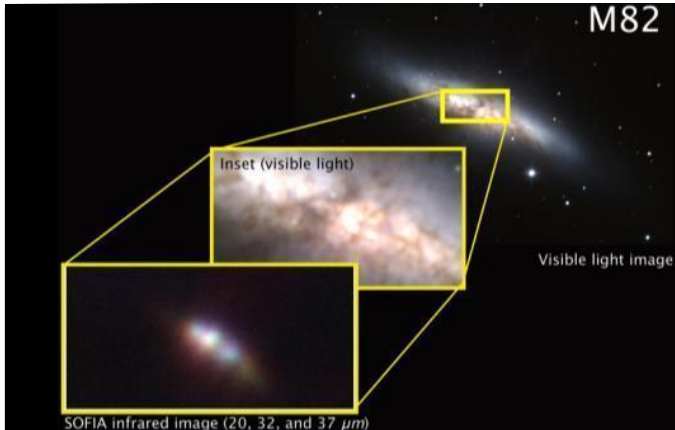
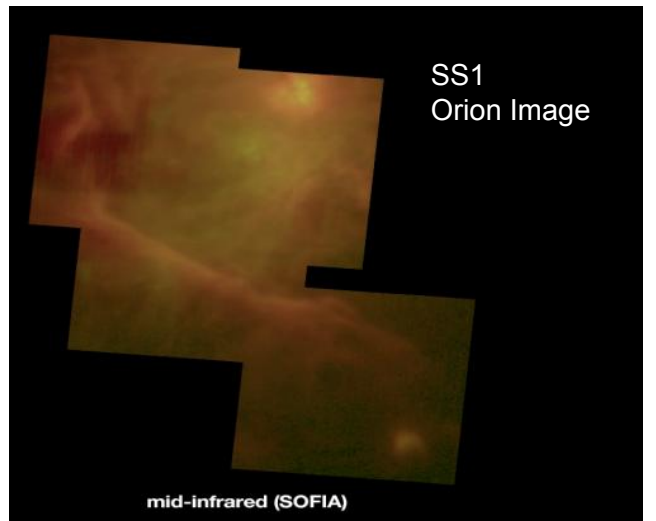


# SOFIA Workshop Program Status

Pamela Marcum  
Project Scientist  
November 7, 2011





# Outline

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- Brief Overview of SOFIA
- Recent Achievements
- Observatory Status
- 1-year “look ahead”
- Summary

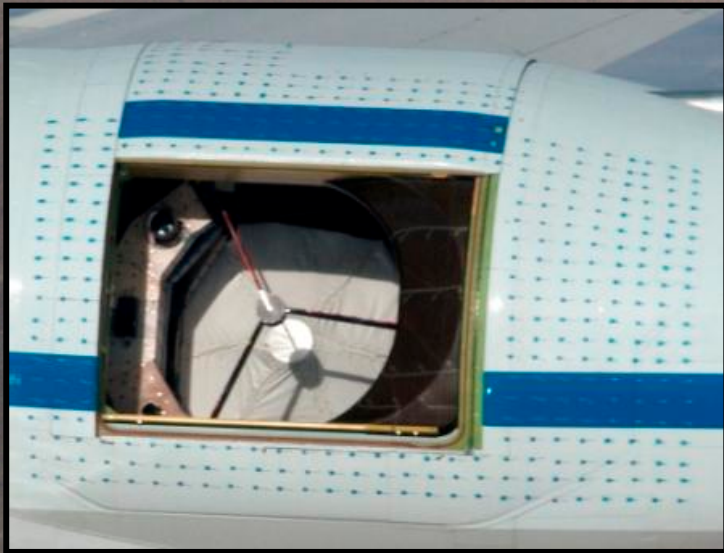
# SOFIA

## Stratospheric Observatory for Infrared Astronomy



Boeing 747SP

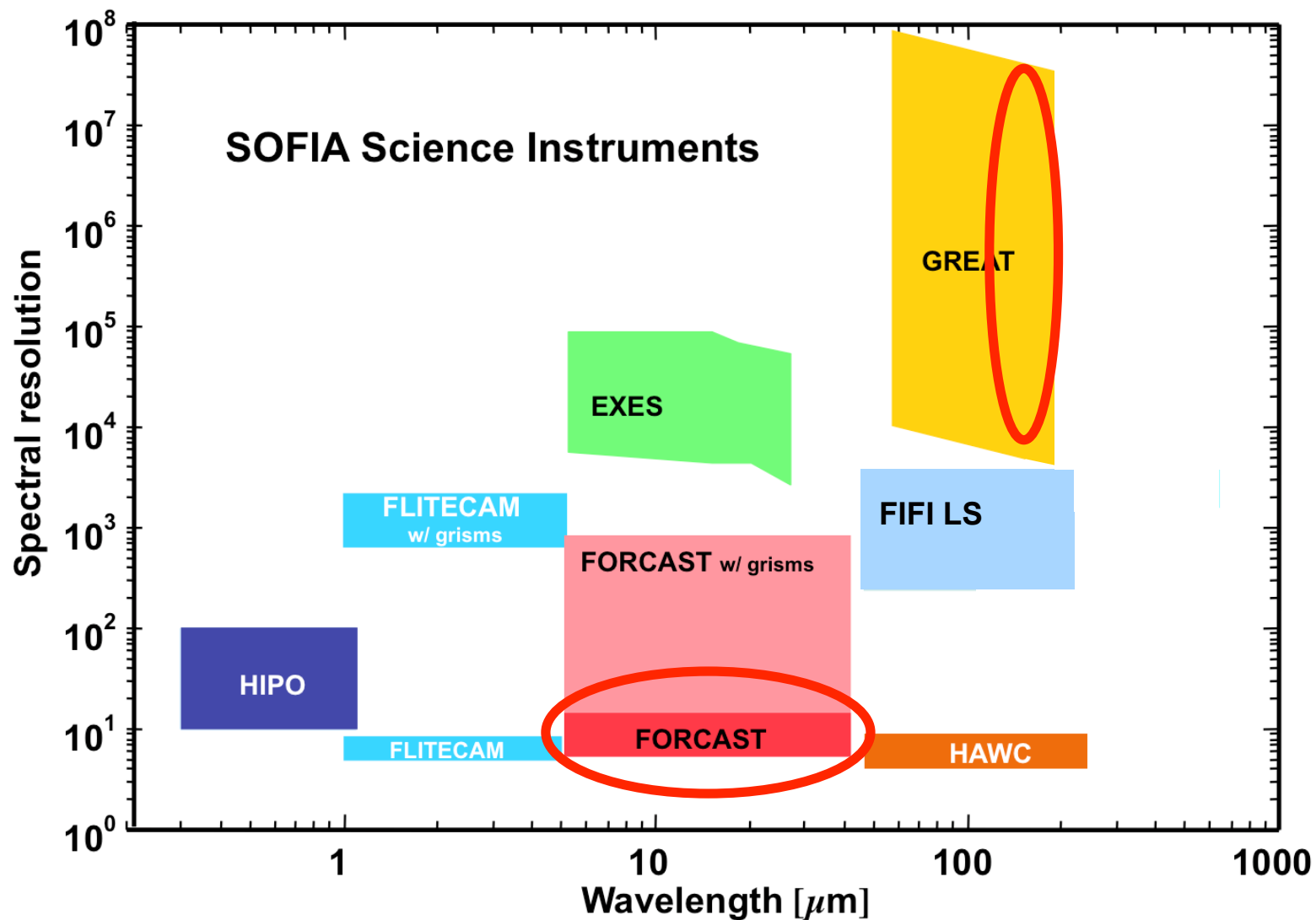
2.7-meter



International partnership:  
80% -- NASA (US)  
20% -- DLR (Germany)



# Instrument Capabilities Available to Early Science GIs





# Recent Successes

The program has successfully completed:

- **Basic Science proposals selected: Nov 2010**
- **FORCAST Science flights (Nov-Dec 2010; May-June 2011)**
- **GREAT Science flights (April 2011; July 2011; Sept, Nov 2011)**
- **Pluto occultation (June 2011, HIPO)**
- **2<sup>nd</sup> Generation Science Instrument Call for Proposals**
- **Observatory Characterization flights (June, Oct, Nov-Dec 2011)**
- **HIPO/FLITECAM commissioning (Dec 2011)**
- **Airborne Astronomy Ambassador (AAA) pilot program, and inclusion in Cycle 1**
- **Demonstrated global deployment capability (German deployment)**

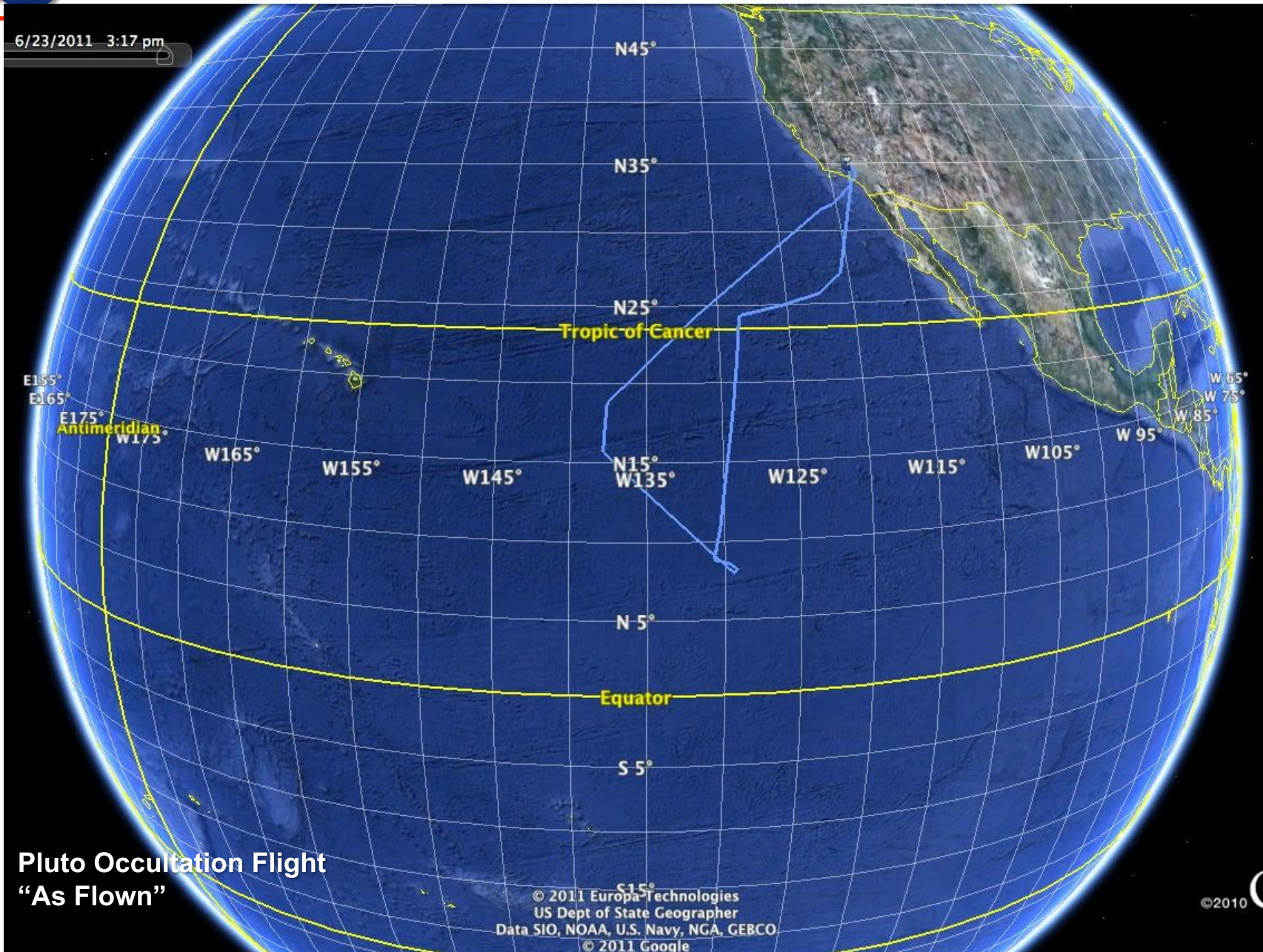
Over 330  
science hours  
... in its first  
year, SOFIA is  
already  
approaching  
KAO science  
flight numbers

 Added or accelerated activities



# Pluto Occultation Flight

6/23/2011 3:17 pm





# Airborne Astronomy Ambassadors

May 26 – July 15, 2011



Mary Blessing, Herndon, Va.  
Cris DeWolf, Remus, Mich. with Dana Backman (SETI)



Pamela Harman (SETI) with Margaret Piper, Frankfort, Ill.  
Kathleen Fredette, Palmdale, CA



Terry Herter (Cornell), Jim De Buizer (USRA) with  
Theresa Paulsen, Mellen, Wis. and Marita Beard, San Jose, Calif.



Cecilia Scorza (DSI) with Wolfgang Vieser, Munich, Germany  
Jörg Trebs, Berlin, Germany



# SOFIA in Germany (Cologne, Stuttgart)







# Observatory Status

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## Progress on meeting Level 1 Requirements:

- Telescope Requirements
  - Effective aperture of telescope: 2.5 meters
  - Telescope elevation range: 20 – 60 degrees
  - Telescope wavelength range: 0.3 to 1600 microns
  - Telescope image size: 80 percent of encircled energy
    - 5.3 arc-second diameter at the focal plane at First Science Flight
    - Goal 1.6 arc-seconds diameter at end of Segment 3
- Operational capability: 6 Hours above 41,000 ft
- At Least 40 Principal or Guest Investigator teams per year at FOC+4yrs
- 960 science hours per year during routine operations at FOC +4yrs
- Global Operations
- Twenty year operational life
- Promote educational opportunities and public outreach

Green = Requirement  
Demonstrated

Black = Requirement yet to  
be demonstrated



# Observatory Status

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- Program has had some challenges during the Early Science Phase
  - Mirror backside surface fractures
  - TA problems
  - MCCS problems
  - Weather problems
  - Delay in Active Mass Damper hardware delivery
  - Instrument integration problems
- Uncertain budgetary climate also poses a threat
  - Future trade studies and program rebalancing may be necessary



# Look Ahead

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- Finish GREAT science flights on 11/7 and 11/9/2011
- Start Active Mass Damper installation; November 14, 2011
- Observatory Characterization flights, first two weeks in December
- Start period of observatory and airplane upgrades (“Segment 3 downtime”); Dec-June 2011.
- 2<sup>nd</sup> Generation Science Instrument selections announced; Mar 2012
- FORCAST commissioning; July-Aug 2012
- Start Cycle 1 observing; Aug 2012
- FLITECAM commissioning; Oct-Nov 2012



# Program Summary

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## **The SOFIA Program has made significant progress:**

- Half of the suite of first-generation instruments have now already successfully flown on SOFIA and acquired science and/or engineering data! (FORCAST, GREAT, HIPO, FLITECAM)
- All FORCAST science flights for “Early Science” now completed
- All GREAT observations for competed community flights nearly complete, finishing remaining flights by November 10
- Several activities accelerated (not originally planned for this year)
  - Pluto occultation
  - Airborne Astronomy Ambassador (AAA) program
  - Demonstrated global deployment capability (German deployment)

## **Upcoming events/activities to watch for:**

- Announcement of Selection of 2nd Generation Science Instruments; Mar 2012
- Next call for observing proposals; Nov 2012
- Dedicated SOFIA session at winter AAS, expect number of papers from this summers flights
- Challenges with observatory, identified during this year’s science flights, will be addressed during “Segment III downtime” starting Dec 2011



# BACKUP



# Basic Science Summary Statistics

|                               | Basic Science 1 |                 | Basic Science 2 |                 | Totals        |                 |
|-------------------------------|-----------------|-----------------|-----------------|-----------------|---------------|-----------------|
|                               | Totals          | Averages        | Totals          | Averages        | Totals        | Averages        |
|                               | Hours           | Hours           | Hours           | Hours           | Hours         | Hours           |
| Flight Hours                  | 98.48           | 9.85            | 111.98          | 10.18           | 210.46        | 10.02           |
| Number of Flights             | 10              |                 | 11              |                 | 21            |                 |
| <b>Flight Statistics</b>      | <b>Totals</b>   | <b>Averages</b> | <b>Totals</b>   | <b>Averages</b> | <b>Totals</b> | <b>Averages</b> |
| Climb_Descent_time            | 19.02           | 1.90            | 24.18           | 2.20            | 43.20         | 2.06            |
| Time_above_FL380              | 83.85           | 8.39            | 96.93           | 8.81            | 180.78        | 8.61            |
| Time_above_FL410              | 52.73           | 5.27            | 64.70           | 5.88            | 117.43        | 5.59            |
| Time_above_FL430              | 30.20           | 3.02            | 42.55           | 3.87            | 72.75         | 3.46            |
| Research_Hours                | 79.47           | 7.95            | 87.80           | 7.98            | 167.27        | 7.97            |
| <b>Scheduled Overheads</b>    | <b>Totals</b>   | <b>Averages</b> | <b>Totals</b>   | <b>Averages</b> | <b>Totals</b> | <b>Averages</b> |
| Setup_Star                    | 2.50            | 0.25            | 3.03            | 0.38            | 5.53          | 0.26            |
| Dead_Legs                     | 0.47            | 0.05            | 10.75           | 1.34            | 11.22         | 0.53            |
| Turns                         | 0.97            | 0.10            | 1.46            | 0.29            | 2.43          | 0.12            |
| <b>Unscheduled Outages</b>    | <b>Totals</b>   |                 | <b>Totals</b>   |                 | <b>Totals</b> |                 |
| MCCS+Aircraft                 | 1.62            |                 | 3.54            |                 | 5.16          |                 |
| Secondary Mirror/TA           | 4.23            |                 | 5.03            |                 | 9.27          |                 |
| Weather/ATC                   | 1.17            |                 | 2.08            |                 | 3.25          |                 |
| Instrument                    | 0.50            |                 | 2.00            |                 | 2.50          |                 |
| <b>Science Time</b>           | <b>Totals</b>   | <b>Averages</b> | <b>Totals</b>   | <b>Averages</b> | <b>Totals</b> | <b>Averages</b> |
| Target_Time_Scheduled         | 59.94           | 5.99            | 69.34           | 6.30            | 129.28        | 6.16            |
| Calibration                   | 15.59           | 1.56            | 6.75            | 1.13            | 22.34         | 1.06            |
| Science_Time_Scheduled        | 75.53           | 7.55            | 76.09           | 6.92            | 151.62        | 7.22            |
| <b>Science_Time_Delivered</b> | <b>68.02</b>    | <b>6.80</b>     | <b>64.43</b>    | <b>5.86</b>     | <b>132.45</b> | <b>6.31</b>     |

Through  
10/1/2011



# Segment 3

| SS3SO 8/24/12                          |    |    |    |   |    |    |    |   |    |    |    | FOC November 23, 2012                               |    |    |    |   |    |    |    |  |    |    |    |                  |    |    |    |
|--|----|----|----|---|----|----|----|---|----|----|----|---|----|----|----|---|----|----|----|--|----|----|----|------------------|----|----|----|
| A/C Sys Funct & TA flts                |    |    |    | 30 RH<br>FORCAST Com                          |    |    |    | 62 RH - 2 flts/wk<br>Observing Campaign #1  |    |    |    | • TA Improvements?<br>Maint./upgrade #3 - 5 wks     |    |    |    | 30 RH -- FOC 11/23/12<br>FLITECAM Com       |    |    |    | 62 RH - 2 flts/wk<br>Observing Campaign #2 |    |    |    |                  |    |    |    |
| 25                                     | 2  | 9  | 16 | 23  | 30 | 6  | 13 | 20  | 27 | 3  | 10 | 17  | 24 | 1  | 8  | 15  | 22 | 29 | 5  | 12   | 19 | 26 | 3  | 10               | 17 | 24 | 31 |
| July -- 2012                           |    |    |    | August -- 2012                                |    |    |    | September -- 2012                           |    |    |    | October -- 2012                                     |    |    |    | November -- 2012                            |    |    |    | December -- 2012                           |    |    |    |                  |    |    |    |
| • TA Improvements?                     |    |    |    |   |    |    |    |   |    |    |    | • OBDMAs<br>• Ground Cooling                        |    |    |    |   |    |    |    |  |    |    |    |                  |    |    |    |
| Maint./upgrade #4 - 5 wks              |    |    |    | 30 RH<br>EXES Com                             |    |    |    | 209 RH - 3 flts/wk<br>Observing Campaign #3 |    |    |    | • TA Improvements?<br>Maint./upgrade #5 - 5wks      |    |    |    | 279 RH - 3 flts/wk<br>Observing Campaign #4 |    |    |    |  |    |    |    |                  |    |    |    |
| 7                                      | 14 | 21 | 28 | 4   | 11 | 18 | 25 | 4   | 11 | 18 | 25 | 1   | 8  | 15 | 22 | 29  | 6  | 13 | 20 | 27   | 3  | 10 | 17 | 24               | 1  | 8  | 15 |
| January -- 2013                        |    |    |    | February -- 2013                              |    |    |    | March -- 2013                               |    |    |    | April -- 2013                                       |    |    |    | May -- 2013                                 |    |    |    | June -- 2013                               |    |    |    | July -- 2013     |    |    |    |
| • Heading Turner<br>• TA Improvements? |    |    |    |   |    |    |    |   |    |    |    | • WVM Upgrade<br>• TA Improvements?                 |    |    |    |   |    |    |    |  |    |    |    |                  |    |    |    |
| Observing Campaign #4                  |    |    |    | 30 RH<br>Maint./upgrade #6 - 5 wks            |    |    |    | 30 RH<br>HAWC Com                           |    |    |    | 140 RH - 3 flts/wk<br>Observing Campaign #5         |    |    |    | Maint./upgrade #7 - 5 wks                   |    |    |    |  |    |    |    |                  |    |    |    |
| 22                                     | 29 | 5  | 12 | 19  | 26 | 2  | 9  | 16  | 23 | 30 | 7  | 14  | 21 | 28 | 4  | 11  | 18 | 25 | 2  | 9  | 16 | 23 | 30 | 6                | 13 | 20 | 27 |
| July -- 2013                           |    |    |    | August -- 2013                                |    |    |    | September -- 2013                           |    |    |    | October -- 2013                                     |    |    |    | November -- 2013                            |    |    |    | December -- 2013                           |    |    |    | January -- 2014  |    |    |    |
| 2 week southern hemisphere deployment  |    |    |    |   |    |    |    |   |    |    |    | • SATCOM installation<br>• TA Improvements?         |    |    |    |   |    |    |    |  |    |    |    |                  |    |    |    |
| 30 RH<br>Inst 8 com                    |    |    |    | 209 RH - 3 flts/wk<br>Observing Campaign #6   |    |    |    | 30 RH<br>FIFI-LS Com                        |    |    |    | Maint./upgrade #8 - Heavy Maintenance Visit - 8 wks |    |    |    |   |    |    |    |  |    |    |    |                  |    |    |    |
| 3                                      | 10 | 17 | 24 | 3   | 10 | 17 | 24 | 31  | 7  | 14 | 21 | 28  | 5  | 12 | 19 | 26  | 2  | 9  | 16 | 23   | 30 | 7  | 14 | 21               | 28 | 4  | 11 |
| February -- 2014                       |    |    |    | March -- 2014                                 |    |    |    | April -- 2014                               |    |    |    | May -- 2014   |    |    |    | June -- 2014                                |    |    |    | July -- 2014                               |    |    |    | Aug -- 2014      |    |    |    |
| RSSO 8/21/14                           |    |    |    |   |    |    |    |   |    |    |    | • TA Improvements?                                  |    |    |    |   |    |    |    |  |    |    |    |                  |    |    |    |
| ↓                                      |    |    |    | 434 RH - 3.5 flts/wk<br>Observing Campaign #7 |    |    |    | Maint./upgrade #9 - 4wks                    |    |    |    | 380 RH - 3.5 flts/wk<br>Observing Campaign #8       |    |    |    |   |    |    |    |  |    |    |    |                  |    |    |    |
| 18                                     | 25 | 1  | 8  | 15  | 22 | 29 | 6  | 13  | 20 | 27 | 3  | 10  | 17 | 24 | 1  | 8   | 15 | 22 | 29 | 5  | 12 | 19 | 26 | 2                | 9  | 16 | 23 |
| Aug -- 2014                            |    |    |    | September -- 2014                             |    |    |    | October -- 2014                             |    |    |    | November -- 2014                                    |    |    |    | December -- 2014                            |    |    |    | January -- 2015                            |    |    |    | February -- 2015 |    |    |    |

Research Hours  
 CY2012 – 184  
 CY2013 – 688  
 CY2014 – 703

|  |  |
|--|--|
|  | Observing Flights                          |
|  | Instrument Commissioning                   |
|  | Platform Flights                           |
|  | Aircraft maintenance / Observatory upgrade |