

UNITED STATES GOVERNMENT

Memorandum

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TO : C/Callaghan

DATE: MAR 21 1967
MCL

FROM : M/Mueller

SUBJECT: Congressional Inquiry

The enclosed information is forwarded for your use in response to Senator Anderson's letter to Mr. Webb regarding the S-II-T accident at the Mississippi Test Facility.

15) *Julian H. Brown* for
George E. Mueller
Associate Administrator
for Manned Space Flight

Enclosure

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The misfit between the facility LH₂ and drain line and the S-II-T stage was rejected by North American Aviation (NAA) inspection. The problem was referred to NAA engineering for disposition. NAA engineering took action to properly position the line for connection to the stage. NAA measured the force required to position the line and then determined that the resulting preload on the stage plus the loads imposed by the normal static operations would not degrade the structural strength of the stage under normal operations.

Thus, in keeping with established procedures, the contractor had to his satisfaction adequately resolved the problem, and according to their determination, the solution did not jeopardize the safety of the S-II-T, nor did the solution cause a cost or schedule impact.

For practical staffing reasons, NASA inspectors do not conduct 100% coverage for tests such as this one involving non-flight hardware. As a result, only if there appeared to be a significant problem would the government be called in to participate with the contractor in the solution.

The Honorable Clinton P. Anderson
Chairman
Committee on Aeronautical
and Space Science
United States Senate
Washington, D.C.

Dear Clint:

In your letter of March 6, of this year, you asked for additional information on the specific area of contractor and NASA procedures for handling the deficiency that existed between the S-II-T stage and the facility LH_2 fill and drain line. Being ^{an R&D} ground test article, the government participation in the activities associated with the S-II-T were much less than that for flight hardware. As a result, only ⁱⁿ the more ^{significant} ~~major~~ problems that might impact on the effort such as safety, schedule, cost, etc. or when an interface problem between other contractors were involved, did NASA normally participate in the resolution of the problem.

In the resolution of the 5-inch gap that existed between the facility line and the S-II-T stage, the contractor properly followed the established procedures when his inspectors duly referred the problem to the engineering group for disposition. The engineering action was, to properly position the line for connection to the stage and calibrate, or measure, the force that was required to ~~fill~~ position the line. Knowing this value they then determined

that the resulting preload on the stage added to the loads ^{imposed} reported by the normal static operations would not degrade the structural strength of the stage to a level that was hazardous to the normal expected operations. Thus, in keeping with the established procedures, the contractor had in his mind adequately resolved the problem, and according to the determination, the solution did not jeopardize the safety of the S-II-T, nor did the solution cause a cost or schedule impact. As a result, it was not necessary for the government to be involved.

The correctness of the solution was subsequently validated through pressurization cycles of the LH₂ tank to normal operation levels in support of the propellant tanking tests and the 8 static firings which completed that planned phase of the S-II-T testing.

During the final pressurized leak check, prior to removing the S-II-T from the facility to make way for the acceptance testing of the first flight stage, the stage was inadvertently over pressurized and destroyed. The fact that the stage LH₂ tank was pressurized to the normal level, and the vent valves were properly maintaining this pressure level, the subsequent closing of the facility blocking valve that was ^{located} downstream of the vent

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valve by the contractor's test conductor, resulted in sealing the doom of the stage and the demise cannot be a surprise to anyone. For when, once the vent capability of the LH₂ tank was ~~destroyed~~^{deleted} and tank pressurization continued, only a matter of seconds remained until the LH₂ tank's ultimate design capability would be reached,^{exceeded} overcome, with rupture of the tank wall.

The surprise then, was not that the tank ruptured, but rather in the Board's findings that the failure actually occurred at a value much less than ultimate load, however, still above the normal operating level. The Board found that in the contractor's determination, they failed to take into account 2 important factors in assessing the amount of preload and the strength of the tank wall. These 2 items were:

- (1) The ^{moment} normal load imposed by the fill and drain line and, the ~~degra~~.
- (2) The degraded connection pad^{Fill could drain on the stage} because of hand weld repairs that were made during the initial fabrication. As a result, the contractor in his determination of the preload only considered the radial load imposed by the offset fill and drain line. Taking all 3 factors into account, the Board determined the stage side~~of~~ the fill and drain port would fail at a value of approximately 23 psi, which was the approximate value determined in reconstructing the

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tank pressure from the flow rates and the time it took from closing of the blocking valve to the rupture of the tank.

Had the contractor taken all 3 factors into account, the true assessment of the situation would have been known and the problem formally called to the attention of NASA and resolved in another manner.

In any event, if the contractor's action had been questioned, a government engineering analysis would have been required to confirm or deny the contractor's analysis. An error such as this can only be detected if the government chooses to fully investigate with engineering analyses every incident of this type requiring 100% participation on the part of the government in all activities associated with the handling of ground test articles.

Sincerely,

James E. Webb
Administrator