

Presented by

Fabien Dezitter, Airbus



# HAIC /HIWC science team meeting – 10/03/2015

2<sup>nd</sup> HAIC/HIWC field campaign - Overview

# HAIC/HIWC International Field Campaign Background

- A 9 week field campaign was conducted out of Darwin, Australia to acquire data in deep convective clouds with the **primary objective to provide 99th percentile total water content statistics, as a function of distance scale**, to industry and regulators.
- The field campaign was the result of an **international collaboration** between the HAIC, EASA-HighIWC and HIWC projects and involved necessary **expertise** in a wide range of skills and the **main stakeholders** in the field, whether they were based in Europe, North America, Australia or Japan.
- HAIC/HIWC Field Campaign terminated on 07-March 2014 in agreement with funding agencies (EASA, FAA, European Commission) following A/C engine issue
- 23 Flights and 72F/H achieved on site (target 150F/H)
  - ▶ High quality dataset
  - ▶ Oceanic convection at FL -30°C and -40°C, only few data at -10°C and -50°C
  - ▶ Most of the data acquired in MCS ~ 2-3 hours after peak intensity

# HAIC/HIWC International Field Campaign Background

As the objective to provide **99th percentile total water content statistics**, as a function of distance scale, was not reached for at least two flights levels, decision to perform **a second campaign in May 2015 out of Cayenne, French Guyana**, to complete the database.

Completion of **regulatory objective** remains the main purpose of the campaign.

The Cayenne 2015 campaign is supported by the **HAIC, EASA-HighIWC and HIWC projects with the additional support of ICC.**

# HAIC/HIWC International Field Campaign Objectives

- Main objectives are unchanged and still applicable
- Industry Objectives

Industry Objectives	HAIC	HIWC	Priority
<b>E1: Characterize 99th percentile TWC and particle size for FAA/EASA regulatory objectives</b>	X	X	P0
<b>E2: Flight-Deck Recognition of the High-IWC Environment Incl. IDS &amp; WXR</b>	X	X (partially)	P1
<b>E3: Development of Tools to Nowcast the High-IWC Environment</b>	X	X	P1

# HAIC/HIWC International Field Campaign Objectives

## • Sciences Objectives

Science Objectives	HAIC	HIWC	Priority
<b>S1: Characterize the microphysical and thermodynamic properties of core or near-core regions</b>	X	X	<b>P1</b>
<b>S2: Determine the small ice particle formation mechanisms and importance to bulk microphysical properties</b>	X	X	P1
<b>S3: Determine the temporal and spatial evolution of the mixed-phase</b>	X	X	P1
S4: Validate and improve ground remote sensing algorithms of cloud properties			
<b>S5: Validate and improve satellite remote sensing algorithms of cloud properties</b>	X	X	<b>P1</b>
S6: Improve cloud resolving model simulations		X	P1
<b>S7: 3D high-resolution characterization of the dynamical and microphysical properties of ice clouds (RASTA / T-Matrix)</b>	X	X	<b>P1</b>

# HAIC/HIWC International Field Campaign Approach

- Conduct a 3 weeks field campaign out of Cayenne, French Guyana to collect data in deep convective clouds with the **primary objective to provide 99th percentile total water content statistics, as a function of distance scale**, to industry and regulators.
- Use the **SAFIRE Falcon 20** aircraft equipped with active remote sensing (airborne Doppler cloud radar) and *in situ* microphysics probes to sample -50°C/-10°C Flight Level
- Use the **NRC Convair 580** aircraft equipped with active remote sensing (airborne Doppler cloud radar) and *in situ* microphysics probes to sample -10°C Flight Level and vicinity of clouds
- Use the **Honeywell B757** aircraft equipped with enhanced weather radar to validate radar ice crystals awareness function thanks to other A/C in-situ measurements
- Use satellite, ground-based radar and lightning networks, and weather models to determine test areas and to support post-test data analysis

# HAIC/HIWC International Field Campaign Aircrafts

- 3 A/Cs to be involved



# HAIC/HIWC International Field Campaign

## Lessons learnt from Darwin 2014

- Instrumentation

- ▶ The camera installation in cockpit should be improved for future campaigns: Recommendation is to install a GO-PRO camera,
- ▶ Background humidity measurement improvement,
- ▶ CDP (condensation issue) / Robust (power drop issue) measurement improvement,
- ▶ Addition of a lightning strike detection system on Falcon 20

- Aircrew

- ▶ A third pilot is recommended to ensure continuity of the operation,
- ▶ A second mechanic is mandatory to ensure continuity of the operation,

- Flight clearance & ATC

- ▶ Need to anticipate flight clearance request,



# HAIC/HIWC International Field Campaign

## Lessons learnt from Darwin 2014

- Flight guidance / PLANET

- ▶ System reliability and availability improvement,
- ▶ On-site support is recommended,
- ▶ Miscellaneous system improvements: invalid strings in chat, geomarkers input format including automatic upload of lightning strike, alignment to UTC time, pick-up point, distance / heading estimation, connection status, file transfer...

- Flight guidance / Control room

- ▶ A large number of people in the control room can be disturbing; a dedicated control room with only people in charge is recommended. Possibly a second room with same information displayed as in control room for people interested, off-duty or involved in control at lower level.

# HAIC/HIWC International Field Campaign

## Lessons learnt from Darwin 2014

- Operation

- ▶ Peak of convection activity occurred during the night, the possibility to operate during the night should be investigated,
- ▶ Weather conditions evolve quickly and are difficult to nowcast / forecast, there is a need for a more flexible / risky approach wrt the decision to fly or not,
- ▶ Need to improve the decision making process wrt rulemaking vs science flight,
- ▶ Need to optimize time between GO/NoGO decision and A/C take-off.

- Miscellaneous

- ▶ NCAR field catalogue to be password protected and accessible from remote locations,
- ▶ Awareness of remote teams should be improved (googlegroup, field catalogue).

# HAIC/HIWC International Field Campaign Schedule & Flight Hours

- The field campaign will take place from **May 9, 2015 to May 29, 2015**  
**(1 month campaign)**

Items	Schedule
Falcon 20 departure from Toulouse and arrival in Cayenne	May 3 to May 6, 2015
Instruments installation, Power ON and Ground tests	May 7-8, 2015
Start of the campaign	<b>May 9, 2015</b>
<i>Preliminary F/T in dry air and high IWC regions</i>	<i>May 9, 2015</i>
<i>HAIC/HIWC Field Campaign</i>	<i>May 11, 2015</i>
End of the campaign	<b>May 29, 2015</b>
Instruments unmounting	May 30, 2015
Falcon 20 departure from Cayenne and arrival in Toulouse	May 31 to June 3, 2015

A/C	Deployment	Flight Hours
<b>SAFIRE Falcon 20</b>	4 weeks including ferry flight → 3 weeks on-site	100F/H including ferry flight → ~60F/H on-site
<b>NRC CONVAIR</b>	3 weeks	~60F/H on-site
<b>HWL B757</b>	2 weeks starting on 15/05/2015	~20F/H

# HAIC/HIWC International Field Campaign Priorities

- Need to manage flight operation wrt different objectives
  - ▶ **SAFIRE F20** : Atmosphere characterization / 99th percentile of TWC and PSD as a function of distance scale
  - ▶ **NRC CONVAIR 580**: Atmosphere characterization / focus on science objectives at FL -10°C and opportunity to complement database for regulatory objective
  - ▶ **HWL B757** : WXR Ice Crystals Awareness Function validation & short / medium / long range performance assessment
- However, primary objective/priority remains to provide the **99th percentile total water content statistics, as a function of distance scale**, to industry and regulators. FL-50°C is the first priority.
- Thus, **SAFIRE F20 shall be the lead aircraft** in the decision making process

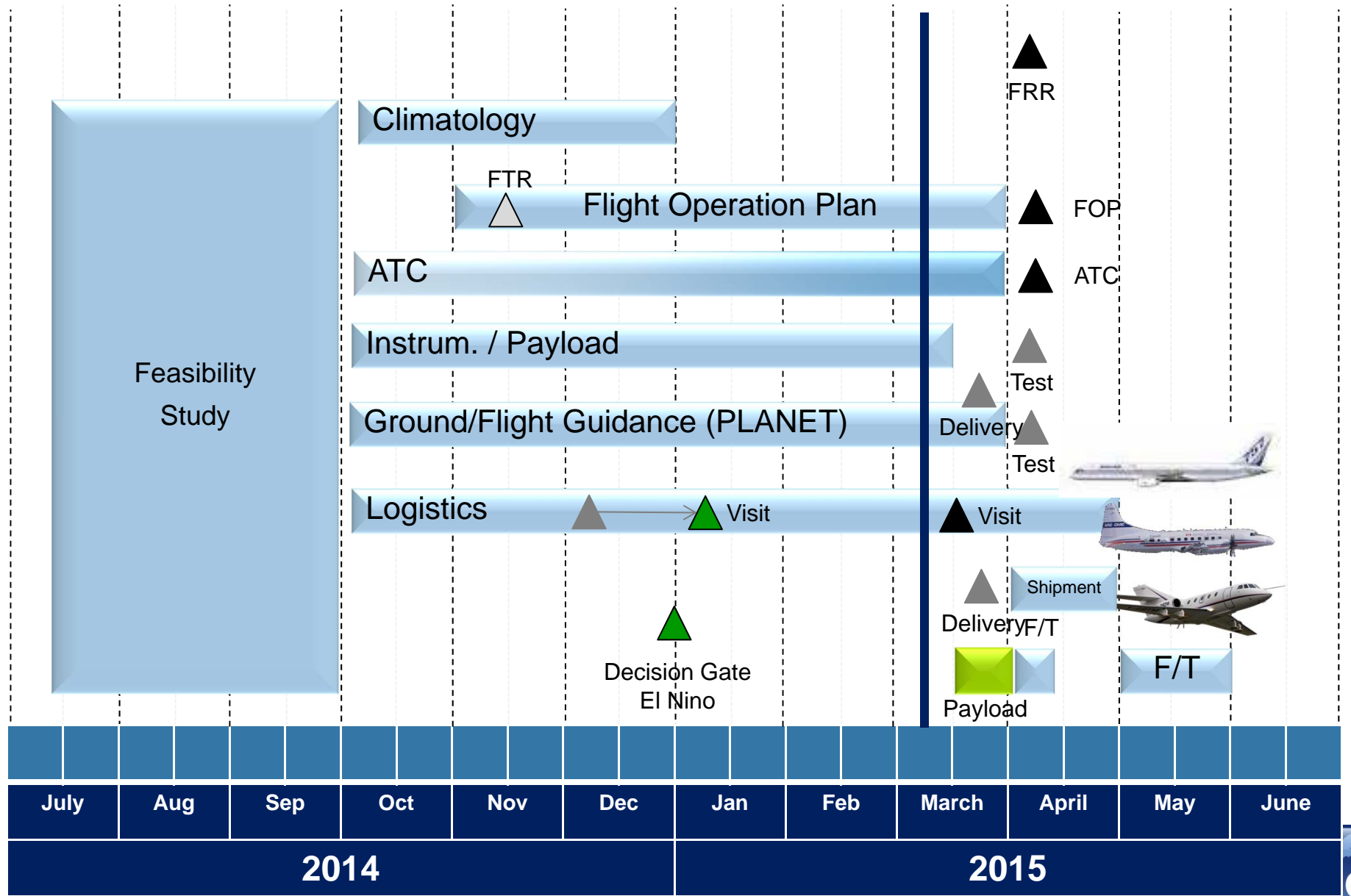
# HAIC/HIWC Science Team Meeting

## Conclusion & Way Forward

- 2 months to complete the preparation of the field campaign
- Some key milestones
  - ▶ SAFIRE Falcon 20: Probes delivery and integration on W10-14 & F/T at Toulouse planned on W14-15
  - ▶ NRC CONVAIR 580: integration on-going and to be completed by mid April 2015
  - ▶ FRR to be planned on W15-16 (1 FRR per A/C)
- SRA and procedures to be finalised for HWL B757 and NRC CONVAIR 580
- **Flight Operation Plan** to be refined and completed by early April 2015 for the FRR
- **Logistics is still challenging** with the involvement of the 3 A/Cs. Highest priority on this topic to fix the remaining issues/uncertainties ASAP

# HAIC/HIWC International Field Campaign

## Conclusion & Way Forward



This document and the information contained are HAIC Contractors' property and shall not be copied or disclosed to any third party without HAIC Contractors' prior written authorization.



High Altitude Ice Crystals (HAIC, 314314)

This document and the information contained are HAIC  
Contractors' property and shall not be  
copied or disclosed to any third party without HAIC  
Contractors' prior written authorization

Project co-funded by the European Commission within the  
Seventh Framework Programme (2012-2016)

