EXHIBIT C
Iridium NEXT Orbital Debris Mitigation Plan[1]

Spacecraft Hardware Design

The amount of debris to be released in a planned manner during normal operations of the Iridium NEXT space stations has been assessed and by design, no debris will be released at any mission phase. In addition, the probability of the Iridium NEXT space stations becoming a source of debris by collisions with small debris or meteoroids smaller than one centimeter in diameter that could cause loss of control and prevent post-mission disposal has also been assessed and limited.

These assessments were explicitly undertaken during the design and development of the Iridium NEXT satellites by Thales Alenia Space in their capacity as the system prime contractor. The satellite subcontractors were required to incorporate into their designs explicit features for minimization of the generation of orbital debris. This included, for example, the use of non-debris generating appendage hold down and release mechanisms, selection of appropriate construction materials including external thermal control surfaces and coatings, and operational procedures.

Mitigating Accidental Explosions

The probability of accidental explosions during and after completion of mission operations has been assessed and limited as part of the Iridium NEXT satellite design. The only sources of stored energy on the Iridium NEXT satellites are as listed below:

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[1] Iridium has a pending application seeking to modify the Orbital Debris Mitigation Plan for the currently operational Iridium Block 1 satellite constellation. *See Application of Iridium Constellation LLC for Minor Modification of Mobile Satellite Service Authorization to Update Orbital Debris Mitigation Requirements*, File No. SAT-MOD-20080701-00140 (filed Jul. 1, 2008).

Chemical/pressure:

- Pressurized monopropellant hydrazine fuel tank (1 per satellite)
- Li-ion battery (252 cells)
- Constant conductance heat pipes (15 per satellite)

Kinetic:

- Reaction wheels (4 per satellite)
- Solar array drive motors (4 per satellite: 2 solar array panels, each with a 2-axis drive mechanism)
- Crosslink drive motors (4 per satellite: 2 gimbaled crosslink antennas, each with a 2-axis drive mechanism) Feeder link drive motors (4 per satellite: 2 gimbaled feeder link antennas, each with a 2-axis drive mechanism).

During the Iridium NEXT satellite design and development program conducted by Thales, the satellite subcontractors were required to perform failure modes and effects analyses (FMEA) to demonstrate acceptably low probability of failure from all possible failure sources. These analyses included the probability of failure of pressure vessels resulting in an accidental explosion. Suitable design safety margins were required and formally verified in order to demonstrate the achievement of acceptably low probabilities of occurrence of such failure modes.

At end-of-life of any given Iridium NEXT satellite, mission operational rules and procedures call for the maneuvering of the satellite to a disposal orbit, followed by passivation of all stored energy sources. This includes de-spinning of the reaction wheels, venting of residual propellant and pressurant by opening all thruster valves, and connection of on-board electrical loads sufficient to cause the satellite's battery to fully discharge (which also results in the passivation of all other on-board kinetic energy sources).

The propulsion system consists of a fuel tank with a bladder. At the beginning of life (BOL), the tank is loaded with up to 164 kg of hydrazine propellant. After the fuel has been loaded, the Fill/Drain (F/D) valve is closed and manually secured with, a screw on safety cap. The bladder portion of the tank system is then pressurized with approximately 1.5 kg of inert gaseous nitrogen to a Maximum Expected Operation Pressure (MEOP) of 24.5 bar [2] using the Fill/Vent Valve (F/V). After pressurization, the F/V is mechanically closed, and after this point there is no possible mechanism for completely depressurizing the system. When the spacecraft is mated to the launch vehicle and on the launch pad, the Latch Valve (LV) is commanded open to allow fuel into the propulsion system between the LV and thrusters. During nominal operations throughout space vehicle life, the LV is never closed.

Throughout the life of the satellite, fuel is consumed for various maneuvers. At the end of operational life, the satellite is commanded into a deorbit maneuver with a depletion burn to exhaust all available fuel. At the completion of this maneuver, the 1.5kg of inert nitrogen pressurant will remain on the "dry" side of the bladder in the tank, at a residual pressure of approximately 6 bar. Also 1.6kg of fuel will remain in the propellant lines of the system in vapor form, which presents no hazard of escaping or causing later rupture, as it is already at an equilibrium pressure with the vacuum of space. In the unlikely event of a small particle (debris or meteor) puncturing the tank, the residual gaseous nitrogen would be released in a rapid manner, similar to a cold gas thruster, with a theoretical maximum delta Velocity of 2.1 m/s. In the extraordinarily unlikely event of a particle striking a passivated SV on precisely the line required to puncture both the fuel portion of the tank and the bladder, the maximum theoretical delta-V is about 3.5 m/s. Given that the orbital velocity during disposal is on the order of 7 km/s,

[2] All propulsion systems are proof tested to 1.5xMEOP, or 36.75 bar in this case, and the design is burst tested to 2xMEOP (49 bar).

this delta-V will have no noticeable effect on the orbit of the satellite, or alter the possibility of space vehicle breakup in any fashion.

To the extent that a waiver of Section 25.114(d)(14)(ii) and/or Section 25.283(c) of the Commission's rules is required to maintain this residual pressure of gaseous nitrogen and residual fuel, it is hereby requested, based on these data presented above.

The batteries used on Iridium NEXT are based on Li-ion cells. There are 252 cells on each satellite. Each cell is roughly the size and shape of a conventional "D" battery, and incorporates a "leak before burst" safety disk to prevent explosion in the event of overcharge.

The heat pipes used in the construction of the Iridium NEXT space stations are aluminum tubes filled with anhydrous ammonia. They are inherently low pressure, and built to leak before burst due to the soft aluminum alloy used. There are no known events of on-orbit explosion of a heat pipe using this type of construction, which has been commonly used for many decades in space.

Safe Flight Profiles

The probability of the Iridium NEXT space stations becoming a source of debris by collisions with large debris or other operational space stations has been assessed and limited. As part of the original system design and development effort conducted by Motorola as the system prime contractor of the current Iridium system in the 1990s, the orbit design of the Iridium satellite system explicitly took into account the probability of collision with large debris, including other operational Iridium satellites. In particular, the phasing offsets selected for Iridium satellites in adjacent orbital planes were specifically analyzed and selected so as to minimize collision probabilities at the convergent polar crossings that occur each orbit. These analyses are equally applicable to the Iridium NEXT space stations, which will operate in the same orbital positions as the space stations in the current Iridium system.

The 66 individual Iridium NEXT mission satellites in their approximately 780 km near-circular mission orbit will be maintained within specific orbital tolerances. Each Iridium NEXT satellite's mission altitude will be maintained via periodic propulsive station-keeping burns to a nominal orbital period of 6028 seconds and an eccentricity of 0.00126. The in-plane position along the velocity direction will be nominally maintained to ± 6 kilometers. Iridium NEXT satellites will be maintained in frozen orbits with perigee at the North pole and apogee at the South pole. A frozen orbit limits the altitude range to be occupied by Iridium NEXT satellites, reducing the number of objects with which conjunctions are possible. A frozen orbit, popularly used by polar orbiting earth observation satellites, also will allow Iridium NEXT space stations to safely co-exist at smaller altitude separations with these other satellites. The cross-track or the Right Ascension of the Ascending Node will be maintained to ± 0.08 degrees with respect to the satellites' in-plane neighbors. Occasionally, various mission operational considerations will result in different tolerances for individual satellites on a case-by-case basis. Spare (*i.e.*, non-mission) Iridium NEXT satellites will be maintained within less stringent orbital tolerances.

As is done today, Iridium uses specialized software in its mission control facility to regularly evaluate collision risks with other space stations, based on the most current available space station orbital element sets maintained and disseminated by USSTRATCOM. Collision avoidance maneuvers will be executed as required to reduce probabilities below NASA recommended thresholds. Experience with the present constellation indicates a vast majority of potential collisions can be alleviated by changing the timing of an existing orbit maintenance maneuver (at zero impact to fuel budget). A portion of Iridium NEXT's mission orbit maintenance fuel budget is specifically reserved for collision avoidance maneuvers.

Whenever Iridium NEXT satellites are required to undergo orbital maneuvers, pre-maneuver coordination with USSTRATCOM will be accomplished so that the appropriate authorities are aware of the maneuver plans and can advise Iridium whether such maneuvers pose any risks. This includes screening planned launch trajectories and ascent from injection orbit to storage, drift, or mission orbit.

Orbit control is specified that any one satellite be within 0.5km radial, 9km intrack, and 5km crosstrack of its nominal position which is more than sufficient to maintain Iridium operations, and support collision avoidance.

Post-Mission Disposal

Iridium NEXT's orbital mitigation plans and procedures call for placing individual satellites in a disposal orbit at end-of-life. Sufficient fuel (39.6 kg) will be reserved to accomplish the disposal maneuver sequence. Post-mission disposal will be carried out by propulsive maneuvering of the satellite into a lower orbit whose lifetime is consistent with NASA and international guidelines for LEO systems, *i.e.*, a predicted orbital lifetime of less than 25 years until atmospheric re-entry occurs as a result of natural orbital decay processes. This constitutes an uncontrolled reentry.

Post-mission disposal will be performed in two phases:

In phase 1, the approximately 780 km near-circular mission orbit altitude is lowered by approximately 30 km to 750 kms to ensure the satellite is removed from the operational constellation "shell."

In phase 2, the perigee of the approximately 750 km circular phase 1 orbit is successively lowered until a perigee altitude of no more than 500 km is achieved. This disposal orbit results in a predicted orbital lifetime of less than 25 years.

The fuel budget includes an allocation of maneuvering and attitude control propellant to accomplish this combined phase 1 and phase 2 disposal orbit maneuvering. There is an adequate margin of fuel reserve to take into account various uncertainties in the maneuvering process (*e.g.*, thruster efficiency, tank blowdown pressure, fuel gauging inaccuracies, etc.).

Two independent methods are used for the calculation of remaining propellant onboard the Iridium satellites. The primary method uses the Ideal Gas Law with propellant tank pressure and temperature readings from the Iridium satellite telemetry to calculate the remaining propellant. The secondary method uses cumulative thruster pulse and on-time information in addition to the pressure and temperature readings to calculate the remaining propellant.[3] These calculations are performed by ground based processing in the satellite control center.
Should sufficient additional fuel reserves exist following attainment of the planned 500 km disposal orbit perigee, additional phase 2 perigee-lowering maneuvers will be conducted to further reduce the orbital altitude, with corresponding reductions in the predicted orbit residual lifetime until atmospheric re-entry.

Following final completion of the phase 2 orbit-lowering maneuvers, passivation of the satellite will be accomplished to remove on-board stored energy from the vehicle, as described above.

3 The first method is used when the pressure transducer is operational. The second method is used only if the transducer fails.

Casualty Risk Assessment

A casualty risk assessment for uncontrolled atmospheric re-entry of Iridium NEXT satellites has been conducted by Thales Alenia Space engineering, using the NASA-supplied DAS (Debris Assessment Software) code (as suggested by FCC 04-130 footnote 19).

As inputs to the DAS software, the Iridium NEXT satellite was modeled as a collection of 97 primitive objects (boxes, cylinders, and flat plates) with a total mass of 569kg (an additional 90kg of smaller items not expected to survive reentry were not included). Appropriate material properties were established for each item. These items were assumed (by the DAS software) to break-up and start reentry at a default altitude of 122km (not editable in DAS). Reentry inclination was set to 84.5 degrees (as predicted by nodal precession during the 25 year orbital decay duration), and reentry year set to 2050 (latest year supported by DAS demographics). Applying these assumptions in DAS, Thales Alenia Space determined that up to 248kg of the satellite might survive reentry, with a total casualty area of 18.8m^2.
Using this information, Thales Alenia Space calculated a raw casualty risk figure that was based on an assumption that all persons are unsheltered. Because the kinetic energy of the fragments *vis-á-vis* how the population is sheltered affects the casualty risk additional analysis was performed by updating the hazard analysis performed by the Aerospace Corporation for Iridium's Block 1 satellites. Consistent with the sheltering assumptions used in that analysis, and applying the population demographics embedded in DAS for the year 2050, the estimated casualty risk for Iridium NEXT is $5.89*10^{-5}$, or 1:17,000, which is clearly better than the established guideline of 1:10,000.