LONG-TERM INVESTMENT IN TECHNOLOGY DEVELOPMENT AND TRANSITION

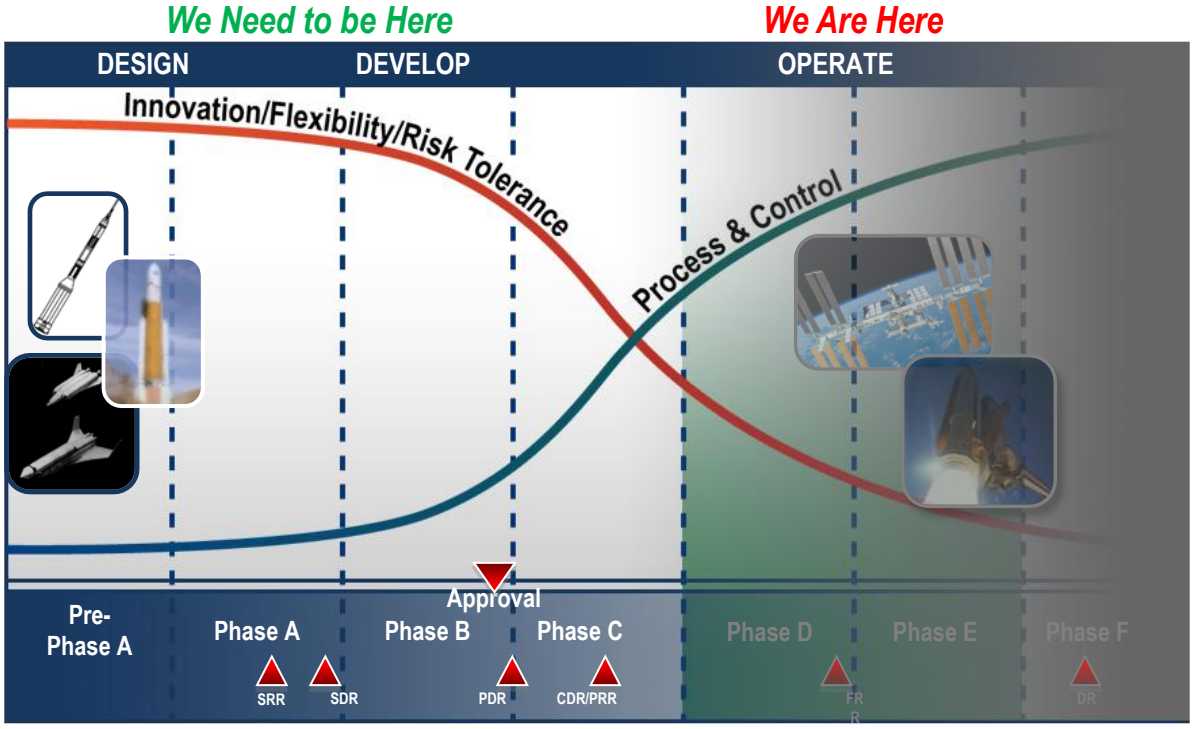
An AIAA Information Paper

ABSTRACT

Aeronautics is a valued sector of the U.S. economy and critical to maintaining national security and aerospace leadership. In 2006 Executive Order 13419 led to the creation of a National Aeronautics Research and Development Policy and subsequent plans to guide aeronautics research and development (R&D) through 2020. While this plan is a vital tool in technology development, there is increasing concern that technology is not being adequately transitioned "in a manner that promotes U.S. national security, job growth, and economic competiveness."[1] Fundamental changes are needed in how aeronautics technologies are matured and transitioned from federal laboratories to industry. The nation must make a commitment for long-term investment in R&D and the requisite critical infrastructure.

BACKGROUND

In 2005 HR 2862 called for the creation of a national aeronautics policy and a national R&D infrastructure plan, which would address, among other issues, the extent to which federal laboratories should focus on long-term, high-risk research. The policy was issued in December 2006 and was followed by the National Aeronautics R&D Plan in December 2007 and the National Aeronautics R&D Infrastructure Plan in December 2008. While the policy calls for the advancement of U.S. technological leadership in aeronautics, neither plan addresses the high-risk research, critical research infrastructure, and long-term financial commitments required to effectively demonstrate the stated goals and objectives for NASA and other federal agencies as stated in the legislation.



[1] Expediting the Transfer of Technology from Government Laboratories into the Aeronautics Industry, Science & Technology Policy Institute, February 2013, p. iii.

With mounting national debt and decreasing R&D budgets (especially the NASA aeronautics budget), our federal laboratories have become increasingly focused on short-term research and investments have become more risk-averse. Willingness to accept failure is a normal, accepted, and necessary part of understanding the capability potential and limits of a technology, and is vital to the successful demonstration of technology readiness. We must recognize the need for testing in order to learn versus simply testing to pass.

The effective transition of aeronautics-related technologies from federal laboratories to civil and military aircraft systems hinges on successful demonstration of the technology readiness level (TRL) required to enable and expedite timely system development and acquisition. Since technology readiness is highly dependent on anticipated operational environments, demonstration in such environments is vital to successful technology transition. A disciplined assessment methodology must be employed at critical milestones throughout the technology and system development processes to validate technology readiness and uncover capability shortfalls that can have detrimental impacts on program cost, risk, and/or schedule.

Aeronautics expertise is critical to U.S. understanding of the potential and limits of revolutionary new aeronautics technologies. However, aeronautics technology development and demonstration programs are becoming increasingly more short-term focused and risk-averse, which impacts U.S. defense capabilities and economic competitiveness. A 2013 report by the Science & Technology Policy Institute (STPI) concluded that "complacency and risk aversion has cost the United States its global leadership more than once since its invention of flight."[2] The report identified almost 70 barriers to effective technology transition, including intrinsic and structural issues, combined with external challenges that lead to risk-averse behaviors with unintended outcomes. Examples of negative and unintended outcomes include an increasingly fragmented knowledge base, siloed decision making, less disruptive innovation, and longer development cycles.[3]

The STPI report set forth a series of goals and recommendations for overcoming the barriers to technology transition, including better communication among key aeronautical stakeholders and the development of meaningful metrics. Fundamental changes must be made in how civil aeronautics technologies are matured and transitioned from federal laboratories to civil aircraft development programs. To meet the goals of the National Aeronautics Plan and to transition new technology effectively to industry end users, the nation must make a commitment for long-term investment in R&D and the requisite critical infrastructure.

Renowned scientist Dr. Wernher von Braun said it well: "One test is worth a thousand expert opinions." This nation must commit to the required investment in technology development that specifically includes a balanced risk portfolio of aeronautics research with demonstration "off ramps" where new technologies that are matured to a sufficient level are transitioned to industry for infusion into new fielded systems. In order to do so, technology programs must include frequent demonstrations through a range of simulations, ground tests, and flight tests that provide adequate validation of new technologies. When planning the test program, agencies should consider how "X-plane" style competitions and capability demonstrations might be used to enhance technology transition and, at the same time, inspire and excite the next-generation workforce. Failure to make the needed long-term investment in aeronautics R&D will likely lead to this nation's loss of international preeminence in aviation.

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[2] Expediting the Transfer of Technology from Government Laboratories into the Aeronautics Industry, Science & Technology Policy Institute, February 2013, p.iv.

[3] Ibid, p. v