

SPACE SYSTEMS SYMPOSIUM (D1)
System Engineering Tools, Processes & Training (I) (3)

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SYSTEM ENGINEERING PROCESSES TO ASSURE RELIABILITY AND SAFETY OF KSLV-I
LAUNCH AND FLIGHT

Abstract

KARI (Korea Aerospace Research Institute) has developed KSLS (Korea Space Launch System) in cooperation with two Russian companies, KhSC and KBTM. KSLS is composed of KSLV-I (Korea Space Launch Vehicle) and NARO space center. The most important objective is to ensure reliability and safety of KSLV-I launch and flight because the space center is located near Yecheon industrial complex, the biggest petrochemical complex in ASIA.

On the other hand, complex structure of KSLS developers and KARI's lack of experience in developing launch vehicle generates the following six problems to be resolved:

1. Cost and schedule
2. Complicated development structure of the companies in charge of designing / manufacturing / testing verifying / operating launch vehicle and ground systems
3. Gap in technology and experience
4. Difference between technological management systems
5. Communication problems due to difference of language and culture
6. Obstruction to technology exchange due to security rules

In order to overcome the six obstructions and establish the processes for effective implementation of reliability and safety activities, the strategy with the five empirical rules is introduced:

- As for the obstructions of 1, 4 and 6, each company applies its own system of reliability and safety management to the component of KSLS with the whole responsibility.

- As for the obstruction of 2, the developer responsible for designing prepares RAP (reliability assurance plan) and SAP (safety assurance plan) and the developer responsible for manufacturing performs and manages the activities and measures for reliability and safety assurance.

- As for the obstruction of 3, KhSC prepares the KSLS RAP / SAP and KARI consistently prepares the RAP / SAP for KSLV-I 2nd stage, PLF and ground station.

- As for the obstruction of 5, the reliability / safety / quality committee composed of KARI, KhSC and KBTM executes the works for flight readiness verification.

- As for the obstructions of 3, 4 and 5, KARI and KhSC identify the required activities and their output for reliability and safety of KSLS on the basis of the Russian standards for reliability and safety assurance and confirm the results jointly in the reliability / safety / quality committee. The reliability activities applied to KSLS development are FMEA, FRACAS, design change control, reliability critical items control, quality control, checkout of test verification and reliability estimation. The safety activities applied to KSLS development are safety critical items control, safety control plan and definition and measures of abnormal situations / emergency situations.

This well-established process leads to the successful international cooperation among the three developers with different development systems, different technological levels and different experiences and then results in satisfying the requirements of KSLS reliability and safety.

The strategy which KARI adopts for the mission success of KSLV-I launch and flight can be a solution for the problem, how a country with industrial infrastructure but without specific experiences of launch vehicle development could make a success of the first launch and flight.