Nozzle gimbal likely culprit on IUS failure

Collapse of the nozzle gimbal mechanism on the first Inertial Upper Stage is the most likely cause of the poor thruster firing which sent the first Tracking and Data Relay Satellite into a low elliptical orbit during STS-8 in April.

These are the findings released by the joint Air Force/NASA Anomaly Investigation Board after three months of study: "Failure of the gimbal system used on the IUS solid rocket motor caused the nozzle to be mechanically jammed in an offset position," the report said. "The actuators were unable to overcome the high mechanical forces caused by the jammed nozzle while the motor was thrusting."

The fault occurred at approximately 83 seconds into the SRM-2 burn. At that point, the motor, which had operated nominally, had an uncommanded rocket motor nozzle position change in both pitch and yaw. This uncommanded deflection resulted in the uncontrolled tumble of the IUS/TDRS stack at a rate of approximately 30 RPM. "No net increase in orbital velocity occurred as tumbling started," the report said. "Even though SRM-2 continued to burn for the planned nominal time of approximately 105 seconds."

The pitch and yaw actuators, which had responded to commands before the gimbal mechanism apparently collapsed at 83 seconds, did not respond to commands from that point until after the burn was completed.

The Investigation Board identified four potential sources of the nozzle gimbal mechanical failure: a breakdown of thermal protection in the flexible seal around the nozzle; long-term seal leakage quality or manufacturing problems; or environments to which the assembly was exposed.

The Air Force said a firm decision about the near-term launch schedule of the IUS is expected this fall. NASA is tentatively planning to return an IUS/Spacelab launch for STS-12 in March 1984.

The Air Force's IUS Program office has identified three means to resolving the problem, the Air Force said. They include nozzle component testing, nondestructive testing of motor nozzles leading up to ground test firings, and a rebuild of the nozzle using stringent quality control.

STS-8, STS-9 delayed for TDRS checkout

Launch dates for STS-8 and STS-9 have been pushed back to Aug. 30 and Oct. 28, respectively, to allow extra time for ground verification testing of the Tracking and Data Relay Satellite (TDRS-A).

Although the satellite itself so far has performed nominally, important ground tests of the system are not expected to be completed and both Shuttle flights require that most of the tests be completed.

The decision to delay the first Spacelab mission by about one month was reached jointly by NASA and the European Space Agency. The joint NASA-ESA mission was originally scheduled for Sept. 30.

Proper checkout and operation of the TDRS satellite is essential for the Spacelab mission due to the enormous amount of scientific data that is to be transmitted through the satellite to ground stations. Some of the experiments aboard require specific alignments of the Sun, Earth and Moon, and the next acceptable alignments beyond Sept. 30 occur in late October.

During STS-8, the Indian National Satellite, INSAT 1-B, will be deployed from Challenger's cargo bay on the second day of the mission. Flight days three and four involve operations with the Payload Flight Test Article, and tests with the TDRS will be interspersed throughout the mission. Program officials said the scheduled five-day flight may be extended an additional day, if necessary, to allow for a more complete checkout of the TDRS satellite.

Plans call for regular air-to-ground communication through the TDRS on STS-8 as soon as Challenger passes Dakar on the first orbit. A series of four detailed test objectives and flight test objectives are planned to be run during three days of the flight. Nominal TDRS-A coverage begins at about the mid-Pacific Ocean and ends near where the Indian Ocean Station coverage begins on the east coast of Africa.

The planned launch time Aug. 30 is now 1:15 a.m. CDT, rather than the 1:21 a.m. launch time scheduled for an earlier launch date.

Problems with ground checkout of the TDRS began in July when a software anomaly occurred in ground computers. Two additional days were lost later in the month when a power failure caused two emergency generators at the NASA-Spacecom White Sands ground station to come on line and one caught fire.

A major element of the checkout still to be completed is the tracking test of the Ku-band antennas on the TDRS. The antennas must track other satellites, as well as Shuttle orbiters, for nominal operations.

At the Kennedy Space Center last week, the Challenger was moved from the Orbiter Processing Facility to the Vehicle Assembly Bldg. and mated with the external tank and solid rocket boosters. Challenger's stay in the OPF was the shortest for any orbiter to date. The vehicle spent 27 days in the OPF, with crews working around the clock shifts every day during that time except the Fourth of July holiday.

Work is still progressing satisfactorily on the Columbia, which will return to service for the Spacelab mission. Plan now call for installation of the Spacelab components in mid-August and rollover to the Vehicle Assembly Bldg. in late August. The Columbia is scheduled to go to Launch Pad 39A in late September.
Although NASA had conducted the ceremony, it was not until JSC recently that it had been some time since the Center recognized its contributions to the Space Program and its employees. The time came July 21, 1983, when JSC went to the top to honor a broad range of awards to individuals, groups, and organizations. Some 63 Certificates of Commendation, 53 Superior Achievement Awards, four Equal Opportunity Awards, 72 Certificates of Appreciation, 35 Group Achievement Awards, and two Special Awards were presented during the ceremony.

A list of those recipients is presented below. In addition, the certificates of appreciation have been provided for presentation to winners during the JSC Honors Ceremony recently.

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**Space News Briefs**

**STS-8 to carry 260,000 postal covers**

The cargo for STS-8 will include some 260,000 special-cast postal covers which will go on sale from the U.S. Postal Service after the flight. Each of the covers will be placed in a specially designed folder and sold for $15.35 each from the USPS Philatelic Sales Division. The covers will bear the recently announced $9.35 postage stamp, intended primarily for use on these covers. Each cover will be a full-color replica of the STS-8 crew patch, and on the back will be NASA’s 25th anniversary logo. Each year the STS-8 patch will be issued for each cover will be carried on the STS-8 launch date of Aug 14, which is also the issue date of the stamp. After the flight, the actual launch date will be noted on the back of the cover. NASA has indicated the date proceeds from the sale of the Shuttle Flight Folder, Philatelic Sales Division, Washington, D.C., 20265-9977.

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**Bulletin Board**

**U.S. Model Rocket Championship set for JSC**

For the third time in 25 years, the National Association of Rocketry will hold the U.S. Model Rocket Championship at JSC. The event will take place during the week of Aug. 7 to 12. The competition is open to public viewing, and details of the event will be released. Like previous championships, held at JSC, annual meet 12 and 21, the 25th competition will be comprised of several different days, including flights with 400 or more entries and the NASP members may compete in the championship, although a non-competitor category will be available for non-NASP participants. For more information, contact Contest Director Ron Goforth at 481-7316 or 488-2085.

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**Cookin’ in the Cafeteria**

**Week of August 8-12, 1983**

**Monday, August 8, 1983**

- Spicy Spaghetti (Special), Fried Chicken, Misty Diced Ham, Baked Spaghetti (Special), Spaghetti, Rabbit, Guacamole, Cheddar Cheese, Green Olives, Spinach
- Grilled Ham, Mashed Potatoes, Peas & Carrots, Leaf Lettuce, Mixed Vegetables

**Tuesday, August 9, 1983**

- Young’s Grilled Ham, Ham & Cheese, Tilted Chilean, Cold Chicken, Mixed Vegetables, Tilted Chilean, White Rice, Mashed Potatoes, Peas & Carrots, Mixed Vegetables

**Wednesday, August 10, 1983**

- Spicy Spaghetti (Special), Fried Chicken, Misty Diced Ham, Baked Spaghetti (Special), Spaghetti, Rabbit, Guacamole, Cheddar Cheese, Green Olives, Spinach
- Grilled Ham, Mashed Potatoes, Peas & Carrots, Leaf Lettuce, Mixed Vegetables

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**NASA**

**Space News Roundup**

**August 5, 1983**

The JSC rocketry competition was held to honor a broad range of awards to individuals, groups, and organizations. Some 63 Certificates of Commendation, 53 Superior Achievement Awards, four Equal Opportunity Awards, 72 Certificates of Appreciation, 35 Group Achievement Awards, and two Special Awards were presented during the ceremony.

A list of those recipients is presented below. In addition, the certificates of appreciation have been provided for presentation to winners during the JSC Honors Ceremony recently.
A WET-F run in space

STS-11 EVA is dress rehearsal for STS-13 and Solar Max

The most demanding and far-ranging EVA ever attempted in space is now scheduled for STS-11, in a visual and technological tour de force leading up to the Solar Max mission on STS-13.

Since the lunar surface EVAs of the Apollo era and the first Space Shuttle EVAs, the training for this exercise has involved new approaches for the crew trainers, EVA planners and the crew members themselves.

"The training has been as much a development process as the training itself," says STS-11 EVA planner Barry Boswell of the EVA and Crew Systems Section, Training Division. "We're still somewhat in the developmental stages, with some hardware still being defined, rather than refined."

Usually, crews are brought into the picture only after various procedures for working with different pieces of hardware have already been worked out. But the ventures on STS-11 and STS-13 involve demonstrations of several integral tasks for future work in space — even beyond STS-13 — and the complexity of both the training and the jobs to be performed next spring is considerable.

The result, Boswell said, is that one new wrinkle to training for these two flights is "the crews themselves have been 'down in the dump' with us for some time, and they are very much involved in the development and buyoff of the equipment and procedures."

The STS-11 EVAs are essentially dress rehearsals for the challenging work to be done on STS-13, where it is planned to rendezvous with, stabilize, grasp, fix and deploy the ailing Solar Maximum Mission satellite. But there is more to the STS-11 EVA periods and training than just that.

Crewmembers Bruce McCandless and Robert Stewart (the first representatives of the U.S. arm scheduled to fly in space) will not only demonstrate the procedures necessary for the Solar Max repair, but they will also perform the first in-space checkout of the Manned Maneuvering Unit (MMU) and the Manipulator Foot Restraint (MFR), demonstrate curved path tracking, simulate the checkout of a Solar Max main electronics box and demonstrate operations while grappling the satellite — all of that in addition to training for such contingencies as problems with the payload bay doors, bulky sun shields on the PALAPA-B-2 and WESTAR-6 satellites, a malfunctioning robot arm or difficulties with the SPAS Shuttle pallet satellite.

"We are in a space quality speculating the STS-13 equipment and procedures on STS-11," Boswell said. "It's something of a WET-F (Weightless Environment Training Facility) run in space."

A summary of the STS-11 timeline for two different EVAs illustrates the complexity of the planned tasks:

EVA-1: McCandless and Stewart will egress from the Orbiter Challenger's airlock for a five-hour extra-vehicular period. Two MMUs will be positioned in Flight Support Structures (FSS) on the forward bulkhead of the payload bay. The second Shuttle Pallet Satellite (SPAS), a 1A, will be the forwardmost payload, and will provide television coverage of the egress along with the two regular closed circuit television cameras mounted on the aft bulkhead.

McCandless will be the first to don an MMU, at approximately 10 minutes into the EVA. He will perform a check-out of the system in the payload bay, making sure that all 260 meters on the unit are working properly. He will then use the MMU to dock with a trunion pin attach devise (TPAD) mounted on an equipment storage box located on the starboard side of the payload bay near the MMUs. The TPAD is the same attachment device astronaut George Nelson will grasp with to stabilize Solar Max during the STS-13 EVA.

A second TPAD will be mounted on the SPAS-1A for STS-11, and will come into play during both EVAs.

After docking with the TPAD, McCandless will do both a 150-foot and a 300-foot translation away from Challenger. He will be carrying an MMU-mounted 35mm camera and a small closed-circuit television. He will then translate back to the site and begin a recharge of the MMU.

While that is underway, Stewart will be performing the first tryout of the manipulator foot restraint, a device which secures an astronaut's feet against the end of the remote manipulator arm. In effect, Stewart will be "grappled" by the arm in much the same way as previous payloads on earlier missions. While in that foot restraint, Stewart will first perform a checkout of the unit, doing force measurements with the RMS in an effort to duplicate ground-based manipulator data, the dynamics and feedbacks in the arm. Stewart will then egress from the MMU and move back to the forward bulkhead to don the port MMU McCandless flew. He will then repeat the initial MMU checkout procedure and then venture first 150 feet away and then 300 feet away from Challenger. Repetition of this task is designed to give crew systems analysts two subjective accounts of the MMU's performance after training.

Once Stewart has returned to the orbiter and doffed the MMU, McCandless will begin service on the manipulator foot restraint and perform a simulation of the Solar Max satellite electronics box replacement which will be performed on STS-13 for Solar Max.

McCandless will then stow the MFR and both astronauts will enter the airlock some five hours after venturing out into the vacuum of space.

EVA-2: During this EVA, the starboard or, second, MMU will be used. McCandless will don it first while Stewart assists. He will then attach a TPAD and translate down the length of the payload bay to the vertical stabilizer. By this time, the Solar Max satellite will have been grappled by the robot arm, and the arm will have raised it almost directly over the center of the payload bay, straight up from the "shoulder" joint of the arm. This will then be rotated at approximately the same speed as the Solar Max satellite as it grapples with it about its axis — about one degree per second. From his position near the vertical stabilizer, McCandless will approach the rotating SPAS-1A and demonstrate the circular tracking technique of the MMU, which is essential for the STS-13 Solar Max repair. McCandless will match rates with the SPAS and dock with the TPAD, and then repeat the procedure as often as time allows.

When the timeline calls for it, he will return to the flight support structure and doff the MMU, and Stewart will begin a servicing of the unit. McCandless will then move on to a demonstration of orbital refueling. The procedure under evaluation here is equivalent to what might be used to refuel the Landsat satellite and others now in orbit. McCandless will begin the first such refueling demonstration (essentially, he will connect two pressurized lines using special tools and check to see that there are no leaks — a simulation of a hydrazine transfer on later missions). Stewart will don the starboard MMU and repeat the SPAS tracking and docking procedure.

If time permits, McCandless will then do the first MMU — the port MMU used during the first EVA — and conduct a series of flight evaluations to provide data on the unit's handling characteristics.

"More significant than the distance reached from the 'mother ship,' as it were," Boswell said, "is the complexity, the number of different systems being exercised during the STS-11 EVAs. We've been planning this for several years, and we've made a significant effort to make sure that the STS-11 EVA become even more demanding than the one planned for STS-11. We hope that the training work done for Solar Max mission is perfectly incredible. We will service systems that were, and some that were not, designed for orbital servicing. The entire thing, both the STS-11 and STS-13 EVAs, are opening an entire new effort in working in space."
Flower arrangement — Learn how to make floral arrangements in this six-week course which begins Aug. 11. The class covers basic design, selection of materials and finalization of the product. This course runs from 7 to 9 p.m. and costs $100. Registration deadline is Aug. 9.

Cello basics — Learn the fundamentals of playing the cello in this course designed for fun and profit. The class meets Aug. 31 and Sept. 7 from 7:30 to 10 p.m. The cost is $12 and the deadline is Aug. 12.

Upper body — In this class, you can be valuable in preparing you, should you receive a ticket, and it can teach you how to avoid them. Registration does not apply. Class meets Aug. 17 and from 7:30 to 10 p.m. The deadline is Aug. 12 and space is limited.

Quilting — This beginning quilting class will focus on simple songs, chords, harmony, and melodies. Intermediate classes will cover music theory and finger picking. Beginners meet Mondays from 7 to 9 p.m. from Aug. 8 through Sept. 26. The cost for both of these six-week courses is $25. Registration deadline is Aug. 9.

Dancerelle — Part dance, part exercise, all fun, this class will gradually get you in shape. This ten-week course begins Aug. Tuesdays and Thursdays from 5:15 to 6:15 p.m. The cost is $25 per person.

Speedreading — This course covers the techniques needed to gain greater reading speed and comprehension. The class meets for seven weeks and runs from Aug. 8 to 9 p.m. The cost is $60 and the registration deadline is Aug. 19.

Buying a house — Find out how much money you can afford in today's market and practice what you'll learn in the real estate market.