

ESA Proba-1 CHRIS

End of Mission Workshop Ghent

18th -19th January 2024

20 years of CHRIS operations

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PLANNING COLLECTION PROCESSING ANALYSIS DISSEMINATION

Mission Overview

ESA PROBA-1 micro satellite (less than 1 cubic metre)

- Initially launched as a technology demonstration mission
- Launched 22nd October 2001
- Low Earth Orbit @ 615km

SSTL CHRIS Imager

- 14kg
- Designed, commissioned and operated by Space Group of Sira Electro-Optics, until merger with SSTL in 2006
- Star tracker guidance
- $\pm 25^\circ$ off-nadir in the cross-track
- $\pm 55^\circ$ in its along-track
- Ability to image the same AOI from 5 directions
- Used extensively for vegetation and land cover imaging
- 18 spectral bands in each image @ 17m spatial resolution
- 62 spectral bands per image at a lower 34m spatial resolution

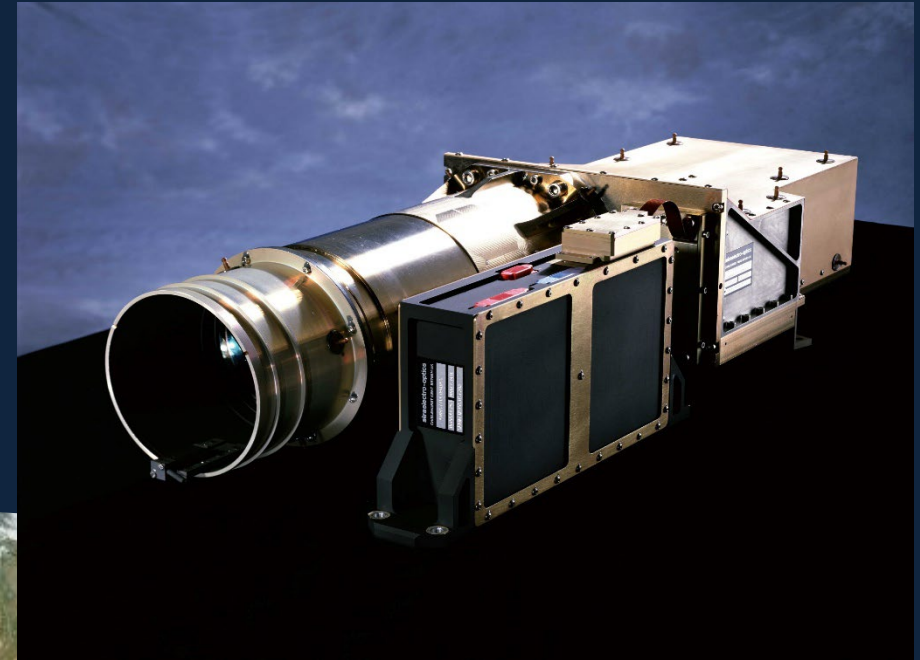


Image Credits SSTL & ESA

DMCii (SSTL/Airbus) Responsibilities

Requests

Reception and logging of requests from RSAC

Checking for errors and ad-hoc requests

Acquisition of Roll, Azimuth and Zenith information (via website)

Generation of configuration files

Transmission of configuration files to Redu (via FTP)

4 members of staff

Processing

Acquisition of raw image data sets

Acquisition of ancillary data sets

Splitting Raw Data into useable files

Processing of data into image files

Checking cloud cover and usability of images

3 members of staff

Pre-Release

De-stripe releasable JPGs

Create quicklook JPGs

Upload JPGs to ESA FTP

Daily summary report via email

3 members of staff

Releasing

Calculation of Image Azimuth and Zenith

Wavelength calibration

Processing to level 1a

Delivery of the data sets to ESRIN

3 members of staff

All tasks – 2 more members of staff from Spring 2019

Additional Responsibilities

Monthly Reports

- Summary of sites
- Processing results
- Summary of issues

Nominal Plan Update

- Add/Remove sites from the request sheet as notified by RSAC
- Assign new sites a CHRIS site code
- Logging of new sites

Training

- 4 team members now available.

Meetings

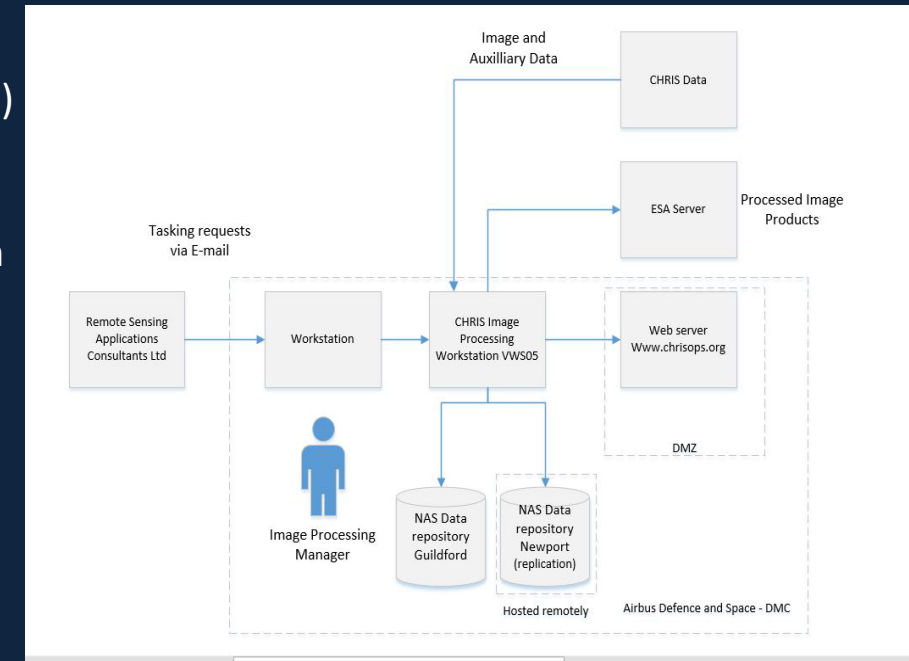
- Attendance at meetings
- Preparation for meetings

Management of Anomalies

- Technical support to aid resolution of operational anomalies
- Ensure efficient handling and resolution of problems/complaints
- Keep a record of changes to Configuration Management

Operational Processes and Infrastructure

1. CHRIS Principal Investigators (PIs) request data from ESA Third Party Missions (TPM)
2. PIs provide details of acquisitions to Remote Sensing Applications Consultants Ltd (RSAC)
3. RSAC carry out feasibility study using orbital information from Reading University
4. Scheduled information sent to DMCii (SSTL/Airbus) to prepare the configuration file
5. DMCii (SSTL/Airbus) transfer configuration files to ESOC ground station in Redu, Belgium
6. Acquisitions undertaken during the day
7. Data downlinked to either Redu or Kiruna ground stations
8. DMCii (SSTL/Airbus) acquire image data from Redu or Kiruna via mirror server or FTP
9. The image data is processed to level 1a and compiled into CHRIS image products
10. The CHRIS image products are transmitted to ESRIN via FTP (including JPG quick looks)
11. PIs can view 'quick looks' at ESA ESRIN website
12. BEAM software developed by Brockman for PIs to process CHRIS images above level 1a
13. All acquired data is backed up to a DMCii (SSTL/Airbus) server



Requested Observations

2 REQUESTED OBSERVATIONS

The following table lists the observations requested for each day during this period. A full set of five images was requested in each case.

Date	Image ID	Target	Imaging Mode	Success	Number of Images Processed	Reason for Failure
March 2019						
2019-03-01	5671	Sturt-Plains	Science	No	5	Heavily cloudy
2019-03-01	5676	Chalkidiki	Science	No	5	Heavily cloudy
2019-03-01	567B	Railroad-Valley-Playa	Calibration	No	5	Heavily cloudy
2019-03-02	5680	Bangalore	Science	Yes	5	
2019-03-02	5685	Table-Mountain	Science	Yes	5	
2019-03-03	568A	Long-Baoton	Science	Yes	5	
2019-03-03	568F	Albufera	Science	Yes	5	
2019-03-03	5694	Chascomus	Science	Yes	5	
2019-03-04	5699	Zhoushan	Science	No	5	Heavily cloudy
2019-03-04	569E	Lavrion	Science	Yes	5	
2019-03-05	56A3	Mysore	Science	Yes	5	
2019-03-05	56A8	Barrax	Science	No	5	Heavily cloudy
2019-03-06	56AD	Pak-Phanang	Science	Yes	5	
2019-03-06	56B2	Podgorica	Science	Yes	5	
2019-03-06	56B7	Buenos-Aires	Science	Yes	5	
2019-03-07	56BC	Sung-Valley	Science	No	5	Heavily cloudy
2019-03-07	56C1	DonanaN	Science	Yes	5	
2019-03-08	56C6	Manly-Beach	Science	Yes	5	
2019-03-08	56CB	Ljubljana	Science	Yes	5	
2019-03-08	56D0	Paraiba	Science	Yes	5	
2019-03-09	56D5	Frascati	Science	Yes	5	

Total Mission PDGS Operations in numbers

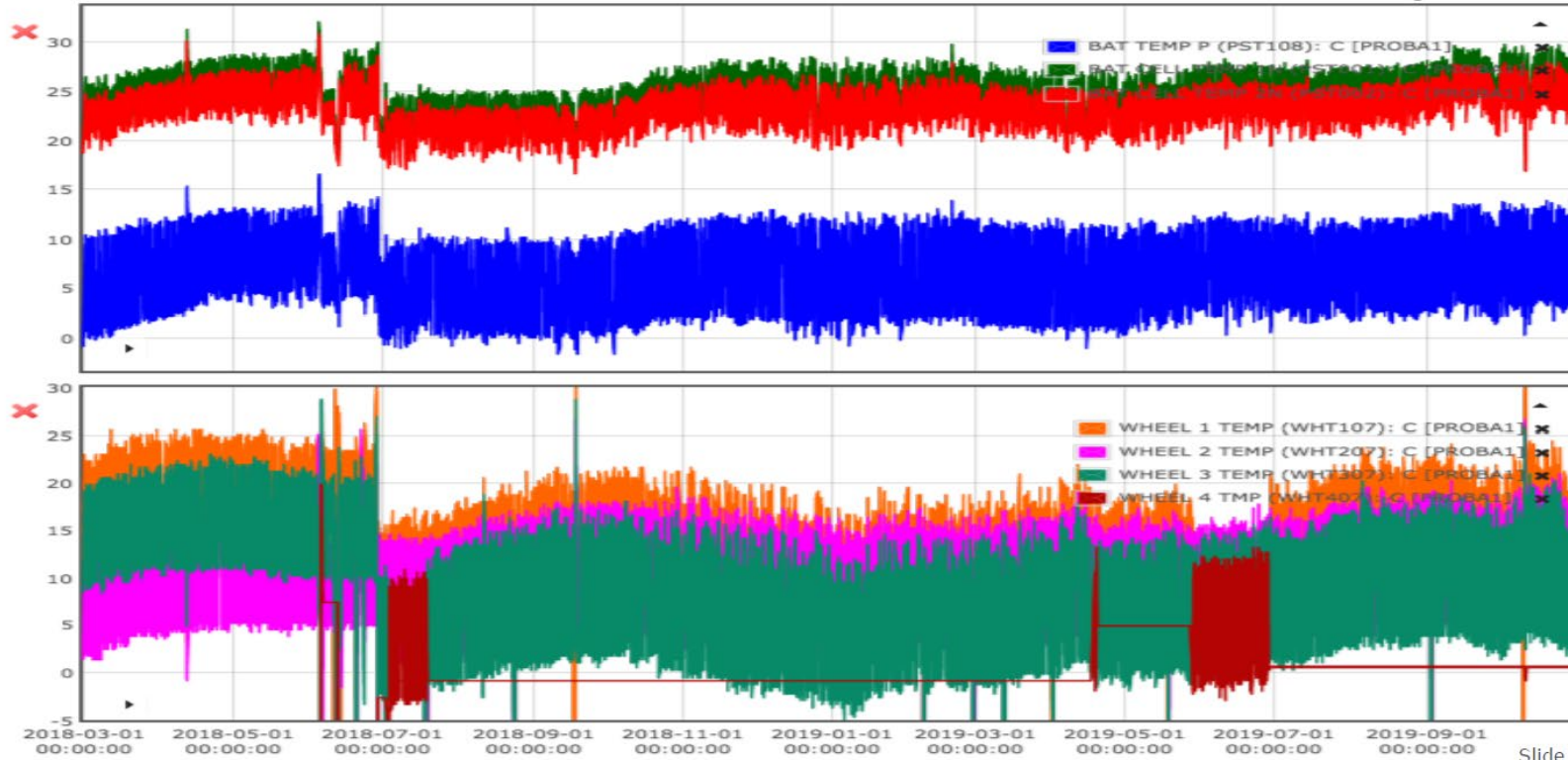
Year	Number of tasking requests	Taskings with 1 or more images downloaded	Taskings with 1 or more images released
2001	1	1	0
2002	361	217	75
2003	531	444	262
2004	843	806	412
2005	1138	1080	515
2006	1331	1259	716
2007	1221	1181	685
2008	1403	1337	693
2009	1054	1008	476
2010	1140	1063	424
2011	449	408	157
2012	674	614	220
2013	937	901	240
2014	897	789	293
2015	754	662	351
2016	877	819	479
2017	903	834	507
2018	895	788	491
2019	908	831	467
2020	892	780	512
2021	899	831	544
2022	904	762	483
Total	19,012	17,415	8,725 *

- Data provided to scientists in 25 countries
- 100 + Principal Investigators
- Over 945 unique sites

* Most taskings released contained 5 images over AOI, so total number of images is approx. **43,600**

Monthly Reporting

Platform key parameter: thermal



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European Space Agency

Acquisitions and Processing Overall Figures - 2016



2281 images released



184 sites covered



88 PI's provided for

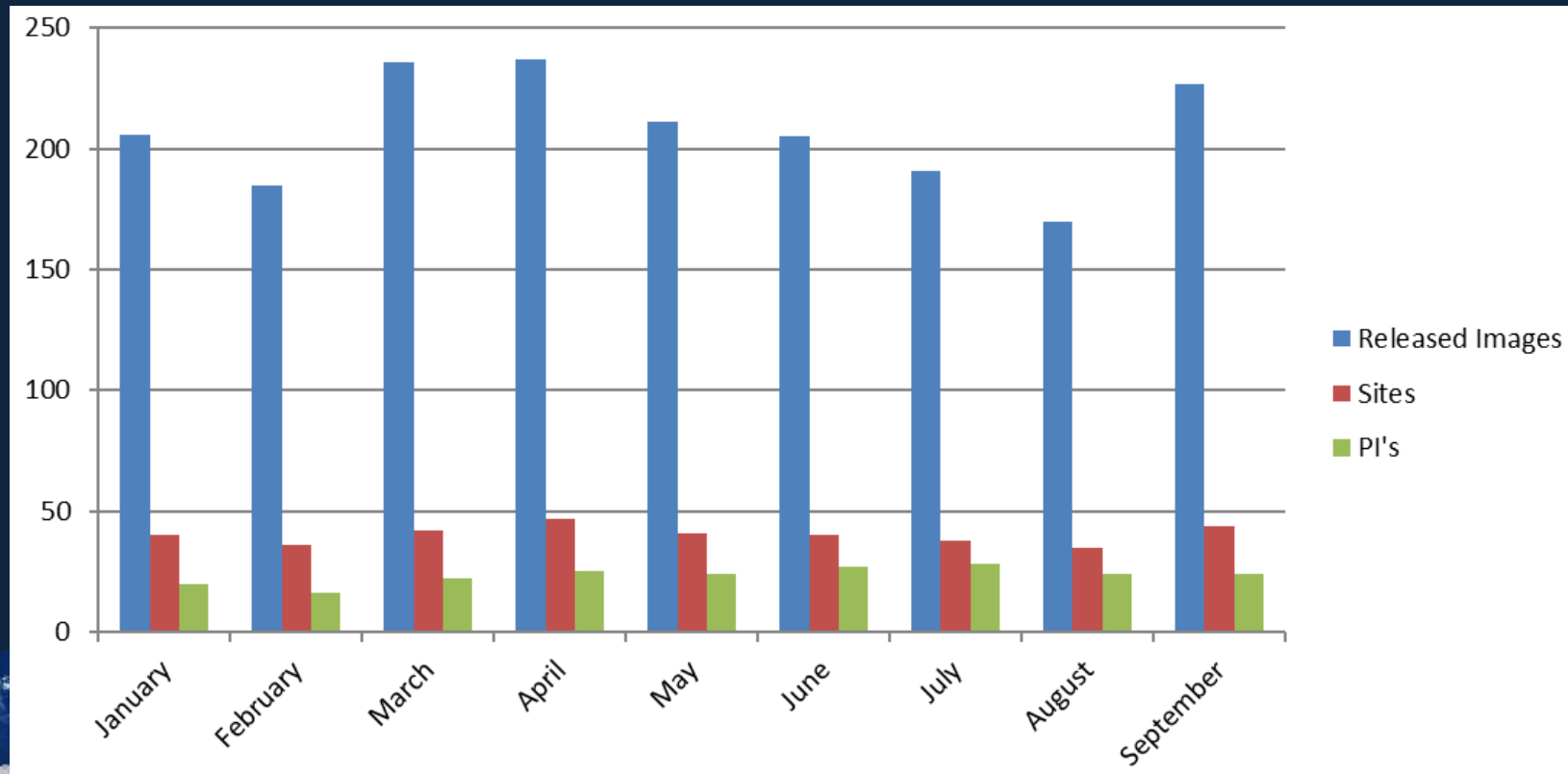
Acquisitions and Processing Monthly Figures - 2019

Images Released: **1868**

(1818 for same period in 2018)

Sites Covered: **161**

PIs Provided For: **60**



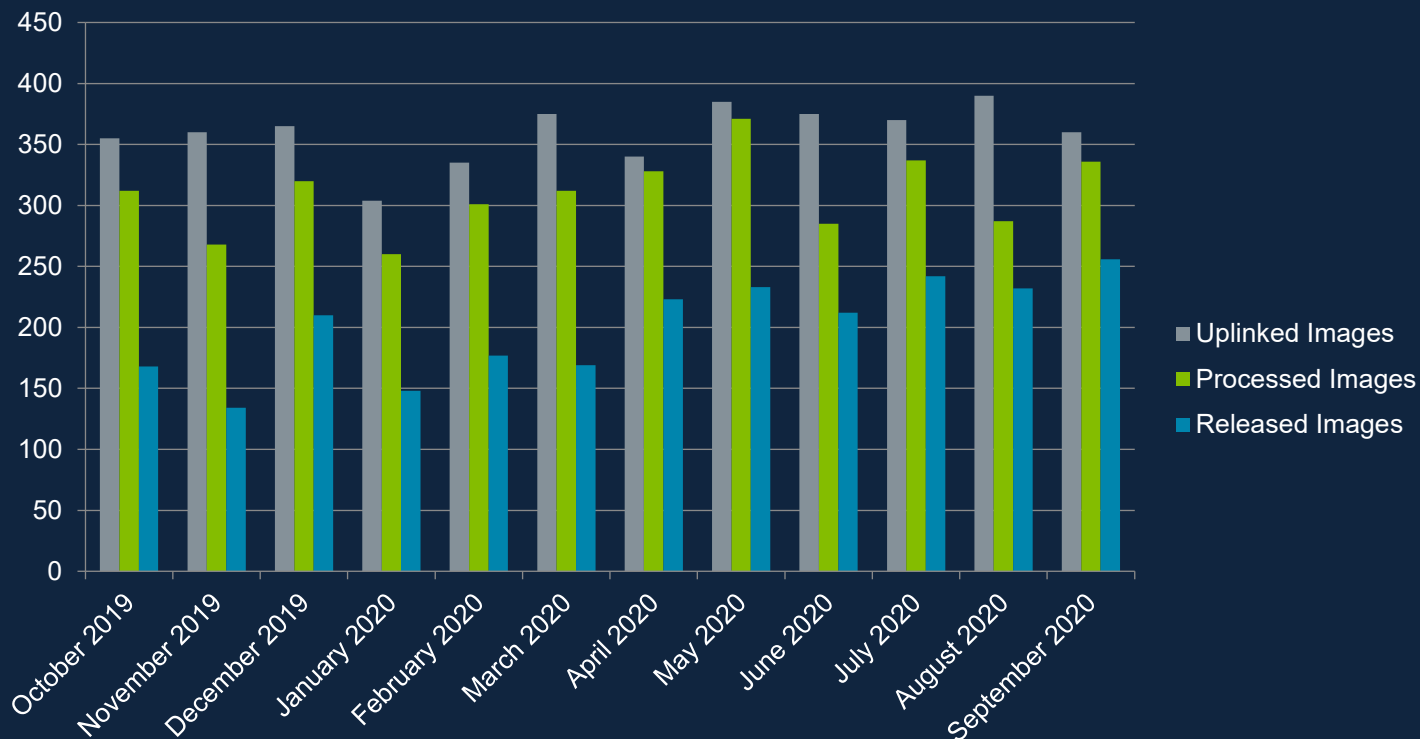
Acquisitions and Processing

Monthly Figures – Oct 2019 – Sept 2020

	Uplinked Images	Processed Images	Released Images
Total:	4314	3717	2404
Monthly Average:	360	310	200

Over the October 2019 to September 2020 period, on average:

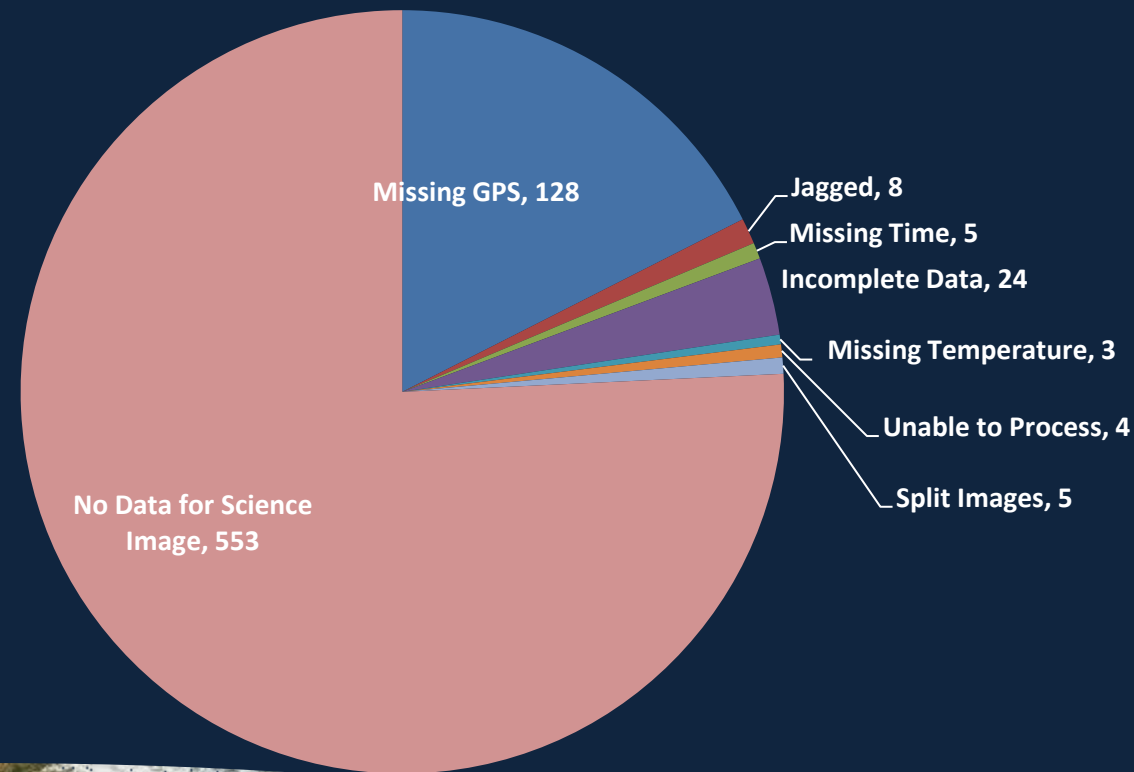
- Of the total images uplinked to the satellite:
 - 86% were received at Airbus and processed
 - 56% were released to end users
- Of the total images processed at Airbus:
 - 64% were released to end users



Acquisitions and Processing

Monthly Figures – Processing Failures

Quality Problem	Total Images Affected	Percentage of Quality Issues	Summary
No Data for a Science Image	553	76%	13% of Uplinked Images were not Received at Airbus
Jagged	8	1%	5% of Images Processed were Impacted by Quality Issues
Missing GPS Data	128	18%	
Missing Time Data	5	<1%	
Incomplete Data	24	3%	
Missing Temperature Data	3	<1%	
Unable to Process	4	<1%	
Split Images	5	<1%	



Acquisitions and Processing

Monthly Figures – Sites and PIs

- Released images between Oct 2019 and Sept 2020:

- Total **2404 images**
- **189 sites** covered, for **63 PIs**

- 93% science; 6% calibration; 1% PR images

- Monthly average:

- 200 images released
- 41 sites covered for 23 PIs

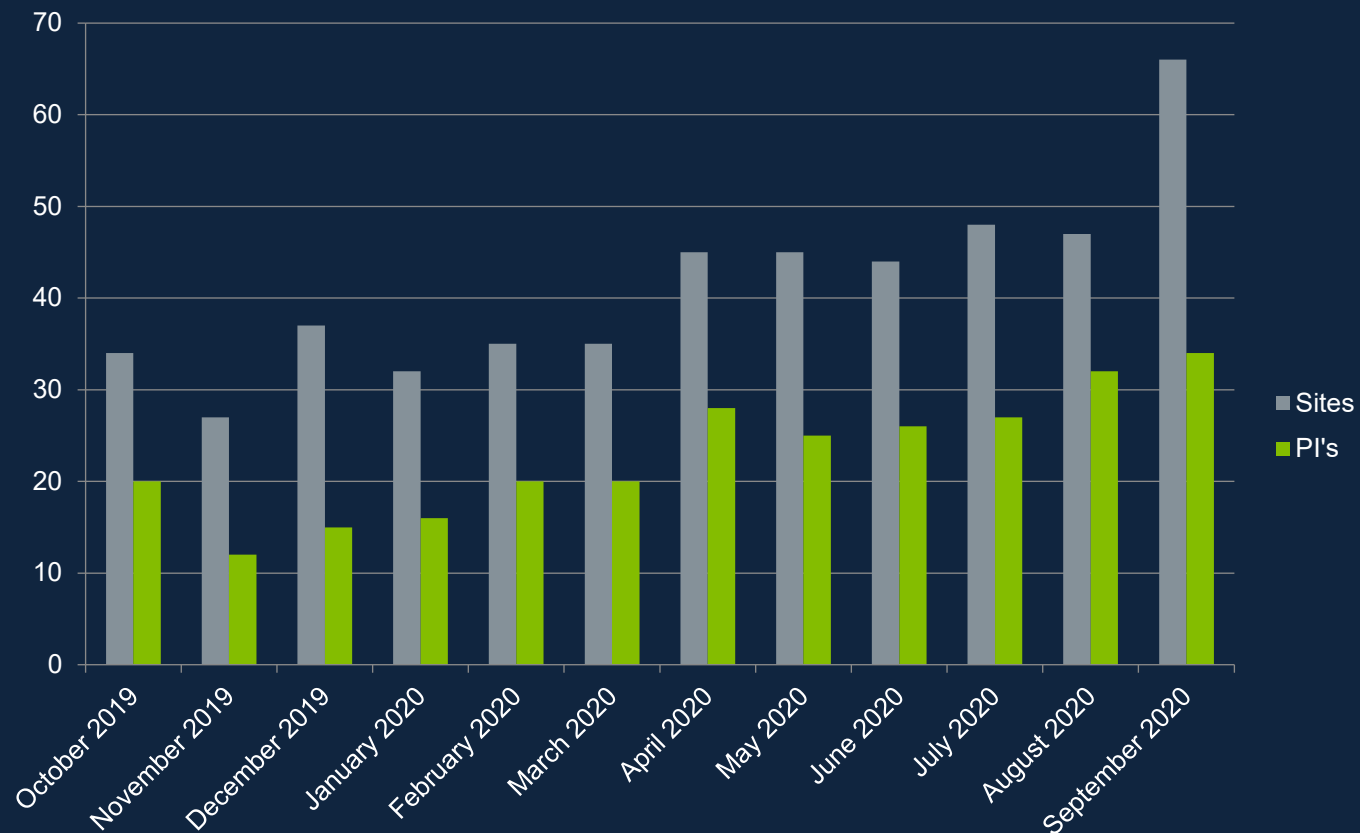
- Two **nominal plan updates** implemented:

- R91 on 05/12/2019:

- 12 sites added
- 2 sites removed and 2 modified

- R92 on 10/08/2020

- 2 sites added
- 7 sites removed



Proba-1 CHRIS Images



Credit ESA



Thank you and De-orbit!

orbit evolution: Half time before re-entry!

