

# SOFIA Science Mission Operations



**Erick Young**  
SOFIA Science Mission Operations

SOFIA Workshop  
NASA Ames Research Center  
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# SOFIA Operations

- Science flights will originate from Palmdale California
  - Aircraft operation by NASA Dryden Research Center from the Dryden Aircraft Operations Facility (DAOF)
- Science Center is located at NASA Ames Research Center
  - USRA is responsible for Science Operations on SOFIA
- World Wide Deployments
- SOFIA will ramp up to ~1000 science hours per year
- SOFIA will support the development of new generations of instruments, promising ever increasing capabilities

# Introduction to the Science Mission Operations

- SOFIA Science Mission Operations (SMO) is the organization responsible for operating SOFIA as a scientifically productive observatory
- The SMO is a collaboration between the US and Germany, forming a single organization that has staff from both countries.
  - From the US, most of the staff come from the Universities Space Research Association (USRA)
  - The German members are from the Deutsches SOFIA Institut (DSI) at the Universität Stuttgart.

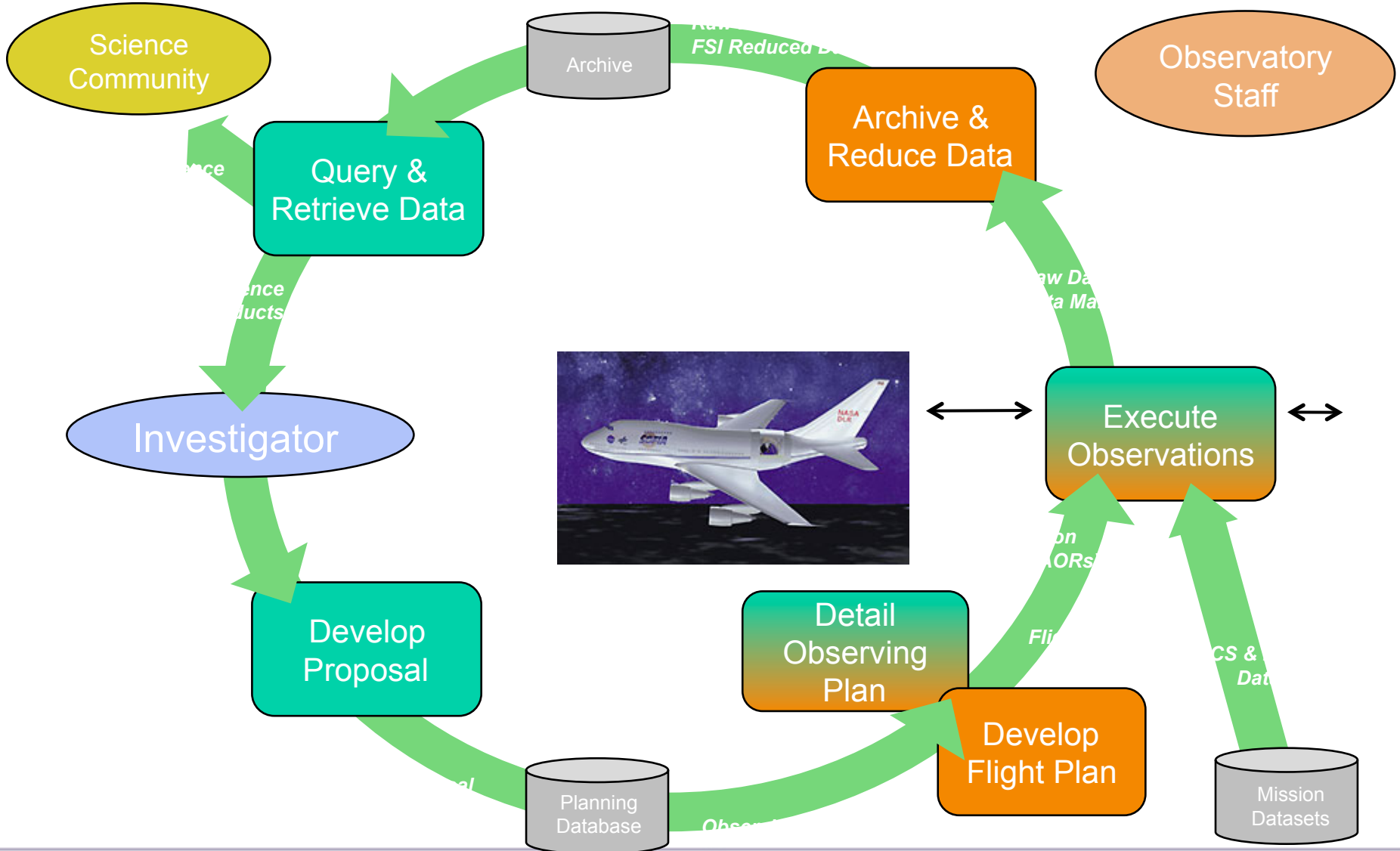
# Some People at the Science Mission Operations

- Director – Erick Young
- Deputy Director – Hans Zinnecker
- Associate Director Project Management – Helen Hall
- Associate Director Science – Bill Reach
- Associate Director Operations – Kortney Opshaug

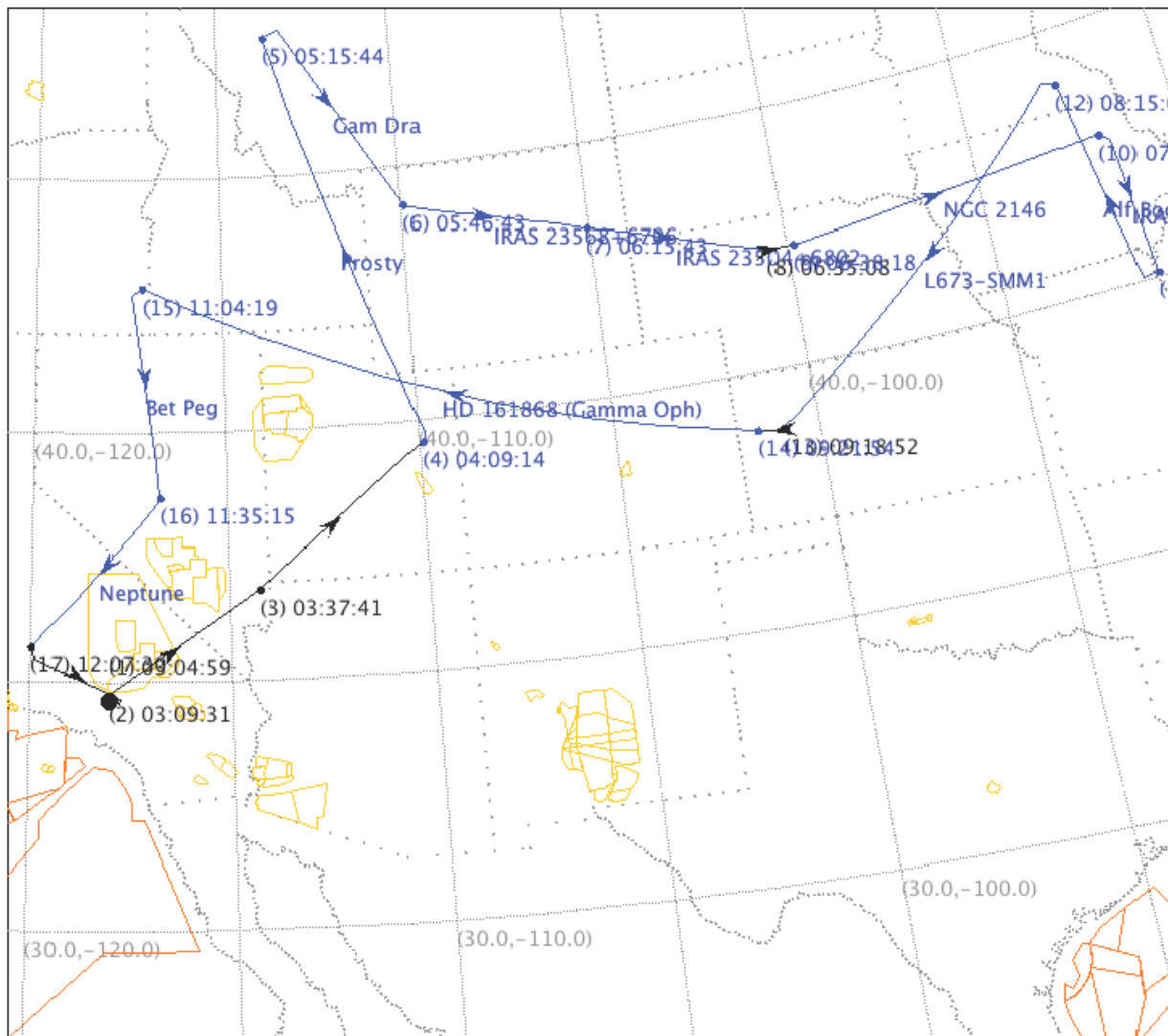
# SOFIA SMO Components

- SOFIA Science Center (NASA Ames Research Center)
  - Data Cycle System
    - Proposal generation
    - Data Pipeline
    - Data Archive
  - Mission Planning
  - Guest Observer support
- SOFIA Operations Center (Dryden Aircraft Operations Facility)
  - Instrument Support
  - Telescope Maintenance
  - Flight Science Operations

# Overview Data Cycle System



# Sample Mission Plan



Basic Science 1  
Flight #3

# SOFIA SMO Components

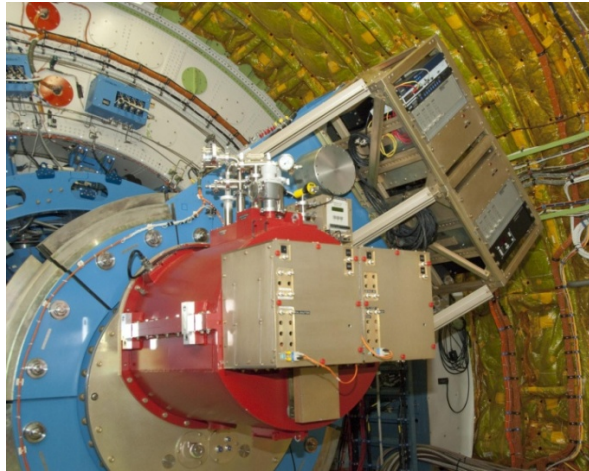
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  - Instrument Support
  - Telescope Maintenance
  - Flight Science Operations
  - Operation and Maintenance of Facility Instruments



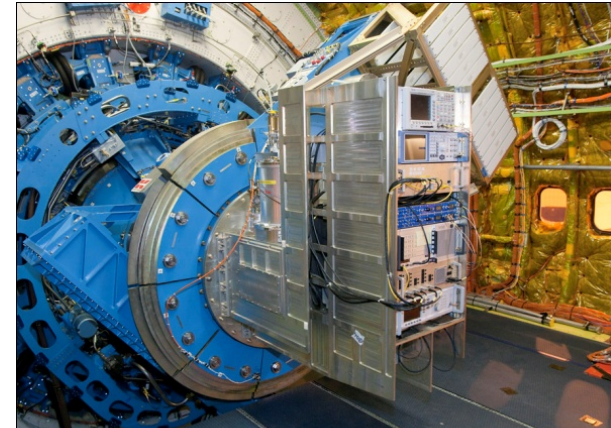
# SOFIA in the Dryden Aircraft Operations Facility



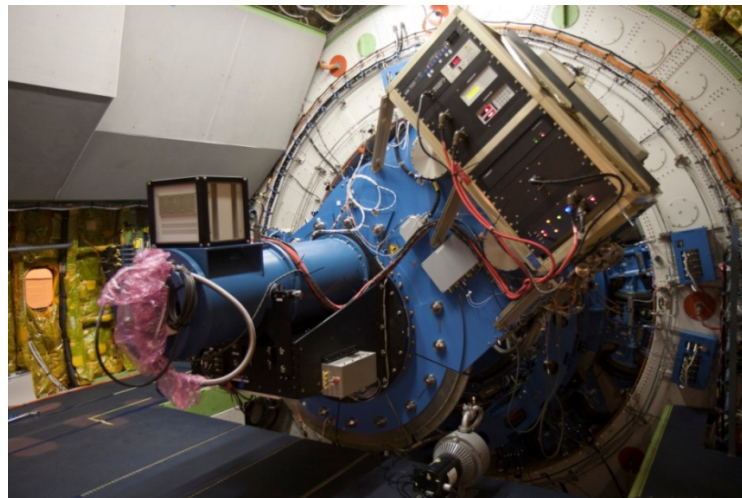
# Four Completed 1<sup>st</sup> Generation Instruments



**FORCAST**  
Mid-IR Camera  
(on SOFIA)



**GREAT**  
Heterodyne spectrometer  
(on SOFIA)



**FLITECAM**  
Near IR Camera

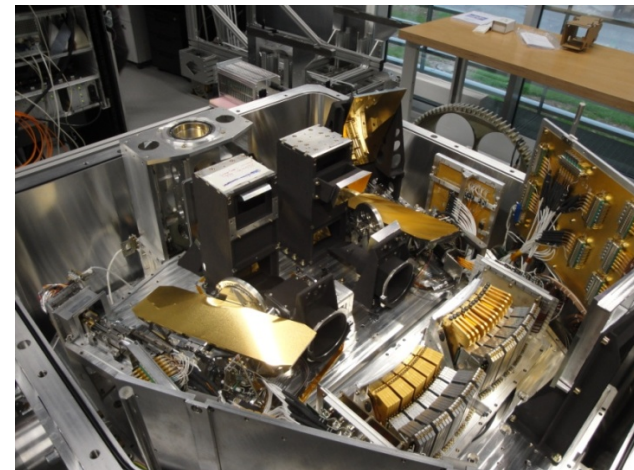
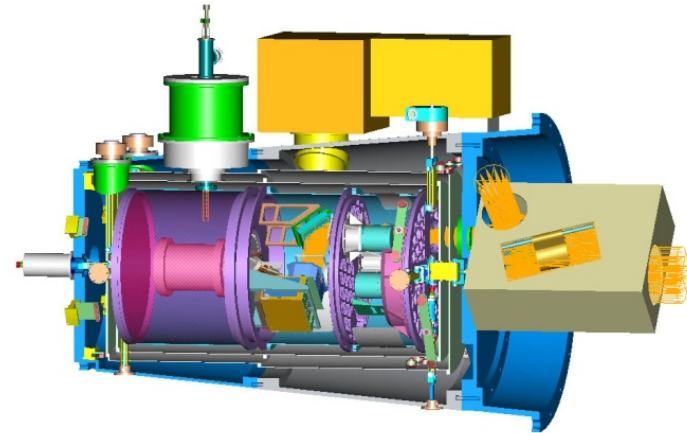
**HIPO**  
Occultation Photometer  
(co-mounted on SOFIA)

# Instruments in development



**EXES**  
Mid- IR Spectrometer  
(at IRTF)

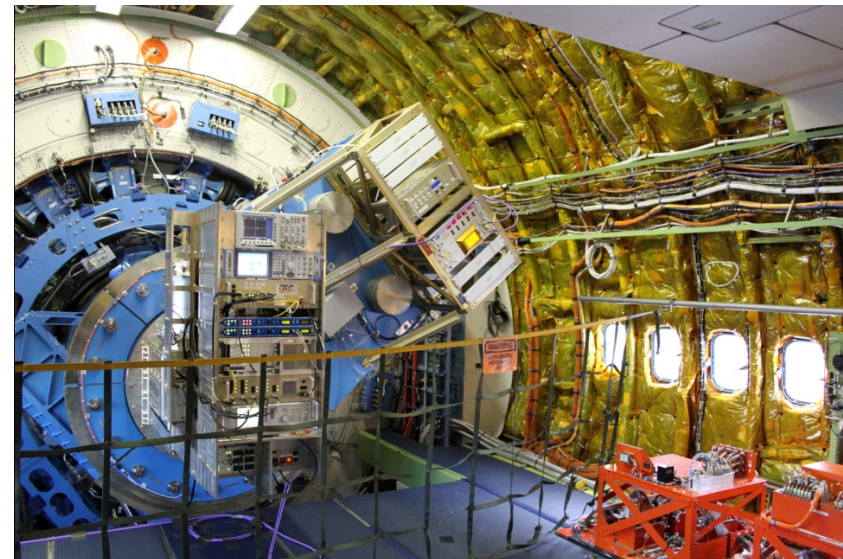
**HAWC**  
Bolometer  
Camera



**FIFI LS**  
Integral Field  
Spectrometer

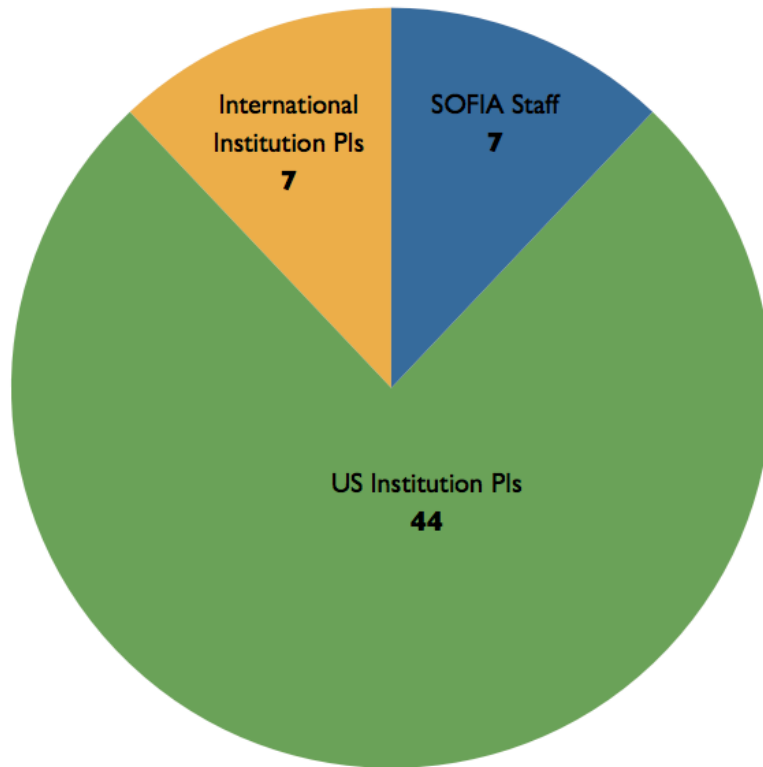
# Successful Start of Science Program on SOFIA

- Short Science 2
  - Series of 3 flights with GREAT heterodyne spectrometer
  - Completed in April 2011
- Basic Science 1
  - Series of 10 flights with FORCAST mid-infrared camera
  - Included Guest Investigator programs solicited from the world astronomical community
  - Flight series completed in June 2011
- Pluto Occultation
  - Successful observation occultation of a background star by Pluto on June 23, 2011.
  - Demonstrates advantage of SOFIA mobility to get to the shadow path at the precise time of the event
- Basic Science 2 and German Science Demonstration Time
  - Series of 10 flights with the GREAT instrument
  - Includes substantial Guest Investigator program
  - First flight July 13, 2011

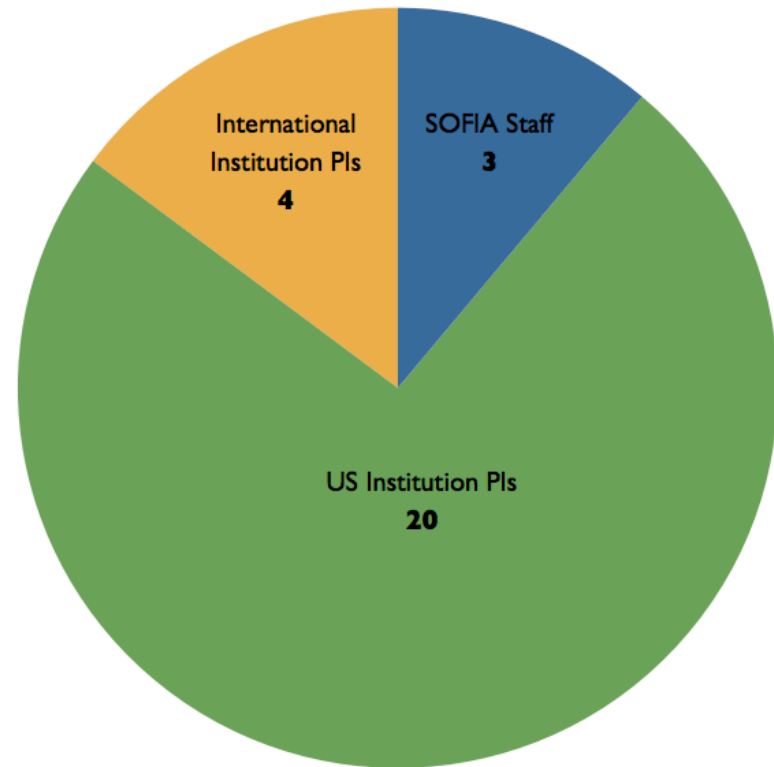


GREAT mounted in SOFIA

# Basic Science Proposal Distribution



Submitted Proposal PIs



Accepted Proposal PIs

# 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	210.47	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	1.79	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
Science_Time_Delivered	68.02	6.80	63.43	5.86	131.45	6.26

## SOFIA EP/O

- Airborne Astronomy Ambassadors Program Launched
  - All 6 US educators in the first AAA class flew on Basic Science 1 flights
  - Parallel German AAA program flew their first educators during Basic Science 2
- SOFIA will be deployed to Germany in mid-September to support the Cologne Air Show September 18, 2011
- NASA has approved SOFIA participation at an EP/O event in Washington to support the First Lady's "Joining Forces" initiative for military families



Educators from the first Airborne Astronomy Ambassadors flight. (l-r) Margaret Piper, Lincoln Way High School, Frankfort, Ill.; Theresa Paulsen, Mellen School District, Mellen, Wis.; and Kathleen Joanne Fredette, Desert Willow Intermediate School, Palmdale, Calif.

## SOFIA Science Center Building



- The SOFIA Science Center will be moving to a new building at Ames Research Center around the end of the year.
- The building features very “green” technologies and should be one of the lowest energy consumption buildings in the country.



## SOFIA Highlights 2011

- April 2011 GREAT Early Science Flights
- May 2011 FORCAST Basic Science Flights
- June 2011 Pluto Occultation Flight
- July 2011 Call for 2<sup>nd</sup> Generation Instruments
- July 2011 GREAT Basic Science
- Sept 2011 Deployment to Germany
- Sept 2011 E/PO Event at Andrews AFB
- Oct 2011 2<sup>nd</sup> Generation Instrument Proposals In
- Nov 2011 Completion of Basic Science
- Nov 2011 Call for Cycle 1 Observing Proposals
- Dec 2011 Begin Segment 3 Downtime



<http://www.sofia.usra.edu>