

# **TOWARDS A « NEW ECONOMICAL SPACE »**

EUCASS - 3AF – 29th june 2022

**Observatoire du spatial**

Murielle Lafaye, Deputy director

## Space Economy Observatory at CNES : EI & Space foresight

**Elaborate and share a common understanding on the context, markets, actors, on-going evolutions and their impacts on space ecosystem**

- ❖ **Developing an autonomous survey capability** for a high level knowledge
- ❖ **Elaborating a common vision/understanding** by mobilising collective intelligence
- ❖ **Analysing evolutions** at short and mid term (context, actors, opportunities,...)
- ❖ **Anticipating impacts** on space ecosystem (industry, services, science, academia)
- ❖ **Become a reference for space economy & foresight**
  - for CNES,
  - for Ministries,
  - for space ecosystem and partners

## Space economy is transforming rapidly

A new « race for space »

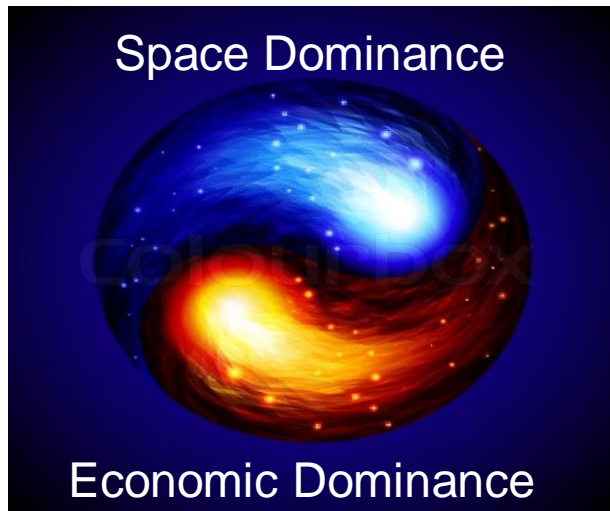
USA, China, Europe...and many other countries

A paradigm shift

a « space as a service » economic model

Space sector is digitalising

Private investments are rising



Space logistics costs are falling

New businesses are emerging

Space, globally

is shifting into

a « new economical space »

## « Race for space »

## USA, China, Europe...



[China's Race to Space Domination](#), an opener illustration and hand-lettering done for *Popular Science Magazine*, October 2016 issue



...and also Russia, Japan, India, UAE, UK...and many other countries !

# Towards a « new economical space »

2022 : **61** Countries have a space agency

2022 Spain



**12** countries

- Brazil
- China
- South Korea
- United States
- Europe
- France
- India
- Iran
- Israël
- Japan
- Russia
- Ukraine

**Have an independant access to space**

**~22** Created since 2000,

**~1 to 2 /year**

## Space agencies budgets - 2021



USA  
NASA ~ 23,27 Md €  
(+2,84%)



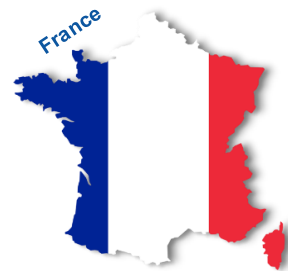
China  
~ 11 Md €



Europe  
ESA ~ 6,49 Md €



Japan ~ 3,47 Md€  
(+23%)



France  
Recovery Plan ~365 M€ +CNES ~ 2,33 Md €  
Space sector



Germany  
DLR ~ 2,22 Md €



Russia  
ROSCOSMOS ~ 2,5 Md €  
(+3%)



India  
ISRO ~ 1,57 Md €

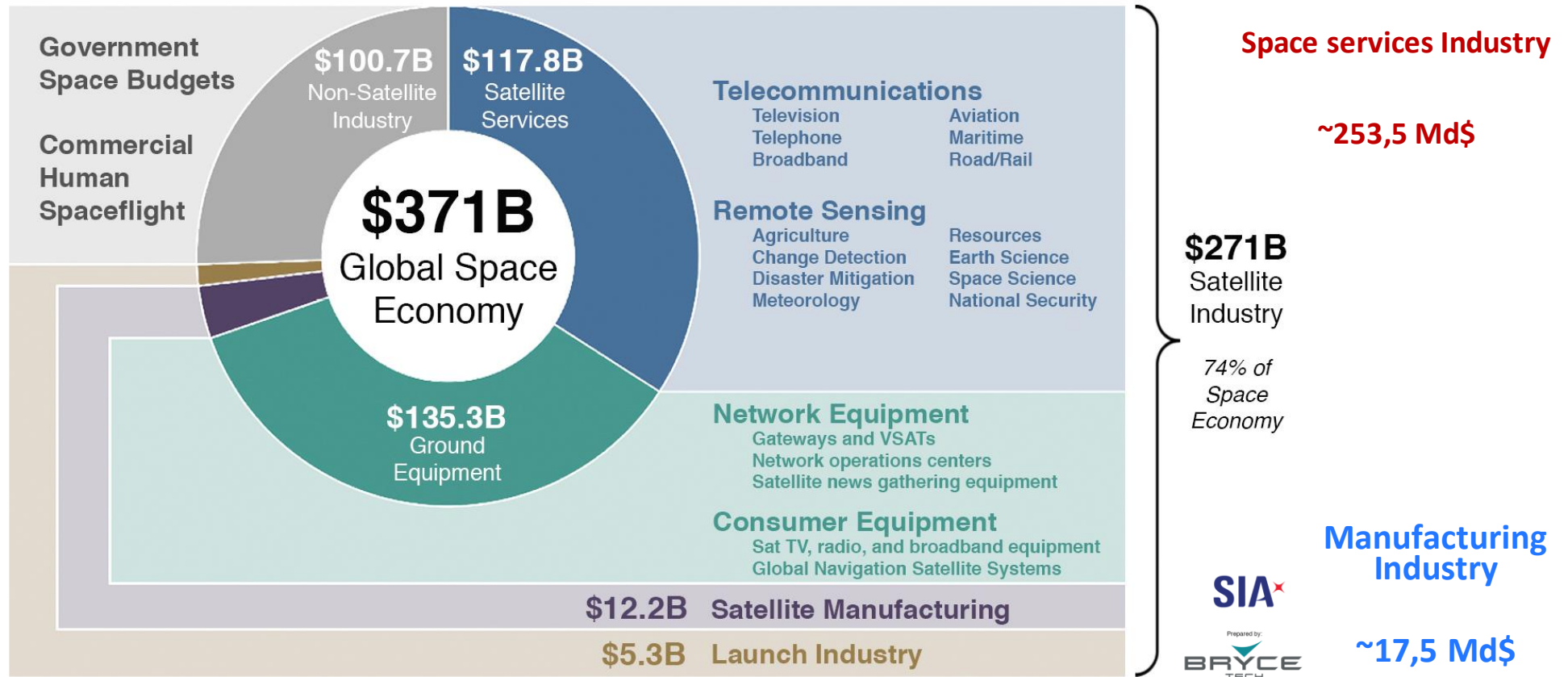
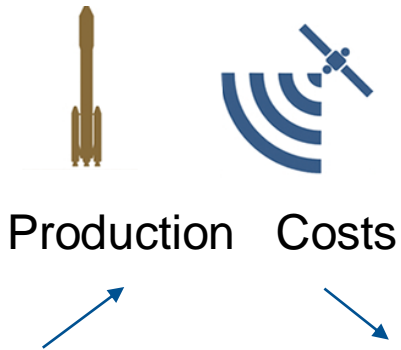
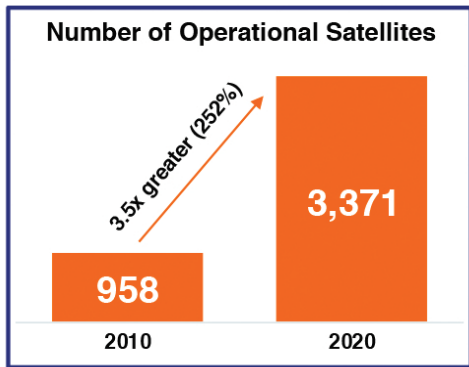
~ 54,5 Md € for 8 major space agencies

## Space economy s transforming : « the next trillion\$ economy »

Morgan Stanley 2018

### The Satellite Industry in Context

(2020 revenues worldwide, in billions of U.S. dollars)



# Towards a « new economical space »

**New actors are « flourishing »...in all sectors  
and Legacy actors are transforming**

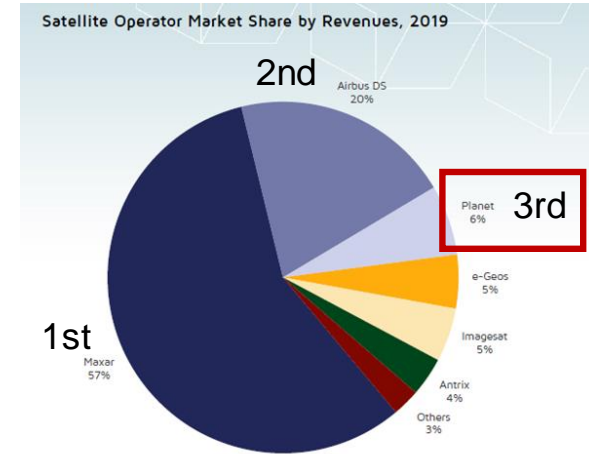
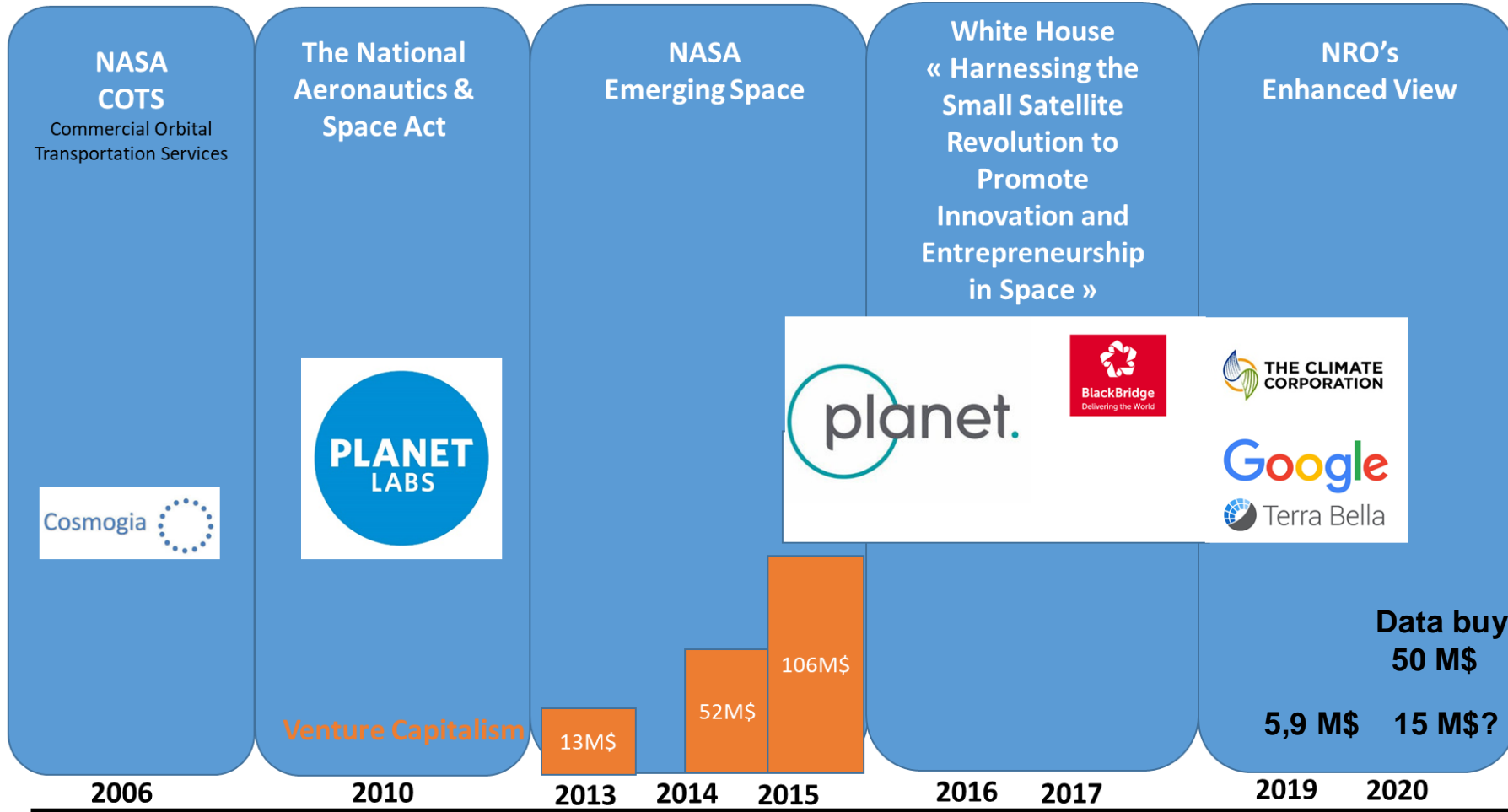




# Towards a « new economical space »

## Legal framework for developping « unicornes »

### An example, Planet, EO services operator & provider



### + SPAC

(special purpose acquisition company)

dMY Technology Group, Inc.

7 July 2021

Valorisation 2,8Md\$

434 M\$ cash

Data buy 50 M\$  
Data buy 100 M\$

5,9 M\$ 15 M\$?

Murielle Lafaye DS/OS

# Towards a « new economical space »

Developping new businesses – Data&sustainable societal challenges  
From space cpaacities... towards a « digitalised space »

## “Space as a service”

A few concrete examples



Defense



Safety & Civil Security



Internet - Digital Divide



Intelligence Reporting



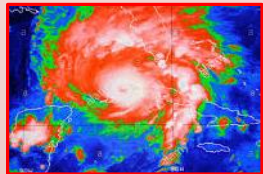
Agriculture



LBS



Oil & Gas



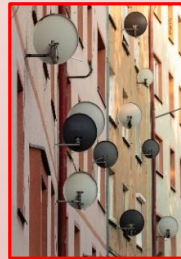
Meteorology



Energy



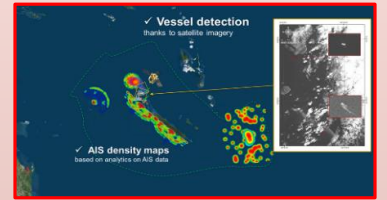
Safer air traffic



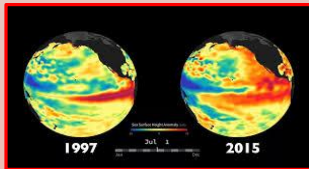
TV



World-wide telecoms



Maritime Surveillance



Climatology



Exploration



Insurance



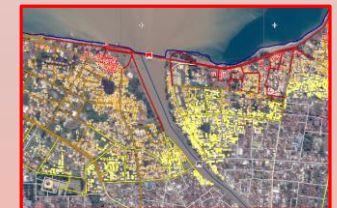
Autonomous car



Stock exchange



ATM



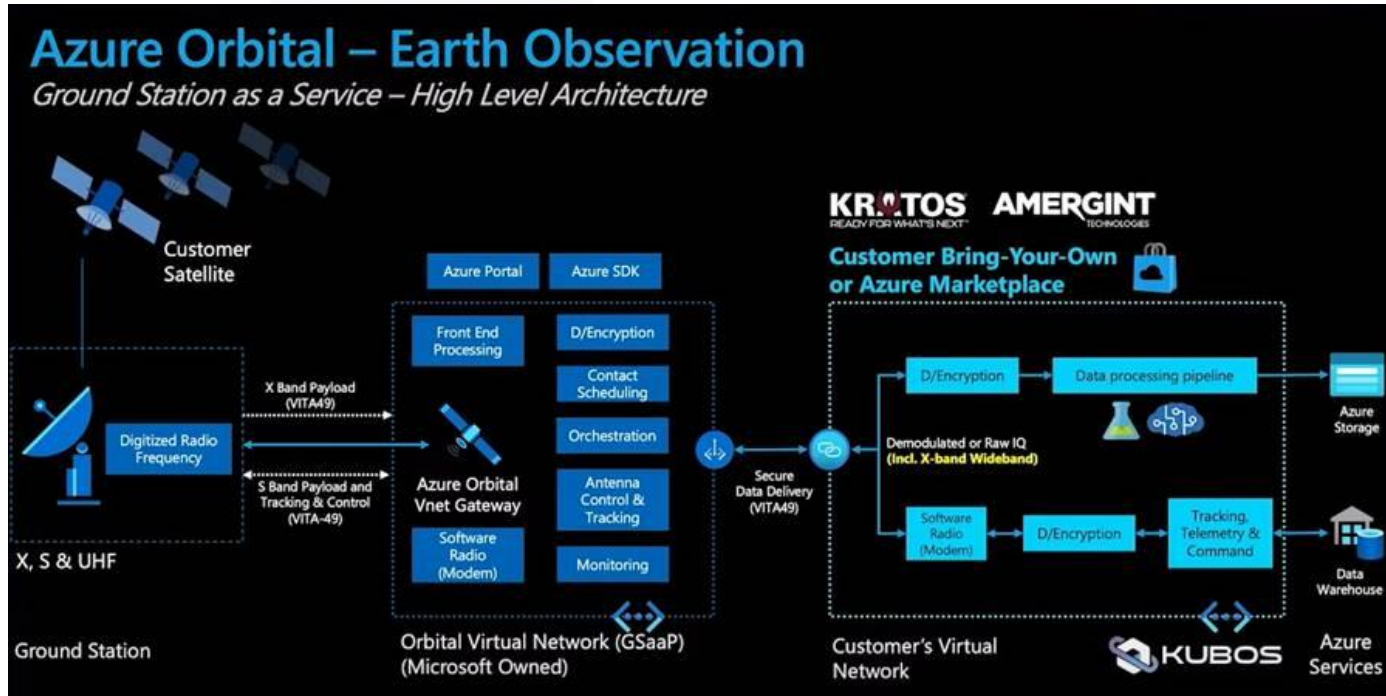
Crisis Management

# Towards a « new economical space »

## Developping new business

Earth Observation h24, 7j/7, day & night

Free Data...ou commercialized



### ML FOR EO MARKET MAP

Landscape of Organizations using Machine Learning Applications with Satellite Data

COMMERCIAL	NON-COMMERCIAL
<b>DATA ANALYSIS &amp; SERVICES</b> sobolt, LHARRIS, TERRASIGNA, OnGeo, MAXAR, planet, azavea, SATELLOGIC, SPACEKNOW, Microsoft, sogeti, AIRBUS, EARTH CUBE, HEXAGON, Rezonet, geo, Ecopia, BLACKSKY, AtlasAI, esri, EARTH BLOX, GSI, 4E, EARTHLABAI, geosys, AISTECH, gtm, AIR, EOX, eagleview, AXELSPACE, CCG, Element, neamap, mdena, TESSELO, ADAM, veraset, SAFEGRAPH, SKYWATCH, CARE, CATALYST, SATELLIGENCE, g1lab	<b>DATA ANALYSIS &amp; SERVICES</b> Radiant Earth Foundation, OAK RIDGE National Laboratory, NASA, USGS, DATA SI, THE WORLD BANK, USGS, DATA SI, WORLD RESOURCES INSTITUTE, Theia, NATIONAL GEOGRAPHIC, SpaceNet, IDinsight, DataKind, Copernicus, CRS, Digital Earth, CADASTA, AIDDATA, esa, DRIVENDATA, FDL, USAID, ZOOVERSE, Open Geo Hub, TERRA EO, vito
<b>ANALYTICS PLATFORMS</b> OnGeo, up42, TERRASIGNA, OnGeo, GSI, AWS, HEXAGON, SPATIAL, HYPERVERSE, SENERGY, ToQadam, [tile]DB, Microsoft, ANALYTICS, Google Cloud, CARTA, AIRBUS, Pura Data Analytics, aerospacelabs, esri, MAXAR, GEO Analytics Canada, Earthstar, Picterra, CATALYST, g1lab	<b>ANALYTICS PLATFORMS</b> OPEN DATA CUBE, Theia, EARTH MAP, TERRA EO, open EO, QCIS, PANGEO, vito
<b>LABELING SOLUTIONS</b> OnGeo, up42, TERRASIGNA, OnGeo, GSI, AWS, HEXAGON, SPATIAL, HYPERVERSE, SENERGY, ToQadam, [tile]DB, Microsoft, ANALYTICS, Google Cloud, CARTA, AIRBUS, Pura Data Analytics, aerospacelabs, esri, MAXAR, GEO Analytics Canada, Earthstar, Picterra, CATALYST, g1lab	<b>LABELING SOLUTIONS</b> OnGeo, up42, TERRASIGNA, OnGeo, GSI, AWS, HEXAGON, SPATIAL, HYPERVERSE, SENERGY, ToQadam, [tile]DB, Microsoft, ANALYTICS, Google Cloud, CARTA, AIRBUS, Pura Data Analytics, aerospacelabs, esri, MAXAR, GEO Analytics Canada, Earthstar, Picterra, CATALYST, g1lab
<b>COMPETITION PLATFORMS</b> OpenANALYTICS, Alcrowd, kaggle, topcoder, HexagonML, ZINDI	<b>COMPETITION PLATFORMS</b> DRIVENDATA
<b>DATA ACCESS AND STORAGE</b> MAXAR, CCG, planet, Microsoft, neamap, earth, Google, Capella Space, Element, Earthstar, AWS, Verisk, HEXAGON, aerospacelabs, ONDA	<b>DATA ACCESS AND STORAGE</b> Radiant Earth Foundation, NASA, Copernicus, Open Geo Hub, USGS, USA, USGS, NASA, SpaceNet, esa, AXA, CBERS, Copernicus, AIDDATA, TERRA EO, esa, EUMETSAT, ONDA

**HOW TO ADD ORGANIZATIONS**  
 Are there organizations that should be included on our list? Please click the link below to submit their names:  
<http://bit.ly/MissingML4EOOrgs>

MANAGED BY  
 Radiant Earth Foundation

LAST UPDATED: JANUARY 2021

# Towards a « new economical space »

## Access to space – Space logistics costs are shrinking



### Falcon-9



~1M\$ for 200 kg in SSO  
⇒ ~5000\$ per kg

~2M\$ for 100 tons in LEO  
⇒ ~20\$ per kg ?

Verticalisation  
Reusability

SPACEX



### Starship



### Chang Zheng

(Longue Marche)

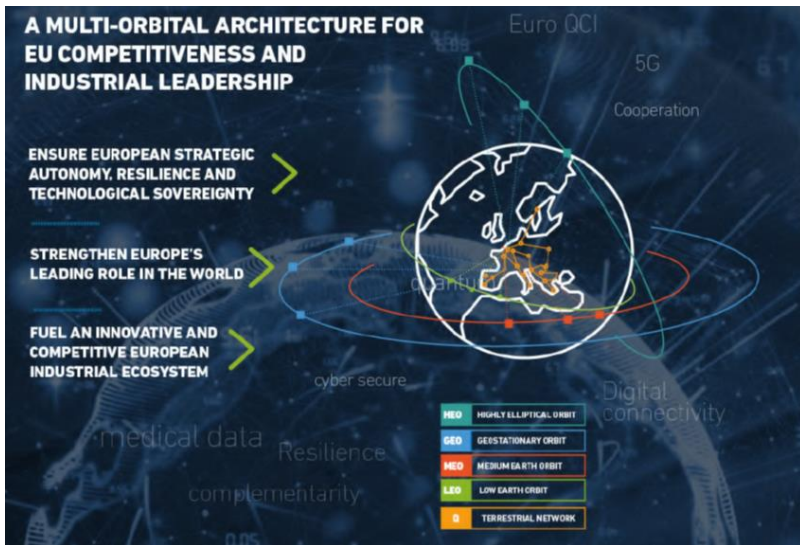


CNSA

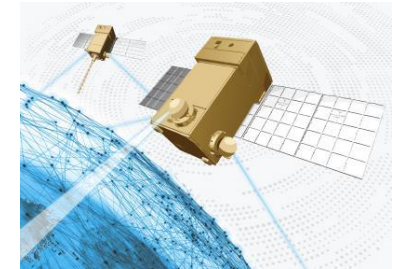
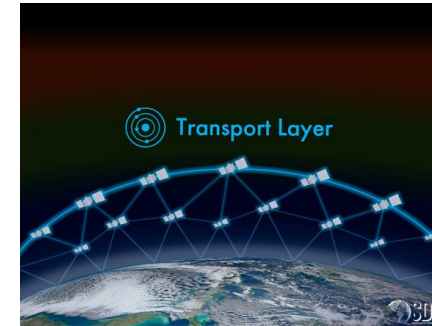
## Developping new businesses – Constellations

### Internet connectivity ... an Earth to Space digital continuum

Cloud-based approach  
ISL  
On board hedge computing  
SDR mission  
Agility in orbit and between orbit plans



### Civils & Defence needs



Starlink  

StarNet 

OneWeb 

Telesat 

# Towards a « new economical space »

## Developping new businesses

Internet connectivity in an Earth to Space digital continuum

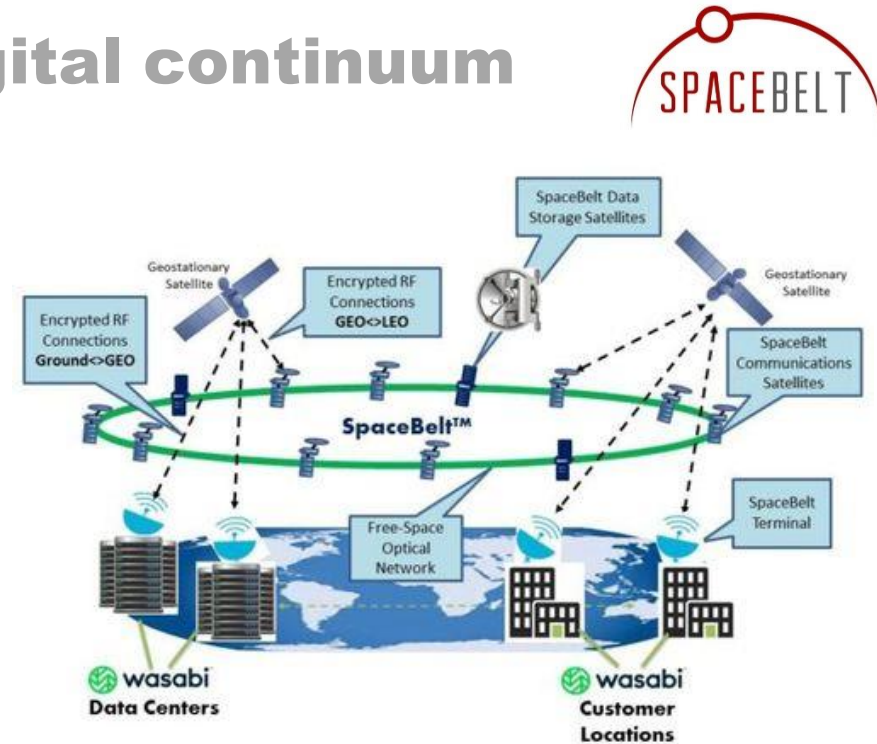
## Data centers & « space clouds »



UNIBAP

“NASA selects Unibap as provider of 25 SpaceCloud units for Distributed Spacecraft Autonomy research”,  
11 février 2021

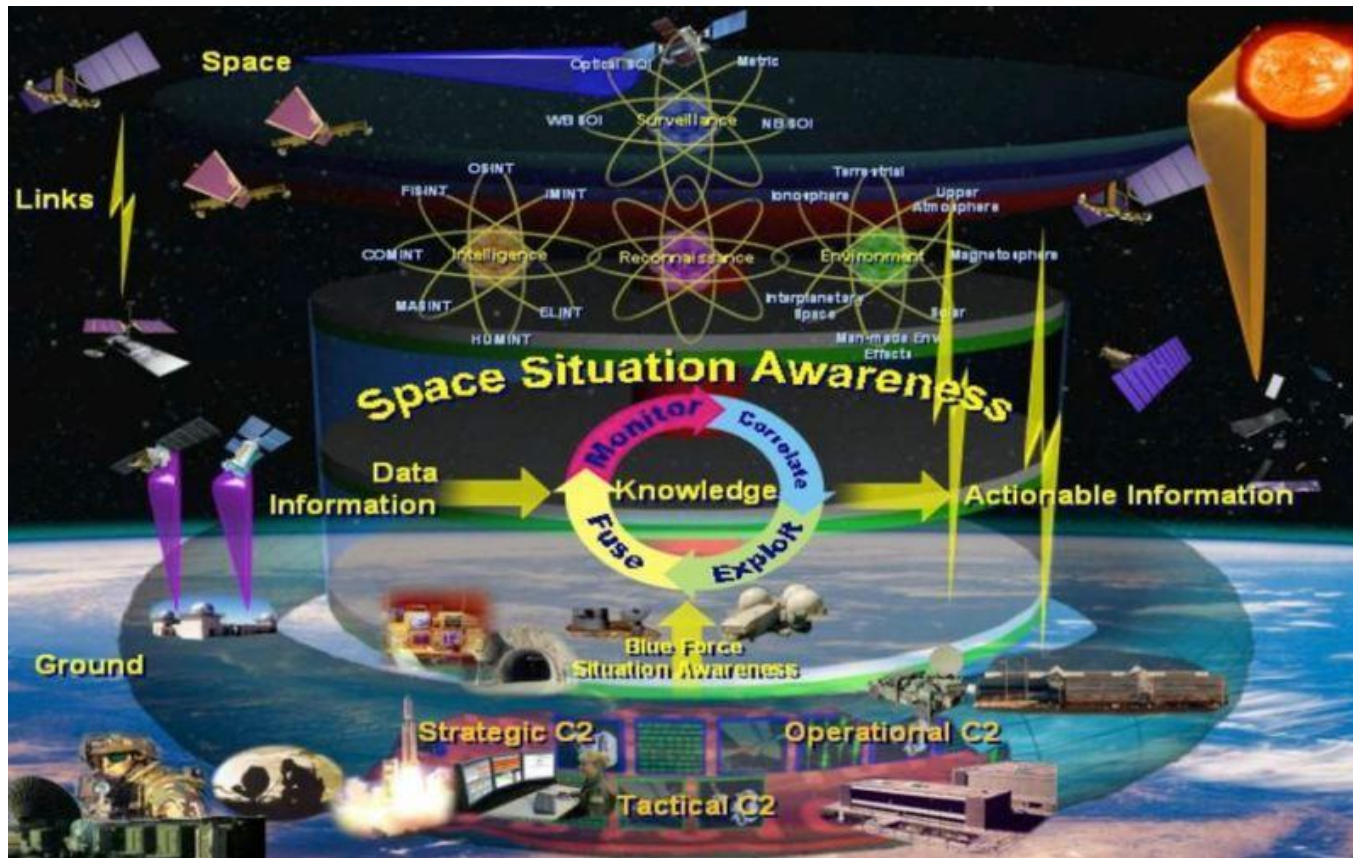
<http://www.publicnow.com/view/9AED9DD7AA4DBBE6A16544FA3462401FF8F17E6A?1613040967>



30 june 2020 AWS set Aerospace & satellite (A&S) solutions

## Developping new businesses – « actionnable intelligence »

SSA, STM : « who is there », « who is doing what? »



Lockheed Martin



**Observe  
Listen  
Connect**

**and**



Meta-constellation : <https://www.youtube.com/watch?v=Tg1dQjtN5jM&t=2s>



**Reconfigure  
systems in  
dynamique**

## Developping new businesses – IoS, ADR, SSA

### In-orbit servicing

Life extension

Relocation

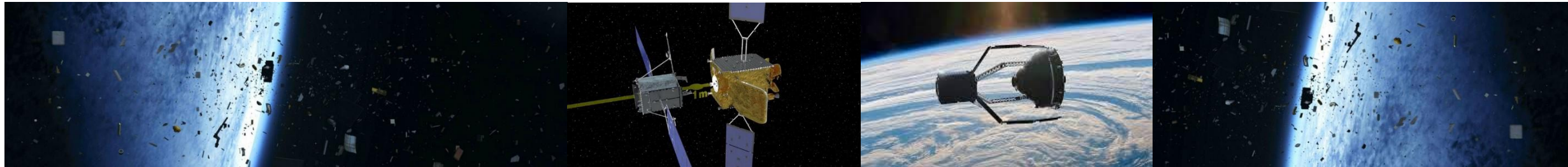
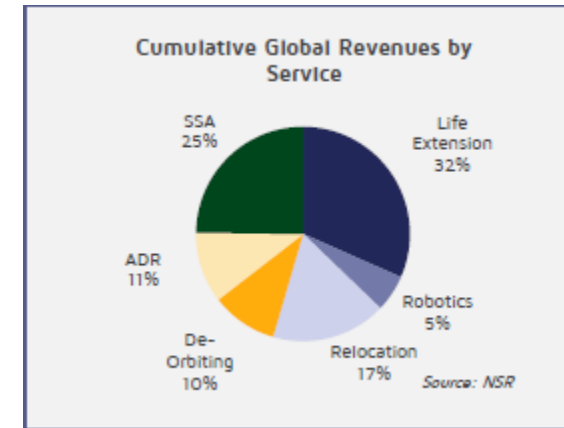
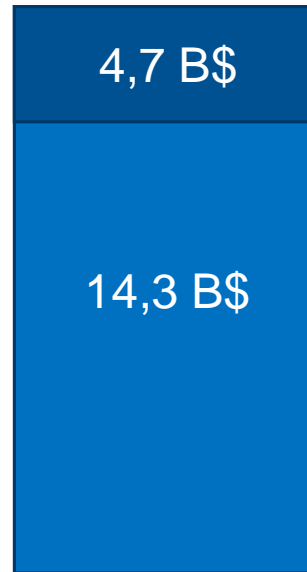
De-orbiting

Robotics

### Active debris removal (ADR)

### Space situational awareness (SSA)

2021-2031





# Towards a « new economical space »

## Developping new businesses – Space tourism

Market ~500 M\$ 2022 ~3,5 Md\$ 2030 source NSR

### Hotel in space



**AXIOM**  
SPACE

ThalesAlenia Thales / Leonardo company Space will build the habitation modules  
~55 M\$ per stay

### Seeing our planet Earth



VSS22, 11th July 2021  
~450 k\$ per seat  
**Virgin GALACTIC**



**SPACEX**



Inspiration4, 16th september 2021



VSS22, 20th July 2021

**BLUE ORIGIN**

## Developping new businesses – Private Space stations



ISS



Private space station



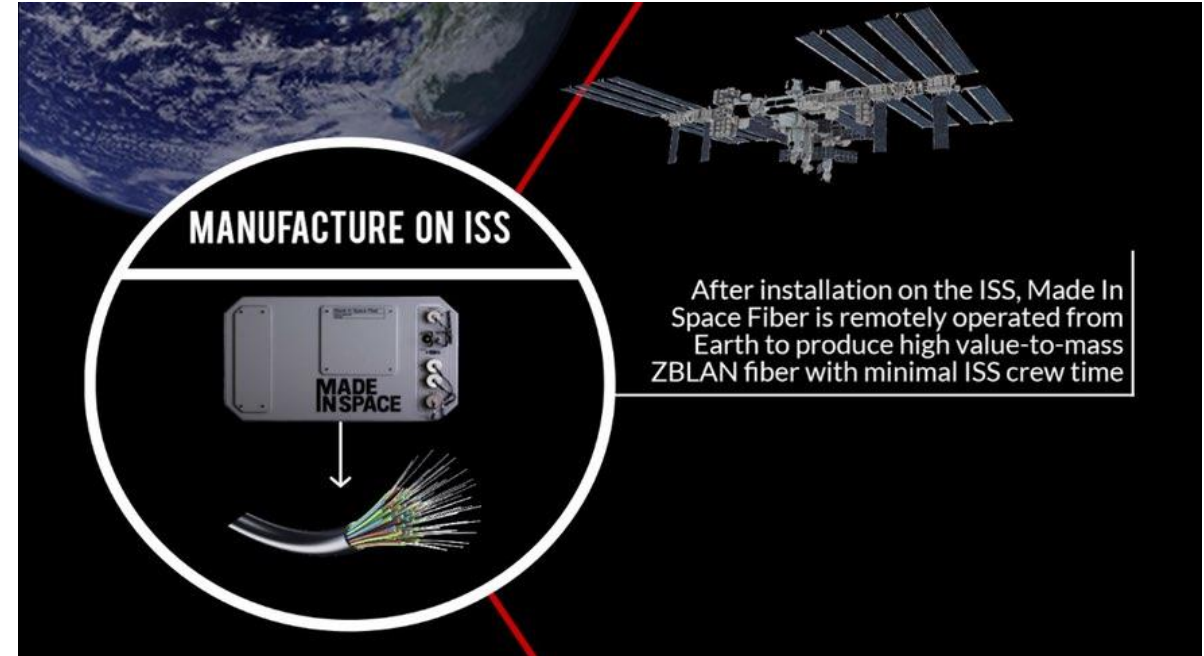
Tian He



## Developping new businesses – Manufacturing in space

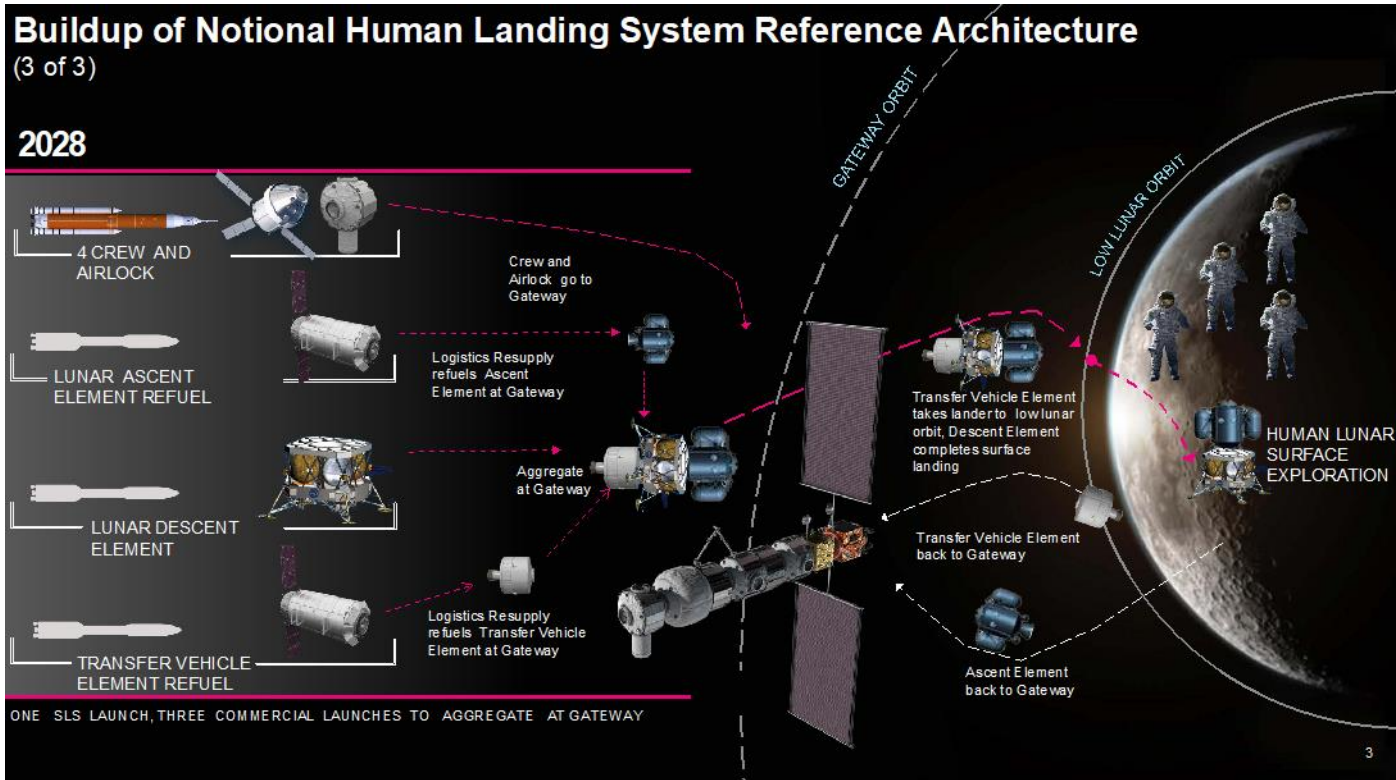


Projet Archinaut



## Developping new businesses – Lunar logistics and ISRU

Towards a sustainable human presence on the Moon



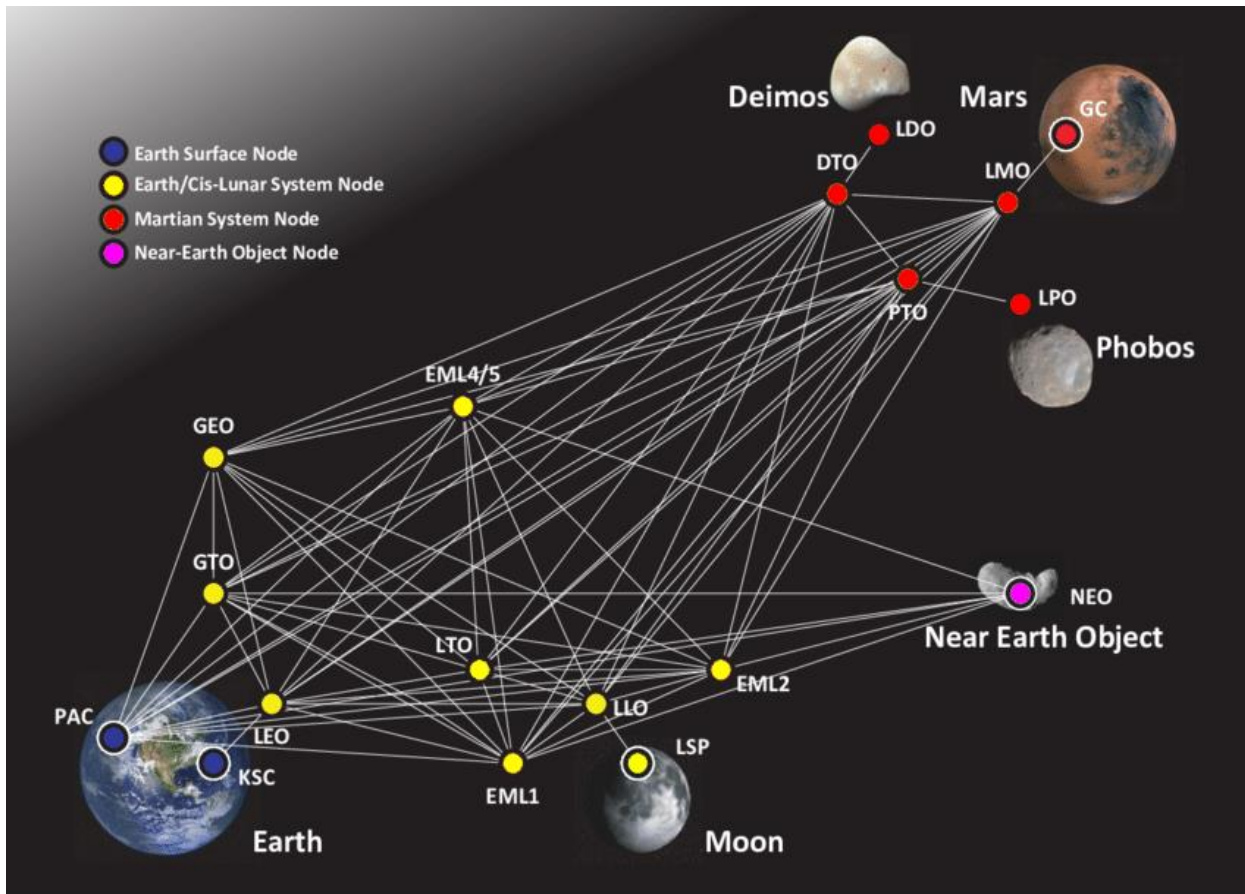
Projet Selenia – Real Dream



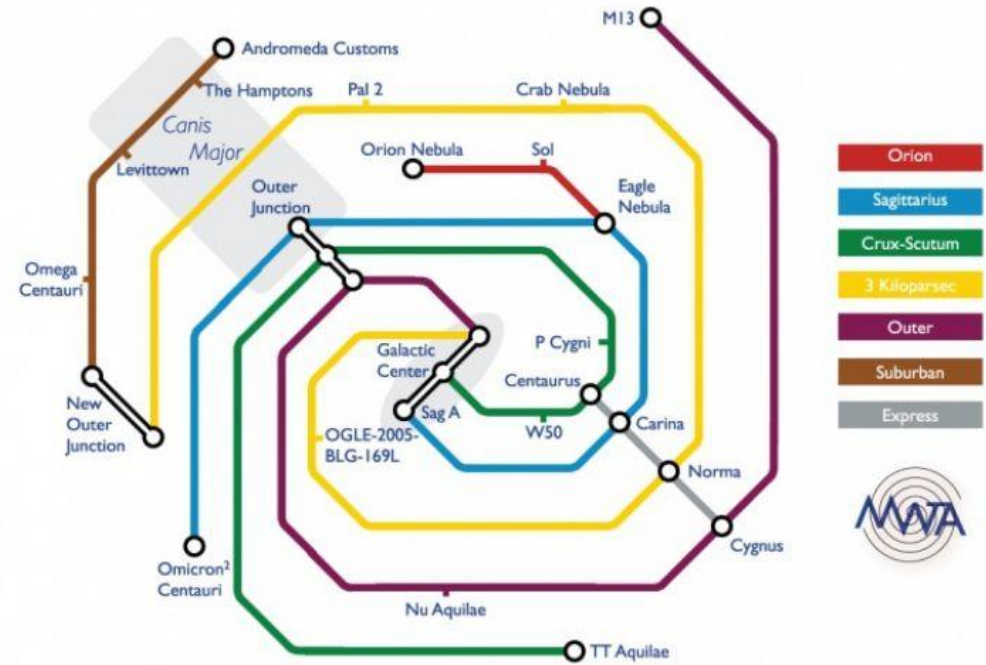
Factor-Tech Magazine

# Towards a « new economical space »

## Foresight – A « new economy for space in LEO and deep space » ...developping space logistics on a « solar system » scale



ResearchGate



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*Sharing ideas...  
creating value*

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