

Earth's Moon: Humanity's Gateway to the Solar System

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What is a Gateway?

- Literally.....
 - 1 a : 1 **GATE** 1,2 b : a *supporting frame* or arch in which a gate is hung
- Is the Moon literally at gateway?
 - No, of course not.

What is a Gateway?

- Metaphorically....
 - **a** : **GATE** 4a **b** : a passage for navigation or travel: as (1) : *any one of a limited number of points* by which the traffic of a defined region can enter...
- Is the Moon metaphorically a gateway?
 - NASA, specifically SMD, goes off into the solar system regularly and regards the Moon as something of a nuisance rather than an entrance.

What is a Gateway?

- Madison_Avenue_speak.....
 - A pathway *purported* to be the best or most convenient or most desirable entrance to a destination
(e.g., *Webster, Texas, is the gateway to NASA*)
- So what are we trying to sell.....and to whom?
 - Most people would answer “NASA”. If so, the specific target must be ESMD, because they have not yet gone anywhere, much less into the solar system (except for LRO). What is ESMD in the market for and does it have any money?
 - The title of this talk says “Humanity”. What is Humanity in the market for and does it have any money?
 - What is the relationship between NASA and Humanity?

Timeline for Human(ity) Spaceflight

- 1958 – 1968 NASA vs. USSR to LEO
- 1968 – 1972 NASA Apollo to the Moon
 - Science added to Apollo
 - Samples returned, ⇨ creation of Planetary Science
 - [Transmogrification of <Apollo Generation>](#)
- {Moon becomes nonscientific object to NASA Science}
- 1973 – 1975 Skylab, Apollo-Soyuz (LEO)
- 1972 – 2010 Space Shuttle (LEO)
 - Growth of Astronaut Corps
- 1984 – International Space Station (LEO)
- [1989 – 1992] SEI
- [{Emergence of Apollo Generation billionaires}](#)
- [2004 – 2011?] VSE

Human(ity) Spaceflight Policy

- 1958 – 1972 None. Reactive to USSR achievements.
- 1972 – 1988 None. Build & operate Shuttle and Station
- 1988 – 1996
 - "Establishing a long-range goal to expand human presence and activity beyond Earth orbit into the Solar System" [Reagan, 1988]
 - "I'm proposing a long-range continuing commitment: First, for the coming decade, for the 1990's, Space Station Freedom...; and next, for the new century, back to the Moon, back to the future, and this time, back to stay. And then a journey to another planet, a manned mission to Mars." [Bush(31), 1989]
- 1996 – 2004 None.
- 2004 – 2010 Vision for Space Exploration
 - Fully endorsed by Congress in 2005
 - Economic expansion into near-Earth space important part of policy but not implementation

Wasn't the VSE as good as it gets?

- The President delivered a strong and definitive public address.
- Congress was onboard in a bipartisan budget authorization.
- The NASA Administrator was excited.
- There was no vocal, overt opposition inside NASA.
- An important external scientific & technical community supported the effort and provided advocacy.
- Capable, experienced people in NASA were given internal leadership roles.
- The Constellation Program was managed competently.

What went wrong?



T. A. Heppenheimer, *The Space Shuttle Decision*,
NASA SP-4221

In civics books, we learn that the three branches of government include the White House, Congress, and the Supreme Court. In making policy and in carrying it out, however, the judiciary rarely plays a significant role. One may speak of a tripartite government with a different set of participants: the White House, Congress, and the Office of Management and Budget (OMB). Though the OMB is part of the Executive Branch and responds to the wishes of the President, its officials have considerable leeway to shape policy in their own right, by cutting budgets. In seeking its post-Apollo future, NASA repeatedly had to accept such cuts, as its senior officials struggled to win support within the White House.

Observations

- Any future NASA [Government] program to expand human presence in space beyond LEO, initiated at our current level of technology, will be technically and programmatically complex.
- NASA as an institution has accumulated a great deal of junk DNA. Its facilities, processes, workforce, and internal agendas need an overhaul that is politically impossible.
- In the absence of a clear national emergency or powerful political patronage, an “expensive” program plan that requires long-term continuity ultimately cannot be sustained in our political system.
 - The perceived benefits of the program must be widely understood and broadly accepted by the general public and by political representatives. Complex, technical explanations requiring a higher education are non-starters.
 - “Plateaus” of achievement that can be realized within a 5-year time frame are possible.
- The people in this room cannot continue their work (as a community) without sustainable Government funding.

So what can we do

- Define and Keep the Faith.
 - As dumb as that sounds, remember that the political process is based on belief systems supported by simplistic statements that “everyone knows”.
 - Make sure “everyone” (particularly the young) has an image of the future that includes what you want to accomplish.
- Learn about the “rocket science” that enables your goals (i.e., launch vehicles, astronaut health, operations, communication systems) and ally yourself with other NASA communities having common technology goals. For example:
 - Anyone advocating a heavy lift vehicle
 - Anyone wanting to send astronauts on long missions outside the terrestrial radiation belts.
 - Anyone wanting to land on the Moon for any reason.
- Don’t get apoplectic about “crazy” ideas for other destinations. They cannot be sustained either, and they may include an early technology element that is important to your vision.

Keep in Mind

- Everyone you debate with implicitly assumes that any human expedition is a Buck Rogers event.
 - Astronauts get into their spaceship, fly somewhere, camp out, walk around, and return as heroes.
 - It is important that you, at least, understand the “rocket science”.
- In a NASA program, nothing is simple or straightforward.
 - Didn't we already do “astronauts to Leo in a capsule” in the Gemini program?
 - Even in the perfect execution of the VSE, NASA only had the budget for minimal lunar surface activities.
 - NASA Headquarters is mostly engineers trying to follow the correct policy with an approved process under inadequate guidance while keeping one eye on Congress. They are rarely visionary; and if they are, they can be dangerous.
- Any path beyond LEO that circumvents NASA should be taken seriously, if you want to get there in your professional lifetime.

Why the Moon is the Gateway to the Solar System

- Key physical parameters in human exploration of the solar system are Delta-V, Time in the space environment, and scale of Infrastructure in space & at destinations.
 - Delta-V capability of the transit vehicles defines our sphere of exploration
 - Time in space addresses the physiological limits of the human crew
 - Infrastructure relates to the scale & scope of the operations
- When you evaluate technology currently, we can build systems and provide for crews to visit the Moon and Near Earth Objects and can fly to the Earth-Sun (& Earth-Moon) Lagrange points.
- *That's all the "Destinations" that we can currently reach!*
- Only the Moon offers opportunities to learn to do more...

If we want to explore the Moon and develop an in-space economy to support such exploration as well as expeditions into the solar system, we must...

- Build off-Earth infrastructure to support transportation systems and crew activities
- Conduct long-duration in-space and lunar surface operations to determine...
 - How to ensure the well-being, both physiological and psychological, and productivity of crew
 - The management institutions to design, oversee, and execute complex, interacting logistics and operations
 - How to build reliable, repairable, efficient systems to provide the essentials of survival and operability to humans (e.g., life support, power, communication, etc.)
- Build a politically viable “space sector” that has enough importance to guarantee continuing Government investment and/or oversight.
- *Is this possible in our current set of institutions?*

W. Mendell (1993) AIAA 93-4175, *Why ask "Why?"*

A lesson of Space Station Freedom is that it is dangerous to promise specific tangible returns from an undefined program. A lesson of the Space Exploration Initiative is that Congress will not buy a large program of human exploration justified by nonspecific, intangible benefits. The value and inevitability of human exploration of space can be argued convincingly on philosophical grounds. However, translating philosophy into funding requires a national consensus on space program policy and strategy before engineers begin designs of spaceships. If the Executive Branch is unable or unwilling to establish a political consensus with the Legislative Branch, then NASA leadership must consider nontraditional alliances to ensure that the space program is perceived by the political process to meet national needs.

Please Note!

- The High Net Worth Individuals (HNWI) [i.e., billionaires] currently building an astonishing variety of privately funded space systems are among those who were transmogrified by Apollo.
- They share the Dream.