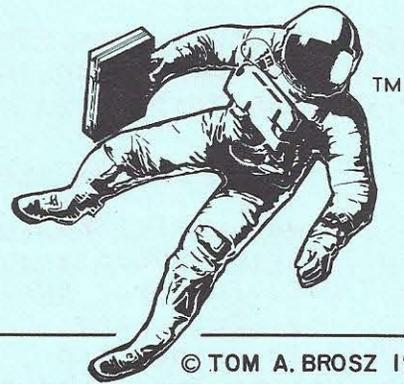


# THE COMMERCIAL SPACE REPORT



PUBLISHED MONTHLY

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Dear Subscriber:

December, 1982

## Space Services Launches "Borrowed" Rocket

The solid rocket booster for the recent "Conestoga I" launch was technically owned by NASA, not by Space Services Inc. Apparently, the actual sale of the booster would have required that the booster be officially declared a "surplus" item. This would have given a number of other federal agencies first crack at it, and the Air Force, among others, would have snapped it up. NASA therefore put the fix in by allowing SSI to merely "use" the booster, charging them a "user's fee" of \$340,000. An additional \$25,000 covered transport and other fees.

Whether or not this affects the Conestoga's status as a "private" vehicle is problematical. However, this blurring of the lines between private and government launch systems may indicate that the export permit precedent (C.S.R., Nov. 1982) may not be as solid as was once feared, since government launch vehicles do not require such permits.

## SpaceTran, Aerospace Companies Considering Commercial Titan

The Space Transportation Co. and Martin Marietta have signed a memorandum of intent along with United Technologies Chemical Systems Division and the Aerojet Liquid Rocket Co. The memorandum provides SpaceTran with exclusive commercial rights to the Titan launch system, and calls for an initial purchase of four Titan 34D vehicles for launch operations beginning in 1986. Additional Titans would be purchased as required over the next decade. (Martin Marietta is the major contractor for the Titan launch system, with UTC and Aerojet building solid and liquid propulsion systems, respectively.)

SpaceTran plans to use the Titan system in combination with the fifth space shuttle orbiter (presently under negotiation--see C.S.R., May 1982). The payload capabilities of both launch systems are comparable, so that the company would be able to provide a great deal of flexibility in launch dates and payloads.

SpaceTran's intention is to become a "one-stop shop," providing not only guaranteed commercial launches, but financing, insurance packages, and technical support as well.

SpaceTran's shuttle purchase looks very iffy right now, according to sources in Washington. Should the orbiter deal fall through, then the Titan could give the company a viable backoff position.

The Titan 34D, a modification of the Titan III, was first launched from Cape Canaveral on Oct. 30 of this year with a payload of

military satellites. The vehicle is capable of launching approximately 27,500 lbs. into low earth orbit, or inserting 4,200 lbs. into geosynchronous orbit.

#### More Companies Enter Direct-To-Home TV Market

Seven additional companies will be joining Satellite Television Corp. in the lucrative direct broadcast market (C.S.R., Nov. 1982). The F.C.C. approved the applications of CBS Inc., the Direct Broadcast Satellite Co., the United States Satellite Broadcasting Co., the Graphic Scanning Corp., RCA American Communications Inc., Video Satellite Systems Inc., and the Western Union Telegraph Co.

All eight companies will have to wait to begin operations until an international conference settles questions of frequencies and orbital slots.

#### NASA Preparing to Sell Shuttle?

NASA is investigating methods of transferring responsibility for the Space Shuttle to some other organization. Initially, this would involve marketing responsibility only, allowing effective competition with businesses like Arianespace. In the long run, NASA hopes to transfer the entire shuttle operation, leaving the agency free for research and development.

At present, this "other organization" would be either a private company or a corporation wholly owned by the government. This organization would act as a "middle man," purchasing services from NASA and selling them on the open market to commercial and foreign customers. Government/military launches would be handled separately.

"We ought to sell it to them (private industry) for a dollar," said NASA administrator James Beggs at a seminar at Stanford University's Hoover Institution. With the shuttle swimming in a lake of red ink, it is not anticipated that even this bargain price will attract private investors.

On Columbia's first commercial flight, the satellites SBS-3 and Anik C-3 were launched from the shuttle's payload bay into orbit. Launch costs for this mission were approximately \$250 million. The fee NASA charged to launch the two satellites was \$17 million, or about 8 percent of the launch costs. By 1987, launch fees will be higher, and NASA hopes that with additional orbiters and more flights, that the fees will eventually begin to exceed launch costs, putting shuttle operations into the black. No one is even pretending that the shuttle will ever recover its estimated \$26 billion development cost.

A U.S. Space Transportation Corp. is the major alternative to private shuttle management. This would be owned by the government, with up to \$1 billion in federal startup funding. If this corporation fails to do well, it would be able to return to Congress for additional funding.

This approach should be avoided at all costs. The example of other Federally-operated businesses (the Post Office, Amtrak, etc.) shows that efficiency and cost effectiveness go out the window as long as the public trough is available. NASA should make every effort to find a completely private organization to handle shuttle operations if

they are to be handled at all. In any case, it may very well happen that a completely different, privately built launch system will end up making the whole question of commercial shuttle operations academic.

### Shuttle Space Suits: The Real Problem

The shuttle space suit has more serious problems than the minor backpack malfunctions which prevented the EVA on the most recent mission. The real controversy involves decisions made some time back on the design approach to suits for extra-vehicular operations.

First, some technical background. The shuttle cabin is pressurized with an oxygen-nitrogen mix at 14.7 psi--a standard sea level atmosphere. This differs from previous American spacecraft (Mercury, Gemini, Apollo, Skylab) which used an oxygen-rich or pure oxygen atmosphere at approximately 5 psi.

In a space suit, the higher the pressure difference between the inside and the outside, the more difficult it is to make the suit flexible enough for an astronaut to move normally. Without special, constant-volume joints, the pressure would hold the suit's arms and legs rigid, locking the astronaut into an immobile "starfish" position. This problem was solved for the low pressures used in earlier spacecraft, resulting in successful spacesuit designs like the complex moon suit used by Apollo astronauts.

With the shuttle's higher cabin pressure, problems arose. Existing suit designs could not be pressurized to 14.7 psi, and, if an astronaut were to go straight from a 14.7 psi oxygen-nitrogen cabin into a 5 psi pure oxygen spacesuit, the pressure change acting on the nitrogen dissolved in his body would cause the "bends", identical to those suffered by deep sea divers who rise to the surface too quickly.

Two solutions to this are: high-pressure suits or prebreathing.

A high pressure suit can be pressurized to 8-14.7 psi with a standard oxygen-nitrogen air mix. Since there is no significant difference between cabin and suit pressure, the "bends" are not a problem.

At NASA, such suits have been designed, prototyped and tested with considerable success, although none have yet been produced for actual use in space. They utilize different types of constant-volume joints and more solid parts than low-pressure suits. In fact, some of these suits are completely solid, with pivoting joints like suits of armor. These are sometimes called "hard suits". Interestingly, in spite of their more rigid appearance, skilled design has made these high-pressure suits as flexible as standard "soft" suits--in many cases even more so.

Prebreathing requires the astronaut to breath pure oxygen for over three hours to flush the nitrogen out of his system. Pure oxygen at 14.7 psi is toxic, so the astronaut must remain in the shuttle airlock, suited up, at 5 psi during this entire time. If he has to go back into the shuttle cabin, and breathes nitrogen again, he has to start another prebreathing period. Needless to say, this complicates the process of leaving the spacecraft. Since nobody can get out of the shuttle in less than 3 hours, any serious external problem, such as a rescue or repair job, could become critical if time were a

factor. This is why two astronauts had to suit up for the shuttle EVA. If one got in trouble, the other would be ready to help without having to go through the prebreathing process.

Also, a considerable amount of work time is lost while two astronauts are cooling their heels in the airlock. Expensive work time, too. Given a one-week, \$250 million mission with 4 astronauts working 16-hour days, each hour of an astronaut's time could be said to be worth over half a million dollars!

With high pressure suits, to leave the cabin an astronaut just suits up and leaves. Only one crew member has to go out at a time since help is only minutes (not hours) away. If he has to come back in for lunch or a break, he can without having to go through another tedious prebreathing session.

Why then did NASA select the low-pressure, prebreathing solution? NASA claims technical reasons, although solutions to almost all high-pressure suit problems were found some time ago. It was also claimed that money could be saved by sticking to existing Apollo-type suit technology (which cannot be pressurized at higher pressures) rather than developing a new technology. Other reasons were tied in with the complex interweavings between industry, bureaucracy, personality and politics that are unavoidable in any government endeavor.

In any case, the existing shuttle suits turned out to be more expensive than planned, with prices per suit (plus backpack) ranging from \$2.1 million to \$17 million, depending on who you ask. It also has been shown that, all things being equal, high-pressure suits can be cheaper and easier to manufacture than the standard type. In addition, the prebreathing problem has been found to be more of a cramp in the shuttle program than had originally been thought.

NASA is now looking again at high-pressure suits, an encouraging sign. Hamilton Standard, present contractor for shuttle suits, has been instructed by NASA to begin design work on 8 psi systems. It is hoped that use will be made of the existing research that has been done in the field, rather than simply patching and reworking the present low-pressure suits. This technology is a critical part of almost all future space operations, and it would be best to do it right this time.

Correction: on p. 4 of the Oct. 1982 C.S.R., the phone number given for Regis McKenna should read: (415) 494-2030.

Until next time,

*Tom Brosz*

## THE COMMERCIAL SPACE REPORT



The **Report** is published monthly, and has a subscription price of \$15 per year. Back issues are available at \$1.50 each from September, 1977. Xerographic copies may be substituted as stocks are depleted. Address all correspondence to: Commercial Space Report, P.O. Box 60547, Sunnyvale, CA 94088. Editor: Tom A. Brosz. The

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