



Funded by the Horizon 2020 framework
program of the European Union

HEMERA WORKSHOP

Work Package 5 : CNES Balloon Launches

André Vargas (CNES)

(Rome, July 4rd - 6th , 2022)



WP 5 : CNES Balloon Launches



- ❖ Provision of Trans-National Access (TNA) to balloon flights
- ❖ Possibility to fly several kg to a hundred kg payloads with no costs
- ❖ 6 Zero Pressure Balloons (ZPB) flights operated by SSC or CNES
 - ❖ 150 00 m³ (150 Z) balloon
 - ❖ A targeted total instrumentation (technological or scientific) mass of 150 kg per flight
 - ❖ The possibility of having an azimuth pointing service on board the gondola
- ❖ Up to 20 Sounding Balloons (SB) flights from Aire sur l'Adour
- ❖ The 3 ZPB balloon launches of the CNES
 - ❖ Kiruna 2021 : 1 x 150 Z balloon and 1 x 402 Z balloon (increase in lift capacity)
 - ❖ Timmins 2022 (planned in August 2022) : 1 x 402 Z
- ❖ The SB balloon launches of the CNES : only 4 flights !!



Kiruna 2021 – Esrange base



ESA PAC framework (France, Germany, Norway, Swiss, Sweden)

Technical and operational buildings in front of the launch pad





Kiruna 2021 – Campaign Schedule



Operational objectives: 4 ZPB flights + 10 SB flights (Aircore & Amulse) for MAGIC

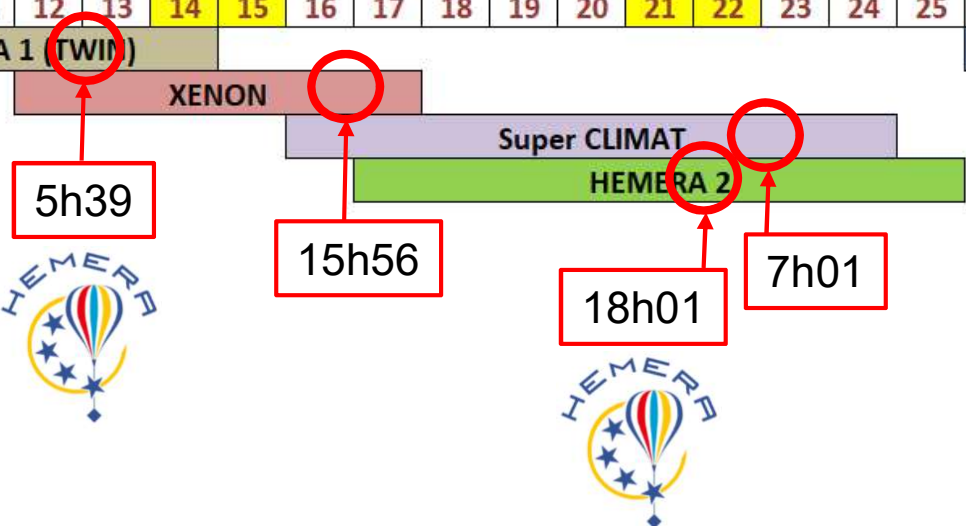
- HEMERA 1 (slow descent)
 - HEMERA 2 (constant float)
 - XENON (slow descent + 2nd float)
 - Super CLIMAT (slow descent)
- } Flights in sequence



Scenario nominal :

Août	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
KRN	→	Installation					RG / BTO	OFF	HEMERA 1 (TWIN)															Desinstallation					→		

Choise of the nominal scenario



HEMERA-1



German gondola
 Mass : 320 kg
 No pointing system
 Experiments :

- Big Lisa (UoG, NL)
- Cryo-sampler (UoF, DE)
- 4 Aircore (IMAU, NL)
- Mega Aircore (JRC, DE)
- pico-SDLA (GSMA, F)

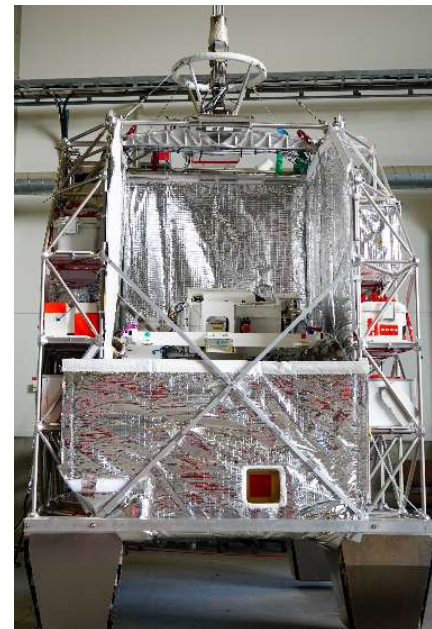
XENON



Carmencita pointing gondola
 Mass : 507 kg
 Experiments :

- XENON (OSUC, F)
- Bernadotte (INSERM, F)
- NLC (ISP, SE)
- BRAD (CNES, F)
- MEDOR (CNES, F)

HEMERA-2



Carmen pointing gondola
 Mass : 815 kg
 Experiments :

- Gloria (KIT, DE)
- Total BRO (UoH, DE)
- ALI (UoS, CA)

Super CLIMAT



Carmencita gondola
 Mass : 510 kg
 No pointing gondola
 Experiments :

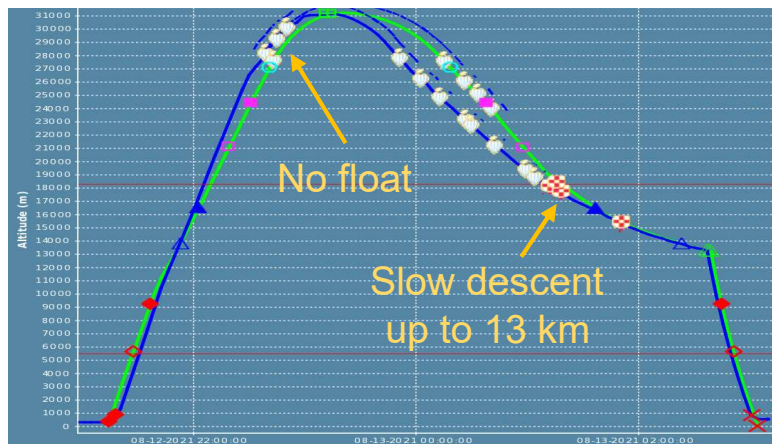
- SPECIES (LPC2E, F)
- Aircore HR (LMD, F)
- 2 Aircore light (LMD, F)
- Amulse bi-gaz (GSMA, F)
- Sample (GSMA, F)



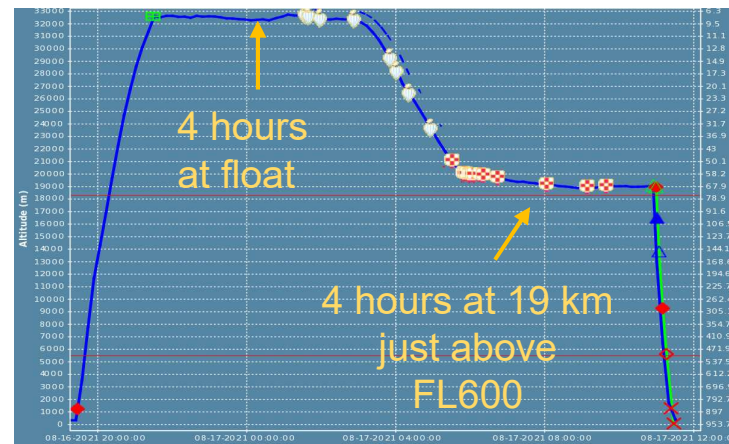
Kiruna 2021 – The Flight Profiles



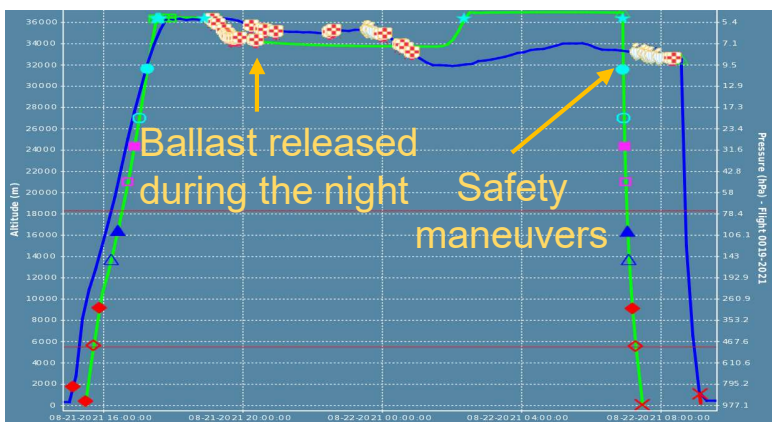
HEMERA 1



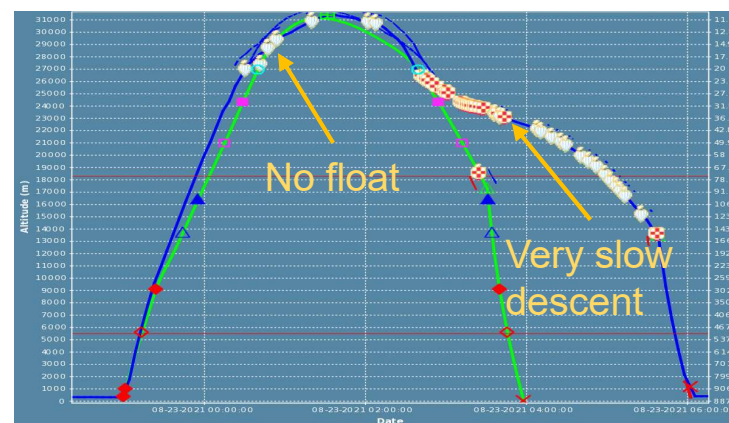
XENON



HEMERA 2



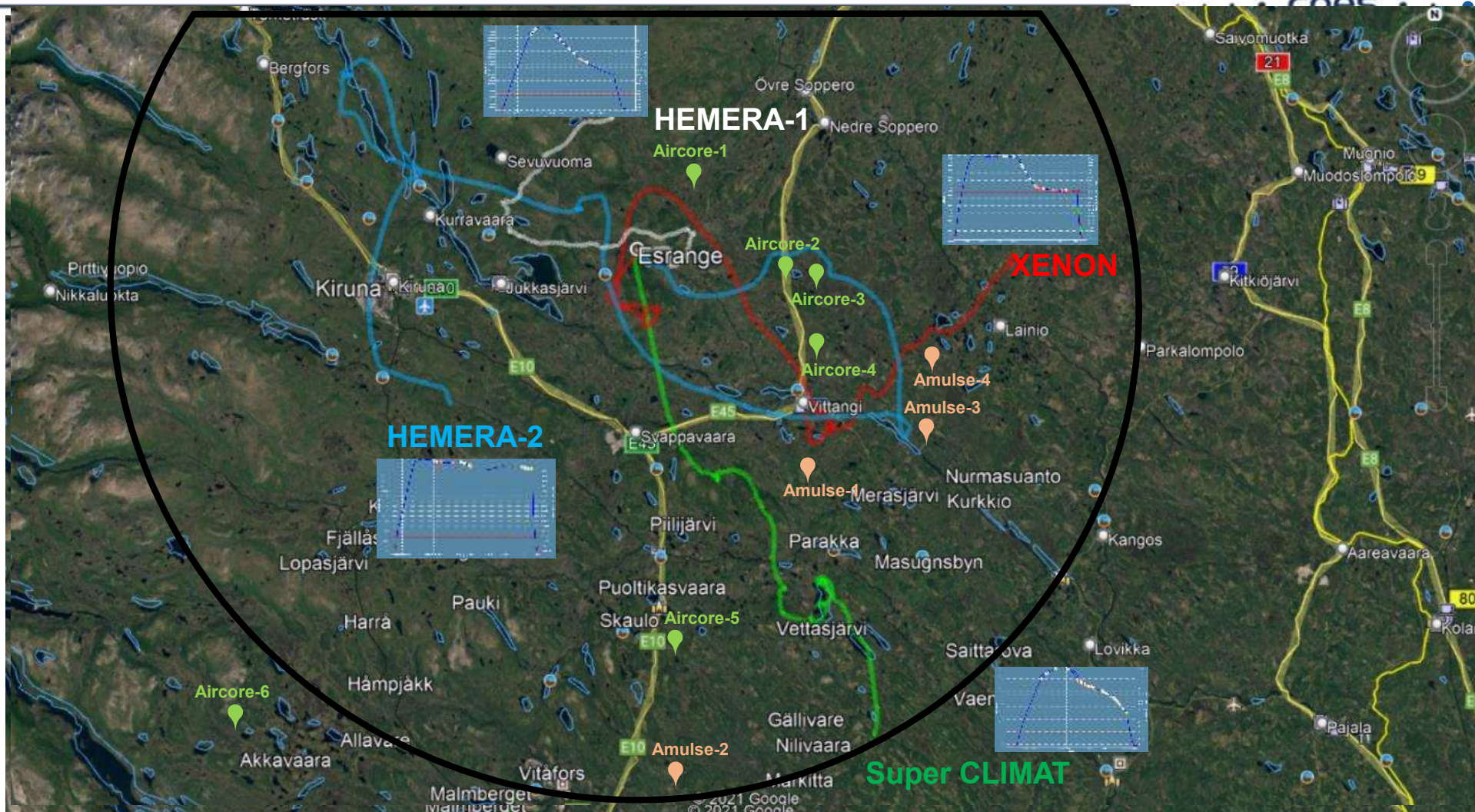
Super CLIMAT



— Forecast
— Real trajectory



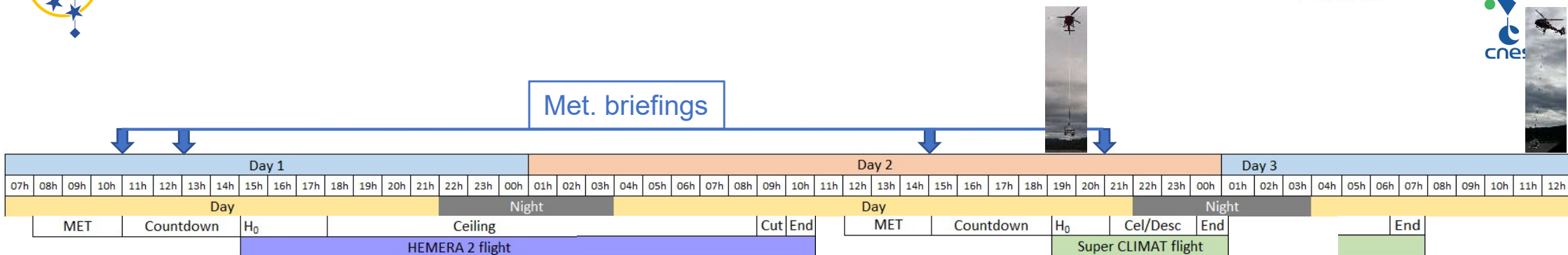
Kiruna 2021 – 4 ZPB Flights in a Small 80 km Radius



HEMERA WORKSHOP, Rome, July 4th - 6th, 2022



Kiruna 2021 - Flight Sequence for HEMERA#2/CLIMAT

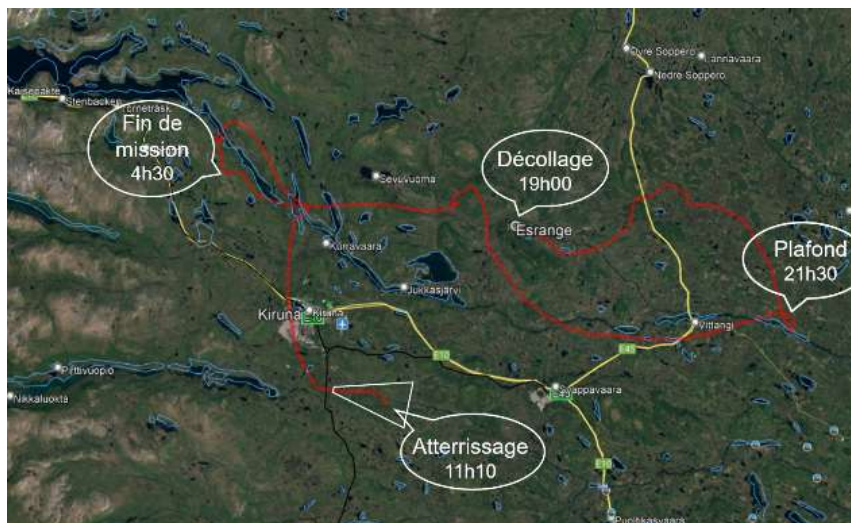


→ Wind between 4 and 5 m/s without gust

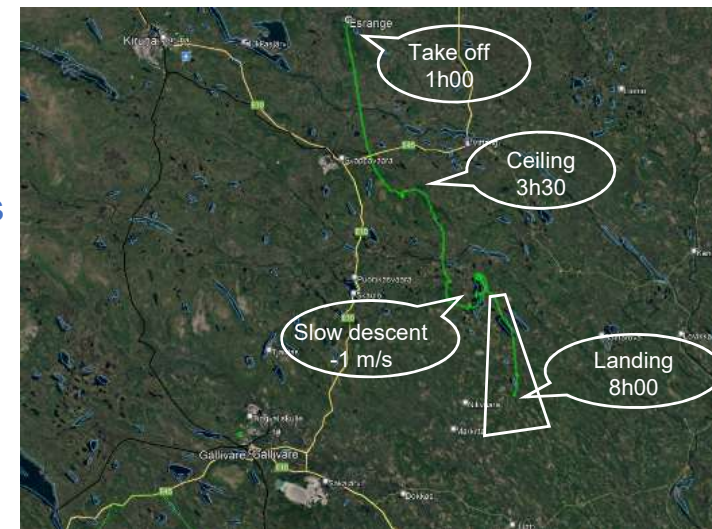
→ Wind 2 to 3 m/s, no risk of rain



Wind 5 to 6 m/s
Gust at 7 m/s



Rainshowers
Wind 3 to 4 m/s



Finally, there was 32 hours (instead of 28 hours) between the two take off !



Timmins 2022 – A New Balloon Launch Facility



A new base built in 2012 by Canadian Space Agency (CSA)

- ❖ The CSA built and maintains the Timmins Stratos launch base
- ❖ The cooperation agreement between CSA and CNES is prolonged for 10 years more
- ❖ The implementation of the new agreement begins with this campaign
- ❖ Coming improvements: a new payloads hall and a new platform for the antenna → 2022

Main building:

- ❖ Flight train hall
- ❖ Control center
- ❖ Offices





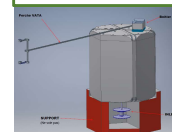


TIMMINS 2022 – General Presentation of ZPB Flights



❖ 4 ZPB flights are planned in August 2022

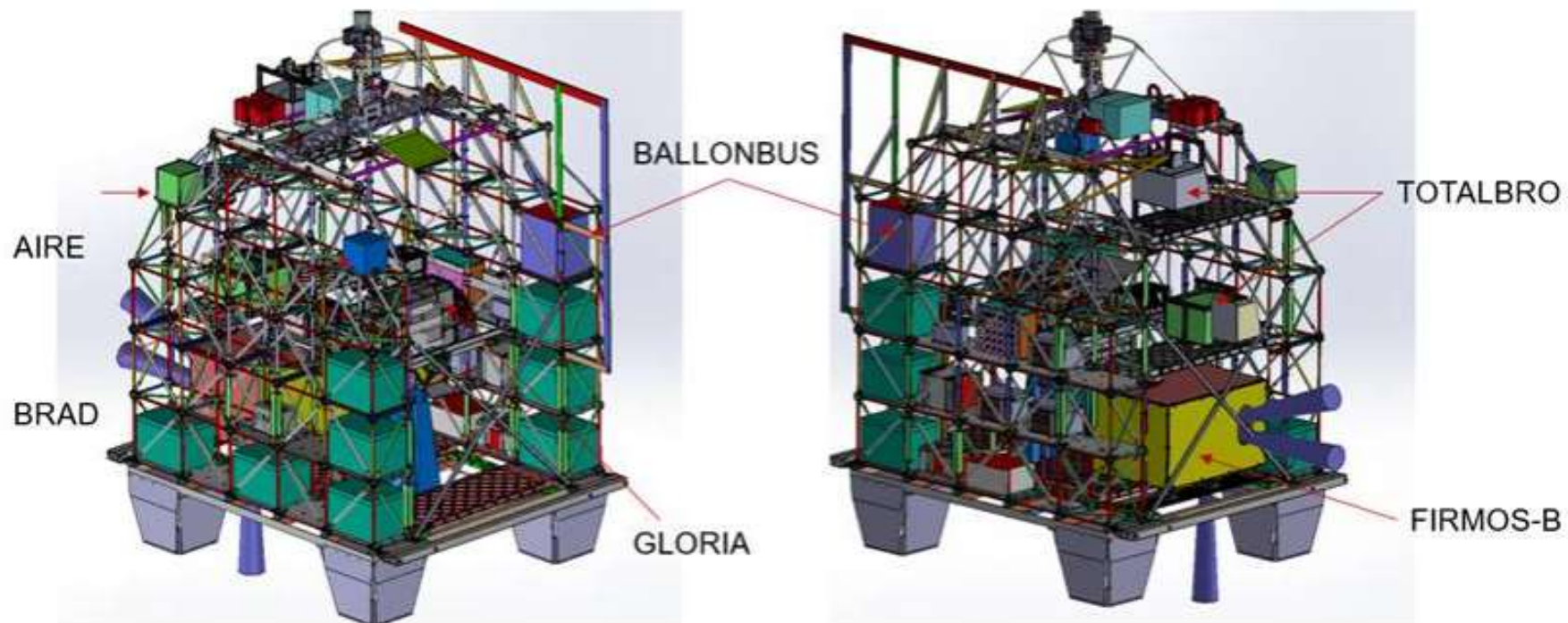
	Balloon size	Flight profile	Payload mass	Gondola & pointing capacity	Duration
 4 flights	HEMERA flight #3 400.000 m³	Float ~36,5 km (~4.6 hPa)	~800 kg	CNES Carmen Pointing system	~12/15 hours
	 400.000 m³ SOLAR flight	Float ~32 km (~9 hPa)	~625 kg	CNES Carmencita Pointing system	~5/7 hours
	400.000 m³	Float ~37 km (~4.3 hPa)	~665 kg	CNES Carmencita Pointing system	~10/12 hours
	150.000 m³	Float ~33 km (~7.7 hPa) 2nd float: 20 km Slow descente until ~13 km	~500 kg	CSA Carmencita No pointing	~6/8 hours



Nacelle Zéphyr (Stratéole-2)



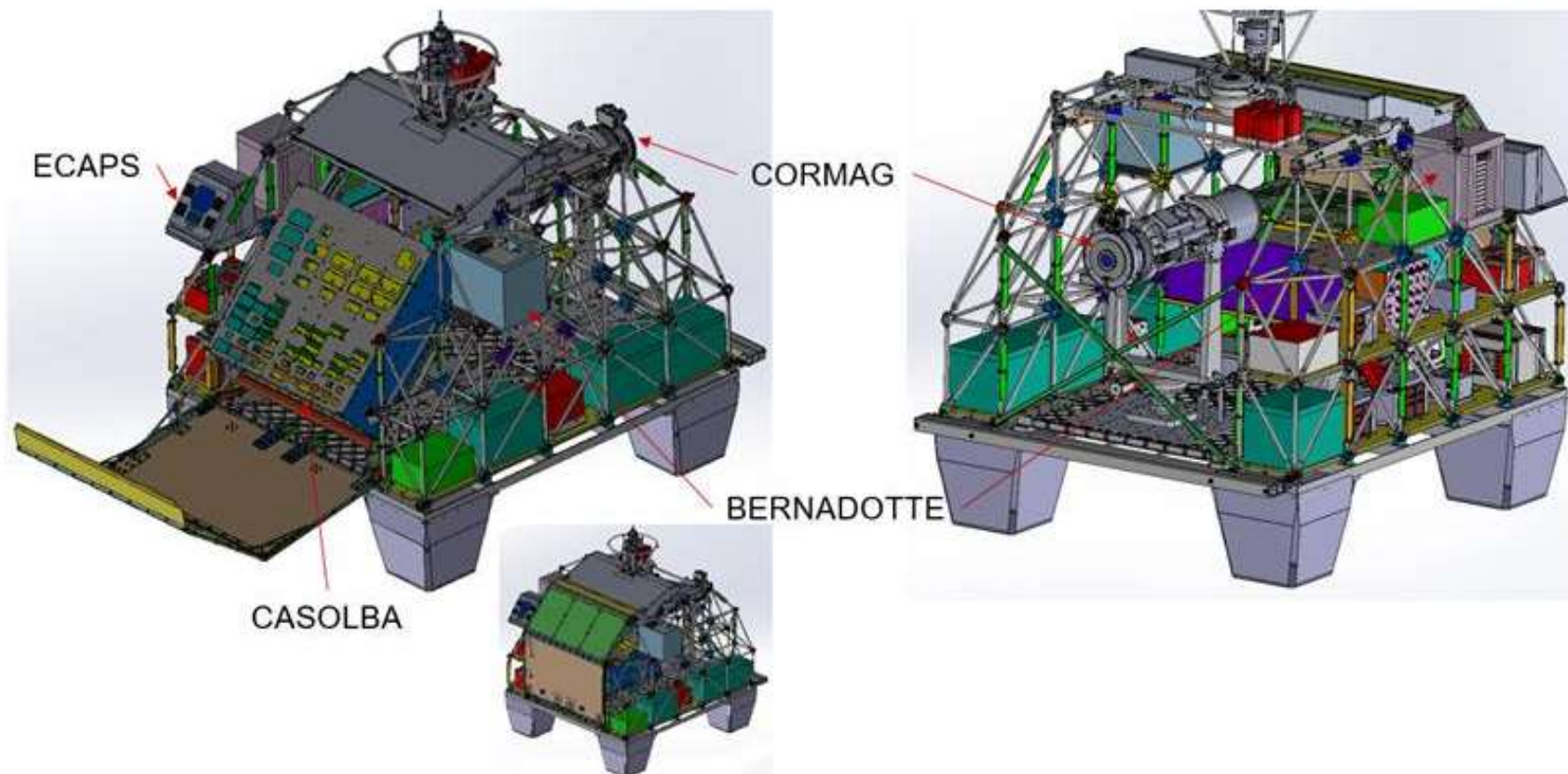
Timmins 2022 – CARMEN Gondola (HEMERA#3)



HEMERA Payloads : GLORIA-B – TOTALBRO – FIRMOS-B – AIRE



Timmins 2022 – HEMERA Payloads (SOLAR Gondola)



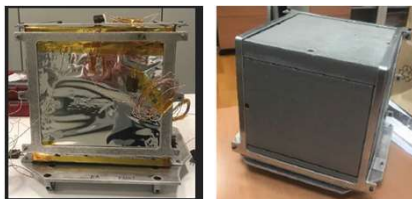
HEMERA Payloads : CorMag - ECAPS



Timmins 2022 – HEMERA Payloads



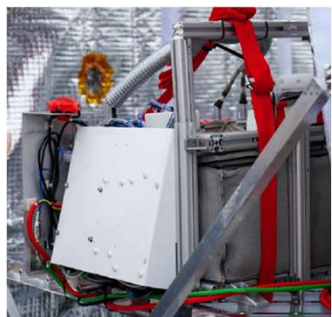
AIRE Payload



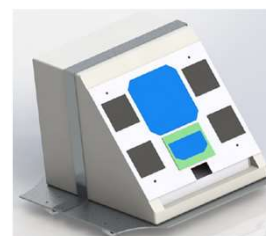
GLORIA B++ Payload



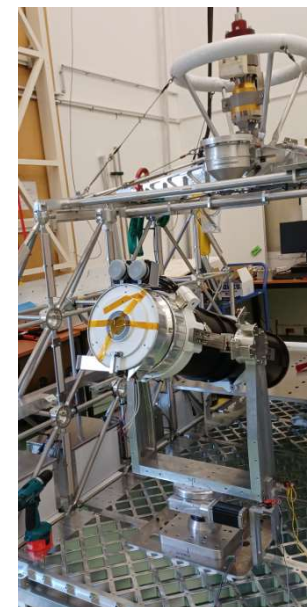
TotalBro Payload



FIRMOS Payload



ECAPS Payload



CorMag Payload





Overview of the CNES Flight Results



- ❖ All the feedback form, completed by the PIs, reflect satisfaction for the 2 ZPB flights of Kiruna 2021
- ❖ The upgrade of 2 flights with a 400 000 m³ (400 Z) balloon permits to significantly increase the total of payload mass !!

Kiruna 2021		Timmins 2022 (forecasts)	
CARMEN (HEMERA#1)	255 kg	CARMEN (HEMERA 3)	255 kg
TWIN (HEMERA#2)	227 kg	CorMag (SOLAR)	105 kg
	482 kg		360 kg
HEMERA Total Mass	842 kg	>> 450 kg	



WP 5 : CNES Balloon Launches



Thanks for your attention,
questions ?

