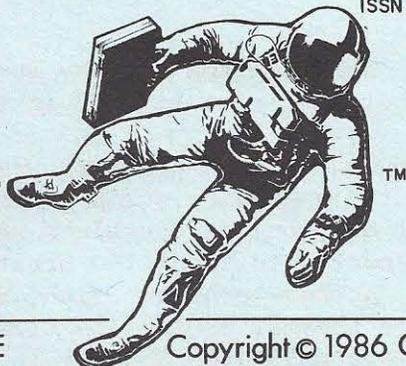


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Shuttle Sets New Record For Delays

The National Aeronautics and Space Administration (NASA) Space Shuttle Columbia set a new record for number of launch postponements before finally getting off the ground January 12. Mission 61-C was originally scheduled to lift off on December 18, 1985, but the Columbia and her crew suffered through seven delays, beating the previous record of six held by the Shuttle Discovery on her maiden flight in 1984.

The postponements were for a wide variety of weather and mechanical problems. Following is a short chronicle of events to serve as an example of the frustrations inherent in operating a complex and sensitive system like the Shuttle:

Dec. 18: The Columbia, which made its last flight in November of 1983, is fresh from the shop after extensive modifications to add instrumentation and improve performance. Today, she has her first launch attempt postponed until Dec. 19 when initial checkout procedures begin falling behind schedule. No real problems so far.

Dec. 19: The crew of seven astronauts, including Rep. Bill Nelson (D.-Fla.), confidently boards the Shuttle for the first time and waits for the countdown. At T-14 seconds, a hydrazine powered hydraulic power unit (HPU), one of two redundant units that powers the steering mechanism for the right-hand solid rocket booster, is shown by sensors to have exceeded its redline turbine speed and is shut down. The HPUs are restarted, and the test repeated, with the same results. Were both HPUs on one booster to fail during flight, the giant solid rocket motor (which cannot be shut off once lit) would become unsteerable--a deadly situation. The launch is postponed until Jan. 4, and the astronauts file out of the orbiter. On checkout, the problem proves to be in the sensors, not the HPUs, but the launch is postponed again until Jan. 6 to provide additional simulator time for the astronauts.

Jan. 6: The crew boards a second time. Then, with only minutes left until launch, a computer sequencing problem too convoluted to detail here causes 1,500 gallons of essential liquid oxygen propellant to drain from the Shuttle's External Tank (ET), where it had just been loaded. This puts a short hold on the countdown. The hold gets longer when the orbiter's auxiliary power units (APUs) have to be shut down to conserve propellant. Now, more time must be allowed to let the APUs cool down for restart and to realign the orbiter's inertial navigation units.

The hold finally cascades into a scrub when the launch window for an RCA satellite on board the orbiter slides firmly closed. The satellite must be ejected from the Shuttle's payload bay at a certain place and time to be within communications range of two aircraft-borne mobile communications stations during the critical solid motor burn that will propel the satellite into geosynchronous transfer orbit. Launch is postponed until Jan. 7, and the crew leaves the orbiter again after nearly four hours on their backs.

Jan. 7: The astronauts board once again. No mechanical problems, but now bad

weather socks in the Kennedy Space Center as well as critical transatlantic sites where the Shuttle would land in the event of an abort.

Clouds and rain are a problem for the Shuttle. For one thing, they can obscure the Shuttle's landing strip making landings difficult or impossible. This is important not only on the Shuttle's return from orbit, but also during launch--in certain early abort situations the orbiter would have to return to the launch site strip to land. Another problem with rain during a launch is the effect of rain on the Shuttle's thermal protection tiles. The tiles are waterproofed, and can resist rain quite well while the Shuttle is on the pad. At launch velocities, however, the raindrops become tiny bullets which chip the impermeable outer tile coating off and erode the tiles (this has happened even at the relatively low speeds the orbiter has encountered as it has been flown on the back of its carrier 747 aircraft). Eroded tiles are less effective as heat insulators, and more importantly, can ruin the smooth aerodynamic profile of the orbiter and interfere with control. So, the launch is scrubbed until Jan. 9 and the crew marches out once again.

Jan. 9: During the loading of liquid oxygen into the External Tank, a five-inch-long temperature sensor in the liquid oxygen line breaks off and is pumped into the tank. Unfortunately, it is carried by the oxygen flow into a critical Shuttle Main Engine valve where it sticks, jamming the valve open. Without this valve, a smooth shutdown of the engine after launch is not possible. Launch is postponed again until Jan. 10. Fortunately, this time, this all takes place before the astronauts have to board.

Jan. 10: On go the astronauts. In comes the weather again, with driving rain. Scrub goes the launch until Jan. 12. Off go the astronauts, beginning to get a little peeved.

Jan. 12: Preparing to board the Columbia for the fourth time, the astronauts apparently suspect that a Hex of some sort may be plaguing the mission. Suspicion falls on astronaut Steve Hawley, a mission specialist who was also aboard the Discovery flight which held the previous record for delays. Attempting to fool any "evil spirits," an elaborate disguise (a "Groucho" nose and glasses) is affixed to Hawley for the boarding this time. All of this is accomplished, of course, with tongue firmly in cheek (at least I hope so!) Launch personnel snap a film clapboard in front of the cameras for another "take."

On this day, Columbia finally roars flawlessly into the sky. Perhaps it was the Groucho disguise--who knows?

The launch took place just in time. Launch Pad 39-A had to be cleared to allow the orbiter Discovery to roll out to begin critical testing for the launching of the Galileo Jupiter mission (more on this in a moment). The schedule slip will also affect the launch of Mission 51-L. The orbiter Challenger, mounted on nearby pad 39-B, will leave the ground on Jan. 24 rather than Jan. 23. To push the schedule along, NASA planned to bring Columbia back to the Kennedy landing strip a day early to begin preparations for her next mission (61-E, currently scheduled to launch March 6). Unfortunately, as of press time, the weather has moved into Florida again and the landing was postponed. I suppose Hawley had to take off the disguise sooner or later to use a camera or something...

One can see how a single mission delayed can affect the entire Shuttle launch schedule. Currently the problem is exacerbated by the fact that the launch schedule for 1986 is particularly ambitious, with fifteen flights planned. In addition, there are many science and astronomy payloads scheduled, some of which have critical launch windows which must be met. Some examples:

Mission 51-L will carry a telescope designed to observe Halley's Comet. A

delay would mean the telescope would be unable to observe the comet before it slips behind the sun on its orbit in early February. Similarly, Mission 61-E will also carry Halley-watching equipment which, if launched on time, will be able to coordinate data with the observations of the Soviet Vega 2 spacecraft and the European Giotto spacecraft, both of which will make close approaches to the comet on March 9 and 13 respectively. If this Shuttle mission is delayed, much data will be lost.

Most timing-critical will be Missions 61-F and 61-G, the International Solar Polar Mission (Ulysses) and the Galileo Jupiter orbiter mission. Both will be ejected from the Shuttle payload bay and then propelled by Centaur upper stages along the same trajectory to Jupiter. Ulysses will use Jupiter for a gravity swing-by that will eventually take it past the Sun in a polar trajectory. Galileo will enter Jupiter orbit and launch a probe into the Jovian atmosphere (if launched on time, it will also fly by the asteroid Amphitrite for the first close observation of such a body). To hit the correct trajectory, both missions must be launched within a very narrow window. 61-F will launch the Ulysses probe on May 15 aboard the Shuttle Challenger. Only six days later, on May 21, the Galileo probe will be launched aboard the orbiter Atlantis, the only orbiter light enough to carry out the mission. The launches could be delayed until about June 6 before the window closes, but any further delay would result in a wait of at least a year before another attempt could be made.

To complicate things further, both missions will use a new version of the Centaur liquid-fueled upper stage that has never been used before, and many tests are needed before it is ready for launch.

Also scheduled for launch this year is the Hubble Space Telescope. Originally due for launch on August 18 on Mission 61-J, the \$1.2 billion dollar payload has been switched with the launch slot occupied by Mission 61-K, due to fly October 27 (both missions will use the orbiter Atlantis). This gives NASA two more months to accommodate any delays (in the case of the Space Telescope, the delays have been largely payload related).

So, this year will be an acid test to see if NASA can keep the Shuttle on a tight schedule. The agency's record has been spotty so far. In the earliest stages of the Shuttle program, NASA had planned to have flown 48 flights by October of 1985. By 1981 that number had been cut to 34. The actual number flown by the end of last October was 22. In 1984, NASA scheduled ten Shuttle missions and only five were flown. In 1985, 13 missions were scheduled, 9 were flown. As mentioned earlier, NASA plans 15 missions for 1986. In four years, the agency intends to fly 24 Shuttle missions per year. Throughout it all, NASA must effectively balance the schedule requirements against the real possibility of disaster or tragedy should the Shuttle system be rushed too fast or pushed too far. We shall see.

* * *

Space Station Running Into Funding Problems

The Office of Management and Budget proposed cutting NASA's Space Station funding for FY 1987 from \$580 million down to \$100 million as part of the effort to cut the Federal deficit. This would result in a three-year delay of the program, pushing the Station's operational date to 1997.

NASA appealed to President Reagan, with the result that a compromise was reached. Currently, FY 1987 funding for Space Station will be about half of the requested \$580 million instead of the less than 20% originally proposed. The resultant delay would be on the order of 1 to 1 1/2 years instead of 3. With open season on government spending coming up, it's likely that this is not the only crisis the NASA Space Station will have to weather.

Update: Geostar

Geostar, Inc. has granted licenses to the Sony Corporation of America and M/A Com's Telecommunications Division to develop, manufacture and market Geostar system terminals. The Geostar system, a nationwide satellite positioning and message transfer network, will enable trucks, cars, trains, boats and aircraft to communicate their positions and short messages to a central facility where the information can be processed and distributed to customers (C.S.R. April 1983, p. 2; June 1985, p. 5). The user terminal is expected to cost customers about \$3,000 in addition to a monthly fee of \$22.50. So far, Geostar has lined up over 12,000 orders for terminals, each with a 5% deposit (don't run for the calculator--it adds up to about \$1.8 million cash). These orders have attracted many investors. The company raised over \$12 million in equity investment in 1985, and a multi-million dollar line of credit is expected to come from the Bank of Virginia.

Geostar has also gotten a license--from the Federal Communications Commission--to operate its first satellite relay, which is incorporated into GTE Spacenet's G-STAR II satellite and scheduled to be launched on an Ariane 3 on Feb. 14. The radiopositioning service offered by this initial relay is referred to by Geostar as "Link One." A full system of three dedicated Geostar satellites is expected to be in operation before 1989. At that time, customers will be able to use more accurate pocket sized terminals which could cost less than \$500.

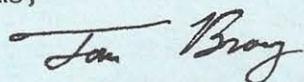
Geostar is in the process of signing a modified launch services agreement with NASA to launch these additional satellites (sources within NASA claim the agreement has already been finalized). NASA apparently offered the company a good deal, the terms of which have not been revealed, but which caused Geostar to select the Shuttle over Ariane for its launches.

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