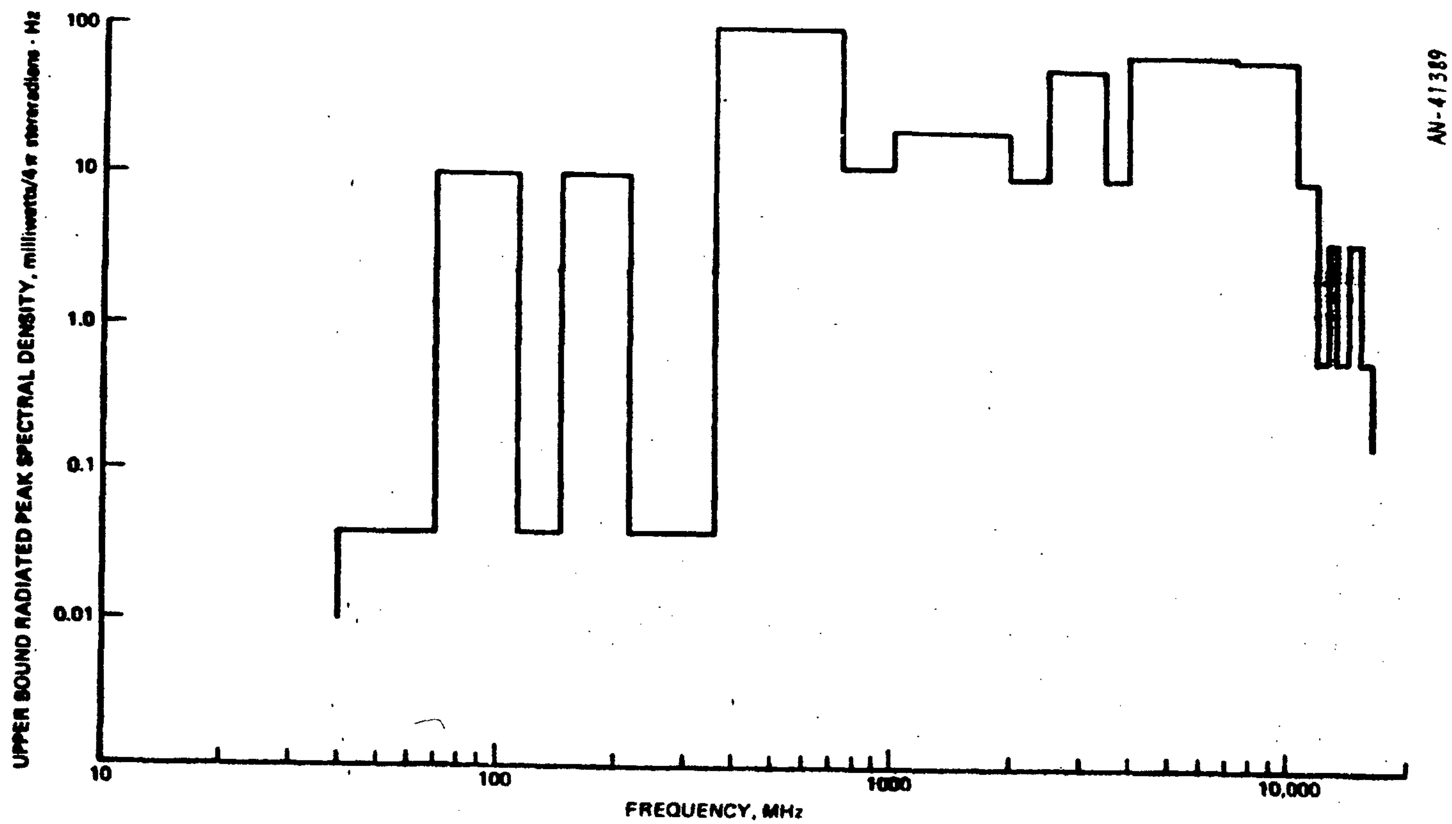


Figure 4.4. Airborne Emitter Spectral Characteristics

By and large, however, the frequencies we are considering here are "line-of-sight frequencies." Hence, the COR ground-based equipment will not affect other ground-based equipment more than a few miles beyond the horizon, a range of less than 50 miles. The ground-based equipment could, however, interfere with high-flying aircraft carrying sensitive equipment at a range of perhaps 400 miles. The airborne COR equipment could likewise perhaps interfere with non-participating receivers at a range of perhaps 400 miles, depending upon the aircraft altitude. These potential influences must continue to be avoided or minimized through a comprehensive frequency management program.

Sensitive equipment can be defined as any receiver tuned to the radiating frequency or a receiver which does not have sufficient reception capability to eliminate strong signals outside the intended pass band. Two types of reception failure typically occur. First, the receiver does not filter out strong signals close to its intended pass band due to insufficiently sharp tuned circuit filtering. The second type occurs in superheterodyne-type sets. In this instance, the "image" pass band is not sufficiently rejected by the first (radio frequency) stages prior to the mixer. If either of these conditions exist, strong out-of-band signals will be received as interference.

Receiver antenna construction is important to the capability of a receiver to reject unwanted signals. Most higher frequency antennas are constructed with a moderately high gain, such as the typical fringe area TV antenna. Antennas with a good gain characteristic reject signals which arrive out of the antenna main beam pattern. Mobile receivers seldom are equipped with high-gain antennas. Hence, mobile equipment and the base stations to which they communicate would in general be more likely susceptible to the COR radiations for antenna reasons alone.

There may be a few highly directional antennas with either a main beam or a large sidelobe pointed in the direction of one or more of the

COR transmitters. These would tend to be very susceptible to COR radiations, if tuned to the emission frequency.

4.2.3.1 Ground-Based Equipment

It has already been stated that the ground-based equipment will not interfere with other ground-based equipment beyond a range of perhaps 50 miles. There are a few other generalities which can be made concerning this equipment:

1. It is highly unlikely that local television, FM or standard broadcast reception will be interfered with. The ground-based equipment does not operate in these frequency bands. If any interference is likely to occur, it will most likely be on Channel 7 (insufficient adjacent band signal reception) or because of poor image rejection in some receivers. Either of these faults should be correctable.

2. Interference with aircraft communications is unlikely; the COR radiations are outside these bands, with one exception. Certain civil air patrol bands (143.9 and 148-149.9 MHz) may be interfered with occasionally.

3. Many mobile (industrial, domestic and public safety service) bands occur within the 140-170 MHz range. These are for the most part land mobile and hence not particularly susceptible to interference beyond the horizon limitation.

4. Some aeronautical radio location equipment may be affected within the band just above 1000 MHz. Radars are typically highly directional devices, however, and the interference is likely not to be serious.

5. Above 2000 MHz, most equipment is highly directional in character and interference in this region is generally unlikely.

6. Some types of service, notably television remote pickup, etc., may occasionally be adversely affected, as will some amateur bands, provided the equipment being operated is within the horizon limitation.

It generally appears that the ground based COR transmitters are not likely to cause complete disruption of any FCC-allocated service. Furthermore, there is a considerable history of such operations conducted by the Air Force, and consequently procedures and safeguards have been developed to assure that such operations will be conducted with minimal interference to participating and non-participating equipments.

4.2.3.2 Airborne COR Equipment

The COR airborne equipment, when no care is taken in its use, has the potential to interfere with nearly all types of service over a large area. This general class of equipment is not new to COR, having been used on many other military test ranges throughout the US. Consequently, there is a history of experience in operating such equipment with the necessary safeguards to keep any possible interferences to tolerable levels. This prior experience has shown that the most essential feature in developing these safeguards is the establishment of a frequency management authority which carefully and in a detailed manner screens each test. Potential interferences are identified and modifications or alternatives to the test procedure are instituted where warranted.

4.3 IMPACTS OF COR-GENERATED AIRCRAFT NOISE AND SONIC BOOMS

4.3.1 Impact of Sonic Booms on the Environment

There is considerable difficulty in assessing the COR-induced impacts on the environment due to supersonic flight activity. There exists a considerable history of supersonic flights in the COR region as demonstrated in Fig. 4.5, which summarizes the data compiled in the USAF supersonic log for the year 1973. The figure shows the cumulative flight path miles and

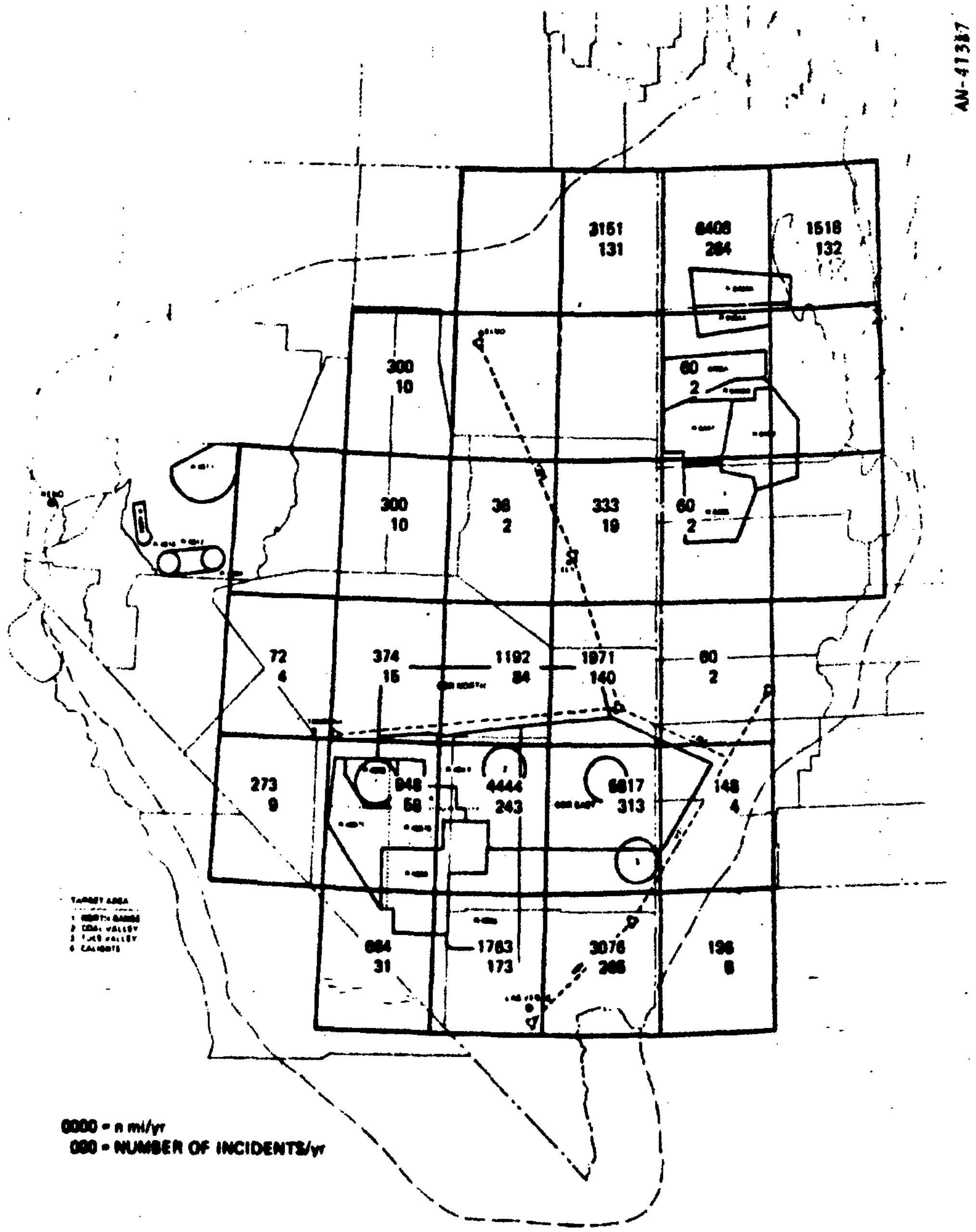


Figure 4.5. Supersonic Activity, 1973 AF Aircraft Except SR-71

numbers of incidences of recorded supersonic activity occurring in regions bounded by 1° × 1° squares. The supersonic log shows an order of magnitude greater activity throughout this region if SR-71 flights are included. However, this aircraft operates at extremely high altitudes from which booms would be significantly attenuated and much less sharp in terms of rise times, due to non-uniformities in the atmosphere and other factors. For these reasons, SR-71 booms are probably less distinguishable as booms and therefore the SR-71 supersonic activity is not represented in the figure. The aircraft contributing most all the supersonic activity shown in Fig. 4.5, are F-4, F-111, F-104, and F-105.

According to Fig. 4.5, supersonic activity is primarily associated with the test range complexes at Nellis and H/W/D. On an annual basis, approximately 1500 incidents of supersonic activity can be associated with Nellis Range test activities and air combat maneuvering (ACM) exercises of the Fighter Weapons Instructor Course. ACM exercises probably account for the activity shown clustered over the Hill AFB test range.

This type of activity is to continue under COR with a modest expansion. The addition of special use airspace (R-48XX and COR North), primarily to meet ACM requirements, will probably spread the activity, causing slight increases in the levels of supersonic activity in the new airspace while incurring dilution of activities in other areas. ACM exercises are expected to generate some sonic boom overpressures up to 5 lb/ft^2 which may extend in width on the ground to 22 to 27 miles at boom cutoff (see Appendix F). Overpressure on the ground at the cutoff point may be between 0.6 and 1.2 lb/ft^2 depending on source Mach number and type of aircraft.

Under mid- and far-term COR, high-speed and supersonic flights above 30,000 feet altitude are to be conducted between H/W/D and the COR/Nellis range. Figure 4.5 shows little supersonic activity exists at present that could be interpreted as flights between the two range complexes. Therefore, it appears that a potential for impact may be associated with the initiation of such activity. COP plans for mid- and far-term activity in this respect are not yet well-defined and location of supersonic flight tracks between H/W/D and COR/Nellis will be studied carefully. Non-maneuvering sonic boom generations at or above 30,000 feet can be expected to develop overpressures of 1.0 to 1.6 lb/ft^2.

4.3.1.1 Exposure of Human Activities to Sonic Booms

Existing Nellis AFB operational restrictions require that supersonic activity avoid populated or otherwise sensitive areas. During a mock-duel the aircraft usually are supersonic for such a short period of time that the activities of all the engaging aircraft are within about an 8-n mi-diameter circle away from populated areas. With the boom width on the ground added to this dimension, the area of impact from any given engagement is a circle of approximately 30 to 35 n mi in diameter. Even in as sparsely populated an area as the State of Nevada, it is unlikely that the booms will go undetected. However, the location of booms is not expected to change significantly from the occurrences experienced currently and in the past.

Directly under the ACM activity, sonic boom strengths may reach 5 lb/ft^2 at which the probability of producing window glass breakage[28] is around 10^{-5} per pane. In general, the range 2.0 to 5.0 lb/ft^2 is regarded as the region of incipient damage to structures.[28*] However, ACM exercises could, because of the maneuvers, produce "super-booms"[29] which may have peak overpressures of at least twice and up to 4 times as high. The probability of window breakage at 10 and 20 lb/ft^2 could be 10^{-3} per pane and 0.02 per pane, respectively, for these increases in overpressure. Clearly ACM activities will be planned and conducted over structureless regions. It should be noted that "super-booms" do not produce a moving carpet as is normally associated with aircraft in level supersonic flight. Instead the ground area where the super boom is incident is fixed and of the order of 1 square mile.[29]

---

*Window breakage and structural damage (plaster cracks, etc.) are the most common sources of damage claims.

Physiological and behavioral responses of humans have been extensively studied. One review[30] of these studies developed some general categories for human responses as a function of boom overpressure. Direct physiological effects have been reported at 95 lb/ft^2; however booms in the range 20-144 lb/ft^2 have been experienced without injury. Temporary effects such as temporary hearing loss may occur in this range, however. Level of overpressure in this range would only be generated for aircraft in low-level (near 200 feet above ground level) supersonic flight. The extent and duration of tests of this nature under COR have not been identified and should a test need develop for them, they would be planned to occur over the land restricted areas and under procedures that would assure safety of test range personnel and equipment.

At boom overpressures in the range 1.5 to 2.0 lb/ft^2 significant public reaction can be expected. At 1.0 to 1.5 lb/ft^2 public reaction is probable. However, in sparsely populated and quiet areas not accustomed to sonic booms, they may be less tolerated. The responses undoubtedly will depend on individual natures and history of exposure to sonic booms.

At the present time, as in the past, sonic booms are a likely irritation to outdoor recreationists, and increased frequency such as coming in clusters certainly would add to the irritation. It is difficult to assess how often a reactionist must be startled by sonic booms before their reaction turns from passing interest to irritation.

4.3.1.2 Exposure of Animal Populations to Sonic Booms

Importance of structured behavior has been mentioned already as it relates to the reproductive model (Appendices B and C) and as reviewed in EPA-NTID300.5 [US, 1971] and Bell [1972]. Generally, the most delicate and sensitive behavior of animals is that associated with reproduction, since this has evolved specifically to insure the species' survival. Unfortunately, neither the impact on reproductive behavior modification nor observed animal responses to previous sonic booms in this region has been satisfactorily related to the likelihood of successful reproduction. For wild animals only descriptive accounts of individuals in the breeding population have been offered.

These possible behavioral modifications are difficult to assess under natural conditions in the field, particularly as the frequency of occurrence increases during the mid- and far-term. It seems likely that an increased number of sonic booms coming in clusters (from ACM exercises) presents a new stimulus for evaluation of behavior modifications among exposed birds and mammals.

The limited data available do not show that big game animals have their behavior altered by sonic booms or simulated sonic booms in any appreciable way, although they may show momentary concern [Bell, 1972]. Panic reactions are apparently very rare. Desert Bighorn Sheep have been observed to offer no reaction to single sonic booms. Multiple sonic booms repeated several times a day with increasing frequency might possibly cause Mule Deer to become edgy and move around more, but such activities may or may not influence or change breeding behavior activities.

Although domestic livestock and horses have been observed during exposure to sonic booms, their reactions have not been conclusive; in most cases, they respond only to the recognition of a sound stimulus. The magnitude of animal responses have generally been slight, even to only a matter of ear twitching. But, activities of COR suggest a potential clustering of sonic booms over the range areas, providing a rather different type of stimulus. Responses to these clusters can hardly even be conjectured at the present time.

Data on sonic effects on birds are also scarce. Bell [1972] urges the need of experimental data on birds, especially with any significant increase in frequency of exposure. Data on such influences are of particular interest during the egg laying and hatching periods. It has been asserted that in Germany the failure of Osprey eggs to hatch is a result of embryo mortality due to sonic booms [Moll, 1959]. COR may offer the opportunity to observe and gather such data.

Real concern exists over secondary problems resulting from temporarily disrupting nesting birds. Jack Helvie (Manager, Pahranagat National Wildlife Refuge, pers. comm.) has watched nesting ducks startled and flushed from nests by sonic booms as frequently as ten times per week. The problem here results not from the actual flushing but factors following that. Normally, when waterfowl leave nests, they cover their eggs to reduce the risk of aerial predators. Such precautions are not taken when the ducks are startled and leave immediately, but instead they defecate on their eggs. The combined effects of (1) no parents present, (2) uncovered eggs, and (3) defecation about the nest will tend to increase predation on eggs by both aerial predators, such as gulls, and mammals, such as skunks. Uncovered eggs will also be exposed to significant periods of solar radiation, which is known to kill embryos at certain critical development stages.

Air space for combat maneuvering is about 8 n mi in diameter, but the sonic boom carpet will increase this diameter by 22 to 27 n mi, thus producing overpressures over an area defined by a circle at least 30 to 35 n mi in diameter. The duration of each boom will be in the order of 0.1 seconds with a peak overpressure up to 4-5 lb/ft^2, diminishing to around 1-1.6 lb/ft^2 at cutoff.

As with the behavioral responses to sound from sonic booms, there are practically no data on the direct effects of overpressure on animals. Bell [1972] refers to the data on massive hatching failure of Sooty Terns on the Dry Tortutga Islands, reportedly caused by overpressures that may have been 100 lb/ft^2 or more. This value is some 20 times greater than the highest overpressure peaks expected for most operations within COR. However, an aircraft traveling 200 feet above the ground level could generate an overpressure from sonic booms of 40 lb/ft^2 directly under the aircraft which conditions are not necessarily prohibited within the restricted areas. A potential problem may exist in some bird species, which have accumulated high body burdens of chlorinated hydrocarbons, resulting in the thinning of egg shells [Cade, et al., 1971]. It has been observed that in some raptors with thinned eggshells the weight of the incubating female has caused egg breakage. However, there are no data on which to conclude that some booms can cause similar damage to uncovered, weakened eggshells.

Overpressure damage to fish would seemingly be negligible. Cook, et al., [1972] suggest that even when overpressures exceed background noise pressure by a factor of 100, it is still much less than pressures known to harm marine life in single exposures. However, overpressure data relating to fish living in shallow streams, such as those in the Pluvial White River Drainage, are needed before any effect, or lack of it can be documented. Several of the fish species of concern to COR are small minnow-type fish such as the Moapa Dace, and little is known of their sensitivities. The current data [Cook, et al., 1972] suggest that sonic boom pressures can be expected to exceed the ambient noise pressures, at least momentarily, by up to 50 dB from the surface down to depths of a few hundred feet, between frequencies of 0.5 to a few hundred hertz. Fish in shallow streams will very likely sense these levels, but the consequences cannot be determined at the present time for past, present, or future exposures.

As far as dairy and beef cattle are concerned, overpressures of 2.6-0.75 lb/ft^2 have apparently had no effect [Bond, 1972]. It is rather unlikely that overpressures will affect Mule Deer, Desert Bighorn Sheep, American Antelope, Wild Horses, Burros or domestic livestock.

Although the direct response to overpressures from sonic booms is not likely to cause measurable behavior interference or direct damage, prey species might possibly increase their risk to predators, by responding in any manner to overpressures such as an ever-so-slight movement.

Only recently has work been initiated on the response of animals to noise, not to mention the effects of sonic booms per se [USEPA-NTID300.5, 1971]. Some attention has been given to farm animal responses to uncontrolled noise such as sonic booms; in some cases, definite negative prompt responses have been demonstrated, although recovery was always rapid and seldom resulting in measurable effect. In a recent period (1961-1970), 238 sonic boom animal claims were filed with the US Air Force, 98 of which were settled and received payment [Bell, 1971]. Most of the claims were made for farm animals.

During the course of these early investigations, data were gathered on animal responses to sonic booms. The summary of 1971 review of the available data are well-documented and presented by Bell [1971] and USEPA-NTID300.5 [1971]. Bell abstracted these data with:

> Individual domestic or pet animals may react to a boom, a simple startle response being the most common reaction. However, specific reactions differ according to the species involved, whether the animal is alone, and perhaps whether there has been previous exposure. Occasional trampling, moving, raising head, stampeding, jumping, and running are among the reactions reported. Avian species occasionally run, fly, or crowd. Reactions vary from boom to boom and are not predictable. Animal reactions to booms are similar to their reactions to low-level subsonic airplane flights, helicopters, barking dogs, blown paper, and sudden noises. Conclusive data on effects of booms on production are not available, but no change in milk production by one dairy herd was noted. The reactions of mink to sonic booms have been studied in considerable detail. Female mink with kits may be alerted, pause in activity, and look for source of sound. Sleeping females may awaken and mating pairs may show momentary alertness but the mating ritual is not disturbed. No wounding, killing, carrying, or burying of kits in nest by females have been observed in the studies. In one series of observations, the reactions of the mink to barking dogs, truck noises, and mine blasting were similar to their reactions to booms. The effect of booms on eggs being

> hatched under commercial conditions was examined in detail, and no effects on hatchability were found. However, a mass hatching failure of the Dry Tortugas Sooty Tern occurred in 1969, and the circumstantial evidence suggests that physical damage to the eggs by severe sonic booms caused by low-level supersonic flights was responsible. Observations on wild and zoo animals are quite limited, but those made on deer, reindeer, and some zoo animals revealed no reaction or only minimal and momentary reaction, such as, raising the head, pricking the ears, and scenting the air.

The report submitted to EPA by Memphis State University [USEPA-NTID300.5, 1971] places the possible effects of noise into two categories; (1) interference with behavior signals and (2) direct effects on the animal. Noise that would interfere with behavior would generally be in a frequency range that would tend to "jam" the signals, while direct effects would likely come from persistent exposure to high intensity or sonic booms. This review summarizes its findings with:

> Clearly, the animals that will be directly affected by noise are those that are capable of responding to sound energy, and especially the animals that rely on auditory signals to find mates, stake-out territories, recognize young, detect and locate prey, and evade predators. These functions could be critically affected, even if the animals appear to be completely adapted to the noise (i.e., they show no behavioral response; such as, startle or avoidance). Ultimately, it does not matter to the animal whether these vital processes are affected through signal-masking, hearing loss, or effects on the neuro-endocrine system. Even though only those animals capable of responding to sound could be directly affected by noise, competition for food and space in an ecological niche appropriate to an animal's needs, results in complex interrelationships among all the animals in an ecosystem. Consequently, even animals that are not responsive to or do not rely on sound signals for important functions could be indirectly affected when noise affects animals at some other points in the ecosystem. The "balance of nature" can be disrupted by disturbing this balance at even one point.

This summary, generally, suggests possible effects that pertain to the relationships discussed in Appendix B. While such effects of manmade sonic impulses are not known for the long-term, the accommodation of birds, mammals, and fish to thunder over the long-term is assured. Also, the species that reside in COR have reached some degree of accommodation with sonic booms as well as with explosives and gunfire (military and recreational).

4.3.2 Impact of Aircraft Noise on the Environment

4.3.2.1 Community Noise Exposure Due to Nellis Landings and Takeoffs

Figure 4.6 shows the normal weather approach and takeoff patterns for Nellis AFB activities. As the figure indicates, the normal approach path to Nellis AFB just cuts the northern extremity of the Las Vegas city limits. Approximately 20 percent of the time local winds are such that takeoffs must be made in the reverse direction along the normal approach pattern. Takeoff conditions typically generate more severe noise levels than do approaches; consequently, the greatest potential for continued occurrence of noise intrusion on Las Vegas residents occurs during the 20 percent of the time that takeoffs must be made in the direction toward Las Vegas.

Nellis AFB received about six complaints in calendar year 1973 from such conditions and the complaints arose from residents located about three and one half miles from the center of the Nellis runway. Rough estimates based on prescribed Nellis procedures indicate that slant ranges for maximum effective perceived noise (EPN) levels incident on the complainants are approximately 9000 to 10,000 feet with an assumed aircraft altitude of 3000 feet. These slant ranges could be expected to produce effective perceived noise (EPN) levels of 100, 94, and 90 EPN dB for F-4, F-104G, and F-14 aircraft, respectively (Appendix E). Nellis has a greater complement of F-4 aircraft and includes some F-111 aircraft which most likely produce noise levels similar to F-4s (F-4 and F-111 thrusts are of the same order).

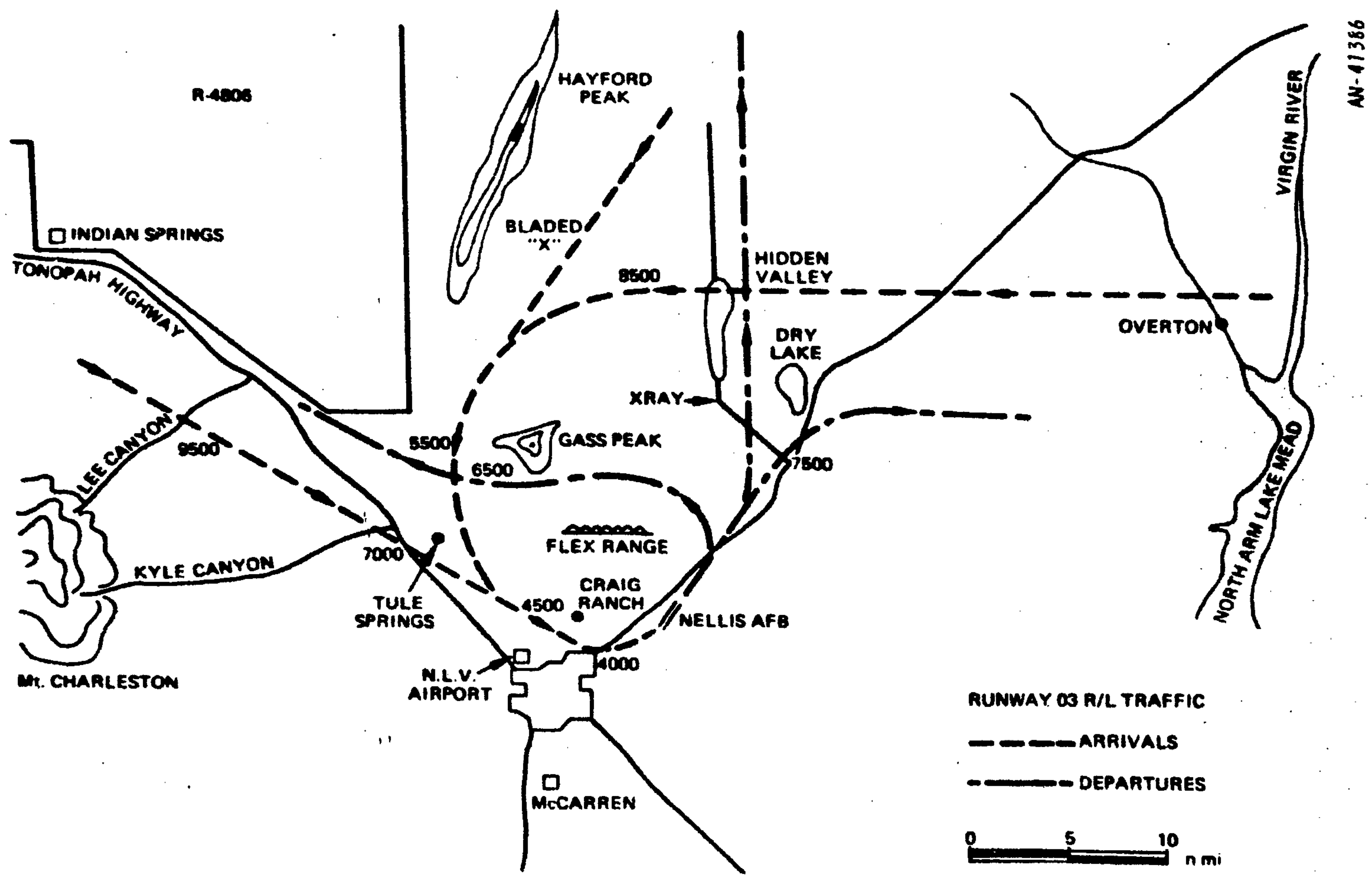


Figure 4.6. Standard Nellis AFB Approach and Departure Routes-Runways 03L&R

Assuming 100 daytime takeoffs per day (existing average Nellis rate) at 100 EPNdB incident on the region of complaint a noise exposure forecast (NEF) number of 32 dB would be deduced. A significantly inhabited area would be expected to voice widespread complaints at this level.[31] However, in this particular case the impacted region of North Las Vegas (vicinity of Lake Mead Blvd. and Lamb Blvd. intersection) is not yet uniformly developed to residential uses.* Also, the NEF value may be in error either way by 5 dB.**

If an NEF of 32 dB is accepted as representative of a threshold complaint criterion, it is possible to make some deductions concerning the likely increases in noise exposure due to the moderate expansion of Nellis AFB activity under far-term COR. In the far-term the daily average number of takeoffs from Nellis may be 140. If these are all performed in daytime hours the increase in NEF above the 100 daily takeoff rate would be 1.5 dB. Thus, residents within slant distances from the aircraft 20 percent greater would be subject to the same NEF as brought forth the original complaints. For example, at a 10 percent takeoff climb angle, a 20 percent increase in altitude (from 3000 to 3600 feet) and corresponding slant range would shift the point of threshold NEF by approximately one mile further along the takeoff flight path. This could well bring the region of threshold NEF into more developed residential areas, (roughly from the intersection of Lake Mead and Lamb Boulevards to the intersection of Lake Mead Blvd. and Pecos Street). These calculations are based on relatively simple depictions of the Nellis operating procedures. Nonetheless they do demonstrate the relative magnitude of the effect increased aircraft operations may have on residential populations nearby Nellis AFB.

---

*Based on an April 1973 street map prepared by the Auto Club of Southern California.

**Noise exposure forecasts must be interpreted with caution. It is a mean subjective measure which attempts to integrate the intrusiveness of a noise source with its frequency of occurrence over a day's period.

About 7 percent of existing Nellis operations are nighttime, which have a greater potential for inducing complaints due to the greater sensitivity accorded them in noise disturbance studies. Under COR, there may be an increase in nighttime operations. Such operations will be carefully investigated and procedures developed to determine the likelihood of undertaking them during periods with adverse wind conditions and their frequency of occurrence.

These estimates of noise exposure forecast and the consequent determination that far-term COR activities at Nellis may bring forth more noise complaints is based on the existing levels of development under the flight path region. Any further development in this region between now and far-term COR would tend to increase the number of complaints. However, the Air Force has put into practice a procedure termed Air Installation Compatible Use Zoning (AICUZ) which attempts to limit the development of future noise and safety problems associated with military operations by working closely with local planning and zoning authorities. The AICUZ concept will be applied to the COR/Nellis activities.

It may be feasible to consider a reduced level of operations when periods of adverse wind conditions exist. Under normal wind conditions takeoffs occur over relatively uninhabited grounds, and approaches, although occurring over the same region that produces complaints when takeoffs are reversed, are sufficiently low in noise generation that the modest increase in Nellis activity under far-term COR should not produce any significant number of complaints.

4.3.2.2 Human Noise Exposures in the Caliente EW Range

No takeoffs or landings by military aircraft will occur in the Caliente region during normal test activities. Present operations are restricted to subsonic speeds less than Mach .85 and altitudes greater than 5000 feet above centers of population, i.e., within two miles from such populations, and farther than two miles aircraft may operate down to 1500 feet above ground level. There are several proposed threat simulator sites at about two miles from the towns of Panaca and Pioche. SAM suppression aircraft in mock attack on such sites may operate with afterburners for short periods when at low-level. Either F-4 or F-105 aircraft may be used. This case probably poses the greatest potential noise intrusion on the populations of those two towns.

At a slant range of 10,000 feet with afterburner power, an F-4 may produce an effective perceived noise level of 102 to 105 EPNdB, depending on aircraft speed, for a very short period of time at the point of observation. For both near and far-term COR, SAM suppression sorties at the Caliente range are expected to average six to seven per day, primarily during daytime. These conditions combine to produce a noise exposure forecast (NEF) of approximately 20 dB. In a residential urban noise background this level would be noticeable but would produce no reaction in the way of complaints.[31] The Caliente region, prior to any military operations, would probably have been considered a very low background noise area. However, there has existed for the past several years a history of EW activity in the Caliente region, and it is quite likely that some degree of accommodation to this activity has resulted. Since COR plans involve only a modest increase above existing activity, it is not expected that any significant level of noise complaints will arise. Outside the existing EW range and particularly in COR North where previous activity has been slight, there is a possibility of eliciting complaints from COR activities depending on how quiet the existing background noise levels are in those areas. For example, survey data reported by the Environmental Protection Agency[31] indicates that, on the basis of a 24-hour average, a rural farm area may be exposed to A-weighted outdoor noise levels of 37 dBA and an urban residential area to 50 dBA. Peak noise levels during the 24-hour period for the same locations were reported at 53 dBA and 69 dBA, respectively. It is against this difference in expected background levels that COR operations may be expected to generate an occasional complaint from quiet regions.

Flyovers of small towns (i.e., Pioche, Panaca, or Caliente) at 5,000 feet above ground level and cruise power may produce effective perceived noise levels of 75 to 90 EPNdB, depending on the number (up to four) and closeness of aircraft in formation. A noise exposure forecast for up to 20 such incidences per day would probably be inconsequential. However, if in the course of the test mission, engine power settings were to approach takeoff or afterburner levels when over these small towns, noise exposure levels to the population would be of concern.

Before considering further restrictions on aircraft operations over small centers, careful detailed studies of flight profiles and their generated noise exposure levels will be made and appropriate procedures will be established to minimize these influences.

4.3.2.3 Other Potential Human Noise Exposures Arising from Proposed COR Operations

Single isolated incidences of severe noise exposure may occur whenever a mission aircraft flies at low-level over a person (or party) in the field (e.g., prospectors or rock hounds). These occasions may arise anywhere within the uninhabited regions of COR East or North, where aircraft operations may be as low as 1500 feet above ground level, or along specified low level routes where flights are typically at 500 feet above ground level. At 500 feet altitude effective perceived noise levels may range between 100 and 128 EPNdB for F-4 and F-104G aircraft depending on power setting. Corresponding peak sound pressure levels may range between 98 and 127 dB. Although the upper value is below the threshold of pain and the duration of exposure is probably too short to cause permanent damage, the exposure of people to this level would be classed as annoying.

Perhaps greater concern would be expressed over possible disruptive effects on the activities people might be pursuing. For example, the Utah State Archeologist, David B. Madsen,* notes one incident of damage wherein

*Letter to General Research Corporation, January 11, 1974.

a low-altitude overflight resulted in a cave-in on one of a crew involved in an archeological excavation. Unless such a site was directly under an assigned low-level route such an incident would have to be regarded as random. Given that some of the known archeological sites may be fragile in this respect (rock shelte[illegible]aves, etc.) the Air Force will take care in planning any changes or a[illegible]ns to the system of designated low-level routes to avoid known archeological sites that could be damaged. When made aware of plans for new archeological excavation, the Air Force will cooperate to avoid disruptive effects on such activities insofar as COR objectives are not negated.

4.3.2.4 Exposure of Animal Populations to Jet Noise Sources

The topic of noise has been the subject of several reviews as regards animals (e.g., Bond [1971]; USEPA, NTID300.5 [1971]). Before discussing noise, it should be pointed out that the major body of data are derived from domestic or zoo-kept animals. Because of this fact, the data are not necessarily valid when applied at face value to wild animals. Most literature suggests that domestic animals are little affected by the sorts of noise generated by jet aircraft. However, low-flying aircraft in close order may present a series of rather different effects. Such exposures have been occurring in the COR area for more than 20 years.

In general, experience with birds of prey suggests that sudden noise, such as would be produced by a low-flying aircraft appearing over a hill, will quickly flush the bird from its nest. Sudden noise when no aircraft is visible could have a similar effect, although visual awareness may be a governing factor in determining the bird's response.

The type of noise produced also has differential effect on wildlife. For example, nesting hawks, eagles, and falcons are more easily frightened and startled by the noise generated by a piston-driven Sikorsky S-56 helicopter than by a Hiller FH-1100 jet helicopter [White and Sherrod, 1974]. It is not clear what the type of noise generated by a low-flying jet will do to bird populations; while it might be difficult to demonstrate a short-term effect produced by jet noise, there is a possibility that effects will only express themselves on a long-term basis. For example, aircraft and other camp-related activities on the Alaskan tundra had little effect on the population density of adult Longspurs, per se, but a lowered reproductive success was indicated in the disturbance sites over the control sites [L.G.L. Ltd. 1972a]. Such an effect, thus, could be detected in the long-term if a lowered population density was observed as a result of the present and continued levels of activity in the COR area.

Snow Geese on pre-migratory staging grounds can be disturbed by aircraft at elevations up to 10,000 feet where flocks may flush as much as nine miles away from the approaching aircraft. If harassed, they may be driven completely away from areas as large as 50 mi^2 [L.G.L. Ltd., 1972b]. The effect on geese may be a function of visual rather than auditory disturbance. There is little doubt but what low-flying jet aircraft will induce a response from birds, but it is uncertain what the effects will be or what degree of accommodation will result except that in the COR area, past activities have surely reached a significant measure of accommodation.

Indirect effect on birds may take place in the form of a reduction of a food source. Insects may be adversely affected by sound [USEPA, NTID300.5, 1971] and in the course of making adjustments may, in turn, have a resulting effect on insect-eating birds. When insects avoid an area or cease moving because of noise, those organisms relying on them for food may leave the area.

The best-documented effect of noise on man or animals, especially well documented with laboratory animals, is the production of hearing loss or damage to the auditory system. Damage can be produced by either a brief exposure to a very loud sound or by a prolonged exposure to moderate levels of sound [USEPA, NTID300.5, 1971].

Heretofore, most of the work done with animals, including man, has been done in the range of 100-200 dB. Animals apparently have the ability to undergo temporary threshold shifts when exposed to low sound pressure levels of 70-90 dB [Peters, 1965] such that they, in a sense, accommodate to noise. Werner [1959] found that noises simulating thunderclaps, with a frequency range of 40-200 Hz at 98-100 dB given in rapid succession over a duration of 20 minutes, produced emotional responses in the experimental animal. The responses were measured by analyzing secretions in urine.

Aircraft passing over the Caliente Range may be as low as 1500 feet above ground or near 500 feet above the ground on assigned low-level routes. At these altitudes, the sound-pressure-levels are expected to range between 98 and 127 dB. It is quite likely that with eight to nine missions per day at low level, the frequency of exposure to the 100-dB range of sound will not be frequent enough to elicit physiological damage.

Zoo animals appeared to show more "awareness" or concern for moving objects than for sound [Bell, 1972]. It may well be the wild animals will likewise be more disturbed by flying jets than by the noise they generate. Certainly when approaching a nesting eagle in a helicopter, visual awareness of the aircraft elicits more reaction than does the sound of the aircraft. Concern would seem to lie in those areas where aircraft are low to the terrain. In these instances, aircraft will be low enough that they could appear to be directly above the animal and thus a threat to it, but there has been insufficient investigation to test and confirm such a hypothesis.

In summary, the data on animal responses to noise are insufficient to enable accurate deductions of potential impacts arising from COR operations. There is particular uncertainty regarding the effects that might arise from long-term protracted exposures. Furthermore, there has been a history of exposure to the animal populations in the Nellis range and Caliente EW range areas from previous and existing Air Force activity. If any of the response mechanisms discussed above have been operative throughout the history of exposure, it is quite likely that there has been adaptation and accommodation to it on the part of the natural environment. Little in the way of any adverse impacts from this exposure have been noted, but it would be premature to base any conclusions on this general observation in that there has not been a continuing, comprehensive environmental monitoring of this region. Furthermore, some potential effects, as noted above, may be observed only in the long term, and sufficient time in many cases has not transpired to demonstrate such long-term effects. We should note, however, that in addition to a projected gradual increase in Air Force activity in the COR region, there will be slight redistributions of activities to areas that have less history of exposure. In such cases, there may occur impacts that could cause some readjustments and accommodations among impacted species and ecosystems.

4.4 IMPACT OF GROUND ACTIVITIES

The primary construction in COR will likely involve some roads and instrument trailer pads. There may also exist the possibility of fencing the pads to assist in the necessary security. Fortunately, most of the extended field roads necessary are already present; thus, only small sections of access roads are required. This will reduce road construction and the concomitant impact to a bare minimum. Road construction in undeveloped environments may cause several results:

1. Increased off-road recreational activities,
2. Increased erosion potential,
3. Dispersion of solid wastes into new areas,
4. Additional dust,
5. Disruption of certain wildlife habitats,
6. Disruption of remote plant and animal refuges,
7. Increased potential for disrupting breeding and nesting behavior, and
8. Increased human access and possible fire and vandalism.

If any of these become excessive, the results could become a matter of concern. With the road system already present, it is unlikely that many of the hazards mentioned above will become serious.

Perhaps Item 6 above has the greatest risk attached. Care will be taken to avoid road or instrument pad construction that would necessitate accessing the habitats of any member included among the important check-listed species. Opening these areas to easy public use could have uncorrectable consequences in a few years or generations, particularly with plants such as the Bristlecone Pine. Item 7 is particularly important when considering species with nervous nesting habits, such as the Golden Eagle. Eagles, and several other species, will readily abandon a nest when repeatedly disrupted and possibly break eggs in the process. Some will even eat their young when disrupted excessively.

Perceived impacts will be avoided as much as possible with appropriate environmental consultation and careful engineering. In the surveying of new roads, or instrument pads, care will be taken to avoid undesirable pollution. Should the instrument pads have to be secured, they will likely be either temporarily posted with closed roads, or fenced. Any new roads will be planned so as not to restrict ranchers from their necessary activities.

Generator noises provide a general nuisance to human and wildlife alike, but they seem to accommodate to it rather rapidly. There will always be avoidance behavior displayed by certain shy species, particularly those with strong mobility such as coyotes and bobcats. Insofar as possible effort will be taken to reduce the generator noise in hunting areas during hunting seasons. Generally, generator noises, a very local effect, will probably be insignificant.

There exists the possibility of killing animals with either live or inert ordnance applications. Two important species may be exposed to this potential hazard (Dark Kangaroo Mouse, M. m. sabulanis and Pallid Kangaroo Mouse, M. p. ruficollaris) since small portions of their geographic ranges are found in the North Range.

Fire caused by live ordnance has the potential of removing relatively large areas of vegetation especially during those infrequent years when there is abnormal fire fuel buildup (high productivity). This occurs during years of high fall precipitation, with pregermination of ephemeral species, followed by adequate spring moisture to cause heavy growth. The heavy growth of these species produces the fuel for fire. Some species involved are Red Brome (Bromus rubens), Fiddleneck (Amsinkia spp.) and Red Stem Filaree (Eurodium cicutarium) and on previously disturbed soils Russian thistle (Salsola kali). In view of the fact that 25 percent of the 20 mm ordnance are tracers, there is a possible hazard of fire. However air-to-air and air-to-ground gunnery activity is carefully controlled and there are no known instances where the Air Force has been responsible for any of the fires that have occurred on the Desert Game Refuge (shared with the South Range). Moreover, use has been made of 20 mm tracer ordnance on the test ranges over a period of many years and range procedures have been developed to keep this hazard to a minimum. No increase in this type of ordnance expenditure is planned for COR and it is fully expected that the improved instrumentation of COR will allow a reduction in its use.

4.5 IMPACT ON AIR QUALITY

The Great Basin generally enjoys excellent air quality, owing primarily to its sparse population. Only in urban centers such as Las Vegas is there noticeable deterioration in air quality over a significant area. Court interpretations of the Clean Air Act require that areas of very high air quality must not be allowed to deteriorate significantly even though such a deterioration would not violate air quality standards. Clear, precise quantitative interpretations of this ruling have not yet been offered. Nonetheless there is a need to assess to what degree COR operations may cause deteriorations in air quality.

There appear to be two primary areas of concern; the landing and takeoff activity at Nellis AFB and the routine mission operations over the test ranges. Since no increase in Fallon activity as part of COR is forecast, it will be assumed that COR activities cause no additional contributions to emissions at Fallon. Total activity projected for H/W/D has not been identified and, consequently, the effects on air quality in that area cannot be discerned. With respect to making estimates of increases in pollutant emissions, necessary detailed information on military landing, takeoff, and other possible profiles is not available. Consequently, the following estimates of COR contributed emissions are very approximate.

Data recently compiled by the Air Force Weapons Laboratory[32] on source emissions of various Air Force engines shows a wide variation in emission outputs depending on the particular engine and the particular operating mode (i.e., idle, military thrust, afterburner, etc.). Emissions data on particulates, carbon monoxide (CO), unburned hydrocarbons (HC), and nitrogen oxides (NO_x) for 29 engines, eight of which are turbojets, were included in the compilation. Data for the F-4 and F-111 engines were used to estimate the effects of typical COR operations.

4.5.1 <u>Estimates of Emissions for Nellis AFB</u>

Nellis airstrip activities of concern in calculating emissions are: engine idle and taxi time prior to takeoff, takeoff time (until aircraft clears the runway), and duration of climb profile that can reasonably be expected to make emissions contributions to the air quality in and around Las Vegas. For the first condition it is assumed that takeoff is made at military thrust.

Typical profiles used by the EPA[33] suggest the following durations for each mode of the landing and takeoff cycle for <u>military jets at civilian airports</u>:* 6.5 minutes for idle and taxi, 0.4 minutes for takeoff,

*No standardized intervals for military operations at military airports are available.

0.5 minutes for climbout to 3500 feet, 1.6 minutes for approach and landing and 6.5 minutes for idle and taxi. Thus, there are 2.5 minutes of operation at or near military thrust and 13 minutes at idle/taxi thrust. Since 3500 feet is an approximate mixing depth for air quality considerations, emissions above that altitude are not considered in the calculations.* Yearly totals for aircraft pollutant emissions are derived based on one takeoff and one landing per sortie, and 28,275 sorties per year and 39,000 sorties per year for existing Nellis and far-term COR activities, respectively. Calculations were performed first assuming all Nellis AFB sorties were flown with F-4 aircraft and then repeated assuming they were all flown for F-111 aircraft. Table 4.1 presents the results of calculations based on these assumptions with idle-time (assumed to be 13 minutes per sortie) contributions itemized.

These estimated increases in pollutant contributions to Clark County (Las Vegas Standard Metropolitan Statistical Area) Nevada air quality are probably of minor significance. An annual increase of 153 tons of particulates represents 15 percent of the existing aircraft sources but only 0.2 percent of all sources in Clark County. Similarly, COR Nellis NO_X increases represent 7 percent of all aircraft NO_2 emissions and less than 0.1 percent of county-wide NO_2 emissions. Increases in CO and HC emissions due to COR Nellis are even less significant when compared to existing county-wide totals or totals for aircraft only.

Although Las Vegas presently exceeds air quality standards for oxidants (photochemical smog) the direct contributions of Nellis aircraft should cause only an imperceptible increase in oxidant levels. Similarly the indirect contribution due to COR-induced economic growth should be small and masked almost entirely by the contributions from the expected levels of economic growth due to other stimuli.

---

*In general, severe air pollution episodes occur when atmospheric inversions are quite low (much less than 3500 feet). Emissions generated above the inversion do not contribute materially to the pollution episode. Consequently, the calculation of emissions contributions based on a 3500 foot mixing depth overestimates the impact on air quality.

TABLE 4.1

ESTIMATED COR/NELLIS POLLUTANT EMISSION

Contributions to Las Vegas Air Quality

(tons per year)

			Particulates	NO_x	CO	HC
Existing Nellis						
	F-4	total	339	138	405	45
		idle	212	24	386	40
	F-111	total	403	127	574	138
		idle	204	12	563	137
Far-Term COR						
	F-4	total	468	190	559	62
		idle	293	33	533	55
	F-111	total	556	175	792	190
		idle	282	17	778	189
Increase Due to COR						
If all F-4			129	52	154	17
If all F-111			153	48	218	52

NOTE: Calculations assume all Nellis AFB sorties flown by F-4 or, alternatively, F-111.

Potentially the most significant problem area is perhaps with particulate air quality. The Nellis monitoring site indicates that presently air quality is slightly better than the standard. The localized effect of the COR/'ellis activity may cause peak levels to exceed standards for particulate concentrations. However, particulate emissions of interest to air quality--and the ones typically measured for sources--are in the sub-micron size category and are considered to be as generally diffusive as the other species. It should also be noted that an Air Force effort has been initiated to reduce visible (and other) emissions from Air Force aircraft. One such project is described in a report by the Aero Propulsion Laboratory entitled, Assessment of Pollutant Measurement and Control Technology and Development of Pollutant Reduction Goals for Military Aircraft Engines (AFAPL-TR-72-102).

4.5.2 COR Impact on Rural Air Quality (Caliente Area)

Since no takeoffs or landings during missions will occur in the Caliente region the only concern is with aircraft overflights below 3500 feet above ground level (assumed mixing depth for air quality calculations). Flight restrictions over and near small towns are such that most emissions from any aircraft lower than 3500 feet will be at more than two miles from the town. Furthermore many of the aircraft sorties (e.g., strike force aircraft with electronic countermeasures) are at altitudes around 12,000 feet. Assuming that all SAM suppression sorties under COR operations ($\sim$1400/yr) over the Caliente range each involve 20 miles of low-level activity at military thrust, it is estimated that 8 tons per year of particulates would be added to the Lincoln County emissions inventory. This represents approximately a 3.2% increase in existing particulate emissions and can be judged a minor though significant contribution. Because threat simulator sites are rotated from site-to-site on a frequent basis, the locations of low-level flight tracks of attacking aircraft would vary throughout the Caliente range causing the pollutants to be dispersed.

4.5.3 Other Air Quality Impacts

For many of the COR air-to-ground missions, activity will include the discharge of live ordnance. Such tests are conducted at the land-restricted ranges of the Nellis and H/W/D complexes. Previous assessments[34] of live ordnance impacts on the ground have concluded that contributions to degraded air quality are minimal and in terms of total impact on an extremely localized area are overshadowed by the direct effects of the explosive (blast and cratering). Furthermore, with the improved test instrumentation to be used for the proposed COR there will probably be less need to employ live ordnance in many missions, since precise measurements of interacting test elements will allow reasonably accurate scoring via computer simulation.

4.6 ECONOMIC IMPACTS

The economic impact of the proposed COR activities can be manifest in many ways. One, of course, is in the staffing of COR. Current plans are tentative regarding the mix of Air Force and contractor personnel used to man COR facilities and provide for operations and maintenance of the range. Different mixes may result in slight variations in the manning levels; however, the forecast levels previously mentioned for COR are approximately correct and most personnel will still come from outside the area. So, for the purpose of this section, the level, rather than the nature of the staffing is important.*

The number of direct employment opportunities created by COR is difficult to establish at present as the mix between Air Force and contractor personnel to man the COR facilities has not yet been determined.

*It should be noted that while the economic differences attached to different mixes are negligible, there may be some social differences. While stationed in remoter areas such as Tonopah or Caliente, AF personnel are rotated frequently. Thus while their economic activity supports the town they are never really integral, and are less affected by the remoteness. Contractor personnel will be more permanent and can be affected by a long stay in a remote area.

In any case they will certainly add to local business activity and secondary employment and thus increase the gross income of the area. These additions to gross business activity must of course be balanced against the costs associated with educating more children and adding to other facilities, such as schools.

The COR is programmed to develop to its planned staffing levels over a period of approximately 5 to 6 years after which the staffing levels should remain constant. It is difficult to predict what the levels of COR activity may be beyond the far-term. However, it deserves mention to note that COR activity will not be tied directly to any specific military conflict such as Vietnam. Its role will be much the same as the Fighter Weapons Instructor School presently existing at Nellis which should provide COR with a measure of stability in the longer term.

The introduction of new population where the staying power is not certain can raise important issues for people who are the present residents of these communities. The infusion of new money can hardly be opposed in circumstances of economic decline, but the steadiness of the income and the burdens on public facilities may raise important issues. Some analysis of these factors on community planning is necessary to assess these effects and project suitable measures which may be implemented.

One important way the impact may be felt is in the increased economic activity supported by the increase in direct employment. The best way to measure this is to estimate the additional or secondary employment which will be supported. This is done with an employment multiplier, which measures the change in local employment resulting from a unit change of employment in a basic industry. This multiplier varies from region to region and generally ranges from about one to two.[35,36] A study of the Southern Nevada area has indicated that a multiplier of 0.8 is appropriate.[37]

The impact is also measured in terms of increased AF procurement and construction levels. Since procurement is on an as-needed basis, there are no projections. However, given the current level of expenditures and the percentage increase in base activity, there is no reason to expect that this would be a significant impact. Table 4.2 shows the proposed construction activity. No data is available on the rate or the manning levels of this activity. Las Vegas (see Tables H.9 and I.5) does have a significant level of construction employment, which has handled the construction of many major projects over the past decade.

On the other side of the ledger are the costs of these impacts. These costs are manifested in a variety of ways. One, of course, is the added expense of providing urban services to the increased population. Most of these are municipal services (e.g., education) and are funded through a variety of local taxes. Other services such as housing are normally provided through the private sector. The AF has no plans for building housing on-site in the outlying areas of COR.

The basis of this analysis is the population increases which can be induced by the proposed COR activity. Table 4.3 shows the potential population impacts by geographic location. The staffing levels are

TABLE 4.2

PROPOSED COR CONSTRUCTION COSTS

($ Thousands)

	Nellis	Indian Springs	Hill
FY74	$ 545	--	---
FY75	4,277	917	---
FY76	2,492	205	$903

TABLE 4.3

POTENTIAL POPULATION IMPACTS BY LOCATION

	Staffing	Induced Employment	Total Employment	Potential Population Increase
Caliente (Area)	206	165	371	1187
Las Vegas	186	149	335	1072
Salt Lake City	4	3	7	23
Tonopah	265	212	477	1526

obtained from Table 2.7, grouped by location, and multiplied by the employment factor of 0.8 to obtain the total potential employment impacts. These figures represent an upper bound as areas with high unemployment (Las Vegas, Lincoln) will probably fill some secondary jobs without extensive immigration. However, in an area with unemployment as low as Nye (1.5 percent) the increased demand for employment will need to be met by immigration. The last column in Table 4.3 shows the potential population increase for each area. This figure is derived from the employment potential using an average household size of 3.2 persons.[39] This projected population increase is 0.2 percent, 58 percent, and 86 percent of the existing 1980 population projections for Las Vegas, Caliente/Pioche/Panaca, and Tonopah, respectively.[14]

The important consideration here is to demonstrate the level and possible costs of extra services required by this population increase. Potential impacts upon area schools are shown in Table 4.4a. The increase in enrollment is derived by multiplying the population increase by a factor which shows the percentage of students (K-12) in a normal population.[39] When compared with the current excess capacity, there would be a possible shortage of three to four classrooms in both Caliente and Tonopah.

In addition to capital requirements, there are, of course, operating expenses. Table 4.4b shows the additional operating expenses based

TABLE 4.4

POTENTIAL SCHOOL IMPACTS

a. Capital

	Current Excess Capacity*	Potential Increase in Enrollment	Potential Capacity Shortfall	Percent of 1972 Capacity
Caliente	151	263	112	14
Las Vegas	NA	238	---	--
Tonopah	242	339	97	14

b. Operating

	Yearly Operation Costs Per Pupil**	Potential Additional Operation Costs	Present PL-874 Revenues	Net Projected Additional Operational Costs	Percent of 71-72 County School Receipts**
Caliente	$1,230	$323,500	$56,000	$267,500	25.0
Las Vegas	852	202,800	50,700	152,100	0.1
Tonopah	1,148	389,200	72,000	317,200	20.0

*Nye and Lincoln County Schools.

**Nevada Department of Education, Biennial Report of Selected Data, Carson City, Nevada, 1970-1972.

on the 1972 costs in each county. Under Public Law 874,* the Federal government pays a school district $213 a year for each student whose parent works on a Federal installation and lives in the district. This is obviously not enough to cover the variable cost per student and the resulting

*The continuation of this program into the future is not a certainty. Each year Congress must appropriate and the President must approve the appropriation. It is our assessment that this aid will continue, though if it does not, the financial impact upon local school districts would be even more severe.

increase in yearly operating costs for each district as shown. In addition, in order to show the severity of the impact, the amount is shown as a percentage of the yearly educational receipts for the entire county. The impact is noteworthy in Lincoln and Nye Counties.

Two major sources of revenue represent significant fractions of school operating revenues. About 32 percent is subvented from the state and is based on school enrollments, while 30 percent of the school's budget is supported by local property taxes.[40] As local school enrollments increase due to population growth, the amount of the state's subvention will increase proportionately. If school operating budgets do not increase proportionately any faster than school enrollments the above percentages will remain roughly constant. Should school budgets grow faster or slower than enrollments the percentages supported by local property taxes would change. However, the net impact will be measured by the changes in local tax rates required to balance revenues with costs.

In Tonopah there exists a supply of vacant housing sufficient to provide for most of COR-induced growth. While it is not expected that all existing vacant housing would be utilized before any new houses would be constructed, the prospects are that Tonopah's tax base will grow slowly relative to school revenue requirements. Consequently school tax rates will probably increase. The situation in Caliente/Panaca/Pioche is somewhat different as ultimate COR-induced population growth will probably stimulate some construction. However, these expected additions to the tax base will very likely not meet the increased school revenue requirements without some tax increase as well. The percentage increases in school tax rates required will be less than the percentage shown in Table 4.4b, but it is difficult to predict the levels at this time.

Another possible impact is the potential for lost air transient business due to proposed COR airspace (see Sec. 4.1.2 for more details). Losses in air transient business could result in income losses for private enterprise such as decreases in aviation fuel purchases. Concomitant losses in aviation tax revenues to affected local airports could result as well. The 1972-1973 Special Aviation Tax paid to Nye County was $436. Lincoln County does not assess this tax. The regular $0.06 Aviation Tax adds about $1,310 to Nye County airport funds for a total of $1,746. This contributed only about 0.05 percent of the Nye County fund requirements for 1972-1973.[38]

Area cattle ranchers make extensive use of aircraft for counting cattle, showing cattle to prospective buyers, and counteracting rustlers. It is in the third area where area ranchers could realize a loss due to some loss of scheduling flexibility. Rustling losses in Nye County have amounted to about 1,000 head during the last nine months of 1973. Response to cattle rustling must be immediate to be effective. Some ranchers fear that proposed COR airspace procedures could inhibit them in protecting their cattle (see Sec. 5.2.3).

Another potential impact area is water usage in the affected communities. Table 4.5 shows the potential increase in demand as a percentage of projected demand in 1980. The per capita demand anticipated by the State Engineer's Office in 1980 is combined with the projected population

TABLE 4.5

WATER USAGE (1980)

	Projected Use in Gallons/ Capita/Day*	Induced Demand (AFY)	Projected Demand (AFY)*	Percent of Projected Demand
Clark	445	1.5	241,000	0.0006
Lincoln	355	1.3	1,070	0.1
Nye	410	1.9	3,200	0.06

*Water for Nevada, Report #5, State Engineer's Office, February 1973.

impact to derive COR-induced demand for water. As shown in the last column of Table 4.5, this is an insignificant percentage of total demand. COR plans call for additional range personnel to be stationed at the Nellis range near Tonopah and the Caliente EW range. Implementation of COR plans will very likely necessitate some concomittant effort to avoid potential sewage problems.

Sewage treatment at Tonopah is provided in two undersized raw sewage oxidation ponds. The collection system has few manholes or cleanouts and occasionally runs under homes and buildings. Upgrading the sewage collection system and installing a new secondary sewage treatment facility with an approved effluent disposal process would improve this situation. Pending evaluation of the water source, both existing and new, improvements might entail chlorinating the water supply at the booster pump station, constructing a 14-inch transmission main connecting the terminal storage with the distribution system, and providing approximately 7,000 more feet of key feeder mains in the distribution system and over three miles of additional distribution mains. These community responsibilities will need to include plans to upgrade these facilities should analysis show that the effects of COR-induced growth warrant such measures.

The surfacing of partially treated sewage from underground disposal systems is widespread throughout Panaca. During high runoff in Meadow Valley Wash, the problems become acute and indicate the need for construction of a collection system and secondary sewage treatment plant. Waste treatment at Caliente is provided in an outdated overloaded primary treatment plant. Portions of the collection system run across private property without legal easements or right-of-ways. An improvement project should include upgrading the sewage collection system and installing a new secondary sewage treatment plant with an approved effluent disposal process. Again this is primarily a local responsibility but COR-induced growth should be considered in proposed solutions.

Increased population and economic activity will also mean increased revenues to local government. Several taxes (cigarette, liquor and $0.125 per gallon of gas sold in the state) are subvented to counties on the basis of population.[38] Most county revenue is obtained from property and sales tax revenues. Since COR-related employment would increase economic activity and probably increase assessed valuation, revenues to the counties would increase. This increase would derive from secondary economic and construction activity as COR anticipates no construction which would be on state or local tax rolls.

5 ALTERNATIVES TO THE PROPOSED ACTION

5.1 GENERAL

Alternatives to the proposed action are considered here in the context of the needs for a Continental Operations Range. These needs grew out of the deficiencies identified in existing Air Force ranges.

Operations in Southeast Asia demonstrated that a requirement exists for more comprehensive and realistic training prior to the commitment of our forces in combat. Lessons learned in World War II and Korea could not be exploited and incorporated into peacetime training and had to be relearned or modified based on new wartime experience, often at the cost of losing men and machines to hostile action. During years of peace, our aircrews have either never attained or been inclined to lose the edge required for peak efficiency under the stress of conflict. Lack of resources, especially suitable ranges and associated airspace, have contributed to our limited state of preparedness and inability to transfer the experience of combat veterans to the next generation of aircrews.

Also, the experience in Southeast Asia reinforces Air Force convictions that aircrews must practice their acquired skills in a realistically simulated enemy environment. Familiarization with new weapon systems and their employment is not enough. Realistic training sorties, combining integrated activities across the full spectrum of tactical operations, must become a way of life during peace and war. To be effective, this additional training must provide for basic weapon systems employment, near-real combat practice, and a measurement capability to determine aircrew and weapon effectiveness under varying situations.

Complementary to the need for realistic training and practice is the need for adequate test and evaluation of the weapon systems provided to our aircrews. Deficiencies in the operational test and evaluation data obtained on new weapon systems were pointed out by the Blue Ribbon Defense

Panel. Weapons systems have become increasingly more sophisticated, and technology has provided us with a variety of hardware designed to increase our combat effectiveness. Without the airspace and ranges for integrating aircrews and weapon systems in a simulated combat environment, the real capability of our aircrews and weapons effectiveness cannot be determined directly, but can only be inferred, at best, by extrapolation from smaller scale tests. In response to growing Congressional and Department of Defense concern over inadequate operational test and evaluation of new weapon systems to support procurement decisions, section 506 of Public Law 92-156 requires test data, obtained in real operational situations, to accompany and support requests to Congress for weapon system procurement authorizations and funds.

The demands of Congress and the Department of Defense for demonstrated performance from weapon systems stem from the necessity to minimize the technical risks involved in acquiring new weapon systems for the inventory. The basic purpose of test and evaluation in the Department of Defense and the Air Force is to fulfill that requirement for information on the performance of weapon systems. That performance is to be demonstrated with actual hardware in a realistic environment. To do this for most major Air Force systems requires large controlled land, air, or water areas to accommodate the requirements for full system demonstration. All of these requirements reinforce the need for an operational test and evaluation range such as the Continental Operations Range is conceived to be.

The deficiencies of our existing ranges to support realistic training and testing stem from

1. A lack of integrated air defense environment that is representative of a network of foreign ground and airborne air defense systems, which includes the air defense detection, identification, tracking, interception, and weapon guidance functions.

2. A lack of airspace and freedom that permits unconstrained employment of penetrator tactics, including electronic warfare to counter the enemy's command, control, and weapon guidance systems.

For the foregoing reasons the course of no action was not considered a viable alternative.

5.1.1 <u>One Alternative: Improve An Existing Range</u>

To correct these deficiences, a first consideration is naturally the improvement of an existing range. About a year ago, in an AFSC briefing on Range Constraints, this alternative was examined in view of the test programs for our new systems, and our existing ranges were found wanting.

Current and planned workloads were analyzed for the following ranges/test centers.

Air Force Eastern Test Range (AFETR)

Space and missile Test Center/Western Test Range (SAMTEC/WTR)

Armament Development Test Center (ADTC)

Air Force Flight Test Center (AFFTC)

Aerospace Defense Weapons Center (ADWC)

Tactical Fighter Weapons Center (TFWC)

Hill/Wendover/Dugway Complex (H/W/D)

Examples of the new systems for which operational tests now are, or will be, constrained to a significant degree by various limitations on our ranges, are

1. Air-to-air and standoff weapons/targets

- Drone/Remotely Piloted Vehicles

- AIM-9/AIM-7 Air-to-Air Missiles
- Modular Guided Glide Bombs
- Air-Launched Cruise Missiles

2. Aircraft
   - F-15
   - B-1

The new weapon systems entering the inventory require larger, not smaller range airspace and associated ground space to accommodate their footprints.* Range and airspace problems of the newer airplane systems will hinge on the ability to accommodate tests of their supersonic capabilities, their electronic warfare capabilities, and to conduct tests involving multiple aircraft in cooperative "teamwork" tactics. When a pattern to be used in testing the capability of the F-15 to deliver the AIM-7 missile at Mach 1.25 is overlaid on the White Sands Missile Range, the safety footprint area exceeds the width of the White Sands Missile Range. If more freedom of action for the pilot is desired for certain tests, the missile safety footprint would be much greater. White Sands cannot accommodate all supersonic air-to-air testing of the F-15. These tests are presently possible on the Pacific Missile Range; however, testing there is hampered by poor weather conditions.

Weather is increasingly restraining test programs. Statistics gathered from conventional munitions testing at Eglin AFB between December 1970 and November 1971 show that 41% of test flights were cancelled due to weather. Poor weather does not necessarily restrict operational <u>employment</u> of the systems to be tested, but restricts use of vital instrumentation, safety, test control, and monitoring functions. With increasing numbers and capabilities of systems requiring tests, little capability to expand OT&E testing at Eglin AFB appears to exist.

In attempting to conduct tests of electronic warfare equipment, there are increasing electromagnetic interference problems relative to public and commercial broadcasting channels. At Eglin, certain ECM tests, FCC limits testing to between the hours of 2 and 4 in the morning.

*The footprint for an aerospace vehicle at a given position and time in flight is the area on the ground defined by its greatest possible impact dispersion pattern.

Airspace for supersonic testing is continually becoming more limited. There is only one overland corridor available for supersonic air-to-ground testing on the Eglin Range. The corridor is narrow, permits no maneuvering, and has Mach and altitude limits which are functions of meteorological conditions in order not to exceed over-pressure limits at the range boundary.

Supersonic flight over national parks and monuments is prohibited by AFR 55-34, which requires area clearance by 1/2 nautical mile per thousand feet. The planned B-1 tests program at Edwards AFB will be flown at subsonic and supersonic speeds over a route dictated by the location of the AFFTC data acquisition and transmission system. Unless waivers to AFR 55-34 are obtained, additional flights and money may be required for the B-1 test program. Operations at White Sands must consider potential damage to the Gran Quivira Indian ruins, a national monument, located in the north of the White Sands Missile Range reservation.

At a time when expansion would be desired, the Air Force finds it difficult to expand range lands for future requirements. The larger problem, then, is created by increased system capability in the face of shrinking ranges.

Oil companies are looking increasingly at new off-shore oil resources. They consider the entire coastline of the United States as a potential source of oil. Off the Louisiana coast, there are presently some 1800 of these off-shore platforms, some of which are over 1/5 mile long with derricks up to 400 feet high. These complexes were built up over a 10-20 year period. Off-shore drilling technology is growing rapidly, and the density of rigs is expected to grow more rapidly in new areas.

The Department of the Interior has advertised its intent to open the Eastern Gulf for oil exploration. The current interest for oil exploration in the Eglin area stems from the existance of a geological formation called the Smackover Fault which looks like a favorable area for oil finds.

This fault runs from the vicinity of Pensacola through the Gulf to South Florida below Tampa. At the end of April 1973, there were 39 producing oil wells at Jay, Florida, northeast of Pensacola, with others being added. In addition, wells are now being drilled in the Big Cypress Swamp. Oil producers are capable of drilling at water depths up to 600 feet (100 fathoms).

All ranges are feeling the effects of population growth. This can be seen particularly in the Antelope Valley surrounding the Air Force Flight Test Center at Edwards. Anticipated population growth in Southern California, by the 1980's could bring about several constraining actions on Flight Test Center Operations. Within that time frame, the AFFTC will be ringed by a freeway system. These highways will eliminate a practical buffer zone existing around the Edwards precision impact range.

Approach and departure routes planned for the proposed Palmdale Intercontinental Airport are such that one departure route cuts through the southern half of the Edwards airspace complex. Traffic forecasts for the Palmdale Airport range as high as one aircraft movement every 30 seconds during peak periods by the mid-1980's. Development of the Mojave Airport will necessitate relocating the operating areas of some low and medium altitude missions. A Kern County referendum in February 1972 allotted $100,000 for improvements to the airport. The FAA has approved an Instrument Landing System (ILS) installation with a proposed final approach area which may interfere with other operations at Edwards. Development of the Palmdale and Mojave Airports will certainly result in an increase in general aviation activity in the Antelope Valley, which will reduce existing safety margins at the AFFTC.

Another current range constraint is that the FAA has initiated a project to withdraw all restricted airspace at and above FL180.

Our new systems have placed new demands on existing test ranges. In addition, our operational commands need adequate ranges for operational test and evaluation and training in order to demonstrate complete weapon systems in a simulated combat environment and provide confidence and planning factors based on the weapon system effectiveness. The problem of adequately satisfying the test needs of newer programs cannot be solved alone by improvement of existing ranges. Accommodation of these needs can only be handled with the development of the Continental Operations Range. Testing on COR will relieve the load at the other ranges. The reduced operations test load at the other ranges will be more than compensated for by an increase in the development testing that is done on those ranges.

5.1.2 Alternatives to Test Ranges

In view of the pressures arising as a natural consequence of population growth which seem to be relegating the CONUS ranges to sparsely populated land areas of the continental United States, a second alternative might be the development of feasible testing methods and systems which do not depend upon large water and land areas used as ranges. These alternatives must offer feasible solutions for continued testing and training missions.

Alternatives which might reduce the dependence on existing ground ranges are extremely limited at this time. Those available today, those under development, and those under consideration fall into two categories: (1) range equipment alternatives, and (2) simulator alternatives.

.At best, these are poor substitutes for COR. Rather, range equipment alternatives, such as frangible bullets and simulated bomb scoring systems, can free land space below the used airspace for other uses, such as grazing, for example. However, there will always be some requirement to drop ballistic ordnance to validate tactics and training and to calibrate/confirm the weapons release systems used in most newer aircraft. Air combat maneuvering systems have the potential for scoring all air-to-air engagements without firing actual weapons. A system such as this is being planned for the COR. Such systems would also eliminate the ground range area (footprint) safety concern for projectile fallout. The simulator alternative must be based upon analytical models of system elements and sensitivities. Such models are constructed by dividing the mission to be tested into a network of discrete operations, each of which can be modeled by a computer algorithm or a semi-automatic machine function. Small, independent exercises would then be used to validate the individual portions or subsections of the model. Then, actual combat experience, such as occurred in Viet Nam, would have to be used to validate the overall model, including interactive effects of a two-sided multiple-participant engagement. The obvious limitation is that the adequacy of the representation of the enemy's equipment, doctrine, tactics, etc. of any particular real-war engagement can seldom be checked. In addition, simulators are expensive and can only, at best, replace a portion of the actual flying training requirements.

There are no current alternatives that can fulfill the requirement to simulate (to the maximum extent possible short of wartime risk of life) the combat situation. The conclusions are inescapable. Valid data leading to information required by the operations on a COR-type facility cannot be obtained in any other fashion. In the past, the simulator alternative has been tried, to a lesser degree than is now possible, with unacceptable results. Simulations, even when they are validated piecemeal by actual flight testing, fall far short of satisfying the requirement for test ranges. Indeed, test ranges, and ultimately, large-scale testing are necessary to check simulations and invest them with credibility and utility.

5.1.3 Build a Range Encompassing Existing Ranges

This alternative requires that existing non-research and development ranges be improved and integrated to accomplish the desired tests and training objectives. It is the alternative that offers maximum capability with minimum investment and risk. It reduces total investment by making use of a great deal of expensive equipment and facilities currently used for both training and operational testing. Near optimum capability can be achieved at reasonable investment and very low technical risk. Further, the existing missions of the range (training and testing) are enhanced by the creation of a COR-like facility.

In the location, design, and operation of a COR-like facility, prime consideration must be given to civil air traffic distribution, population density, climate, topography, existing facilities, existing special-use airspace, Government owned land, and radio frequency interference effects. It was using precisely these criteria that led to the selection of the site now proposed for COR.

The geographic area for the minimum general aviation aircraft population is shown in Fig. 5.1. The proposed COR site area, super-imposed on this figure, avoids the main commercial air traffic routes. The site is positioned on the basis of the least interface with existing air carrier traffic routes and large civilian air terminals.

The minimum IFR and VFR air traffic density regions are shown in Fig. 5.2. The proposed COR site falls in a location that is in one of the minimum IFR and VFR density regions avoiding the main commercial air traffic routes.

From these figures, it can be deduced that the proposed COR site location is mutually acceptable to the minimum aircraft population and minimum IFR and VFR traffic density regions. When the accessibility of existing ranges is also considered, it appears that the proposed COR site is the most desirable in the CONUS.

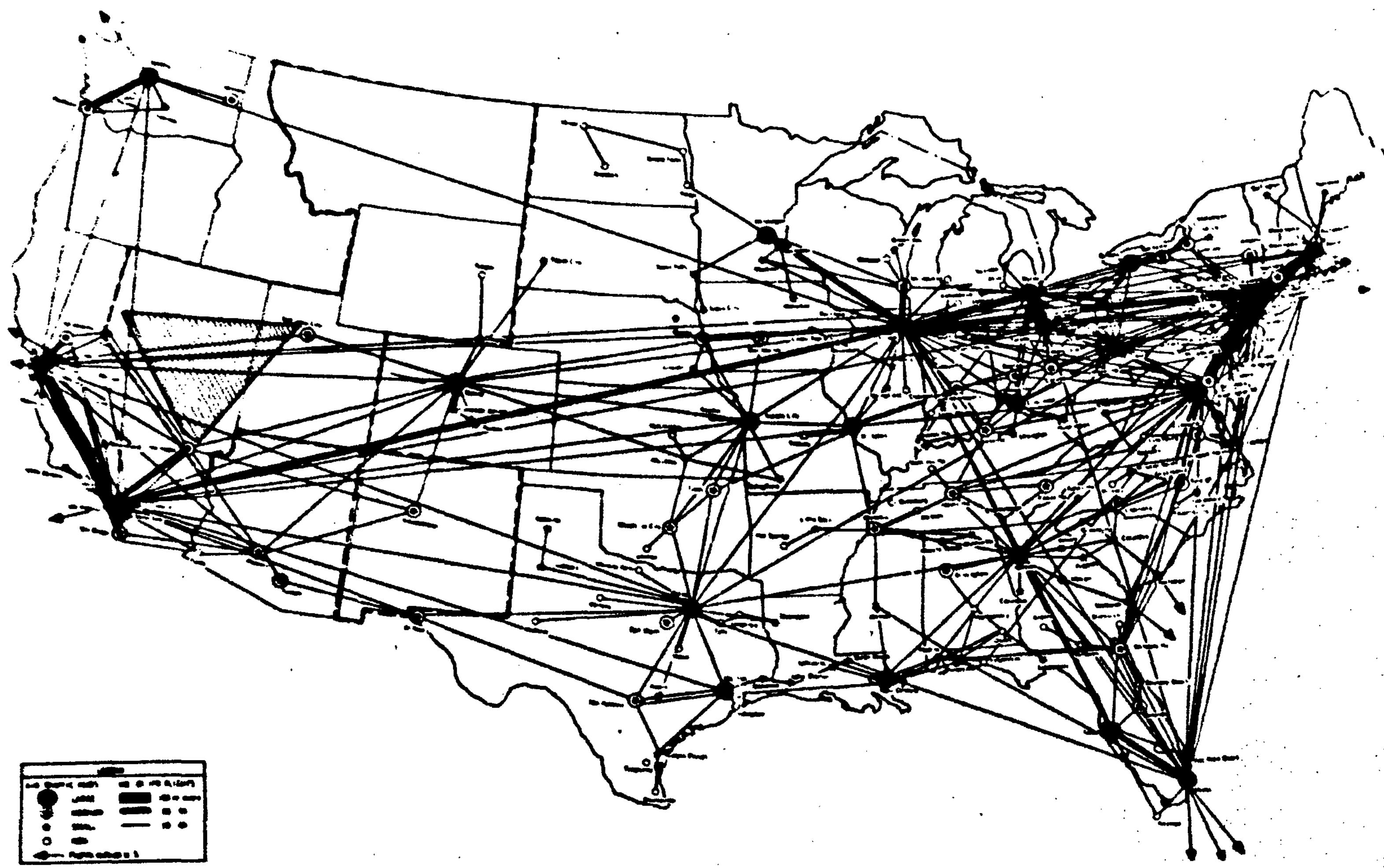


Figure 5-1 COR Site Location Within the General Aviation Aircraft Population Area

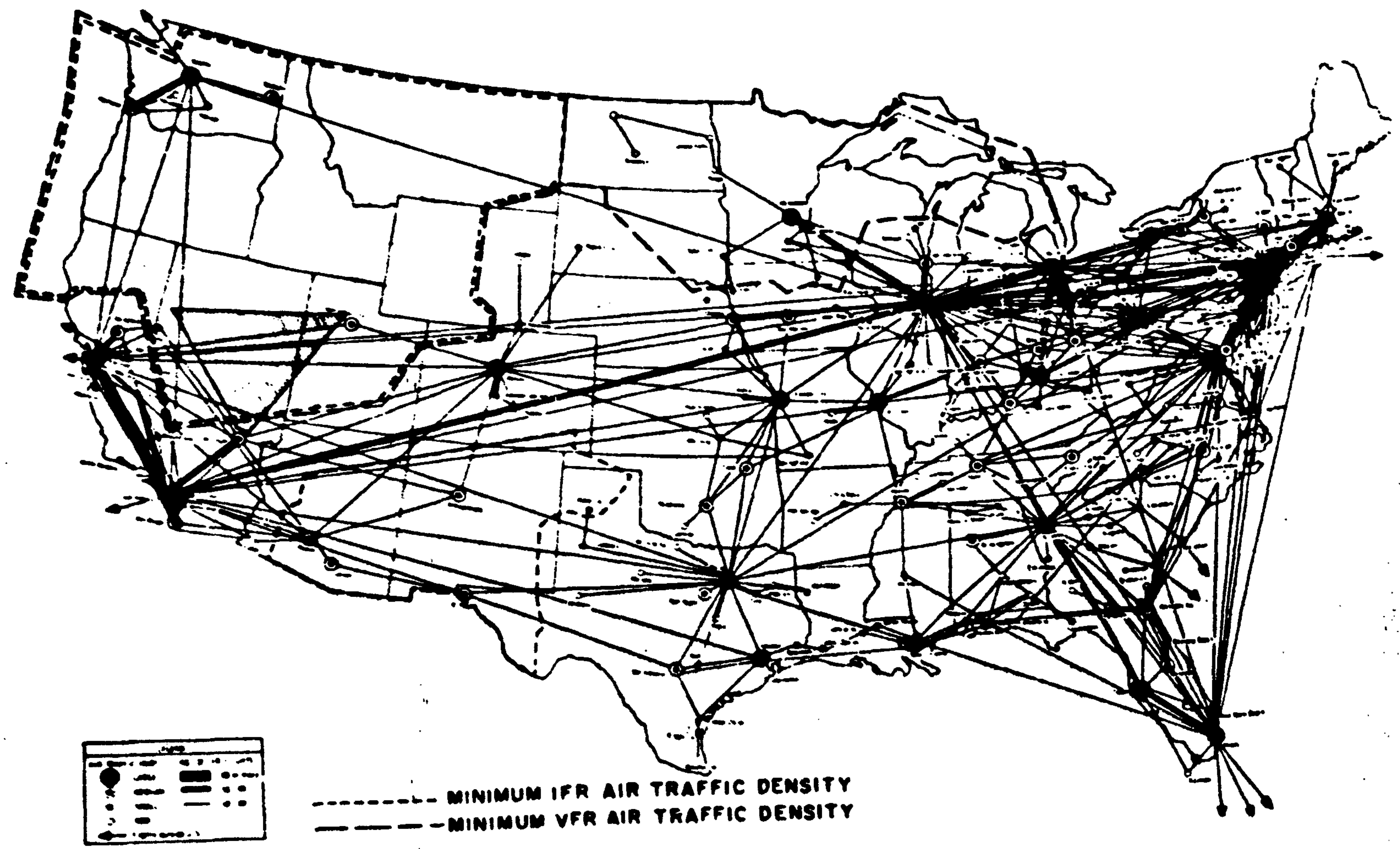


Figure 5-2 COR Site Location within the Minimum VFR, IFR Air Traffic Density Area

Until recently, the distribution of urban areas affected range selection primarily in regard to the cost of lease or purchased acreage and the need for safe impact areas. Large impact areas were required for air-to-air weapons, but these could generally be provided over water. For air-to-surface weapons, only that airspace above a small target, together with a limited maneuver area, was required to be restricted.

For large force operational training or evaluation, with sustained flight speeds up to Mach 3, a large Special Use Airspace (SUA) is necessary. Such an area would be at least the size of the off-shore SUA's (usually designated by the FAA as Warning Areas) typically designated for air-to-air gunnery exercises or about 10,000 square miles. If such an area is to be placed within the CONUS, then the population density becomes a serious problem.

A relative comparisor of population density for various sections of the CONUS based on the 1960 census is shown in Fig. 5.3. The proposed Utah/Nevada area has a population of about 50,000. This site is much less densely-populated than most any other area in the CONUS.

Severe thunderstorms such as those that occur during the summer in the southeast portion of the CONUS can seriously impair flight operations. For example, military aircraft returning from a target area may have to be diverted to an alternate field because of a thunderstorm over their home base. The field may be shut down due to severe winds, turbulence, low visibility, or a combination of these. Also, the rainfall in such storms is often so heavy that braking is impaired and landing roll-outs are increased by as much as 80 percent to 100 percent.

These storms do not usually remain over a field for more than about 30 minutes, but, for most operational aircraft conducting ordnance training, this is enough delay to make diversion necessary. Diversion results in schedule delays as well as maintenance and logistics problems.

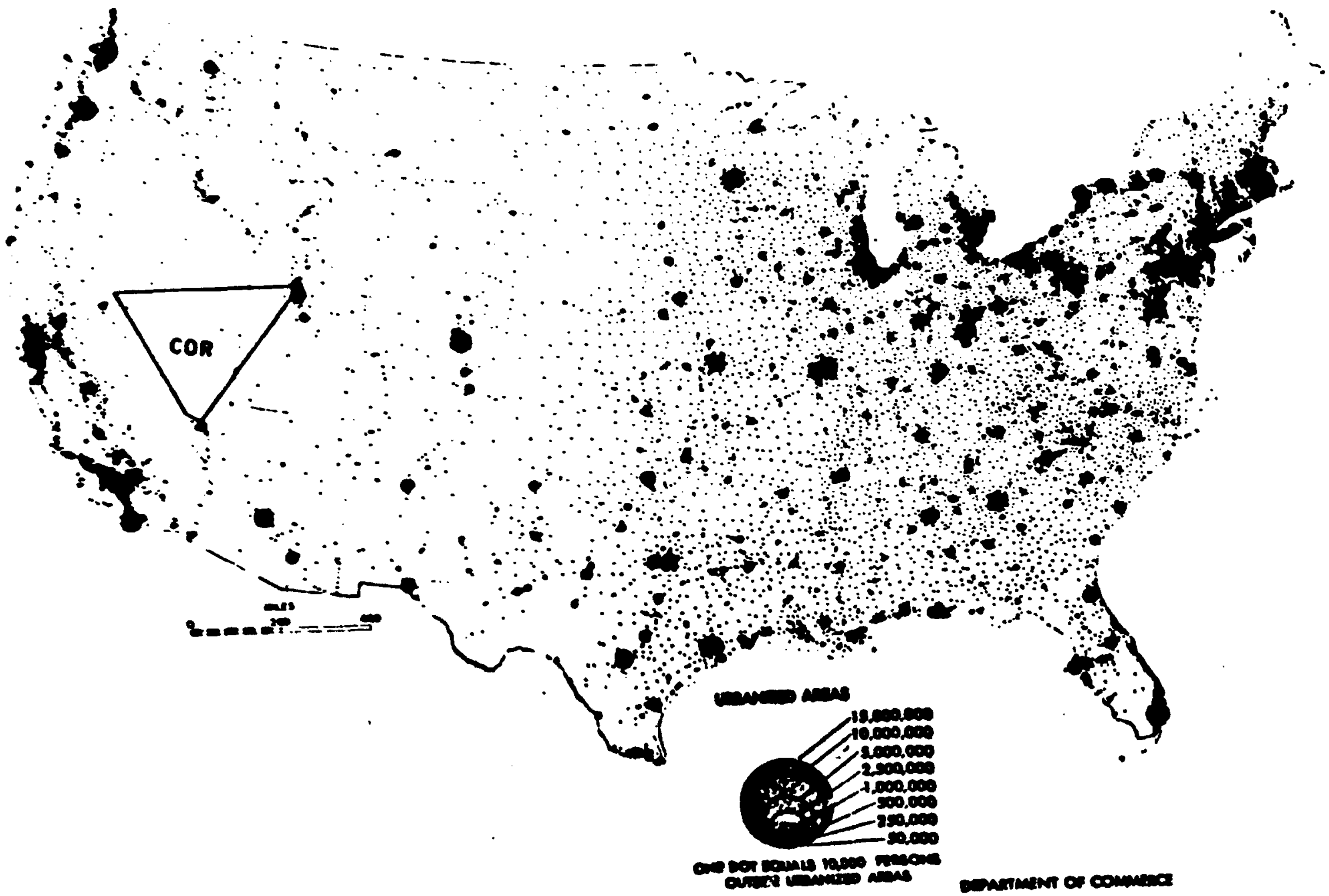


Figure 5-3 CONUS Population Distribution: 1960

The proposed COR site lies in low-to-moderate thunderstorm areas. There are two to three times as many thunderstorms per year in the Eglin area as are in the vicinity of the COR site.

Since mission planning and success is very dependent on topography, it is desirable to have a test facility that includes all types of topography which the forces might encounter under operational conditions. The only way such a goal could even be approached within the CONUS would be to have several ranges and fragmented missions.

Two different types of topography are represented between the proposed COR site and the Eglin area. Flat terrain with semi-tropical growth is found in the southeast CONUS and mountainous terrain with temperate and/or semi-arid flora is found in the Utah/Nevada part of the western CONUS; thus, these ranges in the CONUS could provide some of the desired variety in terrain and foliage.

The Federal Government owns real property in each of the 50 states and the District of Columbia. Within the CONUS, Nevada and Utah (in that order) have the greatest percentage of federally-owned acreage. Thus, from an economical standpoint of establishing a Continental Operations Range, this area is also a prime candidate for COR.

In summary, the Nevada/Utah site, selected on the basis of air traffic density, is also well located with regard to climate and population density constraints. Complete topography requirements cannot be met at any site in the entire CONUS. However, by fragmenting the mission, and using several ranges, it should be possible to train and evaluate the combat command units with a reasonable degree of confidence. Other advantages of the proposed COR site are its accessibility to all users and their support by virtue of its central location, its somewhat enhanced security by dint of its inland location protected from uninterrupted surveillance from unfriendly submarines or other vessels, and its benefits engendered by co-location with operational and combat training activities. It thus appears that the Utah/Nevada area is probably the ideal location.

5.2 ALTERNATIVE IMPLEMENTATIONS OF THE PROPOSED COR

5.2.1 Flight Corridors and Alternative EW Range Areas

During mid-term COR, increased use is to be made of interconnecting flight activities between Hill/Wendover/Dugway range and the COR/Nellis range. These flight activities will involve low-level subsonic aircraft, drones, and remote piloted vehicles as well as high altitude (above 30,000 feet) supersonic and subsonic aircraft. The collection of flight tracks comprised by these activities can be grouped and located to minimize environmental impact.

Similarly, alternative range areas for electronic warfare (EW) activities can be selected which minimize environmental impact. Accordingly several areas have been selected as shown in Fig. 5.1 for study as potential alternative EW range areas. The selection is based primarily on ecological considerations, and other extenuating or conflicting factors are analyzed. Since low-level groups of flight tracks could potentially impact the environment in the same manner as EW activities, the ecological considerations in selecting tracks are equally appropriate.

5.2.1.1 Ecological Considerations for Corridor and EW Range Area Selections

Corridors are selected to exclude direct overflights of population centers, recreation sites (especially water-based recreation and important hunting and camping sites), ranching areas, highways, active mining centers and other areas where frequent high-speed, subsonic flights might have the greatest impact on humans and wild and domestic animals.

The most important sites to be considered for possible impact in connecting Fallon NAS with COR/Nellis are in the Fallon farming district and the Stillwater National Wildlife Refuge.

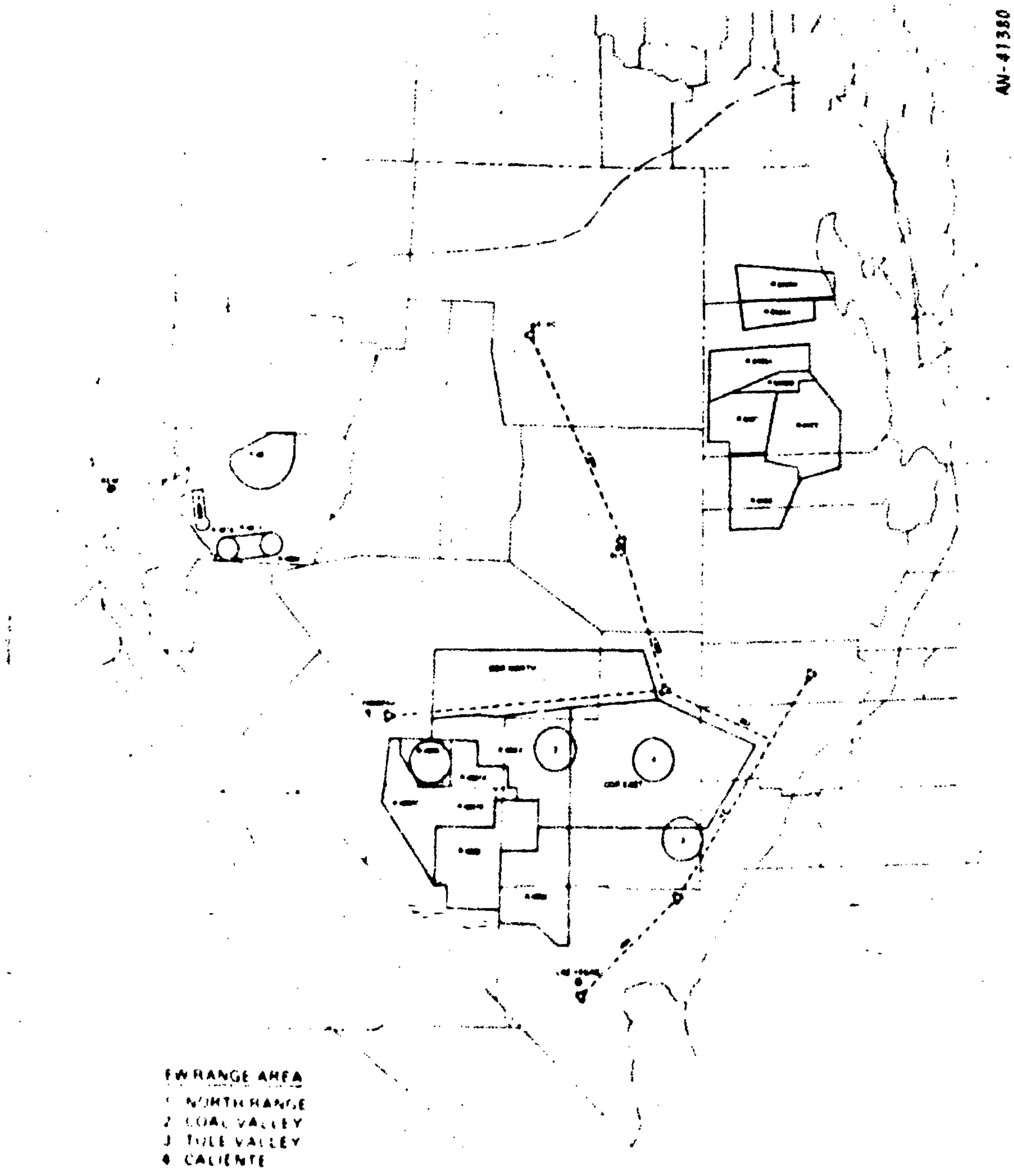


Figure 5.4. Alternative EW Range Areas

Tracks connecting H/W/D with COR/Nellis or Fallon NAS will be selected to exclude Elko, the Ruby Lakes National Wildlife Refuge, Ely, Austin, Eureka, Preston, Lund, the Kirch Wildlife Management Area, and the Duckwater Indian Reservation. It may also be possible to avoid the Monitor, Toquima, Toiyabe, Ruby, East Humboldt, and other mountain ranges with relatively high hunting and general recreation.

North-South corridors over the eastern half of the COR area will be selected to utilize R-6406B, R-6407, and R-6405 in western Utah if feasible. This will allow exclusion of the important wildlife and recreation areas in the Shell Creek and Snake Ranges of Nevada. Areas to be avoided in the Caliente area are the White Rock and Wilson Peak areas in eastern Nevada. They are considered high-quality, heavy-use deer hunting and recreation sites.

In addition to the North Range and Caliente EW range areas, two alternative EW Range areas (Coal Valley and Tule Valley) were selected because they occur away from the relatively populated area near Caliente, Panaca, and Pioche and can be reached via corridors that cross areas of less environmental importance. Coal Valley has ground access via Hiko and Tule Valley via the Carp Road from Interstate 15 on Mormon Mesa. These two sites are less important from the wildlife and vegetation standpoint, although they do provide year-round or seasonal grazing for domestic livestock.

5.2.1.2 Descriptions of the Environment in Alternative EW Range Areas

North Range (EW Range Area 1)

This area is within R-4809 where it is already restricted. Generally, it seems to be located where the least negative impact would be expected, although the Pallid Kangaroo Mouse (M.p. ruficollaris) and the Dark Kangaroo Mouse (M.m. sabulonis) both have restricted ranges overlapping the North

Range. Perhaps as much as 15 percent of the range of the Pallid Kangaroo Mouse is included in the EW range area, while only about 10 percent of the Dark Kangaroo Mouse is included. There are also American pronghorn and wild horses in the area. The BLM wild horse range is found in or adjacent to this EW Range area.

Coal Valley (EW Range Area 2)

This area includes the proposed Worthington Peak microwave repeater site and the general Coal Valley area. Key Pittman and Kirch Wildlife Management Areas are found along the north and south edges of this area, respectively. Waterfowl could well be disturbed in these two areas. The following endangered or restricted species of fish would fall in the area: White River Spinedace, White River Colorado Gila, the Pahranagat Spinedace and the White River Springfish, as well as the Dark Kangaroo Mouse (M.m. sabulonis) and the Botta Pocket Gopher (T.u. nanus). All of these species have only a portion of their ranges within the EW Range area.

Caliente (EW Range Area 4)

This area includes the geographic region in the vicinity of Caliente, along with three other small towns: Pioche, Panaca, and Ursine very close by. Although there are only a few people included in all four towns, they rely on these communities for their support.

This area also includes a portion of the largest mule deer hunting unit in southern Nevada and the heaviest hunted. Any additional access roads may conceivably bring more hunter pressure on the mule deer, perhaps to the extent that restricted hunting permits would be required in future management practices. There may also be concern if increases in COR activity might induce more restrictions on hunters, possibly causing hunter irritation. Two endangered or threatened species are found in this area: the Dark Kangaroo Mouse which has about 30 percent of its range within the EW Range area and the Bristlecone Pine [Baily, 1970].

Appreciable amounts of recreation activities are centered in this area, including water sports and camping, since Cathedral Gorge State Park, Echo Valley State Park, and Eagle Valley Dam would be within this area. Also, there is some agriculture and ranchihg centered in the vicinity of Panaca-Caliente.

Tule Valley (EW Range Area 3)

This site does not include any towns, although several ranches in the lower Meadow Valley Wash are close to its western edge, and agriculture in the Virgin Valley is close to the eastern edge. It is entirely possible that both of these areas would experience the sonic booms from maneuvering aircraft. None of the endangered or threatened species overlap the area, although two small herds of intensely managed Desert Bighorn Sheep are partially included in this area.

Perhaps one of the most serious drawbacks of using these areas is the withdrawal from BLM management of a new range that may attract more public interest than the other sites. Also, a portion of this would be in Utah, necessitating decisions with an additional political entity.

5.2.1.3 Airspace Considerations

The alternative EW Ranges described above were made on purely ecological grounds. The addition of the following airspace considerations narrows the choice of locales which are available for use as EW Ranges. While the areas are depicted in Fig. 5.4 as circles with 10 n mi radii, the airspace associated with each area may be described as a cylinder of 20 n mi radius. The required vertical extent naturally depends on the type of exercise proposed for each target; however, the typical integrated mission described in Sec. 2 describes an air combat patrol which is nominally stationed at approximately 30,000 feet. Thus it can be inferred that airspace in the area could be required up to at least 30,000 feet.

Referring to Fig. 5.5 it can be seen that the airspace for EW Range areas 2 and 3 overlap the following airways:

EW Range Area 2: V-244 and J-58-80 above FL 180

EW Range Area 3: V-21 and J-9-107 above FL 180

This overlapping of required EW Range airspace makes the choice of these areas unattractive because of the cost and effort required to relocate airways and navigation facilities. This is especially true in the case of J-58-80 which has one of the heaviest traffic loads in the US.

Relocating the proposed EW Range areas in order to reduce the overlap is only a partial improvement. The proposed ceilings of COR North, COR East, and R-48XX are FL 180.

Because of this, penetration of Area 2 above FL 180 would be restricted to a 150-degree sector (from about 080 degrees magnetic to about 230 degrees magnetic). High altitude penetration of Area 3 would be even more severely restricted to a segment of only 120 degrees (from about 240 degrees magnetic to about 360 degrees magnetic).* Since a wide range of random entry tracks and altitudes are necessary attributes of a useful EW Range, proposed Areas 2 and 3 are both less useful than Areas 1 and 4.

The airspace required for Area 1 can be wholly within R-4809 and R-4807 which already extends from the surface to unlimited altitudes. With the exception of a segment of only 90 degrees in the North, high-altitude entry can be from almost any direction. COR East will extend from the surface up to FL 180. Thus high-level (above FL 180) penetration of Area 4 will always occur in unrestricted airspace. Although all airspace above FL 180 is under continuous positive control, Area 4 does not suffer the disadvantages (shared by Areas 2 and 3) of overlapping or close proximity to heavily travelled jet routes.

*Note: Low-level penetration tracks are not a competing factor among the four proposed EW Range areas.

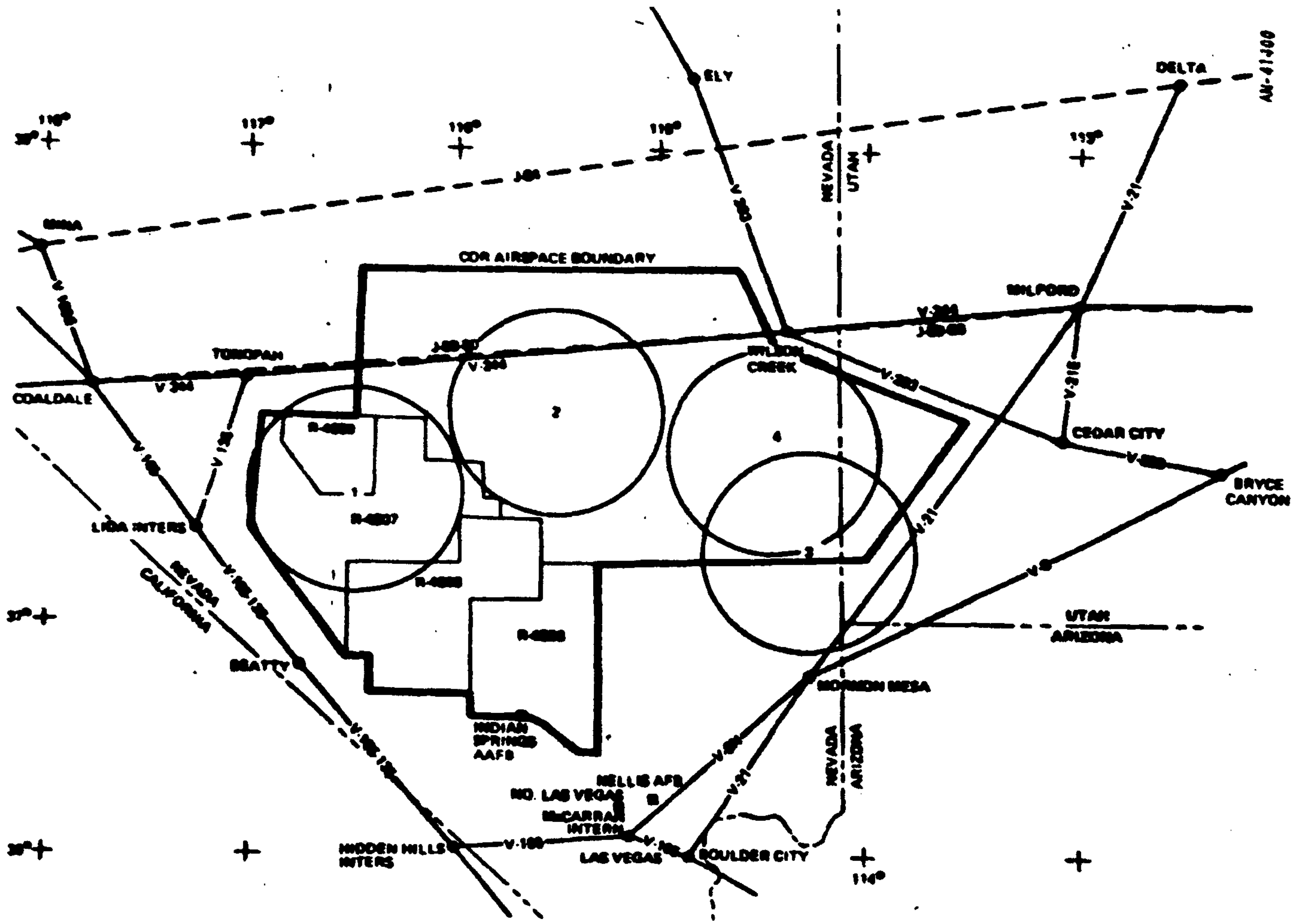


Figure 5.5. Potential EW Range Area Airspace

Thus locales available for designation as EW Range areas are reduced to only Area 1 and Area 4.

5.2.1.4 Other Considerations in the Selection of Alternative EW Range Areas

Areas 2 and 3 (Coal Valley and Tule Valley) would bring a degree of new air activity not now experienced in those areas. The Caliente area has been used for some time as an electronic warfare range and a degree of accommodation of these activities with the human environment has been achieved. Undoubtedly the natural environment in terms of the relevant ecosystems has also undergone some (unmeasured) accommodation. Thus a shift of this activity to new areas would require new accommodations. Furthermore the corresponding reduction in activity that would occur at Caliente under such a shift would very likely entail undesirable economic dislocations.

Both of the Coal Valley and Tule Valley areas possess road accesses. However, neither area has any developed capability in the way of public facilities to accommodate the number of range personnel anticipated; thus increased costs would be incurred in order to provide the necessary facilities and the creation of the modern counterpart of a tent city would be required. Avoiding the necessity to develop new areas with the necessary complement of public facilities would require personnel to be driven or flown in from the nearest town of reasonable accommodation (very likely Las Vegas for Tule Valley and the Caliente area for Coal Valley). Each of the commutes would significantly detract from the time personnel could spend manning the threat simulators and hence range mission time would likely be decreased. Longer or additional shifts at added cost could restore losses in range mission time.

5.2.2 Alternative Methods for COR Manning

A study was performed to evaluate the cost-effectiveness of different methods of manning COR facilities. Four alternatives, using Air Force personnel, were considered for study:

1. Establish a range base similar to the one at the Hill test range,

2. Provide contract quarters,

3. Provide government quarters, and

4. Continue full per diem TDY* support.

The evaluation of each alternative was performed on the basis of the manning requirements for the Caliente EW Range.

5.2.2.1 Range Base Similar to Hill Range

To support the Hill AFB range operations, a small base (Lakeside Base) was established to provide quarters and meals for permanently assigned and TDY personnel. Lakeside Base is managed by the 2849 Air Base Group which has its headquarters at Hill AFB and is commanded by the Hill AFB Commander.

The Lakeside Base has accommodations for 120 personnel (120 beds). Approximately 60 beds are required for base support personnel (fire department, safety officer, cooks, dishwashers, motor pool mechanics, clerks, medics, etc.), 10 beds are utilized by personnel who run and maintain the range instrumentation, leaving approximately 50 beds for TDY personnel who participate in range testing. The Minuteman test activities have required approximately 30 TDY personnel at Lakeside each week; consequently, there are only about 20 beds available for TDY personnel who support other tests.

Military and civilians compose the Lakeside Base Support Group. The military personnel assigned PCS to the Lakeside Base serve up to 15 months on a remote tour basis. The civilians are hired in with the work site designated as Lakeside Base and, with the exception of the quarters and meals at nominal cost, no other compensation is provided.

*TDY designates temporary duty away from regularly assigned military base.

Assuming that the Lakeside Base is effectively and efficiently managed, then one could deduce that it takes approximately 60 base support personnel to maintain adequate facilities for approximately 60 people whose functions are to operate and maintain range instrumentation. The range operations at Caliente require approximately 50 people. Consequently, this would require a Lakeside Base type facility, a growth of approximately 100 percent in range assigned personnel.

The total cost of the Lakeside personnel facilities was estimated at $1.5 million in 1964. It is estimated that a suitable facility could be provided at the Caliente range for $2.5 million each. The cost estimate could fluctuate upward by 50 percent because of several variables, i.e., environmental requirements, permanent housing or trailers, the energy situation, type of water and power supplies, inflation, etc. Using accounting practices where the capital improvements are absorbed in the year installed, the annual operational cost of each range base would approximate:

50 support personnel @$10,000 per year	$500,000
Utilities	33,000
Comm	21,000
Laundry	2,000
Supplies	84,000
TDY for support personnel	25,000
Total	$665,000

5.2.2.2 Contract Quarters

Range TDY personnel would be housed in all three of the small towns within the range area, Caliente, Pioche, and Panaca, because no one town has sufficient adequate quarters for all the TDY people. To provide contract quarters in the towns of Caliente, Pioche, and Panaca will require contracts with several different motels. Most of the motels available have only 10 to 15 units. It is quite unlikely that they will be willing to contract all their units to the Air Force; consequently, 50 percent has been assumed as the maximum that these motels will contract out. Thus, to house 50 TDY personnel, seven motels at seven to eight contract units each would be required. At present, this utilization rate of the better motels would create a shortage of quarters for other transients.

The work week on the Caliente EW Range would frequently encompass Saturday and Sunday in addition to long shifts on Friday. Consequently, it appears that contract quarters would have to be for a full week, seven nights. The estimated costs of contract quarters if they were available are:

1. Assumptions:

   a. Enough hotel/motel spaces available to house 50 personnel,

   b. Hotel/motels meet minimum adequacy standards in accordance with AFM 30-7,

   c. Hotel/motels could be contracted at $6.50 per man per day,

   d. No additional facilities required, and

   e. Per diem will be reduced to $11.80 per day.

2. Costs:

Quarters, $6.50 per day per unit	
annual cost per unit	$ 2,366
50 units annual cost	118,300
50 personnel TDY @$11.80 per day,	
250 work days, annual cost	147,500
TOTAL COST	$265,800

5.2.2.3 Government Quarters

Permanent Government quarters at the Caliente EW Range would be established close to the intersection of Highways 93 and 25 to take advantage of the available assets there. A trailer village would be more cost effective for a 7-to-10-year time frame than conventional construction. Each trailer would house two people, therefore, 25 units would be required to accommodate the 50 TDY personnel plus a laundry unit and two office units. The unit cost to provide facilities to the village is highly dependent upon the site location. This location would be determined only after a detailed site survey/study.

The drive-in cafe at the intersection will accommodate 15 to 20 people at one time and is open only from 1000 to 1900 hours. This cafe is not adequate, in size and hours of operation, to handle the range TDY personnel if they were all collocated at the intersection. It is assumed that private industry would expand and provide the required service, otherwise the USAF would need to provide a mess hall service with the trailer village.

Considerations and cost estimates for the trailer village are:

Considerations:

1. Water supply, 100 gallons per man per day
   a. Storage tank @$300 per 1,000 gallons
   b. Pipeline @$4.00 per linear foot or trucked @$.15 per mile per 2,000-gallon tank
   c. Cost of water
2. Power Supply
   a. 150-kW line per 50 people @$6.00 per linear foot
   b. Cost of power used or cost of generator plus fuel and maintenance costs
3. Sewage
   a. Septic tank(s)
   b. Leach field
   c. Collection line
4. Environmental Impact
5. Trailer Units
   a. 78 units @$7,500 per unit
   b. Concrete pads and roadways

Estimated Costs:

Capital Costs

28 trailer units, $7,500 × 28	$210,000
Power, water, sewage, concrete pad, and roadways	300,000
TOTAL	$510,000

Operations Costs (Annual)

Maintenance and security, 5 man-years	$ 50,000
55 personnel TDY @$11.80/day, 250 days	162,250
TOTAL	$212,250

5.2.2.4 TDY Support at Full Per Diem

The Caliente Range instrumentation sites are located throughout the Caliente, Panaca, and Pioche area with the intersection of Highways 93 and 25 being the approximate hub. This location is approximately equal distance from most instrumentation sites, has power and water, a cafe, paved road, and a service station. Because of these assets, this site is to be used as range maintenance headquarters. A two-bay vehicle garage is leased for motor pool repairs at this site with collocated maintenance control vans. There is adequate space for parking privately and Government owned vehicles, and during off duty hours some security is provided by the landlord and his station attendants in addition to the surveillance provided by the local law officers.

TDY personnel would have leased/rented quarters in Caliente, Pioche, and Panaca from commercial and private parties. Because of the work week, most of the TDY personnel would maintain their quarters on a weekly basis. Contracting the quarters for a full week makes it possible for the range personnel to establish a more home-like environment instead of just living out of a suitcase. This permanent aspect will add considerably to improving/maintaining high morale as personnel may be required to work exceptionally long hours.

Data from 1 January to 7 December 1973 were used to determine the normal work day when the range is being used. The work day was defined as a 30-minute drive from the maintenance van to the range instrumentation site, 60 minutes of instrumentation warm-up time prior to any aircraft on the range, mission time on range, and a 30-minute drive back to the maintenance van when the last mission aircraft has departed the range. Approximately 90 percent of the work days were 8 hours or longer. To man the site 5 days a week, the range personnel should depart Las Vegas, Nevada, Sunday evening at approximately 1900 hours and return the following Friday, arriving in Las Vegas about 2-1/2 hours after the last mission.

Estimated costs:

50 TDY personnel at $25.00 per day
250 work days per year
Annual cost = 50 × $25.00 × 250 = $312,500

Although there are distinct differences in annual operating costs among these four alternatives, no one alternative has been selected. As other factors may be important it is expected that different alternatives may be chosen for different areas. The proposed approach will consider military manning, justified on a position-by-position basis, irrespective of its cost relative to in-service civilian or contract costs. However, decisions between in-service civilian and contract will be based on cost comparisons in accordance with Air Force regulations, based on Office of Secretary of Defense and Office of Management and Budget guidelines, with the most economical resource being selected.

5.2.3 Alternative COR Airspace Implementations

A potential alternative implementation of the proposed COR airspace dealing with modifications to the Flyways is considered. One possible modification is to reduce the floor of the Flyways to ground level in the vicinities of small airstrips underlying COR North and COR East. The floors of all of the VFR Flyways proposed in COR North and COR East are set at 1,500 feet AGL. In order to enter a Flyway from an airstrip beneath COR North or COR East, an ATC or procedural clearance will be required. The resulting procedural accommodation of these operations could reduce but would not compromise the safety of both COR and non-participating operations.

This procedure will establish VFR access to each airstrip requiring it. Where several airstrips are clustered near each other, procedures will cover the group of strips. Pilots will be free to use this airspace to depart their airstrip and climb into one of the VFR Flyways.

Two probable arguments against this alternative approach are (1) that many access routes may present a potential navigational problem for COR pilots and (2) that the airstrips do not fall neatly under the Flyways. There are, however, only five* charted airstrips which would require only four access airspaces. Figure 5.6 illustrates how the charted airports fit beneath the proposed Flyways. Additional uncharted airstrips for which access airspace is required may in fact exist and a survey would be necessary in determining the efficacy of this proposal.

Airstrips on or close to the boundary of COR airspace will be treated slightly differently, by providing access to airspace beyond the boundaries of COR airspace. An example of this type of strip is Lake Valley airport, about 10 miles northwest of Wilson Creek. Figure 5.3 also illustrates how a small access airspace volume would segregate the small airstrip traffic and COR air traffic.

---

*Note: This count excludes Hot Creek which is charted as an abandoned airport.

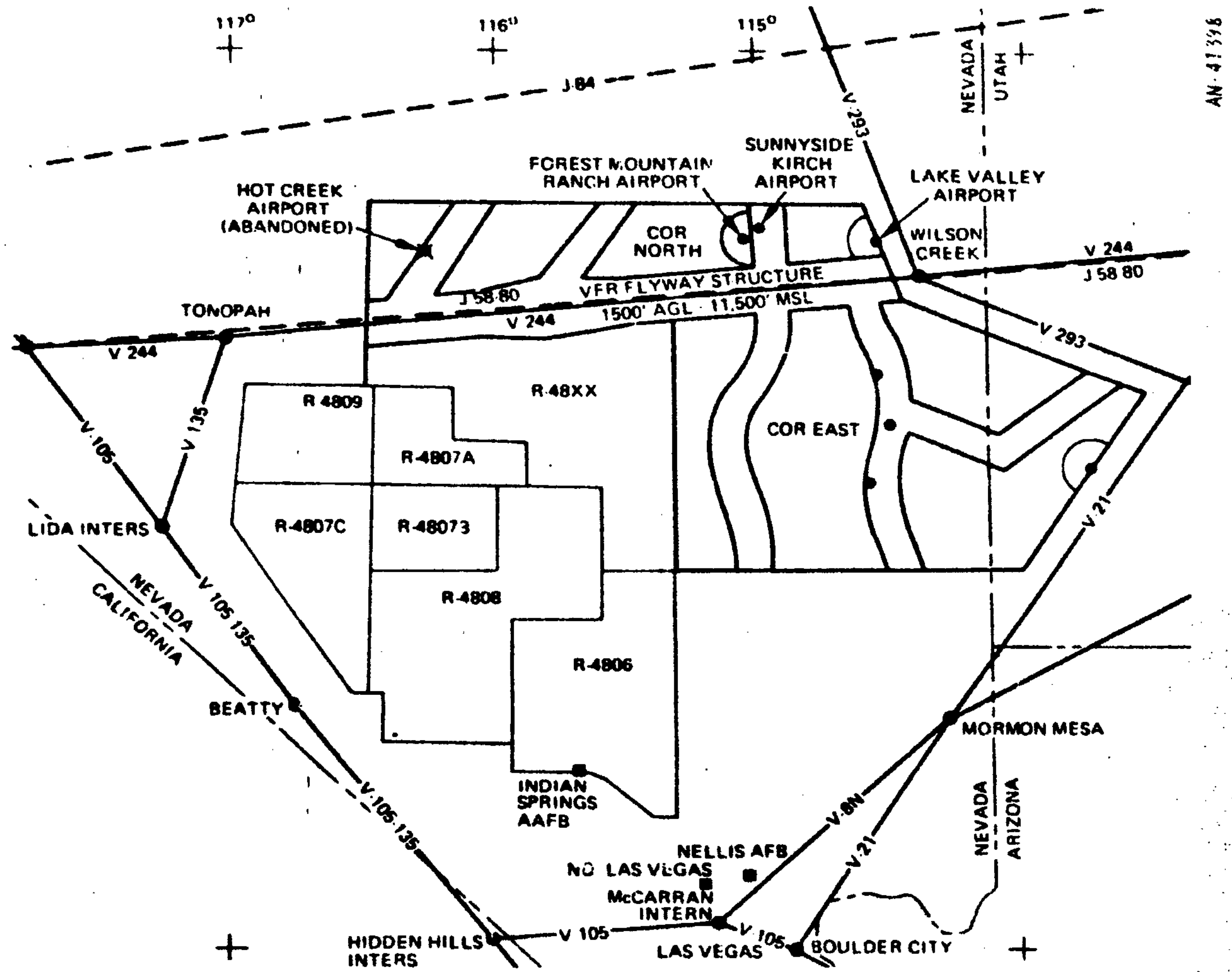


Figure 5.6. Charted Airports and Considered Alternate COR Flyway Structure

6 UNAVOIDABLE ADVERSE IMPACTS AND MITIGATIVE MEASURES

6.1 COR AIRSPACE IMPACTS

Far-term COR air activity is not yet well defined, so it is hard to assess how COR airspace requirements may change with the development of COR. Nevertheless, the proposed COR airspace states that no additional airspace proposals are considered necessary to satisfy the far-term COR airspace requirements* in the Nellis area. Furthermore, R-48XX is proposed as an interim restricted area,* implying that some day (when the North Range ATC facilities are sufficiently developed) the airspace will be derestricted. In addition, the USAF intends to survey users of the Flyways after an initial period of use, to ascertain if adjusted routes could better serve the users.

These three aspects of the proposed COR airspace indicate the fluid and even reversible nature of airspace actions. It is thus difficult to imagine any permanent or even long-term unavoidable adverse impacts resulting from implementation of the proposed COR airspace.

A short-term adverse impact is the effect of permitting uncleared operations into either COR East or COR North without appropriate communications coverage.

The adverse impact will be mitigated through one of several processes. The USAF could provide:

1. A thorough indoctrination, on as wide a geographical basis as possible, to inform pilots of the nature, and general schedules of COR activities.
2. A specialized indoctrination of all pilots who operate in the area to establish an understanding of COR activities in terms of operational safety. This indoctrination could be updated as required by general COR schedule changes.

---

*Note: COR Airspace Proposal, Appendix G.

Other adverse impacts described in Sec. 4 could be mitigated as follows:

1. Impacts on fuel and time: A thorough dissemination program through the FAA, pilot's groups such as the National Pilots Association (NPA) and the Aircraft Owners and Pilots Association (AOPA) would attempt to develop pilot awareness and understanding of COR airspace and its operations. FSS agents, tower operators, and center controllers will also be informed about COR airspace operation. In particular, they would be told the status of each segment of COR airspace and be able to estimate (or to obtain an estimate of) the probability of obtaining the required transit clearance at the time when it would be required.

2. Impacts of the Flyways: The ceiling of 12,500 would permit two routes in opposing directions and would thus reduce the potential for head-on mid-air or near mid-air collisions over the higher peaks and ridges. Raising the ceilings to 13,500 or 14,000 feet MSL would render night VFR (with oxygen) relatively less hazardous, and much more acceptable to pilots by allowing communications and navigation coverage.

   This last issue is significant even though COR airspace would in general not be used by the USAF at night. As a result, clearance to transit COR airspace at 14,000 feet MSL should always be available at night. However, the pilot who doesn't properly understand the COR operation might naively assume that he must use the VFR Flyway, as is the case in a TCA. For this case alone, the ceiling of the Flyway should be high enough to permit relatively safe night VFR with communications and navigation coverage. This measure will also mitigate the adverse impacts regarding search and rescue operations.

3. Fixed Base Operators: In order to deal equitably with the potential impacts on fixed based operators (FBOs) the Air Force could, upon a decision to implement COR, request the FAA to begin air traffic surveillance studies to determine the degree to which FBOs may be affected by COR activities. The goal of such studies would be to establish a quantitative base from which to assess monetary losses to FBOs due to COR-induced air traffic diversions and the like.

6.2 SPENT ORDNANCE ACCUMULATIONS

Air-to-ground and air-to-air activities within COR will involve the use of substantial quantities of live, inert, and practice ordnance. As in the past, these activities result in accumulations of the spent inert parts and the occasional duds and misfires. The latter, of course, are potentially dangerous if left on the test ranges. Present range policing practices appear to be recovering less than 20% of the potential accumulation on the test ranges; thus there is a strong likelihood that all duds and misfires are not recovered. To the degree that spent ordnance is not recovered and ultimately forgotten, these activities may always render a target range unsafe for unrestricted human or animal entry. However, in most cases (except for perhaps air-to-air gunnery discharges of 20 mm ammunition) the ordnance deliveries to the ground are well controlled and the unavoidable consequences of spent ordnance accumulations are minimized.* However, as discussed in Appendix D, desert environments have such low turnover rates, that should spent ordnance accumulations prove harmful to the environment, such a fact may not be found out until many tens of years have passed.

Ordnance deliveries on the Nellis ranges will continue to be performed under COR as they have for the past 30 years. Consequently, spent ordnance will accumulate primarily in target areas where there has been an accumulation from activities of the preceding years. Although there will be a continuing accumulation, it will not degrade any wider areas than have

*Existing Nellis ordnance expenditure activities are discussed in Subsection 2.2.3.3.

already been degraded. This situation will be true for all of the South Range target areas.

In the North Range target areas, however, new target sites will be located near threat simulator sites. Thus whenever ordnance is expended at these new sites, a small new area of range land will begin to accumulate spent ordnance. However, the degree of ordnance usage of these North Range target sites is not well defined and depends on the success with which electronic scoring systems requirements are met. These target sites will likely be used far less for live ordnance deliveries than would a similar site on the South Range. Nonetheless, if range policing is not adequate, these smaller amounts of live ordnance usage may still render such target areas unusable for many other potential applications.

Possible measures to mitigate these consequences would appear to involve either less use of ordnances, whether inert, practice or live, or better range policing measures. Less ordnance use may indeed be possible, if not in fact realized, due to improved COR instrumentation. The quality and extent of COR instrumentation for scoring and evaluating test activities may obviate the need for discharges of ordnance in, for example, air-to-ground missions.

Clearly, great potential exists for improving upon the recovery of spent ordnance and greater investment in personnel and devices to help locate buried and partially buried fragments may be justified. These considerations must be balanced against the benefits of better policing. As long as the accumulations can be kept to isolated areas which are already contaminated, the benefit of reducing the rate of accumulation may be marginal.

6.3 COR ELECTROMAGNETIC EMANATIONS

6.3.1 Indirect Injury Effects

The operation of pulsed emitters of relatively high power such as some of the COR threat simulators is not expected to pose a problem to wearer of prosthetic devices, such as cardiac pacemakers. It has already been noted that the operations of the threat simulators will come under the purview of stringent COR safety procedures which should eliminate any risk to cardiac pacemaker patients.

Under COR, EW activities will continue in the Caliente region at about the same level; however, as COR develops, additional and different simulator hardware will be brought into use. The use of each new piece of equipment will be scrutinized carefully for any potential effects its use may entail.

The problem of undue sensitivity of pacemakers to low-level electric fields is not peculiar only to Air Force activities. FAA radars as well as the incidental uses of several equipments, most notably microwave ovens, pose potential problems. For this reason, the Food and Drug Administration has initiated a program to ultimately address this problem in consultation with the pacemaker manufacturers and the Air Force. The FDA has awarded a contract to standardize pacemaker labeling, terminology, electromagnetic interference thresholds and testing. It is expected that the fulfillment of this contract will eventually lead to some sort of industry standards, especially dealing with the tolerance levels to electric fields and how they are to be measured. Expected manufacturer's response to new standards, coupled with existing pacemaker lifetime of 2 or 3 years may hopefully provide for uniformly less sensitive pacemakers in use in the general population within four to six years.

6.3.2 Electromagnetic Interference

Electromagnetic emanations from COR electronic warfare exercises can potentially interfere with the operation of many non-participating receiving equipments. The number, types, characteristics, and specific details of location of these receivers provides a situation of such complexity that precise prediction of impacts is difficult. Bounding calculations show that under most EW circumstances, there would very likely be significant interferences in nonparticipating equipments if no precautions were taken. The degree and range of the interfering effect depends as well on the way in which the EW activity is planned and timed. The planning and carrying out of a particular COR activity must also take care to guarantee that the test objectives are not compromised by self-interference from the many different COR transmitters that will be in operation.

For these reasons, a frequency management capability has been established which causes each test activity to be screened for proper frequency coordination and electromagnetic interferences. The COR frequency management activity includes: participation in all range scheduling, engineering of all range frequency requirements, coordination will all government and nongovernment frequency management agencies as required (e.g., AEC, FAA, FCC, White Sands Missile Range, etc.), participation in the development of frequency plans for COR exercises, real-time frequency control and scheduling for tests, electromagnetic compatibility analysis and consultation, and interference resolution and range monitoring. Coordination, clearance, and assignment of frequencies for electronic warfare emitters will be a paramount task of the COR frequency management activity. It is expected that these procedures should acceptably mitigate adverse electromagnetic interferences in non-participating equipments.

6.4 REPRODUCTION LOSSES IN IMPACTED SPECIES

No clear cases of unavoidable adverse impacts on the natural environment have been established. However, this situation could be sue as much to the lack of data and basic research concerning the behavioral responses of the various species as it is due to demonstrated lack of impact. The requirement for quantitative appraisals of natural environmental responses to COR activities within a total ecosystem context is discussed in Appendix B. Also, by way of example, in Appendix C the calculation of the sensitivity of the Bighorn Sheep population to small changes in reproduction mechanism may ultimately produce significant impacts. However, these sensitivities are such that ordinary random fluctuations in population caused by variations in forage supply, etc., may make it difficult to detect impending impacts and their true causes.

In the same way that impacts on reproduction may effect the population of a single species, so can other impacts materialize by induced effects progating through sensitive links in an entire ecosystem. Because of the climatic and other restrictions that constrain desert ecosystems there may be a greater proportion of sensitive links in these ecosystems. Withiut undertaking comprehensive and detailed investigations to determine ecosystem sensitivities it is difficult to determine which are the sensitive links.

With regard to these sensitive links, ecosystems which include the important check listed species of the COR area are of primary interest. In an effort to mitigate or even avoid potential adverse impacts on the natural environment of the type discussed above, the Air Force will consider cooperative efforts with State and Federal wildlife managers to improve the quality of environmental monitoring within COR. Effort will especially be made to monitor species responses when COR activities are taking place.

6.5 ECONOMIC IMPACTS

The analysis in Sec 4.6 has demonstrated a potentially significant impact upon the Tonopah City and Lincoln County schools. Both districts could experience an enrollment that would exceed current physical capacity by about 15 percent by the time COR is fully developed (far term). This could be a significant burden to local residents as most capital expansion is funded by local bonded indebtedness. In addition, the level of funding provided under PL-874 is insufficient to cover the yearly operation and maintenance costs per student. It was estimated in Sec. 4.6 that the potential unfunded yearly costs during far-term COR could amount to 20 to 25 percent of the county's existing educational receipts and would likely cause some increase in local tax rates.

7 SHORT-TERM VERSUS LONG-TERM USES OF THE ENVIRONMENT

An issue involved in relating short-term and long-term of the COR environment centers on the concept of the biological turnover rates of environments. Turnover rates are used to describe the rates at which elements of the environment change. Rates of growth (productivity) are often used as indicators for turnover rates; however, the latter may generally be considerably slower. As an example, the growth rates in tropical forests have been documented to be about two orders of magnitude greater than that of deserts or tundra. As a result, it may be inferred that desert turnover rates are at best 100 times lower than those of tropical forests. This concept is developed in Appendix D.

The relationship between turnover rates and test range activities is best described by the example of ordnance that is expended and then left on the range. Any lead in this ordnance will turn over -- that is, it will be assimilated by the desert environment, but very likely only over a period of several hundred years. The effects of this assimilation can, of course, only be measured after the fact. Of concern, then, are such possible long-term effects of such activities.

As has already been pointed out, the direct effects of ordnance expenditure under COR will be pretty much constrained to areas already similarly contaminated by past activities. Although COR will add to these amounts, it is reasonable to assume that the past actions have already constituted a probable long-term effect of the type just discussed.

A specific example of effects which persist for shorter periods is the erection of buildings or other "permanent" structures. In most COR instances, such structures will be erected in already developed areas of the desert. In cases where undeveloped land becomes a construction site, these short-term effects will generally be controllable by COR. By this, we mean that a concrete slab (required for example for a fixed radar mount) could be removed with relative ease if and when the COR mission is completed.

8 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The use of range lands for the expenditure of ordnance constitutes perhaps the only significant irretrievable commitment of resources. The resource is the land area in which expended ordnance (fragments and potentially live ordnances) accumulates. The commitment is essentially irreversible in that these portions of the range are not safe for many of the other normal uses made of this kind of range land, most notably grazing. However, much of the existing ordnance expenditure is constrained to occur in dry lake beds which have virtually no capability to support cattle grazing. The mineral values within these dry lake beds is not established, but is thought to be negligible.

The commitment of resources in this sense is essentially the result of past and present activities on the existing ranges. Except for the possibility of a few new small target sites proposed for the North Range, the effect of the proposed COR would be insignificant in terms of the commitment that has already occurred.

9 DETAILS OF UNRESOLVED CONTROVERSIES

9.1 At the time of the publication of this draft environmental statement there were no known unresolved controversies. During the early stages of the development of the proposed COR concept however, rumors were circulated and some private pilots in the area expressed objections to the project as they then perceived it. The Air Force subsequently made exhaustive efforts to inform the public and correct any misconceptions regarding the proposed COR. The Air Force not only sought to inform the public but it simultaneously attempted to solicit comments on the proposed project. Details of these information efforts are specifically noted in the Information Program for the proposed Continental Operations Range which may be found in Appendix K. Apparently due to this extensive program, as of this writing the potential controversy with the private pilots appears resolved.

10 OFFSETTING FACTORS AND THE CONSIDERATIONS OF OTHER AGENCIES

10.1 OFFSETTING FACTORS

The most significant offsetting factor that would result as an effect of COR development is the increased safety of operation that will be made available to all pilots wishing to use COR airspace. This will be especially true when COR development is completed with respect to the air traffic control instrumentation COR will install in meeting its own needs. Offsetting considerations of existing land restrictions in aiding wildlife management are also important.

10.1.1 Offsetting Factors of the COR Airspace Proposal

The major objective of the proposed COR airspace is "mission accomplishment with safety". Because of this goal, two related offsetting factors emerge as a result of COR airspace.

1. Safety: By exercising an ATC capability in the COR area, the safety of many operations within this area will be enhanced. Even if the frequency of military operations in the area is increased, by segregating air traffic in both time and space, an orderly and safe interaction of both civilian and military aircraft can be achieved. It should be noted, however, that in at least one type of operation (uncleared civilian operations in COR North and COR East) safety would not be enhanced, and that if the frequency of violations increases, the safety of both military and civilian operations may even be reduced.

2. Communications and Surveillance: Part of the COR airspace proposal depends on the development of CORC. CORC will become the nerve center for all COR operations. In addition to interfacing with the FAA on a broad range of ATC issues, CORC will, in the future, develop the capability to control air traffic in COR airspace. To do this efficiently, CORC will require communications and surveillance

systems with good low-level coverage of COR airspace. These systems will enhance the safety and efficiency of flight in COR airspace by permitting CORC to provide ATC services which are not available today.

0.1.2 Offsetting Factors Due to Existing Land Area Restrictions

Although no new lands are to be excluded to human entry as a result of the COR action, the restrictions on the existing Nellis ranges are to continue in support of COR objectives. The existing restricted area in the Nellis North Range--including the AEC/Tonopah Range under airspace boundary R-4809--overlap the BLM designated Wild Horse Range. One of the problems in managing wildlife ranges occurs with poachers and other unauthorized or illegal takings of the animals. Wild horses compete for range forage with freely grazing, domestic cattle and consequently are recognized problems for some ranchers. The restricted land areas of the Nellis range pose problems for poachers and provide non-competitive range sanctuaries and consequently are extremely helpful in the management of the wild horse herds.

The manager of the Desert Game Refuge also expressed the opinion that such restrictions are probably helpful in the management of the Bighorn Sheep herds frequenting the Nellis South Range.

0.2 INTEREST OF OTHER AGENCIES

Interests of other agencies in the proposed COR development extend primarily to procedures for airspace rule making and land withdrawals which are the Federal Aviation Administration and the Bureau of Land Management, respectively.

0.2.1 The FAA Airspace Case Process

The FAA Administrator is manager of all US airspace. In those cases in which some unique use of airspace is required, the Administrator may designate the airspace in terms of a level of restriction and will in these cases designate a user or using agency who is then entitled to enjoy the benefits of the designation. In order to have the Administrator designate airspace, the future user must present an airspace proposal* to the FAA. The FAA then processes the airspace proposal in accord with the Administrative Procedures Act.

10.2.2 BLM Procedures

Consideration of withdrawal of even very small portions of land (for emitters, receivers, communications relays, and instrument sites) is the most permanent and therefore the most constrained by formal procedures. Federal agency heads may request withdrawal or reservation of land--if it is for national security reasons, the application must be submitted to the Secretary of the Interior. The land to be withdrawn must be described in detail--its boundaries and acreage--the purposes must be described, (if for national security purposes, that purpose must be so stated) and statements must be made concerning the possibility of contamination of the land by the proposed use and length of withdrawal period, impact of use on other federal regulations having to do with the resources of the area, and impact on water rights. Finally, the applicant agency must state its legal authority to withdraw the land and provide "A justification for the proposed withdrawal or reservation, including statements showing the need for all the area requested and for the limitation, if any of concurrent uses."

If the area to be withdrawn is in excess of 5,000 acres, there are certain additional requirements involving maps showing legal subdivisions, statements regarding proposed utilization of the property, location of improvements, "and any cultural or other features of the lands requested and of the surrounding area deemed by the applicant to be significant and illustrate the need for and effect of the proposed withdrawal."

*Note: The COR airspace proposal is presented as Appendix G.

Notice of withdrawal must be published in the Federal Register and publicity must be given to the proposal. If there is sufficient protest or if it is deemed in the public interest by the appropriate officer of the BLM, a public hearing may be held. Costs will be borne by the applicant agency. The BLM makes its own investigation of the proposed withdrawal "to determine the existing and potential demand for the lands and their resources." BLM officials will negotiate with the applicant to reduce the size of the withdrawal to a minimum essential to the applicant's needs and providing for maximum concurrent utilization.

The authorized officer of the BLM makes his findings of fact and conclusions on the application. If the applicant does not concur, he may appeal to the Director of the BLM, the Secretary of the Interior, and under certain circumstances to the Office of Management and Budget.

Allowance of a withdrawal will be conditional upon the payment by the applicant agency or upon agreement of the applicant agency to pay to the owner or owners of range or other improvements placed upon the lands pursuant to an agreement with the United States such amount and at such times as the authorized official of the Bureau of Land Management deems fair and reasonable under the circumstances and the terms of such agreement to compensate for the loss of the improvements, providing that the applicant agency is authorized by law to make such compensation. In addition, a holder of a grazing license or permit for lands within a grazing district will be compensated for the loss resulting from the use of the lands embraced in the license or permit for war or national defense purposes in an amount to be determined fair and reasonable by, and to be paid by, the head of the Department or Agency of the Federal Government making such use.

APPENDIX A

VERTEBRATE SPECIES AND COMMON PLANT SPECIES FOUND IN THE AREA

1. *Sorex merriami leucogenys*
   Merriam Shrew
2. *Sorex vagrans vagrans*
   Vagrant Shrew
3. *Sorex tenellus*
   Dwarf Shrew
4. *Notiosorex crawfordi crawfordi*
   Crawford Shrew
5. *Myotis yumanensis yumanensis*
   Yuma Myotis

6. *Myotis evotis evotis*
   Long-eared Myotis
7. *Myotis volans interior*
   Hairy-winged Myotis
8. *Myotis californicus stephensi*
   California Myotis
9. *Myotis subulatus melanorhinus*
   Small-footed Myotis
10. *Lasionycteris noctivagans*
    Silver-haired Bat

11. *Pipistrellus hesperus hesperus*
    Western Pipistrelle
12. *Eptesicus fuscus pallidus*
    Big Brown Bat
13. *Lasiurus borealis teliotis*
    Red Bat
14. *Lasiurus cinereus cinereus*
    Hoary Bat
15. *Euderma maculatum*
    Spotted Bat

16. *Corynorhinus townsendii pallescens*
    Long-eared Bat
17. *Antrozous pallidus pallidus*
    Pallid Bat
18. *Tadarida brasiliensis mexicana*
    Mexican Free-tailed Bat
19. *Tadarida molossa*
    Big Free-tailed Bat
20. *Sylvilagus idahoensis*
    Pigmy Rabbit

21. *Sylvilagus nuttallii grangeri*
    Nuttall Cottontail
22. *Sylvilagus audubonii arizona*
    Audubon Cottontail
23. *Lepus townsendii townsendii*
    White-tailed Jackrabbit
24. *Lepus californicus deserticola*
    Black-tailed Jackrabbit
25. *Eutamias minimus scrutator*
    Least Chipmunk

26. *Eutamias dorsalis grinnelli*
27. *Eutamias dorsalis nevadensis*
    Cliff Chipmunk
28. *Eutamias umbrinus inyoensis*
29. *Eutamias umbrinus nevadensis**
    Say Chipmunk
30. *Eutamias palmeri**
    Palmer Chipmunk

31. *Eutamias panamintinus*
    Panamint Chipmunk
32. *Ammospermophilus leucurus leucurus*
32. Antelope Ground Squirrel
33. *Spermophilus townsendii mollis*
    Towsend Ground Squirrel
34. *Spermophilus variegatus robustus*
    Rock Squirrel
35. *Spermophilus tereticaudus tereticaudus*
    Round-tailed Ground Squirrel

36. *Spermophilus lateralis certus**
    Golden-mantled Ground Squirrel
37. *Thomomys umbrinus brevidens*
38. *Thomomys umbrinus centralis*
39. *Thomomys umbrinus nanus**
40. *Thomomys umbrinus phelleoecus**
    Botta Pocket Gopher

41. *Thomomys umbrinus virgineus*
    Botta Pocket Gopher
42. *Perognathus longimembris panamintinus*
43. *Perognathus longimembris virginus*
    Little Pocket Mouse
44. *Perognathus parvus olivaceus*
    Great Basin Pocket Mouse
45. *Perognathus formosus mohavensis*
    Long-tailed Pocket Mouse

46. *Perognathus formosus incolatus*
    Long-tailed Pocket Mouse
47. *Microdipodops megacephalus albiventer**
48. *Microdipodops megacephalus sabulonis**
49. *Microdipodops megacephalus megacephalus*
    Dark Kangaroo Mouse
50. *Microdipodops pallidus ruficollaris**

51. *Microdipodops pallidus ammophilus*
52. *Microdipodops pallidus purus**
    Pallid Kangaroo Mouse
53. *Dipodomys ordii fetosus*
54. *Dipodomys ordii monoensis*
    Ord Kangaroo Rat
55. *Dipodomys microps centralis*

---

*The entire range of this species is contained within the COR.

56. *Dipodomys microps occidentalis*
Chisel-toothed Kangaroo Rat
57. *Dipodomys merriami merriami*
Merriam Kangaroo Rat
58. *Dipodomys deserti deserti*
Desert Kangaroo Rat
59. *Reithrodontomys megalotis megalotis*
Western Harvest Mouse
60. *Peromyscus crinitus stephensi*
Canyon Mouse

61. *Peromyscus eremicus eremicus*
Cactus Mouse
62. *Peromyscus maniculatus sonoriensis*
White-footed Mouse
63. *Peromyscus boylii rowleyi*
Brush Mouse
64. *Peromyscus truei nevadensis*
65. *Peromyscus truei truei*
Pinyon Mouse

66. *Onychomys leucogaster brevicaudus*
Northern Grasshopper Mouse
67. *Onychomys torridus longicaudus*
Southern Grasshopper Mouse
68. *Neotoma lepida lepida*
Desert Wood Rat
69. *Neotoma cinerea acraia*
70. *Neotoma cinerea lucida*
Bushy-tailed Wood Rat

71. *Microtus montanus fucosus*[*]
72. *Microtus montanus micropus*
Montane Meadow Mouse
73. *Microtus longicaudus latus*
Long-tailed Meadow Mouse
74. *Lagurus curtatus curtatus*
75. *Lagurus curtatus intermedius*
Sagebrush vole

76. *Mus musculus*
House Mouse
77. *Erethizon dorsatum couesi*
78. *Erethizon dorsatum epixanthum*
Porcupine
79. *Canis latrans lestes*
80. *Canis latrans mearnsi*
Coyote

81. *Canis lupus youngi*
Wolf
82. *Vulpes fulva macrotor*
Red Fox
83. *Vulpes macrotis nevadensis*
84. *Vulpes macrotis arsipus*
Kit Fox
85. *Urocyon cinereoargenteus scottii*
Gray Fox

86. *Bassariscus astutus nevadensis*
Ring-tailed Cat
87. *Procyon lotor pallidus*
Raccoon
88. *Mustela frenata nevadensis*
Long-tailed Weasel
89. *Taxidea taxus berlandieri*
90. *Taxidea taxus taxus*
Badger

91. *Spilogale gracilis gracilis*
92. *Spilogale gracilis saxatilis*
Spotted Skunk
93. *Mephitis mephitis estor*
94. *Mephitis mephitis major*
Striped Skunk
95. *Felis concolor californica*
Cougar

96. *Felis concolor kaibabensis*
Cougar
97. *Lynx rufus baileyi*
98. *Lynx rufus pallescens*
Bobcat
99. *Dama hemionus hemionus*
Mule Deer
100. *Antilocapra americana americana*
American Pronghorn

101. *Ovis canadensis nelsoni*
102. *Ovis canadensis canadensis*
Desert Bighorn Sheep
103. *Cervus canadensis*
Wapiti (Elk)
104. Cows
105. Horses

106. Burros
107. Domestic Sheep

---

[*] The entire range of this species is contained within the COR.

1. *Gopherus agassizi*
   Desert Tortoise
2. *Coleonyx variegatus utahensis*
3. *Coleonyx variegatus variegatus*
   Western Banded Gecko
4. *Callisaurus draconoides gabbi*
5. *Callisaurus draconoides myurus*
   Zebra-tailed Lizard
6. *Crotophytus collaris baileyi*
   Collared Lizard
7. *Crotophytus wislizeni wislizeni*
   Leopard Lizard
8. *Dipsosaurus dorsalis*
   Desert Crested Lizard
9. *Phrynosoma platyrhinos platyrhinos*
10. *Phrynosoma platyrhinos calidiarum*
   Desert Horned Lizard
11. *Sauromalus obesus obesus*
   Chuckwalla
12. *Sceloporus graciosus graciosus*
   Sagebrush Lizard
13. *Sceloporus magister*
   Desert Spiny Lizard
14. *Sceloporus occidentalis biseriatus*
   Western Fence Lizard
15. *Uta stansburiana stejnegeri*
   Side-blotched Lizard
16. *Xantusia vigilis*
   Yucca Night Lizard
17. *Eumeces skiltonianus*
   Western Skink
18. *Eumeces gilberti rubricaudatus*
   Gilbert's Skink
19. *Cnemidophorus tigris tigris*
   Whip-Tailed Lizard
20. *Leptotyphlops humilis humilis*
   Western Worm Snake
21. *Leptotyphlops humilis utahensis*
   Western Worm Snake
22. *Arizona elegans eburnata*
   Glossy Snake
23. *Chionactis occipitalis occipitalis*
24. *Chionactis occipitalis talpina*
   Western Shovel-nosed Snake
25. *Coluber constrictor mormon*
   Blue Racer
26. *Diadophis regalis*
   Ring-Necked Snake
27. *Hypsiglena torquata deserticola*
   Spotted Night Snake
28. *Lampropeltis getulus californiae*
   Common King Snake
29. *Masticophis flagellum piceus*
   Common Whipsnake
30. *Masticophis taeniatus*
   Desert Striped Whipsnake
31. *Phyllorhynchus decurtatus perkinsi*
   Spotted Leaf-nosed Snake
32. *Pituophis catenifer deserticola*
   Gopher Snake
33. *Rhinocheilus lecontei lecontei*
   Long-nosed Snake
34. *Sonora semiannulata isozona*
   Western Ground Snake
35. *Salvadora hexalepis mojavensis*
   Western Patch-nosed Snake
36. *Thamnophis elegans vagrans*
   Western Garter Snake
37. *Crotalus cerastes cerastes*
   Sidewinder
38. *Crotalus viridis lutosus*
   Western Rattlesnake
39. *Crotalus scutulatus*
   Mohave Rattlesnake
40. *Crotalus mitchelli*
   Speckled Rattlesnake

1. *Scaphiopus hammondii intermontanus*
   Western Spade-foot Toad
2. *Bufo boreas boreas*
3. *Bufo boreas bombifrons*
   Western Toad
4. *Bufo cognatus*
   Great Plains Toad
5. *Bufo woodhousei*
   Woodhouse Toad
6. *Bufo microscaphus microscaphus*
   Southwestern Toad
7. *Bufo punctatus*
   Desert Toad
8. *Hyla regilla*
   Pacific Tree Frog
9. *Rana catesbeiana*
   Bullfrog
10. *Rana pipiens*
   Leopard Frog

1. *Gavia immer*
   Common Loon
2. *Podiceps caspicus*
   Eared Grebe
3. *Podiceps auritus**
   Horned Grebe
4. *Aechmophorus occidentalis**
   Western Grebe
5. *Podilymbus podiceps*
   Pied-billed Grebe

6. *Pelecanus erythrorhynchos*
   White Pelican
7. *Phalacrocorax auritus albociliatus*
   Double-creasted Cormorant
8. *Ardea herodias treganzai**
   Blue Heron
9. *Casmerodius albus egretta*
   White Egret
10. *Egretta thula brewsteri*
   Snowy Egret

11. *Butorides virescens anthonyi*
   Green Heron
12. *Nycticorax nycticorax h[illegible]*
   Black-crowned Night Heron
13. *[illegible] lentiginosus*
   American Bittern
14. *Ixobrychus exilis hesperis*
   Least Bittern
15. *[illegible] americana*
   Wood Ibis

16. *[illegible]*
   White-faced Ibis
17. *[illegible] columbianus*
   Whistling Swan
18. *[illegible]**
   Trumpeter Swan
19. *[illegible] canadensis [illegible]**
20. *[illegible] canadensis [illegible]*
   Canada Goose

21. *[illegible]*
   Snow Goose
22. *[illegible]*
   Fulvous Tree Duck
23. *[illegible] platyrhynchos**
   Mallard
24. *[illegible]*
   Pintail
25. *[illegible]**
   Gadwall

26. *Anas carolinensis*
   Green-winged Teal
27. *Anas discors*
   Blue-winged Teal
28. *Anas cyanoptera*
   Cinnamon Teal
29. *Spatula clypeata*
   Shoveler
30. *Mareca americana*
   American Wigeon

31. *Aythya americana*
   Redhead
32. *Aythya collaris*
   Ring-necked Duck
33. *Aythya valisineria*
   Canvasback
34. *Aythya affinis*
   Lesser Scaup
35. *Bucephala clangula*
   American Goldeneye

36. *Bucephala albeola*
   Bufflehead
37. *Melanitta deglandi*
   White-winged Scoter
38. *Melanitta perspicillata*
   Surf Scoter
39. *[illegible] jamaicensis**
   Ruddy Duck
40. *[illegible] serrator*
   Red-breasted Merganser

41. *[illegible]**
   Turkey Vulture
42. *[illegible] gentilis**
   Goshawk
43. *[illegible] striatus velox**
   Sharp-shinned Hawk
44. *[illegible]**
   Cooper's Hawk
45. *[illegible]**
   Red-tailed Hawk

46. *[illegible]*
   Swainson's Hawk
47. *[illegible]*
   Rough-legged Hawk
48. *[illegible] regalis**
   Furruginous Hawk
49. *[illegible]**
   Golden Eagle
50. *[illegible] leucocephalus*
   Bald Eagle

---

*This species nests within the COR.

BEST AVAILABLE COPY

51. *Circus cyaneus hudsonius**
Marsh Hawk
52. *Pandion haliaetus*
Osprey
53. *Falco mexicanus**
Prairie Falcon
54. *Falco peregrinus anatum** **
Peregrine Falcon
55. *Falco columbarius bendirei*
Merlin

56. *Dendragapus obscurus obscurus**
Blue Grouse
57. *Centrocercus urophasianus**
Sage Grouse
58. *Lophortyx gambelii gambelii**
Gambel's Quail
59. *Alectoris graeca**
Chukar
60 *Falco sparverius**
American Kestrel

61. *Meleagris gallopavo**
Turkey
62. *Grus canadensis tabida*
Sandhill Crane
63. *Rallus limicola limicola*
Virginia Rail
64. *Porzana carolina*
Sora
65. *Coturnicops noveboracensis*
Yellow Rail

66. *Gallinula chloropus*
Common Gallinule
67. *Porphyrula martinica*
Purple Gallinule
68. *Fulica americana**
Coot
69. *Charadrius alexandrinus nivosus*
Snowy Plover
70. *Charadrius semipalmatus*
Semipalmated Plover

71. *Charadrius vociferus**
Killdeer
72. *Eupoda montana*
Mountain Plover
73. *Pluvialis dominica dominica*
Golden Plover
74. *Pluvialis squatarola*
Black-bellied Plover
75. *Arenaria interpres*
Ruddy Turnstone

76. *Capella gallinago delicata**
Common Snipe
77. *Numenius americanus*
Long-billed Curlew
78. *Actitis macularia*
Spotted Sandpiper
79. *Tringa solitaria cinnamomea*
Solitary Sandpiper
80. *Catoptrophorus semipalmatus*
Willet

81. *Tringa melanoleucus*
Greater Yellowlegs
82. *Tringa flavipes*
Lesser Yellowlegs
83. *Calidris melanotos*
Pectoral Sandpiper
84. *Calidris bairdii*
Baird's Sandpiper
85. *Calidris minutilla*
Least Sandpiper

86. *Calidris alpina pacifica*
Dunlin
87. *Limnodromus scolopaceus*
Long-billed Dowitcher
88. *Calidris mauri*
Western Sandpiper
89. *Micropalma himantopus*
Stilt Sandpiper
90. *Limosa fedoa*
Marbled Godwit

91. *Crocethia alba*
Sanderling
92. *Himantopus mexicanus*
Black-necked Stilt
93. *Recurvirostra americana*
Avocet
94. *Steganopus tricolor*
Wilson's Phalarope
95. *Lobipes lobatus*
Northern Phalarope

96. *Larus californicus*
California Gull
97. *Larus delawarensis*
Ring-billed Gull
98. *Larus philadelphia*
Bonaparte's Gull
99. *Sterna forsteri*
Forster's Tern
100. *Chlidonias nigra*
Black Tern

*This species nests within the [illegible].

**Endangered species, 16 USC 668 aa, Appendix D.

101. *Zenaidura macroura marginella*
Mourning Dove
102. *Zenaidura asiatica*
White-winged Dove
103. *Columba fasciata*
Band-tailed Pigeon
104. *Columbigallina passerina*
Ground Dove
105. *Geococcyx californianus*
Roadrunner

106. *Tyto alba pratincola*
Barn Owl
107. *Otus asio cineraceus**
Screech Owl
108. *Otus flammeolus**
Flamulated Owl
109. *Bubo virginianus occidentalis**
Great-horned Owl
110. *Bubo virginianus pallescens**
Great-Horned Owl

111. *Nyctea nuctea*
Snowy Owl
112. *Speotyto cunicularia hypugaea**
Burrowing Owl
113. *Asio otis**
Long-eared Owl
114. *Asio flameus*
Short-eared Owl
115. *Aegolius acadicus*
Saw-whet Owl

116. *Phalaenoptilus nuttallii nuttallii*
Poor-will
117. *Chordeiles minor hesperis*
Common Nighthawk
118. *Chordeiles acutipennis texensis*
Lesser Nighthawk
119. *Caprimulgus vociferus arizonae*
Whip-poor-will
120. *Chaetura vauxi*
Vaux's Swift

121. *Aeronautes saxatalis saxatalis*
White-throated swift
122. *Calypte costae*
Costa's Hummingbird
123. *Selasphorus platycercus*
Broad-tailed Hummingbird
124. *Selasphorus rufus*
Rufous Hummingbird
125. *Stellula calliope*
Calliope Hummingbird

126. *Megaceryle alcyon caurina**
Belted Kingfisher
127. *Colaptes auratus collaris**
Yellow-Shafter Flicker
128. *Melanerpes formicivorus*
Acorn Woodpecker
129. *Asyndesmus lewis*
Lewis's Woodpecker
130. *Sphyrapicus varia nuchalis**
Yellow-bellied Sapsucker

131. *Sphyrapicus thyroideus nataliae**
Williamson's Sapsucker
132. *Dendrocopos villosus leucothorectis**
Hairy Woodpecker
133. *Dendrocopos pubescens leucurus**
Downy Woodpecker
134. *Dendrocopos scalaris cactophilus**
Ladder-backed Woodpecker
135. *Tyrannus verticalis*
Western Kingbird

136. *Tyrannus vociferans*
Cassin's Kingbird
137. *Myiarchus cinerascens cinerascens*
Ash-throated Flycatcher
138. *Sayornis nigricans semiatra*
Black Phoebe
139. *Sayornis saya saya*
Say's Phoebe
140. *Empidonax brewsteri*
Traill's Flycatcher

141. *Empidonax hammondii*
Hammond's Flycatcher
142. *Empidonax oberholseri*
Dusky Flycatcher
143. *Empidonax wrightii*
Gray Flycatcher
144. *Empidonax difficilis difficilis*
Western Flycatcher
145. *Empidonax difficilis hellmayri*
Western Flycatcher

146. *Contopus sordidulus veliei*
Western Wood Pewee
147. *Nuttallornis borealis*
Olive-sided Flycatcher
148. *Pyrocephalus rubinus flammeus*
Vermillion Flycatcher
149. *Eremophila alpestris utahensis**
Horned Lark
150. *Eremophila alpestris leucolaema**
Horned Lark

---
*This species nests within the COR.

Best Available Copy

151. *Eremophila alpestris ammophila*
Horned Lark

152. *Tachycineta thalassina lepida*
Violet-green Swallow

153. *Iridoprocne bicolor*
Tree Swallow

154. *Riparia riparia*
Bank Swallow

155. *Stelgidopteryx ruficollis serripennis*
Rough-winged Swallow

156. *Hirundo rustica erythrogaster*
Barn Swallow

157. *Petrochelidon pyrrhonota*
Cliff Swallow

158. *Cyanocitta stelleri macrolopha*[*]
Steller's Jay

159. *Aphelocoma coerulescens nevadae*[*]
Scrub Jay

160. *Pica pica hudsonia*[*]
Black-billed Magpie

161. *Corvus corax sinuatus*[*]
Raven

162. *Corvus brachyrhynchos hesperis*[*]
Common Crow

163. *Gymnorhinus cyanocephala*[*]
Pinyon Jay

164. *Nucifraga columbiana*[*]
Clark's Nutcracker

165. *Parus gambeli inyoensis*[*]
Mountain Chickadee

166. *Parus inornatus ridgwayi*[*]
Plain Titmouse

167. *Auriparus flaviceps*[*]
Verdin

168. *Psaltriparus minimus plumbeus*[*]
Bush Tit

169. *Sitta carolinensis tenuissima*[*]
White-breasted Nuthatch

170. *Sitta canadensis*[*]
Red-breasted Nuthatch

171. *Sitta pygmaea melanotis*[*]
Pygmy Nuthatch

172. *Certhia familiaris leucosticta*[*]
Brown Creeper

173. *Cinclus mexicanus*[*]
Dipper

174. *Troglodytes aedon parkmanii*[*]
House Wren

175. *Thryomanes bewickii eremophilus*[*]
Bewick's Wren

176. *Campylorhynchus brunneicapillus*[*]
Cactus Wren

177. *Telmatodytes palustris aestuarinus*[*]
Long-billed Marsh Wren

178. *Catherpes mexicanus*[*]
Canyon Wren

179. *Salpinctes obsoletus*[*]
Rock Wren

180. *Mimus polyglottos leucopterus*
Mockingbird

181. *Dumetella carolinensis*
Catbird

182. *Toxostoma lecontei lecontei*
Lecont's Trasher

183. *Toxostoma dorsale dorsale*
Crissal Trasher

184. *Oreoscoptes montanus*
Sage Trasher

185. *Turdus migratorius propinquus*[*]
Robin

186. *Ixoreus naevius meruloides*
Varied Thrush

187. *Catharus guttata polionota*
Hermit Thrush

188. *Catharus guttata oromela*
Hermit Thrush

189. *Catharus ustulata ustulata*
Swainson's Thrush

190. *Catharus ustulata almae*
Swainson's Thrush

191. *Sialia mexicana bairdi*
Western Bluebird

192. *Sialia currucoides*
Mountain Bluebird

193. *Myadestes townsendi townsendi*
Townsend's Solitaire

194. *Polioptila caerulea amoenissima*
Blue-gray Gnatcatcher

195. *Regulus satrapa*
Golden-crowned Kinglet

196. *Regulus calendula cineraceus*
Ruby-crowned Kinglet

197. *Anthus spinoletta rubescens*
Water Pipit

198. *Bombycilla cedrorum*
Cedar Waxwing

199. *Phainopepla nitens lepida*
Phainopepla

200. *Lanius ludovicianus gambeli*
Loggerhead Shrike

---

[*] This species nests within the COR.

201. Sturnus vulgaris
Starling
202. Vireo vicinior
Gray Vireo
203. Vireo solitarius plumbeus
Solitary Vireo
204. Vireo flavifrons
Yellow-throated Vireo
205. Vireo gilvus swainsonii
Warbling Vireo

206. Vermivora celata orestera
Orange-crowned Warbler
207. Vermivora celata celata
Orange-crowned Warbler
208. Vermivora ruficapilla
Nashville Warbler
209. Vermivora virginiae
Virginia Warbler
210. Vermivora luciae
Lucy's Warbler

211. Helmitheros vermivorus
Worm-eating Warbler
212. Parula americana
Parula Warbler
213. Dendroica petechia
Yellow Warbler
214. Dendroica coronata coronata
Myrtle Warbler
215. Dendroica coronata memorabilis
Myrtle Warbler

216. Dendroica coronata auduboni
Myrtle Warbler
217. Dendroica nigrescens
Black-throated Gray Warbler
218. Dendroica graciae graciae
Grace's Warbler
219. Dendroica townsendi
Townsend's Warbler
220. Oporornis tolmiei monticola
Macgillivary's Warbler

221. Geothlypis trichas scirpicola
Yellowthroat
222. Geothlypis trichas occidentalis
Yellowthroat
223. Geothlypis trichas campicola
Yellowthroat
224. Icteria virens
Yellow-breasted Chat
225. Wilsonia pusilla pileolata
Wilson's Warbler

226. Wilsonia pusilla chryseola
Wilson's Warbler
227. Setophaga picta picta
Redstart
228. Passer domesticus*
House Sparrow
229. Sturnella neglecta neglecta*
Meadowlark
230. Xanthocephalus xanthocephalus*
Yellow-headed Blackbird

231. Agelaius phoeniceus*
Red-winged Blackbird
232. Icterus parisorum
Scott's Oriole
233. Icterus galbula bullockii
Bullock's Oriole
234. Euphagus cyanocephalus*
Brewer's Blackbird
235. Quiscalus quiscala
Common Grackle

236. Molothrus ater obscurus
Brown-headed Cowbird
237. Molothrus ater artemisiae
Brown-headed Cowbird
238. Dolichonyx oryzivorus
Bobolink
239. Piranga ludoviciana
Western Tanager
240. Piranga flava hepatica
Hepatic Tanager

241. Pheucticus melanocephalus
Black-headed Grosbeak
242. Guiraca caerulea interfusa
Blue Grosbeak
243. Passerina amoena
Lazuli Bunting
244. Hesperiphona vespertina brooksi
Evening Grosbeak
245. Carpodacus purpureus californicus
Purple Finch

246. Carpodacus cassinii*
Cassin's Finch
247. Carpodacus mexicanus frontalis*
House Finch
248. Spinus pinus pinus
Pine Siskin
249. Spinus tristis pallidus
Common Goldfinch
250. Spinus psaltria hesperophilus
Lesser Goldfinch

---

*This species nests within the COR.

251. *Loxia curvirostra bendirei*
Red Crossbill

252. *Chlorura chlorura*
Green-tailed Towhee

253. *Pipilo erythropthalmus montanus*
Rufous-sided Towhee

254. *Calamospiza melanocorys*[a]
Lark Bunting

255. *Passerculus sandwichensis nevadensis*[a]
Savannah Sparrow

256. *Pooecetes gramineus confinis*
Vesper Sparrow

257. *Chondestes grammacus strigatus*
Lark Sparrow

258. *Amphispiza bilineata deserticola*
Black-throated Sparrow

259. *Amphispiza belli nevadensis*[a]
Sage Sparrow

260. *Junco hyemalis cismontanus*
Slate-colored Junco

261. *Junco hyemalis montanus*
Slate-colored Junco

262. *Junco hyemalis mearnsi*
Slate-colored Junco

263. *Junco caniceps caniceps*
Gray-headed Junco

264. *Spizella passerina arizonae*
Chipping Sparrow

265. *Spizella breweri*
Brewer's Sparrow

266. *Spizella atrogularis evura*
Black-chinned Sparrow

267. *Zonotrichia leucophrys gambelii*
White-crowned Sparrow

268. *Zonotrichia leucophrys oriantha*
White-crowned Sparrow

269. *Zonotrichia atricapilla*
Golden-crowned Sparrow

270. *Passerella iliaca schistacea*
Fox Sparrow

271. *Melospiza lincolnii*
Lincoln Sparrow

272. *Melospiza melodia fallax*
Song Sparrow

273. *Melospiza melodia montana*[a]
Song Sparrow

274. *Calcarius lapponicus lapponicus*
Lapland Longspur

---

[a]This species nests within the COR.

1. *Salvelinus fontinalis*
   Brook Trout
2. *Salmo clarki henshawi* * *
   Lahontan Cutthroat Trout
3. *Salmo trutta*
   Brown Trout
4. *Pantosteus lahontan*
   Lahontan Mountain Sucker
5. *Pantosteus intermedius*
   White River Mountain Sucker
6. *Catostomus ardens*
   Utah Sucker
7. *Gila robusta jordani* * **
   White River Gila
8. *Richardsonius egregius*
   Lahontan Redshiner
9. *Siphateles bicolor obesus*
   Lahontan Tui Chub
10. *Rhinichthys osculus robustus*
    Lahontan Speckled Dace
11. *Rhinichthys osculus nevadensis*
    Amargosa Speckled Dace
12. *Rhinichthys osculus velifer*
    White River Speckled Dace
13. *Moapa coriacea* * **
    Moapa Dace
14. *Cyprinus carpio*
    Asian Carp
15. *Lepidomeda mollispinus pratensis*
    Big Spring Spinedace
16. *Lepidomeda altivelis*
    Pahranagat Spinedace
17. *Lepidomeda albivallis* *
    White River Spinedace
18. *Ictalurus catus*
    White Catfish
19. *Ictalurus melas*
    Black Bullhead
20. *Crenichthys baileyi*
    White River Springfish
21. *Crenichthys nevadae* *
    Railroad Valley Springfish
22. *Gambusia affinis*
    Mosquitofish
23. *Perca flavescens*
    Yellow Perch
24. *Micropterus dolomieui*
    Smallmouth Blackbass
25. *Micropterus salmiodes*
    Largemouth Blackbass
26. *Lepomis macrochirus*
    Bluegill Sunfish

* The entire range of this species is contained within the COR.

** Endangered species, 16 USC 668 aa, Appendix D.

1.	*Abies concolor*	White fir
2.	*Agropyron spicatum*	Bluebunch wheatgrass
3.	*Agropyron inerme*	Bluebunch wheatgrass
4.	*Amelanchier pallida*	Serviceberry
5.	*Ambrosia dumosa*	Bursage
6.	*Arctostaphylos nevadensis*	Pinemat manzanita
7.	*Artemisia nova*	Black sagebrush
8.	*Artemisia spinescens*	Bud sagebrush
9.	*Artemisia tridentata*	Big sagebrush
10.	*Artemisia spp.*	Sagebrush
11.	*Atriplex canescens*	Four-wing saltbrush
12.	*Atriplex confertifolia*	Shadscale
13.	*Bromus tectorum*	Cheatgrass
14.	*Ceanothus velutinus*	Buckbrush
15.	*Cercocarpus ledifolius*	Mountain mahoghony
16.	*Chrysothamnus nauseosus*	Rubber rabbitbrush
17.	*Chrysothamnus viscidiflorus*	Green rabbitbrush
18.	*Coleogyne ramosissima*	Blackbrush
19.	*Cowania mexicana*	Cliffrose
20.	*Distichlis stricta*	Saltgrass
21.	*Elymus cinereus*	Great Basin wildrye
22.	*Eurotia lanata*	Whitesage
23.	*Grayia spinosa*	Spiny hopsage
24.	*Hilaria jamesii*	Galleta
25.	*Hilaria rigida*	Big galleta
26.	*Juniperus osteosperma*	Utah juniper
27.	*Larrea tridentata*	Creosate bush
28.	*Lycium andersoni*	Box thorn
29.	*Opuntia spp.*	Prickly pear cactus
30	*Oryzopsis hymenoides*	Indian ricegrass
31.	*Picea engelmanii*	Engelman spruce
32.	*Pinus albicaulis*	Whitebark pine
33.	*Pinus flexilis*	Limber pine
34.	*Pinus longaeva*	Bristlecone pine
35.	*Pinus monophylla*	Single needle pinyon
36.	*Pinus ponderosa*	Yellow pine
37.	*Poa nevadensis*	Nevada bluegrass
38.	*Poa secunda*	Sandberg's bluegrass
39.	*Populus tremuloides*	Quaking aspen
40.	*Purshia glandulosa*	Desert bitterbrush
41.	*Purshia tridentata*	Antelope bitterbrush
42.	*Quercus gambellii*	Gambel's oak
43.	*Quercus turbinella*	Scrub oak
44.	*Salsola kali*	Russian thistle
45.	*Sarcobatus baileyi*	Bailey's greasewood
46.	*Sarcobatus vermiculatus*	Greasewood
47.	*Sitanion hystrix*	Squirrel tail
48.	*Stipa comata*	Needle-and-thread grass
49.	*Stipa speciosa*	Desert needlegrass
50.	*Symphoricarpus spp.*	Snowberry
51.	*Yucca baccata*	Spanish bayonet
52.	*Yucca brevifolia*	Joshua tree
53.	*Yucca schidigera*	Mojave yucca

APPENDIX B

ECOSYSTEM MODELING FOR ENVIRONMENTAL IMPACT ASSESSMENT

This appendix is designed to provide the non-ecologist with the perspective needed to evaluate possible impacts. Basically, it is a brief exposure of the processes essential for an ecological understanding of how impacts may be incorporated into an ecosystem.

Natural systems have taken millions of years to evolve to their present state, and if violated may change significantly from the existing state to one quite different. Such a change is necessary for the system to persist, but it certainly will be accompanied by some species adjustment, and in many cases, species departures altogehter. If the latter species have limited ranges, their extinction is inevitable; more dispersed species may simply reduce their ranges or alter their niches. In all, the thousands of adjustments required to prevent system sterility are dynamic and must be considered as such.

Numerous questions require reasonable answers before all these adjustments can be predicted, and that is basically the responsibility of an Environmental Statement (ES). Obviously, neither the technology nor the information is developed enough to provide the complete set of accurate answers. Many of the questions cannot even be asked adequately, although many of the most important seem obvious. It is the latter that must be addressed first; in their solution, others may prove insignificant. Unfortunately, before the questions can be partitioned appropriately, some type of functional model is required.

Since the ES is directly concerned with the existing natural systems (ecosystems), it falls well within the concern of ecological processes; and it must rely on the analytical tools developed by ecologists and their contributing companion disciplines: physiology, evolution, behavior, and genetics (Fig. B.1). Furthermore, Fig. B.1 demonstrates the need to review findings in areas other than strictly ecology, since they may contribute considerably to the solution of many ecological or environmental questions.

Projected Impact Evaluation

The basic ecological unit is now generally accepted as being the ecosystem, since it relates the physical and functional concepts together for total system maintenance. A terrestrial ecosystem has basically four living components: (1) Producers--including the green plants, (2) Primary consumers--including the herbivores, (3) Secondary consumers--including the carnivores, and (4) Decomposers--including the bacteria. Two fundamental processes relate these components: (1) elemental cycling and (2) energy transfer. The differential rates of both processes are functions of intrinsic and environmental factors influencing the relationships of the

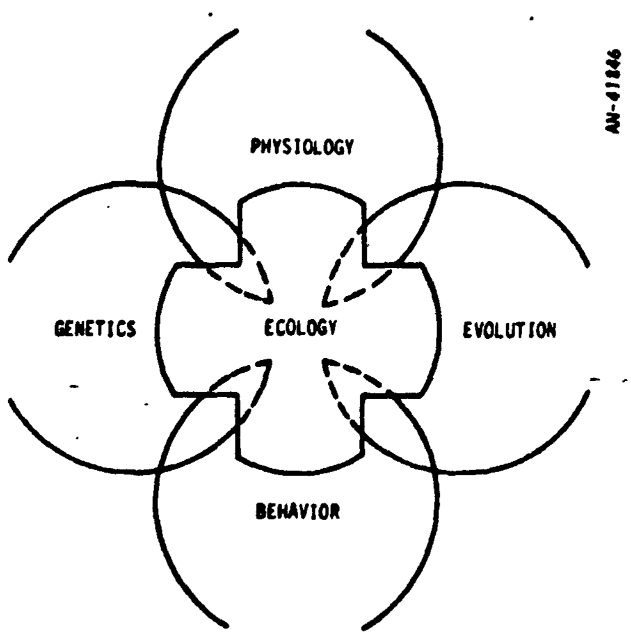


Figure B.1. Interrelations of the Essential Disciplines in an Environmental Statement (ES) physical components. Figure B.2 is a simplified flow diagram of the relationships of the physical components.

Relationships of the components are apparent in Fig. B.2, although it provides no information on the type of relationships. Energy transfer from one component to the next is essentially in the form of consumption (predation, parasitism, grazing, decomposing, etc.). Energy enters as light or as organic import, and leaves as heat (via respiration) or as organic export. Elements essential to species growth are primarily recycled internally, although some may be imported and exported.

The definition of an ecosystem is arbitrary; it usually represents a unit that can be conveniently studied. An ecosystem may be as small as an aquarium or terrarium. Since organic production is restricted to ecosystems, the organic imports and exports are the ties that link the arbitrarily defined ecosystems together. Perhaps the clearest vision would be completely connected systems of interlocking rings (ecosystems) of various sizes, with all systems to a greater or lesser degree interdependent. Thus, induced adjustments will not go unnoticed in others. The magnitude of such adjustments has reached incomprehensible levels with man's mobility and transfer capability. In some cases, several entire components have been removed and transferred to totally different systems, such as found in the expanded agricultural business. However dependent the systems are on each other, the primary impact is felt within a system.

Processes within an ecosystem, which demonstrate the required adjustments when alterations are made by man, are best seen by examining a simple food web. In this case, the food web is theoretical, since none have been developed specifically for desert environments, although the U.S. International Biological Program (USIBP) Desert Biome studies are attempting to model North American deserts altogether. Possibly the best example would include the organisms most likely to be present and interacting on the North Range.

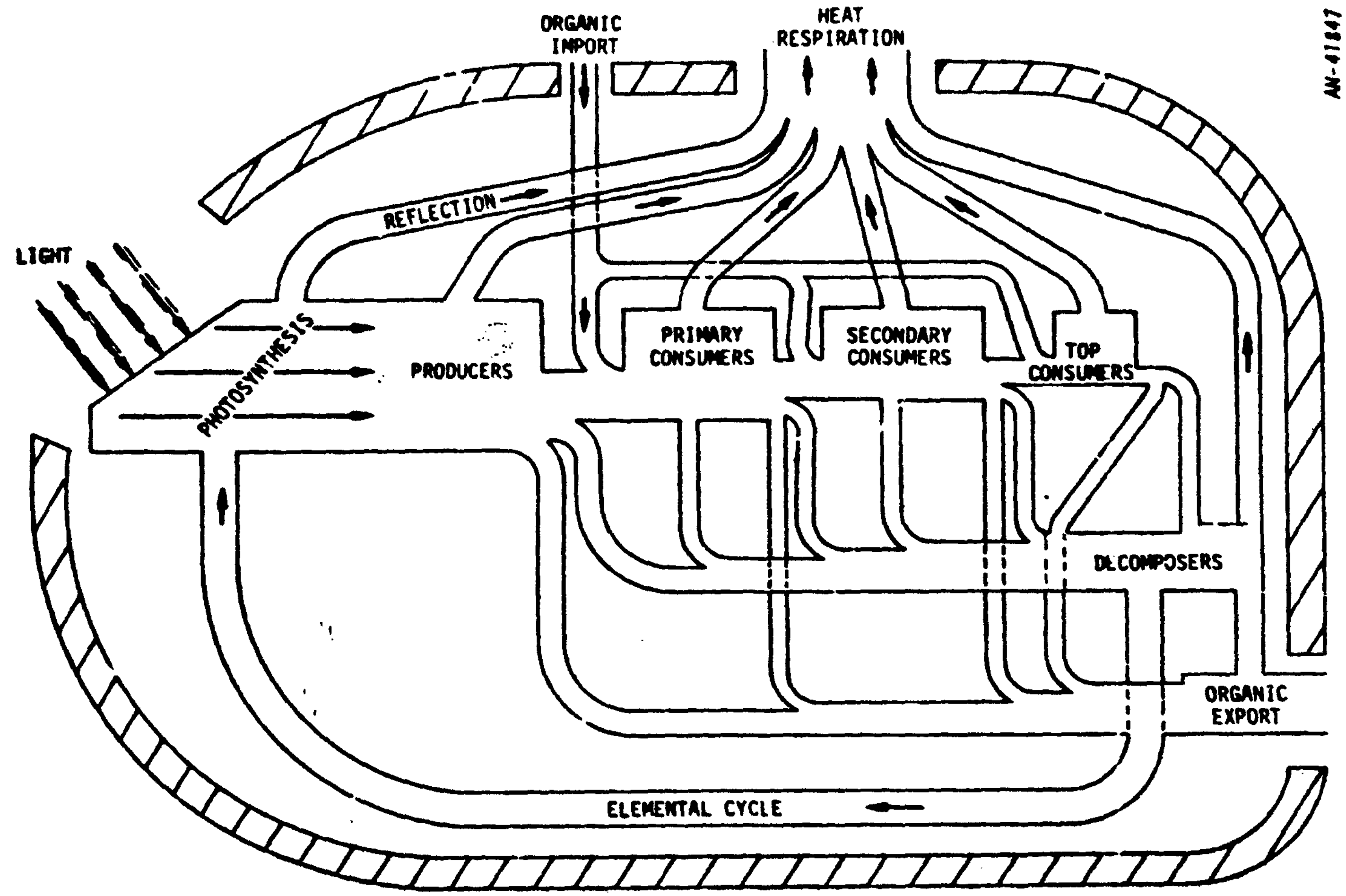


Figure B.2. Interrelationships of Components Within a Terrestrial Ecosystem

The North Range is located primarily in Salt Desert Shrub community, where the principal species are:

Producers -	Black sagebrush Bud sage Four-winged saltbrush Globe mallow Greasewood	Indian rice grass Russian thistle Shadscale Spiny hopsage Winterfat
Primary Consumers -	Brewer's sparrow Chisel-tooth kangaroo rat Horned lark Least pocket mouse Mourning dove	Ord kangaroo rat Pallid kangaroo mouse Sage thrasher Vesper sparrow White-footed mouse
Secondary Consumers -	Horned lizard Kit fox Loggerhead shrike Marsh hawk Rattlesnake	Raven Red-tailed hawk Side-blotched lizard Whip-tailed lizard
Top Consumers -	Badger Bobcat	Coyote Golden eagle

A diagramatic model of these many species (and these are only a partial list) would be very difficult to prepare and almost impossible to interpret visually. Consequently, only a few of the species will be included (Fig. B.3). Obviously, the web illustrated in Fig. B.3 is limited even more than it first appears, since its only driving force is the transfer of energy. Decomposition is not included.

Some liberties can be taken while interpreting the generalized behavior and importance of such a model. Suppose, for instance, that air traffic were to increase to the extent that marsh hawks simply left the area for others where reproduction and feeding suffered less intrusion. Although not necessarily so, this could result in an increase in other secondary consumers which in turn, might reduce the primary consumers. Major shifts in the primary consumers could have significant effect on the composition of producers. Not only would the impact be felt by the North Range biota, but the areas into which the marsh hawks moved would

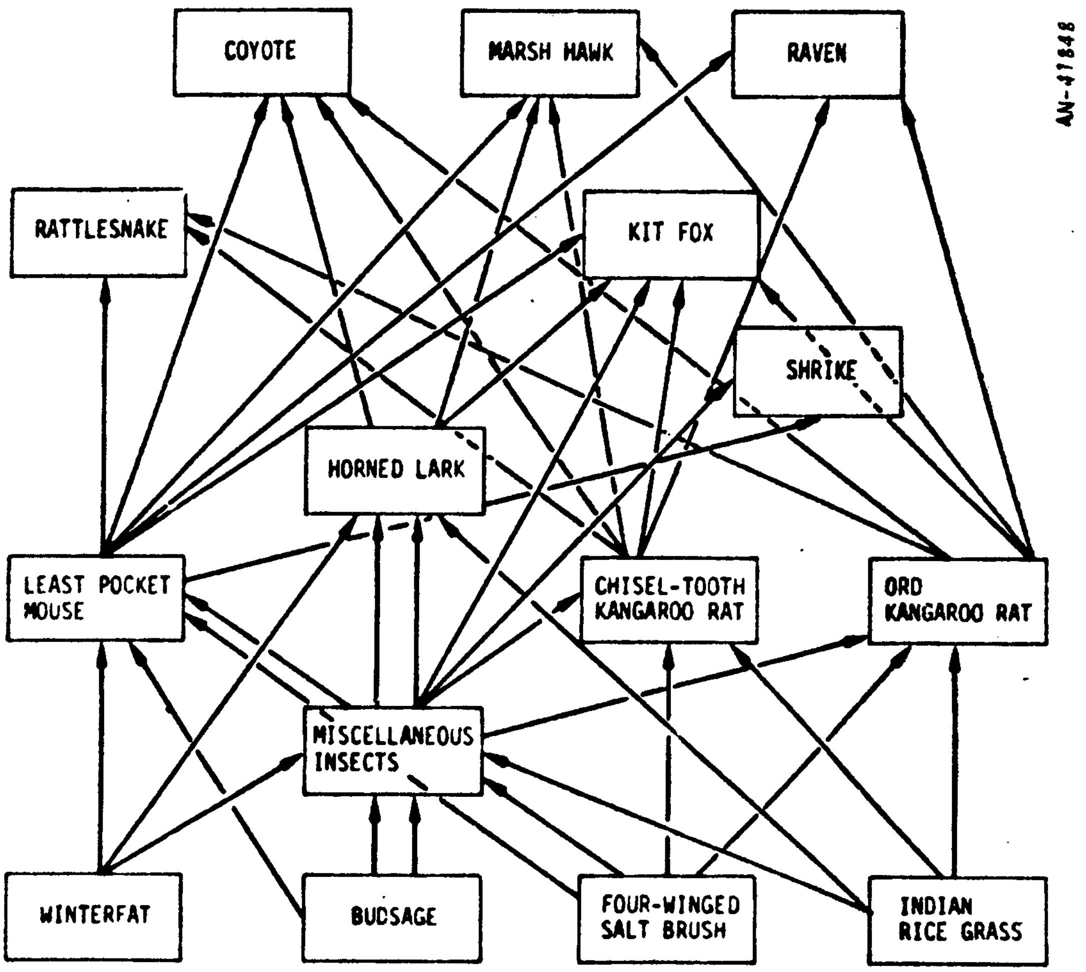


Figure B.3. Theoretical Food Web for the COR North Range

be impacted in a somewhat reverse manner. Obviously, this hypothetical case is much too simplified to be predictable, but it demonstrates the interactions of impact and the concern of ecologists or multiple users of a range. It is possible that activity in the air space could have an impact that will eventually change even the vegetation--without the ground itself even being touched.

The preceding discussion should make it clear that any Environmental Statement must include at least a projected scheme of how an impact may be felt by the environment. Also, it is apparent that such an ES must include an ecosystem analysis to describe the existing ecosystem as the basis for projected impacts. Perhaps a more specific and certainly appropriate evaluation can be made if the interactions of known species are at least projected.

Before a species can survive in an ecosystem, it must evolve an effective means of reproducing. Reproduction is often one of the most specialized activities an organism engages in, and probably the most vulnerable to perturbation because it is so specialized and because it is uncompromising in terms of species survival. Possible impacts on reproduction are best examined in view of the reproductive process itself. This is modeled generally in Figs. B.4 and B.5, which illustrate the essential demographic steps leading to successful reproduction. The generalized model (Fig. B.4) requires some additional detailing (Fig. B.5) as far as N_6 and N_8 are concerned, because these are the stages that assume the responsibility of reproduction, and induced interferences are likely to occur within them. Also, birth rates are essentially a function of what occurs during these stages. In Figs. B.4 and B.5, the N's represent the numbers of organisms in various states (e.g., fetus, offspring, mature male, immature male, etc.) at a given time t. The P's represent the losses to the population from different modes of predation; the D's represent losses to the population by various natural causes; and the R's and B's represent additions to the population by reproduction. The

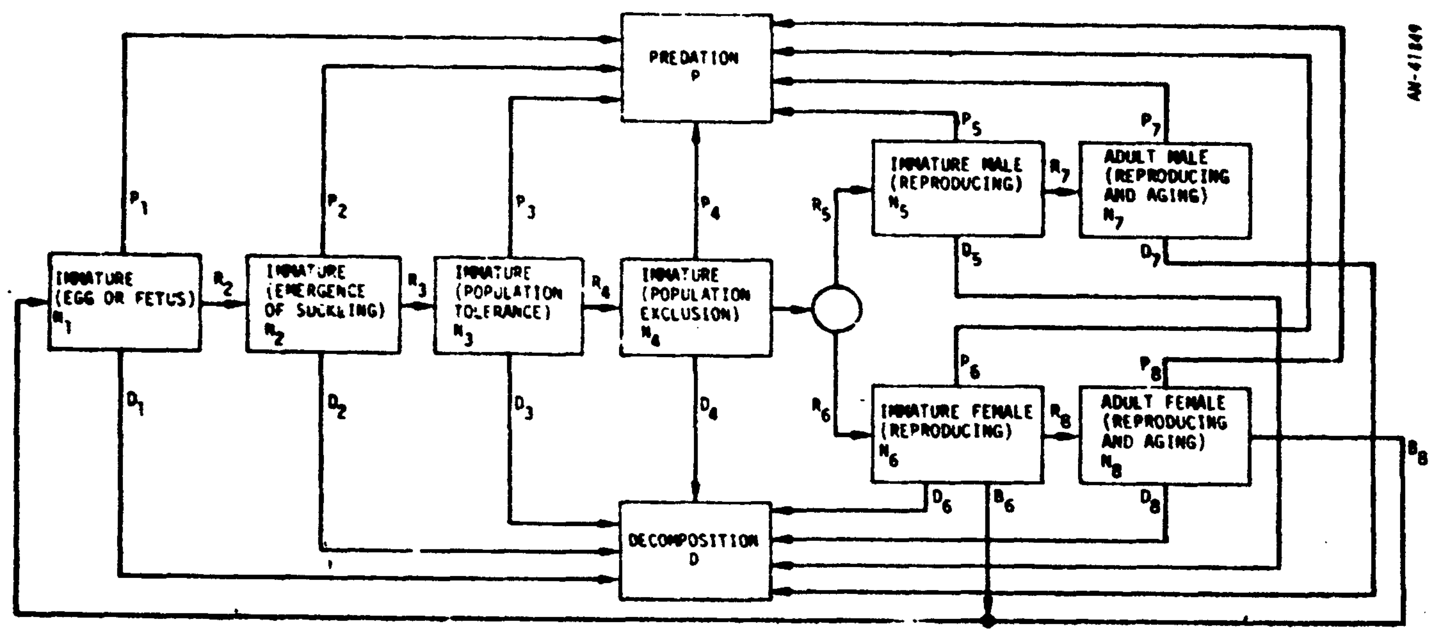


Figure B.4. Flow Diagram for Reproduction in a Natural Demographic Model

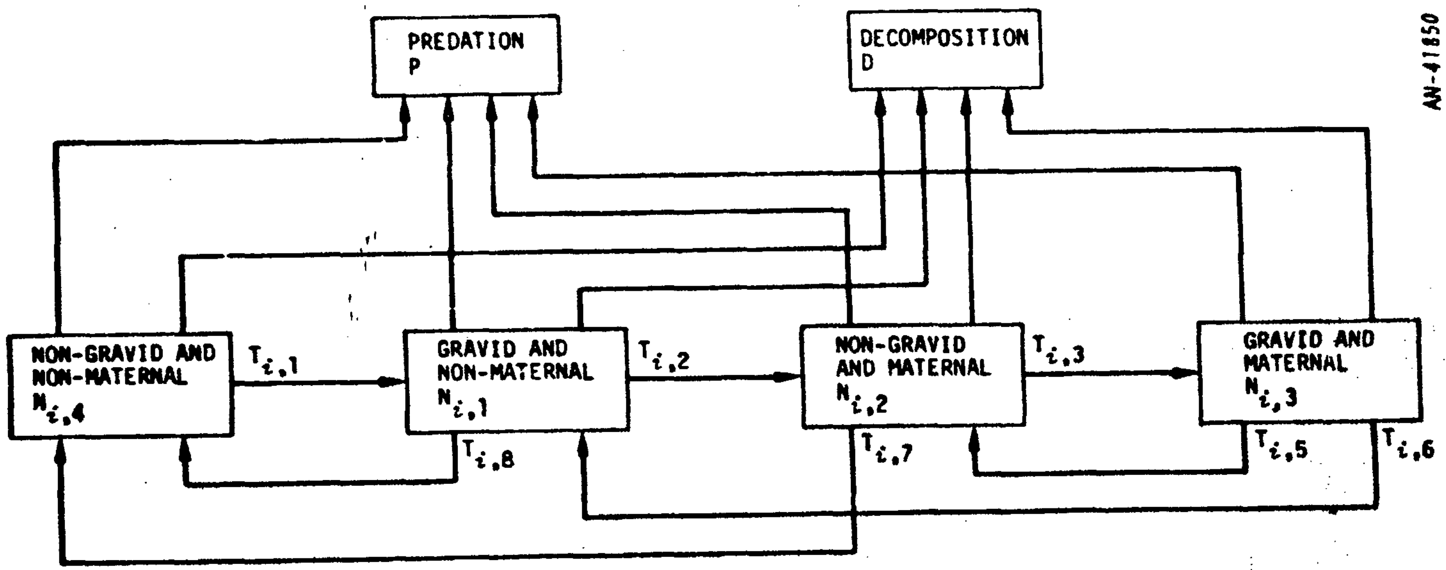


Figure B.5. Flow Diagram for Reproduction Among Females Capable of Reproducing (Block N_6 or N_8)

necessary level of detail in subdividing each of these functions is a model requirement driven by the complexity of the system being modeled.

The model is deliberately designed to be as general as possible so that species with highly different life cycles can be modeled within the generalized scheme with convenient modifications. The rates of change (P,D,R) are obviously the most important factors to estimate, as far as environmental impact is concerned, since they are more sensitive than the status components (N). Since the time interval (as designated for the species concerned) between t and $t + 1$ may be any length in difference equations, the generalized difference equations for all rates may be written as:

State variable at the next time (t + 1) = State variable at the present time (t) + Change in state variable between t and $t + 1$

This is expressed mathematically as:

$$N_i(t + 1) = N_i(t) + C_i(t)$$

where $N_i(t + 1)$ = Number of organisms in category i at time $t + 1$

$N_i(t)$ = Number of organisms in category i at time t

$C_i(t)$ = Change in number of organisms in category i when moving from time t to $t + 1$. This change can be negative, zero or positive, depending on whether the $\underline{i}^{th}$ category is decreasing, unchanging or increasing, respectively.

When specific functional difference equations are generated for different species' parameters, time intervals must be designated. Since this model is obviously only a portion of a total ecosystem model, such time intervals must be long enough to include the discrete nature of certain population processes and yet short enough to approximate the continuous nature of rapidly progressing phenomena. Each species will require its own time intervals.

APPENDIX C

EVALUATION OF THE POPULATION DYNAMICS OF DESERT BIGHORN SHEEP

In most cases, species occupy a niche such that their respective populations would be expected to survive as long as the environment does not shift significantly from its mean. There can be a high degree of variation; but when the mean shifts, all species will have to make an adjustment--some may enlarge their niche and increase numbers, while others decrease their niche and subsequent numbers. Decreased niches, or rather small decreases in fertility rates, can have cascading effects on the population. In summary, most species (particularly those in desert environments) live in an environment imposing rather restrictive ranges on their population parameters. Consequently, small changes in these environments can have dramatic effects on the populations; and most species have evolved very narrow tolerance limits. Desert Bighorn Sheep are examples of these animals and will be illustrated here.

Now that the reproductive model has been developed (Appendix F), one must determine which component(s) to survey periodically to monitor the impact on a chosen species (Desert Bighorn Sheep in this example). Here it is assumed that studies of reproduction are likely to be most illuminating. Also it would be most convenient to require the measurement of only one of the model components; and this might be sufficient in some cases.

The total reproduction of a species is assessed by coordinating the birth and death rates among the states N_1 to N_8, producing what is generally referred to as a "life table." Life tables, when extended to include fertility tables, can conveniently be used to evaluate the "net reproductive rate" (R_o).

These tables are exemplified with Desert Bighorn Sheep data (Hansen 1961, 1962, 1965, 1967). Some of the data required were not available; thus, some extrapolations or even inferences were made to complete the calculations in Table C.1. The terms in these combined tables may be defined as:

x = age interval, years

$d(x)$ = number of dying during the age interval x to $x + 1$

$l(x)$ = number of survivors at the start of age interval x

$q(x)$ = rate of mortality during the age interval x to $x + 1$

$e(x)$ = mean expectation of life for organisms alive at the start of age x

$l'(x)$ = probability of female survival to the pivotal age - $[x + (x + 1)]/2$

$m(x)$ = number of female offspring per female age x, per time unit (one year in this table)

R_o = net reproductive rate

The net reporductive rate (R_o) can be used to generate a logistic growth curve:

$$N(t) = N(0)\, e^{r_m t} \tag{C.1}$$

where $N(0)$ = number of individuals at time 0

$N(t)$ = number of individuals at time t

$r(m)$ = innate capacity to increase (or decrease) for some specific environmental condition

t = time

The factor r_m can be obtained from R_o by

$$r_m = \frac{\log_e (R_o)}{G} \tag{C.2}$$

TABLE C.1

LIFE AND FERTILITY TABLES FOR DESERT BIGHORN SHEEP ON THE SHEEP RANGE OF COR

x	Fertility Table d(x)	l(x)	q(x)	e(x)	Life Table l'(x)	m(x)*	l'(x)m(x) = V_x
0 - 1	66	1000	0.0660	8.7600	1.000	0.00	0.00
2	12	934	.0128	8.3436	0.934	.00	.00
3	14	922	.0151	7.4457	.922	.00	.00
4	12	908	.0132	6.5528	.908	.20	.18
5	32	896	.0357	5.6339	.896	.25	.22
6	49	864	.0567	4.8240	.864	.30	.26
7	81	815	.0993	4.0840	.815	.35	.29
8	71	734	.0967	3.4795	.734	.30	.22
9	91	663	.1372	2.7986	.663	.25	.17
10	112	572	.1958	2.1643	.572	.20	.11
11	186	460	.4043	1.5695	.460	.15	.07
12	132	274	.4817	1.2956	.274	.10	.03
13	88	142	.6197	1.0352	.142	.05	.007
14	37	54	.6851	0.9074	.054	.05	.00
15	12	17	.7057	.7941	.017	.05	.00
16	5	5	1.000	.5000	.005	.05	.00
17	-	0	-	-	.000	.00	.00

$R_o = \Sigma \ell'(x)m(x) = 1.62$**

*Data are not actually available for m_x.

**Since m(x) represents female offspring per female, R_o represents the net reproduction rate of females in the population. For a population that is balanced between males and females, R_o could also be taken as the net reproduction rate of the total population.

with G = the mean length of a generation, defined by

$$G = \frac{\Sigma \ell'(x)m(x)x}{R_o} \tag{C.3}$$

If $R_o = 1$, then $r_m = 0$ (Eq. C.2) and $N(t) = N(0)$ for $t \geq 0$ (Eq. C.1). Thus, an R_o of 1.0 signifies a replacement level of reproduction for which the species population is in steady-state equilibrium. If $R_o > 1$, r_m is positive and the population will grow, doubling in a period equal to $0.693/r_m$. In a similar fashion, $R_o < 1$ leads to a declining population.

The data shown in Table C.1 for age specific fertilities m(x) were synthesized to conform with the limited knowledge concerning Bighorn Sheep reproduction. For example, it is quite well known that the ewes do not hear in the first three years, and that the life expectancy is approximately 15 years. The last few years are expected to be nearly barren. In between, a schedule of age specific fertilities is adopted which shows a gradual buildup and then decline and which can be roughly calibrated against known population data.

With the assumed schedule for m(x), a net reproduction rate of 1.56 is deduced which, if correct, would cause the population to grow. However, it is known that the particular herd from which this data was taken is regulated in number by hunting (only males are taken), and consequently the population had held roughly constant throughout the period 1961 through 1967. Thus when the effect of regulation through hunting is included in the life tables, an R_o for the total population of 1.0 should result.

It is known that the percentage kill among all ages was about 40 percent of all males that died, leaving about 60 percent of all deaths attributable to natural causes. If it can be assumed that through this study period (1961 to 1967) the population was in steady-stage equilibrium with a corresponding stable age structure, then it can be shown that the effect of a steady 40 percent kill rate due to hunting will cause the population to have about twice as many females as males and that the net reproduction rate of the unbalanced population, assuming the same schedule of fertilities, will be near 1.0. Even though this is a necessary condition to validate the assumed fertility schedule, it is not sufficient, as there are other schedules that can meet the same set of constraints. However, the important characteristics of the fertility schedule are: the length of the initial non-bearing period, and the peakedness of the schedule. The one assumed for Table C.1 is fairly flat and should exhibit less sensitivity to perturbing factors than other schedules that could have been constructed.

The death rates $d(x)$ and the fertility rates $m(x)$ probably have the most profound effect on the population and the corresponding net reproduction rate R_o. While a change in death rates will tend to produce proportionate changes in R_o, a change in fertility rates can produce a greater than proportionate change in R_o. For example, a 10% increase in the death rate of an otherwise unregulated population would reduce R_o to approximately 1.4. A 30% decrease in fertility would reduce R_o from 1.56 to approximately 0.9. An increase in death rate of 10% combined with a 30% decrease in fertility devises R_o to approximately 0.8. A similar result would obtain if a large fraction of ewes were taken in the regulated hunts. Thus impacts on the ewes themselves or their capability to reproduce will produce equal effects on the population reproduction rate.

These data and the analyses that proceed from them are not entirely conclusive. Other factors should be considered. The fact that the analysis deals with expected values calls into question the minimum size of the population for which these expectations remain reasonably valid. This would in turn depend on the variations in other population stress factors normally to be expected, such as the variation in forage supply. And because of these factors, it may be somewhat difficult to measure the significant parameters of a population from which meaningful life tables can be constructed and population impacts predicted.

APPENDIX D
TURNOVER RATES IN DESERT ENVIRONMENTS

The concept of turnover rate in an environment was probably introduced initially as an aid in explaining the rate of change among living (and sometimes non-living) components of the environment. Most often it refers to the rate at which certain elements move through ecosystem components, or to the rate of change in the population (Appendices B and C). The rate is most often expressed as a ratio of throughput to total content for element cycling, or as a turnover time for populations and biomass. An expression of the latter is inherent in the calculation of R_o, as defined in Appendix C. This appendix will deal primarily with the turnover of elements, such as those introduced as portions of live ordnance not recovered, or introduced as sewage.

There is yet another type of turnover that must be appreciated in evaluating the problems associated with arid-lands management or perturbations thereto. This is best expressed as the recovery rate of altered ecosystems, otherwise often referred to as secondary succession. In plain terms, if an environment is altered, how long will it take to adjust and finally return to some sort of a stable state?

Since elemental turnover rates are ratios of throughput to total content, the rates are influenced most by the rate of growth among the producers (productivity). Tropical and agricultural systems turn over rapidly because of the natural or managed growth, respectively. The fundamental lack of water in arid environments precludes heavy productivity; thus, turnover is likewise much slower. Walter (1954) found a positive correlation between productivity and rainfall in deserts and woodlands of Africa; also, productivity has most often been demonstrated to be higher in North American non-arid than arid environments (Odum, 1971;

Collier, et al., 1973). Also, the turnover times are faster in non-arid environments, leading to a slower recovery time among the arid ecosystems.

Wallace and Romney (1972) reported an average productivity of about 450 kg/ha yearly in the Southern Shrub community of southern Nevada for combined herbaceous and shrubby species, which may be as little as 10% of almost any other system for which we have substantial data. Comparative productivity data in terms of energy content are shown in Table D.1.

Assuming a direct relationship (which is probably optimistic) between production and turnover time or rate, the apparent conclusion is that deserts are at least 10 times slower than all communities except the Tundra. This would also suggest that recovery would be equally slow.

Wallace and Romney (1972) generally concluded that yield resulting from added nitrogen to the soil is somewhat controlled by the amount of available water, since they experienced only a slight increase when water was not added. Also, since there was already ample nitrogen in the soil

TABLE D.1

ESTIMATED PRIMARY PRODUCTION AMONG SOME MAJOR BIOTIC COMMUNITIES

(Odum, 1971)

Community	Primary Production kcal/m^2/yr
Desert	200
Tundra	200
Grasslands	2,500
Dry Forests	2,500
Coniferous Forest	3,000
Moist Forest	8,000
Croplands	12,000
Tropical Forests	20,000

to support annual turnovers, the addition was not particularly effective. There was already more available nitrogen than the plants could assimilate with the amounts of water received each year. In this regard, it is rather unlikely that nitrogen added through adequately installed sewage management systems would have an observable impact, even if it were in the Pinyon-Juniper woodland where production may be higher than it is in the Northern Shrub, Southern Shrub, and Salt Desert Shrub communities.

Perhaps the most important factor to consider is the recovery rat following construction or environmental destruction from live ordnance. The once tent city of Wahmonie persisted on a bajada in southern Nevada for about three years in the mid-1920s. Evidence of this town is still clearly etched in the vegetation, suggesting that it has only begun to stabilize, and will require perhaps as much as 200-500 years. Activities in these fragile and inordinately slow communities could be essentially permanent as far as the foreseeable future is concerned. Such things as fires and accumulated ordnance fragments may persist in their effects for many hundreds of years.

Data would suggest that as much as 600 tons of ordnance materials are presently being left at the target sites each year. The rates of turnover among these materials would be almost imperceptible; thus the accumulation could become substantial over a few years, particularly as COR activities are increased. Most interesting may be the potential effect of lead on soil. Delivery of ordnance to test ranges undoubtedly involves lead as in, for example, 20 mm ammunition. This lead is inert in the short-term practical sense, but in the long term may eventually become converted to organic lead and assimilated in the biological cycle. This effect is certainly not clear, but one thing is: if there is a negative effect, it will likely be observed long after the accumulation has reached a level so high that recovery is virtually impossible. Also, a summary statement by Wallace and Romney (1971) on the accumulation and effect of lead in desert plants may be an important consideration in the target areas:

Tetra-ethyl lead additives in vehicle fuel have been shown by several investigators to contaminate the soil and vegetation along side roadway networks and urban areas. The portion of U.S. Highway 95 between Las Vegas and Mercury, Nevada is heavily traveled compared to the portion of equal distance extending further northwest as the result of daily commuter traffic. Lead contamination was apparent in foliage of desert vegetation collected alongside the roadway, reflecting the variation in traffic volume on the two portions of U.S. Highway 95 that was sampled. Lead contents greater than ten-fold of normal were found in plant foliage alongside the heavily-traveled roadway.

Of course, the question is simple: how much lead is being deposited at the target area? However much it is, it will apparently persist for hundreds of years and may eventually affect the upper trophic levels of the ecosystem.

While elements may cycle very slowly through desert ecosystems, populations of plants and animals vary widely. This variation is a response to the local productivity in the case of animals, and rainfall in the case of plants. When the rainfall is sufficient and with an appropriate distribution, production will increase many times what it usually is--primarily from a large increase in annual production. Animal species may respond equally dramatically to the high production years, largely by stimulating more active reproduction.

APPENDIX E

JET NOISE CHARACTERISTICS FOR COR OPERATIONS

E.1 INTRODUCTION

COR operations routinely involve large numbers of low-level jet aircraft flights, and such conditions may pose a potential source of impact on the ground activities of either humans or animals. Jet noise effects depend upon many factors among which the most important are: characteristics of the jet engine source, characteristics of the aircraft operation (e.g., takeoff or landing), distance to the observer, and the observer's response characteristics.

For jet engine noise source and aircraft operation characteristics, we will rely on recent flyover noise measurements performed at Wright-Patterson AFB on F-104G, F-4, and F-14 aircraft.* Each aircraft noise source was measured for afterburner, takeoff, and approach power settings. In addition the F-104G and F-14 aircraft were also measured for cruise power noise output. Flyover altitudes during the tests ranged from approximately 450 to 1000 feet. One-third octave band sound pressure levels were measured in standard bands spanning the range 40 to 10,000 Hz. AMRL also provided reduced data for profiles of A-weighted sound levels and perceived and effective perceived noise levels (with and without tonal corrections). Peak values corrected to standard conditions were also provided.

Flight profiles during COR operations are not expected to vary much from those experienced as part of present-day operations on the existing

---

*Raw and reduced data furnished in computer output format by the Aerospace Medical Research Laboratories, Wright-Patterson AFB, to General Research Corporation, "' January 1974.

test ranges. However, the details of typical flight profiles have not been defined at a level commensurate with those of the sound pressure data provided by AMRL. Also the variation in flight profiles for COR operations will continue to be relatively large and tend to obviate second-order effects in noise calculations. Accordingly we have used the AMRL data to develop first-order noise effects to be used in COR impact assessments.

A great deal of research has been performed on human responses to all kinds of noise, and especially to jet aircraft noise. Several measures have been devised to characterize basic human responses in terms of loudness, noisiness, annoyance, or other qualitative factors. The measures "perceived noise level" and "effective perceived noise level" have found greatest application in characterizing responses to jet airport noise. The latter measure is often incorporated in another calculational procedure to derive a "noise exposure forecast" (NEF).

Analysis of the AMRL data indicates that maximum measured perceived noise levels (PNL) do not occur at the same point as maximum overall sound pressure levels (OASPL) when normalized to a constant slant range. Maximum OASPL are weighted to low frequencies relative to the condition of maximum measured PNL. Since typical slant ranges to observers of interest in COR operations will likely be greater than those during the measurements, and atmospheric attenuation reduces the significance of higher frequencies, we have taken the point of maximum OASPL as the condition to scale to greater slant ranges. Figures E.1, E.2, and E.3 show the results of these calculations of effective perceived noise levels for F-104G, F-14, and F-4, respectively, for various engine power settings. A set of dashed curves representing a typical commercial jet is overlaid on each curve and is useful for assessing the drop-off due to atmospheric attenuation for the longer distances. (Straight lines depict only the drop-off with the inverse square of the distance.)

Little is known concerning animal responses to aircraft noise sources, and there are no equivalents to PNL for each particular species. Consequently, for impact assessments regarding animals, overall sound pressure levels are used as a fundamental measure. Figures E.4, E.5, and E.6 represent approximate first-order scalings of peak OASPL versus slant range for the three respective aircraft, for each of the engine power settings used in the tests.

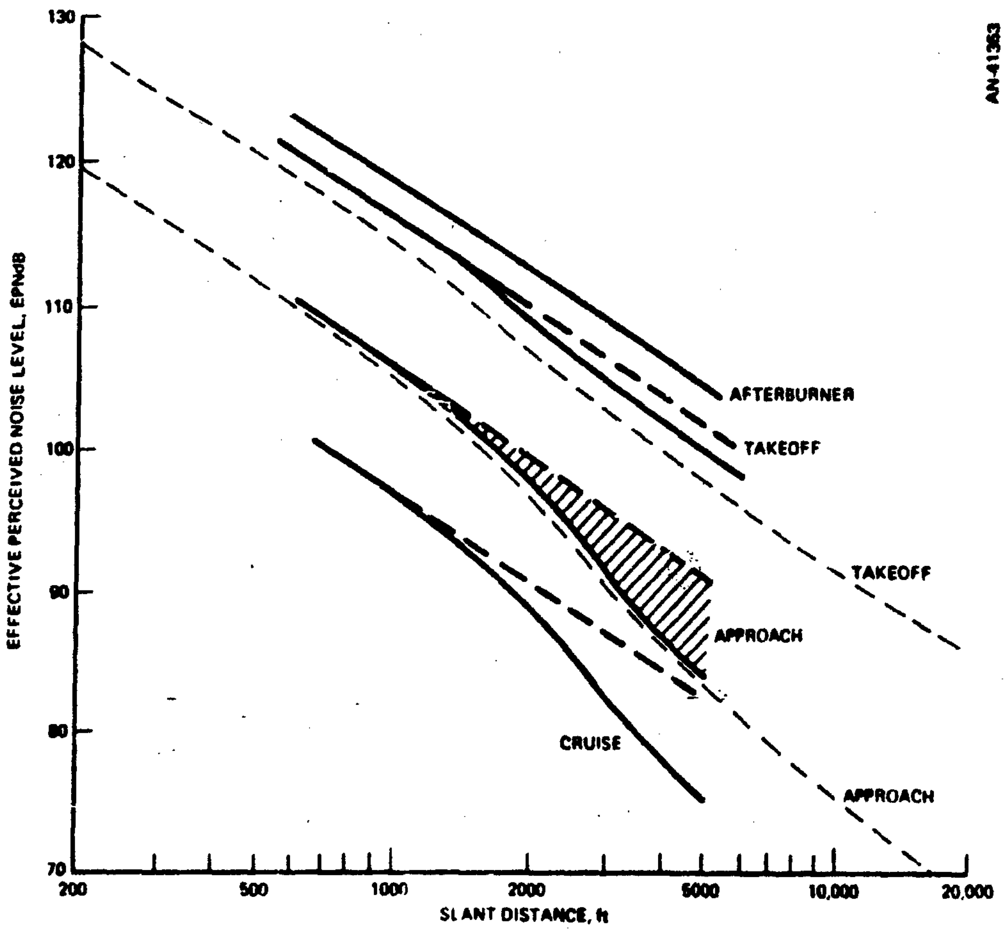


Figure E.1. Effective Perceived Noise Levels -- F-104G (Light Dashed Curves are for 4-Engine Turbojet Transport)

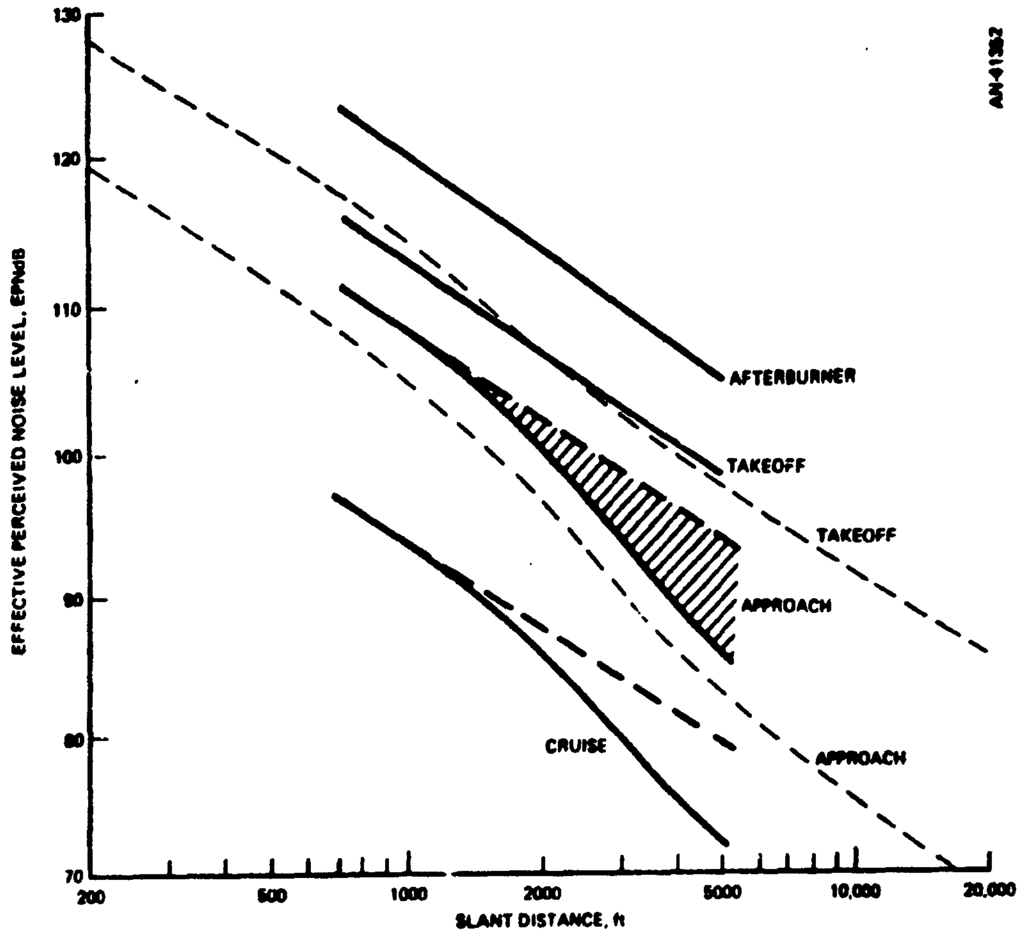


Figure E.2. Effective Perceived Noise Levels -- F-14 (Light Dashed Curves are for 4-Engine Turbojet Transport)

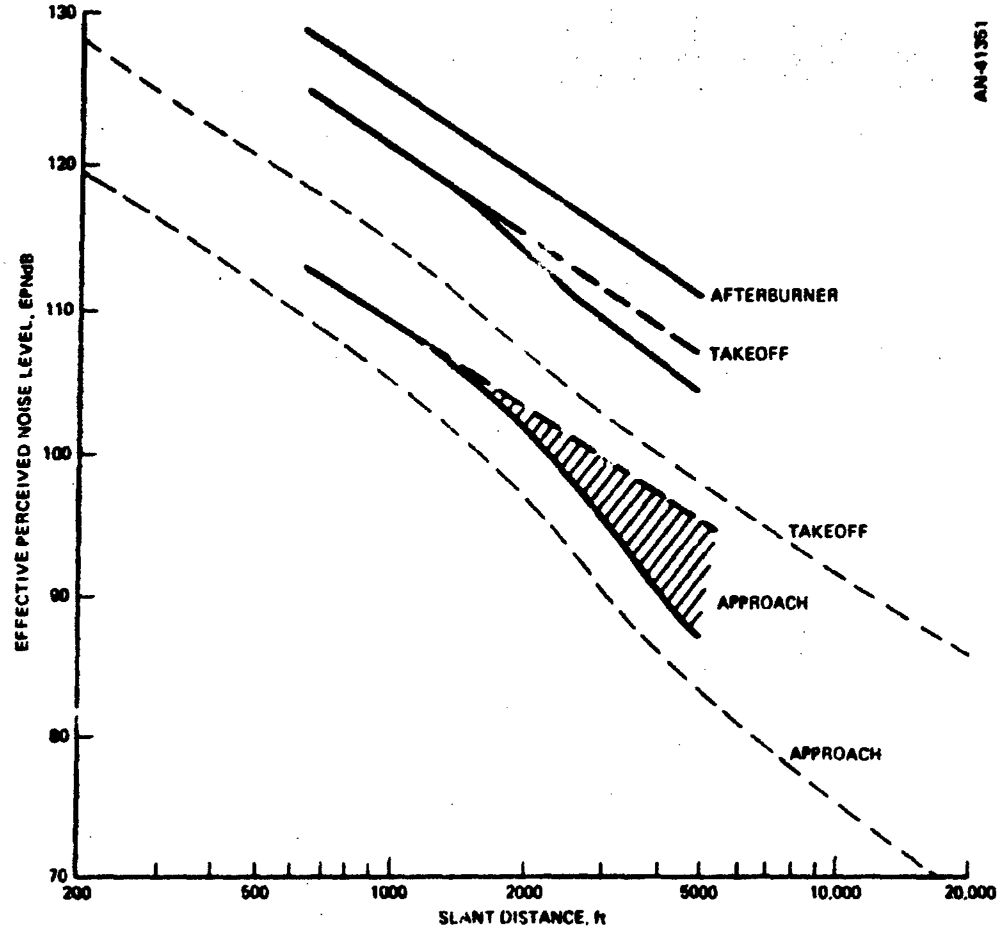


Figure E.3. Effective Perceived Noise Levels -- F-4 (Light D_shed Curves are for 4-Engine Turbojet Transport)

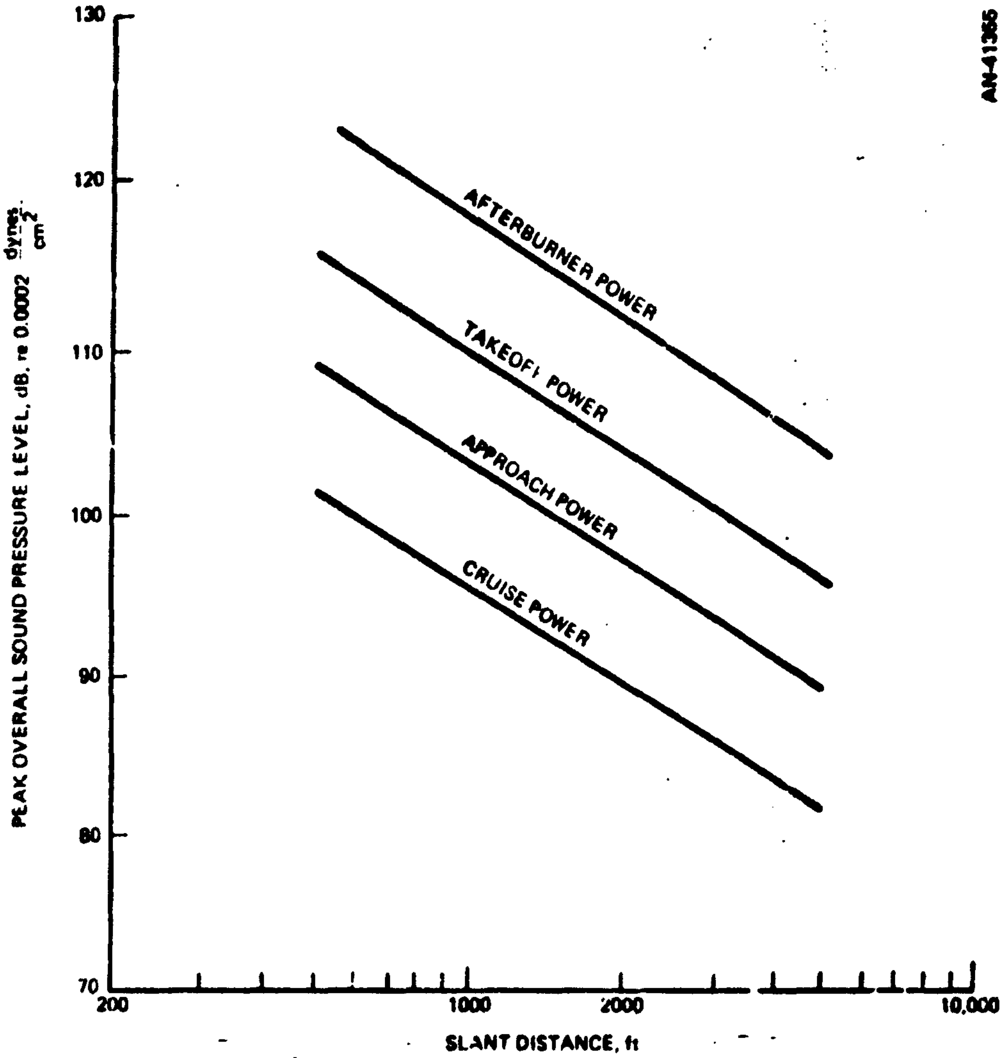


Figure E.4. Peak Overall Sound Pressure Levels -- F-104G

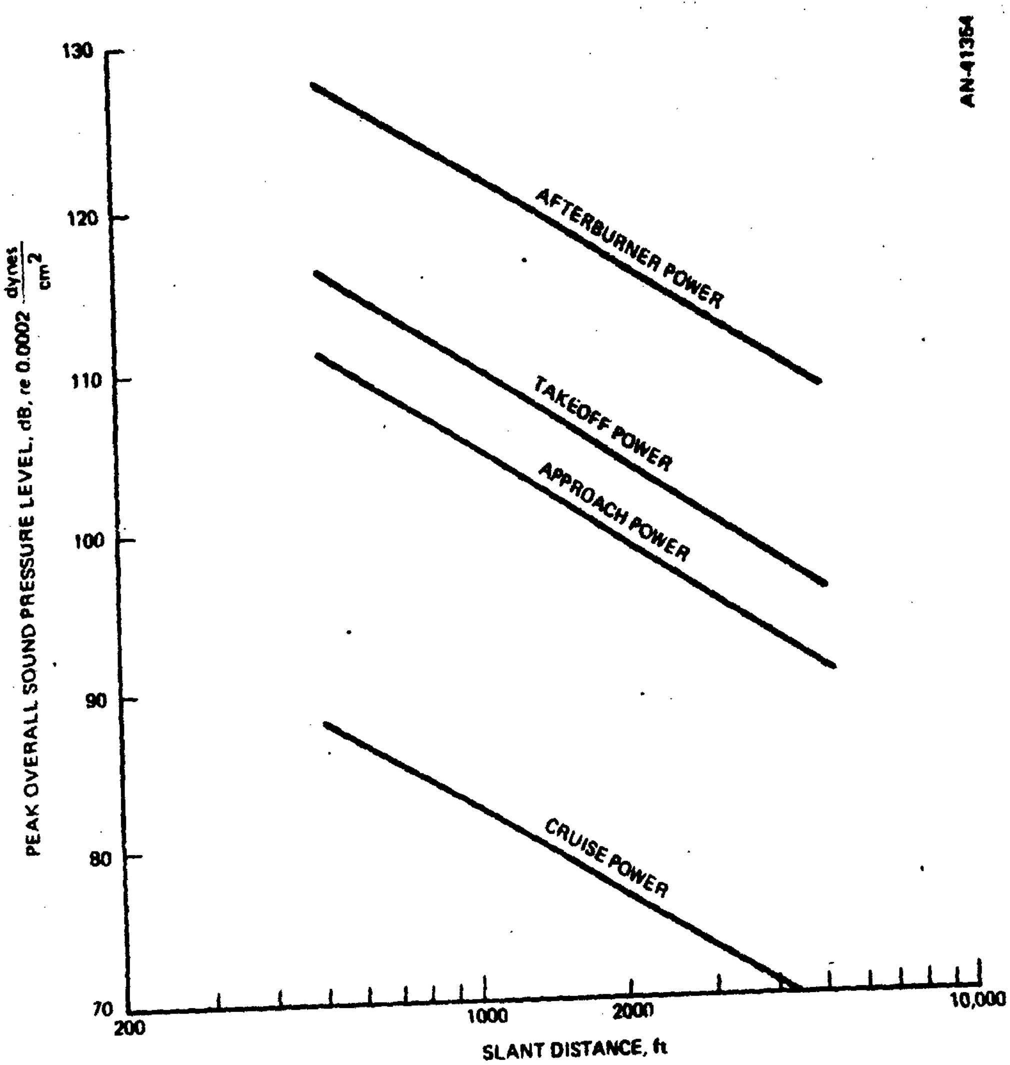


Figure E.5. Peak Overall Sound Pressure Levels -- F-14

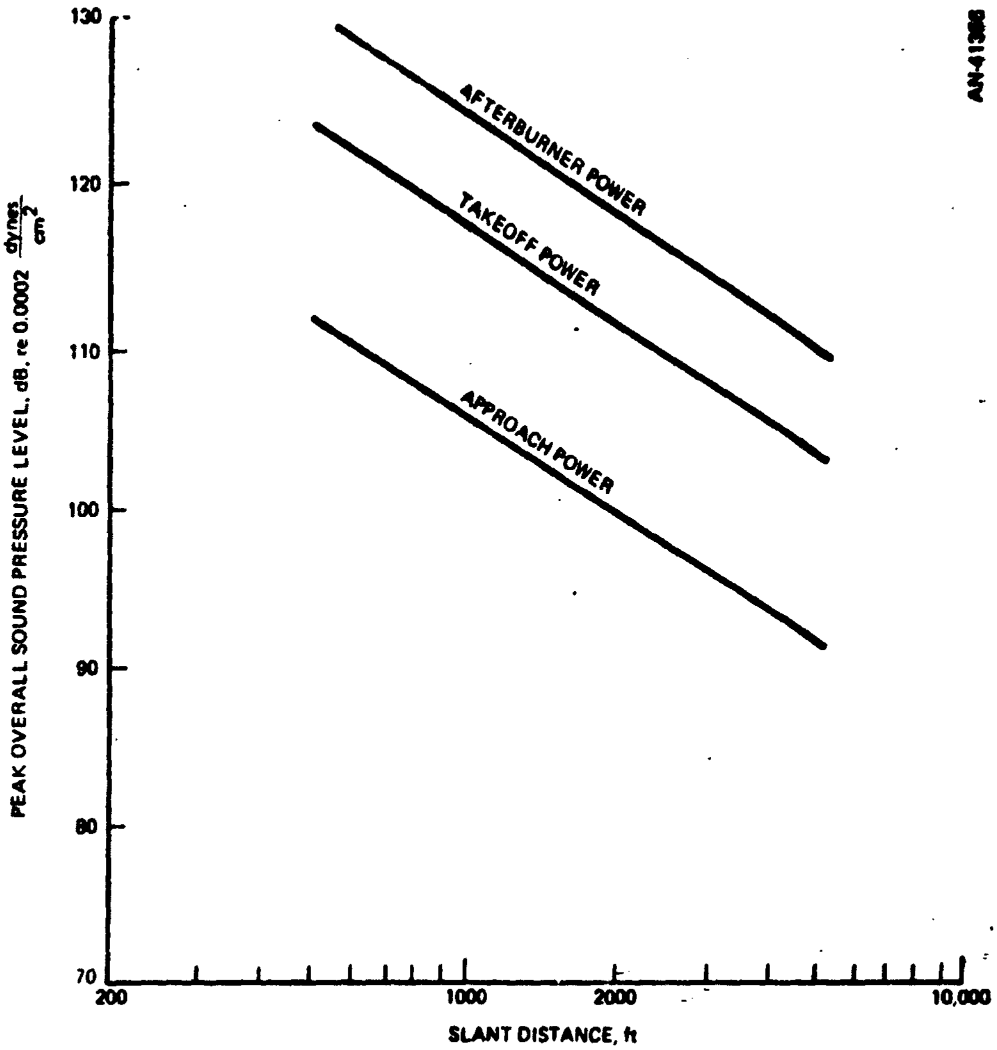


Figure E.6. Peak Overall Sound Pressure Levels -- F-4

APPENDIX F

SONIC BOOM CHARACTERISTICS FOR COR OPERATIONS

F.1 INTRODUCTION

This appendix summarizes some estimates of sonic boom intensity and duration that may be experienced at or near ground level from aircraft flying overhead at supersonic speeds, as have taken place on the Nellis Range and as required for projected COR operations. Estimates of the maximum distances from the ground trace of the flight path at which the boom will be felt (with diminished intensity) are included.

The nature of the problem is illustrated by Fig. F.1. Given the characteristics of an airplane in supersonic flight, it is necessary to determine the characteristics of the surrounding pressure disturbances.

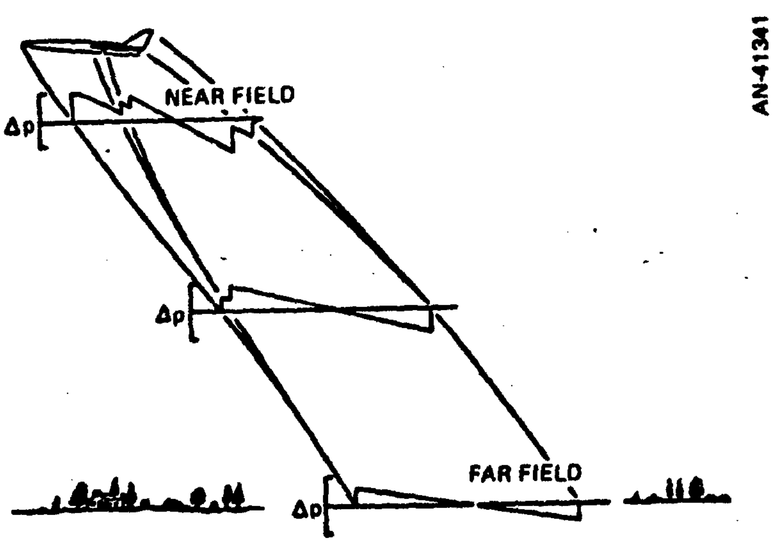


Figure F.1. Sonic Boom Pressure Field

As shown in Fig. F.1, the near-field pressure distribution is influenced by several discontinuities in the airplane shape (wing, canopy, engines, tail, etc.) which generate individual shocks. At greater distances from the aircraft these individual shocks coalesce into the bow and stern shock waves, and result in a far-field variation of pressure with time that can be idealized as an "N-wave." The onset of the boom is felt as a sharp increase in air pressure, followed by an essentially linear decrease in pressure to a value below ambient, followed by a sharp return to ambient pressure. The intensity of the boom has been taken as the peak overpressure. The duration of the boom is measured by the time interval between the arrival of the pressure rise and the return from negative pressure to ambient, at a fixed location.

The intensity of the boom decreases with distance of the observer from the aircraft flight path, and the duration increases. The extent or width of the boom on the ground in the direction normal to the flight path was estimated from Fig. F.2.[41] The overpressure decreases with lateral distance until the "cut-off" distance is reached, at which point the overpressure decreases to zero and the boom is not audible. Figure F.2 gives the calculated lateral extent of sonic booms on the ground at sea level for a still (1962) US standard atmosphere. Wind and temperature variation from the standard influence the lateral extent of the audible sonic boom on the ground as well as the distribution of overpressure. However, for the purposes of this report the lateral extent of the boom in standard still-air atmospheric conditions, as shown in Fig. F.2, was considered adequate with the understanding that specific atmospheric conditions such as temperature inversions can be very important in the propagation.

F.2 CALCULATION OF SONIC BOOM OVERPRESSURE

Boom Intensity. The method used to calculate boom intensity at the ground directly under the flight path was the "first-cut method" described in Ref. 42. The equation given there for boom intensity includes a reflection factor of 1.9 and is:

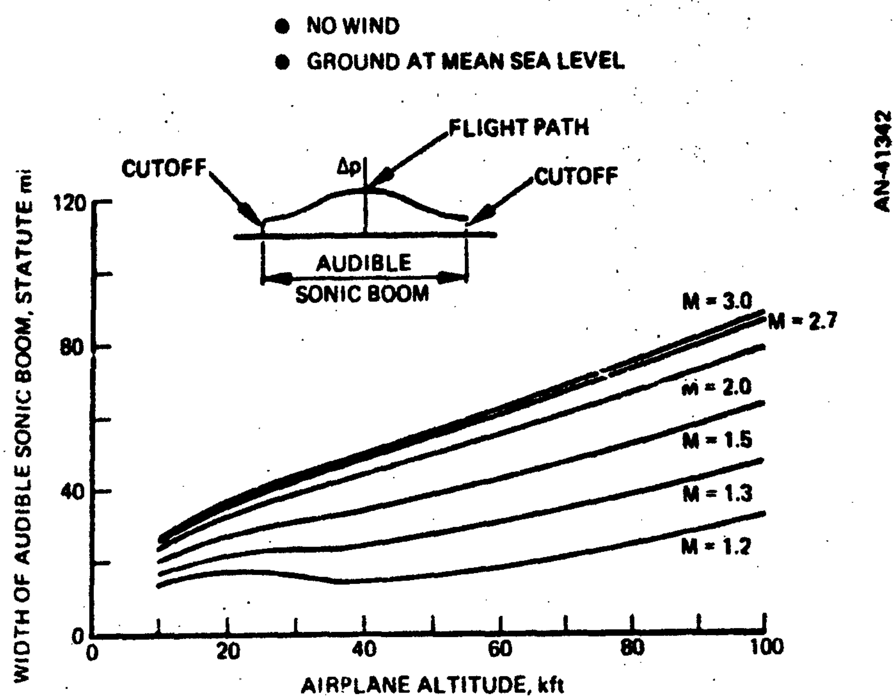


Figure F.2. Width of Audible Sonic Boom on the Ground

$$\Delta p = \frac{1.9\beta^{0.25} K_s K_A \sqrt{p_H p_G}}{(h/\ell)^{0.75}}$$

where

$\beta = \sqrt{M^2 - 1}$

M = Flight Mach number

K_s = Shape factor (Fig. F.3a)

K_A = Atmospheric factor (Fig. F.3b)

p_H = Ambient pressure at flight altitude

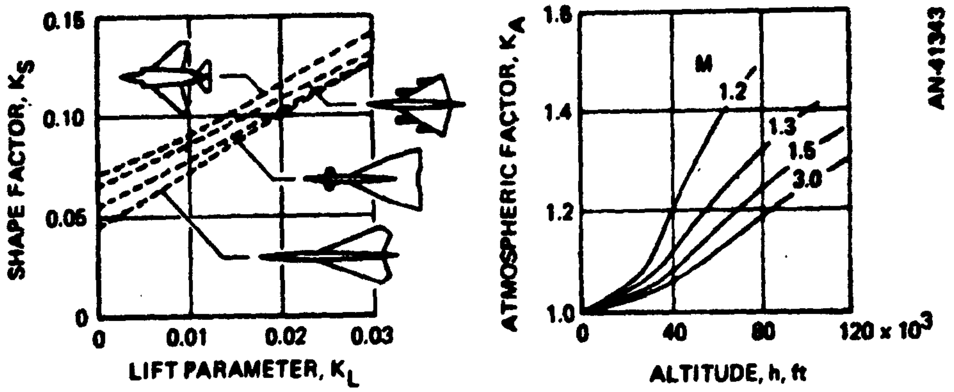
p_G = Ambient pressure at ground level

h = Aircraft altitude above ground level

ℓ = Airplane reference length

Boom intensities at positions on the ground not directly under the flight path were calculated by substituting slant range for h in the above equation. The shape factor K_s was approximated by the following equation:

$$K_s = 0.067 + 2.67 K_L \cos\theta$$



(a) shape factor

(b) atmospheric factor

Figure F.3. Sonic Boom Intensity Factors

where

$$K_L = \frac{\beta n W}{\gamma\, p_H M^2 \ell^2} \quad \text{(the lift parameter)}$$

$\cos\theta = h/r$

h = Distance of flight path above ground level

r = Slant range (measured normal to the flight path)

n = Flight load or maneuver factor

$\gamma = 1.4$

In this way the calculated lift parameter allows for the increase in the contribution of lift to the lift parameter proportional to load factor.

The reduction in the lift contribution to boom intensity with θ, the angle between the lift vector and the slant range direction (measured normal to the flight path) is also taken into account.

Boom Duration. The N-wave duration was estimated by the relationship:

$$\Delta t = \frac{2(\gamma + 1) M s^{0.25} \ell^{0.75} K_s}{\gamma \beta^{0.75} a_H}$$

where s = slant range

a_H = speed of sound at flight altitude

F.3 CASES FOR STUDY

Several cases were chosen for study representing mission profiles appropriate to COR aircraft as they are described in the Air Force "Green Book." Mission profiles which involved supersonic activity primarily by F-4, F-111, F-104, and F-105 aircraft were selected. These four cases seemed to be representative of practical limits on supersonic activity. However, much of the COR testing will not involve the flying of complete mission profiles but only particular portions of them, and consequently these limiting cases of supersonic conditions may not apply universally to COR operations. For example, much supersonic activity that occurs during training is generated in air combat maneuvering engagements, which result in quite different conditions of supersonic flight. Therefore, three more cases for study were added to the original four. For each case it was deemed essential to calculate boom strengths for a maneuvering (typically 5 g's) and a nonmaneuvering case.

F.4 RESULTS

Boom intensities (Δp) and durations (Δt) were estimated for the seven cases as shown in Table F.1. The aircraft parameters which affect the boom are:

Speed
Weight
Load Factor
Reference Length

TABLE F.1

SONIC BOOM INTENSITY AND DURATION AT ZERO OFFSET

Case	1		2		3		4		5	6	7
Aircraft	F-4C	F-4C	F-111A	F-111A	F-111A	F-111A	F-104C	F-104C	F-4C	F-111A	F-15
Speed, kt	1,178	1,178	860	860	1,208	1,208	1,150	1,150	---	---	---
Altitude Above MSL, ft	40,000	40,000	10,000	10,000	36,200	36,200	35,000	35,000	15,000	15,000	15,000
Speed of Sound at Altitude, ft/s	968	968	1,077	1,077	968	968	973	973	1,057	1,057	1,057
Mach Number	2.06	2.06	1.35	1.35	2.11	2.11	2.0	2.0	1.6	1.4	1.8
Pressure at Altitude, lb/ft^2	392	392	1,453	1,453	472	472	500	500	1,195	1,195	1,195
Load Factor	1	5	1	5	1	5	1	5	5	5	5
Lift, lb	36,100	181,500	56,500	282,500	52,800	264,000	19,370	96,850	180,500	282,500	200,000
Reference Length, ft	28	28	61	61	61	61	13	13	28	61	26
K_a	[illegible]	10	1.02	1.02	1.09	1.09	1.09	1.09	1.02	1.02	1.01
Ground Altitude, ft	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Distance Off Track	0	0	0	0	0	0	0	0	0	0	0
Pressure at Ground, lb/ft^2	1,760	1,760	1,760	1,760	1,760	1,760	1,760	1,760	1,760	1,760	1,760
Δp, lb/ft^2	1.10	2.92	8.00	10.2	1.62	2.6	1.08	3.62	5.4	5.8	6.5
Δt, seconds	0.090	---	0.061	---	0.11	---	0.068	---	0.09	0.10	0.09

These require no explanation except for the reference lengths, which were obtained by scaling the wing root chord from drawings of the airplanes.

Atmospheric factors required to calculate boom intensity and duration are atmospheric pressure and speed of sound at flight altitude, and atmospheric pressure at ground altitude. These were obtained from standard atmospheric tables.

Table F.1 lists the assumed conditions and the resulting estimates of boom intensity and duration at the ground, directly under the flight path of the airplane. Table F.2 gives the estimated width across the track of the airplane over which the boom would be audible at the ground, and the boom intensity at the cut-off distance.

Figure F.4 shows the variation of boom intensity with cross-track distance for two typical cases.

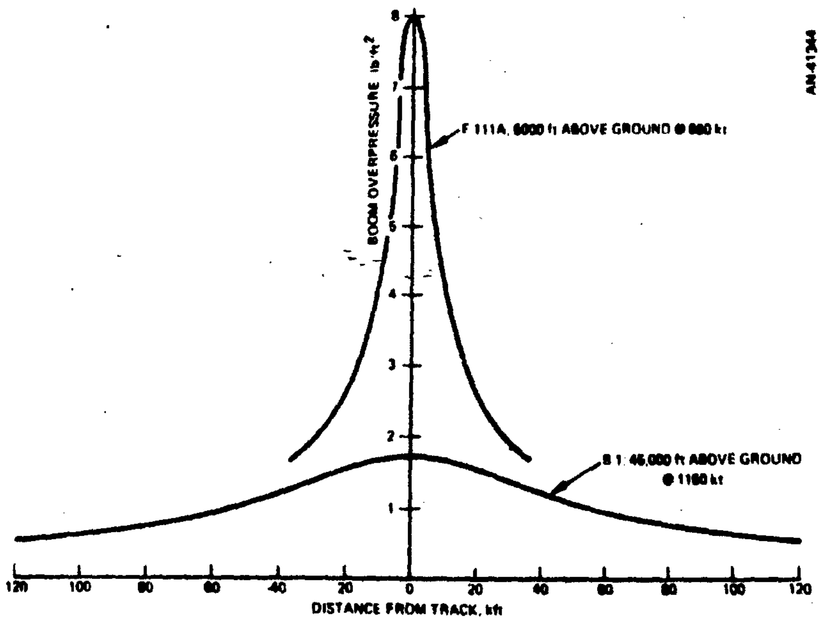


Figure F.4. Typical Cross-Track Sonic Boom Intensity Distributions

TABLE F.2

SONIC BOOM CUT-OFF WIDTH AND INTENSITY AT CUT-OFF

Case	1		2		3		4		5	6	7
Aircraft	F-4C	F-4C	F-111A	F-111A	F-111A	F-111A	F-104C	F-104C	F-4C	F-111A	F-15
Speed, kt	1,178	1,178	860	860	1,208	1,208	1,150	1,150	---	---	---
Altitude Above MSL, ft	40,000	40,000	10,000	10,000	36,200	36,200	35,000	35,000	15,000	15,000	15,000
Speed of Sound at Altitude, ft/s	968	968	1,077	1,077	968	968	973	973	1,057	1,057	1,057
Mach Number	2.06	2.06	1.35	1.35	2.11	2.11	2.0	2.0	1.4	1.4	1.8
Pressure at Altitude lb/ft^2	392	392	1,453	1,453	472	472	500	500	1,195	1,195	1,195
Load Factor	1	5	1	5	1	5	1	5	5	5	5
Lift, lb	36,130	180,500	56,500	282,500	52,800	264,000	19,370	96,850	180,500	282,500	200,000
Reference Length, ft	28	28	61	61	61	61	13	13	28	61	24
K_a	1.10	1.10	1.02	1.02	1.09	1.09	1.09	1.09	1.02	1.02	1.01
Ground Altitude, ft	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Cut-Off Distance, ft	116,000	116,000	37,000	37,000	105,000	105,000	105,000	105,000	58,080	58,080	71,280
Pressure at Ground, lb/ft^2	1,760	1,760	1,760	1,760	1,760	1,760	1,760	1,760	1,760	1,760	1,760
Δp, lb/ft^2	0.30	0.51	1.66	1.73	0.56	0.67	0.24	0.50	0.74	1.16	0.64
Δt, seconds	0.086	---	0.095	---	0.13	---	0.054	---	0.07	0.11	0.07
Width of Audible Boom, Statute Miles	44	44	14	14	40	40	40	40	22	22	27

APPENDIX G

THE COR AIRSPACE PROPOSAL

The COR Airspace Proposal is reproduced below in the form that it was transmitted from the Office of the Air Force Representative, FAA Western Region, to the Chief, Air Traffic Division, Federal Aviation Administration. The maps referenced in the proposal are not reproduced here, since they appear in the body of the report.

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE
WASHINGTON, D.C.

Office of the Air Force Representative
FAA Western Region

SUBJECT: Proposed USAF Continental Operations Range

TO: Chief, Air Traffic Division, AWE-500

1. Events of the past decade have indicated a critical requirement for a system which will provide finite analysis of USAF combat techniques. Accordingly, USAF has undertaken a study and evaluation of all aspects (airspace and environmental) involved in determining the feasibility of proposing a Continental Operations Range (COR) within portions of Nevada and Utah.

2. The proposed COR would be a large scale, long range program for the development and operation of an instrumented operational test and evaluation environment embodying all elements of offensive and defensive combat, including delivery of airborne munitions and employment of electronic warfare. Additionally, COR would be responsible for training selected aircrews and for providing the physical plant, analytical capabilities, and centralized control in support of small-as well as large tactical exercises.

3. To achieve the proposed COR program, implementation would be in three overlapping phases referred to as near-term (1 July 73 - 30 June 75,) mid-term (1 July 75 - 30 June 78) , and far-term (1 July 78 - 30 June 83). Near-term efforts are planned to include exploration and initiation of airspace and environmental actions. This phase would also include the development of data collection, analysis and air traffic control capability

within the Nellis AFB (NAFB) restricted area complex and adjoining areas on the north and east. Moderate interplay of events using both the NAFB, Atomic Energy Commission areas and the Wendover/Hill/Dugway (WHD) restricted area complex is also anticipated during the latter portion of the near-term phase. Introduction of automated air traffic and range instrumentation at WHD is proposed for the mid-term. Far-term proposals provide for further development of central COR control throughout an area possibly including tie-in of U. S. Navy ranges in the Fallon, Nevada complex. Interface with the FAA enroute and terminal control system would be an integral part of the proposed COR design throughout all phases of development.

4. Mission accomplishment with safety is the governing factor in development of the proposed COR and will continue to be the paramount issue in its management when, and if, this proposal becomes a reality. Thus it is considered essential that all necessary techniques and administrative procedures be employed to ensure safe and efficient use of airspace while assuring the integrity of events requiring collection of precision test data that would be conducted within the scope of the proposed COR program. Vital to achievement of these objectives is creation of an airspace environment within which air traffic control and judicious regulatory action can be applied to all airspace users in specified areas. Accordingly, the Department of the Air Force requests that an "Advanced" Notice of Proposed Rule Making (NPRM) be published in the Federal Register at the earliest possible date to accomplish the following:

a. Realign the internal boundaries of Restricted Area (RA) R-4807, R-4808 and R-4809 in order to facilitate efficient joint use.

b. Establish an interim RA (R-48XX) adjacent to the north and east of Nellis/AEC RA Complex.

c. Publish a Special Rule under Federal Aviation Regulations, Part 93, designating airspace north and east of R-48XX as an area requiring a clearance for transit.

5. The intent of the advanced notice is to solicit comments from the public for incorporation in a definitive proposal for airspace action to accommodate to the extent possible the needs of interested airspace users. In this regard, request a 30 day suspense period for public comment be established as an integral part of the advance NPRM. Concurrent with the advance NPRM, USAF personnel will effect coordination with representative aviation organizations in the Nevada/Utah area. The results of this effort will be consolidated with comments received by the FAA and will be reflected in a subsequent formal airspace NPRM. Additionally, it would appear that the interests of the public would best be served by inclusion of the following proposed chronological sequence of events in the advance NPRM.

a. 22 Feb 74 - Formal Notice of Proposed Rule Making published in Federal Register.

b. NET 6 Mar 74 - Inform rspace meeting, if determined necessary in best interest of aviation com nity.

c. 8 Apr 74 - Suspense date for receipt of comments regarding NPRM.

d. 15 Jun 74 - FAA ruling on airspace.

6. Specifically, request that the following proposed actions be published for public comment:

a. R-4809: Relocate the east boundary of R-4809 westward to longitude 116° 30'W, extend the south boundary of R-4809 westward to intersect the western boundary of R-4807 thereby incorporating the extreme northwest portion of R-4807 as a part of R-4809 (Atch 2). Designate R-4809 as a joint use area.

(1) Altitudes: Unlimited

(2) Time: Continuous

(3) Controlling Agency: Los Angeles ARTC Center

(4) Using Agency: Manager, Atomic Energy Commission, Albuquerque, New Mexico

b. R-4808: Relocate the western boundary of R-4808 eastward to longitude 116° 30'W. Relocate the north boundary of R-4808 northward to incorporate the extreme southeast portion of R-4807 and add an area approximately five by eleven nautical miles (Atch 2). Designation of R-4808 will remain unchanged:

(1) Altitudes: Ui · 'ted

(2) Time: Continuous

(3) Using (Controlling) Agency: Manager, Atomic Energy Commission, Las Vegas, Nevada.

c. R-4807 (Atch 3):

(1) Extend the south boundary line of R-4807 eastward to intersection of the east boundary of R-4807. That part of R-4807 north of the east-west line is to be designated as R-4807A.

(2) Connect the east boundary line of R-4809 with the west boundary of R-4808 along longitude 116° 30' W. That part of R-4807 to the east of 116° 30' will be designated as R-4807B, that part west of 116° 30' as R-4807C.

(3) Designate R-4807A, B and C as joint use areas.

(a) Altitudes: Unlimited

(b) Time: Continuous

(c) Controlling Agency: Los Angeles ARTC Center

(d) Using Agency: Commander, Continental Operations Range, Nellis AFB, Nevada.

d. R-4806: No change to boundaries, designate as joint use. Description changed to read as follows:

(1) Altitude: Unlimited

(2) Time: Continuous

(3) Controlling Agency: Los Angeles ARTC Center

(4) Using Agency: Commander, Continental Operations Range, Nellis AFB, Nevada.

e. R-48XX: Designate an interim restricted area beginning at the intersection of the eastern boundary of the Tonopah transition area and R-4809, east and south along the boundaries of R-4809, R-4807A, R-4808 and R-4806, thence north along an extension of the eastern boundary of R-4806 to the point of intersection with the southern boundary of V-244 controlled airspace, west along V-224 to the eastern boundary of the Tonopah transition area, and south to point of beginning (Atch 4). Designate as a joint use area.

(1) Altitudes: 200 feet AGL to FL 180

(2) Time: Continuous

(3) Controlling Agency: Los Angeles ARTC Center

(4) Using Agency: Commander, Continental Operations Range, Nellis AFB, Nevada

f. Designation of Special use airspace under Federal Aviation Regulation, Part 93:

(1) COR East: Beginning at the northeast corner of R-48XX south along east boundary of R-48XX to north boundary of R-4806, east to west boundary of V-21, north and west along V-21 and V-293 to south boundary of V-244, then west along V-244 to point of beginning. VFR flyways with floors of 1,500 feet AGL and ceilings of 11,500* feet MSL will be charted for use by those who cannot take advantage of radar vectoring/flight following provided as an inherent service of the proposed COR(Atch 5).

*It has been requested to modify the airspace proposal to increase the flyway ceilings to 12,500 feet. 12,500 feet is used for the impact assessments in the body of the report.

(2) Designate COR East as a joint use area:

(a) Altitudes: Surface to FL 180

(b) Time: Continuous

(c) Controlling Agency: Los Angeles ARTC Center

(d) Using Agency: Commander, Continental Operations Range, Nellis AFB, Nevada.

(3) COR North: Beginning at the northwest corner of R-48XX, (116° 38' W), east along south boundary of V-244 to west boundary of V-293, north to latitude 38° 30' N, west along 38° 30' to longitude 116° 38', south to point of beginning. VFR flyways with floors of 1,500 feet AGL and 11,500 feet MSL will be charted for those who cannot take advantage of services stated in f (1) above (Atch 5).

(4) Designate COR North as a joint use area:

(a) Altitudes: Surface to FL 180

(b) Time: Continuous

(c) Controlling Agency: Salt Lake City ARTC Center

(d) Using Agency: Commander, Continental Operations Range, Nellis AFB, Nevada.

7. The above airspace areas proposed for designation are those which would satisfy COR near, mid, and far-term requirements in the Nellis/AEC portion of the COR area.

8. This operational concept can be described in general terms as a plan for expansion, automated control, and electronic sophistication of Air Force activities currently conducted in the proposed COR area. Airborne munitions will not be expended in COR North or East. Munitions will be released in R-48XX for impact in R-4807A, B, and C. This, and a lack of radar surveillance during near-term, dictates the need for the additional restricted area for the purpose of protection of nonparticipants. However, the programmed expansion of COR Air Traffic Control (ATC) capability in late near or early mid-term suggests that follow-on action can be taken to rescind the major part or all of R-48XX and identify that airspace as a part of COR East and subject to the lesser constraints of Part 93.

9. Safety considerations are inherent in the proposed COR development program. Assuming COR adoption, a Continental Operations Range Central (CORC) is planned that would function as a single nerve center for air operations within the expanded Nellis/AEC complex. In the midterm phase, the coordination, scheduling, and ATC radar capabilities of CORC would become directly related to those in the WHD complex. Far-term capabilicies are being considered to provide a total interface of CORC ATC capabilities with those of the FAA National Aviation System (NAS). These, coupled with regulatory action as proposed will ensure aviation safety commensurate with state-of-the-art of air traffic control systems.

10. An environmental statement is being prepared in compliance with Subchapter M, Part 214, Sec. 102(2)(C) of the National Environmental Policy Act, Publica Law 91-190 (42 USC 432Z (2)(c)); however, for all practical purposes, the proposed air operations will be very little different from those which have been and are being conducted by military services in the proposed COR area. Ground equipments introduced as a result of this proposal will be located on Air Force or government owned or leased land. Future development could require lease of parcels in accordance with standard contractual practices. Proposed electronic warfare activities may have temporary effect on parts of the frequency spectrum but do not constitute introduction of a new element in military operations.

11. The decision to proceed with submission of a formal Department of the Air Force proposal for rule making action as regards this concept will be made at the termination of the advanced NPRM comment period. However, the inherent advantages of the above proposal as regards safety for all users of the airspace in question is considered an overwhelming advantage and impetus for initiation of such a program.

/s/

RALPH W. ZOERLEIN
Lt. Col. USAF
Air Force Representative

APPENDIX H

PERSONAL INCOME, TOTAL EARNINGS, AND LOCATION QUOTIENTS

Carson City, Nevada
Churchill County, Nevada
Douglas County, Nevada
Elko County, Nevada
Las Vegas SMSA, Nevada (Clark County)
Lincoln County, Nevada
Lyon County, Nevada
Nye County, Nevada
Reno SMSA, Nevada (Washoe County)
Storey County, Nevada
White Pine County, Nevada
Box Elder County, Utah
Juab County, Utah
Salt Lake City-Ogden SMSA, Utah (Davis, Salt Lake, and Weber Counties)
Tooele County, Utah

TABLE H.1

PERSONAL INCOME BY MAJOR SOURCES AND EARNINGS BY BROAD INDUSTRIAL SECTOR

(Thousands of Dollars)

CARSON CITY, NEVADA — JULY 19, 1973

		1967	1968	1969	1970	1971
TOTAL PERSONAL INCOME		45,995	52,106	57,673	65,391	75,007
TOTAL WAGE AND SALARY DISBURSEMENTS	1/	34,439	38,867	42,919	49,632	57,112
OTHER LABOR INCOME		728	798	925	1,186	1,523
PROPRIETORS INCOME		3,728	4,472	5,235	4,296	4,667
FARM PROPRIETORS INCOME		-57	-46	-17	-21	280
NONFARM PROPRIETORS INCOME		3,785	4,518	5,252	4,317	4,387
PROPERTY INCOME		5,034	5,330	5,490	6,268	6,644
TRANSFER PAYMENTS		3,581	4,285	4,973	6,159	7,541
LESS: PERSONAL CONTRIBUTIONS FOR SOCIAL INSURANCE		1,519	1,655	1,869	2,150	2,480
TOTAL EARNINGS	2/	38,895	44,137	49,079	55,114	63,302
FARM EARNINGS		37	54	66	78	390
TOTAL NONFARM EARNINGS		38,858	44,083	49,013	55,036	62,912
GOVERNMENT EARNINGS		21,479	24,634	27,271	31,252	34,826
TOTAL FEDERAL		4,007	4,446	4,313	4,437	4,494
FEDERAL CIVILIAN		3,744	4,162	3,995	4,084	4,1[illegible]1
MILITARY		263	284	318	353	393
STATE AND LOCAL		17,472	20,188	22,958	26,815	30,332
PRIVATE NONFARM EARNINGS		17,379	19,449	21,742	23,784	28,086
MANUFACTURING		516	620	982	1,647	2,296
MINING		488	425	(D)	438	430
CONTRACT CONSTRUCTION		1,644	2,065	2,553	3,203	4,222
TRANS,COMMUNICATION,AND PUBLIC UTILITIES		1,357	1,616	1,929	2,225	2,606
WHOLESALE AND RETAIL TRADE		5,408	5,844	6,111	6,141	6,902
FINANCE, INSURANCE, AND REAL ESTATE		1,148	1,227	1,236	1,178	1,401
SERVICES		6,791	7,605	8,593	8,922	10,190
OTHER		27	47	(D)	30	39

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS, DATA ARE INCLUDED IN TOTALS.

1/ PRIMARY SOURCE FOR PRIVATE NON-FARM WAGES: NEVADA EMPLOYMENT SECURITY DEPT.
2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

TABLE 5.00 P

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE H.2

EARNINGS BY BROAD INDUSTRIAL SECTOR

(Location Quotient for Total Earnings)

JULY 19, 1973

CARSON CITY, NEVADA

	1967	1968	1969	1970	1971
FARM EARNINGS	.0287	.0375	.0393	.0438	.1994
TOTAL NONFARM EARNINGS	1.0351	1.0318	1.0329	1.0316	1.0297
GOVERNMENT EARNINGS	3.3305	3.2946	3.2901	3.2106	3.0567
TOTAL FEDERAL	1.4385	1.3947	1.2450	1.1196	.9958
FEDERAL CIVILIAN	2.2292	2.1979	1.9019	1.6487	1.4242
MILITARY	.2394	.2246	.2338	.2370	.2403
STATE AND LOCAL	4.7635	4.7106	4.7989	4.6966	4.4085
PRIVATE NONFARM EARNINGS	.5591	.5518	.5591	.5452	.5624
MANUFACTURING	.0452	.0477	.0633	.1076	.1356
MINING	1.1792	.9412	(D)	.7900	.7010
CONTRACT CONSTRUCTION	.7145	.7826	.8428	.9476	1.0672
TRANS, COMMUNICATION, AND PUBLIC UTILITIES	.9014	.9297	.9663	.9890	.9691
WHOLESALE AND RETAIL TRADE	.8348	.8010	.7578	.6731	.6547
FINANCE, INSURANCE, AND REAL ESTATE	.5762	.5295	.4838	.4163	.4115
SERVICES	1.2033	1.1858	1.1887	1.0701	1.0495
OTHER	.2414	.2929	(D)	.1724	.2069

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE 5.06 P

TABLE H.3

PERSONAL INCOME BY MAJOR SOURCES
AND EARNINGS BY BROAD INDUSTRIAL SECTOR
(Thousands of Dollars)

CHURCHILL, NEVADA — JULY 19, 1973

		1967	1968	1969	1970	1971
TOTAL PERSONAL INCOME		22,988	24,122	27,952	33,102	33,748
TOTAL WAGE AND SALARY DISBURSEMENTS	1/	15,793	16,236	18,064	22,316	22,443
OTHER LABOR INCOME		416	429	526	679	699
PROPRIETORS INCOME		2,246	2,382	3,900	3,555	3,128
FARM PROPRIETORS INCOME		-33	-534	1,007	1,083	573
NONFARM PROPRIETORS INCOME		2,279	2,916	2,893	2,472	2,555
PROPERTY INCOME		2,830	2,841	2,944	3,582	3,796
TRANSFER PAYMENTS		2,456	3,017	3,389	4,007	4,785
LESS: PERSONAL CONTRIBUTIONS FOR SOCIAL INSURANCE		753	783	871	1,037	1,103
TOTAL EARNINGS	2/	18,455	19,047	22,490	26,550	26,270
FARM EARNINGS		715	265	1,676	1,878	1,455
TOTAL NONFARM EARNINGS		17,740	18,782	20,814	24,672	24,815
GOVERNMENT EARNINGS		9,179	9,744	10,831	13,131	13,538
TOTAL FEDERAL		6,127	6,401	7,093	8,847	8,822
FEDERAL CIVILIAN		2,264	2,265	2,435	2,725	2,857
MILITARY		3,863	4,136	4,658	6,122	5,965
STATE AND LOCAL		3,052	3,343	3,738	4,284	4,716
PRIVATE NONFARM EARNINGS		8,561	9,038	9,983	11,541	11,277
MANUFACTURING		459	520	919	1,091	952
MINING		(D)	88	7	51	-103
CONTRACT CONSTRUCTION		1,362	917	1,029	1,797	1,239
TRANS,COMMUNICATION,AND PUBLIC UTILITIES		434	934	572	758	616
WHOLESALE AND RETAIL TRADE		3,008	3,044	3,744	3,852	3,783
FINANCE, INSURANCE, AND REAL ESTATE		457	490	450	617	889
SERVICES		2,094	2,580	2,662	2,955	3,477
OTHER		(D)	465	600	420	426

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

1/ PRIMARY SOURCE FOR PRIVATE NON-FARM WAGES: NEVADA EMPLOYMENT SECURITY DEPT.
2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

TABLE 5.00 P

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE H.4

EARNINGS BY BROAD INDUSTRIAL SECTOR

(Location Quotient for Total Earnings)

CHURCHILL, NEVADA

JULY 19, 1973

	1967	1968	1969	1970	1971
FARM EARNINGS	1.1089	.4344	2.2908	2.2094	1.7814
TOTAL NONFARM EARNINGS	.9961	1.0187	.9972	.9800	.9749
GOVERNMENT EARNINGS	3.0000	3.0201	2.8314	2.8007	2.8628
TOTAL FEDERAL	4.6369	4.6551	4.4674	4.6342	4.7097
FEDERAL CIVILIAN	2.8403	2.7208	2.5904	2.2800	2.3912
MILITARY	7.3697	7.6175	7.4496	8.5407	8.8023
STATE AND LOCAL	1.7540	1.8074	1.6907	1.5415	1.6513
PRIVATE NONFARM EARNINGS	.5805	.5941	.5563	.5493	.5442
MANUFACTURING	.0847	.0930	.1407	.1479	.1352
MINING	(D)	.4510	.0309	.1900	--
CONTRACT CONSTRUCTION	1.2466	.8043	.7423	1.1044	.7552
TRANS,COMMUNICATION,AND PUBLIC UTILITIES	.3376	.4052	.3600	.4014	.3232
WHOLESALE AND RETAIL TRADE	.9790	1.0938	1.0134	.8767	.8649
FINANCE, INSURANCE, AND REAL ESTATE	.4844	.4895	.3854	.4514	.6294
SERVICES	.7822	.9326	.8038	.7356	.8631
OTHER	(D)	8.7143	8.V000	9.4483	9.5862

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS, DATA ARE INCLUDED IN TOTALS.

2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

-- INSUFFICIENT DATA

TABLE 5.06 P

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE H.5

PERSONAL INCOME BY MAJOR SOURCES

AND EARNINGS BY BROAD INDUSTRIAL SECTOR

(Thousands of Dollars)

DOUGLAS, NEVADA

JULY 19, 1973

	1967	1968	1969	1970	1971
TOTAL PERSONAL INCOME	46,489	50,848	54,312	61,021	66,362
TOTAL WAGE AND SALARY DISBURSEMENTS 1/	39,499	43,148	45,532	51,363	55,758
OTHER LABOR INCOME	895	1,014	1,151	1,422	1,675
PROPRIETORS INCOME	2,276	2,788	3,775	3,668	3,932
FARM PROPRIETORS INCOME	449	622	1,307	1,369	1,578
NONFARM PROPRIETORS INCOME	1,827	2,166	2,468	2,299	2,354
PROPERTY INCOME	3,780	3,820	3,687	4,130	4,385
TRANSFER PAYMENTS	1,632	1,786	2,018	2,615	3,059
LESS: PERSONAL CONTRIBUTIONS FOR SOCIAL INSURANCE	1,593	1,700	1,851	2,106	2,447
TOTAL EARNINGS 2/	42,670	46,950	50,458	56,453	61,365
FARM EARNINGS	1,145	1,366	1,929	2,107	2,396
TOTAL NONFARM EARNINGS	41,525	45,584	48,529	54,346	58,969
GOVERNMENT EARNINGS	2,020	2,275	2,578	2,957	3,229
TOTAL FEDERAL	475	529	576	818	614
FEDERAL CIVILIAN	337	374	404	424	400
MILITARY	138	155	172	194	214
STATE AND LOCAL	1,545	1,746	2,002	2,239	2,615
PRIVATE NONFARM EARNINGS	39,505	43,309	45,951	51,389	55,740
MANUFACTURING	1,017	(D)	1,545	1,834	2,692
MINING	(D)	(D)	(D)	(D)	(D)
CONTRACT CONSTRUCTION	1,924	2,132	1,503	1,907	1,995
TRANS,COMMUNICATION,AND PUBLIC UTILITIES	1,400	(D)	1,648	1,763	1,935
WHOLESALE AND RETAIL TRADE	1,826	2,106	2,287	2,415	2,899
FINANCE, INSURANCE, AND REAL ESTATE	1,001	1,052	1,317	1,662	1,631
SERVICES	32,164	34,948	37,420	41,640	44,619
OTHER	(D)	58	(D)	(D)	(D)

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

1/ PRIMARY SOURCE FOR PRIVATE NON-FARM WAGES: NEVADA EMPLOYMENT SECURITY DEPT.
2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

TABLE 5.00 P

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE H.6

EARNINGS BY BROAD INDUSTRIAL SECTOR

(Location Quotient for Total Earnings)

JULY 19, 1973

DOUGLAS, NEVADA

	1967	1968	1969	1970	1971
FARM EARNINGS	.7679	.9094	1.1941	1.1898	1.2940
TOTAL NONFARM EARNINGS	1.0084	1.0030	.9947	.9965	.9918
GOVERNMENT EARNINGS	.2893	.2863	.3025	.2967	.2922
TOTAL FEDERAL	.1550	.1565	.1615	.1516	.1403
FEDERAL CIVILIAN	.1829	.1831	.1869	.1867	.1429
MILITARY	.1127	.1159	.1223	.1259	.1357
STATE AND LOCAL	.3839	.3831	.4039	.3954	.3919
PRIVATE NONFARM EARNINGS	1.1584	1.1549	1.1412	1.1902	1.1514
MANUFACTURING	.0809	(D)	.1053	.1169	.1517
MINING	(D)	(D)	(D)	(D)	(D)
CONTRACT CONSTRUCTION	.7618	.7592	.4830	.8914	.8200
TRANS,COMMUNICATION,AND PUBLIC UTILITIES	.4713	(D)	.4712	.4394	.4351
WHOLESALE AND RETAIL TRADE	.2971	.2716	.2757	.2586	.2839
FINANCE, INSURANCE, AND REAL ESTATE	.4590	.4267	.5029	.5720	.4953
SERVICES	5.1950	5.1232	5.0346	4.8751	4.7399
OTHER	(D)	.4286	(D)	(D)	(D)

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

TABLE 5.06 P

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE H.7

PERSONAL INCOME BY MAJOR SOURCES AND EARNINGS BY BROAD INDUSTRIAL SECTOR

(Thousands of Dollars)

ELKO, NEVADA JULY 19, 1973

		1967	1968	1969	1970	1971
TOTAL PERSONAL INCOME		45,134	50,178	57,241	59,840	68,399
TOTAL WAGE AND SALARY DISBURSEMENTS	1/	28,297	31,068	32,369	34,461	39,829
OTHER LABOR INCOME		884	993	1,116	1,260	1,619
PROPRIETORS INCOME		8,619	10,025	15,252	14,433	16,301
FARM PROPRIETORS INCOME		3,657	4,396	9,371	9,63[illegible]	11,225
NONFARM PROPRIETORS INCOME		4,962	5,629	5,881	4,7[illegible]	5,076
PROPERTY INCOME		5,469	5,660	5,639	6,037	6,401
TRANSFER PAYMENTS		3,650	4,362	4,852	5,796	6,705
LESS: PERSONAL CONTRIBUTIONS FOR SOCIAL INSURANCE		1,789	1,930	1,987	2,147	2,492
TOTAL EARNINGS	2/	37,800	42,086	48,737	50,154	57,745
FARM EARNINGS		6,129	7,041	11,582	12,259	14,128
TOTAL NONFARM EARNINGS		31,671	35,045	37,155	37,895	43,617
GOVERNMENT EARNINGS		7,176	7,801	8,539	9,695	10,757
TOTAL FEDERAL		1,973	2,024	2,055	2,229	2,480
FEDERAL CIVILIAN		1,819	1,860	1,866	2,019	2,238
MILITARY		154	164	189	210	242
STATE AND LOCAL		5,203	5,777	6,484	7,466	8,277
PRIVATE NONFARM EARNINGS		24,495	27,244	28,616	28,200	32,860
MANUFACTURING		417	379	416	392	441
MINING		(D)	764	1,121	602	860
CONTRACT CONSTRUCTION		1,925	2,943	2,067	2,128	3,508
TRANS,COMMUNICATION,AND PUBLIC UTILITIES		5,076	5,227	5,761	5,755	6,266
WHOLESALE AND RETAIL TRADE		5,857	6,437	6,915	6,817	7,461
FINANCE, INSURANCE, AND REAL ESTATE		941	1,119	1,297	1,442	2,128
SERVICES		9,379	10,073	10,804	10,940	12,072
OTHER		(D)	302	275	124	124

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

1/ PRIMARY SOURCE FOR PRIVATE NON-FARM WAGES: NEVADA EMPLOYMENT SECURITY DEPT.
2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

TABLE 5.00 P

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE H.8

EARNINGS BY BROAD INDUSTRIAL SECTOR

(Location Quotient for Total Earnings)

JULY 19, 1973

ELKO, NEVADA

	1967	1968	1969	1970	1971
FARM EARNINGS	4.6447	5.2281	7.1782	7.6373	7.8882
TOTAL NONFARM EARNINGS	.8682	.8602	.7889	.7806	.7793
GOVERNMENT EARNINGS	1.1448	1.0945	1.0373	1.0946	1.0390
TOTAL FEDERAL	.7291	.6662	.5977	.6175	.6017
FEDERAL CIVILIAN	1.1134	1.0114	.8949	.8956	.8927
MILITARY	.1444	.1368	.1403	.1556	.1628
STATE AND LOCAL	1.4592	1.4140	1.3530	1.4222	1.3183
PRIVATE NONFARM EARNINGS	.8108	.8104	.7358	.7105	.7214
MANUFACTURING	.0374	.0306	.0292	.0281	.0284
MINING	(D)	1.7843	2.3711	1.2000	1.5361
CONTRACT CONSTRUCTION	.8598	1.1689	.6872	.6917	.9712
TRANS,COMMUNICATION,AND PUBLIC UTILITIES	1.9296	1.7974	1.7032	1.6155	1.4986
WHOLESALE AND RETAIL TRADE	.9303	.9250	.8637	.8211	.7760
FINANCE, INSURANCE, AND REAL ESTATE	.4863	.5067	.4971	.5803	.6872
SERVICES	1.7099	1.6469	1.5051	1.4415	1.3631
OTHER	(D)	2.5714	1.8867	.8621	.7241

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

TABLE 5.08 P

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE H.9

PERSONAL INCOME BY MAJOR SOURCES AND EARNINGS BY BROAD INDUSTRIAL SECTOR

(Thousands of Dollars)

AUGUST 24, 1973

LAS VEGAS, NEVADA SMSA (CLARK COUNTY)

	1967	1968	1969	1970	1971
TOTAL PERSONAL INCOME	772,216	899,457	1,054,852	1,180,421	1,299,551
TOTAL WAGE AND SALARY DISBURSEMENTS 1/	584,493	683,800	816,514	920,346	1,006,880
OTHER LABOR INCOME	19,181	22,505	26,410	33,003	38,480
PROPRIETORS INCOME	41,895	59,232	65,522	58,094	61,070
FARM PROPRIETORS INCOME	1,738	1,512	1,635	1,864	1,391
NONFARM PROPRIETORS INCOME	40,157	57,720	63,887	56,230	59,679
PROPERTY INCOME	90,733	105,147	112,363	124,876	134,448
TRANSFER PAYMENTS	47,055	58,149	64,154	79,878	100,681
LESS: PERSONAL CONTRIBUTIONS FOR SOCIAL INSURANCE	21,881	26,632	32,111	37,816	42,008
TOTAL EARNINGS 2/	651,569	785,597	910,666	1,011,583	1,106,530
FARM EARNINGS	2,163	1,966	1,897	2,295	1,871
TOTAL NONFARM EARNINGS	649,426	782,653	908,449	1,009,188	1,104,559
GOVERNMENT EARNINGS	125,890	156,818	173,188	192,549	220,796
TOTAL FEDERAL	64,736	84,000	94,572	100,945	118,551
FEDERAL CIVILIAN	30,250	33,807	38,030	41,637	53,703
MILITARY	34,486	50,193	56,542	59,308	64,848
STATE AND LOCAL	61,154	72,818	78,616	91,604	102,205
PRIVATE NONFARM EARNINGS	523,536	625,835	735,261	816,639	883,803
MANUFACTURING	32,581	36,013	40,839	43,622	43,720
MINING	2,583	2,385	1,472	1,065	766
CONTRACT CONSTRUCTION	41,541	50,812	63,766	90,898	104,393
TRANS, COMMUNICATION, AND PUBLIC UTILITIES	45,855	50,853	61,981	71,993	79,526
WHOLESALE AND RETAIL TRADE	97,776	115,769	133,608	144,975	156,543
FINANCE, INSURANCE, AND REAL ESTATE	28,652	31,961	36,520	39,710	47,705
SERVICES	(D)	(D)	(D)	(D)	(D)
OTHER	(D)	(D)	(D)	(D)	(D)

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

1/ PRIMARY SOURCE FOR PRIVATE NON-FARM WAGES: NEVADA EMPLOYMENT SECURITY DEPT.
2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

TABLE SET 4

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE H.10

EARNINGS BY BROAD INDUSTRIAL SECTOR

(Location Quotient for Total Earnings)

LAS VEGAS, NEVADA SMSA (CLARK COUNTY) AUGUST 24, 1973

	1967	1968	1969	1970	1971
FARM EARNINGS	.0946	.0781	.0665	.0719	.0547
TOTAL NONFARM EARNINGS	1.1327	1.0305	1.0320	1.0307	1.0303
GOVERNMENT EARNINGS	1.1653	1.1800	1.1261	1.0781	1.1083
TOTAL FEDERAL	1.3883	1.5222	1.4717	1.4880	1.5021
FEDERAL CIVILIAN	1.0741	1.0114	.9766	.9156	1.0659
MILITARY	1.4627	2.3018	2.2338	2.1704	2.2713
STATE AND LOCAL	.9958	.9269	.8779	.8653	.8500
PRIVATE NONFARM EARNINGS	1.0054	.9986	1.0120	1.0202	1.0125
MANUFACTURING	.1700	.1604	.1545	.1551	.1476
MINING	.3774	.3032	.1649	.1100	.0722
CONTRACT CONSTRUCTION	1.3777	1.2425	[illegible]	1.5628	1.5104
TRANS,COMMUNICATION,AND PUBLIC UTILITIES	.9670	.9624	[illegible]	1.0014	.9931
WHOLESALE AND RETAIL TRADE	.9019	.9159	.8935	.8659	.8499
FINANCE, INSURANCE, AND REAL ESTATE	.8594	.7962	.7726	.7646	.8026
SERVICES	(D)	(D)	(D)	(D)	(D)
OTHER	(D)	(D)	(D)	(D)	(D)

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

TABLE 5.0R P

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE H.11

PERSONAL INCOME BY MAJOR SOURCES

AND EARNINGS BY BROAD INDUSTRIAL SECTOR

(Thousands of Dollars)

JULY 19, 1973

LINCOLN, NEVADA

	1967	1968	1969	1970	1971
TOTAL PERSONAL INCOME	5,067	5,434	6,182	6,757	7,273
TOTAL WAGE AND SALARY DISBURSEMENTS 1/	3,612	3,439	4,127	4,607	4,892
OTHER LABOR INCOME	133	115	164	181	172
PROPRIETORS INCOME	621	996	922	817	856
FARM PROPRIETORS INCOME	-100	-45	13	45	90
NONFARM PROPRIETORS INCOME	721	1,041	909	772	766
PROPERTY INCOME	216	218	261	302	321
TRANSFER PAYMENTS	755	945	1,016	1,194	1,404
LESS: PERSONAL CONTRIBUTIONS FOR SOCIAL INSURANCE	270	279	360	344	372
TOTAL EARNINGS 2/	4,366	4,550	5,213	5,605	5,920
FARM EARNINGS	122	192	210	278	348
TOTAL NONFARM EARNINGS	4,244	4,358	5,003	5,327	5,572
GOVERNMENT EARNINGS	1,523	1,700	1,932	2,196	2,426
TOTAL FEDERAL	182	204	248	252	265
FEDERAL CIVILIAN	153	174	214	214	221
MILITARY	29	30	34	38	44
STATE AND LOCAL	1,341	1,496	1,684	1,944	2,161
PRIVATE NONFARM EARNINGS	2,721	2,658	3,071	3,131	3,146
MANUFACTURING	91	115	(D)	81	(D)
MINING	742	320	524	567	175
CONTRACT CONSTRUCTION	131	162	(D)	80	216
TRANS,COMMUNICATION,AND PUBLIC UTILITIES	595	603	642	643	679
WHOLESALE AND RETAIL TRADE	649	909	839	843	924
FINANCE, INSURANCE, AND REAL ESTATE	(D)	(D)	(D)	(D)	(D)
SERVICES	438	474	722	845	1,013
OTHER	(D)	(D)	46	(D)	(D)

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

1/ PRIMARY SOURCE FOR PRIVATE NON-FARM WAGES: NEVADA EMPLOYMENT SECURITY DEPT.
2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE 5.00 P

TABLE H.12

EARNINGS BY BROAD INDUSTRIAL SECTOR

(Location Quotient for Total Earnings)

LINCOLN, NEVADA

JULY 19, 1973

	1967	1968	1969	1970	1971
FARM EARNINGS	.7994	1.3188	1.2175	1.5500	1.8907
TOTAL NONFARM EARNINGS	1.6373	.9895	.9926	.9818	.9714
GOVERNMENT EARNINGS	2.1037	2.2054	2.1942	2.2186	2.2767
TOTAL FEDERAL	.5824	.6205	.6742	.6259	.6283
FEDERAL CIVILIAN	.8102	.8741	.9603	.8409	.8198
MILITARY	.2324	.2316	.2330	.2519	.2868
STATE AND LOCAL	3.2566	3.3862	3.2859	3.3123	3.3579
PRIVATE NONFARM EARNINGS	.7798	.7314	.7382	.7098	.6736
MANUFACTURING	.0707	.0861	(D)	.0522	(D)
MINING	16.0283	6.8922	10.3608	10.1200	3.0919
CONTRACT CONSTRUCTION	.5068	.5953	(D)	.2333	.5840
TRANS.COMMUNICATION.AND PUBLIC UTILITIES	1.9983	1.9179	1.7792	1.8199	1.9843
WHOLESALE AND RETAIL TRADE	.8925	1.2087	1.0030	.9088	.9375
FINANCE, INSURANCE, AND REAL ESTATE	(D)	(D)	(D)	(D)	(D)
SERVICES	.6912	.7171	.9403	.9967	1.1154
OTHER	(D)	(D)	2.9333	(D)	(D)

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

TABLE 5.05 P

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE H.13

PERSONAL INCOME BY MAJOR SOURCES AND EARNINGS BY BROAD INDUSTRIAL SECTOR

(Thousands of Dollars)

LYON, NEVADA JULY 19, 1973

		1967	1968	1969	1970	1971
TOTAL PERSONAL INCOME		23,752	27,565	28,362	32,462	34,893
TOTAL WAGE AND SALARY DISBURSEMENTS	1/	13,948	17,095	15,330	17,237	18,910
OTHER LABOR INCOME		701	954	1,174	1,409	1,601
PROPRIETORS INCOME		2,507	2,108	4,465	5,264	4,997
FARM PROPRIETORS INCOME		951	354	2,627	3,150	2,803
NONFARM PROPRIETORS INCOME		1,556	1,754	1,838	2,114	2,197
PROPERTY INCOME		5,809	6,213	5,946	6,658	7,051
TRANSFER PAYMENTS		1,794	2,072	2,293	2,863	3,421
LESS: PERSONAL CONTRIBUTIONS FOR SOCIAL INSURANCE		763	877	846	969	1,087
TOTAL EARNINGS	2/	17,156	20,157	20,969	23,910	25,508
FARM EARNINGS		1,937	1,407	3,508	4,197	3,959
TOTAL NONFARM EARNINGS		15,219	18,750	17,461	19,713	21,549
GOVERNMENT EARNINGS		2,431	2,702	3,022	3,578	3,907
TOTAL FEDERAL		376	435	473	645	667
FEDERAL CIVILIAN		267	316	337	493	495
MILITARY		109	119	136	152	172
STATE AND LOCAL		2,055	2,267	2,549	2,933	3,240
PRIVATE NONFARM EARNINGS		12,788	16,048	14,439	16,135	17,642
MANUFACTURING		1,258	1,408	1,657	1,967	2,217
MINING		(D)	4,558	6,120	(D)	(D)
CONTRACT CONSTRUCTION		1,991	3,647	1,929	1,183	1,563
TRANS,COMMUNICATION,AND PUBLIC UTILITIES		572	709	907	932	1,347
WHOLESALE AND RETAIL TRADE		1,430	2,010	1,746	1,922	2,522
FINANCE, INSURANCE, AND REAL ESTATE		240	296	294	(D)	(D)
SERVICES		2,530	3,303	1,615	1,843	1,988
OTHER		(D)	157	211	(D)	(D)

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS, DATA ARE INCLUDED IN TOTALS.

1/ PRIMARY SOURCE FOR PRIVATE NON-FARM WAGES: NEVADA EMPLOYMENT SECURITY DEPT.
2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

TABLE 5.00 P

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE H.14

EARNINGS BY BROAD INDUSTRIAL SECTOR

(Location Quotient for Total Earnings)

JULY 19, 1973

LYON, NEVADA

	1967	1968	1969	1970	1971
FARM EARNINGS	3.2390	2.1813	5.0544	5.4844	6.9904
TOTAL NONFARM EARNINGS	.9192	.9610	.8812	.8518	.8719
GOVERNMENT EARNINGS	.8546	.7810	.8532	.8471	.8511
TOTAL FEDERAL	.3059	.2992	.3201	.3755	.3661
FEDERAL CIVILIAN	.3611	.3593	.3782	.4578	.4264
MILITARY	.2254	.2070	.2338	.2370	.2597
STATE AND LOCAL	1.2704	1.1586	1.2370	1.1719	1.1685
PRIVATE NONFARM EARNINGS	.9327	.9989	.8829	.8527	.8787
MANUFACTURING	.2492	.2380	.2718	.2962	.3266
MINING	(D)	22.1667	30.0928	(D)	(D)
CONTRACT CONSTRUCTION	1.9611	3.0251	1.4911	.8075	.9808
TRANS.,COMMUNICATION,AND PUBLIC UTILITIES	.4784	.3894	.8239	.5493	.7293
WHOLESALE AND RETAIL TRADE	.5009	.6031	.5070	.4858	.5940
FINANCE, INSURANCE, AND REAL ESTATE	.2734	.2419	.2331	(D)	(D)
SERVICES	1.0165	1.1280	.5227	.9096	.9078
OTHER	(D)	2.7857	3.3667	(D)	(D)

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE 5.06 P

TABLE H.15

PERSONAL INCOME BY MAJOR SOURCES

AND EARNINGS BY BROAD INDUSTRIAL SECTOR

(Thousands of Dollars)

NYE, NEVADA | JULY 19, 1973

	1967	1968	1969	1970	1971
TOTAL PERSONAL INCOME	96,239	107,497	108,262	90,394	92,479
TOTAL WAGE AND SALARY DISBURSEMENTS 1/	91,518	102,118	101,143	83,144	84,102
OTHER LABOR INCOME	2,421	2,766	2,619	2,470	2,691
PROPRIETORS INCOME	1,742	2,010	2,735	2,081	2,274
FARM PROPRIETORS INCOME	182	-6	636	435	642
NONFARM PROPRIETORS INCOME	1,560	2,016	2,099	1,646	1,632
PROPERTY INCOME	2,878	3,087	4,062	4,302	4,903
TRANSFER PAYMENTS	1,119	1,325	1,909	1,718	2,011
LESS: PERSONAL CONTRIBUTIONS FOR SOCIAL INSURANCE	3,431	3,729	3,802	3,321	3,502
TOTAL EARNINGS 2/	95,681	106,894	106,497	87,695	89,067
FARM EARNINGS	834	688	1,218	1,110	1,414
TOTAL NONFARM EARNINGS	94,847	106,206	105,279	86,585	87,653
GOVERNMENT EARNINGS	6,780	7,449	7,773	8,571	8,474
TOTAL FEDERAL	4,921	5,375	5,429	5,862	5,462
FEDERAL CIVILIAN	2,224	2,403	2,409	2,612	2,065
MILITARY	2,697	2,972	3,020	3,250	3,397
STATE AND LOCAL	1,859	2,074	2,344	2,709	3,012
PRIVATE NONFARM EARNINGS	88,067	98,757	97,506	78,014	79,179
MANUFACTURING	267	93	95	118	119
MINING	2,940	3,097	3,237	3,315	3,094
CONTRACT CONSTRUCTION	(D)	3,295	(D)	(D)	(D)
TRANS,COMMUNICATION,AND PUBLIC UTILITIES	(D)	1,246	(D)	813	983
WHOLESALE AND RETAIL TRADE	1,780	2,169	2,438	2,135	2,073
FINANCE, INSURANCE, AND REAL ESTATE	(D)	366	241	244	224
SERVICES	(D)	(D)	(D)	(D)	(D)
OTHER	132	(D)	(D)	(D)	(D)

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

1/ PRIMARY SOURCE FOR PRIVATE NON-FARM WAGES: NEVADA EMPLOYMENT SECURITY DEPT.
2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

TABLE 5.00 P

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE H.16

EARNINGS BY BROAD INDUSTRIAL SECTOR

(Location Quotient for Total Earnings)

JULY 19, 1973

NYE, NEVADA

	1967	1968	1969	1970	1971
FARM EARNINGS	.2493	.2000	.3444	.3907	.3113
TOTAL NONFARM EARNINGS	1.0271	1.0264	1.0226	1.0199	1.0157
GOVERNMENT EARNINGS	.4276	.4115	.4322	.5532	.5283
TOTAL FEDERAL	.7179	.6967	.7224	.9291	.8597
FEDERAL CIVILIAN	.5370	.5149	.5280	.8622	.5099
MILITARY	.9930	.9724	1.0216	1.3741	1.4767
STATE AND LOCAL	.2057	.1998	.2230	.2951	.3109
PRIVATE NONFARM EARNINGS	1.1917	1.1568	1.1474	1.1261	1.1269
MANUFACTURING	.0095	.0031	.0031	.0047	.0049
MINING	2.8962	2.8431	3.1340	3.7800	3.5773
CONTRACT CONSTRUCTION	(D)	.5151	(D)	(D)	(D)
TRANS.COMMUNICATION.AND PUBLIC UTILITIES	(D)	.1693	(D)	.1310	.1519
WHOLESALE AND RETAIL TRADE	.1105	.1228	.1380	.1468	.1399
FINANCE, INSURANCE, AND REAL ESTATE	(D)	.0448	.0443	.0545	.0466
SERVICES	(D)	(D)	(D)	(D)	(D)
OTHER	.4828	(D)	(D)	(D)	(D)

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE 5.06 P

TABLE H.17

PERSONAL INCOME BY MAJOR SOURCES AND EARNINGS BY BROAD INDUSTRIAL SECTOR
(Thousands of Dollars)

RENO, NEVADA (WASHOE COUNTY)

AUGUST 24, 1973

	1967	1968	1969	1970	1971
TOTAL PERSONAL INCOME	419,659	456,977	525,869	580,840	650,775
TOTAL WAGE AND SALARY DISBURSEMENTS 1/	301,622	325,381	374,687	423,477	472,494
OTHER LABOR INCOME	10,951	11,752	14,365	17,344	21,277
PROPRIETORS INCOME	35,736	43,819	48,038	42,435	45,076
FARM PROPRIETORS INCOME	-930	-829	-482	-420	-471
NONFARM PROPRIETORS INCOME	36,716	44,648	48,520	42,855	45,547
PROPERTY INCOME	57,284	57,861	66,745	73,047	77,093
TRANSFER PAYMENTS	28,717	33,720	37,925	45,316	53,547
LESS: PERSONAL CONTRIBUTIONS FOR SOCIAL INSURANCE	14,642	15,556	17,844	20,775	23,716
TOTAL EARNINGS 2/	348,359	380,952	437,088	483,252	543,851
FARM EARNINGS	58	227	402	631	694
TOTAL NONFARM EARNINGS	348,301	380,725	436,686	482,621	543,157
GOVERNMENT EARNINGS	54,637	60,878	68,740	80,618	90,530
TOTAL FEDERAL	14,925	15,876	17,501	20,947	23,706
FEDERAL CIVILIAN	13,635	14,461	15,823	18,993	21,463
MILITARY	1,290	1,417	1,678	1,954	2,243
STATE AND LOCAL	39,712	45,000	51,239	59,671	66,824
PRIVATE NONFARM EARNINGS	293,664	319,847	367,946	402,003	452,627
MANUFACTURING	17,241	18,794	24,207	25,473	29,869
MINING	1,422	2,012	2,281	2,660	2,929
CONTRACT CONSTRUCTION	31,356	30,504	40,793	43,472	52,856
TRANS.,COMMUNICATION,AND PUBLIC UTILITIES	30,728	38,562	42,654	45,012	51,371
WHOLESALE AND RETAIL TRADE	66,243	72,679	80,186	89,965	98,967
FINANCE, INSURANCE, AND REAL ESTATE	22,443	26,501	30,341	30,794	34,255
SERVICES	117,267	130,024	146,699	163,714	181,155
OTHER	532	811	786	913	1,225

1/ PRIMARY SOURCE FOR PRIVATE NON-FARM WAGES: NEVADA EMPLOYMENT SECURITY DEPT.
2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

TABLE 5.00 P

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE H.12 [1]

EARNINGS BY BROAD INDUSTRIAL SECTOR

(Location Quotient for Total Earnings)

AUGUST 24, 1973

RENO, NEVADA (WASHOE COUNTY)	1967	1968	1969	1970	1971
FARM EARNINGS	.0357	.0188	.0272	.0406	.0418
TOTAL NONFARM EARNINGS	1.0360	1.0324	1.0333	1.0317	1.0308
GOVERNMENT EARNINGS	.9457	.9433	.9313	.9445	.9250
TOTAL FEDERAL	.5978	.5776	.5666	.6024	.6115
FEDERAL CIVILIAN	.9051	.8696	.8458	.8733	.8681
MILITARY	.1333	.1298	.1367	.1519	.1589
STATE AND LOCAL	1.2049	1.2163	1.1923	1.1796	1.1306
PRIVATE NONFARM EARNINGS	1.0548	1.0512	1.0549	1.0512	1.0550
MANUFACTURING	.1633	.1675	.1906	.1896	.2051
MINING	.5003	.5196	.5361	.5500	.5567
CONTRACT CONSTRUCTION	1.5233	1.3446	1.5122	1.4602	1.5552
TRANS.COMMUNICATION,AND PUBLIC UTILITIES	1.5144	1.4845	1.4063	1.3113	1.3052
WHOLESALE AND RETAIL TRADE	1.1423	1.1543	1.1169	1.1251	1.0931
FINANCE, INSURANCE, AND REAL ESTATE	1.2579	1.3295	1.3372	1.2374	1.1732
SERVICES	2.3198	2.3489	2.2783	2.2393	2.1716
OTHER	.5172	.5714	.6000	.6552	.7931

[1] EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

TABLE 5.05 P

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE H.19

PERSONAL INCOME BY MAJOR SOURCES

AND EARNINGS BY BROAD INDUSTRIAL SECTOR

(Thousands of Dollars)

JULY 19, 1973

STOREY, NEVADA

		1967	1968	1969	1970	1971
TOTAL PERSONAL INCOME		2,100	2,506	2,689	3,233	3,457
TOTAL WAGE AND SALARY DISBURSEMENTS		1,240	1,457	1,640	2,066	2,143
OTHER LABOR INCOME		49	59	66	96	117
PROPRIETORS INCOME		437	604	502	491	562
FARM PROPRIETORS INCOME		26	27	38	46	115
NONFARM PROPRIETORS INCOME		411	577	464	445	447
PROPERTY INCOME		316	332	334	399	423
TRANSFER PAYMENTS		236	261	290	353	399
LESS: PERSONAL CONTRIBUTIONS FOR SOCIAL INSURANCE		118	127	143	172	187
TOTAL EARNINGS	2/	1,726	2,120	2,208	2,653	2,822
FARM EARNINGS		27	28	39	47	116
TOTAL NONFARM EARNINGS		1,699	2,092	2,169	2,606	2,706
GOVERNMENT EARNINGS		257	291	334	387	430
TOTAL FEDERAL		25	2.	33	35	36
FEDERAL CIVILIAN		18	20	24	25	24
MILITARY		7	8	9	10	12
STATE AND LOCAL		232	263	301	352	3[illegible]
PRIVATE NONFARM EARNINGS	1/	1,442	1,801	1,835	2,219	2,276
MANUFACTURING		44	(D)	(D)	(D)	(D)
MINING		(D)	(D)	637	673	657
CONTRACT CONSTRUCTION		74	150	(D)	(D)	(D)
TRANS,COMMUNICATION,AND PUBLIC UTILITIES		(D)	(D)	(D)	(D)	(D)
WHOLESALE AND RETAIL TRADE		585	791	731	828	958
FINANCE, INSURANCE, AND REAL ESTATE		--	(D)	(D)	(D)	(D)
SERVICES		135	134	103	151	189
OTHER		3	--	--	--	--

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS, DATA ARE INCLUDED IN TOTALS.

1/ PRIMARY SOURCE FOR PRIVATE NON-FARM WAGES: NEVADA EMPLOYMENT SECURITY DEPT.
2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

-- INSUFFICIENT DATA

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE 5.00 P

TABLE H.20 [1]

EARNINGS BY BROAD INDUSTRIAL SECTOR

(Location Quotient for Total Earnings)

JULY 19, 1973

STOREY, NEVADA

	1967	1968	1969	1970	1971
FARM EARNINGS	.4470	.4125	.5347	.5531	1.3215
TOTAL NONFARM EARNINGS	1.0200	1.0194	1.0159	1.0148	.9897
GOVERNMENT EARNINGS	.8981	.8105	.8958	.8262	.8467
TOTAL FEDERAL	.2025	.1828	.2110	.1836	.1795
FEDERAL CIVILIAN	.2407	.2151	.2547	.2089	.1868
MILITARY	.1444	.1333	.1475	.1407	.1667
STATE AND LOCAL	1.4252	1.2781	1.3866	1.2674	1.2843
PRIVATE NONFARM EARNINGS	1.0494	1.0636	1.0415	1.0569	1.0223
MANUFACTURING	.0867	(D)	(D)	(D)	(D)
MINING	(D)	(D)	29.7423	25.3700	24.0000
CONTRACT CONSTRUCTION	.7247	1.2458	(D)	(D)	(D)
TRANS, COMMUNICATION, AND PUBLIC UTILITIES	(D)	(D)	(D)	(D)	(D)
WHOLESALE AND RETAIL TRADE	2.0354	2.2571	2.0152	1.8858	2.0390
FINANCE, INSURANCE, AND REAL ESTATE	--	(D)	(D)	(D)	(D)
SERVICES	.5389	.4350	.3164	.3761	.4368
OTHER	1.0000	--	--	--	--

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

-- INSUFFICIENT DATA

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE 5.06 P

TABLE H.21

PERSONAL INCOME BY MAJOR SOURCES AND EARNINGS BY BROAD INDUSTRIAL SECTOR

(Thousands of Dollars)

WHITE PINE, NEVADA

JULY 19, 1973

		1967	1968	1969	1970	1971
TOTAL PERSONAL INCOME		26,194	29,364	35,640	40,003	42,041
TOTAL WAGE AND SALARY DISBURSEMENTS	1/	17,795	19,794	24,428	27,814	29,010
OTHER LABOR INCOME		1,049	1,505	2,112	2,532	2,793
PROPRIETORS INCOME		2,240	2,345	3,065	2,923	2,796
FARM PROPRIETORS INCOME		429	405	1,329	1,383	1,434
NONFARM PROPRIETORS INCOME		1,811	1,940	1,736	1,540	1,362
PROPERTY INCOME		3,690	3,893	4,220	4,772	5,058
TRANSFER PAYMENTS		2,398	2,887	3,047	3,391	3,918
LESS: PERSONAL CONTRIBUTIONS FOR SOCIAL INSURANCE		974	1,055	1,232	1,429	1,534
TOTAL EARNINGS	2/	21,040	23,644	29,605	33,269	34,599
FARM EARNINGS		870	875	1,721	1,849	1,950
TOTAL NONFARM EARNINGS		20,170	22,769	27,884	31,420	32,649
GOVERNMENT EARNINGS		3,669	4,119	4,739	5,370	6,014
TOTAL FEDERAL		957	1,089	1,309	1,399	1,598
FEDERAL CIVILIAN		850	973	1,173	1,247	1,422
MILITARY		107	116	136	152	176
STATE AND LOCAL		2,712	3,030	3,430	3,971	4,416
PRIVATE NONFARM EARNINGS		16,501	18,650	23,145	26,050	26,635
MANUFACTURING		(D)	2,748	(D)	(D)	(D)
MINING		(D)	(D)	(D)	(D)	(D)
CONTRACT CONSTRUCTION		370	526	569	798	1,319
TRANS.COMMUNICATION,AND PUBLIC UTILITIES		1,277	1,369	1,437	1,595	1,859
WHOLESALE AND RETAIL TRADE		2,933	3,125	3,582	4,239	4,297
FINANCE, INSURANCE, AND REAL ESTATE		464	389	415	420	436
SERVICES		2,605	2,870	3,243	3,192	3,412
OTHER		64	(D)	102	--	--

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

1/ PRIMARY SOURCE FOR PRIVATE NON-FARM WAGES: NEVADA EMPLOYMENT SECURITY DEPT.
2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

-- INSUFFICIENT DATA

TABLE 5.00 P

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE H.22

EARNINGS BY BROAD INDUSTRIAL SECTOR

(Location Quotient for Total Earnings)

JULY 19, 1973

WHITE PINE, NEVADA

	1967	1968	1969	1970	1971
FARM EARNINGS	1.1834	1.1563	1.7553	1.7375	1.8135
TOTAL NONFARM EARNINGS	.9934	.9948	.9741	.9756	.9739
GOVERNMENT EARNINGS	1.0519	1.0283	.9479	.9139	.9656
TOTAL FEDERAL	.6355	.6385	.6261	.5855	.6480
FEDERAL CIVILIAN	.9352	.9428	.9252	.8333	.9033
MILITARY	.1796	.1719	.1655	.1704	.1977
STATE AND LOCAL	1.3669	1.3203	1.1790	1.1406	1.1739
PRIVATE NONFARM EARNINGS	.9814	.9876	.9797	.9894	.9758
MANUFACTURING	(D)	.3956	(D)	(D)	(D)
MINING	(D)	(D)	(D)	(D)	(D)
CONTRACT CONSTRUCTION	.3041	.3712	.3112	.3915	.6096
TRANS.COMMUNICATION,AND PUBLIC UTILITIES	.8721	.8379	.6988	.6746	.7417
WHOLESALE AND RETAIL TRADE	.8372	.7998	.7365	.7698	.7459
FINANCE, INSURANCE, AND REAL ESTATE	.4316	.3143	.2698	.2451	.2346
SERVICES	.8932	.8376	.7434	.6338	.6428
OTHER	1.0345	(D)	1.1333	--	--

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

-- INSUFFICIENT DATA

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE 5.06 P

TABLE H.23

PERSONAL INCOME BY MAJOR SOURCES

AND EARNINGS BY BROAD INDUSTRIAL SECTOR

(Thousands of Dollars)

BOX ELDER, UTAH

JULY 19, 1973

		1967	1968	1969	1970	1971
TOTAL PERSONAL INCOME		72,015	72,408	77,476	84,492	90,394
TOTAL WAGE AND SALARY DISBURSEMENTS	1/	41,134	41,720	43,651	48,022	51,269
OTHER LABOR INCOME		2,369	2,480	2,631	3,191	3,707
PROPRIETORS INCOME		13,924	12,154	12,422	13,811	13,828
FARM PROPRIETORS INCOME		7,948	6,495	6,682	7,847	7,610
NONFARM PROPRIETORS INCOME		5,976	5,659	5,740	5,964	6,218
PROPERTY INCOME		12,309	12,973	15,[illegible]79	15,074	19,977
TRANSFER PAYMENTS		4,862	5,724	6,196	7,639	9,205
LESS: PERSONAL CONTRIBUTIONS FOR SOCIAL INSURANCE		2,583	2,643	3,003	3,245	3,592
TOTAL EARNINGS	2/	57,427	56,354	60,704	65,024	68,804
FARM EARNINGS		9,192	7,792	8,116	9,316	9,109
TOTAL NONFARM EARNINGS		48,235	48,562	52,588	55,708	59,695
GOVERNMENT EARNINGS		8,618	9,189	9,315	10,333	11,070
TOTAL FEDERAL		3,884	4,132	3,887	4,187	4,361
FEDERAL CIVILIAN		3,556	3,791	3,487	3,759	3,889
MILITARY		328	341	400	428	472
STATE AND LOCAL		4,734	5,057	5,428	6,146	6,709
PRIVATE NONFARM EARNINGS		39,617	39,373	43,273	45,375	48,625
MANUFACTURING		23,411	22,286	24,967	26,664	27,983
MINING		92	15	22	--	--
CONTRACT CONSTRUCTION		2,494	3,015	3,530	2,827	3,120
TRANS,COMMUN.CATION,AND PUBLIC UTILITIES		1,149	1,396	1,449	1,629	1,832
WHOLESALE AND RETAIL TRADE		6,518	6,309	6,695	7,072	7,835
FINANCE, INSURANCE, AND REAL ESTATE		925	839	933	1,011	1,105
SERVICES		4,933	5,272	5,534	6,290	6,626
OTHER		215	241	143	122	124

1/ PRIMARY SOURCE FOR PRIVATE NON-FARM WAGES: UTAH DEPT. OF EMPLOYMENT SECURITY
2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

-- INSUFFICIENT DATA

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE 5.0C P

TABLE H.24

EARNINGS BY BROAD INDUSTRIAL SECTOR

(Location Quotient for Total Earnings)

BOX ELDER, UTAH

JULY 19, 1973

	1967	1968	1969	1970	1971
FARM EARNINGS	4.5874	4.3219	4.0595	4.4781	4.2972
TOTAL NONFARM EARNINGS	.8703	.8902	.8980	.8890	.8954
GOVERNMENT EARNINGS	.9053	.9623	.9082	.8998	.8939
TOTAL FEDERAL	.9441	1.0152	.9065	.8957	.8892
FEDERAL CIVILIAN	1.4329	1.5400	1.3411	1.2844	1.2418
MILITARY	.2007	.2140	.2374	.2444	.2674
STATE AND LOCAL	.8738	.9238	.9095	.9026	.8970
PRIVATE NONFARM EARNINGS	.8632	.8748	.8934	.8817	.8958
MANUFACTURING	1.3863	1.3466	1.4149	1.4757	1.5192
MINING	.0849	.0294	.0412	--	--
CONTRACT CONSTRUCTION	.7331	.8946	.9433	.6591	.7248
TRANS,COMMUNICATION,AND PUBLIC UTILITIES	.2874	.3589	.3444	.3535	.3674
WHOLESALE AND RETAIL TRADE	.6817	.6776	.6713	.6574	.6841
FINANCE, INSURANCE, AND REAL ESTATE	.2813	.2838	.2967	.3016	.2998
SERVICES	.5920	.6442	.6191	.6352	.6278
OTHER	1.4138	1.5357	.8000	.6552	.6207

2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

-- INSUFFICIENT DATA

TABLE 5.06 P

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

Best Available Copy

TABLE H.25

PERSONAL INCOME BY MAJOR SOURCES AND EARNINGS BY BROAD INDUSTRIAL SECTOR

(Thousands of Dollars)

JUAB, UTAH

JULY 19, 1973

		1967	1968	1969	1970	1971
TOTAL PERSONAL INCOME		11,434	11,907	12,585	13,394	14,002
TOTAL WAGE AND SALARY DISBURSEMENTS	1/	6,763	6,990	7,617	7,824	8,157
OTHER LABOR INCOME		410	434	531	581	681
PROPRIETORS INCOME		1,993	1,907	1,751	1,801	1,587
FARM PROPRIETORS INCOME		958	789	729	798	515
NONFARM PROPRIETORS INCOME		1,035	1,118	1,022	1,003	1,072
PROPERTY INCOME		1,593	1,716	1,829	1,996	2,115
TRANSFER PAYMENTS		1,065	1,275	1,315	1,676	1,984
LESS: PERSONAL CONTRIBUTIONS FOR SOCIAL INSURANCE		390	415	458	484	522
TOTAL EARNINGS	2/	9,166	9,331	9,899	10,206	10,425
FARM EARNINGS		1,103	940	895	969	688
TOTAL NONFARM EARNINGS		8,063	8,391	9,004	9,237	9,737
GOVERNMENT EARNINGS		1,457	1,552	1,661	1,886	2,021
TOTAL FEDERAL		287	308	329	383	386
FEDERAL CIVILIAN		238	258	271	318	314
MILITARY		49	50	58	65	72
STATE AND LOCAL		1,170	1,244	1,332	1,503	1,635
PRIVATE NONFARM EARNINGS		6,606	6,839	7,343	7,351	7,716
MANUFACTURING		2,493	(D)	(D)	(D)	(D)
MINING		1,632	1,681	1,798	2,040	2,005
CONTRACT CONSTRUCTION		98	275	172	179	220
TRANS.,COMMUNICATION,AND PUBLIC UTILITIES		372	373	347	386	415
WHOLESALE AND RETAIL TRADE		1,286	1,453	1,481	1,621	1,692
FINANCE, INSURANCE, AND REAL ESTATE		99	101	91	96	136
SERVICES		570	609	597	600	691
OTHER		56	(D)	(D)	(D)	(D)

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

1/ PRIMARY SOURCE FOR PRIVATE NON-FARM WAGES: UTAH DEPT. OF EMPLOYMENT SECURITY
2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

TABLE 5.00 P

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE H.26

EARNINGS BY BROAD INDUSTRIAL SECTOR

(Location Quotient for Total Earnings)

JUAB, UTAH

JULY 19, 1973

	1967	1968	1969	1970	1971
FARM EARNINGS	3.4470	3.1469	2.7311	2.4656	2.1222
TOTAL NONFARM EARNINGS	.9119	.9290	.9407	.9390	.9640
GOVERNMENT EARNINGS	.9590	.9817	.9935	1.0464	1.0772
TOTAL FEDERAL	.4372	.4971	.4703	.5216	.5189
FEDERAL CIVILIAN	.6019	.6316	.6402	.6933	.6615
MILITARY	.1866	.1895	.2122	.2370	.2674
STATE AND LOCAL	1.3531	1.3728	1.3693	1.4069	1.4425
PRIVATE NONFARM EARNINGS	.9018	.9176	.9298	.9102	.9381
MANUFACTURING	.9249	(D)	(D)	(D)	(D)
MINING	16.7925	17.6667	18.3093	19.9900	19.8247
CONTRACT CONSTRUCTION	.1807	.4933	.2820	.2790	.3376
TRANS,COMMUNICATION,AND PUBLIC UTILITIES	.5833	.5789	.5058	.5324	.5497
WHOLESALE AND RETAIL TRADE	.8426	.9419	.9130	.9595	.9748
FINANCE, INSURANCE, AND REAL ESTATE	.2109	.2057	.1773	.1829	.2421
SERVICES	.4287	.4494	.4094	.3886	.4322
OTHER	2.1034	(D)	(D)	(D)	(D)

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

TABLE 5.06 P

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE H.27

PERSONAL INCOME BY MAJOR SOURCES

AND EARNINGS BY BROAD INDUSTRIAL SECTOR

(Thousands of Dollars)

SALT LAKE CITY-OGDEN, UTAH NOVEMBER 27, 1973

		1967	1968	1969	1970	1971
TOTAL PERSONAL INCOME		1,957,138	2,106,160	2,270,377	2,516,329	2,761,406
TOTAL WAGE AND SALARY DISBURSEMENTS	1/	1,429,384	1,545,161	1,680,133	1,840,753	2,021,524
OTHER LABOR INCOME		62,.72	71,167	81,587	94,696	111,041
PROPRIETORS INCOME		145,463	146,591	147,320	151,126	157,890
FARM PROPRIETORS INCOME		8,201	8,598	10,339	12,008	12,143
NONFARM PROPRIETORS INCOME		137,262	137,993	136,981	139,118	145,747
PROPERTY INCOME		252,418	258,158	277,121	310,060	326,843
TRANSFER PAYMENTS		142,640	164,468	183,722	220,528	257,029
LESS: PERSONAL CONTRIBUTIONS FOR SOCIAL INSURANCE		74,939	81,365	90,506	100,834	112,921
TOTAL EARNINGS	2/	1,637,019	1,762,919	1,909,040	2,086,575	2,290,455
FARM EARNINGS		11,176	11,692	13,757	15,506	15,708
TOTAL NONFARM EARNINGS		1,625,843	1,751,227	1,895,283	2,071,069	2,274,747
GOVERNMENT EARNINGS		492,516	533,819	567,590	617,419	690,623
TOTAL FEDERAL		328,884	356,132	372,591	394,272	445,755
FEDERAL CIVILIAN		290,620	313,299	327,787	332,896	397,543
MILITARY		38,264	42,833	44,804	61,376	48,212
STATE AND LOCAL		163,632	177,687	194,999	223,147	244,868
PRIVATE NONFARM EARNINGS		1,133,327	1,217,408	1,327,693	1,453,650	1,584,124
MANUFACTURING		248,083	244,893	282,971	308,503	326,527
MINING		(D)	(D)	(D)	(D)	(D)
CONTRACT CONSTRUCTION		87,979	87,654	95,362	107,550	132,728
TRANS, COMMUNICATION, AND PUBLIC UTILITIES		154,295	162,576	174,785	188,569	208,960
WHOLESALE AND RETAIL TRADE		309,824	321,426	349,651	376,209	408,919
FINANCE, INSURANCE, AND REAL ESTATE		80,445	86,538	(D)	101,060	111,413
SERVICES		211,763	234,360	254,137	287,907	315,037
OTHER		(D)	(D)	(D)	(D)	(D)

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

1/ PRIMARY SOURCE FOR PRIVATE NON-FARM WAGES: UTAH DEPT. OF EMPLOYMENT SECURITY
2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

TABLE 5.00 P

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE H.28

EARNINGS BY BROAD INDUSTRIAL SECTOR

(Location Quotient for Total Earnings)

SALT LAKE CITY-OGDEN, UTAH — NOVEMBER 27, 1973

	1967	1968	1969	1970	1971
FARM EARNINGS	.1946	.2063	.2175	.2313	.2219
TOTAL NONFARM EARNINGS	1.0291	1.0262	1.0268	1.0254	1.0250
GOVERNMENT EARNINGS	1.8148	1.7875	1.7602	1.6755	1.6750
TOTAL FEDERAL	2.8059	2.7978	2.7649	2.6287	2.7293
FEDERAL CIVILIAN	4.1288	4.0664	4.0117	3.7578	3.8154
MILITARY	.8239	.8526	.8453	.7333	.8140
STATE AND LOCAL	1.2604	1.0381	1.0387	1.0210	.9834
PRIVATE NONFARM EARNINGS	.8662	.8647	.8716	.8803	.8767
MANUFACTURING	.5165	.5111	.5084	.5322	.5327
MINING	(D)	(D)	(D)	(D)	(D)
CONTRACT CONSTRUCTION	.9071	.8311	.8104	.8401	.9264
TRANS,COMMUNICATION,AND PUBLIC UTILITIES	1.3920	1.3143	1.3199	1.2732	1.2583
WHOLESALE AND RETAIL TRADE	1.1039	1.1028	1.1150	1.0894	1.0721
FINANCE, INSURANCE, AND REAL ESTATE	.9592	.9352	(D)	.9518	.9050
SERVICES	.8918	.9147	.9111	.9121	.8963
OTHER	(D)	(D)	(D)	(D)	(D)

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

TABLE 5.06 P

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE H.29

TOTAL EARNINGS BY BROAD INDUSTRIAL SECTOR

(Thousands of Dollars)

TOOELE, UTAH | SEPTEMBER 29, 1973

	1967	1968	1969	1970	1971
TOTAL EARNINGS	72,347	78,394	79,228	80,238	80,049
FARM EARNINGS	507	402	636	714	677
TOTAL NONFARM EARNINGS	71,840	77,992	78,592	79,524	79,372
GOVERNMENT EARNINGS	57,812	61,479	60,690	61,979	59,889
TOTAL FEDERAL	53,877	57,383	56,336	57,116	54,640
FEDERAL CIVILIAN	48,475	51,897	53,078	55,003	52,844
MILITARY	5,402	5,456	3,258	2,113	1,796
STATE AND LOCAL	3,935	4,126	4,354	4,863	5,249
PRIVATE NONFARM EARNINGS	14,028	16,513	17,902	17,545	19,483
MANUFACTURING	3,977	5,052	5,858	6,008	7,173
MINING	1,075	885	873	1,024	1,035
CONTRACT CONSTRUCTION	1,707	2,907	3,067	2,186	2,305
TRANS.,COMMUNICATION,AND PUBLIC UTILITIES	1,415	1,382	1,335	1,497	1,629
WHOLESALE AND RETAIL TRADE	3,206	3,285	3,521	3,580	3,913
FINANCE, INSURANCE, AND REAL ESTATE	362	380	(D)	553	595
SERVICES	2,249	2,584	2,691	2,695	2,827
OTHER	37	38	(D)	2	5

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

TABLE 5.CO P

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

TABLE H.30

EARNINGS BY BROAD INDUSTRIAL SECTOR

(Location Quotient for Total Earnings)

SEPTEMBER 29, 1973

TOOELE, UTAH

	1967	1968	1969	1970	1971
FARM EARNINGS	.2006	.1594	.2417	.2781	.2733
TOTAL NONFARM EARNINGS	1.0289	1.0278	1.0260	1.0239	1.0233
GOVERNMENT EARNINGS	4.8197	4.6293	4.5352	4.3737	4.1567
TOTAL FEDERAL	10.4008	10.1330	10.0722	9.8999	9.5736
FEDERAL CIVILIAN	15.5093	15.1487	15.6519	15.2333	14.5027
MILITARY	2.6303	2.4421	1.4784	.9741	.8682
STATE AND LOCAL	.5769	.5417	.5595	.5708	.6035
PRIVATE NONFARM EARNINGS	.2426	.2637	.2832	.2763	.3085
MANUFACTURING	.1870	.2193	.2542	.2695	.3347
MINING	1.4057	1.1078	1.1340	1.2800	1.3299
CONTRACT CONSTRUCTION	.3986	.6204	.6272	.4437	.4608
TRANS.COMMUNICATION,AND PUBLIC UTILITIES	.2816	.2547	.2435	.2634	[illegible]
WHOLESALE AND RETAIL TRADE	.2661	.2535	.2702	.2695	.2937
FINANCE, INSURANCE, AND REAL ESTATE	.0977	.0914	(D)	.1342	.1378
SERVICES	.2143	.2271	.2308	.2221	.2301
OTHER	.1724	.1786	(D)	--	.0345

(D) NOT SHOWN TO AVOID DISCLOSURE OF DATA FOR INDIVIDUAL REPORTING UNITS. DATA ARE INCLUDED IN TOTALS.

2/ EARNINGS IS THE SUM OF WAGES, OTHER LABOR INCOME AND PROPRIETORS' INCOME

TABLE 5.06 P

-- INSUFFICIENT DATA

REGIONAL ECONOMICS INFORMATION SYSTEM
BUREAU OF ECONOMIC ANALYSIS

APPENDIX I

LABOR FORCE STATISTICS

Carson City, Nevada

Churchill County, Nevada

Douglas County, Nevada

Elko County, Nevada

Las Vegas SMSA, Nevada (Clark County)

Lincoln County, Nevada

Lyon County, Nevada

Nye County, Nevada

Reno SMSA, Nevada (Washoe County)

Storey County, Nevada

White Pine County, Nevada

TABLE I.1

CARSON CITY WORK FORCE SUMMARY

	1971 Annual Average	1972 Annual Average
Total Work Force	8,770	10,110
Unemployment	880	1,170
Percent of Work Force	10.1%	11.6%
Total Employment	7,880	8,940
Nonagricultural Wage and Salary	6,740	7,680
All Other Nonagricultural Employment	1,130	1,250
Agricultural	*	*
Persons Involved in Work Stoppages	0	0
Total All Industries	6,740	7,680
Mining	30	50
Contract Construction	400	530
Manufacturing	290	390
Transportation and Public Utilities	230	230
Trade	980	1,140
Finance, Insurance and Real Estate	160	190
Service Industries	1,080	1,370
Government	3,570	3,780

*Less than 10.

TABLE I.2

CHURCHILL COUNTY WORK FORCE SUMMARY

	1971 Annual Average	1972 Annual Average
Total Work Force	3,840	3,950
Unemployment	390	340
Percent of Work Force	10.0%	8.5%
Total Employment	3,640	3,620
Nonagricultural Wage and Salary	2,330	2,480
All Other Nonagricultural Employment	460	470
Agricultural	670	670
Persons Involved in Work Stoppages	0	0
Total All Industries	2,330	2,480
Mining	*	*
Contract Construction	120	140
Manufacturing	110	120
Transportation and Public Utilities	60	60
Trade	520	540
Finance, Insurance and Real Estate	90	90
Service Industries	450	500
Government	980	1,010

*Less than 10.

TABLE I.3

DOUGLAS COUNTY WORK FORCE SUMMARY

	1971 Annual Average	1972 Annual Average
Total Work Force	10,020	11,180
Unemployment	630	820
Percent of Work Force	6.3%	7.3%
Total Employment	9,380	10,360
Nonagricultural Wage and Salary	7,230	8,060
All Other Nonagricultural Employment	1,850	2,000
Agricultural	300	300
Persons Involved in Work Stoppages	0	0
Total All Industries	7,230	8,060
Mining	10	*
Contract Construction	170	310
Manufacturing	270	310
Transportation and Public Utilities	170	200
Trade	380	420
Finance, Insurance and Real Estate	170	230
Service Industries	5,670	6,190
Government	380	390

*Less than 10.

TABLE I.4

ELKO COUNTY WORK FORCE SUMMARY

	1971 Annual Average	1972 Annual Average
Total Work Force	7,240	7,740
Unemployment	350	420
Percent of Work Force	4.9%	5.5%
Total Employment	6,890	7,320
Nonagricultural Wage and Salary	5,170	5,570
All Other Nonagricultural Employment	770	800
Agricultural	950	950
Persons Involved in Work Stoppages	0	0
Total All Industries	5,170	5,570
Mining	80	70
Contract Construction	270	400
Manufacturing	50	80
Transportation and Public Utilities	650	670
Trade	1,130	1,240
Finance, Insurance and Real Estate	210	170
Service Industries	1,480	1,580
Government	1,290	1,360

TABLE I.5

LAS VEGAS WORK FORCE SUMMARY

(All Entries in Thousands Except for Percentages)

	1971 Annual Average	1972 Annual Average
Civilian Work Force	133.3	141.1
Unemployment	9.2	10.1
Percent of Work Force	6.9%	7.2%
Unemployment Rate (Seasonally Adjusted)	6.9%	7.2%
Employment Total	124.1	130.7
Nonagricultural Wage and Salary	113.8	120.2
Mining	0.1	0.1
Contract Construction	7.5	7.8
Manufacturing	4.0	4.2
Durable Goods	2.0	2.1
Stone, Clay and Glass	0.7	0.8
Non-Durable Goods	2.0	2.1
Food Products	0.6	0.6
Printing and Publishing	0.9	0.9
Chemicals	0.5	0.5
Transportation and Public Utilities	7.5	7.6
Transportation	3.9	3.9
Railroad	0.5	0.5
Air	1.0	1.1
Public Utilities	3.6	3.7
Total Trade	21.3	22.9
Wholesale	2.9	3.1
Retail	18.4	19.8
General Merchandise and Apparel	4.5	4.6
Eating and Drinking Places	4.7	5.0

TABLE I.5 (Cont.)

	1971 Annual Average	1972 Annual Average
Finance, Insurance and Real Estate	4.8	5.4
Finance	2.0	2.3
Service Industries	52.1	54.9
Hotels, Gaming and Recreation	33.0	35.5
Personal	2.4	2.4
Business	8.1	7.7
Government	16.5	17.3
Federal	4.1	4.1
State and Local	12.4	13.2
Education--State and Local	6.0	6.3
All Other Nonagricultural Employment	10.0	10.2
Agricultural	0.3	0.3
Persons Involved in Work Stoppages	0	0.3

TABLE I.6

LINCOLN COUNTY WORK FORCE SUMMARY

	1971 Annual Average	1972 Annual Average
Total Work Force	1,010	1,040
Unemployment	80	110
Percent of Work Force	7.7%	10.7%
Total Employment	930	930
Nonagricultural Wage and Salary	620	600
All Other Nonagricultural Employment	100	90
Agricultural	220	230
Persons Involved in Work Stoppages	0	0
Total All Industries	620	610
Mining	30	30
Contract Construction	10	20
Manufacturing	*	*
Transportation and Public Utilities	80	70
Trade	120	120
Finance, Insurance and Real Estate	*	*
Service Industries	80	70
Government	280	280

*Less than 10.

TABLE I.7

LYON COUNTY WORK FORCE SUMMARY

	1971 Annual Average	1972 Annual Average
Total Work Force	3,140	3,050
Unemployment	310	290
Percent of Work Force	10.0%	9.4%
Total Employment	2,830	2,760
Nonagricultural Wage and Salary	2,110	2,070
All Other Nonagricultural Employment	300	280
Agricultural	420	420
Persons Involved in Work Stoppages	*	0
Total All Industries	2,110	2,070
Mining	650	610
Contract Construction	110	70
Manufacturing	220	230
Transportation and Public Utilities	100	80
Trade	380	390
Finance, Insurance and Real Estate	20	20
Service Industries	140	140
Government	500	530

*Less than 10.

TABLE I.8

NYE COUNTY WORK FORCE SUMMARY

	1971 Annual Average	1972 Annual Average
Total Work Force	7,490	6,580
Unemployment	100	100
Percent of Work Force	1.3%	1.5%
Total Employment	7,390	6,490
Nonagricultural Wage and Salary	6,100	5,360
All Other Nonagricultural Employment	1,080	920
Agricultural	210	210
Persons Involved in Work Stoppages	0	0
Total All Industries	6,100	5,360
Mining	320	330
Contract Construction	110	110
Manufacturing	10	20
Transportation and Public Utilities	90	110
Trade	250	270
Finance, Insurance and Real Estate	20	30
Service Industries	4,820	4,040
Government	480	460

TABLE I.9

RENO WORK FORCE SUMMARY

(All Entries in Thousands Except for Percentages)

	1971 Annual Average	1972 Annual Average
Civilian Work Force	71.3	76.0
Unemployment	3.7	4.4
Percent of Work Force	5.2%	5.8%
Unemployment Rate (Seasonally Adjusted)	5.2%	5.8%
Employment Total	67.6	71.6
Nonagricultural Wage and Salary	60.3	64.1
Mining	0.3	0.2
Contract Construction	4.1	4.7
Manufacturing	3.2	3.6
Durable Goods	1.9	2.2
Non-Durable Goods	1.3	1.4
Transportation and Public Utilities	4.7	5.1
Transportation	2.4	2.6
Railroad	0.6	0.6
Transportation Exc. Railroads	1.8	2.0
Public Utilities	2.3	2.5
Total Trade	13.2	14.2
Wholesale	3.3	3.5
Retail	9.9	10.7
General Merchandise and Apparel	2.3	2.5
Eating and Drinking Places	2.4	2.7
Finance, Insurance and Real Estate	3.4	3.6
Service Industries	21.0	21.7
Hotels, Gaming and Recreation	13.7	13.6
Personal	1.1	1.1

TABLE I.9 (Cont.)

	1971 Annual Average	1972 Annual Average
Government	10.4	11.0
Federal	1.8	1.9
State and Local	8.6	9.1
Education--State and Local	4.7	5.0
All Other Nonagricultural Employment	7.1	7.3
Agricultural	0.2	0.2
Persons Involved in Work Stoppages	0	0

TABLE I.10

STOREY COUNTY WORK FORCE SUMMARY

	1971 Annual Average	1972 Annual Average
Total Work Force	450	450
Unemployment	60	60
Percent of Work Force	13.7%	12.3%
Total Employment	390	390
Nonagricultural Wage and Salary	310	310
All Other Nonagricultural Employment	80	80
Agricultural	10	*
Persons Involved in Work Stoppages	0	0
Total All Industries	310	310
Mining	60	60
Contract Construction	10	*
Manufacturing	*	*
Transportation and Public Utilities	50	40
Trade	90	110
Finance, Insurance and Real Estate	10	0
Service Industries	30	30
Government	50	50

*Less than 10.

TABLE I.11

WHITE PINE COUNTY WORK FORCE SUMMARY

	1971 Annual Average	1972 Annual Average
Total Work Force	4,580	4,560
Unemployment	240	270
Percent of Work Force	5.1%	5.9%
Total Employment	4,250	4,290
Nonagricultural Wage and Salary	3,660	3,710
All Other Nonagricultural Employment	320	320
Agricultural	270	270
Persons Involved in Work Stoppages	90	0
Total All Industries	3,660	3,710
Mining	1,090	1,020
Contract Construction	140	190
Manufacturing	390	450
Transportation and Public Utilities	170	190
Trade	740	720
Finance, Insurance and Real Estate	50	60
Service Industries	360	390
Government	740	720

APPENDIX J

ATC LETTERS OF AGREEMENT

The airport towers at Nellis AFB, McCarran International, and North Las Vegas operate in close proximity to each other. In order to facilitate a safe and efficient ATC operation at each airport, each tower operator must understand the operations of the other towers. The three towers must operate as a team. This teamwork is formalized through the medium of letters of agreement between the towers (or other ATC facilities in question). Nellis AFB tower and McCarran International tower share several letters of agreement on ATC procedure and responsibility. These agreements are in a continual process of updating, and are as detailed as necessary to resolve questions of safety. Presently, letters of agreement between Nellis and the other towers are being revised and so are not reproduced here. However, North Las Vegas tower and McCarran International tower also share letters of agreement. An example is reproduced below.

LETTER OF AGREEMENT

EFFECTIVE: 1 February 1970

SUBJ: Coordination Procedures

1. PURPOSE. This Agreement establishes standard procedures for coordination of air traffic between Las Vegas Tower and Hughes Tower. This Agreement is supplementary to procedures contained in Handbook 7110.8A.

2. PROCEDURES.

a. Las Vegas Tower shall be responsible for effecting coordination of McCarran traffic with Hughes Tower as follows:

(1) Las Vegas Tower shall keep Hughes Tower advised of all known arriving and departing traffic operating below 5,000 MSL that will proceed within a two mile radius of North Las Vegas Air Terminal.

(2) Las Vegas Tower shall effect coordination at any other time it is deemed necessary or advisable to insure or avoid possible traffic confliction between McCarran and North Las Vegas Air Terminal traffic.

b. Hughes Tower shall be responsible for effecting coordination of North Las Vegas Air Terminal traffic with Las Vegas Tower as follows:

(1) Hughes Tower shall keep Las Vegas Tower advised of all known arriving or departing traffic that will be proceeding through the McCarran control zone.

(2) Hughes Tower shall effect coordination at any other time it is deemed necessary or advisable to insure safety or avoid possible conflictions between North Las Vegas Air Terminal and McCarran traffic.

(3) Hughes Tower shall advise Las Vegas Tower when the operating status of the Hughes Tower will be other than the published hours.

APPROVED:

signed	signed
J. M. Triolo General Manager Hughes Nevada Airport Operations	Ralph R. Petersen Chief Las Vegas Tower Federal Aviation Administration

APPENDIX K

INFORMATION PROGRAM 74-2 FOR THE PROPOSED COR

In accordance with the provisions of Air Force Regulations 12-30, Disclosure of Records; 190-12, Release of Unclassified Information to the Public; and 19-1, Pollution Abatement and Environmental Quality; the Secretary of the Air Force Office of Information published Information Program 74-2, PROJECT COR. This plan states, "...it is the obligation of the Air Force to provide the public with accurate, timely information about its programs and activities at the earliest practicable moment in the planning process."

In addition, this information program is designed to achieve the specific information goals outlined in the Freedom of Information Act, the National Environmental Policy Act, the Intergovernmental Cooperation Act, the Demonstration Cities and Metropolitan Development Act, Executive Order 11514 (Protection and Enhancement of Environmental Quality), Office of Management and Budget Circular A-95, and the Council on Environmental Quality's Preparation of Environmental Statements: Guidelines.

Information Program 74-2, PROJECT COR (see Attachment 1), sets forth three basic objectives:

"a. To provide the general public and specific interest groups full and factual information, consistent with national security considerations, on activities associated with the development and operation of the proposed Continental Operations Range (COR).

"b. To insure that all [Air Force] agencies involved in the development and operation of the proposed COR act in concert in carrying out public affairs activities related to it.

"c. To help develop public understanding of the proposed Continental Operations Range (COR) and what COR's mission would be in the event that a final determination to proceed with the project is made."

The information program was distributed to all of those government agencies thought to have an interest in the development of the project, as well as to the military services, private individuals and organizations. (The initial distribution list can be found on the last nine pages of Attachment 1.)

Information Program 74-2, PROJECT COR, assigns the 57th

Fighter Weapons Wing (FWW) Office of Information (OI), Nellis Air Force Base, Nevada, primary responsibility for informing the public of the activities and development of the proposed COR (by using all available communication channels). Thus far, the Office of Information has employed two primary means: briefings and news releases. (Attachment 2 is a sample news release.)

By May of 1974, the 57th FWW/OI had briefed 19 private and governmental organizations with a total audience of almost one thousand attendees. Organizational interests ranged from community service, environmental protection, military affairs, law, state and county government, wildlife conservation, regional planning, community economics to aviation. The Nevada, Utah and California groups numbered from 15 to 130 people. In most cases, local news media representatives were invited to attend these briefings and to question directly the COR Group Commander or his representatives.

The groups included governors, state legislators, county commissioners, mayors, judges, district attorneys, chiefs of police, directors or administrators of pollution abatement, wildlife, reclamation, highway, recreation, aviation, health, education, land planning and fish and game departments. The briefings were designed to inform the audience of the Air Force's proposal to develop COR.

The 57th FWW/OI also sent out general news releases and answered press queries received at the briefings and at the Office of Information at Nellis AFB. (See Attachment 3, news clippings pertaining to COR.)

In addition, the public was informed of the proposed development plans for COR when the Air Force published its notice of intent to prepare an environmental impact statement in the Federal Register on 16 November 1973 (see Attachment 4).

Information Program 74-2 also tasked the 57th FWW/OI to provide all requesting individuals, groups or agencies with copies of the Draft Environmental Statement (DES) when it is released and to insure that the public is informed of its availability for public comment (this is in addition to the copies normally circulated to various agencies, etc.).

As of 17 May 1974, the 57th FWW/OI had received no formal complaints from the groups, individuals or agencies briefed by its staff or from those who had learned of the COR proposal via their local news media.

4 Attachments
1. Information Program 74-2, PROJECT COR
2. Sample News Release
3. News Clippings
4. Federal Register Item

HEADQUARTERS, UNITED STATES AIR FORCE
WASHINGTON, D.C. 20330

1 JANUARY 1974

INFORMATION PROGRAM 74-2

CLASSIFICATION: Unclassified

TITLE: PROJECT COR

REFERENCES:

A. HQ USAF Program Management Directive (PMD) R-Q 3-078-(1), Continental Operations, 14 June 1973.

B. DOD/DDR&E Development Concept Paper (DCP) #111, approved 17 August 1973.

C. TAC AFCOR Development Plan 72-1, 31 July 1972.

D. TAC Concept of Operations for the Continental Operations Range (COR), 20 July 1973.

E. SAF/OI letter to TAC/OI, 21 August 1973.

F. CSAF/RDQ message 091715Z NOV 73, Continental Operations Range (COR) Interim Direction.

G. AFR 190-41, USAF Information Program

H. AFM 190-9, Information Policies and Procedures

I. TAC Programming Plan 11-73, Near-Term Continental Operations Range (COR) Program, 14 Nov. 1973

Ohhl

J. AFR 19-1, Pollution Abatement and Environmental Quality.

K. AFR 19-2, Environmental Assessments and Statements.

L. General Brown's letter on AFTEC, dated 24 November 73.

M. General Brown's letter to Lt General Evans, subject COR, dated 24 November 73.

N. AFR 12-30, Disclosure of Air Force Records.

O. AFR 190-12, Release of Unclassified Information to the Public.

P. AFR 190-17, Review and Clearance of Department of the Air Force Information.

Q. "Implementation of Office of Management and Budget (OMB) Circular A-95," dated August 7, 1973, signed by Major General M. R. Reilly, Director of Civil Engineering, Hq USAF.

R. "Environmental and Land Use Planning: Information Officers' Responsibilities," dated November 28, 1973, signed by Major General Robert N. Ginsburgh, Director of Information, Office of the Secretary of the Air Force, Hq. USAF.

S. Preparation of Environmental Impact Statements: Guidelines, Council on Environmental Quality, August 1, 1973.

T. AFM 55-2, Procedures for Airspace Assignment and Air Traffic Control Coordination with the Federal Aviation Administratio

1. TASK ORGANIZATIONS:

a. Secretary of the Air Force (SAF/OI)

b. Tactical Air Command (TAC/OI)

c. Air Force Systems Command (AFSC/OI)

d. Air Force Logistics Command (AFLC/OI)

e. Air Force Communications Service (AFCS/OI)

2. OTHER INTERESTED AGENCIES:

a. United States Army: Chief of Information and Commander, Dugway Proving Ground, Utah.

b. United States Navy: Chief of Information and Commanding Officer, Naval Auxiliary Air Station, Fallon, Nevada.

c. Federal Aviation Administration

d. Department of the Interior: Bureau of Land Management

e. Dikewood Corporation

f. Atomic Energy Commission

g. Air Force Test and Evaluation Center (AFTEC)

3. PURPOSE: To provide guidance for the conduct of public affairs activities in support of the proposed Continental Operations Range (COR).

4. OBJECTIVES:

a. To provide the general public and specific interest groups full and factual information, consistent with national security considerations, on activities associated with the development and operation of the proposed Continental Operations Range (COR).

b. To insure that all agencies involved in the development and operation of the proposed COR act in concert in carrying out public affairs activities related to it.

c. To help develop public understanding of the proposed Continental Operations Range (COR) and what proposed COR's mission would be in the event a final determination to proceed with the project is made.

5. SITUATION:

a. Background and Facts:

(1) In early 1966, the Air Force developed a general concept for an integrated air offensive/defensive test environment, versions of which were later known as Advanced Operations War Zone Training Range, HAVE EDGE, Integrated Offensive/Defensive Test Environment, and Continental Operations Range (COR). Numerous Air Force and contractor supported studies were completed and submitted to the Air Staff.

(2) On 15 November 1971, the Director of Defense Research and Engineering (DDR&E) directed the initiation of a Development Concept Paper (DCP) for the Integrated Offensive/Defensive Test

Environment. In the meantime, as a separate but coordinated action, during the summer of 1971, the Office of the Secretary of Defense conducted an extensive review of existing and needed test and evaluation facilities. The study results, approved by Deputy Secretary of Defense David Packard on 29 October 1971, included a proposal for the Continental Operations Range, to be located in the west-central United States. On 5 May 1972, DDR&E tasked the Air Force to complete a DCP on the proposed COR for Air Force oriented operational test and evaluation (OT&E) and training activity. On 6 April 1972, the Operational Concept for the proposed Continental Operations Range was approved by the Air Staff to serve as a guidance document for development of the COR proposal. Tactical Air Command was directed to prepare a plan for the proposed Continental Operations Range, to include near-term improvements for OT&E and training and long-term development. Emphasis was to be placed on an incremental approach within a realistic appraisal of resources. In addition, near-term improvements were to be compatible with long-term proposed COR objectives. The result of this planning effort was TAC AFCOR Development Plan 72-1 (Reference C).

(3) The proposal calls for development of COR in three phases, with the ultimate objective of developing and integrating operations at Nellis, Hill/Wendover/Dugway, and Fallon ranges.

Such an integrated range complex would simulate a realistic offensive and defensive air combat environment in which to conduct OT&E, Development Test and Evaluation (DT&E), and training and tactics development for air warfare elements. While proposed COR near-term development plans are nearly complete, mid- and far-term development plans have yet to be completely defined. The Air Force Systems Command, using normal weapon system acquisition procedures, will complete preparation of the proposed COR development plans.

(a) Proposed near-term development (FY 1974-1975) would establish COR Range Central at Nellis AFB NV and would concentrate on the Nellis area with initial emphasis on Electronic Warfare (EW) and improved OT&E training. The Caliente EW Range is proposed to be instrumented for testing and evaluation with portions of existing equipment relocated to the North Range. The North Range buildup is proposed to consist of EW equipment, improved air-to-ground and air-to-air scoring, and updated target complexes. The South Range OT&E capability is proposed to be further improved with additional and updated instrumentation. An initial remotely piloted vehicle (RPV) test and evaluation capability and improved training operations would also be included. High speed tracks in addition to data links are proposed to link the Nellis/Wendover/Dugway terminal areas.

(b) Proposed mid-term development (FY 1977-1979) would expand COR data control and exercise management and concentrate on the Wendover/Dugway area. An instrumented threat environment with displays at Hill AFB UT is proposed for establishment as requirements are identified. Expanded radar coverage of the high speed tracks and data link coverage are proposed to integrate the Nellis/Wendover/Dugway terminal areas and the airspace between them. Proposed expanded RPV operations will include drone/target launch and recovery facilities at Michael AAF.

(c) Proposed long-term development (FY 1979-1983) would update the simulated threat environment and data management facilities at Nellis and Wendover/Dugway. The Fallon terminal area may be tied into the Nellis/Wendover/Dugway COR through an additional corridor and could be used as a defensive/offensive base through mutual agreements with the U.S. Navy.

(4) Proposed COR would accommodate all types of weapons employment involving supersonic/subsonic, air-to-air, air-to-ground, electronic warfare, remotely piloted vehicles, reconnaissance, helicopter, and airlift missions. These missions would be conducted during both day and night, all-weather range conditions. The facility would support live, inert, captive

and simulated weapons deliveries. Proposed COR activities would include OT&E, DT&E, and training and tactics development for such Air Force missions as tactical and strategic offense, air defense, search and rescue, airlift, and command and control. The proposed COR would be used for large numbers of test/ training sorties against sub-elements of the facility and eventually combat evaluation exercises against the full facility. Some specialized and highly instrumented tests would be conducted on selected portions of the range. Subsequent analysis of data derived from the full spectrum test, evaluation, and/or training operations will produce the essential quantitative information to determine the degree of success or failure predicted from systems/force employment. Selected logistical data would also be collected to develop future resource requirements.

(5) Training analysis and development using the COR would provide a unique training capability for operational commands to better train aircrews in semi-realistic threat environments, provide real-time displays to ground observers, and employ the special proposed COR data processing facilities to analyze and evaluate the results of the training. Also, the COR would be used to determine optimum training methods, techniques, and standards to be used in aircrew training.

(a) The COR would not have the capability to provide training for every aircrew. Each base would retain its own training ranges to perform normal training missions. Operational units based in close proximity would, however, have the opportunity to use the COR.

(b) Large scale exercises are a major component of training and evaluation and, as such, would be conducted on the COR.

(6) Actions taken in connection with development of the proposed COR shall be in accordance with the provisions of the National Environmental Policy Act, as implemented by References J and K. Specifically, planning for development of the proposed COR will involve consideration of the environmental consequences of all proposed actions prior to any final determination to proceed with the project.

(a) Reference A tasked Air Force Systems Command with preparation of an Environmental Impact Statement (EIS) for the proposed COR.

(b) AFSC awarded a contract to Dikewood Corporation which in turn subcontracted General Research Corporation to assist the Air Force in preparation of a draft EIS.

(c) Preparation of the EIS is expected to proceed in accordance with the schedule contained in Reference F, with the final EIS to be submitted to the Council on Environmental Quality on 15 July 1974.

(7) Actions taken in connection with the organization of airspace for proposed COR operations will be in accordance with applicable Federal Air Regulations.

b. Policy:

(1) In accordance with the provisions of the Public Information Principles issued by the Secretary of Defense and AFR 190-12, and the National Environmental Policy Act (42 USC 4321), it is the obligation of the Air Force to provide the public with accurate, timely information on its programs and activities at the earliest practicable moment in the planning process. Consequently, information on the proposed COR will be made available to the public and the news media, unless classified or otherwise exempted from mandatory release under exceptions of the Freedom of Information Act (5 USC 552) and AFR 12-30 and a significant reason exists for withholding information.

6. ASSUMPTIONS:

a. Near-term planning actions for the proposed COR will proceed in accordance with the schedule outlined in Reference F, as amended by the proposed COR Program Management Directive.

b. Civil aviation and environmental interest groups; local, regional, and state officials; the general public in the area adjacent to the proposed COR sites; and news media representatives can be expected to evidence considerable interest in the proposed COR project.

7. RESPONSIBILITIES:

a. Secretary of the Air Force Office of Information (SAF/OI) will:

(1) Provide overall guidance to all agencies concerned regarding public affairs aspects of the proposed COR.

(2) Coordinate public affairs activities in support of the proposed COR with other interested Air Staff agencies, the Office of the Assistant Secretary of Defense, Public Affairs (OASD/PA), other military services, and other government agencies, as required.

(3) Inform AFSC/OI and TAC/OI and other interested commands/agencies of Air Staff actions affecting the proposed COR, which have public affairs implications.

b. TAC/OI and AFSC/OI have joint responsibility for public affairs activities in support of the proposed COR. AFSC/OI will be responsible for those events that are linked to the acquisition phase for COR, should a final decision to proceed with the project be made. TAC/OI will be responsible for those events associated with the existing test facilities the Air Force proposes to dedicate to COR, TAC programs, and day-to-day operations. In all cases where responsibility is not clearly delineated, AFSC/OI and TAC/OI will consult each other to determine who will assume the primary responsibility for the case in question.

c. TAC/OI will:

(1) Provide guidance and direction to the 57th FWW/OI relative to public affairs aspects of the proposed COR.

(2) Establish, within TAC/OI, a point of contact for proposed COR public affairs matters.

(3) Coordinate proposed COR public affairs activities with other MAJCOMs/OI, and SAF/OI. Obtain security review clearance as required by AFR 190-17.

d. AFSC/OI, AFLC/OI, and AFCS/OI will:

(1) Establish a point of contact for proposed COR public affairs matters within the MAJCOM/OI and subordinate units/OI, as appropriate.

(2) Coordinate proposed COR public affairs activities with SAF/OI, TAC/OI, and/or the 57th FWW/OI, as appropriate. Obtain security review clearance as required by AFR 190-17.

(3) Inform TAC/OI, SAF/OI, and/or the 57th FWW/OI of all matters impacting on the proposed COR public affairs program/activities.

(4) Provide public affairs support for proposed COR, as requested.

(5) Maintain liaison with respective major command staff agencies on all matters impacting on the proposed COR public affairs program/activities.

e. 57 FWW/OI will:

(1) Serve as the releasing authority for public releases originated for proposed COR.

(2) Assist the COR Group in providing necessary information to local and regional news media and community groups, opinion leaders, and governmental officials.

(3) Provide such other support as may be requested by the COR Group.

(4) Be the central point of contact for all public affairs activities in support of the proposed COR.

(5) Serve as a member of the COR Group Commander's taff, providing advice and counsel to the Commander and other taff members on public affairs aspects of the proposed COR.

(6) Coordinate proposed COR public affairs activities, ncluding releases of regional/national scope with TAC/OI, AF/OI, and/or other agencies, as appropriate.

(7) Develop and maintain a slide briefing on the pro-os:d COR for presentation to interested audiences, military nd civilian, in accordance with Reference F.

(8) Announce availability of slide briefing, should ny interested group desire to hear it.

(9) Identify any groups interested in environmental atters; interested governmental agencies at all levels of overnment; or other organizations which might desire informa-:ion about COR, and offer to make information available to hem. This effort will be made to assure compliance with OMB :ircular A-95 and AFR 19-1, Pollution Abatement and Environ-iental Quality.

(10) Develop a schedule to accommodate as rapidly as ossible groups requesting the slide briefing.

(11) Present the slide briefing to requesting groups or arrange for qualified speakers from the COR Group to present the slide briefing.

(12) Develop public releases on the proposed COR, and respond to queries, as required. Obtain security review as required by AFR 190-17.

(13) Monitor EIS and airspace proposal actions related to the proposed COR. Insure that substantial comments received from the public are shared with all agencies involved in the preparation of the Airspace Proposal and the EIS in sufficient time to be considered along with all other COR related data.

(14) Recommend changes to this Program to SAF/OI through TAC/OI.

(15) Through 57 FWW/OI, TAC/OI, and SAF/OI, keep internal audiences informed of the proposed COR.

(16) Establish contact and a working relationship with the Dikewood Corporation so that a system of cross-information on the progress of the EIS is accomplished. The efforts of the 57th FWW/OI and others in their public affairs role are to be recorded and made part of the EIS (listing the favorable and

unfavorable comments and how the COR staff attempted to answer these comments). This task is to be concluded upon completion of the draft EIS.

(17) Queries or requests for information pertaining to possible FAA rulings on the Airspace Proposal in support of proposed COR will be referred to and coordinated with the Air Force Representative to the FAA Western Region in Los Angeles, California, Autovon 898-3875. (See AFM 55-2, Chapter 2 for further guidance on the AFRep's duties. In particular, note paragraph 2-3b.)

(18) Identify and insure that environmental protection committees throughout the entire proposed COR region are offered information about the proposed COR program, including the slide briefing.

(19) Perform other such tasks in support of the proposed COR, as may be directed.

(20) Insure that a proposed public news release is prepared and submitted as part of the candidate EIS package. At the time that the draft EIS is released for public comment, insure that local individuals who had expressed an interest in or had commented about the proposed COR Program

are sent a copy of the draft EIS (AF/PREV will make distribution to all other individuals and agencies). Finally, insure local and regional news media promptly are sent a news release announcing the existence and availability of the draft EIS.

8. ADMINISTRATION:

a. This Program is unclassified, and all actions taken to implement this Program will be of an unclassified nature.

b. This Information Program shall remain in effect until it is superseded by publication of an AFSC operation plan. AFSC/OI is responsible for the preparation and publication of a public affairs annex, which will define responsibilities for AFSC/OI and TAC/OI with reference to proposed COR.

c. Information/Public Affairs actions taken in support of the proposed COR will be reported through existing information program report channels, with the exception that special reports may, from time to time, be required.

d. Under the provisions of AFR 190-41, direct communication between Information Officers at all levels is authorized and encouraged in support of this Program. However, direct communication must not be used in any situation where it would interfere with the responsibility and authority of the commander.

e. Department of Defense and Air Force regulations and guidelines will be complied with during execution of this Plan.

f. Proposed participation by news media representatives or dignitaries at other than the local/regional level will be coordinated with SAF/OI through the appropriate MAJCOM.

FOR THE CHIEF OF STAFF

Robert N Ginsburgh

ROBERT N. GINSBURGH
Major General, USAF
Director of Information

2 Atch
1. Annex A, COR Points of Contact
2. Annex Z, Distribution

HEADQUARTERS,UNITED STATES AIR FORCE
WASHINGTON, D.C. 20330

INFORMATION PROGRAM 74-2

ANNEX A - COR POINTS OF CONTACT

AGENCY	NAME	PHONE
SAF/OIC	Capt Angelo J. Cerchione	AV 227-9083
SAF/OIP	Lt Col F. Watkins	AV 227-4496
SAF/OIR	Maj Leo M. Terrill	AV 225-9674
TAC/OIX	Maj Alan G. Schreihofer	AV 432-7751
AFSC/OIP	Lt Col Ernest G. M[illegible]re	AV 858-4135
AFLC/OI	Capt Robert J. O'S[illegible]ch	AV 787-3778
AFCS/OI	Mr. P. Goldberg Capt George T. T[illegible]gue	AV 465-3433 AV 465-3433
OOAMA/OI	Lt Col. E. R. Wolfe	AV 458-5201
Dikewood Corp. General Research	Arve Sjovold	805-969-4539
*57FWW/OI	Maj Walter M. Ryland, III Capt Bobby R. Wright	AV 682-2833 AV 682-2833
AF Rep	Lt Col Robert L. Jenkins	AV 898-3875

*NOTE: The commercial telephone number for the COR Information Officer (57FWW/OI) is AC 702 643-2833 or 643-4479. This number and the Autovon number will change on March 1, 1974. The numbers will be AC 702 643-2750 and Autovon 682-2750.

Atch 1

HEADQUARTERS, UNITED STATES AIR FORCE
WASHINGTON, D.C. 20330

INFORMATION PROGRAM 74-2

ANNEX Z - DISTRIBUTION

Agency	Copies
Secretary of the Air Force Wash DC 20330	
SAF/OI	5
SAF/LL	1
SAF/IL	1
SAF/ILE	1
SAF/GC	1
SAF/RD	2
HQ USAF Wash DC 20330	
AF/IGJ	1
AF/PRCX	1
AF/PREV	1
AF/PRPO	1
AF/RDPQ	1
AF/RDQPS	1
AF/XOOFA	1
AF/XOOWD	1
AF/JAS	1
AF/RDGC	1

Atch 2

Secretary of the Air Force New York Office of Information (SAF/OIN) 663 Fifth Ave. New York, N.Y. 10022	1
Secretary of the Air ' . Midwest Office of Infoi..ation (SAF/OIM) 219 S. Dearborn St., Rm 1936A Chicago, IL 60604	1
Secretary of the Air Force Los Angeles Office of Infor..ation (SAF/OIL) 11000 Wilshire Blvd., Rm 10114 Los Angeles CA 90024	1
ADC Ent AFB CO 80912	
OI	3
DO	1
AFCS Richards-Gebaur AFB MO 64030	
OI	3
XP	1
FF	1
EP	1
AFLC Wright-Patterson AFB OH 45433	
OI	3
XO	1

AFSC
Andrews AFB MD 20331

OI	3
DO	1
VN	1
TAC/LO	1

ATC
Randolph AFB TX 78148

OI	[illegible]
DO	1

AU
Maxwell AFB AL 36112

OI	1
LD	1

AAC
APO Seattle 98742

OI	1

HQ COMD USAF
Bolling AFB DC 20332

OI	1

MAC
Scott AFB IL 62225

OI	1
DO	1

	Copies
PACAF APO San Francisco 96553	
OI	1
DO	1
SAC Offutt AFB NE 68113	
OI	3
DO	1
TAC Langley AFB VA 23665	
OI	10
AD	1
DO	1
AC	1
DR	3
DC	1
DE	1
IN	1
XP	1
SE	1
DP	1
LG	1
JA	1
WE	1
USAFE APO New York 09012	
OI	1
DO	1

	Copies
USAFSS Kelly AFB TX 78243	
OI	1
USAFSO APO New York 09825	
OI	1
AFISC Norton AFB CA 92409	
OI	1
AFMPC Randolph AFB TX 78148	
DPMRCSI	1
DINFOS Ft Benjamin Harrison IN 46216	1
USAFTFWC Nellis AFB NV 89110	
XP	1
COR	3
57 FWW Nellis AFB NV 89110	
OI	3
DOX	1
OOAMA Hill AFB UT 84406	
OI	3
AFSWC Kirtland AFB NM 87117	
OI	3
TE	1
TAC/LO	1

	Copies
RADC Griffiss AFB NY 13441	
IRA	1
OI	1
Department of the Army Wash DC 20310	
CHINFO	2
Department of the Navy Wash DC 20350	
OCINFO	2
Federal Aviation Administration Wash DC 20590	
APA-8	1
AAT-230	1
Atomic Energy Commission Wash DC 20545	1
Department of the Interior Wash DC 20240	1
Bureau of Land Management Wash DC 20240	1
US Fish and Wildlife Service Wash DC 20240	1
The Dikewood Corporation 1009 Bradbury Drive, S.E. University Research Park Albuquerque, New Mexico 87106	1
HQ AMC AMC Building 5001 Eisenhower Ave. Alexandria, VA 22304	
IO	1
Dugway Proving Grounds Dugway UT 84122	
IO	1

	Copies
COMLATWINGPAC NAS Lemoore CA 93245	
PAO	2
NAAS Fallon NV 89406	
PAO	2
FAA Western Region P.O. Box 92007, Worldway Postal Center Los Angeles CA 90009	
AFREP/AWE 590	2
COMNAVPAC Box 120 Naval Air Station North Island San Diego, Cal 92135	2
CINPAC FPO San Francisco 96610	2
CINPAC FLEET U.S. Pacific Fleet FPO San Francisco 96610	2

	Copies
Mr. Bruce Arkeel State Planning Coordinator State Capitol Building Carson City, Nevada 89701	1
Clark County Regional Planning Council County Court House Annex Las Vegas, Nevada 89101	1
Area Council of Governments P.O. Box 1900 Reno, Nevada 89504	1
Tahoe Regional Planning Agency P.O. Box 250 Zephyr Cove, Nevada 89448	1
Mr. William Brussat OMB 9001 New Executive Office Bldg Washington, D.C. 20503	1
Council on Environmental Quality ATTN: Mr. Neil Orloff 722 Jackson Pl, N.W. Washington, D.C. 20006	1
Mr. David Meeker Assistant Secy for Community Development HUD 451 - 7th St., S.W. Washington, D.C. 20410	1
Mr. Sheldon Meyers Director, Office of Federal Activities EPA, Room 537W Waterside Mall 401 M Street, S.W. Washington, D.C. 20024	1
Mr. John Wise EIS Coordinator EPA Region IX 100 California St. San Francisco, Calif. 94111	1

	Copies
Mr. Louis Jefferson Acting Director of Public Affairs EPA Region IX 100 California St. San Francisco, Calif. 94111	1

AIR FORCE NEWS SERVICE

SECRETARY OF THE AIR FORCE OFFICE OF INFORMATION • INTERNAL INFORMATION DIVISION
Distributed weekly to Air Force newspaper editors.
HQ. USAF (SAF/OIIB) • WASHINGTON, D.C. 20330 • Telephone OXford 79080

RELEASE NO. 1-25-74-49

PLANS ANNOUNCED TO IMPROVE TEST AND TRAINING RANGES

NELLIS AFB, Nev. (AFNS) - Air Force has announced plans to substantially improve test and training ranges in the Las Vegas and Salt Lake City areas.

The improvements are part of a 10-year program known as the Continental Operations Range (COR).

The proposed COR will link Nellis AFB ranges in southern Nevada with the Hill, Wendover and Dugway ranges in Utah by means of a comprehensive communications, data and radar net. This improved command and control network will enable Air Force controllers located at Nellis AFB and Hill AFB to closely monitor operations in Nevada and Utah.

Air Force spokesmen said the new setup will improve operations by providing a high degree of positive control. This same type of service also will be provided civilian aircraft in areas where radar coverage is nonexistent.

According to Col. Joseph D. Salvucci, commander of the COR Group at Nellis, "We hope to develop the capability to provide this radar service to civilian aircraft on a daily basis. What this service actually means to anyone flying in the area is that in the event of trouble we will know it immediately and be able to take action accordingly."

Actions to implement the proposed COR are divided into three separate but overlapping time periods. During the next two years, most of the improvements will center on the Las Vegas ranges. Actions will also be taken to install the necessary communications and radar equipment needed to support the flying safety requirements which will characterize the entire proposed COR project. Following this, improvements will begin for the ranges in Utah. Finally, the Air Force foresees the potential for inclusion of the U.S. Navy's ranges near Reno into the COR complex.

COR proposals do not require additional land areas for implementation, neither do they require the closing of any land areas to sportsmen, cattlemen, or miners. In addition, supersonic and bombing operations will continue to take place only in those special areas presently set aside for them.

Air Force officials say that operations will continue to be much the same as they are now, except that training will be much more meaningful and realistic.

E N D

Atch 2

ATTACHMENT 3 to APPENDIX K

NEWS CLIPPINGS ON THE CONTINENTAL OPERATIONS RANGE

The attached news clippings represent a sample of the news coverage on the proposed Continental Operations Range that has taken place in the states of Nevada and Utah since December of 1973.

R-J
Dec. 4, 1973
Pg. 13

NEVADANS HERE FACE MOCK MILITARY ATTACKS IN FUTURE

By Rick Hackman
R-J Staff Writer

In years to come, Southern Nevada may find itself under attack that will come not from a foreign nation, but from its own military.

Don't start building the bomb shelter, however, because the attacks only will be imaginary ones.

According to spokesmen at Nellis Air Force Base, a proposal to link three military range complexes in the western United States to improve military attack and defense capabilities, is in the planning stage, with Nellis acting as the nerve center of the operation.

The link also will include the Wendover-Hill-Dugway complex in Utah and the Fallon Naval Air Station near Reno, the spokesman said

The operation, known as the Continental Operations Range, and commanded by Col Joseph Salvucci, includes a 10-year program to link the three bases through a complex communications system

According to Salvucci, once completed, the Continental Operations Range will accommodate major improvements in the testing of air warfare weapons and in the training of aircrews.

What this means is that military aircraft from this portion of the country, and eventually from other military facilities throughout the nation will be using the Southern Nevada area as a training grounds

Simulated "enemy" areas will be set up with defense systems around them and jets representing the "friendly" forces will stage imaginary attacks trying to penetrate the enemy defense systems

Salvucci said once the link becomes a reality, which may not be for another ten years or so, persons living in the Southern Nevada area may not necessarily see too many more planes in the air than we now have.

He said other military facilities throughout the country probably will want to use the facility, but most of the flying activity will be confined to the restricted areas of the Nellis Bombing Range.

Once completed, the link will become the largest range center in the United States, according to Salvucci, encompassing some 3 million acres.

Although over all cost figures are not available, he said, about $12.4 million will be spent at Nellis alone through July of next year. He also placed the manpower figure used during the first year at about 700 persons for the three-range system.

Salvucci said one area that will change somewhat is the easing of restrictions around the Nellis bombing range.

The borders of the range will be slightly adjusted and he noted some sections of the range, previously off-limits to civilian aircraft, may be periodically opened to allow private and commercial air travel

The air space areas that will be open to civilian aircraft will be dependent upon which sections of the range are being used by the military and, according to Salvucci, hot lines will be set up to Las Vegas, Salt Lake City and Los Angeles to inform pilots when they can travel into a previously restricted area.

So, passengers in commercial airlines who find themselves flying over the Nellis bombing range need not worry about their safety.

Salvucci said the open air space concept will be offered to Federal Aviation Administration officials in hopes of making the plan more attractive to civilian authorities.

The region between the three military bases was chosen, he said, because other areas of the country are becoming too crowded for this type of simulated attack operation. The military needs large amounts of land and air space that are not congested with population and are relatively free of the normal air traffic

Aside from that, he said, this region of the country is more suitable to use by the Air Force because of a minimum of electro-magnetic interference that could hamper communications between the three bases. Salvucci said the Air Force is also making sure it will not distrub television and navigation instrumentation by its communication equipment.

The program involving a continuous growth of capability at the ranges, will be divided into three major phases.

Best Available Copy

3A

Dec. 7, 1973
Pg. 3

Civilian-Military Council to hear KORK-TV veep

Robert Ordonez, vice-president and general manager of KORK-TV, will be the featured speaker at the quarterly meeting of the Civilian-Military Council of Southern Nevada Tuesday.

The meeting will begin at noon at the Nellis AFB Officers' Open Mess.

Also on the program will be a brief presentation by Col. Joseph Salvucci, commander of the Air Force Continental Operations range, on proposals for the expansion and improvement of the bombing and gunnery range at Nellis.

Ordonez is one of four newly-appointed members of the council, which is composed of civic leaders from the area who have an interest in relations between the civilian and military communities.

The other new members are Mark Smith, general manager, KLAS-TV; Charles Gustin, general manager, Dunes Hotel and Country Club; and Lt. Col. Charles Burpee (USAF Retired), credit manager of the Silver Nugget in North Las Vegas.

Best Available Copy

The Salt Lake Tribune, Thursday, November 15, 1973

AF Programs Will Give Utah 700 New Jobs

By Frank Hewlett
Tribune Washington Bureau

WASHINGTON — The Air Force is planning a $60 million intermountain area program which should increase civilian and military employment in Utah by about 700 new jobs, Sen. Wallace F. Bennett, R-Utah, disclosed Wednesday.

The senator said they are going to set up a sophisticated new combat testing program on existing military ranges in Utah and Nevada.

He said the program calls for significant increases in both employment and expenditures at the Wendover and Hill Air Force bases and test ranges, the Army's Dugway Proving Ground range in western Utah and military ranges near Las Vegas and Reno.

Sen. Bennett said the Air Force proposes to spend about $60 million between fiscal 1976 and 1978 for improvements on the Wendover Dugway ranges. He said this will include early warning radar systems, simulated enemy aircraft, missiles, antiaircraft weapons, computer processing data and control facilities.

700 New Jobs

The program will mean 700 new jobs in Utah by fiscal year 1978 with most of them located around Hill AFB, the senator said.

The Air Force told the senator that the program should not affect general aviation in the two-state area or the recently approved joint use of Wendover field by civilian aircraft.

In Three Phases

"There may be times when some of the airspace over the area is closed to general aviation for short periods, but this is already the case," said Sen. Bennett. "If anything it will be safer for general aircraft in this area because of the highly sophisticated radar and tracking systems which will be installed by the air force. However, the general air space over the ranges will be controlled by the Air Force for obvious safety reasons."

He said a three-phase program is planned with the first to be range improvements at Nellis AFB near Las Vegas. The second is Wendover-Dugway which is to start in fiscal 1976. The third phase, range improvements at the Fallon Naval Air Station near Reno, is scheduled after fiscal 1978.

Sen. Bennett said the range complex, when fully operational, will provide a large area within the continental United States for testing of both aircraft systems and training of combat flight crews. He said the Air Force intends to create the most realistic environment possible for simulated air warfare combat and most of the equipment and targets will be mobile so the training and testing exercises can be varied.

The range complex, when completed, will serve as the site for more than 80 percent of the Air Force operational test missions and 10 percent of the training flights for combat crews. Each of the three ranges will have its own range control center and the three ranges will be linked by a main headquarters located at Nellis AFB.

DESERET NEWS, THURSDAY, NOVEMBER 15, 1973

Air Force to install radar units

Deseret News Washington Bureau

WASHINGTON — The Air Force will install sophisticated radar and computer equipment on its aircraft and weapons range complex in western Utah, and eastern Nevada, the Pentagon said today.

In the second phase of the development, two years from now, the range is expected to add 700 new jobs for the Utah section of the range, with most of the additional employees to be located at Hill Air Force Base.

The initial phase of the project will be the improvement of the Air Force range at Nellis Air Force Base Nev., and the installation of headquarters equipment there. Nellis is to control the entire complex when it is finished sometime after 1978.

Sen. Wallace F. Bennett, R-Utah, said that $80 million would be asked by the Air Force for work on the range system in the next two years.

When complete, the range would provide 80 percent of the operation testing and 10 percent of the training for the Air Force.

The area is to be the site of testing and training for drones and remotely-piloted aircraft as well, which are becomining an important part of the Air Force inventory of combat weapons.

The range will be instrumented with mobile radar for early warning and computer equipment to monitor the area and to simulate enemy plann missiles and electronic countermeasures.

The new range will take in areas from Hill, Wendover, Dugway and Nellis west to Reno, most of it already under some form of military control.

Sen. Bennett said the Air Force would not disturb the present joint use arrangement for Civil aircraft at the old Wendover Air Field safety for commercial and general aviation aircraft will be increased, the Air Force said, by providing better monitoring of the area.

A Hill Air Force Base spokesman said the time table calls for improvement of the capabilities at the Wendover-Hill-Dugway range complex in 1975-1977.

The objective of the program is to provide a realistic combat environment for training purposes, he said, adding that the range complexes involved in the program will be connected with data linking and communications.

Sen. Bennett stressed that the program will make the area safer for general aircraft in the long run because of the sophisticated radar and tracking systems which will be employed by the Air Force. There may be times when some of the air space over the area is closed to general aviation, but this is already occurring for short periods of time, he added.

The senator said the equipment and targets used in the program will be mobile to vary to the training experience.

Standard-Examiner, Thursday Nov. 15, 1973

New AF Training Facility To Boost Hill Work Force

Manpower Readjustment On 130 Jobs Announced

An immediate manpower cutback to be followed by a personnel increase beginning in 1975 were announced today for Hill Air Force Base.

The increase will involve some 700 new jobs to be created at the base by a $60 million air combat training facility the Air Force plans to establish on the Utah-Nevada border in 1975-77.

Meanwhile, Hill AFB officials have initiated an immediate program to reduce authorized manpower of the base by next Feb. 10.

A Hill AFB spokesman said the extent of the manpower reduction isn't known but reported 130 temporary employes are being separated effective Friday.

While the base spokesman said the number of permanent slots to be abolished isn't known, the base officials don't anticipate "any major upheaval" in its personnel.

Notices will be given to permanent employes affected by Dec. 7 with a Feb. 10 effective date.

Plans for the $60 million air combat training facility involving the Wendover range and Dugway Proving Ground were outlined Wednesday to congressmen from Utah and Nevada.

Sen. Wallace F Bennett R-Utah, said the facility will be part of a proposed Continental Operations Range (COR) also involving Nellis AFB near Las Vegas and the Fallon Naval Air Station near Reno.

Establishment of the COR complex is contingent on congressional approval and funding.

Sen. Bennett said the Wendover-Dugway facility is expected to be completed in 1975-77 following completion of the Nellis phase of the complex. The Fallon facility is scheduled to be completed after 1978.

When completed, Sen. Bennett said, the complex will provide major improvements in the testing of air warfare weaponry and tactics and in the training of air combat crews.

He said the Wendover-Dugway facility will have one of the world's most sophisticated radar-computer systems.

3 RANGES

Air Force officials said the three ranges — designated as COR — will provide a realistic combat environment whereby squadron sized strike forces can be fully exercised against a large scale multi-defended complex of targets.

Sen. Bennett said the $60 million expenditure at Wendover-Dugway will include installation of early warning radar systems, simulated enemy aircraft, missiles, anti aircraft weapons, computer process and control facilities.

Most of the anticipated 700 support personnel-both civilian and military — will be assigned to Hill AFB, the Utah senator said.

The Air Force told Sen Bennett the program won't affect general aviation in the area and that civilian use of the Wendover field will continue.

A Hill AFB spokesman said the current personnel action which he described as "a realignment rather than a reduction" is based on a "firm manpower programs for fiscal 1974" recently received by the base.

However, he said the number of employes authorized under the manpower isn't known because "it fluctuates" and will continue to fluctuate until the budget for Hill AFB is established for the current year.

He said the base is anticipating a manpower authorization "in the 15,000 area" compared with 15,550 as of Oct. 1.

Air Force Says Range No Threat to Airlines

HILL AIR FORCE BASE — The development of a proposed bombing range-complex in western Utah and Nevada will not jeopardize private and commercial air traffic, according to Air Force sources.

Earlier, when the proposal was announced, Sen. Frank E. Moss, D-Utah, expressed concern that the range might cause certain restrictions on air traffice in the two-state area.

MORE RADAR

But a Hill Air Force Base spokesman indicated that increased military use of the air space over the range would be offset by the addition of more radar coverage — while would be coordinated through data link computers.

Lt. Col. Edward Wolfe, base information officer, said that enough radar devices would be installed by the Air Force to "more than double" the existing radar coverage provided by the FAA.

"We feel that the high degree of coordination provided by these radar systems will insure the safety of all air traffice and actually give more positive control of civilian aircraft traveling those areas," he added.

The proposed range would combine the Nellis AFB range in southern Nevada, the Fallon Naval Air Station range near Reno and the Wendover range complex that cover sectors of western Utah and eastern Nevada.

3F

The Salt Lake Tribune, Thursday, February 28, 1974

For Training

HAFB Role To Spark Building

The U.S. Air Force's "Continental Operations Range" — to operate out of Nellis Air Force Base near Las Vegas, and link with Hill Air Force Base — will mean a nearly $1 million expenditure for construction at the Utah base, Air Force officials told Gov. Calvin L. Rampton.

Maj. Gen. Gordon Blood, Nellis' Fighter Weapons Center commander, and Col. Joseph Salvucci, COR group commander, met with the governor to outline plans to create a more realistic system for training pilots in combat-type conditions, and promised the activities will have no effect on western Utah air control conditions.

The Air Force proposes to create an "air corridor" between Nellis and Hill during exercises, but the net effect will be to provide better air control for all aviation rather than curtail private or commercial flying.

The Hill construction will involve a new squadron operations building and hangar, at an estimated cost of $903,000. Construction is several years away.

The system will link the bases with better communications equipment and computers, and will utilize "red forces," "blue forces" and a "white" umpire force to simulate "actual combat conditions," explained Col. Salvucci.

Computer exercises will substitute for the dropping or firing of munitions in most cases, the officers said. When live weapons are used, they will be confined to the existing Nellis and Wendover weapons test ranges.

The proposed air corridor would function only when aircraft were in the corridor, the officers said. Otherwise, it would be Federal Aviation Agency-controlled flying as usual for non-military craft.

No land acquisition is contemplated in the system.

#H

DESERET NEWS, WEDNESDAY, FEBRUARY 27, 1974

A.F. Plans air corridors between Utah and Nevada

More than $900,000 will be spent to build a hangar and other facilities at Hill Air Force Base in the next few years for the Continental Operational Range, Gov. Calvin L. Rampton was told Tuesday.

The announcement was made by Maj. Gen. Gordon F. Blood, commander, Tactical Fighter Weapons Center, Nellis Air Force Base, Nev., during a briefing for Rampton to acquaint him with the program.

Rampton said the new program would pose no threat to aviation in the area of items on the ground when he was promised that extensive safety measures are taken.

Col. Joseph Salvucci, who conducted the briefing, said the range is being established because the Air Force doesn't have enough space in which to conduct tactical maneuvers involving air defenses, offensive missiles or anti-aircraft batteries.

The Air Force is proposing to establish flexible air corridors between Nellis AFB near Las Vegas, Nev., the Naval Air Station at Fallon, Nev., and the Wendover-Dugway Range in Utah.

In a simulated exercise, he said, aircraft would take off from Hill AFB or Fallon Naval Air Station and attack targets on the Nellis AFB range. Movement of aircraft to the targets areas would be controlled by a computer system to eliminate conflicts with civilian or commercial aviation.

Gen. Blood said establishment of the range will take place between now and 1984 depending on how much money is available.

Tonopah Times - Bonanza 12 April 1974

Tonopah Times-Bonanza
AND GOLDFIELD NEWS
FOR A GREATER NEVADA
73rd Year Tonopah, Nye County, Nevada, Friday, April 12, 1974 15 Cents

COR To Provide Economic Boost

The continental operations range (COR) program will have an economic impact on the Tonopah area although the extent of participation locally has not been finally determined, Tonopah Rotarians were informed Tuesday by Col. William Adams, vice commander, and Capt. Bob Wright, public information officer of the program from Nellis Air Force base.

The program which is designed to provide more realistic tests of enemy capabilities and the U. S. Air Force's ability to respond to attacks using the latest weapons and procedures will also have another benefit in that civilian aircraft in the area can be monitored for safety, it was pointed out.

Experiments in the Tonopah area will be carried out principally at the Tonopah test range of Sandia Corp although some exercises will utilize the Tonopah airport facilities, Col. Adams stated. A minimum of 50 men will be stationed locally during each exercise with the number increased to 100 or more for some tests.

Electronic equipment will be operational in the Tonopah area and throughout the COR region to insure increased air safety, Capt. Wright pointed out in a slide lecture briefing.

"This will provide positive control of civilian aircraft and will make it possible for pilots of light planes to fly over the Nevada test site when exercises are not being carried out, a capability which does not exist at present," the speaker said.

Original improvements are being carried out in the southern Nevada area from Nellis Air Force base, but the 10-year program also envisions improved test and training ranges in the Salt Lake City area and the Reno-Fallon complex.

The program was presented by Rotarian Pete Knight and the visitors were welcomed by president Bob Perchetti.

Best Available Copy

Notices

This section of the FEDERAL REGISTER contains documents other than rules or proposed rules that are applicable to the public. Notices of hearings and investigations, committee meetings, agency decisions and rulings, delegations of authority, filing of petitions and applications and agency statements of organization and functions are examples of documents appearing in this section.

DEPARTMENT OF DEFENSE

Department of the Air Force

CONTINENTAL OPERATIONS RANGE (COR)

Notice of Intent To Prepare an Environmental Impact Statement

NOVEMBER 16, 1973.

Notice is hereby given that in accordance with the National Environmental Policy Act (42 U.S.C. 4321 et seq.), the United States Air Force intends to prepare an environmental impact statement on the proposed Continental Operations Range.

The proposed Continental Operations Range involves the improvement and integration of three existing range complexes in the Western United States. The complex of ranges once completed will accommodate major improvements in the testing of air warfare weapons and tactics and in the training of aircrews. The program will improve the existing facilities at Nellis Air Force Base, Nevada; the Wendover/Hill/Dugway complex, Utah; and Fallon Naval Air Station, Nevada; and will connect these range complexes with suitable data links and communications. Changes in the airspace environment are proposed to insure safe and efficient use. The program objective is to provide a realistic combat environment consisting of the three ranges wherein squadron-sized strike forces can be fully exercised against a large-scale, multiple defended complex of targets. The proposed COR Program will integrate simulated enemy defense radars with their command and control system with scoring systems, instrumentation, and extensive data processing capability at each of the three range complexes. The threat system will be mobile so that various combat situations can be simulated. The program involves a continuous growth of capability at the ranges, but is divided into three major phases: near-term Nellis improvements, mid-term COR, and far-term COR. The near-term actions center on improving and consolidating the existing facilities and equipment at Nellis Air Force Base. The mid-term phase (1975–1977) involves the improvement of capabilities at the Wendover/Hill/Dugway range complex in Utah. The far-term phase (1978–1982) will improve the Fallon ranges near Reno, Nevada, and will complete the integration of communications and data processing for the three range complexes.

All interested persons desiring to submit suggestions for consideration in connection with the preparation of the draft environmental impact statement should send them to Dr. Billy E. Welch, Special Assistant for Environmental Quality, Department of the Air Force, Washington, D.C. 20330 on or before December 18, 1973.

STANLEY L. ROBERTS,
Colonel, USAF, Chief, Legislative Division, Office of The Judge Advocate General.

[FR Doc.73-24195 Filed 11-15-73;8:45 am]

DEPARTMENT OF JUSTICE

Drug Enforcement Administration

[Docket No. 73-21]

HARRY F. LARSON, M.D.

Notice of Hearing

Notice is hereby given that on August 29, 1973, the Drug Enforcement Administration, Department of Justice, issued to Harry F. Larson, M.D., Woodland Hills, California, an Order to Show Cause as to why the Drug Enforcement Administration registration No. AL1456501, issued to him pursuant to section 303 of the Controlled Substances Act (21 U.S.C. 823) should not be revoked.

Thirty days having elapsed since said order was received by Dr. Larson, and written request for a hearing having been filed with the Drug Enforcement Administration, notice is hereby given that a hearing in this matter will be held commencing at 10 a.m. on December 5, 1973, in room 1211 of the Drug Enforcement Administration, 1405 I Street NW., Washington, D.C. 20537.

Dated: November 12, 1973.

JOHN R. BARTELS, Jr.,
Administrator, Drug Enforcement Administration.

[FR Doc.73-24460 Filed 11-15-73;8:45 am]

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

BOISE DISTRICT ADVISORY BOARD

Notice of Meeting

Notice is hereby given that the Bureau of Land Management, Boise District Advisory Board, will meet at 9:30 a.m. on December 12 and 13, 1973, at the Boise District Office, 230 Collins Road, Boise, Idaho 83702.

The agenda for the meeting will include Advisory Board recommendations on 1974 grazing applications and applications for transfer of grazing privileges, election of advisory board officers, and a progress report on district programs.

The meeting will be open to the public. Time will be available for a limited number of brief statements by members of the public. Those wishing to make an oral statement should inform the Advisory Board Chairman, Eugene Davis, prior to the meeting. Any interested persons may file a written statement with the Board for its consideration. Written statements should be submitted prior to the meeting to Eugene Davis, c/o District Manager, Bureau of Land Management, 230 Collins Road, Boise, Idaho 83702.

Further information concerning the meeting may be obtained from the District Manager. Minutes of the meeting will be available for public inspection [illegible] days after the meeting.

WILLIAM L. MATHEWS,
State Director.

[FR Doc.73-24428 Filed 11-15-73;8:45 am]

DEPARTMENT OF AGRICULTURE

Commodity Credit Corporation

[Amdt. 4]

SALES OF CERTAIN COMMODITIES

Monthly Sales List (Fiscal Year Ending June 30, 1974)

The CCC Monthly Sales List for the fiscal year ending June 30, 1974, published in 38 FR 19259, is amended as follows:

1. Provisions beginning with sales item 1 and continuing throughout the balance of Section 32 entitled "Peanuts, shelled or farmers stock—restricted use sales" published in 38 FR 19261 as amended in 38 FR 22808 are revised to read as follows:

Farmers stock. Segregation 1 peanuts may be purchased and milled to produce U.S. No. 1 or better grade shelled peanuts to be exported and the balance exported after fragmentation or crushed domestically.

Segregation 2 peanuts may be purchased for domestic crushing or exported after fragmentation.

Segregation 3 peanuts may be purchased for domestic crushing only.

2. Monthly Sales List (Fiscal Year Ending June 30, 1974): Sales are made on the basis of competitive bids submitted each Tuesday to the Tobacco and Peanut Division, Agricultural Stabilization and Conservation Service, Washington, D.C. 20250.

Effective date: 2:30 p.m., e.s.t., October 31, 1973.

Qtfact 1

REFERENCES

1. Richard G. Lillard, Desert Challenge: An Interpretation of Nevada, Alfred A. Knopf, New York, 1942.

2. Sessions Wheeler, The Nevada Desert, Caldwell, Idaho, Caxton Printers, Ltd., 1971.

3. Business Opportunities in Southern Nevada, Arthur D. Little, Inc., C-71657, June 1970.

4. Las Vegas 1973, Research and Statistical Bureau, Las Vegas, Nevada, Chamber of Commerce.

5. Public Information Office, Nellis AFB, December 1973.

6. Stanley Paher, Nevada Ghost Towns and Mining Corps, Howell-North Booles, Berkeley, California, 1970.

7. Nevada: The Silver State, Vol. 2, Western State Historical Publishers, Carson City, Nevada, 1970.

8. Department of Economic Development, Nevada Community Profiles, Carson City, Nevada, 1970.

9. The Nevadan, Las Vegas, December 9, 1973.

10. Air Quality Implementation Plan for the State of Nevada, Nevada State Commission of Environmental Protection, 30 January 1972.

11. Environmental Analysis, Hill Air Force Base SLUP U-23572.

12. Nevada, Department of Conservation and Natural Resources, Recreation in Nevada, Pt. 1, 1965.

13. Recreation in Nevada, Pt. III, Carson City, Nevada, February 1971.

14. Nevada Rural Communities, Water and Waste Water Plan, Nevada State Planning Board, 1972.

REFERENCES (Cont.)

15. Sol M. Michaelson, Human Exposure to Nonionizing Radiant Energy-Potential Hazards and Safety Standards, Proceedings of the IEEE, Vol. 60, No. 4, April 1972.

16. H. D. Baillie, "Thermal and Nonthermal Cataractogensis by Microwaves," in Biological Effects and Health Implications of Microwave Radiation, Symp. Proc. USDHEN, June 1970.

17. "Biological Function as Influenced by Low-Powers Modulated RF Energy," IEEE Trans. Microwave Theory Tech., Vol. MIT-19, February 1971.

18. Message from the President of the United States Transmitting the Annual Report on the Administration of the Radiation Control for Health and Safety Act of 1968 (PL 90-602), U.S. Govt. Printing Office, May 20, 1971.

19. E. Hendler, "Cutaneous Receptor Response to Microwave Irradiation," in Thermal Problems in Aerospace Medicine, Unwin, 1968.

20. E. Hendler, J. D. Hardy, and D. Murgatroyd, "Skin Heating and Temperature Sensation Produced by Infra-red and Microwave Irradiation," in Temperature Measurement and Control in Science and Industry, Rheinhold, 1963.

21. H. F. Cook, "The Pain Threshold for Microwave and Infrared Radiations," Journal of Physiology, Vol. 118, 1952.

22. E. Sowton, et al., "Electrical Interference in Non-Competitive Pacemakers," British Heart Journal, Vol. 32, No. 5, pp. 626-632.

23. S. Forman, et al., "The Influence of Electromagnetic Environment in the Performance of Artificial Cardiac Pacemakers," Ann. Thoracil Surgery, 6:90-95, 1968.

24. D. H. Gobeli, "Electromagnetic Interference in Cardiac Pacemakers," IEEE International Symposium on Electromagnetic Compatability, Philadelphia, 1971.

25. G. R. King, et al., "Effect of Microwave Oven on Implanted Cardiac Pacemaker," Journal, American Medical Association, Vol. 212, No. 7, May 18, 1970, pp. 1213.

26. R. F. Yatteav, "Radar-Induced Failure of a Demand Pacemaker," New England Journal of Medicine, Vol. 238, No. 26, December 24, 1970.

REFERENCES (Cont.)

27. John C. Mitchell, et al., "Empirical Studies of Cardiac Pacemaker Interference," Journal of Aerospace Medicine, Vol. 45, No.2, February 1974.

28. John H. Wiggins, Effects of Sonic Boom, J. H. Wiggins Co., 1969.

29. Sonic Boom Research, National Aeronautics and Space Administration, NASA SP-147, April 12, 1967.

30. Henning E. Von Gierke, Effects of Sonic Boom on People: Review and Outlook, The Journal of Acoustical Society of America, Vol. 39, No. 5 (Part 2), May 1966.

31. Community Noise, Report No. NTID300.3, Environmental Protection Agency, December 31, 1971.

32. Dennis F. Naugle and Bernard T. Delaney, United States Air Force Aircraft Pollution Emissions, Air Force Weapons Laboratory, Kirtland AFB, November 1973.

33. Compilation of Air Pollutant Emission Factors, Second Edition, Report No. AP-2, Environmental Protection Agency, April 1973.

34. Environmental Assessment for AFLC Test Range Complex, Department of the Air Force, Air Force Logistic Command, 18 February 1972.

35. Ralph Pfouts, et al., The Techniques of Urban Economic Analysis, Chandler Davis Press, 1960.

36. People and Land, National Park and Planning Commission, 1950.

37. Robert E. Willard, The Quantitative Significance of the Gaming Industry in the Greater Las Vegas Area, unpublished Ph.D. thesis, University of Arizona, 1968.

38. Nevada Tax Commission, Annual Report, 1972-1973.

39. U.S. Census, Statistical Abstract of the United States: 1972, Washington, D.C.

40. Nevada Department of Education, Bienneal Report, 1970-1972, Carson City, Nevada.

41. E. J. Kane, "Some Effects of the Non-uniform Atmosphere on the Propagation of Sonic Booms," Proc. Sonic Boom Symposium, J. Acoust. Soc. Am., 39, S26 (1966).

REFERENCES (Cont.)

42. H. W. Carlson and D. J. Maglieri, "Review of Sonic Boom Generation Theory and Prediction Methods," Proc. of Sonic Boom Symposium, J. Acoust. Soc. Am., 51, No. 2 ((Part 3), February 1972.

LITERATURE CONSULTED

Anonymous. 1972. Regulations governing individual sewage disposal systems. Div. Health., Bur. Environ. Health. Carson City, Nevada. 39 pp.

Austin, G. T. 1968a. The occurrence of certain non-passurine birds in southern Nevada. Condor 70:391.

Austin, G. T. 1968b. Additional bird records for southern Nevada. Auk 85:692.

Baily, D. K. 1970. Phytogeography and taxonomy of Pinus subsection Balfourional. Ann Missouri Bot. Gord. 57:210-249.

Barngrover, L., W. Molini and G. Tsukamoto. 1973. Game harvest statistics: big game, upland game, migratory game birds and fur, 1972-1973. Nevada Dept. Fish and Game, Job Progress Report, Project W-48-4: 60 pp.

Bell, W. B. 1972. Animal response to sonic booms. J. Acoust, Soc. Am. 51(2):758-765.

Bond, J. 1971. Noise: Its effect on the physiology and behavior of animals. Agri. Sci. Rev. Fourth Quarter p:1-10.

Brechbill, Raymond. 1973. Personal communication.

Brunnell, F. L. 1972. Lemmings--models and the real world. 1972 Summer Comp. Simul. Conf.:1183-1197.

Cade, T. J., J. L. Lincer, C. M. White, D. G. Roseneau and L. G. Swartz. 1971. DDE residues and eggshell changes in Alaskan falcons and hawks. Science 172:955-957.

Collier, B. D., R. Osborn and N. Stenseth. 1973. Population dynamic model for *Lemmus trimucronatus* at Barrow. (unpublished manuscript).

Collier, B. D., G. C. Cox, A. W. Johnson and P. C. Miller. 1973. Dynamic ecology. Prentice-Hall, Inc. Englewood Cliffs, N.J. 563 pp.

LITERATURE CONSULTED (Cont.)

Cook, J. C., T. Goforth and R. K. Cook. 1972. Seismic and underwater responses to sonic boom. J. Acoust. Soc. Am. 51(2):729-741.

Crummett, J. G. 1970. Acoustic information denial as a means for vertebrate pest control. Paper presented at the 80th meeting of the Acoust. Soc. Am., Houston, November. (not published).

Davis, P. 1967. Raven's response to sonic bang. British Birds 60:370.

Diehl, Fred P. 1969. Sound as a rodent deterrent. Pest Control 37:36-44.

Dooling, R. J., J. A. Mulligan and J. D. Miller. 1971. Relation of auditory sensitivity and song spectrum for the common canary. Acoust. Soc. Am. 50:700-709.

Fenneman, Nevin M. 1937. Physiography of the western United States. McGraw-Hill Book Co., New York: 534 pp.

Fitzwater, W. D. 1970. Sonic systems for bird control. Pest Control 38:9-16.

Frings, H. and M. Frings. 1957. Recorded calls of the eastern crow as attractants and repellants. J. Wildl. Mgmt. 21:91.

Frings, H. and J. Jumber. 1954. Preliminary studies on the use of a specific sound to repel starlings (*Sturnus vulgaris*) from objectionable roosts. Science 119:318-319.

Glasstone, S. 1962. The effects of nuclear weapons. U.S.A.E.C, Washington, D.C.: 730 pp.

Graham, F. 1969. Ear pollution. Audubon 71:34-39.

Griffin, D. R., J. J. G. McCue and A. D. Grinnell. 1963. The resistance of bats to jamming. Expt. Zool. 152:229-250.

Gullion, G. W., M. Pulich and F. C. Evenden. 1959. Notes on the occurrence of birds in southern Nevada. Condor 61:278-297.

Hall, E. R. 1946. Mammals of Nevada. Univ. Calif. Press, Berkeley. 610 pp.

Hall, E. R. and K. R. Nelson. 1959. The Mammals of North America, Vol. I and II. Ronald Press Co., New York. 1083 pp.

LITERATURE CONSULTED (Cont.)

Hansen, C. G. 1961. Significance of bighorn mortality records. Desert Bighorn Council Trans. 5:22-26.

Hansen, C. G. 1962. Progress report from the Desert Game Range. Desert Bighorn Council Trans. 6:73-82.

Hansen, C. G. 1965. Growth and development of desert bighorn sheep. J. Wildl. Mgmt. 29:387-391.

Hansen, C. G. 1967. Bighorn sheep populations of the Desert Game Range. J. Wildl. Mgmt. 31:693-706.

Hayward, C. L., M. L. Killpack and G. L. Richards. 1963. Birds of the Nevada Test Site. Brigham Young Univ. Sci. Bull., Biol. Series, 3:1-27.

Henkin, H. 1969. The death of birds. Environment 11:S1.

Holling, C. S. 1972. Ecological models: A status report. In "international symposium on modeling techniques in water resources systems," A. K. Biswas (ed.). Environment Canada, Ottawa: 3-20.

Houghton, John G. 1969. Characteristics of rainfall in the Great Basin. Special Publication. Desert Res. Inst., Univ. of Nevada System. Rev.: 205 pp.

Humphreys, M. 1966. Extent of seasonal big game range maps. Nevada Fish and Game Comm. Completion Report of Federal Aid Project W-43-R-1. 18 pp.

Hunt, C. G. 1967. Physiography of the United States, W. H. Freeman and Co., San Francisco. 480 pp.

Johnson, N. K. 1965. The breeding avifaunas of the sheep and spring ranges in southern Nevada. Condor 67:93-124.

Johnson, N. K. and F. Richardson. 1952. Supplementary bird records for Nevada. Condor 54:358-359.

Jorgensen, C. D. and C. L. Hayward. 1963. Notes on shrews from southern Nevada. J. Mammal. 44:582.

Jorgensen, C. D. and C. L. Hayward. 1965. Mammals of the Nevada Test Site. Brigham Young Univ. Sci. Bull., Biol. Ser. VI (3). 81 pp.

LITERATURE CONSULTED (Cont.)

Klein, D. R. 1971. Reaction of reindeer to obstructions and disturbances. Science 173:393-398.

La Rivers, I. 1962. Fish and fisheries of Nevada. Nevada State Fish and Game Comm. 782 pp.

L. G. L. Ltd. 1972a. Disturbance studies of terrestrial breeding bird populations. L. G. L. Ltd., Environmental Research Assoc., Edmonton, Canada.

L. G. L. Ltd. 1972b. Snow geese disturbance by aircraft on the North Slope. L. G. L. Ltd., Environmental Research Assoc., Edmonton, Canada.

Linsdale, J. M. 1936. The birds of Nevada. Pacific Coast Avifauna, No. 23: 145 pp.

Lotka, A. F. 1923. Contribution to quantitative parasitology. Wash. Acad. Sci. 13:152-158.

Majeau-Chargois, D. A., C. I. Berlin and G. D. Whitehouse. 1970. Sonic boom effects on the organ of Corti. The Laryngoscope 80:620-630.

Malar, T. and H. Kleerekoper, 1968. Observations on some effects of sound intensity on locomotor patterns of naive goldfish. Am. Zool., 8:741-742.

Mall, K. H. 1969. On the osprey situation in the German Democratic Republic, pp. 341-343. In J. J. Hickey (ed.), Peregrine falcon populations; their biology and decline, Univ. Wis. Press, Madison.

Manley, G. 1970. Comparative studies of auditory physiology in reptiles. Zeitschrift fur Vergleichende Physiologie 67:363-381.

Messersmith, D. G. 1970. Control of bird depredation. Agri. Dept. Coop. State Res. Ser., Maryland.

Miller, R. R. 1948. The cyprinodont fish of the Death Valley system in eastern California and southwestern Nevada. Misc. Publ. Mus. Zool. Univ. Mich. 68:1-155.

Minckley, W. L. and J. E. Deacon. 1968. Southwestern fishes and the enigma of "Endangered Species". Science 159:1424-1432.

LITERATURE CONSULTED (Cont.)

Murie, A. 1944. The wolves of Mouth McKinley. In Faune of the National Parks of the U.S., Fauna Series No. 5, U.D. Dept. Int., Nat. Park Ser.: 238 pp.

Nixon, C. W., H. K. Hille, H. C. Sommer and E. Guild. 1968. Sonic booms resulting from extremely low-altitude supersonic flight: measurements and observations on houses, livestock and people. Aerospace Med. Res. Labs., Rpt. No. AMRL-TR-68-52: 31 pp.

Odum, E. P. 1971. Fundamentals of ecology. W. B. Saunders Co., Philadelphia. 574 pp.

Popez, N. (ed.). 1972. Big game investigations and hunting season recommendations. Nevada Dept. of Fish and Game. Federal Aid Job Progress Report W-43-3.

Page, J. L. and D. J. Seibert. 1973. Inventory of golden eagle nests in Elko County, Nevada. Paper delivered at Calif., Nevada, Hawaii Sect. of Wildl. Soc. Meeting, Fsh. 1973.

Patten, B. C. (ed.). 1971. System analysis and simulation in ecology, Vol. I, Academic Press, New York.

Patten, G. C. (ed.). 1973. System analysis and simulation in ecology, Vol. III, Academic Press, New York (in press).

Parker, J. B. and N. D. Bayley. 1960. Investigations on effects of aircraft sound on milk production of dairy cattle, 1957-1958. U.S. Dept. of Agri., Agri. Res. Ser., Anim. Husb. Res. Div.: 22 pp.

Pearson, E. W., P. R. Skon and G. W. Corner. 1967. Dispersal of urban roosts with records of starling distress calls. J. Wildl. Mgmt. 31:502-506.

Peters, E. N. 1965. Temporary shifts in auditory thresholds of chinchilla after exposure to noise. J. Acoust. Soc. Am. 37:831-833.

Plotkin, K. J., J. E. Robertson and J. A. Cockburn. 1972. Environmental impact of noise from the proposed AEDC high reynolds number tunnel. AEDC-TR-72-151.

Poche, L. B., C. W. Stockwell and H. Ades. 1969. Cochlear hair cell damage in guinea pigs after exposure to impulse noise. J. Acoust. Soc. Am. 46:947-951.

LITERATURE CONSULTED (Cont.)

Rucker, R. S. 1973. Effects of sonic boom on fish. U.S. Bur. Sport Fish and Wildl., Final Rpt., Contract DOT-FA 72 WAI: 72 pp.

Schilling, John H. 1969. Metal mining districts of Nevada. Second edition. Nevada Bureau of Mines: Map 37.

Shaw, E. W. 1970. California condor. Lib. of Cong. Legis. Ref. Ser., SK351:70-127.

Snyder, C. T., G. Hardman and F. F. Zdenck. 1964. Pleistocene lakes in the Great Basin. U.S. Geol. Sur., Misc. Geol. Invest.: Map I-416.

Springer, H. E. 1972. State of Nevada biennial report of the state inspector of mines: 87 pp.

Sprock, C. M., W. E. Howard and F. C. Jacob. 1967. Sound as a deterrent to rats and mice. J. Wildl. Mgmt. 31:729-741.

Stadelman, W. J. 1958. The effect of sounds of varying intensity on hatchability of chicken eggs. Poultry Sci. 37:166-169.

Stebbins, R. C. 1954. Amphibians and reptiles of western North America. McGraw-Hill Book Co., Inc., New York. 536 pp.

Stenseth, N. C., C. D. Jorgensen and H. D. Smith. 1973. Modeling of a desert rodent population. (unpublished manuscript).

Tanner, W. W. and C. D. Jorgensen. 1963. Reptiles of the Nevada Test Site. Brigham Young Univ. Sci. Bull., Biol. Ser. III(3): 31 pp.

Thorpe, W. G. 1969. The significance of vocal initation in animals with special reference to birds. Acta Biol. Experimentia 29: 251-269.

Travis, H. F., G. V. Richardson, J. R. Menear and J. Bond. 1968. The effects of simulated sonic booms on reproduction and behavior of farm-raised mink. ARS 44-200, June 1968, U.S. Dept. of Agric.

U.S. Dept. of Interior, Bureau of Sport Fisheries and Wildlife, Office of Endangered Species and International Activities. 1973. Threatened wildlife of the United States. U.S. Govt. Print. Off., Washington, D.C.: 289 pp.

U.S. Environmental Protection Agency. 1971. Effects of noise on wildlife and other animals. U.S. Environ. Protect. Agcy. MTID 300.5: 74 pp.

LITERATURE CONSULTED (Cont.)

U.S. Environmental Protection Agency. 1971. Community noise. U.S. Environ. Protect. Agcy. NTID 300.3: 100 pp. + 103 pp. appendix.

U.S. Environmental Protection Agency. 1971. Fundamentals of noise: measurement, rating schemes, and standards. U.S. Environ. Protect. Agcy. NTID 300.15: 163 pp.

U.S. Geological Survey. 1969. Mineral and water resources of Utah. Document no. 91-12, U.S. Govt. Print. Off.: 275 pp.

Utah Mining Association. 1967. Utah's mining industry: a historical, operational, and economic review of Utah's mining industry. Privately printed by Utah Mining Assoc., Kearns Bldg., Salt Lake City, Utah: 135 pp.

Volterra, V. 1928. Variations and fluctuations of number of individuals in animal species living together. Conserv. Intern. Explor. 3:3-5.

Wallace, A. and E. M. Romney, 1972. Radioecology and ecophysiology of desert plants at the Nevada Test Site. USAEC, TID-25954: 439 pp.

Walter, H. 1954. Le facteur eau dans less regions arides et sa signification pour l'organization de la vegetation dons les contrees subtropicoles. In Les Divisions Ecologiques du Monde. Centre Nationale de la Recherche Scientific, Paris:27-39.

Watt, K. E. F. 1962. Use of mathematics in population ecology. Amer. Rev. Entomol.:243-260.

Werner, R. 1959. Influence of sound on the intermediary lobe of the rat hypophysis. Compte. Rendus de l'Assoc. des Anatomistes 45:78-788.

White, C. M. and S. K. Sherrod. 1974. Advantages and disadvantages of the use of rotor-winged aircraft in raptor surveys. Proc. Conf. Raptor Cons. Tech., Fort Collings, Colo. (in press).

AIR FORCE PUBLICATIONS BIBLIOGRAPHY

Number	Title
AFM 2-1	Tactical Air Operations--Counter Air, Close Air Support and Air Interdiction
AFM 2-11	Strategic Aerospace Operations
AFM 2-31	Aerospace Environmental Operations
AFR 11-25	Communications with and Service to the Public
AFR 19-1	Protection and Enhancement of Environmental Quality
AFR 19-2	Environmental Assessments and Statements
AFM 51-3	Electronic Warfare Principles (FOUO)
AFM 51-7	A-7D Aircrew Training Manual
AFM 51-34	F-4 Aircrew Training Manual
AFR 53-25	USAF Fighter Weapons School
AFM 55-2	Procedures for Airspace Assignment and Air Traffic Control Coordination with the Federal Aviation Administration
AFR 55-7	Military Civic Actions
AFR 55-10	Air Traffic and Air Traffic Control Coordination
AFR 55-34	Reducing Flight Disturbances that Cause Adverse Public Reactions
AFR 55-44	Performing Electronic Countermeasures in the United States and Canada (S)
AFR 80-14	Test and Evaluation
AFM 55-354	Sonic Boom Reporting System
AFM 60-1	Flight Management Policies
AFM 60-16	General Flight Rules

AIR FORCE PUBLICATIONS BIBLIOGRAPHY (Cont.)

AFR 100-6	Electromagnetic Interference and Radiation Hazards
AFR 136-10	Air Force Explosive Ordnance Disposal Program
AFR 190-4	Community Relations and Emergency Assistance After an Off-Base Accident