Chinese Anti-Satellite (ASAT) Test

FACTSHEET

SECURE WORLD FOUNDATION

Promoting Cooperative Solutions for Space Security

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FengYun-1C. **Photo: Sinodefence.com.**

January 11, 2007

On January 11, 2007, the Chinese government successfully launched a missile on an intercept course with one of its own defunct satellites, Fengyun-1C. The missile struck the satellite at an altitude of 869 kilometers, destroying it.

The Missile

The Chinese ASAT vehicle used for the test is believed to have been the SC-19, a modified version of the DF-21 ballistic missile or its commercial derivative, the Kaitouzhe-1 (KT-1).[1]

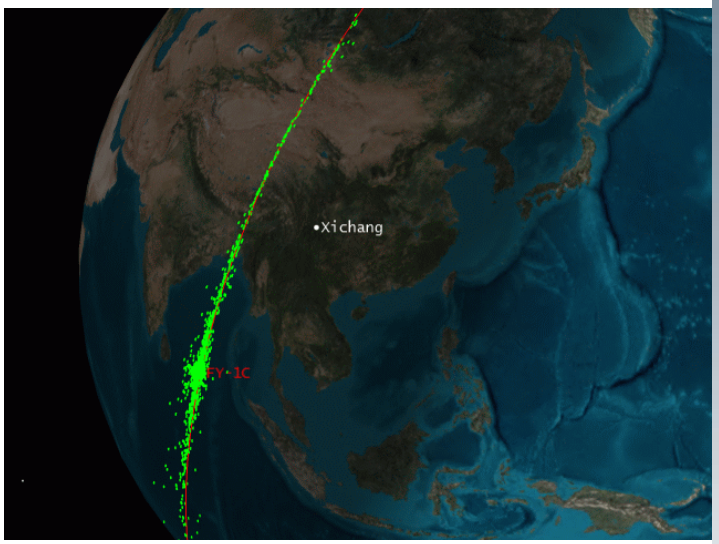
The Satellite[2]

The FengYun 1 (FY-1) series represents China's first meteorological satellite system. A total of four satellites were launched into sun-synchronous orbits (SSO) with an average altitude of 900 kilometers and an inclination of 99° by Long March 4 launch vehicles from Taiyuan Satellite Launch Centre between 1988 and 2005. The satellite and its support systems were designed and developed by the Shanghai Satellite Engineering and Research Centre of the China Academy of Space Technology (CAST). The satellite's payload was developed by the Shanghai Technical Physics Institute of the Chinese Academy of Sciences. The FengYun-1 platform was three-axis stabilized, and used an X-band data transmitter. The satellite's design life was one year. Nickel-cadmium batteries were used for electrical power storage. Attitude control was maintained by a combination of nitrogen cold gas thrusters and reaction wheels.

- FY 1A—Launched aboard a Long March 4A from Taiyuan on September 6, 1988, but failed 39 days later.
- FY 1B—Launched aboard a Long March 4A from Taiyuan on September 3, 1990, but failed 165 days later.
- **FY 1C—Launched aboard a Long March 4B from Taiyuan on May 10, 1999. Remained functional until 2005.**
- FY 1D—Launched aboard a Long March 4B from Taiyuan on May 15, 2005 to replace FY-1C.

The Debris

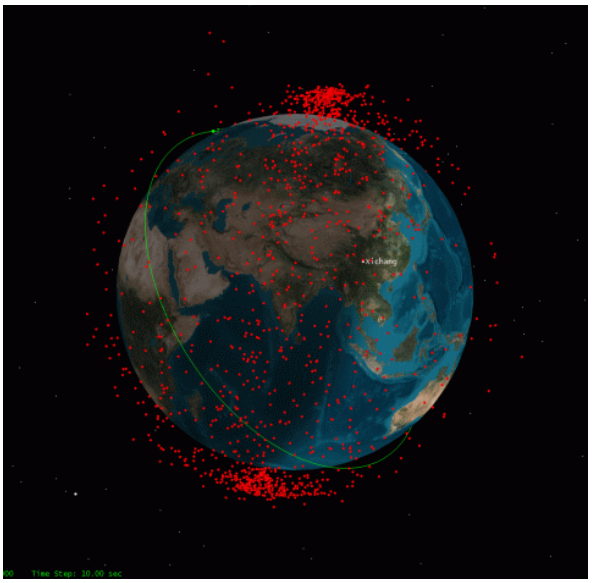
Shortly after impact, a minimum of 517 pieces were created from the resulting explosion. Shortly after impact, 517 pieces were tracked from the resulting explosion. According to United States Strategic Command (USSTRATCOM), which tracks man-made objects in orbit around the Earth, by January 18 the ASAT event had generated 2,377 pieces of debris that could be tracked by their sensors, making this the largest debris-generating event on record.[3] By January 29, the debris cloud had spread throughout low Earth orbit to include pieces as low as 200 km and as high as 3,500 kilometers.[4] The National Aeronautics and Space Administration (NASA) Orbital Debris Program Office now estimates more than 150,000 pieces of debris larger than one centimeter have been generated from this event.[3,5]



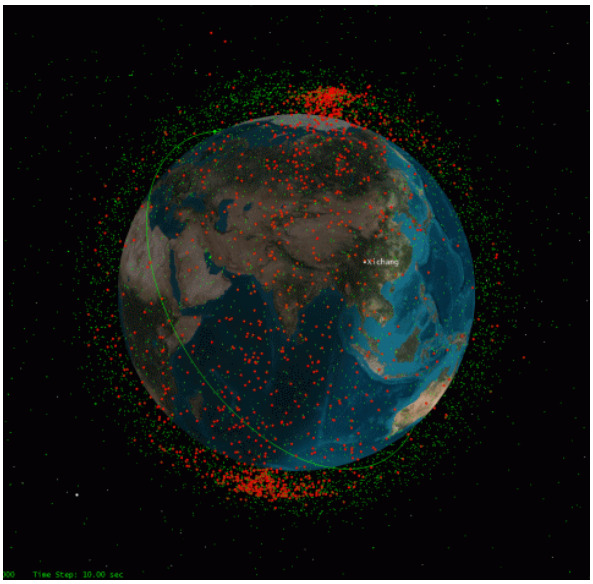
The image above shows the period beginning with the impact event on January 11, 2007 until January 12. The orbit of FY-1C is shown as a thin red line and the location of the Xichang Space Center (the launch site of the ASAT missile) is also shown. FY-1C and the other pieces of debris now catalogued by NORAD are shown in green. **Source: AGI and Celestrak.**

The Center for Space Standards & Innovation (CSSI) provides satellite users and analysts with the Satellite Orbital Conjunction Reports Assessing Threatening Encounters in Space (SOCRATES), a service providing regular information on pending conjunctions on orbit over the coming week. A *conjunction* is the predicted close approach of two objects in orbit; in this case, debris

intercepting a satellite. SOCRATES uses orbital elements and NORAD tracking data to calculate these possible conjunctions for CSSI clients. CSSI conducted SOCRATES analysis on January 22, 2007 and found that there were 3,100 occasions predicted whereby a piece of FY-1C debris would come within five kilometers of a satellite payload in low-Earth orbit (LEO) over the week following—over 28 percent of all predicted conjunctions over that period. CSSI is now routinely seeing about 3,000 conjunctions within five kilometers over a seven-day period between the FY-1C debris and payloads in LEO.



View of ISS Orbit (green) and Debris Ring (red) from Chinese ASAT Test.
Source: AGI and Celestrak.



View of LEO Satellites (green) and Debris Ring (red) from Chinese ASAT Test.
Source: AGI and Celestrak.

According to Celestrak, by January 22, 2007, an analysis showed there were 3,231 payloads in Earth orbit or beyond. Of those, there was readily available orbital data for 2,864 payloads (an estimated 850 are active satellites and probes, though the actual number is classified). Of the missing 367 objects, some were in deep-space orbits around the Sun or other planets and some were classified by the U.S. Government. Of the 2,864 payloads, 1,899 pass through the regime now affected by the debris from the Chinese ASAT test—fully two-thirds of all payloads in Earth orbit. The first acknowledged maneuver to avoid a piece of debris from the Chinese ASAT test occurred on June 22, 2007 when flight controllers at NASA's Goddard Space Flight Center briefly fired the thrusters on their TERRA satellite to avoid a seven percent chance of being struck the following day.[6]

On October 10, 2007, a detailed analysis of the FY-1C debris being tracked indicated predicted that just over six percent of the debris (136 pieces) will have reentered the Earth's atmosphere by 2017 and 79 percent will still remain in orbit until about the year 2108. About 10 days after the ASAT test, less than one percent of the 2,377 bits tracked in the first year have reentered.[7]

Avoiding Incidents Like this in the Future

The Secure World Foundation supports an international legal system that mitigates existing debris in orbit as well as set standards for the prevention of additional debris generation. Access and use of space is in everyone's interest, and failure to develop an orbital debris mitigation regime governed by the rule of law means this access and use will be compromised in the future. The Foundation also considers a treaty banning the research, development, testing, evaluation and deployment of ASAT systems. You can learn more from our **Orbital Debris Mitigation** and **ASAT** fact sheets available at www.SecureWorldFoundation.org.

1. Senator Clinton Questions Vice Admiral John M. McConnell, USN (ret), Director of National Intelligence and Lieutenant General Michael Maples, USA, the Director of the Defense Intelligence Agency at a Senate Armed Services Committee Hearing on Worldwide Threats (February 27, 2007). Retrieved on 2007-04-24.
2. *FengYun 1 Meteorological Satellite*, SinoDefence.com, http://www.sinodefence.com/strategic/spacecraft/fengyun1.asp (accessed June 6, 2008).
3. Kelso, T.S. *Chinese ASAT Test*, http://celestrak.com/events/asat.asp (accessed June 6, 2008).
4. Clark, Colin. "Chinese A-Sat Test Called 'One of the Worst Ever' Debris Incidents," *Space News*. January 29, 2007.
5. "Orbital Debris Quarterly News," Volume 12, Issue 1, 2008 January, page 3.
6. Berger, Brian. "NASA's Terra Satellite Moved to Avoid Chinese ASAT Debris," *Space.com*. July 6, 2007.
7. Kelso, T.S. Celestrak.com (accessed June 6, 2008). Note: This analysis was only done for 2,150 of the 2,247 pieces catalogued as of 2007 October 10 since it appears that 97 pieces were missing from the catalog at that time.