

SPACE SYSTEMS SYMPOSIUM (D1)  
Lessons Learned in Space Systems (5)

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SYSTEMS ENGINEERING CHALLENGES AND LESSONS LEARNED FROM A SPACE MONKEY  
PROJECT

**Abstract**

Sending a living creature into space and returning it safely to earth surface has many technological challenges. Space physiology is a multi-disciplinary field and requires a good knowledge of both space science and physiology. Many other branches of expertise are also involved since designing a space capsule requires life support subsystems, deceleration, recovery and landing subsystems, navigation and command subsystems, telecommunication and telemetry subsystems, ground equipment and other command and control stations. All of these subsystems should work in coordination with each other and the role of systems engineering is very vital in such complicated systems.

After the successful launch and safe recovery of Pishgam (first Iranian space monkey), there was a lot of contradicting comments on the importance and success of this project. In this paper and the accompanying material supporting it, we provide the space community with the actual project, its design, manufacturing and testing process, training of the space monkeys and launch data gathered during flight. These include flight profiles and physiological data such as heart rates and environmental parameters recorded inside and outside space capsule.

Furthermore, we describe technical challenges of the project focusing on important lessons learned during the course of the project. Many tools were developed and used to lead this project according to space standards and many experiences were gained in the fields of system integration, subsystem data sharing and workflow. Some shortcomings of the design and development of the space capsule are also described in order to discuss methods of preventing similar problems in other projects.

The project was carried out for about 3 years and included two successful launch and recovery of the space capsule, one of them without the monkey and the other with monkey onboard. Many flight tests were included for the subsystem evaluation and both successful and unsuccessful experiences worthy of being presented to the scientific community are reported.