

Moderní technologie a bezpečnost

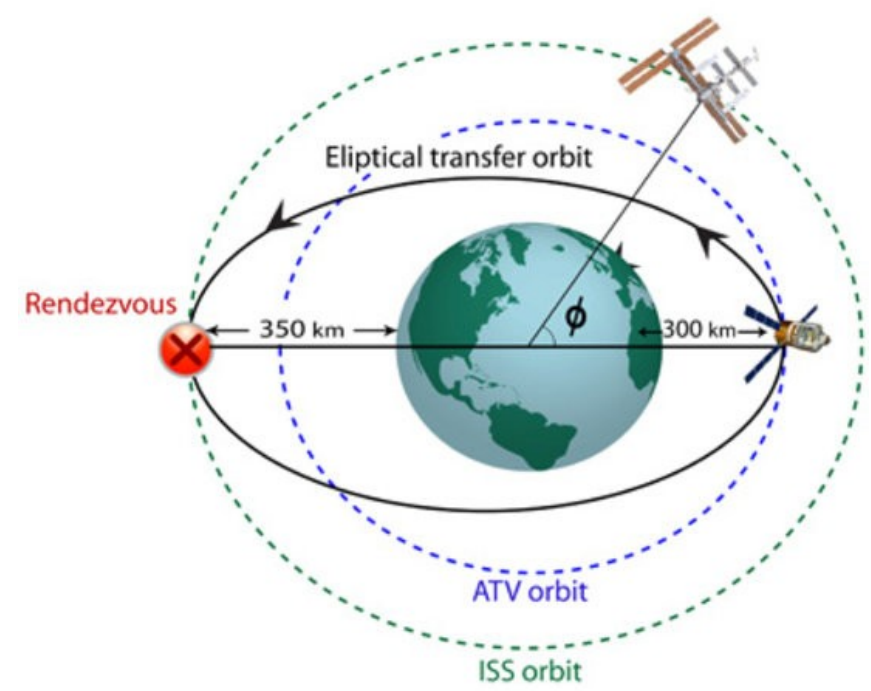
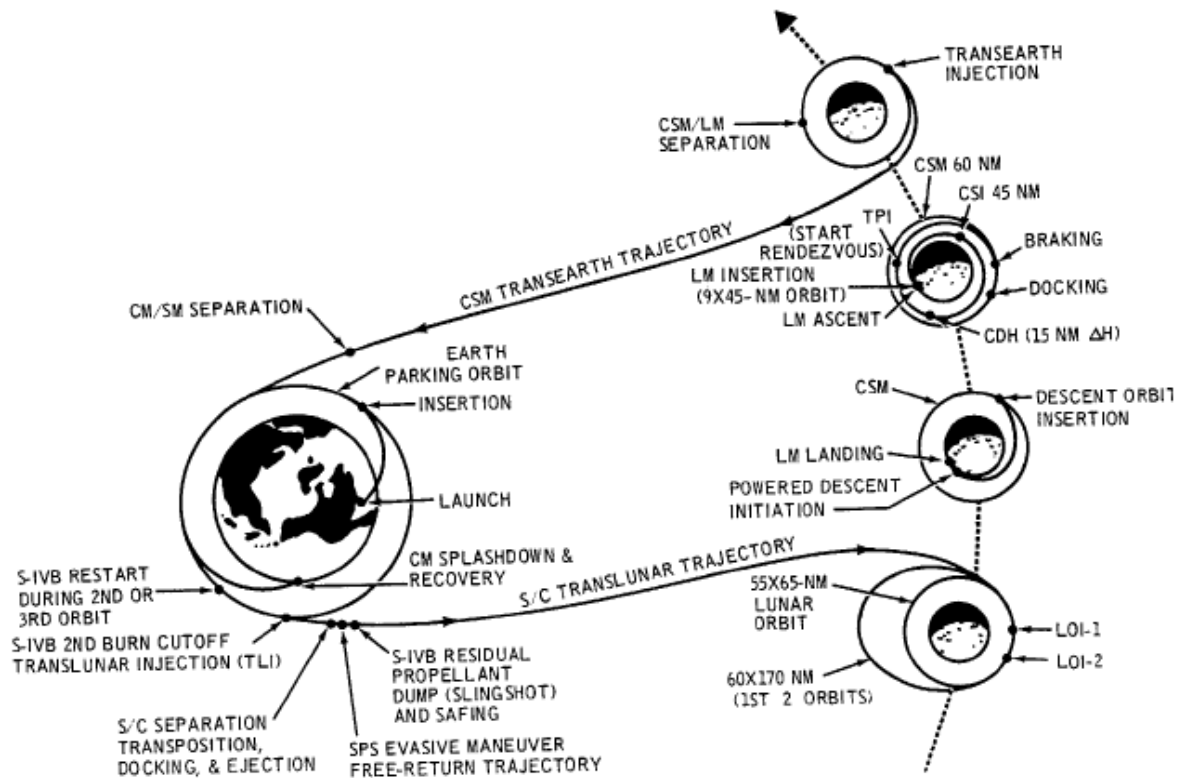
Vesmír



16.10.2023

Marek Dvořáček





- Neil Armstrong and Buzz Aldrin
- Pete Conrad, Alan Bean,
- Alan Shepard, Edgar Mitchell,
- David Scott, James Irwin,
- John Young, Charles Duke,
- Eugene Cernan, Harrison Schmitt





Mission	Launch date (NET)	Spacecraft	Type	Launch vehicle	Launch site	Launch provider	Docking/berthing port
NG-20	November 2023 ^{[308][309]}	Cygnus	Uncrewed	Falcon 9 Block 5	Kennedy LC-39A	SpaceX	<i>Unity nadir</i>
AX-3	November 2023	Crew Dragon	Crewed	Falcon 9 Block 5	Kennedy LC-39A	SpaceX	<i>Harmony zenith</i>
Progress MS-25	1 December 2023 ^[308]	Progress MS No. 455	Uncrewed	Soyuz-2.1a	Baikonur Site 31/6	Roscosmos	<i>Prichal nadir</i>
SpX-29	December 2023 ^{[308][309]}	Cargo Dragon	Uncrewed	Falcon 9 Block 5	Kennedy LC-39A	SpaceX	<i>Harmony zenith</i>
SNC-1	January 2024 ^{[308][309][312]}	Dream Chaser <i>Tenacity</i>	Uncrewed	Vulcan Centaur VC4L	Cape Canaveral SLC-41	United Launch Alliance	<i>Harmony nadir</i>
HTV-X1	3 January 2024 ^[308]	HTV-X	Uncrewed	H3-24L	Tanegashima LA-Y2	JAXA	<i>Harmony nadir</i>
NG-21	January 2024 ^{[308][309]}	Cygnus	Uncrewed	Falcon 9 Block 5	Kennedy LC-39A	SpaceX	<i>Unity nadir</i>
SpaceX Crew-8	February 2024	Dragon 2	Crewed	Falcon 9 Block 5	Kennedy LC-39A	SpaceX	<i>Harmony forward or zenith</i>
Progress MS-26	February 2024 ^[308]	Progress MS No. 456	Uncrewed	Soyuz-2.1a	Baikonur Site 31/6	Roscosmos	<i>Zvezda aft</i>
Soyuz MS-25	13 March 2024	Soyuz MS	Crewed	Soyuz-2.1a	Baikonur Site 31/6	Roscosmos	<i>Prichal nadir</i>
Starliner CFT	Q1 2024 ^{[308][309]}	Boeing Starliner SC-3 Calypso	Crewed	Atlas V N22	Cape Canaveral SLC-41	United Launch Alliance	<i>Harmony forward</i>
AX-4	H1 2024	Crew Dragon	Crewed	Falcon 9 Block 5	Kennedy LC-39A	SpaceX	<i>Harmony forward</i>
Progress MS-27	June 2024 ^[308]	Progress MS No. 457	Uncrewed	Soyuz-2.1a	Baikonur Site 31/6	Roscosmos	<i>Poisk zenith</i>
NG-22	July 2024 ^{[308][309]}	Cygnus	Uncrewed	Falcon 9 Block 5	Kennedy LC-39A	SpaceX	<i>Unity nadir</i>
Starliner-1	Q3 2024 ^{[308][309]}	Boeing Starliner SC-2	Crewed	Atlas V N22	Cape Canaveral SLC-41	United Launch Alliance	<i>Harmony forward</i>





Space junk could destroy satellites, hurt economies

May 31, 2017



There are an estimated 170 as small as paint flakes — ir



NEWS Home Video Wor

US & Canada

Trump sp military b

18 June 2018



China and Russia could cripple the US with a space attack, but the US is pushing back

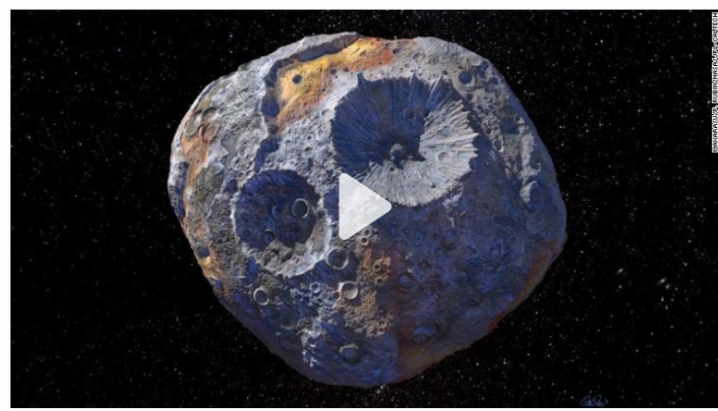


VOLBY SENÁTNÍ VOLBY DOMÁCÍ SVĚT REGIONY

esmír. Spojené státy složku armády pro

Psyche, an asteroid believed to be worth \$10,000 quadrillion, is observed through Hubble Telescope in new study

By Francesca Giuliani-Hoffman, CNN Updated 0354 GMT (1154 HKT) November 2, 2020



An asteroid in space possibly worth more than the entire economy of our planet 01:23

(CNN) — A rare metallic asteroid about three times farther away from the sun than our planet could yield secrets about Earth's molten core, and scientists want to learn all about it.

A new study published Monday in The Planetary Science Journal takes a closer look at this mysterious asteroid, using data from the Hubble Telescope.

Located between Mars and Jupiter, Asteroid 16 Psyche is one of the most massive objects in the

News & buzz

- Officials say defense secretary is prepared for possibility...
- Armed men arrested in Philadelphia may have believed fake...

Security row over EU Galileo satellite project as Britain is shut out

Fears over impact on Brexit talks with UK taxpayers having already contributed £1bn



The Ariane 5 rocket with a payload of four Galileo satellites lifts off from ESA's European Spaceport in Kourou, French Guiana last year. Photograph: S. Martin/AFP/Getty Images

A fresh row over the UK's involvement with the Galileo satellite programme, to which the country's taxpayers have already paid £1bn, threatens to poison the Brexit talks after the EU shut Britain out of the project.

A majority of member states have turned against the UK and voted in favour of pushing forward on the next round of contracts for the £8bn project, despite requests for a delay to allow negotiations over British involvement to progress. UK firms are being blocked from bidding for contracts.

- most viewed
- Live Lewis Hamilton wins the Russian Grand Prix - as it happened
 - Live Ryder Cup 2018: Europe 10.5-8.5 USA - Sunday singles live!
 - Indonesia tsunami: death toll could reach thousands, officials say
 - Live Tsunami in Indonesia: death toll at 832 and expected to rise sharply - live updates
 - Trump professes love for Kim and hate for Kavanaugh torment in freewheeling speech



K dopadení podezřelých z Kuciaka pomohly snímky americké družice, píše Re

AKTUALIZOVÁNO Před 2 hodinami

Slovenská policie zatkla osm osob podezřelých z vraždy novináře Jána Kuciaka a jeho přítelkyně, ve čtvrtek ráno o tom informoval slovenský Denník N.



bez pekelných poplatků

Equa bank

Otevřít účet online

SPACE

Satellite operator Viasat climbs 27% after selling military communications unit to L3Harris for \$2 billion

PUBLISHED MON, OCT 3 2022-11:20 AM EDT | UPDATED MON, OCT 3 2022-4:07 PM EDT

Michael Sheetz @THESHEETZTWEETZ

SHARE f t in e

- KEY POINTS**
- California-based satellite operator business to defense contractor L3Harris
 - Viasat is selling its "Link 16 Tactical Communications System" that connects ships, aircraft and submarines through a secured voice and data link

GAO: Defense, intelligence agencies need a better plan to buy commercial satellite imagery

by Sandra Erwin — September 7, 2022



Satellite image collected by BlackSky over Vasylykiv Air Base, Ukraine, Feb. 28. Credit: BlackSky

GAO director Brian Mazanec: 'Commercial satellite capabilities are increasingly going to be indispensable to the national security enterprise'

SPACE NEWS

As DoD grows more reliant on the relationship

by Sandra Erwin — September 22, 2022

DoD and the intelligence community would use commercial space



ORGANIZATION | TOPICS

e-Library > Official texts (Ch...

NATO's over

17 Jan. 2022 - | Last updated: 1

English | French

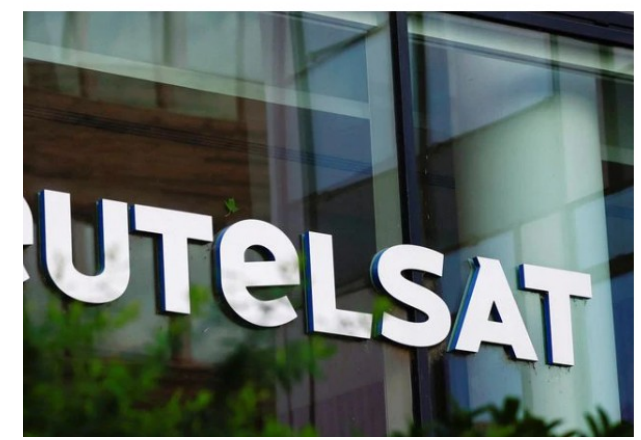
Exclusive: Musk's SpaceX says it can no longer pay for critical satellite services in Ukraine, asks

the tab

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Updated 11 days ago

as Iran of jamming its

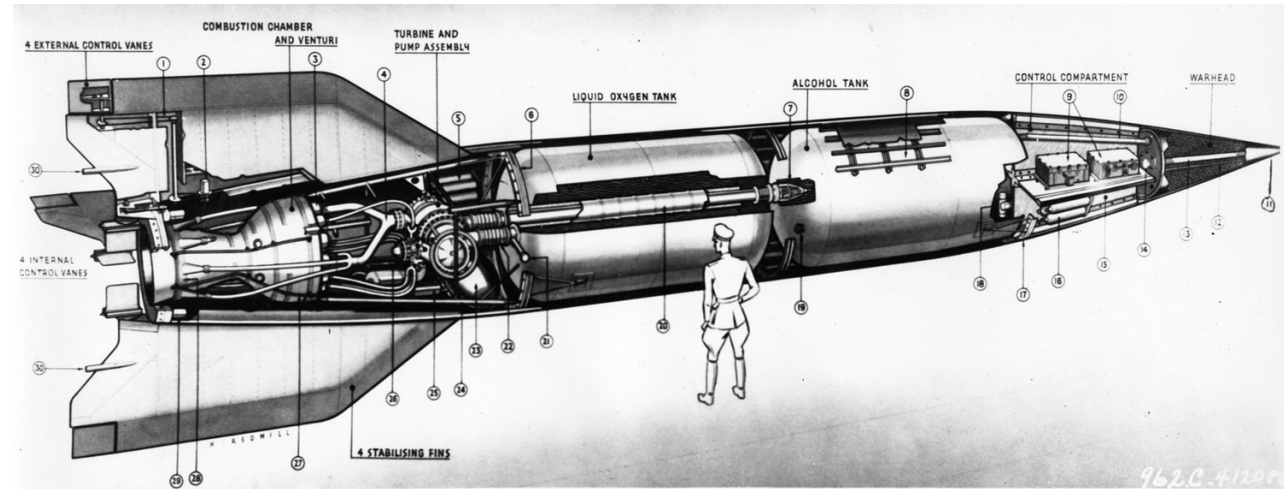


- 1) vesmír a Kármánova linie

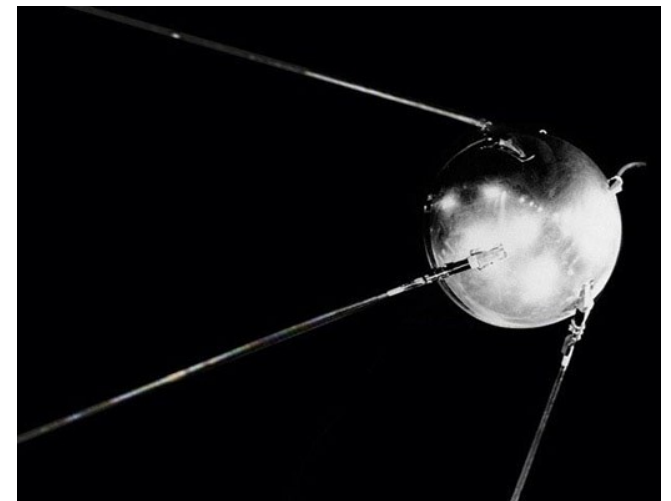
- atmosférický bod ve výšce 100 km
- pro běžné letectví nejvyšším dosažitelným bodem
- pro vesmírné plavidlo je to nejnižší bod, pod nímž je atmosféra příliš hustá na to, aby mohlo setrvat na stabilní orbitě bez kontinuálního tahu svého pohonu

2) historie – 1942 a 1957

- Vergeltungswaffe 2



- Sputnik-1



Satellity

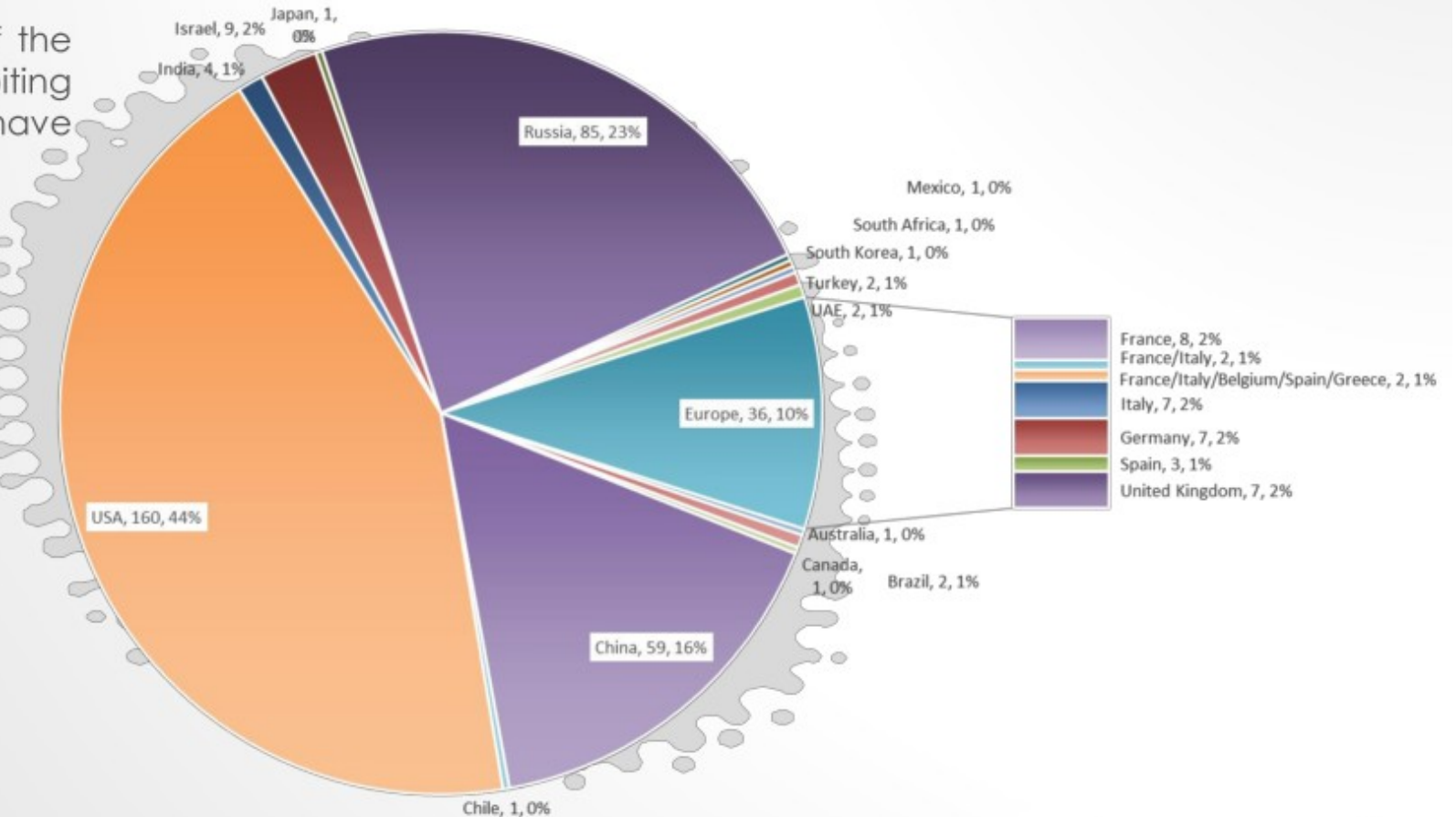
NATIONAL DEFENCE SATELLITES

Approximately 366 satellites of the 1,738 satellites currently orbiting Earth (as at 31 August 2017) have some form of military user.

US: 30.6% Remote Sensing (49)
 27.5% Communications (44)
 19.4% Navigation (31)
 17.5% Technology (28)
 3.1% Space Observation (5)
 1.9% Space Science (3)

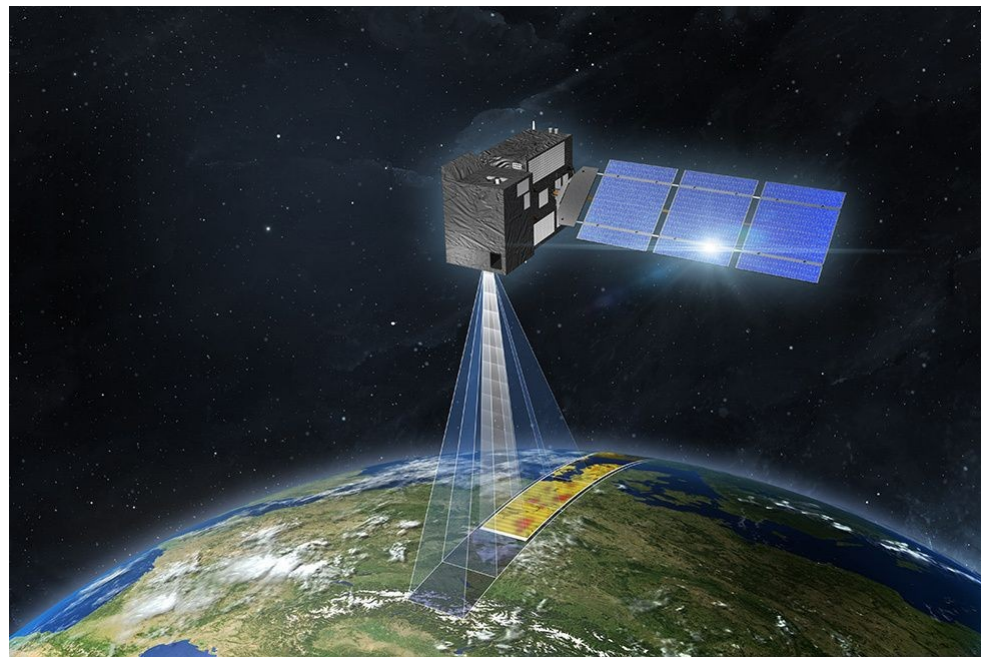
Russia: 50.6% Communications (43)
 31.8% Navigation (27)
 11.8% Remote Sensing (10)
 2.4% Space Observation (2)
 2.4% Technology (2)
 1.2% Earth Science (1)

China: 50.8% Remote Sensing (30)
 37.3% Navigation (22)
 6.8% Communication (4)
 3.4% Technology (2)
 1.7% Earth Science (1)





Satellite



REPORTS & MULTIMEDIA / FEATURE

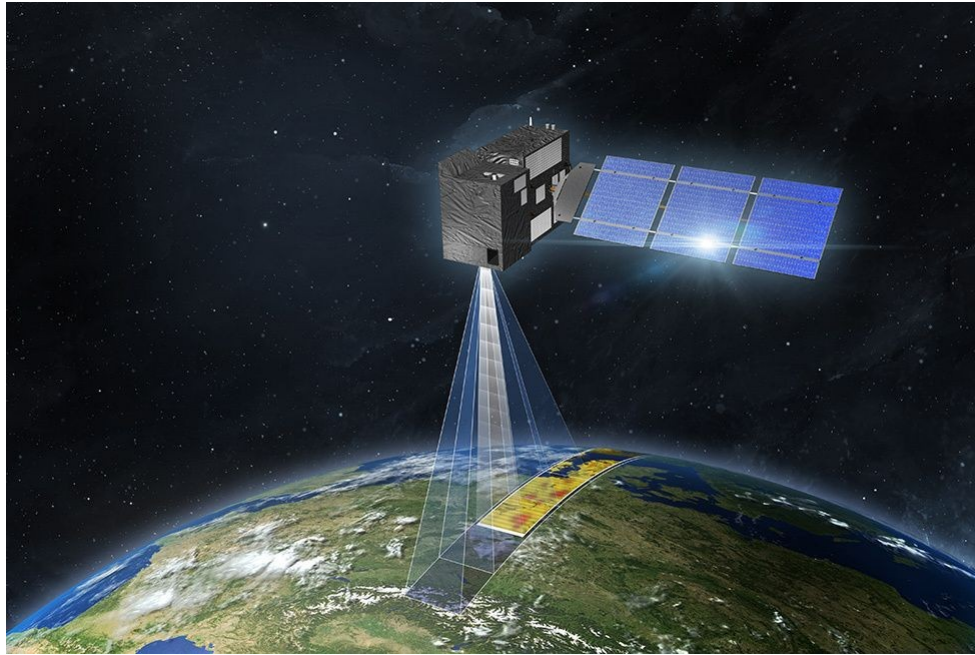
UCS Satellite Database

In-depth details on the 6,718 satellites currently orbiting Earth, including their country of origin, purpose, and other operational details.

Published Dec 8, 2005 | Updated Jan 1, 2023

- **Total number of operating satellites: 6,718**
 - United States: 4,529
 - Russia: 174
 - China: 590
 - Other: 1,425
- LEO: 5,938
- MEO: 141
- Elliptical: 59
- GEO: 580
- **Total number of US satellites: 4,529**
 - Civil: 26
 - Commercial: 3,996
 - Government: 260
 - Military: 247

Satellite



REPORTS & MULTIMEDIA / FEATURE

UCS Satellite Database

In-depth details on the 4,084 satellites currently orbiting Earth, including their country of origin, purpose, and other operational details.

Published Dec 8, 2005 | Updated May 1, 2021

Satellite quick facts

Includes launches through 4/30/2021

- **Total number of operating satellites: 4,084**
 - United States: 2,505
 - Russia: 168
 - China: 431
 - Other: 980
- LEO: 3,328
- MEO: 139
- Elliptical: 57
- GEO: 560
- **Total number of US satellites: 2,505**
 - Civil: 32
 - Commercial: 2,091
 - Government: 166
 - Military: 216

GeoInt

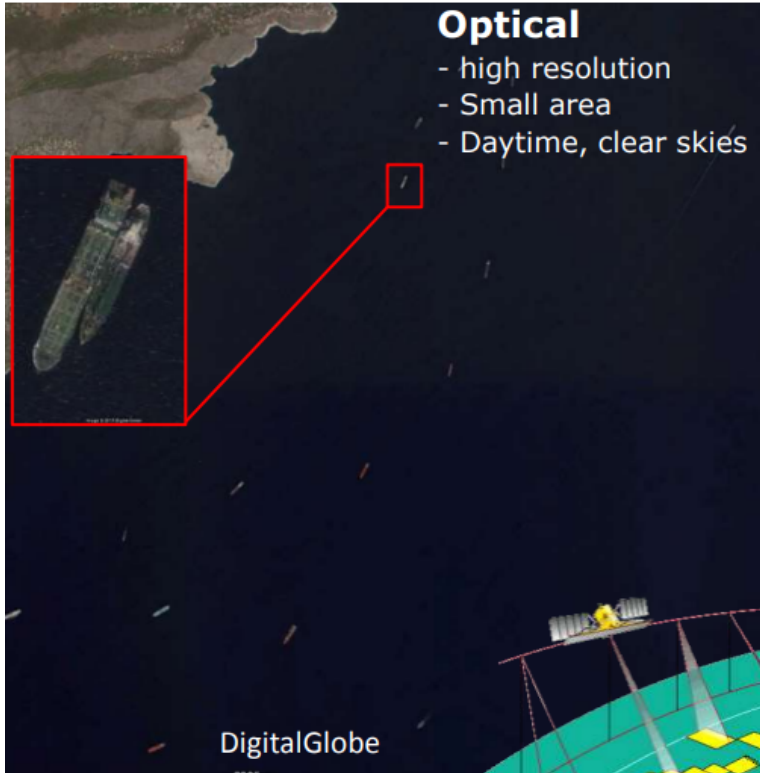
Služby	Využití NATO a efekt	Národní a komerční systémy
Poziční, navigační a časová	<ul style="list-style-type: none"> • Přesné údery • Navigace síly • Podpora pátrací a záchranné služby • Časování sítí 	GPS Galileo
Integrované taktické varování a posouzení hrozeb	<ul style="list-style-type: none"> • Ochrana sil • Přisouzení vážnosti hrozeb • Protiraketová obrana 	Space Based Infrared System
Monitoring prostředí	<ul style="list-style-type: none"> • Plánování misí • Výběr munice • Předpověď počasí 	EUMETSAT Obranný meteorologický satelitní program
Komunikace	<ul style="list-style-type: none"> • Kontrola a řízení • Autonomní systémy • Nasazená komunikace 	GBS Syracuse EUTELSAT SICRAL SKYNET INTELSAT
Zpravodajství, dohled a průzkum	<ul style="list-style-type: none"> • Pokrytí pro výkon operací (v operačním středisku) • Vyhodnocení bojových škod • Zpravodajství • Cílování 	SAR Lupe COSMO SKYMED HELIOSIKONOS
Identifikace	<ul style="list-style-type: none"> • Automatická identifikace 	AIS



Earth observation satellites



→ Used for **recognition**



→ Used for **detection**

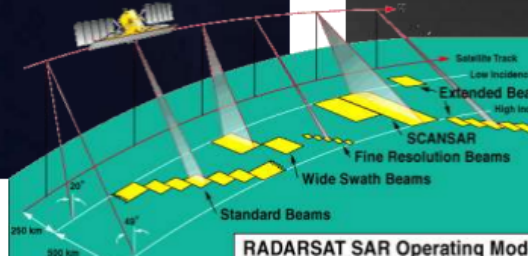
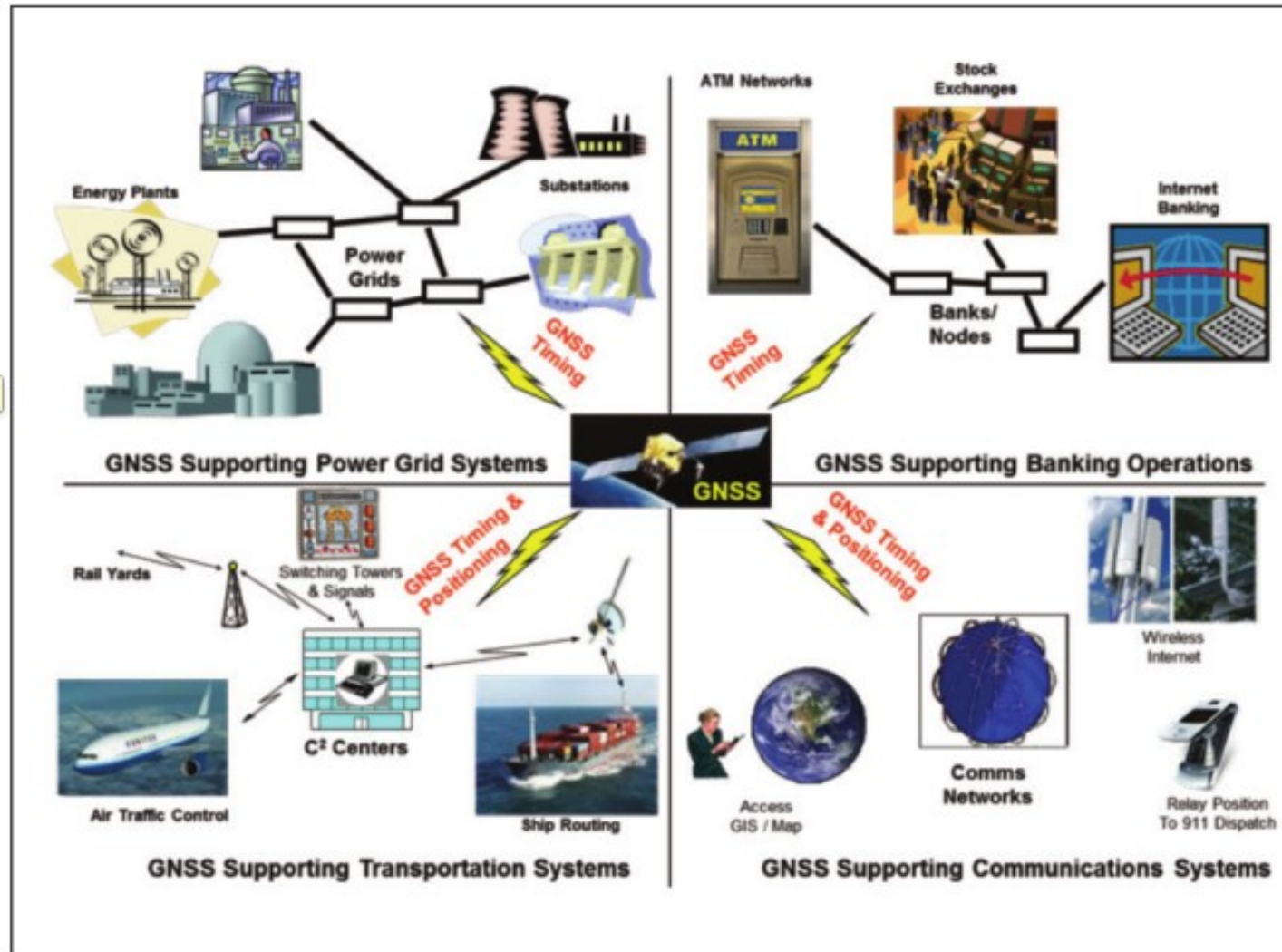
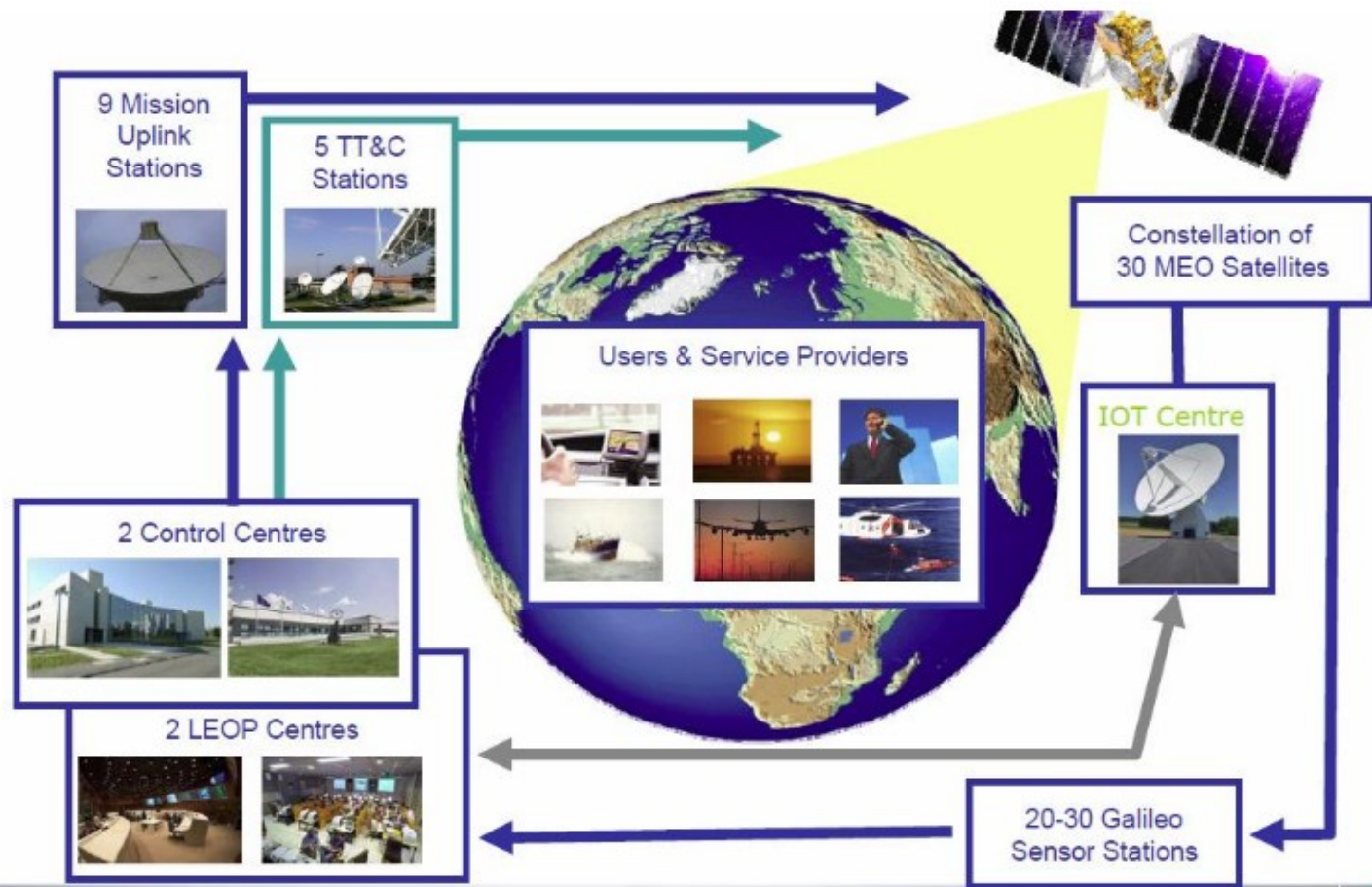


Figure 5: Today's reliance on GNSS positioning and timing signals





Vesmírná bezpečnost:

„Bezpečný a udržitelný přístup k vesmíru a jeho využívání, jakož i svoboda od hrozeb vycházejících z prostoru.“

- definice vychází z principů v Kosmické smlouvě z roku 1967
- vesmír má zůstat volně dostupný pro všechny k mírovému využití nyní i do budoucna

- Clay Moltz:

vesmírná bezpečnost jako schopnost vynášet a operovat se satelity mimo zemskou atmosféru bez externího rušení, poškozování nebo destrukce

- Tři dimenze vesmírné bezpečnosti shrnuje Jean-François Mayence

Tři dimenze

- Kosmický prostor pro bezpečnost:

užití vesmírných systémů pro bezpečnostní a obranné účely

- Bezpečnost ve vesmíru:

jak chránit vesmírné prostředky a systémy před přírodními a/nebo lidskými hrozbami nebo riziky a zachovat udržitelný rozvoj vesmírných aktivit

- Bezpečnost z vesmíru:

jak chránit lidský život a životní prostředí Země před přírodními hrozbami a riziky z vesmíru

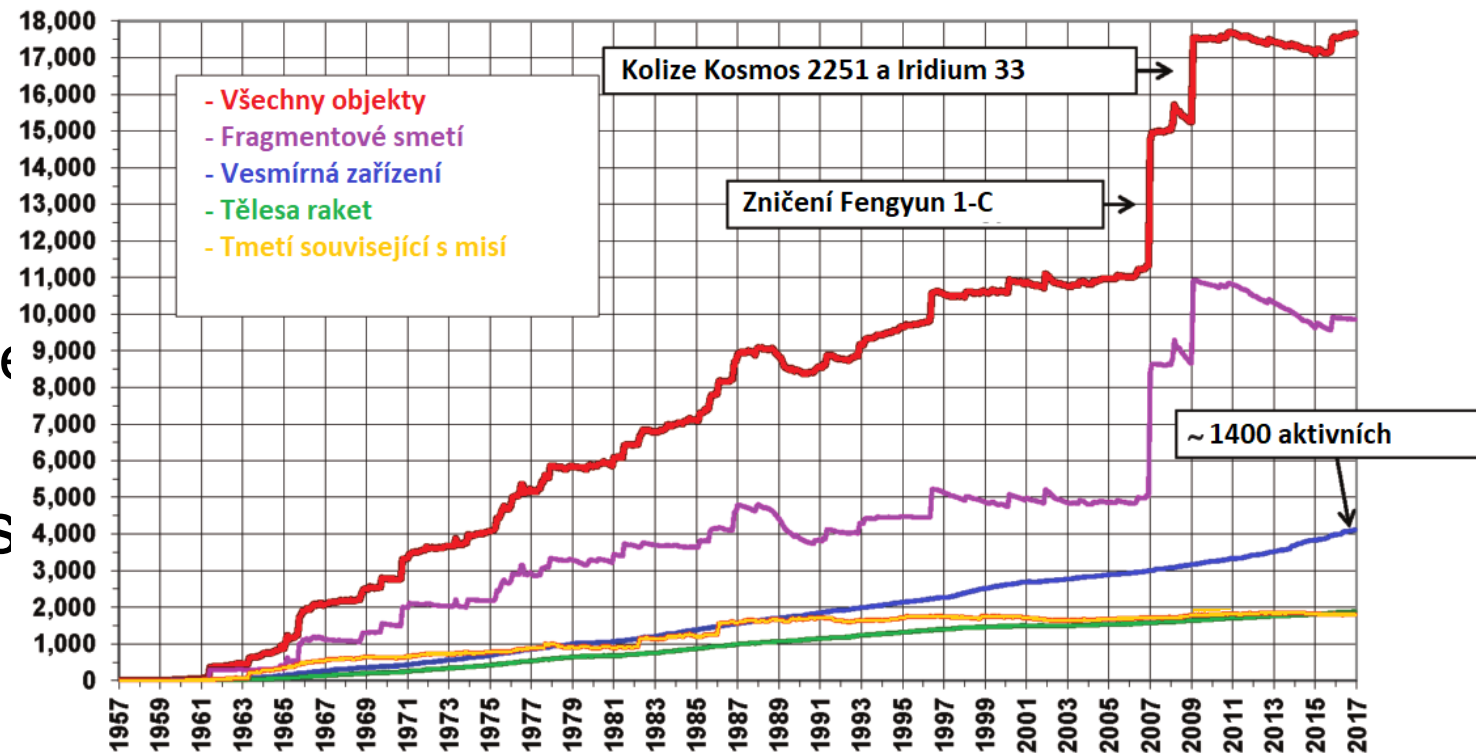
Rizika a hrozby

- Kosmické smetí
 - Kesslerův syndrom – kaskádový nárůst

- Antisatelitní zbraně

- Konvenční
- Jaderné
- Směřované energie - lasery

- Kybernetická bezpečnost



Small LEO space population largely unknown

LEO-crossing (0 to 2000 km) objects
estimated from debris surveys and events

167	>	5 m
350	>	4 m
721	>	3 m
1816	>	2 m
2879	>	1 m
3378	>	90 cm
4650	>	80 cm
5480	>	70 cm
6136	>	60 cm
6816	>	50 cm
7427	>	40 cm
8583	>	30 cm
13329	>	20 cm
18259	>	10 cm
23599	>	9 cm
28981	>	8 cm
34386	>	7 cm
39834	>	6 cm
45210	>	5 cm
50982	>	4 cm
77749	>	3 cm
211729	>	2 cm
364583	>	1 cm

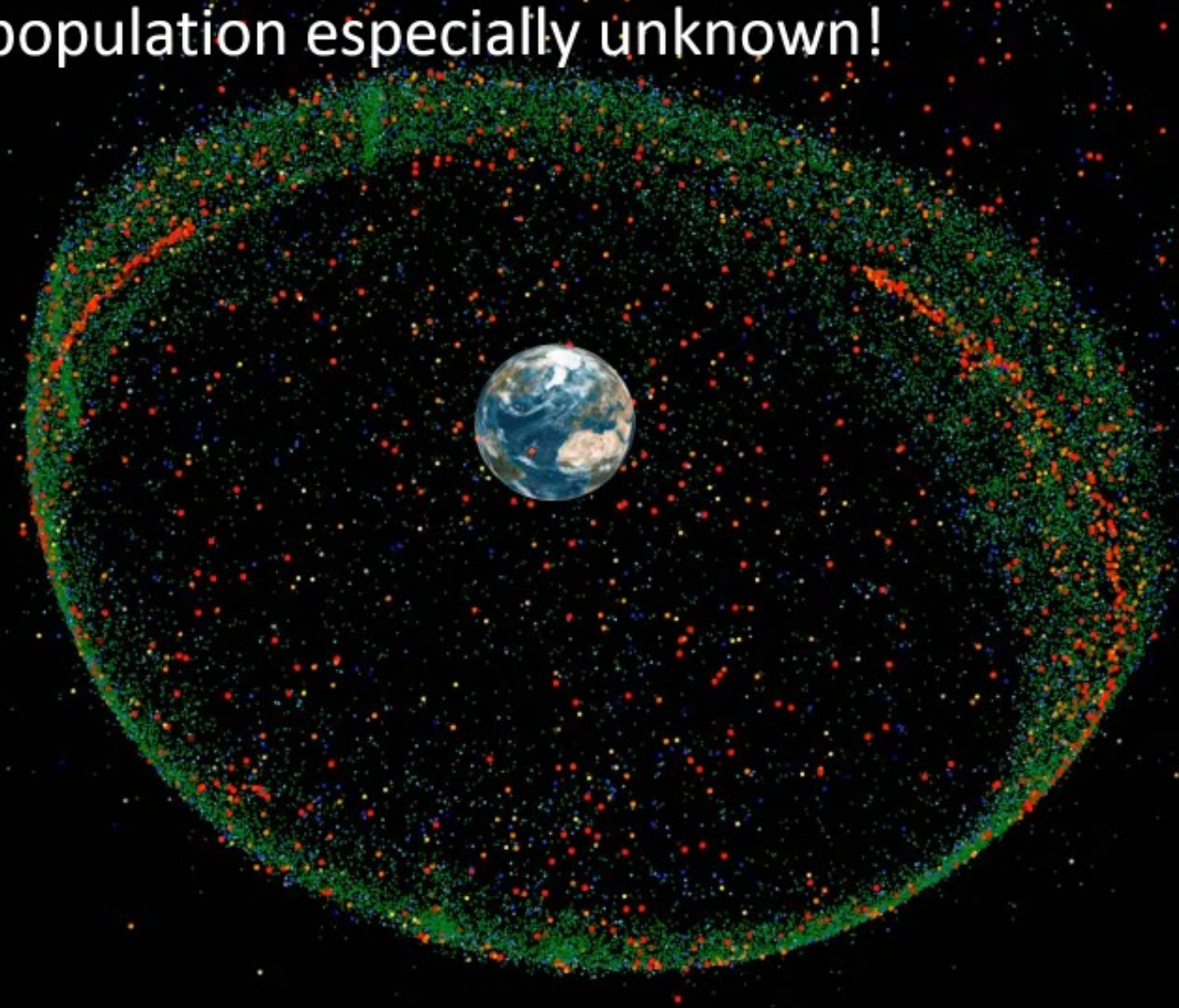
← Today's
public
catalog

Today's current public
catalog contains < 4% of
LEO-crossing objects > 1 cm

Small GEO space population especially unknown!

GEO-crossing ($\text{GEO} \pm 100 \text{ km}$) objects
estimated from debris surveys and events

634	>	5 m
783	>	4 m
960	>	3 m
1188	>	2 m
1378	>	1 m
1406	>	90 cm
1434	>	80 cm
1479	>	70 cm
1512	>	60 cm
1557	>	50 cm
1600	>	40 cm
1660	>	30 cm
1912	>	20 cm
2179	>	10 cm
2677	>	9 cm
3143	>	8 cm
3630	>	7 cm
4120	>	6 cm
4570	>	5 cm
5118	>	4 cm
7190	>	3 cm
17687	>	2 cm
33239	>	1 cm

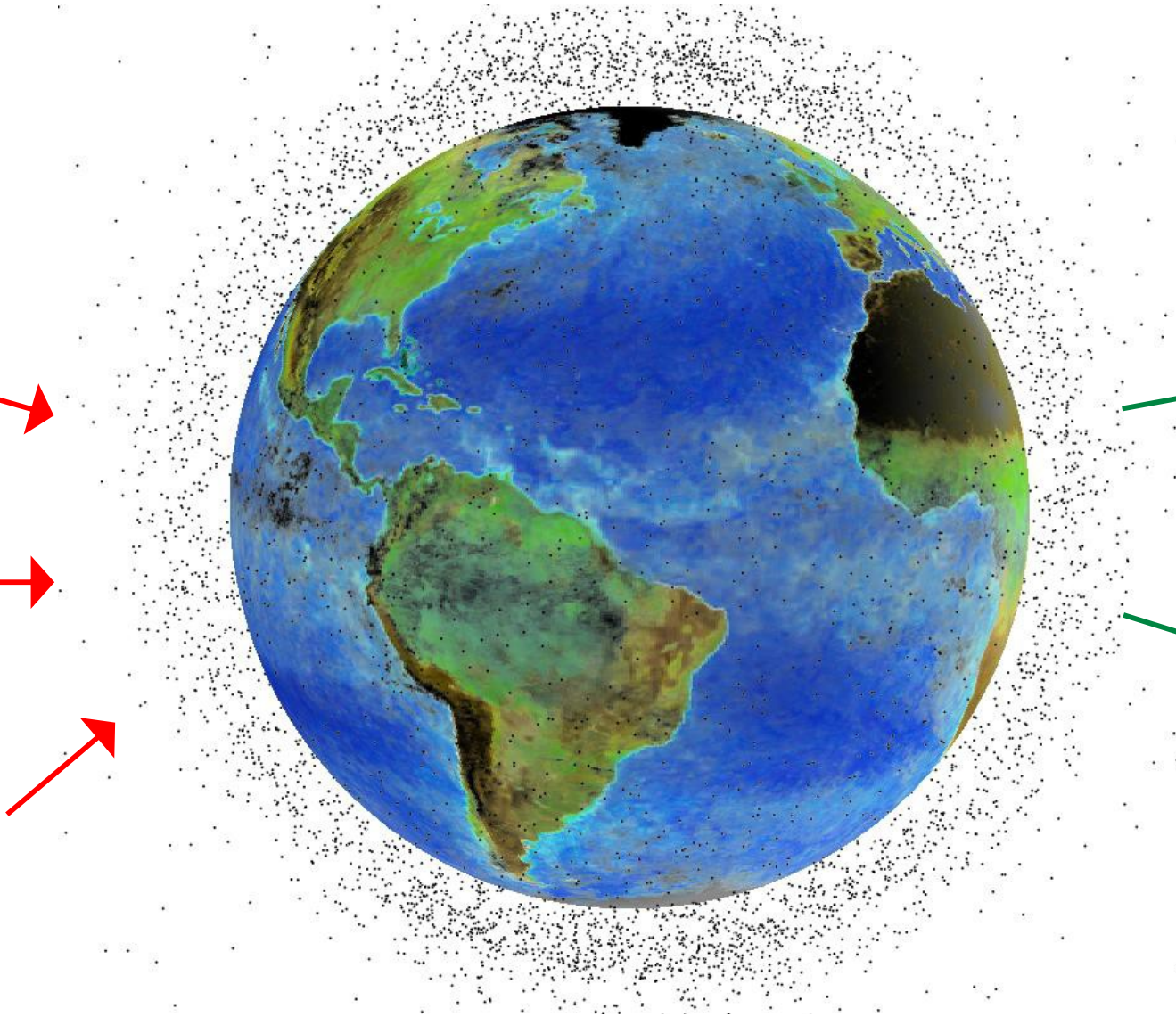


Sources

Launches (rocket bodies, payloads, mission related objects)

Fragmentations (explosions, collisions)

Non-fragmentation debris (surface degradation, solid rocket motor particles)



Sinks

Natural decay (atmospheric drag, solar radiation pressure, lunisolar perturbations)

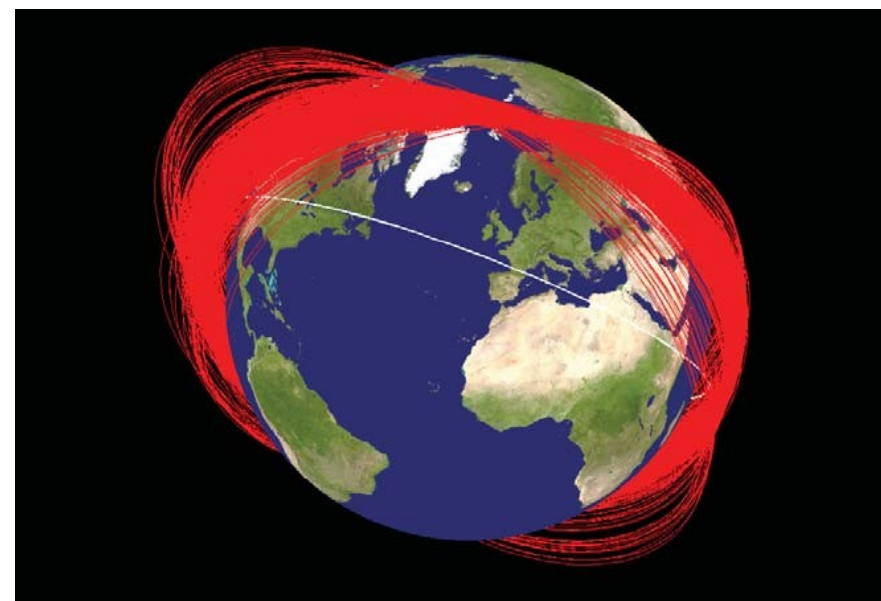
Active Removal (de-orbit, non-propulsive maneuvers)



Starfish Prime
1962



SM-3 raketa
2008



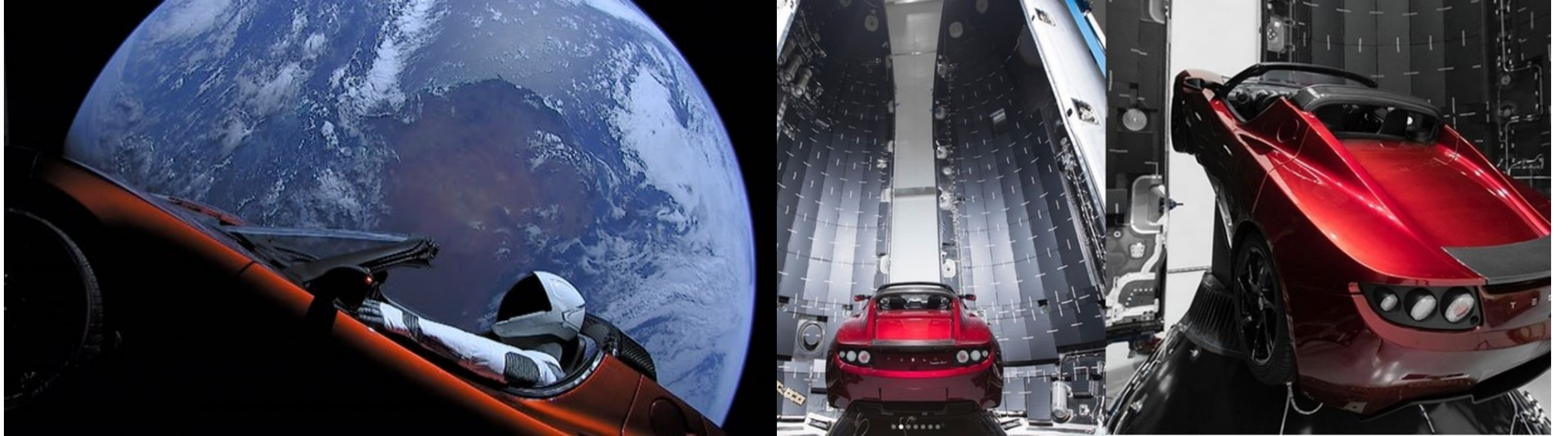
Fengyun-1C
2007

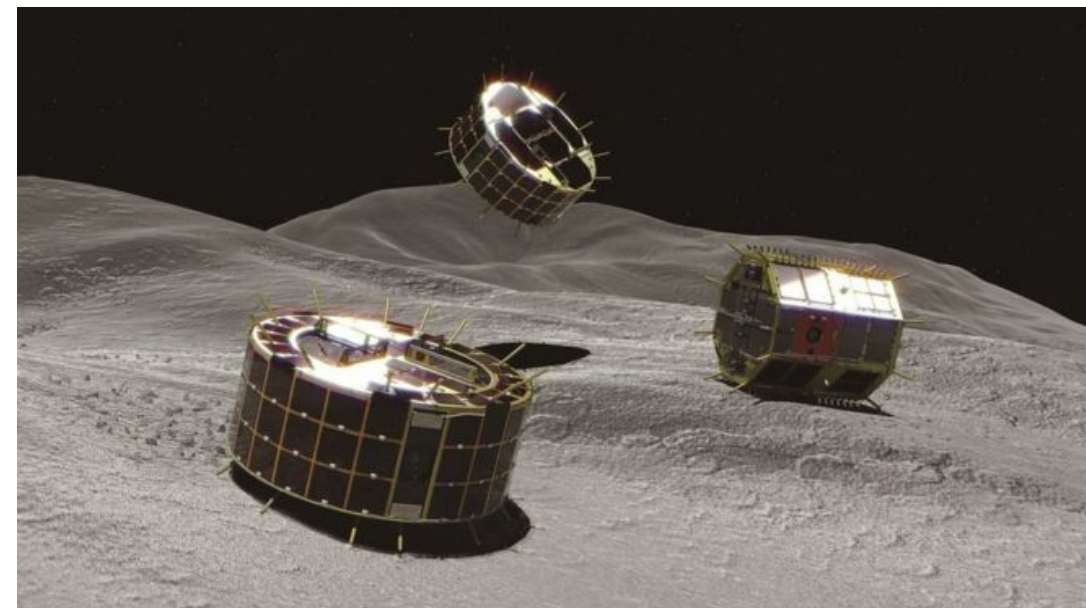
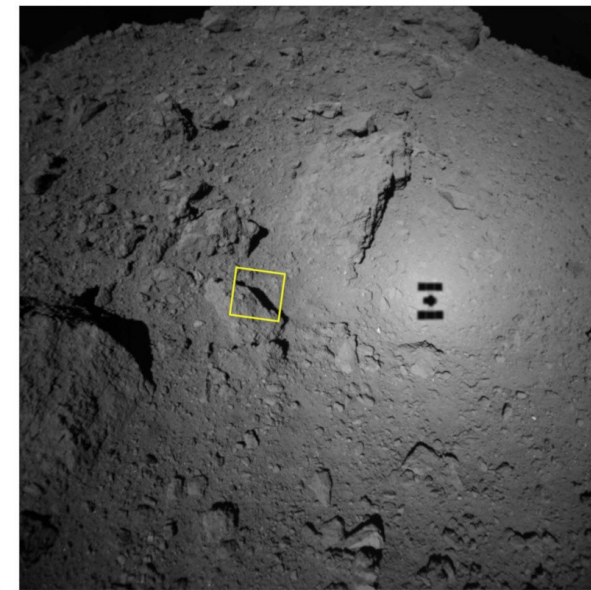
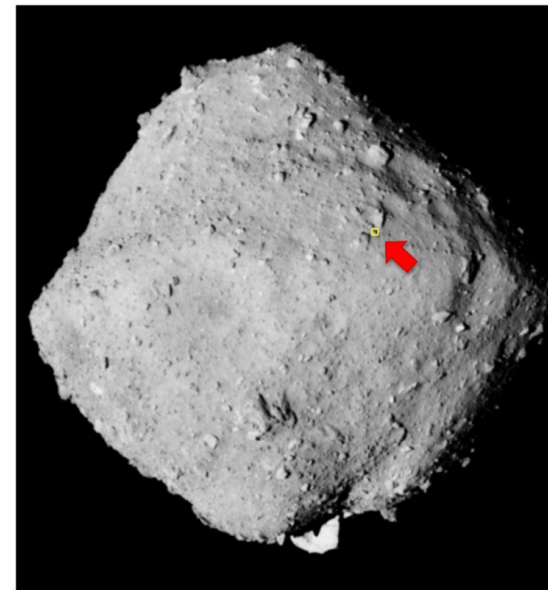
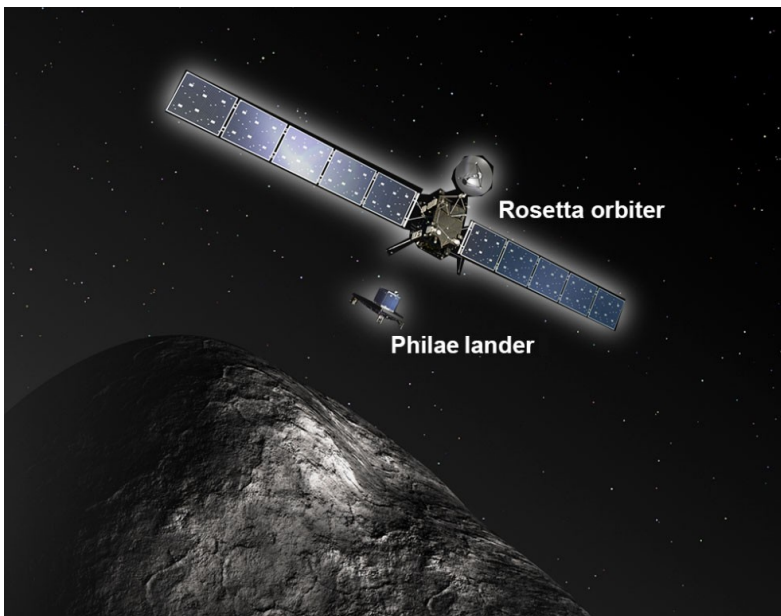
Současné trendy

- Privatizace a komercializace
- Turismus
- Těžba surovin?
- Nárůst počtu aktérů i využívání



NewSpace / Space 4.0





Rosetta Mission - a detailed study of a comet

Hayabusa2 – asteroid sample return mission

Civil

Scientists excited by first look at OSIRIS-REx asteroid samples

Jeff Foust October 12, 2023



- Asteroid Bennu
- Start 2016, sběr 2020, září 2023 návrat na Zemi
- 250 gramů materiálu, cíl mise byl 60 gramů



NewSpace

- Velký nárůst aktérů díky technologickému postupu
 - Zlevňování vývoje, výroby a operování satelitů a nosných raket
- Různorodá odvětví – například technologické IT firmy, investiční a mediální společnosti
- Nové přístupy, důraz na inovaci, snižování celkové ceny z důvodu konkurence
- Společnosti vyrábějí produkty, které nejsou perfektní, ale dostatečné
 - Prioritu má nižší cena před perfektním výkonem, spolehlivostí či výdrží
- Přístup je reflektován v efektivnějších a jednodušších procesech při výrobě
 - Levnější komponenty, 3D tisk, open source software, adaptabilní výrobní a produkční model
 - Nejvíce evidentní u menších společností v satelitním sektoru

Co sledovat?

- Privátní sektor
- Právní systém
- Miniaturizaci - nano a mikrosatelity
- Autonomní systémy
- Antisatelitní zbraně
- Planetary Defence
- 5. bojová doména NATO



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- <http://www.thespacereview.com/article/3331/1>
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- ASBECK, Frank, 2015. Policy Framework for Space Security Activities in the EU. In: Youtube.com [online]. Dostupné z: <https://www.youtube.com/watch?v=xGKdT8oYBX0>
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