The Art and the Science of Long Range Program Planning

Program System Engineering

Bring into Alignment:

- Technical
- Fiscal
- Engagement
- Programmatic
- Political

Solutions.
Main Question: can Europe be a significant & reliable partner in a major exploration effort?

Source: OECD & World Bank
Europe is a big concentration of financial assets
So where is the problem?

The 4 largest European economies (G, F, I & UK) invest less 3% in R&D, including Government & Private & Higher Education

Space represent a negligible fraction of the above investments
R&D is not even a separate item of the EU budget (imbedded in Compet. For Job Growth)

EU invests in ESA about 800 M€ out of 162B€!

ESA does not belong to EU and its funding is provided by national Education & Research Ministries
Unless of a societal change of paradigm, exploration will have to cope with a level of budgeting that will not allow dreaming and will oblige the world space agencies to a very strict pragmatism.

The level and the structure of the European budgeting will NOT allow Europe to be a major partner of an effort that requires orders of magnitude higher investments.

Telepresence, to my humble opinion, is a viable solution/alternative and its spin-off, Virtual Reality, may open new societal appreciation of the exploration endeavor. Europe has indeed the technological and the financial capability to be a significant partner of a cheaper and more pragmatic Exploration Initiative.
R&D as Percent of Discretionary Spending
percentage of outlays, 1962 - 2015

Source: Budget of the U.S. Government FY 2015. © 2014 AAAS
Limits on Discretionary Spending Since FY 2010

billions of constant 2015 dollars

Based on past budget resolutions, the Budget Control Act, and subsequent legislation. Adjusted for inflation using deflators from the FY16 budget request. Excludes war funding proposals. © AAAS 2015
When given different types of scientific research, medical, energy, and national defense research top the list of what voters say the government should fund. Republican primary voters focus on national defense and medical research.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Research</td>
<td>63%</td>
<td>65%</td>
</tr>
<tr>
<td>Energy Research</td>
<td>50%</td>
<td>52%</td>
</tr>
<tr>
<td>National Defense Research</td>
<td>47%</td>
<td>65%</td>
</tr>
<tr>
<td>Agriculture Research</td>
<td>38%</td>
<td>40%</td>
</tr>
<tr>
<td>Climate Change Research</td>
<td>33%</td>
<td>21%</td>
</tr>
<tr>
<td>Space Exploration Research</td>
<td>27%</td>
<td>35%</td>
</tr>
<tr>
<td>Engineering Research</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>Research in the Physical Sciences</td>
<td>23%</td>
<td>22%</td>
</tr>
<tr>
<td>Social and Behavioral Research</td>
<td>15%</td>
<td>10%</td>
</tr>
<tr>
<td>All of These Areas</td>
<td>15%</td>
<td>10%</td>
</tr>
<tr>
<td>None of These Areas</td>
<td>4%</td>
<td>4%</td>
</tr>
</tbody>
</table>
Astronauts & Robots: Partners in Space Science and Exploration

Transhumanist Concept: Augmentation & Extension of the Human Condition
“No bucks, no Buck Rogers”

Traditional, but Simplistic Argument
-Why Does the U.S. Not have a Man-Rated Rocket?

-Why the Demise of the most expensive Federal Lab — 2024

-Why is Humanity Not on the Moon?
Farewell to Strategy

“Politics Always Wins”

Today This Now Defines the Death of Strategy
* Asteroid Redirect Mission under attack
* Flexible Path/ Flexible Architecture
* Congressional battle over Earth sciences vs. Manned space
* NRC/NAS and others arguing to go back to the Moon
* There is no such thing as a Mars Mission — strategy versus budgets
* New Thinking about a Possible Phobos architecture
* Congressional Proposal to make space settlement a national goal
* Congressional Proposal for NASA to develop interstellar propulsion
* Billions of redundant funding on “last mile solutions”
Is it Possible to Bring Back Grand National Space Strategy?

Grand Space Strategy from ABOVE:
Perhaps if a Nation State rival of the U.S. establishes a lunar base & initiates mining activities.

Grand Space Strategy from BELOW:
Perhaps if there is a congressional appointed realignment commission that is charged with connecting strategy and infrastructure, assets and capabilities.
There needs to be a rebirth of Grand Space Strategy and the long-term, multi-decadal, committed resources to achieve these goals.

A coherent, powerful strategy is necessary to enable humanity to pursue critical space activities in a more focused, financially efficient and results oriented fashion.

It is all about scalability and sustainability.

Adapt or perish!