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HAIC-HIWC Cayenne Campaign Preparation

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Honeywell Boeing 757-225 N757HW in Cayenne Campaign

High Altitude Ice Crystals

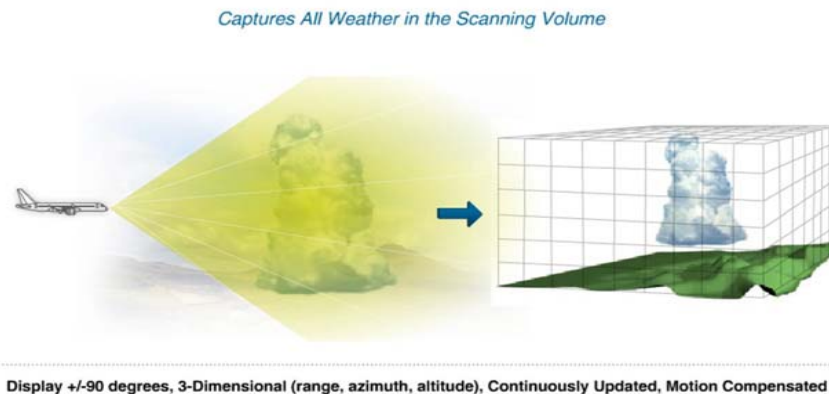
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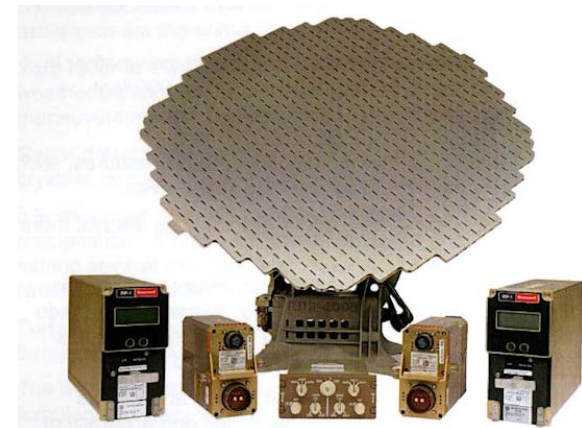
Introduction

Honeywell HAIC role:

- Honeywell is developing SW upgrade of Honeywell IntuVue® RDR-4000 3D weather radar (X-band) to provide icing awareness function



RDR-4000 3D Volumetric Scanning



Introduction

- Lack of data for validation identified during HAIC strategic TRL-3 review – flight campaign proposed
- F/T aircraft needs to carry Honeywell IntuVue® RDR-4000 with 30” antenna and must be able to reach HAIC altitudes of interest as specified in HAIC preliminary requirements
 - ▶ In-situ measurements are needed to validate radar data
 - ▶ Two separate aircrafts needed particularly for long range validation
- Upgraded radar prototype delivery scheduled for November 2015 – flights should be done soon
- RASTA radar on Falcon 20 can provide vertical in-situ icing measurements for comparison – large amount of usable data

Overview of the aircraft



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MISSION: *To safely provide accurate, repeatable and cost-effective data to our internal and external customers.*

- ❑ Airborne Systems, Powerplant & APU Testing
- ❑ Universal test engine Installation that accommodates virtually any Engine Mount / Nacelle Configuration
- ❑ Flight test developmental and production nacelles.
- ❑ Hydraulic & electrical load banks, trailing static cone. (RVSM Qualified)
- ❑ Onboard data recording and display (Including High Frequency Data and Video). SAT COMM (voice & data)
- ❑ Additional Test Capabilities:
 - In-flight Icing
 - Inclement Weather (Water Injection)
 - On Demand Fuel Heating
 - ATS Pneumatic Supply
 - LP Fuel Supply
 - Motive Flow Return To Tank
 - Dedicated Bleed Measurement System
 - Honeywell APU
- ❑ Avionics, Sensors, Flight Management

"One test is worth a thousand expert opinions"

Otto Lilienthal

Overview of the aircraft

- ▶ Capable of testing the RDR-4000 radar with all available antenna configurations (ranging from 12” - 30” antennas)
- ▶ Capable of reaching altitudes up to FL 450
- ▶ Based at KPHX (Phoenix / Sky Harbor), AZ



Overview of the aircraft

Boeing 757-225 registered N757HW	
Certificate of airworthiness "Experimental"	
Ceiling	FL 450
Cruise speed	360-500 kts (TAS) @ ~ FL350
Endurance	8.5 hours in flight
MTOW	115.7t
Payload	4500kg
Available electrical load	400Hz and 60Hz AC, 28v DC
Wingspan	38.05 m (124' 10")
Length	47.32 m (155' 3")
Height	13.56 m (44' 6")
Engines	Rolls-Royce RB211-535E4-37/10
Noise	Level 3
Other features	Engine testing pylon
	Honeywell IntuVue® RDR-4000 WXR
	RVSM
	ADS-B Out
	L Band SATCOM (Voice and Data)
	VHF, HF voice radio
	SmartLanding / SmartRunway
	Digital Data Recording
16 seats (excluding pilots)	

Overview of the aircraft



Flight Test Instrumentation – The Heart of What We Do

Overview of the aircraft



Flight Test Engineering Station – Test Engine Control & Data Analysis

Target flight altitudes

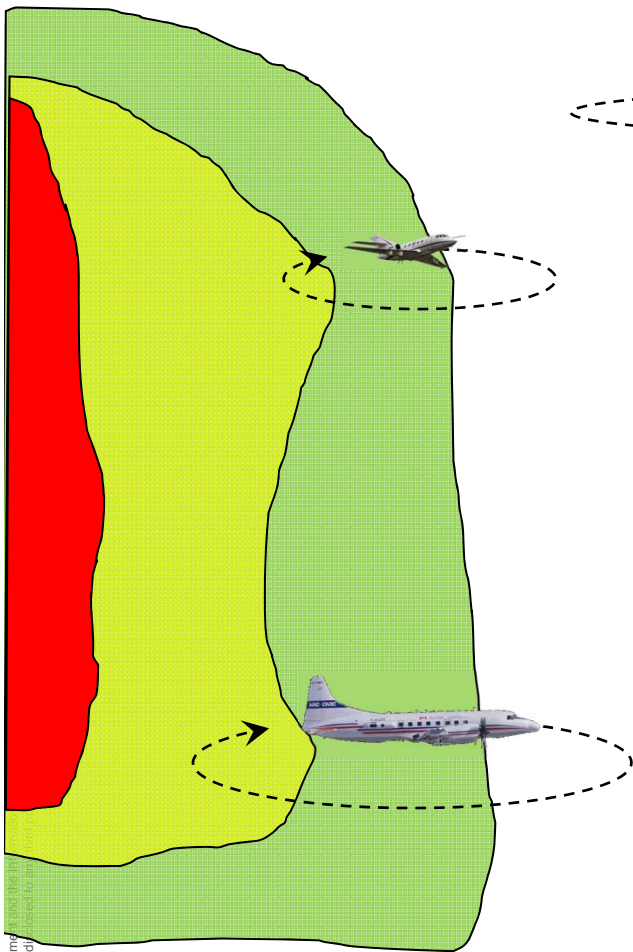
- Typical air transport altitudes
 - ▶ RDR-4000 is a volumetric scanning radar that repeatedly scans entire 3D space out to 320nm.
 - ▶ As long as the in-situ measuring aircraft is within radar field of view, the altitude of the radar-carrying aircraft is not of high importance.

Cayenne schedule

- Only coordinated flights with Falcon 20 and Convair 580
 - ▶ Falcon 20 is the driving factor since it will mostly operate in altitudes of interest
- First flight with Falcon 20 on May 16 (if weather permits)
 - ▶ Ferry flight scheduled for May 15
 - ▶ Ferry flight will be shifted earlier, if a need for additional day on-site before the campaign appears.
- Approx. of 20 flight hours of data collecting flights
 - ▶ One week should be enough, 2 weeks allocated for weather unpredictability
 - ▶ When finished, B-757 may leave Cayenne prior to May 29

Flying with Falcon 20 and Convair 580

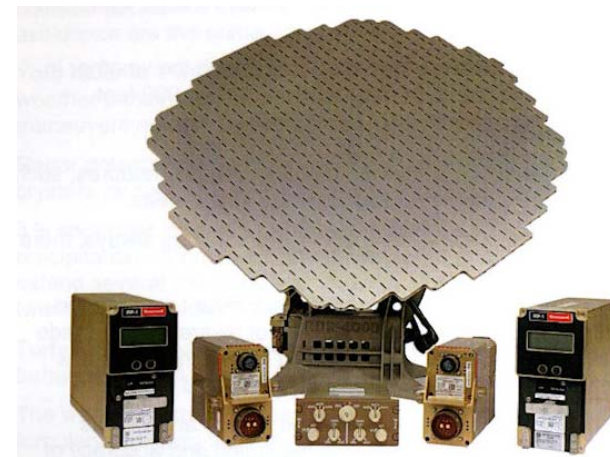
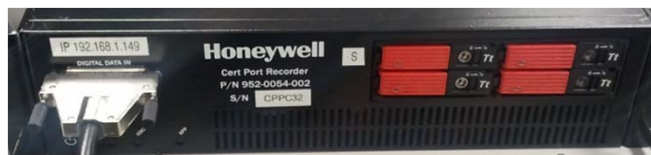
- Falcon 20 and Convair 580 sampling at their altitudes



- Boeing 757 will approach from cca 100 nm, turn around, leave, and repeat

Aircraft instrumentation

- RDR-4000 radar (30" antenna)with Cert. Port Recorders (to record raw data) already installed on Boeing 757.
 - ▶ Including RDR-4000 latest SW release – IntuVue® Hazard update V1.0
 - ▶ Including vertical radar display



- PLANET flight guidance SW
- Most likely, no in-situ icing measurements due to lack of budget (missing \$65k)

Cayenne airport facilities used

- Military part of the airport, where Falcon 20 will be serviced, cannot host large aircraft – poor taxiway conditions
- Boeing 757 will use civilian part
 - ▶ Airport has been contacted, parking place should be available
 - ▶ Fuel will be provided via our contract Fuel Provider—WORLD via GPAR.
 - ▶ Other aircraft services such as Ground handling will also be Provided via GPAR.



Aircraft Crew

- Pavel Badin – responsible for Honeywell HAIC activities at Cayenne, fly/no fly decision maker
- Dave Dischinger – Honeywell engines and air data specialist
- Two pilots
- One flight test engineer
- Two instrumentation engineers (only one required)

Aircraft Crew Duty Time

- **Honeywell Aerospace Flight Test Operations Manual:**

4.8.3 Duty Time:

- The normal crew duty period is 10 hours. Crew duty time may be extended to a limit of 12 hours in any 24 hour period under authority of the PIC. Crew duty time may be extended to a limit of 14 hours in any 24 hour period by the Site Leader/Chief Pilot. *Crews will not be scheduled for more than three consecutive duty periods that exceed 10 hours.*
- If any duty period begins during the hours of 2000L - 0400L, the duty period time is reduced to 8 hours.
- The normal crew rest period is at least 12 hours. The maximum flight time limit is 30 hours in any seven consecutive day period.
- Crew duty time is limited to 10 hours for any High Risk tests. This limitation may not be deviated from or waived.
- NOTE: The normal duty periods noted above may be further limited by a particular Hazard Risk Assessment in a Flight Test Plan.

HAIC-HIWC data sharing – Falcon 20

Honeywell would sincerely appreciate any data measuring for ice water content in a specific small atmospheric volume:

- From Falcon 20 (everything associated at least with time, position, and static air temperature):
 - ▶ Iso-kinetic probe (IKP) measurements
 - ▶ Robust probe measurements
 - ▶ Ice crystal detector measurements (if flown)
 - ▶ Ice particle size density if available
 - ▶ RASTA radar data with all data needed to interpret (e.g. Aircraft attitude)



HAIC-HIWC data sharing – Convair 580

Honeywell would sincerely appreciate any data measuring ice water content in a specific small atmospheric volume:

- From Convair 580 (everything associated at least with time, position, and static air temperature):
 - ▶ Iso-kinetic probe (IKP) measurements (if available)
 - ▶ Robust probe measurements
 - ▶ EC hot wire probe measurements
 - ▶ Ice particle size density if available



HAIC-HIWC data sharing – Boeing 757

In situ instrumentation probably not installed!



- Common air data (static air temperature, position, etc.) – need to receive request before the campaign to record
- RDR-4000 data
 - ▶ Raw data without post-processing and no support – possibly only to partners who already own Honeywell Cert Port Recorder
 - ▶ Processed reflectivity data around trajectory of Falcon 20
 - ▶ Processed reflectivity data around trajectory of Convair 580

High Altitude Ice Crystals (HAIC, 314314)

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