

## 37 – Avoiding Policy Traps

### SUMMARY

This chapter identifies certain popular space policies that risk locking America into programs that will prevent NASA's budget from being able to take full advantage of the emerging capability presented by the reusable heavy lift fleets.

There are certain programs that make no sense as the new capabilities become available. This includes: SLS, Orion, Gateway, and Mobile Launcher 2. There is also the very real risk that NASA's HSF budget will be constrained for decades if we get locked into spending money utilizing the so-call "commercial" LEO stations. Decisions made now will determine if America can seize the remarkable opportunities described in this book.

### BUDGETARY SPACE NEEDED

As mentioned in the previous chapter, the International Lunar Exploration Phase and Base will need to be funded by governments and so room needs to be made within space budgets. Elon Musk is appropriately focusing Starlink revenue on Mars and there is no indication that Jeff Bezos has any idea of funding a government lunar base. Obviously, it is the responsibility of governments to fund a government base and the companies that governments set up to provide the goods and services for a government base will be exactly what will be needed as private settlers grow the base and then branch out. So, how can budgetary room be opened up.

#### **No Increase in Overall Budget**

If we choose to do it correctly, we don't have to expand the overall NASA budget but rather work within traditional budget levels. The reason why this is possible is primarily due to the significantly lower launch costs that become possible when the capability becomes available of a fleet of fully reusable heavy lift vehicles. Plus also, the use of fixed priced contracts can achieve significant savings. However, all of NASA budget is currently called for so something must give to make space.

## What Budgetary Room is Needed For?

To summarize the previous chapter, we need budgetary space to take full advantage of the Starship fleet for transport of cargo and crew to the lunar surface. We need to get busy paying companies to develop full-scale surface systems by the time that we start developing the ILB. The Starship fleet will likely become available before 2030, so time is of the essence. Again, surface systems include: power systems, surface vehicles, large, inflatable habitats, habitat life support, sanitation, a Green-Hab, a centrifuge, and ISRU roughly in that order. And there will need to be operational funding to conduct missions of exploration where each national will pay for their own missions.

## MAKING BUDGETARY SPACE

### Distractions

**Mars Sample Return** - Terribly over budget and delayed, this program would cost perhaps \$5 to \$8 billion more going forward. There seems to be sufficient consensus that the program needs to be stopped even though this may well mean that China will get the first pristine Mars sample back before the United States. However, this amount is insufficient by itself to make enough budgetary space for the Innovative Plan. We have to look elsewhere.

**Military Space** - A few space advocates think only in terms of "great power competition" and how America's civil space (e.g. lunar return) fits within the picture of national security space. There's certainly plenty of reasons for concern about China here on Earth. But, as discussed in Chapter 38, the Moon is far less significant in any way as it relates to our competition with China than things like trade relations, the South China Sea, Taiwan, their military build-up, or such. If we develop some sort of space policy based upon our concerns about China but we don't grasp the rather large advantage of world leadership that international exploration and the Lunar Base, then we will fail to understand how to best use our civil space program to advance our interests vis a vis China.

**Orbital Debris and Planetary Defense** - Again, these are relatively small budgetary items. The quantitative risk of either is pretty small despite routinely inflated concerns expressed. Again, the foreign policy gains of the Innovative Plan would be a far greater achievement than any policy regarding these two items. These are not bad but shouldn't take precedence over our international leadership on the Moon.

**National Space Council (whole of government)** - Again, not bad. The space policy directives of the first Trump Administration were consistently good achievements. But, apart from the Moon first directive, such actions are not as significant as policies in support of opening the way for humanity to expand to the Moon and Mars.

**Pro-settlement Policy** - In the past, some space advocates have promoted the idea that space settlement will only occur if NASA's charter is changed to make space settlement a formal goal. A government lunar base is a legitimate governmental goal not requiring any change to NASA's charter. And from a technical standpoint, both government bases and private settlements require power systems, habitats, life support, agriculture, etc. -- all of the very things that the Innovative Plan proposes. In other words, the best way to achieve settlement is for NASA to pursue a government base with companies able to provide those goods and services and the setting will be in place for private settlement to naturally grow from those capabilities.

### **Actually Making Budgetary Space**

Rather, if we are going to make sufficient budgetary space for the Innovative Plan, once the Starship capability demonstrates itself, several large programs will become unnecessary and will therefore open up the budgetary space needed. Those programs include:

- The Space Launch System (SLS)
- The Exploration Upper Stage (EUS)
- The Mobile Launcher 2
- The Orion capsule
- The Gateway

Just like the ending of the Apollo Program opened enough budgetary space for the Shuttle system to be developed, the ending of the above programs would open up about \$3-5 billion annually which would be sufficient for the return to the Moon program.

### **Cynicism of Government**

It is very common for space advocates to reflexively dismiss US space policy transitioning away from the very expensive SLS system to the much more cost-effective Starship-based transport system. The cynical argument that they make is that politicians will never, ever agree to a change that takes away a program from their district.

First, such changes have already happened several times before. When it becomes apparent that a current program no longer makes sense, congress has allowed otherwise painful changes. The Apollo program budget was allowed to come down from its peak. Certain Saturn V contractors lost their business when it was agreed to attempt a transition to the reusable Shuttle system. The orbiter portion of the Shuttle system was shut down (with the resulting loss of certain jobs) after it became obvious that that system was too dangerous. There is agreement that the ISS program will need to shut down in 2030.

The argument here is that, when Starship demonstrates docking and transfer of propellant from a LEO depot then it is obviously a matter of time before it becomes fully operational. That is the space policy tipping point after which it is a matter of time before a transition from SLS to Starship will occur. If the Administration wants to achieve the rather remarkable outcomes stemming from the Innovative Plan in this book, then a fundamental transition to include development of surface systems becomes essential.

### **Letting Go of SLS**

There is another common and somewhat legitimate objection to transitioning from SLS-Orion to a Starship-based Earth-Moon transport system. That objection is, we have a human-rated SLS-Orion system now, but Starship has not yet demonstrated the ability to launch people to space. It's the one bird in the hand versus two birds in the bush argument. Well, Starship can reach orbit now if they just allow their engines to burn for about 8% longer. Also, SpaceX can now safely launch crew to LEO on their Falcon 9-Dragon where they would be able to transfer to a fully fueled Starship. So, an honest approach would be to have NASA put out a request for information (RFI) indicating how heavy lift systems could complete a full Earth-to-Moon mission without SLS, Orion, or the other systems listed above.

From the safety perspective, can Orion really be cancelled when Starship is not designed with a launch abort system? Besides the Falcon 9-Dragon approach mentioned earlier, Elon has also indicated that the necessary level of safety can be achieved via the engine out capability that Starship's first stage has already demonstrated and after numerous Starlink launches, the safety record of the upper stage can be determined. For example, as of this writing, 570 Falcon 9 launches in a row successfully made it to orbit. Rockets will never be perfectly safe but

NASA has revised its criteria of a 1 in 300 chance of loss of crew (compared to Shuttle's 1 in 68). It seems that Starlink launches would be the path to revealing any remaining failure modes to reach the needed level of safety.

On occasion, a really bad suggestion is made that, even after Starship is made operational, the SLS program should be continued as a "back up" in case the Starship system fails. The SLS system is so expensive (\$4.1 B/mission) that continuing it would mean that we would have insufficient budget to utilize the Starship capability much at all.

## **COMMERCIAL SPACE IDEOLOGY**

### **Fixed-price Contracts**

NASA is now routinely using fixed-price contracts rather than cost-plus contracts. This places the burden for both cost and schedule overruns on the companies and not NASA. The results have been really pretty good and should be used wherever possible.

### **The Good Parts of Commercial Space**

GEO communications satellites and LEO internet constellations are truly commercial space and obviously good things that don't require large NASA programs. Rather, when commercial space policies are being promoted, it is usually about what government can do to help grow commercial space activities in areas where they haven't been able to already do it on their own. In other words, there is a (correct) assumption that the "smart money" (e.g. venture capitalists) is not convinced that so-called commercial space ventures will be profitable else they would fund the programs using their own money. Rather, government needs to provide grants, contracts, and/or guaranteed usage to stand up commercial entities to provide the service. So, if government funding is absolutely essential, just how "commercial" is it?

Well, actually there is one excellent example of how this approach has worked amazingly well. In 2008, SpaceX was on the verge of going bankrupt. With the COTS, Commercial Cargo, and Commercial Crew programs, SpaceX went from barely surviving to where it is now dominating the world launch market with 90% of the world's payload mass into space in 2025.

## **Lots of "Commercial" Struggles**

Unfortunately, that is a rare example of success. Other so-called "commercial space" programs haven't been anywhere near as successful. People who follow such developments will know of the examples of Boeing's Starliner capsule, Antares rocket that hasn't launched any commercial satellite as its primary payload, Sierra Nevada's Dreamchaser really struggling with reduced NASA funding, CLPS lander companies dependent upon NASA funding for survival, and the dozens to hundreds of companies surviving only on the next NASA grant. Even Blue Origin has survived for 25 years not because of commercial profitability but from Jeff Bezos' willingness to sell \$1 billion of his stock per year to fund it. This might better be called "philanthropic space". In the next section, we'll discuss the so-called "Commercial" LEO Destinations and how we really need to make sure that we lose the Moon because we budgetarily got stuck in LEO like we have for the past 25 years.

## **Government First Then Commercial Later**

Commercial space is a very good goal. But we need to be realistic. The Innovative Plan proposed in this book recognizes that there will need to be a government funded phase first for lunar exploration and an international base. Only after cheaper access to the Moon becomes routine and only after companies repeatedly add modules and services to the base can we consider the possibility of private individuals being able to afford incremental goods and services from those companies and hence the base starts to have truly commercial operations.

## **Commercial Lunar Payload Services (CLPS)**

NASA started its small lander program ten years ago and has spent about \$2.6 billion over that time. This was well before SpaceX's Starship program was started. Given the significant payloads that Starship is projected to be able to land on the Moon, one could envision dozens of rovers driving perhaps 50 km in every direction for the Starship landing point. The Soviet Lunokhod 2 rover drove about 39 km. Looking at the high-neutron map of the lunar south pole, it appears that about a dozen Starship landings with rovers spreading out from there should complete the prospecting phase of the most interesting sites at the lunar south pole. What then could have been done with the past and future CLPS funding? Well, the development of one of the surface systems needed for the ILB would seem to be a good use of that funding.

## **AVOIDING NEW BUDGETARY BURDENS**

Another large concern is that we will get ourselves stuck with unending budgetary commitments that will hinder NASA's ability to fund lunar development or even a SpaceX-NASA Mars partnership. Namely, the concern has to do with LEO stations.

### **The International Space Station (ISS)**

It is estimated that the ISS has cost perhaps \$150 billion to develop, operate, and maintain, of which NASA's contribution has been about \$100 billion. That is a crazy amount of money. Additionally, we spend between \$3 and \$4 billion annually to operate the ISS.

Was that the best use of our space budget over the last 27 years? On the one hand, we got a lot of zero gee research. On the other hand, we therefore didn't have enough funding to rapidly develop a Moon and Mars program. From the public's point of view, do they even know who is on the ISS now? Do you, the reader know that? Are they amazed by the research being produced by that national laboratory? Do you even know what is going on? But, when astronauts were on the Moon, people knew about it.

### **"Commercial" LEO Destinations**

Well, what was done was done. We can't change that. But the concern expressed here is about the desire for a "gapless" transition to so-called "Commercial" LEO Destinations (CLDs). We like to fund two and not just one commercial entities (two cargo, two crew, and two lander providers). So, if we fund two CLD stations in LEO, even if each cost less than the ISS, we may well end up paying for two of them. And for how long?

There is the sunk cost fallacy. If we pay companies to establish their stations, won't we want to pay to use what we paid to establish? Will we utilize the stations conducting another 25 years of research? And how much will that all come to and how many fewer Starship missions to the Moon and Mars will we lose out on?

Considerable effort has been made to try to get commercial activity on the ISS. Analysis of the effort has come to rather negative conclusions. For example, NASA Inspector General, Paul Martin testified;

*"Candidly, the scant commercial interest shown in the station over its nearly 20 years of operation gives us pause about the agency's current plans,"*

Despite that failure, there is hope that the CLDs will be different. Most actual investors are not convinced of the profitability of said stations and so are dependent upon NASA funding. There is hope that the killer app will be found for the CLDs. But even if there is, it seems likely that NASA will still be paying for usage for a long time.

If we spend only \$1 billion annually for each of two CLDs, there won't be much savings from ISS to apply to the Moon and Mars. Continued, indefinite NASA utilization of stations in LEO is very popular. But maybe we need to set some sort of reasonable limit on how much money we will spend there instead of the Moon and Mars. Perhaps limiting the expense to \$10 or \$15 B would be reasonable. More than that and we must ask ourselves how much we are losing in lunar and Martian development.

Once we start down the CLD path it will be very difficult to end that expenditure and we need to make sure that another 25 years hanging out in LEO is the best use of our space bucks.

Further, if other countries think that their citizens are more interested in the Moon and Mars than LEO then they could choose to contract with SpaceX whether the United States is able to participate or not. Do we really want to leave it to other nations to collaborate with each other on the Moon and Mars and be the ones to establish humanity's first permanent foothold off Earth without the involvement of the United States?

## **The Lunar Gateway Station**

NASA's Traditional Plan currently includes a small, occasionally crewed station in high lunar orbit. This station is a hold-over from Obama's NASA when they were trying to figure out what they could do in lunar orbit without going to the surface of the Moon. It also resulted from the combination of the Orion capsule being too heavy and the European Service Module being too underpowered to go anywhere other than high lunar orbit. This was all before the Starship development program. Elon Musk has indicated that Starship would be able to do lunar missions all by itself and so not need the Gateway. It seems likely that the Gateway will be recognized as unnecessary as Starship becomes capable of refueling at a LEO depot and conducting lunar missions by itself. Being co-manifested with the Orion capsule, the Gateway won't be dreadfully expensive but will still likely get cancelled nonetheless.