

COMMITTEE VI
The Universe and Its Origin:
From Ancient Myth to Present Reality
and Fantasy

SOME SINCERE ADVICE ON ENABLING
(AND NOT ACCIDENTALLY DISABLING)
THE INTERPLANETARY HUMAN FUTURE

Discussion on
Brian O'Leary's paper,
"HUMAN EXPLORATION AND DEVELOPMENT
OF THE SOLAR SYSTEM -- THE
FIRST STEPS"

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"As for me, my task is not to foresee the future,
but to enable it" -- Antoine de Saint-Exupery

Brian O'Leary's vision and imagination have never been known to be restricted by the gravity which holds our bodies fast to the surface of our birthworld. His mind roams the solar system, and in its roaming opens trails for others to follow and, each in his own right, extend.

His blueprint for human expansion into the solar system is a sound one, and the edifice of a future spacefaring civilization constructed along the lines O'Leary delineates would be a thrilling, inspiring structure. Yet few space prophets now at the end of the second millenium could be shortsighted enough to imagine the mid-third-millenium humanned solar system will actually turn out to look as we can imagine it. No, all that we space prophets can hope for is to produce "existence proofs" of the feasibility and desirability of such extraterrestrial civilizations. The actual constructions must be left to others, inspired it is to be hoped by our visions but armed with their own special plans and skills which are today still unimaginable.

Hence it is of no consequence that I might

quibble with some of O'Leary's suggested techniques, since the technology base is constantly burgeoning and since O'Leary himself has shown the classical space prophet's traditional open-mindedness about new "tricks of the spaceflight trade". Based on past experience, we are confidently able to EXPECT such breakthroughs while not being able to specifically PREDICT what they will be. The entire history of human exploration and discovery on this planet teaches that lesson, and this next phase cannot be expected to be different.

For example, I predict that a surprising "sleeper" spaceflight technology of the next half century will be "tethers", long/strong cables connecting space vehicles in orbit. The "rope tricks" that can be accomplished involve momentum exchanges that at first look like magic, but which must -- and will -- become the "common sense" of future space operations. Such tethers will be complemented by the "mass drivers" which O'Leary mentions, electromagnetic catapults which a decade ago were the stuff of visions (and the jury-rigged hardware of specialists associated with O'Neill's "Space Studies Institute") but which today are the centers of bountifully funded anti-missile research projects (where they are called "rail guns"). Such research could enable the engineering advances which transform lunar mining and asteroid shoving

from the realm of space visionaries to the even more exotic universe of engineering development and funding.

Sadly, O'Leary still speaks in earthbound metaphors when he describes three SEPARATE goals for future activities, that is, the Moon, the asteroids, and Phobos-Deimos. To treat them thusly is to bait the trap of "either-or", or the sequential, linear style of thinking characteristic of planetbound cultures. It is the COMMONALITY of these goals, not their DIFFERENCES, which needs to be stressed. Certainly the hardware is at least 80% common, and possibly more so if developed with sufficient long range thinking and foresight. Buy one, we should be telling today's earthers, and you can get the second for 20% full price, and the third for 10%. "Cheaper by the dozen" should be the motto of would-be asteroid miners. Such statements are both true and useful, and might make a good "party line" for space enthusiasts of the crucial next decade.

If one particular rock (or set of rocks) needs to be picked out, then I opt for Phobos-Deimos (and leave Mars for later, perhaps much later). This "Ph-D" strategy, championed by Fred Singer, could be the key (or the fuel depot) to the Solar System, as I came to realize during careful examination of

the logic, over the past four years.

The "Mars Underground" made famous by two seminal private colloquia in Boulder, Colorado, has now surfaced and become preempted by the space industry and bureaucracy.

Very well, it is the fate of the far-sighted to be denounced as "crackpots" right up until their ideas become so widespread their pioneering primacy is forgotten. Let it happen again: the "Phobos Underground" has already been conceived, and a newsletter of the Houston Chapter will soon appear. Its motto is:

H₂O@1/gm

that is, water at a dollar per gram. If Phobos (and/or Deimos) can support such refining processes, they open the literal high road to the asteroids, trans-jovia, and even some interesting fossil comets.

The intellectual and conceptual leap of mining the asteroids is a great one, with the mental gulfs nearly as wide (in terms of difficulty) as the physical ones. To make the concept more "down home" and less "gee whiz", some authentic (and very useful!) items of human history can be applied.

For example, human beings have been mining the asteroids since the dawn of civilization. The first metals beaten into tools and weapons were meteorites, chips off of asteroids which accidentally

fell to Earth and were retrieved by ancient humans. Even today, some of the richest metal ores in the world are being mined at Sudbury, Ontario, only recently recognized as a two billion year old "astrophobole" ("star wound", or fossil crater). The dispute continues over whether the metal there is actually a physical trace of the miles-wide asteroid or merely native ores which belched up from deep inside the planet's mantle when the overlying crust was blasted aside. One advocate of the exogenous theory issued the quip that such a hypothesis called for not only pennies from heaven, but nickel too.

The moral of the story is this: future prospecting among the asteroids would be only a more efficient way of conducting a traditional human activity, by exploiting resources first where they fall and later by pursuing them to their points of origin, whether upstream, upwind, or up-gravity.

In any case, such spacefaring activities must at first be conducted by organized human collectives such as governments or trans-national corporations. And here, in the issue of international cooperation (particularly US/USSR cooperation), I feel I must sound a depressingly cautionary warning bell. The price we may have to pay for getting the Soviets to join with us on the road to Mars may be

far higher than the cash value -- if any -- we save in our space budgets.

An examination of the cast of characters in the current "together-to-Mars" chorus reveals some distressing motivations and proposed "bargains". It may look like a ticket to the planets, but it might prove to be a "veto" instead.

As I testified to the Presidential Commission on Space during their hearings in Houston recently, the arguments for joint US/USSR manned missions are far more political than practical. Some of the most outspoken advocates of such cooperation for a manned exploration of Mars are the very same people who have been bitterly opposed to manned space flight in the past. They are now engaged in an extremely transparent political ploy, embraced (if not originally conceived) in Moscow: "Give up 'Star Wars' and we'll give you the Universe!" The Soviets have been holding hostage the question of future cooperation, based on an American repudiation of advanced missile defense systems, and some of the loudest and most well-known advocates of "space cooperation" are academics and politicians who have been consistently pushing the anti-SDI doctrine for a long time. So their recent embrace of US/USSR cosmic togetherness rests on motivations which may not be reliable over the long term needed to intitiate, fund, develop, build and fly such

missions. At any point along that years-long process, if their ulterior goals of US/USSR relations are satisfied through some other means, they are liable to abandon the joint manned space project with alacrity, and resume their former opposition to such projects. Their current support contains the seeds of a built-in downstream betrayal; by agreeing now to such an alliance, we would probably be giving eleventh-hour veto power over the project to people who are known to hate it, and to a nation who is known to hate us.

That anxiety may be grounds for some cynicism, and some caution, in enthusiastically rushing into such an alliance!

As a long advocate of expanded US/USSR space cooperation, I speak with some moral authority on this subject. I was publicly for a Shuttle/Salyut rendezvous when it was considered absurd, even insane. I have vigorously denounced the anti-cooperation myths such as "they stole our space secrets" (no sign of that) or "they're copying our shuttle" (a nitwit notion). If then I utter Cassandra-like warnings about proceeding with too high hopes, my motivations are founded on my sincere enthusiasm for fulfilling the space expansion blueprint O'Leary (and before him, numerous other experts including myself) has laid

out.

One hope I have held for "Shuttle-Salyut" is that it may help defuse the current torrent of venom issuing forth from Moscow on the American space program in general, on the Space Shuttle in particular, and on some individual astronauts by name. My deep-seated anxiety is that such a smear campaign may be pushing the Soviets to "talk themselves into a corner" from which their only feasible reaction to a polar orbit DoD shuttle mission may be warnings, threats, and ultimately force. The rhetoric is mounting to pre-justify a "Korean airliner in space" tragedy, I fear.

Agreement on a joint mission might just diffuse such inflammatory talk.

But we cannot draw too close an analogy with the Apollo-Soyuz mission a decade ago. That project, after all, was a symptom, not a cause, of diplomatic detente. US/USSR relations had been improving, and the joint mission was commissioned to illustrate that motion, which was already under way. The ASTP project did not CAUSE such "good feelings" (the "beau geste" theory of diplomacy), but merely reflected them. And by the time the joint mission actually occurred, it was already an anachronism, with Soviet tanks rolling into Saigon, Soviet-sponsored coups in several African nations, planning well along for the "painless" takeover of

Afghanistan, and so forth.

In another metaphor, the robin is the harbinger, not the cause, of spring, and Apollo-Soyuz was the "robin" for detente, even if it did not arrive until well into autumn! It has become enshrined as a myth of what can be accomplished if both nations are not hostile, but as with all political myths (and sausages, and laws), one should not observe too closely the processes by which they are created!

What can be done besides despair? Let me suggest we approach the problem as engineers, not politicians. The latter would prefer to build a single spacecraft with every first bolt produced in Detroit and every second bolt in Dnepropetrovsk. But there are other ways to approach joint exploratory activities which need not involve such intimate melding of hardware.

One potentially efficient approach could be based on the practical realization that a major portion of the cost of a manned space project is devoted to reliability, back-up systems, contingencies, planning for emergencies, etc. If a 90% reliable system costs \$X million, a 95% reliable system is going to cost \$2X million and a 99% reliable system several times as much. Today's shuttle astronauts probably spend half their time

practicing maneuvers they will never have to perform in space (such as aborts), and a great deal of the rest of their time is spent on familiarization with contingency procedures. That, too, is very expensive -- but vital.

If both the US and USSR were operating manned vehicles at Mars (as, for example, they are today in Antarctica), the very existence of such systems purely for emergency rescue purposes should allow significant cost reductions for both nations. The reason for this is that a lower single-spacecraft reliability would be acceptable if another spacecraft could be counted on for "worst case scenarios". Even a slight reduction in the required reliability percentage could cut the total program cost in half, or better.

For example, if the Soviets had a base on Phobos and could be counted on to fulfill their current treaty obligations regarding the rescue of endangered spacefarers, an American spacecraft orbiting Mars could do without some of the third and fourth backup systems and without the excruciatingly expensive equipment and procedures qualification activities that would be needed if the astronauts were entirely on their own. The "do-or-die" requirements of their Earth-return rocket engine could also be significantly relaxed, resulting in additional major cost savings.

Never forget, too, that we are talking about base costs of manned Mars orbital operations on the order of half or less of "one Apollo", the normalized unit cost of the man-to-the-moon program of the 1960s. So even without savings, the expeditions are already affordable by a single country. Cost savings by splitting up the hardware may be mostly illusory to begin with, and as mentioned may be a political dead end as well. Cost savings based on parallel independent operations, on the other hand, promise to be substantial without the threat of mutual veto.

Such a strategy is also "stable" in the scientific sense, that is to say, deviations from the partnership will generate "restoring forces" rather than the tensions, fears, and mistrust which could uncontrollably tear apart a mixed-mode cooperation strategy at the first sign of diplomatic difficulties. The reason for this is that without one side's participation, the other side could proceed with its own homegrown hardware, but at a recognizably higher risk to the lives of the spacefarers. In the real world, a Soviet unilateral pull-out would make for immensely bad imagemanship, since it would merely succeed in increasing the danger to the American astronauts without stopping them cold. If in a worst case the

absence of a promised Soviet "safe haven" rescue option did actually result in fatalities, the damage to the USSR's international prestige would be literally cosmic in scale. Such a possibility, therefore, should produce a large inducement for them to stay in the agreement despite any temporary bilateral diplomatic problems; such an inducement does not exist in the mixed mode strategy, which actually may provide all-too-tempting blackmail opportunities for late-inning threats of pull-out or delay.

In this analysis, what I call the parallel joint strategy is thus inherently stable, while the current favorite, the mixed joint strategy, is inherently unstable. Neither has any clearcut cost advantage, although if forced to make an intuitive judgment, I would opt for the parallel strategy as the dollar-wise cheaper alternative.

We can also cooperate with the Soviets without having to like them, despite the American urge to think of all our teammates as "the good guys". We were co-belligerents against a greater danger in 1941-1945, but if anything Stalin ran an "evil empire" worse than Hitler's -- except for the moment he was not bent on world domination. We can cooperate today on other fields of common need, but we don't have to forget the genocide going on as we speak in Afghanistan, the spiritual crushing of

Poland, the brutal destruction of an innocently lost airliner and the horrible deaths of the 269 people aboard it, the mountains of lies and hypocrisies which strangle the souls of ordinary Soviet citizens. For reasons, we can cooperate with the USSR, or South Africa, or even daffy Khadafy -- for good reasons.

Space may be such a reason, and may be worth the moral association. But if so we should forge the alliance with no illusions. And most of all, I urge that we design the team so as not to give known enemies the power and the temptation to unilaterally pull the plug on our future.

Ad astra per aspera! Who ever promised a rose garden, on Earth or off it?

*****JEO*****