

# Rocket fuel freeze caused EU satellite mislaunch, probe finds

October 8 2014, by Mariette Le Roux

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A Russian Soyuz rocket is seen blasting off from a launch pad at the Russian-leased Baikonur cosmodrome in Kazakhstan, on March 26, 2014

Fuel that froze on a Russian Soyuz rocket caused two satellites from Europe's troubled Galileo navigation system to be placed into the wrong orbit in August, an investigation concluded Wednesday.

The error was caused by a problem with fuel pipes on the launcher's fourth, Fregat, stage—"a design flaw" that can be easily fixed for future

launches, chief executive officer Stephane Israel of launch firm Arianespace told AFP.

It would be too late, however, for this orbiter pair—valued at about 40 million euros (\$51 million) each—as they do not have enough onboard fuel to boost themselves into their intended position in the satnav constellation.

Pipes containing hydrazine propellant on the Fregat stage had been placed too close to super-cold helium feed lines, the investigators found.

The mishap is the latest in a series of problems encountered by Europe's 7-billion-euro alternative to America's GPS satnav system.

The very launch of the two satellites, the fifth and sixth in the system, had been delayed by more than a year due to "technical difficulties".

Meant to be the first fully operational Galileo orbiters, the pair was boosted into space from Kourou in French Guiana on August 22 to join four others already there.

## **Lost in space**

They should have been slotted into a circular orbit at an altitude of 23,500 kilometres (14,600 miles), inclined at 56 degrees to the equator, but were placed instead in an elliptical orbit at a height of 17,000 kilometres.

And experts have said there was no way to boost the satellites, weighing about 700 kg (1,500 pounds) each, into their correct spot.

A commission set up by Arianespace, the European Space Agency (ESA) and the European Commission, which finances Galileo, said the

problem kicked in about 35 minutes after launch.

Hydrazine propellant froze in the pipes, starving two altitude control thrusters of fuel, which caused a loss of power and a misorientation of the Fregat upper stage, which is designed and produced by Russian aerospace firm NPO Lavochkin.

"The root cause of the anomaly on flight VS09 is therefore a shortcoming in the system thermal analysis performed during stage design, and not an operator error during stage assembly," said an Arianespace statement, adding the fix could be applied "easily and immediately".

According to Israel, Soyuz should be able to resume service from Kourou in December, though not necessarily with a Galileo launch.

The plan had been to hoist two more navigation satellites by the end of 2014, opening the way for a first phase of Galileo services in 2015, including applications for smartphones, in-car navigation and search-and-rescue location.

By 2017, according to the Galileo schedule, all 24 operational satellites would be in place.

Six backups would join the fleet by 2020, at which point the system would be fully operational.

Each launch with a Soyuz costs an estimated 65-70 million euros.

In 2013, the annual global market for satellite navigation products and services was valued at 175 billion euros, according to figures cited by the European Commission.

This was expected to reach 237 billion euros by 2020.

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