# Aeolus Science Conference 2023

22-26 May 2023 | Rhodes Island, Greece

## The Aeolus Payload Data Ground Segment: A Challenging Journey From Launch To Re-Entry Preparation

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# MISSION REQUIREMENTS

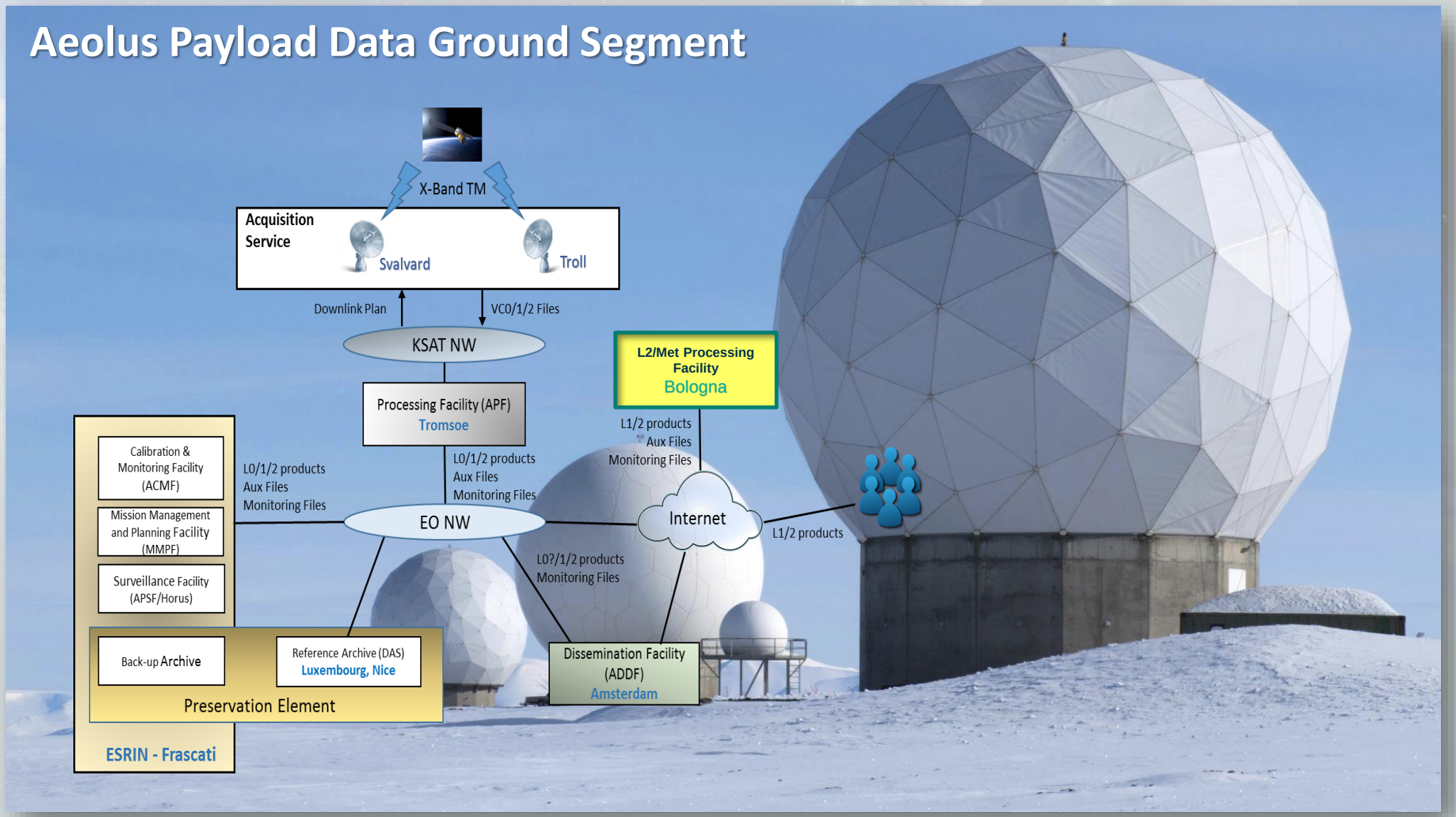
**MR-10: ESA shall implement NRT delivery of L1B data to users, delivery of a L2B processor** and L2A, **L2B**, L2C, calibration and auxiliary products […]

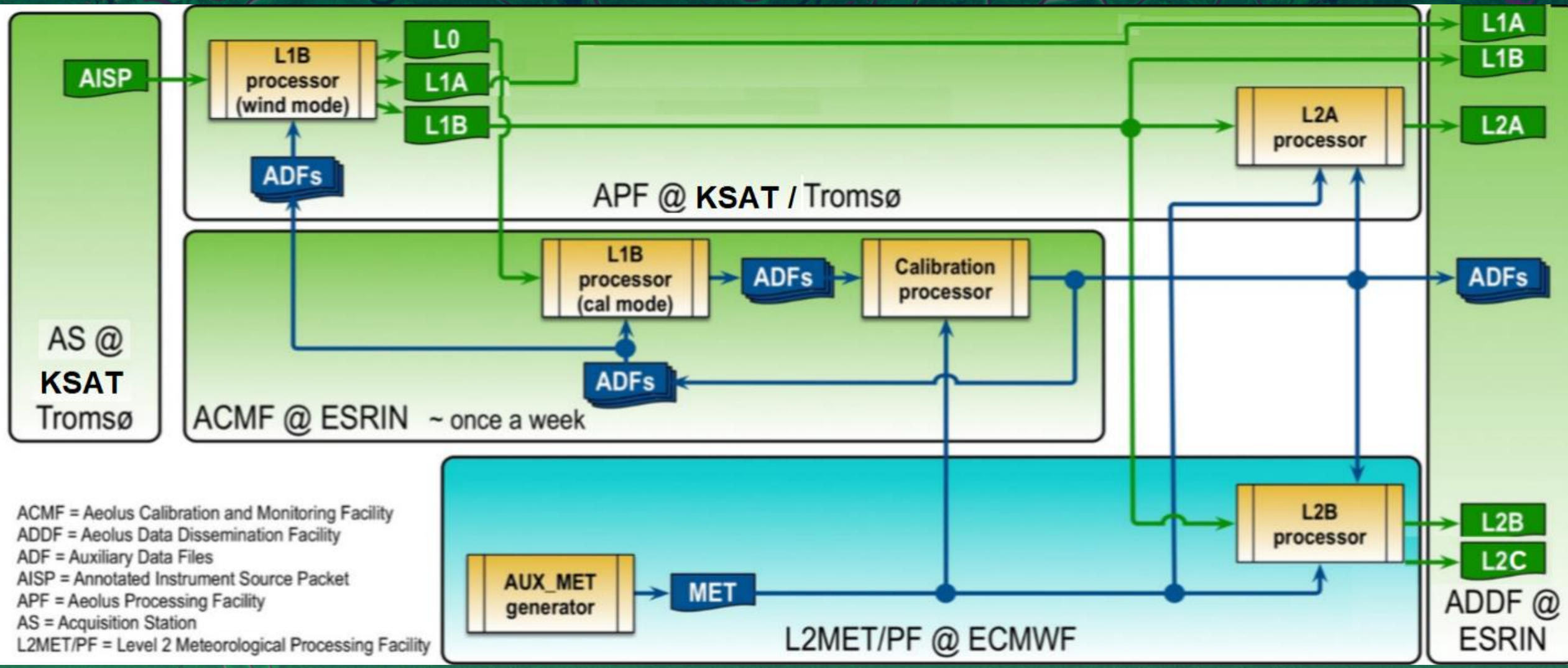
**MR-140:** The mission shall ensure **L1B data delivery (timeliness) within 3 hours of sensing**, in particular for the areas influencing European weather on short range (12-72 hrs)

**MR-150:** The mission shall ensure a horizontal track wind observation **data availability of at least 95%** within a repeat cycle during routine operation in phase E2

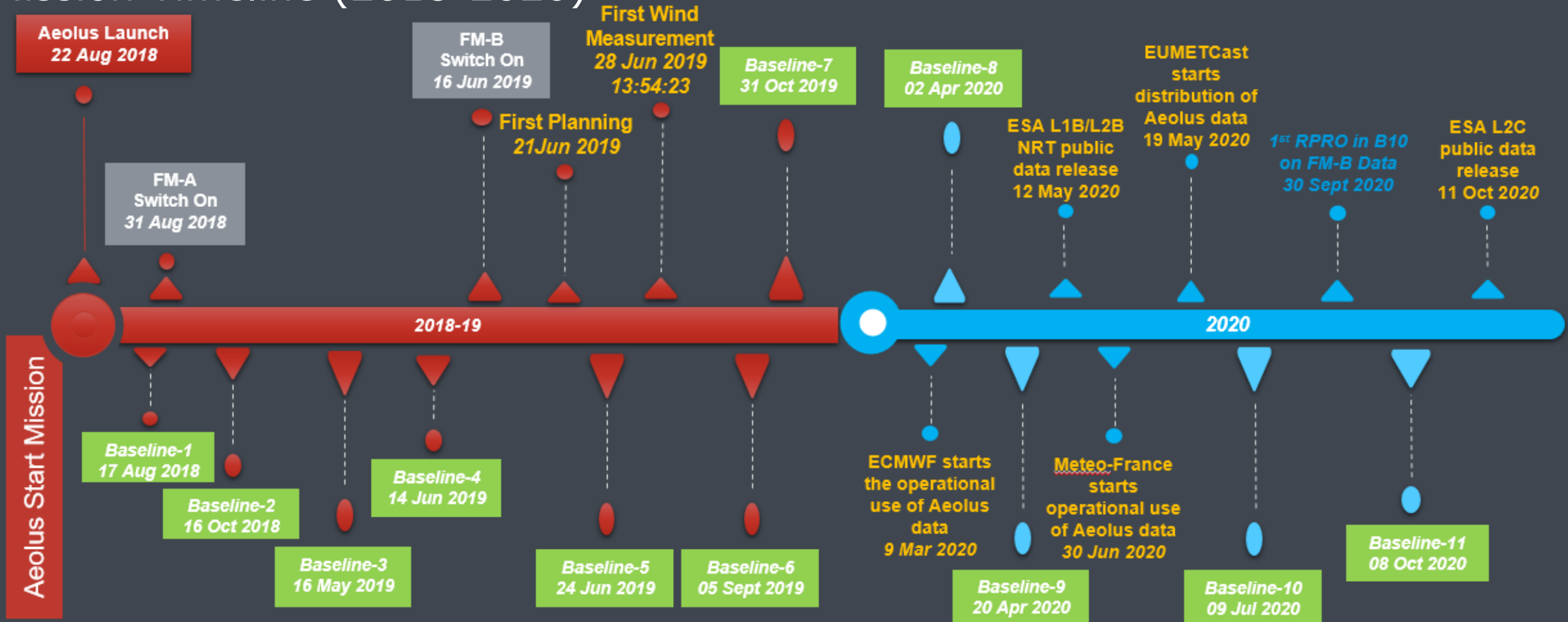
**MR-160: The mission dataset length shall be at least 3 years**

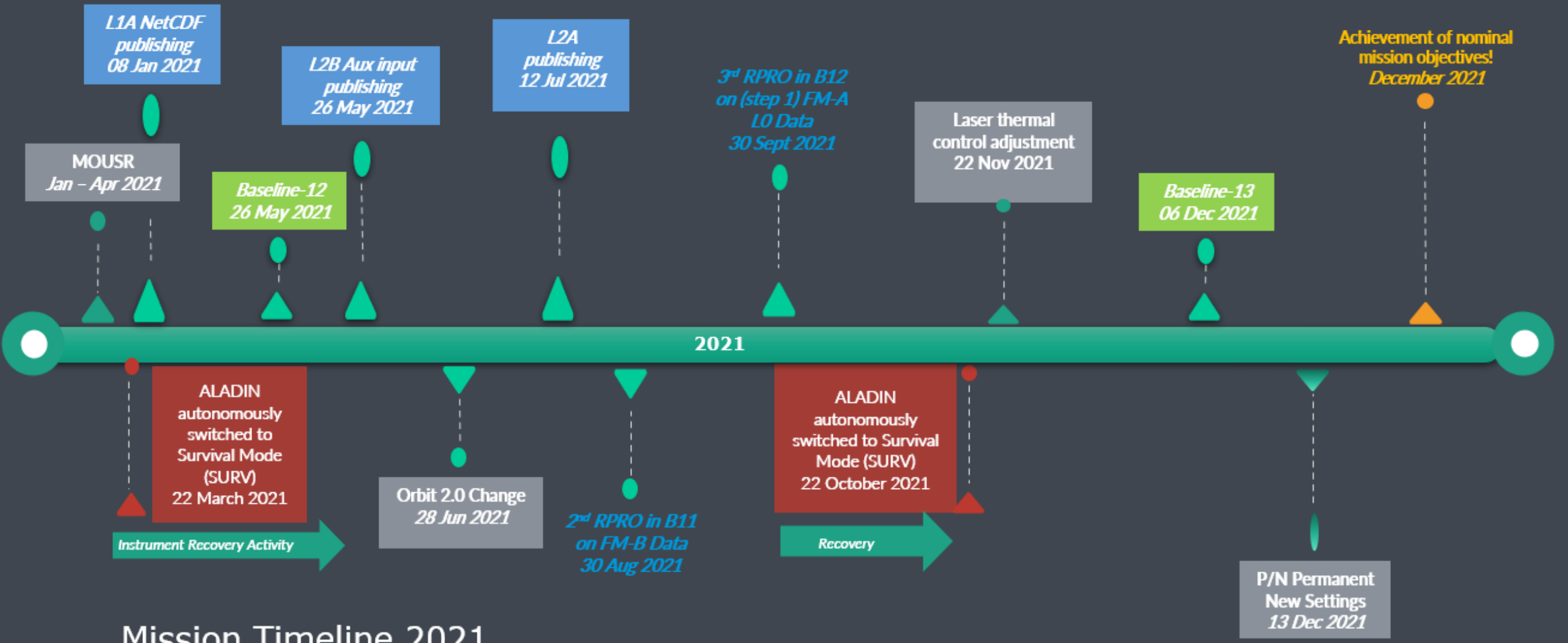
# Aeolus Payload Data Ground Segment




AISP
L1B processor (wind mode)
L0
L1A
L1B
ADFs
APF @ KSAT / Tromsø
L1A
L1B
L2A processor
L2A
AS @ KSAT Tromsø
L1B processor (cal mode)
ADFs
Calibration processor
ADFs
ADFs
ACMF @ ESRIN ~ once a week
ACMF = Aeolus Calibration and Monitoring Facility
ADDF = Aeolus Data Dissemination Facility
ADF = Auxiliary Data Files
AISP = Annotated Instrument Source Packet
APF = Aeolus Processing Facility
AS = Acquisition Station
L2MET/PF = Level 2 Meteorological Processing Facility
AUX_MET generator
MET
L2MET/PF @ ECMWF
L2B processor
L2B
L2C
ADDF @ ESRIN

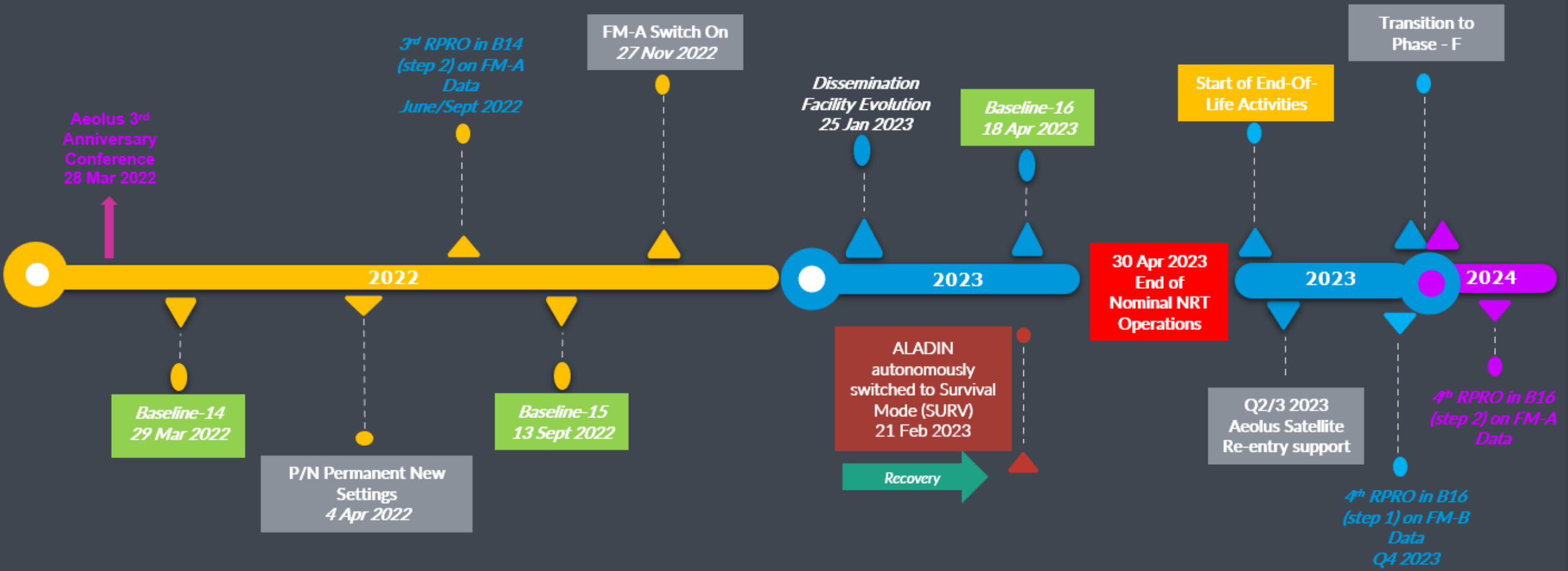
# Mission Timeline (2018-2020)






Mission Timeline 2021

# Mission Timeline (2022 - 2023)

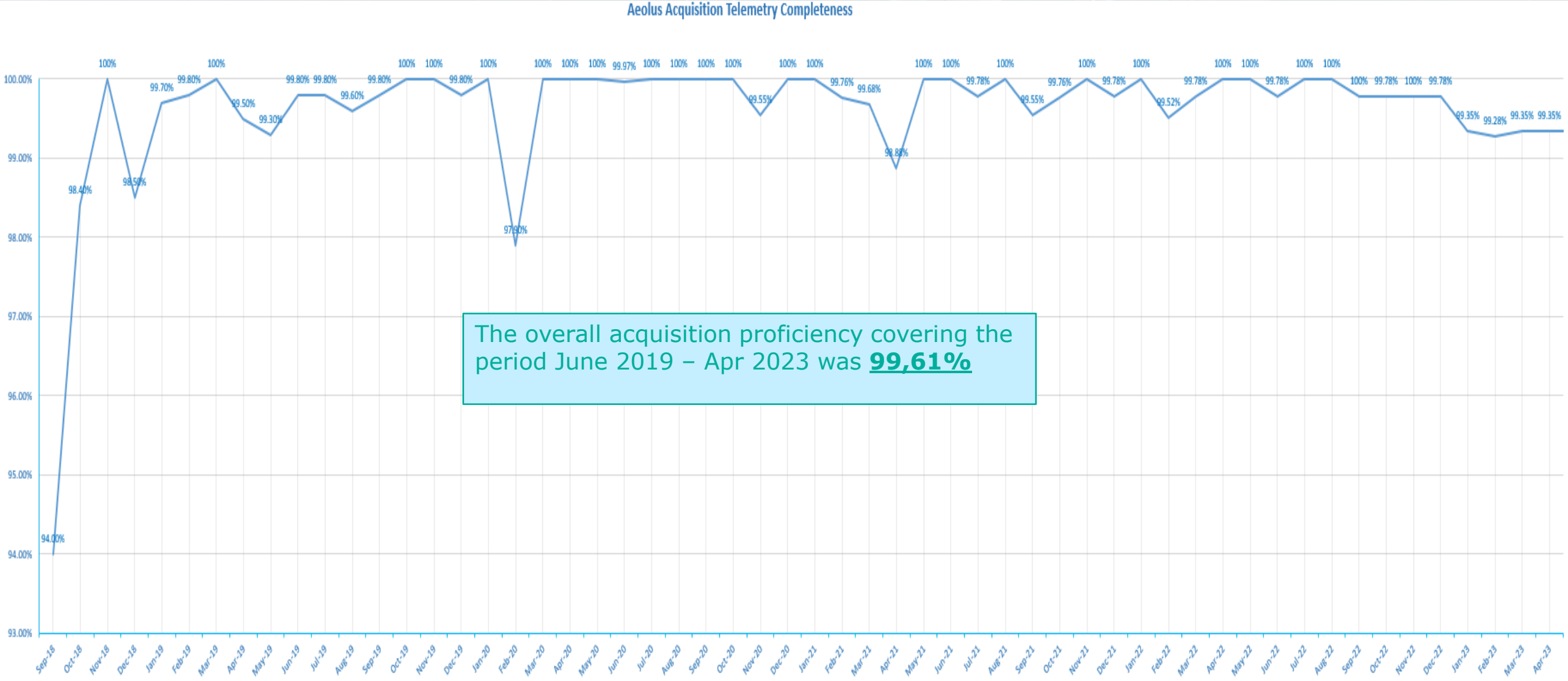


# Master Archive datasets & Numbers

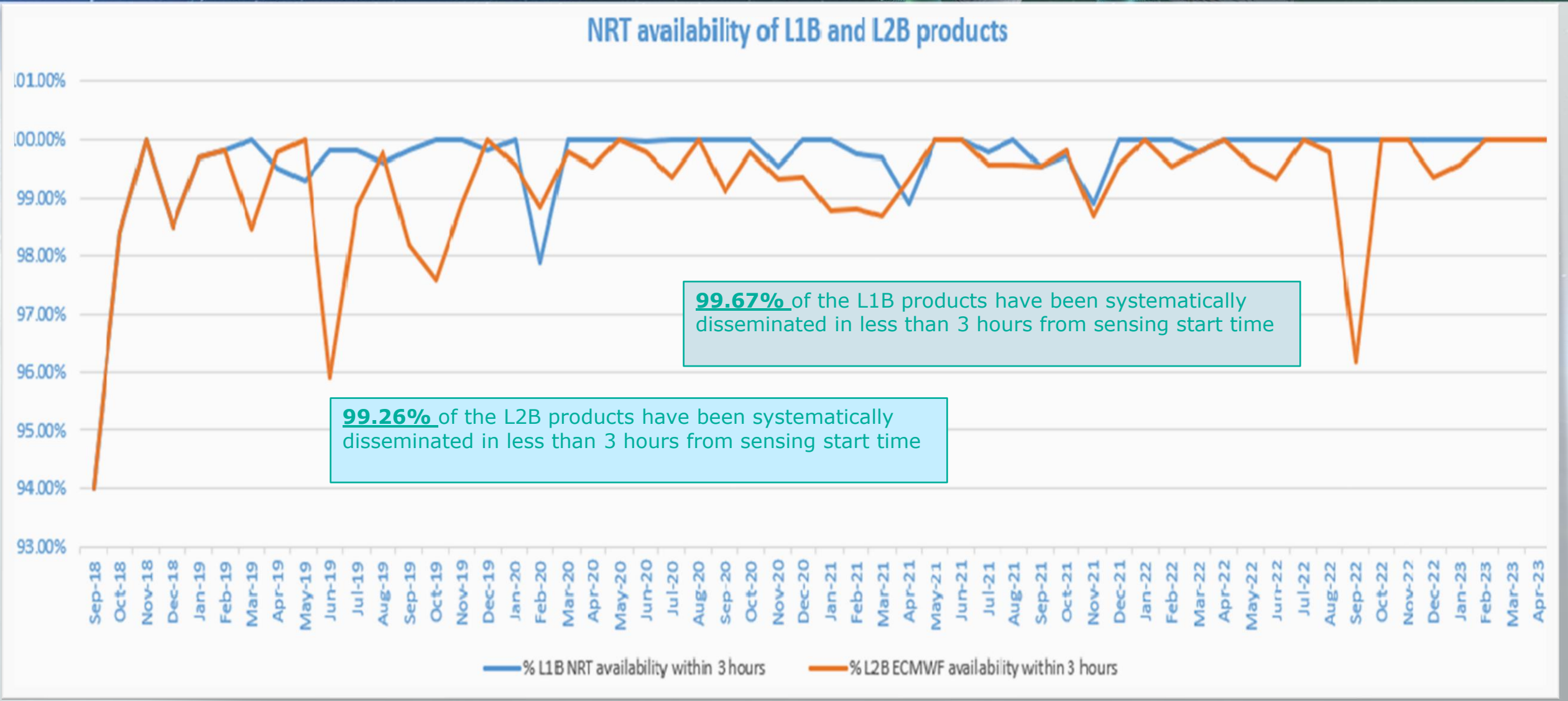
- FMA: 284 days from 06/09/2018 to 17/06/2019
- FMB: 1198 days from 24/06/2019 to 04/10/2022
- FMA: 154 days from 27/11/2022 to 30/04/2023

*1606 days of operations generated the following **numbers** of a consistent, consolidated and validated set of data records which is declared as **Master,** i.e. usable for any future higher level re-processing campaign or future analysis.*

| Instrument | VC1 | L0 | L1A | L1B | L2A | L2B | L2C | Tot |
|---|---|---|---|---|---|---|---|---|
| **FM-A** | 4219 | 9285 | 4719 | 4719 | 4015 | 4700 | 3569 | **35234** |
| **FM-B** | 15185 | 19130 | 20046 | 20044 | 21762 | 20064 | 14785 | **131016** |
| **FM-A** | 6363 | 6265 | 5963 | 5963 | 5945 | 5960 | 5587 | **42046** |

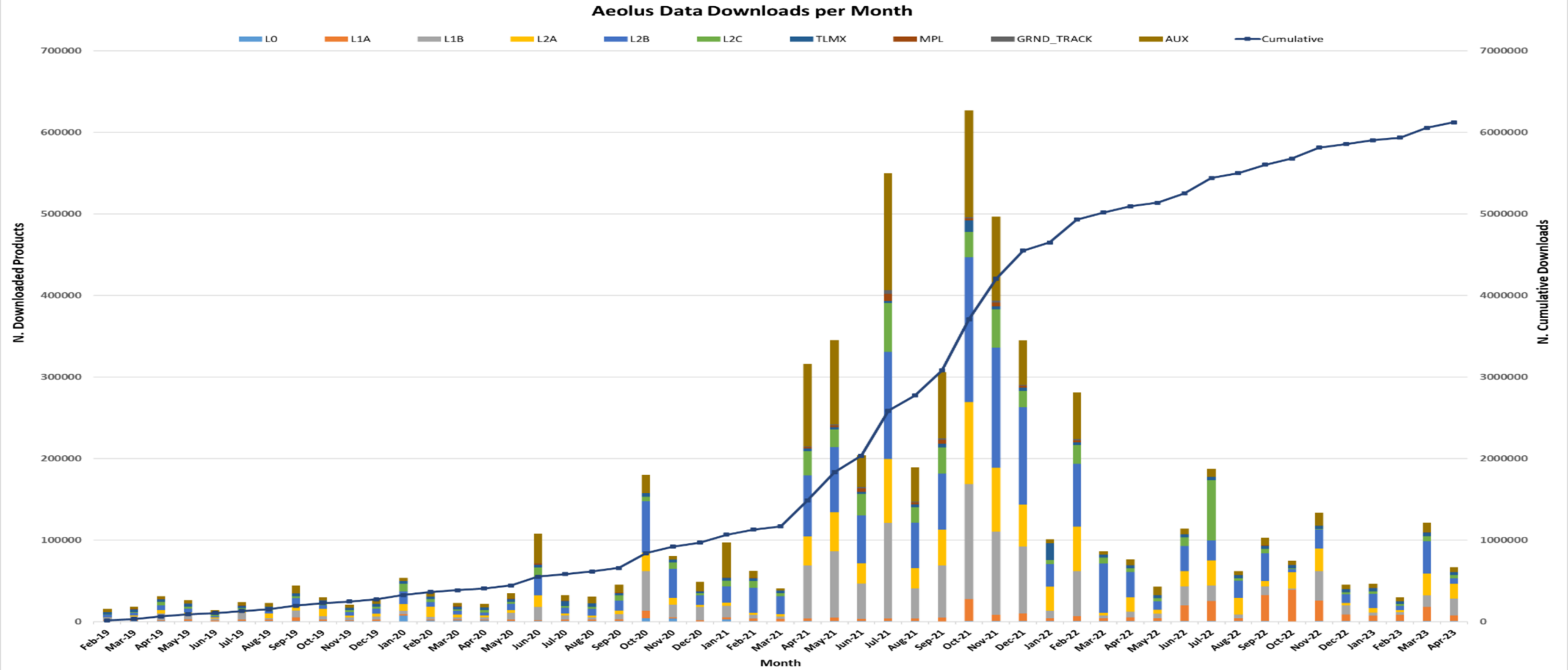



The overall acquisition proficiency covering the period June 2019 – Apr 2023 was **99,61%**




**99.67%** of the L1B products have been systematically disseminated in less than 3 hours from sensing start time

**99.26%** of the L2B products have been systematically disseminated in less than 3 hours from sensing start time


Aeolus Data Downloads per Month
L0
L1A
L1B
L2A
L2B
L2C
TLMX
MPL
GRND_TRACK
AUX
Cumulative
N. Downloaded Products
N. Cumulative Downloads
Month
700000
600000
500000
400000
300000
200000
100000
0
7000000
6000000
5000000
4000000
3000000
2000000
1000000
0
Feb-19
Mar-19
Apr-19
May-19
Jun-19
Jul-19
Aug-19
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Feb-23
Mar-23
Apr-23

# Mission Planning - Wind Timeline (2018-2021)

28 Jun 2019 - 13:54:23
First Wind Measurement

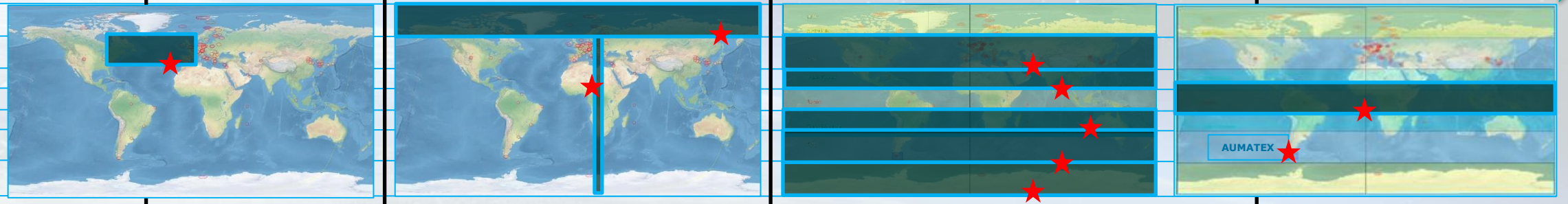
13 Jan 2020
RBS for NORTH POLE

13 May 2020
RBS for Summer Season

20 Jul 2020
RBS for AUMATEX

**MMPF WIND planning**

POLARIS NP
extraTropics
VENUS
QBO2020
VENUS
extraTropics
POLARIS SP




Sept2019
RBS for AVATARI campaign

09 Nov 2019
RBS for AMV campaign

13 Jan 2020
RBS for STRATEOLE campaign

13 Jan 2020
RBS for QBO2020

03 May 2021
+RBS Gravity Waves

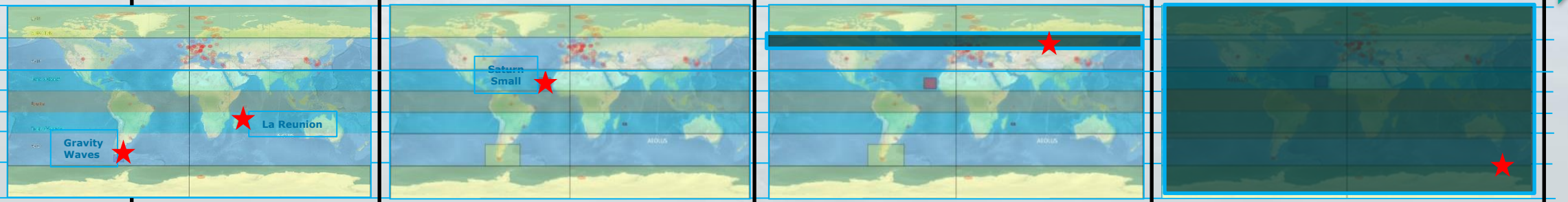
Summer 2021
+RBS SATURN small (Tropical Campaign)

13/12/2021
+RBS EPOS

17 Dec 2021
+RBS OHP

**MMPF WIND planning**

POLARIS NP
extraTropics
VENUS
QBO2020
VENUS
extraTropics
POLARIS SP




22/03/2021
Instrument to Survival

17 May 2021
+RBS LaReunion

22/10/2021
Instrument to Survival

19/01/2022
MPL_ORBSCT updated

13 Dec 2021
Permanent P/N Settings

# Mission Planning - Wind Timeline (2022-2023)

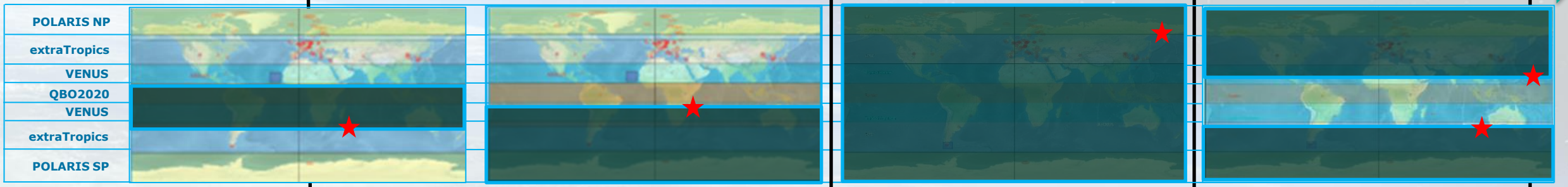
19 January 2022
+RBS TONGA

21 March 2022
DUDEs over Southern Hemisphere

11 April 2022
solar background i.t. 100=4=30000 TMC=625µs

02 May 2022
-EPOS band, +POLARIS SP

MMPF WIND planning




19 Jan 2022
MPL_ORBSCT updated

04 April 2022
N=5/P=114 parameters settings for WIND mode

25 April 2022
solar b.i.t. 101=5=60000 TMC=1250µs

22 August 2022
ExtraTropics RBS 2022 bins to 1km

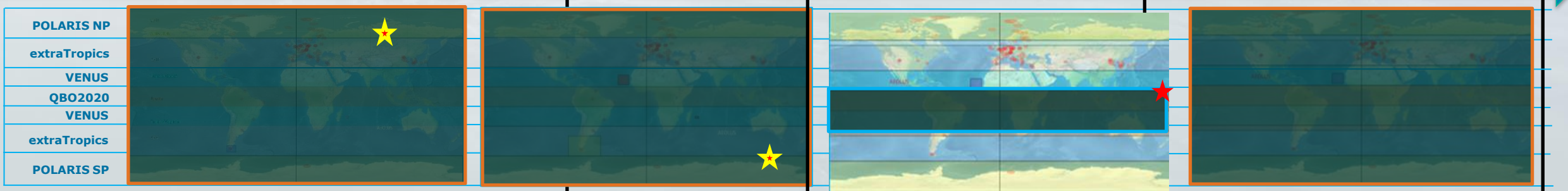
October 2022
Switch to FM-A starting ops

21 November 2022
Re-start of nominal wind MEAS

20 March 2023
DCMZ over 1 Orbit, Ironic over Tropics

20 March 2023
+WITTY band

MMPF WIND planning




04 November 2022 - FIRST POSSIBILITY
to re-start nominal wind measurement operations (IFID=WVM)

FM-A BRCs, CF1, CS
and MEAS_TLE Update

20 February 2023
IRC over Sahara Desert on week#08

30 April 2023, at 23:59 UTC
END OF NOMINAL AEOLUS MISSION OPS

- Aeolus deorbiting will be implemented through an “assisted” approach
  - The orbit lowering from the nominal science altitude of 320 Km to re-entry is implemented via a mixed approach of natural decay and orbit control manoeuvres

- For the first time for an ESA EO mission, PDGS will support critical re-entry operations until the very end (150 Km and possibly below…)
  - Dumps of the satellite HKTM stored on the satellite on-board memory – including GPS data required by FOS to plan the de-orbiting manoeuvres with the required accuracy – can be acquired only via X-Band
  - Mission planning support throughout the re-entry period

- X-band acquisition service procured by PDGS requires significant enhancements with respect to routine phase support to maximise chances of acquiring and tracking the satellite signal at extremely low altitudes
    - Synergies with S-band service provided by KSAT to FOS (at technical, operational and financial level)

- Main enhancements:
    - Usage of S-Band as acquisition aid for X-band (S- and X-band service support from same antennas)
    - Procedure to measure and apply TOVs (Time Offset Values)
    - Application of scheduling margins to passes to consider orbit predictions inaccuracy
    - Operations support from specialised KSAT technical team (same for S- and X-band)
    - Dedicated testing and validation campaign (coordinated by FOS)

# CONCLUSIONS

- ✓ Aeolus Ground segment operations ensured through network of tailored operational services and collaboration of specialised international teams
- ✓ Operational mission objectives fully met with impressive PDGS performance in 4+ years of Aeolus operations (well above 99% NRT science data availability)!
- ✓ PDGS achieved an impressive number of milestones in 4+ years (16 baseline deployments, 3 reprocessing campaigns, continuous Mission Planning operations), also taking advantage of the flexibility of the PDGS design and the relevant teams expertise
- ✓ A prime for ESA EO missions, PDGS will provide a critical support to re-entry operations notably through an enhanced X-Band acquisition service

# THANK YOU!