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Author: Ms. Svenja Stellmann

Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany, stellmann@gmail.com

Mr. André Weiß

University of Bremen, Germany, Andre.Weiss@dlr.de

Mr. Daniel Schubert

Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR), Germany, daniel.schubert@dlr.de

HISTORICAL EVOLUTION OF SPACE SYSTEMS

Abstract

Since the launch of Sputnik in 1957, thousands of satellites and space probes have been sent into space. The typical spacecraft subsystems were subject of steady technology improvements during the last five decades, which led to many changes in design and layout.

Darwin taught us that biological systems adapt and improve by a process of natural selection, known to us as evolution. The question rises if similar forces lead to an evolution within the technical world of spacecraft engineering. Can technical systems evolve over time so that one can call it technology evolution? Influences like technology S-curves, trend analysis, disruptive technology innovations, technology maps, space system failure studies and different subsystem development ratios are only a few factors that need to be considered in order to answer the question.

The results presented in this paper are based on the intensive research and analysis of a specially created database, fed from several (smaller) databases containing technical specifications (mass power budgets) of hundreds of spacecrafts. The raw data was sorted concerning a classification system (e.g. Earth observation satellite, deep space probes, surface rover and human spaceflight) and then analysed with different regression and correlation algorithms in order to reveal specific trends of a spacecraft subsystem as a function of time.

Analysing the evolution of spacecraft systems has two main purposes: To give technical guidance for future spacecraft designs (performed e.g. in Concurrent Engineering studies) as well as to establish a system to evaluate which technologies are worth investing in, depending on their overall technology maturity.

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