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Mitigation of Orbital Debris

Spacecraft Hardware Design
Telenor Satellite AS, which was responsible for the design, manufacture and operation of the THOR7 satellite, has assessed and limited the amount of debris released in a planned manner during normal operations.

No debris is generated during normal on-station operations, and the spacecraft is in a stable configuration.

Telenor has also assessed and limited the probability of the orbital location becoming a source of orbital debris by collisions with small debris or meteoroids that could cause loss of control and prevent post-mission disposal. The design of the THOR7 satellite locates all sources of stored energy within the body of the structure, which provides protection from small orbital debris.

Telenor requires that spacecraft manufacturers assess the probability of micrometeorite damage that can cause any loss of functionality. This probability is then factored into the ultimate spacecraft probability of success. Telenor has taken steps to limit the effects of any collisions through shielding, the placement of components, and the use of redundant systems.

Minimizing Accidental Explosions:
The LS1300 satellite was designed and manufactured by Space Systems/Loral. Telenor has assessed and limited the probability of accidental explosions during and after completion of mission operations.

The design of the LS1300 spacecraft is such that the risk of explosion is minimized both during and after mission operations. In designing and building the spacecraft, the manufacturer took steps to ensure that debris generation will not result from the conversion of energy sources on board the satellite into energy that fragments the satellite. All propulsion subsystem pressure vessels, which have high margins of safety at launch, have even higher margins in orbit, since use of propellants and pressurants during launch decreases the propulsion system pressure. Burst tests are performed on all pressure vessels during qualification testing to demonstrate a margin of safety against burst. Bipropellant mixing is prevented by the use of valves that prevent backwards flow in propellant and pressurization lines. All pressures, including those of the batteries, are monitored by telemetry.

At the end of operational life, after the satellite has reached its final disposal orbit, onboard sources of stored energy will be depleted or secured, and the batteries will be discharged.

Safe Flight Profiles
Telenor has assessed and limited the probability of THOR7 becoming a source of debris by collision with large debris or other operational spacecraft.
Specifically, Telenor has assessed the possibility of collision with satellites located at, or reasonably expected to be located in the vicinity of THOR7.

	IS 10-02	THOR6	THOR5	THOR7
Location	1.0ºW	0.85ºW	0.75ºW	0.65ºW
Variation ±	± 0.05º	± 0.05º	± 0.05º	± 0.05º

Telenor uses longitudinal separation for co-location. On-station operations are kept within +/- 0.05 degrees for N-S station-keeping and +/- 0.05 degrees for E-W station-keeping, thereby ensuring adequate collision avoidance distance from other satellites.

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Telenor uses Jspoc to monitor the risk of close approach of its satellites with other objects. If required, avoidance maneuvers are performed to eliminate the possibility of collisions.

Post Mission Disposal Plan
Post-mission disposal of the satellite from operational orbit will be accomplished by carrying out maneuvers to raise the satellite to a higher orbit. The fuel budget for elevating the satellite to a disposal orbit is included in the satellite design.
Telenor has assessed fuel-gauging uncertainty and has provided an adequate margin of fuel reserve to address the assessed uncertainty.