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COMPTROLLER GENERAL OF THE UNITED STATES

WASHINGTON, D.C. 20548

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The Honorable Les Aspin  
House of Representatives

R Dear Mr. Aspin:

In response to your request of June 5, 1973, and subsequent discussions with your office, we attempted to obtain information regarding the nature and cost to the Government for corrections of deficiencies disclosed by the B-1 component-testing programs. We interviewed B-1 System Program Office and contractor officials and examined test reports, technical memorandums, engineering change proposals, contract change proposals, master change records, contractor studies and analyses, and cost performance reports.

B-1 airframe and engine contracts are for designing, developing, and testing three aircraft and their engines. Cost-plus-incentive fee contracts were awarded to the Rockwell International Corporation for the airframe and to the General Electric Company for the engines on June 5, 1970, at target prices of \$1,350.8 million and \$406.7 million, respectively. They cover a period of about 8 years, and as of December 6, 1973, the target prices amounted to \$1,550.2 million (\$1,168.5 million for the airframe and \$381.7 million for the engine).

These lower prices resulted primarily from reducing the number of vehicles from five to three. The Systems Program Office estimates of total prices at contract completion as of September 30, 1973, are \$1,444.6 million for Rockwell and \$411.9 million for General Electric. The estimates are expected to change because changes in the development program are being made.

Under the cost-plus-incentive-fee contracts, the Government bears all costs (there is no contract ceiling price). Each contractor can receive a fee up to 12 percent if actual

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costs incurred are below the target cost. If target costs are exceeded, 90 percent of the excess is borne by the Government and 10 percent by the contractor in the case of Rockwell and 80 percent by the Government and 20 percent by the contractor in the case of General Electric, until each contractor's fee is reduced to 2 percent. From that point, the Government bears all costs incurred. Many factors are considered in establishing sharing ratios, among which are the degree of risk being assumed by the contractor and the degree of uncertainty in the final price. The cost the Government will bear is higher when there is a greater risk to the contractor and when there is a greater uncertainty in the final price.

We could not precisely identify the cost of corrections made as a result of testing, except when the action was outside the scope of the existing development contracts. According to B-1 System Program Office officials, there is no system within either contractor's operation to enable us to identify additional costs the Government will ultimately bear if there is a need to correct deficiencies when the contractor is responsible for the correction and when no change is required to the contract target costs. The contractors can identify estimated cost to complete, by component or sub-assembly, but it would be impossible to sort the cost changes associated specifically with the test program.

During development, contractors must meet certain goals specified in the contracts and make the necessary corrections if test results show that the correction is necessary to meet the original goals. The goals may change for several reasons as tests continue. Changes in the scope or amount of the contracts are controlled through contract change proposals, engineering change proposals, and specification change notification processes.

We did, however, identify one significant change and one contract requirement deletion to the Rockwell contract which, in our opinion, were prompted by results of the testing programs. The actions required were not actually corrections of defects but were developmental changes. As such, they were outside the scope of the existing contracts and contract changes were required. According to a System Program Office official, the principal factors for making the changes

were development cost and life-cycle cost savings. Further details of the changes follow.

<u>Contract changes prompted by test results</u>				
<u>Date of change</u>	<u>Description</u>	<u>Nature of correction</u>	<u>Correction</u>	<u>Increase or decrease(-) in target cost</u>
12-22-72	Compression inlet (note a)	Redesign	Changed type of engine air inlet	\$7,665,671
1-31-72	Fuel deaeration system	Deletion of requirements	Amendment to aircraft specifications	-284,207
Net increase to B-1 cost				<u>\$7,381,464</u>

<sup>a</sup>Rockwell's inlet change increased the scope of General Electric's engine contract by \$105,671 for a front frame and distortion screens. This cost is included in the compression inlet amount.

### Compression inlets

Since program inception, contractor and Air Force officials have been concerned about the type of compression inlet system that should be installed on the B-1. Compression inlets are used to control airflow to the engines. When comparing the two types of inlets--mixed compression and external compression--the basic difference is the way shock patterns are controlled. With the mixed inlet, shock patterns are controlled externally and internally. With the external inlet, all shock patterns occur away from the aircraft.

In terms of supersonic performance and growth potential, Rockwell, on the basis of its studies, considered the mixed inlet to be better than the external inlet. A Rockwell official told us that the B-1 cannot fly at speeds much faster than the current design with an external inlet due to limitations of the inlet to control the shock-wave system. With the mixed inlet, however, the B-1 could fly at speeds slightly faster than those obtainable with the external inlet.

As part of the statement of work in the development contract awarded in June 1970, the contractor was to work on developing the mixed inlet and was required to conduct a trade study comparing the mixed and external inlets. On the basis of the study results, Rockwell recommended incorporating the mixed inlet because it was considered technically superior to the external inlet. The external inlet, however, was shown to be less costly, lighter, and simpler in design.

Subsequent wind tunnel development tests on mixed inlet scale models showed excessive drag occurred at subsonic speeds, performance was reduced, and a heavier, more complicated inlet control system was required.

In April 1972 the Air Force initiated an in-house study to compare the two inlet types. In August 1972, as a result of this study, the external inlet was recommended for incorporation on the B-1. Air Force study results were similar to those of Rockwell's conclusions in that the external inlet would provide a potential weight savings of about 2,000 pounds, reduce production costs, be simpler, and perform better during a low-level subsonic mission (the primary mission for the B-1) than the mixed inlet.

In February 1973 a change to the development of the external inlet was incorporated into the Rockwell contract at a cost of \$7,560,000. This change also increased the scope of the General Electric engine contract by \$105,671 for a front frame and distortion screens. Although an increase is estimated for the development contract, Rockwell estimates that the reduced costs for production will be about \$132,000 per production aircraft, or \$31.8 million if 241 aircraft are procured with the external inlets. The Air Force agrees that the cost for the production aircraft would be reduced by at least this amount.

#### Fuel deaeration system

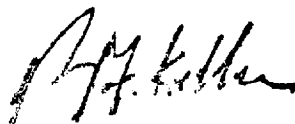
Deaeration of fuel is a process for removing dissolved oxygen for safety of operation and mission survivability. Tests of the system disclosed that, although specifications weren't quite met, Rockwell found no impact to the B-1's survivability.

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In light of these test results, Rockwell recommended deferral of fuel deaeration in development aircraft. A change of contract scope resulted in January 1972 with an estimated cost decrease of \$284,207 in development. Deletion of the deaeration requirement from production vehicles is scheduled for consideration after review of ground and flight tests.

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Sincerely yours,



**Acting**

Comptroller General  
of the United States