



United States
General Accounting Office
Washington, D.C. 20548

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National Security and
International Affairs Division

B-254857

November 22, 1993

The Honorable John D. Dingell
Chairman, Subcommittee on Oversight and
Investigations
Committee on Energy and Commerce
House of Representatives

Dear Mr. Chairman:

This report responds to your request that we review the design and construction of certain ground support systems included in the production facility for the B-2 bomber at Air Force Plant 42, Palmdale, California. Specifically, you asked that we determine (1) the costs of correcting problems in the ground support systems that provide hydraulic pressure, cooling air, and fuel to B-2 aircraft during test and checkout and production flight tests; and (2) whether Northrop misrepresented problems with these systems to the Air Force. As a result of discussions with your office, we also reviewed the causes of the problems that occurred and determined whether some costs were incurred that might have been avoided. We also inquired about the level of oversight of the construction project provided by the Air Force.

Your request made reference to a false claims act lawsuit brought against the Northrop Corporation by one of its employees, alleging that Northrop had installed ineffective ground support systems in one building, and had failed to install the systems in other buildings. It further alleged that Northrop, upon determining that the systems were ineffective, and knowing that the systems were not installed in some buildings, delivered the systems to the Air Force, misrepresented the causes of the problems to the Air Force, and inappropriately charged to the Air Force under a fixed-price construction contract, certain costs of repairing and or replacing the systems. The lawsuit was amended later to recognize that the contract was cost reimbursable. The false claims act lawsuit was dismissed without prejudice, with the consent of the United States Attorney, in July 1993.

BACKGROUND

In 1981, the Air Force initiated full-scale development of the B-2 bomber, awarding a cost-plus-incentive-fee contract to the Northrop Corporation to develop the B-2 as well as deliver and test six development aircraft. In December 1983, the Air Force also awarded Northrop a cost reimbursable, no fee, facilities contract to design and construct a government-owned, contractor-operated facility to be used for final assembly, ground test and checkout of B-2 development aircraft and planned production aircraft. The Air Force contracted with Northrop for nearly all aspects of the design and construction of the facility.

The facilities contract provided for the facilities to be built in several phases. A main assembly building (Building 401), and a JP-4 aircraft fueling complex were to be completed in the first phase; an engine run shelter (Building 430) was to be completed in the second phase; and a two-bay inspection hanger (Building 435) was to be completed in a third phase.

The buildings were to include ground support systems that provide external power sources that are necessary to test and check out the systems on the aircraft. Aircraft engines that provide the power to operate hydraulic and cooling systems in-flight are not yet installed when tests are performed in the aircraft assembly process and/or cannot be run in the test stations in buildings 401 and 435 because the buildings are not designed to suppress noise or dissipate engine exhaust. Ground support systems were required to provide hydraulic power and cool the aircraft cabin and electrical equipment. Aircraft undergoing production flight tests also require fueling and defueling at various locations. The JP-4 jet aircraft fuel system was constructed at Site 4 to provide that capability.

RESULTS IN BRIEF

The concurrent development of the B-2 aircraft and construction of a facility in which to assemble it contributed substantially to problems in providing effective ground support systems. Neither the design of the aircraft nor the procedures to test and check out the aircraft were firmly established when Northrop first identified the requirements that the ground support

systems needed to meet. The decision to build facilities and install ground support systems before completing the aircraft's design later required that changes be made to installed ground support systems to properly test and checkout B-2 aircraft.

Of over \$250 million planned to be spent to construct the B-2 facilities at Palmdale, about \$9.6 million was spent or planned to install the hydraulics and cooling air ground support systems, and a JP-4 jet aircraft fuel system. The costs of initial installation as well as repair and replacement were borne by the Air Force under the cost reimbursable facilities contract and cost-plus-incentive-fee development contract with Northrop. We believe most of the amount of \$981,000 for installation of an ineffective hydraulic ground support system in building 401, and about \$200,000 for installation of an improved system, might have been avoided if Northrop had required its aircraft hydraulic systems design engineers to review and approve final construction plans/drawings before contracts were awarded for installation of the original systems.

We did not identify unnecessary costs for installation and modification of hydraulic ground support systems in other buildings, cooling air systems in any buildings, or the JP-4 fuel system. The costs associated with modification of those systems appeared to result from concurrency (designing the B-2 and simultaneously constructing a facility to assemble it) or from changes in requirements which Northrop did not anticipate. In fact, Northrop, upon recognizing in 1986 that the hydraulic ground support system installed in building 401 would provide insufficient capability, deferred installation of the same types of systems planned for building 435 during the third phase of the construction project.

Following discovery that the systems initially installed in building 401 were insufficient, Northrop officials did provide information to the Air Force that mentioned the need to increase the capabilities of the ground support systems. They indicated that increased capabilities were needed to support revised aircraft requirements.

The Air Force B-2 Program Office provided limited oversight of a project that will cost over \$250 million and did not challenge Northrop on why the problems

occurred and who was responsible. The Air Force supervising engineer advised us that he did not challenge Northrop to provide details on why the problems occurred because the cost reimbursable nature of the contracts with Northrop would have required the Air Force to incur the costs of construction and modification of the facility regardless of the reasons the modifications were needed. The Air Force had not accepted delivery of the systems as of October 1993.

COSTS TO CORRECT PROBLEMS

Northrop identified \$9.6 million that it spent or planned to spend to provide effective hydraulic and cooling air ground support systems, and a JP-4 jet aircraft fuel system. Costs for architecture and engineering services, subcontract management, and for other services, are not included in this estimate.

Although there were many problems with the ground support systems the only costs we identified that might have been avoided concerned the hydraulic system in building 401. In May 1985, a subcontract was awarded for installation of the hydraulic system in building 401. The installation was nearly complete in March 1986 when Northrop hydraulic systems and manufacturing engineers reviewed the system and determined it was not functional, not effective, and was urgently in need of modifications to meet planned schedules for testing assembled aircraft. The cost to install the original system was about \$981,000.

The cost to remove the ineffective hydraulic system in building 401 and install a modified one totaled about \$1.6 million. The original hydraulic utilities and equipment were removed from building 401 at a cost of about \$69,000; a new hydraulic piping system was installed costing about \$707,000; hydraulic pressure units were modified (essentially remanufactured to new specifications) at a cost of \$702,000; modified pressure units were reinstalled at a cost of about \$106,000; and replacement trench covers were fabricated and installed for about \$25,000. The work was completed in January 1992.

Most of the costs of about \$981,000 for installation of an ineffective hydraulic ground support system in building 401, the \$69,000 for its removal, \$25,000 for

new trench covers, and some of the \$106,000 for reinstallation of a different system, might have been avoided. This amounts to about 12 percent of the almost \$9.6 million that was spent or planned to install the hydraulic and cooling air ground support systems, and a JP-4 jet aircraft fuel system.

Northrop engineering managers initially defined some general requirements for the hydraulic system and, through an architect and engineer subcontractor, produced the specific drawings that were used for the actual construction. Northrop had only its contracting personnel and the facilities engineering personnel managing installation of the system in the building approve the drawings before a contract was awarded for construction. The drawings were also approved by the Air Force supervising engineer.¹ Nevertheless, hydraulic systems design engineers told us that if they had reviewed the drawings before construction began, they would have known that the hydraulic system to be installed in building 401 would not meet the test and checkout requirements for B-2 aircraft.

We did not identify costs that clearly could have been avoided involving installation and modification of hydraulic ground support systems in buildings 430 and 435, cooling air systems in all buildings, and the JP-4 fuel system. Many of the problems requiring modifications appeared to be caused by concurrency, and/or other changes in requirements that evolved as the design of the B-2 and the test and checkout procedures were finalized. It was not clear that Northrop could have anticipated the growth in requirements. For example, changes were made to cooling air systems because requirements for cooling air to service the aircraft continued to increase after the initial design of the system was approved and a subcontract had been awarded for their installation. To increase the cooling air to the aircraft, Northrop coupled existing cooling air units to provide sufficient cooled air to support the first

¹A supervising engineer is a graduate engineer or licensed professional engineer who supports the facilities procurement contracting officer, and provides technical engineering support for facilities and other projects.

aircraft and later acquired units with increased capacity.

Some costs that were incurred involved the deferred installation of systems and needed additions that were not initially incorporated in the buildings. For example, construction of the hydraulic systems for two aircraft positions in building 435 had not started in March 1986 when problems were identified in building 401 that indicated the system would not provide sufficient capability. The construction subcontract for building 435 was awarded, but installation of complete hydraulic piping inside the building to the two aircraft positions was deleted from the scope of work. Northrop subsequently installed piping that was sufficient to the two aircraft positions. Further, only hydraulic pressure units with adequate capability were acquired for building 435.

The JP-4 fuel system, with the construction drawings approved and the construction subcontract awarded in 1984, was affected by a state law which became effective in 1990 regulating above ground storage tanks and related piping. Northrop concluded that the JP-4 fuel underground pipeline was covered by the law and did not comply and could not be used as installed. Northrop plans to use fuel trucks instead of the pipeline to transfer the fuel from the JP-4 fuel tanks to aircraft.

NORTHROP'S REPRESENTATIONS
TO THE AIR FORCE

Northrop did provide information to the Air Force in budget estimates and readiness briefings that mentioned the need to increase the capabilities of the ground support systems to support revised aircraft requirements.

In a five-year budget estimate submitted to the Air Force in August and November 1986, Northrop requested additional funding to modify features of the hydraulics and cooling air systems, and to make some needed changes to the JP-4 fuel system. Northrop observed that aircraft requirements were more complete, and these systems would require additional capacity or capabilities in order to support revised aircraft requirements. In a January 1987 production readiness review, Northrop reported to the Air Force that all utility systems installed in completed buildings and buildings under construction were usable

(underscore added), but would "...require additional capacity or additional capabilities in order to support the revised aircraft requirements both for FSD (full scale development) and production...". Northrop's characterization of the systems as "usable", was in our view, an overstatement since all of the systems had to be modified or rearranged to meet requirements and planned schedules to test and check out the aircraft. We have no information, however, to indicate that Northrop intentionally misrepresented the situation.

Further, it was alleged that Northrop misrepresented the facts in September 1987 when it offered to transfer to the Air Force the building 401 hydraulic system, which did not meet contractual requirements for effective testing and checkout of aircraft. A certification made in connection with this offer, however, only stipulated that the items being transferred met the applicable drawings and specifications approved by the Air Force, not that they had been determined to be effective for testing and checking out B-2s.

AIR FORCE OVERSIGHT OF THE PROJECT

The Air Force B-2 Program Office did not effectively oversee the project to construct the production facilities, and did not accept the systems without delay after they were offered to the Air Force, or document why the systems were inadequate.

At a cost of over \$250 million, construction of the B-2 production facilities can be characterized as an extremely large project. One Air Force supervising engineer located in Dayton, Ohio, was assigned to oversee the project, evaluate designs proposed by Northrop, approve hundreds of construction drawings, and accept final construction of all facilities for the Air Force. Normally, the Defense Plant Representative Office (formerly the Air Force Contract Management Division) at Air Force Plant 42 performs contract administration activities, including detailed on-site inspection, on such projects. However, this office did not assist on this project because it requested three staff positions for this assistance and the B-2 System Program Office refused to provide them.

The Air Force B-2 System Program Office did not challenge Northrop to provide details on the problems that occurred

and who was responsible. Air Force B-2 program officials wanted to be kept updated on issues raised during the readiness review, but program officials told us there were no open questions at the completion of the review. The Air Force supervising engineer told us he did not determine who was responsible for these problems because the work was being done under a cost reimbursable contract and, therefore, the Air Force would have had to pay to correct the problems.

Northrop has occupied the facility since September 1987. According to Air Force guidance, the facility is to be turned over to the government either wholly or in usable increments as soon as practical after construction has been completed to a point where it is fully capable of accommodating its designed function. The Air Force is not to delay signing the transfer documents because of deficiencies unless the deficiencies preclude beneficial acceptance by the user. Although 6 years have passed since the systems were first offered to the Air Force, the Air Force has not accepted the systems. The Air Force supervising engineer told us this was only because Northrop needs to provide "as built" drawings, which now have errors and must be validated by Northrop. No reasons have been documented for not accepting these systems.

SCOPE AND METHODOLOGY

We interviewed Northrop and Air Force officials, and reviewed Air Force and Northrop documents concerning the establishment of initial and revised requirements, specifications and drawings, and constructed facilities. The costs for these systems were associated with larger fixed-price contracts, so we obtained estimates from Northrop facilities engineering officials and reviewed supporting construction contract values, equipment purchases, and cost report documentation. We evaluated representations by Northrop to the Air Force by reviewing the facilities contract and Air Force regulations and reports and related documents Northrop submitted to the Air Force; and discussed what was reported with Northrop facilities managers and Air Force B-2 officials.

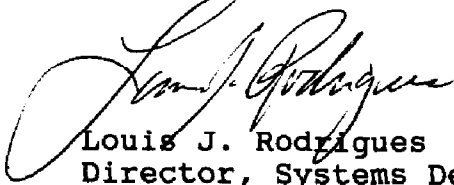
We discussed the facts concerning this report with officials of the Air Force and Office of the Secretary of Defense. Their comments have been incorporated in this report as appropriate.

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We are sending copies of this report to the Secretaries of Defense and the Air Force. We will make copies available to others upon request.

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Please contact me on (202) 512-4841 if you or your staff have any questions concerning this information.

Sincerely yours,



Louis J. Rodrigues
Director, Systems Development
and Production Issues

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