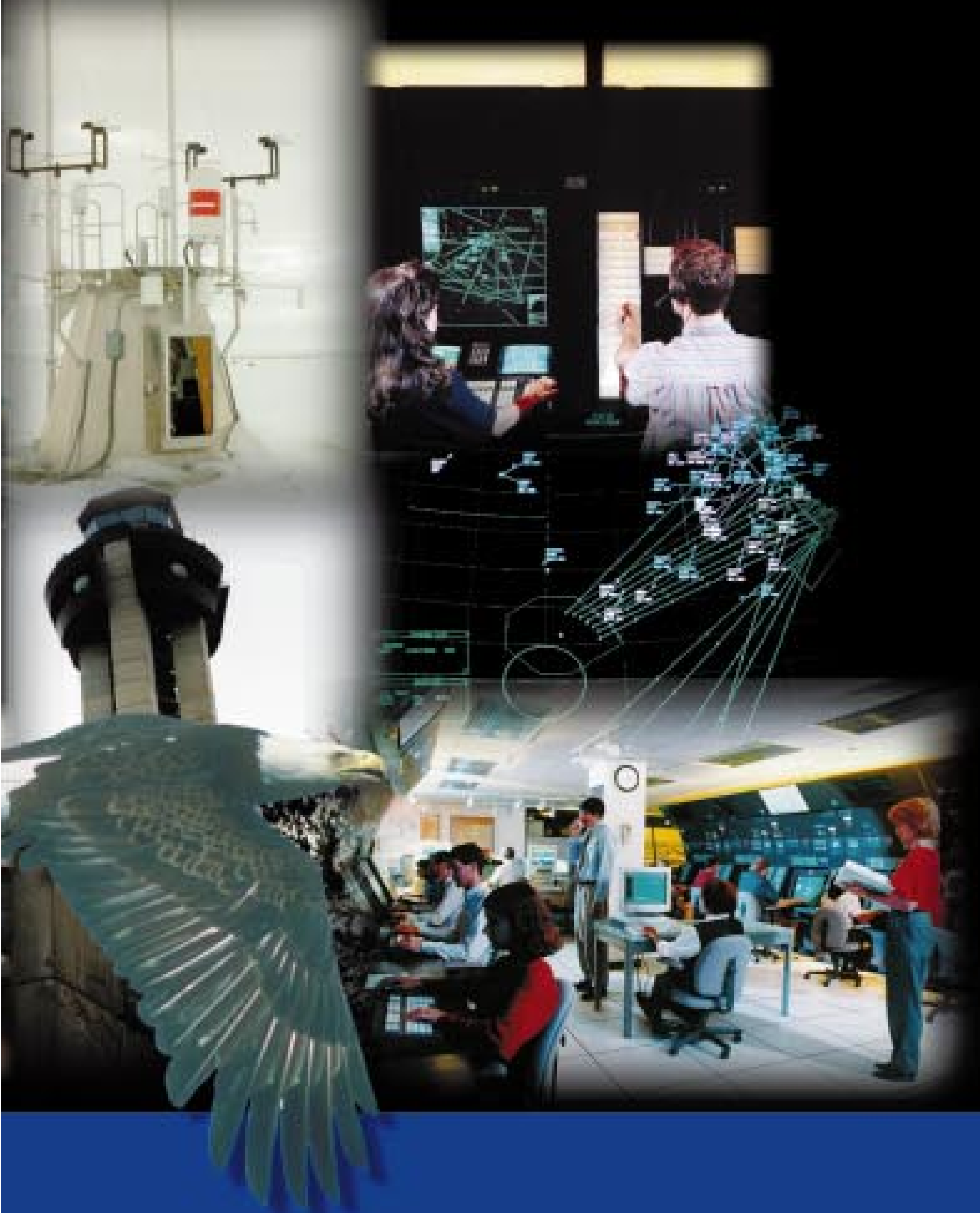


AUA PROGRAM MASTER PLAN

March 1997

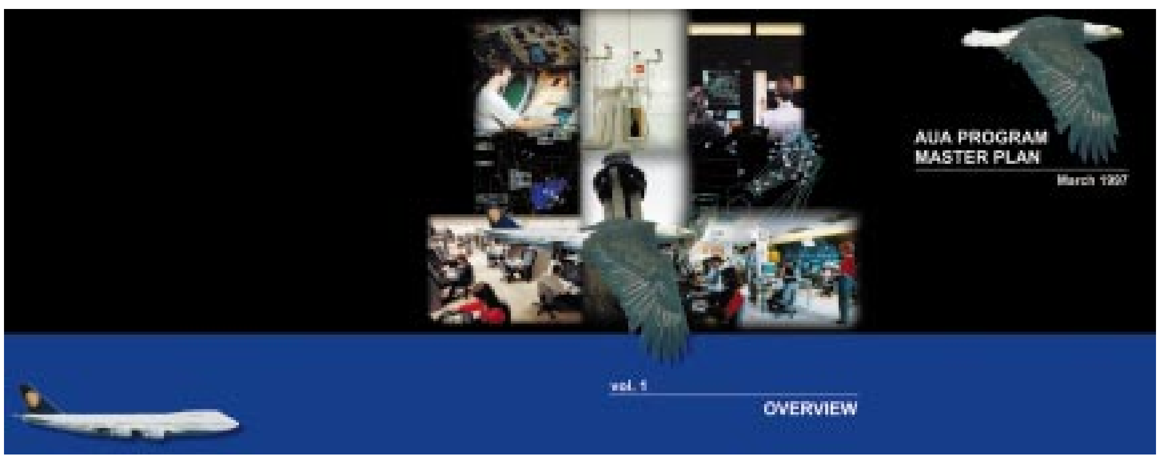
vol. 1

OVERVIEW

Office of Air Traffic Systems Development

“Information technology presents opportunities that will again revolutionize the industry, in ways as significant as the introduction of the jet engine forty years ago. Air traffic today is still controlled through ground-based radar, and on a point-to-point basis. Satellite-based navigation will bring a fundamental change in the way that air traffic is directed, and make the notion of “highway lanes in the sky” as obsolete as bonfires that used to guide early fliers. Digital technology will replace analog systems, making communications with and among aircraft dramatically faster, more efficient and effective. These and other new technologies offer tremendous opportunities for improved safety, security and efficiency, and will transform aviation in the same way that the Internet and World Wide Web are transforming the way the world does business.”

Final Report to President Clinton,
White House Commission on Aviation Safety and Security,
Vice President Al Gore, Chairman,
February 12, 1997



About the Cover:

The cover of the Automation Program Master Plan symbolizes the evolution of air traffic control through the development and fielding of improved automation systems. The American Eagle portrays "free flight" - a goal of the aviation industry and the FAA which increases airspace capacity and the efficiency of its use through collaborative management of airspace operations. The path to "free flight" is in part through improved automation systems currently being deployed and developed by the FAA Office of Air Traffic Systems Development (AUA). The relationship of the airplane (today's capability) to the Eagle depicts the progress the planned automation systems will make towards "free flight". Future investments will be required to fully realize the benefits in capacity and efficiency symbolized by the Eagle's higher flight level.

Within the FAA, the Office of Air Traffic Systems Development Supports Current Operations and Future Growth

During the twentieth century, aviation in the United States has evolved from a small number of pioneers piloting simple aircraft in clear weather during daylight hours to a sophisticated and growing industry, one which fuels American economic growth both here and abroad. On the average, over 4000 commercial flights carrying 100,000 passengers leave the nation's airports every hour of every day, in all but the most severe weather - a total of 24 million flights and 560 billion passenger miles per year; pilots flying private aircraft as well as military aircraft add to this growing industry.[1]

A photograph of the aircraft situation display which is depicting all flights under FAA control being flown in the U.S. and abroad at that specific time. Each dot represents a single aircraft.

As the nation's airways have become busier over the past sixty years, air traffic control has become more sophisticated - from one individual waving a flag to tell a pilot that it's safe to land to approximately 17,000 controllers supporting the safe and efficient movement of air traffic through the national airspace.

[1]All cited numbers are approximations based on data in "FAA Aviation Forecasts, Fiscal Years 1997-2008," Office of Aviation Policy and Plans, Federal Aviation Administration, Washington, DC

During the 1950s, automation - or computer augmentation - was introduced to air traffic control equipment to assist air traffic controllers in carrying out their duties. The systems and equipment which provide that support have become much more complex - handwritten notes pinned to message boards have evolved into an integrated set of systems and equipment at over 8,500 locations across the United States and its territories.

The Federal Aviation Administration (FAA) has over 47,000 permanent employees dedicated to the safe and efficient use of the nation's airways. The FAA is responsible for providing the national airspace system infrastructure and services needed to support air traffic operations within the United States and over eighty percent of the world's controlled oceanic airspace. This responsibility extends from air traffic control and management, system security, and safety, to international coordination.

The FAA must provide a safe and secure infrastructure 24 hours a day, 365 days a year. In order to fulfill its mission in an efficient and cost-effective manner, the agency has two major organizations which play key roles in the development and implementation of air traffic control systems and equipment. One of the two organizations - the Office of Research and Acquisitions (ARA) - is responsible for developing and testing systems and equipment. The other - the Office of Air Traffic Services (ATS) - is responsible for operating, maintaining, and enhancing the systems once they are installed and operational. Within the ATS organization, the Air Traffic System Requirements Service (ARS) works closely with ARA organizations to ensure that operational needs and requirements are reflected in ARA system development and acquisition efforts.

Ten integrated product teams - each supported by system engineers, logisticians, and testing, contract, and legal specialists - are responsible for systems development under ARA. They are divided between two suborganizations, one of which - the Office of Air Traffic Systems Development (AUA) -- is responsible for managing the development, acquisition, and fielding of automated air traffic control systems.

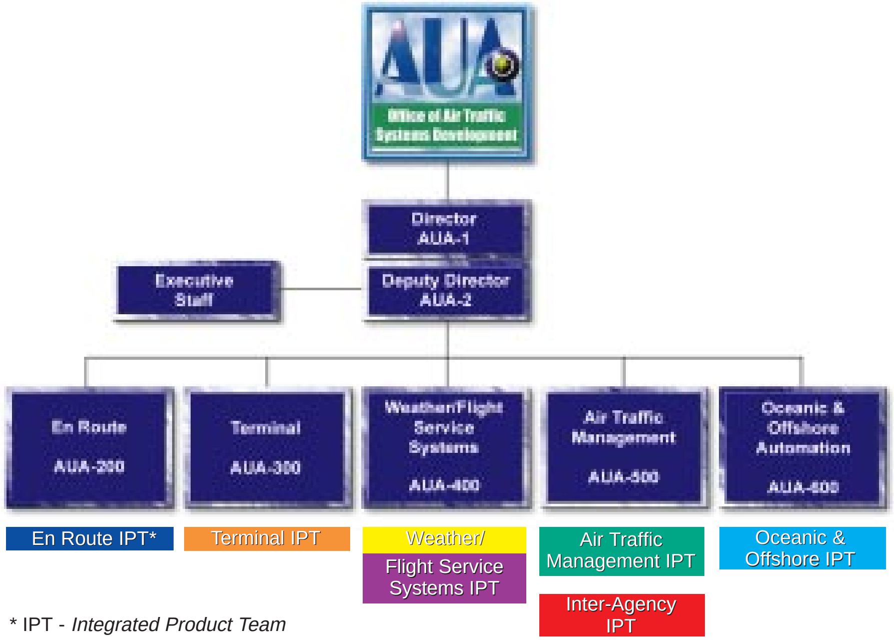
Internal government reports, including the FAA Strategic Plan, the FAA Capital Investment Plan, and the Office of Research and Acquisition (ARA) Business Plan, provide the framework which is used by AUA to help set its future goals and direction. New acquisition reforms, implemented by the FAA in April 1996 to reduce the time and cost needed to field new systems, call for greater user involvement and provide a means by which promising new technologies can be evaluated quickly and then inserted in existing systems for maximum benefit to airspace users.

The mission of AUA is to ensure needed automation systems will be available to support air traffic control and management as it evolves in the twenty-first century. Working closely with other FAA organizations, the Department of Defense, the National Aeronautics and Space Administration (NASA), international aviation organizations, and aviation industry members, AUA plans and manages the acquisition of new automation systems for the national airspace system. It also sustains or enhances existing automation systems until they can be replaced by more reliable and easier-to-maintain commercial-off-the-shelf systems designed to meet the growing need for safer, more efficient, and more economical air travel.

AUA products support air traffic control efforts throughout the U.S. and in Guam and Puerto Rico, as well as in U.S.-controlled oceanic airspace. AUA products also support air traffic control in Mexico, Canada, Great Britain, France, and Russia.

AUA is organized into integrated product teams which support the air traffic control functions. The integrated product teams work closely together to develop and acquire automation systems which promote

inter-operation and provide an open and robust architecture for the national airspace system.



* IPT - *Integrated Product Team*

- En Route Integrated Product Team manages the acquisition and deployment of automation systems supporting air traffic control services to domestic airspace users not specifically delegated to an oceanic, terminal, or tower control facility. The area of control includes the airspace adjoining Mexico and Canada and extends 100 miles over adjoining ocean areas and from the earth's surface to 60,000 feet above mean sea level.

- Terminal Integrated Product Team manages the acquisition and deployment of automation systems supporting such air traffic control services as the separation and sequencing of aircraft arrivals, departures, and over flights within a radius of approximately 40 miles around designated airports.

- Weather/Flight Services Integrated Product Team manages the acquisition and deployment of automation systems which measure and disseminate weather data needed by the FAA and airspace users and services systems which provide airspace flight planning, flight plan filing, and flight advisory services.

- Air Traffic Management Integrated Product Team manages the acquisition and deployment of automation systems supporting traffic flow management services to expedite the safe and orderly flow of air traffic across the national airspace and distribution of aircraft situation data to the airlines and aviation industry members. The team also manages the development of decision support tools used in conjunction with airspace automation to assist controllers and traffic management specialists in predicting and optimizing air traffic flow.

- Air Traffic Management Inter-Agency Integrated Product Team conducts research, in conjunction with NASA and the aviation industry, to determine how to make the national airspace safer, more efficient, and less costly to operate and maintain.

- Oceanic and Offshore Integrated Product Team manages the acquisition and deployment of automation systems for six oceanic and offshore centers providing air traffic control services to aircraft flying beyond the nation's coastlines over large portions of the Atlantic and Pacific Oceans. This area currently includes 80 percent of the world's controlled oceanic airspace.

The airspace within approximately five miles of an airport (including taxiways and runways on the ground) is controlled by the airport tower. Automation systems for the tower are being developed, acquired, and deployed by the Terminal, Weather/Flight Services, and Air Traffic Management Integrated Product Teams.

The FAA National Airspace System Architecture Defines Future Automation Requirements

Early American aviators saw little need for an organized system of air traffic control. Charles Lindbergh crossed the Atlantic and Amelia Earhart earned her place in aviation history without ever talking to an air traffic controller. But the birth of modern commercial aviation changed the environment considerably. By the mid-1950s, commercial air service was being provided around the clock, with pilots flying in almost all weather conditions. As the airspace around busy airports became more congested, the need for imposing an efficient system of air traffic control and management became critical.

Many forces are driving the requirement to change the air traffic control automation system. Demand for additional system capacity is growing. The growth in commercial air traffic operations will be approximately 30 percent through the year 2008, or an increase from 24 to 31 million flights. The regional/commuter passenger segment of the industry is expected to grow faster than the industry as a whole, with the move to larger high-speed turboprops and regional jets providing growth opportunities in nontraditional regional/commuter markets. International passenger traffic between the United States and the rest of the world is

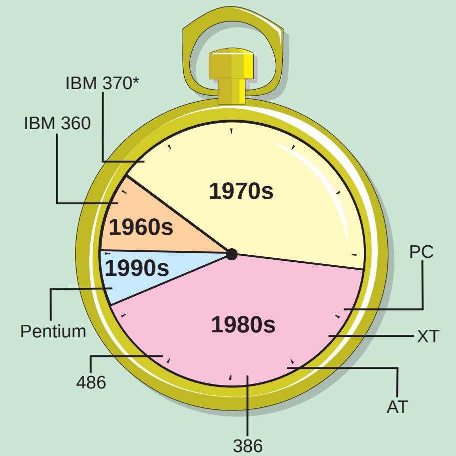
INFRASTRUCTURE OVERVIEW

The basic facilities, equipment, interconnecting networks, and operational software programs needed to operate the national airspace system are called the "infrastructure". This interconnected and interoperating set of systems is located in approximately 1800 facilities - airport towers, flight service stations, terminal facilities, en route centers, and the Air Traffic Control System Command Center outside Washington, D.C.

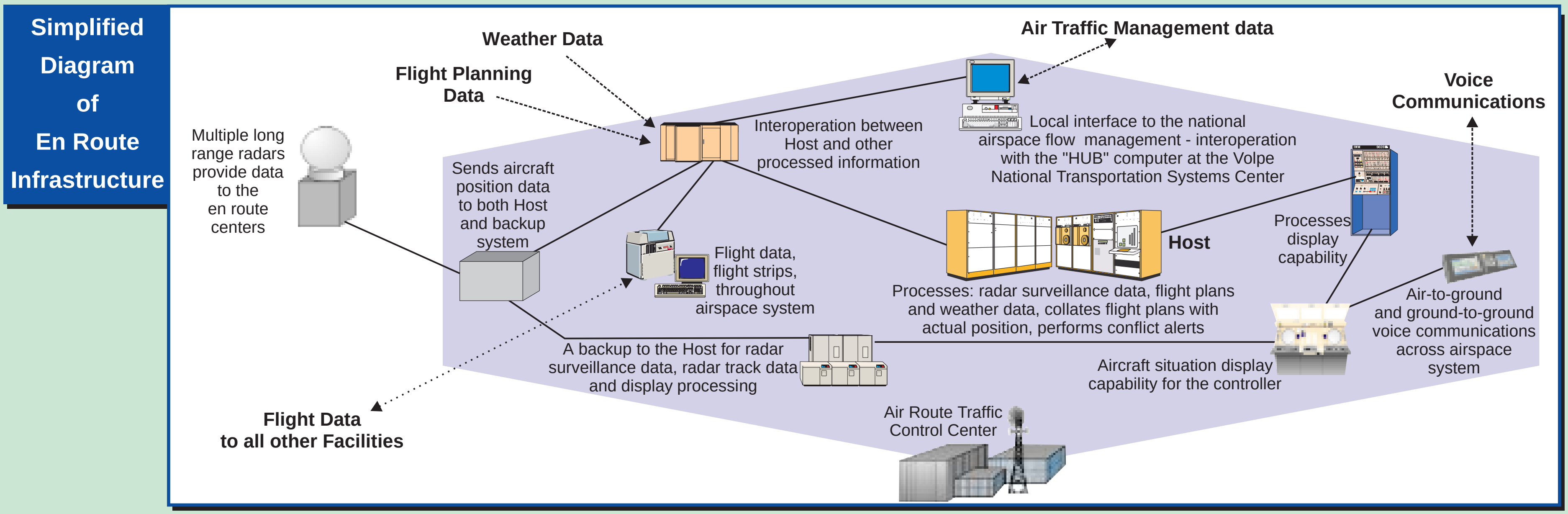
When a controller views an aircraft position on a display, the representation is the result of over 50 processing systems. Each of these systems provides information that is time-synchronized and geographically consistent with all processed information across the airspace system. To ensure flight safety, each of the systems must operate on a 24 hour, round-the-clock basis. The equipment reliability required can often only be attained by providing backup components, which automatically switch on when there is a failure of the primary system. The spectrum of processed data includes flight planning, surveillance, communications, and weather.

The primary automation system of the en route center - the Host computer system - is a major element of the overall national airspace system infrastructure. The Host provides flight, radar, and display data. It interfaces with systems located at different FAA air traffic management and control facilities, as well as with external data sources, such as the National Weather Service, U.S. Customs Service, the Department of Defense, and foreign governments.

AUA plans emphasize the upgrading of the national airspace system automation infrastructure to the standards, technology, and power of commercial processors.



The face of the watch represents the proportion of each equipment age groups found in today's infrastructure. On the rim are milestones representing the evolution of commercial processor technology and power.



projected to increase by 5.7 percent annually. General aviation operations are expected to grow one percent annually during this period. As the industry grows over the years and aircraft and aviation systems became more sophisticated with each leap in technology the nation's air traffic control system will be expanded to ensure the safety of the flying public.

National airspace system users and operators define their needs on a continuous basis. These needs get reflected in research, which is presented at technical and professional symposia and then infused in joint research and development efforts. During the mid-eighties, the FAA recognized the growing user demand and cost of supporting aging systems would require new system hardware components and operating software in the twenty-first century. Reports and studies commissioned at the time emphasized the need to acquire systems and software programs providing common, open interfaces to facilitate equipment upgrade and maintenance and to support future growth. In 1994, the FAA, in coordination with representatives from other government agencies, the aviation industry, and the academic community developed a model for a comprehensive airspace system architecture. AUA, a principal participant in this effort and is using an updated version of the model as a baseline for planning the incremental upgrading and improvement of national airspace system automation capabilities.

The current version of the national airspace system architecture model is being circulated throughout the aviation community to establish a dialogue with users and gather more information about their requirements. AUA product teams are working closely with the Air Traffic System Requirements Service and the airline industry to develop procedures and prototypes for decision support tools. Both the civilian and military operators of the national airspace system are represented on the product teams making decisions about how to enhance current capabilities and recommending which systems to acquire.

Today, the nation's air traffic control automation system supports a set of local, regional, and national capabilities through a multitude of networked automation systems and programs. Using over 800 automation products and services, FAA controllers and specialists manage the busiest, most crowded and safest airspace system in the world.

This photograph of the Aircraft Situation Display at the Air Traffic System Command Center graphically portrays the "busy skies" facing the air traffic managers and air traffic controllers of the FAA

With the advent of modern electronics and automation technology, air traffic control is going to evolve into a system which allows the airspace user to select a flight path and aircraft speed in real time. AUA's vision for future air traffic control and management centers on a collaboratively-managed system in which airspace users take a more active role in system control and FAA restrictions on flight planning and scheduling are reduced. This system will eventually lead to "free flight":

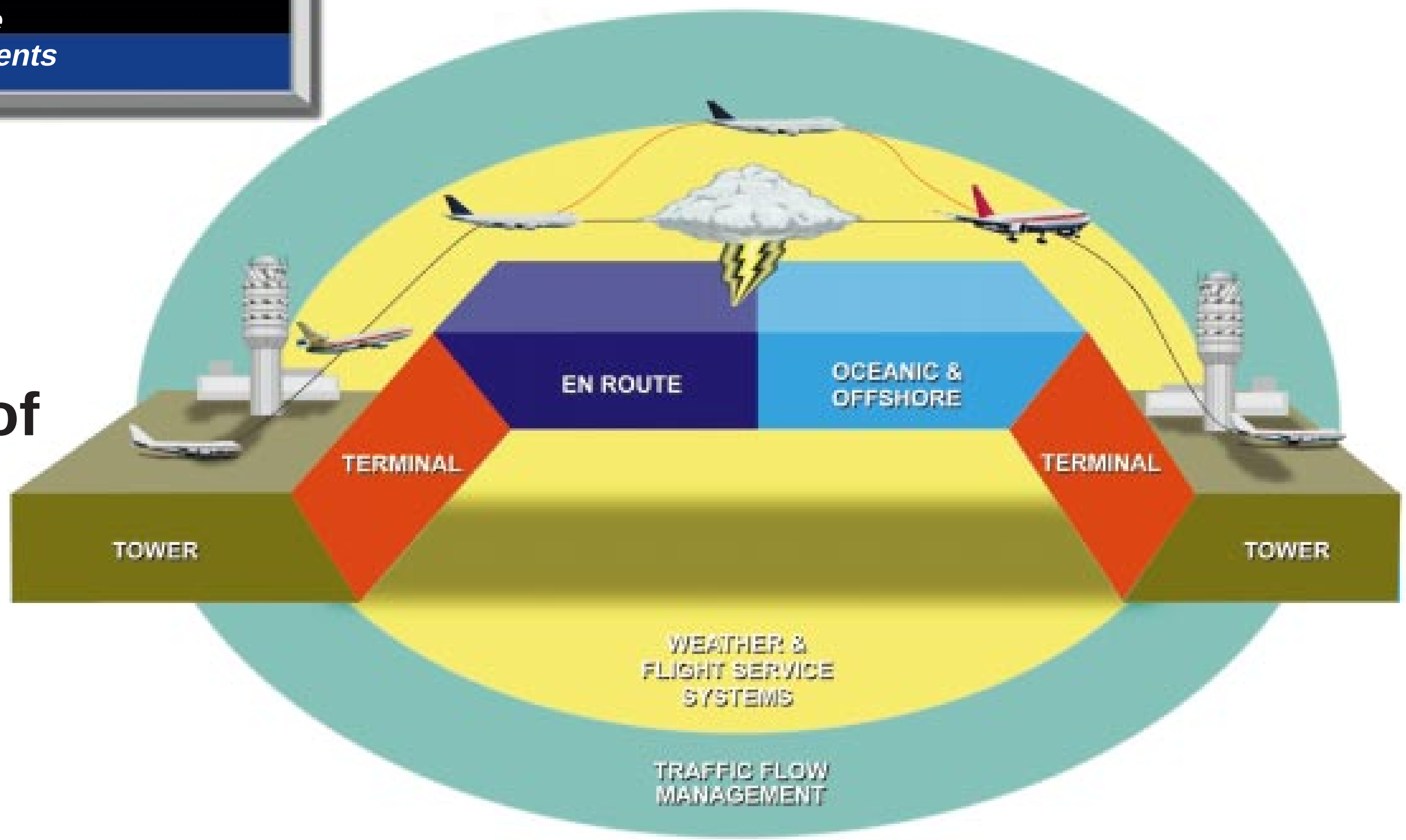
> Free flight is …"a safe and efficient flight operating capability under instrument flight rules in which the operators have the freedom to select their path and speed in real time. Air traffic restrictions are only imposed to ensure separation, to preclude exceeding airport capacity, to prevent unauthorized flight through special use airspace, and to ensure safety of flight. Restrictions are limited in extent and duration to correct the identified problem."

Report of the RTCA Board of Director's Select Committee on Free Flight, Task Force 3.

Moving toward this vision of "free flight" will require marked changes to current hardware systems and operating programs.

Automation Programs Will Meet Future Requirements

Flight Profile of Automation Supported Services



Flight Service: Timely and accurate aviation weather and aeronautical information; pre-flight and in-flight plan processing and briefings; emergency information to general aviation users

Weather: Continuous and accurate information on weather conditions for the national airspace system

Traffic Flow Management: Safe, orderly, and expeditious flow of air traffic across the national airspace system; aircraft situation data to airlines and aviation industry members; automated decision aids to help controllers and air traffic managers reconfigure the airspace to compensate for weather and other disruptive situations

En Route: Automated flight planning and tracking data storage and retrieval across the national airspace system (including military controllers); automated air traffic control including international hand-offs; traffic flow information/decisions; ground-to-ground and air-to-ground voice communications; processed weather information and forecasts

Oceanic & Offshore: International automated flight-planning data; weather information and forecasts; automated traffic management based on aircraft position reports from a variety of sources (high frequency radios, air-to-ground and ground-to-ground live data link, processed surveillance information from sources including automatic dependent surveillance)

Terminal: Automated aircraft separation and spacing during climb-out and descent from tower hand-off to en route hand-off; information on airfield conditions and local weather passed to aircraft directly and via en route controller; automated flight tracking information for terminal controller and tower use

Tower: Instructions, information, and directives for ground operations; departure and arrival information; aircraft de-icing control; airport configuration changes; use of selected runways and taxiways; weather information to local users

Today, AUA is undertaking over 40 capital improvement and research, engineering, and development programs to provide more reliable, easier-to-maintain systems with enhanced capabilities. These systems will provide an infrastructure and features that will move air traffic control and management operations closer to the “free flight” concept envisioned by the FAA and the aviation community.

Using the following systematic, incremental, and evolutionary approach, AUA will achieve the required evolution of automation capabilities.

- *Ensure current system modifications will support existing capabilities, be more reliable, and easier to maintain.* AUA is currently sustaining 20 products, some as old as thirty years. Although many of these products will be replaced by more reliable and easier-to-maintain systems in the near future, AUA is continuously evaluating alternatives for inserting more advanced technology into existing systems and equipment to increase operational efficiency while extending useful life at lower cost to the FAA.

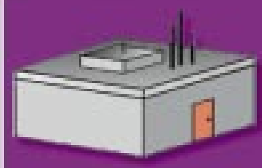
- *Upgrade existing system infrastructure using more reliable, standard, commercially-available hardware and software*. AUA is currently managing eight programs designed to acquire and deploy more reliable, open system computers which allow for growth and future enhancement. These acquisitions are proceeding as planned.

- *Improve automation system capabilities incrementally and use improvements as soon as proven suitable and safe to attain early FAA and user benefits*. AUA is undertaking nine programs which are evaluating automated decision tools and procedures in various stages of concept validation and prototyping. In conjunction with upgrades to the system infrastructure, these new tools and procedures will result in new features that enable controllers and airspace users to collaboratively manage the system more effectively and efficiently.

- *Continue to perform research, engineering, and development to identify enhancements which meet the requirements for future system automation evolution*. AUA is funding nine programs aimed at identifying and validating potential technological enhancements that, when added to the upgraded infrastructure, will enable the FAA to perform its mission, including service and system maintenance, more efficiently. Some of these efforts will result in the development of operational systems which will complete the evolution to “free flight” operations within the next decade.

Safety is paramount at the FAA and will be maintained during the transition to new systems. New systems and features will be installed, tested, and brought into operation without disrupting on-going traffic operations. This complex undertaking will be carefully planned and coordinated between agency organizations to ensure new systems and equipment are properly integrated.

Major program activities include the following:



Flight Service Systems

Upgrade flight service automation to provide a common computer which pilots and flight service specialists can access for weather information and flight planning and filing

The demand for flight planning and filing services continues to grow as the volume of air traffic increases. Flight service information must be readily accessible to users of the national airspace system, since pre-flight planning and knowledge about system status are prerequisites for the safe and efficient operation of aircraft. Flight service specialists currently use two different systems to provide the weather briefing information needed to operate safely in the national airspace. An automated system which integrates the functions of the current systems and provides all required data will be needed in the future.

- 1998-2001. Automated flight service stations will begin to receive the operational and supportability implementation system during this period. The new system enables pilots and FAA specialists to access the same flight planning information. In addition, pilots, through a personal computer, will be able to view and chat with the specialist about a particular product. To be located exclusively at automated flight service stations, the new system will support future enhancements, improving productivity and the quality of services through increased processing speed and easy-to-use tailored products. Maximizing the use of commercial off-the-shelf hardware with open system architecture will provide new options varying from the more traditional depot maintenance philosophy. Instead of purchasing costly depot support equipment and maintaining large inventories of spares, the FAA will be able to remove and replace faulty components and use "just-in-time" inventory processes to significantly reduce support costs over the life of the system.

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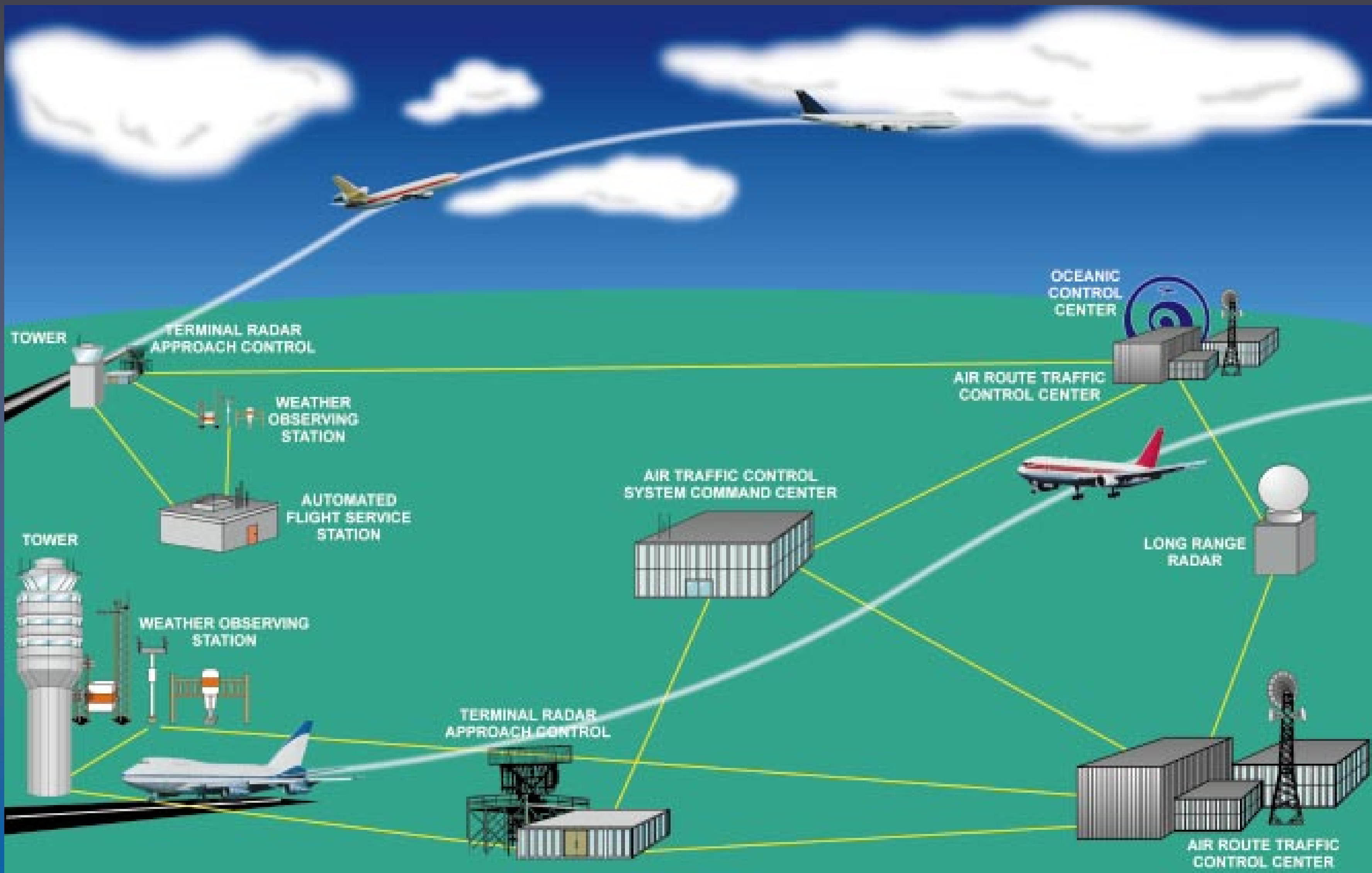
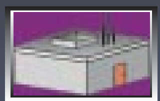
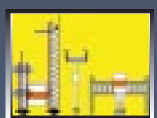
Automation and the National Airspace System



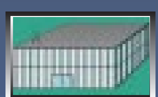
Today's automation systems support all phases of flight, from initial flight planning to successful landing and post-flight analysis. The systems provide communications, surveillance, display, flight planning, and weather data to a suite of computers where the data is processed and then reformatted for use by controllers and traffic managers alike. AUA products and services can be found at all six types of facilities that the FAA operates to provide safe and efficient air traffic control and management services to airspace users.



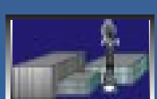
Automated flight service stations provide pre-flight and in-flight services, including flight plan processing, weather information, and emergency assistance to commercial, military, and general aviation pilots. Today these services are provided in a "walk-up" briefing or toll-free via a combination of automation systems - one directly linked to a user's personal computer and the other via telephone briefings by flight service specialists.



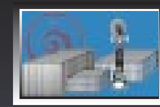
Vital weather information - consisting of observations from manned and automated weather observing systems operated by the FAA and enhanced by data from the National Weather Service, which provides satellite data as well as periodic forecasts - is collected, compiled, and disseminated using processors located at en route centers. Digital altimeter setting data and a time standard are also provided. This information is distributed to all elements of the national airspace system.



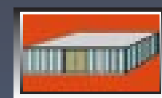
Air traffic managers track and analyze traffic flow across the entire national airspace. Located at the air traffic control system command center in Herndon, Virginia, the managers are supported by personnel and computer resources located at the Volpe Transportation Center in Boston, Massachusetts. Each en route center and selected terminal facilities have interoperational systems which use data provided by the command center to support local traffic flow management decisions. The command center manages ground delay programs to prevent excessive congestion at airports operating within the airspace system. Air traffic management data is shared with airline operations centers, contiguous nations, and the academic community for research purposes.



Twenty en route centers control domestic air traffic not specifically delegated to an oceanic, terminal, or tower control facility. The airspace extends up to 100 miles of the United States coast line and its borders with Canada and Mexico. The en route centers operate the computer suite which processes radar surveillance and flight planning data, reformats it for presentation purposes, and sends it to the displays used by controllers to track aircraft. En route centers also control the switching of voice communications between aircraft and the center as well as between the center and other national airspace facilities. Weather data is processed and distributed by the en route centers.



The oceanic air traffic control centers control aircraft over portions of the Atlantic and Pacific oceans. Two oceanic centers are collocated with en route centers in New York and Oakland, while a third is located at Anchorage, Alaska. The air traffic control provided over the ocean is substantially different from that provided over land since there are few reliable surveillance systems which can provide exact aircraft position. Position reports based on on-board aircraft navigational systems are radioed to the controller. Due to the uncertainty in position report reliability, planned overseas flight tracks must provide greater separation margins to ensure safe flight. The oceanic computer suite has considerable interoperability with the national airspace system.



Terminal facilities provide air traffic control services for an air space located approximately five to 40 miles from an airport and usually below ten thousand feet in altitude. The terminal controller establishes and maintains the sequence and separation of aircraft taking off, landing, or operating within the terminal airspace. Terminals are interconnected with local towers and provide surveillance and position data of aircraft under terminal control to specialized displays within the tower. Selected terminal facilities are interconnected to the traffic flow management systems at the air traffic systems command center. Flight planning documents are provided from the en route computer suite. Weather data is provided from the weather processing and distribution communications network.

Tower controllers manage and control the airspace within approximately five miles of an airport, including taxiways and runways on the ground. Tower controllers control ground operations on airport taxiways and runways and take-off and landing traffic. Towers are provided with flight planning documents by the en route computer suite. Weather information is available from the weather processing and distribution communications network.

From takeoff to landing, users of the national airspace system are controlled and managed by air traffic controllers and traffic flow managers who depend on the reliable operation of AUA products. The capability to operate systems at individual facilities which provide needed information to other facilities integrates the entire system, an essential element in the safe and efficient control of air traffic.

As aircraft are handed-off from tower to terminal, and then to en route control, the automation systems exchange data in real-time. The airspace system requires interoperation of over 50 programs to provide the environmental conditions, surveillance, processing, communications, and user interfaces. Each system has backups to ensure individual failures will not cause the overall system to fail which is critical to system safety for the operator, the user, and the flying public.

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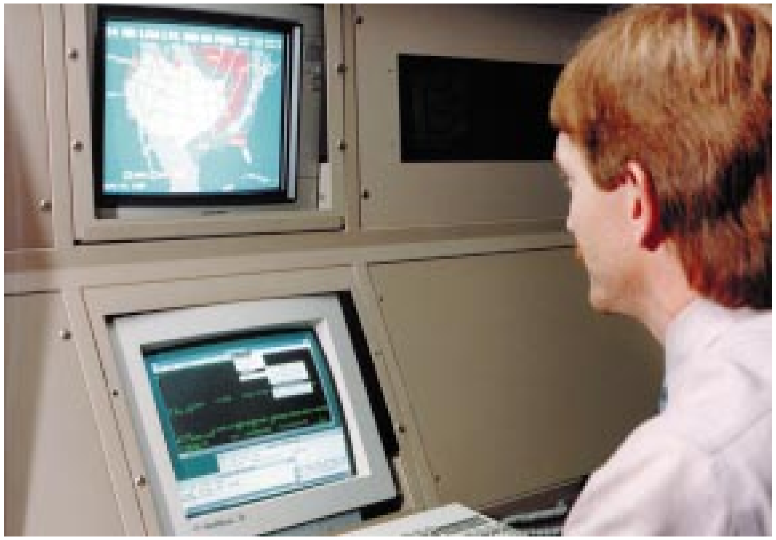
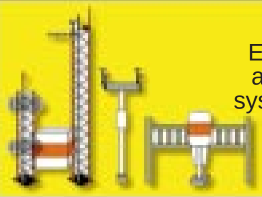
A flight service specialist provides pre-flight data to a national airspace system user. The 61 automated flight service stations across the nation handle as many as 50,000 calls per month.





Weather

Expand the distribution and consistency among automated weather observation systems; upgrade models and processors; and provide accurate long range and short range forecasts across the airspace system.

1997-1999. Automated observing systems are being procured and installed to provide data on current weather conditions at many towered and non-towered airfields. These additional sites will provide consistent weather measurements over a wider expanse of territory. The sites will provide more timely and accurate forecasts by weather analysts. System performance is monitored at a central location and maintenance technicians are dispatched, if required, to maintain the weather observing systems. This centralized approach minimizes support costs while maintaining high reporting availability.

1997-2001. The weather and radar processor is a state-of-the-art automated system which collects, processes, and disseminates “next generation” radar weather data and other weather information to air traffic controllers, traffic managers, meteorologists, and other users. The system will provide a mosaic of weather images, thereby improving the quality of weather information available.

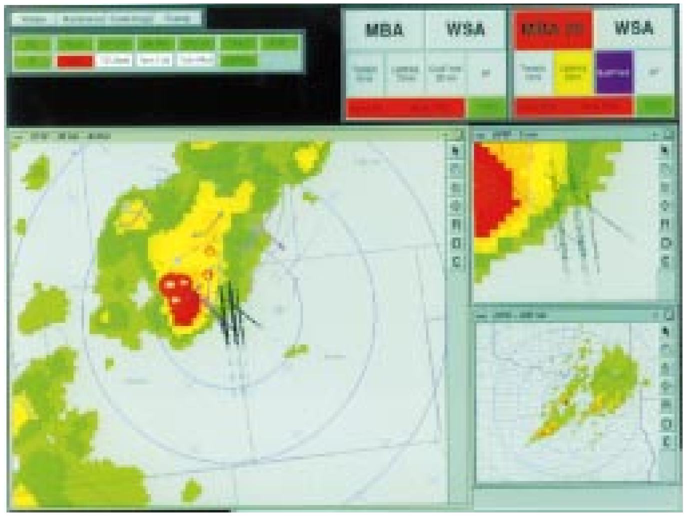
Development and deployment of the system will occur in phases, beginning in 1997. The initial phase provides for the leasing of commercial off-the-shelf hardware and software components as a replacement for the existing meteorological weather processor. In the succeeding phases, the leased system will be upgraded to receive and process next generation radar inputs and distribute related weather information to controllers and traffic flow managers at en route centers. Like many of the automated systems being deployed, the weather and radar processor system will be monitored by a “health” sensing system connected to an operations control center. Malfunctions will be sensed in real-time, speeding corrective maintenance and decreasing the duration of degraded operation.

Automated observing systems are to be provided to many towered and non-towered airports throughout the United States. The systems continuously collect and disseminate surface weather data.

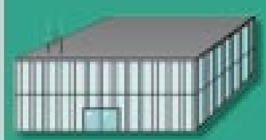
Meteorological data is transmitted to a processor located at an en route center. The weather and radar processor will provide en route air traffic controllers with improved weather displays and better methods for interpreting traffic flow and weather information.

2001-2003. An integrated terminal weather system will provide current terminal weather and accurate short-term (30 minutes into the future) weather forecasts. The system will integrate various meteorological data and products from FAA and National Weather Service automated observing systems, terminal doppler weather radar, airport surveillance radar, next generation weather radar, down linked data from aircraft, and low-level windshear alert systems. FAA controllers will be able to provide airspace system users with critical flight weather information, including windshear, microburst prediction, terminal area winds (both on the runway and aloft), and cloud ceiling and visibility predictions.

1997-2005. In a collaborative effort with government, the aviation industry, and the academic community, aviation weather research develops new tools for continuously measuring and forecasting hazardous aviation weather conditions. Sensors and models are being developed that will aid in the understanding, detection, and prediction of thunderstorms, in-flight icing, snow forecasts (i.e., ground de-icing), turbulence, cloud heights, and visibility, as well as new aviation-related weather information databases and improvements to forecasting models.



This integrated terminal weather system controller display depicts hazardous weather conditions about to engulf the Dallas-Fort Worth airport. The circles indicate thunderstorm downdrafts that would produce a 30 knot (20 mph) airspeed loss (windshear) when encountered by an aircraft.



Traffic Flow Management

Upgrade traffic flow management automation infrastructure; perform research, validate, and implement new capabilities, including decision support tools for conflict resolution and collaborative decision-making

The Air Traffic Management Integrated Product Team manages the acquisition of systems supporting traffic management services, which include the safe, orderly, and expeditious flow of air traffic, aircraft situation data for the airlines and aviation industry members, and automated decision support tools for system reconfiguration.

1997-1998. The traffic management system will be rehosted on a commercially-available, open system computer to eliminate dependency on a proprietary software. The new computer will serve the traffic management system at the national, en route center, and

The Air Traffic Control System Command Center manages national airspace system traffic flow.

selected terminal facility levels. Implementation of the new operating software will allow for more efficient processing at the sites, thereby reducing system response times. Hard-to-maintain hardware and proprietary software will be replaced, reducing maintenance cost and providing a modern, open system infrastructure capable of supporting enhanced functionality in future years.

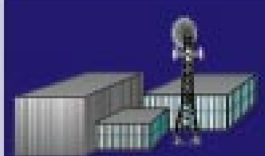
1998-1999. The traffic flow management hub computer complex performs the bulk of national-level traffic flow operations processing. The hub performs national airspace system demand/capacity modeling, develops airspace situation displays, and monitors the overall system for overload conditions. The hub computer suite will be replaced and will use previously upgraded software.

1997-2005. Functional enhancements to national-level traffic flow management capabilities and decision tools will be evaluated and enhanced in partnership with national airspace users. The goal of these studies is to facilitate collaborative decision-making between FAA and airspace users to their mutual benefit.

The Air Traffic Management Integrated Product Team also manages the development, acquisition, and deployment of decision support tools used by controllers and traffic management specialists to predict and optimize national traffic flow. Primarily research and development activities, these efforts proceed through design and evaluation prior to entering full scale engineering development. Once the FAA makes a decision to implement a new capability, full-scale development, production, and deployment is carried out by the appropriate AUA product team.

1998-2005. Capabilities under study will provide automated flow management tools to traffic flow managers and controllers. The tools will be used to assist control personnel in optimizing traffic arrival rates, merging multiple streams of traffic, and managing terminal controller workload.

1999-2000. A two-year evaluation of air traffic management concepts and technologies in Hawaii and Alaska called "Flight 2000" will demonstrate the abilities of existing technology to support the concept of free flight. Technologies being tested in the project include the global positioning system navigation satellites; digital data link for communications, navigation, and surveillance; and conflict probe and safety alert systems for both the aircraft and the ground. The evaluation will help to determine the benefits of providing weather displays, collision avoidance alerts, and other safety instruments directly into the cockpit.



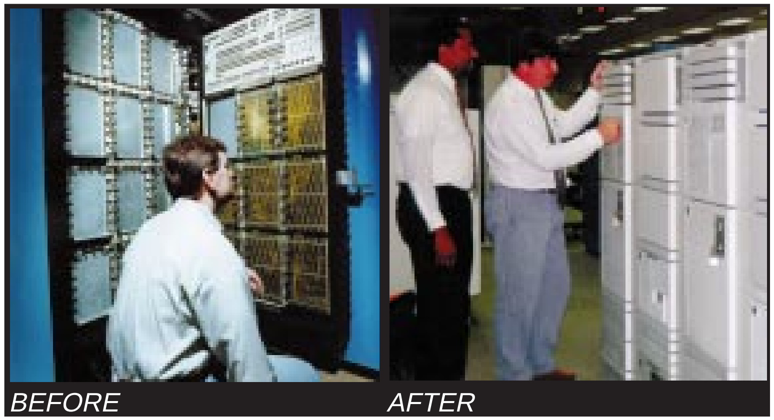
En Route

Upgrade existing infrastructure to common processing computers; transfer existing en route and traffic flow management capabilities and features to the new computers, and standardize interfaces and common software

1997. The replacement of aging telephonic switching equipment and air-to-ground circuits with a single integrated computer controlled, digital voice switching system is completed. The new communications systems became fully operational at all 20 air route traffic control centers on February 18, 1997. The voice switching and control system enables en route controllers to talk to aircraft pilots and other controllers. The switching system employs modular architecture to support growth, increased capacity, and added functionality. Operational displays and controls are fully compatible with the controller interface in order to support future upgrades to the national airspace system. The system includes a microprocessor-based digital switching subsystem and interactive infrared color touchscreen display monitors. The switching system will also be installed in the new controller workstation consoles being phased into service during the 1998 to 2000 timeframe.

The voice switching and control system in the existing controller workstation. This system represents the first digital technology upgrade deployed to en route centers. The $1.6 billion program was deployed on schedule and within budget.

1997. Hardware infrastructure improvements are made as state-of-the-art computers are installed at five en route centers to replace failing display channels. The display channel complex rehost consists of modern, commercial-off-the-shelf computers which receive aircraft position and flight planning data from the en route computer processor suite and reformat it for presentation on radar displays used by en route controllers to track aircraft movement. The rehost is an interim upgrade designed to ensure the reliable operation of the national airspace system until new controller workstations - the display system replacement - become fully operational beginning in 1998.



The display channel complex rehost is an example of new technology insertion in the existing system. Requiring only ten percent of the space needed by the old display channel, the new system is four times as power efficient. Processing speed has been increased 5 fold and memory 16 fold.

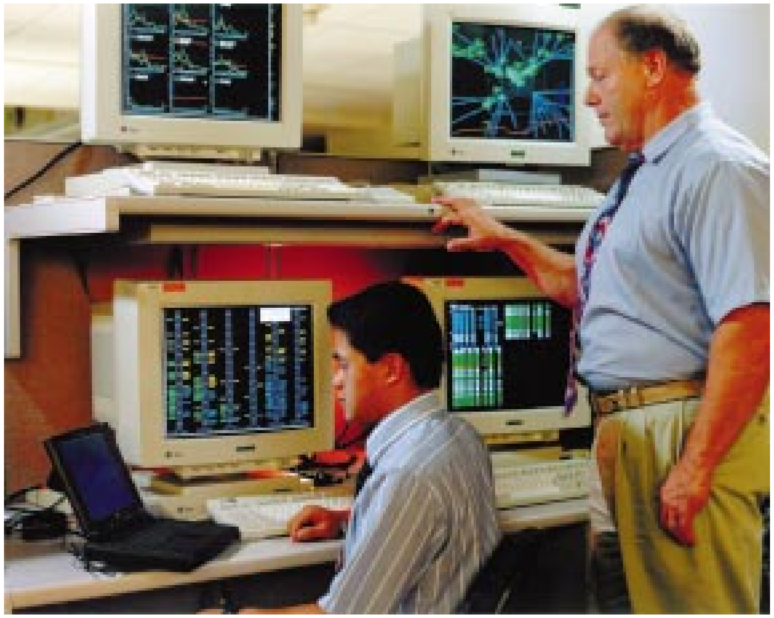
1997-1998. A new local area network and appropriate interface devices employing industry standard network protocols are installed to network multiple new applications such as traffic management functions to the en route prime processing system.

1998-2000. The display system replacement will be deployed at 20 en route centers. The system modernizes the air traffic control automation infrastructure at the centers and provides a hardware platform for future enhancements. Replacing aging, 20-to-30 year old en route controller workstations, computer suite components, and software, the new display systems provide the interconnectivity needed to receive the weather inputs from weather processing and sensing equipment being upgraded. The system also replaces the aging printers which provide controllers with flight data information.

The display system replacement is a critical part of the en route infrastructure and operations must be highly reliable. If there is a failure, it must be easily restored to full operation. This is accomplished using redundant hardware and software, automatic recovery features, along with a fully integrated and automatic fault detection and isolation routine. These features identify faults and the failed units with no degradation or disruption to air traffic control operations.

The display system replacement in operation with the voice switching and control system

1997-2001. Research, engineering, development, and prototyping of automated flow management tools designed to optimize traffic arrival rates is continued and yields a set of traffic control tools that can be integrated into the upgraded display system platforms at en route centers. Automatic conflict detection/alert tools are also developed, validated, and prototyped. These tools will provide the capability to automatically alert pilots to potential conflicts with other aircraft.



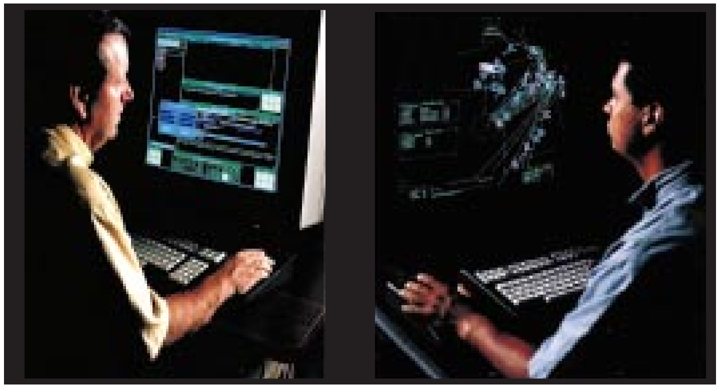
Developing prototype decision support tools to provide automated flow management upgrades for the en route system

2001-2005. Planning is completed to replace the 16 year old computer processor performing bulk processing for en route operations. The existing system will be nearing the end of its useful life and maximum processing capacity. The new computer system architecture will conform with previous en route upgrades by using commercial-off-the-shelf hardware and software products.

Oceanic

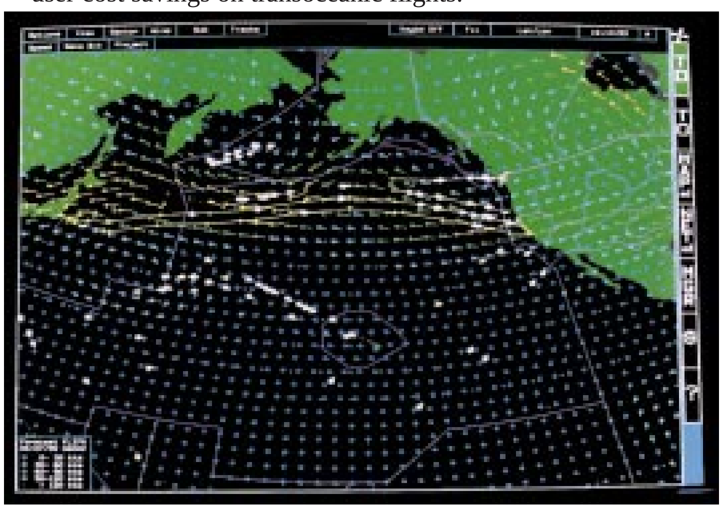
Upgrade existing infrastructure to common processing computers; introduce the use of data down link for enhanced satellite-based communications and automatic dependent surveillance to provide traffic control capability for oceanic control and a more flexible route structure with reduced separation standards

1997. The oceanic display and planning system has been upgraded with a state-of-the-art telecommunications processor and situation display. The equipment provides a new oceanic controller workstation which dramatically improves maintainability and reliability, while providing a platform for future system enhancements. In addition, a new, upgraded surveillance processor, the micro en route automated radar terminal system is operational at offshore FAA facilities.



The telecommunications processor supports air traffic control using an air-to-ground data link to the oceanic center (left). A new controller workstation is being field tested at the Oakland oceanic control center (right).

1998. The dynamic ocean track system generates flexible oceanic routes which take into account user requirements with respect to wind and weather conditions. The aging hardware in this system will be upgraded with new, commercial-off-the-shelf equipment and system functionality will be enhanced. Provision of improved weather information will enable the flexible oceanic routes to be even more time- and fuel-efficient, thereby providing additional user cost savings on transoceanic flights.

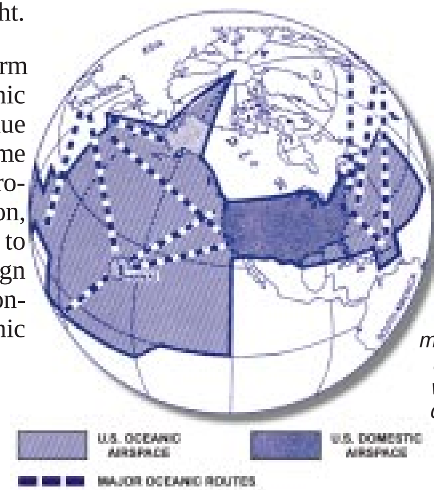


A reproduction of a dynamic ocean track system screen displays the traffic under control across the Pacific Ocean

1998-1999. The oceanic display and planning system will be incrementally improved. The interim situation display and telecommunications processor systems previously deployed provide the infrastructure needed for adding new functionality. Air-to-ground data links have been established in South Pacific airspace as a result of FAA, industry, and foreign government efforts. In addition, an automated conflict probe is used to manage air traffic in U.S.-controlled Pacific airspace. System enhancements include a conflict probe expansion system adaptation for use in New York oceanic airspace. An oceanic data link capability for transferring aircraft navigation information automatically via satellite to controllers will be expanded to include more oceanic airspace and aircraft. The automatic down link will provide improved position and performance data. The increased accuracy and frequency of this data will allow the reduction of lateral separation by approximately one half with no decrease in safety. The reduction of these standards coupled with improved automated tools for enhancing interfacility communications and assisting in forecasting and preventing potential traffic conflicts should bring major economic benefits to oceanic airspace users with no degradation in safety.

2000-2001. During this period, oceanic center operations will evolve based on an evaluation of prototype system performance, including the future air navigation system one project and the Flight 2000 project. Today, the separation standards provided over oceanic airspace are a level of magnitude greater than those provided for aircraft flying over land because of limited aircraft position data availability. The application of new technologies, such as data link, will for the first time provide immediate aircraft position data in oceanic airspace. These new technologies offer high benefit-cost ratios in terms of accommodating increased oceanic traffic volume. They will also provide the flexibility needed to move toward free flight.

2000-2005. Long-term planning for oceanic systems will continue based on the outcome of the Flight 2000 project demonstration, which is expected to yield important design and development considerations for oceanic control centers.



United States oceanic centers manage and control 80 percent of the world's controlled oceanic airspace.

Terminal

Upgrade existing terminal automation infrastructure with new computers based on commercially-available hardware and software

The national airspace system's 207 terminal facilities currently employ three types of automated terminal systems. Current efforts focus on sustaining their operation with limited hardware and software upgrades until they are replaced by a standardized system in 2001.

- 1999-2000. The standard terminal automation replacement system will be acquired as a joint FAA/military procurement, thereby realizing cost savings for the government. The infrastructure and operational software provides a platform that will accommodate the introduction of new automation functions needed to ensure safety and enhance airspace user efficiency and flexibility in the future.

The use of commercial off-the-shelf equipment, coupled with hardware containing many common system components, will significantly reduce maintenance costs. System operational status and failure monitoring and recovery will be possible locally or from centralized control centers collocated at the terminal facilities or at remote locations. At these facilities, maintenance personnel may conduct fault diagnosis and isolation to aid in the replacement of the faulty modules. Software will be centrally maintained, upgraded, and then distributed to operating systems over the FAA wide area network, where it will be installed without disruption to air traffic control operations. These innovations will increase productivity and reduce system down time.

The standard terminal automation replacement system will be installed at 171 FAA terminal facilities which support 362 airports. This system will also be fielded at 124 military facilities.

- 2001-2005. The standard terminal automation replacement system becomes operational, thereby providing the infrastructure needed to support terminal area functional enhancements. Pre-planned functional enhancements will be fielded incrementally by the year 2000. The functionality enhancements include tools for the optimal merging of multiple streams of aircraft and flight profiles which minimize fuel consumption.

Tower

Enable tower facilities to interoperate with all required systems of the national airspace infrastructure.

- 1996-1997. A pre-production, surface movement advisor prototype is in operation at Atlanta's Hartsfield Airport. The prototype is designed to help all system users collectively expedite the safe, orderly, and efficient movement of traffic on the airport's surface. It provides dynamic prediction capabilities and unprecedented access to surface movement and planning data, all of which will be used to augment operational decisions made by airline personnel, airport managers, and air traffic controllers. A full-time, operational assessment of the system is being conducted to determine whether the system and its forty new functions provide sufficient benefits to justify expanded national deployment. After the assessment is completed, system impact on airport and surface traffic operations will be evaluated. The system may yield improvements in ground movement operations and savings in fuel consumption. The assessment data will also be used to facilitate decisions about future system installations around the country.

With increased traffic expected at both civilian and military towers during this period, it will be necessary to install an additional 48 digital bright radar indicator tower equipment systems in selected towers. These systems increase airport safety and reduce controller workload by providing a situation display of aircraft activity in the tower. The procurement is an interim activity, since the displays will be replaced by the standard terminal automation replacement system scheduled to be fielded at these sites beginning in 2001.

- 1999-2001. Air traffic control towers will be upgraded in conjunction with the installation and operation of the standard terminal automation replacement system. The upgrade will include modification of the tower air traffic situation display so that it will operate in conjunction with the new terminal system.

The AUA approach will result in a national airspace system automation infrastructure with the computer and software programs in place which are required to move toward free flight. This evolutionary, incremental approach for upgrading the system will ensure continuity of service to both the airspace user and the flying public. The development of decision support tools which assist controllers and traffic flow managers along with collaborative procedures developed with the aviation industry will add flexibility and efficiency to the system. System users may quickly derive benefits such as better on-time performance - an "added value" immediately visible to the airspace user and the flying public.

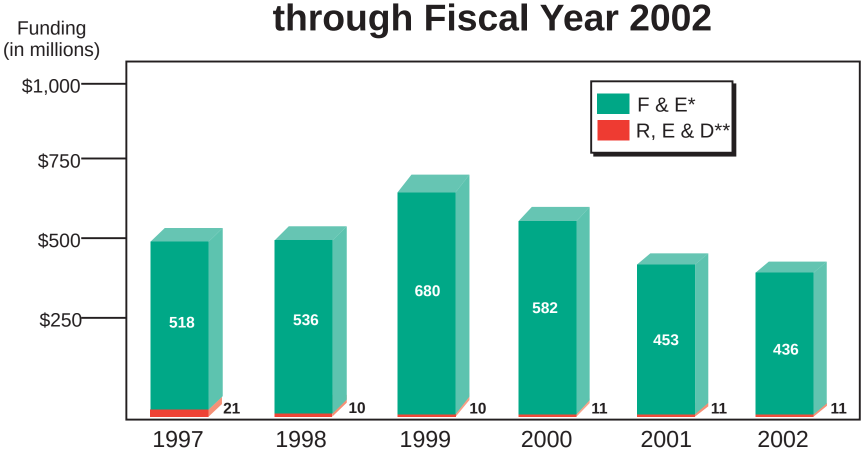
The new Dallas-Ft. Worth airport tower. This tower, like other towers around the nation, houses the terminal radar approach control facility.

AUA Measures Progress Toward Automation Goals

User requirements and FAA goals and priorities are documented in the product plan which describes the means by which a product team will organize, operate, and interact with other teams as well as other FAA organizations and airspace user groups. A product plan is developed by the integrated product team and then approved by the agency.

Product team progress against the plan is measured by a performance measurement system which includes earned value management to measure progress against a baseline of cost, schedule, and performance goals. Earned value management provides quantifiable measures for evaluating cost and schedule performance. The data derived from the system is used to project future outcomes based on past performance as well as forecasts of at-completion results. Earned value management is one of many tools product team managers are using to make more effective decisions concerning the development and acquisition of new automation products.

Requested funding for AUA programs through Fiscal Year 2002



* Facility and equipment funding is used to develop selected solutions and purchase the equipment and software that will be used to satisfy FAA mission requirements.

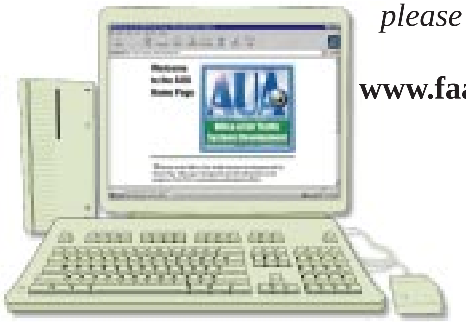
* * Research, engineering, and development funding is used to perform research to define mission needs and develop preliminary candidate solutions.

The budget profile displays current research, engineering, and development and facilities and equipment funding levels through the year 2002. These budget levels are adequate to accomplish the current AUA plan for automation upgrades during that period. However, as new requirements are identified, the budget profile and the allocation within the profile will be adjusted to reflect those needs. AUA recognizes other new automation systems and capabilities will be needed beyond 2002 to complete the evolution to the "free flight" operational concept. The current budget levels provide research, engineering, and development funding to procure analysis and data for selecting the best technological alternatives for meeting future operational requirements.

AUA is making substantial progress on all its programs. AUA is executing its plan for evolving current automated systems for air traffic management and control to even higher standards of safety, efficiency, and convenience to the flying public.

"We live in times of change, and we will either be architects of the change or the victims of it."

- John Volpe
Secretary of Transportation,
1969-1973



For additional information concerning the Office of Air Traffic Systems Devlopment, please visit us at our web site:

www.faa.gov/aua/auahome.htm

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