Reduced Vertical Separation in the North Atlantic Experiment Plan

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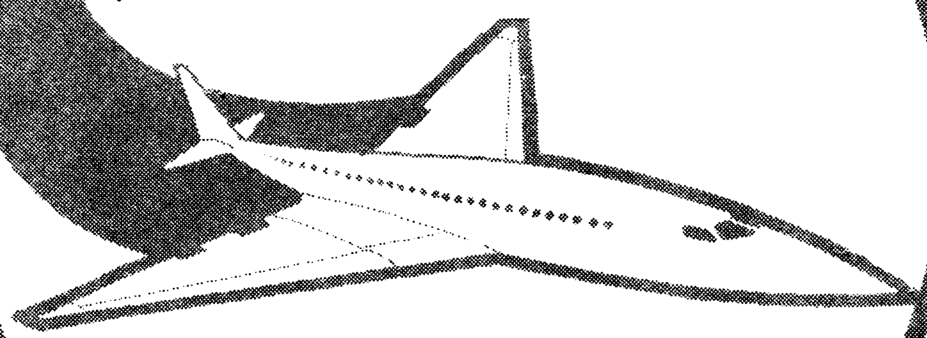

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16. Abstract

This experiment plan provides the background, objectives, and methodologies for conducting the reduced vertical separation minima (RVSM) experiment.

The experiment will use real-time simulation to evaluate oceanic air traffic RVSM in the North Atlantic (NAT) region.

This document addresses Phase 1 of a 2-phase simulation study. The study is aimed at achieving early implementation of RVSM in the NAT region.

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EXECUTIVE SUMMARY

This document provides the background, objectives, methodologies, and international context for conducting the reduced vertical separation minima (RVSM)[1] experiment. It also positions the planned simulations as strategic activities in the evaluation of RVSM.

The experiment will use real-time simulation to evaluate the workload effects and feasibility of the implementation of RVSM in the New York Air Route Traffic Control Center (ARTCC) portion of the North Atlantic Minimum Navigation Performance Specification (MNPS) airspace. The RVSM experiment stems from a conclusion by the North Atlantic Systems Planning Group (NATSPG) to carry out studies aimed at achieving early implementation of RVSM in the North Atlantic (NAT) Region. This plan includes simulations conducted in two phases. These simulations will precede a variety of other coordinated activities that will culminate in the full implementation of RVSM.

This document provides an overview of the experiment plan, and more specifically, the methodologies to be used in the Phase 1 simulation.

[1]RVSM - 1000 ft. Vertical Separation Minima (VSM) above FL 290 up to FL 410, inclusive.

1. INTRODUCTION.

The technical feasibility and cost benefits of establishing reduced vertical separation minima (RVSM) in the North Atlantic (NAT) Region have been the subject of many studies by affected International Civil Aviation Organization (ICAO) member states. The results of these studies have led to ICAO planning for implementation of reduced minimums in January 1998, with trials/verification scheduled to begin in January 1996. In the United States, the Federal Aviation Administration (FAA) plans to conduct a series of Air Traffic Control (ATC) simulations to assist Air Traffic organizations in identifying and defining requirements for the implementation of RVSM.

The RVSM experiment described in this plan will be conducted under the auspices of the FAA National Simulation Capability (NSC) Program. The NSC will rely heavily on the expertise of controllers from the New York Air Route Traffic Control Center (ARTCC) oceanic area of specialization. NSC will also rely on the expertise of the following organizations: Air Traffic Rules and Procedures Service (ATP-100), Air Traffic System Management (ATM-100), Air Traffic Plans and Requirements Service (ATR-300), Flight Standards (AFS-400), Operations Research Service (AOR-20), Research and Development Service (ARD-20 and ARD-100), and Research Directorate for Aviation Technology (ACD-300).

1.1 BACKGROUND.

In the late 1950s it was determined that there was a need to increase the prescribed vertical separation minimum (VSM) of 300 meters (m) (1,000 feet (ft)) due to the inaccuracy of pressure sensing barometric altimeters as altitude increased. In 1960, flight level (FL) 290 was selected as the vertical limit for the 300 m VSM, and a 600 m (2,000 ft.) VSM was established for aircraft operating above FL 290. This vertical limit was chosen based on the operational ceiling of the aircraft at that time. In 1966, although FL 290 was established as the vertical changeover level on a global basis, consideration was already being given to the application of RVSM above FL 290 on a regional basis. Consequently, ICAO provisions stated that RVSM could be applied under specific conditions and within designated portions of airspace. In order to support this statement, it was recognized that a thorough assessment of the risk associated with reducing the VSM would need to be accomplished.

In 1980, at its fourth meeting, the ICAO Review of the General Concept of Separation Panel (RGCSP) concluded that the potential benefits of reducing vertical separation above FL 290 to 300 m outweighed the cost and time involved. Member states were encouraged to conduct the necessary evaluations. In 1982, coordinated by the RGCSP, studies were initiated to evaluate reducing the VSM above FL 290. The studies were carried out by Canada, Japan, member states of EUROCONTROL (France, Federal Republic of Germany, Kingdom of the Netherlands, and United Kingdom), the Union of Soviet Socialist Republics, and the United States. In December 1988, at the RGCSP sixth meeting (RGCSP/6), the results were reviewed.

Using a Target Level of Safety (TLS) of 2.5×10^{-9} fatal accidents per aircraft flight hour, it was concluded that a 300 m VSM above FL 290 was technically feasible. Today's height-sensing systems can be built, maintained, and operated such that the expected performance is consistent with safe implementation and use of a 300 m VSM above FL 290. In reaching this conclusion about technical feasibility, the panel found that it would be necessary to establish:

a. Air-worthiness performance requirements embodied in a comprehensive minimum aircraft system performance specification (MASPS) for all aircraft utilizing the reduced separation.

b. New operational procedures.

c. A comprehensive means of monitoring the safe operation of the system.

The RGCSP identified the NAT Region as an area where early implementation of RVSM was possible because of the traffic patterns and equipment requirements of the aircraft population. On this basis, and in view of the substantial benefits, the NATSPG, at its 26th meeting (Paris, 21 May-1 June 1990) agreed to carry out studies aimed at achieving early implementation of RVSM in the NAT Region. World-wide and regional provisions concerning the implementation of RVSM were finalized for applicability in November 1992[1]. Thus, reduced vertical separation may be implemented within Minimum Navigation Performance Specification (MNPS) airspace and/or in other defined transition areas in the ICAO NAT Region.

The FAA New York ARTCC personnel are responsible for the provision of ATC services in the New York Oceanic Control Area, part of the ICAO NAT Region. New York ARTCC sectors 71 and 72 encompass this region. For RVSM, their duties will include transitioning aircraft to/from domestic and non-MNPS/RVSM airspace to RVSM airspace (see figure 1). Aircraft en route to/from RVSM airspace traverse an area that lies mostly outside of radar coverage. A significant amount of this area lies in a portion of the Western Atlantic Route System (WATRS), and thus will be considered in the RVSM experiment.

1.2 PURPOSE.

The long range air traffic forecast for the NAT Region estimates that air traffic will double by the year 2010[2]. The reduction of vertical separation in the MNPS airspace, NAT Region, between FL 290 and FL 410 inclusive, would theoretically accommodate such a projected increase in air traffic and provide for a more efficient use of the available airspace. This enhancement in system capacity would also result in significant improvements in flight economy.

It is believed that the most difficult problems associated with operating under RVSM in the MNPS airspace would be the transition of aircraft to conventional vertical separation minima (CVSM)[3]. Additionally, the procedures for transition may differ based upon the geographical restrictions.

There are two geographical areas that have been identified as potential transition areas. The first transition area to be evaluated will be within the MNPS airspace (see figure 2). Transition within this area will require all westbound aircraft to be separated by CVSM prior to leaving unless the aircraft are entering radar coverage in the depicted northern portion of sector 72 or into Canadian airspace which is either MNPS or radar coverage.

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[1]Manual on Implementation of a 300 m (1000 ft.) VSM between FL 290 and FL 410 inclusive is ICAO Doc. No. 9574-AN/934, dated 1992.
[2]Agenda Item 2, Working Paper 131 agenda presented at the Limited North Atlantic (COM/MET/RAC) Regional Air Navigation Meeting held in Cascais, Portugal, in November 1992.
[3]CVSM - 2000 ft. VSM above FL 290 up to FL 450, inclusive.

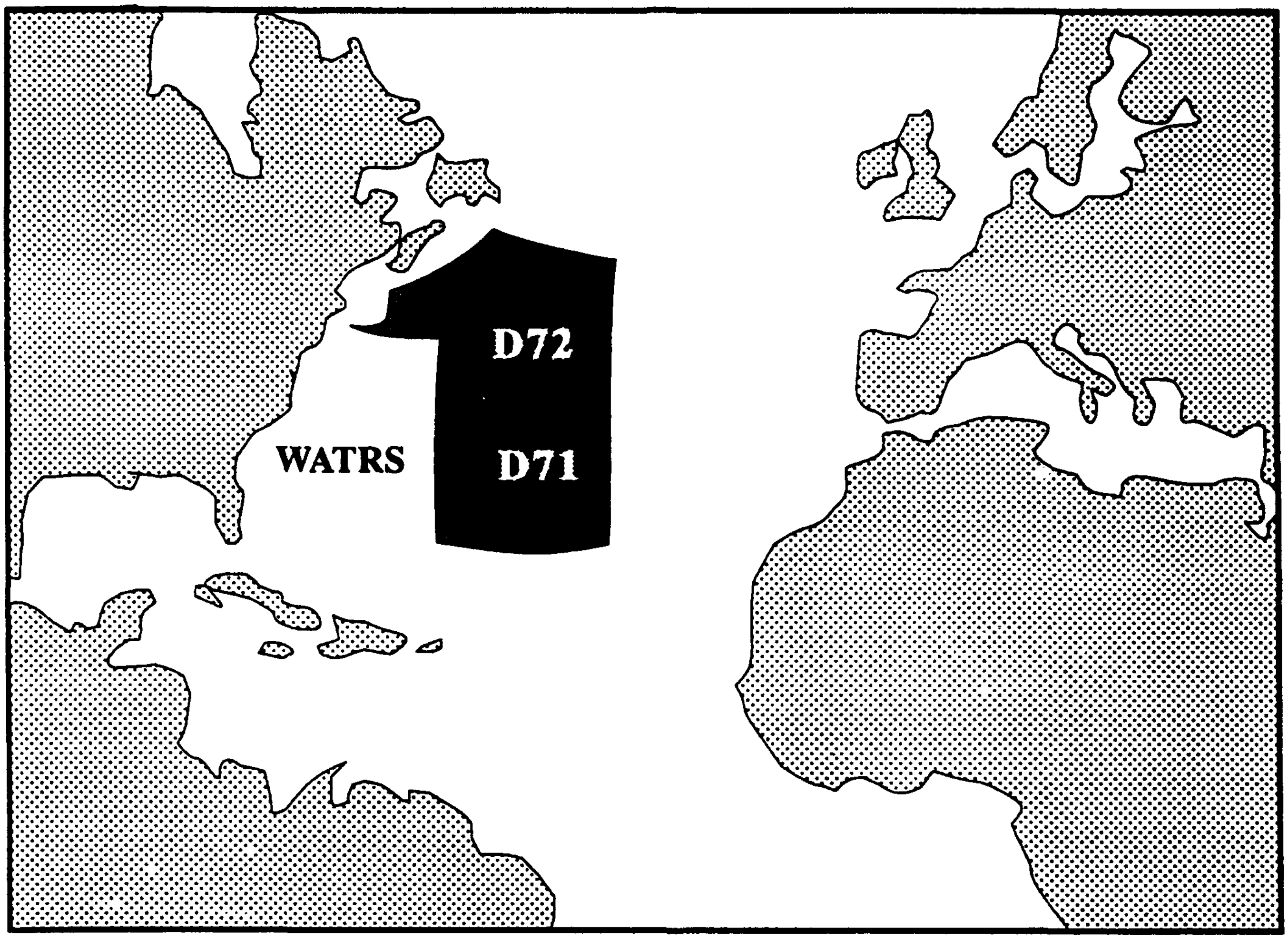

FIGURE 1. MNPS/RVSM AIRSPACE UNDER NEW YORK ARTCC CONTROL

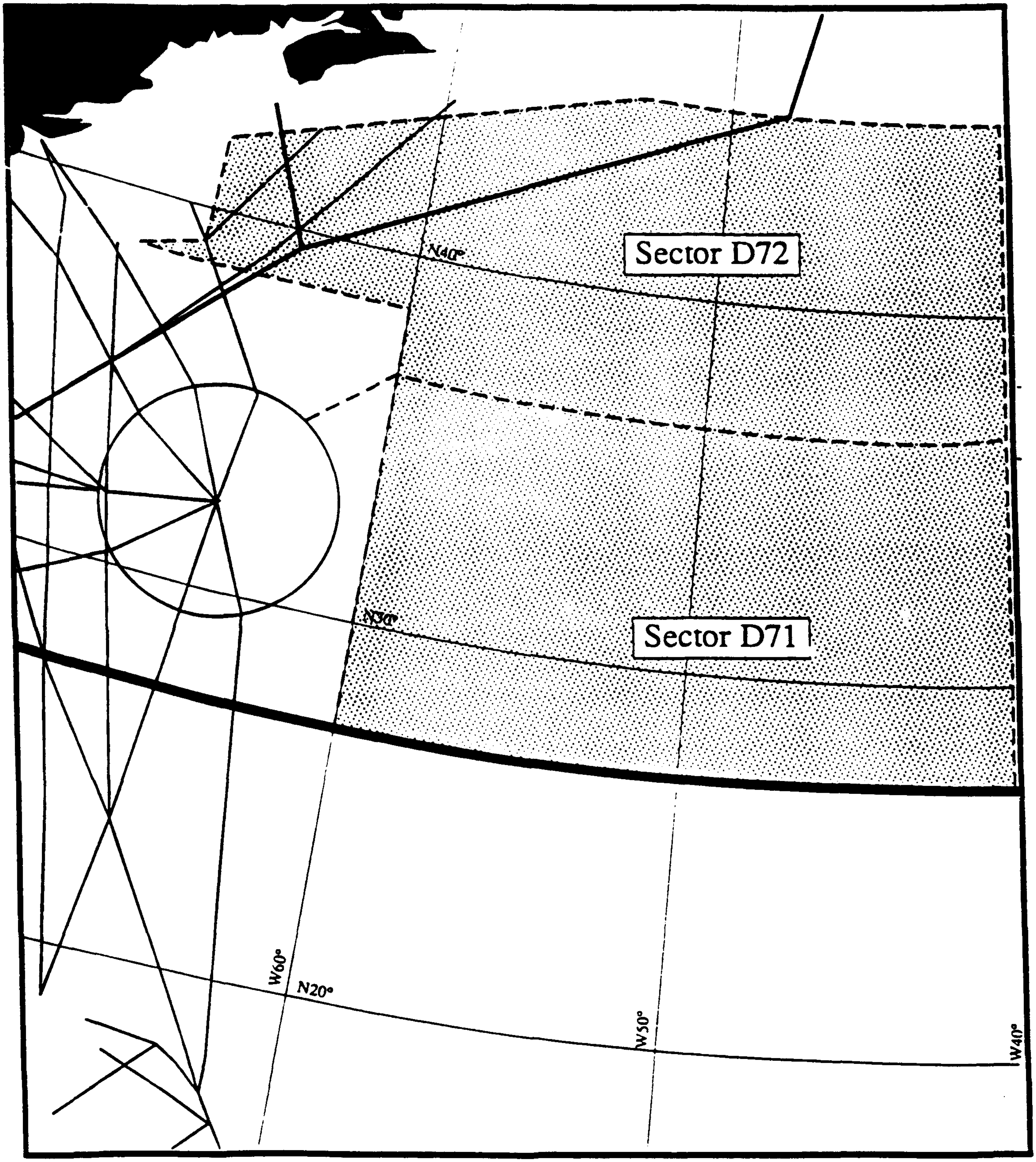

FIGURE 2. PHASE 1 TRANSITION AREA

The second transition area (see figure 3) will have use of radar coverage available for transitioning RVSM-approved aircraft from RVSM to CVSM standard. The transition would occur when RVSM-approved aircraft have entered the radar coverage area and after two-way direct very high frequency (VHF) communications have been established. It must be noted that those aircraft that transition within Bermuda radar coverage will be permitted to traverse a small portion of the WATRS airspace while still using RVSM flight rules. It is envisioned that future experiment phases will focus on other areas that may be used for transition such as the WATRS area.

ATC procedures for the various potential RVSM transition areas within the NAT region and adjacent ICAO regions need to be defined prior to implementation. The proposed RVSM experiment will evaluate procedures used by controllers in transitioning aircraft from RVSM to CVSM.

The NSC RVSM experiment, and associated activities, are designed to provide Air Traffic service organizations, especially the International Procedures Branch (ATP-140), with the vital human performance information needed to define RVSM implementation procedures. The findings/conclusions will be closely coordinated and shared with all NAT ATC provider states to help facilitate the development of a unified implementation plan. An ICAO-developed activity schedule ensures that all efforts are coordinated (see appendix A).

1.3 OVERALL OBJECTIVES.

The first objective of the RVSM experiment is to identify the geographical areas where aircraft can be safely transitioned from RVSM to a CVSM environment, and to establish procedures to effect the transition.

Secondly, the experiment will address changes in controller workload that may be attributed to increased flight operations and problems associated with transitioning RVSM-approved aircraft to and from the designated RVSM area. Part of this objective is to study the impact on the controller of weather-related or other contingencies that could cause an aircraft to deviate from an assigned altitude and/or flight path. The study will evaluate the ability of controllers to work RVSM traffic and to issue instructions to pilots in sufficient time to allow a resolution of projected conflicts. It should be noted that operational boundaries for sectors change from day to day in the operational environment to allow for equitable distribution of workload

A separate experiment in Fiscal Year 1994 will evaluate and compare the current New York ARTCC oceanic ATC capabilities with the planned future ATC/aircraft capabilities. The projected system capabilities will include expected availability of Automatic Dependent Surveillance (ADS), Global Navigation Satellite System (GNSS), Enhanced Situation Displays (ESDs), enhanced automation, etc. The projected system capabilities will be based on those envisioned for 1995 that are listed in the Oceanic Concept of Operations FAA document. This document was developed over the past two years by the FAA Oceanic System Requirements Team (OSRT).

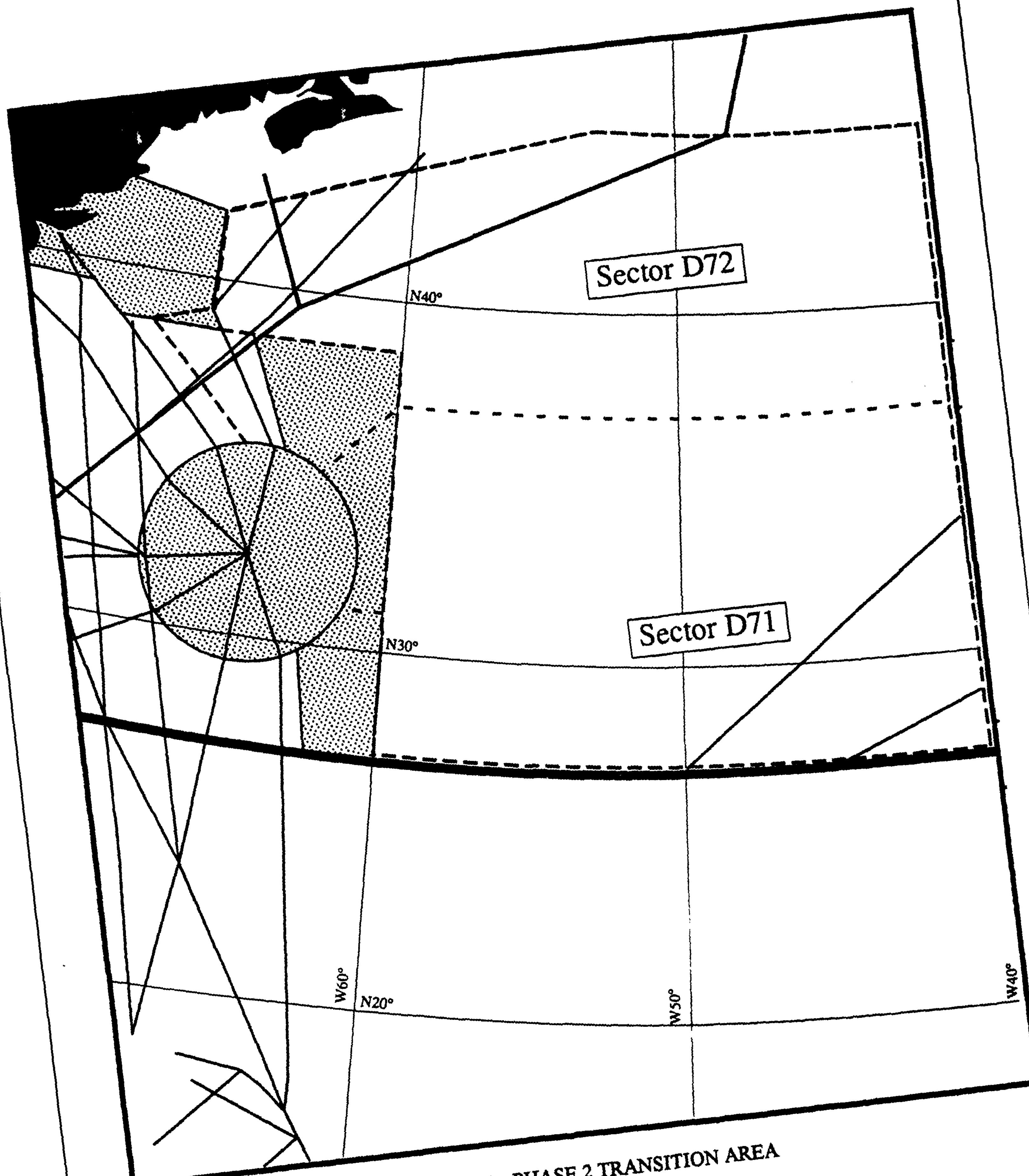

FIGURE 3. PHASE 2 TRANSITION AREA

These experiments represent a critical step by Air Traffic Service in assessing current and projected New York ARTCC oceanic ATC system capabilities. They will provide the baseline for the identification of additional system requirements, if needed, and provide important information for the development of an FAA RVSM implementation plan.

1.4 APPROACH.

The experiment will incorporate real-time ATC simulations designed to evaluate workload when controllers apply separation and other ATC services in designated oceanic transition airspace areas. Currently, most of the candidate transition oceanic airspace areas are non-radar areas. However, one or more of the designated transition areas may fall into airspace where radar coverage is available.

The approach of the RVSM experiment will adhere to the internationally agreed upon guidelines as a basis for the development and definition of simulation scenarios. These guidelines are:

a. RVSM will be effected coincident with MNPS airspace and in defined transition areas.

b. The transition to/from reduced CVSM should be effected in transition areas.

c. The transition areas will be:

1. Defined as Class A airspace within which aircraft proceeding to/from MNPS airspace will be authorized to transition to/from 1,000 ft VSM.

2. Contained within horizontal limits determined by provider states, either individually or in consultation.

3. Adjacent to, overlapping with, or contained within, MNPS airspace.

4. Within radar coverage using direct controller/pilot communications wherever practical.

5. Contained within vertical limits of FL 290 to FL 410, inclusive.

d. When operating within transition areas, RVSM may be applied between those aircraft approved for such operations when transitioning to/from MNPS airspace.[4]

The initial experiment will be accomplished in two phases (simulations) that investigate and measure the effects of RVSM implementation. Each phase will require the development and simulation of several different air traffic scenarios. The phases are:

a. Phase 1. Study transition of westbound aircraft from RVSM to CVSM before leaving RVSM/MNPS airspace (see figure 2) with the exception of aircraft that enter radar coverage adjacent to RVSM/MNPS airspace or Canadian airspace which is either MNPS or radar coverage.

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[4]Agenda Item 2, Working Paper 131 presented at the Limited North Atlantic (COM/MET/RAC) Regional Air Navigation Meeting held in Cascais, Portugal, in November 1992.

b. Phase 2. Investigate the acceptability of the use of the radar coverage available for transitioning RVSM-approved aircraft from RVSM to CVSM standard. The transition would occur when RVSM-approved aircraft have entered the radar coverage area and after two-way direct VHF communications have been established (see figure 3).

Upon the successful completion of these two phases, additional testing of other potential transition areas may be investigated. For example, aircraft traversing through the WATRS area would be allowed to continue using RVSM rules and transition would occur within radar coverage provided by surrounding domestic centers (i.e., Miami, Jacksonville, Washington, and Boston).

These experiments will incorporate the study of aspects alluded to in the previously mentioned objectives. They are expected to provide valuable information in assessing RVSM implementation strategy and ATC system requirements for other NAT ATC providers. Other NAT Region ATC provider states affected by RVSM implementation are also planning similar experiments.

2. PHASE 1. SIMULATION DESIGN.

This section defines the objective, approach, simulation methodology, and analysis planned for the Phase 1 simulation of the RVSM Experiment.

2.1 SIMULATION DESIGN OBJECTIVE.

The objective of this simulation is to measure controller workload attributed to changes in standard operating procedures. This phase will do the following:

a. Measure changes in controller workload levels as impacted by RVSM operations.

b. Identify operational issues associated with RVSM operations.

c. Identify any operational difficulties associated with controllers' ability to transition aircraft from RVSM to CVSM within MNPS airspace.

d. Identify other issues related to reverting from RVSM rules to CVSM rules.

2.2 SIMULATION DESIGN APPROACH.

Each simulation parameter (scenario, protocol, and instrumentation) has been designed to enable valid and informative comparisons between current CVSM operations and RVSM conditions. Toward this purpose, overall traffic load will be held constant for each simulation run, with only the separation rules and constraints being varied under each condition.

2.3 SIMULATION DESIGN METHODOLOGY.

The simulation will be carried out in the Oceanic Development Facility (ODF) located at the FAA Technical Center. The immediate physical environment (as shown in figure 4) realistically simulates the New York ARTCC, including the available equipment and communication

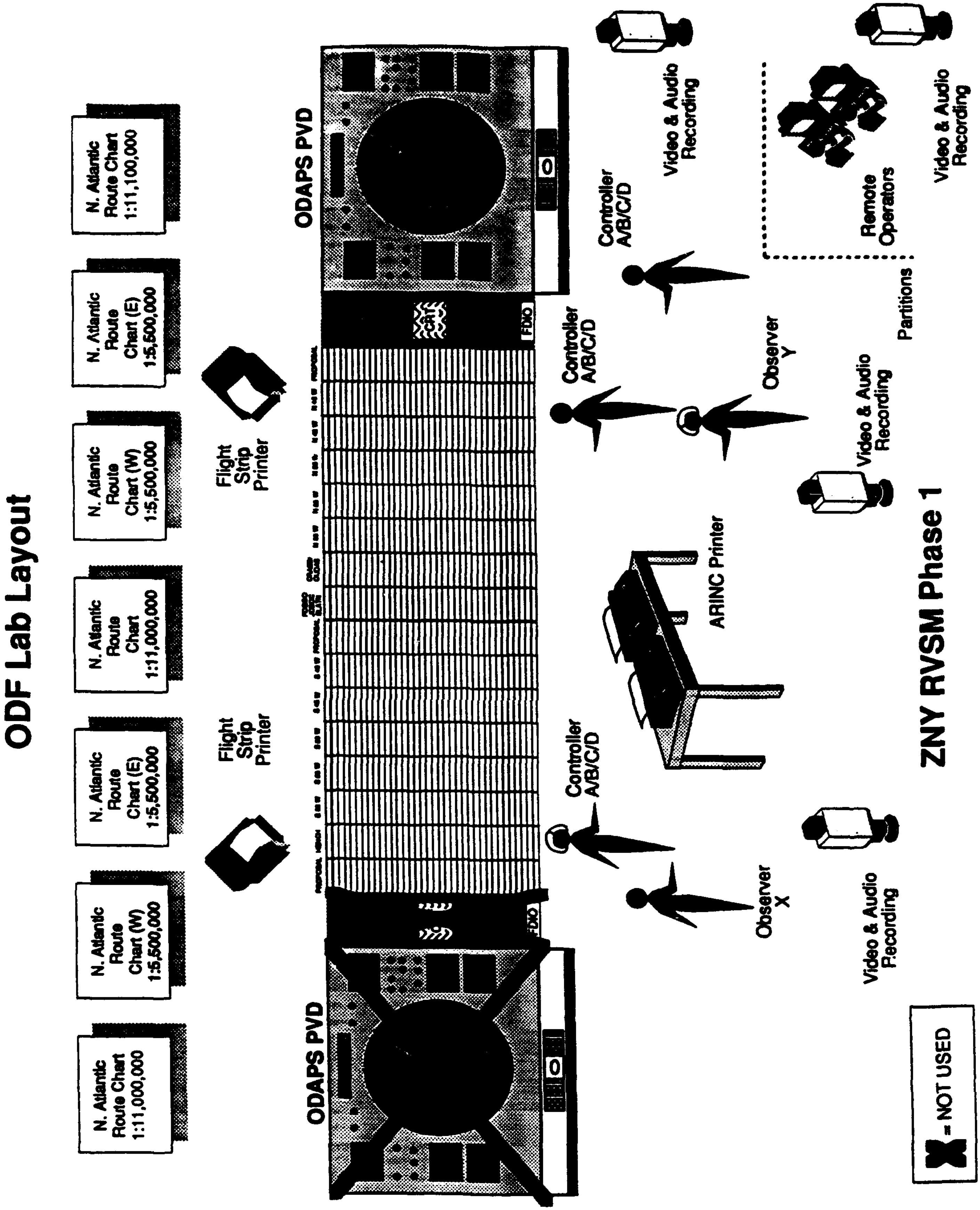

FIGURE 4. ODF LABORATORY LAYOUT

interfaces. All flights will be generated by the ODF. The supporting Aeronautical Radio Incorporated (ARINC) communications will also be simulated. The ATC environment will be fully instrumented (video recording, audio recording, and computer recording) to support the collection of controller performance data.

2.3.1 ODF Laboratory Configuration.

The ODF was developed to provide a complete oceanic ATC environment to support realistic testing and evaluation of oceanic ATC equipment, interfaces, and procedures. The configuration of the ODF laboratory will include two complete oceanic control positions, each consisting of an M1 console, including strip bays, integrated Flight Data Input/Output (FDIO) equipment, voice communication equipment, flight strip printers, emulated ARINC printers, and overhead sector charts. It should be noted that only one Oceanic Display and Planning System (ODAPS) Plan View Display (PVD) will be used in the simulation. This is in accordance with normal operating procedures for New York ARTCC oceanic control.

External interfaces will be exercised as they would be in the field. Controllers involved in the simulation will also be exposed to a realistic control environment. Voice communications to ARINC and adjacent facilities will be simulated. Simulated aircraft will react dynamically to controller-issued clearances.

Key components of the ODF are described in the following paragraphs.

The scenario generator accepts scenario data provided by the lab user taken from actual operations (System Analysis and Recording (SAR) tapes). The test analyst has the capability to list planned event data interleaved with aircraft way point crossings in chronological order, associating an expected simulation time with each element in the list.

The target generator provides position reports that represent the trajectory of simulated aircraft specified in the scenario. The position reports reflect:

a. The effects of simulated forecast winds.
b. Controller clearances.
c. On-line adjustments to the route made by the remote operator.

The remote operator engages in voice communications with controllers, effectively simulating an ARINC operator relaying voice communications to and from the pilot of a controlled aircraft in the controller's sector, a controller in an adjacent Flight Information Region (FIR) transferring control and accepting aircraft or performing other coordination functions, and a controller at another sector or ARTCC.

The remote operator will enter controller clearances to the ODF. The remote operator will also accept an agreement made with another simulated ATC entity (such as an adjacent FIR) and enter it into the ODF. The ODF uses these entries to record and modify flight data.

2.3.2 ODAPS.

This component provides oceanic flight data processing and oceanic display capabilities for selected domestic ARTCCs that have oceanic control responsibilities. ODAPS performs flight data processing for oceanic flights in three sectors of the New York ARTCC's area of responsibility. ODAPS processes flight plan data and related messages in conjunction with stored adaptation data to produce outputs to be transmitted via FDIO control units to FDIO equipment located at the oceanic sector positions. The FDIO equipment will use the data output by ODAPS to print flight strips and other messages essential to oceanic ATC at the appropriate sector positions. ODAPS also provides the oceanic controllers with a graphical representation of the flight plan extrapolated position of all aircraft under their control.

2.3.3 Simulation Participants.

Four controllers from New York ARTCC, all sector certified, will participate in Phase 1. These controllers will rotate the staffing of the two "D" and one ODAPS positions. Two ARINC radio operators will be used to staff the remote operator position. Two technical observers from New York ARTCC will be trained to observe and record subjective performance data on the controllers working the sectors. Additional support staff will be provided by ACD-330, ACD-340, ACD-350, and ACN-600 of the FAA Technical Center.

2.3.4 Scenario Description.

New York oceanic environment data were obtained from an Adaptation Controlled Environment Subsystem (ACES) tape from March 18, 1993. Flight plans, including a mix of aircraft types and equipment (domestic versus foreign carrier, military versus commercial carrier) were created from a Data Analysis and Reduction Tool (DART) run of the SAR tape dated March 18, 1993. The scenario represents a westbound traffic flow on the five published NAT tracks and on random routes from 1400Z - 1800Z. The airspace the controller participants will be responsible for includes sectors 71 and 72 of the New York ARTCC (see figure 2). The flight strips will be printed and placed in the flight strip bay at appropriate times by support personnel. Planned events based on March 18 (such as aircraft reports of turbulence, altitude change requests, routine position reports, emergencies, etc.) will be scripted and used in the appropriate simulation conditions. These events will, in most cases, be introduced via the remote operator position at pre-scheduled times.

2.3.5 Performance Measures.

To date, an insufficient amount of work has been conducted on the assessment of controller workload in the oceanic control environment. Therefore, it will be necessary to determine which controller-performance measures in the oceanic environment are suitable as indicators of controller workload. Questionnaires will be provided to controllers and simulation results will be reviewed to identify critical indicators of controller workload. Sample forms/questionnaires are provided in appendix B.

2.3.5.1 Objective Measures.

Several aspects of oceanic controller performance are being considered as indicators of controller workload, including, but not limited to:

a. Delays.
b. Response to user requests.
c. Rerouting.
d. Restrictions.
e. Operational errors.
f. Timeliness of controller-initiated instructions.
g. Total number of altitude changes.
h. Number of altitude changes experienced per aircraft.
i. Amount of coordination/communications.
j. Ability to transition aircraft from RVSM to CVSM within the MNPS area.

These performance measures will be assessed comparatively and will be expressed as a "percentage" change from the baseline CVSM simulation runs.

2.3.5.2 Subjective Measures.

In addition to the objective performance measures, the following subjective measures will be collected to assess levels of controller workload:

a. "Real-time" ratings of workload obtained by having the technical observer prompt a verbal report from all controllers at regular time intervals (approximately every 15 minutes) throughout each simulation run. This procedure, called the Air Traffic Workload Input Technique (ATWIT), is an FAA-validated technique used for the assessment of controller workload on a continual basis.

b. Controller responses to technical observer-administered structured interviews and questionnaires conducted after each baseline CVSM and each RVSM simulation run.

c. Real-time observations of critical controller actions recorded by trained technical observers throughout each simulation run.

2.3.6 Data Collection.

Comparisons between the workload reported at baseline CVSM and at RVSM conditions 1, 2 and 3 (as defined in section 3.2) will be based on data collected via:

a. Automated recording of ODAPS via SAR tapes.

b. Observations of critical controller actions confirmed by analyzing audio-video records of the simulation runs.

c. Analysis of flight progress strips used during simulation runs.

d. Observation or frequency counts of critical controller actions made in real-time by technical observers with "quick" data collection forms.

e. Controller responses to structured interviews and questionnaires conducted after each baseline CVSM and each RVSM simulation run.

f. Other available computer-recorded performance data.

2.4 ANALYSIS APPROACH.

Objective and subjective data analysis will identify controller workload issues. Descriptive statistics will be used to organize and summarize simulation metrics. In addition, inferential statistics will be used as necessary to address other specific questions of interest that may arise.

2.4.1 Data Analysis.

The data will be collected from simulation runs and will be analyzed in an effort to detect any change in controller performance. The analysis period between simulations serves two purposes: (1) the controller performance measures can be established, and subsequent instances of these measured conditions can be used for comparison; (2) the results of data may indicate additional controller performance measures that may prove useful as indices of controller workload in the oceanic environment. The overall purpose of the data analysis for Phase 1 is to address the issue of whether workload changes occurred. The analysis will also summarize any comments and observations made by controllers and technical observers that address procedural requirements regarding operations.

2.4.2 Analysis Procedures.

In addition to reporting standard descriptive statistics (e.g., mean, frequency, standard deviation, etc.), the analysis may be composed of a number of inferential statistics. These inferential statistics may include Analysis of Variance (ANOVA), protected t-tests, tests for normality and homogeneity of variance, regression analysis, correlation, and non-parametric methods. The purpose of performing any inferential statistical analysis would be to attempt to identify patterns of performance or controller behavior that would be useful in addressing procedural requirements regarding RVSM operations.

3. PHASE 1. SIMULATION PROCEDURES.

The following sections describe the procedures for the Phase 1 simulation.

3.1 STAFFING and TRAINING REQUIREMENTS.

The following section describes the staffing and training requirements for the Phase 1 simulation. The staffing section details the personnel required from both the New York ARTCC and the FAA Technical Center. The training section describes the training for the controllers and the technical observers.

3.1.1 Staffing.

The simulation will be staffed by four air traffic controllers, all currently certified within the past two years on sector 71 and 72, from New York ARTCC. Additionally, the New York ARTCC will provide two training officers to participate as technical observers during the simulation. Two ARINC radio operators will also participate. The FAA Technical Center will provide the technical support staff (human factors engineers, statistical analysts, and ODF technical support) to conduct the simulation and analyze the results.

3.1.2 Training.

The following sections describe the training that will be necessary for select categories of technical staff.

3.1.2.1 Controller Participants.

New York ARTCC controllers will be given several hours of practice using the FAA Technical Center's ODF prior to baseline data collection, to familiarize themselves with the configuration and system performance. Although every attempt is being made to duplicate the operational environment of the New York ARTCC oceanic work area, the FAA Technical Center's ODF may, in some ways, differ slightly in system performance, interface responsiveness, and workspace configuration. Familiarization training will include limited simulation runs specifically scripted to exemplify the configurations of the FAA Technical Center ODF so that the controllers can become accustomed to any differences from the New York ARTCC oceanic control facility. The controllers will be trained and directed on special procedures for the RVSM environment.

3.1.2.2 Technical Observers.

The training of technical observers will occur before and during the practice simulation runs conducted prior to baseline data collection. During this training, the observers will become familiar with their roles in the simulation runs. Since practice simulation runs are specifically scripted to familiarize controllers with the FAA Technical Center ODF, the observers will have an opportunity to practice recording controller performance in the actual experimentation system configuration.

This training procedure will familiarize the observers with the critical controller actions, behaviors, and occurrences that will be used in the assessment of controller workload. Further, observers will be trained to record this information on the "quick" reporting form that they will have for each controller within each simulation run; the purpose of this instruction is to keep errors in the hand-recording of data to a minimum and to optimize rating reliability.

3.2 SIMULATION DESIGN PROCEDURES.

The following sections provide a description of the simulation procedures and the subject scheduling.

3.2.1 General Procedures

Phase 1 will be composed of two parts, with each part containing two experimental conditions. There will be two simulation runs per experimental condition for a total of eight simulation runs during Phase 1. All simulation runs will use the New York ARTCC oceanic traffic (aircraft types, numbers, and tracks), which occurred on March 18, 1993, as the basis to construct each scenario. March 18 has been chosen because it represents a full capacity, five-track traffic flow day. All simulation runs will occur in a two-sector configuration (sector 71 and sector 72) with each having a "D" and sharing a single ODAPS controller position. Each simulation run will last approximately 6.5 hours. Controllers will rotate through the controller positions so that each controller will break for 30 minutes after working a position for approximately 1 1/2 hours. During the position exchange, no pause or break in the simulation will occur, replicating a realistic work environment.

There will be two scenarios developed for each experimental condition. The two scenarios are identical to each other with the exception that planned events, such as change in altitude request, are made by different aircraft. This is done to minimize the opportunity for controllers to "learn" the script of the scenarios due to repeated exposure. The two different scenarios will be run on two consecutive simulation days.

Two ARINC radio operators will be required to assist in the remote operator position, which will simulate contacts with ARINC, other domestic and oceanic controllers, and other FIRs. In addition, a technical observer will record specific activities at each sector.

The comparison between CVSM baseline operations and RVSM operations will be of prime importance in providing information regarding controller workload levels. By using the same group of oceanic controllers for both the CVSM baseline operation and the RVSM operation, it will be possible to account for changes in controller strategies for working traffic. Hence, major differences in controller performance can be attributed to the impact that the different operations have on controller workload.

3.2.2 Baseline CVSM/Basic RVSM Experimental Conditions/Runs.

Part 1 (four days in duration) consists of two experimental conditions (see table 1). The first is a two day CVSM baseline, and second is a two day RVSM basic (altitude compression only). As previously stated, the baseline CVSM and the basic RVSM experimental conditions will be conducted for two days each. The baseline CVSM scenarios will use the traffic load of March 18. However, the basic RVSM scenarios will use the same traffic as CVSM, except that some aircraft will be reassigned even altitudes representing the application of RVSM flight rules.

3.2.3 RVSM-Minimum Time Track (MTT)/RVSM-Clear Air Turbulence (CAT) Experimental Conditions/Runs.

Part 2 (four days in duration) consists of two experimental conditions (see table 1). The first is a two day RVSM (RVSM-MTT) with aircraft moved closer to the MTT, and second is a two day RVSM (RVSM-CAT) with reports of greater than moderate CAT. On the first two days,

Table 1 - Controller Assignments: NSC Phase I Simulation

All conditions: Day 1 & Day 2
4 Controllers: A, B, C, D

Minutes Time Interval	Sector 71 Observer X	ODAPS X & Y	Sector 72 Observer Y	On Break
0 1/2 hour	A	B	C	D
30 1 hour	D	B	C	A
60 1 1/2 hours	D	A	C	B
90 2 hours	D	A	B	C
120 2 1/2 hours	C	A	B	D
150 3 hours	C	D	B	A
180 3 1/2 hours	C	D	A	B
210 4 hours	B	D	A	C
240 4 1/2 hours	B	C	A	D
270 5 hours	B	C	D	A
300 5 1/2 hours	A	C	D	B
330 6 hours	A	B	D	C
360 6 1/2 hours	A	B	C	D
390	end	end	end	end

RVSM-MTT will consist of two simulation runs with RVSM rules in effect. It must be noted that there will be no increase in the number of aircraft, but the density on the MTT will increase due to the increased number of available altitudes.

The second experimental condition RVSM-CAT will be conducted on the third and fourth days. This will consist of simulation runs similar to basic RVSM until two pilots report greater than moderate CAT. When this situation occurs, the controller is required to comply with the ATC in-flight contingency procedures for RVSM airspace defined in the NAT Vertical Separation Implementation Group (VSIG) Meetings 1[5] and 2[6]. The purpose of these simulation runs is to examine the controller's ability to comply with the proposed NAT VSIG procedures.

3.3 CONFIGURATION MANAGEMENT.

Configuration management will ensure repeatability for all simulation activities. All project items used in connection with the RVSM project will be documented and retained in a library within the Human Factors Laboratory building at the FAA Technical Center. Project items may include documentation, questionnaire and observer forms, facility tapes, data reduction and analysis (DR&A) recording tapes and listings, and simulation run-time logs. Project records will be accessible for review by project management and customer/government personnel.

Configuration management activities will:

a. Assure configuration control for all NSC simulation activities.

b. Ensure compliance with simulation procedures.

c. Document problems and deficiencies encountered during simulation.

d. Authenticate and assure control of simulation records.

e. Maintain and control all inputs and outputs (tape, printout, etc.) during the entire simulation period.

f. Maintain NSC Documentation Library.

[5]Summary of Discussions of the First North Atlantic Vertical Separation Implementation Group (NAT VSIG/2) of the North Atlantic Systems Planning Group. Paris. 18-22 Nov 1991

[6]Summary of Discussions of the Second North Atlantic Vertical Separation Implementation Group (NAT VSIG/2) of the North Atlantic Systems Planning Group. Annapolis 30 March to 3 April 1992

GLOSSARY

Flight Information Region (FIR) - Airspace within which air traffic control services may be provided.

Minimum Aircraft System Performance Specification (MASPS) -Specification defining aircraft avionics performance standards which must be met to authorize flight in the MNPS.

Minimum Navigation Performance Specifications (MNPS) - A specified minimum navigation performance standard which aircraft must meet in order to operate in MNPS designated airspace. In addition, aircraft must be certified by their state of registry for MNPS operation. The objective of MNPS is to ensure the safe separation of aircraft and to derive maximum benefit, generally through reduced separation standard, from the improvement in accuracy of navigation equipment developed in recent years.

Minimum Navigation Performance Specification Airspace (MNPSA) - A portion of the NAT airspace between FL275 and FL400 extended between latitudes 27N and the North Pole, bounded in the east by eastern boundaries of control areas Santa Maria oceanic, Shanwick oceanic, Reykjavik, and in the west by the western boundaries of CTA Gander oceanic and the western boundary of CTA New York oceanic, excluding the area west of 60W and south of 38.40N.

Western Atlantic Route System (WATRS) - Beginning at a point 27.00N/77.00W direct to 20.00N/67.00W direct to 18.00N/62.00W direct to 18.00N/60.00W direct to 38.30N/60.00W direct to 38.30N/69.15W thence counterclockwise along the New York oceanic control area/flight information region boundary to the Miami oceanic control area/flight information region boundary, thence southbound along the Miami oceanic control area/flight information region boundary to the point of beginning.

Sector 71 boundaries - Beginning at the northeast corner, 37.00N/40.00W, south to 27.00N/40.00W, west to 27.00N/60.00W, north to 31.00N/60.00W, west to 31.00N/61.33W, northwest arc on the Bermuda boundary to 34.41N/62.25W, northeast to 37.00N/60.00W, east to 37.00N/55.00W, east to 37.00N/50.00W, east back to 37.00N/40.00W.

Sector 72 boundaries - Beginning at the northeast corner, 45.00N/40.00W, south to 37.00N/40.00W, west to 37.00N/60.00W, southwest to 34.41N/62.25W, northwest arc on the Bermuda boundary to 35.20N/65.14W, northwest to 38.35N/69.02W, northeast to 39.00N/67.00W, north to 41.52N/67.00W, northeast to 43.56N/60.01W, northeast to 44.40N/55.00W, northeast to 45.00N/53.00W, east back to 45.00N/40.00W.

ACRONYMS

AC	Advisory Circular
ACES	Adaptation Controlled Environment Subsystem
ACJ	Advisory Circular, Joint
ADS	Automatic Dependent Surveillance
ANOVA	Analysis of Variance
ARIMA	Auto-Regressive Integrative Moving Average
ARINC	Aeronautical Radio, Inc. (a support contractor)
ARTCC	Air Route Traffic Control Center
ATC	Air Traffic Control
ATWIT	Air Traffic Workload Input Technique
CAT	Clear Air Turbulence
CVSM	Conventional Vertical Separation Minima
DART	Data Analysis and Reduction Tool
DR&A	Data Reduction and Analysis
ESD	Enhanced Situation Display
FAA	Federal Aviation Administration
FDIO	Flight Data Input/Output
FIR	Flight Information Region
FL	Flight Level
ft	Feet; foot
GNSS	Global Navigation Satellite System
HMU	Height Monitoring Unit
ICAO	International Civil Aviation Organization
m	Meter(s)
MASPS	Minimum Aircraft System Performance Specification
MNPS	Minimum Navigation Performance Specification
MTT	Minimum Time Track
NAT	North Atlantic
NATSPG	North Atlantic Systems Planning Group
NSC	National Simulation Capability
ODAPS	Oceanic Display and Planning System
ODF	Oceanic Development Facility
OSRT	Oceanic System Requirements Team
PVD	Plan View Display
RGCSP	Review of the General Concept of Separation Panel
RVSM	Reduced Vertical Separation Minima
SAR	System Analysis and Recording
TLS	Target Level of Safety
VHF	Very High Frequency
VSIG	Vertical Separation Implementation Group
VSM	Vertical Separation Minimum
WATRS	Western Atlantic Route System

APPENDIX A
FULL IMPLEMENTATION SCHEDULE FOR RVSM

November 1992	a. (LIM) NAT (RAN) Meeting endorsement of plans and programs for the implementation of RVSM; and b. ATC simulation commences (United States).
January 1993	a. Begin field evaluation of prototype height monitoring unit (HMU); and b. ATC simulation commences (Canada and Iceland).
February 1994	a. Publish Advisory Circular/Advisory Circular Joint (AC/ACJ) and distribute to NAT user states for consideration and b. Start approval of aircraft/operators.
June 1994	a. Decide on system performance monitoring technique to be used; b. Acceptance of prototype HMU system; and c. HMU contract to competitive tender.
October 1994	a. Implement state and central data base of approved users.
January 1995	a. Commence building operational HMUs; and b. All ATC simulations completed.
April 1995	a. Target of 50 per cent of operators approved for reduced VSM operations; b. Operational HMUs come on-line; c. ATC procedures and transition arrangements finalized; d. Start system verification in 2,000 ft VSM environment; 1. On the basis of data collected, ensure that aircraft meet the global system performance specifications; and 2. Ensure that the system meets the NAT Region TLS of 5.0×10^{-9} (second-half 1995). a) Acceptance (progressive) of HMUs; and b) All ATC facilities and arrangements in place.
January 1996	a. Target of 90 per cent of operators approved for RVSM operations; b. Applicability of MASPS; and c. Applicability of the NAT SUPPs relating to height-keeping performance.

January 1997	a. Confirm that at least 90 per cent of operators approved for RVSM (the remaining 10 per cent could be accommodated outside MNPS airspace); b. Applicability of the SUPPs relating to the implementation of 1,000 ft VSM; c. Implementation of the transition areas; d. Start of operational trials in 1,000 ft VSM environment; and e. Aircraft and operators not approved for operations in MNPS airspace (including MASPS) will be excluded.
January 1998	Full implementation

APPENDIX B

SIMULATION CONTROLLER FORMS/QUESTIONNAIRES

NSC SIMULATION: CONTROLLER FORM I.
INSTRUCTIONS:

1. This form is to be completed by all controllers prior to participation in the NSC Phase One Simulation activities. The form consists of requests for general background information and an initial (baseline) judgment regarding oceanic control practices.

2. Controllers should be advised that their names will not be listed or appear in any of the NSC's data records to insure anonymity and to encourage unbiased reporting. Findings will be reported as group data and generically, as Controller A, B, C, etc. In order to facilitate data analysis, the experimenters will use the last four digits of a controller's social security number tc . .llate various data records belonging to a particular simulation subject.

NSC SIMULATION: CONTROLLER FORM I.

GENERAL BACKGROUND INFORMATION

Date: ____________

Last four digits of your Social Security Number: _________

Age: ______

How many years of experience as a controller (FPL) ? ______years_______months

How many years of experience as an Oceanic FPL? _____years _______ months

How much time as an oceanic controller in the North Atlantic Region? ______

Name the last three facilities at which you have worked starting with your current assignment:

(1)___________________ (2)___________________ (3)___________________

GENERAL PROCEDURES & PRACTICES INFORMATION

1. If you had an opportunity to change three current elements in the oceanic area (practices, procedures, equipment, etc.), what would they be?

2. Based on your experience with high traffic and high workload in oceanic operations;
a) What are some of the things that can occur that could cause you to have significant difficulties in maintaining an orderly and expedititous traffic flow ?

b) Which of these events tend to occur most frequently?

c) Which of these events tend to most likely cause additional problems?

3. Please check all items below that you feel contribute significantly to high levels of workload in the current oceanic ATC system:

- ❐ Printer Speed ODAPS__ ARINC__
- ❐ ODAPS Update Rate
- ❐ ARINC Communication Delays
- ❐ Phone System
- ❐ Special Pilot Requests
- ❐ Other ____________________
- ❐ Coordination with Foreign Facilities
- ❐ Coordination with Fellow Controllers
- ❐ Oceanic Track System
- ❐ Random Routes
- ❐ Aircraft Performance Characteristics/Mix
- ❐ Other ____________________

Comments on any of the above checked items:

NSC SIMULATION: CONTROLLER FORM II.
INSTRUCTIONS:

1. This form is to be completed by all controllers after each completed simulation run in the NSC Phase One Simulation activities. The form consists of requests for information regarding overall experiences and judgments about the just completed simulation run.

2. The RATING NUMBERS to be used for item #4 are:

1 = Remarkably good
2 = Moderately good
3 = So-so
4 = Not very good
5 = Unusually poor

3. Page 2 of the Form consists of two different versions: Version 1 is to be filled out after CVSM (baseline) simulation runs, Version 2 is to be filled out after simulations with RVSM conditions. The difference between these two versions is that version 2 elicits additional, RVSM-specific information.

NSC SIMULATION: CONTROLLER FORM II
POST SIMULATION RUN QUESTIONNAIRE

Simulation Condition: ❑ CVSM ❑ RVSM ❑ RVSM- MTT ❑ RVSM- CAT

Your SS#-(4 last digits) ________Date:__________Simulation Run No:_______

1. Please estimate your overall WORKLOAD during the last simulation (circle one)?

1	2	3	4	5	6	7	8	9	10
VERY LOW				MODERATE					VERY HIGH

2. In terms of REALISM, how real was the PHYSICAL SIMULATION ENVIRONMENT for you (circle one)?

1	2	3	4	5	6	7	8	9	10
VERY LOW				MODERATE					VERY HIGH

3. In terms of FUNCTIONAL REALISM, how real was the SIMULATED TRAFFIC for you (circle one)?

1	2	3	4	5	6	7	8	9	10
VERY LOW				MODERATE					VERY HIGH

4. Please judge your OWN PERFORMANCE over the most recent simulation run. Using the RATING NUMBERS from the instruction sheet, for each position worked, insert the appropriate rating into each box next to the following factors:

ODAPS-POSITION	D-POSITION
❑ Proper Coordination	❑ Proper Coordination
❑ Promptness of Actions	❑ Promptness of Actions
❑ Situation Awareness Maintenance	❑ Situation Awareness Maintenance
❑ Communication Management	❑ Communication Management
❑ Proper Message Construction	❑ Proper Clearances Issued
❑ Computer Entry Management	❑ Flight Strip Management
❑ Other_________________	❑ Maintenance of Separation

5. What was most difficult for you to accomplish during the simulation ?

a) (at the) ODAPS position	b) (at the) D-Position
____________________	____________________
____________________	____________________
____________________	____________________

CVSM (BASELINE) CONDITION CONTROLLER FORM II

continued

6. If you could change something about the last simulation run (anything at all about the traffic scenario, aircraft, procedures, etc., etc.) , what would it be ?

7. Did you change your usual control and work strategies in any way in order to work the traffic in the last simulation? If so, how? What did you do differently?

8. Based upon your experience with the traffic load during the last simulation run, what procedures would have to be changed and/or implemented in order for you to continue to be comfortable about working this same traffic but under reduced vertical separation minima (RVSM)?

9. What was your primary safety concern considering traffic, events, and procedures in the last simulation run?

RVSM CONDITIONS CONTROLLER FORM II

continued

6. If you could change something about the last simulation run (anything at all about the traffic scenario, aircraft, procedures, etc., etc.) , what would it be ?

7. Did you change your usual control and work strategies in any way in order to work the traffic with RVSM? If so, how? What did you do differently?

8. Based upon your experience with RVSM in the last simulation run, what procedures would have to be changed and/or implemented in order for you to continue to be comfortable about working this traffic ?

9. What was your primary safety concern considering traffic, events, and procedures in the last simulation run?

NSC SIMULATION: <u>OBSERVER FORM I</u>
INSTRUCTIONS:

1. This form is to be completed by all technical observers prior to participation in the NSC Phase One Simulation activities. The form consists of requests for general background information and an initial (baseline) judgment regarding oceanic control practices.

2. Observers should be advised that their names will not be listed or appear in any of the NSC's data records to insure anonymity and to encourage unbiased reporting. Findings will be reported as group data and generically, as Controller/Observer 1, 2, 3, etc. In order to facilitate data analysis, the experimenters will use the last four digits of an observer's social security number to collate various data records belonging to a particular simulation subject.

NSC SIMULATION: OBSERVER FORM I.

GENERAL BACKGROUND INFORMATION

Date: ___________

Last four digits of your Social Security Number: _________

Age: ______

How many years of experience as a controller (FPL) ? ______years ________months

How many years of experience as an Oceanic FPL ? _____years ________months

How much time as an oceanic controller in the North Atlantic Region? ________

How many years/months since you have controlled oceanic traffic? __________

How many years/months as a trainer/developer in an ATC facility ? __________

GENERAL PROCEDURES & PRACTICES INFORMATION

1. If you had an opportunity to change three current elements in the oceanic area (practices, procedures, equipment, etc.), what would they be?

____

____

____

____

2. Based on your experience with high traffic and high workload in oceanic operations;
a) What are some of the things that can occur that could cause a controller to have significant difficulties in maintaining an orderly and expedititous traffic flow ?

____

____

b) Which of these events tend to occur most frequently?

____

____

c) Which of these events would most likely tend to cause additional problems?

____

____

3. Please check all items below that you feel contribute significantly to high levels of workload in the current oceanic ATC system:

- ❒ Printer Speed ODAPS___ARINC___
- ❒ ODAPS Update Rate
- ❒ ARINC Communication Delays
- ❒ Phone System
- ❒ Special Pilot Requests
- ❒ Other ____________________
- ❒ Coordination with Foreign Facilities
- ❒ Coordination with Fellow Controllers
- ❒ Oceanic Track System
- ❒ Random Routes
- ❒ Aircraft Performance Characteristics/Mix
- ❒ Other ____________________

Comments on any of the above checked items:

____

____

____

____

NSC SIMULATION: TECHNICAL OBSERVER "QUICK" FORM.
INSTRUCTIONS:

1. This form is to be completed by trained technical observers during each simulation run.

2. Observations and responses will be recorded in 15 minute intervals. A new (identical) form will be used for each 15 minute time period. As much information as possible will be preprinted on the forms (example, the interval will be specified as T+15, T+30, T+45, etc.).

3. Observations will be made on this form primarily for the "D-Position" controller. However, both controllers will be prompted for their workload rating at 15 minute intervals and the observer will make "quick evaluations" about performance on both positions.

4. The rating numbers for WORKLOAD are on a scale from 1 to 10 with

1 = very low workload
5 = moderate workload
10 = very high workload

5. The rating numbers for the rest of the QUICK EVALUATIONS are

1 = Remarkably good
2 = Moderately good
3 = So-so
4 = Not very good
5 = Unusually poor

TECHNICAL OBSERVER "QUICK" FORM.

INTERVAL: ______________ TIME:____:____:____

Simulation Run No.______________

Date:________ Sector Number:________ Observer ID ____________________

Prompt for workload rating from the controllers every 15 minutes!

WORKLOAD RATING - "D"Controller :	1	2	3	4	5	6	7	8	9	10
WORKLOAD RATING - "ODAPS" Controller :	1	2	3	4	5	6	7	8	9	10

RESTRICTIONS ISSUED (hashmarks):

❑ SPEED					
❑ TIME					
❑ ALTITUDE					
❑ ROUTING					

ARINC COMMUNICATIONS GROUPINGS (hashmarks):

ONE CLEARANCE				
TWO AT A TIME				
THREE AT A TIME				
FOUR OR MORE AT A TIME				

OPERATIONAL ERROR OBSERVED:

TIME:_____:_______:_____

❑ Loss of Separation

❑ Other____________

Briefly describe what happened:

____

____

____

QUICK OBSERVER EVALUATIONS (circle one)

"ODAPS" CONTROLLER	"D" CONTROLLER
WORKLOAD RATING	
1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10
COORDINATION & COMMUNICATION	
1 2 3 4 5	1 2 3 4 5
TRAFFIC MANAGEMENT & CONTROL JUDGMENT	
1 2 3 4 5	1 2 3 4 5
FLIGHT STRIP MANAGEMENT	
1 2 3 4 5	1 2 3 4 5

NSC SIMULATION: OBSERVER FORM II.
INSTRUCTIONS:

1. This form is to be completed by all observers after each completed simulation run in the NSC Phase One Simulation activities. The form consists of requests for information regarding overall experiences and judgments about the just completed simulation run.

2.The RATING NUMBERS to be used for item #4 are:

1 = Remarkably good
2 = Moderately good
3 = So-so
4 = Not very good
5 = Unusually poor

3. Page 6 of the Form consists of two different versions: Version 1 is to be filled out after CVSM baseline simulation runs, Version 2 is to be filled out after simulations with RVSM. The difference between these two versions is that version 2 elicits additional, RVSM-specific information.

NSC SIMULATION: <u>OBSERVER FORM II.</u>
POST SIMULATION RUN QUESTIONNAIRE

Simulation Condition: ❐ **CVSM** ❐ **RVSM** ❐ **RVSM-MTT** ❐ **RVSM-CAT**

Observer ID# __________ **Date:**__________ **Simulation Run No.:**__________

1a. For each controller please estimate the overall "D" position WORKLOAD during the last simulation (circle one):

Controller SS# (four digits)________

1	2	3	4	5	6	7	8	9	10
VERY LOW				MODERATE					VERY HIGH

Controller SS# (four digits)________

1	2	3	4	5	6	7	8	9	10
VERY LOW				MODERATE					VERY HIGH

Controller SS# (four digits)________

1	2	3	4	5	6	7	8	9	10
VERY LOW				MODERATE					VERY HIGH

Controller SS# (four digits)________

1	2	3	4	5	6	7	8	9	10
VERY LOW				MODERATE					VERY HIGH

NSC SIMULATION: <u>OBSERVER FORM II.</u>

continued

1b. For each controller please estimate the overall ODAPS position WORKLOAD during the last simulation (circle one):

Controller SS# (four digits)________

1	2	3	4	5	6	7	8	9	10
VERY LOW				MODERATE					VERY HIGH

Controller SS# (four digits)________

1	2	3	4	5	6	7	8	9	10
VERY LOW				MODERATE					VERY HIGH

Controller SS# (four digits)________

1	2	3	4	5	6	7	8	9	10
VERY LOW				MODERATE					VERY HIGH

Controller SS# (four digits)________

1	2	3	4	5	6	7	8	9	10
VERY LOW				MODERATE					VERY HIGH

2. In your opinion, in terms of REALISM, how real was the PHYSICAL SIMULATION ENVIRONMENT for the controllers (circle one)?

1	2	3	4	5	6	7	8	9	10
VERY LOW				MODERATE					VERY HIGH

3. In your opinion, in terms of FUNCTIONAL REALISM, how real was the SIMULATED TRAFFIC for the controllers (circle one)?

1	2	3	4	5	6	7	8	9	10
VERY LOW				MODERATE					VERY HIGH

NSC SIMULATION: OBSERVER FORM II.

continued

4. Please judge OVERALL CONTROLLER PERFORMANCE during the most recent simulation run.
Using the RATING NUMBERS from the instruction sheet, insert the appropriate rating number for each of the positions observed into the box next to each of the following factors:

Controller SS# (4 digits)_____________

ODAPS-POSITION	D-POSITION
❐ Proper Coordination	❐ Proper Coordination
❐ Promptness of Actions	❐ Promptness of Actions
❐ Situation Awareness Maintenance	❐ Situation Awareness Maintenance
❐ Communication Management	❐ Communication Management
❐ Proper Message Construction	❐ Proper Clearances Issued
❐ Computer Entry Management	❐ Flight Strip Management
❐ Other____________________	❐ Maintenance of Separation

Controller SS# (4 digits)_____________

ODAPS-POSITION	D-POSITION
❐ Proper Coordination	❐ Proper Coordination
❐ Promptness of Actions	❐ Promptness of Actions
❐ Situation Awareness Maintenance	❐ Situation Awareness Maintenance
❐ Communication Management	❐ Communication Management
❐ Proper Message Construction	❐ Proper Clearances Issued
❐ Computer Entry Management	❐ Flight Strip Management
❐ Other____________________	❐ Maintenance of Separation

NSC SIMULATION: <u>OBSERVER FORM II.</u>

continued

Controller SS# (4 digits)____________

ODAPS-POSITION	D-POSITION
❐ Proper Coordination	❐ Proper Coordination
❐ Promptness of Actions	❐ Promptness of Actions
❐ Situation Awareness Maintenance	❐ Situation Awareness Maintenance
❐ Communication Management	❐ Communication Management
❐ Proper Message Construction	❐ Proper Clearances Issued
❐ Computer Entry Management	❐ Flight Strip Management
❐ Other____________________	❐ Maintenance of Separation

Controller SS# (4 digits)____________

ODAPS-POSITION	D-POSITION
❐ Proper Coordination	❐ Proper Coordination
❐ Promptness of Actions	❐ Promptness of Actions
❐ Situation Awareness Maintenance	❐ Situation Awareness Maintenance
❐ Communication Management	❐ Communication Management
❐ Proper Message Construction	❐ Proper Clearances Issued
❐ Computer Entry Management	❐ Flight Strip Management
❐ Other____________________	❐ Maintenance of Separation

5. What was most difficult for controllers to accomplish during this simulation ?
a) (at the) ODAPS position b) (at the) D-Position

____
____
____
____
____
____

CVSM (BASELINE) CONDITION OBSERVER FORM II

continued

6. If you could change something about the last simulation run (anything at all about the traffic scenario, aircraft, procedures, etc., etc.) , what would it be ?

7. Did the controllers change their usual control and work strategies in any way in order to work the traffic in the last simulation? If so, how? What did they do differently?

8. Based upon your observations with the traffic load during the last simulation run, what procedures would have to be changed and/or implemented in order for the controllers to be comfortable about working this same traffic but under reduced vertical separation minima (RVSM)?

9. What was your primary safety concern considering traffic, events, and procedures in the last simulation run?

RVSM CONDITIONS OBSERVER FORM II

continued

6. If you could change something about the last simulation run (anything at all about the traffic scenario, aircraft, procedures, etc., etc.) , what would it be ?

7. Did the controllers change their usual control and work strategies in any way in order to work the traffic with RVSM? If so, how? What did they do differently?

8. Based upon your observations with RVSM in the last simulation run, what procedures would have be changed and/or implemented in order for the controllers to continue to be comfortable about working this traffic ?

9. What was your primary safety concern considering traffic, events, and procedures in the last simulation run?

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