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**Position Statement on the
National Aeronautics and Space Administration (NASA) FY 2016 Budget Request
submitted by the ASME NASA Task Force**

April 14, 2015

Key Recommendations for FY 2016:

- The Task Force is concerned about proposed flat and reduced funding for key research and education accounts within NASA. NASA's educational activities require sustained increases in funding in order to maintain and enhance outcomes and competitiveness in the US aeronautics workforce against emerging countries investing in STEM and space exploration.
- The Task Force highly recommends that Congress and the Administration work to increase the aeronautics portion of NASA's research budget to maintain funding and activities for aeronautics research at the FY 2015 level of \$651 million. Achieving this goal will help maintain the research programs needed to support and maintain a world-class aeronautics and aerospace industry and globally competitive research workforce.
- Solar Electric Propulsion (SEP)- Space Technology continues to develop critical technologies to improve access to and travel through space to benefit both NASA and commercial space endeavors including completion of high-power solar electric propulsion subsystems, currently in progress toward a full system demonstration. Once proven, high-powered solar electric propulsion will enable more efficient orbit transfer for satellites and accommodate increasing power demands for government and commercial satellites. Space Technology Mission Directorate (STMD), in coordination with Asteroid Redirect Mission (ARM) and In-Space Robotic Servicing (ISRS), proposes to begin long lead component acquisitions for solar electric propulsion (SEP) technology demonstration. The Task Force recommends funding this program.
- Laser Communication: The goal of Laser Communications Relay Demonstration is to demonstrate bi-directional optical communications relay services between geosynchronous orbit and Earth. The outcome of this demonstration will prove optical communications technology in an operational setting, providing data rates up to 100-times faster than today's radio frequency based communication systems. This technology can evolve only through sustained support for related NASA missions and the Task Force is supportive of it.

Overview of NASA's Fiscal Year 2016 Budget Request

All NASA's programs involve substantial mechanical engineering content and hence are of considerable interest to ASME.

The Task Force recognizes the fiscal challenges our country faces and supports the Administration's strategy of promoting fiscal discipline in a thoughtful way – strategically cutting programs where possible and investing in programs which improve our long-term economic competitiveness. With the FY 2016 budget, NASA attempts to address the challenge of advancing U.S. leadership in space exploration, space and Earth science, and aeronautics while dealing with the current fiscal climate.

The President's FY 2016 budget request includes \$18.529 billion for the National Aeronautics and Space Administration (NASA), which is an increase of \$519 million or 2.9 percent above the FY 2015 enacted level. NASA continues to grapple with the challenge to meet the goal of advancing US leadership in space exploration, space and earth science, and aeronautics in the current fiscal climate.

In FY 2016, NASA continues to plan and refine the requirements for its first-of-a-kind mission to capture and redirect a near-Earth asteroid into a stable orbit around the Moon, where astronauts will explore the asteroid. In support of this cross-agency activity, a multi-segment mission is planned that will advance the deep space exploration. The advanced solar electric propulsion, as managed by the Space Technology Mission Directorate, will provide the spacecraft with sufficient energy and thrust so it is able to rendezvous with a small, non-threatening asteroid and move it into a stable lunar orbit. Designers of the mission spacecraft will also incorporate anticipated technological advances in lightweight materials, communication, data storage and transfer, and space navigation. Many of these technologies will also be useful for other NASA missions, as well as for commercial space activities. In the third segment of the mission, NASA will employ the Orion crew vehicle to send human crews deep into space to examine and collect samples from the redirected asteroid by 2025.

This budget request supports International Space Station (ISS) research, including experiments and technology demonstrations in diverse disciplines such as physics, biology, materials science, robotics, communications, and human physiology.

The James Webb Space Telescope remains on track for launch in 2018 with adequate funding proposed for FY2016. NASA will also continue formulating a mission to Europa, Jupiter's icy moon that, data suggests, may have organic material on its surface. NASA's Space Technology program plans to continue funding Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) programs.

The FY 2016 Budget request supports STEM education programs, though, at a minimal level. It also proposes to make efficient use and adequate protection for NASA's assets.

Need to Expand Aeronautics Research

The Task Force has consistently noted the value of NASA's aeronautics research and technology (R&T) programs contained within the Aeronautics division. This portion of the NASA budget offers immediate and practical benefits for the nation, and the Task Force is concerned about the Administration's proposed \$571.4 million budget for Aeronautics in FY 2016, a -12.23 percent decrease from FY 2015. In light of this reduced funding path, the Administration's out-year

budget plan for Aeronautics will be insufficient to support the development of important aeronautics research missions.

Aeronautic products represent our greatest single national export. These exports are now being threatened by foreign competition whose governments are largely supportive of their aeronautics enterprises. This represents not only a commercial threat but a potential threat to our national security as well. Strong investment in fundamental engineering research in aeronautics will ensure that the US will retain its long-term leadership in this field.

The Task Force recommends that the aeronautics portion of the NASA budget be increased to \$1.0 billion over the next five years, with a long-term target of attaining a level of 10 percent of the total NASA budget. Achieving this target would re-establish aeronautics funding, as a percentage of the NASA budget at its pre-1990 level, and put US aeronautics R&D funding at levels commensurate with the needs of a world-class aeronautics and aerospace industry.

An increase in R&D funding for Aeronautics could provide immediate and strategic benefits to the US economy. More funding will allow rapid improvements in fuel economy and noise abatement technology development through full-scale or sub-scale flight demonstrations that speed transition of these technologies into production aircraft, and leverage current Aeronautics investments in environmentally responsible aviation technologies. Strategically, more R&D funding could allow the Aeronautics to take a greater role in Next Gen technology development for air traffic control, and to possibly take a lead role in the National Airspace System, leading the way to safely flying unmanned vehicles in our national airspace and maintaining US leadership in this critical technology.

US Aeronautics and Aerospace Workforce

Several interrelated critical challenges confront the US aeronautics enterprise – a sharp decrease in the number of new commercial and military aircraft programs, a decline in the quality of the research infrastructure, and erosion in the technologically literate workforce needed to ensure pre-eminence in an increasingly competitive marketplace. Robust investment by NASA in aeronautics research and space technology development addresses all these problems and will help balance NASA's portfolio to reflect the importance of aeronautics and aerospace to the global economy.

Aeronautics faces the same pressures being felt by the space industries, where fewer research dollars over time has resulted in fewer companies with skilled workers capable of designing and building complex aeronautical systems. As result, the US is increasingly dependent on immigration and outsourcing to meet its technical workforce needs. In fact, the NSF's 2014 S&T Indicators report found that over 50 percent of Doctorate level engineers working in the US engineering fields, including aeronautical and aerospace engineering, came from foreign backgrounds, an increase from 41 percent in 2000. Investment in aeronautics is a matter of strategic importance, as it creates highly skilled manufacturing jobs and helps create a foundation for a strong national defense. Additionally, the same report found that both the number and percentage of science and engineering doctoral degree recipients with temporary visas reporting plans to stay in the US peaked in 2007 and declined in recent years after rising since 2002, indicating that the US cannot take its scientific workforce for granted during tough economic

times. The Task Force calls on Congress to create legislation that allows the best and brightest students trained in our universities to find a path to permanent residency.

While regional economies differ, the Aerospace industry overall suffers from a lack of available young workers with advanced technology degrees who can step in to replace retiring, experienced workers. The aerospace industry looks to NASA to create a demand for long-term R&D to encourage students to go to graduate school and on to companies who are doing aeronautical research and development. There is a clear correlation between research dollars and the number of graduate students in a particular field. Therefore, as the funding for aeronautics has decreased by more than half over the last decade, the number of younger faculty and graduate students decreased. The elimination of the space shuttle program has further impacted the younger generation of engineers. There is a lag between funding increases and student enrollment increases, and this decade-long erosion must begin to be reversed now. Accordingly, the Task Force reiterates its support for a revitalization of aeronautics and aerospace research and development efforts at NASA.

Recommendations Concerning ITAR Restricted Research

The Task Force again recommends that NASA receive increased funding for research programs conducted through academic partnerships, and recommends maintaining NASA's education budget at a minimum FY 2012 level of \$136 million, rather than the FY 2016 request of \$89 million. In this context, Congress should consider having a broad range of technologies reviewed and declared non-International Traffic in Arms Regulation (ITAR) restricted in order to reduce costs and barriers to performing research in academic laboratories.

While basic research does not face ITAR restrictions, many applied and advanced categories of research on space related technologies face significant barriers for foreign nationals at academic institutions. At present almost all space launch technologies are ITAR restricted, eliminating the possibility for many foreign students to participate in the research at many universities.

Recognizing that many aerospace companies perform restricted work and need to hire legal residents or US citizens, the Task Force recommends that a process be established to screen new foreign engineering students and start the green card process and path to citizenship as a part of their student employment through US taxpayer funded grants working on technology in the aerospace and astronautics fields. This would restrict funding to individuals that would later be eligible for employment in the US after conclusion of their PhD, allowing for easier entry into the US aeronautics workforce. This would also reduce the cost to small business hiring new non-US graduates and streamline the US aeronautics workforce development pipeline.

Conclusion

Our nation is facing an ongoing struggle in two areas that are interrelated, which are: declining technical workforce and foreign competition for aeronautics and space exploration leadership. We believe one element of the solution to both problems is investment in aeronautics research and development. There is a strong correlation between technical degrees being awarded and consistent funding for research and development. NASA can help its own workforce problems as well as some of the same problems facing the rest of the country by increasing, in a persistent fashion, research in aeronautics. This in turn would have a positive effect on the US economy in the long run by enabling our country to better compete in the future global marketplace.

The Administration's proposed NASA budget for FY 2016 indicates an overall philosophical commitment to revitalizing space technology research and development efforts, which the Task Force fully supports. However, a strong aeronautics R&D program is also essential for the national necessity of retaining a US world-class aeronautics workforce and the Administration's 5-year (FY 2017-FY 2020) funding projection for NASA is incongruent with the Administration's overall goal of spurring a revitalization of R&D at NASA and in the US aeronautics industry. Aeronautics is a vital industry that produces tangible economic and security benefits for the nation. NASA's charter for aeronautics and space means that it must address both. Therefore, the Task Force reiterates its support for an expansion in NASA's overall ARMD's budget portfolio to ensure support for existing long-term aviation research and infrastructure goals as well as the development of new space technology research and development capabilities.

As other nations seek to expand their efforts in aeronautics and space exploration, there is a strong rationale for Congress to consider real increases to the NASA aeronautics and space technology budgets. Congress must help the US remain competitive and innovative in this vital area by providing adequate funds and consistent support for NASA's missions. Furthermore, NASA's aeronautics budget should reflect the priorities laid out in the NSTC National Aeronautics Research and Development Policy, which supports stable and long-term foundational research. Only a robust aeronautics budget will meet this goal. The decrease in NASA's aeronautics budget is a step in the wrong direction. The US must maintain and expand its investments in scientific research to ensure continued US leadership in space exploration and aeronautics and aerospace technological development.

ASME and the NASA Task Force

The NASA Task Force is pleased to have the opportunity to provide its views on the Fiscal Year (FY) 2016 budget request for NASA.

ASME is a nonprofit, worldwide engineering society serving a membership of over 140,000 people. It conducts one of the world's largest technical publishing operations, holds more than 30 technical conferences and 200 professional development courses each year, and sets many industrial and manufacturing standards. The NASA Task Force represents approximately 15,000 members from industry, academia, and government. Task Force members are involved in all aspects of aeronautical and aerospace engineering at all levels of responsibility. They have a long-standing interest and expertise in the nation's federally funded aeronautics, exploration, space operations, and aerospace research and development activities at NASA, and the agency's efforts to create a pipeline of young engineers interested in aerospace and aeronautics. In this statement, the Task Force will address programs that are critical to the long-term health of the nation's aerospace workforce and the global economic competitiveness of the US aerospace industry.

This testimony represents the considered judgment of the NASA Task Force and is not necessarily a position of ASME as a whole.