SPACEBOUND AGAIN: THE MIXING OF THE FLEET

NASA's launch plans for 1988 and beyond represent more than just the shuttle's return

By JONATHAN EBERHART

The unquestioned highlight of NASA's launch plans for 1988 is the expected return to service of the space shuttle, grounded ever since the Challenger explosion on Jan. 28, 1986. Almost as important, however, will be the agency's adoption of a policy that is seemingly the same as what it has been doing all along: the use of a "mixed fleet" combining both shuttlecraft and unmanned, one-shot rockets now known as "expendable launch vehicles," or ELVs.

Now NASA is planning three shuttle missions and seven ELV launches for next year, eight shuttle flights and five ELVS for 1989 and eight of each for 1990. On the surface, a mixed fleet does not seem to represent anything new — NASA has never had a year in which it launched only shuttles, and even in 1986 it had been planning for as many as 10 ELV flights in addition to 15 shuttle missions. But NASA was phasing out ELVs, threatening to force virtually everything that the agency sent into space to ride the shuttle.

That idea had its beginnings back in the late 1970s, when the shuttle was still being developed, as the agency was becoming painfully aware that its highly touted new transportation system would not come even close to providing the less expensive "access to orbit" that had been used as one of its chief selling points. Some critics of the system, in fact, argued that ELVs were being deliberately done away with in order to shore up the shuttle's shaky economic *raison d'être.*

Cost was not the shuttle's only problem. Its sophisticated equipment, elaborate mission plans and multiple satellite deployments created a host of factors that could delay its takeoffs — anathema to customers like the Department of Defense (DOD), who needed to know that they could count on having a promptly available launch vehicle in case they needed to replace a critical but malfunctioning satellite. What did it matter that astronauts could sometimes simply repair a vital satellite instead of deploying a new one, if it could never be known in advance when the shuttle would in fact be able to take off?

About four years ago, in fact, DOD decided to start leaning more heavily on ELVs again in its own launches, rather than relying on the shuttle. And this year, NASA, having been roundly criticized during the Challenger aftermath for consciously leaving itself no choice but to launch all its eggs in one basket, came to the same decision. (Some critics, notably space scientists, had voiced the same complaint almost as soon as the shuttle program was initiated in 1972. At that time, however, the argument was primarily an economic one, championed by researchers who feared that the expense of a manned system would drain funds needed for the very projects that were one of the shuttle advocates' justifications. A similar complaint is heard these days from opponents of the envisioned U.S. space station.)

Not all of the launch problems have been with the shuttle. Most of America's ELVs had years-long records of reliability, but the months following the Challenger disaster saw a staggering succession of ELV mishaps, ranging from NASA's tried-and-true Delta rocket to the most powerful member of DOD's own launch stable, the Titan 34D. Even Europe's ELV, Ariane, was put on hold after a launch failure. In addition, safety concerns following the Challenger explosion prompted NASA to ban a liquid-hydrogen-burning rocket called the Centaur from use in the shuttle; specially designed for the purpose by modifying an earlier ELV version, the shuttle-Centaur was the most powerful vehicle NASA had for sending a spacecraft into deep space from the low orbit at which the shuttle would deploy it.

Since that time, the Delta, Ariane and Titan 34D have all performed successfully. The most recent return to favor was that of the Titan, which on Oct. 26 launched a classified payload reported to be a Central Intelligence Agency KH-11 reconnaissance satellite. Three months ago, a "strap-on" rocket motor designed to improve the performance of the Delta failed during a ground test, but NASA announced on Oct. 29 that the cause of the failure has been established "beyond any doubt," and that remedial steps have been taken.

The ELV components of NASA's mixed fleet, in other words, appear to be ready to do their parts, and also under discussion are additional vehicles such as an unmanned version of the shuttle designed to carry payloads two to three times as heavy as the existing, manned ones.

Even the present shuttle, of course, is still an open question. As recently as the beginning of this year, flights were scheduled to resume next Feb. 18, with the first of half a dozen flights scheduled for 1988. Now the date has slipped to no earlier than June 2, and the number of missions planned for the year is back to three. NASA officials are expressing cautious confidence, and the redesigned version of the shuttle's huge, solid-rocket boosters has been successfully test-fired on the ground.

On the other hand, a leak was discovered a month ago in the oxygen turbopump of one of the craft's main engines, not long after one from a batch of 10 such engines had successfully passed a ground test. Engineers are now working to determine whether the leak is a fault in just the one engine or a design flaw. There are a number of other major test milestones to be passed as well, and officials readily acknowledge that the schedule leading to a June 2 launching is "success-oriented." In other words, the shuttle's return-to-flight calendar contains little room for either malfunctions or mistakes.

Drawing up NASA's launch plans cannot wait until every technical issue has been resolved, however, particularly in the case of the shuttle. Hence, the agency has already completed the initial version of the "flight manifest" covering operations of its newly sanctioned mixed fleet. Specific shuttle missions have been "manifested" only through 1990, but ELV launches are tentatively listed through 1995 (though some are merely reserved launch opportunities, rather than plans for lofting specific satellites). Still, there are various empty blanks in the plan, as well as many details that are "TBD" (to be determined); in fact, the entire document is labeled "for planning purposes only."

For 1988, in the first of the year's three shuttle missions, the shuttlecraft Discovery will have two primary goals: flight-testing the various modifications and procedures that have been incorporated since the Challenger catastrophe, and deploying the second of NASA's Tracking and Data-Relay satellites (TDRS). The TDRS satellites are designed to let NASA phase out much of its ground-based tracking network, as well as to markedly increase the amount of time that orbiting shuttles and other space-borne devices are in communication with the ground; in addition, a number of forthcoming NASA satellites such as the Hubble Space Telescope (due for shuttle launch in 1989)

have been designed on the assumption that at least two TDRS's will be available at any given time. Besides deploying the new TDRS, that first shuttle mission will carry a variety of "secondary payloads" such as biomedical and materials-processing experiments. Another TDRS is scheduled for 1989, and another for 1990.

The other two 1988 shuttle flights are to be classified DOD missions, in large measure because the Pentagon has been faced with a growing backlog of its own since the shuttle was grounded. For the third year in a row, in fact, the DOD space budget is larger than the whole budget of NASA. Besides the two shuttle missions, five of NASA's scheduled ELV launches are to carry military payloads – two of them classified, plus communications and navigation satellites for the Navy and an "instrumented test vehicle" for a test of the proposed U.S. antisatellite (ASAT) system. The only scientific payload on NASA's 1988 calendar is the tentatively listed San Marco D_L satellite, a joint NASA/Italian project that has appeared on the schedule for five years without getting off the ground.

Science is scheduled for a much more significant role in 1989, with space shuttles launching the Hubble Space Telescope, the Galileo orbiter-and-probe of Jupiter, the Magellan Venus-orbiting radar mapper and the earth-orbiting Astro-1 ultraviolet observatory. A payload originally planned to have been launched by the shuttle but now assigned to an ELV will be the Cosmic Background Explorer (COBE), an earth-orbiting satellite designed to map the pattern of emissions remaining as evidence of the Big Bang at the birth of the universe.

Military missions listed on the NASA manifest for the year account for three of the eight planned shuttle flights (one of them carrying an "Infrared Background Signature Survey" payload to gather information for the Strategic Defense Initiative) and three of five ELVs, including another ASAT test.

For 1990, the manifest includes four scientific missions, two of them to be carried aloft by shuttle: a major astronomy satellite called the Gamma Ray Observatory and Ulysses, a European space probe to study the poles of the sun. Destined for an ELV ride is an earth-orbiting probe known as the Combined Release Radiation Effects Satellite (though it, like COBE, was originally to have gone on the shuttle). Developed jointly by NASA and the U.S. Air Force, it is to yield data on the radiation environment awaiting satellites in orbit, as well as on the behavior of artificial "comets" formed by releasing clouds of ions into earth's magnetosphere and the solar wind. Also scheduled for ELV deployment is ROSAT – a roentgen satellite designed for X-ray experiments.

Though shuttle missions beyond 1990 are still being negotiated, the manifest itemizes about 200 other shuttle payloads for which flights have been requested between 1988 and 1996. (Major shuttle payloads are not usually assigned until about 18 months before launch, the document notes, with berths for secondary payloads typically held until about 12 months to go.) Only ELVs are so far listed for even tentative launchings after 1990, most of them to be carried out by rockets the choice of which is still "TBD."

Even before the setbacks of 1986, NASA's launch manifest was a continually evolving document, reflecting the complexities of planning the agency's forays into space. Yet despite TBDs and other uncertainties, such as increasingly tight budgets and attempts to shift some launch services to the private sector, the new version of the document is significant as NASA struggles to restore some order to the shape of things to come. □

PLANNED MISSION SCHEDULE

1988	
• *DOD-2*	*Jan.*
NOAA-H	*Feb.*
San Marco D_L	*Mar.*
• *ITV-2 [ASAT]*	*May*
TDRS-C	June 2 (Discovery)
• *DOD-3*	*Aug.*
• *SOOS-3 [USN]*	*Aug.*
• DOD	Sept. 8 (Atlantis)
• *FLTSATCOM-F8 [USN]*	*Oct.*
• DOD	Dec. 1 (Columbia)
1989	
TDRS-D	Feb. 2 (Discovery)
COBE	*Feb.*
• *SOOS-4 [USN]*	*Feb.*
NOAA-D	*Mar.*
• *ITV-3 [ASAT]*	*May*
Magellan	Apr. 27 (Atlantis)
Space Telescope	June 1 (Discovery)
ASTRO-1	June 29 (Columbia)
• *NOVA-11 [USN]*	*Aug.*
• DOD	Aug. 24 (Atlantis)
Galileo	Oct. 9 (Discovery)
• GPS-1 [DOD]; IBSS [SDI]	Nov. 9 (Columbia)
• DOD	Dec. 7 (Atlantis)
1990	
ROSAT	*Feb.*
• *Transit 27 [USN]*	*Feb.*
• GPS-2 [DOD]; Syncom IV-5	Mar. 1 (Columbia)
GOES-1	*Mar.*
• Starlab [DOD]	Mar. 29 (Discovery)
• DOD	April 26 (Atlantis)
• *ITV-4 [ASAT]*	*May*
Gamma Ray Obs.	June 4 (Columbia)
CRRES [NASA/USAF]	*June*
NOAA-1	*June*
• DOD	July 2 (Discovery)
TDRS-E	Aug. 2 (Atlantis)
• *Transit 28 [USN]*	*Aug.*
Skynet 4A; EURECA-1L	Aug. 31 (Columbia)
Ulysses	Oct. 5 (Discovery)
GOES-J	*Dec.*

• = military (DOD, USN, SDI, ASAT)
ELV launches are italicized