

MethaneSAT

Results of the Anomaly Investigation into the Loss of Communication with MethaneSAT

On 20 June 2025, MethaneSAT experienced an on-orbit anomaly resulting in loss of communication with the spacecraft. The unknown event occurred following a ground station pass where all communications and spacecraft state of health data were normal. Mission operators worked to re-establish communications with the satellite for 21 days following the anomaly, including nearly 400 attempts at communication between ground stations and the satellite, without success.

Spacecraft that cannot communicate with ground stations are challenging to investigate because of the limited data that is available from space. To better understand what may have caused the loss of communication, MethaneSAT LLC obtained on-orbit optical imagery of the spacecraft on three occasions (June 28, July 4 and July 16).

All images showed that the spacecraft was intact, with no evidence of any visible damage or nearby debris. However, the images also showed that MethaneSAT was not in its normal or expected orientation. This information marked the official end the mission and the beginning of a formal investigation.

Investigation Process

The formal anomaly investigation by MethaneSAT LLC and its partners utilized standard aerospace industry practices and tools. The last data transmission received from MethaneSAT indicated normal activity and no information could be obtained from the spacecraft following the anomaly. To evaluate possible root causes, the investigation therefore drew on data from 15 months of MethaneSAT operations and the rigorous testing process the spacecraft underwent prior to launch.

During the investigation, MethaneSAT LLC and its partners also had support from industry leading, third-party technical experts. These experts reviewed and agreed with the approach taken by the investigation and the findings below.

Investigation Findings

The investigation concluded that the MethaneSAT anomaly was due to a solitary event that spread to, or began within, one of two subsystems; affecting either the flight avionics unit (a spacecraft computer subsystem which executed commands, maintained attitude and controlled communications) or the electrical power subsystem, which is responsible for providing power to most other spacecraft components, subsystems, and payloads.

A disruption in either of these two subsystems would have resulted in an off-nominal orientation of MethaneSAT and loss of communications. While the investigation concluded that the direct cause began with or spread to one of the two identified subsystems, the specific reason for the system failure remains unknown.

All potential modes of failure were evaluated during the anomaly investigation process and assessed as to their likelihood of being the root cause of the failure.

Three possible contributors to the failure of the flight avionics or electrical subsystem on MethaneSAT were identified:

- A printed circuit board failure within the spacecraft bus avionics;
- An electronic component or printed circuit board failure on a spacecraft bus interface; or
- A thruster or associated system failure which sent high current to other bus subsystems.

Based on the limited data available, it is not possible to state the relative likelihood among these possible factors.

In addition to identifying likely contributors to the anomaly, the investigation identified and evaluated several factors that were determined to be less likely contributors. While these were determined to have a very low probability of being the root cause, they cannot be fully ruled out.

- A micrometeoroid or orbital debris event;
- A destructive radiation event effect impacting a component or software caused by a high-energy solar particle strike (such as a cosmic ray);
- A space environment induced electrostatic spacecraft event;
- A flight avionics unit to electronics subsystem communications error; or
- Unexpected fault system interactions.

These should all be considered equally likely, but individually they are significantly less likely than the three possible contributors identified by the investigation.