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TECHNOLOGICAL RELATIVISM COMPARING THE DEVELOPMENT CYCLE TIME OF SPACE  
SYSTEMS

**Abstract**

Innovation takes place in the firms and government agencies that develop and operate technology and much of this innovation is incremental, building on experience and existing systems and knowledge. Within the space industry the pace of innovation is sometimes staggering and sometimes reliant upon heritage technologies. This paper explores the pace of innovation within both the commercial and civil space sectors relative to other agencies and firms that build large technological systems across the economy. Is innovation in space technologies moving faster or slower than other agencies or firms? What measures and analogies can be explored that allow for a useful comparison among different technologies and different institutions? This paper will establish development timelines for technologies that share key attributes and similar, complex requirements for systems integration, such as commercial aircraft, gas turbine engines, commercial satellites, offshore oil rigs, and the commercial automotive industry. As part of this analysis, the paper will describe what made each case innovative and characterize what kinds of technology development challenges were overcome. This paper will use these cases, as well as detailed analysis of key commercial and government technology programs, to provide a useful comparison of technology development times. Beyond the individual cases, the taxonomy for comparing technology development timelines presented in the paper for provide a useful basis for future research exploring additional cases. Ultimately, these cases will help structure discussion and additional research which seeks to understand what makes some programs and institutions appear as more rapid innovators.