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Satellite platforms

New Space Economy

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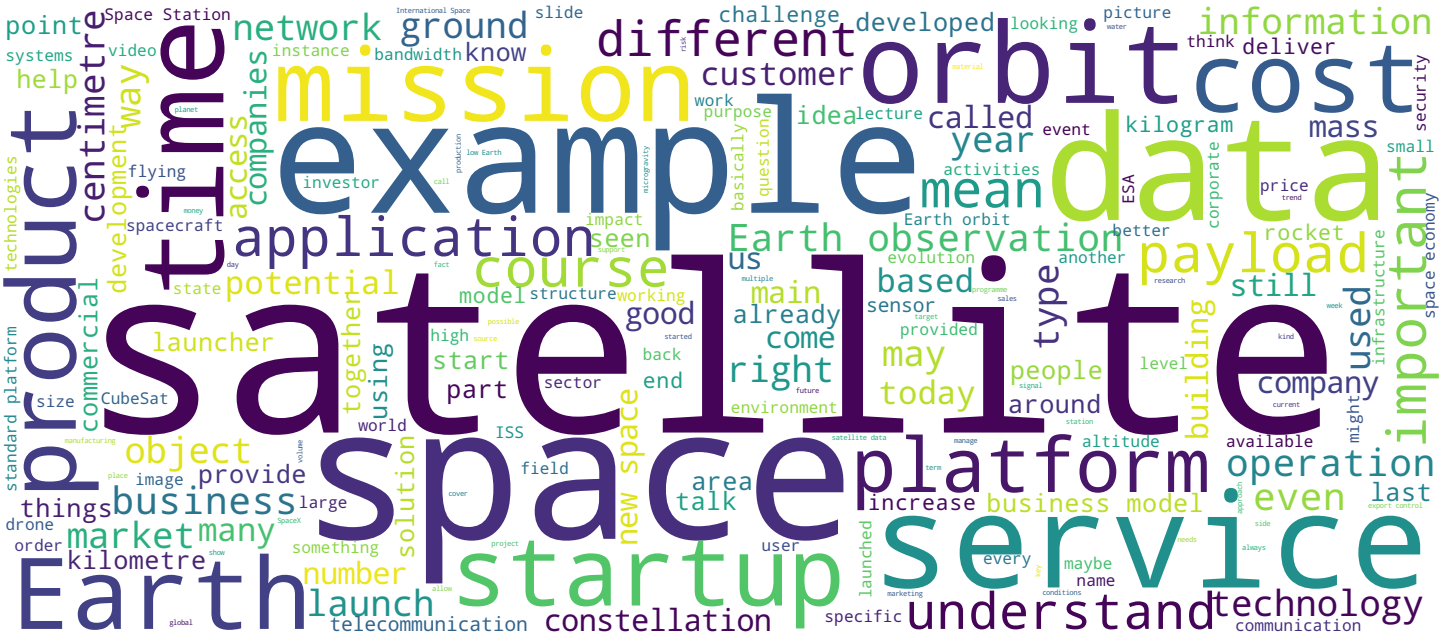

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Agenda

- What do we understand by “satellite platforms”?
- Why it matters?
- What will be the evolution?

Welcome for this session of the MOOC New Space Economy. My name is Grégoire Bourban, Deputy Head of Space Innovation at the Swiss Federal Institute of Technology in Lausanne - EPFL, and I will cover the topic of satellite platforms. In the first slides, I will give definition of what we understand by satellite platforms and provide some examples. Then we will see why it is important and why we should consider it when defining a business model based on satellite infrastructure, we will finish with some ideas on future evolutions in this domain.

Notes

Summary

0m 05s

Satellite platforms vs Payloads

- The **platform** (or bus) of a satellite is the structure on which the **payload** (sensor, scientific instrument, telecommunication system…) will be mounted.
- The trend is to develop standard platforms which can adapt many different payloads for different orbits.
- This can be seen as a car chassis in the automotive industry shared among different brands.

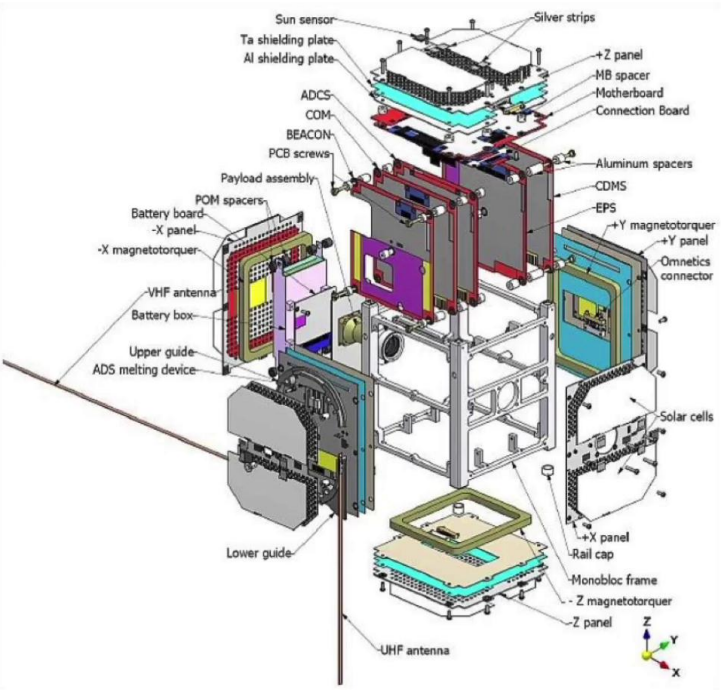
The platform or bus of a satellite is the structure on which the payload, it could be a sensor, could be a scientific instrument, a telecommunication system will be mounted. The trend is to develop standard platforms which can adapt many different payloads for different orbits. This can be seen as a car chassis in the automotive industry, shared among different brands.

Notes

Summary

0m 43s

SwissCube



Credit: EPFL

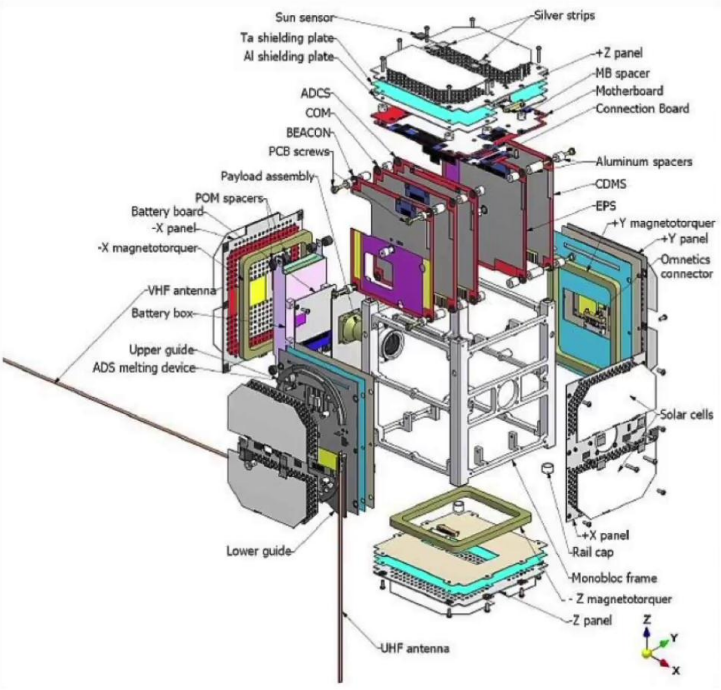
Let's take the example of SwissCube, a student satellite developed at EPFL and launched in 2009. The satellite was developed as 1-Unit CubeSat 10 by 10 by 10 centimetre, a standard established at Caltech in the 90s. In the exploited picture, you see all the subsystems of the satellite from the structure, here the frame in aluminium, to the solar cells on each faces of the satellites, with the attitude and orbit control system, the onboard computer and the batteries inside the satellite. In the middle of this picture you see the payload, which was a small telescope. It was used to observe a phenomenon called airglow. Keep in mind the full satellite was 10 by 10 by 10 centimetres, so very small and very compact setup. SwissCube was fully developed from scratch, an integrated commercial off the shelf components to keep the cost low. Since then, a multitude of companies based their business on the development of parts for CubeSats. You can basically buy all your CubeSats in one of these one stop shop. The total cost can be estimated at one hundred thousand dollars but you still need a service behind, since building your satellite is not the trickiest part.

Notes

Summary

1m 08s

SwissCube



Credit: EPFL

Testing, commissioning for launch and operations are important parts of the satellite life. The CubeSat philosophy changed radically what was usually done when building a satellite. Cost is decreased as you are taking more risk, using cost components, non-qualified processes, but the yield if you're flying a constellation is still okay. In the beginning, the purpose was mainly educational, but as we will see then, it changed quite a lot.

Notes

Summary

2m 36s

Why it matters?

Launch price is directly linked to the size and the mass of the satellite, but not only…

Having a standard platform permits series production and cost reduction but also an optimisation of the launch capacity through the use of a dispenser.

Flight heritage of a standard platform is high and this increases the reliability.

As we have seen, usually the payload is only a fraction of the mass and volume of a satellite. Therefore, an optimization of the platform and its standardisation are welcomed by end users, which are usually focused on the service to be sold to customers. Launch price is directly linked to the size and the mass of the satellite. We usually speak about ten thousand dollars for one kilogram in orbit, but this price is decreasing with the evolution and launchers. This is not only the important things. Having a standard platform permits series production and cost reduction but also an optimisation of the launch capacity through the use of a dispenser. You can see here the example manufacture by Ruag Space for the constellation Oneweb where the satellites are attached to the dispenser and separated once in orbit. Flight heritage of a standard platform is quite high and this increases also the reliability by using this platform. For CubeSat, the dispenser protects the satellite. It is a box around a small box of 10 by 10 by 10 centimetres. This permits to avoid some tests such as the shocks and it ensure the prediction of the main satellite into the launcher. This will decrease the overall risk of a launch.

Notes

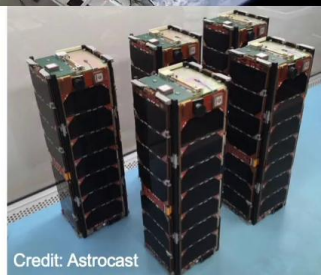
Summary

3m 08s

Platforms tailored to targeted application

Iridium next (2017-2019): 800kg, altitude 780km, 66 operational satellites

Starlink: 227-260kg (1.1x0.7x0.7m), altitude 540-570km, >12’000 satellites in 2025



I will give you some examples of platforms tailored to targeted applications. The first one is Iridium next. Iridium is the first provider of a global communication system, also in the polar regions. Each satellite has a mass of 800 kilograms and is flying at an altitude of 780 kilometres. The full constellation has currently 66 operational satellites and was launched in between 2017 and 2019. The total cost of the constellation is estimated at three billion dollars, which makes a few tens of million dollars per satellite. The second example is the well known cancellation Starlink. Starlink will provide low latency broadband Internet systems. Each satellite has a mass of between 227 and 260 kilogram, for roughly one cubic metre in volume. They're flying at an altitude in between 540 and 570 kilometres. In 2025, Starlink is supposed to be with 12,000 satellites in orbit but they are looking for much more. The cost per satellite, here in this example, is roughly half million.

Notes

Summary

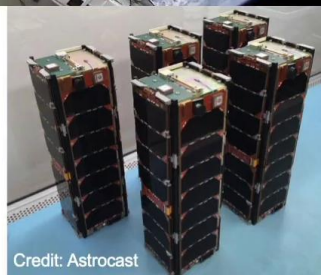
4m 37s

Platforms tailored to targeted application

Iridium next (2017-2019): 800kg, altitude 780km, 66 operational satellites

Starlink: 227-260kg (1.1x0.7x0.7m), altitude 540-570km, >12’000 satellites in 2025

Astrocast: 3kg (0.3x0.1x0.1m), altitude 510-530km, up to 100 satellites in 2024



The third example is Astrocast. One full session of this MOOC is based on this model, so Astrocast is flying nanosatellite, 3-unit CubeSat, four Internet of Things services, one satellite is three kilograms and 30 centimetres by 10 by 10 centimetres. They are flying at an altitude in between 510 and 530 kilometres and they will have up to 100 satellites in 2024. Here the cost of a satellite can be estimated around hundred to two hundred kilo euro.

Notes

Summary

6m 02s

A ticket to space

- ESA and the European Union signed an agreement with the company Innovative Solutions In Space (ISISpace) to offer in-orbit demonstration (IOD) and in-orbit validation (IOV) service in space.
- Experiments will be integrated onboard 6-units CubeSats and the operations after launch will be provided by ISISpace

Prior flying full constellation, institutions like the European Space Agency, ESA, and the European Union are supporting the implementation of commercial in orbit demonstration and in orbit validation services. Customers who wants to fly their payloads or test new technologies, will have to manage only the interface with the satellite. In 2020, ESA and European Union signed an agreement with the company Innovative Solutions in Space, ISISpace, to offer IOD and IOV service in space. Experiments will be integrated onboard 6-units CubeSats and the operations after launch, will be provided by ISISpace. We can mention also here, the service is provided by the company Space Applications and its service Ice Cube, onboard International Space Stations, where you can basically run your experiment for roughly fifty thousand euros for one kilo experiment during a few months in the ISS. The platform Bartolomeo also on the ISS, is provided by Airbus and exposed outside the station. Finally, the company NanoRacks also providing IOD and IOV services.

Notes

Summary

6m 41s

Evolutions

- The development of standard platforms is driven by the satellite constellation needs but once developed it will be available for other customers.
- With the increase of computing power and the use of artificial intelligence, platforms are more autonomous supporting more demanding applications.

As we have seen, the development of standard platforms is driven by the satellite constellation needs. But once developed, it will be available for other customers With the increase of computing power and use of artificial intelligence, platforms are more autonomous supporting more demanding applications. This will definitely drive new future business models.

Notes

Summary

8m 04s

Key take aways

Consequences of the evolution of platforms:

-It has enabled the new space by decreasing the costs along with the evolution of launchers and computing power.

-It has enabled new applications/opportunities for new companies.

-Access to space is becoming more reliable as processes are streamlined.

In summary, the consequences of the evolution of platforms are the following ones. First of all, it has enabled the new space by decreasing the cost along with the evolution of launchers and computing power. It has enabled new applications, opportunities for new companies. Finally, the access to space is becoming more reliable as processes are streamlined.

Notes

Summary

8m 29s