FAA Financial Requirements

June 4, 1997

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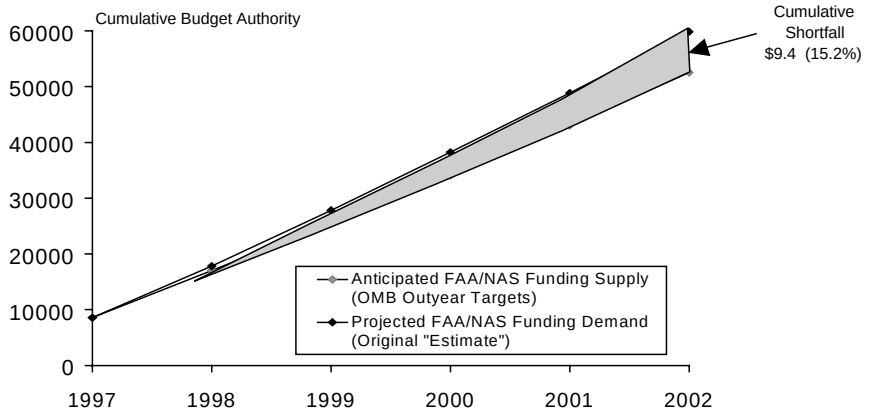
In June 1995, the FAA developed a "total requirements" estimate for the period FY 97-FY 02 to help explain the difficulty of supporting a dynamic, growing aviation industry under a federal budget picture which projected flat or reduced funding for the agency. The FAA's estimate for the six-year period was $59.3B in budget outlays. An update to this estimate in January 1997 produced a slightly increased requirement of $60.3B. Projections for FAA's funding level within a balanced budget framework have ranged from $45B to $50B, leaving an estimated shortfall of at least $9B as illustrated in Figure 1.

Figure 1. Summary of FAA/NAS Funding Demand vs. Supply, FY 97 through FY 02.
In millions of dollars



Source: ASD SETA Contractor, March 1997.

Coopers & Lybrand's (C&L's) independent financial assessment determined that the FAA's calculation of requirements were reasonable under a status quo environment. C&L argued that this status quo was unsustainable and suggested numerous cost-saving opportunities. (They also recognized the difficulty in achieving agreement on reductions.) C&L pointed out potential cost ***increases*** the FAA may face such as the Gore Commission recommendation to accelerate modernization, problems with FAA computers approaching the year 2000, and the Flight 2000 initiative which provides equipment for aviation users to test Free Flight capabilities in Alaska and Hawaii.

For purposes of discussion, this paper will use the FAA's January 1997 estimates as the basis for the future requirements. These estimates are for appropriated amounts required over the six-year period. The $61.9B in budget authority equates to $60.3B in outlays or a $1B increase over the initial $59B estimate. The increase results from Gore Commission recommendations for additional security and safety personnel as well as additional security equipment over the six-year period. The Gore Commission recommendations to accelerate modernization have not yet been included. Table 1 depicts the FAA's January 1997 estimate of requirements.

TABLE 1. REQUIRED BUDGET AUTHORITY FOR FAA FINANCIAL FY 97 THROUGH FY 02. - "ORIGINAL

	FY 97	FY 98	FY 99	FY 00	FY 01	FY 02	Cumulative Totals
Operations	4,954.9	5,386.1	5,845.0	6,231.7	6,597.7	6,960.5	35,975.9
Facilities and Equipment	1,937.5	1,875.0	2,436.3	2,515.9	2,516.4	2,331.2	13,612.3
Additional Security	0	0	150.0	150.0	150.0	150.0	600.0
Research, Engineering and Development	208.0	200.0	441.0	426.0	415.0	420.0	2,110.0
Airport Improvement Program	1,460.0	1,000.0	1,950.0	1,900.0	1,638.1	1,638.2	9,586.3
Total Budget Authority	8,560.4	8,461.1	10,822.3	11,223.6	11,317.2	11,499.9	61,884.5

FAA "Revised Outyear Estimates", January 1997.

Please note the sharp increases between FY 98 and FY 99 reflect that FY 99 numbers represent the first year in which FAA estimated requirements no longer reflect actual appropriated budgeted amounts or a budget submission. At the time this estimate was developed, the President's FY 98 budget had been sent to Congress.

The purpose of this paper is to explain the basis of the FAA requirement estimate. The paper will include a section for each of the following three appropriations areas:

Section A: Operations;
Section B: Facilities and Equipment; and
Section C: Research, Engineering, and Development.

The fourth appropriation area, the Airport Improvement Program (AIP) will be addressed in a separate paper.

Lastly, **Section D** entitled "User Investments," will discuss the investments required by the aviation system users to modernize their avionics to be compatible with the FAA's future space-based navigation system. User investment in avionics will be a key component in reducing the FAA's maintenance costs for land-based navigation systems.

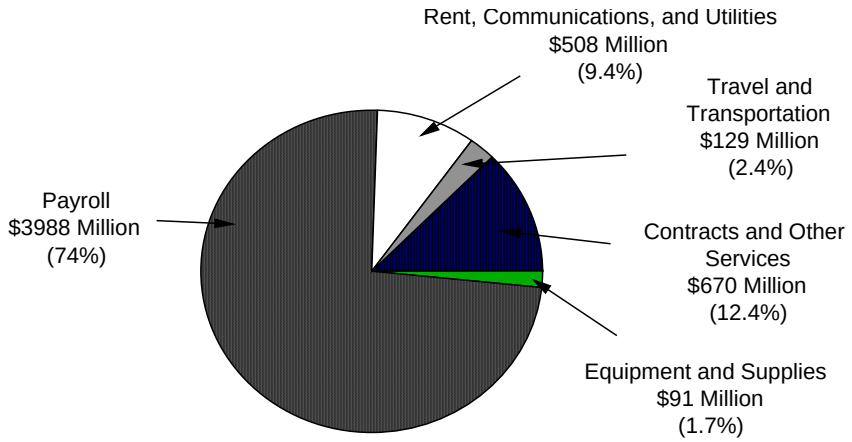
Also note, there may be short and long-term ties between appropriations. Investments in facilities and/or equipment may reduce operations costs if a new system requires less maintenance or automates a function. Many of the FAA's investments, however, involve new sites or new functions required to meet the capacity demands of the users. For these investments, the operations and maintenance costs will normally increase. With all FAA investments the transitions must be done real time which requires supporting both the old and new systems for

some period of time. Where new systems are tied to new aircraft avionics, the FAA must support old and new systems until all aircraft are upgraded (or deny services). These nuances account for why an immediate decrease in the FAA's operating costs is not seen neither during or right after modernization. Most savings for investments in the FY 98-FY 02 time period will not be realized until after FY 02.

Section A: Operations

The operations account finances the personnel and support costs required to operate and maintain the ATC system, and to ensure the safety and security of its operation. It is the FAA's largest account, comprising 64% of the agency's FY 98 budget submission to Congress, and it pays for most of the FAA's personnel, (74% is spent on payroll). Figure 3 illustrates the breakdown of expenditures within this category.

Figure 2. Spending Distribution by Major Object Class within the Operations Appropriation, FY 98.



Source: FAA Budget in Brief, FY 98, Figure 3, page 7.

The operations portion of the $61.9B estimate ($36B) provided resources (with inflation) to continue existing services (FY 95) through the six-year period along with the following expenses: growth in the controller work force to accommodate anticipated growth in aviation activity; minimal growth in the maintenance technician work force (25 per year); and increases of $70M-90M per year for the operation and maintenance of new NAS systems coming on line.

This operations estimate also includes growth in safety inspector and security work forces as recommended by the Gore Commission; and the "non-safety" work forces will be held constant. As stated previously, operations cost increases associated with Gore Commission recommendations accelerating modernization.

Regarding Air Traffic Control staffing increases, between FY 97 and FY 02, the controller work force will expand from 17,300 to 18,022 personnel. The expansion is mainly in response to aviation activity. The increase in demand for controllers in relation to aviation activity is illustrated in Attachment B. The projected aviation activity indicates a growth of approximately 18% by FY 02. NAS "Hand-off" represents increased annual operations cost to provide maintenance and operations support for new deliveries being funded through the Facilities and Equipment (F&E) account, and is the only significant nonstaffing portion of operations that would increase.

In the area of Regulation and Certification (AVR), certification is a high-priority activity for which funding requirements are growing in both flight standards and aircraft certification. For example, in flight standards, the estimated growth for certificate management is forecast at 3.4% annually. In aircraft certification, the forecasted growth is approximately 5-6% annually. Additionally, Congress approved 154 additional inspectors, 152 administrative and clerical support in flight standards and 106 technical and support personnel in aircraft certification. These additions are a part of the outyear estimates.

Additionally, in the $61.9B requirements estimate there is approximately $214M for the implementation of Challenge 2000 (a study that examined AVR's work and concluded in part that the aviation industry will present challenges to the certification process); the implementation of the 90-day safety review (a review that examined immediate areas of concern of the agency especially with respect to safety inspections); and additional training and staffing of 612 new employees. Finally, the Gore Commission made several recommendations for which funding requirements were not included in the $61.9B requirements estimate.

The FAA's security program was reviewed by both the Aviation Security Advisory Committee (ASAC) and the Gore Commission. Both reviews indicated shortfalls in the current civil aviation security system. The ASAC contends that terrorism is a national security issue and, as such an improved security baseline should be funded by a Congressional appropriation from the general fund. They estimate a funding level of approximately $9.9B over the next 10 years. No decision about funding sources or the FAA's portion of these expenses was made.

The Gore Commission recommended that a total of 600 additional security personnel be hired over the next 3 years. This equates to approximately $100.9M in FY 97-FY 02. One-half of the 600 additional security personnel are included in the $61.9B requirements estimate.

Potential cost saving and/or cost avoidance initiatives for air traffic, regulation and certification, and security are included in the cost savings paper.

Attachment C includes a detailed breakout of the operations estimate for each of the FAA lines of business (LOB).

Section B: Facilities and Equipment

The FAA capital inventory includes over 24,000 facilities or equipment sites. These include 591 major air traffic control facilities, 396 radars, 1,027 navigational aids, 1,197 landing systems, and 2,427 communication sites. Most of these facilities and systems are being modernized. Table 2 illustrates a part of the FAA's aging infrastructure in need of modernization.

Table 2.

The NAS Is Aging

NAS Systems / Facilities Essential for Providing Air Traffic Control Services:

System / Facility	Average Age (Years)	Quantity	Year of Replacement
Control Facilities			
Air Route Traffic Control Center (ARTCC)	37	21	None Planned Some Modernization
Terminal Radar Approach Control (TRACON)	31	170	3-5 TRACON / ATCTs Planned Replacements / Year
Air Traffic Control Tower (ATCT)	27	476	
Computer & Display Systems			
ARTS Data Displays	24	100	98 - 04
ARTS Radar Displays	13	200	98 - 04
Direct Access Radar Channel	11	20	02 – 05
Host Computer	9	20	02 - 05
Communications Systems & Facilities			
Remote Center Air / Ground Communications	23	701	04 – 12
Remote Transmitter / Receiver	18	1,265	04 – 12
Radar Systems			
Air Traffic Control Beacon Integrator - 4	26	81	99 – 03
Air Traffic Control Beacon Integrator - 5	21	162	99 – 03
Airport Surveillance Radar - 7	19	35	98 – 02
Airport Surveillance Radar - 8	16	70	99 – 02
Air Route Surveillance Radar - 3	16	22	01 – 04 Service Life Extension Project

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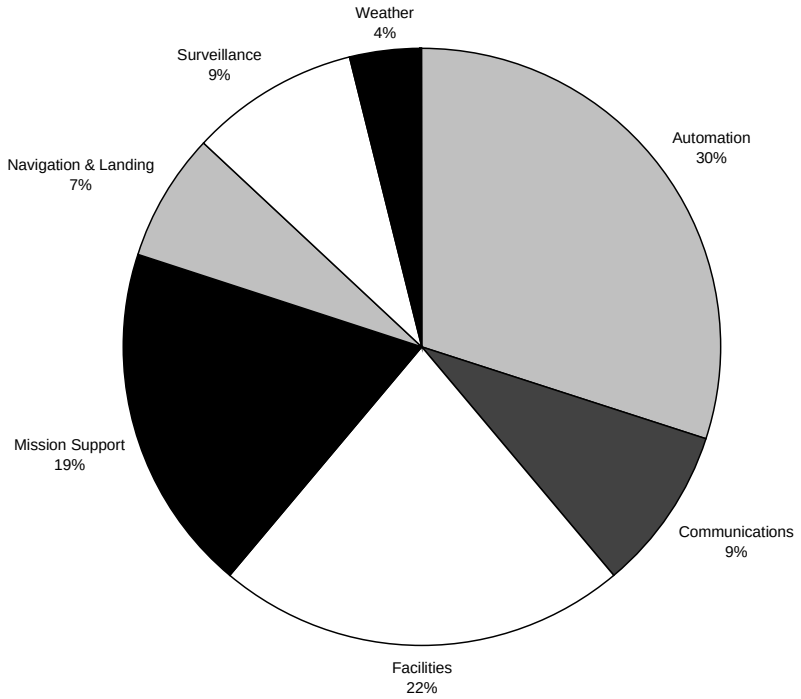
The (F&E) account contains the FAA's funding for all capital investments (except airport infrastructure) including development, implementation, and the first year's support costs. Currently, the F&E account is made up of nearly 200 individual projects which are individually justified in the budget to Congress. For planning purposes, the FAA groups these projects into the following categories: automation, communication, mission support, navigation and landing, facilities, weather and surveillance.

Figure 3 below illustrates the percentage of F&E funds allocated to these investment areas.

Figure 3.
FY 97-FY 02 Facilities and Equipment (F&E) Budget Authority by Functional Area



The following discussion includes the impacts on F&E of the FAA level based on the "total requirements" assessment, accelerated funding level and reduced (i.e., continuing at current funding levels) funding level. In the FAA's revised requirements estimate of $61.9B, the F&E

portion is $13.6B. From FY 99-FY 02, the average annual F&E investment will be approximately $2.4B. In FY 97, the F&E appropriation was $1.9B. F&E has been decreasing since FY 92 when it was $2.4B.

- **Required F&E Funding Level**[1]

The $2.4B annual level allows the FAA to both modernize aging infrastructure and cost-effectively implement new air traffic control (ATC) tools. Many of the new tools which provide cost savings to airway system users are now in prototype form. These systems include: Conflict Probe, Traffic Management Advisor (TMA), Final Approach Spacing Tool (FAST), Integrated Terminal Weather System (ITWS), and Surface Movement Advisor (SMA). To deploy these tools on a national level requires significant "hardening" of the software code. As the FAA controllers begin to rely on these tools and aircraft separation is reduced, it becomes extremely important that these systems are highly accurate and reliable. The tools above represent more than one million lines of software. Full Scale Development (FSD) and implementation across numerous sites with unique requirements is both time consuming and costly.

With funding at the FAA's required level, a modernized infrastructure would be available to the user community by FY 07. Modernization includes a new space-based navigation system, new communications with automatic data link between controllers and the aircraft cockpit, and new controller automation equipment in ATC facilities. Although the FAA will have a modernized infrastructure by FY 07, the FAA has projected that all aircraft would not be upgraded until FY 12. During this period the FAA will be required to operate and maintain both the old and new infrastructures. Aircraft may also be required to have dual equipment as the FAA modernizes over time. The FAA is striving to strike a balance between effectively implementing ATC modernization, dual equipage and sustaining existing capabilities.

Also included in the FAA's estimates are the modernization and/or replacement of many of the 591 ATC facilities, support contractors, facility leases, support equipment, hazardous material management and environmental cleanup. The revised requirement estimate also includes an additional $600M for aviation security. It is an initial estimate inserted for explosives detection equipment at airports, similar to equipment acquired in the FY 97 supplemental appropriation. This equipment included sophisticated baggage checking equipment for installation at the FAA's top 30 airports.

- **Accelerated F&E Funding Level**

An accelerated funding profile requires that the FAA embark on concurrent transitions of navigation, surveillance, communication and ATC automation systems. The rapid deployment is intended to increase the collaboration ability between the FAA and users, which will increase the flexibility, predictability, and availability of the system. The risk for successful implementation is significant due to aggressive development and deployment schedules, extensive cross domain integration, and training across multiple new systems while still operating many older legacy systems. This also assumes aggressive user transition to the new CNS avionics. These are many of the same risks that applied to the Advanced Automation System (AAS) of the 1980s.

In 1997, the White House Commission on Aviation Safety and Security (The Gore Commission" issued its report. Many of its recommendations have significant funding implications, which were not included in the original estimate of FAA requirements. The major recommendations significantly impacting FAA costs are:

(1) Deploy existing security technology to airports;

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[1] "Required" represents the F&E level in the January 1997 FAA "total requirements" assessment.

(2) Form joint Government-industry R&D program for security;
(3) Reduce the accident rate by a factor of five within a decade;
(4) Accelerate NAS modernization to achieve full operational capability by FY 05;
(5) Commit greater resources to improving aviation security as a national security issue, and provide substantial funding for capital improvements;
(6) Accelerate GPS use as the international standard for air navigation.

The NAS Architecture team currently is developing cost estimates for the NAS modernization acceleration recommended by the Gore Commission. Other FAA elements are addressing cost increases related to the Gore Commission and other emerging needs (e.g., personnel reform requirements). Currently, the NAS Architecture team believes that acceleration will significantly increase F&E costs every year through FY 08.

On an individual program basis, there are opportunities for accelerating capabilities without significant increases in development risks. Version 3.0 of the Architecture is expected to be published in late 1997 and will contain the FAA's best effort to produce an optimal mix of capital investments. This mix will address the needs of the aviation community along with modernizing antiquated equipment.

Recognizing the uncertainty, Attachment A is an assessment of the probable impacts of funding reductions and potential accelerations for selected FAA capital investments (i.e, continuing F&E at $1.9B level). The FAA has nearly 200 capital investment programs.

- **Current F&E Funding Levels**

At the current level of funding, the FAA will have to make tradeoffs between providing improved services and sustaining current services. Reductions in sustainment will impact the availability and predictability of the NAS services, due to more frequent equipment failures and longer duration of failures associated with aging equipment. Safety of the NAS will always be considered paramount and ground delay programs may be used to ensure that NAS safety is not jeopardized. The users would experience increased system delays, mostly on the ground, due to equipment outages and more airports and sectors reaching critical capacity. The users also will experience decreased system flexibility due to the system being operated near its capacity limit for longer periods of time. (See attachment A for potential impacts on individual programs.)

Section C: RE&D

Although the RE&D budget is a relatively small portion (about 2%) of the total FAA budget, RE&D is viewed as having a central role in helping FAA accomplish its missions. Inclusive in RE&D are the following program areas: ATM technology validation (Flight 2000), ATM operations concept (for Free Flight), ATM decision support tools, digital air-ground communications, weather research, surveillance (runway incursions), airway facilities maintenance technology, airport technology (pavement research), aircraft safety, human factors and aviation medicine, and environment and energy. While RE&D funding represents only 9% of the total increased funding levels during FY 97-FY 02, RE&D would receive the largest percentage increase so that the spending level of $420M in FY 02 would more than double from $208M in FY 97. This level of requirements was based on an intensive 30 day zero-base review accomplished jointly with the National Aeronautics and Space Administration (NASA) , which resulted in a program report in November 1996. This report shows funding levels year-by-year

of between $400M to $450M, peaking in 1999. Examples of RE&D efforts that would be increased include:

- Full-scale validation and demo of new ATM technologies
- ATM operations concept development and system design
- Aviation weather research
- Safety & security of ATM software and communications
- More cost-effective aircraft and system certification methods
- Air-ground digital communications
- System maintenance technology
- Surveillance, including mitigation of runway incursions
- Human factors
- Aircraft safety
- Wake vortex detection/prediction

The Flight 2000 initiative, need to be factored into this requirements base. Nonetheless, the requirements noted above are considered a satisfactory level of funding, assuming cooperative leveraging of NASA and industry research.

At the current RE&D funding level (approximately $200M), the FAA would be unable to expand its RE&D efforts, especially in emerging areas such as human factors, considered key to improving aviation safety and reducing accidents. Moreover, since RE&D is intended in part to "create" commercial products/non-developmental items (COTS/NDI) that FAA could then acquire cheaply and quickly, the net effect will be to increase the cost and time required to acquire new systems through the F&E process. Such a result would unravel the gains of FAA acquisition reform and defer the ultimate cost savings that would be otherwise available through greater productivity in FAA/NAS operations. Finally, there would be a harmful effect on ATM equipment exports, a surplus area for U.S. trade, since these same products proven first in the FAA environment become the commercial leaders in markets overseas

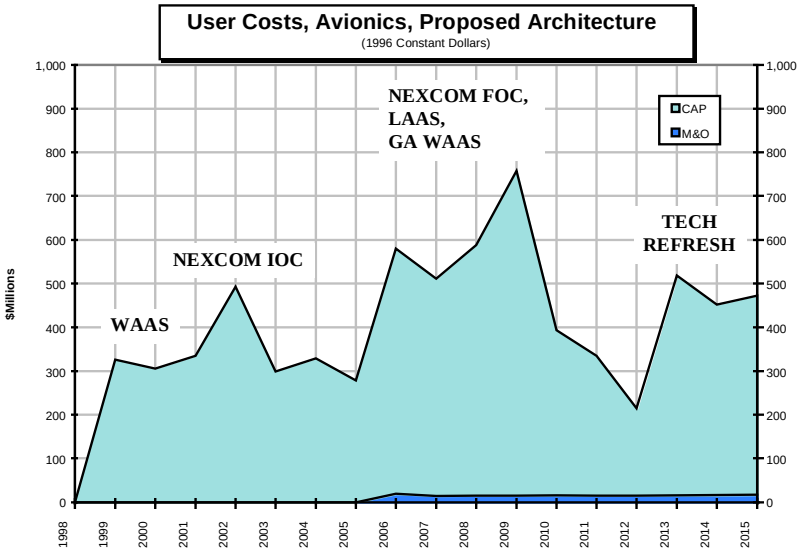
Section D: User Investments

Besides the FAA**,** civil and military NAS users will need to make very sizable investments for new avionics to work with the new Communications, Navigation, and Surveillance (CNS) systems proposed in the NAS Architecture (version 2.0). Replacement aircraft radios will need both a digital voice and data capability, and also must be "backward compatible" with the existing analog system to ensure safety and continuity of operations during the transition period. For navigation, avionics capabilities will evolve in three phases. Initially, there will be a requirement for a GPS receiver for en route and non-precision approach needs. Later, wide-area augmentation of GPS will require an upgrade to permit precision approach. Finally, an additional avionics upgrade will be needed to receive local augmentation signals for GPS and to satisfy the most stringent performance requirements for Category II and III precision approaches. For surveillance, most aircraft will need a transponder and, ultimately, need some modification to provide broadcast automatic dependent surveillance (ADS-B), which will eventually become the primary system for surveillance in the United States.

Figure 4 depicts the projected user costs for new avionics to ensure compatibility with the NAS Architecture, with implementation phased in through 2015. New avionics investments are tied to the FAA's implementation of the Wide Area Augmentation System (WAAS), Next-Generation Communication System (NEXCOM), and Local Area Augmentation System (LAAS). All

aircraft are assumed to be upgraded by 2012. "Tech refresh" represents replacement of the initial avionics systems on a 10 year life cycle. The cumulative user avionics investment over 17 years is estimated at $10B (then-year dollars) for all new and existing aircraft. This estimate is low; it does not include certain significant costs, such as installation, out-of-service revenue loss, training and establishment of a spares pool. However, in many cases, in-kind replacement of avionics would be necessary in any case during this period due to expiration of the avionics' economic service life, whether or not there would be a conversion to new CNS systems. Therefore, the entire $10B is not a true marginal cost.

Figure 4



Attachment A

PROGRAM	Function(s)	Current Funding	FAA Requirements ($59B)	Accelerated
Host/EDARC Replacement	Host/EDARC system is the FAA's computer backbone. System is reaching end of life cycle.	• Rehost partially funded as insurance without deployment • Replacement in kind funding delayed until FY 00 • Initial Capability 2006 • $250M	• Rehost partially funded as insurance without deployment • Concurrently replacement with minimal enhancements fully funded beginning in FY 99 • Initial Capability 2005 • $365M	• Rehost fully funded and deployed • Initial Capability 2002 • Concurrent replacement with full enhancements funding to begin in FY 98 and add additional capabilities for NAS Information System • 365M +++
Conflict Probe	Provides Automated Conflict Detection in En Route environment. Facilitate granting preferred routes to users.	• Fully fund beginning in FY 99 • Initial Capability 2002 (2 years after DSR) • $150M	• Fully fund beginning in FY 98 • Initial Capability 2001 (1 year after DSR) • $200M	• Accelerate and begin funding in FY 98 • Initial Capability 2000 (6 months after DSR) • $200M +
CTAS (TMA & FAST) (Center-TRACON Automation System)	Provides optimal metering of aircraft entering terminal airspace. Saves aircraft fuel.	• Fully fund TMA Single Center • Delay funding for TMA Multi Center for 1 year • Delay funding for FAST until FY 01 • Delay STARS P3I 1 year • $95M	• Fully fund TMA Single Center, TMA Multi Center and FAST • Restore funding STARS P3I • $120M	• Fully fund TMA Single Center, TMA Multi Center, and FAST • Accelerate STARS P3I • $120M +
Oceanic Automation	Provides automation infrastructure necessary for reduced separation over ocean. Saves aircraft fuel.	• Funding for partial Build 1.5 • Hardware problems still an issue • $110M	• Funding for Build 1.5 • Includes replacement of aging system • Achieves 50/50 separation in 2001 • Achieves 30/30 separation after 2010 • $130M	• Fully funds replacement of aging hardware • Achieves 30/30 separation in 2003 • Integrates with NAS Information System • $130M ++
Tower/TRACON Replacement/ Modernization	Provides for replacement and modernization of FAA's 450 Towers and nearly 200 TRACONs.	• Partially Funded (about 3-5 facilities per year) • $590M	• Additional Funding (about 5-7 facilities per year until 2001, then increase to replace/modernize all by approximately 2020) • $650M +	• Additional Funding (about 5-7 facilities per year until 2000, then increase to replace/modernize all by approximately 2015) • $650M ++
Information Security	Provides for secure transfer of critical data between FAA facilities and aircraft.	• Not included	• Initial Capability 2002 • $120M	• Not available
En Route Development Infrastructure	Provides interface standards as well as software and hardware platforms for new En Route functionality.	• Initial Capability 2006 • $200M	• Initial Capability 2005 • $390M	• Not available

PROGRAM	Function(s)	Current Funding	FAA Requirements ($59B)	Accelerated
Long-Range Radar (LRR)	Renovation and replacement of Long-Range Radars- required if either WAAS not fully implemented or aircraft not equipped.	• Continuous capability not guaranteed though transition • $70M	• Funds continued capability for 2012 "sunset" of LRR function. • $165M	• Not applicable
ARTCC Modernization (Air Route Traffic Control Center)	Facilities responsible for en route air traffic control. Funding required for modernization of aging facilities	• Facilities not upgraded to OSHA standards. Minimal modernization. • $320M	• OSHA improvements facility modernizations do not delay equipment upgrades. • $470M	• Acceleration of complete facility replacements/expansions allows for possible consolidations of centers. • $1370M
Critical Telecom	Modernizes and adopts various existing telecon systems to meet changing FAA needs. Covers increased telecommunication costs associated with demand for additional data transfer.	• **Most critical requirements sustained. Restrictions on additional capabilities.** • **$33M**	• **Funds all critical requirements and most additional capabilities.** • **$93M**	•
Power Systems	Replaces aging power system infrastructure. Power failures are one of the leading causes of system outages.	• **Replacements focus on critical equipment. Delays upgrades.** • **$110M**	• **Power system procurements support upgrades to new equipment/functionalities** • **$160M**	• **Not available**
Communication Facility Expansion and Radio Replacements		• **Defers procurement of additional radios and limits expansion of air to ground communications to meet growing needs of FAA.** • **$65M**	• **Replaces obsolete radios and meets FAA's growth needs.** • **$125M**	• **Not available**
NEXCOM (Next Generation Communication)	Modernizes air to ground communication to digital environment.	• Fully funded • Initial Capability 2004 • $370M	• Fully funded • Initial Capability 2004 • $370M	• Fully funded • Initial Capability 2002 • $370M +
Data Link	Allows routine messages pilots and controllers to be sent automatically. Future system will allow aircraft to begin "self separation"	• Partially funded • Initial Capability with NEXCOM for en route Controller to Pilot Data Link Communications (CPDLC) [no Flight Information Service (FIS)] • $60M	• Additional Funding for early implementation of limited en route CPDLC over service provider • Initial Capability 2001 (1 year after DSR) • $65M	• Accelerate for full CPDLC via service provider then NEXCOM • Aggressively pursue additional Terminal and en route capabilities including FIS • $65M ++
Local Area Augmentation System (LAAS)	Allows for precision landings when installed at airports. Replaces Integrated Landing Systems (ILSs)	• Development of standards funded, but full scale development and deployment not funded (assume users/airports pay) • $20M	• Development of standards funded, but full scale development and deployment not funded (assume users/airports pay) • $20M	• Development of standards funded • Full scale development and deployment fully fund beginning in 2000 • Initial Capability 2002 • $20M ++
Surface Movement Advisor (SMA)	Provides airline Ramp Controllers and FAA tower controllers with runway demand projections. Improves utilization of runways.	• Not funded • $0M	• Not funded before 2004 • Initial Capability approximately 2008 • $0M	• Pursue national capability on integrated tower display • Initial Capability approximately 2003 • $0M ++