Status of Plans for Cycle 1 Observing

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Outline

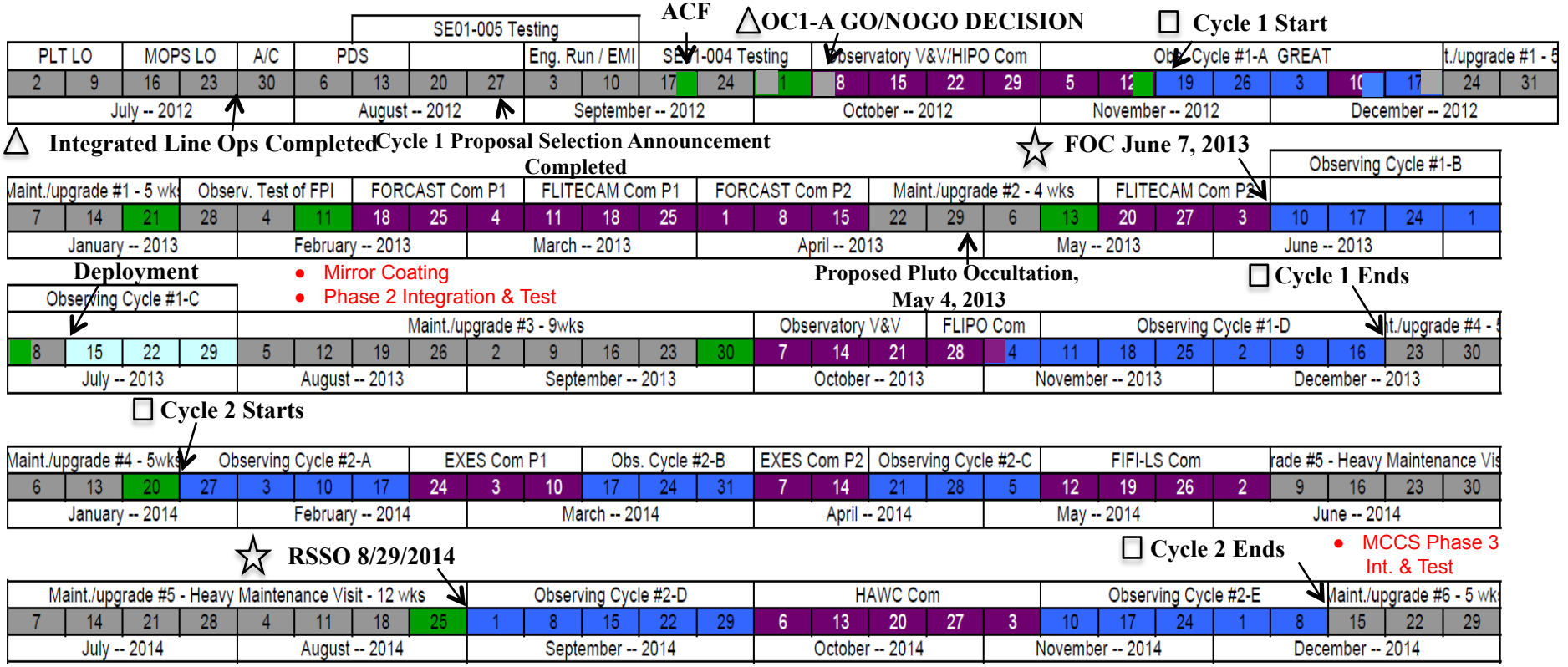
- Long Range Planning
- Flight Planning
- Phase 2 process
- Observation planning and scripting for Cy 1

- Long Range Planning

Cycle 1 results

- The SMO Director and Deputy Director approved
  - 40 Regular programs
  - 10 Do-if-Time available programs (second priority)
  - 2 SURVEY ("snap shot") programs ("Filler" programs)
  - 3 Target of Opportunity programs
- Program has designated 4 "Observing Campaign Windows"
  - One prior to any formal instrument commissioning
    - Only GREAT available
  - One designated as a Southern Deployment Campaign
- The distribution, by number of proposals, targets and requested time, is lopsided towards FORCAST and GREAT
- A policy decision was made that the Southern Deployment be done with GREAT

IMS Overview



Observing Cycle #1 flts/wk

OC	WK 1	WK 2	WK 3	WK 4	WK 5	WK 6	Tot
1-A	1	2	2	1			6
1-B	2	2	3	3			10
1-C	0	3	4	2			9
1-D	3	3	4	2	4	4	20
FLIPO	1						1

Program
Observatory
Project

Observing Flights
Instrument Commissioning
Platform / Engineering Flights
Aircraft Maintenance / Observatory Upgrade
Deployment

Cycle 1: 18 weeks, 46 flights, 200.9 CfP Hours (8.00 RH per flight, 327.5 RH)

Science hour estimates were calculated based on maximum possible flights at 89% reliability.

Cycle scheduling

- We have developed a software tool called the “Cycle Scheduler” that allows us to evaluate observing efficiencies, options and strategies over a full cycle
  - Iterative (“Monte Carlo”) methodology optimizing
    - Visibility
    - Heading
    - Instrument Flight Series
  - For given constraints
    - Target requirements (instrument, coordinates timing)
    - Flight location
    - Non-science constraints (Engineering, maintenance etc)
    - Flight campaign requirements (how often can change instruments)
  - Provides a reasonable target pool for each flight (not accurate to individual flights or exact target location)
  - Does not handle ToOs or single time critical observations

Baseline Cycle Scheduler Runs

- Based on the selected proposals, the IMS and need for GTO observations we have used the CS to set up a baseline cycle schedule
  - NASA/USRA and DLR/DSI selected targets treated the same
  - Observations are restricted to the four Observing Campaigns
  - Only GREAT available in OC 1A
  - GREAT to be used for Southern Deployment (OC 1C)

0:th order results:

- OC 1A and OC 1C: GREAT
  - All northern GREAT GI targets fit into OC 1A
- OC 1B and 1D: FORCAST
  - The FLITECAM targets are few and split between “summer” and “winter”
    - Insert a one-week FLITECAM Flight Series each in OC 1B and OC 1D each
- Activated ToO observations will be dealt with on a case-by-case basis

Cycle Schedule to Flight Planning

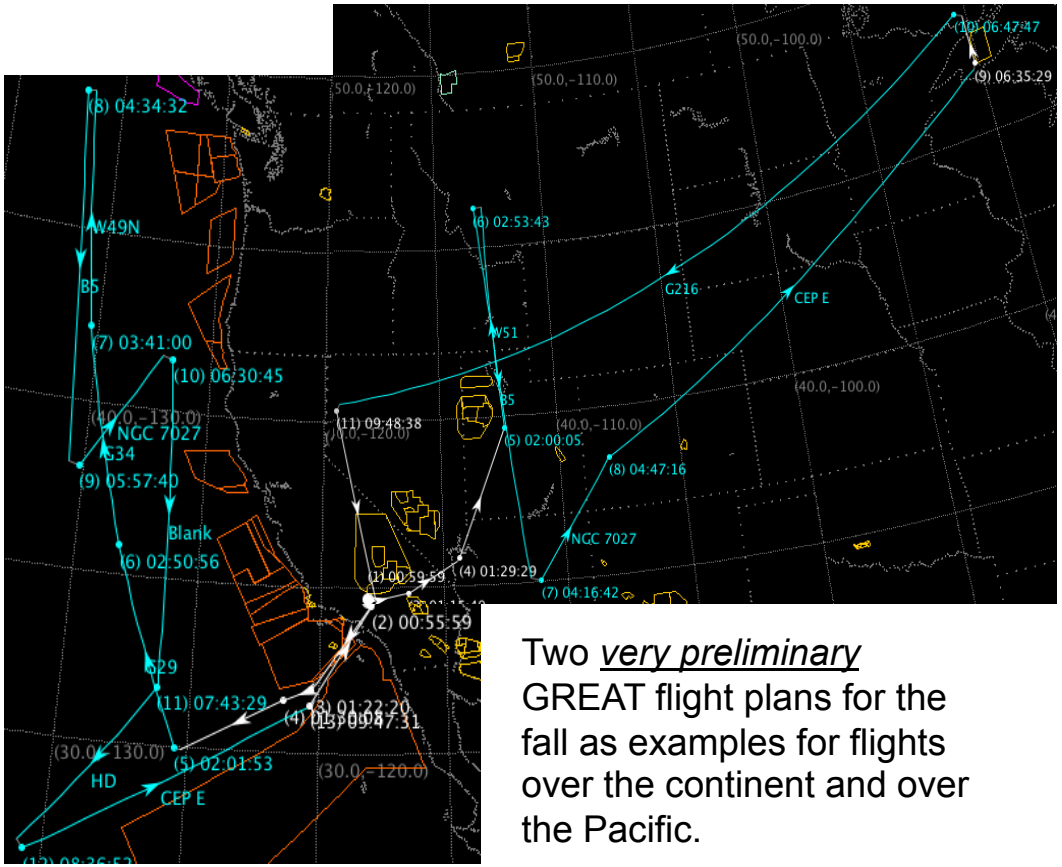
- The output of the Cycle Scheduler is a set of bins (week long) with assignments of
  - Instrument
  - Targets
- Each bin is over-populated by targets to provide the Flight Planner flexibility in building flight plans
  - Order of targets not considered by CS
  - Calibration not included
  - Flight restrictions (restricted areas etc) not considered
- Based on the CS output the Flight Planner generates a preliminary set of flights for the upcoming Flight Series
- "Left over" targets get returned to the pool and an updated long range plan is generated by CS
  - For Cycle 1 (at least) we do not expect to allow the instrument cadence to change after the base line run
- Activated ToOs will (/might) require a re-baselining of the remaining cycle

- Flight Planning

Status of Flight Planning

- The tests and commissioning flights prior to the observing campaigns are being planned.
- With the Instrument schedule laid out, the detailed flight planning starts.
- Using the Cycle Scheduler's source pool for the 1st observing campaign (OC-1A; GREAT) preliminary flight plans have been prepared. These plans will still go through several iterations, the next one waiting for the Phase 2 AOR details.
- The effects of selecting targets for the fall flights on the other GREAT flights gets evaluated using the Cycle Scheduler and by drafting flight plans for that series.

Flight Planning is an ~10 week process for each Flight Series (from CS output to flight)



Two *very preliminary* GREAT flight plans for the fall as examples for flights over the continent and over the Pacific.

- Phase 2 Process

Phase 2 development

- We choose to implement the observing requests for SOFIA as a two phase process (similar to HST)
  - Phase 1 only included scientific justifications, exposure time estimates and general feasibility discussion
  - Phase 2 will be used to set up the detailed requirements for each observation and generate Astronomical Observation Requests (Oars)
- We have adapted the IPAC tool SPOT to be used for producing the SOFIA AORs (SSPOT)
- Rules for AORs and templates (AOTs) have been developed for each instrument by the Instrument Scientists with inputs from the instrument teams, the IDS, and pipeline group.
- Instructions and web pages for both SSPOT generally, and the phase 2 implementation for each instrument are available
- Each accepted proposal has been assigned a specific support scientist – in addition to the User Support group

Phase 2 cannot, however, be fully deterministic

- SOFIA observations are not fully deterministic
  - Possible length of flight legs
    - Might not accommodate long observations
  - Field rotation (relative to North)
  - Time between Line-of-Sight resets
  - vary with time of year and flight leg heading
    - For large chop throws, certain chop angles (in the telescope reference frame) are not allowed, due to mechanical constraints. Depending on the time of year and flight leg heading these angles translate to different Position Angles on the sky.
  - The length of an observation might be set by flight planning requirements in addition to science requirements
  - If a complete target observation cannot be implemented in a single, uninterrupted leg, different science priorities may require different modifications, e.g.:
    - Do all of a specified filter first vs. cycle through all filters in short order

AOR to Observing Script

- How do we make sure that the executed observations conform to the Gis intentions? Given:
  - The variations depending on specific flight considerations
  - The need to turn around flight plans on a short and reliable time scale
    - What do you do if the GI isn't available?
  - The need to execute a queue observing program with more time dependence than at a ground based queue based observatory
  - Staffing limitations within the SMO?

Implementation of Observations

- We are still developing the long-range solution to the dependence of observation implementations on flight planning details
- Our working concept is one of “atomized AORs”
- The GI generates a nominal full-length AOR and provides “t_{min}” the smallest acceptable per-occasion observation
  - All AORs are then broken into pieces “atoms” short enough to “always” fit inside the time between LOS resets
  - Program Support Scientist gathers priorities and requirements and populates the flight legs from the atomic AORs
- For Cycle 1 we will be developing and implementing these ideas in a more interactive way with the users

Summary

- The instrument schedule for Cycle 1 has been established
- AOTs and observing script templates are developed
- We have started the Phase 2 process for Cycle 1
- Flight planning for OC 1A is under way
- We are working on how to best implement a semi-automated process for adapting the nominal AORs to all observing constraints
- We have a very good staff of experienced support scientists and a manageable proposal load for Cycle 1 to allow us to implement and evaluate our nominal method.