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Starstruck's Dolphin Flies, But Company Status Unknown

Starstruck has succeeded in launching the company's hybrid test rocket, the "Dolphin." Launched from the Pacific Ocean, the Dolphin reached a maximum height of nearly half a mile before a guidance failure obligated test personnel to shut the rocket down. The Dolphin made a hard landing in the ocean and broke up. Parts were recovered, while others sank or were purposely discarded. The flight, in spite of some problems, was termed successful for the most part, meeting the primary objectives for the mission.

The success, however, was long in coming, and may possibly be too late. Starstruck spent far more time and money on this first test than anticipated, and the company is undergoing a major reorganization. The outcome is uncertain as of press time, but the company's offices in Redwood City, Calif., are presently closed up and a number of employees have apparently been laid off.

Details of the Launch:

Starstruck had already attempted a launch three times this year. The first try on Feb. 6 resulted in a small fire and accidental separation of the nose cone (C.S.R., Feb. 1984). The second try, on Mar. 30, was scrubbed due to electronic failures (C.S.R., April 1984, p. 5). A third try, on July 14, ran into problems with gas leaks in the thrust vector control system.

On August 3, Starstruck crews brought the 50-foot rocket out onto the Pacific Ocean for a fourth try. The launch area was in waters restricted by the U.S. Navy, located ten miles east of San Clemente Island off the coast of southern California. The weather conditions, which had been a problem during other tests, were ideal in this more protected area of water. The Dolphin's oxidizer tank was filled about 1/3 full with 3,300 lbs. of liquid oxygen, and the rocket was deployed into the ocean.

The deployment mechanism, slightly different from that used on some earlier tests (C.S.R., Nov. 1983, pp. 3-4), consisted of a semi-cylindrical cradle in which the rocket rested. This cradle, supported on casters, rolled down rails affixed to the boat deck and slid into the water. The rocket floated free of the cradle, which then began to sink. A 150-foot nylon cable connecting the aft skirt of the rocket to the cradle allowed the cradle to serve double duty as a ballast weight, pulling the rocket upright in the water to its launch position.

The first problem arose as the Dolphin bobbed in the water waiting for launch. About an hour before the scheduled time of launch, the cable connecting the rocket to its cradle "anchor" apparently chafed on some metal part of the rocket's aft skirt, and broke. The cradle went to the bottom, and the rocket settled back into a horizontal floating position. Launch personnel attached a back-up ballast weight (one of the five-ton concrete blocks similar to those used in earlier tests), and the rocket returned to a vertical launch attitude.

Fifteen minutes before launch, the LOX tank was pressurized to 400 psi, and the two support vessels began moving to observation positions. When the boats were at their final stations for launch, the boats and the rocket were approximately located at the three corners of a triangle, with each boat being about a mile from the rocket and each other.

As the countdown reached zero, ignition took place and the oxygen valves were opened. The engine lit, the exhaust plume underwater cut the nylon rope holding the rocket to the ballast weight, and the rocket took off. (Originally there were pyrotechnic back-up systems to cut the rope if the plume failed, but they were lost with the cradle. Fortunately, they were not needed.)

The rocket's guidance system corrected an initial tilt of the rocket as it left the water (about 4 degrees pitch and 2 degrees yaw) using the four thrust vector control valves mounted around the engine nozzle (these valves deflect the rocket exhaust by injecting liquid oxygen into the exhaust stream). This proper operation of the guidance system was an important achievement for this test.

The rocket engine was intended to burn for about fifteen seconds, propelling the Dolphin to a maximum altitude of 8,000 feet. However, one of the thrust vector control valves, which had opened and closed properly for the initial course correction, froze shut about 3 seconds into the flight. The rocket began to veer off course after about 14 seconds, and was unable to correct its attitude. Launch control personnel sent a coded signal to the rocket which commanded it to shut its engine off, and the rocket did so. Thrust at shutdown was estimated at about 22,000 lbs., and the rocket was traveling at about 121 miles per hour. At this time the rocket was tilted about 45 degrees off the vertical.

The Dolphin coasted to an altitude of about 2,300 feet. Unfortunately, this altitude was too low to permit the Dolphin's recovery parachutes to operate, and the rocket tumbled into the ocean at over 200 miles per hour and broke apart. The aft portion, the combustion chamber containing the solid rubber-like fuel, sank. The liquid oxygen tank remained afloat. The interstage between the LOX tank and the nose cone (constructed of aluminum rather than the high-yield steel comprising much of the rest of the vehicle) fractured and sank, along with the avionics. The avionics were not a major loss--according to Starstruck the impact alone probably wrecked them anyway. The nose cone, containing champagne and other souvenirs, remained afloat and relatively undamaged.

Starstruck personnel examined the oxygen tank, and, deeming it not worth salvaging, scuttled it. The nose cone was recovered and returned to Starstruck's Redwood City facility.

The flight, although far from optimum, was considered successful, since most of the company's test objectives were attained. Underwater ignition, ballast drop, and a water launch were accomplished. Although cut short by a frozen valve, the thrust vector control system operated properly for the first few seconds of flight. Also, the independent command shutdown link was shown to work.

If Starstruck overcomes its present financial problems, further testing is scheduled. Two more Dolphin test rockets are already under construction, and another short test flight is tentatively planned before the end of the year. Its objectives, among others, would include improvement of vehicle reliability, and a test of recovery and refurbishment methods.

Starstruck had planned to market the Dolphin initially as a sounding rocket, while developing an orbital capability with its "Constellation" launch vehicle, still on the drawing boards.

Arianespace Moving Forward

Successful Launch of First Ariane 3:

Arianespace placed two communications satellites into nominal geosynchronous transfer orbits with the tenth launch of an Ariane launch vehicle, and the first launch of the Ariane 3 version. The launch took place on August 4 (the day after Starstruck's launch), and orbited Europe's ECS-2 and France's Telecom 1-A satellites.

This was the second Ariane launch under the responsibility of Arianespace (the first was the May 22 launch of GTE's Spacenet 1 communications satellite aboard an Ariane 1).

Ariane 3 is basically a stretched version of Ariane 1 with the addition of improved liquid-fueled engines and two solid-fueled outboard boosters. It can carry two satellites weighing 2,634 lbs. each into geosynchronous transfer orbit, compared to a single 3,858 lb. payload for Ariane 1.

Ariane 4:

Arianespace will begin launching more powerful versions of Ariane in 1986 under the designation Ariane 4. Using systems in common with the Ariane 3, Ariane 4 incorporates a stretched first stage and a variety of liquid and solid-fueled outboard boosters. Ariane 4 will come in six configurations, with payloads ranging from 4,190 to 9,260 lbs. into geosynchronous transfer orbit.

Arianespace is also going to initiate a novel pricing policy with the Ariane 4. Rather than setting a particular flat fee to launch a satellite on a particular version of the Ariane 4, Arianespace would provide a continuous pricing scale based on payload weight for satellites in the 2,500 to 5,500 lb. range (the pricing policy is based on launching two satellites on each vehicle). Prices would begin at about $12,250 per pound for the 4,190 lb. payloads, and would go down linearly as the payload weight increased. These prices would apply to all Ariane 4 launches, regardless of which version is used.

As payloads are booked, Arianespace will then be able to mix and match satellites and different versions of the Ariane 4 to arrive at combinations which will result in meeting the customers' needs while delivering the maximum amount of payload with the minimum number of launches. This will increase Arianespace's efficiency and profitability.

From the customers' point of view, this would allow them to use a single pricing scale to calculate costs without having to worry about the type of rocket required to launch it, or how the price would be divided up between all the payloads on a given flight.

Large satellites, which are required to be launched as single payloads, would pay the normal full price for the Ariane launch vehicle required. Few payloads are expected to fall into this category--the only one booked so far is the Intelsat VI.

Ariane 5:

The European Space Agency is looking ahead to launch vehicles with bigger payloads and lower costs. The next step beyond Ariane 4 would be the Ariane 5. As yet still in the design stage, it would be able to place about 33,000 lbs. into low earth orbit, or from 8,800-11,000 lbs. into geosynchronous transfer orbit. Ariane 5 would utilize a new LOX/hydrogen engine called the HM60.

Three basic designs are being considered for the Ariane 5. One, the Ariane 5/Reference, would utilize hardware from the Ariane 4 system, with a number of improvements, including an HM60-equipped second stage. Another, the Ariane 5C (Cryogenic), would have both its first and second stages powered by HM60 engines. A third design, which seems the most promising, is called the Ariane 5P (the P stands for "Poudre," a French term meaning the same thing as "solid" in the phrase "solid-fueled"). As seen in Figure 1 (at right), the Ariane 5P has two large outboard solid-fueled boosters mounted onto a LOX/ hydrogen central core. This core is powered by a single HM60 engine. The payload fairing, mounted on top of the central fuel tank, is 16.4 feet in diameter, and capable of accomodating many Shuttle-sized payloads. Note the resemblance between the Ariane 5P and the Boeing ULV pictured in last month's C.S.R. (both are drawn to the same scale--approximately 1:480).

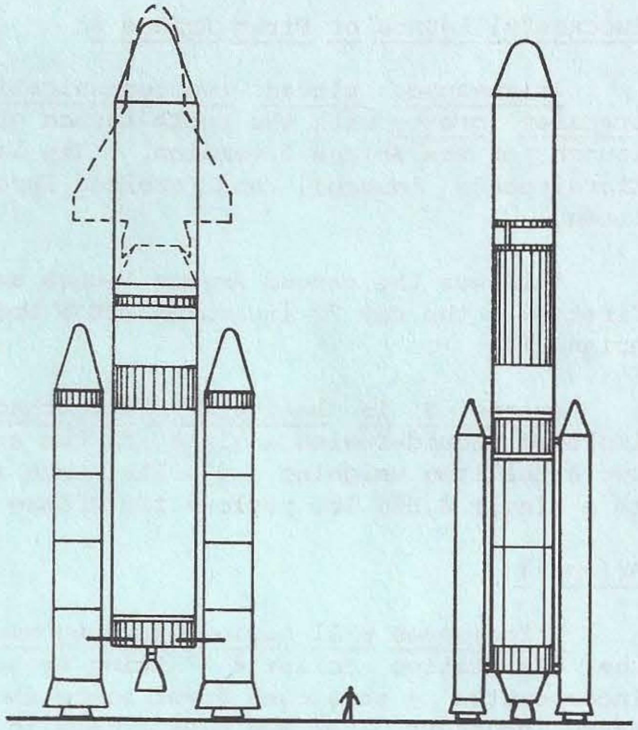

Fig. 1

Long-Range Plans:

Ariane 5 also has the capacity for manned flights. The Ariane 5's 33,000 lb. payload to low earth orbit would permit it to launch a small, manned, Shuttle-type winged spacecraft called "Hermes" (shown in outline in Figure 1) which could carry four astronauts and a small payload into space. Hermes is still in the design stages of development, but a first flight on the nose of an Ariane 5 could occur as soon as 1996.

Fully reusable boosters are also being investigated for the long term (the late 1990's). ESA plans include designs incorporating winged, recoverable first stage boosters and expendable or reusable second stages.

Japanese Working Up To Commercial Booster Market

The Space Development Council of Japan has approved the development of a new expendable launch vehicle, the H-2 (Figure 1). The H-2 is an improvement on the H-1, a launch vehicle already under development and scheduled to fly sometime in 1986. Japan's National Space Development Agency (NASDA) is aiming for a first flight date for the H-2 sometime in 1991, and expect the cost of development to be approximately $830 million.

Early versions of the H-2 would be able to place 3,300 lbs. into geosynchronous orbit. Improved versions could increase this payload to 4,400 lbs. The payload to low earth orbit would be about 13,200 lbs. The H-2 would have cryogenic first and second stages, in addition to two strap-on solid-fueled boosters. The first stage would be powered by an upgraded version of Japan's LE-5 LOX/hydrogen engine called the LE-X. The LE-5 is already under development for the second stage of the H-1, and will also be used for the second stage of the H-2.

The H-2 is a step up from earlier Japanese launch vehicles (including the H-1 and the existing N-series of boosters) which use some technology, under license, from the McDonnell Douglas Delta launch vehicle.

This technology was licensed to Japan by the United States under the restriction that Japan could not use the resulting launch vehicles to sell launch services to other countries. The H-2, which is manufactured using Japanese technology, will not be subject to these restrictions.

Therefore, Japan will be able to enter the commercial launch services market in the early 90's, a fact which is likely to cause some concern in the offices of the National Aeronautics and Space Administration (NASA), Arianespace, and other launch vehicle operators.

NASA To Privatize Scout Launch Vehicle

NASA is requesting expressions of interest from private industry to take over operation of the Scout expendable launch vehicle. The Scout, built by the Vought subsidiary of the LTV Corp., is a small, four-stage solid-fueled rocket with a long history of successful flights.

LTV has not yet decided whether to privatize the Scout itself, but Space Services, Inc. (SSI) of Houston, Tex. may be interested. The Scout can place about 300 lbs. into a 500-nautical-mile sunsynchronous orbit (SSO), the polar orbit into which SSI wants to place earth resources satellites.

Space Services, Space Vector Go Separate Ways

Space Services, Inc. and Space Vector Corp. of Northridge, Calif., are no longer working together on the Conestoga launch vehicle. Richard Rasmussen, president of Space Vector, has resigned his position on the SSI board of directors. There has been no formal contract between the two since May, 1983 (C.S.R., Mar. 1984, p. 3), and the severing of the informal relationship was reportedly cordial. Cause of the breakup was not officially disclosed. Some sources say it was due to a general lack of forward motion (not to mention funds) on the Conestoga project, while others lay at least part of the blame on a battle among executive personnel of the two companies over ownership of the Conestoga vehicle.

Space Services retains the name "Conestoga," and will be working in the future with Space Data, an aerospace company located in Tempe, Ariz. SSI will also continue to work with the Morton Thiokol company (which manufactures the solid-fueled motors which would be used in the Conestoga rocket) and Eagle Engineering.

SSI is marketing six versions of Conestoga. The first four versions would vary in the number of Thiokol Castor IV solid motors (presently in production) used in the lower stages, and would have payloads to SSO ranging from 500 to 2,000 lbs. (Conestoga II, the version which has been the most clearly defined, has three Castor motors in the first and second stages (C.S.R., April 1983, p. 1), and a payload into SSO of about 1,000 lbs.) The other two versions would be built around a newer type of Castor motor still in the design stage. SSI would sell launches for about $15 million, and reportedly has a line on several prospective customers.

Space Vector, in the meantime, is proceeding with its own concept for an expendable launch vehicle. Called the "LEO 3" (for Low Earth Orbiter, Three-Stage), the rocket is similar to Space Vector's original design for the Conestoga II orbital launch vehicle. Both systems would use Castor IV solid motors for their first and second stages. However, whereas the present design for Conestoga II uses Thiokol's Star solid motors for its third and fourth stages, the LEO 3 would use an as yet unspecified single solid motor as a third stage. Space Vector calls the Star motors "too expensive," and cites the problems of the Star 48 in McDonnell Douglas' Payload Assistance Module (PAM).

The LEO 3 is designed to place about 600 lbs. into a 500-nautical-mile sunsynchronous orbit--less payload than the Conestoga II, but more than the Scout.

General Dynamics Gets Customer For Commercial Atlas

Rainbow Satellite, Inc. will launch two communications satellites aboard General Dynamics' Atlas/Centaur expendable launch vehicle, marking Atlas' first sale as a commercial launch vehicle. In return, General Dynamics will provide a loan guarantee in the amount of $200 million to help finance Rainbow's operations. This deal-sweetener from General Dynamics was probably a major factor in luring Rainbow away from Arianespace, which had already reserved slots for the company's payloads last December (Rainbow may still hold these slots as backups).

Arianespace could probably have launched the satellites for about $15 million less (Atlas/Centaur launches go for about $65 million), but Rainbow needed the financing help badly. Other financial backing is being provided by Citicorp Industrial Credit, Inc., which is putting up $75 million of its own money and arranging financing from other quarters.

The first satellite, RSI-I, is scheduled for launch during the first quarter of 1987, while the second satellite, RSI-II, would fly during the second quarter of that year.

Insurance may be a problem for Rainbow's satellite launches. The loss of Westar 6 and Palapa B-2 in February (C.S.R., Mar. 1984, p. 4) had already put a strain on the insurance industry, but the loss of an Intelsat 5 satellite in June made things even worse. The fact that the Intelsat 5 was lost due to the failure of the Centaur stage during an Atlas/Centaur launch will probably not make Rainbow's insurance shopping any easier.

Rainbow Satellite is owned by Trexar Corp., Woodbury, N. Y., and Rainbow Communications, Inc., Laguna Hills, Calif.

Other Notes:

Transpace Carriers, Inc., which is marketing the Delta launch vehicle, has relocated to new offices. The new address is: 6411 Ivy Lane, Suite 500, Greenbelt, MD 20770. Phone: (301) 982-7800.

Until next time,

Tom Brosz

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