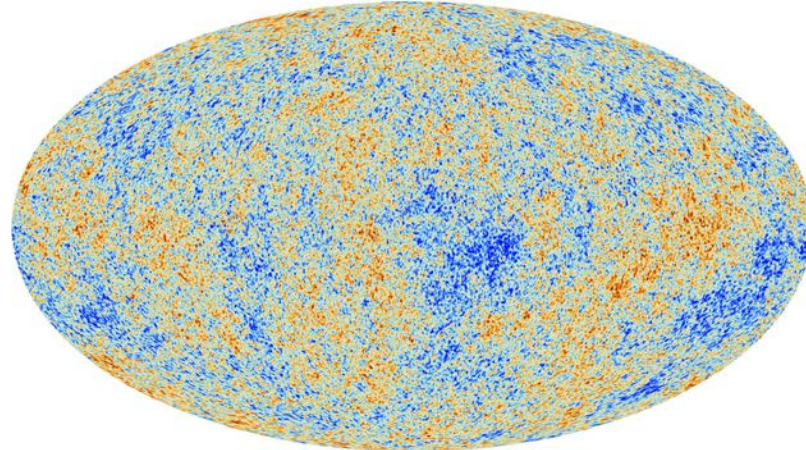


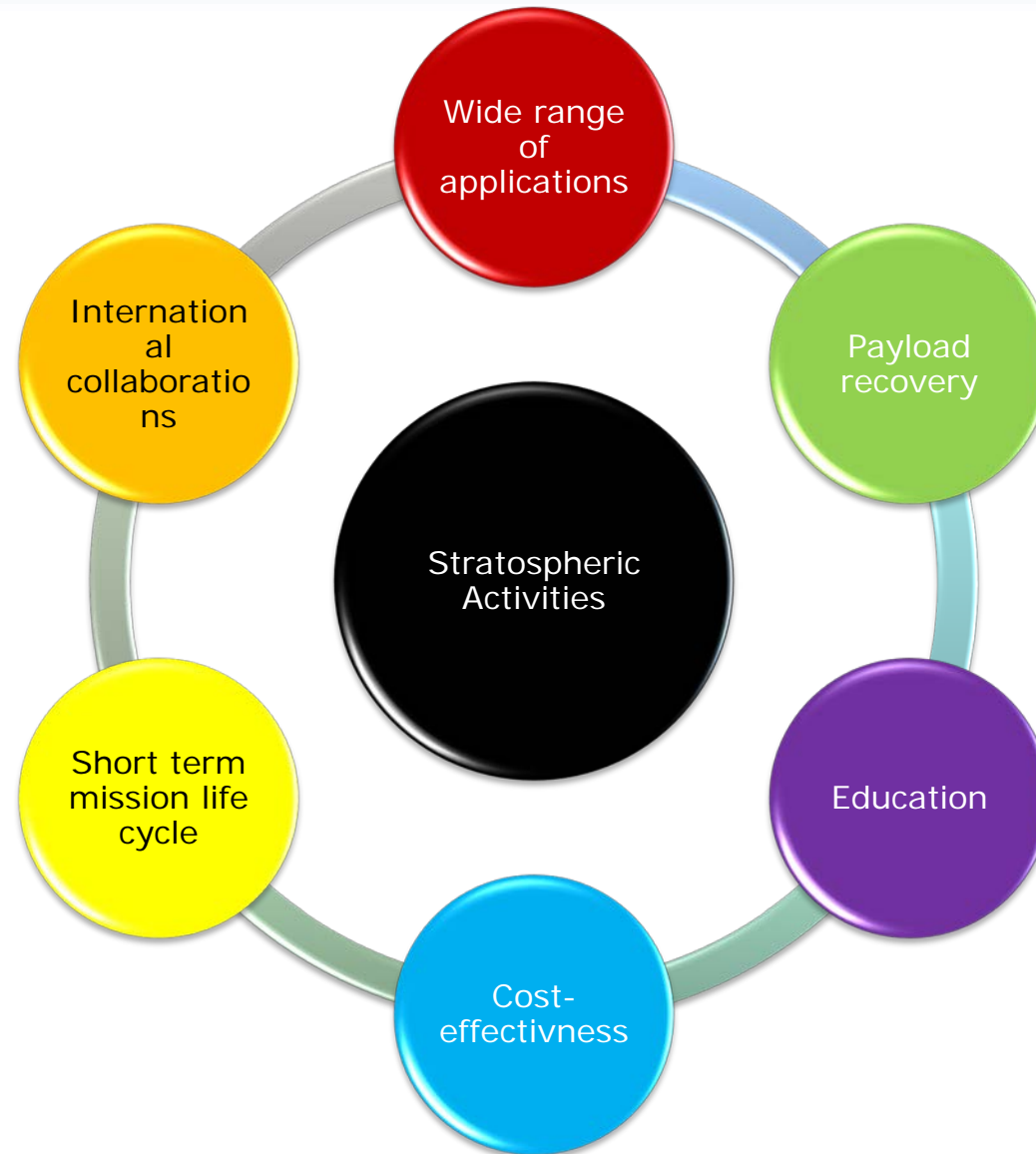
ITALIAN SPACE AGENCY SPACE Balloon launch opportunities

Marta Albano, Angela Volpe

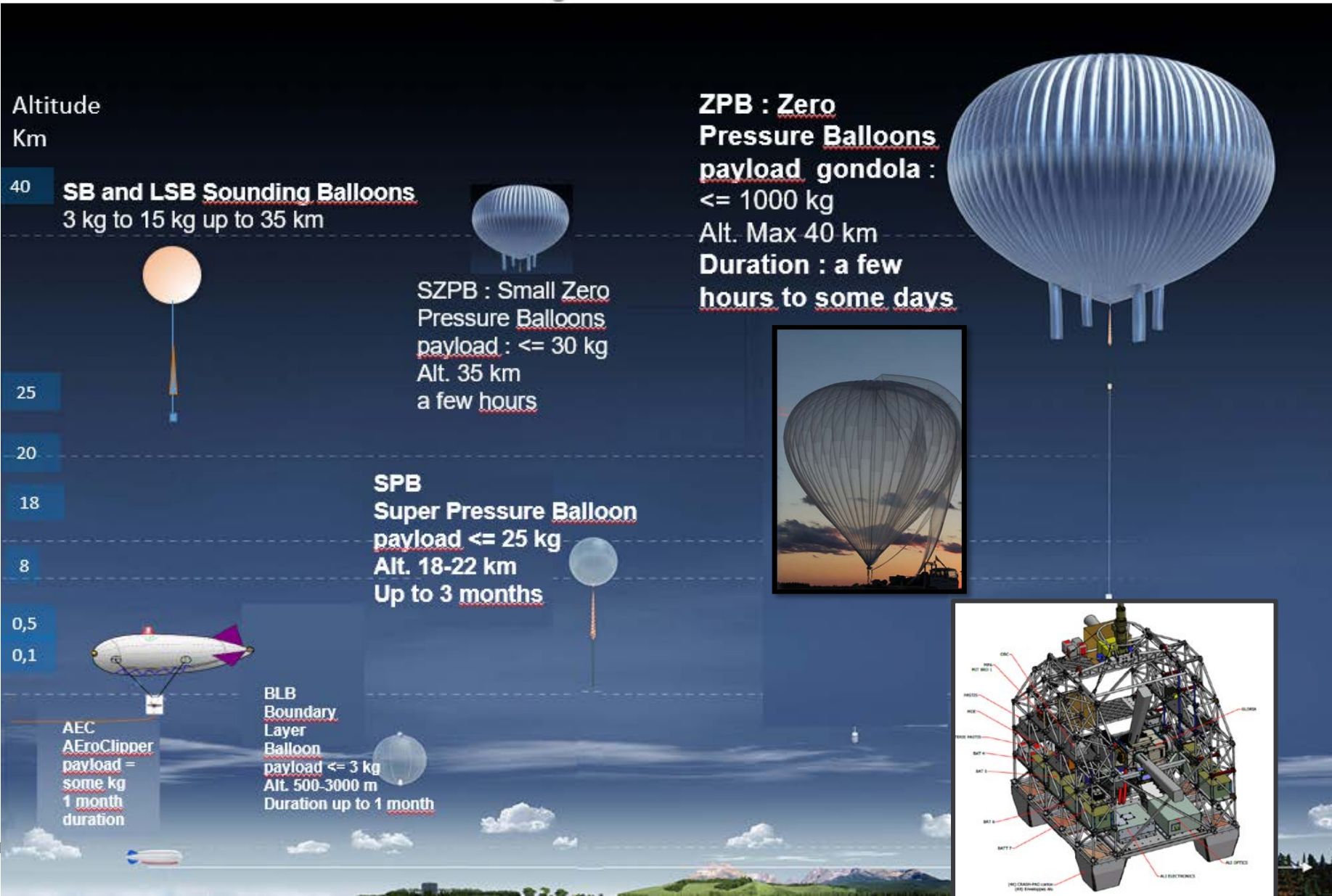


CMB Day 2, ASI, 16-18 October 2023

Advantages of balloons



Scientific balloons and gondolas



Types of Balloons

- Sounding Balloons

- Zero pressure Balloons
- New Technology: Super Pressure Balloons



- Payloads up to 3 Kg
- Float altitude 20-30 Km
- It blows up (no explosives)
- Duration: few hours

Agenzia Spaziale Italiana

Types of Balloons

- Sounding Ballons
- **Zero pressure Ballons**
- New Technology: Super Pressure Ballons

They are open at the bottom, to allow gas to escape and to prevent the pressure inside the balloon from building up during gas expansion as the balloon rises above



- Payloads up to 3 Tons
- Float altitude up to ~40 Km
- Explosives to separate the payload from the balloon
- **Duration: up to few weeks**

Types of Balloons

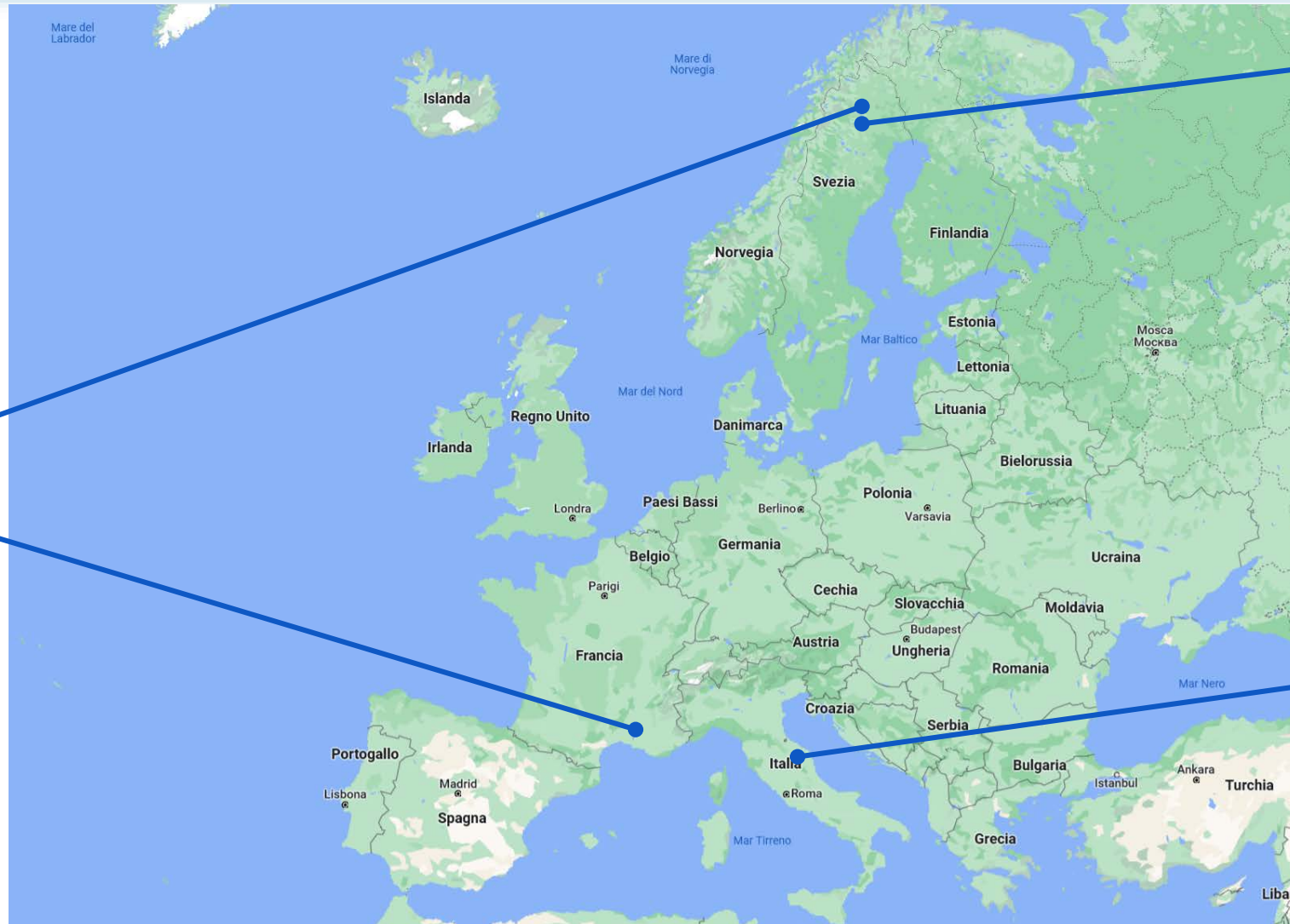
- Sounding Ballons
- Zero pressure Ballons
- **New Technology: Super Pressure Ballons**





They are completely sealed. Gas cannot escape the balloon and pressure builds up as the gas expands, while the volume of the balloon is kept constant.



- Payloads up to 1 Ton
- Float altitude up to ~35 Km
- Explosives to separate the payload from the balloon
- **Duration: up to 100 days**

Stratospheric balloon operators in Europe



-  SSC (Swedish Space Corporation)
-  China, Russia, India, Brasil, Japan...
-  ASI in collaboration with SSC
-  CNES-CNES/CSA



Scientific needs- payload

Payload weight	
Weight range (kg)	Percentage of interest
20-50	28%
200-1000	15%
1000-1500	42%
> 1500	15%

- Payload recovery: 57%
- Pointing: 28%
- Payload compatibility with recovery in the sea: no

Desired geographical area	
Latitude ranges	Nr. of answers
Equatorial (from 10N to 10 S)	3
Tropical and subtropical area (from 23.5 N to 23.5 S except for the equatorial region)	3
North temperate zone (from 23.5 N to 66.5 N)	5
South temperate zone (from 23.5 S to 66.5 S)	4
North and south poles (> 66.5 N; 66.5 S)	5

Season	
Season	Nr. of answers
Winter	-
Spring/Autumn	-
Summer	3
Autumn	-
No constraint	4

Flight duration	
Desired days of flight	Nr. of answers
< 1 day	1
1-5 d	2
5-10 d	1
10-20 d	2
>20 d	2
N/A	

- Flight altitude: 35-40 km
- Multi campaign need



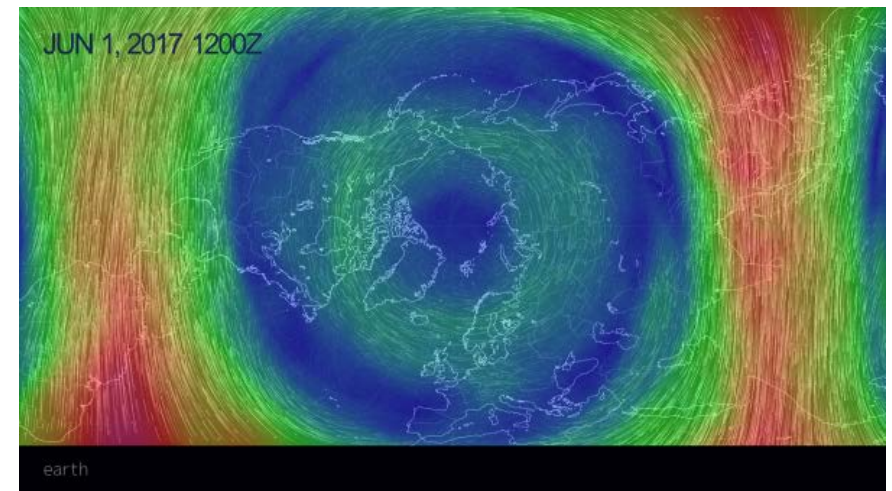
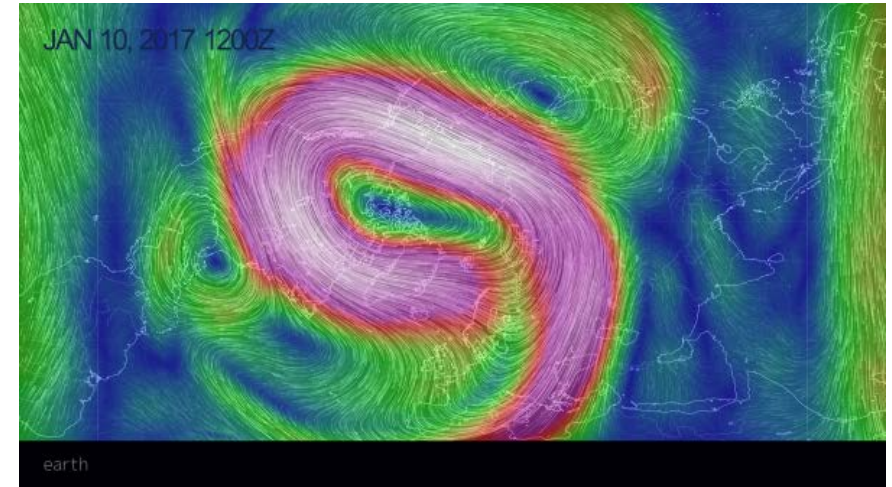
Scientific needs- communications

- Onboard recording capacity: All requires recording on board from 1 Gb to 10 Tb
- Type of connection: IP/RS232/TOR

TM/TC bandwidth	
Bandwidth	Nr. of answers
0-10 kbit/s	0
10-50 kbit/s	1
50-200 kbit/s	3
200-800 kbit/s	1
>800 kbit/s	1

Projects shall consider flight constraints in the design phase

- Payload mass/ balloon type /mission
- Trajectory and windows
- Orientation
- Flight environment
- Descent loads
- Communication
- Others specific for the case study



ASI in stratospheric activities

- Agenzia Spaziale Italiana has a tradition in stratospheric activities from '70s
- The last launch campaign was carried out in July 2018. The main payload, also created on ASI contact, is Olimpo, of approximately 2000 kg and had the aim of analyzing the Sunyaev-Zel'dovich effect of the cosmic microwave background. ASI's activity concerned both the management of the launch campaign and the creation of various elevator payloads of scientific value
- ASI participated to the Hemera project for the design and development of new technologies for flight train, flight campaigns and new launch sites study.



- ✓ Balloon technologies developments



- Bilateral meeting ASI/CNES
- International meetings and working groups
- LSPE flight campaign study
- Bilateral meetings with Italian operators



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THANK YOU FOR YOUR ATTENTION