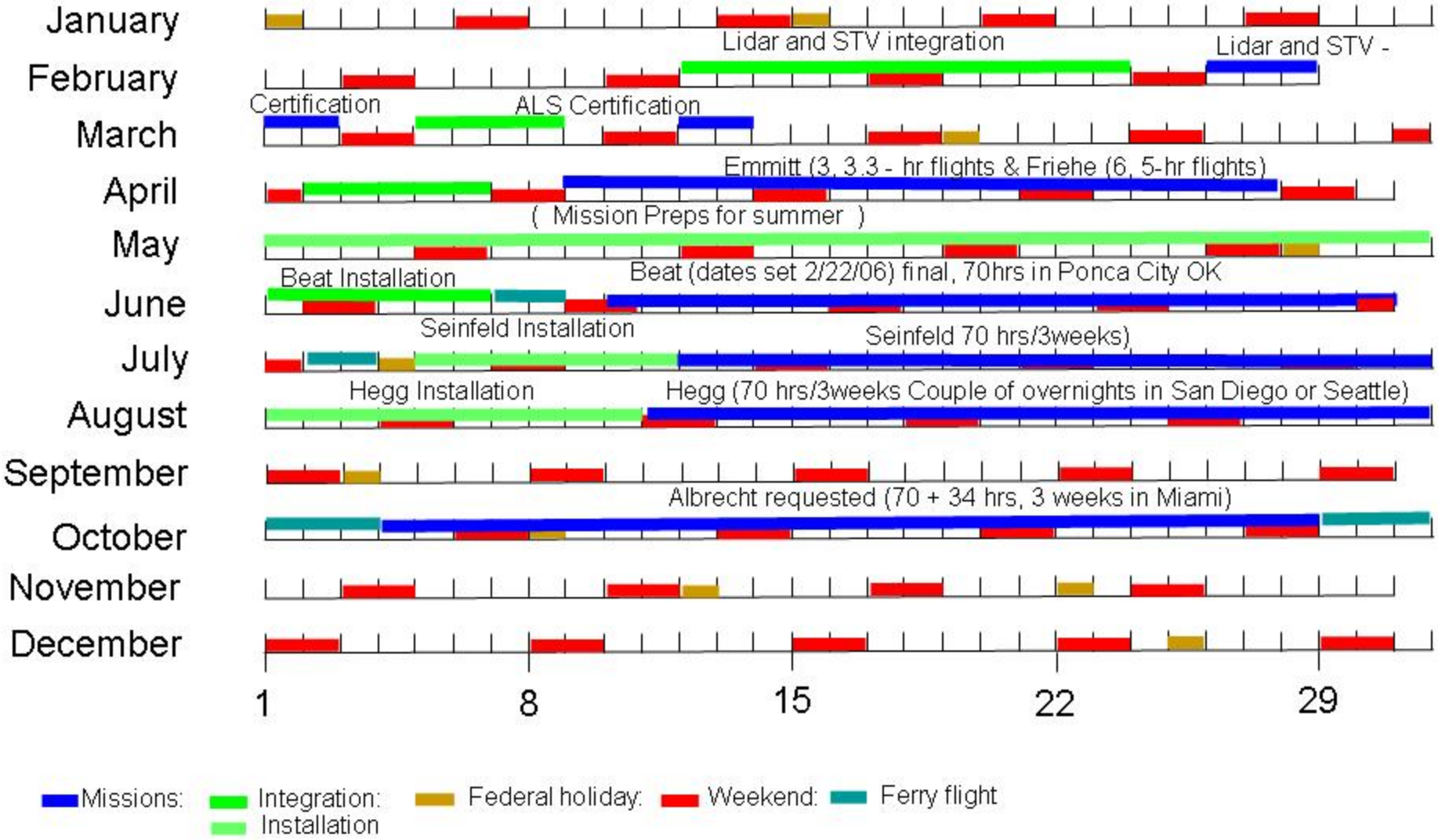
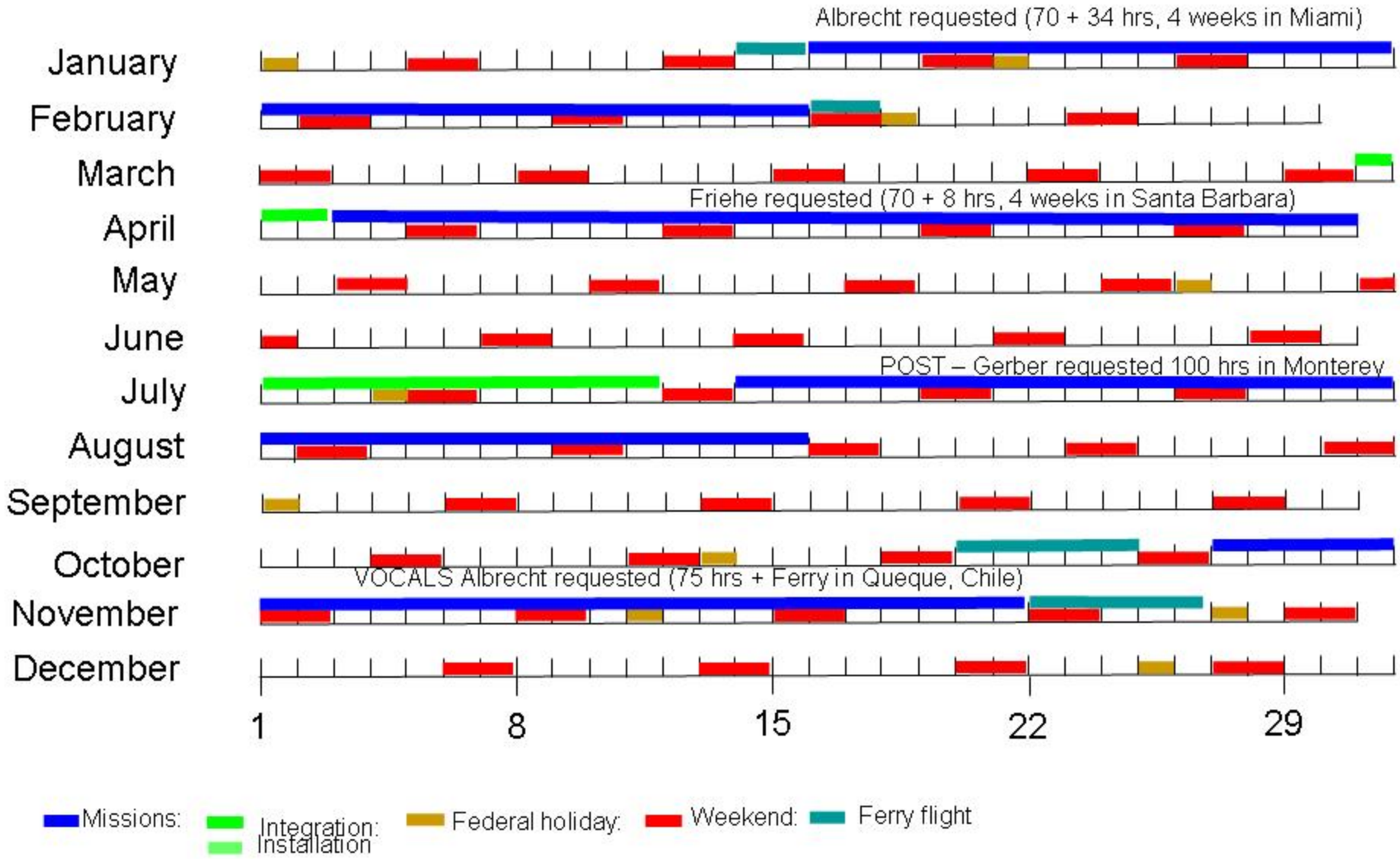
Twin Otter Schedule 2007

(as of 11/20/2006)



Twin Otter Schedule 2008

(as of 9/20/2007)



Controlled Towed Vehicle (CTV)

A new aircraft-towed platform for air-sea interaction measurements

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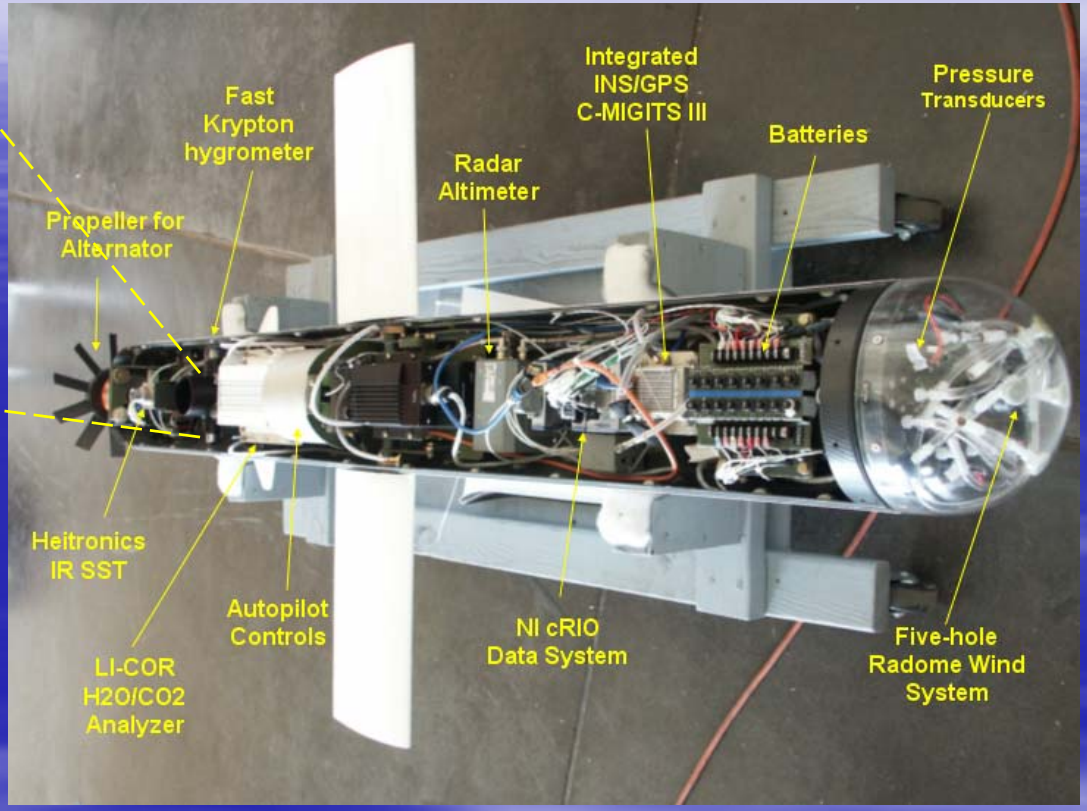
Purpose: Obtain near-surface measurements over the ocean in high to hurricane winds

The Controlled Towed Vehicle (CTV) allows Instruments to 'fly' at **controlled** altitudes as low the *canonical reference height* of 10 m above the ocean while the tow aircraft is safely above. (In general, manned research aircraft do not fly lower than 30 m or 100 ft). It measures:

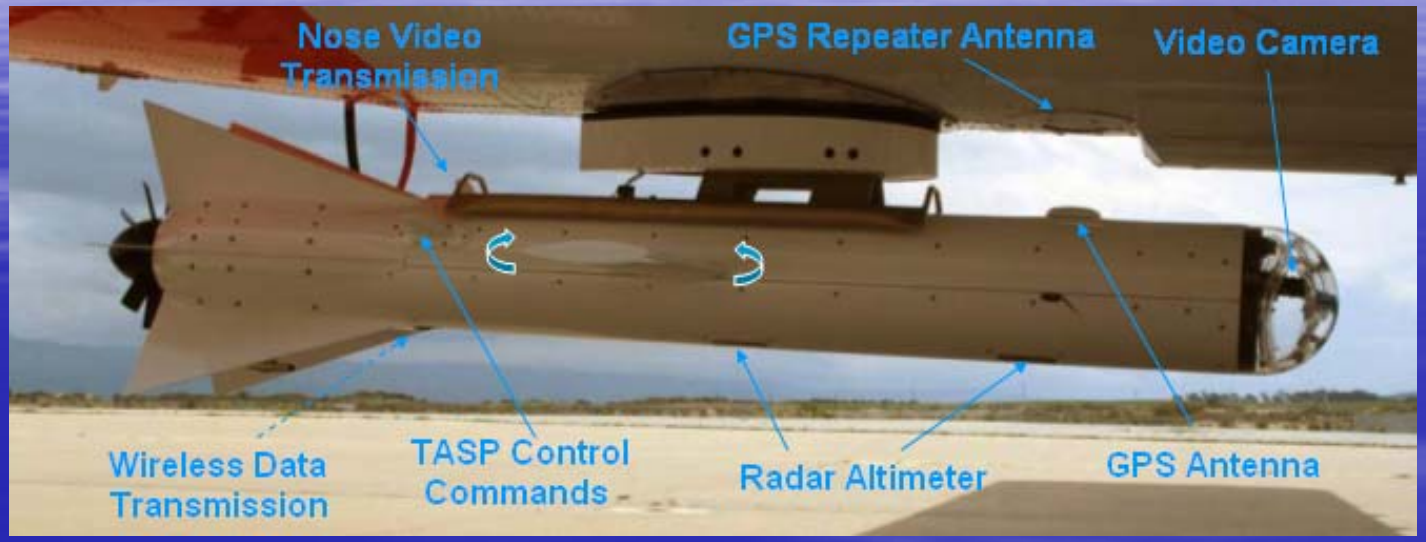
- Fluxes of momentum, heat, water vapor
- Mean meteorology (U, T, T_d, T_s, P) & profiles
- Aerosols, CO2
- Wave height and direction
- Other measurements possible – chemistry, radiative transfer

CTV Instruments



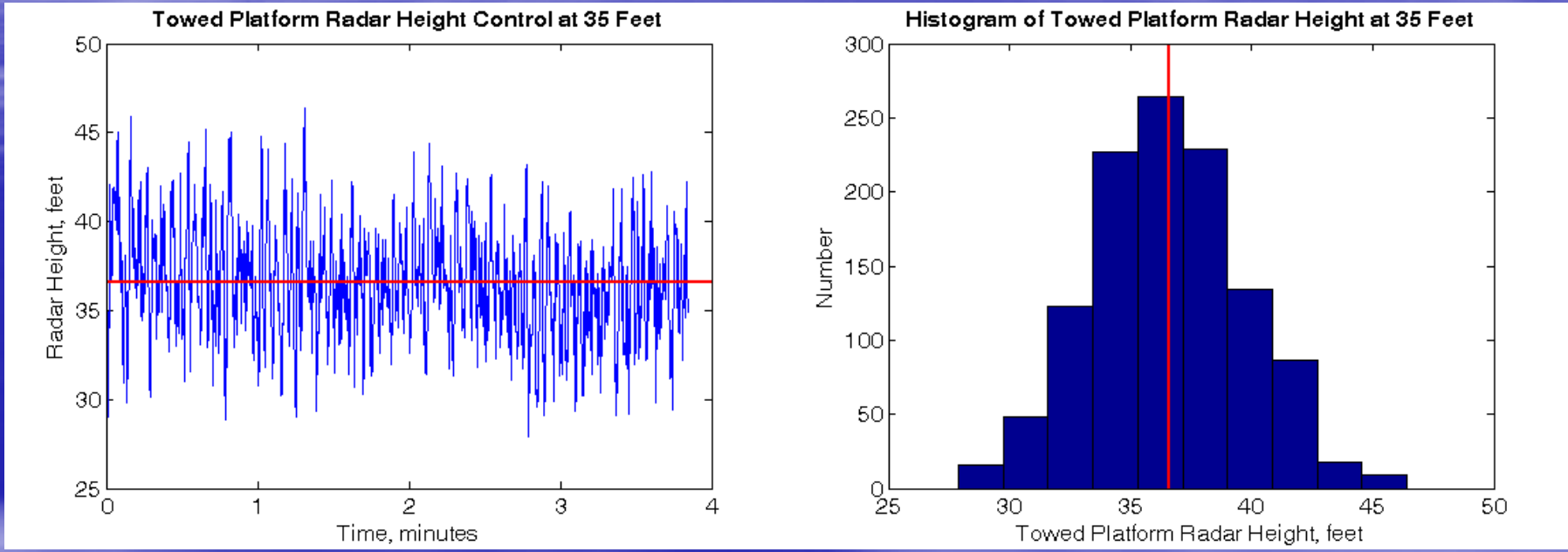
- Airspeed vector: 5-hole hemispherical nose cap & pressure transducers
- CTP motion and attitude: C-MIGITS III integrated GPS-Inertial unit
- Static (barometric) Pressure
- Air Temperature: Rosemount Pt Wire
- Humidity: LI-COR absorption (2 Hz & CO_2); Krypton absorption (50Hz)
- Sea Temperature: Heinman IR radiometer

Communication & Control



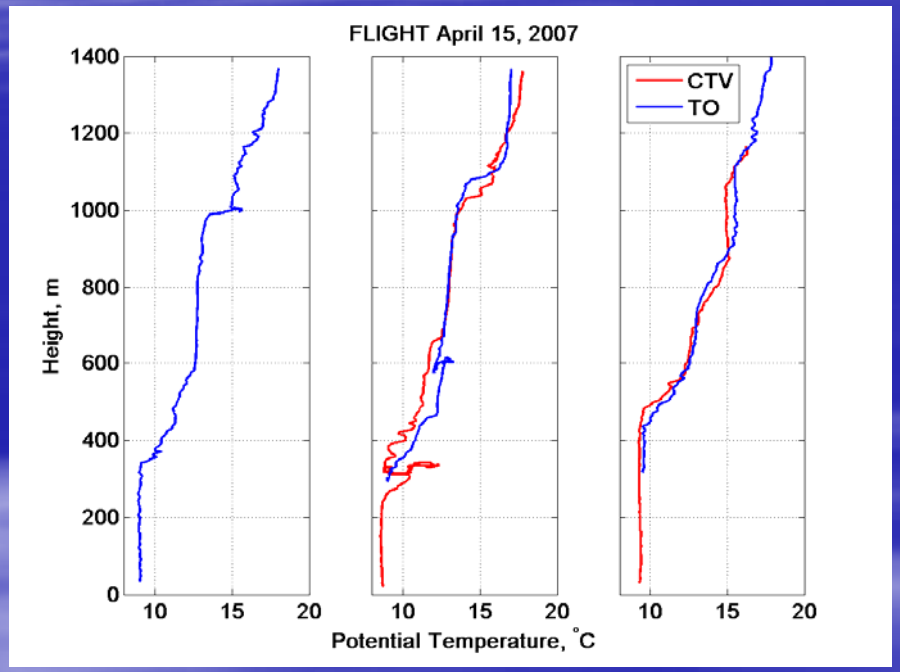
- Wireless link between aircraft and CTV to set height
- Smart active altitude control system (Meggitt's) comprises a radar altimeter, a computer and a wing servo to detect and hold the prescribed altitude.
- Video from nose camera is transmitted wirelessly to tow aircraft for display in cockpit and at control station.
- Data from research instruments are recorded on CTV data system and transmitted via wireless Ethernet link to aircraft computer for *real-time* monitoring and redundant storage.

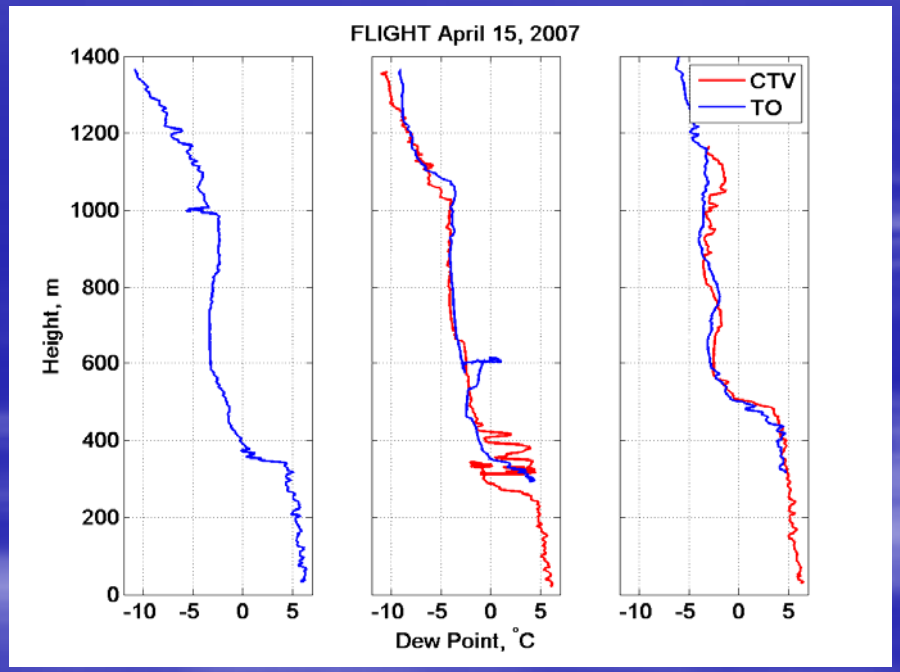
Radar Height Control at 36 feet (11 m)



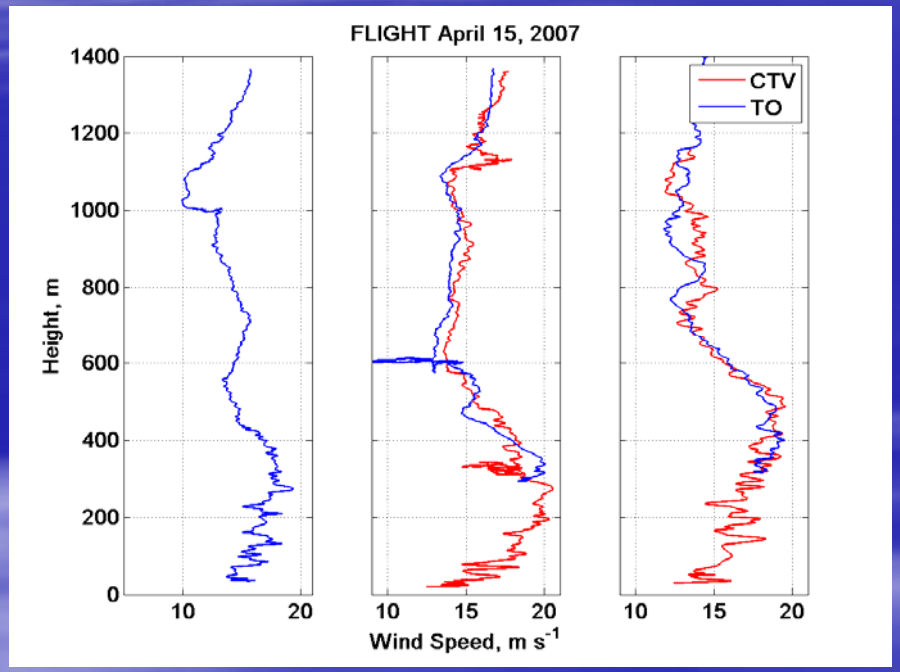
Mean = 36.57 feet (~11 m) ; Standard Deviation = 3.2 feet (~1 m)

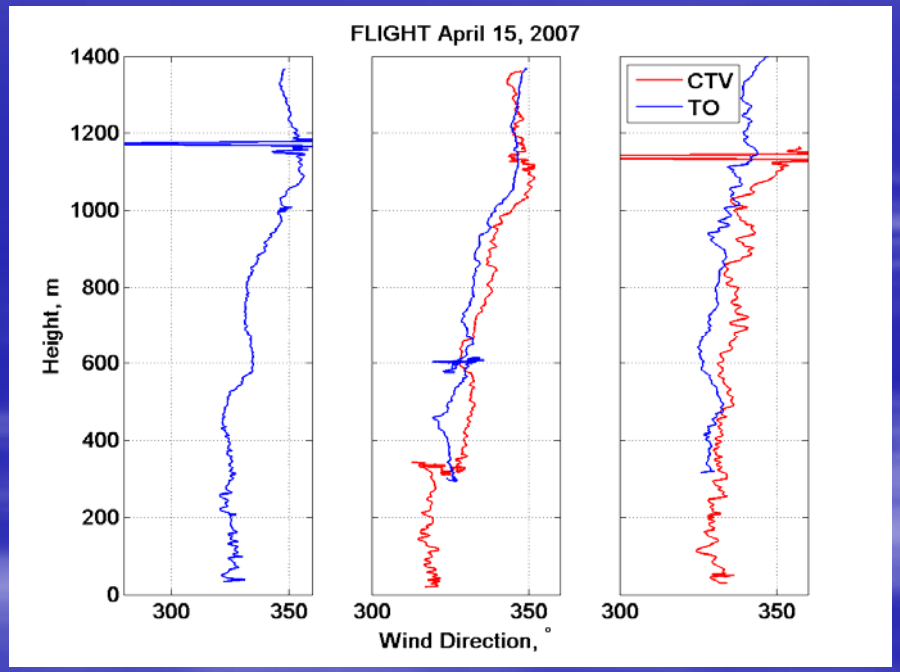
Temperature and Dewpoint Profiles





Wind Speed and Direction Profiles





CTV on CIRPAS Twin Otter

Control Station

2.1 m, (83”)

Weight: 45 kg, (~100#)

Technology Transfer

Towed drones are used for military target training. The **Meggitt TLX drone** is towed from small jet aircraft (Lear, Falcon) and contains a radar altimeter-servo-wing system to skim across the sea surface at *controlled* heights down to ~10m/30ft.

TLX drone (orange) and winch (white, blue) wing-mounted on Lear and Falcon jets.

Conclusions

The results obtained from the newly developed CTV indicate that research aircraft will have enhanced capabilities such as:

- MABL mean and turbulence measurements as low as 10 m. This was only possible from surface platforms (FLIP, ships, ASIT, spar buoys) BUT these lack the spatial coverage aircraft have.
- Simultaneous measurements from two different heights inside the MABL or with aircraft in/above clouds and CTV below/in clouds, respectively (useful to clouds dynamics and processes studies.)
- Simultaneous measurements of surface fluxes and wave field mapping/imaging would be possible from aircraft during experiments focusing on wind forcing and wave field coupling such as GOTEX (NSF/NCAR C130) with the bonus of optimized flight time.
- CTV may be an alternative to the very likely curtailment of low-level boundary-layer flights with NOAA P3s due to recent operational problems attributed to sea salt contamination of the engines during low flights in hurricanes.