Turning Off the Lights

Automating SkySat Mission Operations

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The SkySat Fleet

- Planet owns and operates the largest commercial fleet of satellites
- Constellation of 15 satellites in sun synchronous orbit with morning and afternoon crossing times
- Tasked high resolution imagery vs. continuous imaging of Earth’s landmass
Scripts, Plots, and APIs

- Web-based command and telemetry services
- Python scripting engine
- Ground-based telemetry monitoring
- APIs built on web standards enabled new services to interact with the ground systems
Original Idea:
Let’s make a web app!

- A pass planning tool was built by operators, for operators
- Used ground system APIs to aggregate and distribute information needed for orbit-to-orbit operations
- This platform grew to be a central hub information that operators used
Whole Orbit Utilization

- Operators leveraged unutilized phases of orbit for maintenance tasks
- With smaller fleet, activities were manually planned
- As fleet grew, this became unwieldy and time consuming

**Solution**: Automate task scheduling with defined constraints for each type of activity

† not to scale, representative orbit only
Scaling Day-to-Day Operations

- Some on-orbit activities require active comms with satellite
- Manual operations does not scale!
  - Then: 1-2 contact every 90 minutes
  - Now: 2-4 contacts simultaneously
- How did we track the completion of routine maintenance activities? Spreadsheets!
- Next up: Automate the tracking and execution of scripts that need ground in the loop
I'm sorry, Dave
I'm afraid I can't do that

- The automated operator plans and tracks execution of activities
- The system takes constraints into account
  - State of the satellite
  - Last time activity occurred
  - Success/failure of activity execution
  - Contact length
- No more spreadsheets!
The Automated Operator

- Automated operator manages the following tasks:
  - Nominal operations
  - Routine maintenance
  - Responses to well-characterized anomalous states
- Other tasks, like anomaly recovery or one-off activities, are still performed by operators.
All Hands on Deck!

- Despite the growing fleet, the SkySat operations team has maintained a constant, lean team size.
- Time outside operations center:
  - Remote/on-call support
  - Muted notifications/alerts
- Hours per week has decreased by over 60%.
- The team is empowered to stay agile by making change where they see it’s needed.
Lessons Learned
If I Could Turn Back Time...

• Flexibility was key
• Agile iteration allowed to build autonomous operations incrementally
• Empowering the operator to build their own tools allowed them to shape their user experience
What’s next?

• Continue to characterize anomalous states
• Build out the repository of responses
• Continue to reduce hours per week until the team can operate completely on-call