

NASA Needs the Institute for Advanced Concepts

By Matthew Silver

"I am enough of an artist to draw freely upon my imagination. Imagination is more important than knowledge. Knowledge is limited. Imagination encircles the world."

—Albert Einstein

"Creativity and imagination are necessities, not luxuries." —Robert Cassanova, director, NASA Institute for Advanced Concepts

In mid-March NASA announced that it will likely shut down the NASA Institute for Advanced Concepts (NIAC) after nine years of operation. The ostensible reasons for this decision involve budgetary constraints and the need to focus engineering and developmental efforts on near-term goals. While budget concerns are very real, the cost-benefit analysis that led to this decision is highly dubious. NIAC's budget is tiny, just \$4 million per year. Yet its termination would deal a terrible blow to NASA's future and the innovative potential of the broader United States aerospace sector.

In just nine years the institute has grown to occupy a unique and critical niche within NASA's innovation ecosystem. Under the leadership of Dr. Robert Cassanova, it has operated with a simple yet powerful philosophy: The greatest advances often occur where imagination and creativity are not bound by the constraints of near-term financial demand. Playing a

role similar to that of DARPA for the military, NIAC encourages, identifies and then catalyzes big, high risk ideas with the potential to revolutionize space exploration and, by extension, humanity as a whole. As the military knows, such big thinking is necessary for the U.S. to maintain global technological leadership. Yet, because the research is by definition high-risk, the government has a critical role in supporting it.

NIAC's impact, relative to its size, has been tremendous. It has initiated 162 projects spanning aeronautics, space transportation, lunar and Mars exploration, mission operations, and space science. These include the now famous space elevator championed by Dr. Bradley Edwards; a radical new skintight spacesuit designed by Professor Dava Newman of MIT; innovative genetic engineering experiments with implications for living on Mars; and magnetic sails, to name a very few. Such studies have opened important and unforeseen technological options for NASA and the civil space exploration industry. They have generated intellectual capital and other returns far in excess of the relatively minor initial investment.

Some NIAC projects have moved from radical concept to viable NASA mission in a surprisingly short time period. In 2004 Webster Cash of the University of Colorado proposed the New Worlds Imager, a highly innovative optical system that would use a specially shaped occulter on its own spacecraft to block starlight and reveal Earth-like planets that presumably




orbit distant stars. Under NIAC funding, the team assembled by Dr. Cash showed that by using only existing aerospace technology, it is possible and affordable for NASA to seriously undertake the search for habitable planets and to study them for signs of life. The cost savings and scientific returns of such a project could be enormous. Dr. Cash estimates that if implemented in place of previously planned technology, the New Worlds Imager could conceivably save NASA over \$5 billion for the same science return. The savings made possible by this project alone could support NIAC for 1,250 years.

NIAC's return on investments extends beyond the potential to hit it big on a specific mission concept. Dr. Diana Jennings, the institute's deputy director, has noted that projects often have a ripple effect in the industry. This is well illustrated by the space elevator project. As a direct result of NIAC's \$574,000 support, outside entities such as the Air Force, X Prize Foundation, NASA Centennial Challenges Program, and private investors have put on the order of \$20 million toward maturing ancillary technologies. The viability of the concept has spurred significant interest in extreme-strength materials based on carbon nanotubes, and Dr. Edwards' group expects further direct funding for their development in the very near future. Beyond catalyzing cutting-edge technological development, the space elevator is featured in space exhibitions around the world, has inspired millions of people, created more than 75

jobs and resulted in multiple master's degrees and Ph.D.s. By giving life to such inspiring ideas, NIAC contributes significantly to the health and innovative potential of the aerospace sector and U.S. economy.

Three principal factors, among others, contribute to NIAC's outside impact: First, it is the only NASA entity that encourages and rewards high creativity and high risk, open-ended concepts. Second, like DARPA, it does not rule out proposals from outside the traditional circles and therefore taps the full creativity of the U.S. scientific community. Finally, because the concepts it funds are by definition revolutionary, they are also inspiring. This creates broader public interest as well significant national and international press coverage. This last point should be given due weight at a time when many are concerned with the number of students and young professionals entering engineering and science in the U.S.

As a whole, NIAC has proven tremendously valuable in bringing ideas from imagination to reality. If discontinued, no other NASA entity will fulfill its mission. Shutting it down will save little and will greatly damage the innovative potential of aerospace in the U.S. 



It's Full of Stars...

Hubble's view of the Carina Nebula shows star birth in a new level of detail. The fantasy-like landscape of the nebula is sculpted by the action of outflowing winds and scorching ultraviolet radiation from the monster stars that inhabit this inferno.

Image Credit: NASA, ESA, N. Smith (University of California, Berkeley), and The Hubble Heritage Team (STScI/AURA)