

SPACE SYSTEMS SYMPOSIUM (D1)  
System Engineering Tools, Processes and Training (1) (3)

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DISRUPTIVE INNOVATION: A COMPARISON BETWEEN GOVERNMENT AND COMMERCIAL  
SPACE**Abstract**

The world is changing around us, and it is driven by innovation. For over five decades now, space exploration required and benefited from novel technologies and processes to expand human presence into distant destinations, while also broadening our understanding of the universe. The scale of such innovations varied from incremental through radical to disruptive. These are commonly recognized innovation terms, yet many of the characteristics are different between space and consumer markets. Furthermore, government supported space agencies may innovate differently from established and emerging commercial space companies. The former is driven by human or robotic exploration goals - instead of profits - coupled with system and process complexities, high development costs, risk averseness, near term stakeholder needs, budgetary uncertainties, changing priorities, government driven earmarks, policies, solidified processes, often rigid management approaches, and many other factors. Today, these present a particular challenge for introducing disruptive innovations. In comparison, profit driven commercial space industries benefit from previous investments and breakthroughs by government agencies, or can be highly dependent on agencies as funding sources and subsequent technology infusion pathways. Due to the close coupling, many characteristics are common between the two. Yet the desire and need persists to accelerate progress by bringing disruptive innovations to space technologies. This may require new approaches drawn from a new way of thinking. While good leadership, management, science and technology expertise can successfully reconcile constraints between usability, feasibility and viability of programs, projects, and processes, a design thinker could go a step beyond and successfully harmonize these. Thus, the introduction of design thinking to space technology developments and processes could benefit portfolio management, future planning, and could result in closer ties with stakeholders. If successfully applied, this may yield superior break through technology and process innovations. This paper provides a snapshot of the current state of space technology innovation domain, including working through development pipelines, infusion pathways, using various tools and processes, stakeholder interests and constraints, and identifies potential barriers to innovation. The discussion is followed by an introduction to design thinking within the space technology framework, and highlight its potential benefits to at least a subset of future technology and process development needs.