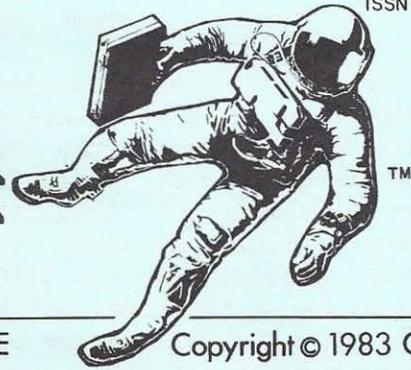


THE COMMERCIAL SPACE REPORT

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Dear Subscriber:

Corrections and Further Information: Pre-breathing

In last month's issue, the rationale given for the shuttle astronauts' pre-breathing procedure was partially incorrect. The article stated that "pure oxygen at 14.7 psi is toxic, so the astronaut must remain in the shuttle airlock, suited up, at 5 psi during the entire time." Obviously, entering a 5 psi airlock from a 14.7 psi shuttle cabin would bring on the same bends as the 5 psi suit would. Rather, the prebreathing process is done at 14.7 psi using pure oxygen (which is normally not toxic at that pressure). Only after all nitrogen is flushed out is the pressure reduced in the suit. This is done in the airlock not because of a pressure difference, but because that's where the suit life-support connections happen to be.

Other methods have also been suggested to accomplish the same results, while allowing astronauts to move about performing useful work in the cabin:

- (1) Reduce the (oxygen/nitrogen) pressure very slowly in the entire cabin until 5 psi is reached. (This is normal decompression procedure for divers.)
- (2) Fill the cabin with pure oxygen at 14.7 psi to flush nitrogen out while astronauts are working. They can then don 5 psi suits immediately without ill effects.
- (3) Have astronauts wear pure-oxygen masks while working in the oxygen/nitrogen cabin, then hold their breath while donning the suits so as not to re-contaminate their bodies with nitrogen.

The problems with these methods are, respectively:

- (1) If the cabin pressure is lowered to 5 psi, the effectiveness of the air as a cooling medium for avionics is drastically reduced. Everything overheats.
- (2) Pure oxygen at 14.7 psi makes anything flammable a bomb waiting to go off. This was tragically demonstrated by the Apollo fire which killed three astronauts. Their capsule was pressurized to 16.7 psi with pure oxygen at the time of the disaster. Even with care in materials selection, it is still far too risky. There is hazard enough in having the suits alone filled with 14.7 psi oxygen. There has already been a fire in an unmanned test suit backpack in 1980, sparked by metallic debris in the system.
- (3) The mask idea avoids most of the problems of (1) and (2), and seems like a good idea. However, it turns out that an astronaut, having removed the mask, cannot hold his or her breath long enough to don the suit, a process more difficult than had been originally expected. Also, it is risky, since even an unintentional and possibly unnoticed breath of nitrogen-filled air can be enough to cause the bends.

Hence, the present suit problem outlined in last month's C.S.R., which indicates the need for high-pressure suit systems. (Thanks to Jim Ransom, among others, for pointing out the errors and adding the additional background information.)

Orbital Systems Corp. Refining Upper Stage Proposal

The Orbital Systems Corporation is working in cooperation with NASA in the development of an upper stage for geosynchronous applications (C.S.R., Nov. 1982). The present design, called the "SRM-1X" is a solid booster based on the Boeing/UTC SRM-1 (the first stage of the IUS). The SRM-1X will be compatible with the shuttle as well as the commercial Titan 34D to be marketed by SpaceTran (C.S.R., Dec. 1982). Geosynchronous payloads using these two vehicles would be 6,900 and 5,700 lbs. respectively, greater than the 3,100 lbs. of Ariane 3 or the 5,200 lbs. of Ariane 4. Circularization of the final orbit would be accomplished by a kick motor built into the satellite. First flight is planned for 1986, and funding totalling \$25 million will be required between now and then.

High Frontier Update

The High Frontier project (C.S.R., April 1982) is making considerable progress in promoting the concept of "Mutual Assured Survival" rather than "Mutual Assured Destruction" using non-nuclear methods, space-based and otherwise. Financial support is urgently needed. Donations are accepted, and the 175-page High Frontier report is still available for \$15.00. A 25-minute 16 mm film costs \$225.00, or can be rented for \$50.00 per week. Videocassettes are available for \$60.00 (VHS, Beta, or 3/4"). All donations and payments are tax deductible. As an alternative to the present multi-billion dollar, incoherent strategic plans, it's a worthy cause.

"Phoenix" Launch System Update

More information is now available on the "Phoenix" launch vehicle concept proposed by Gary C. Hudson (C.S.R., Nov. 1982). Hudson has formed a new company, Pacific American Launch Systems, which has undertaken the promotion of the Phoenix system as a major project. As yet, this project is still in its preliminary stages.

The vehicles, designated "Phoenix LP" and "Phoenix C/E", use the same type of advanced, highly efficient dual-fuel engine, four for the smaller LP and 24 for the larger C/E. The vehicles are designed to be largely autonomous in function, requiring minimal ground support and turn-around time. The objective is to get the launch costs as close as possible to actual recurring operating costs (fuel costs, etc.).

The marketing approach for the Phoenix vehicle permits the launch customer the option of either purchasing the launch service alone, or, unlike any other system, actually purchasing his own launch vehicle, allowing the customer unprecedented flexibility in control and launch scheduling. The small Phoenix LP may cost less than \$20 million, and the Phoenix C/E less than \$100 million.

Fuel costs for a simple orbital launch are expected to range from about \$10,000 per flight for the LP to about \$50,000 per flight for the C/E. If the minimum design goals of 100 flights for the engines, airframe and avionics can be met, total flight costs could be as low as a few hundred thousand per flight for the Phoenix LP and two or three times that for the Phoenix C/E. It is estimated that the insertion of an average Delta-class communications satellite into geosynchronous orbit should cost less than 10 million 1982 dollars.

Potential customers include private and public organizations involved in existing and potential space markets. It is estimated that the current sales market for each type of vehicle is 10 to 20 units worldwide. The future market would be expected to grow as the low launch costs open up further profitable space-related applications.

On the facing page, Figure 1 shows the Phoenix LP and C/E in both manned and unmanned configurations. Figure 2 compares the vehicles with other launch systems.

FIG. 1

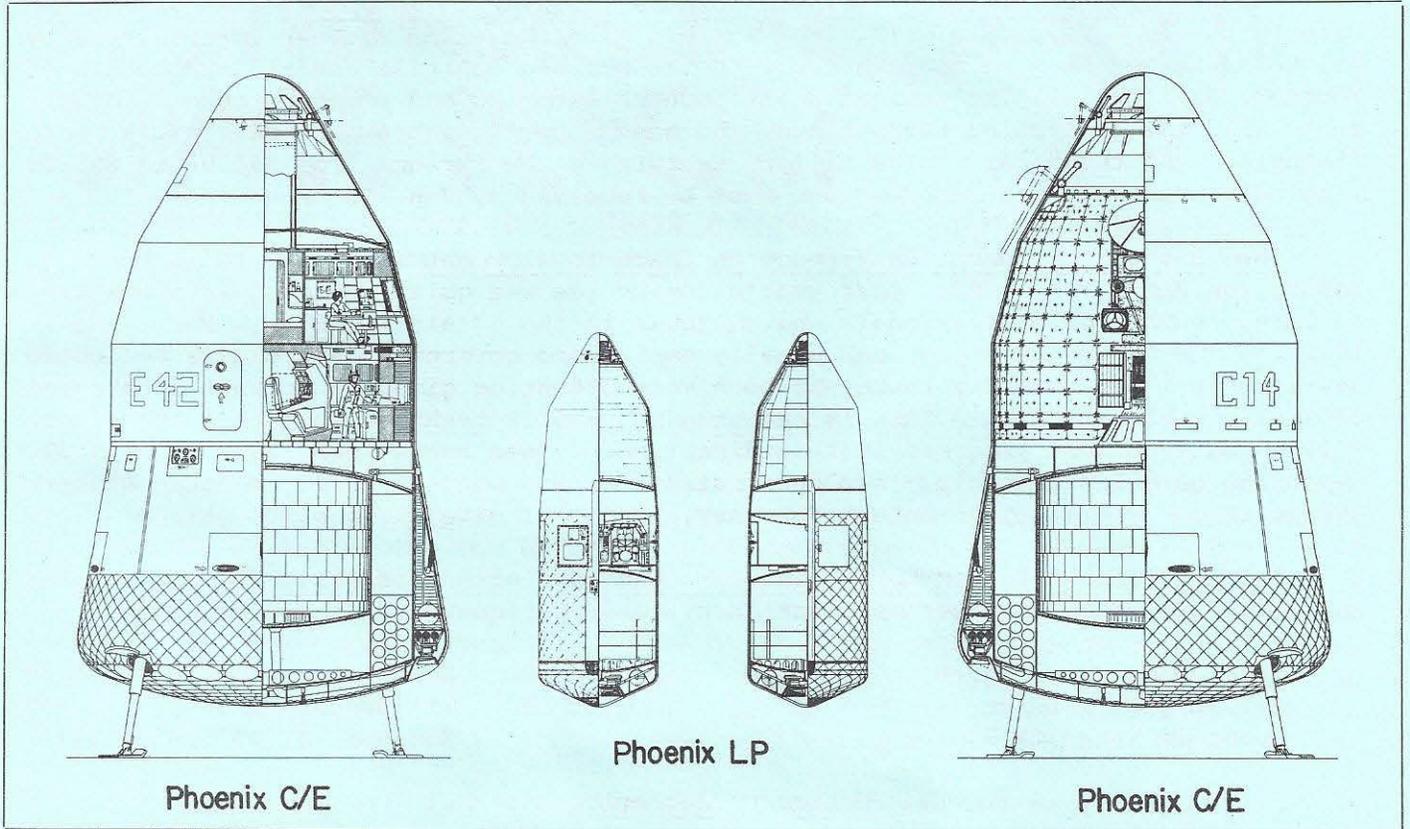
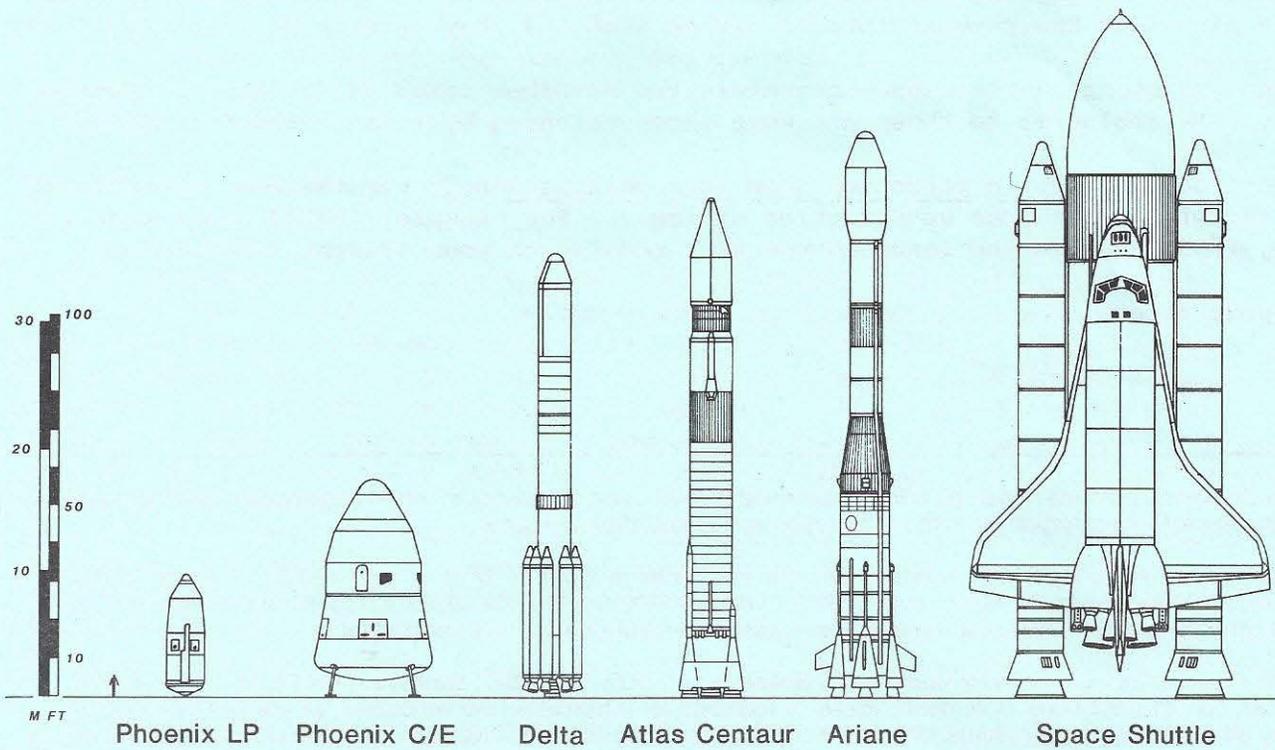


FIG. 2



Coming Events

"Space Commercialization--Getting Down to Business Up In Space" is a seminar to be held on Wednesday, Jan. 12, 1983 in Palo Alto, Ca. The seminar is sponsored by the Terra-Mar company in cooperation with the Harvard Business School Association of Northern California. The seminar will focus on existing and proposed space projects that will be generating revenue over the next 5 to 10 years. Speakers in both financial and technical fields will be featured. Fees range from \$50.00 to \$65.00 (including dinner), and reservations must be received by Jan. 10.

The L-5 Second Annual Conference on Space Development will be held in Houston, Texas, on April 1-3, 1983. Last year's conference was quite successful, attracting a large number of professionals and amateurs in the field (C.S.R., Mar., April 1982). The L-5 organization has usually emphasized government approaches to space development, but recently there has been more attention given to private enterprise as a viable alternative. This is encouraging, and it is hoped that this conference will show even more progress in this direction. Fees range from \$25.00 to \$75.00, depending on L-5 membership, early registration, and whether or not banquet tickets are desired. Registration before February, 1983 will give the best bargain.

Information sheets for both events are included with this issue for all regular subscribers. Others may get information by sending requests to these addresses:

Terra-Mar, attn. Mr. Donn Walklet
2113 Landings Drive
Mountain View, CA 94043

L-5 Conference
114 Byrne St.
Houston, TX 77009

Notice to Subscribers

A subscription extension offer was made to all subscribers in the Nov. 1982 C.S.R., intended to allow them the option of extending their subscriptions at the old, lower rate before rates went up this month. Reply cards and envelopes were included in all mailings for that month to make this option more convenient. Unfortunately, a number of subscribers mistakenly interpreted the enclosure of a reply card to mean that their subscriptions had expired and they were up for renewal.

The extension offer announcement in the November issue may have been worded vaguely. My apologies to those who were inconvenienced by this misunderstanding.

The four numbers in parenthesis on your mailing label, for the record, indicate the issue with which your subscription expires. For example, (0883) means that the August, 1983 issue is the last one you will receive on your present subscription.

Until next time,



The Commercial Space Report (C.S.R.) is published monthly, and endeavors to report and analyze developments in the field of private initiatives in the exploration and exploitation of space.

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