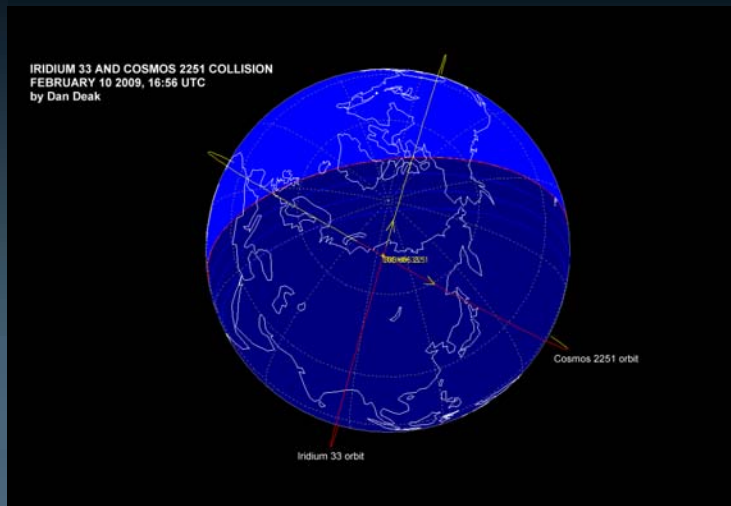


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Graphic showing the orbits of Iridium 33 and Cosmos 2251. Note the perpendicular nature of the intersection. Image: Dan Deak. An Iridium LM700 satellite. Image: Sky and Telescope.

## February 10, 2009

On February 10, 2009, an inactive Russian communications satellite designated Cosmos 2251 collided with an active commercial communications satellite operated by U.S.-based Iridium Satellite LLC. The incident occurred approximately 800 kilometers (497 miles) above Siberia. As of February 12, ground sensors were tracking nearly 700 pieces of debris measuring at least ten centimeters (four inches) in diameter in two clouds.<sup>1</sup>

## The Iridium 33 satellite

Iridium 33 was a 689-kilogram (1,518-pound) LM700 series satellite operated by U.S.-based Iridium Satellite LLC. It was launched along with six other Iridium satellites aboard a Russian Proton launch vehicle on September 14, 1997 from Baikonur, Kazakhstan. The satellite, an LM700 model (above right), was manufactured by Motorola and Lockheed Martin, represented one of a 66-member constellation orbiting at an altitude of 780 kilometers (485 miles) distributed across six orbital planes (about 10 satellites per plane along a “string of pearls” configuration). These satellites provide L-band mobile telephonic services to users on the ground.<sup>2</sup>

Iridium began operations in 1998 following a series of successful launches beginning in 1997. The company filed for bankruptcy a year later. In 2001, though the firm and its assets were valued at \$6 billion, the company was purchased in cooperation with the U.S. Department of Defense (DoD) for \$35 million and rebranded as Iridium Satellite LLC. DoD, in turn, contracted with Iridium to provide services for \$100 million. This arrangement saved on-orbit and ground assets and allowed Iridium Satellite LLC to gain future customers. The company has about 285,000 subscribers.<sup>3</sup>

## The Cosmos 2251 satellite

The 900-kilogram (1,980-pound) Cosmos 2251 was a Strela 2M military store-and-forward communications platform launched on June 16, 1993 from Plesetsk, Russia aboard a Kosmos 3M launch vehicle. Typically, Strela 2 series satellites have a service life of five years, and Cosmos 2251 was inactive at the time it collided with Iridium 33. Strela 2M uses the same KAUR-1 satellite bus as that of the Strela 1 series, pictured at right. Strela-2M satellites were launched one at a time into orbits of 800 kilometers (497 miles) altitude in three orbital planes inclined 74 degrees to the equator, each unit spaced 120 degrees apart. The satellites are built by Reshetnev and operated by the Russian Ministry of Defense.<sup>4</sup>



A Strela 1 store-and-forward communications satellite. Cosmos 2251 had a similar appearance. Image: [www.astronautix.com](http://www.astronautix.com).

## The debris clouds

An official statement from the United States Government issued during the 46<sup>th</sup> session of the Scientific and Technical Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space (COPUOS) points out that the U.S. Space Surveillance Network was tracking 505 pieces from the Cosmos 2251 satellite and 194 pieces from the Iridium 33 satellite by February 12.<sup>1</sup>

The two satellites were both orbiting the Earth at an approximate velocity of 7.5 kilometers per second (16,777 miles per hour) and collided with an estimated velocity of about 10 kilometers per second (22,000 miles per hour). More debris is expected in the coming days and weeks as the two clouds distribute themselves.<sup>1</sup>

## The 1972 Liability Convention

This incident represents the first potential liability issue involving two spacecraft colliding in outer space. It is too early to know how, if applied, the Liability Convention will be brought to bear on the situation, but any result will set an important precedent. Article III of the Convention states that "In the event of damage being caused elsewhere than on the surface of the earth to a space object of one launching State or to persons or property on board such a space object by a space object of another launching State, the latter shall be liable only if the damage is due to its fault or the fault of persons for whom it is responsible." Some points of consideration include:

- ♦ Is Russia liable for leaving a dead satellite in an orbit which could potentially interfere with other active satellites?
- ♦ Is Iridium Satellite LLC responsible for making sure its on-orbit assets avoid collisions with other objects which lack the capability to maneuver?
- ♦ Is the U.S. responsible for providing warning to either Iridium or Russia about the impending collision, given that they have the only source of information to provide such warning?
- ♦ Are both the U.S. and Russia liable for any debris from this collision that in turn collides with a 3<sup>rd</sup> Party satellite in the future?

## Avoiding incidents like this in the future

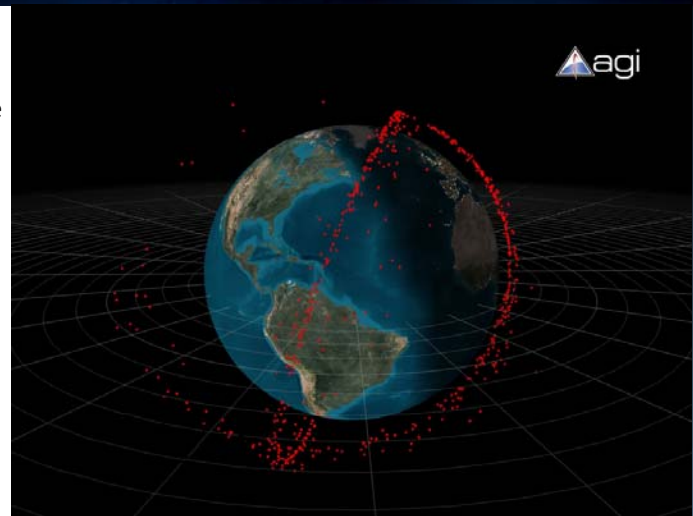
Currently, the DoD maintains the most complete catalog of man-made objects in Earth orbit, including debris and inactive satellites. Some of the data is publicly available, although they do not have the accuracy to give reliable warning for collisions. Other States like Russia maintain limited catalogs based on their own tracking networks. Sometimes these catalogs are supplemented by more precise owner-operator positional data and maneuver schedules, but this is not widespread.

The Secure World Foundation supports discussion and creation of a new international civil space situational awareness system with the goal of providing basic data necessary for all space actors to operate in a safe, secure and sustainable manner. The system would produce standardized orbital data and analytical services to all satellite owner-operators via a central data center, which would then make the entire data pool available to all participants while maintaining an appropriate level of data security and privacy. The data center would also provide analytical capacity to those States and actors that do not have indigenous capability.

The Foundation also supports both research into the feasibility of removing debris from orbit and the global implementation of the Inter-Agency Space Debris Coordination Committee (IADC) Orbital Debris Mitigation Guidelines endorsed by the United Nations to further minimize the creation of orbital debris. You can learn more from our Orbital Debris Mitigation fact sheet available at [www.SecureWorldFoundation.org](http://www.SecureWorldFoundation.org).

## Footnotes

1. Faulconbridge, Guy. "U.S. and Russia track satellite crash debris," *Reuters*, February 12, 2009. Also Wright, David. "Colliding Satellites: More Space Junk in Exactly the Wrong Place," backgrounder for the Union of Concerned Scientists, February 12, 2009.
2. Iridium Satellite LLC website ([www.iridium.com](http://www.iridium.com), accessed February 12, 2009).
3. Vernon, David. "A Heavenly Sign - The Iridium satellite story," *The Canberra Journal*, February 20, 2007.
4. Wade, Mark. [www.astronautix.com](http://www.astronautix.com) (accessed February 12, 2009).



Graphic showing the two debris clouds resulting from the collision. This is a statistical model using Gaussian distribution. Debris not to scale. Image: Analytical Graphics, Inc. ([www.agi.com](http://www.agi.com)).