

## Summing up notes on thephi-week opening day

### The main lessons from today

1. Remind us of the intimate relationship between the costs and ambitions of the launch industry, satellite builders, computing companies, and earth observation service provision - this is a positive feedback in terms of the democratisation of the space and EO services.
2. **We will know we have succeeded when space and earth observation and all the rest has become an invisible part of the system, just as it is with GPS.** But we have a lot of work to do to develop the ecosystem that makes this happen, especially in helping our entrepreneurs scale up. And New Space companies must engage with VCs if they are to transform - not live one grant to the next. **Last mile domain knowledge of the customer is essential.**
3. AI and machine learning will play an ever greater role in developing applications of EO data, by combining many datasets to generate information and making it easier to develop user led solutions. But EO will also play a role in helping the AI community identify new challenges to resolve and for which to develop new classes of AI.
4. Data from space can offer help to those who need help the most, where traditionally collected data is sparse. Is it possible we'll see developing countries leapfrog technologies to apply remote sensing data, just as they've done with mobile phones.
5. **Space as a Service will be realised when we can do a constellation for only 10M - and if you'd like to do that, here's my number,**
6. **Earth is our spaceship, an oasis that is as precious to mankind as the ISS is to the astronaut.** Despite all the successes we heard about today in terms of democratising space the scale of projects needed to work in space means that we must have co-operation across Europe and beyond to develop these systems.
7. The technology of the **21st century is helping us fulfil the visions of our parents and grandparents, allowing AI and whole hosts of new technologies to realise the dreams of our forefathers of going into space and using space to help mankind. AI is already in space and will colonise our swarms of satellites**
8. Our job as ESA is to help people be agile, to help them adopt these disruptive new technologies and to **enable and foster the generation of visionaries who will develop new science and new industries.**

**THANK ALL THE PANELISTS FOR TODAY, ROUND OF APPLAUSE FOR ALL OUR CHAIRS AND SPEAKERS. THANKS TO PP MATHIEU, YL DESNOS, DIEGO GARCIA FERNANDEZ, SABRINA LODADIO AND ANNE-LISA PICHLER**

## Space for Earth

Jan Woerner - **earth is our spaceship**, Space 4.0 is more than just New Space, new ministerial cycle for ESA means a time for us to change, **our future is about enabling the visionaries**

Josef Aschbacher - the visions of the future have long foreseen role of AI HAL 9000, but also the sentinels, and we too have AIs today and our own Sentinels, 150 Tb whose data is being downloaded every day. **The sensor web of the future from Explorers through to drones**, now with powerful computing and data capabilities and with hundreds of new launches forecast. **AI is now ubiquitous and even moving to the edge and into space. We are now fulfilling the visions of the past, bringing AI and whole hosts of new technologies to realise the dreams of our forefathers in going out into space.**

Samantha Cristoforetti - **Space is about visionaries and it speak to us a very fundamental level. Was fascinated by Space from an a early age. The community of space explorers is a small tightly knit group that's spread around the world.** Went to the ISS, which after your 8/9 minutes ride to space seems like an oasis. ISS an extraordinary example international cooperation - in a sense this is its greatest legacy. It's also a laboratory where a lot of research is going on. **For 18 years it has been continually occupied - anyone 18 years old or younger is truly part of a space faring species that has colonised Earth's orbit**, we are expanding further into space. Depending on new space craft, but also new technologies like miniaturised instruments and AI

**Lucia Linate, enabling access to space, and reducing the costs of launch and driving innovation**, we have a strong family of launchers which have outstanding accuracy - **Aeolus was put into an orbit a only 200m from the ideal orbit.** Developing new initiatives. L3 initiative will launch next year carrying (lots) of small sats. And by 2021 we will have Spacerider, which will give us an independent reusable space capability. Enabling the 4th dimension of space transportation, creating new markets, offering sovereignty and driving competition.

## **Transformative technologies for space**

**Alison Lowndes nVidia** - vast improvements in data science and AI compute power, with extraordinary new techniques like agents based reinforcement learning.

**Heike Riel IBM** - **convergence of technologies is allowing an extraordinary leap to take place - new customised hardware runs AI 3000x faster.** Combining datasets provides context that permits the transformation of data into information.

**Damian Borth, U St Galen**, experiences of coming from AI to earth observation were fascinating. **AI for good (natural disasters, climate change) is an extraordinary driver for the AI community**, and just as AI has a lot to give to Earth Observation, so too the vast datasets that earth observation provides into the earth and human systems provides new impetus to ai scientists to develop new and better classes of artificial intelligence.

**Clare Melamed Global Partnership for Sustainable Development Data** - told us about how earth observation data from space can fill crucial gaps in the information available to governments

**Marino Fragnito Arianespace** - more actors want cheaper access to Space, so European launcher makers are responding. developments in Arianespace Vega C and Ariane 6 will increase access small sat and cubesat makers and industries.

## **Entrepreneurship & new business models**

### **SPACE SUCCEEDS WHEN IT DIRECTLY ADDRESSES MARKET NEEDS**

**Adina Gillespie Earth-i** - EO is part of a much bigger landscape, 2. costs coming down through small satellite, lower cost computing power, 3. the right collaborative environments, 4. access to finance, 5. Diversity. **Most startups fail because of lack of market demand, or run out of money, or have the wrong team, or because the products are already been delivered well by others. We musn't live one grant to the next, we have to use VC to help us change as industries.**

**Rainer Horn Spacetechn** - complex dynamics of the geointelligence game on B2B or B2Gov. Detailed review of business applications by new space companies. How can a small start-up compete or collaborate with a Corporate counterpart. Corporates like to work with lawyers and procurement people, while startups usually have a couple of front people and they need to **fake the complexity the big Corporates want to see to convince them** that there's something real there. Public funders should be happy to cut off funding when companies aren't succeeded and give it to successes.

**Jaap Schellekens Vandersat** - **Example of how a small company can use EO products to develop products that can be sold all around the World.** Produce mainly soil moisture products at a range of length scales, and which they can derive all around the world. Dealing

with a large number of product users from the US, to Europe to India working with major agri-food industries like BASF, Rijkswaterstaat. How do you retain competitive advantage? By using the right IP approaches, keep investing in efforts to stay ahead of the innovation curve, and reinvest also in marketing.

**Monica Valli D-Orbit** - 82 constellations now with of the order of 23000 satellites being talked about. D-Orbit offers services for launch, precision positioning, **example of providing extraordinary end-to-end services that satisfy the needs of all classes of new space satellite operators.**

**Simon Jackman Oxford Uni** - experience in having a lack of market and running out of money. Oxford offers a range of services to support startups: an official innovation programme, a VC fund, and an incubator that helps student-led start-ups. And there's a change in the thinking of the students themselves. We also have developed climate services for infrastructure, but the interesting thing is that business wanted more than the climate modellers can provide, so it was **essential to pivot to work backwards from the clients' problem using ML to link to the data the physics can provide. His hunch is we'll see more and more of AI in developing applications of EO.**

## Innovation for Space

### THE OVER-RIDING THEME AGAIN WAS SPACE FOR APPLICATIONS ON EARTH

**Manuel Garcia Herranz UNICEF** - UNICEF deals with big and complex problems (pandemics, CC, urbanization, migration etc); the poorest people will feel the brunt of climate change; when we try to help remote places there's little knowledge there. **The most important thing is to connect with others to develop the new applications and services that will help both the poorest and us all.**

**Pekka Laurila ICEYE** - small sat SAR is allowing very powerful new services, from shipping to the state of the sea, to agriculture and with hourly data availability. Many new applications -safety & security; activity monitoring to support financial information; rapid damage estimation; bringing trust into markets;

**Will Marshall Planet** - how we can apply AI to EO data to detect change, PLANET's Dove satellites are small but **overcome any technical weaknesses by achieving much higher frequency of coverage which allows data to get quickly into the decision making look;** AI allows us to index the Earth, like Google indexed the internet; myriad applications - like transport, forestry/deforestation, infrastructure, pipeline monitoring

**Peter Platzer Spire** - **new space is here to stay.** Constellation 1.0 was 1bn, 2.0 is 100m, 3.0 is 10m... how do we do this? What can we learn from how Jeff Bezos built Amazon. He spotted a trend of online shopping, picked a boring application (books), built it amazingly well, then added CDs, electronics, groceries etc etc etc. That said, building satellites is hard. It often takes iteration 15.0 before things really start to hum. Then Amazon started renting

AWS. The equivalent in space is creating Space as a Service, letting companies get into space by providing the infrastructure. **Space as a Service will be realised when we can do a constellation for only 10M - and if you'd like to do that, here's my number,**

**Jean Michel Darroy Airbus** - there is faster acceleration today than we have every seen before, and this will democratise the access to satellite industry, and get even closer to the end users needs. Main changes - data, digital platforms, partnership, processing and markets and how this all combines into the OneAtlas platform

**Andreas Veispak EU - What is innovation?** Space is still relatively technology driven, but is now clearly space is moving out of space; focus on where your expertise is; real innovation takes place on the borderline of disciplines, and for space this is a merger of space with the other tissues of society; **not all solutions on earth require space solutions.** For downstream applications it is a voyage of discovery, finding out where space is relevant. Demand for Copernicus data has hugely outstripped expectations. Users don't care where the data comes from. The downstream potential is x10-15 greater than the upstream sector. Role of the public sector is as a financier, enabler, intelligent demand, framework and the right regulations. We don't commercialise fast enough in Europe, but public sector can provide intelligent demand.