



COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON D.C. 20548

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The Honorable Jack Brooks
Chairman, Committee on
Government Operations
House of Representatives

Subject: Review of the Federal Aviation Administration's
Response to Chairman Jack Brooks' Letter on the
National Airspace System Plan (GAO/AFMD-82-91)

Dear Mr. Chairman:

As requested in your May 25, 1982, letter (see encl. I), we have analyzed the Federal Aviation Administration's (FAA's) response to your letter and to our report AFMD-82-66 on FAA's National Airspace System (NAS) Plan (see encls. II and III).

GAO RECOMMENDED STUDY OF
DIRECT REPLACEMENT ALTERNATIVE

While the FAA Administrator considers our report useful, he states in his May 18, 1982, letter that he is confused over what he perceives as inconsistencies between our April 20, 1982, report and our June 1981 testimony before the Subcommittee on Transportation, Aviation, and Materials, House Committee on Science and Technology.

In our testimony we said that direct replacement was our preferred option for replacing only the computers at the 22 en route centers, not all computers in the air traffic control system. We believed this would solve FAA's identified near term problems of capacity shortfall, reliability, and cutoff of spare parts in the en route system. However, we also said FAA should not take our word on this. We recommended a detailed study of direct replacement as opposed to FAA's earlier plan for one-step en route system replacement. We felt that the capability of processing the near term en route workload would give FAA additional time to adequately develop its requirements for future years. In contrast, the Administrator has extended this option well beyond what we intended. In the NAS Plan, his approach is a massive replacement of not only the 22 en route computers, but also the 188 terminal facilities and about 716 controller displays. This degree of direct replacement goes well beyond that discussed in our testimony. (See p. 7.)

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In our April 1982 report, we were asked to, and did, provide the Congress with an appreciation of lower risk alternatives and potential consequences of FAA's decision. Consequently, we concurred with FAA's analysis of IBM 9020A to 9020D conversion as a less risky alternative to FAA's short term requirements. (See p. 8.)

A FIRM COMMITMENT FOR EARLY
REDESIGN OF SOFTWARE IS NEEDED

In his letter, the Administrator states that he is further confused by GAO's concern "that the existing software will not be updated when the GAO is well aware that I am planning to replace the 9020 software with new software at the earliest possible date."

In our report we stated that FAA's strategy of rewriting the software in conjunction with implementing the sector suite carries considerable risk. Concern about this point was raised during FAA hearings before the House Public Works Committee on March 17, 1982. The Administrator was asked if he was being overly optimistic in understanding the difficulty of changing software after the new hardware was installed. He responded that "If the new software is delayed for a year, 2 years, 3 years, we can still have the greater capacity capability because the new machine has 10 times the processing capability."

We believe that computer capacity gained through rehosting ^{1/} will provide FAA the opportunity to extend the use of the current software with no incentive to follow through with a software redesign effort.

Our experience with other agencies that use a "buy hardware now and rewrite software later" approach indicates that the software is often not rewritten. Based on this experience and the expressed views of the Administrator, we believe the Committee should obtain from the Administrator a firm commitment to redesign and rewrite the software. (See p. 8.)

CURRENT DECISION DOES NOT CLOSE OUT OPTIONS

In his letter, the Administrator states that

"* * * the slack time for decision has been used up by these prior year vacillations. I no longer have an option for further study but have been forced to make a decision that (a) does not entail technological risk;

^{1/}A rehost computer is a current generation computer system that can process the existing IBM 9020 software. The IBM 9020 software would be adapted to run on this new "host" computer.

(b) does not force a simultaneous development of computer software, and sector suite displays that interface; (c) does not result in 'throw away' of newly procured computers but allows them to grow to higher capacity if aircraft population growth occurs as forecasted; (d) gives me an emergency fallback position in the event either the new computer or new software encounter development problems; and (e) holds cost down to the lowest possible level commensurate with substantiated needs."

We agree with the Administrator that FAA cannot continue its vacillations of previous years. However, we do not fully agree that his decision closes out options based on the criteria stated. (See p. 10.)

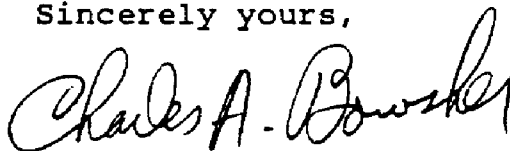
CONCLUSIONS

We see no inconsistencies between our June 1981 testimony and our April 1982 report. We also feel that our concern about software updating is justified by our experience with other agencies.

Because of the risk inherent in FAA's strategy, we believe that the Committee should obtain from the Administrator a firm commitment to redesign and rewrite the software, set milestones, and furnish periodic progress reports.

We are concerned that efforts to improve air safety be successful, economical, and efficient. We believe that the Administrator shares our concern and that the NAS Plan is a step in the right direction. Therefore, to avoid any further possibility of confusion, it may be beneficial for the Administrator to discuss with us any of our recommendations or any other matters on which we may be of assistance.

Sincerely yours,



Comptroller General
of the United States

Enclosures

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NINETY-SEVENTH CONGRESS
Congress of the United States
House of Representatives

COMMITTEE ON GOVERNMENT OPERATIONS

2157 Rayburn House Office Building

Washington, D.C. 20515

May 25, 1982

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The Honorable Charles A. Bowsher
 Comptroller General
 General Accounting Office
 441 G Street, N.W.
 Washington, D.C. 20548

Dear General:

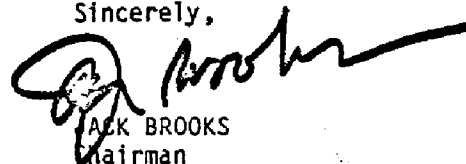
Enclosed is the Federal Aviation Administration's response to my letter of April 26, 1982, which transmitted a copy of GAO's report entitled, "Examination of The Federal Aviation Administration's Plan For The National Airspace System -- Interim Report," dated April 20, 1982.

While the FAA Administrator considers the GAO report useful, he stated that he was confused "when in June 1981 the GAO recommended direct replacement (rehosting), which I have now adopted as FAA's next step, and in April 1982 recommended what they now describe as less risky alternatives such as upgrading IBM 9020A's to 'stone age' IBM 9020D's." The FAA Administrator admitted that he was further confused by GAO's concern that the existing software will not be updated since GAO is aware that he is planning to replace the existing software at the earliest possible date.

Given the cost and complexity of the FAA modernization program, it is imperative that the key decisionmakers in this critical multibillion dollar project fully understand GAO's concerns before proceeding with the selected course of action. We cannot allow continued confusion or misinterpretations to undermine the development and implementation of a modern, safe air traffic control system. I therefore request that GAO respond within 10 days to these and the other issues addressed by the Administrator in his letter to this Committee.

With best wishes, I am

Sincerely,


 JACK BROOKS
 Chairman

Enclosure



U.S. Department
of Transportation
Federal Aviation
Administration

Office of the Administrator

800 Independence Ave., S.W.
Washington, D.C. 20591

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HOUSE COMMITTEE ON
GOVERNMENT OPERATIONS

The Honorable Jack Brooks
Chairman, Committee on
Government Operations
House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

Thank you for your letter of April 26 concerning the Federal Aviation Administration's (FAA) plans to upgrade existing computers and communications systems. I am currently reviewing the report from the General Accounting Office (GAO) which you forwarded with your letter. That portion concerning administrative computers will be responded to by the Assistant Secretary for Administration, Department of Transportation.

The GAO report does provide a useful input to my planning but in one specific area leaves me very confused. The GAO makes the following recommendation: "FAA's decision to upgrade ATC computers and to continue using the current software will have both short and long term consequences. Initially, a risk will be run that the software will not be updated. The end consequences, under these conditions, would be that hardware capacity would be increasingly absorbed by obsolete software. It appears that less risky alternatives should be considered; otherwise, FAA may simply be deferring today's problem until tomorrow."

The GAO goes on to state in the body of their report that less risky alternatives to rehosting the existing software on modern computers should be considered including upgrading IBM 9020A computers to IBM 9020D computers.

My confusion stems from the fact that the above recommendation directly contradicts GAO testimony before the Subcommittee on Transportation, Aviation and Materials of the Committee on Science and Technology in Hearings on June 17, 1981. In those Hearings Mr. Donald Scantlebury and Dr. Carl Palmer of the GAO recommended the following with respect to the existing en route computers: "Our option would be to go toward immediate direct replacement of the existing computers with new computers in the

same line, where you would not have to change the programs immediately, and to keep on going with the ultimate development of the system toward the 1990's that FAA is presently working on." The GAO went on to state that rehosting was cost effective and would allow early replacement of the IBM 9020 line which was described as "stone age" by the GAO. That recommendation weighed heavily in my deliberations that led to the selection of a computer replacement strategy.

I am sure you can understand my confusion when in June 1981 the GAO recommended direct replacement (rehosting), which I have now adopted as FAA's next step, and in April 1982 recommended what they now describe as less risky alternatives such as upgrading IBM 9020A's to "stone age" IBM 9020D's.

I am further confused by the current GAO concern that the existing software will not be updated when the GAO is well aware that I am planning to replace the 9020 software with new software at the earliest possible date.

Unfortunately, the slack time for decision has been used up by these prior year vacillations. I no longer have an option for further study, but have been forced to make a decision that: (a) does not entail technological risk; (b) does not force a simultaneous development of computer, software, and sector suite displays that interface; (c) does not result in "throw away" of newly procured computers but allows them to "grow" to higher capacity if aircraft population growth occurs as forecasted; (d) gives me an emergency fallback position in the event either the new computer or new software encounter development problems; and (e) holds cost down to the lowest possible level commensurate with substantiated needs.

Thank you for your consideration. I look forward to discussing this question at your earliest convenience.

Sincerely,



J. Lynn Helms
Administrator

GAO ANALYSIS OF CONCERNS EXPRESSEDIN FAA'S LETTER

Considering the cost and complexity of FAA's multibillion dollar modernization program, it is imperative that key agency officials fully consider feasible alternatives. Our analysis of the points that the Administrator states are causing him confusion are discussed below.

GAO RECOMMENDATION TO STUDY
SHORT TERM DIRECT REPLACEMENT
ALTERNATIVE

The Administrator compared our June 1981 testimony and the April 1982 report. Our testimony recommended direct replacement as our preferred option. Our option included only the computers at the 22 en route centers, not all computers in the air traffic control system. This was based on our report of outmoded computers in the Federal inventory. ^{1/} We felt that direct replacement would solve FAA's identified near term problems of capacity shortfall, reliability, and cutoff of spare parts by the manufacturer. However, we also said FAA should not take our word on this. We recommended a detailed study of direct replacement as opposed to FAA's earlier plan for one-step en route replacement. We felt FAA's approach carried substantial risk of delays in the replacement program with negative impact on the reliability and safety of the computer system support in the late 1980s and early 1990s.

Since then, the Administrator has announced a decision to develop a total air traffic control system based on rehost (software compatible) computers. These computers eventually would be capable of processing not only the IBM 9020 en route system but also the Sperry Univac ARTS IIIA terminal system and the Burroughs ARTS II terminal system. This approach is drastically different from the one-step replacement FAA espoused at the June 1981 hearings. It is also significantly different from the short term en route replacement approach we outlined in our June 1981 testimony.

Our approach, if found to be feasible and desirable, would have freed the FAA en route air traffic control system from its anticipated short term capacity problems, allowed needed safety enhancements to be made in the 1980s, and permitted redevelopment of the current en route software in higher level languages at a deliberate, controlled pace. We felt that the capability of processing the near term en route workload would provide FAA with additional time to adequately develop its requirements for future years.

^{1/}"Continued Use of Costly, Outmoded Computers in Federal Agencies Can be Avoided," AFMD-81-9, Dec. 15, 1980.

We believe the design of the new air traffic control system and software should be as free as possible of technological carry-over from its predecessor. We believe the option proposed in our June 1981 testimony would achieve this and is a logical, economical, and low risk alternative.

CONVERSION OF IBM 9020As
TO 9020Ds AT CRITICAL SITES

Our response in the report relative to converting IBM 9020A sites to 9020Ds is directed to the Committee's question A.10, "Are other less risky approaches available to FAA [for hardware replacement] which would allow the agency to accommodate immediate capacity shortfalls while developing a new system?" We said that FAA could, not should (as stated in the Administrator's letter), upgrade its IBM 9020A computers at some centers to 9020Ds to address capacity problems in the late 1980s, should rehost computers not be installed as scheduled.

In its report, "Responses to Congressional Recommendations Regarding the FAA's En Route Air Traffic Control Computer System," dated January 1982, FAA states that upgrading IBM 9020A sites to 9020D sites as a near term solution would

- provide a 150-percent capacity increase since the IBM 9020D is 2.5 times faster than the 9020A,
- postpone until 1996 the onset of "delay days" which tend to slow air traffic,
- carry a low risk because the transition is well understood since FAA has upgraded the IBM 9020A to 9020D at the Jacksonville Center, and
- cost \$32 to \$40 million for the whole program including new memory.

On the basis of this FAA analysis, we agree that conversion of IBM 9020As to 9020Ds is a less risky approach that would meet FAA's foreseeable capacity shortfalls in the en route system.

FIRM COMMITMENT FOR EARLY
REDESIGN OF THE SOFTWARE

As stated in our testimony, our preferred option continues to be that FAA move toward immediate direct replacement of its existing computers with new computers of the same architecture procured competitively. FAA would not have to face concurrent hardware and software implementation schedules and could concentrate on the development of the new air traffic control system for the 1990s. The capability of processing the same software on a newer technology computer should be viewed only as a short term measure to ease transition. This option implies that new software

will be written to fully utilize the technical capabilities of the future air traffic control system. It does not imply that FAA should perpetuate the existing software and its associated management deficiencies.

We are aware of the Administrator's promise to replace the IBM 9020 software at the "earliest possible date." However, FAA's strategy to rewrite the software in conjunction with the sector suite implementation carries the risk that computer capacity gained through rehosting will allow FAA to extend the use of the current software without software redesign.

Mitre Corporation, in its August 1981 report, "The Obsolescence of the National Airspace System (NAS) Software," states that the NAS software is approaching the end of its useful life, that it is undesirable to use as the basis for proposed automation enhancements, and that it should be rigorously redesigned. Also, Mitre concludes, it would be extremely difficult to develop software to perform the proposed automation enhancements without a fundamental redesign.

Our review of the NAS Plan shows that the rewritten software is to be implemented between 1988 and 1991. At briefings, FAA officials have indicated they believe the rewritten software will be operational in 1989 or 1990. However, another scenario was provided by the Administrator during his testimony before the House Public Works Committee on March 17, 1982. He was asked if he was being overly optimistic in understanding the difficulty of changing software after the new hardware was installed. The Administrator responded that "If the new software is delayed for a year, 2 years, 3 years, we can still have the greater capacity capability because the new machine has 10 times the processing capability. It is just not doing it efficiently with the old software."

We believe FAA should begin the design and development phases for the new software immediately after award of the contract for the rehost computer. Otherwise, FAA will be incapable of resolving the software problems and management deficiencies identified in appendix IV of our report and cited in the Mitre study.

Additionally, our experience with other agencies that use the "buy hardware now and rewrite software later" approach indicates that the software is often not rewritten. Based on this experience and the expressed views of the Administrator, we believe the Committee should obtain from the Administrator a firm commitment to redesign and rewrite the software, set milestones, and furnish periodic progress reports.

CURRENT DECISION DOES NOT CLOSE OUT OPTIONS

We agree with the Administrator that FAA cannot continue its vacillations of previous years. However, we do not fully agree that his decision closes out options based on the criteria stated in the last paragraph of his May 18 letter.

Technological risk

The Administrator states that his decision does not entail technological risk. We believe that the scope of the NAS Plan, including its computer modernization component, does entail technological risk. For example, within the automation area alone, over 30 time-critical events are scheduled between 1981 and 2000. Slippage in any of these events could have a ripple effect on the others. These events include complex and technical tasks such as the procurement, test, evaluation, and installation of rehost computers for 20 en route centers, 30 terminal hubs, and 3 support facilities; design, development, and installation of about 2,520 air traffic controller sector suites and associated computer software; consolidation of about 209 facilities to 60 hub centers; rewrite of the software for the rehost system; and events involving Mode S, landing, collision avoidance, and radar systems. Such risk should be eased with the formulation of a detailed transition plan--as advocated in our April 1982 report.

Simultaneous development

The Administrator contends that his decision does not force a simultaneous development of computer, software, and sector suite displays that interface.

In its request for Delegation for Procurement Authority to the General Services Administration, FAA states "Because the computers are part of a closely integrated system of computers, communications and electronic services, they must be acquired in consonance with other parts of the system rather than an isolated item."

We believe that such a closely integrated system will require FAA to perform some form of simultaneous development. Such simultaneous development is necessitated by the NAS Plan itself. As discussed above, technological risks are inherent in implementing so many concurrent actions.

Throwaway of newly procured computers

The Administrator contends that the FAA intends to build on the rehost computers if aircraft population growth occurs as forecasted. However, in its "Responses to Congressional Recommendations Regarding the FAA's En Route Air Traffic Control Computer System," FAA states

"(c) Evolution of this system in the 1990's to accommodate the evolving aviation system environment and higher levels of automation (AERA-2 in Figure 1-1). This may include additions to the new software and augmentation or replacement of the host computer. However, that decision can be deferred to the late 1980's and the need reaffirmed at that time."

Therefore, we can only conclude that there is a possibility of "throwaway" in FAA's future plans.

Emergency fallback position

The Administrator states that his decision "gives me an emergency fallback position in the event either the new computer or new software encounter development problems."

We are in agreement if the Administrator's point is to be interpreted as FAA being able to use the rehost as a "fallback" to delays in implementing the advanced computer system. However, as pointed out in FAA's own option analysis, other strategies incorporate similar, although not identical, fallback capabilities.

Cost held to the lowest possible level

As of the date of this letter, repeated attempts by the Congress to have FAA provide detailed cost figures on the individual NAS projects have been unsuccessful. Therefore, we cannot validate the Administrator's claim that his decision will hold costs "to the lowest possible level commensurate with substantiated needs."