

Scientific Objective and Infrastructure of Space Exploration (1)  
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INNOVATION INFRASTRUCTURE: THE CRITICAL ROLE OF CIVIL SPACE TO NATIONAL  
SECURITY AND ECONOMIC GROWTH

**Abstract**

Infrastructure is increasingly recognized as a core foundation of U.S. national security and economic growth. Improving and maintaining national infrastructure has traditionally been understood to yield a variety of long-term benefits. In 2017, a new appreciation for infrastructure, the various types and their significant cross-over effects, is emerging as an important focus for policy and economic research.

National infrastructure is typically categorized as physical (agriculture, energy, defense industrial base) and social (education, RD, international affairs competency). Furthermore, there is basic economic infrastructure which facilitates commerce and is responsible for ensuring the nation's business runs smoothly. However, this paper suggests Innovation Infrastructure is a unique phenomenon and new class of productive activity whose impacts ripple powerfully across multiple industrial sectors and value chains. It also suggests that many civil space projects, most notably those of NASA, initially created as innovation infrastructure either wholly or partially transition into the nation's basic economic infrastructure.

NASA is one of the nation's most significant public agency producers of innovation infrastructure and understanding this capability could alter the strategy for future American space programs. Some major projects, such as the space shuttle or International Space Station, started out as innovation infrastructure, capable of producing new scientific knowledge, engineering and process advancements, but eventually transitioned into basic economic infrastructure, capable of facilitating commercial activity. A host of current policy problems - the economic development of low-Earth orbit, the diffusion of basic research and early stage technology into the broader ecosystem and an estimate of NASA's impacts on the broader U.S. economy - reflect a pressing need to more diligently examine this phenomenon.

This paper addresses these questions directly by defining the unique innovation infrastructure that NASA produces, identifying its core contributions to economic growth and national security, and presenting a suite of policy options to strengthen civil space's contribution to the nation.