

IAF SPACE PROPULSION SYMPOSIUM (C4)  
Liquid Propulsion (1) (1)

Author: Mr. Andrii Kovalenko  
Yuzhnoye State Design Office, Ukraine

TESTS TO STUDY THE INFLUENCE OF THE LOW TEMPERATURE OF STRUCTURE AND  
PROPELLANTS ON THE PERFORMANCE OF VEGA STAGE 4 MAIN ENGINE**Abstract**

The paper discusses the results of the test that have been run to prove the performance of the main engine assembly (MEA) at the low temperatures of MEA structure and propellants at inlet. The objective of work is to enhance the performance of the VEGA launch vehicle by considerably extending the launch vehicle's operation time on orbit. To meet this objective, a unique thermal conditioning facility has been developed to maintain the required temperature field and quickly rectify the temperature condition of the main engine assembly if required. Relying on the previous experience of tests with the main engine assembly, this paper proposes the sequence of operations, including the cooling method and the heat-transfer agent to be used, determines the criteria of success, analyzes possible engineering risks, and recommends the respective risk mitigation measures. A FLIR A655sc thermal scanner and 36 thermal couples were used for monitoring the temperature field of the main engine assembly. The main engine assembly was test-fired nine times, with two starts in each test-fire. In some instances during tests, oxidizer freezing was registered in oxidizer pressure measuring pipes in the inlet manifold and before nozzles. This paper discusses the measures to prevent this situation in flight. The paper demonstrates that the low temperatures of main engine assembly and propellants have no considerable effect on the stability of processes, MEA start parameters, and the dynamic behavior of automation equipment when starting the main engine assembly. The results of MEA fault detection and the stability of MEA start operations (repeatability of parameters) prove no fault of the MEA performance.