



Arianespace Flight 142: Inquiry Board Report and Action Plan

Press Release From: Arianespace (<http://www.arianespace.com/>)
Posted: Tuesday, August 7, 2001

The Inquiry Board appointed to investigate the malfunction of Ariane 5's EPS upper stage during Flight 142 submitted its report to Arianespace on August 1. As requested, the board pinpointed the causes for the anomaly and recommended corrective measures. All of the recommendations have been accepted, and they will be applied as quickly as possible. Arianespace is now targeting the next Ariane 5 launch for late November, a delay of approximately two months compared to the initial schedule for this mission.

The Inquiry Board Report

Background

The seven-member Inquiry Board was appointed July 16 following the malfunction in Ariane 5's EPS storable propellant upper stage that occurred during Flight 142 on July 12. This malfunction resulted in the mission's dual satellite payload being delivered to a lower than expected orbit.

The Inquiry Board made a complete analysis of all measurements recorded during Flight 142 and studied the production, quality and technical background documents concerning all Ariane 5 missions to date. Also reviewed by the board was the work of production and development teams in Europe.

Mission details and causes of the malfunction

The board's findings confirmed that all processing and countdown operations for Flight 142 proceeded nominally, as did the Ariane 5's flight prior to ignition of the upper stage's Aestus engine.

The Inquiry Board's report identified a combustion instability during the Aestus engine's ignition. The resulting degraded engine combustion conditions led to a lower than normal thrust output. In addition, these conditions also resulted in the premature

depletion of one of the propellants, which in turn caused the engine to shut down earlier than normal.

The strong pressure variation responsible for the combustion instability at Aestus engine ignition is attributed to a dynamic hydraulic coupling between the upper stage's propellant feed system and the engine's combustion chamber internal circuits.

As part of its investigation, the inquiry board clearly ruled out any link between the Ariane 5's upper stage malfunction and the operation of propulsion systems on the Ariane 4 launch vehicle.

Recommendations

The abnormal operating conditions encountered during Flight 142 will be studied in depth to further define the engine's ignition phase.

The Inquiry Board made the following recommendations:

- The hydraulic conditions that occur during Aestus engine ignition should be dynamically modeled mathematically.
- The upper stage's ignition phase improved to make it steadier and smoother.
- The qualification criteria adapted to the modified ignition phase.
- The test benches adapted to more closely duplicate flight conditions.
- The in-flight operating margins demonstrated by an engine test program.
- The next flight engines should be qualified according to these new criteria.

Arianespace accepted all of these recommendations. Arianespace will apply them as quickly as possible, coordinated with the manufacturers concerned.

Action plan

After analyzing the board's recommendations, Arianespace - in conjunction with the European Space Agency and the French CNES space agency, and supported by the Ariane program industrial partners - has defined an action plan comprising the following aspects:

- Analysis of the data recorded during ground tests and in-flight operations of the Aestus engine and the EPS stage, especially data allowing an in-depth analysis of the ignition sequence.
- Dynamic modeling of the propellant supply system.
- Updating the mechanical modeling of certain combustion chamber parts.
- Analysis of a MMH propellant flow control system.
- Definition, validation and qualification of the modifications necessary for the ignition sequence.
- Modification of the engine test bench to more closely duplicate flight conditions.
- A test program involving Aestus qualification and flight engines.
- Reassessment of the production quality and inspection procedures.
- Application and acceptance of Aestus engine modifications for upcoming Ariane 5 launches.

Based on the timely application of this action plan, Arianespace now expects the next Ariane 5 launch to take place in late November. This would be a delay of about two months compared with the initial schedule.

Arianespace launches continue

Arianespace is continuing its launch activities at the Guiana Space Center, with the next mission, Flight 143, to use an Ariane 4 to orbit the Intelsat 902 communications satellite. Arianespace Flight 143 is now scheduled for the end of August.

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