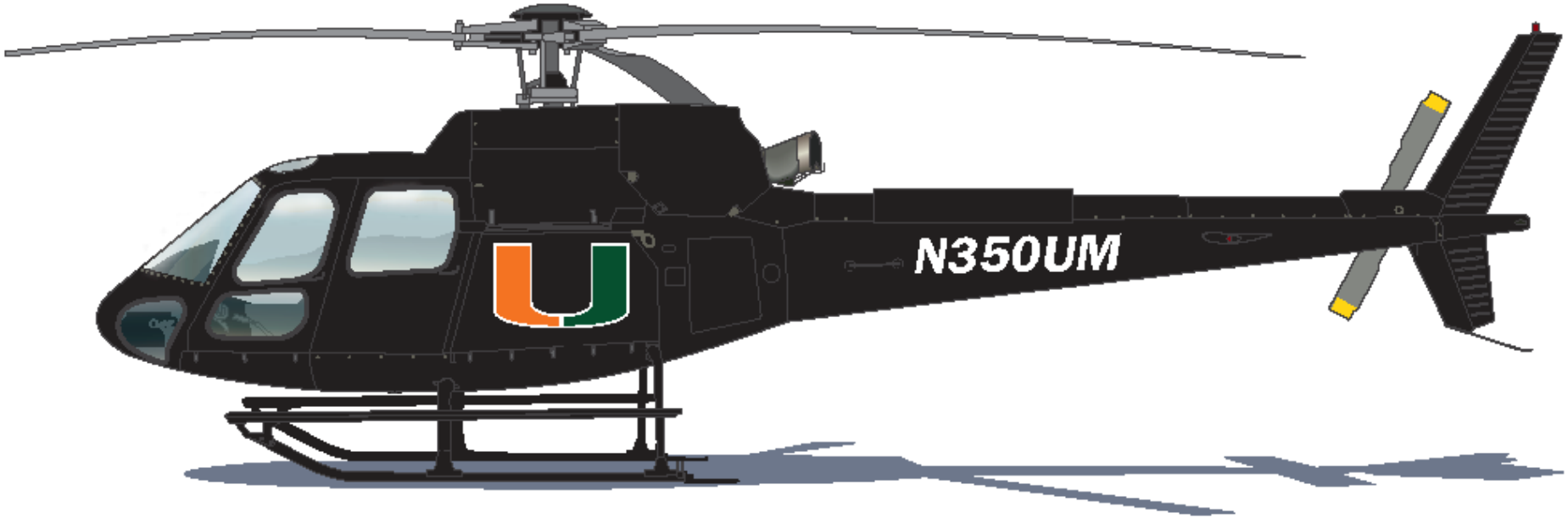
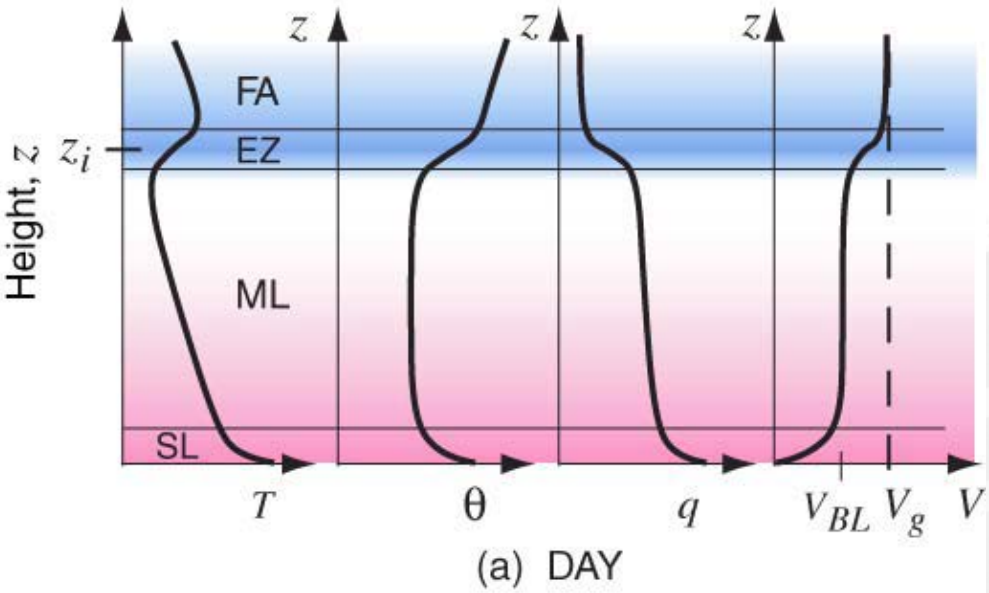
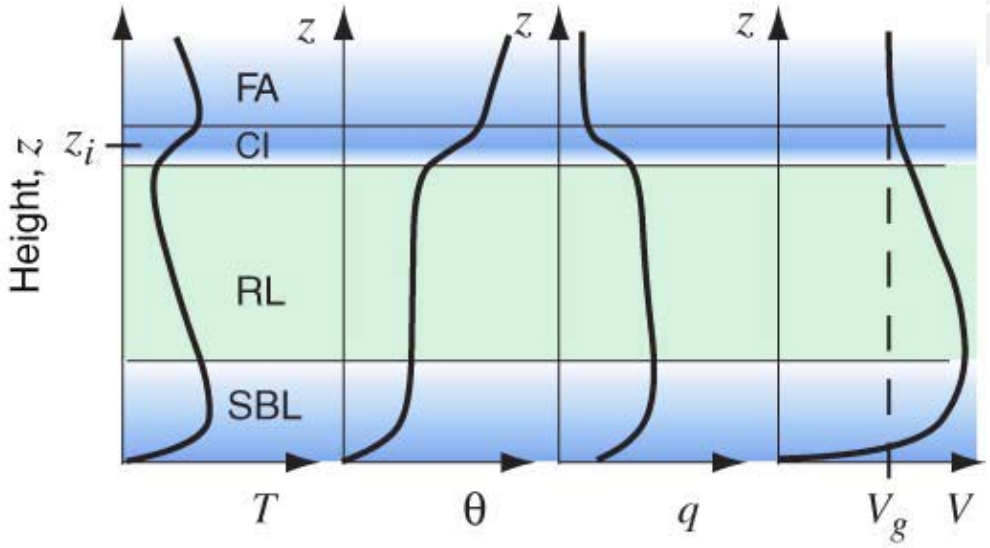
The University of Miami Helicopter Observation Platform (HOP)

Roni Avissar
PI and Chief Pilot





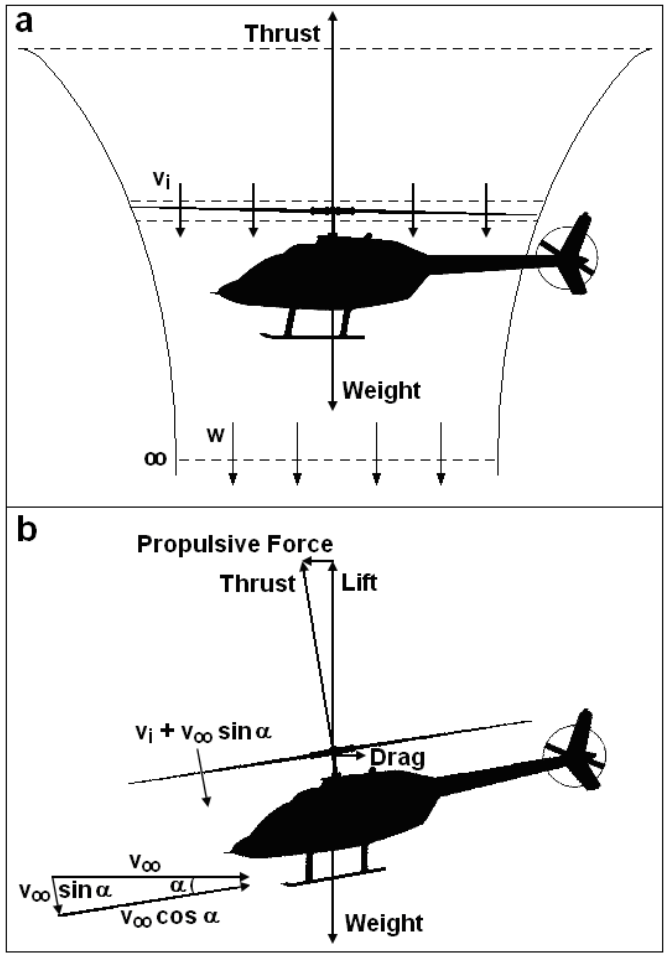
(a) DAY

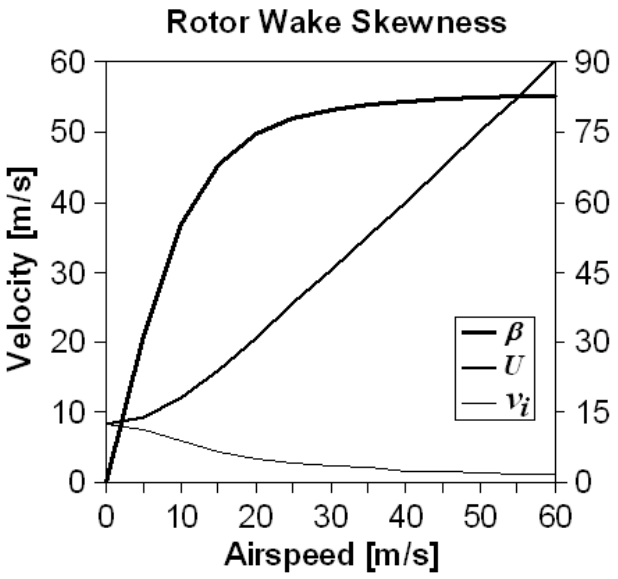


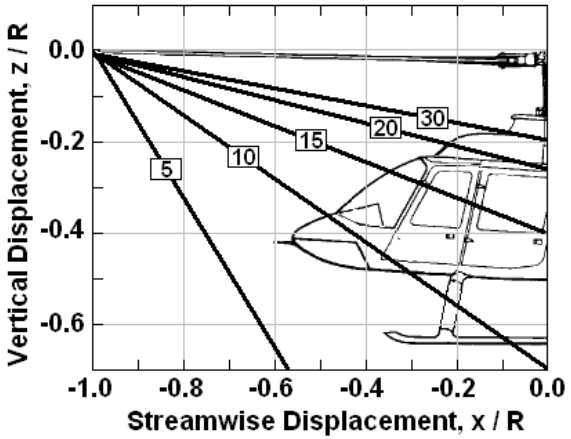
(b) NIGHT

Why a helicopter?

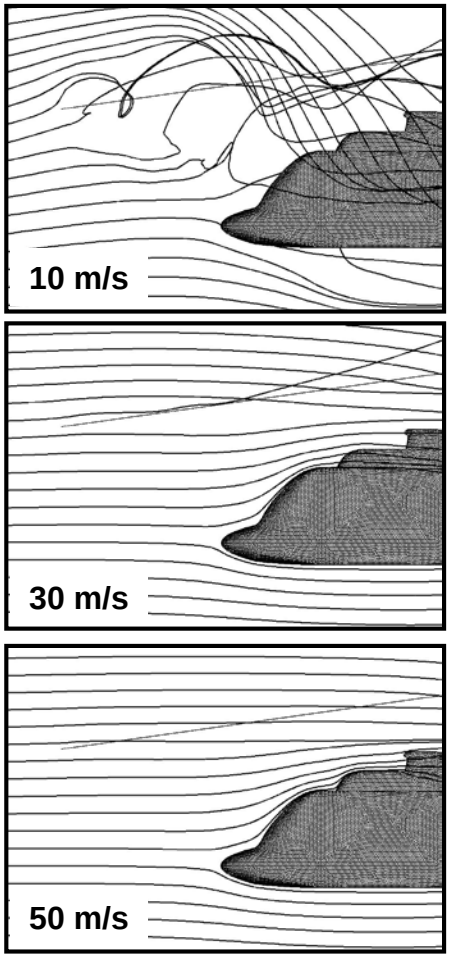
1. Various environmental observations require low altitude, very-high frequency of sampling, and/or slow speed of sampling (e.g., aerosols, which have a key impact on climate and health; fluxes – water, carbon, others)
2. Maneuverability (complex terrain, urban areas, quick turns for flight tracks)
3. Time at station (with a fuel truck on the ground, no need to commute to an airport)
4. Remote location (e.g., operation from a ship)



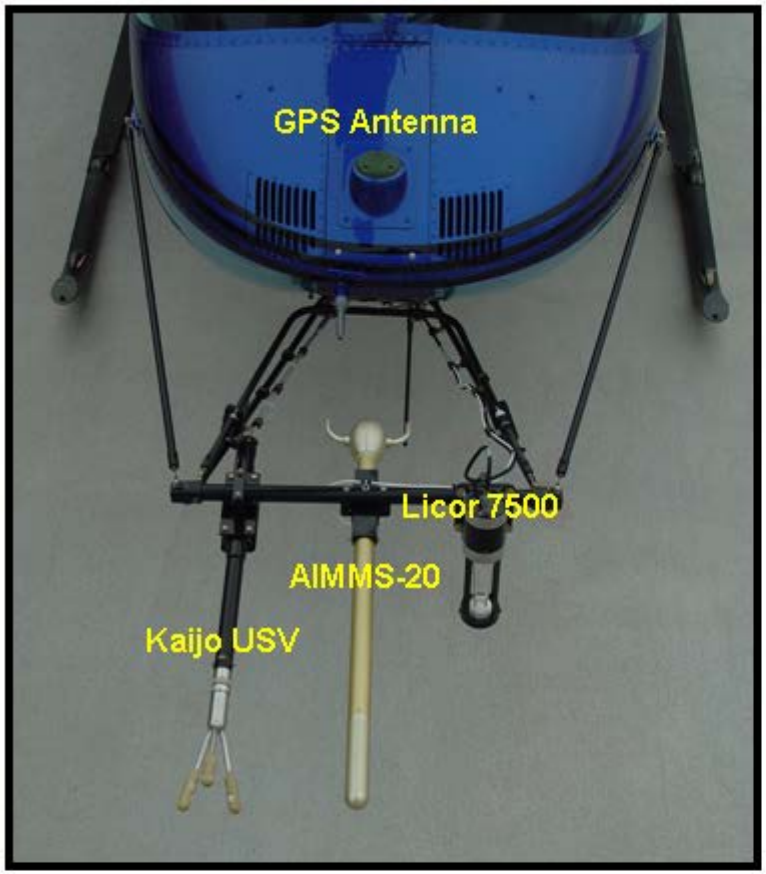


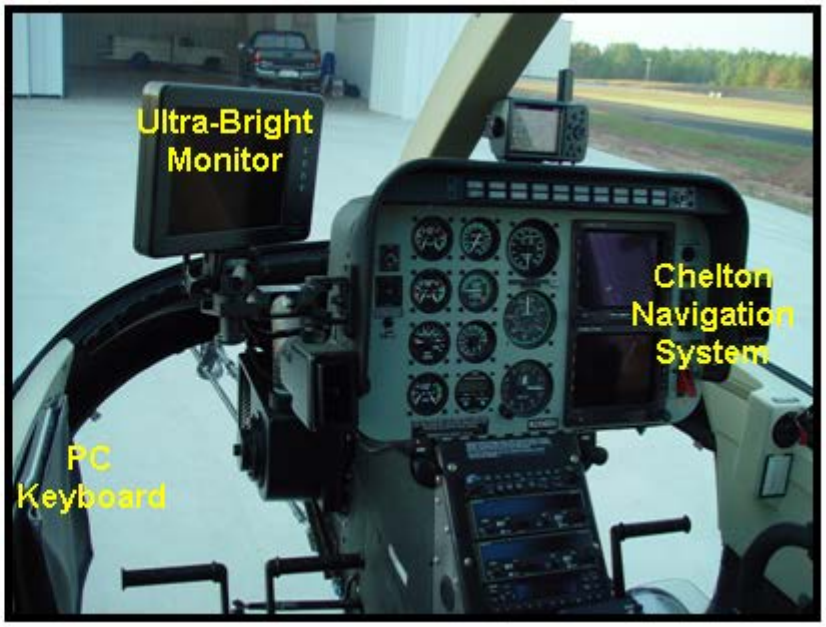


Fluent CFD

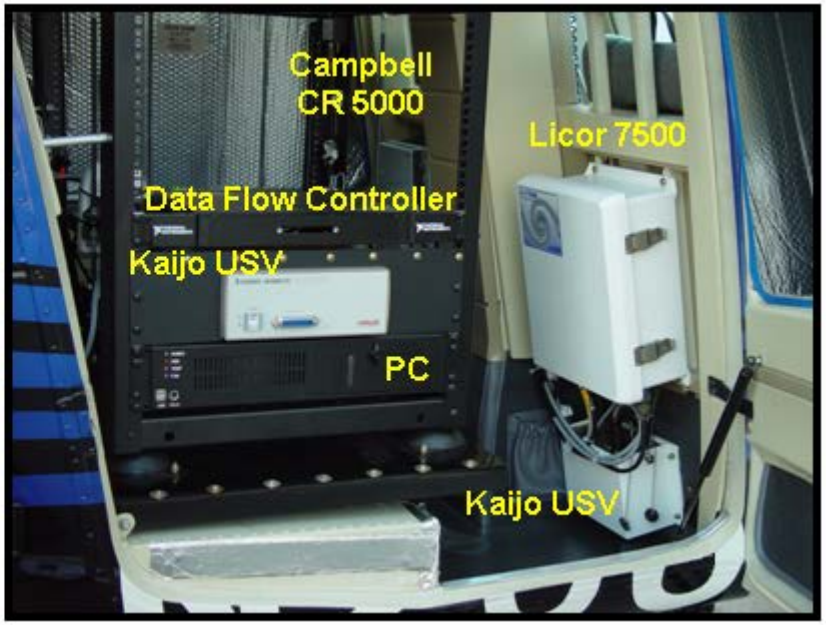


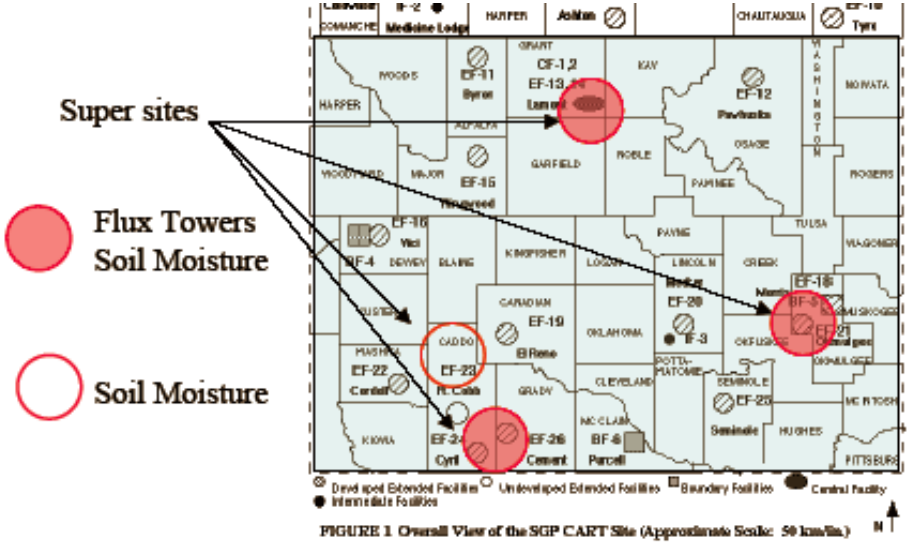
Glauert's (1935) rotor-wake model: $U = \sqrt{(v_\infty \cos\alpha)^2 + (v_\infty \sin\alpha + v_i)^2}$


GPS Antenna
Licor 7500
AIMMS-20
Kaijo USV

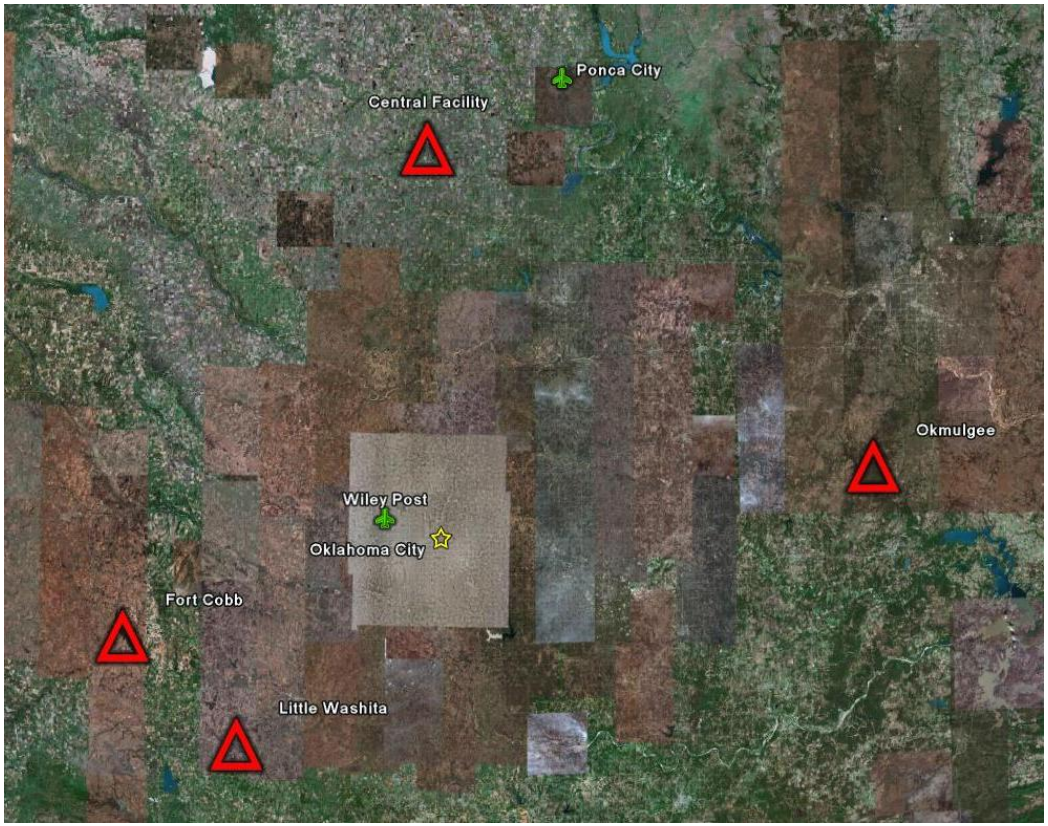

Ultra-Bright Monitor
Chelton Navigation System
PC Keyboard


GPS Antennas
N206DU


Campbell CR 5000
Licor 7500
Data Flow Controller
Kaijo USV
PC
Kaijo USV

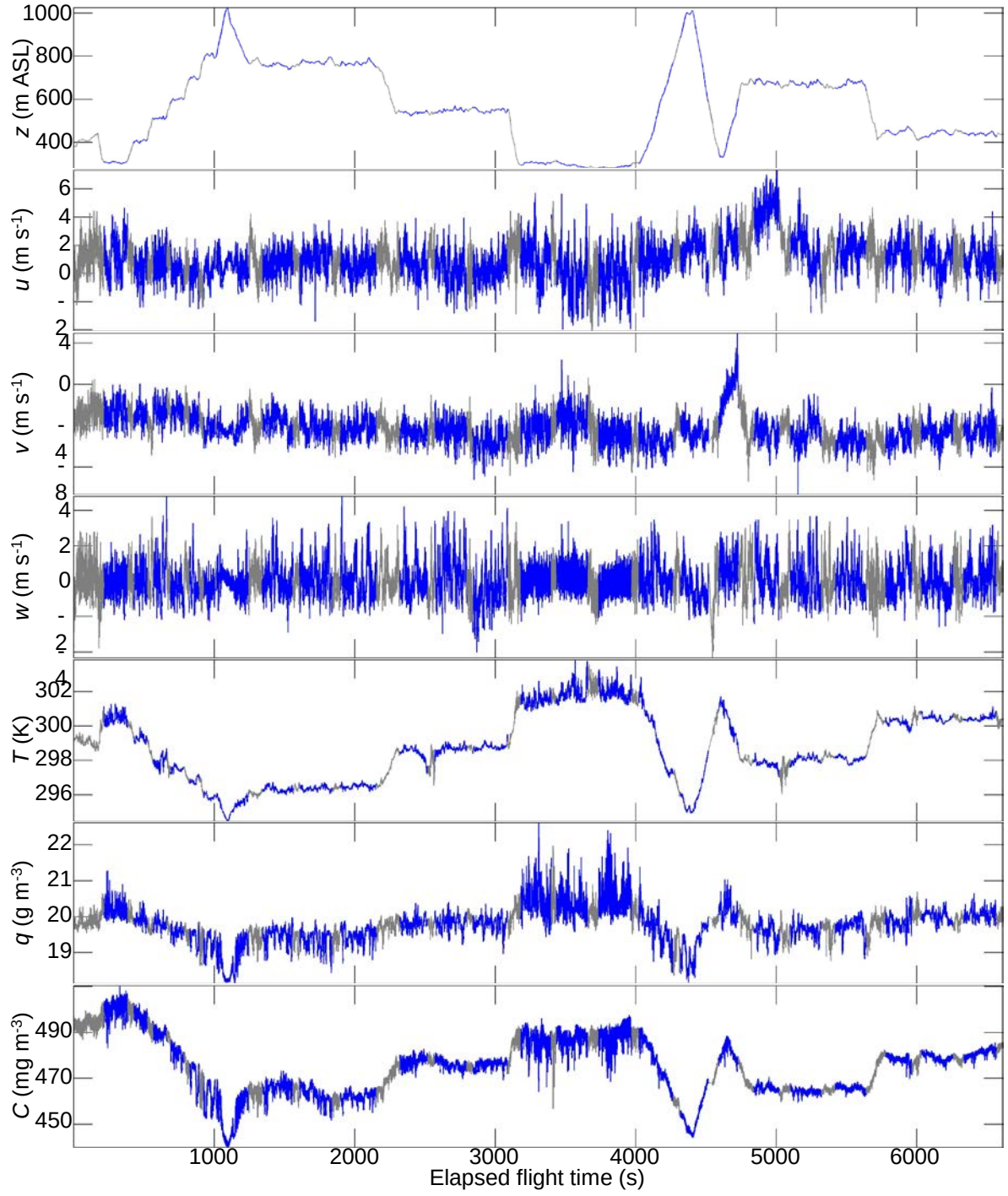


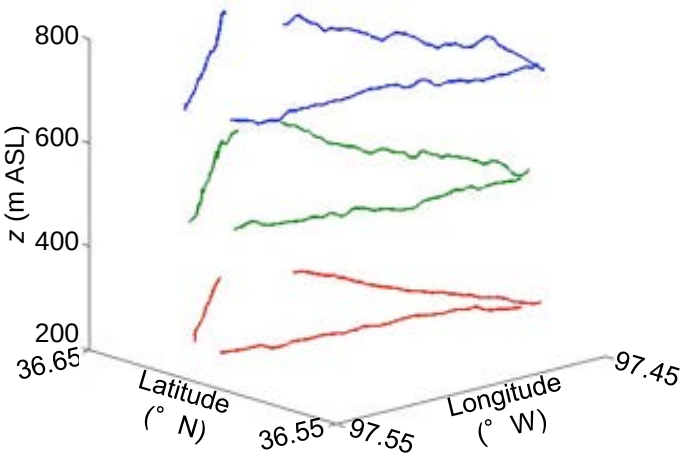
CLASIC Experiment
Oklahoma, June 2007

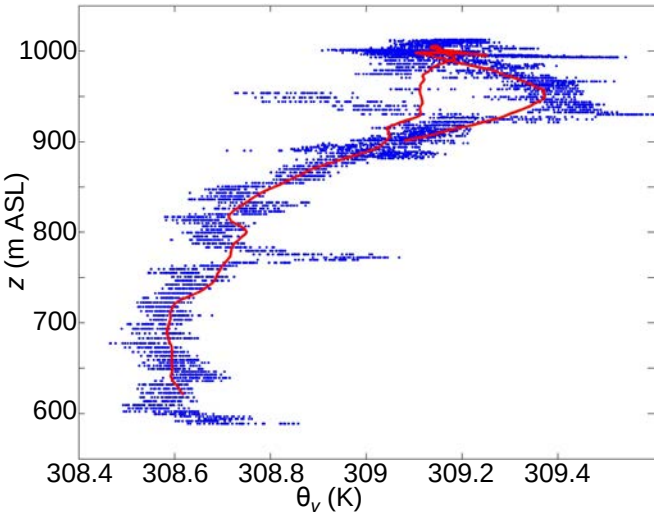


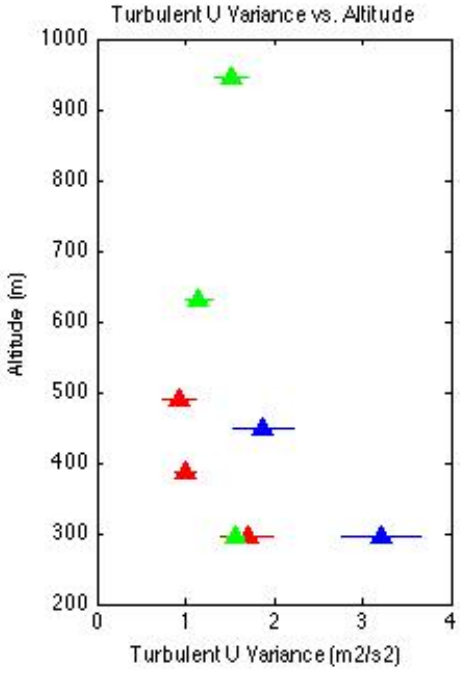
HOP Data

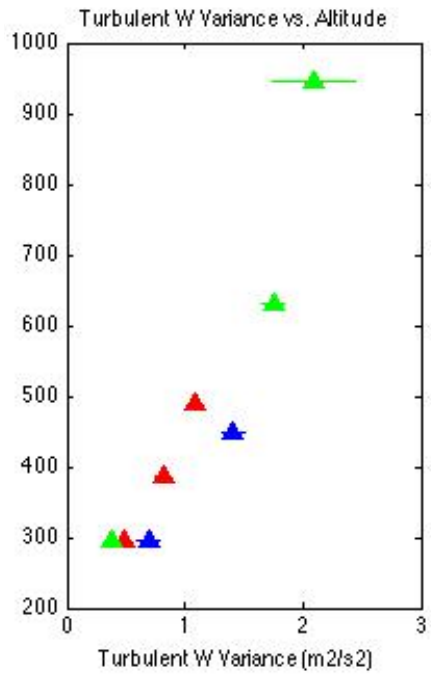
19 June 2007 CLASIC HOP flight

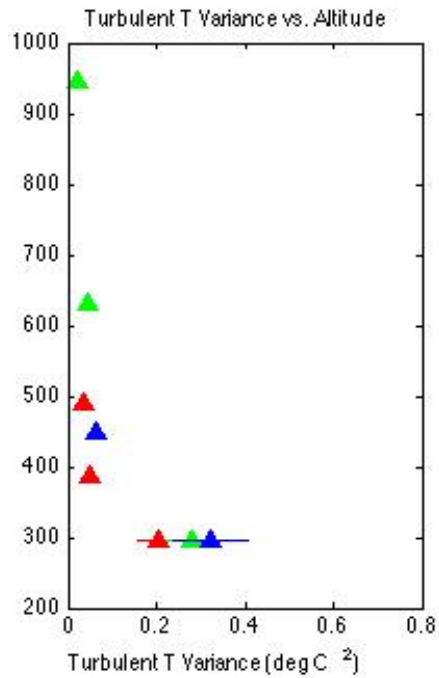


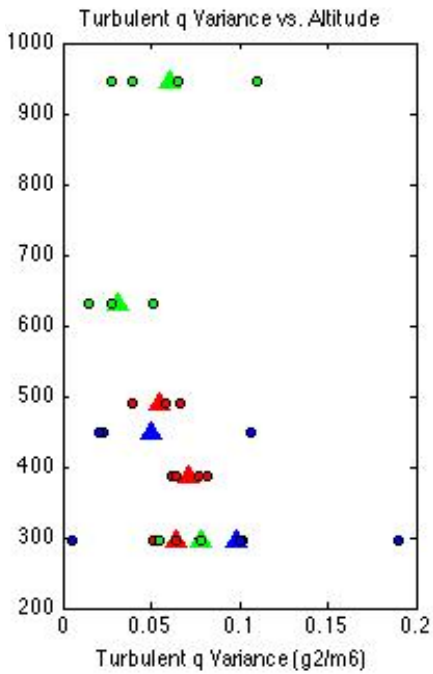


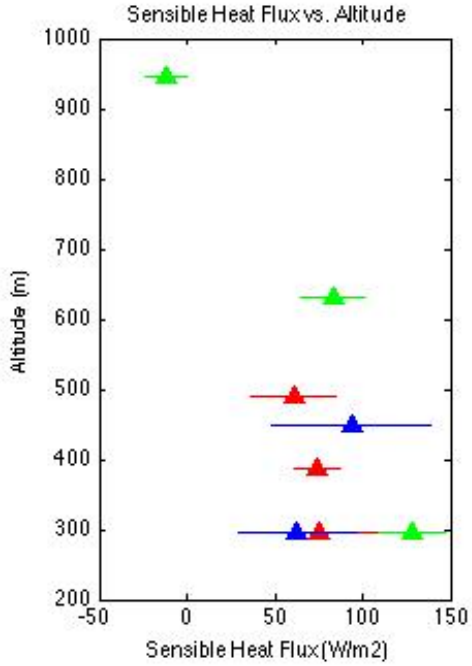


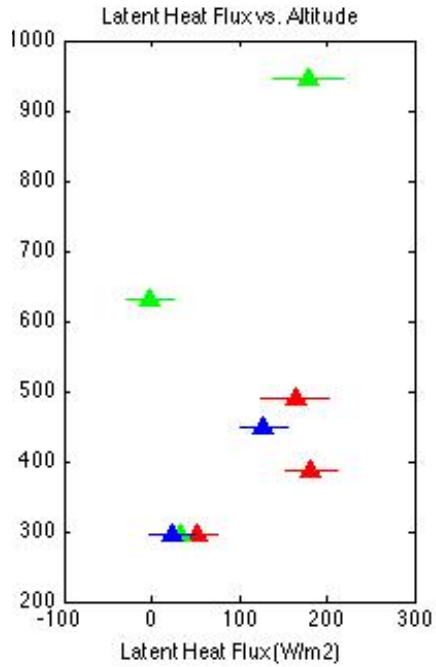

Turbulent U Variance vs. Altitude
Altitude (m)
Turbulent U Variance (m2/s2)

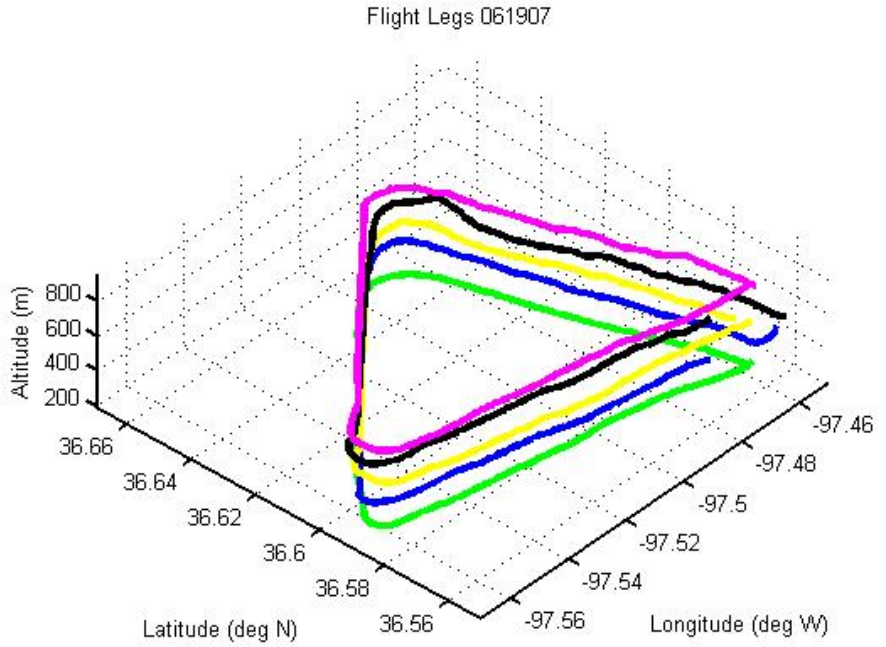

Turbulent W Variance vs. Altitude
Turbulent W Variance (m2/s2)


Turbulent T Variance vs. Altitude
Turbulent T Variance (deg C 2)


Turbulent q Variance vs. Altitude
Turbulent q Variance (g2/m6)


Sensible Heat Flux vs. Altitude
Altitude (m)
Sensible Heat Flux (W/m2)

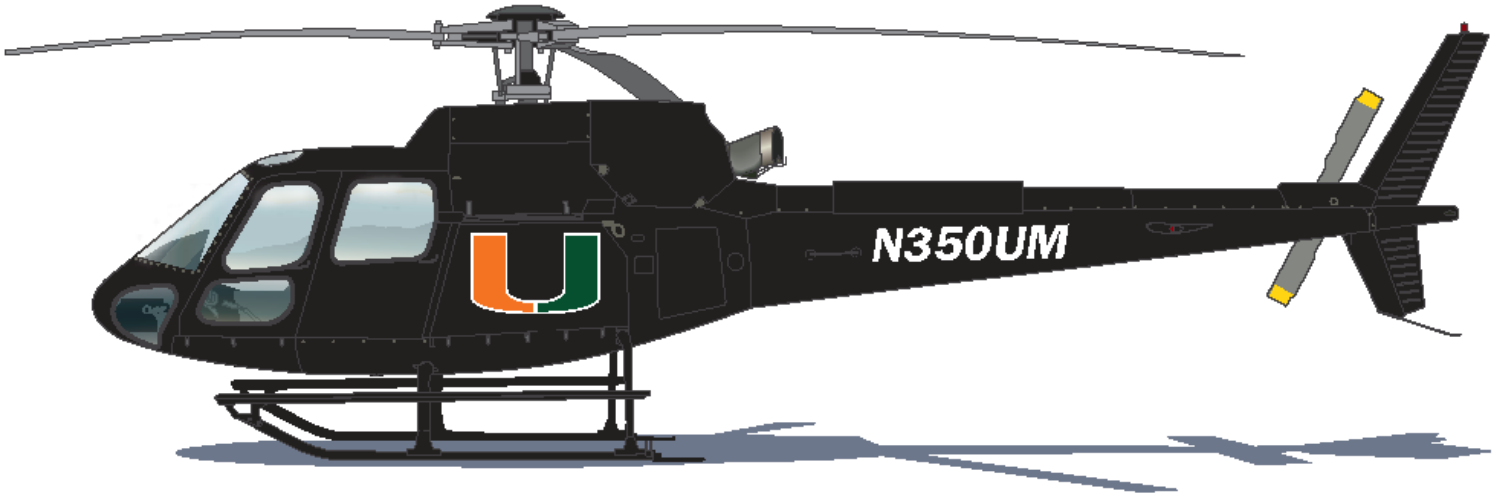

Latent Heat Flux vs. Altitude
Latent Heat Flux (W/m2)

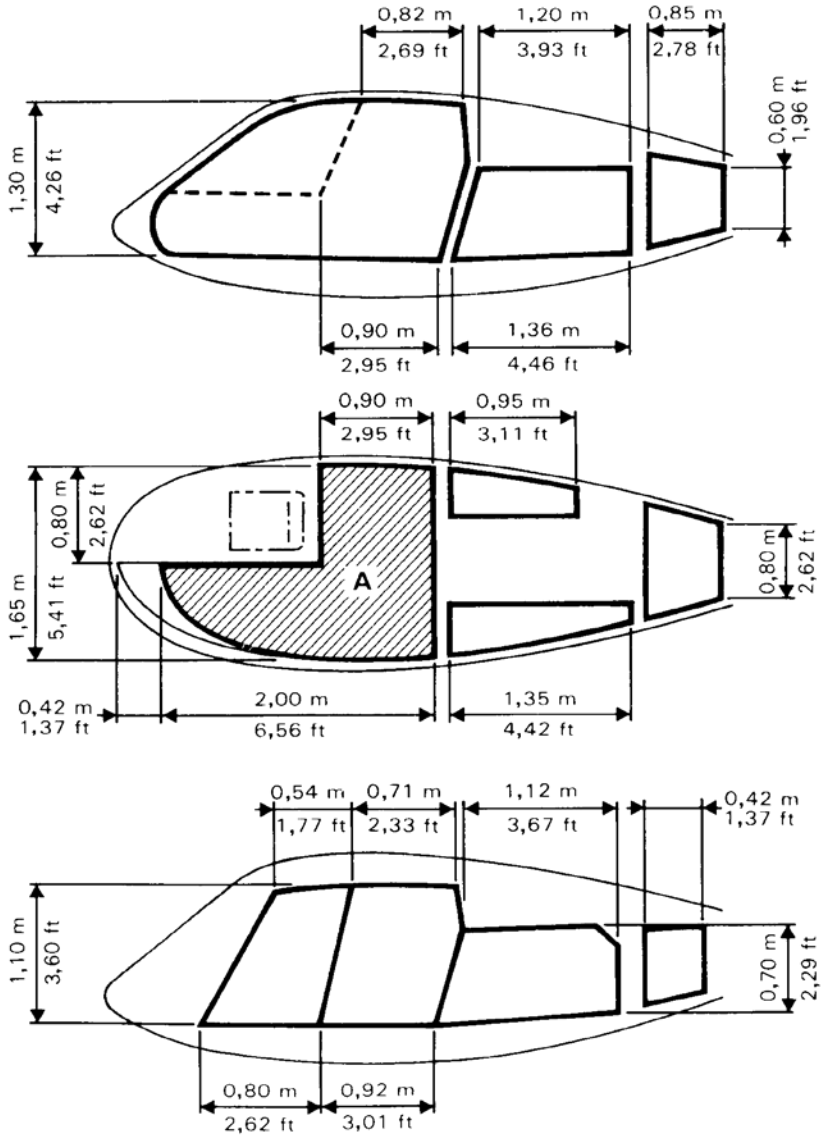

Flight Legs 061907
Altitude (m)
Latitude (deg N)
Longitude (deg W)


N564AE

Airbus Helicopter AS350B3e - Performance at Max. GROSS WEIGHT, ISA, SL

Maximum speed (Vne)	155 kts / 287 km/hr
Fast cruise speed	140 kts / 259 km/hr
Range (@127 kts)	345 nm / 638 km
Max Endurance	4’23” (no reserve) – 4 hrs for science mission
Rate of climb	1,959 ft per min / 10 m/s
Service ceiling	16,550 ft / 5,044 m
Hover ceiling IGE	13,200 ft / 4,023 m
Hover ceiling OGE	11,100 ft / 3,383 m
Maximum Altitude	23,000 ft / 7,010 m (landed on Mt Everest!)
Maximum takeoff weight	5,225 lb / 2,370 kg
Maximum Scientific Payload	1,200 lb (fully fueled with pilot and co-pilot)
Maximum with external load	6,172 lb / 2,800 kg (+950 lb for Payload)
Maximum cargo-swing load	3,086 lb / 1,400 kg



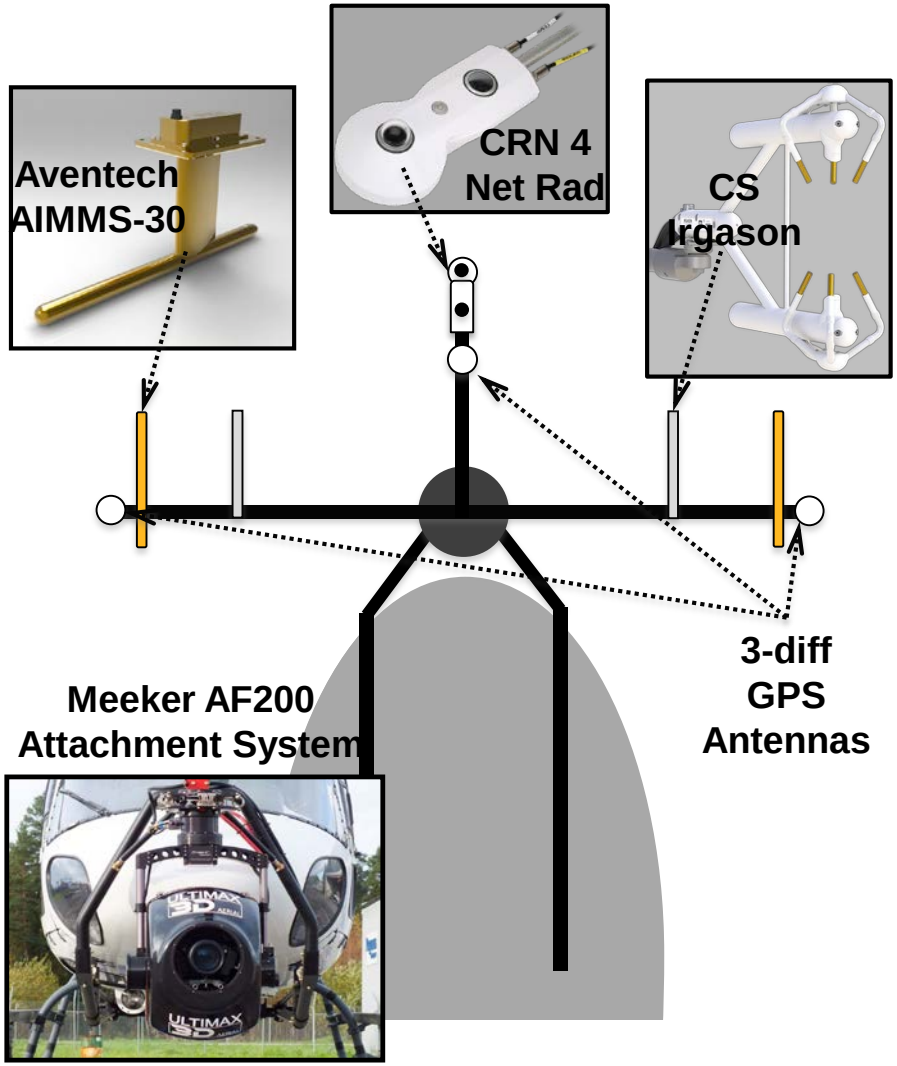


Cabin main dimensions

CABIN	
Surface A	2.60 m² 27.98 ft²
Volume	3.000 m³ 105.94 ft³
LH HOLD	
Surface	0.43 m² 4.62 ft²
Volume	0.235 m³ 8.29 ft³
RH HOLD	
Surface	0.35 m² 3.76 ft²
Volume	0.200 m³ 7.06 ft³
REAR HOLD	
Surface	0.55 m² 5.92 ft²
Volume	0.565 m³ 19.95 ft³
TOTAL HOLDS	
Surface	1.33 m² 14.3 ft²
Volume	1.000 m³ 35.30 ft³

The UM HOP: Airbus Helicopter AS350B3e

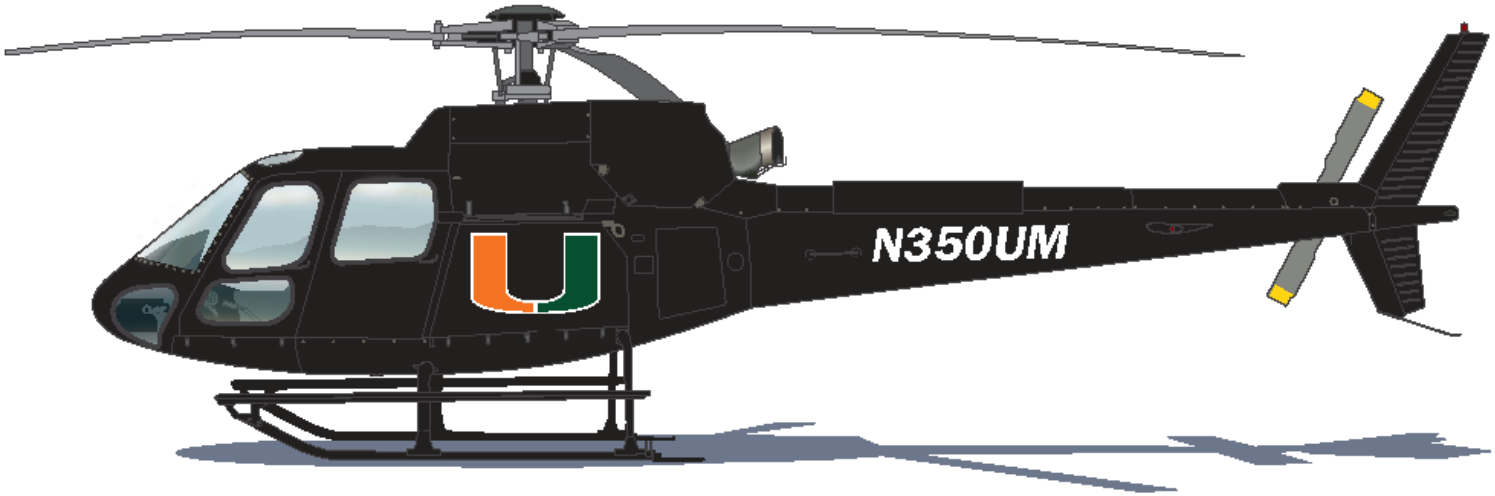
Combat version



Schematic illustration of the HOP nose with its dual EC system viewed from under the aircraft. The attachment system and gimbal are showed here on the Airbus Helicopter AS350B3e – same as the HOP – but with a camera instead of the EC system (lower left picture).

Cost of Operation…

Rate will be $1,500-$2,000/hr (including ALL costs). A typical intensive field campaign lasts about 10 days. Flying 5 hr/day on average results in 50 hours of data collection and costs $75K-$100K.



Conclusions

We demonstrated that HOP is a valuable addition to the research aircraft fleet, especially for land-atmosphere and air-sea interactions. An operational version of the Duke prototype is being rebuilt at the University of Miami Rosenstiel School based on the knowledge gained with this prototype. The platform is on schedule to be available for research in January 2015.

- Avissar et al, 2009, *Bull. Amer. Met. Soc.*, ., **90**, 939-954.
- Holder, Bolch and Avissar, 2010, *J. Atmos. Ocean Tech.*, **8**, 671-683.
- Bolch, Walko and Avissar, 2013, *J. Atmos. Ocean Tech.*, submitted.