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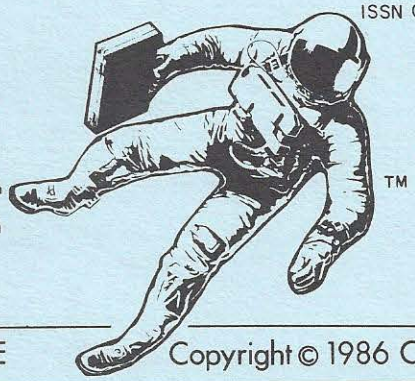

A MONTHLY NEWSLETTER ON FREE ENTERPRISE IN SPACE

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Titan, Delta, Launches End In Failure

In a shocking series of incidents, the first two major American space launches after the Space Shuttle Challenger disaster ended in similar balls of fire. One vehicle, a Titan 34D, was being launched by the Department of Defense (DOD) from Vandenberg Air Force Base. The other, a Delta 3914, was being launched by the National Aeronautics and Space Administration (NASA) from Cape Canaveral. Both were unmanned expendable launch vehicles (ELVs), and no injuries resulted. The Titan payload was a military reconnaissance satellite, while the Delta payload was a geosynchronous weather satellite.

On April 18, the DOD's Titan 34D exploded just seconds off the pad. The Titan 34D uses two large solid rocket motors constructed in segments in the same way as the ones used on the Shuttle (the Titan's solid motors are slightly smaller than those used on the Shuttle). One of these motors apparently exploded, and triggered the destruct system which destroyed the rest of the Titan booster. The Titan's liquid-fueled engines had not yet been ignited--under normal conditions they are not ignited until the solids burn out later in the flight. The explosion was almost instantaneous--probably too fast to be caused by a seal failure such as that which destroyed the Challenger. Investigation is still under way to find the problem.

This was the second Titan 34D failure in a row--another failure occurred last August due to a completely different problem. The current launch had been postponed until officials had completed their investigation of that problem. Needless to say, the Titan 34D is grounded again.

On May 3, NASA attempted to launch a Delta--its first launch since the Challenger disaster. The Delta lifts off using a liquid-fueled main engine burning in parallel with nine Castor solid rocket motors wrapped around the first stage. About 70 seconds into the flight, the liquid-fueled main engine shut down prematurely. Unlike the Titan's solid boosters, which have steering capability, the Delta's solids do not, and the Delta relies solely on its gimbaling main engine to guide it. When this engine cut off, the Delta began to tumble while the solid motors continued to burn. At over 1,400 miles per hour, the powerful aerodynamic forces began to tear the vehicle apart. The payload shroud disintegrated, and the Delta spun wildly. Range safety officers had no choice except to destroy the vehicle. Investigators suspect electrical problems in the engine control systems. Like the Titan, the Delta is now grounded until investigations have been completed.

To add insult to injury, the Atlas/Centaur launcher is also grounded--the Atlas main engines use control systems similar to those used in the Delta.

NASA, the DOD, and much of the space community is in shock. The United States is now without any launch capability whatsoever, with the possible exception of the tiny Scout which can carry a grand total of about 400 lbs. into low earth orbit. Despite dark speculations about sabotage, it seems more likely that this is just a

bizarre series of coincidences, enhanced by managerial and quality control problems.

What makes the situation unbelievable is the reputation for reliability that the Titan and Delta have enjoyed in the past.

The Titan's solid boosters had never had any serious problems before. 136 Titan rockets of various configurations have been launched to date, including nine Titan 34Ds, the largest of the series. Of these launches, six failed. Two of these six were the 34D failures in August and April. This gives the Titan series as a whole an excellent reliability rating (ratio of successful flights to unsuccessful flights) of 96%. The Titan 34D has a less impressive rating of 78%.

The Delta series has been highly successful. Out of 177 launch attempts since its first launch in 1960, only 12 have failed (including the current failure). This gives the Delta a reliability rating of 93%. Add to this the fact that before this recent failure, 43 consecutive Delta launches were successful.

As a point of comparision, Europe's Ariane has had four failures in 18 flights for a rating of only 78%. The Shuttle, with one catastrophic failure out of 25 flights, is currently rated at 96% (good for an ELV--lousy for a manned system. Consider the number of fatal crashes which occur in the airline industry versus hours flown.)

The Titan that exploded in April was apparently carrying a military reconnaissance satellite, probably a 25,000 lb. USAF/Lockheed "Big Bird" (the payload was classified). The 34D which was lost last August was probably carrying either a Big Bird or a KH-11, another type of reconnaissance satellite. Both resemble large telescopes, and are used to obtain close-up photographs of facilities and activities on the ground. They are too large to be launched by any existing vehicles except the Titan 34D or the Shuttle. Since reconnaissance satellites are placed in low polar orbits for maximum coverage, satellites launched from the United States are launched from Vandenberg to enter such orbits (polar launches from Cape Canaveral would pass over inhabited areas).

The grounding of the Titan and Shuttle places the United States in a serious national security situation. There is currently only one KH-11 satellite in orbit to handle U.S. close reconnaissance needs. The normal complement is two. If all goes well, the satellite could last until the end of 1987.

Recently the Air Force announced that it was considering postponing the first Vandenberg Shuttle launch until after 1990 (the first such launch was originally scheduled for this July). If this is true, then only the Titan will be ready before then to replace or supplement the existing KH-11, and it will be at least six months to a year before the Titan is checked out for flight again and the damaged launch pad repaired.

With luck, the operating KH-11 will last until then. If it should fail for some reason, a serious gap in reconnaissance capability would result.

In addition to the reconnaissance satellites, there are also satellites in geosynchronous orbit over the Soviet Union with the vital task of watching for missile launches. These satellites, with infrared sensors, are currently operational, but are vulnerable to laser jamming. A new type of early warning satellite, with improvements to prevent this, was due to be launched in 1987. Such satellites also require the Titan 34D or Shuttle for launch, although they are launched from Florida instead of Vandenberg. It is uncertain now when they can be launched. New military navigation and communications satellite systems scheduled to be operational by the 1990s also face delays.

Military observation, early warning, navigation and communications satellites perform national security roles which are so important that they are considered legitimate and essential even by those who normally dispute any other military role in space. The current launcher situation threatens the viability of this satellite system.

The Delta was carrying a weather satellite, the Geostationary Operational Environmental Satellite (GOES-G). This satellite would have been stationed in geosynchronous orbit over the United States to monitor weather developments. There is currently one GOES satellite in orbit (GOES-6), which has had to perform the duties normally performed by two such satellites. This has been accomplished by moving its geosynchronous station over the U.S. from west to east and back again as seasons vary. This allows the satellite to at least partially cover the east coast during hurricane season (June to October) and the west coast during its storm seasons (over the winter). Such coverage, particularly over the oceans, is essential for weather services to provide effective early storm warnings. There is one more GOES satellite on the ground waiting for launch--the GOES-H. Originally set for launch in October, 1986, it will now be delayed by the Delta problems. It is hoped that it could still be launched before 1987. The next generation of weather satellites on order will not be available for launch until 1990.

The GOES satellite series has been plagued by early failures, due to encoder lamps burning out. In the GOES-6, out of four redundant lamps, one has already burned out. If luck holds, along with the lamp filaments, GOES-6 should have enough station-keeping propellant to keep performing its back-and-forth trick for another two years. However, if GOES-6 fails during the 1986 hurricane season, the U.S. would have serious problems tracking major storms and possible losses of life and property could result.

The U.S. space program is now even worse off than after the Challenger disaster (C.S.R., Mar. 1986). Not only is the Shuttle down for the count, but now the Titan, Atlas and Delta, the major ELV alternatives, are also frozen on the pad. A serious payload backup has elevated itself into what may become an actual threat to national security. How is the U.S. reacting?

The U.S. Government is flailing around trying to come up with a solution. A near-paralysis has set in, due to clamoring special interests and defense of bureaucratic turf. The private sector, frozen out of the market until now by Shuttle pricing policies, is not yet in a position to take up the slack.

The Department of Defense wants its payloads to have priority when the Shuttle resumes operations. Given the current national security situation, there is considerable justification for this attitude (in any case, by prior agreement with NASA, DOD already has the option of "bumping" other customers for DOD payloads).

In light of this, the Air Force wants a policy decision that would prohibit commercial satellite customers from using the Shuttle for satellites that could be launched using ELVs. The Air Force says this would not only give the DOD the launch capacity it requires, but would encourage U.S. companies which are promoting commercial expendable launch vehicles. The Air Force would further encourage the market for expendables by holding a competitive bid for launching smaller DOD payloads on them such as the DOD's Global Positioning Satellites. The Air Force could guarantee four such launches per year, and pointed out that the winning vehicle could also compete commercially with Ariane. The Air Force obviously expects one of the current existing launchers (Titan, Atlas and Delta) to come out the winner should this competition be held, but given the current situation it would not be impossible for some other company to come up with a vehicle to fill the bill just as reliably.

A moratorium on Shuttle launches of commercial satellites is also being

suggested by the White House Senior Interagency Group on Space (SIG-Space) which is trying to figure out a way to pull the American space program back together again and is running into considerable difficulty. The moratorium (which would not currently include customers already signed up for Shuttle flights) is part of a SIG plan which also includes purchase of another Shuttle orbiter and more ELVs. The price tag for all this, presented to President Reagan on May 15, was estimated to be up to $8 billion (!). That latter exclamation point was echoed by the President, who liked the idea of ending commercial satellite launches on the Shuttle, but did not like the price on the rest, or the arrangements for coming up with the money (neither NASA nor the DOD want it to come out of their budgets). The President told SIG to go back and work on it some more, and space plans remain in limbo.

The Department of Transportation (DOT), which is still actively promoting commercial ELVs, echoed SIG-Space's call for moving commercial satellites off the Shuttle. Unfortunately, the DOT is running into heavy opposition from pro-Shuttle interests. Rep. Bill Nelson (D.-Fla.), chairman of the House subcommittee on space science (which oversees the budget for DOT's Commercial Space Transportation office) took a dim view of the idea. Nelson is firmly in the Shuttle camp, and has already been treated to a free ride aboard the space vehicle (C.S.R. Oct. 1985, p. 5). So now the DOT is in deep trouble. The subcommittee set the budget of the Commercial Space Transportation office for FY 1987 at $575,000. The DOT had requested $2.27 million. In addition, there are now efforts to strip the DOT of its ELV licensing authority and give it to the Department of Commerce, or even NASA (talk about setting the fox to guard the henhouse...).

As for NASA, even as the agency struggles to free itself from the morass of disasters that it has fallen into, a strange myopia seems to prevail. While still probing details on O-rings, memos, and the roundness of booster casings, a number of policymakers at both NASA and other government agencies seem to have no intentions of changing the basic policies that were instrumental in placing us in this current position.

James Fletcher, NASA administrator from 1971 - 1977, was overwhelmingly approved by the Senate (by a vote of 89-9) to once more take that job. Many believe Fletcher to be responsible for a number of NASA's current problems. During the Senate hearings, he was charged with mismanagement, misleading projections regarding the Shuttle, and an adherence to the bureaucratic policies that resulted in the present mess. Confronted with the inaccurate Shuttle cost projections, Fletcher said "something must have happened on the way to the bank." Nevertheless, he was approved.

Almost immediately Fletcher and his supporters in NASA and the government began making noises in support of business as usual. Even as Challenger's wreckage continues to wash ashore, talk of 13 flights per year, or even as many as 24 again, is being tossed about. There is no talk of changing the Shuttle's pricing policy, and commercial satellites are still considered as fair game.

However, at the same time other NASA and industry managers and some Shuttle astronauts are pushing for more conservative Shuttle policies. For example, Rockwell International, builder of the Shuttle orbiter, is recommending fewer than 9 flights per year through 1989. Also, the practice of taking non-essential personnel aboard the Shuttle may be suspended. The definition of "non-essential" almost certainly includes "passengers" such as Congressmen and teachers, and may be extended to include payload specialists from private industry and foreign countries. Keeping industry payload specialists off the Shuttle scraps projects such as drug manufacturing and other materials processing in space until the ban ends.

The net result of all this activity is that chaos continues, and no coherent U.S. space policy looks like it is going to gel anywhere in the near future. In the

meantime, much of our capability to see and track both Soviets and hurricanes--human and natural adversaries--relies on two fragile satellites high above the Earth, and their clocks are ticking.

* * *

Aerojet Offers Single-Unit Solid Boosters For Shuttle--Again

Aerojet General has proposed that NASA use Aerojet's concept of a Shuttle Solid Rocket Booster (SRB) cast in a single piece instead of cast in segments. The current concept could use existing SRB casing segments, which would be assembled empty. Then, rubber insulation would be applied seamlessly over the entire interior, and the propellant would be cast into the casing in a single operation. This should eliminate any sealing problems completely. The catch is, of course, that such a booster must be shipped in a single piece. However, Aerojet has a facility in Florida with 150-foot-deep casting pits which could be used to build the booster. It could then be shipped by barge to the Kennedy Space Center for launch. Delivery could come as soon as 15 months after startup, with three more months set aside for testing.

Aerojet's current proposal to NASA was unsolicited. When the original contract for the SRBs was bid in the 1970s, Aerojet made a similar proposal which was turned down in favor of Morton Thiokol's segmented design (C.S.R., Feb. 1986, p. 3).

While no precise figures are yet available, Aerojet believes that its solution to the Shuttle's booster problem would not only be safe, but less expensive than redesigning the entire system.

Penny Wise...

A little information for those who like to compare an ounce of prevention and a pound of cure: NASA administrator James Fletcher estimates that it will take over $600 million to resolve the accident and get the Shuttle ready to fly again. Safety and abort systems that could have saved the Challenger orbiter and its crew were scrapped from the Shuttle design due to excess cost and weight (C.S.R., Feb. 1986).

For the record, the cost of such a system was estimated to be $270 million over the entire life of the Shuttle program. The estimated weight penalty: two percent.

Chinese May Launch Satellites Rescued By Shuttle Astronauts

A Houston, Texas company is working on acquiring the satellites rescued from orbit by the Space Shuttle and relaunching them using boosters from the People's Republic of China. This ironic development occurred when Teresat, a partnership of Universal Satellite Corp. of New York and First National Trust of Houston, entered negotiations with insurance underwriters to purchase the Palapa B-2 and Westar 6 communications satellites. These satellites had been rescued from space by the crew of Shuttle Mission 51-A in 1984 (C.S.R., Dec. 1984, pp. 3-4). The original owners wrote them off and the insurers took possession after the rescue.

Teresat has signed a letter of intent with the China Great Wall Industry Corp. to launch the satellites aboard China's Long March 3 launch vehicles sometime between October and December of 1987. Originally, Teresat had considered using the Shuttle, but Shuttle launch slots are currently hard to come by.

China is offering a launch price about 15% less than the going rate on Ariane or the Shuttle, and is willing to throw in insurance for a premium of about 22% (exact prices are not being released). China has been pushing its Long March vehicles to satellite operators for some time, and also has an agreement with the

Swedish Space Corp. to launch one of that country's small (220 lb.) Mailstar satellites. This would make Sweden China's first commercial launch customer, while Teresat would be China's first U.S. customer.

There are a number of problems to be solved and risks to consider before Teresat can make a success of this venture: First, Teresat has still not completed acquisition of the two satellites, and there are other companies also interested in obtaining them. Second, the U.S. Government must approve an export permit for the satellites. Third, NASA must approve any launch of these satellites on a booster other than the Shuttle. NASA rescued the two satellites with the understanding that they would be eventually relaunched by the Shuttle, and is not likely to take a positive stance on the proceedings. Fourth, geosynchronous orbital slots have to be made available. Teresat hopes to acquire them through agreements with companies which already have them. Fifth, the Long March 3 in has flown only three geosynchronous missions. Of these, only two were successful, a reliability rating of only 67% (although the number of launches is still too small for an accurate rating).

Orbital Sciences Finally Lands A Customer: NASA

Orbital Sciences Corp. (OSC) will get a contract to build the upper stage for NASA's Mars Observer interplanetary mission (the Mars Observer, scheduled for launch in 1990, is a relatively low-cost probe designed to orbit Mars and study that planet's climate. RCA Corp. will receive the contract to build the spacecraft). OSC was formed in 1982 to develop a commercial upper stage for spacecraft launched from the Space Shuttle. This upper stage, called the Transfer Orbit Stage (TOS), was originally intended for commercial satellite launches. Until now, no customer had signed up although OSC had raised over $60 million in investment capital and signed contracts with Martin Marietta to build the TOS. The NASA contract is OSC's first order, and is estimated to be worth about $20 million.

Hughes Aircraft, which also bid for the contracts, is filing a protest. Hughes claims that NASA changed the rules of the bidding in the middle to favor a separate spacecraft and propulsion package, rather than the integrated package Hughes was favoring. At present, it seems likely that the protest will be dismissed by NASA.

This contract is not quite the turnaround for OSC that it may appear to be. The company's prospectus states that at least seven TOS sales would be required for the company to just pay back its investments, much less make a profit. As it stands now, OSC's only real customer is the government, and there appear to be only about three to five NASA scientific spacecraft that could use the TOS between now and the turn of the century. Obviously, if OSC is going to stand as an example of private enterprise in space, the company is going to have to come up with something else to make a profit.

Until next time,

Tom Brosz

The Commercial Space Report (C.S.R.) is published monthly, and endeavors to report and analyze developments in the field of private initiatives in space transportation and exploitation.

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Address all correspondence to: *Commercial Space Report, P.O. Box 60547, Sunnyvale, CA 94088.* Editor: Tom A. Brosz. Tel: (415) 965-8666. Comments, ideas, or requests for information are welcomed, as are any items which may be of interest to our readers.