

International Space Policy Drivers

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UCL SPACE WEEK

The space activity has been structured by the political cycles of the 20th Century

- Importance of the Cold War and of the Nuclear and Ballistic era
 - US and USSR, Russia 2 first space faring countries
 - Gradually, largely dominating role of the U.S. as a structuring actor for the space activity
- End of the Cold-War Era:
 - 1 / What new political meaning for space (budgets, programs, etc)
 - 2 / What actors in space ? (new countries, Public/Private actors, etc)
 - 3 / What regulation ? How about new rules of the road?

Very different views depending on national interests and history

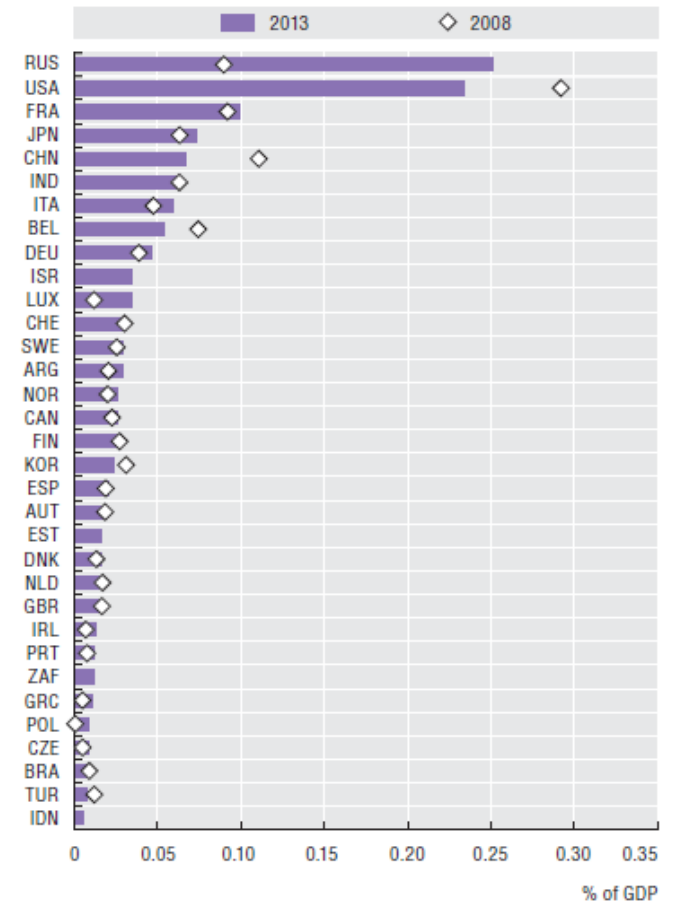
Table 1.1. Space budgets in PPP and per capita for selected countries

	Space budget in USD millions (PPP), 2013	Budget per capita
USA	39 332.2	123.2
CHN	10 774.6	7.9
RUS	8 691.6	61.0
IND	4 267.7	3.3
JPN	3 421.8	26.9
FRA	2 430.8	38.0
DEU	1 626.6	20.1
ITA	1 223.3	20.7
KOR	411.5	8.2
CAN	395.9	11.5
GBR	338.9	5.3
ESP	302.9	6.7
BRA	259.2	1.3
BEL	244.8	21.9
IDN	142.0	0.6
CHE	133.0	16.6
SWE	122.0	12.7
NDL	110.5	6.6
TUR	104.3	1.4
NOR	89.6	18.5
ISR	89.3	11.1
POL	80.7	2.1
ZAF	76.4	1.5
AUT	73.0	8.6
FIN	53.9	9.9
DNK	38.2	6.9
PRT	32.2	3.0
GRC	30.3	2.7
CZE	25.4	2.5
IRL	25.3	5.6
AUS	24.9	1.1
LUX	17.0	34.5
HUN	8.9	0.9
MEX	8.5	0.1
EST	5.4	4.0
SVK	4.8	0.9
SVN	2.9	1.4

Source: OECD calculations based on national data and OECD MEI data.

3.3. Space budget as a share of GDP for selected countries

% of GDP (based on current USD), 2008 and 2013



Source: OECD calculations based on national data and OECD MEI data.

StatLink <http://dx.doi.org/10.1787/888933141760>

A somewhat unique situation...

What political meaning for the space activity ?

- Historically, the driving force behind space:

Technological capabilities + political project


→ Must be connected

Civilian space : episodic connection

Military space: enduring connection

- 
- Result : A two-sided activity with different cycles and international differences

Part I - Defining General Space Policy Drivers

- **Civilian space** (Pub. Exp.): episodic interest in the main space faring countries
 - The US example (by far the most heavily investing country)
 - Apollo
 - Space Station after 1993
 - Information applications starting from the middle of the 90's (linked to security issues)
 - Moon-Mars January 2004
 - Orion/SLS
- 

A few reminders:

- Historically, relationships between space and security have also been determined by military strategies and their historical and legal contexts
 - 1955: Space was born from the " nuclear induced " military revolution :
"Strategic space" has remained alive over the years = an unsurpassable base
 - 1990: Space adapting to new strategic conditions: " Operative/tactical space " built for " major theater wars "
 - 1995-2000s: Mission extension determined by the emergence of "new threats" :
"Security space "

« Strategic Space »

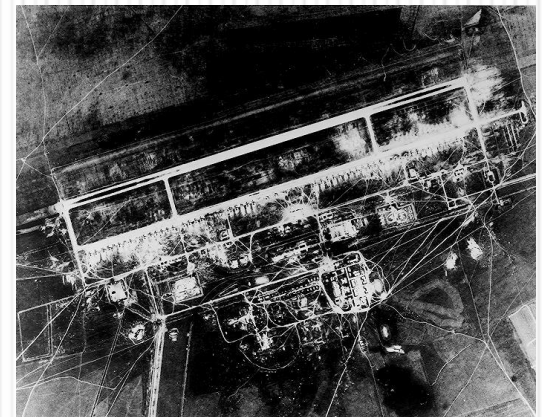
-1955 in the U.S. : "Meeting the threat of the surprise attack "

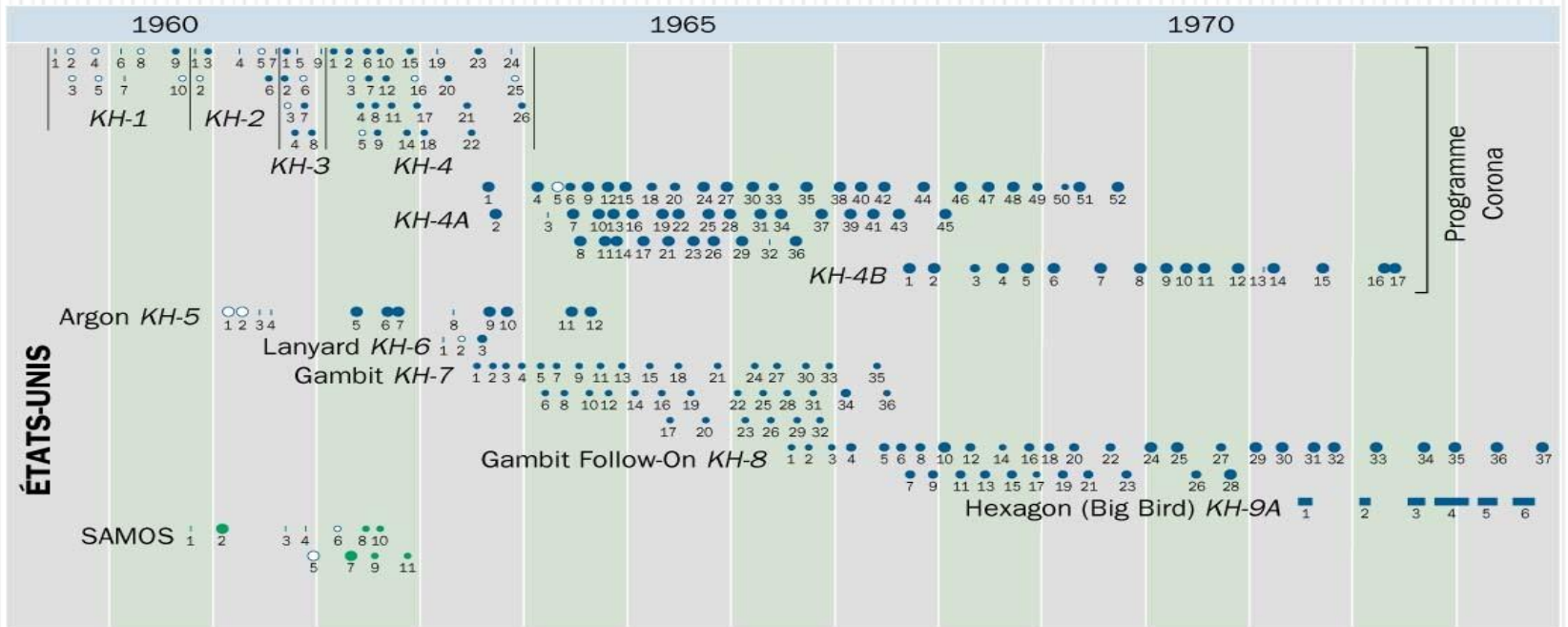
- Use space to assess the ennemy's ballistic arsenal:

- Ballistic launch detection
- Nuclear tests detection
- Infrastructures and silos monitoring

- Protecting against ballistic threats

- First ABM programmes





Type d'image et de transmission

- Film récupéré par capsules parachutées
- Transmission radio d'images électro-optiques
- Transmission radio d'images sur film
- Transmission radio d'images radar

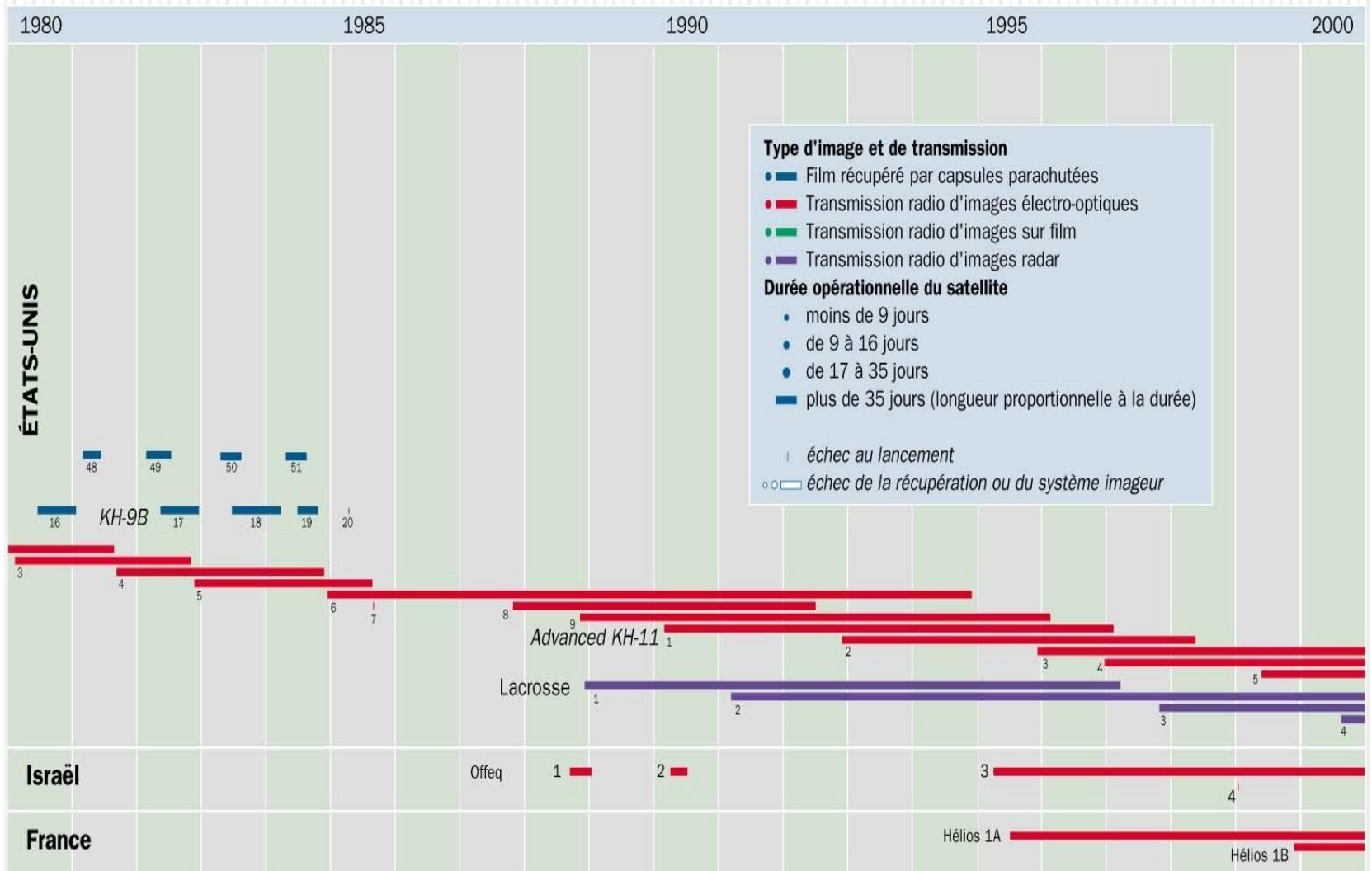
Durée opérationnelle du satellite

- moins de 9 jours
- de 9 à 16 jours
- de 17 à 35 jours
- plus de 35 jours (longueur proportionnelle à la durée)

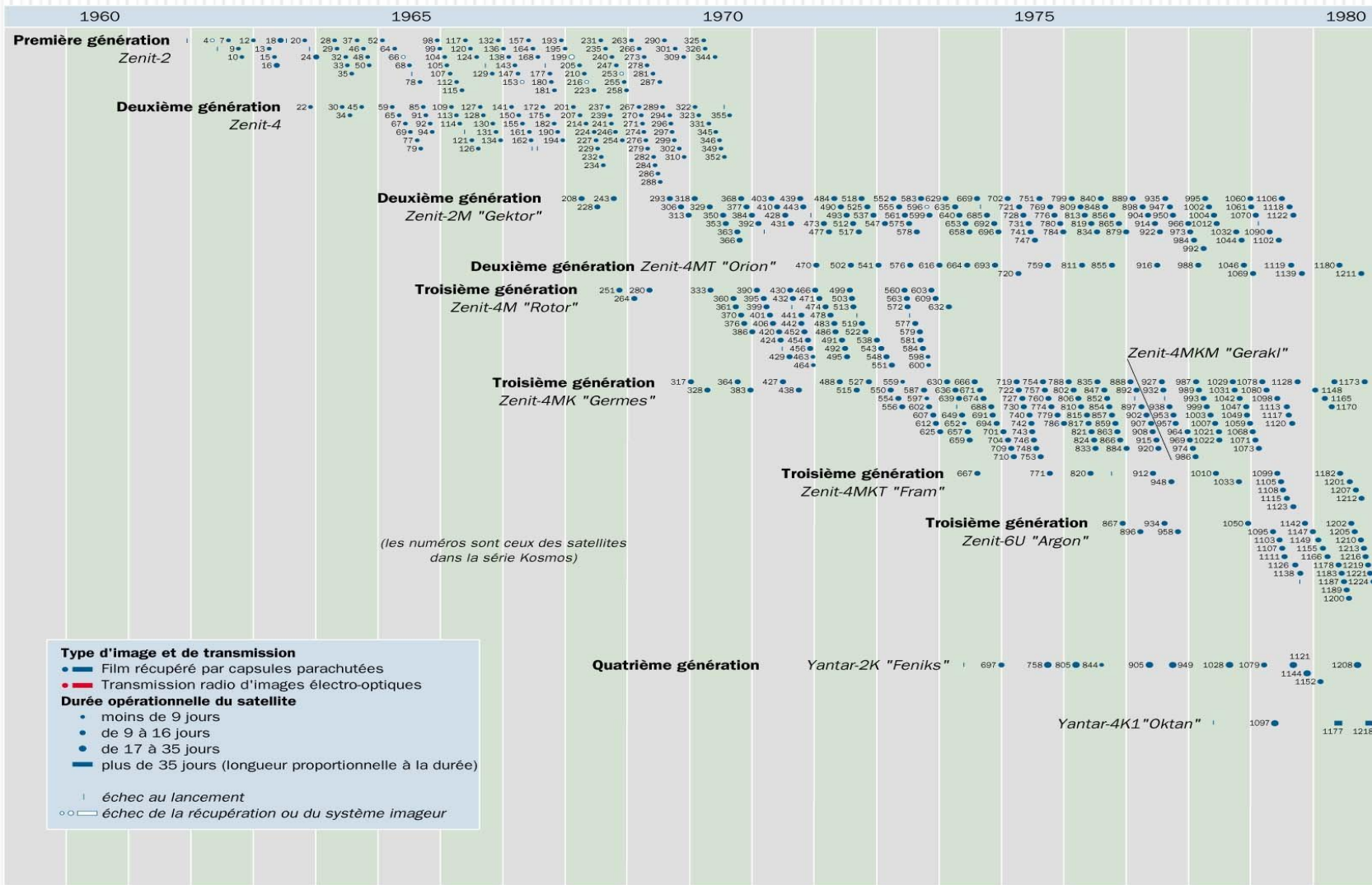
⊥ échec au lancement

○ □ échec de la récupération ou du système imageur

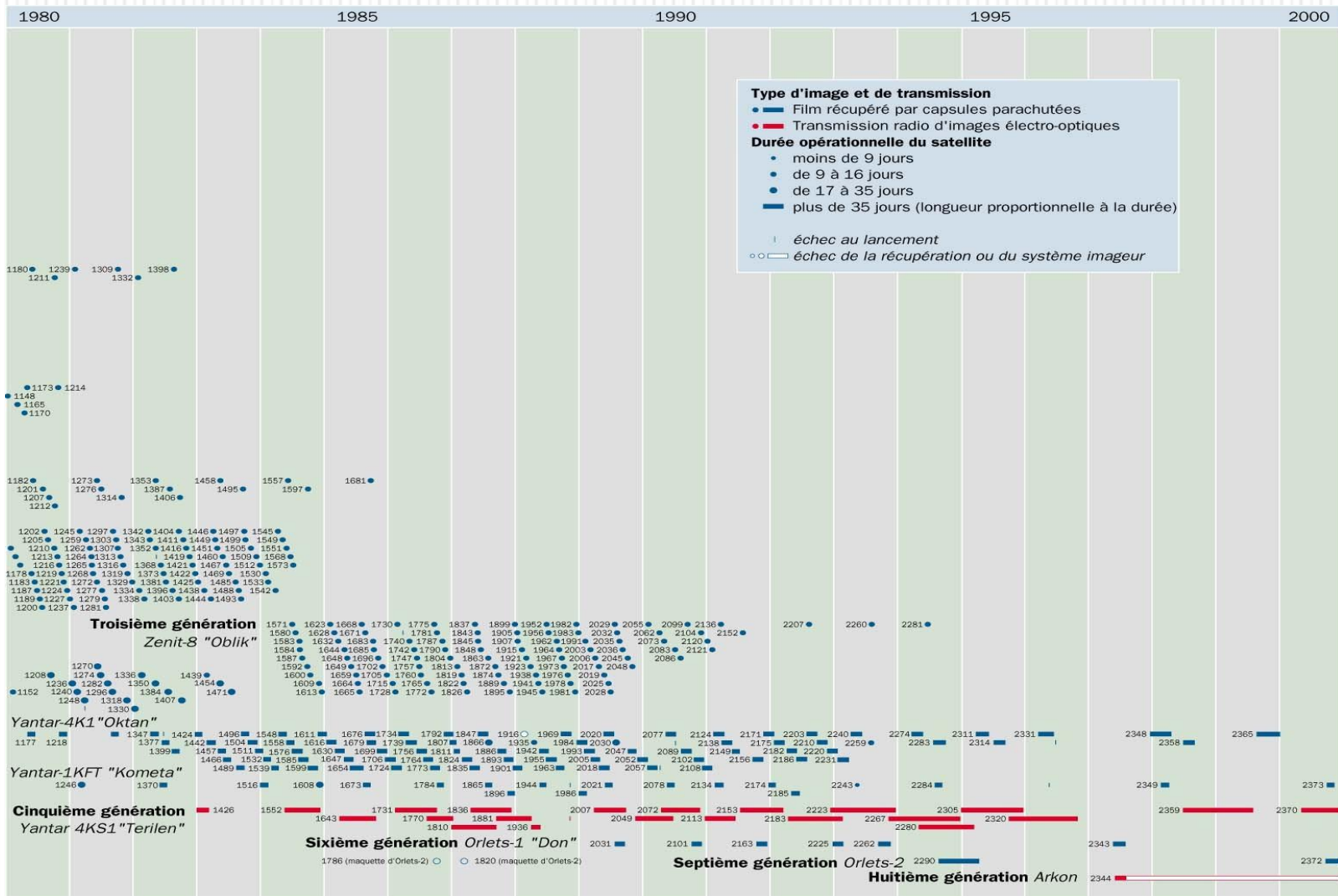
U.S. EO Military Systems History 1/2)



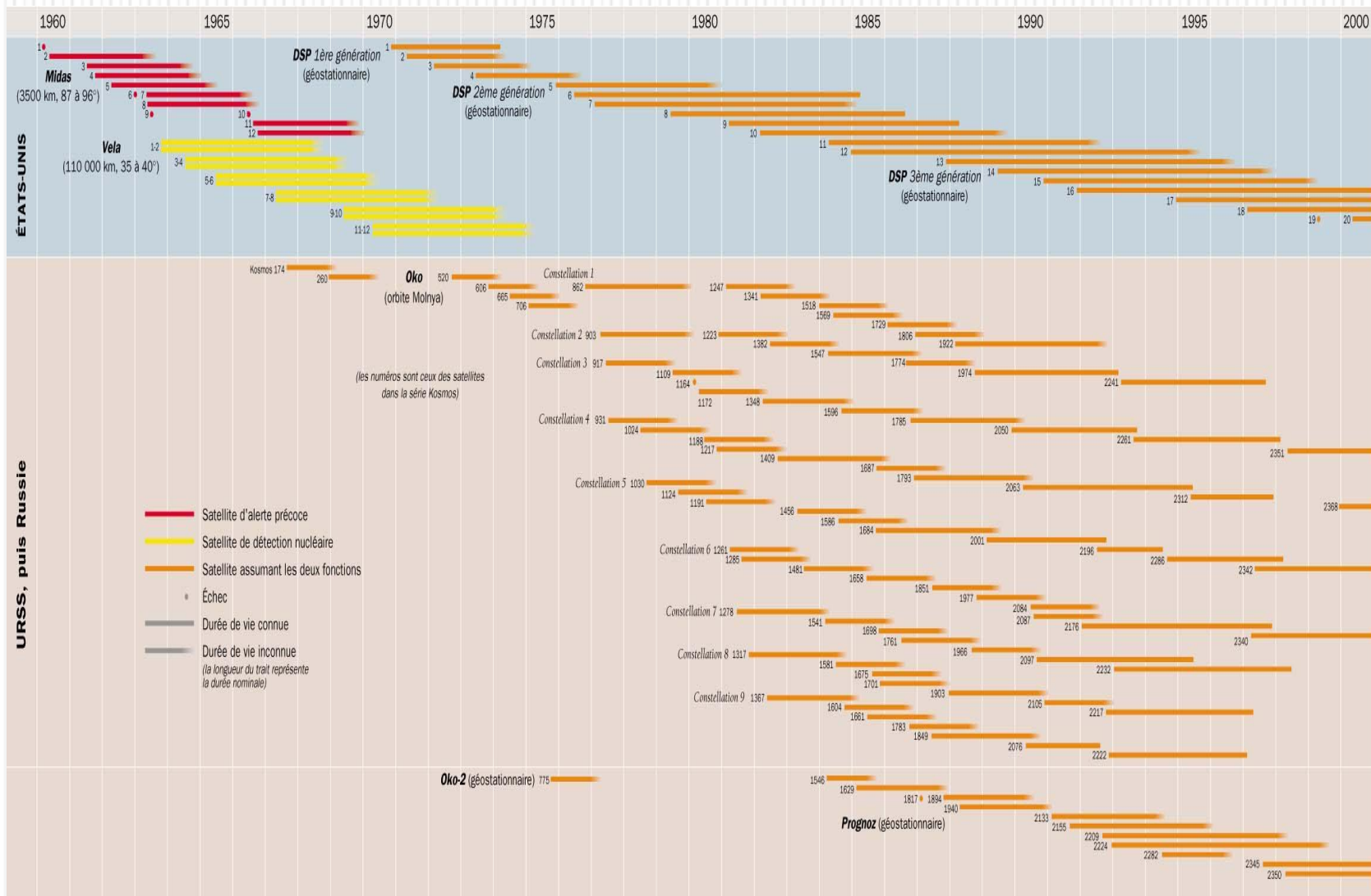
U.S. EO Military Systems History (2)



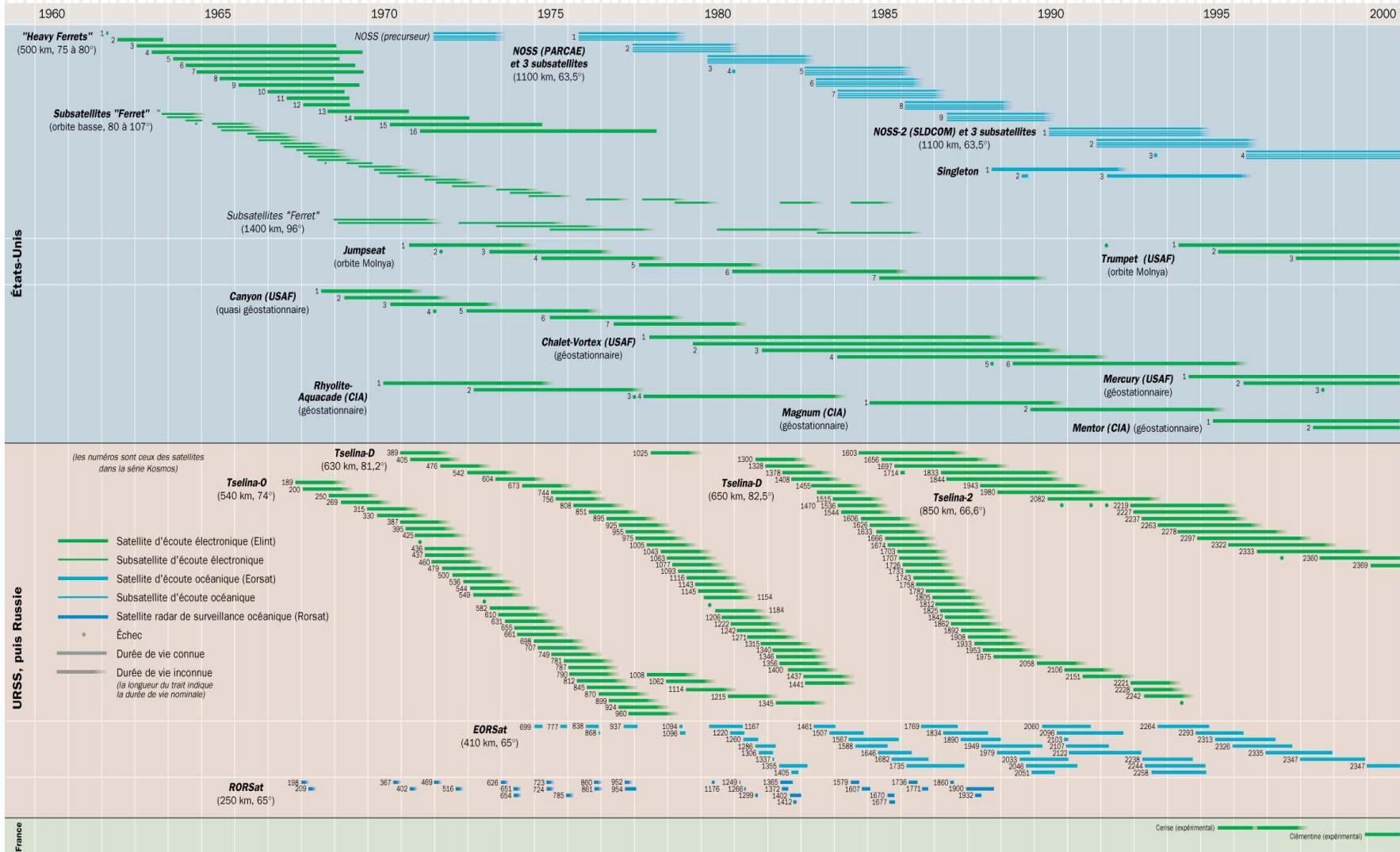
U.S.S.R. EO Military Systems History 1/2



U.S.S.R. EO Military Systems History (2)



Early Warning Systems History



SIGINT History

"Strategic space " (2)

- Space law has conformed to the strategic balance built by the new nuclear era :
 - First legal "premiere" with the overflight of sovereign territories by Sputnik in October 1957 (UN acknowledgement)
 - Outer space treaty (1967): Peaceful uses of outerspace as a "pragmatic " concept fully compatible with the "useful" military applications of space (monitoring, early warning, communications)
 - ABM Treaty (1972): Affirms the importance of "National Technical Means" (NTM, i.e. satellites) as a first contributor to the strategic balance



-The military use of space was a primary condition for the MAD doctrine to ever exist

These historical roots of space activities have given a prominent role to States, with the following characteristics :

- State being the central actor
- Dynamics generated by State strength and voluntarism
- Promotion of national interest and prevalence of foreign policy consideration



Space was born from the Cold War !

"Operative/Tactical Space" : 2nd layer

- Wider use of space "on the battlefield" : New

- Triggered by the first Gulf War

- MTW context
- Space viewed as a "force multiplier"
- Increasing needs for data and information (special forces, etc.)

	Total des munitions	Munitions guidées	% total guidage laser	% total guidage GPS
Irak 1991	238000	4% (9500)	Total de 4%	0%
Serbie 1999	27300	32% (7700)	29%	3% (700)
Afghanistan 2002	22000	59% (13000)	27%	32% (>7000)
Irak 2003	30000	66,5% (19950)	39,5%	27% (8100)

- New applications for space systems:

- Proliferation/SRBM monitoring and detection
- Guided weapons
- Multi-sensor/multi platforms for military operation monitoring
- Tactical mobile telecommunication (anti jamming, wideband, high data rates)

"Security Space" : 3rd Layer

■ New goals and expectations

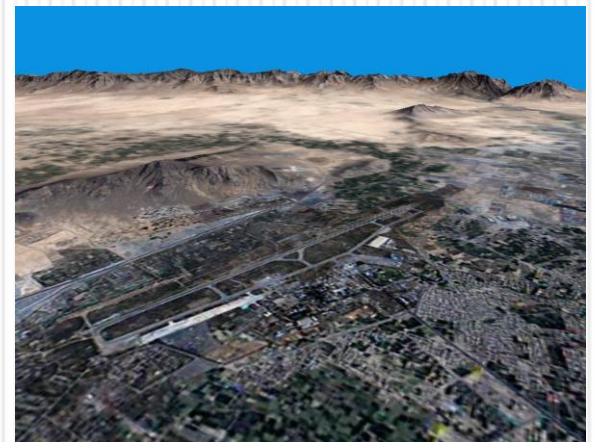
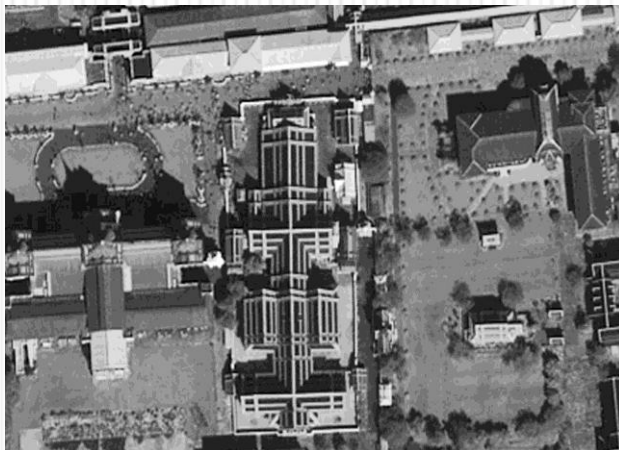
- Space must become a " strategic enabler"
- Space applications at the heart of weapon as well as intelligence and information systems



Space applications are to become indistinct elements of a global security and defense system (architectures, System of systems, etc.)

Creates a "holistic" approach of national security federated by a comprehensive information system answering the need of:

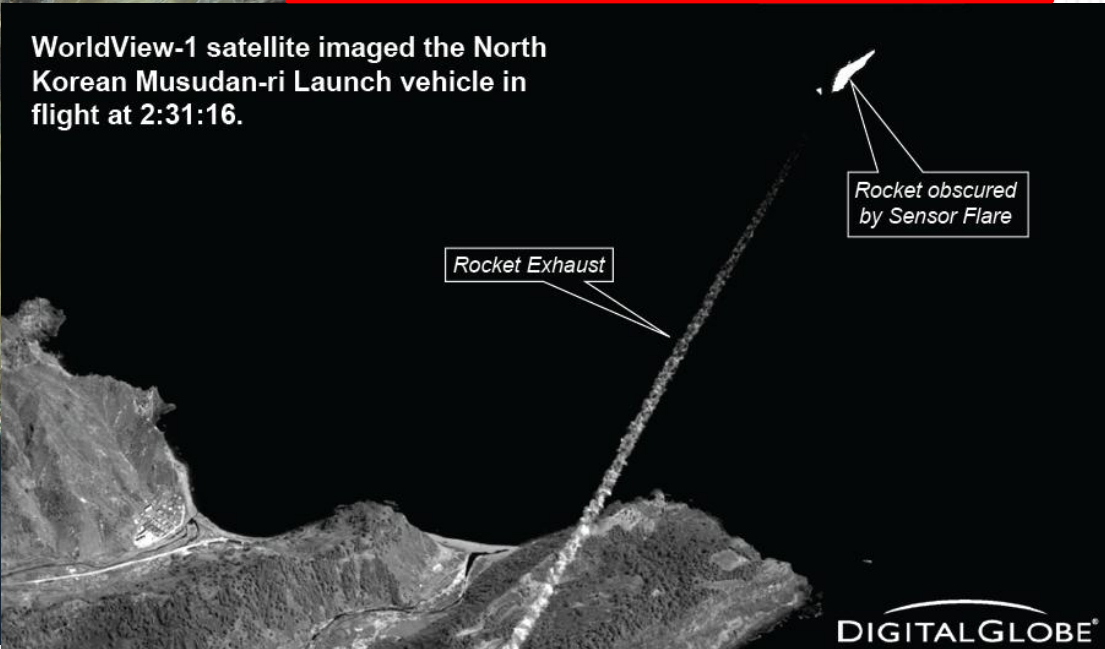
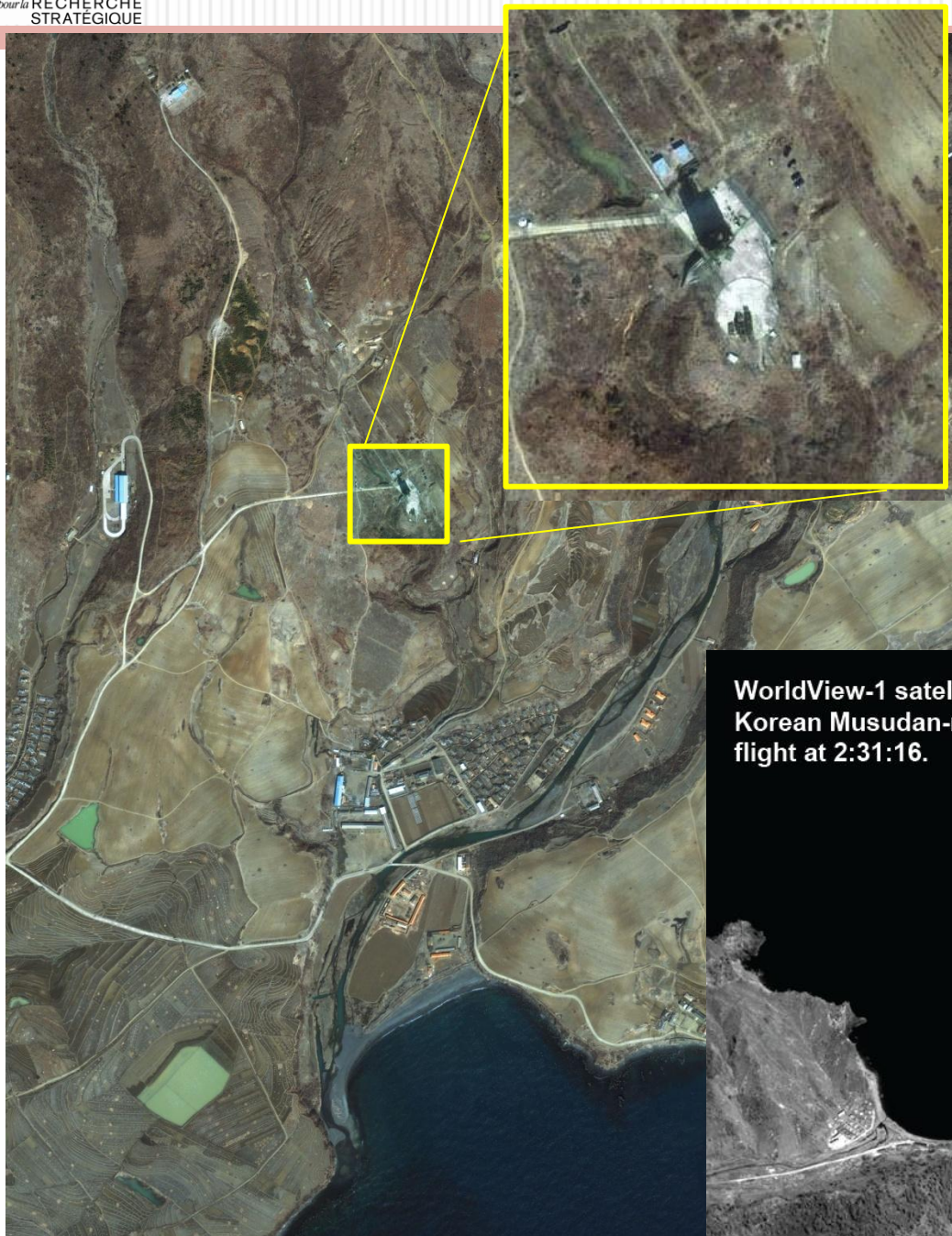
- Military security;
- Environmental security;
- "Homeland Defense", security of the citizen;
- "Economic and industrial security"



- “3rd layer” evolution:
- More and more security and defence oriented (not only military per se)
 - From tactical military uses during the conflict to global security uses before and after the conflicts
 - Architecture (intra-space and space/air/ground)
 - Dual-purpose or dual-use system

Space seen as a key contributor to the « Global Information Grid »

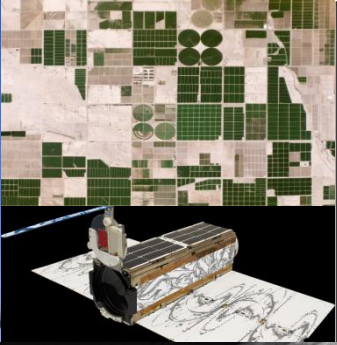
This evolution is described in most of the recent strategic documents published by the main space fairing countries or organizations (e.g. European Union)



“Space policy” references have changed : Why ?

- The “2nd and 3rd Layers” have brought more complexity
 - Change of international context
- The rise of new space actors
 - New “space” nations (almost 70 countries owning at least one satellite in orbit)
 - Europe, other countries (India, China, Israel, ...) have all emerged as space actors in the last decades. Others have emerged since !
 - Very different national interests and cultural, historical, economic contexts
 - May translate into different space programmes and interests
 - “New space” / private actors

A New Era in Spaceflight

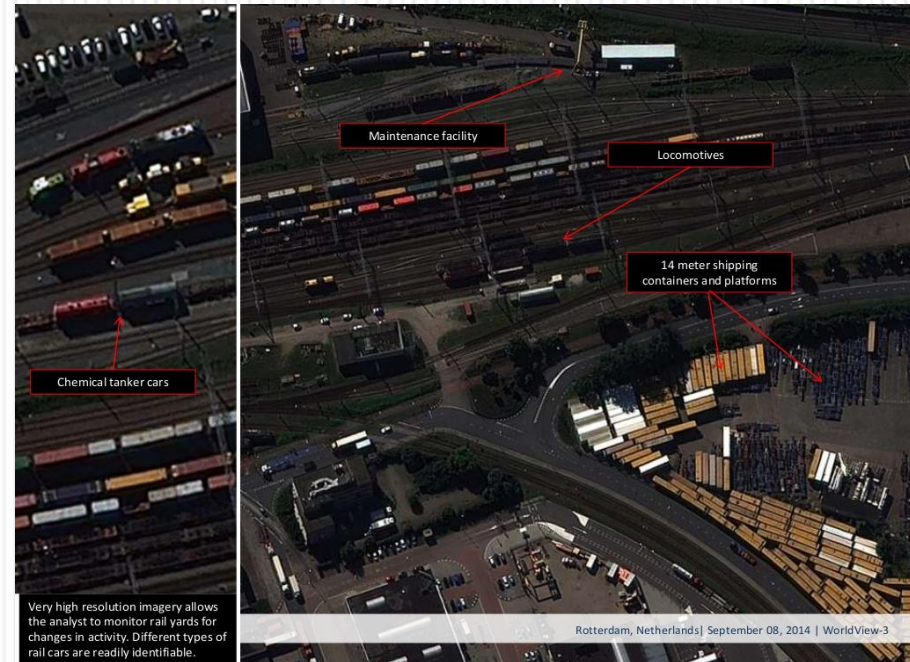
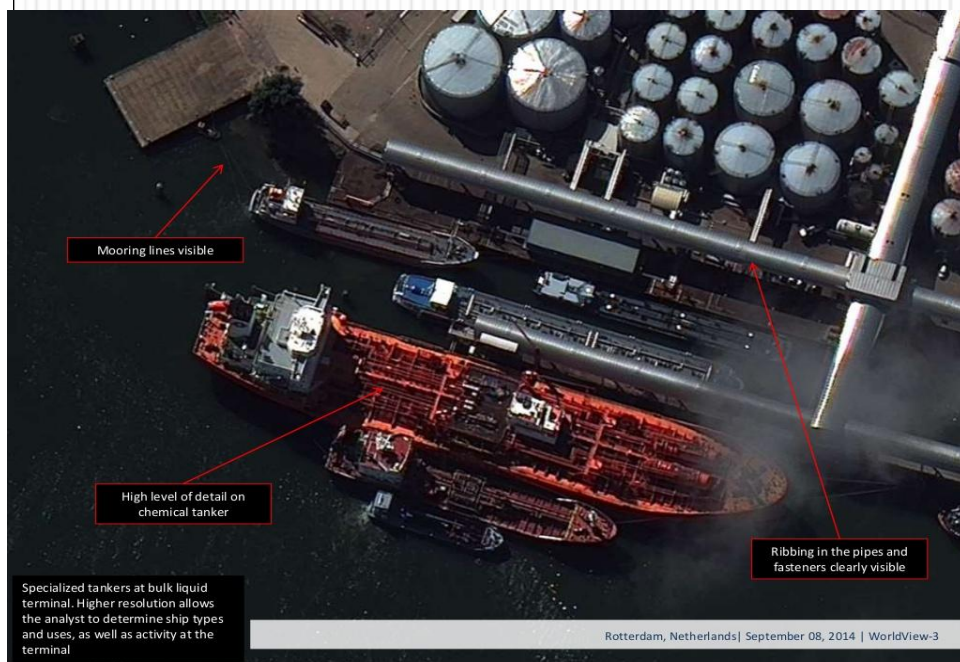


TRILLIONS \$ AWAIT

Jesús Díaz · GIZMODO



Commercializing space in the 90's : sowing the seeds of the New Space





DigitalGlobe™

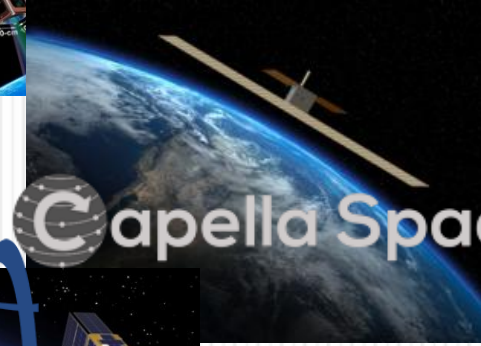
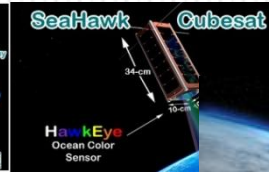
2000's: The rise of the space "Start-ups"

The screenshot shows the Planet EyeFind interface. On the left, there's a table of image acquisitions:

Image	Acquired at	Clouds	Black Fill	Catalog ID
	2016-05-15	0	0	25692000
	2016-05-31	8	0	25948626
	2016-05-09	8	0	25620078
	2016-05-28	9	0	25901712
	2016-05-12	11	0	25697597
	2016-05-22	14	12	25805350

The map shows a grid over Nevada, with labels for Medford, Twin Falls, Humboldt-Toiyabe National Forest, Las Vegas, Long Beach, and Tijuana, Mexico. A scale bar indicates 100 km.

planet.



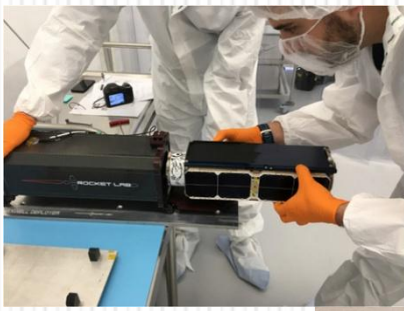
Capella Space



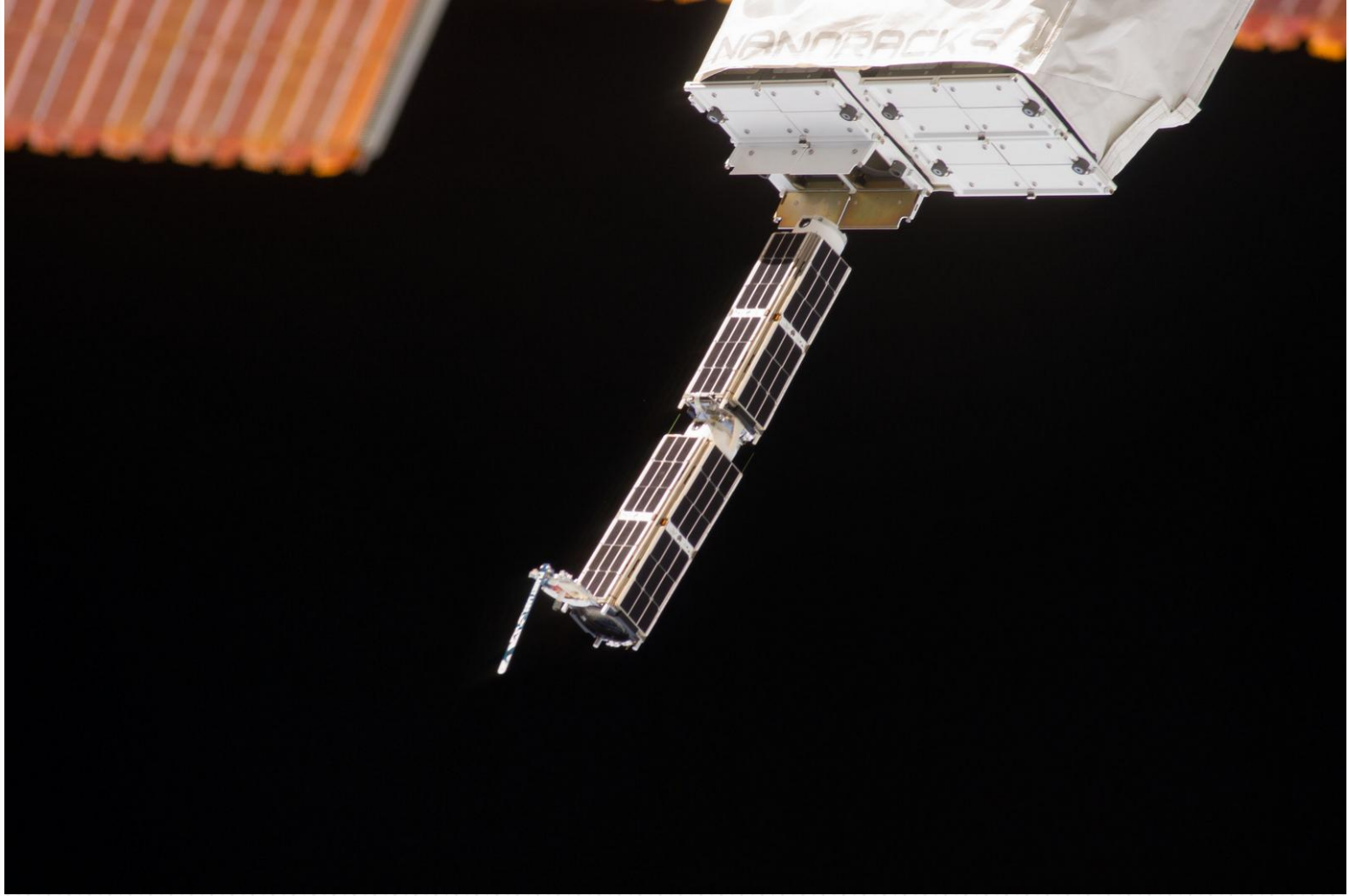
BLACK SKY

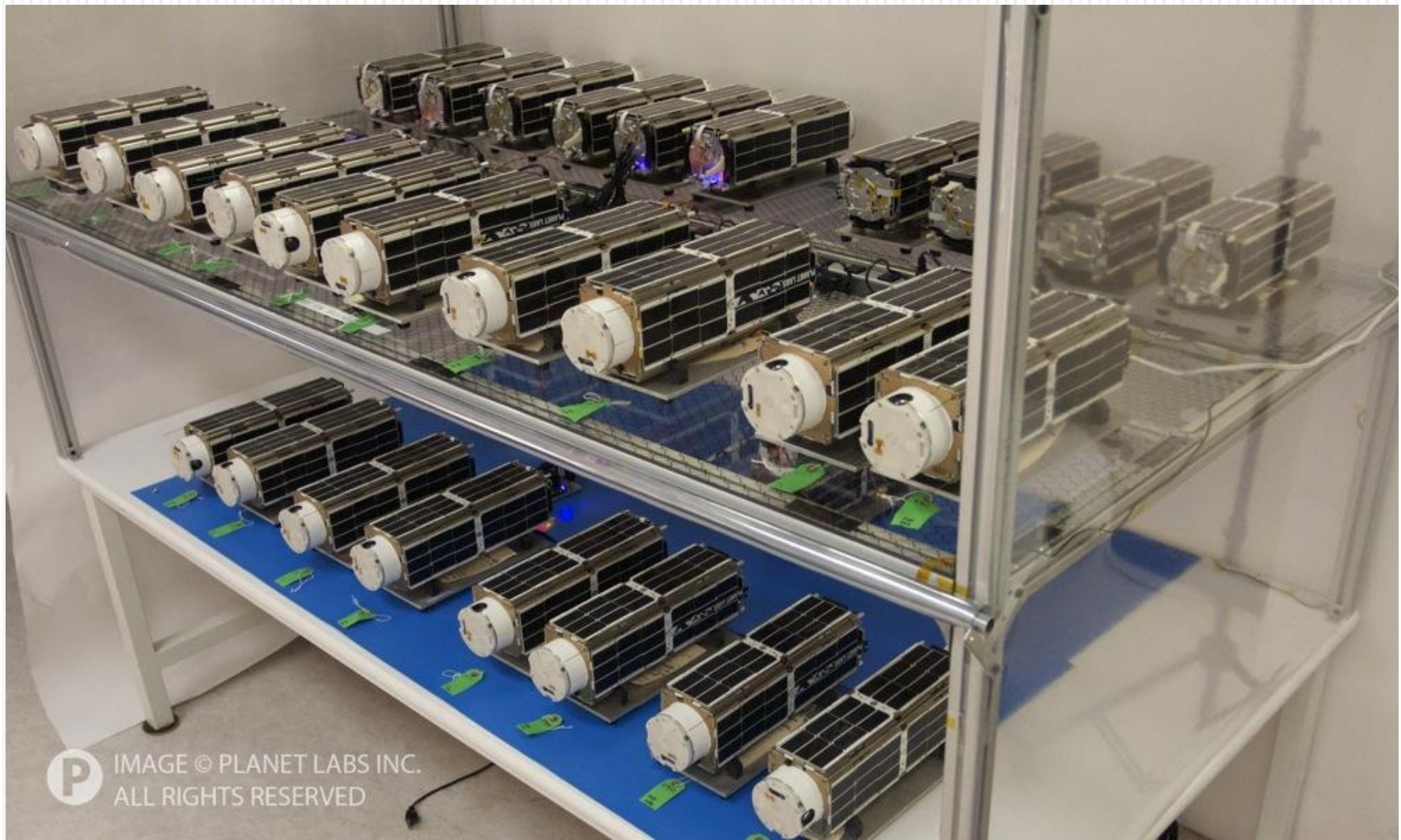


HySpecIO



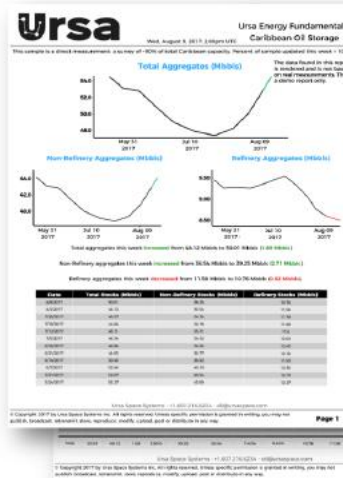
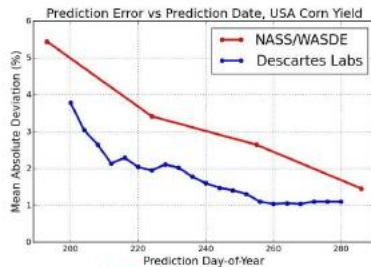
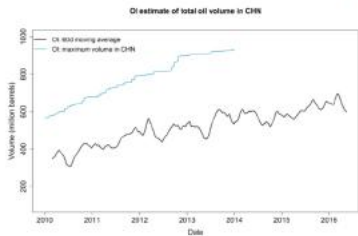
2000's: The rise of the space "Start-ups"





Down stream activities ?

Orbital Insights

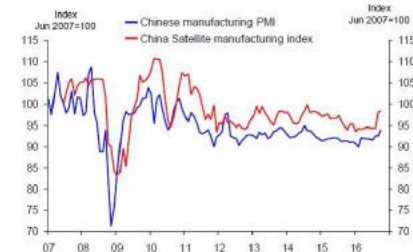


Geospatial analytics & insights



Online decision support & data science

Less China risk going into December FOMC meeting: China satellite manufacturing index jumped in September and October



The SpaceKnow satellite index monitors over 6,000 industrial facilities all across China from space imagery and uses proprietary algorithms to measure level of manufacturing activity. Bloomberg Index: SPCICOM Index. Source: OPL, SpaceKnow, Hover Analytics, Bloomberg Finance L.P., DB Global Markets Research. Deutsche Bank Research | Twitter: @db, www.db.com | +1 212 250-2155 | November 2016 | 72

The Chinese reaction

MAPPING OF CHINA'S NEWSPACE

GENERAL VERSION
MARCH 2019



UPSTREAM

SATELLITE MANUFACTURING



LAUNCHER MANUFACTURING



DOWNSTREAM

SATELLITE OPERATORS



GROUND SEGMENT



OTHER



SATELLITE SERVICE PROVIDERS



CHINA-AEROSPACE.BLOG

The European reaction

Mapping of Newspace startups – Europe

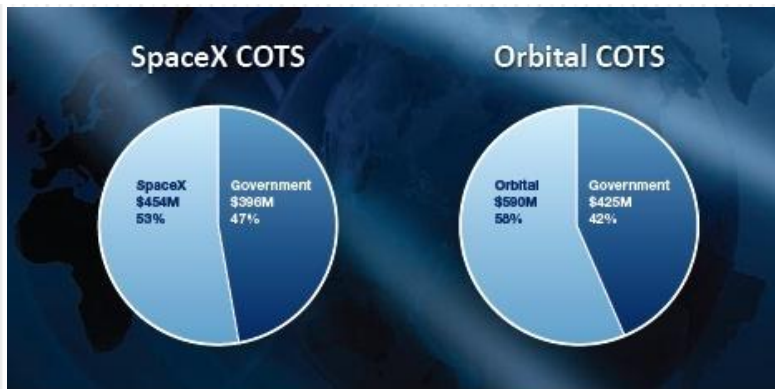


Sources: Guilhem de Vregille, Léa Philippot – VCs @ XAnge

The rise of “commercial” space-service providers



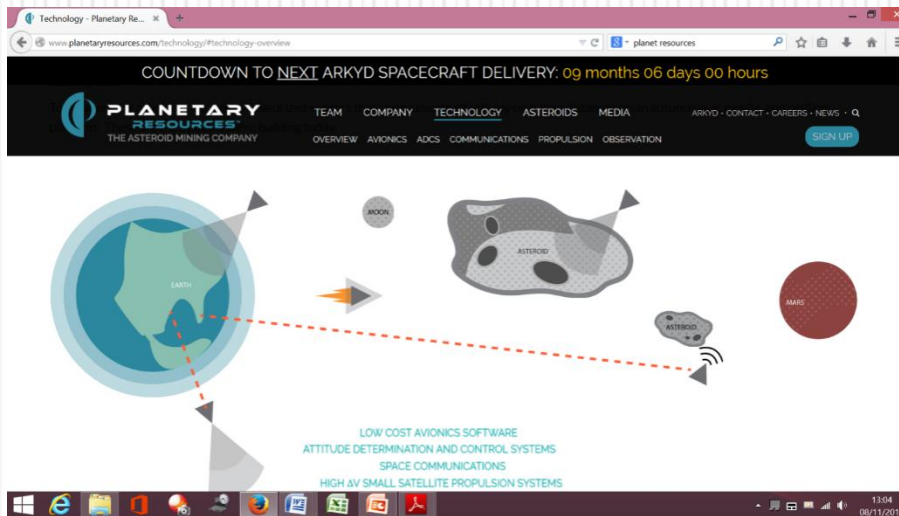
Launch Vehicle	Orbital Antares	SpaceX Falcon 9
Height	40.1 m	48.1 m
Diameter	3.90 m	3.66 m
Mass at Launch	275,000 kg	313,000 kg
Payload to International Space Station Orbit	5,200 kg	9,800 kg
First Stage		
Thrust	3.27 MN (735,000 lbs)	3.80 MN (854,000 lbs)
Propellant	LOX and RP-1	LOX and RP-1
Second Stage		
Thrust	322 kN (72,000 lbs)	414 kN (93,000 lbs)
Propellant	Solid propellant	LOX and RP-1
Cargo Spacecraft	Orbital Cygnus	SpaceX Dragon
Height	5.1 m	5.1 m
Diameter	3.05 m	3.66 m
Maximum Pressurized Cargo		
Up Mass / Volume	1,700 kg / 18.75 m ³	3,310 kg / 6.8 m ³
Down Mass / Volume	2,000 kg / 18.75 m ³ disposed	2,500 kg / 6.8 m ³
Maximum Unpressurized Cargo		
Up Mass / Volume	0	3,310 kg / 14 m ³
Down Mass / Volume	0	2,600 kg / 14 m ³ disposed



The rise of “commercial” space-service providers

- Commercial Crew Development (CCDev): 2009
 - CCDev 2 : 2011
 - CC Integrated Capability: 2012
 - Boeing, Space X, Sierra Nevada
- Commercial Crew Transportation Capability: 2014-2017
 - Boeing, Space X
- Commercial Resupply Service (Round 1)  2017-19
- Commercial Resupply Service (Round 2)  2024

- Public budget have played a key role in the rise of commercial space
- Commercial space can only develop if it makes sense and is supported politically



- Commercial Space Launch Competitiveness Act (Nov. 2015)
- Moon Express, etc.

"Controlled space" as a 4th layer: Towards a new international political and legal era ?

- As soon as the end of the 90s, space has been perceived as a new vulnerability given its increasing role in Defense and security at large
 - Space applications have gained a major economic and societal role, involving human security
 - Ex : Defense Directive 3100/10, 9/07/1999 (SecDef Willam Cohen): Space as a « National vital interest for the U.S. »

- From the « sanctuary » approach to a « contested, congested and competitive » view of space

"Controlled space" as a 4th layer : Towards a new international political and legal era ?

- **Military aspects:** emergence of a "space control" doctrine
 - Example: Counter Space operations (AF doctrine document – September 2004)
- Three pillars:
 - Space monitoring and situational awareness
 - Defensive counterspace
 - Offensive counterspace
- Change of era:
 - Resurgence of ASAT experiments in an unregulated space world
 - Chinese ASAT test in January 2007
 - U.S. ASAT event in February 2008
 - Indian ASAT Test in March 2019...
 - Emergence of « counterspace » related experiments
 - Increased jamming, cyber threats, etc.

"Controlled space" as a 4th layer : Towards a new international political and legal era ?

-Diplomatic aspects:

-change of strategic context =>New legal initiatives to "regulate" such activities as well as to face the problems related to an ever more intensive international occupation of space:

- International Code of Conduct initiative (European Union), mid-2007
 - Space operations
 - Debris
 - Pre-notifications
 - Informations, consultations
- Chinese-Russian PPWT project, 2008
 - Prohibition of weapons deployed in space
- UN initiative for the sustainable development of space activities, COPUOS, 2009
 - Long Term sustainability of space (debris, spectrum, traffic, space weather, etc.)
- GGE under the auspices of the UNGA (2012-Juillet 2013)
 - First and unique framing document agreed upon by main space powers
- GGE PAROS under the auspices of the Disarmament Conference in Geneva
 - Difficult work underway



General Assembly

Distr.: General
29 July 2013

Original: English

Sixty-eighth session
Item 99 (c) of the provisional agenda**
General and complete disarmament: transparency and
confidence-building measures in outer space activities

Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities

Note by the Secretary-General

The Secretary-General has the honour to transmit herewith the report of the Group of Governmental Experts on Transparency and Confidence-Building Measures in Outer Space Activities. The Group was established pursuant to General Assembly resolution 65/68.

Exchanges of information on forecast natural hazards in outer space

40. In accordance with the Outer Space Treaty, States should immediately inform other States or the Secretary-General of the United Nations of any phenomena they discover in outer space, including on the Moon and other celestial bodies, which could constitute a danger to the life or health of astronauts or to human spaceflight activity. States should also consider providing, on a voluntary basis, timely information to other governmental and non-governmental spacecraft operators of natural phenomena that may cause potentially harmful interference to spacecraft engaged in the peaceful exploration and use of outer space.

Notification of planned spacecraft launches

41. States should provide pre-launch notifications of space vehicle launches and the mission of launch vehicles. The Group noted that the Hague Code of Conduct against Ballistic Missile Proliferation provides an example of such a notification.

69. The Group endorses efforts to pursue political commitments, for example, in the form of unilateral declarations, bilateral commitments or a multilateral code of conduct, to encourage responsible actions in, and the peaceful use of, outer space. The Group concludes that voluntary political measures can form the basis for consideration of concepts and proposals for legally binding obligations.

Extracts

Exchanges of information on orbital parameters of outer space objects and potential orbital conjunctions

39. Exchanges of information on the basic orbital parameters of outer space objects may assist in increasing the accuracy of the tracking of space objects. Specific measures could include:

(a) Exchange of information on the orbital elements of space objects and the provision, to the extent practicable, of notifications of potential orbital conjunctions involving spacecraft to affected government and private sector spacecraft operators;

(b) Provision of registration information to the United Nations as soon as practicable, in accordance with the Convention on Registration of Objects Launched into Outer Space (1975) and General Assembly resolution 62/101, entitled "Recommendations on enhancing the practice of States and international intergovernmental organizations in registering space objects";

(c) Provision of public access to national registries of space objects.

Such notifications, through bilateral, regional and multilateral mechanisms, can provide transparency regarding specific space activities. Shared awareness of spaceflight activity may foster global spaceflight safety and contribute to avoidance of mishaps, misperceptions and mistrust.

"Controlled space" as a 4th layer : Towards a new international political and legal era ?

- New legal and policy-oriented norms aiming at preventing the development of conflicts in space and at promoting better transparency and
 - Prevention of the development of space weapons
 - Curbing the causes of satellite destructions (debris, intentional activities)
 - Management of orbital positions and traffic
 - Management of radio interferences

Many actors are involved while heavy political issues are at stakes:
overarching organization not reached yet



THANK YOU

ANY QUESTIONS ?