MOOG

12 July 2012
Richard Aubrecht, Ph.D.

"Spurring Economic Growth and Competitiveness Through NASA Derived Technologies"

Thank you for the opportunity to testify at the Subcommittee on Space and Aeronautics hearing on the topic of Spurring Economic Growth and Competitiveness Through NASA Derived Technology.

I have worked at Moog Inc., headquartered in East Aurora, NY, for most of my 40 year career. For the past 17 years I have concentrated on the development of Moog's business and technology strategies. In our planning processes I have seen directly the technical capabilities developed on NASA projects be applied to many other products and applications.

Moog has a 40+ year relationship with NASA, beginning with the components supplied for the Mercury Program. On Gemini, Apollo and the Shuttle Programs we developed even more complex actuation systems to steer the engines on the launch vehicles and the Shuttle's flight control surfaces.

As we have seen over the last 20 years, many countries have the ability to design, build and fly rockets. So what is extraordinary about the NASA programs? The manned space programs all have really hard problem statements. It is one thing to launch a small satellite in low-earth orbit. It is quite another thing to put three astronauts on the top of a Saturn vehicle and send them on a mission to land on the moon and return safely. So what makes manned space missions a really hard problem? First, the acceptable probabilities for failure are much, much smaller than unmanned missions. Second, the launches are fully covered by the television news, so the public is very engaged and aware of the successes, and the failures. Because manned space vehicles are really hard problems, there are a couple of consequences. First, the boundaries of technology will be expanded so as to provide more reliable lower weight and higher performance systems. Second, companies will put their best, brightest, and experienced engineers and technologies on the NASA programs.

The result is the development of many new technical capabilities. At Moog, these include:

- Systems design
- Simulation and modeling
- Design tools
- New materials
- New fabrication techniques
- New product designs

Equally important is the confidence developed by the design team that they can undertake the really hard problems, develop new technical capabilities, and succeed.

At Moog, our NASA experiences in the 1960's, 1970's and 1980's enabled us to develop the core technologies for fly-by-wire flight control systems. Since the 1980's we have continued to evolve these flight control technologies in both commercial and military aircraft as well as for all type of space launch vehicles. Today, a Moog led team has all the flight control actuation on the F-35 and Moog alone has all the flight control actuation on Boeing's 787 and the Airbus A350. In addition, we supply the engine steering controls on many of the launch vehicles for commercial and military satellites. The global center for aerospace flight controls is now centered in East Aurora, New York with supporting facilities in Salt Lake City and the Los Angeles area. If we had not participated on the NASA project, we would not have had the technologies, tools and confidence to undertake these many other projects.

It is important for the Subcommittee to recognize that the technical know-how is embodied in the people on the technical teams. There are technical reports, test results, drawings and process descriptions to document the NASA work. However, it is the people, their knowledge and experience which enable the technologies to be applied in other project, other aircraft as well as non-aerospace applications.

I do not believe Moog's experience is unique. I can see the effect on the providers of vehicle elements adjacent to the Moog hardware. Their NASA experiences also caused them to expand their boundaries. Although I do not have a studied knowledge of the hundreds of other systems on the NASA vehicles, my anecdotal data supports the same conclusion. NASA's really hard manned space problem statements push the technology boundaries and has enabled the USA to be the world's leading country for aerospace vehicles, products and technologies.

Why do countries such as China, India and Japan have manned space programs? My observation is that they understand the effect manned space programs can have on the technical competencies in country. They have seen the NASA model and the effect is has had on US industry. They are looking to accelerate the development of hundreds of technologies in country.

At present, NASA is benefiting from Moog's experiences on the F-35, the Boeing 787, the Airbus A350, and many other programs, as all these have enabled us to maintain and innovate our technical competencies. NASA has funded some study contracts since the Shuttle was designed and built, but these are not enough to keep a design and development team together to maintain the technologies necessary for manned space vehicles.

"Spurring Economic Growth and Competitiveness Through NASA Derived Technologies"

The invitation letter posed four questions. The above is a long answer to question 1. The following are brief answers to the four questions:

1. "How has your company's NASA work translated into benefits to your company, to the broader economy, and to society? Please provide examples."

   The short answer is that our NASA work enabled is to become the world's leading aerospace flight control company. This has led to more business at Boeing, more efficient passenger aircraft, better flight controls on military aircraft, and more reliable, less expensive launch vehicles.

2. "What challenges does your company encounter in transitioning its NASA work into other business opportunities? What could be done to address those challenges?"

   We have not had any significant challenges in transitioning our technology developed in NASA work to other applications.

3. "How effective are NASA's technology transfer and commercialization efforts, including licensing, and what can be done to enhance them?"

   We at Moog have not licensed any NASA technologies. I read the NASA e-mails about technology transfer opportunities so I am aware of the types of technologies being offered.

4. "What policy issues should Congress consider to help maximize the economic and societal benefits gained from the nation's investments in NASA and the civil space program?"

   Congress should insist NASA have clear statements of objectives to be accomplished with target dates. I read recently, Professor Steven Squire of Cornell and Chairman of the NASA Advisory Council, spoke about the need for clear, concise mission statements. I am in full agreement.

   Another policy issue is the need for constant, continuous funding to NASA, to the prime contractors and subcontractors such as Moog. As I stated above, the key to advancing technology is to have a technology team working on a continuum of projects. The start-

stop recent NASA history is not helpful in building technology teams. Circumstances can certainly change, but awarding contracts and then canceling them is very costly to the overall program and will cause companies to shy away from bidding on NASA work.

My overall conclusion is that NASA has played a very significant role in the development of leading edge technologies. These core technologies and knowledge have enabled much economic growth in the USA, not only in aerospace industries but in many other sectors of the economy who benefit from the new technologies. The model of NASA investing in really hard problems and challenging American companies has enabled the development of many core, pre-competitive technologies. This model is an example of where a Federal investment in technology development has an enormous impact on the overall economy.