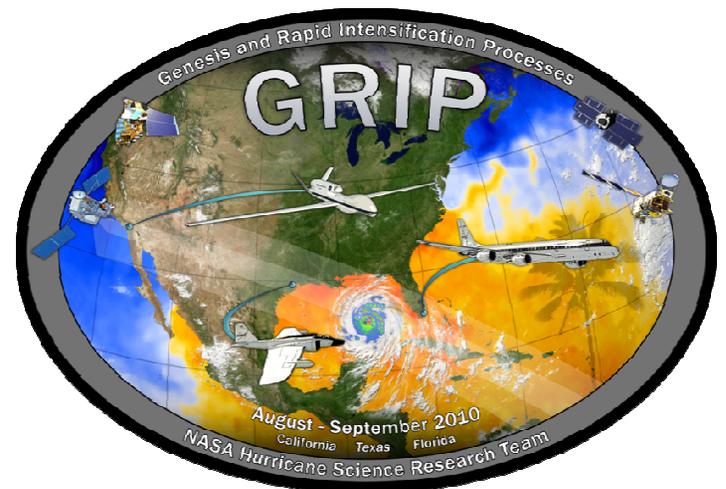


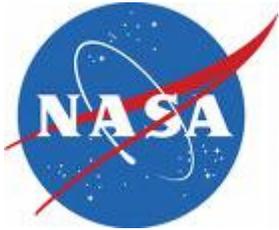
**GRIP Hurricane Mission**  
Genesis and Rapid Intensification Processes



# NASA's Genesis and Rapid Intensification Processes Mission

Media Teleconference  
August 5, 2010





## GRIP Hurricane Mission

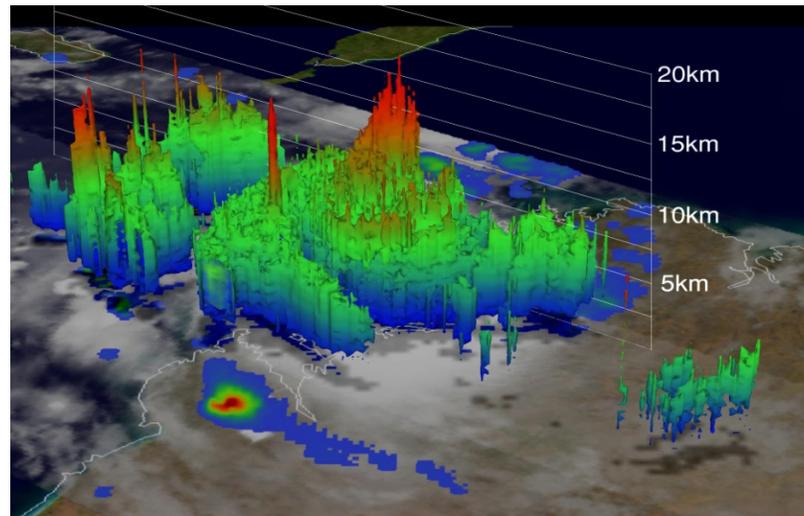
Genesis and Rapid Intensification Processes



# WHY DO THIS MISSION?

Ramesh Kakar, NASA Headquarters

- To develop a better understanding of the science behind the genesis of tropical storms and hurricanes and their behavior once they are formed.*



**TRMM satellite 3-D  
Image of Cyclone  
Magda Jan. 2010**



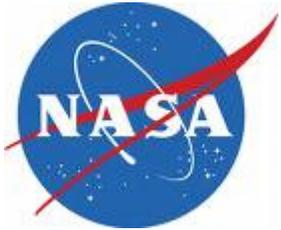
## GRIP Hurricane Mission

Genesis and Rapid Intensification Processes



## WHAT'S NEW AND DIFFERENT HERE?

- *Several high-quality remote-sensing instruments*
- *Low noise state-of-the-art microwave radiometers, radars and lidars*
- *Simultaneous measurements of temperature, moisture, precipitation and surface wind velocity currently measured by satellite based sensors.*



## GRIP Hurricane Mission

Genesis and Rapid Intensification Processes

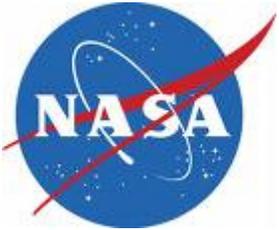


### WHAT'S NEW ABOUT THE TECHNOLOGY?

- *The aircraft, satellites*
- *Will enable improvements for predicting weather and extreme weather events.*

### WHAT PAST MISSIONS ARE WE BUILDING FROM?

- *CAMEX-3, CAMEX-4, TCSP, NAMMA*



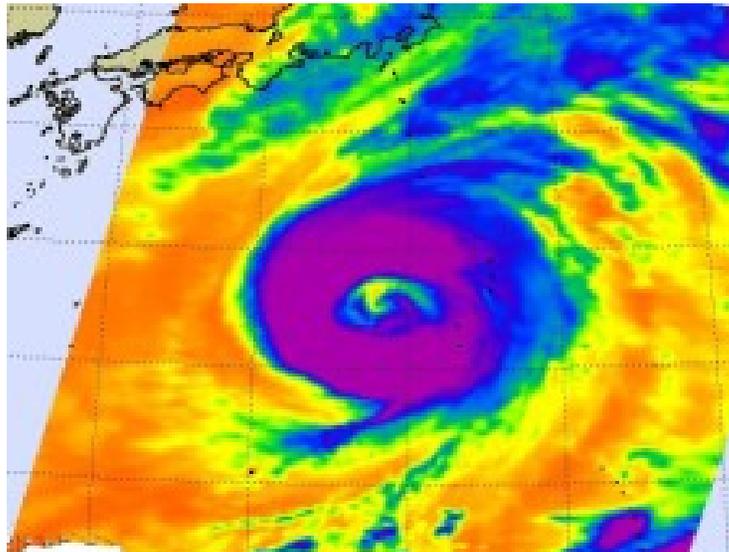
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Genesis and Rapid Intensification Processes

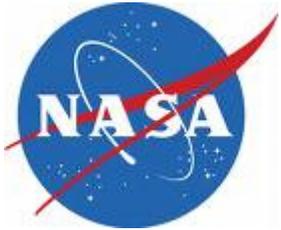


## GRIP AND 2 OTHER HURRICANE MISSIONS

- *NSF & NCAR: PRE-Depression Investigation of Cloud-systems in the Tropics mission*
- *NOAA: Intensity Forecast Experiment 2010*



**NASA AIRS Image of  
Typhoon Choi-Wan  
Sept. 2009**



## GRIP Hurricane Mission

Genesis and Rapid Intensification Processes



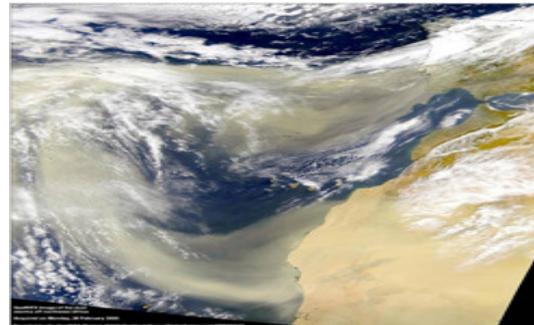
# THE MAJOR SCIENCE REASONS WE'RE FLYING GRIP

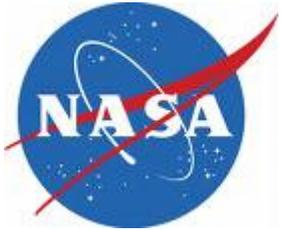
Scott Braun, NASA Goddard Space Flight Center

- *What are the relative roles of the storm environment versus internal processes?*
- *Does the large-scale environment play a significant role in cyclone formation, or are smaller, cloud-scale processes more important?*
- *Are some disturbances better protected from common inhibiting influences than others?*
- *What roles do Saharan dust and other aerosols play?*
- *Does a vortex start from the bottom and work up, or does it begin from a higher altitude and work its way down?*
- *Do the massive "hot towers" of convection occasionally present near the inner eye walls of a hurricane cause the vortex to intensify, or are they a response to that intensification?*

**Saharan Dust -NASA's SeaWiFS satellite**

**Feb. 28, 2000**





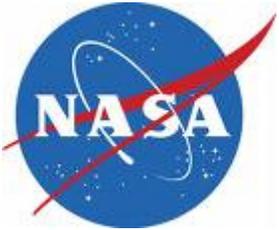
## GRIP Hurricane Mission

Genesis and Rapid Intensification Processes



## GRIP'S SUCCESS WILL LIE IN SUCCESSFUL INTEGRATION OF AIRCRAFT AND SATELLITE DATA

- *Satellites will provide data on environmental temperature/humidity, rainfall, lightning, cloud structure, ocean temperature, Saharan dust*
- *Aircraft data*
  - *GH: Inner-core precipitation structure and winds, environmental profiles of T, RH, and winds.*
  - *DC-8: Environmental winds, T, RH, dust and in-storm precipitation structure and microphysics.*
  - *WB-57: Surface winds and rainfall*
- *A/C data fill critical voids in satellite data*



## GRIP Hurricane Mission

Genesis and Rapid Intensification Processes



## GRIP MISSION FIRSTS

**Gerry Heymsfield, NASA Goddard Space Flight Center**

- *Global Hawk provides first unmanned coverage of tropical cyclone or hurricane with 8-16 hour continuously flying over and/or in their immediate environment.*
- *First time for instruments to measure winds, precipitation, moisture and temperature in tropical storm environment.*

**DC-8:** *DAWN (wind measurements in clear regions)*

**Global Hawk:** *HIWRAP (winds and precipitation)*

*HAMSR (temperature, moisture, precipitation)*

*DROPSONDES (temperature and winds)*

**WB-57:** *HIRAD (ocean surface winds, precipitation)*

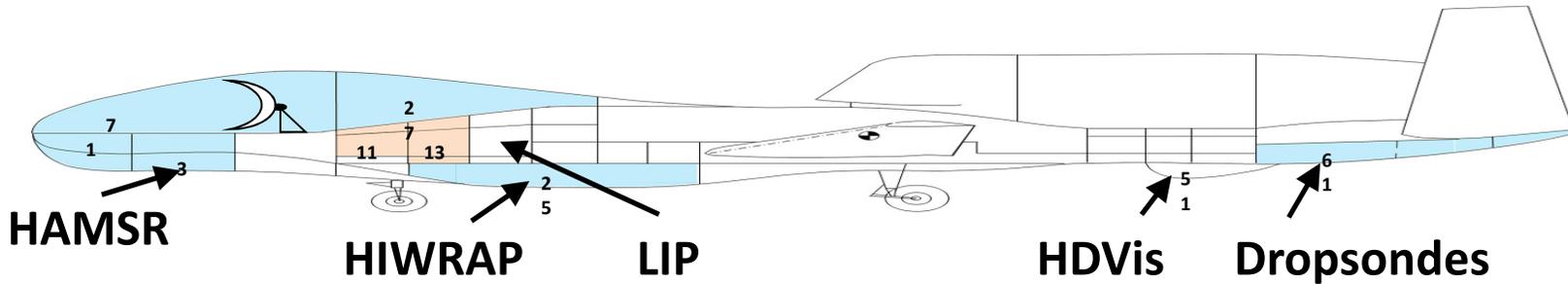


# GRIP Hurricane Mission

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## GLOBAL HAWK



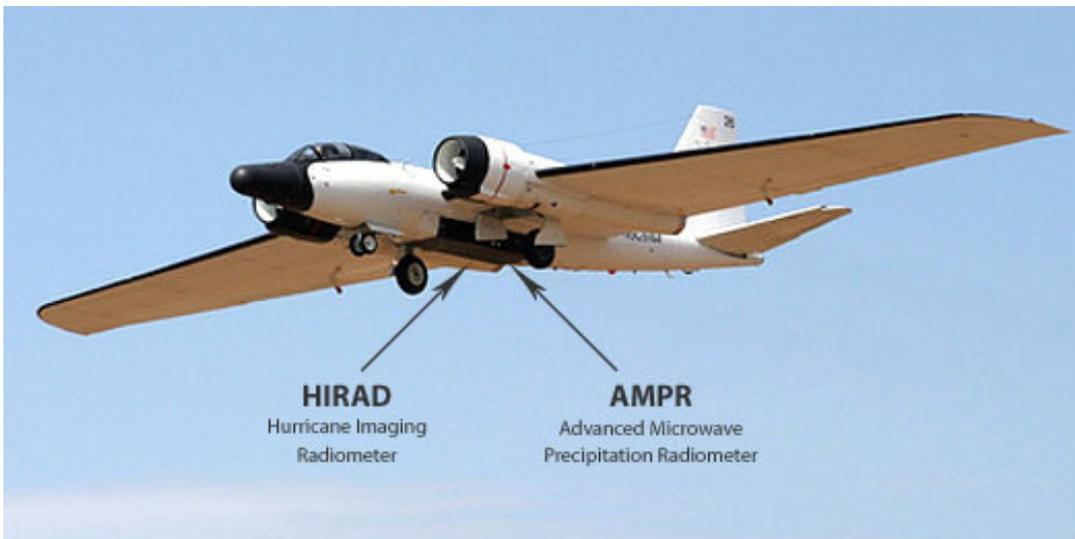
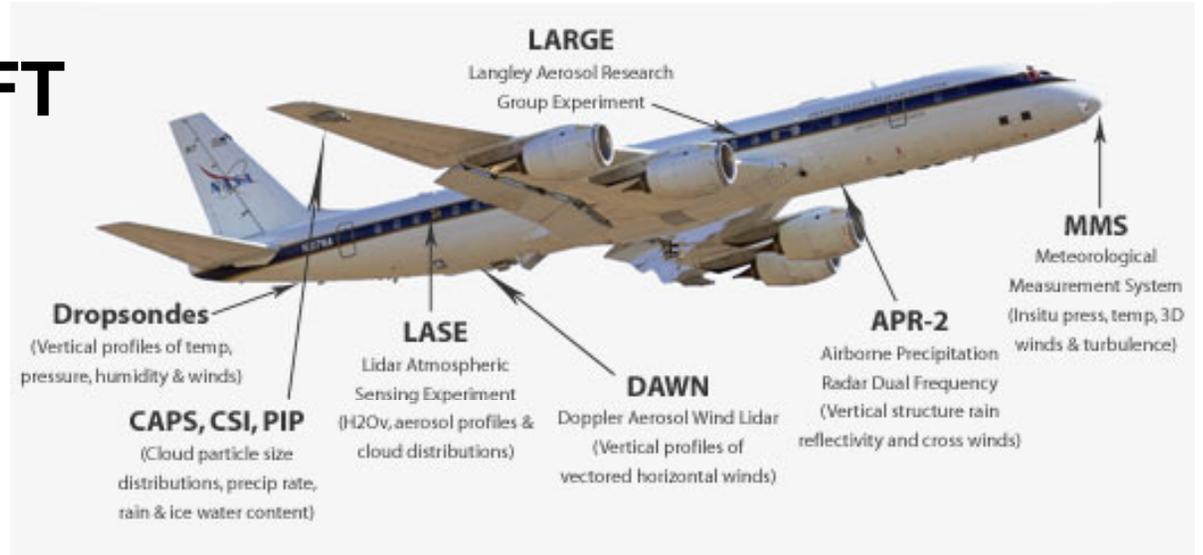


# GRIP Hurricane Mission

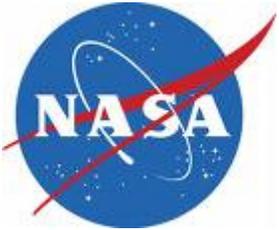
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## DC-8 AIRCRAFT



## WB-57 AIRCRAFT



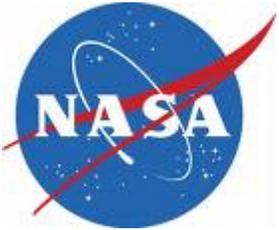
## GRIP Hurricane Mission

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## MISSION FIRSTS

- *Collaboration will provide unprecedented coverage of tropical storms in both time and space due to the large number of aircraft studying the same developing tropical systems.*
- *Measurements from the airborne instruments coupled with observations from NASA's spaceborne instruments (TRMM, Aqua and CloudSat) will provide a more complete view of winds, temperature, humidity, clouds, ice, lightning, aerosols and other factors inside tropical cyclones in and around developing systems.*



## GRIP Hurricane Mission

Genesis and Rapid Intensification Processes



# FLIGHT TRACKS FOR ACHIEVING SCIENTIFIC OBJECTIVES

Ed Zipser, University of Utah

- *Investigating potential GENESIS situations - Flying in a highly scripted grid pattern*
- *In flights into already named storms - crossing the storm center, to examine both the near-center and medium-range environment of the storm*
- *To find out factors favoring intensification or weakening, and repeat these patterns on several consecutive days.*



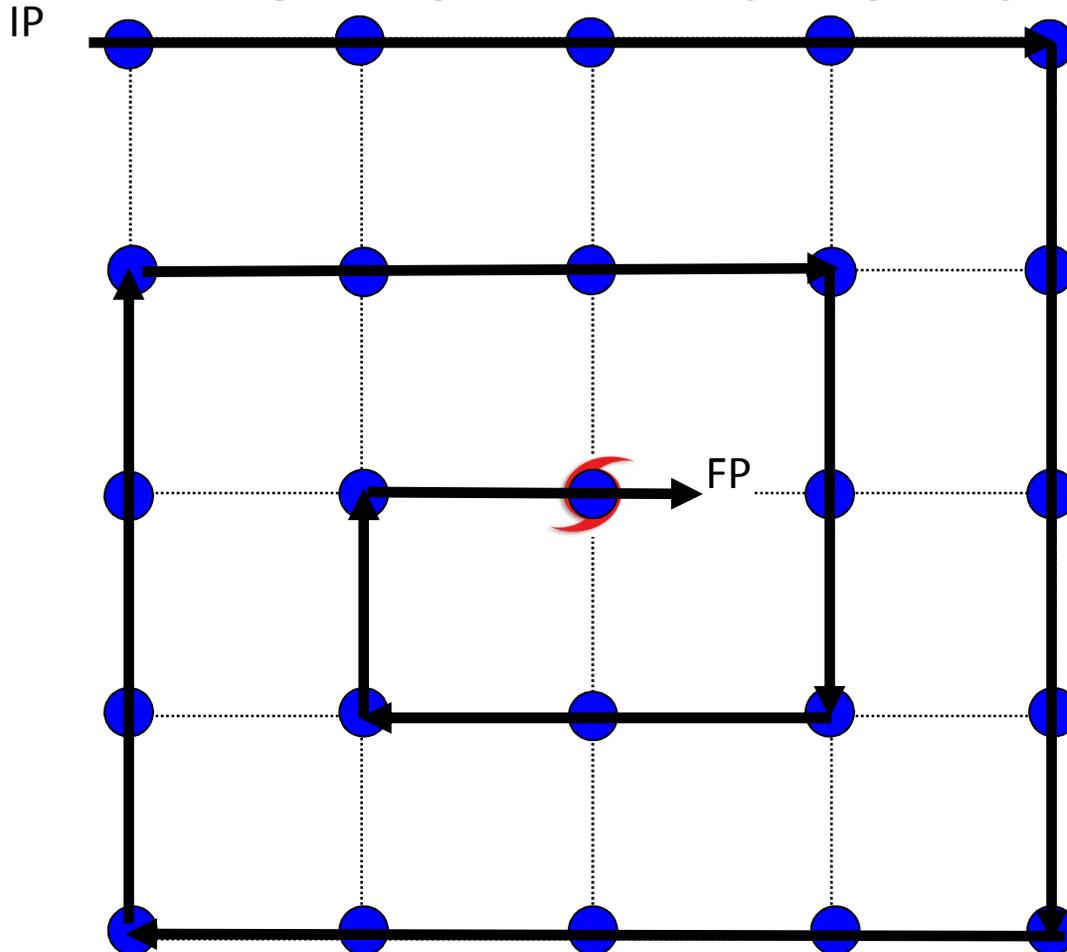
# GRIP Hurricane Mission

Genesis and Rapid Intensification Processes



## FLIGHT TRACKS

5 x 5 Square Spiral (150 km grid spacing)



3600 km total  
(1944 nmi)

Approximate  
Duration:  
GIV - 4.5 hr  
DC8 - 4.5 hr  
GH - 5.6 hr



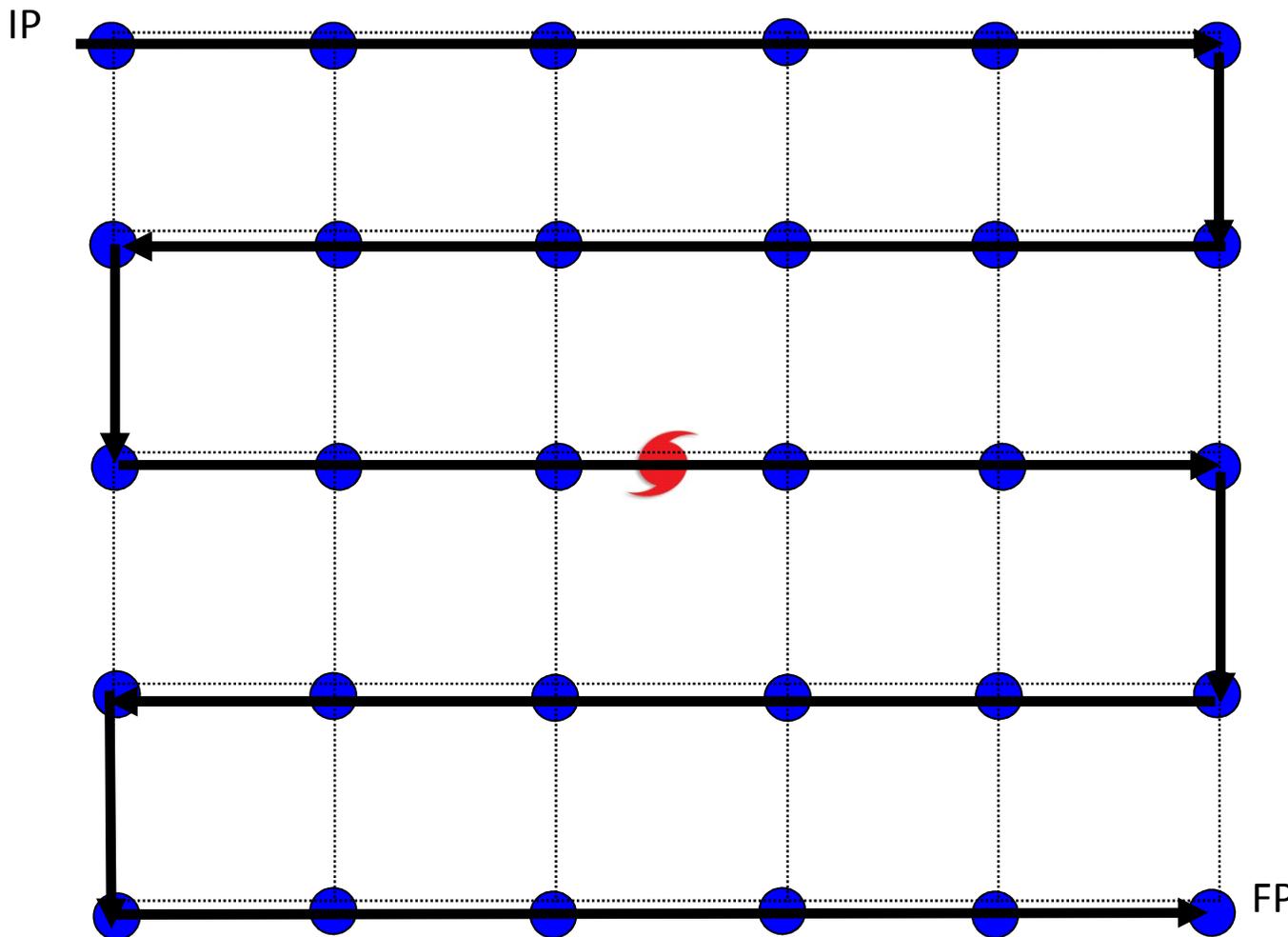
# GRIP Hurricane Mission

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## FLIGHT TRACKS

6 x 5 Lawnmower (150 km grid spacing)

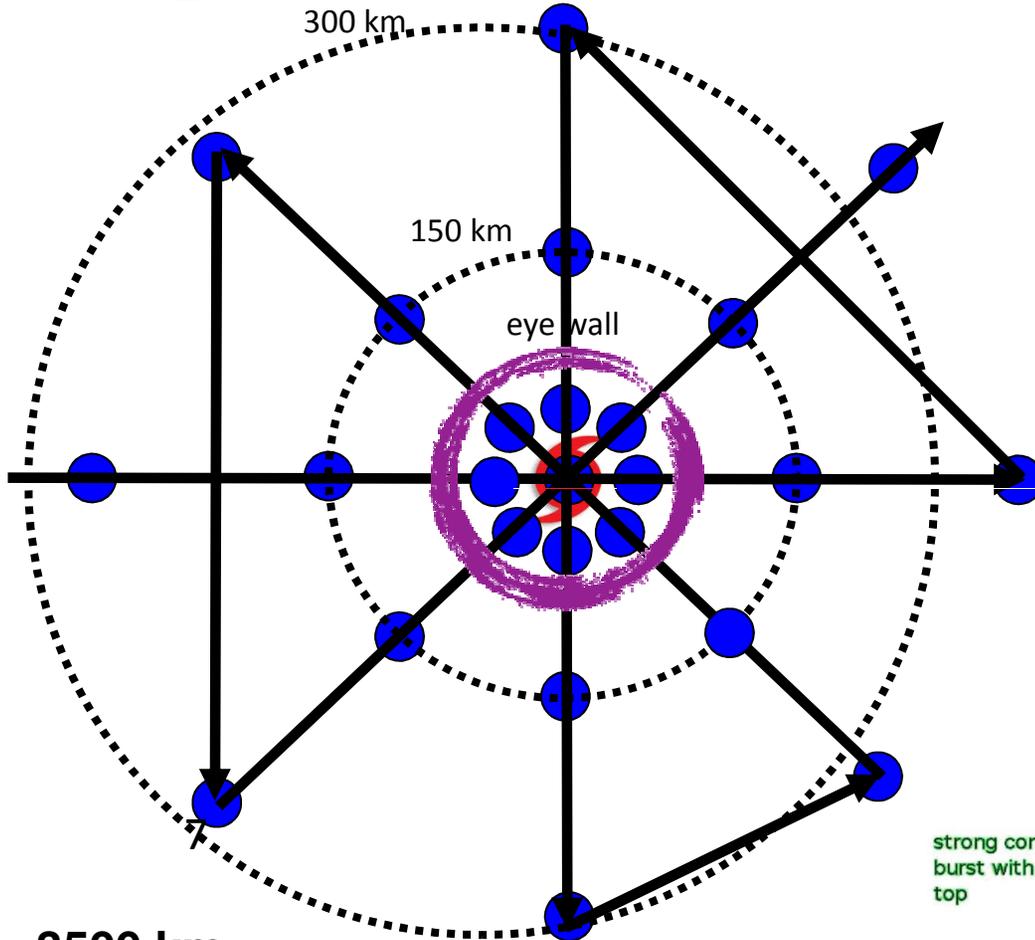


4350 km total  
(2348 nmi)

Approximate  
Duration:  
GIV - 5.3 hr  
DC8 - 5.3 hr  
GH - 6.5 hr



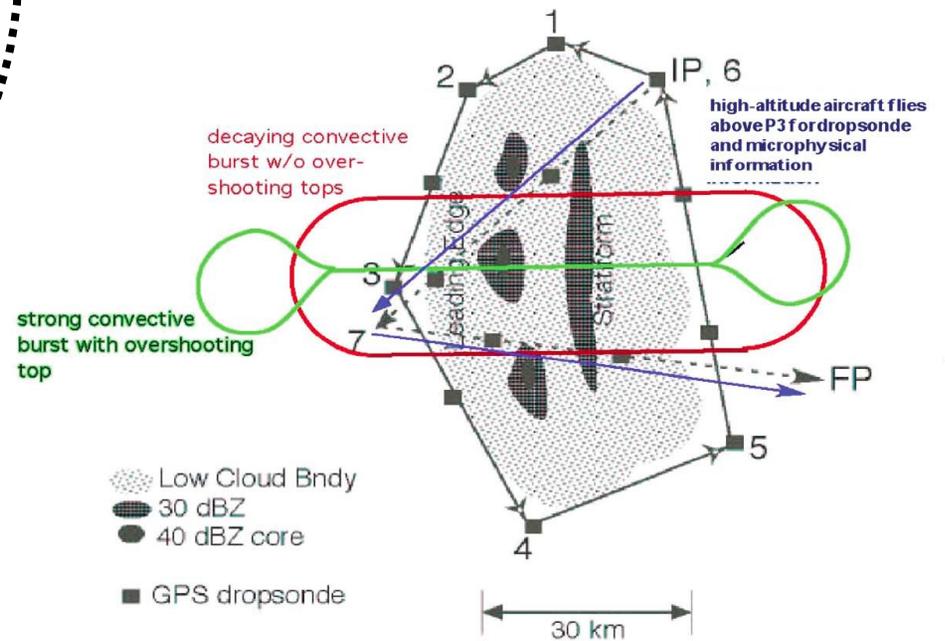
# FLIGHT TRACKS



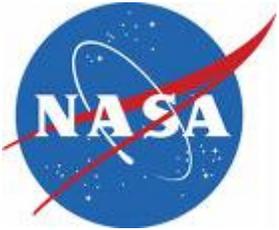
3500 km  
total (2175  
nautical  
miles)

Rotating Figure 4  
(300 km radius  
legs)

## “Convective Burst” Module



high-altitude aircraft flies above P3 for dropsonde and microphysical information



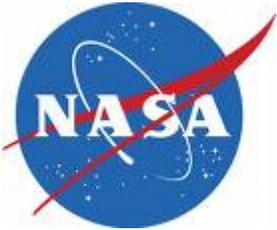
## GRIP Hurricane Mission

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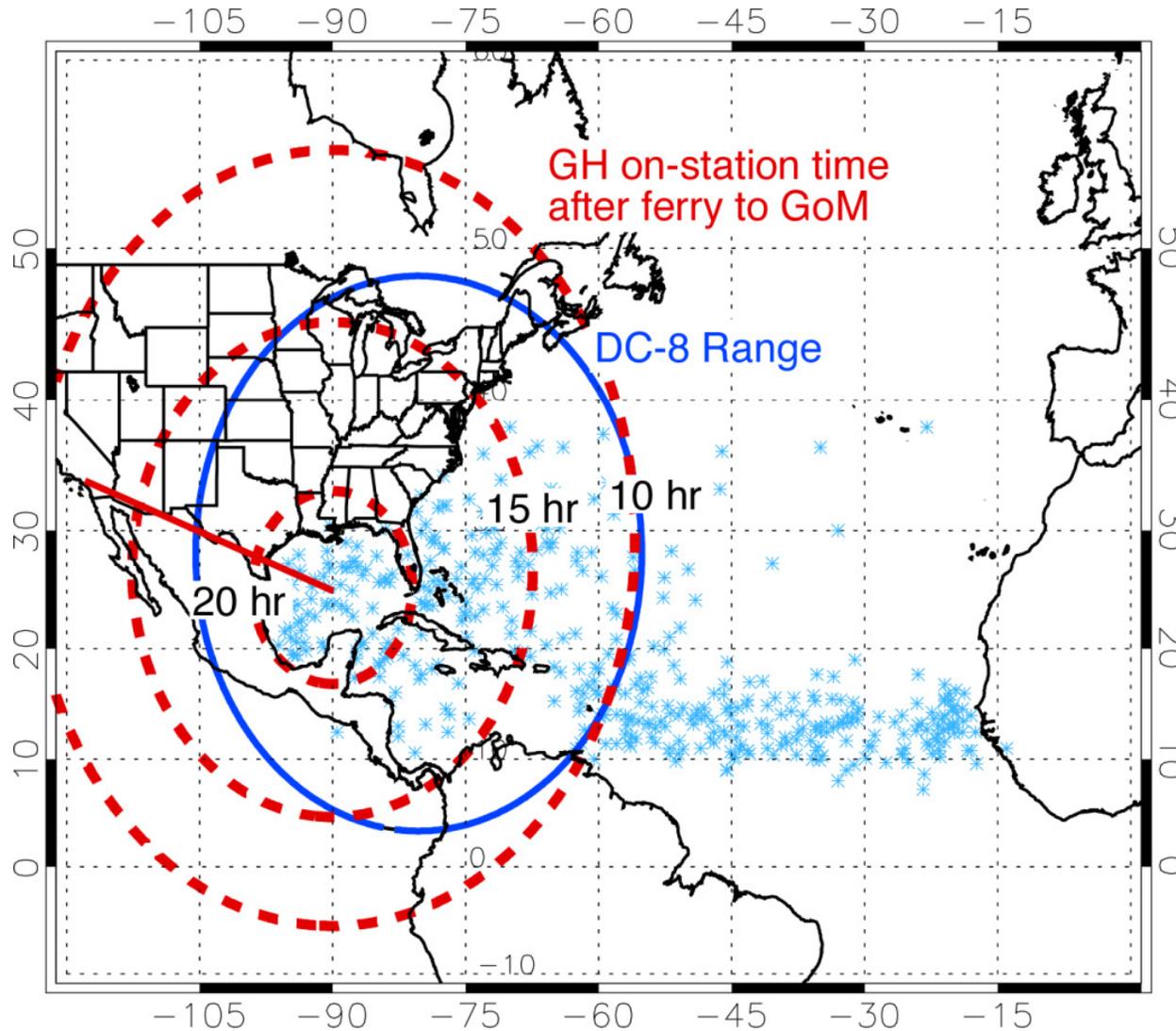
## HOW GRIP FLIGHT PLANNING WILL INTERACT WITH NOAA AND NSF FLIGHT PLANNING

- *Since NASA airplanes cannot fly more often than once daily (each), NASA will alternate scripted flight patterns with NOAA and NSF airplanes, every 12 hours*
- *All 3 agencies will be able to work together to achieve what cannot be done by one of us alone*



# GRIP Hurricane Mission

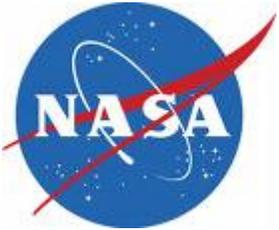
Genesis and Rapid Intensification Processes



**Blue line: DC-8 range for 9-h flight, 3 h on station**

**Red lines: Global Hawk range for 30-h flight with 10, 15 and 20 h on station**

**Light blue X: Genesis locations for 1940-2006**



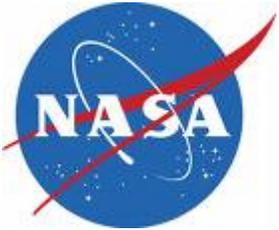
## GRIP Hurricane Mission

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## FLIGHT DETAILS

- *Optimum location for collaboration with NSF and NOAA planes (to achieve maximum time continuity) is between Puerto Rico and Florida.*
- *Also fly consecutive missions (with NOAA but without NSF) in the Gulf of Mexico, and when the occasion arises, east of Puerto Rico by a suitcase deployment of the DC-8*



## GRIP Hurricane Mission

Genesis and Rapid Intensification Processes



**NASA is ready to take to the field!**



[www.nasa.gov/grip](http://www.nasa.gov/grip)

For NASA Hurricane Storm Updates:

[www.nasa.gov/hurricane](http://www.nasa.gov/hurricane)