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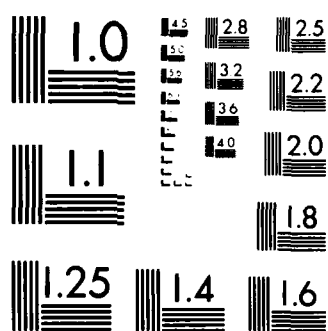
NATIONAL AIRSPACE SYSTEM OPERATIONAL REQUIREMENTS(U)
FEDERAL AVIATION ADMINISTRATION WASHINGTON DC OCT 84

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US Department
of Transportation
**Federal Aviation
Administration**

National Airspace System

Operational Requirements



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CHAPTER I

INTRODUCTION

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INTRODUCTION

The National Airspace System Plan for Facilities, Equipment and Associated Development has set a framework for the modernization of the NAS for the next decade. It was developed with specific overall goals in a mind. These include the replacement and modernization of an aging air traffic control and navigation system, the development of a total system related to the specific needs of the user community, and the design of that system to serve as a basis for further enhancement of safety, improved efficiency, and reduced operation costs.

Since the publication of the first NAS Plan, the agency has undertaken a multilateral approach to ensure that the implementation of the NAS Plan is consistent with and accomplishes the intent of those broad goals. Continuous review of the NAS Plan, along with the comprehensive review of the NAS airspace and its attendant procedures through the National Airspace Review, have provided the aviation community with a unique opportunity for assisting and advising the FAA in the direction of that system evolution.

In consonance with these efforts, the agency has developed companion plans for the NAS engineering and development programs and the NAS maintenance and operations necessary to support the future system. The NAS Plan for Engineering and Development outlines the projects required to support the acquisition of the future system, as well as those activities necessary to make use of an evolving, fast-changing technology to meet user needs that cannot be met by current system technology.

A related activity, initiated by the agency in support of the NAS Plan development, provides documentation of the operational requirements that are being addressed in the various FAA programs set forth in the NAS Plan. Those requirements have been consolidated in this document to facilitate the verification of the NAS Plan goals for meeting the user needs and to provide a forum for extensive user coordination and the associated requirements validation. These requirements are presented in the form of capabilities which are required of the NAS to provide agency personnel the necessary tools to ensure safe and efficient services to the aviation public. The detailed approach for translating the operational requirements into functional capabilities and implemented systems will be determined through the NAS system design

activity. The NAS Operational Requirements Document provides a basic tool in the systems engineering process and is followed in a hierarchical sense, by four design documents. The first is the Level I Design Document, which presents a qualitative high-level system definition that identifies the allocation of functions to specific equipment and facilities, provides a description of the interfaces, and outlines the data flow across each interface. The Level II Design Document will contain the system topology. It will identify the quantity, location, and connectivity of equipment and facilities, performance requirements, data and voice loading on each of the interfaces. The Level III Document will establish a series of implementation packages and specify the time and engineering requirements for installation of each package at each individual site. The Level IV Document will provide the detailed, site specific designs and implementation, training, logistics and test requirements.

The initial preparation of the requirements document involved two parallel efforts. The first was a review of the operational services provided by the NAS directly to users. A hierarchy of these services was developed from extensive review of applicable documentation and from general reference to the Airman's Information Manual, the Air Traffic Control Handbook, and the Flight Services Handbook supplemented by general knowledge about the NAS. In addition, new or enhanced services that might be provided in the future were developed from reference to the NAS Plan and from various studies about future demand or improvements needed in today's system.

The second of the parallel efforts was to review existing documents of various types to identify operational requirements that had already been established. Many of these requirements were stated explicitly in the documents, but others were inferred from the content of the documents. These documents are listed in Appendix A (Bibliography).

Following these iterations, the document was then presented to a group of Air Traffic Service controllers and managers from around the nation for validation of the requirements. Once the basic content and structure of the requirements were fixed, the necessary quantification and performance standards were added to ensure that in the following years, the various programs and products have actually satisfied the requirements and met the goals of the system.

The process is specifically pointed toward meeting those broad goals of the FAA and aviation user community. The agency has outlined a set of goals and objectives for the future NAS which has been delineated in the NAS Plan. These goals, which directly apply to the NAS requirements assessment, are to:

- o Meet the national demand for aviation services as these needs grow and evolve.
- o Allow the users of the system to operate with a minimum of artificial constraints.
- o Provide for the use of capabilities and integration of systems for fuel-efficient flights.
- o Reduce operational errors.
- o Reduce the risks of midair and surface traffic collisions, landing and weather-related accidents, and collision with the ground.
- o Increase productivity of the agency work force, including air traffic controllers, flight specialists, and the technical staff.
- o Constrain the overall cost of operations.

DOCUMENT OBJECTIVES

The Operational Requirements Document presents a compilation of operational requirements that serve as a basis for subsequent design and program planning activities. The primary objective of the document is to provide a comprehensive and accurate representation of the requirements of the entire aviation community, while accommodating modifications or new requirements in response to changing operational needs during the NAS evolution. Since this document encompasses requirements for both existing and projected future capabilities in the NAS, some variation in the level of detail will exist until further requirements assessment and analyses are completed.

The document presents requirements which are oriented toward the systems capability to provide services to the aviation public. It is not a stand alone document, but one that is supported by a myriad of other documents and specifications.

Documents such as Airways Planning Standards and the National Plan of Integrated Airports Systems provide establishment and discontinuance criteria which determine specific amounts and types of equipment allotted to various facilities of the NAS.

Similarly, this document is intended to support existing procedures established in Federal Air Regulations (FAR) and FAA Orders. The intent is to provide those required capabilities to enable agency personnel to comply with these directives.

CHAPTER II

OVERVIEW

CHAPTER II

OVERVIEW

The operational requirements presented in Chapter 3 of this Document are organized in a top-down hierarchical structure that facilitates their orderly development to the required level of detail. Each two digit section (3.1) broadly describes the operational function performed. Listed below each of these sections are three digit sections (3.1.1) which contain a statement of the general requirement to be fulfilled, followed by the specific requirements of the system (3.1.1, A; B, etc.). These sections provide the required capabilities that are necessary for providing services to the users of the National Airspace System (NAS).

Requirements are grouped into eight operational categories which are summarized below.

Flight Planning Requirements

Flight planning for both visual and instrument flight supports specialists and users in establishing safe and efficient flight. This planning requires accurate and timely weather information; current aeronautical information; and knowledge of potential or actual airspace or route saturation. In addition, the NAS must be capable of receiving flight information from varied sources and distributing this information to the appropriate user/specialist.

Control Requirements

Control of operations requires extensive capabilities to achieve the safe and efficient flow of air traffic throughout the NAS. To exercise control of aircraft, the system must have information about the current and expected trajectory for each aircraft operating in the system. The control requirements address the following capabilities:

- o Flow control, including the allocation of available airspace capacity and determination and communication of flight restrictions to ensure delays are minimized.
- o Approach and departure sequencing to determine the order of aircraft landing at, or departing from, an aerodrome.
- o Aircraft separation to provide clearances that maintain separation standards for specified conditions.

- o Control outside of independent surveillance coverage to establish separation based on user position reports and application of expanded, improved separation standards.
- o Collision Avoidance, including the prediction of collisions and determination of conflict avoidance maneuvers.
- o Weather Avoidance, including the prediction and specialist notification of an aircraft encounter with potential hazardous weather and determination of avoidance procedures.
- o Ground and obstacle avoidance to provide ground-based assistance to users in maintaining safe clearance from the ground, mountainous terrain and man-made obstacles.
- o In-flight emergency assistance, including the procedures and communications for providing emergency assistance to users.
- o Search and rescue capabilities to meet the federal interagency agreements for assisting aircraft experiencing in-flight emergencies.
- o Special services for military aircraft to accommodate requests for special handling of aircraft within the NAS, in accordance with established agreements.
- o Airport movement area control requires that aids be provided to both the user and the specialists to ensure safe operations on airport movement areas.

Monitoring Requirements

The VFR monitoring requirements provide for various flight services to support VFR operations within the NAS. These capabilities include provisions for flight following to monitor flight progress over hazardous areas and to issue traffic and weather advisories. Generally the VFR monitoring capabilities are supported by facilities and procedures different from those associated with Instrument Flight Rule control due to the significant differences in IFR and VFR flight operations and equipment.

Navigation Requirements

The navigation requirements encompass the capabilities to provide en route and terminal navigation aids to assist the pilot of an aircraft in locating his position in the airspace at any given time and, additionally to provide assistance in locating terminal facilities.

The en route navigation requirements are fulfilled by various navigation aids to assist pilots in determining aircraft bearing and/or range from a pre-determined aeronautical fix. These requirements describe standard international civil navigation aids which provide the backbone of the en route and terminal systems. Other navigation systems such as the Global Positioning System (GPS) and Loran which provide service in conjunction with the NAS systems, are termed supplemental systems and are currently considered beyond the scope of this document.

Terminal approach and landing aids assist the pilot in the identification of an aerodrome and active landing area and to provide guidance to aircraft under primarily instrument meteorological conditions. Visual approach and landing aids will assist in the identification of aerodromes and active landing areas under reduced visibility and visual meteorological conditions.

Air Defense and Law Enforcement Surveillance Requirements

These requirements are concerned with the detection, identification, location and control of aircraft in the Air Defense Identification Zone (ADIZ) and in the Distasteful Early Warning Identification Zone (DEWIZ) in the vicinity of U.S. and international airspace boundaries.

Additional provisions are included for communications and coordination among FAA and military specialists and law enforcement officials for operations that involve defense of U.S. airspace.

The surveillance requirements specifically address the use of Department of Defense/FAA radars to ascertain the position, velocity and altitude of non-beacon and beacon equipped aircraft in the ADIZ/DEWIZ and to identify unauthorized intruder aircraft.

Communications Requirements

NAS communications requirements encompass extensive capabilities for providing voice and data communications throughout the NAS and with external facilities and government agencies. These address the air-to-ground, ground-to-ground interoperability and ground-to-ground

intrafacility voice and data communications requirements between aircraft and air traffic control and flight service facilities, between FAA and external facilities, and within NAS facilities.

Maintenance Support Requirements

Maintenance support requirements entail the overall provision of maintenance equipment and facilities to support the requirements of the NAS. Additionally, support will be provided to accomplish the necessary monitoring and testing to ensure that the services provided meets the goals of the system.

System Effectiveness Requirements

Effectiveness requirements describe the tolerances associated with the loss of service and prioritize each of the NAS functional categories with respect to the safe operation and control of the system.

CHAPTER III

OPERATIONAL REQUIREMENTS

3.0 REQUIRED OPERATIONAL CAPABILITIES

The mission of the FAA includes the central objective of providing for the safe and efficient use of the nation's airspace, while minimizing constraints on its use. This section of the NAS requirements document presents the requirements for direct services to users (e.g., pilots, airlines, military) and specialists (e.g., flight service specialists, controllers) in order to support both IFR and VFR flights under varying conditions of weather, demand on the system, and emergency situations. Flight planning, aircraft separation, air defense, law enforcement, control, and monitoring capabilities are required along with surveillance, navigation, and communication capabilities supporting the oceanic, en route, terminal, and airport operations.

3.1 Flight Planning

Safe and efficient use of the nation's airspace requires the provision of flight planning capabilities. Flight planning requires information such as expected route, altitude, and time of flight, as well as the anticipated flight conditions including weather, navigation systems, available routes, special use airspace, and flow control conditions. IFR flights are usually assigned to specific routes and altitudes and are under active NAS control. VFR flights are restricted in the kinds of weather conditions they can tolerate, the routes and altitudes used, and they may not be under active NAS control.

3.1.1 Weather Information (Strategic) Requirements

General Requirements

Weather conditions can significantly affect aircraft performance and safety. Planning of flights requires the availability of timely and accurate weather information such as: upper air winds, upper air temperatures, and hazardous weather data. A capability is required to select and access weather information which could affect flight planning. Weather information is required by specialists and users.*

Specific Requirements

- A. The NAS shall acquire and maintain weather information covering the area of NAS responsibility for both domestic and foreign operations. Weather information shall include current, trend, and forecast weather and shall include surface and atmospheric weather to the highest altitudes affecting flight planning, efficiency, and safety.
 - 1. The NAS shall acquire and maintain current, trend, and forecast weather information for all areas of the U.S. (including Alaska and Hawaii), Canada, Mexico, the Caribbean and the Gulf of Mexico.
 - a. The NAS shall acquire weather information in U.S. airspace as indicated below from FAA, NWS, DOD and private sources of weather data.
 - b. The NAS shall acquire weather information from Canada, Mexico and the Caribbean in whatever form and with whatever frequency provided.
 - 2. The NAS shall acquire and maintain current weather information. Current weather information includes surface aviation weather observations and weather conditions aloft obtained by pilot reports and sensors (e.g. radar and satellite.)

* This section identifies weather information requirements. It includes the requirements for weather information acquisition and maintenance, coverage, accuracy, timeliness and content. Two sections dealing specifically with weather information utilization requirements, i.e., 3.2.6 Weather Avoidance Requirements and 3.3.3 Weather Advisory Requirements, will generally not repeat these requirements, but will reference 3.1.1. except where the requirements in those sections are additional to those already covered in 3.1.1.

- a. Surface aviation weather observations are observations at a single point on the ground. Surface observations shall include the following elements, measured to the precisions and accuracies indicated.

Cloud Cover - given as clear, scattered, broken or overcast. Cover is determined by looking upward from the ground according to the criteria--clear means less than 10% sky cover, scattered means 10-50% cover, broken means 50-90% cover and overcast means more than 90% cover.

Ceiling - expressing the ceiling as that cloud layer where the cumulative amount of cloud cover from the surface to that layer exceeds 50% or more cloud cover in 100's of feet ACL for ceilings up to 5,000 ft. and in 1000's of feet for ceilings above 5,000 ft. Accuracy required is ± 50 ft. for ceilings up to 500 ft., ± 100 ft. for ceilings from 500 to 1,500 ft. and $\pm 10\%$ from 1,500 to 5,000 ft.

Surface Visibility - the greatest visibility seen through at least 180 degrees of the horizon and expressed in statute miles, given to the nearest quarter of a mile for visibility up to 2 miles, to the nearest half mile for visibilities from 2 to 4 miles and given as 4 plus when visibility is over 4 miles. Accuracy shall be $\pm 1/8$ mile for visibilities up to 2 miles and $\pm 1/4$ mile for visibilities from 2 to 4 miles. Indications of the nature of obstructions to visibility shall be provided when visibility is less than 4 miles.

Runway Visual Range - represents surface visibility in the direction of a designated runway expressed to the nearest 100 feet from 150 to 1,000 ft. to the nearest 200 ft. from 1,000 to 3,000 ft., and to the nearest 500 ft. from 3,000 to 6,000 ft. Accuracy shall be $\pm 1\%$ from 150 to 2,400 ft. and $\pm 5\%$ from 2,400 to 6,000 ft.

Precipitation - observations shall indicate the presence of precipitation and give its type and shall indicate intensity as light, moderate or heavy according to the following criteria:

Rain -- Light - up to 0.10 inch per hour
 Moderate - 0.11 inch to 0.30 inch per hour
 Heavy - above 0.30 inch per hour.
Snow -- Light - visibility 5/8 mi. or more
 Moderate - visibility less than 5/8 mi.
 but not less than 5/16 mi.
 Heavy - visibility less than 5/16 mi.

The rate of liquid precipitation shall be given with an accuracy of 0.01 inches per hour. The location of areas of precipitation shall be given with a range accuracy of 1.0 mile and an azimuth accuracy of 5 deg.

Accumulations of snow or liquid water shall be reported when it affects the usable landing surfaces of the aerodrome according to the following criteria:

-- Snow - depth on aerodrome usable surfaces shall be given to the nearest 1/2 inch up to 3 inches, to the nearest inch from 3 inches to one foot, and with indication of "1-foot plus" whenever snow accumulation exceeds one foot.

-- Slush - depth on usable surfaces shall be given to the nearest 1/8 inch up to 1/2 inch, to the nearest 1/4 inch up to one inch, to the nearest half inch from 1 to 2 inches, and with an indication of "2 inches plus" when over 2 inches.

-- Standing water - depth on the runway shall be given to the nearest 1/8 inch up to 1/2 inch, to the nearest 1/4 inch from 1/2 inch to 1 inch, to the nearest 1/2 inch from 1 to 2 inches and with an indication of "2 inches plus" when over 2 inches.

-- Ice on runways - shall be reported as compacted, wet, glazed, rough or under snow.

Temperature - given to the nearest degree Fahrenheit. Accuracy shall be + 1 degree for temperatures above -38°F, + 1.5 degrees for temperatures from -38 to -65°F, and + 2 degrees for temperatures below -65°F.

Dew Point - given to the nearest degree Fahrenheit. Accuracy shall be + 2 degree F.

Wind Speed and Direction - Surface wind shall be given to the nearest 10 degrees and the nearest knot, for speeds up to 35 knots and to the nearest 5 knots for speeds from 35 to 80 knots, and as an indication of "80 plus" for speeds over 80 knots. The accuracy shall be ± 10 degrees in direction and ± 2 knots for speeds up to 20 knots and $\pm 10\%$ for speeds from 20 to 80 knots. Observations shall indicate the speed of the sustained wind and shall also indicate peak speeds of gusts.

Altimeter Setting - given to the nearest hundredth of an inch of mercury. Accuracy shall be ± 0.01 inches of mercury.

- b. The NAS shall provide an automated means for measuring surface weather to the accuracies indicated in a. that shall require no human operation.
- c. The NAS shall provide a weather observation capability for elements indicated in a. above (except Runway Visual Range) at all U.S. aerodromes that have approved IFR approach procedures.
- d. Runway Visual Range measurement capability shall be provided for designated runways at selected U.S. aerodromes with precision approach procedures.
- e. The automated weather observation capability shall report weather information once per minute to local users and to a national data base every 60 minutes.
- f. Special surface weather observations shall be taken and reported when any of the following occur:

Ceiling - The ceiling forms or dissipates below, decreases to less than, or if below, increases to equal or exceed:

- 1) 3,000 feet
- 2) 1,500 feet
- 3) 1,000 feet
- 4) 500 feet
- 5) All nationally published landing minimums applicable to the aerodrome.

Sky Condition - A layer of clouds or obscuring phenomena aloft is present below:

- 1) 1,000 feet and no layer aloft was reported below 1,000 feet in the preceding reported observation.
- 2) The highest published landing minimum, including circling minimums, applicable to the aerodrome and no sky cover aloft was reported below this in the preceding reported observation.

Visibility - Visibility as reported decreases to less than, or if below, increases to equal or exceed:

- 1) 3 miles
- 2) 2 miles
- 3) 1 1/2 miles
- 4) 1 mile
- 5) All nationally published landing minimums applicable to the aerodrome.

Runway Visual Range - decreases to less than, or if below, increases to equal or exceed 6,000 feet, 4,000 feet, and 2,400 feet.

Tornado, Funnel Cloud, or Waterspout -

- 1) Is observed.
- 2) Disappears from sight.
- 3) Occurred within past hour according to outside sources, but was not observed or recorded at the station.

Thunderstorm -

- 1) Begins (a special observation is not required to report the beginning of new thunderstorm if one is currently reported in progress at the station).
- 2) Increases in intensity (T to T+).
- 3) Ends.

Precipitation -

- 1) Hail begins or ends.
- 2) Freezing precipitation begins, ends, or changes intensity.
- 3) Ice pellets begin, end, or change intensity.
- 4) Any other type of precipitation begins or ends.

Wind and Wind Shifts -

- 1) Mean surface wind direction changes by 30 degrees or more from that given in the latest report, the mean speed before and/or after the change being 20 knots or more.
- 2) Mean surface wind speed changes by 10 knots or more from that given in the latest report, the mean speed before and/or after the change being 30 knots or more.
- 3) Variations from the mean surface wind speed (gusts) increase by 10 knots or more from that given in the latest report, the mean speed before and/or after the change being 15 knots or more.

Pressure Jump - Barometric i.e., pressure is rising or falling rapidly.

- g. The NAS shall provide the capability to provide weather conditions aloft information for all U.S. airspace. Weather conditions aloft provided by sensors shall include the following elements, measured to the precisions and accuracies indicated.

Wind Speed and Direction Aloft - Winds shall be given to the nearest 10 degrees and to the nearest 5 knots. Winds aloft shall be available in 1,000 ft. increments up to 29,000 ft. MSL and in 2,000 ft. increments from 29,000 ft. to 60,000 ft. Accuracy shall be ± 10 knots, meaning that the difference between the true wind component and the measured wind component in any direction shall not exceed 10 knots.

Tops and Bottoms of Cloud layers - represented to the nearest 1,000 ft. for altitudes up to 29,000 ft. MSL and to the nearest 2,000 ft. for altitudes above 29,000 ft. MSL.

Turbulence - expressed as light, moderate, severe or extreme according to the criteria:

- Negligible
- Light - Momentarily causes slight erratic changes in altitude and/or attitude.
- Moderate - Changes in altitude and/or attitude occur but an aircraft remains in positive control at all times. Usually causes variations in indicated airspeed.
- Severe - Causes large, abrupt changes in altitude and/or attitude. Large variations in indicated airspeed occur. An aircraft may be momentarily out of control.
- Extreme - An aircraft is violently tossed about and is practically impossible to control. May cause structural damage.

The NAS shall determine the horizontal and vertical extent of turbulence with any of these intensity levels.

Precipitation Reflectivity - expressed as one of 6 weather radar echo intensity levels with these definitions:

- Level 1 (weak) - Light turbulence possible with lightning. (0 - 30 dBz)
- Level 2 (moderate) - Moderate turbulence possible with lightning. (30 - 41 dBz)
- Level 3 (strong) - Severe turbulence possible, lightning. (41 - 46 dBz)
- Level 4 (very strong) - Severe turbulence likely, lightning. (46 - 50 dBz)

- Level 5 (intense) - Severe turbulence, lightning, organized wind gusts. Hail likely. (50 - 57 dBz)
- Level 6 (extreme) - Severe turbulence, large hail, lightning, extensive wind gusts. (greater than 57 dBz)

The NAS shall determine the horizontal and vertical extent of thunderstorms with any of these intensity levels.

Hail -- For each storm cell detected, the NAS shall provide the probability of that cell producing hail. Four probability levels shall be provided:

No hail
 Probable hail
 Definite hail
 Insufficient information

Mesocyclones -- The NAS shall indicate the central location of mesocyclones and other shear features with the following indicator of feature types:

Uncorrelated Shear
 3-D Shear
 Mesocyclone

For each mesocyclone the NAS shall provide the:

location of mesocyclone center
 radial diameter
 azimuthal diameter
 altitude of base
 altitude of top

- h. The NAS shall provide the weather conditions aloft indicated in g. from 6,000 ft. above the ground to 60,000 ft. MSL.
- i. The NAS shall provide the weather conditions aloft indicated in g. from ground level or from above the local horizon as viewed from the aerodrome to 10,000 ft. AGL within 45 nm of quantifying aerodromes.

- j. The above weather conditions aloft information shall be updated every 5 minutes to the then current information.
- k. The weather conditions aloft shall be reported to a national data base every 60 minutes.
- l. Weather conditions aloft, except for thunderstorms, shall be retained on a 50 nm x 50 nm grid.
- m. Thunderstorm data shall be retained on a 10 nm grid by 10 nm grid in three altitude bands.
- n. The NAS shall provide imagery and derived products from the current GOES or successor. The following products are required with full resolution:
 - Infrared imagery
 - Visible imagery
 - Water vapor imagery
- o. The NAS shall measure wind shear and microbursts in the approach and departure areas of qualifying aerodromes.
- p. Wind shear and microbursts shall be reported for a coverage area of one nm either side of the runway centerline for 7 nm beyond both the approach end and departure end of any active runway at a qualifying aerodrome. The coverage area shall extend from ground level up to 1,500 ft. AGL within this area.
- q. Each portion of the coverage area (above subparagraph) shall be measured no less frequently than once every minute.
- r. Wind shear exceeding 10 knots per 1000 ft horizontally or 5 knots per 100 ft. vertically shall be detectable. Wind shear intensity shall be expressed to the nearest ± 2 knots per 1000 ft horizontally or ± 1 knot per 100 feet vertically. The maximum wind shear reported shall be within ± 2 knots per 1000 ft. horizontally or ± 1 knots per 100 ft. vertically of the true maximum wind shear within the coverage area.

- s. The NAS shall detect and report microbursts in the coverage area having a vertical wind speed in excess of 10 knots at altitudes of less than 1500 ft. AGL.
- t. The NAS shall provide the capability to acquire, receive and maintain Pilot's Reports (PIREPS) about weather information aloft. These reports shall include the following components, reported only as applicable to the specific situation:
 - Position of phenomena
 - Time of observation
 - Flight level
 - Type of aircraft
 - Type of clouds
 - Bases of clouds
 - Tops of clouds
 - Static air temperature
 - Wind direction
 - Wind speed
 - Turbulence intensity
 - Turbulence altitude
 - Icing intensity - expressed as trace, light, moderate or severe according to the criteria:
 - Trace - Ice becomes perceptible. The rate of accumulation is slightly greater than the rate of sublimation. Not hazardous over short (less than one hour) periods even without use of deicing/anti-icing equipment.
 - Light - Occasional use of deicing/anti-icing equipment removes/prevents accumulation.
 - Moderate - Rate of accumulation is such that short encounters become potentially hazardous; use of deicing/anti-icing equipment or flight diversion is necessary.
 - Severe - Rate of accumulation is such that deicing/anti-icing equipment fails to reduce or control the hazard. Immediate flight diversion is necessary.
 - Icing type
 - Icing altitude
 - Remarks (explanatory or special conditions, e.g., wind shear)

- u. The NAS shall provide the capability to receive PIREPS via the following means.
 - Voice report on UHF frequencies when the user is within UHF coverage.
 - Voice report on VHF frequencies when the user is within VHF coverage.
 - Data reports entered in the cockpit by the user and transmitted to the ground via a data channel when the user is within coverage for the data medium.
 - Voice report filed by a user after landing via any telephone connected to a commercial telephone network or in person.
 - Data report filed by a user after landing via any suitable data terminal connected to a commercial telephone network.
- v. The NAS must provide processing for PIREPs and efficient assimilation of PIREPs into appropriate data bases (i.e., screening, purging).

3. The NAS shall acquire and maintain trend weather information. Trend information shall include the following.

- a. All observations made during the past three hours and any forecast values from unexpired terminal forecasts for the following surface weather elements.
 - Cloud cover
 - Ceiling
 - Visibility
 - Runway visual range
 - Temperature
 - Dew point
 - Wind speed and direction
 - Altimeter setting
- b. Position, altitude, and intensity data from the past three hours and forecast data from any unexpired forecasts about thunderstorms.

- c. All PIREP data from the past three hours.
4. The NAS shall acquire and maintain forecast weather information. Forecast weather includes Terminal Forecasts, Area Forecasts, Winds Aloft Forecasts, and unscheduled short-term advisories and forecasts.
- a. Terminal Forecasts shall be updated at least every 4 hours for qualifying terminal areas and shall cover a forecast period from 0 to 24 hours. These forecasts shall include the following components:
 - Terminal Identification
 - Date and beginning and ending times of the forecast period
 - Sky cover
 - Ceiling
 - Visibility
 - Weather and obstruction to visibility
 - Surface wind direction and speed
 - Remarks.
 - b. Area Forecasts shall be updated at least every 4 hours and shall cover a forecast period from 0 to 24 hours. These forecasts shall include the following components:
 - The date and time period for which the forecast is valid
 - Description of the forecast area
 - Synopsis - briefly summarizes locations and movements of fronts, pressure systems, and circulation patterns. It may also give moisture and stability conditions.
 - Significant clouds, weather and outlook
 - Icing level
 - Freezing level.
 - c. Winds and temperatures aloft forecasts shall be updated at least every 8 hours and shall cover a forecast period from 0 to 24 hours. These forecasts shall include the following components:

- The date and time period for which the forecast is valid
 - Description of geographical area for which the forecast is valid
 - Wind speed and direction at various altitudes
 - Temperatures at various altitudes.
- d. Unscheduled advisories shall be generated by the ACF support meteorologist for use by specialists and users. These advisories shall be for conditions beginning within the next 2 hours and shall reflect the weather conditions in existence at the time of issuance.
 - e. Unscheduled forecasts shall be generated by the ACF support meteorologist. These forecasts will generally describe conditions expected to begin 4 to 12 hours after issuance to aid air traffic personnel in planning traffic flows around expected hazards.
 - f. The NAS shall predict the movement of storm cells for periods of 10, 20 and 30 minutes into the future and be updated every 5 minutes.
 - g. The NAS shall be able to establish the likelihood of occurrence of wind shear of intensity greater than 20 knots per 1,000 ft. horizontally or 10 knots per 100 ft. vertically in the approach and departure areas of qualifying aerodromes at least 30 minutes before the actual occurrence of such wind shear in those areas.
 - h. The NAS shall be able to establish the likelihood of occurrence of microbursts with vertical wind speeds greater than 10 knots at altitudes below 1,500 ft. AGL in the approach and departure areas of qualifying aerodromes at least 30 minutes before the actual occurrence of such microbursts in those areas.
5. The NAS shall acquire and maintain advisories about significant weather conditions of concern to aviation.

- a. Advisories of concern to all aircraft shall be acquired and maintained for the following hazardous weather phenomena:
 - Severe and extreme turbulence
 - Severe icing
 - Widespread duststorms, sandstorms or volcanic ash lowering visibilities to below three miles
 - Tornadoes
 - Lines of thunderstorms
 - Embedded thunderstorms
 - Thunderstorm areas greater than or equal to level 4
 - Hail greater than or equal to 3/4 inch diameter.
- b. Advisories generally of concern to light aircraft shall be acquired and maintained for the following phenomena:
 - Moderate icing
 - Moderate turbulence
 - Sustained winds of 30 knots or more at the surface
 - Widespread area of ceilings less than 1,000 ft. and/or visibility less than 3 miles
 - Extensive mountain obscurement.
- d. Hurricane Advisories shall be acquired and maintained. These advisories shall include the following components:
 - Number, name or both of hurricane
 - State(s) affected
 - Time of issuance
 - Description of vulnerable areas and forecast time period of vulnerability.

B. Information concerning weather conditions that are potentially hazardous to aviation shall be given priority as to acquisition and dissemination.

- 1. Dissemination of hazardous weather information to users and specialists shall be given priority over the dissemination of routine weather information.

2. Hazardous weather information shall be accurate in area coverage to 1 mile horizontal and in altitude coverage to 500 feet.
- C. The NAS shall be capable of providing pictorial displays of real-time weather data (e.g., radar) to users and specialists.
1. Graphic information available to the ACF support meteorologist shall include:
 - Mosaicked weather radar data
 - Satellite data
 - NWS graphics
 - Local station model plots
 - Upper air data.
 2. The ACF support meteorologist shall be capable of viewing animation and overlay of the above products.
 3. Pictorial real-time weather information provided and displayed to specialists shall include:
 - Weather radar
 - Satellite
 - NWS graphics
 - Specialist annotations.
 4. Pictorial information including weather radar, satellite images, and NWS graphics shall meet the accuracy requirements specified in A.2 above.
 5. Real-time weather information described above shall be provided to users in a format suitable for pictorial display on user supplied compatible devices on the ground and in the cockpit.
- D. Weather information shall be processed and presented in such a way as to support its interpretation by users and specialists.
1. Pictorial displays shall allow different elements of the display to be separately distinguishable, e.g., by utilizing levels of brightness or colors.

2. Weather information shall be supplied in a consistent format for an area of interest (see F.), e.g., weather elements such as wind speed, temperature, precipitation, cloud cover, etc., shall be available throughout any area of interest.
 3. Weather information shall include both horizontal and vertical depictions of weather conditions.
- E. Flexible and convenient access to required weather information by users and specialists is required.
1. The NAS shall provide RS-232, RS-449, telephone, UHF, VHF or equivalent interfaces and support to provide for users access to weather information. The NAS shall allow access via voice to specialist over telephone and VHF or UHF radio.
 2. The NAS shall provide user-friendly interactive on-line support to both users and specialists including such features as function keys, input menus, and prompting.
- F. Weather retrieval capabilities shall allow the selection of weather for a specified route, area, or location and shall include weather for all phases of flight.
1. The NAS shall provide route-oriented retrievals along a corridor up to 200 miles wide along a specified route. The following components of weather information shall be included for those reporting stations within the specified retrieval corridor in route oriented weather information retrievals:
 - Surface weather observations at en route locations
 - Surface weather observations for departure, destination, and alternate destination
 - Density altitude
 - Terminal forecasts at departure, destination, and alternate destination
 - Winds and temperatures aloft at the desired altitudes along the route segments
 - Pilot reports
 - Cloud cover information
 - Surface visibility
 - Weather phenomena and tops

- Convective activity (heavy precipitation and thunderstorms) mile horizontal and in altitude
 - Icing and freezing levels
 - Turbulence intensity and altitude.
- be capable of providing pictorial displays
2. The NAS shall provide area-related weather information for predefined or user/specialist defined areas and altitudes of interest. Areas shall be defined by a location and a radius of flight to 100 nautical miles or by a State or Great Lakes identifier.
 3. The NAS shall provide weather information by reporting station and weather type as specified by a user/specialist.
 - station model plots
 4. Weather information retrievals shall allow filtering of weather information appropriate to the departure, destination and enroute portions of the flight by criteria to include weather type, altitude of flight, content of the weather information and time of flight.
 - real-time weather information provided and
- G. Hazardous weather information shall be provided with sufficient accuracy and emphasis in sufficient time to permit users to avoid the hazard and/or permit specialists to assist users in avoiding the hazard.
- graphics
1. The NAS shall alert users and/or specialists to the presence of hazardous weather whenever any of the following conditions exist.
 - ding weather radar, images, and NWS graphics shall meet the
- a. Severe or extreme turbulence is detected.
 - b. Light, moderate or severe icing is detected. It shall be made available to users in a format suitable for pictorial displays.
 - c. Thunderstorms of intensity level 3 or higher are detected in the cockpit.
 - d. Wind shear exceeding 10 knots per 1,000 ft. in horizontally or 5 knots per 100 ft. vertically is detected in approach or departure areas of aerodromes.
 - displays shall allow different elements of
 - e. Microbursts having a vertical wind speed, of.g., by greater than 10 knots at altitudes of less than 1,500 ft. AGL are detected in approach or departure areas of aerodromes.

- f. Sustained surface winds exceeding 30 knots are detected.
 - g. Widespread low visibility (ceilings less than 1,000 feet, visibility less than 3 miles, or widespread mountain obscurement) is detected.
 - h. Heavy precipitation, lightning or hail is detected.
- 2. Hazardous and routine weather information shall be presented to the specialist within two seconds of a request.
- 3. Hazardous weather information shall be available to specialists and users within 2 minutes of identification of the hazardous weather phenomenon, and shall be current nationally to within 30 minutes or less as conditions warrant thereafter, until the hazard has dissipated.
- 4. Terminal area hazardous weather information shall be available to specialists and users within one minute of detection, and shall be current to within one minute thereafter, until the hazard has moved out of the terminal area or dissipated.
- 5. When hazardous weather information is received by NAS, the specialist shall be alerted by an audible and/or visual alarm.
- H. NAS capacity to acquire, process, and disseminate weather information must be sufficient to meet required response times during peak demand. Communication links must be adequate to avoid user/specialist delay in gaining access.
 - 1. Specialist access to weather information shall be provided with a mean response time of two seconds (2.5 seconds for route oriented weather information retrieval) from the time a request for information is made.
 - 2. User access via communication links (e.g., commercial telephone, dedicated or dial-up ports) shall be provided in accordance with the requirements set forth in section 3.6.2, Ground-Ground Interfacility, and specifically in 3.6.2.B.5.a. and b. (Commercial Voice Channels), and 3.6.2.B.6.a. and b. (Data Channels).

3. Once a user has gained access to the NAS, weather information shall be provided with a mean response time of two seconds (2.5 seconds for route oriented weather information retrieval) from the time a request for information is made.
 4. The NAS is required to meet the expected demand for weather requests, i.e., pilot briefings, during times of peak demand. The peak demand for weather briefings per hour forecast for 1995 at the peak AFSS is as follows:
 - 48 route-oriented briefings via a specialist
 - 271 route-oriented briefings via user direct user access devices
 - 25 local briefings via a specialist
 - 143 requests for local briefings via direct user devices.
- I. Weather information shall be continuously (24 hours a day) accessible to users with or without the aid of a specialist.

3.1.2 Aeronautical Information (Strategic) Requirements

General Requirements

Aeronautical information (e.g., information regarding special use airspace, preferred or fuel-efficient routes, traffic management, or the condition of selected NAS components) is required in support of flight planning. Such information is required to be easily and conveniently available to users for the total geographic area of NAS responsibility. Because of the large volume of aeronautical information, there is a requirement to tailor the information presented to only that which is important to a specified route and time of flight or to specified locations or areas. Such information is required by users during all phases of flight.

Specific Requirements

- A. Aeronautical information shall be acquired or generated and maintained current by the NAS.
 - 1. This information shall include at a minimum the following, for the entire geographic area of NAS responsibility:
 - a. Information concerning the establishment, condition, or change in any component of the NAS, the timely knowledge of which is essential to personnel concerned with flight operations.
 - b. Information regarding the boundaries and times of restriction for special use airspace.
 - c. Information regarding preferred, fuel-efficient, and/or low altitude routes.
 - d. Traffic management information.
 - 2. The NAS shall be capable of accepting, and in selected cases verifying, aeronautical information from any source, including users, military and other governmental organizations, and private organizations concerned with operations or components of the NAS.
 - 3. Information regarding special use airspace or preferred routes shall be available at least 24 hours in advance of the time it becomes effective. Other aeronautical information shall be available for dissemination no later than one minute after entry into any NAS data base.

4. Aeronautical information which becomes no longer valid/ relevant shall be deleted from the base of available information within one hour.
- B. Aeronautical information shall be continuously (24 hours a day) accessible to specialists.
- C. Aeronautical information shall be continuously (24 hours a day) accessible to users upon request with or without the aid of specialists.
- D. Aeronautical information shall be obtainable along a specified route, or in conjunction with specified locations or areas, or by reporting location.
 1. The selection of aeronautical information shall accommodate routes of arbitrary length, with up to 40 route elements.
 2. As many as 8 specified locations or a single area shall be accommodated per request.
 3. Information from as many as 8 reporting locations shall be selectable per request.
- E. Communication capabilities must be adequate to avoid user delay in gaining access and to avoid delay in dissemination of aeronautical information.
 1. Users shall be able to access aeronautical information over common carrier telecommunications lines.
 2. Access over common carrier telecommunications lines shall be in accordance with requirements 3.6.2.A.5.a and 3.6.2.A.5.b.
- F. The NAS capacity to provide aeronautical information must be sufficient to meet required response times during peak demand.
 1. The time from initiation of a request for aeronautical information by a specialist and receipt of the requested information shall not exceed 10 seconds.
 2. The time from initiation of a request for aeronautical information by a user and receipt of the requested information shall not exceed 10 seconds.

3.1.3 Flow Control and Delay Advisory Requirements

General Requirements

Saturation of specific airspace or aerodromes may require that aircraft be delayed or diverted in order to maintain safety. Knowledge of actual or potential saturation during flight planning allows plans to be adjusted for maximum efficiency. Therefore, the flow control and delay advisory information that affects flight planning must be disseminated.

Specific Requirements

- A. Flight information, including official airline data, airway/route usage, flight data summarized as to time and location, and real-time flight data (cancellations, diversions, delays, etc.) shall be available to users and specialists.
 - 1. The NAS shall provide flight information to specialists at the Air Traffic Control Command Center (ATCCC) where central traffic flow management is performed. This flight data shall include the following:
 - a. Official airline data and pre-stored flight plans.
 - b. Current and future airway/route usage for up to 8 hours in advance, including en route aircraft type.
 - c. Total system flight data summarized as to time, departure and arrival aerodromes, location, airway/route, and aircraft type.
 - d. Current flight plan data, summarized as to time, location, filed speed, airway/route, and aircraft type. This data includes all amendments, delays, cancellations, diversions, etc.
 - 2. Local traffic management coordinators at ARTCCs, selected terminals and future ACFs shall be provided with flight data and flow management information pertaining to their assigned airspace structure boundary. Additionally, local traffic coordination specialists shall be provided NAS central flow information summaries, which include the following:

- a. Current flow restrictions in effect throughout the NAS.
 - b. Traffic loading information summarized by fix, sector, airway/route, or boundary crossing points and by time (e.g., 15 minute intervals).
3. The NAS shall provide users with flight information pertaining to flow management including current weather and forecasts, and current and future delay advisories in effect along the user's proposed flight path.
- B. Current and forecast weather data, both foreign and domestic, shall be available for flow control use.
 1. Current weather data shall be available within 5 seconds of a specialists or meteorologists request.
 2. Current weather data shall be the NAS weather database.
 3. Weather forecasts shall be available within 5 seconds of a specialists request.
 4. Weather forecasts shall be provided up to 24 hours in advance.
 5. Weather data (both forecast and current) shall be available for the entire NAS Geographic Coverage Area and Oceanic Area. Foreign weather shall also be available, including terminal forecasts at major international aerodromes.
 6. The NAS shall provide the capability for the local traffic management coordinators to receive unscheduled weather forecasts that generally describe conditions expected to begin 4 to 12 hours after issuance.
- C. Processing and communications capacity shall be provided to accommodate the demand for the dissemination of flow control and delay advisory information.
 1. Users shall receive requested flow control and delay advisory information within 6 seconds of a request. ATCCC specialists and local traffic management coordinators shall receive requested information within 5 seconds of a request.

2. Users shall receive flow control information from the NAS over standard commercially available voice and data channels. ATCCC specialists and local traffic management coordinators shall receive flow control information continuously via NAS communications capabilities.

3.1.4 Flight Plan Submission and Evaluation Requirements

General Requirements

The NAS shall process foreign and domestic flight plan information and exchange it with users and specialists.

Specific Requirements

- A. The NAS shall provide a capability to receive proposed flight plans and amendments to proposed flight plans from users and specialists.
 - 1. The NAS shall be capable of receiving proposed flight plans and amendments to proposed flight plans in the following ways: user direct at NAS facilities, user direct via user input/output devices, and via specialist inputs at NAS facilities.
 - 2. The system shall be capable of validating and processing flight plans submitted in either a domestic or an international flight plan format.
 - 3. The system shall be capable of accepting both VFR and IFR flight plans.
 - 4. The system shall be capable of accepting multiple flight plans and stopovers (a flight plan with more than one leg filed) from users.
- B. The NAS shall provide for direct user input/output of flight plan information over easily used input/output devices readily available to users.
 - 1. The NAS shall be capable of receiving proposed flight plans and amendments to proposed flight plans via direct inputs from commercially available input devices, over commercially available communications systems.
 - 2. The NAS shall be capable of providing prompts and formatting information to allow users to file flight plans directly from input/output devices, such as portable computers or terminals.
- C. The NAS shall provide a method to utilize commonly used flight plan information, e.g. preferred routes, standard aircraft profiles, etc., without re-entering such information for every flight plan.

1. The system shall interactively support NAS and user preferred routes between departure and destination points.
 2. The NAS shall be capable of accepting flight plans defining user-preferred speed and altitude profiles in detail.
 3. The system shall be capable of duplicating repetitive information (aircraft equipment code, color, speed, etc.) when a user is submitting multiple flight plans.
- D. The NAS shall provide a capability for direct interaction with users/specialists in the process of flight plan validation and acceptance. The NAS shall inform users/specialists of errors it detects and allow correction of such errors.
1. The system shall be capable of evaluating a proposed flight plan or amendment prior to acceptance. The evaluation process shall include identification of the user and aircraft, and a logic check of the data being submitted.
 2. The system shall provide the user/specialist with the reason(s) for rejection of a flight plan. The user/specialist shall have the option of correcting only the system-identified error(s) without having to re-input the entire flight plan.
 3. The NAS shall inform users/specialists when a flight plan or amendment has been accepted.
- E. The NAS shall provide a capability for specialists to amend active flight plans.
1. The system shall provide safeguards to ensure that active flight plans may be amended only by authorized specialists.
 2. The system shall provide safeguards to ensure that flight plans may be opened or activated only by authorized specialists.
 3. Amendments to active flight plans, once accepted, shall be immediately incorporated into the flight plan so that any specialist viewing that flight plan will see only the most current information.

4. The NAS shall ensure that once a flight plan has been displayed to a specialist, any amendment made to that flight plan between the time the flight plan has been passed and the time that specialist accepts the handoff, shall be easily discernible from the original message (different color, italics, parentheses, etc.).
 5. The NAS shall retain the original flight plan request (exclusive of preferred departure routings (PDR's), preferred arrival routings (PAR's), and other ATC impositions), for possible retrieval by a specialist in the departure ACF.
- F. The NAS shall disseminate flight plan information to all NAS and foreign facilities that provide control/support to the proposed plan of flight.
1. The NAS shall be capable of automatic addressing and dissemination of flight plan information processed by the system to affected NAS Area Control Facilities (ACF), Flight Service Stations (FSS), Radar Approach Control Facilities (RAPCON), Terminal Radar Approach Control Facilities (TRACON), and adjacent foreign facilities.
 2. The NAS shall be capable of automated exchange of flight plan information and traffic handoffs with appropriately equipped adjacent foreign facilities.
 3. The NAS shall be capable of passing flight plan information to adjacent foreign facilities within the time frames specified by international and bilateral agreements. This will normally be at least 30 minutes prior to transferring control of the flight.
 4. The NAS shall be capable of reformatting international flight plan information, if required by adjacent foreign facilities, to either ICAO or other agreed upon formats for the exchange of flight plan information.
- G. Direct interfaces are required between NAS automation systems and user automation systems for the exchange of flight plan information.
1. The NAS shall be capable of exchanging flight plan information with user automation systems through interfaces with common carrier communications networks.
 2. The NAS shall be capable of being accessed through user supplied, commercially available communications interfaces.

3. The NAS shall be capable of supporting user supplied, dedicated, sole use interfaces with selected user automation systems (airlines, military, etc.)
 4. The system shall provide appropriate safeguards to protect flight plans from unauthorized modifications.
- H. NAS capacity must be sufficient to meet required response time during peak demand. Communication links must be adequate to avoid user delay in gaining access.
1. The NAS provided interfaces shall have sufficient capacity for users to be able to gain direct access within 5 seconds after the connection has been made.
 2. Every FSDPS shall be capable of accepting a maximum of 38 dial-up lines and 22 multi-point lines (each capable of handling up to 4 terminals).
 3. The NAS shall be capable of validating and processing proposed flight plans and amendments to proposed flight plans and responding to the user/specialist within 6 seconds (99th percentile) of the input.
 4. The NAS shall be capable of validating and processing active flight plans and amendments to active flight plans within .5 seconds (99th percentile) of the input.
- I. The NAS capacity to process flight plan information must be sufficient to meet required response times during peak demand.
1. Storage shall be sufficient to hold 5000 active and proposed IFR flight plans in memory per Area Control Facility (ACF).
 2. Each automated Flight Service Station (FSS) shall be capable of storing 1000 flight plans.
 3. The system shall be capable of accepting and storing recurring (canned, stereo, etc) flight plans from NAS approved users (military, airlines, etc).
 4. The system shall store prefiled flight plans, and process them in correct time sequence, prior to the time the flight becomes active.

- J. The NAS shall provide a capability for specialists and users to cancel or close flight plans which have been entered into the system.
 - 1. The system shall be capable of accepting flight plan cancellations or closings directly from users via commercially available communications systems or through specialist inputs at NAS facilities.
 - 2. The NAS shall initiate the Search and Rescue process at a preset time (normally 30 minutes) after the estimated time of arrival of an aircraft whose flight plan has been opened (activated), but not closed.

3.2 Control

The NAS has responsibility to ensure the safe and efficient flow of traffic from departure aerodrome (or entrance to the system) to destination aerodrome (or exit from the system). It includes flight control processes in the en route, terminal, and oceanic airspace. It also includes search and rescue requirements to locate lost aircraft. In order to exercise control of aircraft, the NAS must have information about the expected routes, times, altitudes of flight, and aircraft characteristics. It must also have information about current location, altitude, and heading for each aircraft in the system.

3.2.1 Flow Control Requirements

General Requirements

Maximum safety and efficiency in the use of airspace or aerodromes results from a flow of air traffic which matches airspace user demands with available capacity, reducing congestion and unnecessary delays, and allowing delays to be taken on the ground whenever possible. Maintaining this type of traffic flow imposes a requirement for a traffic management function which collects data on current and predicted airspace capacity and demand and compares these to detect potential and actual airspace saturation.

Specific Requirements

- A. The NAS shall be capable of projecting the current and future capacity of, and demand on, specified sectors, and airway route segments.
 - 1. IFR traffic capacity projections shall be available to ATCCC specialists and local traffic management coordinators for specified sectors, airway route segments and aerodromes. The NAS shall monitor and use information pertinent to capacity projections such as sector area current weather and forecast weather, navigation equipment operational status, aerodrome operational status, runway configuration, and aircraft performance characteristics, etc.
 - a. Sector capacity projections shall be provided to ATCCC specialists for up to 8 hours and to local traffic management coordinators for up to 2 hours beyond the current time.

- b. Airway route segment capacity projections shall be provided to ATCCC specialists for up to 8 hours beyond the current time, and for up to 2 hours beyond the current time to local traffic management coordinators .
- 2. IFR traffic demand projections shall be available to ATCCC specialists on any specified sector or airway route segment. The NAS shall monitor and use information pertinent to demand projections such as stored flight plan information, filed flight plan information, aerodrome operational status, historic demand profiles, scheduled special events, military operations, etc.
 - a. Sector demand projections shall be provided to ATCCC specialists for up to 8 hours beyond the current time, and to local traffic management coordinators for up to 2 hours beyond the current time.
 - b. Airway route segment demand projections shall be provided to ATCCC specialists for up to 8 hours beyond the current time, and to local traffic management coordinators for up to 2 hours beyond the current time.
- 3. Capacity and demand projections shall be performed on request and the results shall be available to the ATCCC specialists and to the local traffic management coordinators within 5 seconds of a request.
- B. The NAS shall be capable of projecting for specified aerodromes and runways the numbers of arrivals and departures that can be handled and the number of planned arrivals and departures.
 - 1. The number of arrivals and departures of IFR traffic that can be handled by a specific aerodrome shall be provided by the NAS. Factors such as runway surface conditions, surface weather, winds aloft, local acceptance rate data, terminal navigation equipment status, etc. shall be monitored and used to determine actual capacity projections.
 - a. Aerodrome capacity projections shall be displayed by number of aircraft per minute, or time interval specified, and categorized by aircraft performance type.

- b. Aerodrome capacity projections shall be provided to ATCCC specialists up to 8 hours in advance, and up to 2 hours in advance to local traffic coordinators, updated when conditions change.
- 2. The number of planned arrivals and departures of IFR traffic projected in the future at a specific aerodrome or runway shall be provided by the NAS. Factors such as runway surface conditions, surface weather, winds aloft, terminal navigation equipment status, etc. shall be monitored and used to determine actual capacity projections.
 - a. Aerodrome future demand projections shall be provided for up to 8 hours in advance.
 - b. These projections shall be displayed to the specialist by number of aircraft per time interval specified by the specialist and other selected criteria.
- C. The NAS shall have the capability to determine, for each aircraft in controlled airspace, the current location, altitude, speed, and heading. This information shall be available to the appropriate specialists.
 - 1. Information about each aircraft's position, altitude, speed and heading shall be provided to the local traffic management coordinators. Information accuracy shall be within the following limits:
 - a. Horizontal position information provided to local traffic management coordinators shall be accurate to within 2.04 nm for target ranges greater than 100 nm and to within 1.0 nm for target ranges less than or equal to 100 nm.
 - b. Altitude information provided to the local flow management coordinator shall be accurate to within 1000 feet for predicted altitude profiles derived from aircraft specific data.
 - c. The displayed heading for straight line flight shall not differ from the true heading by more than 5 degrees at the 99th percentile.
 - d. The displayed speed shall be accurate to within 20 nm of the true speed for a constant, straight line flight.

2. This information shall be available to local traffic management coordinators performing a flow control function for any IFR aircraft in the conterminous United States, Alaska and Hawaii on request, and shall be available within 5 seconds of a specialists request.
- D. The NAS shall have the capability to predict, for each aircraft in controlled airspace, estimates of future location, altitude, speed, and heading. This information shall be available to the appropriate specialists.
1. Short term predictions (up to two hours) shall use current surveillance information, such as actual aircraft position, speed, heading, etc. in conjunction with associated flight plan information.
 2. Short term prediction accuracy shall be based on the following minimum criteria:
 - a. Metering delay estimation accuracy shall be better than 1 minute, 99 percent of the time.
 - b. The metering advisory accuracy shall provide less than 10 percent difference between the amount of delay time which a speed or descent advisory is calculated to absorb and the actual delay absorbed.
 - c. Given that a flight plan conflict probe prediction, based on trajectory information, indicates that a conflict will occur 20 minutes in the future and that both aircraft follow their flight plans unamended, the probability that a conflict (violation of desired aircraft separation) will in fact occur shall exceed 95 percent.
 - d. Given that a flight plan conflict probe indicates that no trajectory conflict will occur within twenty minutes and that all aircraft in the facility follow their flight plans unamended, the probability that the probed aircraft and any other aircraft will in fact violate desired separations shall be less than 10 percent.
 3. Predictions shall be available for the entire flight of aircraft (long term predictions), based on flight plan information.

4. Predictions shall be available within 5 seconds of an ATCCC specialist or local traffic management coordinator request for this service.
- E. Current and forecast weather data, both foreign and domestic shall be available for flow control use. Such data shall include hazardous terminal and en route weather, local terminal forecasts, winds aloft, etc.
1. Current weather data shall be available within 5 seconds of an ATCCC specialist or local traffic management coordinator request.
 2. Current weather data shall be the latest available weather information collected by the NAS.
 3. The NAS shall be capable of providing weather forecasts within 5 seconds of a specialist's request.
 4. Weather forecasts shall cover a forecast period of 0 to 24 hours.
 5. Weather data (both forecast and current) shall be available for the entire NAS Geographic Coverage Area and Oceanic Area. Foreign weather shall also be available, including major international aerodromes.
 - a. ATCCC specialists shall be provided with graphical presentations of the weather anywhere in the NAS coverage area. Precipitation, winds and temperatures aloft and hazardous weather areas shall be displayed. Forecast information for up to 24 hours in advance shall be available in graphic form. Textual weather and forecast information shall be available for foreign weather and NAS terminal weather.
 - b. Local traffic management coordinators shall be provided with complete weather information for the airspace assigned to their ARTCC. This includes graphical representation of winds and temperatures aloft, precipitation and hazardous weather. Terminal area weather and sector forecast weather for up to 24 hours in advance and updated every 4 hours shall be displayed graphically. Textual information shall be provided for adjacent airspace forecast and current weather.

6. The NAS shall provide the capability of receiving and storing visible and infrared Geostationary Operational Environmental Satellite (GOES) data (East and West) at the ATCCC. The GOES data shall be updated every 30 minutes.
 7. The NAS shall provide the capability to produce and store a national weather radar mosaic for flow control use at the ATCCC. This product shall be generated every 10 minutes or upon request.
 8. The NAS shall provide the capability to display at the ATCCC weather products from individual ACFs.
- F. The NAS shall have the capability to determine actual or potential saturation of any selected airspace and/or aerodromes specified by the specialist. Information shall be generated that will summarize the problems with regard to saturated airspace.
1. Potential saturation of airspace or aerodromes shall be predicted at least 8 hours before saturation occurs.
 2. The NAS shall generate and provide both local traffic management coordinators and ATCCC specialists with traffic count summary information for each sector in the NAS including total number of aircraft, aircraft IDs and aircraft types.
 3. The NAS shall provide the local traffic management coordinators with automatic displays, for various look-ahead times, of sector workload information such as traffic count, flight plan complexity, predicted conflicts, and traffic density.
 4. The NAS shall provide for detection and notification to the local traffic management coordinator of the following problems for current flight plan based trajectories:
 - a. Metering and flow restrictions
 - b. Preferential route restrictions.
 5. The NAS shall provide a capability to automatically evaluate trial plans and to notify the local traffic management coordinator, upon request for a trial plan, of any of the following detected problems:
 - a. Flow restrictions

- b. Airspace restrictions
 - c. Preferential route restrictions
- G. If airspace or aerodromes are or will be saturated, the traffic management function shall have the capability to allocate available airspace or aerodromes capacity, determine flight restrictions for specific aircraft, and communicate these restrictions to users and specialists.
- 1. The NAS shall provide a capability for both ATCCC specialists and local traffic management coordinators to generate alternate trial re-routing of proposed aircraft flight plans to resolve or minimize saturation conditions.
 - 2. The NAS shall provide the capability to transfer both voice and data flow control information between local traffic management coordinators at ARTCCs, selected towers or future ACFs, controllers at aerodromes, flight service stations and the ATCCC specialists.
 - a. Local traffic management coordinators shall have direct voice and data connectivity to the ATCCC specialists, all towers and all flight service stations in their airspace coverage area, and all controllers in their resident facility.
 - b. ATCCC specialists shall be provided direct voice and data connectivity with each local traffic management coordinator. Dial-up access to all NAS towers and all flight service stations shall also be provided.
 - c. ATCCC data connectivity shall be provided to selected air traffic control towers and to all flight service stations.
 - 3. The NAS shall provide a capability to meter traffic to achieve a balance between traffic demand and capacity of the NAS airspace and aerodrome resources.
 - 4. The NAS shall provide the capability for a Central Altitude Reservation Function that supports flow planning and conflict-free scheduling for the mass movement of aircraft, primarily including military missions.

- a. The NAS shall provide a capability to process, store and display altitude reservations which define detailed flight plans and associated airspace requested by the airspace users.
 - b. The NAS shall provide a capability for trial entry of a requested or pending altitude reservation to determine potential conflicts with other approved altitude reservations.
 - c. The NAS shall provide the capability to coordinate the requested altitude reservations with local traffic management coordinators in the facilities affected by the altitude reservation and with applicable international organizations.
 - d. Airspace users who require the altitude reservation service shall be provided voice and data connectivity with specialists at the ATCCC.
- 5. The NAS shall provide a capability for ATCCC specialists to generate plans and specify flow restrictions to alleviate traffic flow problems on an interfacility basis.
 - 6. The NAS shall provide a capability for local traffic management coordinators to generate plans and specify local flow restrictions to alleviate traffic flow problems within their local airspace boundaries.
 - 7. The NAS shall provide a capability to evaluate the effectiveness of flow restrictions implemented in the NAS.

3.2.2 Approach and Departure Sequencing

General Requirements

To make the most efficient use of airspace, specialists must provide instructions to users which will result in the establishment of landing and departure sequences at specific aerodromes. This sequencing imposes a requirement on the NAS to provide accurate location information.

Specific Requirements

- A. The NAS shall provide aircraft identification, location, altitude, heading, speed, and characteristics of aircraft within the assigned airspace.
 - 1. The NAS shall provide specialists with a unique aircraft identification for each aircraft in the assigned airspaces surrounding major aerodromes. (i.e., approach control, departure queue, local terminal control and ground control).
 - 2. The NAS shall provide specialists with aircraft horizontal position accurate to within .12 nm of an aircraft's actual horizontal position at a maximum 50 nm from the sensor.
 - 3. The NAS shall provide specialists with altitude information accurate to within 100 feet of a target's actual altitude.
 - 4. The NAS shall provide specialists with azimuth information accurate to within .23 degrees of a target's actual azimuth.
 - 5. The NAS shall provide specialists with speed information accurate to within 10 knots from the aircraft's true speed.
 - 6. The NAS shall provide specialists with aircraft performance characteristics, such as optimal descent and ascent profiles, maximum turning capability, minimum certified IFR airspeed, and acceleration/deceleration constraints.
- B. The NAS shall receive and transmit position information via two-way communications with aircraft within the assigned airspace.

1. Air-ground voice and/or data communications coverage within the assigned airspace shall provide data and voice communications from ground level to a minimum of 3000 feet AGL for a distance of 5 statute miles around towers at terminal facilities in the conterminous United States, Alaska, Hawaii and Puerto Rico.
- C. The NAS shall receive specialist inputs, shall display positional data received from all sources, process this information, apply procedural standards, and issue sequencing and spacing advisories to specialists.
1. The NAS shall receive specialists inputs on aerodrome acceptance rates. Using the flight plan information and available surveillance data, the NAS shall apply the standards for separation assurance and generate traffic sequencing and spacing advisories for orderly traffic flow making the maximum use of available aerodrome and airspace capacity.
 2. The NAS shall adjust the sequences based on inputs from specialists specifying desired sequence and time at meter fixes for selected aircraft.
 3. The NAS shall respond to changes in the specialists' inputs in no more than 1 second and shall keep the sequencing and spacing information updated within 1 second of receipt of new flight data, flight plan changes or within 1 second of each scan of the surveillance sensor for flight progress data.
- D. The NAS shall be able to receive and process all departure requests and display them to the appropriate specialists.
1. The NAS shall receive departure requests from sources such as specialists, users filing pre-flight requests from existing ground communications systems, aircraft based communications systems, etc.
 2. The NAS shall accept, validate, and display departure requests to the appropriate flight service specialist, tower controller, en route and approach controller, and flow control specialists. This information shall be available to the pertinent specialists within a locally adaptable number of minutes prior to departure.
 3. Departure request information as a minimum will include the following items:

- a. Proposed departure and destination locations and times.
 - b. Aircraft ID and type
 - c. Assigned altitude.
- E. The NAS shall compare the actual flight paths of aircraft with the paths assigned by specialists and notify the specialists of any significant deviations.
 - 1. The NAS shall compare the actual flight paths of all aircraft in the assigned airspace to the flight path assigned to the aircraft by specialists once each scan of the surveillance sensor.
 - 2. The NAS shall provide aids to the specialists by automatic adjustment of the flight plan based trajectory when the track position along the flight plan path exceeds preset conformance bounds from the nominal position.
 - 3. The NAS shall notify specialists when an aircraft has deviated from its locally adaptable parameter tolerances in lateral or vertical direction. Altitude deviations of ± 300 feet shall also be annunciated.
 - 4. Specialists shall be alerted of any deviation within 3 seconds after the deviation exceeds tolerance as defined above. Notification shall be both aural and visual and shall require controller acknowledgment. The notification will include a summary of the 3-D deviation for each pertinent aircraft ID.
- F. The NAS shall analyze the available information and provide recommendations for current runway selection.
 - 1. The NAS shall analyze available information influencing traffic pattern and active runway selection, such as current local traffic flow, local inbound traffic flow, flow metering and flight plan information, precipitation, winds aloft, local wind, barometric pressure, and runway surface conditions.
 - 2. Notification of an impending change in current runway operations shall be provided to tower controllers 15 minutes prior to the configuration recommendation becoming effective.

G. The NAS shall provide recommendations for future runway selections based on forecast weather and traffic conditions.

1. The NAS shall receive and analyze all available information influencing selection of future traffic patterns and active runways using predicted and current traffic conditions, current and forecast weather, flow metering information, etc.
2. Runway selection processing for future runway configuration shall be performed every 2 hours, and immediately upon any wind changes of more than ± 2.5 knots or 45 degrees in direction.

3.2.3 Aircraft Separation Requirements

General Requirements

In order to maintain a safe airspace environment, the NAS is required to maintain separation appropriate to the flight conditions and types of aircraft in the system. The NAS is required to have information about aircraft in controlled airspace (e.g., terminal, en route, and oceanic). The NAS shall notify the specialist when it detects a potential or actual violation of separation standards. The NAS shall notify specialists and users when a deviation from an approved clearance is detected. The NAS is required to determine recommended maneuvers to avoid or remedy such situations.

Specific Requirements

- A. The NAS shall acquire actual flight information such as identification, current and projected location (position), altitude, speed, and heading for each aircraft in controlled airspace or expected to enter controlled airspace (e.g., terminal, en route, and oceanic).
 1. The NAS shall detect the location of each aircraft in NAS controlled airspace within the following limits:
 - a. The NAS shall detect the position of each aircraft in controlled airspace within .75 nm and .23 degrees of the aircraft's actual position.
 - b. The NAS shall detect the velocity of each aircraft in controlled airspace within 20 knots of the aircraft's actual speed.
 - c. The NAS shall report the altitude of each aircraft in controlled airspace within 100 feet of the aircraft's actual altitude.
 2. The NAS shall project flight paths for each aircraft controlled airspace by projecting the following flight information.
 - a. Aircraft Identification
 - b. Current position
 - c. Route of Flight
 - d. Heading
 - e. Velocity
 - f. Altitude
 - g. Weather Conditions

3. The NAS shall project flight paths for all aircraft in controlled airspace or expected to enter controlled airspace, for not less than 20 minutes in advance.
 4. Actual flight position on each aircraft shall be periodically updated by the NAS at least every once per scan of the surveillance sensor.
 5. Actual flight information shall be acquired by the NAS for each aircraft in controlled airspace or inbound towards this airspace within a locally adaptable time or distance parameter from the NAS boundary.
- B. The NAS shall acquire flight plan information for each aircraft in controlled airspace or about to enter controlled airspace including planned changes such as route, altitude, and speed.
1. The NAS shall acquire validated flight plans and amendments from NAS facilities including Flight Service Stations, Air Route Traffic Control Centers, Air Traffic Control Towers, Military Base Operations, and users.
 2. The NAS shall acquire flight plan information on all IFR aircraft under NAS control in controlled airspace or within a locally adaptable time or distance parameter from the NAS boundary.
 3. Flight plan information shall be updated by the NAS whenever any flight plan change occurs, with separation assurance processing accomplished no more than 3 seconds after validated entry of an amendment.
 4. The NAS shall provide for flight plan based trajectories that are not constrained by physical ATC facility boundaries.
 5. The NAS shall provide for flight-plan-based trajectories for all valid flight plans and for all portions of the flight plan.
 6. The NAS shall support the specialist in constructing a detailed four dimensional trajectory corresponding to the entire flight plan, as originally filed or amended.

7. The NAS shall provide aid to the specialist in generating revisions to flight plan based trajectories. These shall include aids to retrieve and revise previously requested flight plan based trajectories, and to provide direct routings to a specified navigation point.
 8. The NAS shall provide aids in replanning flight plan based trajectories, based on types of resolution maneuvers (e.g., altitude change, speed change). The NAS shall, when requested by the specialist, create alternate trial plans and invoke the evaluation capability for trial plans.
 9. The NAS shall provide a capability to identify a trial plan (trial flight plan based trajectory) for use in evaluation for suitability of implementation.
 10. The NAS shall provide a capability to automatically evaluate trial plans for potential violations of separation standards.
- C. The NAS shall correlate actual flight information to flight plan information for each aircraft in controlled airspace.
1. The NAS shall project flight paths for each aircraft in controlled airspace by associating the following flight plan information with actual flight information:
 - a. Aircraft identification
 - b. Route of flight
 - c. Destination
 - d. Estimated Time of Arrivals
 - e. Velocity
 - f. Altitude
 - g. Weather conditions
 2. The NAS shall provide for correlation of three dimensional trajectories for all portions of each aircraft's flight plan.
 3. The NAS shall provide aids to the specialist by automatic adjustment of the flight plan based trajectory when the track position along the flight path exceeds preset conformance bounds from the projected nominal position.

4. The NAS shall provide aids to the specialist to determine the heading to realign a deviating aircraft with it's authorized flight plan route.
 5. The NAS shall provide reminders to the specialist for each designated maneuver point in the flight plan based trajectory.
 6. The NAS shall alert the specialist when tracked aircraft position is outside preset conformance bounds from the authorized position.
- D. The NAS must provide accurate weather information such as real-time winds and temperatures aloft to support flight path prediction.
1. Forecast weather shall be provided for trajectory development within 30 seconds of the weather product's delivery to the NAS.
 2. The NAS shall provide both current and forecast weather information in a compatible form to the systems performing the projection function through a direct data communication connection.
 3. The NAS shall display graphic weather data to the specialists with at least 6 levels of precipitation intensity. These levels shall be independently selectable by the controller.
- E. The NAS shall provide for the detection of any aircraft throughout an Air Defense Identification Zone (ADIZ), Distant Early Warning Zone (DEWIZ), and conterminous U.S. airspace.
- F. The NAS shall acquire and display surveillance information with accuracies sufficient to allow the achievement of separation of aircraft using parallel runways, or using closely spaced parallel routes.
1. The NAS shall detect and display surveillance information with sufficient accuracy to support aircraft conducting approaches to parallel runways under the following conditions:
 - a. When runways are at least 2500 feet apart successive aircraft will be 2 nm apart on adjacent terminal approach/landing systems.

- b. When runways are at least 4300 feet apart simultaneous approaches may be made by aircraft on adjacent terminal approach landing systems.
- G. The NAS shall provide surveillance coverage to the ground at all qualifying aerodromes and to minimum altitudes authorized for instrument flights in all other areas.
 - 1. The NAS shall provide surveillance coverage of aircraft through a means which does not require cooperating equipment on the aircraft. Such surveillance shall generally be provided over CONUS from 6,000 feet MSL to 200 FL over nonmountainous terrain; and from 6,000 feet MSL or MEA, whichever is higher, to 200 FL in mountainous terrain.

Exceptions to this requirement are permitted in areas where extraordinary measures would be required to meet the requirements; in these areas coverage shall be provided based on considerations of the cost of providing surveillance and of air traffic levels in the area.
 - 2. The NAS should detect any aircraft, through dependent surveillance means, in NAS airspace from 60,000 feet MSL to 2000 feet AGL in designated mountainous area, to 1000 feet AGL in en route airspace, to 500 feet MSL in designated off shore routes and to ground level in terminal areas.
 - 3. The NAS shall process surveillance information received and make it available for display it within 3 seconds of receipt.
 - 4. The NAS shall update each aircraft's position at a minimum of each scan of the surveillance sensor.
- H. The NAS shall display aircraft positions and related data such as aircraft identifications, assigned altitudes, conformances to assigned altitude, the source and accuracy of displayed altitude data.
 - 1. The NAS shall display the following information to specialists for each aircraft under control:
 - a. Aircraft Identification
 - b. Aircraft Position
 - c. Actual or Reported Altitude and Assigned Altitude
 - d. Aircraft Velocity

- e. Aircraft Type
 - f. Altitude Conformance
 - g. Handoff Status
 - h. Track Status
 - i. Ground Speed
 - j. Beacon Code
 - k. Computer Identification Number
 - l. Conflict Resolution Advisory
 - m. Heavy Jet Indicator
 - n. Remarks
 - o. Beacon Codes 7700, 7600, 7500
 - p. Conflict Alert
 - q. Minimum Safe Altitude Warning
 - r. Conflict Probe Violation
 - s. Failure Indication of Attempted Data Transmission
2. The specialist shall have the capability to selectively inhibit display information and/or to reposition display information.
 3. The NAS shall indicate the accuracy of the displayed altitude readout.
 4. The NAS shall indicate to the specialist the source of the altitude information displayed.
 5. The NAS shall display to the specialist flight plan information for any aircraft under control of the sector or about to enter any the sector.
 6. The NAS shall display to the specialist flight plan data, sector posting data and sector data relative to the aircraft under control. This includes, but is not limited to:
 - a. Aircraft Identification
 - b. Aircraft Type
 - c. Beacon Code
 - d. Aircraft Velocity
 - e. Departure Point
 - f. Destination
 - g. Altitude
 - h. Route of flights
 - i. Times relative to the Movement of the Flight
 - j. Holding Information
 - k. Approach Information

- l. Departure Information
 - m. Fixes
 - n. Handoff Indicator
 - o. Vector Information
 - p. Scratch Pad
 - q. Remarks
7. The NAS shall have the capacity to display flight plan information for a minimum of 50 aircraft per sector except in oceanic sectors where the capacity shall be a minimum 100 aircraft.
 8. The NAS shall record, and maintain independently, a history of all data processed or displayed to the specialists.
 9. The NAS displays shall be capable of discriminating between designated functional categories such as levels of weather intensity, controller alerts, flight plan amendments, emergencies, altitude assignments and track control.
 10. The NAS shall display to the specialist critical information such as:
 - a. Time
 - b. Altimeter Setting
 - c. Range Marks
 - d. Tabular Lists
 - e. Duty Runway
 - f. Beacon Codes being monitored
 - g. Beacon Codes available
 - h. Emergency Information
 - i. Trackball position
 11. Any problems identified in a trial plan will be displayed to the requesting specialist as priority (action necessary) or advisory (information only) item.
- I. The NAS shall display appropriate geographic information and/or airspace structure information.
 1. The NAS shall display current information on the ground, terrain, obstacles and special use airspace throughout the NAS coverage area.
 - a. Ground and terrain information shall include elevation and landmark information throughout the NAS airspace.

- b. Obstacle information, updated every 56 days, shall include all obstacles which constitute a hazard to aviation or effect a minimum IFR vectoring altitude, or obstacle position information shall be provided within .05 degree of the obstacles actual position on the situation display.
- 2. The NAS shall provide a flexible (variable scale, sector integrated) capability for accepting and displaying map outline data overlaid on surveillance information. This will allow both airspace structure and geographic landmark information to be used by the specialist.
 - a. The NAS shall provide the specialist with the capability to filter position display data selecting to present only the information desired.
 - b. The NAS shall provide the capability to display outlines of runway taxiway and landing areas.
- J. The NAS shall display aircraft positions and related data in relation to the displayed geographic information and/or airspace structure information.
 - 1. The NAS shall ensure a positional accuracy in the display of overlaid geographical and airspace structure information relative to aircraft position horizontal information of no more than 1 nm at 100 nm range.
- K. The NAS shall generate clearances, deliver clearances, monitor the adherence of aircraft to their clearances, and notify the specialist and/or the users whenever an aircraft deviates from its clearance by a prescribed amount.
 - 1. The NAS shall provide clearances to users which ensure appropriate separation for the type of aircraft and specific route flown.
 - a. The NAS shall provide for detection of aircraft-to-aircraft, aircraft-to-airspace and aircraft-to-ground conflicts and/or violations.
 - b. The NAS shall provide clearances which are assigned with cognizance of current preferential route restrictions, metering and flow restrictions, weather obstacles, and NAS airspace restrictions.

2. Clearances shall be delivered to users within sufficient time to ensure adequate separation is maintained.
 3. The NAS shall be capable of delivering clearances via voice or data link communications to aircraft within NAS controlled airspace.
 4. The NAS shall alert the specialist when a tracked aircraft's position is outside preset conformance bounds from the flight plan position.
 5. The NAS shall notify users of non-adherence to an ATC clearance within 10 seconds of the deviation reaching the specified tolerance levels.
- L. The NAS shall detect actual and potential violations of separation standards.
1. The NAS shall update and project each aircraft's flight path every scan of the surveillance sensor.
 2. The NAS shall compare flight path projections of each aircraft for at least 20 minutes in advance for potential conflicts.
 3. The NAS shall detect potential en route separation standards violations within 80 seconds, and shall detect potential terminal area separation standards violations within 30 seconds.
 4. The NAS shall alert the specialist within 3 seconds of detecting an actual or potential violation of separation standards.
 5. The NAS shall provide symbology that discriminates between an actual and potential violation alerts.
 6. The NAS shall provide for continuous assurance of detection of aircraft-to-aircraft conflicts (within parameter time horizon) for current flight-plan-based trajectories. The NAS shall alert the specialist with priority (action necessary) or advisory (information only) messages.
- M. The NAS shall detect an actual or potential violation of separation standards between aircraft in the same sector, in different sectors, or in airspace controlled by different facilities. The NAS shall detect potential violations

sufficiently early as to allow remedial action to be taken. Detection of an actual or potential violation of separation standards shall cause the NAS to provide a resolution advisory and a suitable alarm.

1. The NAS shall provide continuous aircraft collision risk assessment for all tracked aircraft pairs irrespective of airspace structure boundaries, such as sector boundaries, terminal airspace boundaries, etc.
- N. The NAS shall generate resolution advisories which consider the type of violation, the performance characteristics of the aircraft involved, and potential effects on other aircraft in the system. (See Section 3.2.5)
- O. The NAS shall effect coordination with all concerned specialists upon detection of actual or potential violations of separation standards.
1. The NAS shall notify any involved specialist of a separation standard violation situation which is predicted to occur.
- P. The NAS shall provide the capability to transfer control responsibilities for an aircraft from one jurisdiction to the next.
1. The NAS shall provide the specialist with capabilities to handoff control of aircraft across sector boundaries with no loss of separation services.
 2. The NAS shall provide the capability to automatically alert a receiving specialist that a tracked aircraft is within the system-adaptive time or distance parameter and the aircraft's route of flight will enter the receiving specialist's airspace.
 3. The acknowledgment by the receiving controller of the automatic handoff shall transfer track control.
- Q. The NAS shall be capable of providing aircraft separation services continuously.

3.2.4 Control When Outside of Independent Surveillance Coverage

General Requirements

Aircraft operating outside of independent surveillance coverage must rely heavily on procedural methods to determine and report aircraft positional data to ATC facilities. Generally, these position reports are derived from navigational aids or from the aircraft's internal navigation system. A system is required that will assist users in accurately determining their position and transmitting this information, either by voice or data link, to specialists. The NAS shall receive, process, and display this information and assist control personnel in providing safe and timely instructions to users to avoid violation of separation standards.

Specific Requirements

- A. The NAS shall provide accurate navigational aids for use in determining aircraft position information when the aircraft is outside independent surveillance coverage.
 - 1. The system shall provide for a network of navigational aids which ensure coverage of the areas for which the NAS has responsibility (e.g., oceanic, mountainous).
 - 2. The NAS navigational system shall be capable of providing coverage above 2000 feet AGL over an area designated as mountainous area, above 500 feet MSL out to 300 nm from shore in areas qualified as offshore areas, and above 1000 feet AGL in other cases up to 60,000 feet AGL.
 - 3. The NAS shall provide positional accuracy adequate to support route widths of 4 nm on low altitude offshore routes, 8 nm on domestic routes and 100 nm on oceanic routes below 44,000 feet and 60 miles above 45,000 feet.
- B. The NAS shall, on a real-time basis, receive, process, and display data derived from an aircraft's internal navigation systems.
 - 1. The NAS shall be able to accept information on aircraft operating outside surveillance coverage received from various sources at various rates (e.g. specialist data entry equipment, satellites, user supported activities (i.e. ARINC, AFTN), data links and airborne navigation equipment)).

2. The NAS shall be capable of receiving, processing and displaying flight information about aircraft outside surveillance coverage which includes:
 - a. Call Sign
 - b. Type aircraft
 - c. Position
 - d. Speed
 - e. Clearance limit
 - f. Estimates of time of arrival at reporting fixes.
 - g. Altitude
 - h. Remarks
3. The NAS shall be capable of displaying oceanic areas on situation displays with a maximum range of 4000 nm.
4. The system shall process position and identification information received from non-surveillance sources and display that information within 15 seconds of receipt. This capability shall be provided in all oceanic areas served by the NAS, in offshore areas along shorelines and in remote land areas where surveillance is not available (i.e. Alaska)
5. The NAS shall be able to estimate the current position and store flight plan information on aircraft operating outside surveillance coverage. The estimated current position of an aircraft shall be automatically updated within an adaptable parametric time window of 1 to 10 minutes.
6. The NAS shall have the capacity to display information for 100 aircraft per oceanic sector and 50 aircraft per non oceanic sector for areas outside surveillance coverage.

3.2.5 Collision Avoidance Requirements

General Requirements

The first priority of air traffic control is to maintain safety in flight by separating aircraft. The capability is required to provide assistance in predicting and avoiding imminent collisions or near-collisions. The NAS shall predict potential collisions in sufficient time to allow avoidance actions to be taken without causing further conflict.

Specific Requirements

- A. The NAS shall project the flight paths of all aircraft within or entering controlled airspace and determine imminent potential collisions between two or more aircraft.
 1. The flight path projection shall be based on current position, course, speed, altitude, vertical velocity and vertical and horizontal acceleration, including turn rate.
 2. The NAS shall alert the specialist prior to a violation of separation standards.
 - a. The warning time (time to go to violation of separation standards, measured at time of first alert) shall be at least 30 seconds (99% probability) in terminal airspace, but outside immediate aerodrome areas.
 - b. The warning time for conflicts occurring in en route airspace, but outside of immediate aerodrome areas, shall be at least 80 seconds (99% probability).
 3. System accuracy shall be such that nuisance alerts (an alert that would not be declared if the sensor system provided perfect information and if a perfect tracker were in place, but which is nevertheless declared using the data provided) shall be no more than 2% of all alerts declared.
 4. The NAS shall generate a conflict alert if the flight path projections of two or more aircraft indicate that the aircraft will at any point have less than minimum separation standards for the operational environment (en route or terminal airspace, etc).

- B. The NAS shall project aircraft positions by look-ahead times that are sufficient to allow avoidance actions to be taken without causing further conflicts.
 - 1. The flight path projection shall be of sufficient lead time to allow collision prediction, maneuver determination, rank order alternatives, specialist analysis, communications with the affected flight(s), flight crew reaction, and aircraft maneuver.
 - 2. The collision avoidance look ahead function shall consider the entire flight path for not less than 20 minutes into the future (look ahead time).
 - 3. The flight path projections shall be updated at least once per scan of the surveillance equipment.
- C. The NAS shall be capable of alerting both the responsible specialists and users (using any combination of audio and visual signals) immediately following the prediction of a potential collision.
 - 1. The NAS shall alert the specialist to an imminent collision by aural and/or visual signals that are distinct from any other signals presented to the specialist.
 - 2. The specialist shall be notified of an NAS predicted imminent collision within one second after the prediction is made.
 - 3. The NAS notification message to the specialist shall include, as a minimum, the call sign of each positively identified aircraft predicted to collide.
 - 4. The NAS shall be capable of alerting appropriately equipped users to the collision danger within 10 seconds after the prediction is made.
 - 5. The NAS notification message to appropriately equipped users shall include as a minimum the relative position of the primary threat(s), and the maneuver recommended.
- D. The NAS shall be capable of determining aircraft maneuvers to avoid a predicted potential collision, eliminating those options which create a new conflict situation.

1. The NAS shall, upon prediction of a collision, evaluate possible climb, descent, turn, and speed control maneuvers by one or all aircraft involved.
 2. The collision avoidance function shall consider the aircrafts' performance capabilities, current maneuver status (climbing, turning, descending, etc.) and imminence of collision.
 3. The evaluation of aircraft maneuvers shall consider not only the immediate threat, but the potential for conflict with other aircraft resulting from the execution of each maneuver considered.
 - a. Resolution advisories shall be such that no conflicts are induced in less than 2 minutes after execution of the resolution vector.
 4. The NAS shall rank order possible maneuver(s) for each positively identified aircraft involved in the predicted collision.
- E. The NAS shall display the recommended maneuvers to the specialists.
1. Recommended avoidance maneuvers shall be displayed to the specialist within 1.2 seconds (99th percentile) after the prediction of a collision.
 2. The NAS shall display to the specialist at least one set of recommended maneuvers for each aircraft involved in the predicted collision.
- F. The NAS shall make the collision avoidance capability available on a continuous basis.

3.2.6 Weather Avoidance Requirements

General Requirements

Hazardous weather is a significant threat to safety of flight for all aircraft, particularly in the very critical take-off and landing phases of flight. Reducing this threat requires that potential encounters with hazardous weather be predicted sufficiently far in advance to allow appropriate avoidance actions to be determined and executed. The prediction of a potential encounter requires determination of the present and future heading of the aircraft and the present and future location of the hazardous weather. The degree of hazard posed by the weather depends upon its intensity, the characteristics of the aircraft, and the phase of flight (take-off, en route, landing).

Specific Requirements

- A. Surveillance data: requirements A, B, C, D, and J of 3.2.3 also apply to this paragraph. (Section 3.2.3 identifies surveillance information requirements. This section will generally not repeat these requirements, but will reference 3.2.3.)
- B. Weather Data: requirements A, B, C, D, and F of 3.1.1 also apply to this paragraph. (Section 3.1.1 identifies weather information requirements. It specifies the requirements for weather information acquisition and maintenance, coverage, accuracy, timeliness and content. This section will generally not repeat these requirements, but will reference 3.1.1 except where there are unique or additional weather information requirements not already covered in 3.1.1.)
- C. Hazardous weather information shall be provided with sufficient accuracy and emphasis and in sufficient time to permit users to avoid the hazard and/or permit specialists to assist users in avoiding the hazard.
 - 1. The NAS shall alert users and/or specialists to the presence of hazardous weather whenever any of the following conditions exist.
 - a. Severe or extreme turbulence is detected.
 - b. Light, moderate or severe icing is detected.

- c. Thunderstorms of intensity level 3 or higher are detected.
 - d. Wind shears exceeding 10 knots per 1,000 ft. horizontally or 5 knots per 100 ft. vertically are detected in approach or departure areas of aerodromes.
 - e. Microbursts having vertical wind speeds of greater than 10 knots at altitudes of less than 1,500 ft. AGL are detected in approach or departure areas of aerodromes.
 - f. Sustained surface winds exceeding 30 knots are detected.
 - g. Widespread low visibility (ceilings less than 1,000 feet, visibility less than 3 miles, or widespread mountain obscurement) is detected.
 - h. Heavy precipitation, lightning or hail is detected.
2. The information provided shall include:
- Location and extent of the weather phenomena
 - Intensity - at least 2 levels
 - Wind velocity
 - Rate of precipitation
 - Direction of movement.
3. Minimal levels of accuracy required shall be as in 3.1.1.A.2.
4. The NAS shall be capable of providing hazardous weather information to users while airborne, for the volume of airspace extending from the surface to an altitude of 60,000 feet MSL and within 100 nm lateral distance from the aircraft's current position.
5. The NAS shall be capable of providing hazardous weather information to specialists for any airspace within 150 nm of the service area of the facility at which the specialist is on duty within two seconds of a request.
6. The NAS shall be capable of providing to a specialist, upon request, a summary of hazardous weather information for any airspace within the continental United States. The mean response time shall not exceed 2 seconds.

7. The NAS shall have the capability to provide hazardous weather information in both graphical and text formats. The graphics format shall allow representation of at least three levels of intensity.
 8. The NAS shall be capable of providing an aural alert when there is a significant change in the content of the hazardous weather message.
 9. Hazardous weather information shall be available to specialists and users within 2 minutes of identification of the hazardous weather phenomenon, and shall be current to within 30 minutes thereafter, until the hazard has dissipated.
 10. Terminal area hazardous weather information shall be available to specialists and users within one minute of detection, and shall be current to within one minute thereafter, until the hazard has moved out of the terminal area or dissipated.
- D. The NAS shall be able to detect the level of weather intensity in order for users to decide if any avoidance actions are necessary.
1. Observed weather conditions shall be categorized into levels of intensity as defined in 3.1.1.A.2.
 2. The NAS shall be capable of determining or measuring weather intensity with sufficient accuracy to assign the appropriate intensity level, while meeting the accuracy requirements of 3.1.1.A.2 above.
- E. The NAS shall alert appropriate users/specialists when a potential encounter with hazardous weather has been predicted. The alert shall include the location and time at which the encounter is predicted, identification of the aircraft involved, and an indication of the level of weather intensity.
1. The NAS shall have the capability to predict potential encounters with hazardous weather for an interval of time at least 30 minutes into the future.
 2. The users/specialists alerted shall include the pilot of the aircraft receiving separation services for which a potential encounter is projected and the controller handling that aircraft.

3. The location of the predicted encounter given in the alert shall be accurate to within 1 nm.
 4. The time of the predicted encounter given in the alert shall be accurate to within 3 minutes.
 5. The system shall screen each flight plan or amendment for proposed flight into areas of reported or forecast hazardous weather and shall alert the user/specialist to the potentially hazardous conditions.
- F. The NAS shall be capable of recommending aircraft actions to avoid hazardous weather.
1. Recommended actions shall include new routes, changes in altitude, vectors around weather, and course deviations.
 2. In making recommendations the NAS shall give consideration to hazardous weather intensity, extent, and direction of movement, the type of aircraft, the amount of fuel remaining in the aircraft, alternate aerodromes and routes available, and air traffic.
 3. Recommendations shall be available within 1 minute of a request for service.
- G. Recommendations shall be made available to the pilot of the aircraft over voice or data communications equipment.
1. The users/specialists provided recommended actions shall include the pilot of the aircraft for which a potential encounter is projected, and the controller handling that aircraft.
- H. The NAS shall be capable of assisting specialists in determining the impact of the avoidance actions and modifying the avoidance actions if required to maintain safe separation in the affected sectors.
1. The NAS shall be capable of ranking avoidance actions in order of preference, including alternatives generated automatically and alternatives generated by a specialist.

2. The rank ordering shall consider safety factors (traffic, terrain, fuel remaining, aircraft capabilities) and also efficiency (additional fuel consumed, additional time in flight).
- I. The weather avoidance function shall be available on a continuous basis.
 - J. The NAS shall be capable of forecasting and detecting the presence of wind shear (microbursts, gust fronts) within terminal areas.
 1. Detection of wind shear and microbursts shall be in accordance with 3.1.1.A.2 (o, p, q, r, s).
 2. Forecasts of wind shear and microbursts shall be in accordance with 3.1.1.A.4 (g,h).
 - K. The NAS shall be capable of continuously displaying surface wind speed, wind direction, and gust information within terminal areas.
 1. Wind information shall be displayed within the air traffic control tower.
 2. Information displayed shall include wind speed, wind direction, and variations in surface winds among selected points on the aerodrome surface. Displayed information shall be accurate to the tolerances in 3.1.1.A.2.a (wind speed and direction).
 3. Information displayed shall be current to within one minute.

3.2.7 Ground, Obstacle, and Special Use Airspace Avoidance Requirements

General Requirement

Safe operation requires that aircraft maintain specific distances from the ground, mountainous terrain, man-made obstacles (such as buildings, antenna towers, and overhead lines), and special use airspace. Although avoiding such hazards is ultimately the responsibility of the user, the NAS is required to provide assistance in avoiding these hazards.

Specific Requirements

- A. Specific requirements A, B, C, and J of 3.2.3 also apply to this paragraph.
- B. The NAS shall develop and maintain accurate, complete, and current information on the ground, terrain, obstacles, and special use airspace throughout the area of NAS responsibility.
 - 1. Ground and terrain information developed and maintained shall include elevation data accurate to within 50 feet at each point of a grid of sufficient detail that each location in the continental U.S. is within 0.5 nm of a grid point.
 - 2. The location and elevation of all man-made obstacles whose maximum height above the surrounding terrain exceeds 200 feet shall be maintained. The location of the obstacle on the earth's surface shall be determined and maintained to an accuracy of within one arc second. This information shall be updated as required to remain current.
 - 3. Information locating the boundaries of all special use airspace and specifying times when active shall be maintained. The location information shall be accurate to within 1 nm.
- C. The NAS shall make available to users/specialists accurate, complete, and current information on the ground, terrain, obstacles, and special use airspace.
 - 1. Information shall be provided upon request to users and specialists at the levels of accuracy, completeness, and currency specified in (B) above.

2. The user/specialist shall be able to obtain information for specific geographic areas or routes of flight.
 3. Information shall be available to specialists in a visual format which includes minimum altitudes to clear obstructions.
- D. The NAS shall predict potential encounters of an aircraft with the ground, terrain, obstacles, or special use airspace in sufficient time to avoid the encounter.
1. Potential encounters with ground, terrain, obstacles, or special use airspace shall be predicted sufficiently far in advance to meet the warning time requirements of E.1 below.
 2. Prediction of potential encounters shall be made from current flight plan based trajectories.
- E. The user and specialist shall be alerted to a potential encounter of an aircraft with the ground, terrain, obstacles, or special use airspace.
1. The appropriate specialist shall be alerted at least 40 seconds in advance of the predicted time of encounter for terminal airspace, 75 seconds for en route airspace.
 2. The alert shall include both aural and visual alarms, and identification of the aircraft involved. An indication shall be given that the message is either priority (action necessary) or advisory (information only).
- F. The NAS shall determine aircraft actions to avoid a predicted potential encounter with the ground, terrain, obstacles, or special use airspace. The local terrain, nearby obstacles, weather conditions, and the presence of other aircraft in the vicinity shall be considered in determining appropriate actions to avoid an encounter.
- G. The NAS shall display a recommended action, or a set of alternative actions, to the specialist in sufficient time to avoid the encounter.
1. The recommended actions shall be displayed to the specialist within 5 seconds following the prediction of an encounter.

- H. The ground avoidance, terrain avoidance, obstacle avoidance, and special use airspace avoidance capabilities shall be available on a continuous basis.

3.2.8 In-Flight Emergency Assistance Requirements

General Requirement

There are emergency conditions that range from concern about safety to imminent threat to life. These impose a requirement to provide a wide spectrum of assistance to resolve or reduce the criticality of the situation. The NAS is required to respond to requests for assistance from in-flight users.

Specific Requirements

- A. The NAS shall continuously monitor and respond to emergency transmissions received via such communication methods as radio, radar beacon, and data link.
 - 1. The system shall simultaneously monitor commercially available, air-ground communications systems utilizing designated frequencies to detect emergency transmissions from users.
 - 2. Any FAA facility receiving an emergency transmission from a user shall be capable of providing assistance to the user within 10 seconds.
 - 3. All received or transmitted emergency communications shall be recorded.
 - 4. The capability shall be provided to minimize the need to change channels or frequencies when communicating with a user that has declared an emergency.
 - 5. The capability shall be provided to notify other FAA agencies, specialists, and foreign, federal, state, and local government and private agencies of the existence of an emergency and to transfer essential information to them within 5 minutes of determination that an emergency situation exists.
 - 6. Essential information shall include, but not be limited to, the type of emergency, aircraft identification, last recorded or last known position, weather conditions at last recorded or last known position, type of aircraft, aircraft range, and number of persons on board.

- B. The NAS shall evaluate alternative courses of action and provide recommendations to expeditiously resolve the emergency situation. This shall include, but not be limited to, conflict-free flight path generation recommendations, aerodrome recommendations, and other methods of providing assistance.
1. The system shall provide the specialist with the following recommendations for resolving an emergency within 10 seconds of the specialists' request:
 - a. The names, distances, and times to the nearest aerodromes.
 - b. The heading and recommended control instructions for descent to the aerodrome selected by the user.
 - c. Identification and location with respect to the aircraft in distress of other aircraft in conflict with the recommended emergency flight path.
 - d. Recommended control instructions for each aircraft in conflict with the emergency flight path that can clear the flight path and still avoid other conflict.
 - e. Additional recommended ways to provide assistance to the aircraft with an emergency.
 2. Recommendations provided by the system shall be based on the following information provided by the specialist or retrieved from the system data base:
 - a. Type of emergency.
 - b. Aircraft identification.
 - c. Current position.
 - d. Current altitude.
 - e. Current airspeed.
 - f. Current heading.
 - g. Fuel remaining.
 3. Recommended courses of action shall be provided to the requesting user within 30 seconds of his/her initial request for assistance.
- C. The NAS shall provide a means for alerting specialists when an airborne communications failure is determined to have occurred.

1. The system shall alert specialists at FAA facilities within 3 minutes that an air-ground communications failure has apparently occurred.
- D. The NAS shall provide alternative means of communicating with users who have lost normal communication with specialists.
1. Alternative forms of communications, such as visual signals transmitted by specialists, shall be provided in case air-ground voice and data communications and radar beacon transponders fail or are unavailable.
- E. The NAS shall provide techniques for acquiring essential information including aircraft identification, last known position, remaining fuel, etc..
1. The system shall provide specialists with the original and amended flight plan data and any other essential information stored in the system within 10 seconds of their request.
- F. The NAS shall determine the location of an aircraft in an emergency situation.
1. The system shall provide specialists at FAA facilities with the azimuth, range, and altitude of an aircraft with respect to a known geographic position within 20 seconds of their request.
 2. The azimuth shall be precise to within 0.12 degrees, the altitude to within 200 feet, and the range to within 1 nautical mile.
 3. Specialists shall be provided with the capability to determine the location of an aircraft to within 1 mile of its actual location with respect to two separate, known, geographic positions within 2 minutes of their request.
- G. The NAS shall provide the user with distance and magnetic heading information to an aerodrome or navigational aid.
1. The distance and magnetic heading to any aerodrome or navigational aid within the NAS area of coverage shall be provided to users within 120 seconds of their request.

2. The distance and heading information provided to users shall be precise to within 0.5 miles, and 0.12 degrees, respectively.

3.2.9 Search and Rescue Requirements

General Requirements

Early detection and location of overdue and downed aircraft greatly enhances the chance of occupant survival. Many agencies have resources for providing assistance. NAS has the requirement for detecting, initiating, and assisting in search and rescue activities.

Specific Requirements

- A. The NAS shall detect overdue or unreported aircraft.
 - 1. The elapsed time since last position report shall be compared every 10 minutes with the expected time of arrival at next reporting position or at destination.
 - 2. Specialists shall be alerted automatically within 2 seconds when the difference between the current time and the expected time of arrival at the next reporting position or at the destination exceeds 30 minutes.
 - 3. Overdue or unreported aircraft outside the NAS area of coverage but within Flight Information Regions that the NAS has responsibility for, shall also be detected.
- B. The NAS shall initiate search and rescue procedures for overdue or unreported aircraft.
 - 1. The system shall be capable of initiating search and rescue procedures within 10 seconds of a request by a specialist at an FAA facility.
- C. The NAS shall provide assistance in search and rescue operations (such as position information and communications capabilities).
 - 1. Essential information provided to the specialist concerning the specified aircraft shall include, but not be limited to, the following:
 - a. Information contained on the original and any amendments to the filed flight plan.
 - b. Last recorded or last known position.
 - c. Last recorded heading.

- d. Weather conditions in area of last recorded or last known position.
 - e. Weather conditions projected along last reported heading or along predicted flight path.
- 2. Essential information available within the system data base shall be automatically retrieved and provided to the requesting specialist within 10 minutes of his/her request.
- 3. Essential information and other communications shall be exchanged as needed between specialists and any of the following, via dedicated or switched data and/or voice communications channels, or via other commercially available means.
 - a. The appropriate Rescue Coordination Center.
 - b. Any military, federal, state, and local facilities or agencies in the area.
 - c. Any neighboring, foreign ATC and/or military facilities or agencies.
 - d. Any pilots airborne in the area.
- D. The NAS shall monitor ELT transmissions.
 - 1. The emergency locator transmitter (ELT) frequency shall be monitored throughout the NAS area of responsibility for emergency transmissions on a continuous basis.
 - 2. The capability to monitor ELT transmissions shall be provided at ATC facilities, such as ATCTs, FSSs, and ARTCCs.
 - 3. The capability shall be provided to receive and process reports from non-ATC sources (pilots, amateur radio operators, satellites, etc.) concerning received ELT transmissions.
 - 4. Specialists shall be provided with the geographic coordinates of ELT transmission sites within 10 minutes of detection or of receiving a report of detection from a non-ATC source.

- E. The NAS shall provide a list (tailored to the route of flight and destination aerodrome) of aerodromes, terminal areas, and ARTCC's to be contacted in the initial inquiry to locate an overdue aircraft.
 - 1. The NAS shall list all aerodromes, terminal areas, and ATC facilities located within a 100 mile wide corridor along the projected route from the last known or last reported position within 10 seconds of receiving a request from a specialist.
- F. The NAS shall prepare messages for specialists' review and transmission to other facilities in attempting to locate the aircraft.
 - 1. Messages containing the following information, as a minimum, shall be prepared for transmission to the facilities selected by the ATC specialist:
 - a. Type of emergency
 - b. Aircraft identification
 - c. Aircraft type and description
 - d. Aircraft overdue (or unreported).
 - e. Destination.
 - f. Aircraft endurance (from flight plan).
 - g. Last recorded position.
 - h. Last recorded heading.
 - i. Number and identification (if available) of passengers.
 - j. Other remarks deemed pertinent by the specialist.
 - 2. Messages shall be provided to the ATC specialist for review within 10 seconds of receiving the specialist's request.
 - 3. Messages shall be available for transmission to the selected addressees within 12 seconds of being approved by the specialist, and shall be received by the selected addressees within 3 minutes.
- G. The NAS shall provide the capability to exchange information with all agencies and facilities concerned with search and rescue activities.
 - 1. The capability shall be provided for the real-time transmission and receipt of information over cooperatively provided, commercially available communication systems.

2. The capability shall be provided to input data received from other agencies or facilities with minimal manual processing.

3.2.10 Special Services for Military Aircraft

General Requirements

The Military Services, because of their mission, require a number of special services from the NAS. A means is required for assisting the military services and specialists in making efficient use of the NAS. The NAS must be able to disseminate required information about military activities to users.

Specific Requirements

- A. The NAS shall receive, process, and store airspace reservations from military users.
 1. The NAS shall receive flight plan reservations from the military users, who include:
 - a. Central Altitude Reservation Facility (Military Liaison)
 - b. Military scheduling activities
 - c. Military base operations
 - d. Major Air Force, Army, Navy, and Marine Corps commands requiring airspace reservations
 - e. Military non-ATC Facilities such as range control activities, fleet scheduling activities, and air defense facilities.
 2. The NAS shall process Special Use Airspace reservations received from military users within 60 minutes of receiving the request.
 3. The NAS shall provide the capability to store and retrieve various military air traffic control plans associated with national emergencies such as the Wartime Air Traffic Priority List, The Emergency Security Control of Air Traffic Plan, Tactical Air Movement Plan, and The Security Control of Air Traffic and Navigation Aids Plan.
 4. The NAS shall be able to store and process a minimum of 2000 low level routes for use by military users.

- B. The NAS shall assist the military mission planner and specialists by providing for the issuance of alternatives concerning routes of flight, altitudes, and departure times to resolve possible airspace conflicts.
 - 1. The NAS shall provide the capability to receive and process requests from military users for special movement activities of military aircraft within 24 hours of the users request.
 - 2. The NAS shall be capable of receiving and responding to emergency order of precedence requests (class three or above) immediately.
- C. The NAS shall be able to receive classified and unclassified route proposals from military scheduling activities manually, process this information and advise users and specialists of the most efficient schedule for usage of the airspace.
 - 1. The NAS shall be capable of receiving, manually processing, and storing classified route proposals with security classifications up to including those classified as Secret.
 - 2. The NAS shall provide the capability to process route proposals based on unique military requirements such as hazardous cargo, presidential flights, special refueling and other special interest flights.
- D. The NAS shall provide the communications with military aircraft using specific routes particularly at the low-altitude designated entry and exit points.
 - 1. The NAS shall be capable of communicating with all military aircraft utilizing designated low level training routes between the entry/exit altitude of the route and 10,000 feet AGL.
- E. The NAS shall disseminate information concerning the status of Special Use Airspace to users/specialists.
 - 1. The NAS shall disseminate information on flight activity being conducted in Special Use Airspace which includes: Restricted Areas, Warning Areas, Military Operating Areas, Controlled Firing Areas, Parachute Jumping Areas, and Military Training Routes.

2. The NAS shall provide information on activities being conducted within military Special Use Airspace to users desiring to utilize this airspace within 1 minute of request.
 3. The NAS shall provide this information to commercially available devices such as personal computers via commercial telephone lines.
- F. The NAS shall detect violations or possible violations of separation standards near or in specific Special Use Airspace.
1. The NAS shall provide the surveillance capability to monitor and provide separation services to participating and non-participating aircraft inside of, and within 5 nm of military Special Use Airspace; and within 500 ft below and 500 ft above such airspace.
- G. The NAS shall alert the specialists in sufficient time to allow them to take corrective actions to preclude violations of separation standards.
1. The NAS shall predict a possible violation and alert specialists at least 80 seconds before the violation of separation occurs inside of, within 5 nautical miles, and within 500 ft below or 500 ft above military Special Use Airspace.
- H. The NAS shall advise the specialists of alternative courses of action to preclude violation of separation standards.
- I. The NAS shall allow specialists to inhibit the separation assurance functions for those aircraft for which the military has assumed responsibility for separation.

3.2.11 Airport Movement Area Control

General Requirements

The NAS has responsibility for the control and separation of aircraft and vehicles on the movement areas of qualifying aerodromes in all weather conditions. This shall include separation of aircraft from obstructions.

Specific Requirements

- A. The NAS shall provide the capability to determine the identification and location of aircraft and vehicles on airport movement areas at qualifying aerodromes within specified weather conditions.
 1. The NAS shall provide the capability to detect all aircraft and vehicles on movement area at qualifying aerodromes.
 2. The NAS shall provide surveillance coverage for all movement areas (runways, landing areas, taxiways, instrument landing system critical holding areas, etc.) and airport master plan approved additions for qualifying aerodromes. This requirement may be satisfied by multiple sensors capable of presenting information on a common display.
 3. The NAS shall provide surface detection equipment capable of coverage for 360 degrees of azimuth for surface ranges from 500 feet to 12,000 feet, and for elevation angles of -31 degrees to 0 degrees.
 4. The NAS shall provide surface detection equipment which shall be capable of detecting aircraft and vehicles within the coverage area in conditions of 16 millimeters of precipitation per hour.
 5. The NAS shall detect aircraft and vehicles through a process which does not require equipment on aircraft or vehicles.
 6. The NAS shall be capable of discriminating between two aircraft types/classes of vehicles when they are separated by 40 feet in range or 40 feet in azimuth at a range of 6000 feet. Examples of types/classes are:

<u>Type/Class</u>	<u>Vehicle Length</u>
Small Aircraft (Cessna 150) or Vehicle	Up to 50 feet
Medium Aircraft (B-727, DC-9)	90 - 160 feet
Large Aircraft (B-747, DC-8)	180 + feet

Resolution of two aircraft types/class of vehicles is also required when separated by 50 feet in any combination.

7. The NAS shall display target position within 20 feet of the target's actual position.
 8. The NAS shall be capable of discriminating between aircraft or vehicles of 50 feet or less, 90 - 160 feet, or 180 + feet in length.
 9. The NAS shall provide the capability at qualifying aerodromes, to determine if an aircraft has taxied on to an active runway during periods of reduced (100 foot) visibility.
 10. The NAS shall provide the capability, at qualifying aerodromes, to determine if an aircraft is in position for takeoff on the proper runway, in the case of parallel runways.
- B. The NAS shall provide means to display position data of aircraft and ground vehicles on the airport movement areas under all lighting conditions.
1. The NAS shall provide the capability to display positional data which shall at a minimum include:
 - a. Location
 - b. Aircraft/Vehicle call sign
 - c. Type aircraft/vehicle
 - d. Destination
 - e. Remarks
 2. The NAS shall display positional data on aircraft and vehicles with a presentation of sufficient contrast and brightness to be seen under all ambient light conditions and the display must be free of reflection and glare.
- C. The NAS shall display aircraft positions and related data in relation to appropriate geographic information.

1. The NAS shall provide the capability of accepting map outline data (runways, landing areas, taxiways, parking areas, etc.) that can be overlaid on the position displays.
 2. The NAS shall provide the specialist with the capability to selectively modify the display to present desired information.
 3. The NAS shall provide the capability of defining and displaying runway and taxiway outlines within 12 feet of the actual edge of the runways and taxiways.
- D. The NAS shall provide the specialist with an unobstructed view of the airport movement area.
- E. The NAS shall have the capability to provide airport movement area control on a continuous basis at qualifying airports.
- F. The NAS shall provide the capability for specialists to communicate with aircraft and vehicles on the airport movement area.
1. Alternative forms of communications such as visual signals transmitted by specialists shall be provided in case normal air-ground voice and data communications fail or are unavailable.

3.3 Monitoring (VFR)

VFR operations are enhanced by the availability of monitoring services. The NAS is required to provide monitoring services to assist the user in avoiding other aircraft and adverse weather.

3.3.1 Flight Following Requirements

General Requirements

The NAS shall be capable of monitoring flights to assure timely emergency assistance in the event the need develops.

Specific Requirements

- A. The NAS shall provide a method for users to request and accept flight following service.
 - 1. The NAS shall be capable of two way communications with appropriately equipped aircraft operating in hazardous or remote areas.
 - 2. The NAS shall be capable of automatic flight following of appropriately equipped users.
 - 3. The NAS shall be capable of automatic flight following through the use of commercially available equipment which users may purchase and install on their own aircraft.
 - 4. The NAS shall obtain such information as identification, position, speed, altitude, and future routing information on aircraft requesting or obtaining flight following.
- B. The NAS shall provide flight following service when requested.
 - 1. The NAS shall ensure that flight following service is available for users operating in hazardous or remote areas.
 - 2. Flight following service shall be available regardless of weather conditions.
 - 3. The NAS shall be capable of monitoring and updating the progress of aircraft receiving flight following.

4. The NAS shall be capable of providing flight following service regardless of surveillance coverage of the route being flown.
 5. The NAS shall expand the areas receiving flight following to include selected low altitude and remote area environments such as off-shore oil platforms, etc.
- C. The NAS shall alert the specialist when a VFR flight being provided with flight following service is overdue.
1. The NAS shall use any type of visual and/or aural alert to the specialist.
 2. The alert shall repeat itself regularly until manually deactivated by the specialist.
 3. A flight making airborne position reports shall be considered overdue if out of surveillance coverage, and contact has not been re-established within 15 minutes of the expected report time, as determined by the specialist.
- D. The NAS shall provide the specialist with information on the overdue aircraft, such as aircraft identification and type, and time and location of last position, etc.
1. Initial notification to the specialist shall consist of at least aircraft identification and type, time and location of expected position report, and last known frequency used.
 2. The NAS shall be capable of providing additional information to the specialist on request, such as time and location of last reported or known position, expected future routing, etc.
 3. The NAS shall be capable of providing the specialist with a prioritized list of the facilities to be notified to begin a communications search for the overdue aircraft.
 4. The NAS shall be capable of providing the specialist with any additional historical data known on the overdue aircraft and prioritized by relevance to the communications search.

3.3.2 Traffic Advisory Requirements

General Requirements

The NAS shall be capable of providing traffic advisory services to VFR aircraft.

Specific Requirements

- A. The NAS shall be capable of providing traffic advisories to VFR aircraft.
 - 1. The NAS shall be capable of communicating with appropriately equipped users on normal communications channels, plus at least one emergency use channel.
 - 2. The NAS shall be capable of displaying the position of appropriately equipped aircraft in terms of relative position to other aircraft, altitude, relative speed, and closure rate.
- B. The NAS shall be capable of providing safety advisories and vectoring services to VFR aircraft when time-critical situations occur involving proximity to the ground, terrain, obstructions, special use airspace, or other aircraft.
 - 1. The NAS shall maintain current data on the altitude of terrain and obstructions within the area of NAS responsibility.
 - 2. The NAS shall alert the specialist to a predicted aircraft impact with terrain or obstructions in sufficient time to permit specialist analysis, communication with the flight crew, crew reaction, and aircrew maneuvering prior to the predicted collision.
 - 3. Specialists shall alert appropriately equipped and participating aircraft to an NAS predicted conflict with the terrain, obstructions, aircraft or special use airspace within 10 seconds of the NAS prediction.
 - 4. The NAS shall be capable of selecting and displaying to the specialist a recommended avoidance vector for an aircraft with an NAS predicted conflict. This recommendation should be displayed within 1.2 seconds (99th percentile) of the prediction of a conflict.

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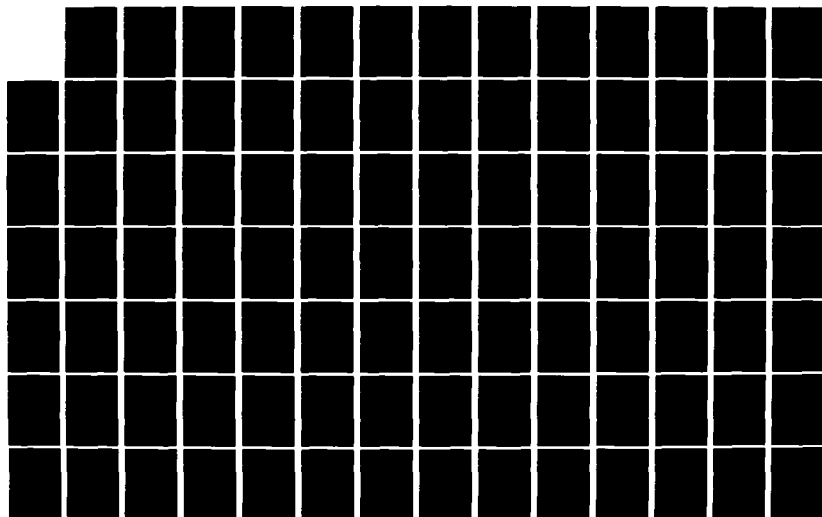
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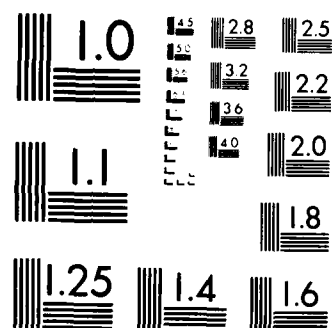
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- C. The NAS shall be capable of providing sequencing and separation services to VFR aircraft in terminal arrival and departure phases of flight.
 - 1. The NAS shall be capable of displaying the positions of VFR aircraft in terminal arrival and departure phases of flight.
 - 2. The NAS shall be capable of applying both IFR and VFR separation standards when both types of traffic are operating within terminal areas.
 - 3. The NAS shall be capable of pointing out other traffic to pilots when applying VFR separation standards.
- D. The NAS shall be capable of providing advisory and vectoring services to VFR aircraft approaching special use airspace.
 - 1. The NAS shall monitor the airspace around special use airspace.
 - 2. The NAS shall be capable of automatically notifying the specialist when an unauthorized aircraft approaches special use airspace.
 - 3. The NAS shall be capable of selecting and displaying to the specialist a recommended avoidance vector for an aircraft predicted to violate special use airspace.
 - 4. The NAS shall maintain current data on the status and boundaries of special use airspace.
- E. The NAS shall obtain identification, position, speed, altitude, and heading information on aircraft being provided traffic advisory service.
 - 1. Identification, speed, altitude, and heading information shall be correlated with the specialist's display data to confirm aircraft identification.
 - 2. All available information on VFR traffic may also be used by the specialist when he is pointing out that aircraft to another flight under his control.
- F. The NAS shall be capable of determining when a potential traffic conflict exists between a VFR aircraft and other aircraft.

1. The NAS shall monitor the altitude and track of all appropriately equipped aircraft for the purpose of traffic advisories.
2. The NAS shall project the flight paths of all known traffic to predict potential conflicts.

3.3.3 Weather Advisory Requirements

General Requirements

The NAS has a requirement to inform users of hazardous weather conditions and to allow users to request and accept in-flight weather advisories.* The prediction of a potential encounter requires determination of the present and future heading of the aircraft and the present and future location of the hazardous weather. The degree of hazard posed by the weather depends upon its intensity, the characteristics of the aircraft, and the phase of flight (take-off, en route, landing).

Specific Requirements

- A. The NAS shall be capable of providing weather advisories to aircraft in flight.
 - 1. The NAS shall be capable of continuous broadcasts of hazardous weather.
 - 2. The NAS shall provide for direct specialist-to-pilot communications for exchange of weather information.
 - 3. The NAS shall provide direct user access to weather advisories on a request/reply basis.
 - 4. Response times for user and specialist access to NAS weather data is provided in 3.1.1.H.1.&3.
 - 5. Coverage requirements shall be as stated in 3.2.6.C.4.
- B. Weather advisory information shall be continuously available at general aviation aerodromes with instrument approach procedures and terminal areas.

* Section 3.1.1 is utilized to identify the weather information requirements. It includes the requirements for weather information acquisition and maintenance, coverage, accuracy, timeliness and content. Section 3.2.6 lists requirements for hazardous weather avoidance and applies to aircraft receiving separation service. Section 3.3.3 will generally not repeat these requirements, but will reference 3.1.1 and 3.2.6 except where there are unique or additional weather information requirements not already covered in 3.1.1 or 3.2.6.

1. Aerodrome surface observations should be updated once per minute, and continuously broadcast.
 2. The NAS shall be capable of continuously broadcasting aerodrome and terminal area conditions on communications media which can be accessed by aircraft in flight and on the ground.
 3. The NAS shall be capable of responding to user and specialist requests for weather information from either NAS facilities, such as an AFSS, ACF, or tower, or from user owned and operated input/output devices, through common carrier communication networks.
- C. Users shall have direct access at all times to current information on hazardous weather conditions along their routes of flight.
1. The NAS shall broadcast, on communications media which can be accessed by appropriately equipped aircraft, current information on hazardous weather conditions.
 2. Hazardous weather broadcasts shall be updated at least every 30 minutes, and not more than 5 minutes after a significant change of weather.
 3. Dissemination of hazardous weather information shall be given priority over the dissemination of routine weather information.
 4. The hazardous weather information stated in 3.2.6.C.1 shall be available to pilots in flight.
 5. The NAS shall be capable of automatically disseminating selected weather information directly to appropriately equipped aircraft.
- D. Weather phenomena which pose a hazard to VFR aircraft shall be detected, located, and monitored.
1. Weather phenomena that may affect VFR flight operations shall be tracked and reported with the same resolution, accuracy, and dissemination as any other weather conditions which are considered hazardous to flight.
 2. The NAS shall provide advisories on those conditions listed in 3.2.6.C.1. & 2.

- E. The NAS is required to predict potential encounters with hazardous weather sufficiently far in advance to allow appropriate avoidance actions to be determined and executed.
 - 1. The NAS shall be capable of displaying hazardous weather to the specialist.
 - 2. The prediction time should be sufficient to allow for: system display, specialist analysis, communication with aircraft requesting service, flight crew reaction and aircraft maneuver time.
- F. The NAS shall assist the user in determining an appropriate course of action in avoiding weather or transferring to instrument flight.
 - 1. The specialist shall, upon user request, suggest: new routes, new altitudes, course deviations, or alternate aerodromes.
 - 2. The NAS shall provide for rapid transition to IFR operation upon request by an appropriately rated and equipped user.
- G. The NAS shall provide reliable communications links between users and specialists for the exchange of information relating to weather avoidance.
 - 1. The NAS shall be capable of accepting and responding to requests for weather information from airborne aircraft via voice or data link communications.

3.4 Navigation

The NAS shall provide a system of navigational aids that will enable users to safely and efficiently navigate aircraft from take-off to landing within the area of NAS responsibility under all weather conditions.

3.4.1 En Route Navigation

General Requirements

The NAS is required to provide en route navigation aids that enable users to define and use routes of flight and determine aircraft position.

Specific Requirements

- A. The NAS shall provide a navigational network to meet user requirements.
 1. The NAS shall provide navigational information in such a manner that a pilot can determine his position by bearing and range from a predetermined aeronautical fix.
 2. The NAS shall provide navigational information in a manner that a pilot can determine his position relative to a predetermined flight path.
 3. NAS provided NAVAIDS that provide guidance in terms of rho/theta coordinates shall be referenced in the following manner: the rho coordinate shall be referenced to the location of the NAVAID, and the theta coordinate shall be referenced to magnetic north.
 4. The NAS shall provide coverage from 1000 feet AGL (2000 feet in designated mountainous areas) up to and including 60,000 feet above MSL, for all NAS designated controlled airspace.
 5. NAS approved enroute navigational aids designated for use in oceanic areas between the altitudes of FL 275 and FL 400 for normal density traffic shall support route widths of less than 60 nm.
 6. NAS approved enroute navigational aids designated for use in domestic areas between the altitudes of 500 feet and FL 600 for normal and high density traffic shall support route widths of 8 nm or less.

7. NAS approved enroute navigational aids designated for use in remote areas between the altitudes of 500 feet and FL 600 for normal density traffic shall support route widths of 20 nm or less.
 8. NAS approved enroute navigational aids designated for limited use applications, such as rotorcraft, between the altitudes of 500 feet and 5,000 feet for low density traffic (off-shore) shall support route widths of 8 nm or less.
 9. NAS approved enroute navigational aids designated for limited use applications, such as rotorcraft, between the altitudes of 500 feet and 3,000 feet for high density traffic shall support route widths of 4 nm or less.
 10. The primary en route navigational system should have sufficient capacity to provide bearing information to an unlimited number of aircraft, and distance information to at least 100 aircraft simultaneously.
 11. There should be no ambiguity (two or more possible position fixes, with the same set of measurements, with no indication of which is the most nearly correct) within the primary en route structure of the navigational system.
 12. The navigational system must have a capability of recovering from a temporary loss of signal in such a manner that the correct current position will be indicated without the need for complete resetting.
 13. The NAS shall support the development and certification (NAS and ICAO) of modern systems of aircraft navigation which meet or exceed current standards, and are not currently part of the NAS navigational networks.
 14. The NAS navigational network, or any component thereof, shall be capable of shutdown within one minute to support national defense requirements.
- B. The NAS shall provide a navigation network that is compatible with NAS approved user equipment.
1. The navigational network shall be referenced to NAS approved radionavigation aids, the magnetic compass, geographic coordinates, and navigation charts.

2. The primary system of enroute navigation shall have a sufficient update rate of position and deviation from a selected course to allow coupled autopilot operation.
 3. The navigational aids provided shall be similar to that provided to terminal areas, so that much of the same airborne equipment can be used for en route navigation as is used for terminal navigation.
 4. Navigational aids provided by the NAS shall meet or exceed applicable ICAO performance standards.
- C. The NAS shall be capable of providing certain status and location information for specific navigational aids such as geographical reference, identification, operating status, bearing information, and distance information.
1. The NAS shall provide the capability to automatically monitor the performance parameters of navigational aids.
 2. The NAS shall provide for identification and diagnosis of failures of selected navigational equipment from centralized maintenance facilities.
 3. The NAS shall provide for monitoring of signals from certain supplemental (non-NAS) navigational systems.
 4. The NAS shall inform users of the status of supplemental systems, and provide correction values, if required, to improve navigational accuracy.
 5. The NAS shall discontinue, within 10 seconds, the operation of NAS provided navigational aids whose performance is outside of the acceptable parameters.
 6. The NAS shall provide the capability for both automatic and manual switching to redundant equipment (where redundancy is required).
 7. The NAS shall alert users and specialists to a failure of NAS monitored navigational aids that may affect operations within the NAS airspace.
 8. The location of each NAS provided rho/theta type NAVAID shall be provided in geographic coordinates (lat/long).

9. Every NAS provided NAVAID shall transmit an identification code that is unique within that NAVAID's area of signal coverage. Transmittal of the identification code shall be discontinued whenever the operation of the NAVAID has been discontinued or is being tested.

3.4.2 Terminal Navigation

General Requirements

The NAS shall provide a system that will allow users to navigate to and from aerodromes. Navigation guidance shall be provided in the lateral and vertical planes and a means shall be provided to indicate distance information.

Specific Requirements

- A. At specified aerodromes, the NAS shall provide navigational capabilities that will give users approach, landing, and departure information such as continuous distance measuring, vertical guidance (glide slope), and azimuth guidance.
 1. The NAS shall provide terminal navigation information in such a manner that a pilot can determine his position by bearing and range from a predetermined aeronautical fix.
 2. The NAS shall provide approach information in a manner that a pilot can determine his position relative to a predetermined flight path.
 3. NAS provided NAVAIDS that provide guidance in terms of rho/theta coordinates shall be referenced in the following manner: the rho coordinate shall be referenced to the location of the NAVAID, and the theta coordinate shall be referenced to magnetic north.
 4. NAS approved terminal navigational aids designated for use between the altitudes of 500 feet and FL 180 for high density traffic shall support route widths of 4 nm or less.
 5. NAS approved non-precision approach and landing navigational aids designated for use between the altitudes of 250 feet and 3000 feet above the surface for normal density traffic shall support route widths of 2 nm or less.
 6. NAS approved precision landing systems designated for Category I approaches shall provide guidance between the altitudes of 100 to 3000 feet above the surface, and shall support lateral accuracies of ± 9.1 meters at 100 feet above the surface.

7. NAS approved precision landing systems designated for Category II approaches shall provide guidance between the altitudes of 50 to 3000 feet above the surface, and shall support lateral accuracies of ± 4.6 meters at 50 feet above the surface.
8. NAS approved precision landing systems designated for Category III approaches shall provide guidance between the surface and 3000 feet above the surface, and shall support lateral accuracies of ± 4.1 meters at the touchdown point.
9. A single accuracy standard is desirable for all precision approaches, regardless of landing category. This accuracy standard at the runway threshold shall be at least ± 20 feet laterally, ± 2 feet vertically, and ± 100 feet in forward distance.
10. Primary terminal navigation aids and all precision landing systems shall have a sufficient update rate of both position and deviation from a selected course to allow coupled autopilot operation.
11. Precision landing systems shall have the capacity to provide course and glide slope information to an unlimited number of aircraft simultaneously.
12. Precision landing systems shall be capable of providing distance information to at least 100 aircraft simultaneously.
13. Precision landing systems shall have no ambiguity potential.
14. Precision landing systems shall permit 90 degree captures of the extended runway centerline.
15. Precision final approach coverage shall be provided in a sector defined by at least ± 40 degrees laterally from the extended runway centerline and from 0.9 degrees to 15 degrees above the horizon, and within 20 nm from the landing area.
16. The NAS shall provide for non-precision approaches to be conducted with 0.6 nm lateral accuracy, of which the NAS equipment shall contribute less than 0.05 nm error at the missed approach point.

17. The NAS shall provide a means of indicating the missed approach point for non-precision approaches.
 18. The navigational aids provided shall, whenever possible, be similar to those provided in the enroute structure, so that much of the same airborne equipment can be used for both terminal and enroute navigation.
 19. The terminal and approach navigation systems must have a capability of recovering from a temporary loss of signal in such a manner that the correct current position will be indicated without the need for complete resetting.
 20. Terminal navigation aids and approach and landing systems provided by the NAS shall meet or exceed applicable ICAO performance standards.
- B. Navigational capabilities shall be provided to users on a continuous basis under all weather conditions.
1. The NAS terminal navigation and approach systems shall function with no degradation of performance in all weather conditions.
- C. The NAS shall provide for monitoring of navigational information for status and operational performance parameters and shall alert user/specialists if there is a change in status (such as: changing between functioning as prescribed and not functioning as prescribed, or changing between being available for use and not being available for use).
1. The NAS shall provide the capability to automatically monitor the performance parameters of navigational aids.
 2. The NAS shall provide for identification and diagnosis of failures of selected NAS navigational equipment from centralized maintenance facilities.
 3. The NAS shall provide for monitoring of signals from certain supplemental (non-NAS) navigational systems.
 4. The NAS shall inform users of the status of supplemental systems, and provide correction values, if required, to improve navigational accuracy.

5. The NAS shall discontinue, within 10 seconds, the operation of NAS provided navigational aids whose performance is outside of the acceptable parameters.
6. The NAS shall provide the capability for both automatic and manual switching to redundant equipment (where redundancy is required).
7. The NAS shall alert users and specialists to a failure of NAS monitored navigational aids that may affect operations within the terminal airspace.
8. The location of each NAS provided rho/theta type NAVAID shall be provided in geographic coordinates (lat/long).
9. Every NAS provided NAVAID shall transmit an identification code that is unique within that NAVAID's area of signal coverage. Transmittal of the identification code shall be discontinued whenever the operation of the NAVAID has been discontinued or is being tested.

3.4.3 Visual Navigation Aids

General Requirements

The number of airports and other landing areas required to support the increasing user demand has made location and identification of the area of intended landing difficult for aircraft not equipped with electronic landing aids. To aid all users during times of reduced visibility or darkness, visual aids to navigation independent of cockpit instrumentation are required. These devices shall include, but are not limited to lighting, visual descent guidance devices, aerodrome location aids, and standardized aerodrome marking aids.

Specific Requirements

- A. The NAS shall provide visual aids that provide for curved, offset, and straight-in guidance as dictated by individual aerodrome/terrain characteristics for non-precision and visual approaches.
 - 1. The NAS shall provide runway approach lighting systems, at qualifying aerodromes, that start at the landing threshold, are aligned with the runway centerline, and extend in the approach direction a minimum of 2400 feet for precision instrument runways and for a minimum of 1400 feet for non-precision instrument runways.
 - 2. The NAS shall provide additional approach lighting systems that supplement certain electronic approach aids by providing for curved, offset, high angle, and straight-in visual guidance as dictated by individual aerodrome size, service, and terrain characteristics.
 - 3. The NAS shall provide visual approach lighting systems which will provide guidance to the user in locating and aligning his aircraft with the landing surface.
- B. The NAS shall provide highly accurate visual aids that provide the user with information on runway alignment, height perception, roll guidance, and horizontal references.
 - 1. The NAS shall provide selected aerodromes with approach slope guidance lighting with an effective visual range during clear weather of a minimum 3 miles during daylight hours and 20 miles during night hours.

2. The NAS shall provide selected aerodromes with approach slope guidance lighting systems that will, at a minimum, identify a 3 degree glideslope and incursions outside of acceptable approach slope tolerances.
 3. The NAS shall provide selected aerodromes with runway end identifier lights to provide rapid and positive identification of the approach end of a particular runway. It shall also provide runway edge light systems, touchdown zone lighting, runway centerline lighting, runway remaining lighting, and taxiway turn-off lights.
- C. The NAS shall provide visual aids to identify and locate aerodromes.
1. The NAS shall provide lighting systems to identify the type of aerodrome (i.e. military, civil, seaplane), which can be seen for a minimum of 20 nm at night, and 3 nm during daylight hours.
 2. The NAS shall provide lighting systems to locate and discriminate aerodromes from surrounding features (i.e. city lights, terrain, structures).
- D. The NAS shall ensure proper marking of obstructions in the vicinity of the landing area.
1. To identify obstructions, the NAS shall provide lighting systems which will be visible from a minimum distance of 20 nm in clear weather during hours of darkness.
 2. The NAS shall provide lighting and markings on those permanent obstructions on the aerodrome surface that could pose a threat to departing, arriving, or taxiing aircraft.
 3. The NAS shall provide a means of visually marking/identifying runways, taxiways, landing areas, runway limiting characteristics and other landing indicators which may be necessitated by specific site requirements.
 4. The NAS shall provide selected aerodromes with lighting systems that provide obstruction clearance within ± 10 degrees of the extended runway centerline to a minimum of 4 nm from the runway threshold.

- E. The NAS shall provide the capability for specialists to operate the lighting systems for which it has responsibility.
 - 1. The NAS shall provide for the operation of aerodrome lighting systems from the control tower.
 - 2. The NAS shall provide the capability for various light intensity settings for approach lighting systems which are controlled by specialists.
 - 3. At aerodromes without operating control towers, the NAS shall provide for the operation of aerodrome lighting systems from a remote, designated ATC facility.
- F. The NAS shall provide users with the capability of operating lighting systems where appropriate.
 - 1. The NAS shall provide the capability, at selected aerodromes where lighting is required, for pilots to remotely control aerodrome lighting systems such as approach lights, runway and taxiway lights by use of commercially available, airborne equipment.

3.5 Air Defense and Law Enforcement Surveillance Requirements

The NAS shall provide for the detection of any aircraft throughout an Air Defense Identification Zone (ADIZ), Distant Early Warning Identification Zone (DEWIZ), and all other airspace for which NAS has responsibility. The NAS is required to ascertain the position, velocity, and altitude of aircraft in such airspace and to identify unauthorized intruders.

3.5.1 Aircraft Detection and Identification Requirements

General Requirements

All aircraft entering an Air Defense Identification Zone (ADIZ) or the Alaskan Distant Early Warning Identification Zone (DEWIZ) shall be under surveillance at all times. The NAS shall be required to provide the current and expected location, altitude, speed, and heading of each aircraft. National security and law enforcement interests require a method to determine whether the aircraft is authorized or unauthorized. This capability must be available at all times. The NAS must provide a means for communication to support these requirements.

Specific Requirements

- A. All aircraft entering an ADIZ/DEWIZ must be detected at all altitudes.
 - 1. The NAS shall detect any aircraft entering an ADIZ/DEWIZ area of surveillance coverage within 12 seconds of penetration.
 - 2. The NAS shall detect any aircraft entering an ADIZ/DEWIZ to a maximum altitude of 100,000 feet MSL and to a maximum surface range of 200 nm, from -5 degrees to +30 degrees relative to an earth tangential plane at the sensor site.
- B. The NAS shall provide the position, velocity, and altitude of all aircraft.
 - 1. The NAS shall detect the position of an aircraft entering an ADIZ/DEWIZ within 0.125 nm and 0.176 degrees of the aircraft's actual position.
 - 2. The NAS shall detect the velocity of an aircraft entering an ADIZ/DEWIZ within 20 knots of the aircraft's actual speed.

3. The NAS shall independently detect the altitude of an aircraft entering an ADIZ/DEWIZ within 1500 feet of the aircraft's actual altitude.
- C. The NAS must provide for the identification of aircraft entering an ADIZ/DEWIZ.
1. The NAS shall correlate the flight plan of known inbound aircraft with a penetrating target within 8 seconds of penetration.
 2. The NAS shall alert specialists within 1 second when the track of an inbound aircraft cannot be associated with a flight plan.
- D. The aircraft detection and identification capabilities and the related communications capabilities must be available continuously.
- E. The NAS shall provide a capability for the exchange of flight plan data between specialists, military air defense personnel, and law enforcement officials.
1. The NAS shall provide the capability to exchange data by voice grade and/or automated equipment with military and law enforcement authorities (e.g., NORAD, FBI, DEA, INS).
 2. The NAS shall be capable of providing flight plan data that at a minimum will contain:
 - a. Aircraft Call Sign
 - b. Type Aircraft
 - c. Position
 - d. Altitude
 - e. Direction of Flight
 - f. Velocity
 - g. Remarks
 3. The NAS shall assist military specialists in identifying aircraft entering an ADIZ/DEWIZ.
 4. The NAS shall assist law enforcement authorities to identify and follow aircraft of special interest.
 5. The NAS shall provide the capability to alert specialists within one minute of detecting when an aircraft using the registration number of a reported stolen aircraft is operating in NAS airspace.

- F. The NAS shall provide communications between specialists and appropriate military and law enforcement officials.
 - 1. The NAS shall provide for cooperative communications capability between FAA and military specialists and law enforcement officials.
 - 2. The NAS shall provide protected communications capability to alert military and law enforcement officials.

3.6 Communications

The transfer of information between aircraft and the ground (air-ground), between ground facilities (interfacility ground-ground), and within NAS facilities (intrafacility ground-ground) is necessary for safe and efficient operation of the NAS. The information to be transferred includes surveillance, flight plan, flight movement, weather, and monitoring and control information. Both voice and data communications capabilities must be provided. The communications must be reliable and secure.

3.6.1 Air-Ground

General Requirements

The NAS must be capable of transferring information between aircraft and NAS ground facilities. This capability is required at all altitudes and locations within the NAS area of responsibility.

Specific Requirements

- A. The NAS shall provide air-ground communications within the operational jurisdictions of NAS.
 1. Air-ground voice and data communications coverage shall be provided for the en route and terminal airspace of the conterminous United States, Alaska, Hawaii, and Puerto Rico.
 - a. VHF voice channels in the 117.975 to 136.000 MHz band and UHF voice channels in the 225 to 400 MHz band shall be provided for air-ground voice communications coverage. Generally, VHF and UHF voice channels shall be used by civil and military users, respectively.
 - b. Data channels in the frequency band appropriate for air-ground data communications equipment shall be provided for data communications coverage for both civil and military users.
 2. The following voice coverage capabilities shall be provided as a minimum:
 - a. VHF/UHF voice channels for en route communications between specialists in ARTCCs and FSSs and users at altitudes at and above 1000 feet AGL (at and above 2000 feet AGL in designated mountainous areas).

- b. VHF/UHF voice channels for communications from ground level to a minimum altitude of 3000 feet AGL for a radial distance of 5 statute miles around control towers serving users at terminal facilities.
 - c. VHF voice channels for ground control or clearance delivery communications between specialists at terminal facilities and users and vehicles on the aerodrome surface or controlled movement areas. In addition, UHF voice channels shall be provided at terminal facilities serving both civil and military users for ground control communications.
 - d. At least 5 discrete UHF voice channels for single-frequency approach communications from ground level to a minimum altitude of 3000 feet AGL for a radial distance of 5 statute miles around control towers serving military single-piloted, jet users.
 - e. Receipt and transmission of emergency voice communications via VHF and flight service facilities while maintaining voice communications via normal assigned VHF and/or UHF channels.
 - f. VHF/UHF channels for communication of pre-recorded and/or computer-generated voice messages for repetitive and non-repetitive broadcast at all en route, terminal, and flight service facilities.
 - g. VHF/UHF voice channels at selected FSSs for en route flight advisory service (EFAS) communications between specialists and users.
3. The following data coverage capabilities shall be provided as a minimum:
- a. Repetitive and non-repetitive data message broadcasts between en route, terminal, and FSS specialists and users.
 - b. Data communications to ground level at qualifying terminal facilities (those meeting Air Traffic Service criteria for air-ground data communications).
 - c. Data communications at all other locations at and above 6000 feet MSL, or at and above minimum en route altitude, whichever is higher, up of 100,000 feet MSL.

- d. Data communications at qualifying terminal facilities for ground control or clearance delivery exchange between specialists and users on the aerodrome surface or controlled movement areas.
- 4. Voice and data communications shall have the following response capabilities:
 - a. The one-way voice communications connection between the specialist and the user shall be completed within 1 second of the keying of the specialist's microphone.
 - b. Data messages shall be delivered and displayed (CRT or hard copy) to users or to specialists within 8 seconds of being released for transmission by the specialist or user with a probability of 0.99.
- 5. The quality of voice and data communications provided between specialists at en route, terminal, and flight service facilities and users shall be as follows:
 - a. Voice communications shall be clearly intelligible when using a normal conversational tone and normal volume.
 - b. No more than 1 in 10^7 data messages shall be delivered to the wrong user or to the wrong ATC facility.
 - c. A single data message delivered to a user or to an ATC facility shall contain no more than 1 in 10^7 undetected bit errors.
- 6. Data communications between specialists and users shall provide the following capabilities as a minimum:
 - a. Discrete addressing for transmitting certain data messages to specific users and ATC facilities within communications range.
 - b. Broadcast communications for transmitting data messages to all suitably equipped users.
 - c. Single key acknowledgment of message receipt and content.
 - d. Retention and display of sender/addressee identification.

- e. Automated message preparation.
 - f. Automated detection of message preparation errors.
7. The system shall provide the capability to automatically determine when radio frequency changes for users shall occur when changing sectors; automatically select the appropriate frequency to be assigned to the user after changing sectors; automatically notify affected specialists and users of the completed frequency change.
 8. The system shall provide the capability to indefinitely sustain the transmission of short data messages (48 information bits each) at a rate of 45 messages per minute to each user, and long data messages (1000 information bits each) at a rate of 1 message per 30 seconds to each user.
 9. Data messages shall be deliverable to specifically identified users with a probability of 0.95 when 32 users are contained in a 10 nm by 10 nm area, and with a probability of 0.99 when 497 users are contained in a 50 nm by 50 nm area.
 10. The system shall provide a modular expansion capability for en route, terminal, and FSS voice and data (where required) communications. Voice equipment shall be capable of operating with 25 kHz channel separation.
 11. Where air-ground voice and data communications capabilities are not available down to ground level at an aerodrome, the system shall permit the user to enter the IFR system via a telephone clearance.
- B. The NAS shall provide protection against interference from undesired signals on the same or adjacent frequencies.
1. All VHF/UHF voice channels used in the NAS shall have a center frequency spacing of 25 kHz.
 2. The system shall reject by 80 dB all signals at frequencies greater than or equal to + 150 kHz from the tuned center frequency of the receiver. The 80 dB rejection criteria is with respect to a signal at a frequency within + 150 kHz of the receiver center frequency to which the minimum receiver output response is 10 dB (S+N)/N.

3. The system shall reject, by more than 60 dB, all signals at or beyond ± 25 kHz from the receiver center frequency. The bandwidth of the intermediate frequency amplifier for 25 kHz center frequency spacing shall conform to the following profile:

<u>attenuation</u>	<u>bandwidth</u>
6 dB	± 9 kHz min
20 dB	± 14 kHz max
40 dB	± 15 kHz max
60 dB	± 16 kHz max
80 dB	± 20 kHz max

4. Air-ground data communications systems shall be capable of detecting desired data signals in the presence of interfering signals whose levels are at least 6 dB below the level of the desired data signal.
- C. The NAS shall be able to receive, store, retain, and readily retrieve all NAS air-ground communications.
1. All air-ground voice and data communications transmitted or received by FAA facilities shall be recorded.
 2. Voice and data recordings shall be retained in "on-line" storage for not less than 24 hours, and in "off-line" storage for not less than 15 days.
 3. Individual voice recordings shall be retrievable from "on-line" storage within 10 minutes, and from "off-line" storage within 30 minutes of a request by authorized FAA personnel.
 4. Individual data messages shall be retrievable from "on-line" storage within 2 minutes, and from "off-line" storage within 30 minutes of a request by authorized NAS personnel.
- D. The NAS shall provide the capability to monitor any operating position without introducing any change in transmission or reception characteristics.
1. Each NAS control facility shall provide supervisory positions and designated specialist positions with the capability to selectively monitor all voice and data communications and all video displays at all other

operating positions within the facility on an individual basis.

- E. The NAS shall provide air-ground communications on a continuous basis.
- F. The NAS shall have the capability to reconfigure communication capabilities to support changes in operating position responsibilities.
 - 1. The selective reassignment or reconfiguration of voice and data communications channels to different specialist positions within the same ATC facility shall occur within 10 seconds of a reconfiguration command from the supervisory position.
 - 2. Preset reconfiguration modes shall be achieved within 10 seconds of a supervisory reconfiguration command for individual positions and within 5 minutes for an entire facility.
 - 3. Specialists in one ATC facility shall be able to assume control of the air-ground voice and data communications capabilities associated with designated sectors and/or sector regions within 5 minutes of a reconfiguration command from the supervisory position.
 - 4. The reassignment or reconfiguration of communications capabilities shall not result in the degradation of air-ground voice or data communications.

3.6.2 Ground-Ground Interfacility

General Requirements

The NAS must be capable of transferring information between the various NAS facilities, and between NAS facilities and communication systems outside the NAS, both governmental and non-governmental.

Specific Requirements

- A. The NAS shall provide a communications capability between selected operating, supervisory, maintenance, and administrative positions at separate NAS facilities.
 - 1. The NAS shall provide single-key voice access between individual specialists in one facility and designated specialists in another facility. Single-key access means that a specialist can activate voice access to a designated specialist in another facility with a single action of a single physical device.
 - a. Each specialist in an air route traffic control center (ARTCC), an air traffic control tower (ATCT), or a flight service station (FSS), shall be able to have single-key voice access to a total of 20 specialists in other air traffic control facilities.
 - b. The probability that single-key access calls are not connected due to saturation of equipment shall not exceed 1 in 10,000 calls.
 - c. For calls that are connected, the access connection shall be established within 1 second of key activation with a probability of 0.95. All calls shall be connected within 2 seconds.
 - d. The NAS shall provide the capability for a single ARTCC to establish 60 simultaneous single-key voice access channels with other ARTCCs. A single ARTCC shall be able to establish single-key voice access channels with up to 6 other ARTCCs, and shall be able to establish a maximum of 20 simultaneous single-key voice access channels with a single ARTCC.

- e. The NAS shall provide the capability for a single ARTCC to establish 2 simultaneous single-key voice access channels with each of 10 air traffic control towers and to establish 1 simultaneous single-key voice access channel with each of 30 other air traffic control towers.
 - f. The NAS shall provide the capability for a single ARTCC to establish 2 simultaneous single-key voice access channels with each of 6 FSSs.
 - g. The NAS shall provide the capability for a single FSS to establish 2 simultaneous single-key voice access channels with a single ARTCC.
 - h. The NAS shall provide the capability for a single FSS to establish 1 single-key voice access channel with each of 7 air traffic control towers.
 - i. The NAS shall provide the capability for a single ATCT to establish 2 simultaneous single-key voice access channels with a single ARTCC.
 - j. The NAS shall provide the capability for a single ATCT to establish 1 single-key voice access channel with each of 3 other air traffic control towers or military radar approach control facilities.
 - k. The NAS shall provide the capability for a single ATCT to establish 1 single-key voice access channel with 1 FSS.
 - l. The NAS shall provide the capability for a single ARTCC to establish a single-key voice access channel with the FAA national command center.
 - m. The NAS shall provide the capability for a single ARTCC to establish a single-key voice access channel with the Air Traffic Control Command Center (ATCCC).
2. The NAS shall provide the capability to establish additional single-key voice access channels in the event of catastrophic failure of a single ARTCC. Such additional channels shall be operative within 48 hours of a catastrophic failure.

- a. An ARTCC shall be able to establish new single-key voice access channels with 2 new ARTCCs. The total capability shall remain within the limits described in paragraph 1.d above.
 - b. An ARTCC shall be able to establish new single-key voice access channels with 10 new ATCT. The total capability shall remain within the limits described in paragraph 1.e above.
 - c. The ARTCC shall be able to establish new single-key voice access channels with 1 new flight service facility. The total capability shall remain within the limits described in paragraph 1.f above.
 - d. A FSS shall be able to establish new single-key voice access channels with a new ARTCC. The total capability shall remain within the limits described in paragraph 1.g above.
 - e. An ATCT shall be able to establish new single-key voice access channels with a new ARTCC. The total capability shall remain within the limits described in paragraph 1.i above.
3. Each specialist in an ARTCC, an ATCT, a FSS, the FAA national command center, or the Air Traffic Control Command Center (ATCCC) shall have multi-digit voice calling access to selected other positions in the NAS. Multi-digit voice access calling means that a specialist can establish voice access to a designated position with multiple actions on 1 or more physical devices. Each specialist shall have multi-digit voice access calling to at least 49 other positions outside his own facility.
- a. This access shall be achieved by dialing no more than 4 digits.
 - b. The probability that any multi-digit access call is not connected due to saturation of equipment shall not exceed 1 in 1000 calls.
 - c. For multi-digit access calls that are connected, the connection shall be established within one second of all digits having been dialed with a probability of 0.95. All multi-digit access calls shall be connected within 2 seconds.

4. Supervisory personnel at an ARTCC, an ATCT, a FSS, the ATCCC, the FAA national command center, or a maintenance facility shall have multi-digit voice calling access to any other position in the NAS.
 - a. The probability that any multi-digit access call is not connected due to saturation of equipment shall not exceed 1 in 1000 calls.
 - b. For multi-digit access calls that are connected, the connection shall be established within 1 second of all digits having been dialed with a probability of 0.95. All multi-digit access calls shall be connected within 2 seconds.
5. The NAS shall provide the capability for authorized personnel in any FAA manned facility to establish voice communications with personnel in any other FAA manned facility through interface with commercial communications networks.
 - a. The probability that any call is not connected due to saturation of equipment shall not exceed 1 in 200 calls.
 - b. For calls that are connected, the connection shall be established within 5 seconds after all dialing is completed.
6. The NAS shall provide for voice communications between any unmanned FAA facility when personnel are on site and a maintenance facility, an ARTCC, an ATCT, or a FSS.
 - a. The probability that any call is not completed due to saturation of equipment shall not exceed 1 in 200 calls.
 - b. For calls that are completed, the connection shall be established within 5 seconds of call initiation.
7. The NAS shall provide the capability for FAA facilities to conduct emergency voice communications via means other than ground telephonic communications.

- a. The capability shall exist for personnel at any one of the following facilities to conduct voice communications with personnel at any other of these facilities via means other than ground telephonic communications: an ARTCC, an ATCT, a FSS, a maintenance facility, a FAA regional office, the ATCCC, and the FAA national command center.
 - b. Any one of these facilities need establish voice communication with only 1 other facility at a time.
 - c. It shall be possible to establish voice communications within 2 minutes of initiating an attempt.
 - d. It shall be possible to establish secure voice communications between any of the facilities listed in 7.a. above.
8. A single ARTCC shall be capable of establishing 30 simultaneous multi-digit voice access channels to other facilities. These should be able to be established as follows:
- a. two channels to each of 4 adjacent ARTCCs.
 - b. one channel to each of 2 other ARTCCs.
 - c. one channel to each of 10 ATCTs.
 - d. two channels to each of 2 FSSs.
 - e. two channels to a single maintenance facility.
 - f. four channels to various other facilities.
9. A single ATCT shall be capable of establishing 5 simultaneous multi-digit voice access channels to other facilities. These should be able to be established as follows:
- a. one channel to an ARTCC.
 - b. one channel to a FSS.
 - c. one channel to another ATCT.
 - d. one channel to a maintenance facility.
 - e. one channel to an unspecified other facility.
10. A single flight service facility shall be capable of establishing 15 simultaneous multi-digit voice access channels to other facilities. These should be able to be established as follows:

- a. two channels to an ARTCC.
 - b. one channel to each of 7 ATCTs.
 - c. one channel to each of 2 other FSSs.
 - d. one channel to a maintenance facility.
 - e. three channels to various other facilities.
11. A single maintenance facility shall be capable of establishing 10 simultaneous multi-digit voice access channels to other facilities. These should be able to be established as follows:
 - a. two channels to each of 2 ARTCCs.
 - b. one channel to a FSS.
 - c. one channel to each of 2 ATCTs.
 - d. one channel to another maintenance facility.
 - e. two channels to various other facilities.
12. The ATCCC shall be capable of establishing 10 simultaneous multi-digit voice access channels to other facilities. These should be able to be established as follows:
 - a. One channel to each of 5 ARTCCs.
 - b. One channel to each of 4 ATCTs.
 - c. One channel to various other facilities.
13. Each ARTCC shall be able to support single-key and multi-digit interfacility voice access communications for up to 430 positions. This includes positions for specialist and supervisory personnel involved in direct control of air traffic as well as other management or coordination positions such as weather service, military operations, traffic management, maintenance, or facility managers positions.
14. Each ATCT shall be able to support single-key and multi-digit interfacility voice access communications for a minimum of 12 specialist and supervisory control positions.
15. Each FSS shall be able to support single-key and multi-digit interfacility voice access communications for a minimum of 60 specialist and supervisory positions.
16. The ATCCC shall be able to support multi-digit interfacility voice access communications for a minimum of 10 specialist and supervisory positions.

17. All interfacility voice channels shall provide for clear intelligibility of phrases spoken with a normal conversational tone and loudness.
18. The NAS shall provide the capability for a specialist at any ATC facility to force an urgent single-key or multi-digit interfacility voice access call through to the receiver.
19. The voice communications capability for a specialist or supervisory position shall be able to queue up to 3 incoming interfacility voice calls in addition to the call in progress. These can be any combination of intrafacility or interfacility calls.
20. The NAS shall provide the capability for supervisory personnel to monitor the single-key and multi-digit interfacility communications of all specialists.
21. A single position in an ATC facility (ARTCC, ATCT, FSS) shall have the capability to create a conference call with up to 10 other positions using any combination of single-key or multi-digit voice access channels. These may be any combination of intrafacility or interfacility calls.
 - a. It shall be possible to conduct at least three conference calls simultaneously in a single ATC facility with the maximum number of simultaneous conference calls being determined by the number of positions in the facility and the number of conferees per conference call.
22. The NAS shall provide the capability for a specialist at any air traffic control facility to forward any interfacility voice access call to any other position within that same facility.
23. The NAS shall provide the capability for a specialist at any air traffic control facility to place any interfacility voice access call received on hold (except for urgent calls being forced through the system).
24. The NAS shall provide the capability for a specialist at any air traffic control facility to transfer any interfacility voice access call received (except for urgent calls being forced through the system) to any other position within that same facility.

25. The NAS shall provide for data communications between NAS facilities, and between designated NAS and DOD facilities.
- a. A data communications capability shall be provided between ARTCCs and FSSs that are within 100 nm of military operations areas (MOAs) or that are within 100 nm of SAC instrument routes.
 - b. A data communications capability shall be provided between ARTCCs and designated SAC centralized scheduling units.
 - c. A data communications capability shall be provided between ARTCCs and air defense facilities for exchange of aircraft movement information service (AMIS) messages.
 - d. A data communications capability shall be provided between air defense control facilities (ADCFs) and ATC facilities for immediate notification of lost radar/radio contact with air defense interceptor aircraft.
 - e. A data communications capability shall be provided for the exchange of remote maintenance monitoring system information between the facility equipment being monitored, the maintenance work centers, the maintenance monitor console at the en route maintenance processor subsystem location, and the maintenance control center at the sector maintenance processor subsystem location.
 - f. A data communications capability shall be provided that has sufficient capacity to support communications requirements, such as ATC information transfer, weather data transfer, control instruction transfer, flight data transfer, emergency assistance data transfer, etc.
 - g. Data delivery time requirements shall be as required to support the exchange of data between various high speed and low speed devices and to meet the information availability response times of various specialists, i.e., controllers, weather specialists, maintenance specialists, etc.
 - h. Connectivity for data communications between NAS facilities and between NAS and DOD facilities shall

be as required to support the response time requirements for the various types, volumes, and transmission times of data message traffic.

- i. The interfacility data communications capability shall have sufficient error protection to ensure that an undetected bit error shall not be introduced into a data item that can affect the safety of flight with frequency greater than 1 bit error in 10^7 transmitted data bits.
26. Data communications shall be provided in such a way that, in the event of catastrophic failure of a single ARTCC, the following data communications capabilities can be established within 48 hours of the catastrophic failure.
- a. An ARTCC adjacent to the failed facility shall be able to establish data communications with two remote ARTCCs and conduct data communications as if they were adjacent facilities.
 - b. An ARTCC adjacent to the failed facility shall be able to establish data communications with up to 60 surveillance facilities which normally serve the failed facility and conduct data communications as if those surveillance facilities were its own.
 - c. An ARTCC adjacent to the failed facility shall be able to establish data communications with up to 25 ATCTs normally associated with the failed facility. Data communications shall be able to be carried out as if these ATCTs were normally associated with the ARTCC adjacent to the failed facility.
 - d. An ARTCC adjacent to the failed facility shall be able to establish data communications with two FSSs normally associated with the failed facility. Data communications shall be able to be carried out as if these FSSs were normally associated with the ARTCC adjacent to the failed facility.
27. The NAS voice and data communications shall be provided in a modular fashion so that future increases in capacity can be accommodated in a cost-effective way.
- B. The NAS shall provide a communications capability between selected operating, supervisory, maintenance, and

administrative positions at FAA facilities and other public/private communications facilities.

1. The NAS shall provide voice and data communications between the FAA national command center and FAA regional centers, law enforcement agencies, ARTCCs, FAA Headquarters, Department of Transportation (DOT), Department of Defense (DOD) activities, the ATCCC, and the National Aviation Weather Processing Facility (NAWPF).
 - a. Single-key voice access calling shall be provided between the FAA national command center and FAA regional centers, ARTCCs, FAA Headquarters, DOT, specific DOD activities, the ATCCC, and the NAWPF such that 95% of the individual calls attempted shall be connected within 1 second of call initiation. All calls shall be connected within 2 seconds.
 - b. Multi-digit access calling shall be provided between the FAA national command center and federal, state, and local law enforcement agencies through an interface to the direct distance dialing (DDD) networks. Multi-digit access calling shall also be provided between the FAA national command center and each of the elements listed in B.1.a. above that have single-key access calling capabilities. All multi-digit access calls attempted through the interface to the DDD network shall be connected within 5 seconds of call initiation. Individual multi-digit access calls attempted between the elements listed in B.1.a. through the NAS communications system shall be connected within 1 second with a probability of 0.95, while all such calls shall be connected within 2 seconds of call initiation.
 - c. Direct data communications channels shall be provided between the FAA national command center and the regional centers, ARTCCs, FAA Headquarters, DOT, DOD activities, the ATCCC, and the NAWPF.
 - d. The system shall provide the capability for the receipt, recording, storage, and retrieval of communications transmitted to or received from NAS

facilities and from agencies connected to communications systems external to the NAS, such as AUTOVON, FTS, AUTODIN, DDD, etc.

- e. The system shall provide interactive terminals for the display of information received from NAS facilities and other agencies in communications with the communications control center.
- 2. The NAS shall provide the capability for personnel in selected operating, supervisory, maintenance, and administrative positions at NAS facilities to be able to access external public or private telephone networks from their positions.
 - a. An ARTCC shall have the capability to establish 30 simultaneous voice channels for access to external public or private telephone networks.
 - b. An ATCT shall have the capability to establish 10 simultaneous voice channels for access to external public or private telephone networks.
 - c. A FSS facility shall have the capability to establish 15 simultaneous voice channels for access to external public or private telephone networks. These channels shall support functions other than pilot briefings. Requirements for pilot briefings are listed elsewhere in this document.
 - d. The ATCCC shall have the capability to establish 5 simultaneous voice channels for access to external public or private telephone networks.
 - 3. The NAS shall provide the capability for personnel in selected operating, supervisory, maintenance, and administrative positions at each ATC facility, at the ATCCC, and at the FAA national command center, to access the DOD automatic voice network (AUTOVON) and any future replacement of that network.
 - 4. The NAS shall provide the capability for personnel in selected operating and supervisory positions at each ATC facility, the FAA national command center, and the ATCCC to exchange flight plan data, aircraft movement information, and related messages with military facilities (such as air

defense control facilities and military base operations centers), airline dispatch offices, and foreign national ATC and military facilities. This capability shall be provided through data communications interface to public, private, and government owned data communications networks, such as AUTODIN.

5. The NAS shall provide the capability for users to access designated ATC facilities through commercial voice communications networks for the purpose of filing flight plans and amendments, requesting and receiving terminal and area specific weather reports, and other related purposes.
 - a. The probability that any call is not connected due to saturation of equipment shall not exceed 1 in 200 calls.
 - b. For calls that are connected, the connection shall be established within 5 seconds after all dialing is completed.
6. The NAS shall provide an automatic and/or manual dial-up capability for users through commercial telephone lines to provide data communications for the purpose of filing flight plans and amendments, requesting and receiving terminal and area specific weather data, and other related purposes.
 - a. The probability that any call is not connected due to equipment saturation shall not exceed 1 in 200 calls.
 - b. For calls that are connected, the connection shall be established within 5 seconds after all dialing is completed.
7. The NAS shall provide an automatic dial-up capability over commercial telephone lines as a back-up to the data communications channels carrying remote maintenance monitoring system data between selected ATC and maintenance facilities.
8. The quality of voice or data service provided by the NAS interfacility communications network shall not be diminished by accessing public or private networks.

9. The capability shall be provided to allow supervisors to selectively assign or restrict individual position access to public or private telephone networks.
- C. The NAS shall have the capability to reconfigure interfacility ground-ground communication capabilities to support changes in operating position responsibilities.
1. The NAS shall have the capability to reconfigure the distribution of interfacility voice communications within a single ARTCC to accommodate daily combining and decombining of sectors.
 - a. Reconfiguration shall not interrupt a call in progress and shall not result in the loss of any call in a queue.
 - b. Reconfiguration shall be able to change from one set of single-key and multi-digit connectivities at a single position to another completely different set.
 - c. Reconfiguration shall be accomplished rapidly so that the loss of an interfacility communications capability at a single position shall not exceed 10 seconds.
 - d. It shall be possible to reconfigure from one to 10 positions simultaneously and to complete this reconfiguration within 10 seconds.
 - e. Any position not involved in the reconfiguration shall not experience any loss of interfacility communications capability.
 - f. This reconfiguration shall involve only redirection within the air traffic control facility. It shall not involve changes of the interfacility communications between facilities.
 2. The NAS shall have the capability to reconfigure the distribution of interfacility voice communications within an ARTCC to permit that facility to provide service in airspace normally served by a failed ARTCC. This requirement does not mean that the connectivities between facilities must be changed; it means only that the distribution of interfacility voice communications within the facility must be changed.

- a. Reconfiguration shall not interrupt a call in progress and shall not result in the loss of any call in a queue.
 - b. It shall be possible to predefine and store up to 10 backup configurations. Each of these may define changes to the connectivity of any number of positions within the air traffic control facility.
 - c. It shall be possible to activate any one of these 10 backup configurations with a single action from a designated supervisor's position
 - d. The backup configuration shall be usable within one minute of activation.
 - e. Any position not involved in the reconfiguration shall not experience any loss of interfacility communications capability.
3. The NAS shall provide the capability to reconfigure the distribution of interfacility voice communications within a single ATCT to accommodate daily changes in position responsibilities.
- a. Reconfiguration shall not interrupt a call in progress and shall not result in the loss of any call in a queue.
 - b. A supervisor shall be able to reconfigure all positions within the air traffic control tower with a single action.
 - c. Reconfiguration shall be accomplished rapidly so that the loss of interfacility communications capability shall not exceed 10 seconds.
 - d. This reconfiguration shall involve only redirection of voice channels within the air traffic control tower. It shall not involve changes of the configuration between facilities.
4. The NAS shall provide the capability to reconfigure the distribution of interfacility voice communications within a single FSS to accommodate daily changes in position responsibilities.

- a. Reconfiguration shall not interrupt a call in progress and shall not result in the loss of any call in a queue.
 - b. A supervisor shall be able to reconfigure all positions within the flight service facility with a single action.
 - c. Reconfiguration shall be accomplished rapidly so that the loss of interfacility communications capability shall not exceed 10 seconds.
 - d. This reconfiguration shall involve only redirection of voice channels within the flight service facility. It shall not involve changes of the configuration between facilities.
5. The NAS shall provide the capability for the automatic and/or supervisory control of the reconfiguration of data communications capabilities at specialist positions in an ARTCC or an ATCT.
- a. Data communications reconfiguration shall not interrupt the transmission of a data message to another facility.
 - b. Data communications reconfiguration for the purpose of facility back-up shall be accomplished by supervisory command only.
 - c. Data communications reconfiguration shall be accomplished within 10 seconds at a single position, and within 5 minutes for the entire facility.
 - d. This reconfiguration shall involve only the reallocation of data communications channels and hardware within the facility. It shall not involve changes in the physical data communications configuration that shall exist between facilities.
6. The system shall provide the following capabilities with respect to monitoring and controlling the interfacility voice and data communications:
- a. Transmission routing and multiplexing control.
 - b. Voice and data switch routing control.

- c. Communication system status monitoring.
 - d. Voice and data communication traffic monitoring.
 - e. Transmission system testing.
 - f. Communication utilization control.
- D. The NAS shall be able to receive, store, retain, and readily retrieve all NAS interfacility ground-ground communications.
- 1. All interfacility voice and data communications entering or leaving each specialist's position at an ARTCC, an ATCT, or a FSS, the FAA national command center, or the ATCCC shall be recorded.
 - 2. Voice and data recordings shall be retained in "on-line" storage for not less than 24 hours, and in "off-line" storage for not less than 15 days.
 - 3. Individual voice recordings shall be retrievable from "on-line" storage within 10 minutes, and from "off-line" storage within 30 minutes of a request by an authorized FAA supervisor.
 - 4. Individual data messages shall be retrievable from "on-line" storage within 2 minutes, and from "off-line" storage within 30 minutes of a request by an authorized FAA supervisor.
 - 5. A coded time source shall be provided and recorded at each facility listed in D.1. above and shall be interfaced with voice and data communications recordings to provide time-related data.
- E. The NAS shall provide interfacility ground-ground communications on a continuous basis.
- F. Communications between remote terminals and computer processors containing classified information shall be secured.
- 1. The capability shall be provided to encrypt/decrypt classified information at classification levels up to SECRET for data transmission between selected NAS facilities, and between selected NAS facilities and military facilities.

- a. Each ARTCC shall be able to transmit or receive encrypted classified data communications from another ARTCC, from the FAA national command center, from the ATCCC, or military facilities.
 - b. The FAA national command center shall be able to transmit or receive encrypted classified data communications from each ARTCC, the FAA national command center, and military facilities.
 - c. The ATCCC shall be able to transmit or receive encrypted classified data communications from each ARTCC, the FAA national command center, and military facilities.
 - 2. Equipment for encryption of data communications or storage of classified information shall not be interfaced to computer equipment performing any air traffic control function or to any other computer equipment in any FAA facility.
 - 3. Physical security facilities shall be provided for the protection of classified material for classification levels up to and including SECRET.
- G. Access to critical operational data bases from remote terminals or public networks shall be controlled to maintain data integrity.
- 1. Provisions shall be made to limit the access of non-FAA users to only those data bases for which they have authorization.
 - 2. Control of computer equipment and access to computer operational programs for computers storing data critical to the safety of flight shall only be possible from work stations located within the building housing the computer equipment. This applies to the following facilities:
 - a. Air route traffic control centers.
 - b. Air traffic control towers.
 - c. Flight service station facilities.
 - d. The ATCCC.
 - e. The FAA national command center.

3. The NAS shall provide protection against physical access by unauthorized personnel to computers storing data critical to the safety of flight.

3.6.3 Ground-Ground Intrafacility

General Requirements

The NAS must be capable of transferring information within the various NAS facilities.

Specific Requirements

- A. The NAS shall provide a means for communication between selected operating, supervisory, maintenance, and administrative positions within a NAS facility.
 - 1. The NAS shall provide single-key voice access between specified positions within a single facility. Single-key access means that a specialist can establish voice access to another designated position within the same facility with a single action of a single physical device.
 - a. Each position in an air route traffic control center (ARTCC) shall be able to have single-key voice access to a total of 20 other positions in that facility.
 - b. Each position in an air traffic control tower (ATCT) shall be able to have single-key voice access to a total of 5 other positions in that facility.
 - c. Each position in a flight service station (FSS) shall be able to have single-key voice access to a total of 5 other positions in that facility.
 - d. Each position in the ATCCC shall be able to have single-key voice access to a total of 5 other positions in the facility.
 - e. Each position in the FAA national command center shall be able to have single-key voice access to a total of 5 other positions within the command center.
 - f. For any of the capabilities in a. through e. above, connection shall be established within 0.5 seconds of key activation with probability 0.95.
 - 2. The NAS shall provide multi-digit voice calling access between positions within the same facility. Multi-digit voice calling access means that a specialist can establish voice access to another

designated position within the facility with multiple actions on one or more physical devices.

- a. Each specialist in an ARTCC shall have multi-digit voice calling access to at least 49 other positions within his own facility.
 - b. Supervisory personnel at an ARTCC shall have multi-digit calling access to any other position within his facility.
 - c. Each specialist and supervisor in an ATCT shall have multi-digit voice calling access to all other positions within his facility.
 - d. Each specialist and supervisor in a FSS shall have multi-digit voice calling to all other positions within his facility.
 - e. Each specialist and supervisor in the ATCCC shall have multi-digit voice calling access to all other positions within their facility.
 - f. Each specialist and supervisor in the FAA national command center shall have multi-digit voice calling to all other positions within the command center.
 - g. For any of the capabilities listed in a. through f. above, connection shall be established within 0.5 seconds of entering the multi-digit access number sequence with a probability of 0.95.
3. Specialists and supervisors in a FSS shall be able to receive at their positions incoming commercial telephone calls for the purpose of providing non-routine flight services to users by voice.
 4. Each ARTCC shall be able to support single-key and multi-digit intrafacility voice access communications for 430 positions. This includes positions for specialist and supervisory personnel involved in direct control of air traffic as well as other management or coordination positions such as weather service, military operations, traffic management, maintenance, or facility managers positions.

5. Each ATCT shall be able to support single-key and multi-digit interfacility voice access communications for a minimum of 12 specialist and supervisory control positions.
6. Each FSS shall be able to support single-key and multi-digit intrafacility voice access communications for a minimum of 60 specialist and supervisory positions.
7. The ATCCC shall be able to support multi-digit intrafacility voice access communications for a minimum of 10 specialist and supervisory positions.
8. All intrafacility voice channels shall provide for clear intelligibility of phrases spoken with a normal conversational tone and loudness.
9. The NAS shall provide the capability for a specialist to force an urgent single-key or multi-digit intrafacility voice call through to the receiver.
10. The voice communications capability for a specialist or supervisory position shall provide the ability to queue up to 3 incoming voice calls in addition to the call in progress. These can be any combination of intrafacility or interfacility calls.
11. The NAS shall provide the capability for supervisory personnel to monitor the single-key and multi-digit intrafacility communications of all specialists.
12. Each position in an ATC facility shall have the capability to create a conference call with up to 10 other positions using any combination of single-key or multi-digit voice channels. These may be any combination of interfacility or intrafacility calls.
 - a. It shall be possible to conduct at least three conferences simultaneously in a single ATC facility with the maximum number of simultaneous conferences being determined by the number of positions in the facility and the number of conferees per conference.
13. The NAS shall provide an intrafacility data communications capability at each ARTCC to provide connectivity between terminals, displays and computer equipment at various locations within the facility.

- a. The intrafacility data communications capability shall make available to specialists aircraft position and identification information, flight plan information, pictorial hazardous weather information, textual weather observation and forecast information, equipment status information, Notice to Airmen information, aerodrome status information and aircraft data communications.
- b. The intrafacility data communications capability shall permit the specialist to interact with ATC computer equipment for such functions as modifying flight plans, initiating or terminating a track, assigning beacon codes, or controlling the content and characteristics of his displays.
- c. The NAS shall provide the capability for supervisory personnel to monitor the data flow to or from any specialist's position from a separate position. This shall include the capability to duplicate the specialist's situation display and to view any data inputs created by a specialist or to view any messages displayed to the specialist. This monitoring capability shall not interfere with the operation of the specialist's position.
- d. The intrafacility data communications capability shall make available to maintenance personnel and to the system manager information on the status of all equipment within the ARTCC. It shall also permit them to control or interact with the various systems within the ARTCC.
- e. The intrafacility data communications capability shall make available to aviation meteorologists in the ARTCC pictorial hazardous weather information, textual weather observations and forecasts from both regional and national sources, and various other weather products. It shall also permit them to interact with weather processing equipment and to modify weather data bases.
- f. The intrafacility data communications capability shall make available to traffic flow management specialists in the ARTCC data on aerodrome conditions, planned number of departures, arrivals and overflights and flow management directives. It shall also permit them to interact with flow management processing equipment to enter flow

management information and to control the content and characteristics of their displays.

- g. The intrafacility data communications capability shall permit computer-to-computer data communications within an ARTCC as necessary to meet various other requirements stated elsewhere in this document.
14. The NAS shall provide an intrafacility data communications capability at each FSS to provide connectivity between terminals, displays and computer equipment at various locations within the facility.
- a. The intrafacility data communications capability shall make available to individual specialists flight plan information, pictorial hazardous weather information, textual weather observation and forecast information, equipment status information, Notice to Airmen information and aerodrome status information.
 - b. The intrafacility data communications capability shall permit the specialist to interact with flight service processing equipment for such functions as entering, closing, or modifying flight plans, entering Notice to Airmen information, or controlling the content and characteristics of displays.
 - c. The intrafacility data communications capability shall make available to maintenance personnel information on the status of all equipment within the FSS.
 - d. The intrafacility data communications capability shall permit computer-to-computer data communications within each FSS as necessary to meet various other requirements stated elsewhere in this document.
15. The NAS shall provide an intrafacility data communications capability at each ATCT to provide connectivity between terminals, displays and computer equipment at various locations within the facility.
- a. The intrafacility data communications capability shall make available to individual specialists aircraft position and identification information,

flight plan information, pictorial hazardous weather information, textual weather observation and forecast information, position information about aircraft and vehicles on the aerodrome surface, wind shear information, and equipment status information.

- b. The intrafacility data communications capability shall permit the specialists to interact with computer equipment for such functions as inputting or modifying flight plans, creating Notices to Airmen, controlling aerodrome equipment, or controlling the content and characteristics of their displays.
 - c. The intrafacility data communications capability shall make available to maintenance personnel information on the status of all equipment within the ATCT and on the aerodrome surface or in its vicinity.
 - d. The intrafacility data communications capability shall permit computer-to-computer data communications within each ATCT as necessary to meet various other requirements stated elsewhere in this document.
16. The NAS shall provide an intrafacility data communications capability at the ATCCC to provide connectivity between terminals, displays and computer equipment at various locations within the facility.
- a. The intrafacility data communications capability shall make available to individual specialists aerodrome and airspace capacity and demand information, pictorial hazardous information, textual weather observation and forecast information and equipment status information.
 - b. The intrafacility data communications capability shall permit the specialists to interact with traffic management processing equipment for such functions as inputting traffic flow management directives or limitations, or for controlling the content and characteristics of their displays.
 - c. The intrafacility data communications capability shall make available to maintenance personnel

information on the status of all equipment within the ATCCC.

- d. The intrafacility data communications capability shall permit computer-to-computer data communications within the ATCCC as necessary to meet various other requirements stated elsewhere in this document.
17. The NAS shall provide an intrafacility data communications capability at the FAA national command center to provide connectivity between terminals, displays and computer equipment at various locations within the facility.
- a. The intrafacility data communications capability shall make available to the FAA national command center personnel national facility status information, traffic flow information, position and identification information on selected aircraft, pictorial hazardous weather information, and textual weather observation and forecast information.
 - b. The intrafacility data communications capability shall permit national command center personnel to interact with computer equipment for such functions as creating and transmitting orders or instructions to various air traffic control facilities or controlling the content and characteristics of their displays.
 - c. The intrafacility data communications capability shall make available to maintenance personnel information on the status of all equipment within the national command center.
 - d. The intrafacility data communications capability shall permit computer-to-computer data communications within the national command center as necessary to meet various other requirements stated elsewhere in this document.
18. The intrafacility data communications capability within an ARTCC, a FSS, an ATCT, the ATCCC, and the FAA national command center shall have availabilities as necessary to support the requirements of the operating, supervisory, maintenance, and administrative positions referenced in this document.

19. The intrafacility data communications capability within an ARTCC, a FSS, an ATCT, the ATCCC, and the FAA national command center shall have capacities as required to support the peak busy hour exchange of data between the positions referenced in this document.
 20. The capability shall be provided to allow supervisors to selectively assign or restrict access to any or all of the special communications features at an individual specialist's position. The special communications features include access to commercial telephone service from the position, access to AUTOVON, monitoring capability, or the capability to have multi-digit voice access to any position in the facility.
 21. The intrafacility voice and data communications system shall be capable of modular expansion to meet future communication needs, including increased traffic loads, increased number of operating positions, and new connectivity requirements.
- B. The NAS shall have the capability to reconfigure communication capabilities to support changes in operating responsibilities.
1. The NAS shall have the capability to reconfigure the distribution of intrafacility voice communications within an ARTCC to accommodate daily combining and decombining of sectors.
 - a. Reconfiguration shall not interrupt a call in progress and shall not result in the loss of any call in a queue.
 - b. Reconfiguration shall be able to change from one set of single-key and multi-digit connectivities at a single position to another completely different set.
 - c. Reconfiguration shall be accomplished rapidly so that the loss of an intrafacility communications capability at a single position shall not exceed 10 seconds.
 - d. It shall be possible to reconfigure from one to 10 positions simultaneously and to complete this reconfiguration within 10 seconds.

- e. Any position not involved in the reconfiguration shall not experience any loss of intrafacility communications capability.
2. The NAS shall have the capability to reconfigure the distribution of intrafacility voice communications to permit an ARTCC to provide service in airspace normally served by a failed ARTCC.
- a. Reconfiguration shall not interrupt a call in progress and shall not result in the loss of any call in a queue.
 - b. It shall be possible to predefine and store up to 10 backup configurations. Each of these may define changes to the connectivity of any number of positions within the ARTCC.
 - c. It shall be possible to activate any one of these 10 backup configurations with a single action from a designated supervisor's position.
 - d. The backup configuration shall be usable within one minute of activation.
 - e. Any position not involved in the reconfiguration shall not experience any loss of intrafacility communications capability.
3. NAS shall provide the capability to reconfigure intrafacility voice communications within an ATCT to accommodate daily changes in position responsibilities.
- a. Reconfiguration shall not interrupt a call in progress and shall not result in the loss of any call in a queue.
 - b. A supervisor shall be able to reconfigure all positions within the ATCT with a single action.
 - c. Reconfiguration shall be accomplished rapidly so that the loss of intrafacility communications capability shall not exceed 10 seconds.
4. The NAS shall provide the capability to reconfigure intrafacility voice communications within a FSS to accommodate daily changes in position responsibilities.

- a. Reconfiguration shall not interrupt a call in progress and shall not result in the loss of any call in a queue.
 - b. A supervisor shall be able to reconfigure all positions within the flight service facility with a single action.
 - c. Reconfiguration shall be accomplished rapidly so that the loss of intrafacility communications capability shall not exceed 10 seconds.
- 5. The NAS shall provide the capability for the automatic and/or supervisory control of the reconfiguration of intrafacility data communications capabilities at specialists positions within an ARTCC or an ATCT.
 - a. The reconfiguration of data communications shall not interrupt the transmission of data messages to another position within the facility.
 - b. The reconfiguration of data communications for the purpose of re-sectorization, i.e., combining or de-combining adjacent sectors, shall be accomplished by supervisory command only.
 - c. The reconfiguration of data communications shall be accomplished within 10 seconds at a single position, and within 5 minutes for the entire facility.
 - d. This reconfiguration shall involve only the reallocation of data communications channels and hardware within the facility. It shall not involve the physical data communications configuration that shall exist between facilities.
- C. The NAS shall be able to receive, store, retain, and readily retrieve all NAS intrafacility ground-ground communications.
 - 1. All intrafacility voice communications entering or leaving each specialist's position at an ARTCC, an ATCT, a FSS, the ATCCC, and the FAA national command center shall be recorded.
 - 2. Intrafacility data messages entering or leaving each specialist's position at each of the facilities listed in C.1. above shall be recorded. The data recorded shall ensure that all information displayed at the

specialist's position and all actions or messages initiated by the specialist can be reconstructed.

3. Voice and data recordings shall be retained in "on-line" storage for not less than 24 hours, and in "off-line" storage for not less than 15 days.
 4. Individual voice recordings shall be retrievable from "on-line" storage within 10 minutes, and from "off-line" storage within 30 minutes of a request by an authorized FAA supervisor.
 5. Individual data messages shall be retrievable from "on-line" storage within 2 minutes, and from "off-line" storage within 30 minutes of a request by an authorized FAA supervisor.
- D. The NAS shall provide intrafacility ground-ground communications on a continuous basis.
- E. Intrafacility ground-ground communications containing classified information shall be secured.
1. Physical security facilities shall be provided for the protection of classified material for classification levels up to and including SECRET.
 2. Voice communication of classified information shall be by face-to-face contact. Intrafacility voice communications shall not be used for classified information.
 3. There shall be no computer-to-computer intrafacility data communications for classified information.
- F. Access to critical operational data bases shall be controlled to maintain data integrity.
1. The NAS shall provide a means of verifying user authorization and limiting access to computer operational programs for computers storing data critical to safety of flight.
 2. The NAS shall provide protection against physical access by unauthorized FAA or non-FAA personnel to computers storing data critical to safety of flight.

3.7 Maintenance Support Requirements

Responsive operational service to the users of the National Airspace System requires that FAA personnel and equipment be provided at appropriate locations to meet the current and expected demand. The requirement varies from providing assistance in determining optimum designs and locations of air traffic control facilities to ensuring that the support capabilities provide for continued reliable operation of the system. This requirement is an all-inclusive support requirement as it includes not only location of sites but the necessary testing, training, maintenance, and monitoring to ensure absolute system availability.

3.7.1 Maintenance and Monitoring Requirements

General Requirement

Safe operation of the National Airspace System (NAS) depends on the high availability and reliable performance of equipment and software. Ensuring this high level of availability requires timely maintenance and monitoring. Preventive and corrective maintenance are required to minimize equipment outages and repair faulty items of equipment when detected. Monitoring the performance and status of NAS equipment and software and notification of operations and maintenance personnel when problems arise are essential to ensuring safe and reliable operation. Considerations of efficiency and cost effectiveness require that monitoring and control capabilities be automatic and remote for selected items, with data and failure indications transmitted to centralized repair facilities for action by appropriate maintenance personnel. Equipment critical to safety requires continuous real-time monitoring with periodic airborne flight inspection capabilities for systems involving ground-to-air and air-to-ground communications. An integrated logistics support system is required for maintenance management.

Specific Requirements

- A. The NAS shall provide the capability to monitor and display system and equipment status and performance and to control appropriate parameters when preventive or corrective maintenance is required. An immediate alarm shall be made to appropriate maintenance and operations personnel when failure of equipment or systems critical to safety is pending or has occurred.
1. The capability shall be provided at selected sites to monitor equipment status and performance, and to control appropriate parameters from remote centralized or

portable workstations using sensors and built-in circuits.

- a. The monitoring system shall have the capability to collect data on equipment maintenance relevant to status and performance.
 - b. Monitoring devices, both built-in and external, shall not degrade the performance and user availability of the equipment being monitored.
 - c. Equipment, software, and the systems used to control and monitor such equipment and software, shall provide positive evidence of their proper functioning.
 - d. The monitoring system shall have the capability to interpret sensor information indicating degraded performance or expected equipment failure.
 - e. Remote control capabilities shall be provided for selected equipments, allowing adjustment of equipment to keep parameters being monitored within specified ranges, switch-over to back-up equipment in the event of equipment failure or performance degradation, and certification of equipment performance.
2. The NAS shall provide continuous monitoring of operational status and significant performance parameters of surveillance, navigation, approach and landing aids, and other equipment and systems critical to safety.
 - a. The characteristics of the radiated signals from a navaid shall provide means for the users to monitor the operational status of the navaid.
 - b. The monitoring system shall provide notification of any automatic switchovers for equipment and systems that are required for system safety.
 3. The appropriate operations and maintenance personnel shall be automatically alerted whenever an equipment parameter being monitored or controlled remotely is outside of a pre-specified range or exhibits a trend which will result in parameter measurements outside the pre-specified range.

- a. Monitoring systems shall alarm when the monitored equipment performance levels deteriorate below acceptable limits.
 - b. An alarm status shall automatically be routed to appropriate control points in the NAS for timely notification of failures to NAS users, specialists, and maintenance personnel.
 - c. An alarm status shall be retained and indicated at control points until operational status is restored.
- B. The NAS shall have the capability to perform flight inspections which verify the operation and performance of equipment and systems critical to safety including electronic and visual navigation aids, approach and landing guidance, surveillance, and communications for each initial commissioning, at periodic intervals and after certain maintenance actions.
- 1. Flight inspections shall be conducted to determine that all navigation, approach and landing aids meet the performance criteria necessary to support their operational requirements.
 - 2. Flight inspections shall be conducted to determine that air traffic control surveillance systems have the coverage and accuracy characteristics necessary to support their operational requirements.
 - 3. Flight inspections of communication facilities shall be conducted on all ground-to-air frequencies to determine that the communications are clear and readable throughout specified service volumes.
 - 4. Flight inspections of lighting systems that support approach and landing operations shall be conducted to determine that intensity, color, and alignment meets operational requirements.
- C. The NAS shall provide facilities, equipment and systems necessary to perform preventive and corrective maintenance activities including adjustment, diagnosis, replacement, repair, reconditioning, and re-certification at scheduled intervals and in response to the monitoring system or general user and FAA technical surveillance.

1. Equipment parameters relevant to maintenance shall be monitored and analyzed to determine preventive maintenance intervals for all NAS equipment.
 - a. The capability shall be provided, either locally or remotely, to adjust equipment for desired performance and to verify the correct adjustments.
 - b. Preventive maintenance tools to be provided for NAS computer systems shall include on-line diagnostic aids with multi-level remote access to allow operational software and associated data bases to be exercised through all functional paths for isolation of system problems.
 - c. The capability shall be provided for the re-certification of equipment following maintenance actions to verify the suitability of the equipment for operational use.
 - d. Access to the remote monitoring equipment shall be limited to the minimum number of personnel required to assure safe and reliable operation.
2. Test circuitry and analysis capabilities shall be provided to allow diagnosis of the cause of an equipment system failure and isolation of the fault to one or more modules, boards, or components at an on-site, centralized or depot repair facility.
 - a. The capability shall be provided for on-site repair of items whose characteristics (e.g. size, weight, or configuration) make removal and transportation to a centralized or depot repair facility difficult.
 - b. Central repair facilities shall be provided with capabilities to perform repairs on selected modules, boards, and components.
 - c. Capabilities for diagnosis of complicated problems and repair of complex modules and equipment shall be provided at the FAA depot repair facility.
3. Physical access shall be provided for maintenance personnel, test equipment and replacement equipment, modules, and components at all NAS facilities.
 - a. Common workstation interfaces shall be provided for maintenance and centralized monitoring facilities.

- b. Communication links shall be provided between maintenance personnel at NAS sites and central repair facilities to support multi-level diagnosis and repair of equipment.
- D. The NAS shall provide integrated logistics support and information management systems for maintenance activities to ensure the availability of test equipment and repair parts to maintenance personnel, provide a National data base of problems and their solutions, and to preserve maintenance and failure records for trending and analysis.
 - 1. All test equipment and repair parts required for repair of repairable modules, boards, and components shall be provided to appropriate maintenance personnel.
 - a. Spare parts shall be provided for on-site, central, and depot maintenance involving replacement of modules, boards, or components; preventive maintenance; and repair of equipment when necessary.
 - b. Computer system hardware shall be provided so that failed modules or components may be replaced or repaired without interruption of critical system functions.
 - 2. The capability shall be provided to collect, record, process, summarize, and report information concerning equipment performance and related preventive maintenance and repair activities.
 - a. Equipment problems or failures and maintenance actions taken shall be recorded and available for retrieval by maintenance personnel.
 - b. The capability shall be provided for processing, recording, and correlating parameter measurements, including analysis of trends and forecasts of time to failure.
 - c. Equipment status, performance and maintenance activity information shall be stored in a nationwide distributed data base, with files that are national in scope residing at a central site. The data base shall be available to authorized maintenance, administrative, engineering, and operations personnel.

3.7.2 Training Support Requirements

General Requirements

Facilities, equipment, and materials to support an extensive training program are required to effect the implementation of the maintenance philosophy embodied in the NAS, to facilitate the transition to NAS equipment and computer software, and to provide for the progressive improvement and consistent maintenance of the knowledge and skill levels of all NAS personnel.

Specific Requirements

- A. The NAS shall support a training program, including facilities, equipment, and materials which prepares technicians for implementation of the NAS Maintenance Philosophy as discussed in detail in Paragraph 3.7.1. The NAS shall support the training of:
 - 1. The technical work force to accomplish their primary mission of the monitoring, identification and diagnosis of failures, and control of equipment at remote sites.
 - 2. Technicians to accomplish highly specialized maintenance tasks at consolidated Airway Facilities sites:
 - a. Predevelopmental and Developmental Technicians shall be capable of replacing lowest replaceable units (LRU's) at remote sites under the supervision of a Journeyman Technician.
 - b. Developmental Technicians shall be capable of repairing and aligning LRUs at Sector repair shops, assisted by Predevelopmental Technicians and supervised by Journeyman Technicians.
 - c. Journeyman Technicians shall be capable of repairing and aligning complex modules and equipment at a Depot, assisted by Predevelopmental and Developmental Technicians.
 - d. Journeyman Technicians shall be capable of certifying the operation and calibration of systems from a centralized control facility, and at a remote site.
 - e. Journeyman Technicians and engineers at Regional and FAA Headquarters shall be capable of providing

technical assistance to field units for the resolution of difficult maintenance problems.

3. Airway Facilities personnel to utilize an automated maintenance management system.
- B. The NAS shall support a training program, including facilities, equipment, methods and materials which prepares specialists and technicians for the transition to NAS equipment, computer software, and procedures.
1. Selected specialists and technicians shall be capable of contributing to the planning, conduct, and evaluation of Developmental and Operational Testing of NAS equipment and computer software.
 2. Technicians shall be capable of executing the extensive installation program associated with the phase-in of NAS equipment.
 3. Specialists and technicians at field sites shall be instructed on the operating and maintenance requirements of NAS equipment and computer software prior to installation of the item at the site.
- C. The NAS shall support a training program, including facilities, equipment, methods, and materials, which results in the continuous and progressive improvement and maintenance in the skill level of specialists and technicians.
1. The NAS shall provide the training:
 - a. Necessary to satisfy all levels up to specialist full performance level requirements.
 - b. Necessary to satisfy all levels up to technician maintenance certification requirements.
 - c. Identified by the agency as necessary for each position for the achievement of required efficiency.
 - d. Identified by the agency as necessary for each position for the achievement of optimum efficiency.
 - e. Required for the individual to improve his/her performance.

- f. Needed by the individual to prepare him/her for specific potential future responsibilities.
- 2. The NAS shall provide a distributed training system with instructional programs allocated among a centralized FAA training facility, local training facilities (ACFs, AFSs, RSSs), and external facilities.
 - a. The centralized training facility shall provide Resident Training on the basic skills and the operation and maintenance of new systems, subsystems, equipment, and computer software.
 - b. The centralized training facility shall develop Directed Study Courses to provide training on operations and maintenance of new systems, refresher training on existing systems, and prerequisite courses for Resident Training. These courses shall be presented by a variety of methods, such as OJT, classroom instruction, correspondence, Computer Based Instruction (CBI), and System Embedded Training (SET). Directed Study shall be conducted at local training facilities.
 - c. The centralized training facility shall provide local training facilities with self-study, CBI, and SET courses on the operations and maintenance subjects which first-line supervisors may use for promotional and remedial training.
 - d. The local training facility shall provide classroom, CBI and SET instruction on new procedures, regulations, and equipment. The local training facility shall provide CBI, SET, and audio visual equipment and materials for refresher operations and maintenance training, and off-line interactive devices for refresher and remedial training of specialists and technicians.
 - e. Training facilities external to the FAA shall be used for the providing of unique training for small numbers of FAA employees, for training FAA employees at cost fewer than in-house training, and for training of contract maintenance personnel.

3.7.3 Testing Support Requirements

General Requirement

A vigorous program of factory, laboratory, and site testing of new and modified equipment and computer software is required to verify contractual compliance, verify functional and operational performance, to validate the integration of an item into the NAS, and to ensure the item can and will be used and maintained by operational personnel. The NAS must supply personnel, procedures, training, facilities, equipment, materials, and computer software to support test and evaluation programs.

Specific Requirements

- A. The NAS shall support Developmental Testing (DT), conducted at the developer's/manufacturer's factory to verify contractual compliance, verify functional and operational performance, and to validate factory integration of the item.
 1. Equipment end items and components shall be subjected to repetitive testing by the contractor to develop statistics that demonstrate to the government the compliance of the test item with the reliability, maintainability, human engineering, environmental, EMI, safety, quality assurance, functional design, and physical characteristics requirements of the contract. The NAS shall provide operational personnel to participate in test design reviews and walk-throughs, to observe tests, review test data, and to evaluate test results. The NAS shall provide special support equipment where required.
 - a. Where specified in the items' contract, the FAA Technical Center (FAATC) shall supply vibration and temperature test facilities, anechoic chambers, site equipment, test sets, data, and other test support items required for the conduct of compliance testing.
 - b. FAATC engineers, specialists, and technicians shall participate in all factory compliance testing planning, observe all testing, participate in testing where required, review test data, and evaluate test results to ensure contractual compliance.

- c. Field specialists and technicians shall be utilized during DT of equipment to provide operational inputs during test design reviews for man-machine interface, human engineering and maintainability demonstrations, and other functional and operational acceptance tests.
 - d. Field specialists and technicians shall be utilized during DT of computer software to provide operational inputs during test design reviews and walk-throughs for demonstrations and other acceptance tests.
- 2. All end items and components shall be subjected to integration testing at the developer's/manufacturer's factory to demonstrate functional integration of hardware components, software elements, hardware and software, and the end item with other equipment.
 - a. Where specified in the item's contract, the FAATC shall supply site equipment, test sets, test drivers, scenarios, simulators, data reduction equipment and software, and other test support items required for the conduct of integration testing.
 - b. FAATC engineers, specialists, and technicians shall participate in the planning of factory integration testing, participate in or observe testing, review test data, and evaluate test results to validate integration of the item and its components/elements.
 - c. Field specialists and technicians shall be utilized during integration testing of hardware and computer software to provide operational inputs to testing planning, conduct of the tests, and evaluation of the results of the testing.
- B. The NAS shall support integration testing conducted in a laboratory environment at FAATC to determine the degree of operational integration of the item with the NAS.
 - 1. All contractor hardware and software shall be subjected to OT&E by FAATC engineers, specialists, and technicians, to test the integration of the item internally and externally under realistically simulated operational conditions, and to identify potential operational problem areas. FAATC shall provide:

- a. A Testbed consisting of all NAS equipment, including remote monitoring and control equipment, which can be configured to provide the physical and functional interfaces found at any NAS operational site.
 - b. Simulators, target and message generators, and external interfaces necessary to exercise the item.
 - c. Instrumented aircraft to test the item in the system under known conditions.
 - d. Data recorders and data reduction equipment and programs necessary for evaluation of the performance of test items.
 - e. Test equipment and spare parts for maintenance of items under test.
 - f. Laboratory facilities to conduct environmental and EMI tests.
 - g. Engineers, specialists, and technicians necessary to plan testing, operate and maintain the item under known conditions, and to evaluate test results.
2. All equipment and computer software developed in-house, or modifications to equipment or computer software shall be subjected to testing by FAATC engineers, specialists, and technicians to ensure compliance with design specifications, verify functional and operational performance, and to validate the integration of the item. FAATC shall supply support items listed in paragraph 3.7.3.B.1 above for support of this testing.
- C. All new or modified equipment or computer software shall be subjected to Operational Test and Evaluation (OT&E) at the FAATC Testbed. During this testing, conducted in a simulated operating environment, Specialists shall evaluate operational procedures established for the item, and the effectiveness of the item. Specialist training and manning requirements shall also be evaluated. Technicians shall evaluate the suitability of maintenance procedures, documentation, test equipment, tools, parts, and maintenance training for each new or modified item during this phase of testing. FAATC shall provide the support items listed in paragraph 3.7.3.B.1 above during this testing.

D. The NAS shall support validation of new or modified equipment or computer software at operational sites to verify item local integration with the site and the NAS, and to verify its suitability for use in an operational environment. This testing shall be conducted in parallel with normal operations, on a non-interference basis. During this phase of testing:

1. The contractor shall provide installation as previously standardized by FAATC. The FAATC shall provide planning and assistance to site personnel, test equipment and tools unique to the system, and installation and operations materials.
2. FAATC shall provide appropriate personnel, data recorders, and data reduction equipment and software for the analysis of test results if necessary for a test item. If necessary, FAATC shall also provide instrumented aircraft for the conduct of this testing.
3. Site specialists shall operate the item and site Technicians shall perform preventive and corrective maintenance on the item during this testing phase.

E. Prior to placing a new or modified item into service, testing shall be conducted at each site to certify the item. A Shakedown Test shall be conducted to determine if the item is ready for the Operational Readiness Test (ORT) (1981), to familiarize personnel with the item, and to build confidence in the item. This shakedown will be initially conducted off-line, then switched on-line with the replaced item remaining in a standby mode. Upon satisfactory completion of the Shakedown, the GEP shall be contacted to demonstrate the item to the necessary performance standards for the site, and the item is ready for use.

1. Experienced technicians from the site shall operate and maintain the item during Shakedown and ORT.
2. FAATC shall provide unique installation tools and equipment, unique test equipment required only for initial site certification; instrumented aircraft; and data recording, reduction and analysis equipment and programs.

3.7.4 Facilities Requirements

General Requirement

The effective and efficient operation of the NAS is directly related to the adequacy of the facilities provided for FAA personnel, equipment, and furnishings employed in the system. These facilities must be designed and located so as to optimize system efficiency and effectiveness, provide suitable working conditions for NAS personnel, and provide appropriate operating conditions for NAS equipment.

Specific Requirements

- A. Individual NAS facilities shall be located so as to maximize total system efficiency and effectiveness.
 - 1. En route and approach control facilities shall be consolidated into area control facilities wherever possible.
 - 2. En route, approach control, flight service, telecommunications and maintenance facilities shall be reduced in quantity by consolidating existing sites.
 - 3. Maintenance sites shall be located to:
 - a. Support maximum system availability by providing efficient restoration service, and
 - b. Provide economical preventive maintenance service.
 - 4. Centralized repair facilities (i.e., Depot, Sector, Site) shall be established and located to facilitate the service and return of repairable items to sites in minimum time and at the lowest possible cost.

5. Unmanned sites shall be located to achieve maximum effectiveness of installed equipment.
- B. Manned facilities shall be designed to provide a safe, secure, and adequate work environment for assigned personnel and installed equipment.
1. Access to manned NAS facilities shall be controlled at all times to prevent interruption of service, distraction of specialists, and theft of government property.
 2. Manned facilities shall comply with all OSHA, FAA, and local safety and sanitary regulations.
 3. Dependable and adequate heating/ventilating/air conditioning (HVAC) systems shall be provided at NAS facilities to provide an optimized operating environment for equipment and personnel.
 4. Ambient noise shall be controlled inside manned NAS facilities to foster maximum efficiency of specialists.
 5. Manned NAS facilities shall be constructed to applicable agency and local standards to protect personnel and equipment from the adverse weather conditions and natural disasters which may be expected to occur at a site.
 6. Manned facilities shall be provided with an electrical power system which ensures maximum availability of services.
 7. The maximum amount of various types of equipment shall be installed at each site, consistent with coverage and EMC considerations.
- C. Unmanned NAS facilities shall be designed to provide a safe, secure, and adequate operating environment for installed equipment.
1. Access to unmanned facilities shall be remotely monitored and controlled to prevent theft and damage to government property.

2. Unmanned NAS facilities shall be constructed to applicable agency and local standards to protect the installed equipment from the adverse weather conditions and natural disasters which may be expected to occur at a site.
3. Unmanned NAS facilities shall be provided with an electrical power system and systems for remote monitoring and control which ensure maximum availability of services.
4. The maximum amount of various types of equipment shall be installed at each site, consistent with coverage and EMC considerations.

3.7.5 Frequency and Spectrum Engineering

General Requirement

Present national policy dictates that prior to the procurement of telecommunication systems which involve the use of radio frequencies, the developers shall ensure that adequate radio spectrum is available and that such systems will not cause nor receive harmful interference to or from other authorized users. This establishes a requirement for frequency and spectrum allocation and management assistance programs.

Specific Requirements

- A. The NAS shall develop a formal program to ensure that frequency and spectrum development activities for new systems being conducted by the FAA are compatible with current and projected use by national and international aviation interests.
 1. Frequency allocation proposed for new transmitting and receiving equipment at a site shall be coordinated to ensure electromagnetic compatibility with existing FAA systems present or planned for that site.
 2. Coordination with agencies outside the FAA is required to prevent electromagnetic compatibility problems with other new or existing national or international systems.
- B. The NAS shall provide frequency and spectrum management assistance to all new and existing programs to ensure that national and international standards are complied with and that no new items of equipment are introduced that would interfere with existing systems.
 1. Band occupancy studies shall provide NAS system designers assistance with proper for appropriate frequency bands for new or existing FAA systems.
 2. Management assistance for the allocation of frequency bands to NAS systems shall include automated frequency assignment studies.

3.8 System Effectiveness

NAS equipment, systems, installations, and facilities whose functioning is required by the services described in this document must be designed to ensure that they perform these intended functions under any foreseeable operating conditions. The NAS shall meet the user/specialist-related measures of effectiveness described in the following sections. Compliance with these requirements shall be proven by analysis and where necessary, by appropriate simulation or test.

3.8.1 Operational Readiness

General Requirement

NAS equipment, systems, installations and facilities shall be kept in an operable and committable state according to their criticality to safe operation and control of aircraft.

Specific Requirements

- A. NAS services to the user/specialist shall be categorized according to the severity of impact of loss of that service on safe separation and control of aircraft. These categories are:
 - 1. Critical. Functions or services which if lost, would prevent the NAS from exercising safe separation and control over aircraft.
 - 2. Essential. Functions or services which if lost, would reduce the capability of the NAS to exercise safe separation and control over aircraft.
 - 3. Routine. Functions or services which if lost, would not significantly degrade the capability of the NAS to exercise safe separation and control over aircraft.

NAS services as required by this document are categorized in Table 3.8.

- B. The availability of a function or service to the user/specialist, expressed as one (1) minus the ratio of the total time the service is not provided to the user/specialist to the maximum available operating time, shall be as follows:
 - 1. Critical Services - .99999

- 2. Essential Services - .999
- 3. Routine Services - .99
- C. No single failure of equipment, system, installation or facility shall cause loss of service to the user/specialist.
- D. No single loss of service event shall exceed the duration shown below.
 - 1. Critical Services - 6 seconds
 - 2. Essential Services - 10 minutes
 - 3. Routine Services - 1.68 hours
- E. The frequency of occurrence of any loss of service event shall not exceed 1 per week.

TABLE 3-8

NAS SERVICE FUNCTIONAL CATEGORIES

SECTION	CRITICAL	ESSENTIAL	ROUTINE
<u>3.1.1 - Weather Information (Strategic)</u>			
A.		X	
B.	X		
C.		X	
D.		X	
E.			X
F.			X
G.	X		
H.		X	
I.		X	
<u>3.1.2 - Aeronautical Information (Strategic)</u>			
A.		X	
B.		X	
C.		X	
D.			X
E.		X	
F.		X	
<u>3.1.3 - Flow Control & Delay Advisory</u>			
A.			X
B.			X
C.		X	

TABLE 3-8

NAS SERVICE FUNCTIONAL CATEGORIES
(Continued)

SECTION	CRITICAL	ESSENTIAL	ROUTINE
<u>3.1.4 -- Flight Plan Submission & Evaluation</u>			
A.		X	
B.		X	
C.			X
D.			X
E.		X	
F.		X	
G.			X
H.			X
I.		X	
J.		X	
<u>3.2.1 -- Flow Control</u>			
A.		X	
B.		X	
C.	X		
D.		X	
E.		X	
F.		X	
G.		X	
<u>3.2.2 -- Approach & Departure Sequence</u>			
A.	X		
B.	X		
C.		X	
D.		X	
E.		X	
F.		X	
G.		X	

TABLE 3-8

NAS SERVICE FUNCTIONAL CATEGORIES
(Continued)

SECTION	CRITICAL	ESSENTIAL	ROUTINE
<u>3.2.3 - Aircraft Separation</u>			
A.	X		
B.	X		
C.	X		
D.			X
E.		X	
F.	X		
G.	X		
H.	X		
I.		X	
J.		X	
K.		X	
L.	X		
M.	X		
N.		X	
O.		X	
P.		X	
Q.	X		
<u>3.2.4 - Control Outside Independent Surveillance</u>			
A.	X		
B.		X	
<u>3.2.5 - Collision Avoidance</u>			
A.	X		
B.	X		
C.	X		
D.		X	
E.		X	
F.	X		

TABLE 3-8

NAS SERVICE FUNCTIONAL CATEGORIES
(Continued)

SECTION	CRITICAL	ESSENTIAL	ROUTINE
<u>3.2.6 - Weather Avoidance</u>			
A.		X	
B.		X	
C.		X	
D.		X	
E.			X
F.			X
G.			X
H.			X
I.		X	
J.		X	
K.		X	
<u>3.2.7 - Ground, Obstacle, and Special Use Airspace Avoidance Requirements</u>			
A.	X		
B.	X		
C.	X		
D.	X		
E.	X		
F.		X	
G.		X	
H.	X		
<u>3.2.8 - In-Flight Emergency Assistance</u>			
A.	X		
B.	X		
C.		X	
D.		X	
E.		X	
F.	X		
G.		X	

TABLE 3-8

NAS SERVICE FUNCTIONAL CATEGORIES
(Continued)

SECTION	CRITICAL	ESSENTIAL	ROUTINE
<u>3.2.9 - Search & Rescue</u>			
A.		X	
B.			X
C.			X
D.		X	
E.			X
F.			X
G.			X
<u>3.2.10 - Special Services for Military Aircraft</u>			
A.		X	
B.			X
C.			X
D.		X	
E.		X	
F.		X	
G.		X	
H.		X	
<u>3.2.11 - Airport Movement Area Control</u>			
A.		X	
B.		X	
C.		X	
D.		X	
E.		X	
F.	X		

TABLE 3-8

NAS SERVICE FUNCTIONAL CATEGORIES
(Continued)

SECTION	CRITICAL	ESSENTIAL	ROUTINE
<u>3.3.1 - Flight Following</u>			
A.		X	
B.		X	
C.		X	
D.		X	
<u>3.3.2 - Traffic Advisory</u>			
A.			X
B.	X		
C.		X	
D.		X	
E.			X
F.	X		
<u>3.3.3 - Weather Advisory</u>			
A.		X	
B.		X	
C.		X	
D.		X	
E.		X	
F.		X	
G.	X		
<u>3.4.1 - En Route Navigation</u>			
A.	X		
B.		X	
C.		X	

TABLE 3-8

NAS SERVICE FUNCTIONAL CATEGORIES
(Continued)

SECTION	CRITICAL	ESSENTIAL	ROUTINE
<u>3.4.2 - Terminal Navigation</u>			
A.	X		
B.	X		
C.		X	
<u>3.4.3 - Visual Navigation</u>			
A.		X	
B.		X	
C.			X
D.		X	
E.		X	
F.			X
<u>3.5.1 - Aircraft Detection & Identification</u>			
A.	X		
B.		X	
C.	X		
D.		X	
E.		X	
F.			X
<u>3.6.1 - Air-Ground Communications</u>			
A.	X		
B.		X	
C.		X	
D.	X		
E.		X	
F.		X	

TABLE 3-8

NAS SERVICE FUNCTIONAL CATEGORIES
(Continued)

SECTION	CRITICAL	ESSENTIAL	ROUTINE
<u>3.6.2 - Ground-Ground Interfacility Comm</u>			
A.	X		
B.		X	
C.		X	
D.		X	
E.	X		
F.		X	
G.		X	
<u>3.6.3 - Ground-Ground Intrafacility Comm</u>			
A.	X		
B.		X	
C.		X	
D.	X		
E.		X	
F.		X	
<u>3.7.1 - Maintenance & Monitoring</u>			
A.		X	
B.		X	
C.		X	
D.		X	
<u>3.7.2 - Training Support</u>			
A.			X
B.			X
C.			X

TABLE 3-8

NAS SERVICE FUNCTIONAL CATEGORIES
(Concluded)

SECTION	CRITICAL	ESSENTIAL	ROUTINE
<u>3.7.3 - Testing Support</u>			
A.			X
B.			X
C.			X
D.			X
E.			X
<u>3.7.4 - Facilities</u>			
A.			X
B.		X	
C.		X	
<u>3.7.5 - Frequency & Spectrum Engineering</u>			
A.			X
B.			X

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APPENDIX A
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GLOSSARY

APPENDIX B GLOSSARY

ACF SUPPORT METEOROLOGIST - Meteorologist stationed at each ACF with equipment organized for the purpose of detecting, displaying, and disseminating weather information in a timely manner.

ADDITIONAL SERVICES - Advisory information provided by ATC which includes but is not limited to the following:

1. Traffic advisories.
2. Vectors
3. Altitude deviation information of 300 feet or more from an assigned altitude.
4. Advisories that traffic is no longer a factor.
5. Weather and chaff information.
6. Weather assistance.
7. Bird activity information.
8. Holding pattern surveillance.

Additional services are provided to the extent possible contingent only upon the controller's capability to fit them into the equipment performance of higher priority duties on the basis of limitations, volume of traffic, frequency congestion and controller workload. The controller has complete discretion for determining if he is able to provide or continue to provide a service in a particular case.

ADVANCED AUTOMATION FUNCTIONS - The ACCC shall receive from other ACCCs Trial Plans, Trajectory update information and messages containing inputs to and/or outputs from advanced automation functions such as Flight Plan Conflict Probe. The messages shall include flight plan conflict and airspace conflict alerts and displays.

ADVISORY - Advice and information provided to assist pilots in the safe conduct of flight and aircraft movement (See Advisory Service).

AREA CONTROL FACILITY (ACF) - A restructured ARTCC which will perform both functions of an ARTCC and of a TRACON.

AERODROME - A defined area on land or water (including any buildings, installations, and equipment) intended to be used either wholly or in part for the arrival, departure, and movement of aircraft (Aerodromes may include airports, heliports, and other landing areas).

AERODROME LIGHTING - Various lighting aids that may be installed on an aerodrome.

AERONAUTICAL CHART - A map used in air navigation containing all or part of the following; topographic features, hazards and obstructions, navigation aids, navigation routes, designated airspace, and airports.

AIRCRAFT - Vehicle/s that are used or intended to be used for flight in the air and when used in air traffic control terminology may include the flight crew.

AIRCRAFT IDENTIFICATION - The words, letter(s), and numerals (or combination thereof) which uniquely identify an aircraft. eg Air Force 1, N1234Y, United 341, T5678.

AIRPORT - An area of land or water that is used or intended to be used for the landing and takeoff of aircraft and includes its buildings and facilities, if any.

AIR DEFENSE IDENTIFICATION ZONE/ADIZ - The area of airspace over land or water, extending upward from the surface, within which the timely identification, the location, and the control of aircraft are required in the interest of national security.

ALPHA INFORMATION MANUAL/AIM - A publication containing Basic Flight Information and ATIS Procedures designed primarily as a ground instructional manual for use in the National Airspace System of the United States.

AID NAUTICAL FACILITY - Any facility used in, available for use in, or designed for use in, aid of air navigation, including landing areas, lights, any apparatus or equipment for disseminating weather information, for signaling, for radio-directional finding, or for radio or other electrical communication, and any other structure or mechanism having a similar purpose for guiding or controlling flight in the air or the landing and take-off of aircraft.

ARRIVAL ACCEPTANCE RATE - A dynamic input parameter specifying the number of arriving aircraft which an airport can accept from the ACF.

ARRIVAL DETECTION EQUIPMENT/IDE - Equipment specifically designed to detect all principal features on the surface of an airport including aircraft and vehicular traffic and to present the information as an indicator in the control tower. Used to augment visual observation by tower personnel of aircraft and/or vehicular traffic on runways and taxiways.

ARRIVAL SERVICE - A service provided by a control tower for aircraft operating in the movement area and in the vicinity of an aerodrome.

AIR ROUTE TRAFFIC CONTROL CENTER/ARTCC - A facility established to provide air traffic control service to aircraft principally during the en route phase of flight. When equipment capabilities and controller workload permit, certain advisory/assistance services may be provided to VFR aircraft.

AIR TRAFFIC - Aircraft operating in the air or on an airport surface, exclusive of loading ramps and parking areas.

AIR TRAFFIC CLEARANCE/ATC CLEARANCE - An authorization by air traffic control, for the purpose of preventing collision between known aircraft, for an aircraft to proceed under specified traffic conditions.

AIR TRAFFIC CONTROL/ATC - A service by appropriate authority to promote the safe, orderly, and expeditious flow of air traffic.

AIR TRAFFIC CONTROL FACILITY - A facility that provides an Air Traffic Control Service.

AIR TRAFFIC CONTROL COMMAND CENTER/ATCCC - An Air traffic service facility consisting of four operational units.

1. Central Flow Control Function/CFCF - Responsible for coordination and approval of all major intercenter flow control restrictions on a system basis in order to obtain maximum utilization of the airspace.
2. Central Altitude Reservation Function/CAKF - Responsible for coordinating, planning and approving special user requirements under the Altitude Reservation (ALIR) concept.
3. Airport Reservation Office/ARO - Responsible for approving IFR flights at designated high density traffic airports (John F. Kennedy, LaGuardia, O'Hare, and Washington National) during specified hours.
4. ATC Contingency Command Post - A facility which enables the FAA to manage the ATC system when significant portions of the system's capabilities have been lost or are threatened.

AIRWAY - A control area or portion thereof established in the form of a corridor, the centerline of which is defined by navigational aids.

ALPHANUMERIC DISPLAY/DATA BLOCK - Letters and numerals used to show identification, altitude, beacon code, and other information concerning a target on a display.

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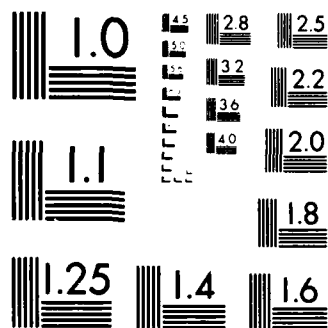
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ALTITUDE - The height of a level, point, or object measured in feet above ground level (AGL) or from mean sea level (MSL).

1. MSL Altitude - Altitude expressed in feet measured from mean sea level.
2. AGL Altitude - Altitude expressed in feet measured above ground level.
3. Indicated Altitude - The altitude as shown by an altimeter. On a pressure or barometric altimeter it is altitude as shown uncorrected for instrument error and uncompensated for variation from standard atmospheric conditions.

ALTITUDE READOUT/AUTOMATIC ALTITUDE REPORT - An aircraft's altitude, transmitted via the Mode C transponder feature, that is visually displayed in 100-foot increments.

ALTITUDE RESERVATION/ALTRV - Airspace utilization under prescribed conditions normally employed for the mass movement of aircraft or other special user requirements which cannot otherwise be accomplished. ALTRVs are approved by the appropriate FAA facility.

AREA CONTROL FACILITY (ACF) - A restructured ARTCC which will perform both functions of an ARTCC and of a TRACON.

AREA NAVIGATION/RNAV - A method of navigation that permits aircraft operations on any desired course within the coverage of station-referenced navigation signals or within the limits of self-contained system capability.

1. Area Navigation Low Route - An area navigation route within the airspace extending upward from 1,200 feet above the surface of the earth to, but not including, 18,000 feet MSL.
2. Area Navigation High Route - An area navigation route within the airspace extending upward from and including 18,000 feet MSL to flight level 450.
3. Random Area Navigation Routes/Random RNAV Routes - Direct routes, based on area navigation capability, between waypoints defined in terms of latitude/longitude coordinates, degree/distance fixes, or offset from published or established routes/airways at a specified distance and direction.

4. RNAV Waypoint/W/P - A predetermined geographical position used for route or instrument approach definition or progress reporting purposes that is defined relative to a VORTAC station position or in terms of latitude/longitude coordinates.

ATC INSTRUCTIONS - Directives issued by air traffic control for the purpose of requiring a pilot to take specific actions.

ATCCC SPECIALIST - Traffic management specialists resident at the air traffic control command center (ATCCC) who coordinates with local traffic management specialists at ARTCC's and manages flow control operations. See ATCCC description.

AUTOMATED FLIGHT SERVICE STATION (AFSS) - A station that will provide interactive alphanumeric and graphic workstations for the flight service specialists.

AUTOMATIC ALTITUDE REPORTING - That function of a transponder which responds to interrogations by transmitting the aircraft's altitude in 100-foot increments.

AUTOMATIC TERMINAL INFORMATION SERVICE/ATIS - The continuous broadcast of recorded noncontrol information in selected terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information. It normally includes weather and important airport/terminal area information of interest to users.

AVAILABILITY - Probability that a system, subsystem, or equipment will be operable.

BEARING - The horizontal direction to or from any point, usually measured clockwise from true north, magnetic north, or some other reference point, through 360 degrees.

BROADCAST - Transmission of information for which an acknowledgement is not expected.

CALL SIGN - The unique identification of an aircraft or air traffic facility. For aircraft it is the identification as filed in the flight plan and for a facility it is the facility name followed by its type or function (ie, Washington Center, Boston Departure).

CEILING - The heights above the earth's surface of the lowest layer of clouds or obscuring phenomena that is reported as "broken," "overcast," or "obscuration," and not classified as "thin" or "partial."

CENTER WEATHER ADVISORY/CWA - An unscheduled weather advisory issued by Center Weather Service Unit meteorologists for ATC use to alert pilots of existing or anticipated adverse weather conditions within the next 2 hours. A CWA may modify or redefine a SIGMET.

CLEAR AIR TURBULENCE/CAT - Turbulence encountered in air where no clouds are present. This term is commonly applied to high-level turbulence associated with wind shear. CAT is often encountered in the vicinity of the jet stream.

CODES/TRANSPONDER CODES - The number assigned to a particular multiple pulse reply signal transmitted by a transponder.

CONFLICT - The recognition of the predicated loss of separation minima.

CONFLICT ALERT - A function of certain air traffic control automated systems design to alert specialists to existing or pending situations recognized by the program parameters that require his immediate attention/action.

CONTERMINOUS U.S. - The forty-eight adjoining states and the District of Columbia.

CONTROLLED AIRSPACE - Airspace designated as a continental control area, control area, transition area, or positive control area within which some or all aircraft may be subject to air traffic control.

CONTROLLER - See Specialist

CONVECTIVE SIGMET/WST/CONVECTIVE SIGNIFICANT METEOROLOGICAL INFORMATION - A weather advisory concerning convective weather significant to the safety of all aircraft. Convective SIGMETs are issued for tornadoes, lines of thunderstorms, embedded thunderstorm of any intensity level, areas of thunderstorms greater than or equal to VIP level 4 with an area coverage of 4/10 (40%) or more, and hail 3/4 inch or greater.

COORDINATES - The intersection of lines of reference, usually expressed in degrees/minutes/seconds of latitude and longitude, used to determine position or location.

COORDINATION FIX - The fix in relation to which facilities will handoff, transfer control of an aircraft, or coordinate flight progress data. For terminal facilities, it may also serve as a basepoint for arriving aircraft.

COURSE

1. The intended direction of flight in the horizontal plan measured in degrees from north.
2. The ILS localizer signal pattern usually specified as front course or back course.

DEVIATIONS

1. A departure from a current clearance, such as an off course maneuver to avoid weather or turbulence.
2. Where specifically authorized in the FAR's and requested by the pilot, ATC may permit pilots to deviate from certain regulations.

DIRECTED STUDY - Those courses mandated for all Specialists or Technicians by agency, regional, or local authorities because of changes in equipment, procedures, or regulations.

DIRECTION FINDER/DF - A radio receiver equipped with a directional sensing antenna used to take bearings on a radio transmitter. Specialized radio direction finders are used in aircraft as air navigation aids. Others are ground based primarily to obtain a "fix" on a pilot requesting orientation assistance or to locate downed aircraft. A location "fix" is established by the intersection of two or more bearing lines plotted on a navigational chart using either two separately located Direction Finders to obtain a fix on an aircraft or by a pilot plotting the bearing indications of his DF on two separately located ground based transmitters both of which can be identified on his chart.

DISCRETE FREQUENCY -- A separate radio frequency for use in direct pilot-controller communications in air traffic control which reduces frequency congestion by controlling the number of aircraft operating on a particular frequency at one time. Discrete frequencies are normally designated for each control sector en route/terminal ATC facilities.

DISTANCE MEASURING EQUIPMENT/DME - Equipment (airborne and ground) used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigational aid.

DISTANT EARLY WARNING IDENTIFICATION ZONE - (DEWIZ) - An ADIZ over the coastal waters of the State of Alaska.

EMERGENCY - A safety condition of being threatened by serious and/or imminent danger which requires immediate or timely assistance.

EMERGENCY LOCATOR TRANSMITTER/ELT - A radio transmitter attached to the aircraft structure which operates from its own power source on 121.5 MHz and 243.0 MHz. It aids in locating downed aircraft by radiating a downward sweeping audio tone, 2-4 times per second. It is designed to function without human action after an accident.

EN ROUTE - One of three phases of flight services (terminal, en route, oceanic). En route service is provided outside of terminal airspace and is exclusive of oceanic control.

EN ROUTE AIR TRAFFIC CONTROL SERVICES - Air traffic control service provided aircraft on IFR flight plans, generally by ARTCCs, when these aircraft are operating between departure and destination terminal areas. When equipment capabilities and controller workload permit, certain advisory/assistance services may be provided to VFR aircraft.

EN ROUTE FLIGHT ADVISORY SERVICE/FLIGHT WATCH - A service specifically designed to provide, upon pilot request, timely weather information pertinent to his type of flight, intended route of flight and altitude.

EN ROUTE MINIMUM SAFE ALTITUDE WARNING/E-MSAW - A function of the NAS Stage A en route computer that aids the controller by alerting him when a tracked aircraft is below or predicted by the computer to go below a predetermined minimum IFR altitude.

FAILURE - The event, or inoperable state, in which any item or part of an item does not, or would not, perform as previously specified.

FAR - Federal Air Regulation

FLIGHT FOLLOWING - The monitoring of the progress of a flight whose navigation is being provided by the pilot. The system will correlate the aircraft position with the proposed flight plan. Flight Following may be accomplished either through procedural methods or surveillance assisted.

FLIGHT PATH - A line, course, or track along which an aircraft is flying or intended to be flown.

FLIGHT PLAN - Specified information relating to the intended flight of an aircraft that is filed orally or in writing with an ATC facility.

FLIGHT INFORMATION REGION/FIR - An air-space of defined dimensions within which Flight Information Service and Alerting Service are provided.

1. Flight Information Service - A service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights.
2. Alerting Service - A service provided to notify appropriate organizations regarding aircraft in need of search and rescue aid, and assist such organizations as required.

FLIGHT SERVICE STATION/FSS - Air traffic facilities which provide pilot briefing, en route communications and VFR search and rescue services, assist lost aircraft and aircraft in emergency situations, relay ATC clearances, originate Notices to Airmen, broadcast aviation weather and NAS information, receive and process IFR flight plans, and monitor NAVAIDS. In addition, at selected locations FSSs provide Enroute Flight Advisory Service (Flight Watch), take weather observations, issue airport advisories, and advise Customs and Immigration of transborder flights.

FLOW CONTROL - Measures designed to adjust the flow of traffic into a given airspace, along a given route, or bound for a given airport so as to ensure the most effective utilization of the airspace.

GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE (GOES) - A visible and infrared earth sensing satellite. There exists two satellites in geostationary orbits, one covering the eastern U.S. and the other covering the western U.S.

HANDOFF - An action taken to transfer the control of an aircraft from one controller to another if the aircraft will enter the receiving controller's airspace and radio communications with the aircraft will be transferred.

HAZARDOUS WEATHER - Weather conditions which have the potential to significantly increase the likelihood of aviation accidents. Hazardous weather conditions include moderate to severe icing, moderate to severe turbulence, moderate to severe precipitation, wind shear, thunderstorms, sustained high winds near the surface or widespread areas of low visibility.

HELIPORT - An area of land, water, or structure used or intended to be used for the landing and takeoff of helicopters and includes its buildings and facilities, if any.

IDENT FEATURE - The special feature in the Air Traffic Control Radar Beacon System (ATCRBS) equipment. It is used to immediately distinguish one displayed beacon target from other beacon targets.

IFR AIRCRAFT/IFR FLIGHT - An aircraft conducting flight in accordance with instrument flight rules.

IFR CONDITIONS - Weather conditions below the minimum for flight under visual flight rules.

INSTRUMENT FLIGHT RULES/IFR - Rules governing the procedures for conducting instrument flight. Also a term used by pilots and controllers to indicate type of flight plan.

INSTRUMENT LANDING SYSTEM/ILS - A precision instrument approach system which normally consists of the following electronic components and visual aids.

1. Localizer
2. Glide Slope
3. Outer Marker
4. Middle Marker
5. Approach Light

INSTRUMENT METEOROLOGICAL CONDITIONS/IMC - Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling less than the minima specified for visual meteorological conditions.

INTERNATIONAL CIVIL AVIATION ORGANIZATION/ICAO - A specialized agency of the United Nations whose objective is to develop the principles and techniques of international air navigation and to foster planning and development of international civil air transport.

INTERROGATOR - The ground-based surveillance beacon transmitter-receiver, which normally scans in synchronism with a primary radar, transmitting discrete radio signals which repetitiously request all transponders, on the mode being used, to reply. The replies received are mixed with the primary returns and displayed on the same plan position indicator. Also applied to the airborne element of the TACAN/DME system.

KNOWN TRAFFIC - With respect to ATC clearances, means aircraft whose altitude, position and intentions are known to ATC.

LANDING AREA - That part of the movement area intended for the landing and takeoff of aircraft.

LIGHT GUN - A handheld directional light signaling device which emits a brilliant narrow beam of white, green, or red light as selected by the tower controller. The color and type of light transmitted can be used to approve or disapprove anticipated pilot actions where radio communications are not available. The light gun is used for controlling traffic operating in the vicinity of the airport and on the airport movement area.

LONGITUDINAL SEPARATION - The longitudinal spacing of aircraft at the same altitude by a minimum distance expressed in units of time or miles.

LOST COMMUNICATIONS/TWO-WAY RADIO COMMUNICATIONS FAILURE - Loss of the ability to communicate by radio. Aircraft are sometimes referred to as NORDO (No Radio).

LOW ALTITUDE AIRWAY STRUCTURE/FEDERAL AIRWAYS - The network of airways serving aircraft operations up to but not including 18,000 feet MSL.

MANNED FACILITY - A facility which is normally occupied by Specialists, Technicians, or other FAA personnel for the conduct or support of NAS operations.

MESOCYCLONE - A vertical column of cyclonically rotating air, typically 2 to 15 km in diameter, within a severe thunderstorm.

METERING - A method of time-regulating arrival traffic flow into a terminal area so as not to exceed a predetermined terminal acceptance rate.

MICROBURST - A downdraft-induced, diverging, horizontal flow near the surface, whose initial dimension is less than 4 km, and whose differential velocity is greater than 10 m/s.

MILITARY OPERATIONS AREA/MOA - (See Special Use Airspace)

MINIMUM SAFE ALTITUDE/MSA

1. The minimum altitude specified in FAR Part 91 for various aircraft operations.
2. Altitudes depicted on approach charts which provide at least 1,000 feet of obstacle clearance for emergency use within a specified distance from the navigation facility upon which a procedure is predicated. These altitudes will be identified as MINIMUM SECTOR ALTITUDES or EMERGENCY SAFE ALTITUDES and are established as follows:

MINIMUM VECTORING ALTITUDE/MVA - The lowest MSL altitude at which an IFR aircraft will be vectored, except as otherwise authorized for departures and missed approaches.

MINIMUMS/MINIMA - Weather condition requirements established for a particular operation or type of operation.

MODE - The letter or number assigned to a specific pulse spacing of radio signals transmitted or received by ground interrogator or airborne transponder components of the Air Traffic Control Radar Beacon System (ATCRBS). Mode A (military Mode 3) and Mode C (altitude reporting) are used in air traffic control.

MONITORING - The flight Following of aircraft, whose primary navigation is being performed by the pilot, to note deviations from it's authorized flight path, airway or route.

MOVEMENT AREA - The runways, taxiways, and other areas of an aerodrome which are utilized for taxing/hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and parking areas. At those airports/heliports with a tower, specific approval for entry onto the movement area must be obtained from ATC.

NAS STAGE A - The en route ATC system's radar, computers and computer programs, controller plan view displays (PVDs/radar scopes), input/output devices, and the related communications equipment which are integrated to form the heart of the automated IFR air traffic control system. This equipment performs Flight Data Processing (FDP) and Radar Data Processing (RDP). It interfaces with automated terminal systems and is used in the control of en route IFR aircraft.

NATIONAL AIRSPACE SYSTEM/NAS - The common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information, and manpower and material. Included are system components shared jointly with the military.

NATIONAL SEARCH AND RESCUE PLAN - An interagency agreement which provides for the effective utilization of all available facilities in all types of search and rescue missions.

NAVAID CLASSES - VOR, VORTAC, and TACAN aids are classed according to their operational use. The three classes of NAVAIDS are:

- T - Terminal
- L - Low altitude
- H - High altitude

NAVIGABLE AIRSPACE - Airspace at and above the minimum flight altitudes prescribed in the FARs including airspace needed for safe takeoff and landing.

NAVIGATIONAL AID/NAVAID - Any visual or electronic device airborne or on the surface which provides point to point guidance information or position data to aircraft in flight.

NOTICE TO AIRMEN/NOTAM - A notice containing information (not known sufficiently in advance to publicize by other means) concerning the establishment, condition, or change in any component (facility, service, or procedure of, or hazard in the National Airspace System) the timely knowledge of which is essential to personnel concerned with flight operations.

NUISANCE ALERT - An unwarranted alert message to a specialist, warning of a present or predicted unsafe situation.

OBSTACLE - An existing object, object of natural growth, or terrain at a fixed geographical location, or which may be expected at a fixed location within a prescribed area, with reference to which vertical clearance is or must be provided during flight operation.

OBSTRUCTION - An object/obstacle exceeding the obstruction standards specified by FAR Part 77, Subpart C.

OFF-LINE STORAGE - Storage facilities allowing access to information (voice and/or data) recorded within the past 15 days.

ON-LINE STORAGE - Storage facilities allowing immediate access to information (voice and/or data) recorded within the past 24 hours.

POSITIVE CONTROL - The separation of all air traffic within designated airspace, by air traffic control.

POSITIVE CONTROL AREA/PCA - (See Controlled Airspace).

PRECIPITATION - Any or all forms of water particles (rain, fog, sleet, hail, or snow) that fall from the atmosphere and reach the surface.

PREDICTED - That which is expected at some future time, postulated on analysis of past experience and tests.

PREFERENTIAL ROUTES - Preferential routes IPDRs, PARs, and PDARs) are adapted in ARTCC computers to accomplish inter/intra-facility controller coordination and to assure that flight data is posted at the proper control positions.

1. Preferential Departure Route/PDR - A specific departure route from an airport or terminal area to an en route point where there is no further need for flow control. It may be included in a Standard Instrument Departure (SID) or a Preferred IFR Route.
2. Preferential Arrival Route/PAR - A specific arrival route from an appropriate en route point to an airport or terminal area. It may be included in a Standard Terminal Arrival (STAR) or a Preferred IFR Route. The abbreviation "PAR" is used primarily within the ARTCC and should not be confused with the abbreviation for Precision Approach.
3. Preferential Departure and Arrival Route/PDAR - A route between two terminals which are within or immediately adjacent to one ARTCC's area. PDARs are not synonymous with Preferred IFR Routes but may be listed as such as they do accomplish essentially the same purpose. (See Preferred IFR Routes, NAS Stage A)

PREFERRED IFR ROUTES - Routes established between busier airports to increase system efficiency and capacity. They normally extend through one or more ARTCC areas and are designed to achieve balanced traffic flows among high density terminals.

PROHIBITED AREA - (See Special Use Airspace).

PUBLISHED ROUTE - A route for which an IFR altitude has been established and published.

QUOTA FLOW CONTROL/QFLOW - A flow control procedure by which the Central Flow Control Function (CFCF) restricts traffic to the ARTC Center area having an impacted airport thereby avoiding sector/area saturation.

RELIABILITY - The probability that an item can perform its intended function for a specified interval under stated conditions.

REMOTE COMMUNICATIONS AIR/GROUND FACILITY/RCAG - An unmanned VHF/UHF transmitter/receiver facility which is used to expand ARTCC air/ground communications coverage and to facilitate direct contact between pilots and controllers.

REMOTE COMMUNICATIONS OUTLET/RCO AND REMOTE TRANSMITTER/RECEIVER/RTR - An unmanned communications facility remotely controlled by air traffic personnel. RCO's serve FSS's RTR's serve terminal ATC facilities. An RCO or RTR may be UHF or VHF and will extend the communication range of the air traffic facility.

REPORTING POINT - A geographical location in relation to which the position of an aircraft is reported.

REQUIREMENT - A specified capability which must be provided by the NAS. Types include operational, functional, general and specific.

1. Functional Requirement - Type of requirement that describes what the system must do to satisfy the operational requirements. A functional requirement must have an action verb and should have well defined inputs and outputs.
2. General Requirement - Type of requirement that relates the characteristics of the operational requirements.
3. Operational Requirement - Type of requirement that qualifies and quantifies the services and products which must be provided to users and specialists. Operational requirements should be directly related to the NAS mission.
4. Specific Requirement - Type of requirement that describes how well a function or services must be performed and may be either qualitative or quantitative.

RESCUE COORDINATION CENTER/RCC - A search and rescue (SAR) facility equipped and manned to coordinate and control SAR operations in an area designated by the SAR plan. The U.S. Coast Guard and the U.S. Air Force have responsibility for the operation of RCCs.

ROUTE - A defined path, consisting of one or more courses in a horizontal plane, which aircraft traverse over the surface of the earth.

RUNWAY - A defined rectangular area, on a land airport prepared for the landing and takeoff run of aircraft along its length. Runways are normally numbered in relation to their magnetic direction rounded off to the nearest 10 degrees, e.g., Runway 01, Runway 25.

SAFETY - Freedom from conditions that can cause death, injury, occupational illness, or damage to or loss of equipment or property.

SAFETY ADVISORY - A safety advisory issued by ATC to aircraft under their control if ATC is aware the aircraft is at an altitude which, in the controller's judgement, places the aircraft in unsafe proximity to terrain, obstructions, or other aircraft.

1. Terrain/Obstruction Advisory - A safety advisory issued by ATC to aircraft under their control if ATC is aware the aircraft is at an altitude which, in the controller's

judgment, places the aircraft in unsafe proximity to terrain/obstructions.

2. Aircraft Conflict Advisory - A safety advisory issued by ATC to aircraft under their control if ATC is aware of an aircraft that is not under their control at an altitude which, in the controller's judgment, places both aircraft in unsafe proximity to each other.

The issuance of a safety advisory is contingent upon the capability of the controller to have an awareness of an unsafe condition.

SEARCH AND RESCUE/SAR - A service which seeks missing aircraft and assists those found to be in need of assistance. It is a cooperative effort using the facilities and services of available Federal, state and local agencies.

SEPARATION - In air traffic control, the spacing of aircraft to achieve their safe and orderly movement in flight and while landing and taking off.

SEPARATION MINIMA - The minimum longitudinal, lateral, or vertical distances by which aircraft are spaced through the application of air traffic control procedures.

SEVERE WEATHER AVOIDANCE PLAN/SWAP - An approved plan to minimize the affect of severe weather on traffic flows in impacted terminal and/or ARTCC areas. SWAP is normally implemented to provide the least disruption to the ATC system when flight through portions of airspace is difficult or impossible due to severe weather.

SIGMET/WS/SIGNIFICANT METEOROLOGICAL INFORMATION - A weather advisory issued concerning weather significant to the safety of all aircraft. SIGMET advisories cover severe and extreme turbulence, severe icing, and widespread dust or sand storms that reduce visibility to less than 3 miles.

SPECIAL USE AIRSPACE - Airspace of defined dimensions identified by an area on the surface of the earth wherein activities must be confined because of their nature and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities.

TYPE OF SPECIAL USE AIRSPACE:

1. Alert Area - Airspace which may contain a high volume of pilot training activities or an unusual type of serial activity, neither of which is hazardous to aircraft. Alert Areas are depicted on aeronautical charts for the

information of non-participating pilots. All activities within an Alert Area are conducted in accordance with Federal Aviation Regulations and pilots transiting the area are equally responsible for collision avoidance.

2. Controlled Firing Area - Airspace wherein activities are conducted under conditions so controlled as to eliminate hazards to nonparticipating aircraft and to ensure the safety of persons and property on the ground.
3. Military Operations Area (MOA) - An MOA is an airspace assignment of defined vertical and lateral dimensions established outside positive control areas to separate/segregate certain military activities from IFR traffic and to identify for VFR traffic where these activities are conducted.
4. Prohibited Area - Designated airspace within which the flight of aircraft is prohibited.
5. Restricted Area - Aerospace designated under FAR Part 73, within which the flight of aircraft, while not wholly prohibited is subject to restriction. Most restricted areas are designated joint use, and IFR/VFR operations in the area may be authorized by the controlling ATC facility when it is not being utilized by the using agency. Restricted areas are depicted on en route charts. Where joint use is authorized, the name of the ATC controlling facility is also shown.
6. Warning Area - Airspace which may contain hazards to nonparticipating aircraft in international airspace.

SPECIALIST - A person authorized to provide air traffic control service. The individual that interacts directly with the subsystems that comprise the NAS (e.g. Air Traffic Controller, Flight Service Station Specialist, Traffic Management Specialist, Air Traffic Supervisor, Weather Specialists).

SPEED ADJUSTMENT - An ATC procedure used to request pilots to adjust aircraft speed to specific value for the purpose of providing desired spacing. Pilots are expected to maintain a speed of plus or minus 10 knots or 0.02 mach number of the specified speed.

SURVEILLANCE - A system which detects and reports the location of aircraft and/or objects. For air traffic control purposes surveillance systems are electronic in nature and exclude visual surveillance methods. Surveillance are differentiated as independent or dependent systems.

1. Independent Surveillance - A system which requires no airborne compatible equipment.
2. Dependent Surveillance - A system which requires airborne compatible equipment (e.g. ATCRBS, Mode S).

TACTICAL AIR NAVIGATION/TACAN - An ultra-high frequency electronic rho-theta air navigation aid which provides suitably equipped aircraft a continuous indication of bearing and distance to the TACAN station.

TARGET SYMBOL - A computer-generated indication shown on a display resulting from a primary return or a radar beacon reply.

TERMINAL AREA - A general term used to describe airspace in which approach control service or airport traffic control service is provided.

TERMINAL AREA FACILITY - A facility providing air traffic control service for arriving and departing IFR, VFR, Special CFR, Special IFR aircraft and, on occasion, en route aircraft.

TOWER/AIRPORT TRAFFIC CONTROL TOWER - Terminal facility that uses air/ground radio communications, visual signaling, and other devices to provide ATC services to aircraft operating in the vicinity of an airport or on the movement area. Authorizes aircraft to land or takeoff at the airport controlled by the tower or to transit the airport traffic area regardless of flight plan or weather conditions (IFR or VFR). A tower may also provide approach control services.

TRACK - The actual flight path of an aircraft over the surface of the earth.

TRAFFIC

1. A term used by a specialists to transfer radar identification of an aircraft to another controller for the purpose of coordinating separation action. Traffic is normally used (a) in response to a handoff or point out, (b) in anticipation of a handoff or point out, or (c) in conjunction with a request for control of an aircraft.
2. A term used by ATC to refer to one or more aircraft.

TRAFFIC ADVISORIES - Advisories issued to alert pilots to other known or observed air traffic which may be in such proximity to the position or intended route of flight of their aircraft to warrant attention. Such advisories may be based on:

1. Visual observation.
2. Observation of radar identified and nonidentified aircraft targets on an ATC radar display, or
3. Verbal reports from pilots or other facilities.

The word "traffic" followed by additional information, if known, is used to provide such advisory; e.g., "Traffic, 2 o'clock, one zero miles, southbound, eight thousand."

TRAFFIC MANAGEMENT COORDINATOR - A traffic management specialist resident at the ARTCC traffic management unit (TMU) provides coordination between the national level central flow control function of the ATCCC and local ARTCC controllers.

TRAFFIC MANAGEMENT UNIT (TMU) - A non-control, coordination position at ARTCCs connected to the central flow control function at the ATCCC and responsible for dissemination of flow control information at the local level.

TRAJECTORY - An ordered union of all converted fixes and route segments for a Flight Plan or Trial Plan.

TRANSFER OF CONTROL - That action whereby the responsibility for the separation of an aircraft is transferred from one controller to another.

TRANSFERRING CONTROLLER/FACILITY - A controller/facility transferring control of an aircraft to another controller/facility.

TRIAL PLAN - A modified form of an active flight plan that is proposed as a possible replacement for that active flight plan. A Trial Plan shall be processed by route processing and advanced automation functions before entry as an active flight plan or amendment.

UNCONTROLLED AIRSPACE - Uncontrolled airspace is that portion of the airspace that has not been designated as continental control area, control area, control zone, terminal control area, or transition area and within which ATC has neither the authority more the responsibility for exercising control over air traffic.

UNICOM - A non-government communication facility which may provide airport information at certain airports.

UNMANNED FACILITY - A facility which is normally not occupied by personnel for the conduct or support of NAS operations. Such facilities normally contain equipment which is operated, controlled, and monitored from a manned facility.

UNPUBLISHED ROUTE - A route for which no minimum altitude is published or charted for pilot use. It may include a direct route between NAVAIDS, a radial, a vector, or a final approach course beyond the segments of an instrument approach procedure.

USER - The external individual or group that receive services from the NAS (e.g. Pilot, Air Carrier, General Aviation, Military, Law Enforcement Agencies).

VECTOR - A heading issued to an aircraft to provide navigational guidance.

VERTICAL SEPARATION - Separation established by assignment of different altitude or flight levels.

VFR AIRCRAFT/VFR FLIGHT - An aircraft conducting flight in accordance with visual flight rules.

VFR CONDITIONS - Weather conditions equal to or better than the minimum for flight under visual flight rules.

VISIBILITY - The ability, as determined by atmospheric conditions and expressed in units of distance, to see and identify prominent unlighted objects by day and prominent lighted objects by night. Visibility is reported as statute miles, hundreds of feet, or meters.

VISUAL FLIGHT RULES/VFR - Rules that govern the procedures for conducting flight under visual condition. The term "VFR" is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of flight plan.

VISUAL METEOROLOGICAL CONDITIONS/VMC - Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling equal to or better than specified minima.

VISUAL SEPARATION - A means employed by ATC to separate aircraft in terminal areas. There are two ways to effect this separation:

1. The tower specialists sees the aircraft involved and issues instructions, as necessary, to ensure that the aircraft avoid each other.

2. A pilot sees the other aircraft involved and upon instructions from the specialists provides his own separation by maneuvering his aircraft as necessary to avoid it. This may involve following another aircraft or keeping it in sight until it is no longer a factor.

VORTAC/VHF OMNIDIRECTIONAL RANGE/TACTICAL AIR NAVIGATION - A navigation air providing VOR azimuth, TACAN azimuth, and TACAN distance measuring equipment (DME) at one site.

WEATHER ADVISORY/WS/WST/WA/CWA - In aviation forecast practice, an expression of hazardous weather conditions not predicted in the area forecast, as they effect the operation of air traffic and as prepared by the NWS.

WIND SHEAR - A change in wind speed and/or wind direction in a short distance resulting in a tearing or shearing effect. It can exist in a horizontal or vertical direction and occasionally in both.

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