

EDITORIAL
July 14, 2009

By Marcia S. Smith

In his article for [The Space Review](#) today, Edward Ellegood summarizes previous blue ribbon panels that have made recommendations on the future of the U.S. human space flight program.

Mysteriously, the best one (in this writer's extremely biased opinion) is omitted - the 1986 report of the U.S. National Commission on Space (NCOS). It was also omitted from the list presented at the June 17 public meeting of the Augustine panel.

In the interest of completeness, let's look back at the NCOS report - how it came to be, what it recommended, and what effect it had on the U.S. space program. Published in 1986 by Bantam Books, [Pioneering the Space Frontier](#) remains a classic for its origin, its content, and its rich illustrations by Robert McCall and William Hartmann (unfortunately the only version available on the Web is text-only).

NCOS was nothing if not bold. Its bottom line was that America should lead the way in opening the inner solar system for science, exploration and development, or in the words of the report:

A Pioneering Mission for 21st Century America

To lead the exploration and development of the space frontier, advancing science, technology, and enterprise, and building institutions and systems that make accessible vast new resources and support human settlement beyond Earth orbit, from the highlands of the Moon to the plains of Mars.

Why was NCOS Created?

Unlike the Augustine panel and all the others, the National Commission on Space had its origin in law.

It has largely gone unnoticed, but this year is the 25th anniversary of President Ronald Reagan's [1984 State of the Union address](#) where he announced that the United States would build a space station and invite other countries to join us. (OK. He said it would be done in 10 years, but we'll skip over that part.)

In selling the program to Congress and the public, NASA's slogan was that the space station was "The Next Logical Step" in the human space flight program. To make a long story short, some in Congress asked "the next logical step to what" and NASA did not have a ready answer - or at least an answer that it was allowed to articulate publicly.

Consequently, Congress inserted a provision in the 1985 NASA authorization act directing the President to establish a National Commission on Space to develop a long term (20 year) plan for the civil space program. It was not restricted to human space flight, but covered the gamut of space science, human space flight, and commercial space activities - a nascent concept at the time. The law directed the President to name 15 members to the commission and for them to report back in one year. In the same law, Congress also authorized NASA to begin the space station program, so it did not delay that program waiting for the answer, but the provision did signal an interest on the part of Congress in where the space station was expected to lead the country.

President Reagan named former NASA Administrator Thomas O. Paine to chair the Commission. Dr. Paine headed NASA during the first seven Apollo missions, including the Apollo 11 lunar landing and the Apollo 13 incident. Importantly in this context, he led NASA's participation in Vice President Spiro Agnew's 1969 Space Task Group (STG) that recommended post-Apollo goals for the space program. That is another long story, but the space shuttle and later the space station evolved from the STG study.

A fervent advocate of sending humans to Mars, Tom Paine championed that goal during the Space Task Group deliberations, during the National Commission on Space, and as a member of the original 1990 "Augustine Committee." Had he not died in 1992, he undoubtedly would be leading the charge for humans-to-Mars today.

Like the current Augustine panel, the NCOS was composed of science and technology luminaries: legends in air, space, and science - Luis Alvarez, Neil Armstrong, Bernie Schreiber, and Chuck Yeager; space visionary Gerry O'Neill; space scientists Paul Coleman, George Field, and Laurel Wilkening (who was vice-chair of the Commission); technologists Chuck Herzfeld and Jack Kerrebrock; former U.N. Ambassador Jeane Kirkpatrick; astronaut Kathy Sullivan; and Lt. Gen. (Ret.) Bill Fitch and David Webb. Not a shrinking violet among them.

I was privileged to be Executive Director of the Commission and freely admit my bias. With Tom Paine's leadership, this august and highly opinionated group remarkably was able to reach a consensus on the future of the U.S. civil space program that stands the test of time.

If only it didn't cost so much....

What Did NCOS Recommend for Human Space Flight?

The Commission made many recommendations in the areas of space science and commercial space opportunities, but since this article responds to current debate about the future of human space flight, only those NCOS recommendations will be summarized here.

The short answer is: humans back to the Moon in 20 years (by 2005) and on Mars in 30 years (2015). It is worth noting that the Commission envisioned robotic missions preceding and complementing human missions to both the Moon and Mars.

Here's the longer version.

The first thing Tom Paine did was to extend the Commission's horizon to 50 years instead of 20 years, knowing that 20 years is pretty short for space programs. While the Commission members had extensive experience in space, Tom wanted to get input from the public since they pay for it. NCOS Research Director Leonard David, ably assisted by colleagues Linda Billings, Steve Hartman and Ted Simpson, set up 15 public forums across the country during the last three months of 1985 (whew!). The use of public forums subsequently has been embraced by other groups, but it was innovative in 1985. We also utilized a brand new technology of the time - the Internet - to obtain public input. Perhaps the best outreach experiment, however, was one we did not know about until after the fact. Carl Sagan wrote an article in a popular Sunday supplement - Parade - encouraging the public to write to us. Every person who participated in a meeting or a public forum, or sent us a letter or an email, was acknowledged by name in our report. The Commission wanted this to be a report of the American people, not just the 15 chosen to be on the Commission.

What did NCOS conclude? The overarching goal, as noted earlier, is that America should lead the way in opening the inner solar system for science, exploration, and development. International involvement and participation of the commercial sector were *sine qua nons*. This may seem obvious today, but was less so at the time.

Some of the commissioners were not enthusiastic about the space station NASA sold to the President and Congress *inter alia* because its planned orbit at 28.5 degrees limited its utility for earth observations (a situation that greatly improved when Russia joined the program in 1993 and the inclination was changed to 51.6 degrees to accommodate its launches). But the space station and the space shuttle were "givens" with which the Commission was not allowed to tinker, so it recommended a second space station in a higher inclination orbit. The more significant aspect of this space station, however, is that it would rotate via a tether to produce variable gravity and thus serve as a "Variable-g Research Facility." Gravity could be zero at the center for microgravity experiments and 1g at the ends to better accommodate humans for long durations, or varied to study the effects of different gravity levels on human physiology. It was viewed as a prototype for other space stations and spacecraft that were part of the NCOS plan.

Connecting the Earth and these space stations would be a "Highway to Space." At the time, much discussion was ongoing about single-stage-to-orbit (SSTO) vehicles such as the National Aerospace Plane (NASP). The commissioners could not reach agreement on the virtues of SSTO versus an advanced reusable rocket vehicle system to replace the shuttle. They proposed a 5-year technology development program for both types of systems after which a decision could be made. There were points of solid consensus, though: that separate launch systems be developed for passengers and cargo; that both be designed from the beginning to be operated by the commercial sector; and that "never again" should the United States have a gap in the ability to launch astronauts into space as happened between Apollo and shuttle.

The Commission recommended that humans return to the Moon by 2005 and build lunar bases with closed-loop environmental control systems. Meanwhile, a "Bridge Between Worlds" would be created starting with a space station constructed at the L1 Earth-Moon Lagrange point to serve

as a space transportation hub (a "spaceport") for spacecraft traveling among the Earth, Moon, Mars and other destinations.

A fundamental precept of the NCOS report was to avoid the "dead end" Apollo model, where a few crews land and the program then is canceled. Thus the Commission did not focus on "boots on Mars," but instead on creating an infrastructure to allow routine trips to Mars on variable-gravity "cycling spaceships" in permanent orbits around the inner solar system. A traveler could hop on one that would be on the short leg (6 months) to Mars. Once in the Mars vicinity, a "taxi" would take her down to the surface where she would stay until another cycling spaceship on a short leg was available for a 6 month journey home. Alternatively, scientists who wanted to study the universe could take the longer legs of the trajectory. Thanks to the variable gravity design, those planning to stay on Mars would be able to adjust to 1/3 g during the course of the trip there, and back to 1g on the return leg.

Yes, it was bold. And expensive.

Where was the money to come from? The Commission argued that civil space had been roughly 1% of the gross national product (GNP) during Apollo and, recognizing the economic constraints of the day but the need for U.S. leadership in space, should be no less than about 0.5% of the GNP in the future. Coupled with international and commercial participation, the program was affordable per the Commission's analysis.

What Impact Did the NCOS Report Have?

Many would argue that the NCOS Report had no impact. But there is another viewpoint.

First, it should be remembered that the space shuttle Challenger tragedy happened in the middle of the NCOS deliberations. We got underway in July 1985 and Challenger was in January 1986. The Commission had drafted its report by that time and stopped to reconsider its recommendations, but concluded that although it could not predict when the shuttle would resume flight, that surely it would at some point. Since the Commission's recommendations reached out 50 years, the commissioners felt that they remained solid despite this tragic setback.

The report finally was delivered to the President and Congress in July 1986 (that's a whole 'nother story). Many observers would note that that was probably the worst possible time to deliver a bold report on the future of the space program. It wasn't just Challenger, it was the economy. Today's economic woes may make the 1980s pale in comparison, but the country was facing unprecedented deficits because of the Reagan defense buildup, sparking the "Gramm-Rudman-Hollings" deficit control measures of the late 1980s. Though NASA fared better than many agencies during that era, it was not enough to fund a bold human space flight program.

The NCOS report was delivered in 1986. Three years later, President George H.W. Bush, who was Vice President under Ronald Reagan, announced that the United States would return humans to the Moon and go on to Mars. Inexplicably - to this writer, at least - the NCOS report gets no

credit for that bold announcement. There is no public proof as to what prompted it. That is a history yet to be written. But certainly the NCOS report, prepared for the President and Congress, at least was sitting on someone's shelf.

Today, the country is still struggling with the question of the future of human space flight. For those who rue the slow pace at which the country is pushing the boundaries of human space flight and wonder about the value of another blue ribbon panel, this writer would offer that the previous efforts were not in vain. It is not that the nation rejected the recommendations, it is simply taking longer - much longer to be sure - to accomplish than anticipated.

While the NCOS recommendations may have been bolder than most, the basics are the same - send humans to the Moon and Mars as part of a broad civil space program that has a significant space science component, achieved by the U.S. government partnering with other countries and the commercial sector.

When this writer first met Tom Paine, she asked him about the Space Task Group report and how it had failed and why would NCOS be different. He didn't blink an eye - the STG report had not failed, it was just taking longer to execute than expected. As a young lass at the time I thought this an incredible statement. As a more experienced person today, I see its wisdom.

