The largest satellite, the largest threat:

potential fault liability in the collision with Envisat.

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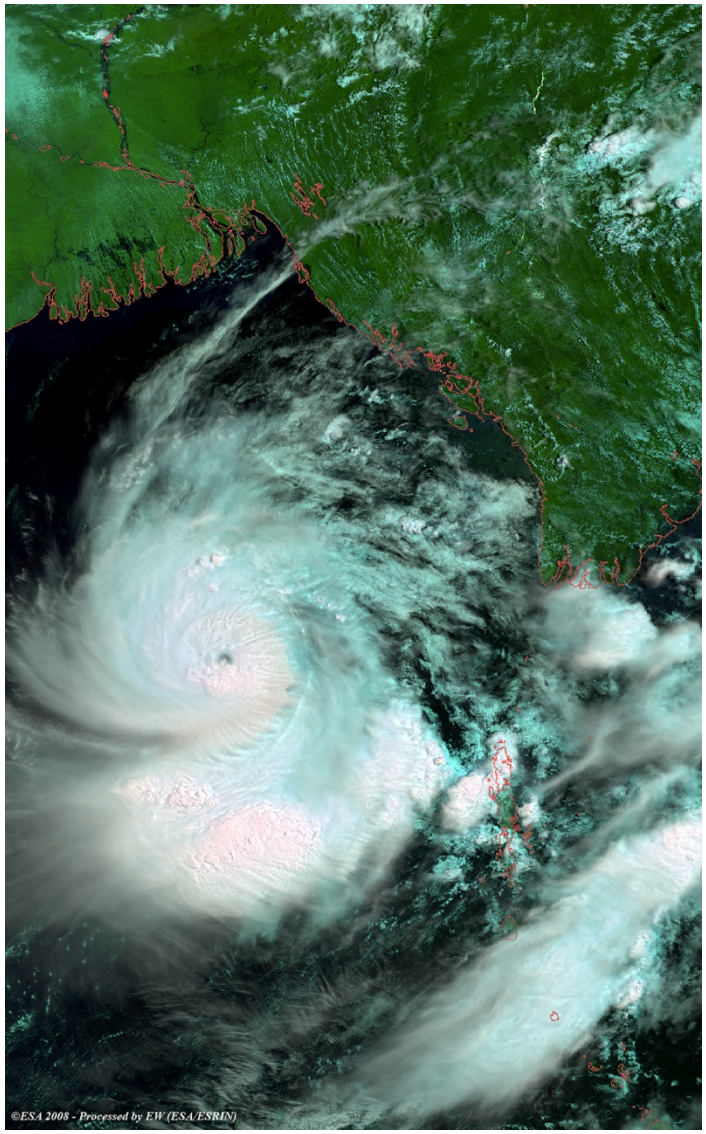
Cyclone Nargis: captured by Envisat



Envisat captures Cyclone Nargis making its way across the Bay of Bengal just south of Myanmar on 1 May 2008, with its Medium Resolution Imaging Spectrometer (MERIS) instrument working in Reduced Resolution mode to deliver a spatial resolution of 1200 metres.

Issues:

1. Envisat: from Birth to Death
2. Collision and the Apllication of Liability Convention
3. Key Element 1: Damage
4. Key Element 2: Fault

A. What is Envisat ?

Envisat is the world's largest imaging satellite for civil use launched by the ESA in 2002.

The main objective of the Envisat program was to enhance Europe's remote sensing capabilities, expanding those of the European Remote Sensing (ERS) missions with instruments dedicated to ocean and ice monitoring.

B. the life of Envisat

2002: European Space Agency launched the remote sensing Envisat satellite.

2007: Envisat was due to be decommissioned, since its original life was planned to be 5 years, but was extended.

2009: 2009 ESA approved again the extension of Envisat operations for three more years (2011, 2012 and 2013)

2012(Apr.):April 2012 the communication link between Envisat and ground stations ceased abruptly.

2012(May.):ESA delared the end of life of Envisat.

Collision Risk:

A piece of huge space debris?

Size:

mass: 8 tons

Length: 9 meters

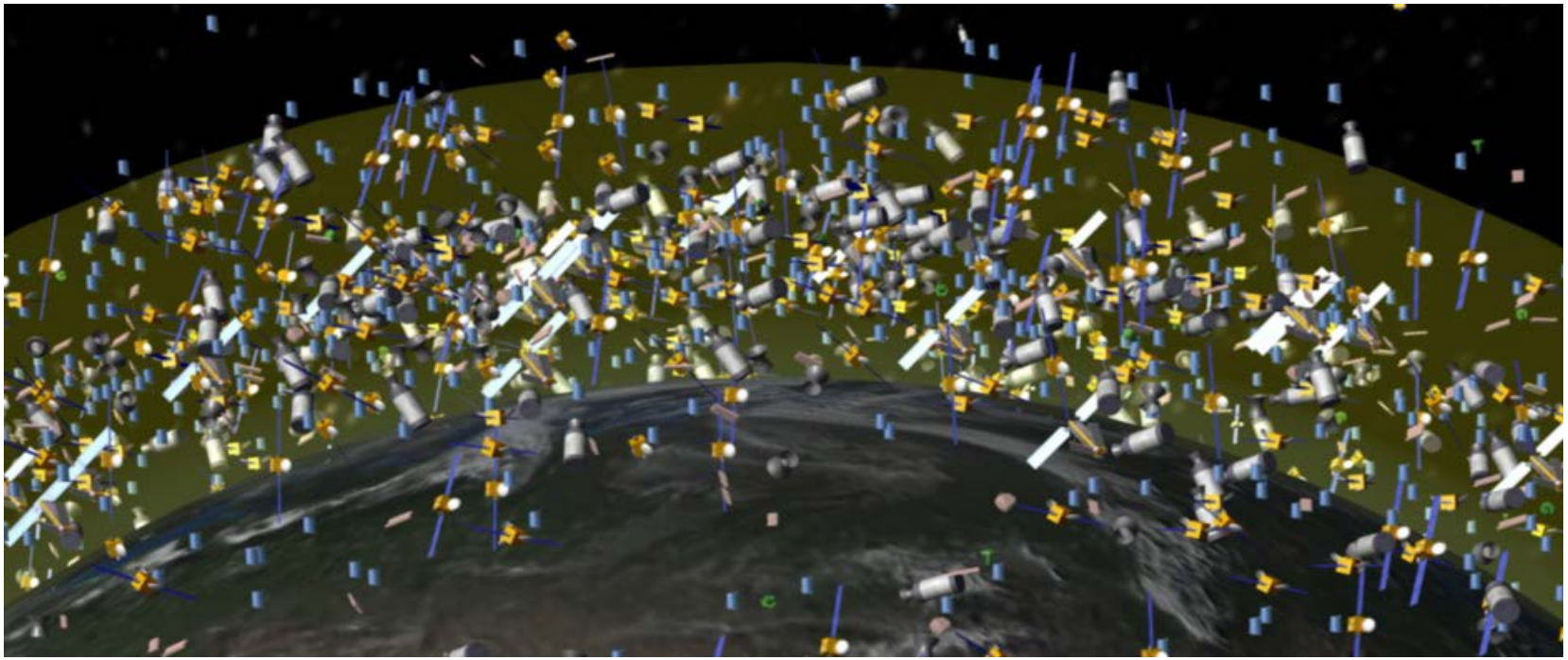
Width: 5 meters

with a huge 5 by 14 meter solar array

Collision Risk:

Envisat's orbit: 768km (provided by ESA)

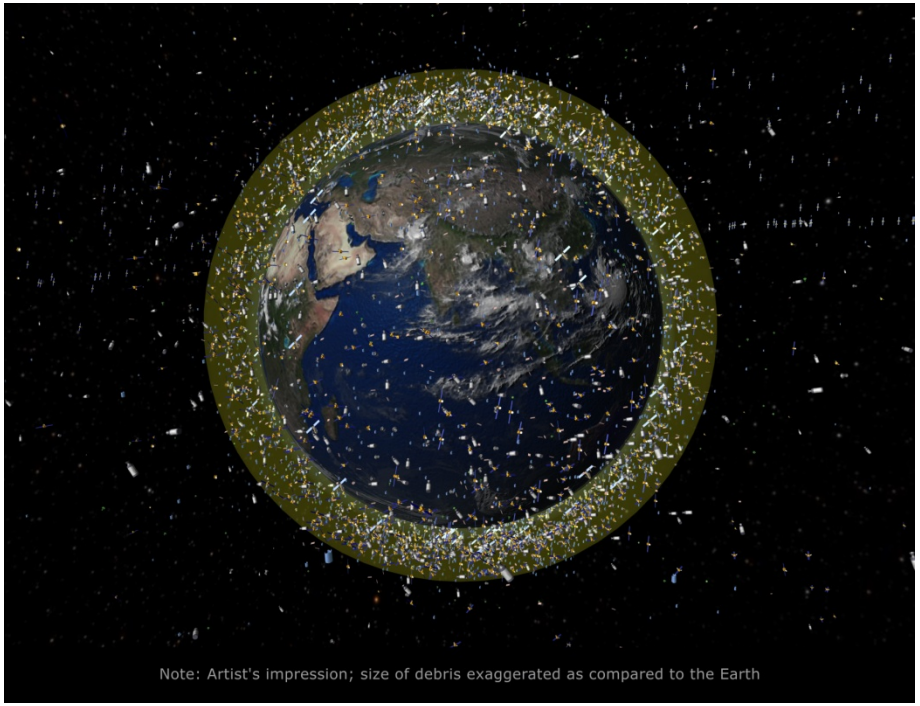
——low earth orbit, the most populated area, there are many operational satellites around.



Collision Risk:

There is a high risk of collision for Envisat:

An analysis of the space debris environment at Envisat's orbit suggests that there is a 15 percent to 30 percent chance of the satellite colliding with another space object during the 150 years it remains in orbit.



—— De Selding, Huge Satellite Poses 150-Year Threat of Space Debris, Space News, 26 July (2010).

Collision Risk:

Once an active satellite collided with Envisat:

The damages to the operational satellite and even the loss of the whole satellite.

Trigger the liability of ESA to pay the compensation for the damage.

Application of Liability Convention:

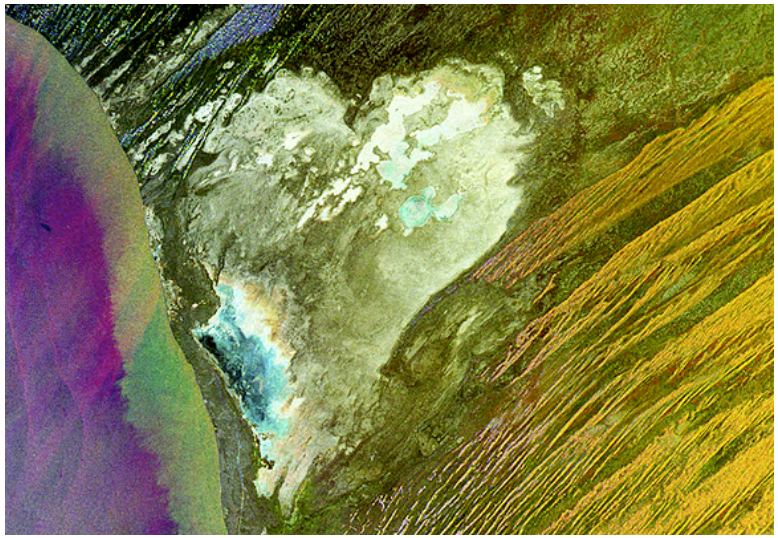
Convention on International Liability for Damage Caused by Space Objects, *entered into force* Oct. 9, 1973.

Article III of Liability Convention:

In the event of damage being caused elsewhere than on the surface of the Earth to a space object of one launching state or persons or property on board such space object by a space object of another launching State, the latter shall be liable only if the damage is due to the fault or the fault of persons for whom it is responsible.

Key Element 1: damage

Since Envisat is out of control and has ended its mission, will it suffer any damage in the collision?



The love on earth
——Envisat

Key Element 1: damage

Definition of the term DAMAGE (to property):

The situation in which the property is rendered less suitable for those purposes for which it was originally valued or is in any way rendered unfit for the use for which it was intended.

———Bryan Schwartz & Mark L. Berlin, After the Fall: An Analysis of Canadian Legal Claims for Damage Caused by Cosmos 954, 27 *McGill Law Journal*. 676, 698 (1982).

Key Element 1: damage

Damage:

The active satellite

Envisat

a. loss of contact or control.
b. even the explosion of the satellite.

Reduced value?

a . There is still a chance for it to recover.
b. different type of Environmental Satellite by providing information on the orbital debris environment had it been recovered

Key Element 1: damage

There will hardly be any damage to Envisat:

Reason 1:

damage refers to reduction of value for the property's original purpose of use; Envisat will serve a different purpose of use even if it would recover.

Reason 2:

the chances of recovery have been considered to be extremely low.

Key Element 2: fault

Natural and ordinary meaning of fault:

failure to exercise due diligence under given circumstances, or to act negligently.

—— Black Law Dictionary

Key Element 2: fault

A hot debate recently:

Focus:

whether ESA's action to continue operating Envisat in 2010, but not to lower Envisat to the orbit at 750km suggests fault?

Key Element 2: fault

Martha Mejía-Kaiser:

claims that ESA acted with negligence, when continuing to operate its Envisat beyond the year 2010, because it could have lowered the orbit of Envisat to 750km at which the remaining life time would have been to reduced to 25 years.

miss the Lowering:fault?

Michael Khan:

Wrote an article criticizing this paper, saying:
The author has made a technical mistake, pointing out that if Envisat was lowered to the altitude of 750km, it would remain in the orbit for 75 years, not 25years.

Impossible for the lowering of orbit;
Lack of scientifical ground for the claim of liability.

Key Element 2: fault

Official response from ESA:

2012.10.11:

The ESA present an official response, which pointed out that even if controllers had lowered the satellite immediately after launch in 2002, there would not have been enough fuel to bring it down low enough – to around 600 km – where it could re-enter within 25 years .

Other complex factors

Due diligence requires knowledge or awareness of foreseeable injury and subsequent measures for prevention.

Two typical factors about fault in the presently acceptable space operator's risk environment:

Factor 1 : Information sharing

Factor 2: Avoidance maneuver

Factor 1: information sharing and fault

Although Envisat is out of control, the duty of due diligence still requires ESA to take some actions to help prevent the collision with Envisat. To provide instant information is one of the requirements which is essential to the collision avoidance analysis.

Reason: the uncontrolled Envisat is prone to solar activity that renders its orbital positioning unstable. Without crucial information from ESA about the out of control satellite, such as its instant locations, orbital data and health status, the owner of the active satellite was not able to be aware of the accurate risk of collision or make further analysis on the need of an avoidance maneuver.

Factor 1: information sharing and fault

Recently development: **Space Situational Awareness(SSA)**

Two key tools:

a. **orbital data**
b. **analytical capacity to utilize that data in decision-making processes of all space actors.**

Factor 1: information sharing and fault

National SSA system:

There are already several national SSA service providers. The one in the leading place is the U.S. Space Situational Awareness. but they all developed with different objectives, capabilities and clients.

Global SSA system :

It could serve as the reference for the standard of due diligence, because have the international SSA system been established, the the owner of the encountering state also have access to the reliable information, the duty of due diligence emposed on ESA may be relieved to some distance.

Factor 1: information sharing and fault

CONCLUSION 1:

Fault of ESA:

concerning the informational sharing, whether the the owner of the encountering satellite is a client to a SSA system and the capabilities of this SSA should be taken into consideration.

Factor 2: avoidance maneuver and fault

Standards of due diligence: established by practice among members of a community that exercise a similar activity.

UN COPOUS Space Debris Mitigation Guidelines reflect the commen practice:
a.have been adopted as UN GA Resolution in 2007.
b.Several national or international legislations have made the mitigation guidelines compulsory.
c. International Standardization Organization has worked on the adoption of standards for mitigation of space debris on the basis of UN COPOUS Space debris mitigation guidelines.

Factor 2: avoidance maneuver and fault

Guideline 3: Limit the probability of accidental collision in orbit:

If available orbital data indicate a potential collision, adjustment of the launch time or an on-orbit avoidance manoeuvre should be considered.”

【 if reliable data shows a potential collision, the absence of an avoidance maneuver from the encountering satellite operator might indicate the failure to exercise due diligence and constitute fault.】

THANK YOU!

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