



Ground Systems Architecture Workshop

Flexible Operations on ASTERIA with Cloud-based Ground Station Services

Peter Di Pasquale, Ground Data Systems Engineer

Jet Propulsion Laboratory, California Institute of Technology

Kyle Hughes, Lorraine Fesq, Alessandra Babuscia

Jet Propulsion Laboratory, California Institute of Technology

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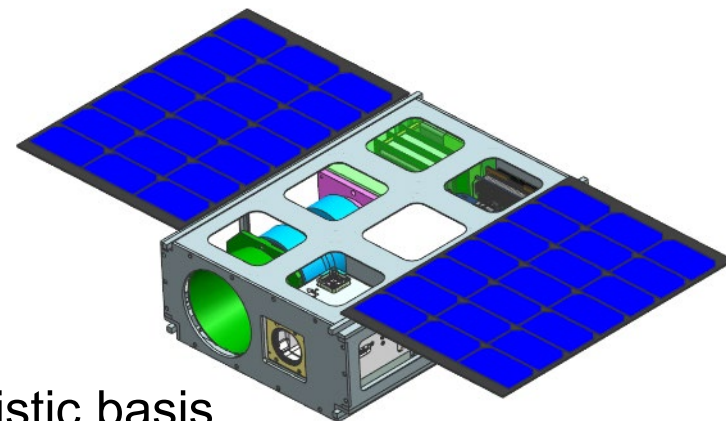
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ASTERIA Mission Profile

ASTERIA is a *technology demonstration* mission to advance capabilities in technology areas that *enable photometric studies of astrophysical phenomena* using CubeSats.

Mission Objectives:

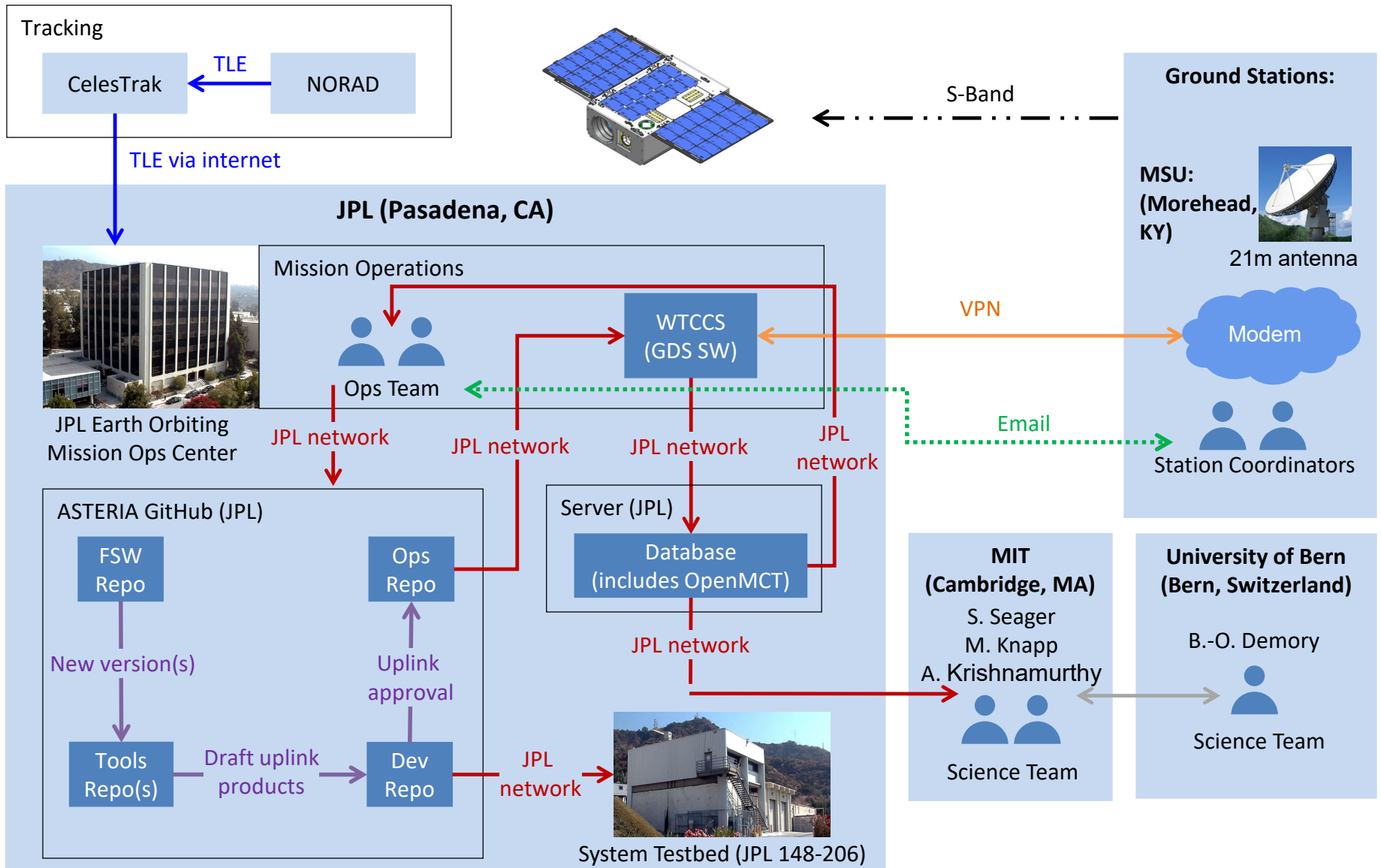
1. Demonstrate high precision optical line-of-sight pointing
2. Demonstrate high precision focal plane temperature control
3. Conduct photometric measurements of astrophysical sources on an opportunistic basis



Status:

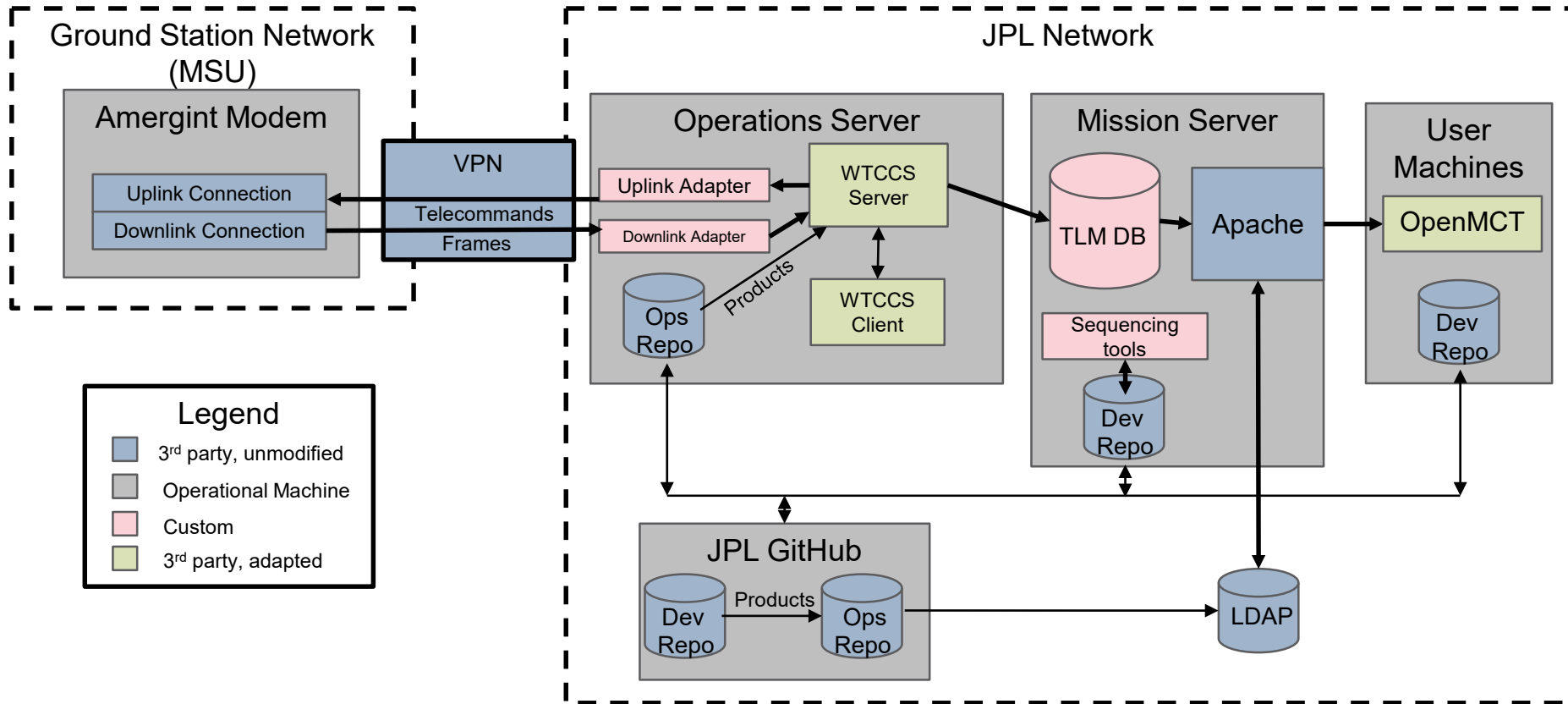
- Spacecraft was deployed from the ISS in Nov, 2017.
- Prime technology demonstration was successfully completed along with several extended missions.
- Spacecraft has been silent since early December.

ASTERIA Operations



ASTERIA's 'traditional' Ground Data System

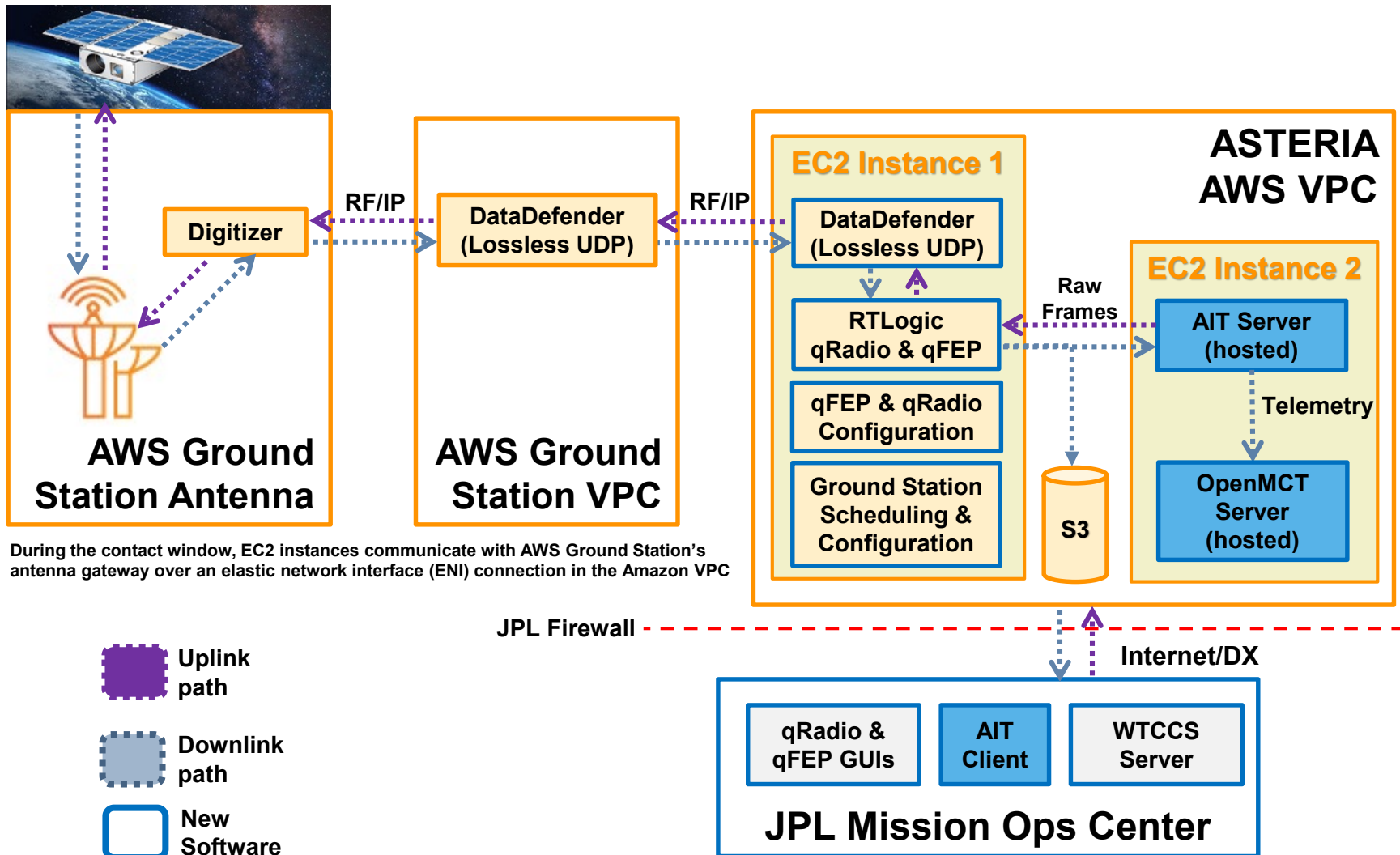
Heritage from previous JPL missions and open-source tools.



Demonstration Goals - Proposed

1. Demonstrate telecom compatibility and downlink between ASTERIA and AWS Ground station
2. Acquire NTIA Approval for uplink licensing.
3. Demonstrate telecom compatibility and uplink between AWS Ground Station and ASTERIA over ASTERIA licensed frequencies.
4. Conduct Ground Data System Demonstration in AWS Virtual Private Cloud – Virtual Mission Operations.
5. Document AWS-compatible GDS design, including heritage points, performance characteristics, recommendations and lessons learned for other cubesats

Proposed AWS Ground Station Experiment



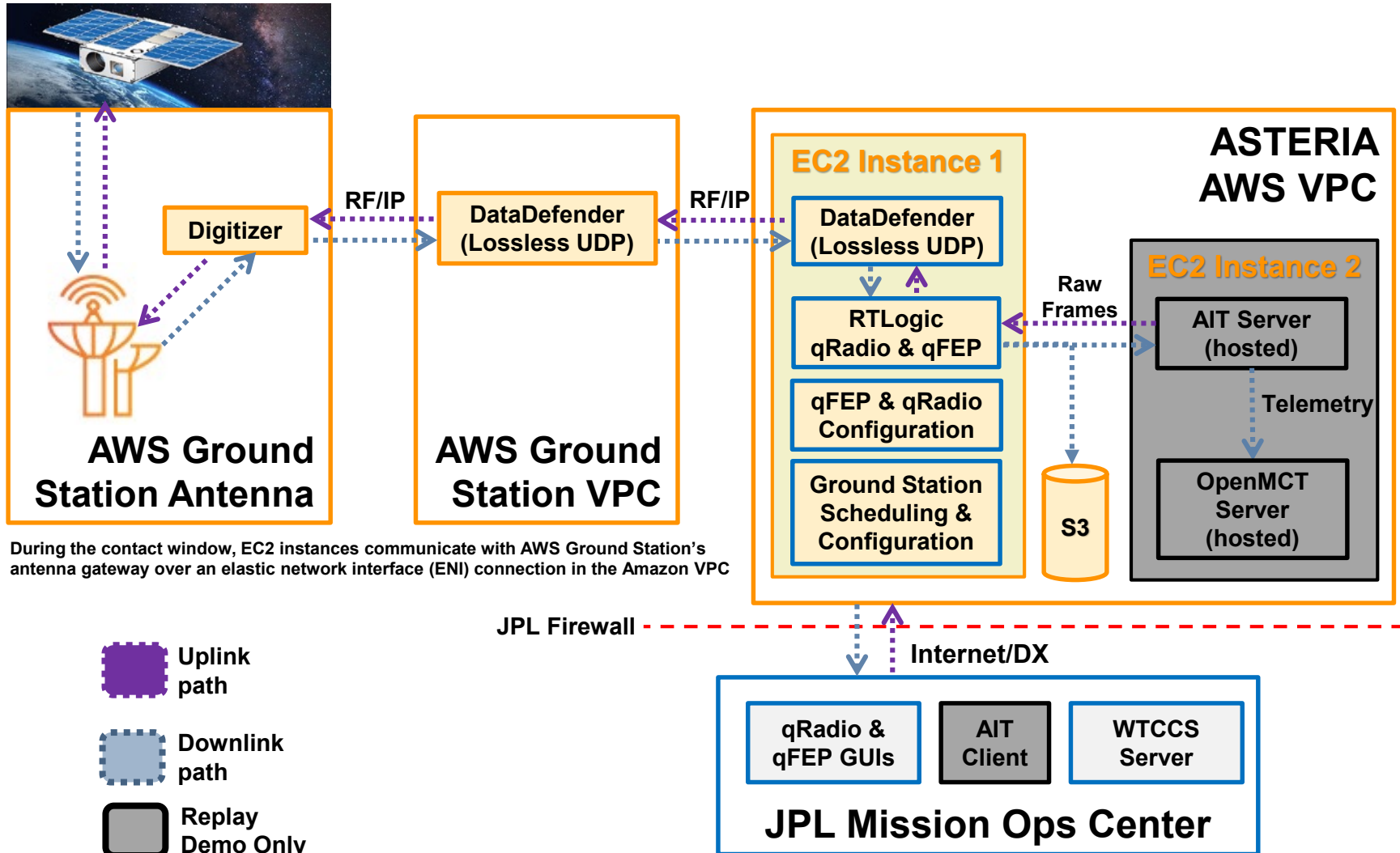
During the contact window, EC2 instances communicate with AWS Ground Station's antenna gateway over an elastic network interface (ENI) connection in the Amazon VPC

Demonstration Goals - Actual

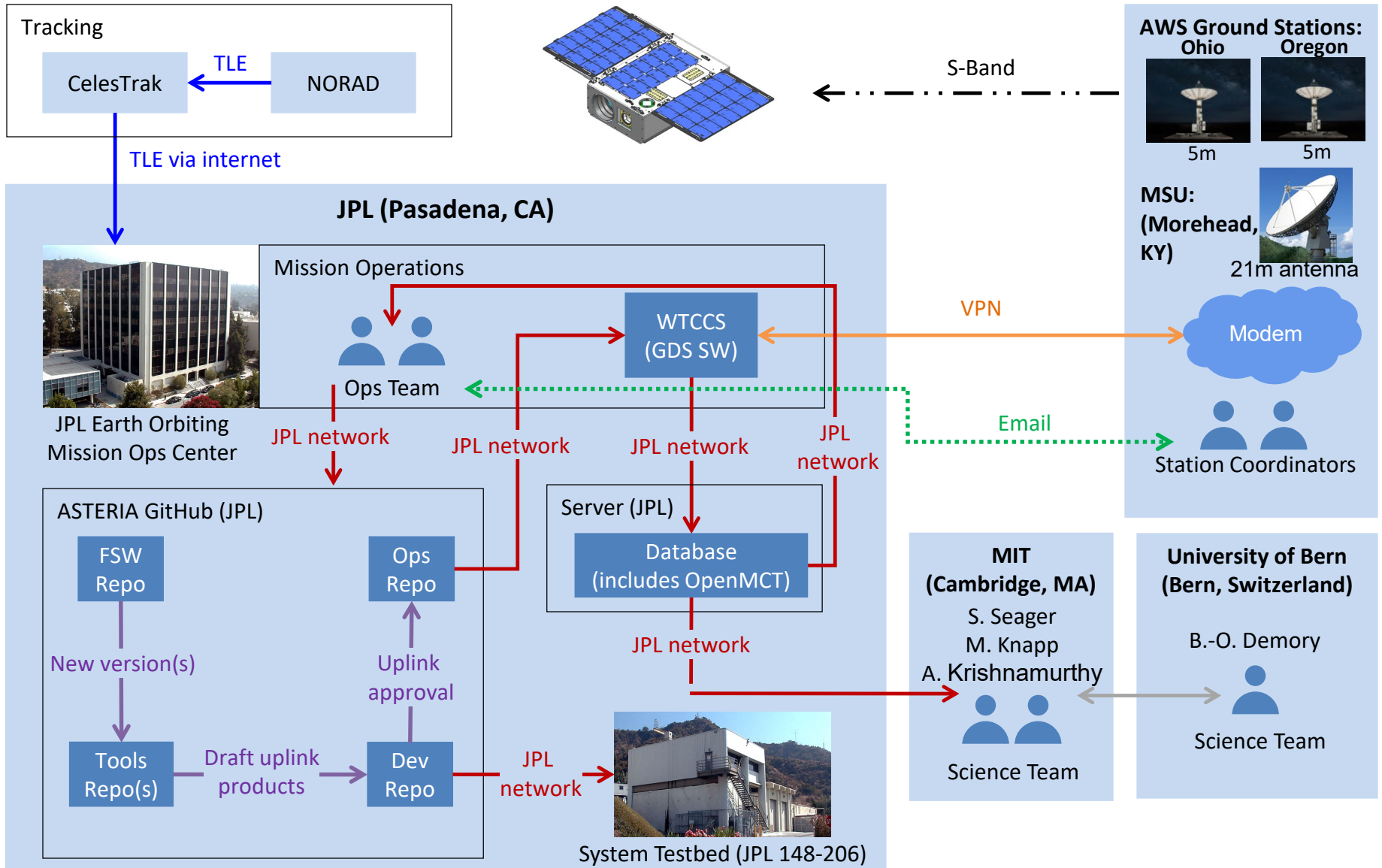
1. Demonstrate telecom compatibility and downlink between ASTERIA and AWS Ground station
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4. Conduct Ground Data System Demonstration in AWS Virtual Private Cloud – Virtual Mission Operations.
5. Document AWS-compatible GDS design, including heritage points, performance characteristics, recommendations and lessons learned for other cubesats.

Demonstration schedule and scope changed due to ground station anomaly in fall 2019 and spacecraft anomaly in December 2019.

Demonstrated Ground Station Experiment



Updated ASTERIA Operations



Gotchas

- Licensing for transmit takes a very long time – for developing missions this isn't an issue, but for operating missions this can pose an obstacle.
- Currently stations are AWS region based, which makes transitioning from regions take a little bit of work.
- ASTERIA kept its original testbed configuration – missions in development would need to do something different most likely.
- Due to our hybrid cloud/local GDS, we were able to effectively operate out of MSU and AWS at the same time with no GDS changes – this allowed extensive ghost-tracking to ensure things would work. Most missions would do this testing in mission development instead.



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