

FORMOSAT-7/COSMIC-2 Neutral Atmosphere Radio Occultation Profile Count Statistics and Impacts in 2020

William S. Gullotta^{1*}, Gavin C. James², Mike Perotta²
 John J. Braun², Wei Xia-Serafino³
 *william.gullotta@noaa.gov

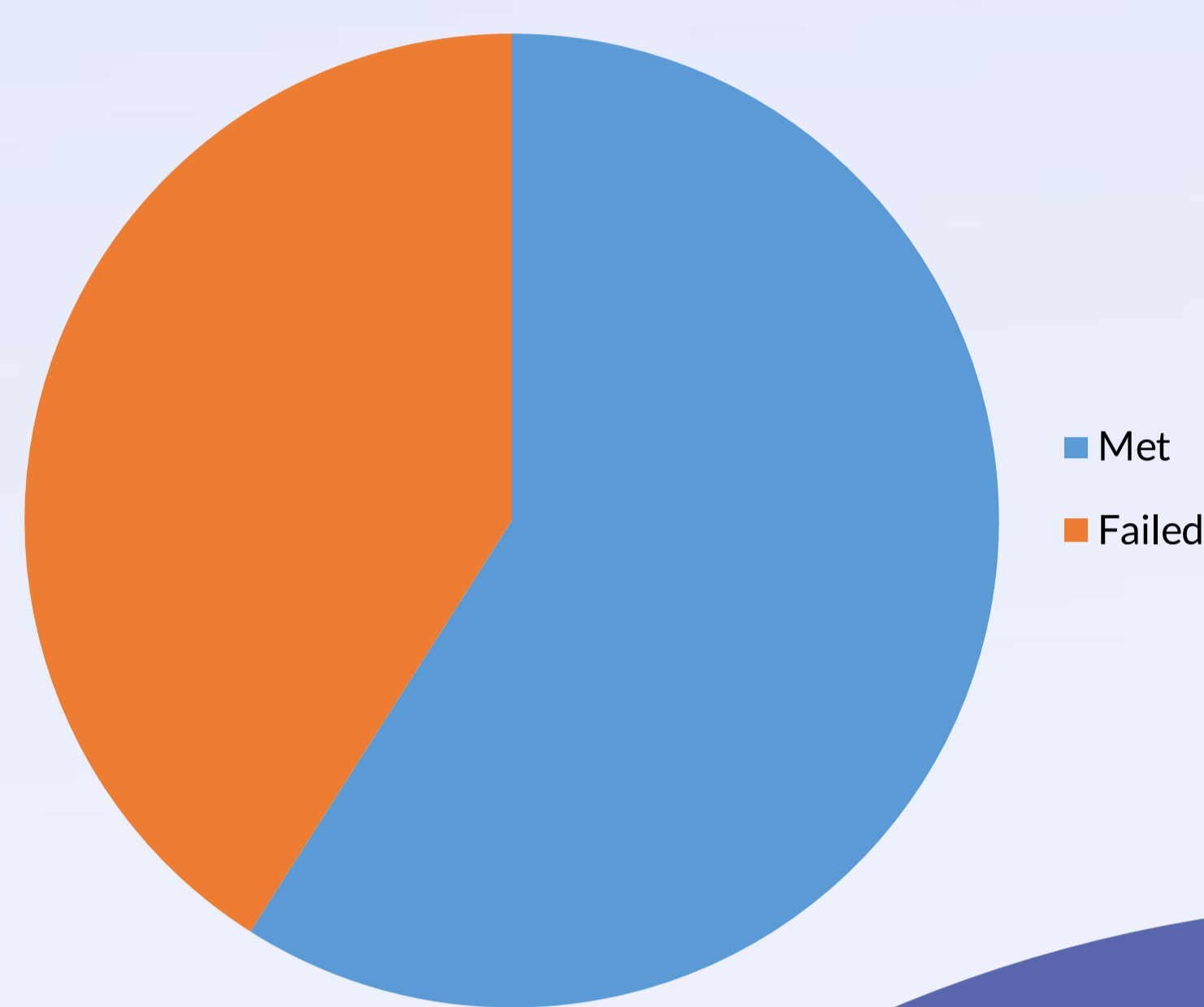
Introduction

The FORMOSAT-7/COSMIC-2 (FS7/C2) mission has a requirement to produce at least 4000 and a goal of 5000 neutral atmosphere radio occultation (RO) profiles per day. 2020 is the first full year of operations for the RO payload.

2020 Overall Count Statistics

- 2020 Total: 1429535 Profiles
- Maximum: 5738 (01 Apr 2020)
- Minimum: 1960 (27 Jun 2020)
- Median: 4209
- Mean: 4077

FS7/C2 Profile Count Requirement Achievement in 2020



Examining the sources of data loss show the causes of profile count drops and give insight why the requirement wasn't met on some days. The main influences on counts stem from two factors - availability and issues on the spacecraft.

Influences on Profile Counts

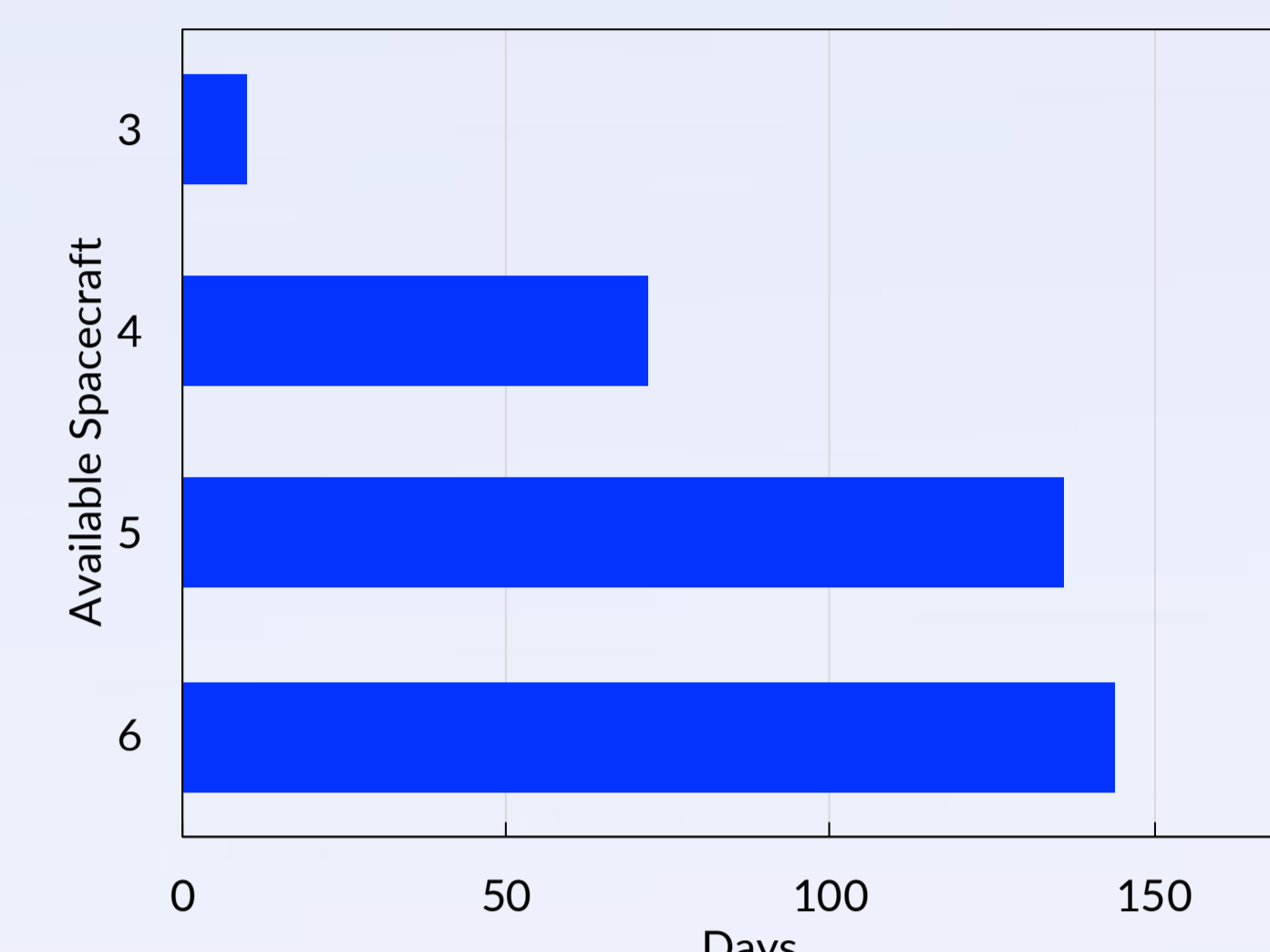
Spacecraft Availability

218 days with <6 spacecraft available

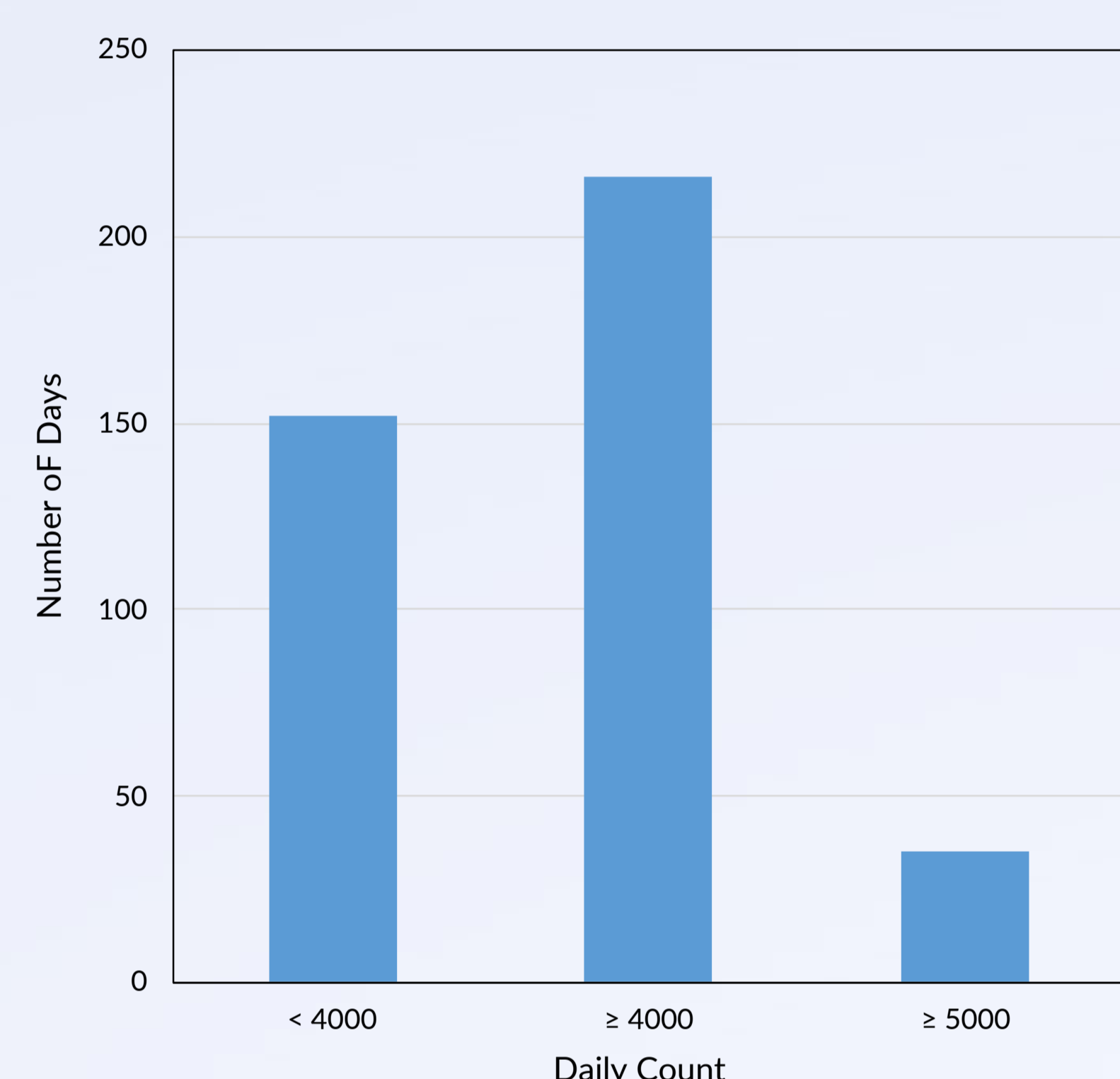
Of 150 days under 4000 Profiles:

- Orbit Transfer: 86 days
- Safe Modes: 104 days
- Updates: 14 days

FS7/C2 Spacecraft Availability 2020



FS7/C2 Daily Counts in 2020

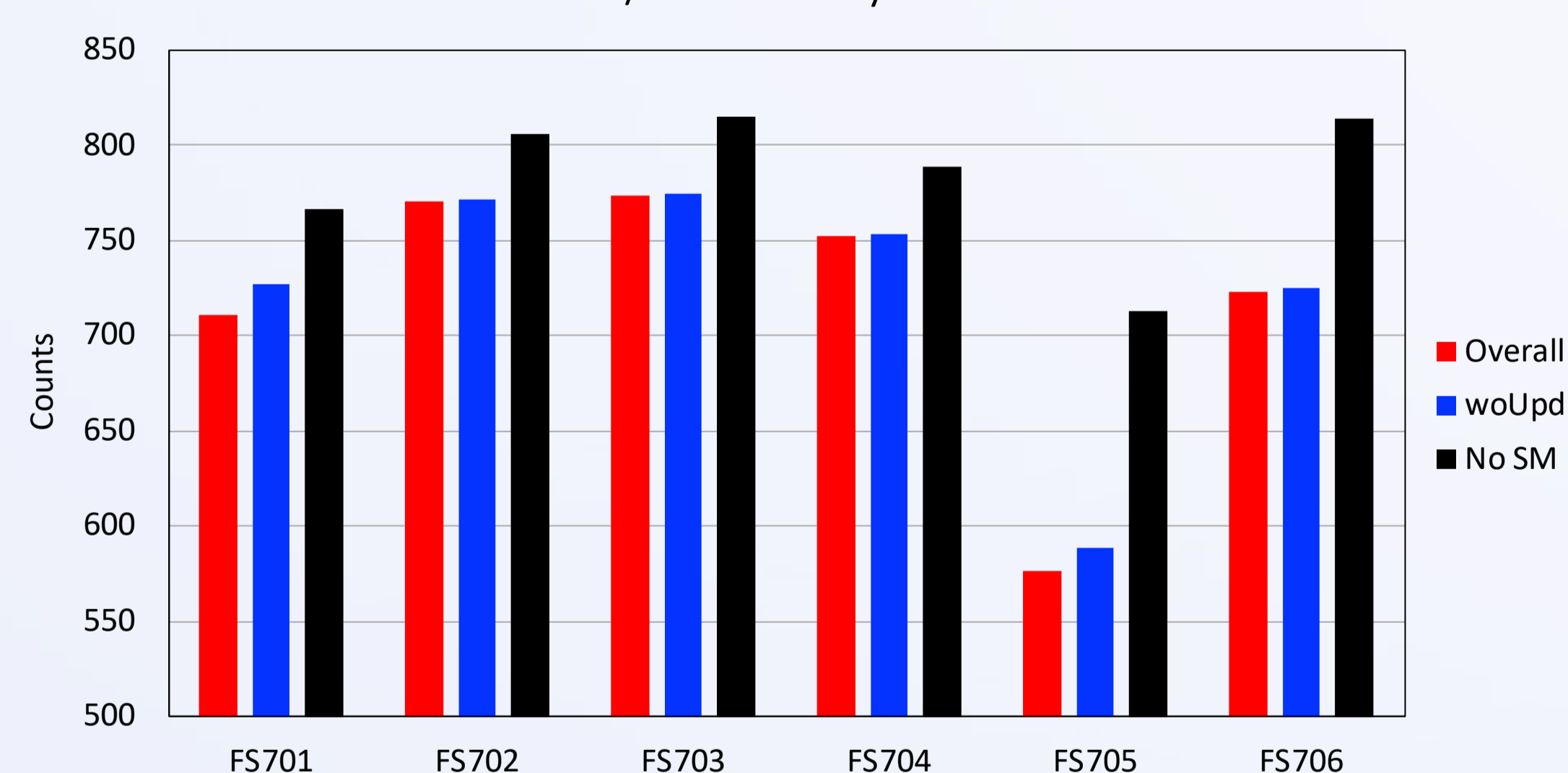


Spacecraft Performance Stats

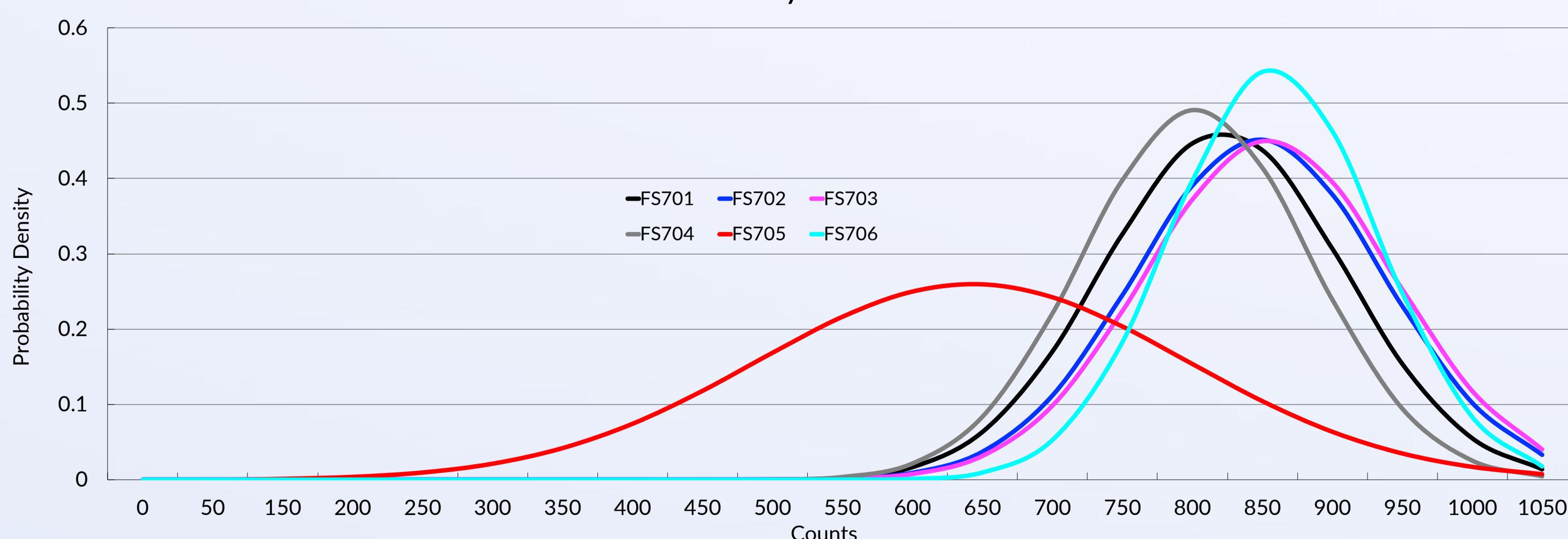
Displayed below are the distribution of daily counts for each spacecraft and their average performance in 2020.

The individual spacecraft data show that the performance of FS701, FS702, FS703, FS704, and FS706 are quite similar. All have performed well above the 667 daily profile average required to achieve 4000.

FS7/C2 Mean Daily Counts



COSMIC-2 2020 Daily Count Distribution



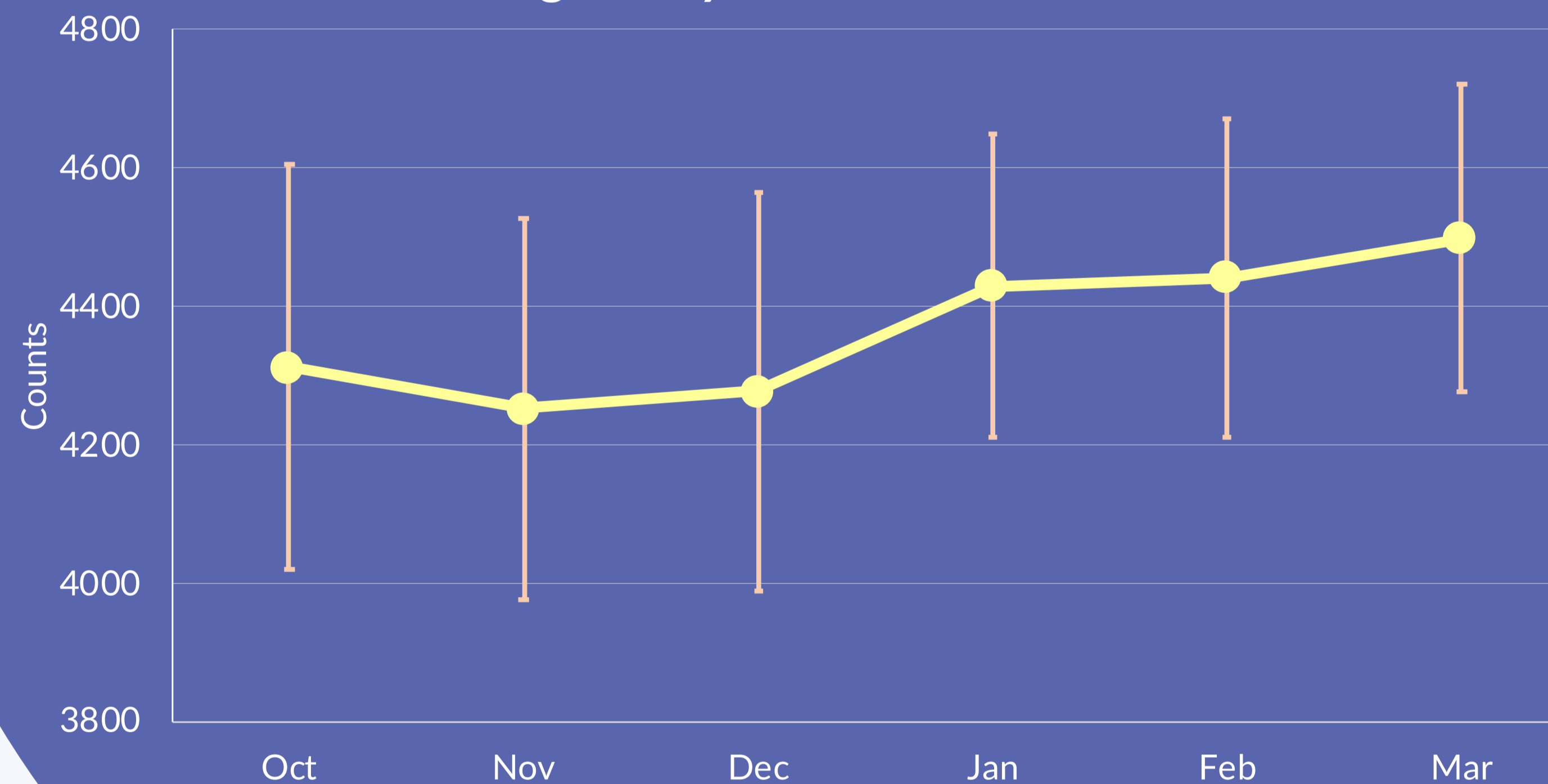
FS705 is a clear outlier in daily profile counts. It has been experiencing an anomaly since August 2020 that has been reducing its daily RO profile counts. Work is ongoing to resolve the cause of that anomaly.

FS7/C2 RO Profile Stats in 2020 and Beyond

Achieved 4000+ daily profile average in 2020

Safe modes and spacecraft availability were largest negative influences on profile counts

Average Daily RO Profiles 2020-2021



Daily profile counts have increased in 2021 and are expected to rise further in the future

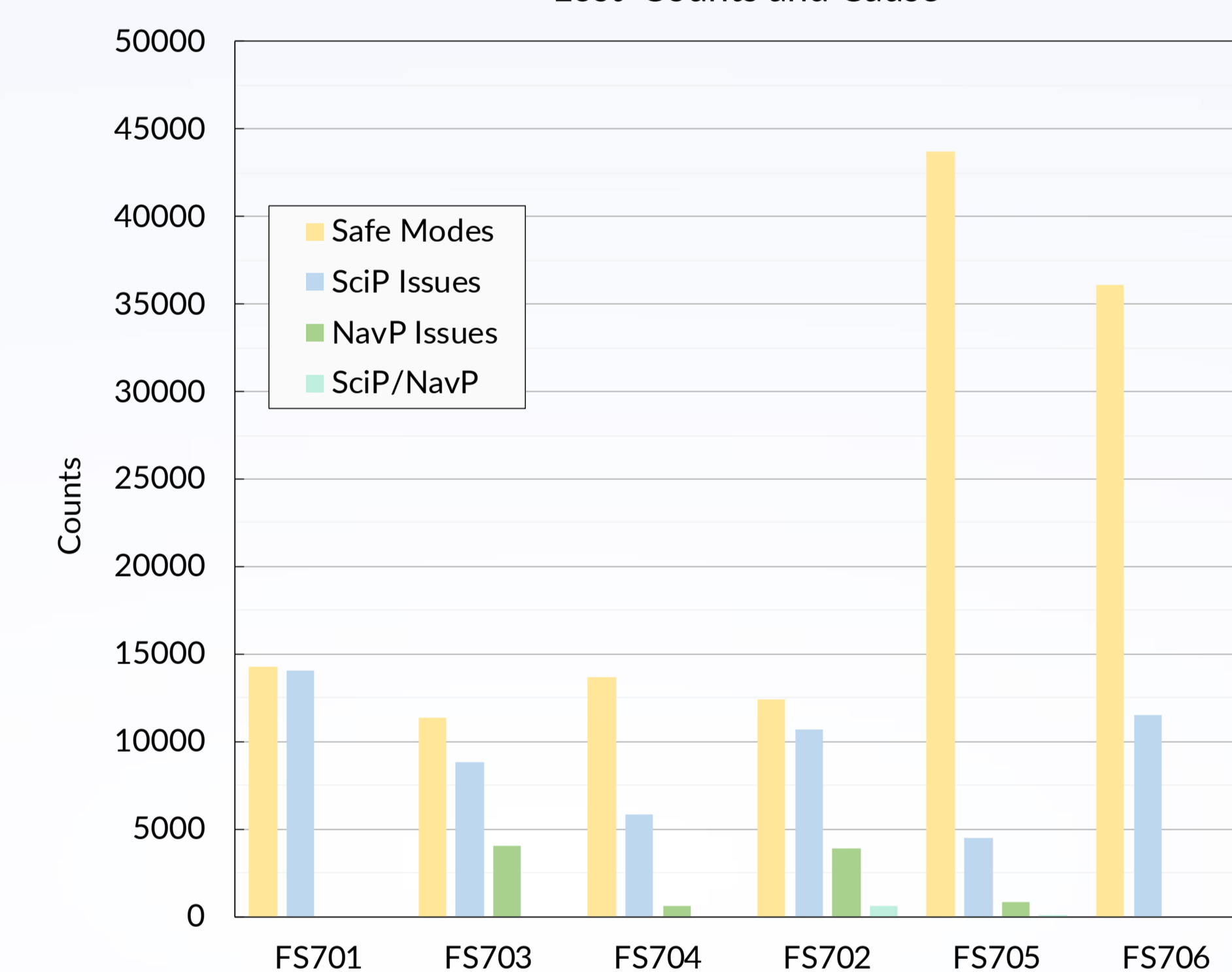
Count Loss

Quantified count "lost" by subtracting performance on issue days from daily spacecraft averages.

Issues Causing Loss:

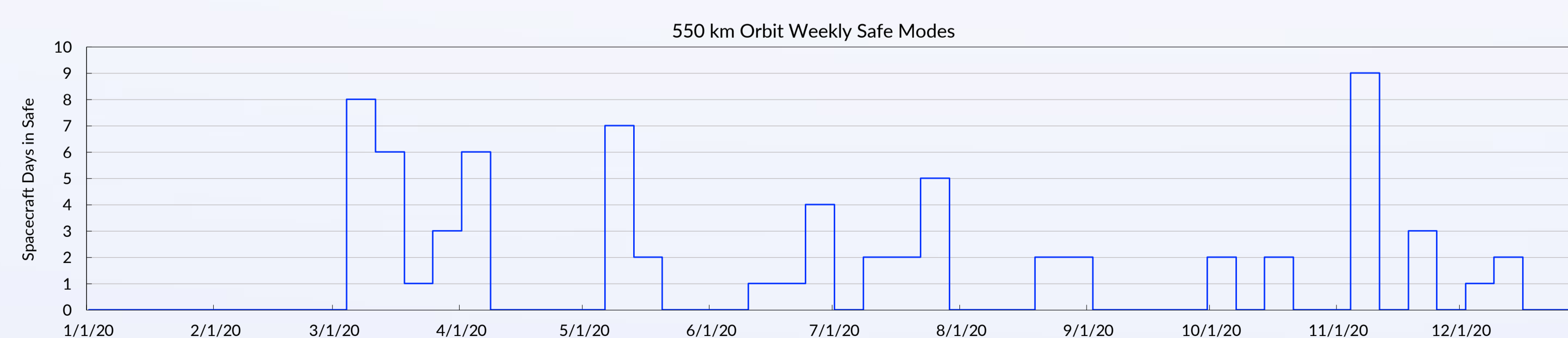
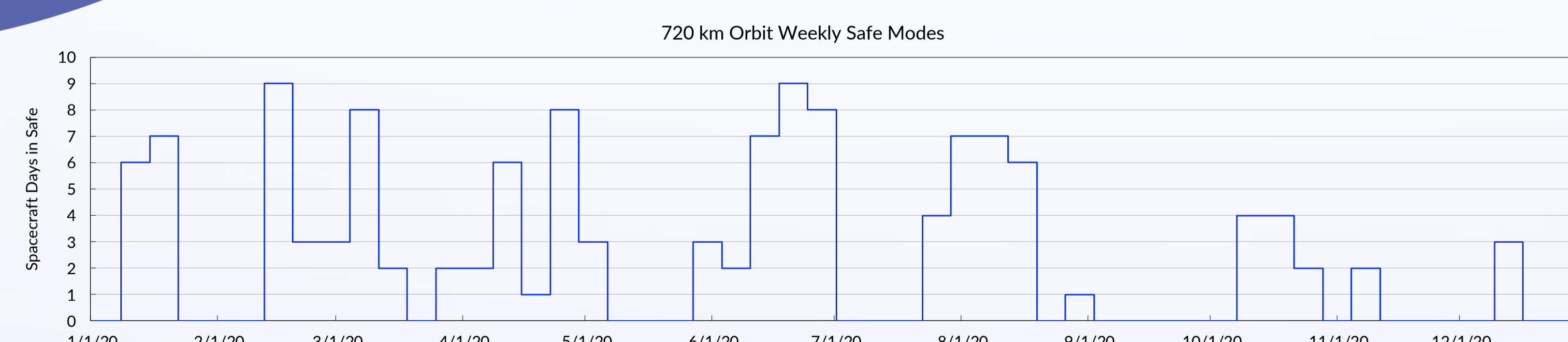
- Safe Modes: 66%
- Payload Issues: 33%
- Unknown: <1%

'Lost' Counts and Cause



Potential Count Improvements

In spite of experiencing significant count loss in 2020, FS7/C2 expects experience reduced loss in the future through mission design and progressive improvement activities.



Spacecraft experienced significantly fewer days in safe mode at mission altitude of 550 km compared to 720 km parking orbit. With all spacecraft at 500km, fewer safe mode events are expected to occur, improving profile counts.

Additionally, the FS7/C2 team continues to update the flight software to improve performance as much as possible.

Acknowledgements:

Many thanks to all of the cooperative institutions that are members of the joint FORMOSAT-7 / COSMIC-2 Joint Team. Special thanks to the Taiwan National Space Organization, the National Oceanic and Atmospheric Administration, the University Corporation for Atmospheric Research, the United States Space Force, the Aerospace Corporation, and NASA Jet Propulsion Laboratory.



Affiliations:
¹Science and Technology Corp, contract to NOAA NESDIS, Office of Projects, Planning, and Analysis, Contact Address: william.gullotta@noaa.gov
²University Corporation for Atmospheric Research, UCAR Community Programs, FORMOSAT-7/COSMIC-2 US Data Processing Center
³NOAA NESDIS, Office of Projects, Planning, and Analysis