

Mounting delays stress space station systems

Oxygen problems exacerbated; flight schedules affected

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Growing delays in the delivery of space hardware have begun to significantly affect the day-to-day operations of the international space station and the flight schedules for the second half of this year.

Aboard the station, the hard failure of the Elektron oxygen generation system and the imminent exhaustion of a secondary source of oxygen will force the crew by Monday to begin burning chemical canisters known as "oxygen candles" in order to continue breathing. Normally a robust and reliable system, these units have burst into fire on occasion, nearly killing the crew of Mir in a 1997 incident.

Replacement parts for the Russian Elektron system, originally expected to reach the station on a robot supply ship next month, will now not be available until later in the year. Although a small electronics box may still fly in June, it's a long-shot repair, sources say. The more promising repair of the system needs a 300-pound liquid unit whose manufacture in Russia has been seriously delayed.

Even more significantly, the launch of the next space station crew may be put back a full month. NASA internal documents obtained by MSNBC.com yesterday show that the date for launching the Soyuz TMA-7 is now listed a Oct. 22, instead of the original Sept. 27 date.

This delay means the mission of the current crew, Russian Sergei Krikalev and American John Phillips, would be extended from 175 days to 200. That would push their own Soyuz vehicle, in which they arrived at the station last month, close to its maximum certified orbital lifetime, but past Soyuz capsules have spent up to 210 days in space before returning safely.

The extension would also give Phillips the record for the most time spent in space by an American over the course of a career. Krikalev will acquire the world record with this mission, even without the extension.

Burning the candles

Of the four sources of oxygen aboard the space station, two are now unavailable: The Elektron system doesn't work and the store of oxygen bottles sent up on a supply ship in March will be exhausted by Monday. While extra bottles have been loaded into the next unmanned supply ship, it is not scheduled to launch for the station until June 17.

So the crew must now rely on the third source, the so-called "oxygen candles." These "solid-fuel oxygen generators" (known as SFOGs to NASA and TGK in Russian) are scuba tank-sized cylinders containing a briquette of solid lithium perchlorate. Each canister provides a little less than two pounds of oxygen, enough for one crewman for one day.

There are currently 106 such canisters aboard the space station. While some may turn out not to be functional, this is still enough to provide the two-man crew with about 50 days of breathing air — more than enough to last until the next supply ship arrives with more oxygen bottles in about a month.

Each canister is loaded into a special chamber and activated by firing a spring-driven mechanical squib (there are two chambers aboard the station, but the squib mechanism in one of them has already broken). This initiates "thermal decomposition" of the material at an internal temperature of up to 900 degrees F, releasing oxygen — and about 800 watts of waste heat. (For comparison, an oven in a home gives off about 350 watts.)



NASA / AP file

Of the four sources of oxygen aboard the space station, one is broken and the second will be exhausted soon.

The malfunction in February 1997 saw a torch-like flame burst from the front of the canister, filling the station modules with choking, blinding smoke and cutting off access to one of the station's two bail-out capsules.

Had the chemical canister been oriented in a slightly different direction, space engineers later realized, the flame would have quickly burned through the cardboard-thick aluminum hull and outrushing air would have briefly fanned the flames until the crew suffocated.

If for some reason the oxygen candles become unusable, or are used up before a new supply mission can be sent to the station, the crew has recourse to the fourth and last source of breathable air: oxygen tanks attached to the U.S. 'Quest' airlock. They are thought to contain about 362 pounds of gas, adequate for about 90 days of breathing.

Long range implications

As new questions arise about the expected repair schedule for the Elektron unit, some safety officials at NASA have privately questioned what this means for the space shuttle's key "safe haven" concept. Under return to flight guidelines, if something were to go wrong with a NASA space shuttle in the future, crews are supposed to camp out on the station until a rescue shuttle can be launched.

Had the shuttle been launched last week as originally hoped, the station would have had enough emergency oxygen on hand even without Elektron for the shuttle crew and the station crew to last until rescue. But as the shuttle is delayed into July, and perhaps even into September, the lack of a functioning oxygen generation system means the station crew is eating into consumable supplies that would otherwise have been available if the "safe haven" was needed.

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