

NRC Committee on Human Spaceflight- Request for Input on Role of Human Spaceflight

Why we need to continue with human spaceflight

Submitted by Derek Webber, Executive Director, Spaceport Associates

Thank you for the opportunity to submit a short white paper on the topic of the role and future of human spaceflight. Space exploration and utilization in general are conducted to provide a series of benefits to society and individuals, and within that overall context, human spaceflight is a sub-category which brings its own specific benefits. So in this paper, we address both the overall benefits of space exploration, and then add the benefits associated with the human spaceflight subset.

Benefits of General Access to Space

We have to acknowledge that these points are rather well-rehearsed, 56 years since Sputnik 1 first went into orbit. But, no doubt, they bear repetition especially at a time when government is seeking to manage its budget by cost reduction measures. However, before listing the benefits, it is worth stating that it is *not* now necessary for government involvement in order to derive *all* of the following benefits; indeed some of them have always been achieved by way of commercial engagement with space. We simply list the benefit areas, from what used to be called “the Conquest of Space” in no particular order:

- Security (national, planetary)
- Science
- Prestige
- Employment
- Exploration
- Engineering Excellence
- Education
- Civil (Meteorology, Navigation)
- Commercial (Telecommunications, Broadcasting, Earth Resources)
- Spinoffs (Computer chips, etc.)
- International Cooperation

Human Spaceflight Specific Benefits

We may usefully repeat the caveat we provided at the beginning of the former section: although the pioneering work of human spaceflight was carried out for the US by NASA’s human spaceflight program, it is now distinctly possible to achieve some of the

benefits *without* the use of government astronauts. The same list we have provided above for general space applications (except for the commercial subsets) is also applicable to human spaceflight, with perhaps the amount of *extra* benefit attributable to human presence being a matter of degree. However, in addition, there are some new categories that can *only* by definition operate in the human spaceflight category, or can only function satisfactorily by having humans in space to manage the process. We therefore add these to the previous list:

- Settlement (essential in the very long term)
- Assembly in orbit (for lower cost interplanetary travel spacecraft)
- Commercial (space tourism, resource mining, satellite servicing)

We should note that with regard to space tourism, there are parallel revenue opportunities in space and on the ground – with spaceports standing to benefit from terrestrial tourists while the space travelers fly in space. Also, with regard to resource mining, the celestial body in question may be an asteroid or a moon.

Greatest Challenges to Sustaining a US Government Human Spaceflight Program

The biggest challenge is probably 1) being able to succinctly state and communicate the way in which space developments in general support the national agenda in terms of tackling both short and long term problems, then 2) being able to clearly articulate the extent to which a human spaceflight program fits within that overall need.

It is unlikely (and in opinion polls the US public do not want) for NASA to receive a significant increase in annual budget. So the future plans of NASA must take this reality into account. The budget will remain around \$17 B. There are however, even within this budget limit, two factors which will make an ongoing NASA human spaceflight program possible, achievable and desirable. The first is an encouragement and support of the *growth of the new commercial sector*, including space tourism and asteroid mining initiatives. Space tourism revenues can help extend the presence of NASA astronauts from low Earth orbit up into geostationary orbit or beyond (see eg paper IAC-12-A5.2 x 13278 – “Space Tourism – Essential Step in Human Settlement of Space”, Naples, 2012). Knowledge gained by the commercial asteroid mining initiatives will contribute to NASA’s eventual ability to deflect Earth-threatening asteroids. The second consideration (perhaps the hardest part) is the careful scripting of a space development plan that provides the benefits listed in this and other white papers, while *avoiding any excessively partisan suggestions*. The annual NASA budget process is a hopeless basis for long term planning of space endeavors, and therefore the best that can be done is to allow at least four years at a time of steady progress towards achieving plan milestones which will inevitably extend into a subsequent presidential administration. This will not be difficult if efforts are made to underline the common cause, and if the Administration is open to suggestions from all sources, and is willing to incorporate some of them, into the overall long term plan for space - of which the plan for human spaceflight is a subset.

It should be pretty easy to create this area of common cause from the lists in this paper and others. Security would be one such obvious area – eg protection from asteroid impacts. STEM education would be another. However, the US public needs to be exposed to a realistic statement about the very long term nature of some space benefits. Human spaceflight will increasingly be happening through revenue-generating space tourism, and other new commercial space ventures. There are already some commercial endeavors under way to extend the exploration initiative by private means (eg Golden Spike, Mars 1, Inspiration Mars). There is a logical, if very long term, path from exploration, thru tourists to eventual settlement. This path should be in the background of NASA's human spaceflight planning. NASA's astronauts need to be doing the initial exploring. A few decades later the tourists will follow. And then there may begin the settlement of a celestial body – with all of the preliminary testing having been done by NASA.

Of course, it is a totally artificial distinction to consider crewed and uncrewed spacecraft as in some way competing (for budget and other resources). It will always be a parallel development of both crewed and robotic missions.

Ramifications if US Government Terminated NASA's Human Spaceflight Program

As stated in the previous paragraph, this approach would not be tenable since the advancement of the space program depends on the *joint* development and operation of human and robotic explorers. But we consider below some of the more obvious implications if such an unwise decision were in fact made.

There would in any case still be human spaceflight happening in the US, but it would simply not involve government (NASA) astronauts. The commercial astronauts would continue to develop their capabilities. The NASA astronauts would accelerate their move *en bloc* to the commercial space tourism providers.

There are international implications with respect to the ISS, of course. The benefits of the use of the facility would be preferentially obtained by the other ISS partners, not the US. It might be decades before this worked its way through to new products or drugs in the world marketplace, but the US would miss out.

No plans could be progressed for any interplanetary vehicles destined to be assembled in orbit. Only a limited amount of assembly could be contemplated without astronauts managing the process on site in space.

Commercial work towards asteroid mining and eventual space settlement would continue, but be significantly held back without the support of NASA astronaut test flight missions, where such concepts as ISRU could be evaluated.

Other nations, such as China, would progress steadily to erode the 40 year lead that the US has created for itself in space exploration. The next phase involves generating

revenues from space, and it would be, to put it mildly, a sad outcome if the US gave up now after having spent considerable time, money and courage to reach this point.

The Possible Future of Human Spaceflight

- The future will be a continuation of joint robotic and human missions.
- There will be a gradual switch to more commercial operations. A great deal of money will eventually be made through spaceflight operations.
- Eventually the whole space enterprise will become a net revenue generator.
- Space tourists will fly suborbitally, orbitally, possibly to geostationary orbit, and to lunar orbit. Some may even go to the vicinity of Mars.
- Asteroids will be seen both as threat and opportunity. Commercial asteroid miners will help operate industrial resource extraction operations in space, and government (NASA) astronauts will be evaluating and testing ways to deflect asteroids that threaten Earth.
- Government (NASA) astronauts will be operating ISRU facilities to make it possible eventually for humans to be self-sufficient on the surface of celestial bodies such as the Moon or Mars.

So, why do we need to continue with human spaceflight? For survival, profit, knowledge and the other things.....

*Derek Webber
Executive Director
Spaceport Associates
PO Box 614
Damariscotta, Maine 04543*

*www.SpaceportAssociates.com
DWspace@aol.com*

5th June, 2013