Presented by

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Prepared by

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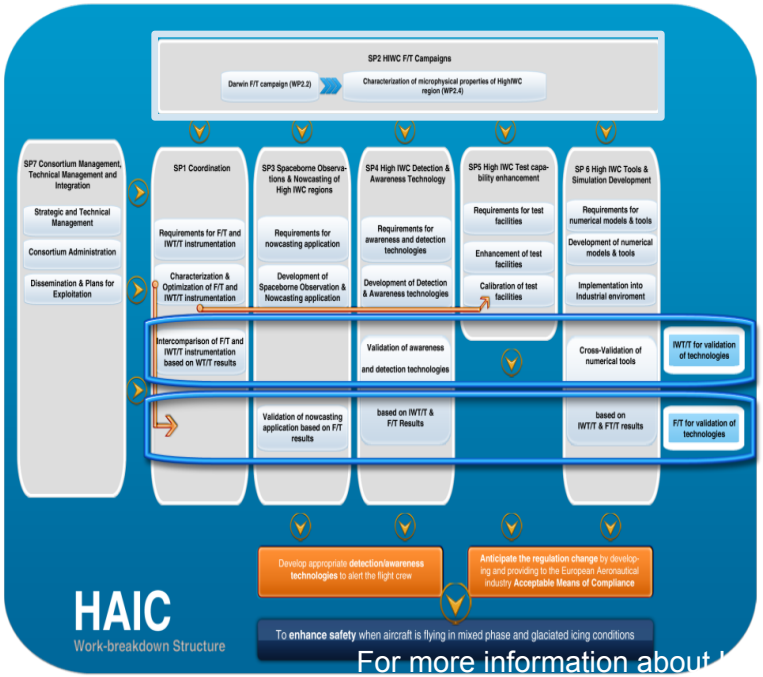
Flight Test Demonstrator HAIC

Indonesia 2016

FTD HAIC
Introduction

- **"Flight Test Demonstrator HAIC"** project is supported by the large-scale integrated project called HAIC (High Altitude Ice Crystals) aiming at enhancing aircraft safety when flying in mixed phase and glaciated icing conditions. It involves several partners and is coordinated by Airbus.
- HAIC is sub-divided into several sub-projects. **"Flight Test Demonstrator HAIC"** is part of SP2 – High IWC F/T campaigns. It aims at organizing, managing and conducting the 3rd F/T campaign whose objectives are to demonstrate the performances of the technologies and instrumentations developed in the framework of the HAIC project.



For more information about

SP2 High IWC Flight tests Campaigns
Lead: Airbus **Partners: AI-F, AI, AI-D, BoM, CNRS, CIRA, DASSAV, ATM, DLR, INCAS, ONERA**
Objectives • Organize, manage and conduct **three flight test campaigns** in 2014, 2015 and in 2016. - In the first two flight test campaigns, it brings the French Falcon 20, equipped with active remote sensing (airborne cloud radar) and in situ microphysics probes, to collect cloud data in deep convective clouds and to provide 99th percentile total water content statistics, as a function of distance scale, to industry and regulators. - In the third flight test campaign, SP2 brings for the first time a **Flying Test Platform (large payload and long endurance Airbus flight test A/C) to the industrial and scientific community for validation and demonstration of the maturity of the technologies (up to TRL6) developed within HAIC project** • Characterize the **microphysical properties** of High IWC regions
Main Activities • Run three field experiments (HAIC/HIWC International F/T campaign in Q1 2014 & Q2 2015 – and Airbus F/T campaign in Q1 2016) • Process aircraft data and retrieve geophysical parameters from the two experiments (Darwin / Cayenne / Airbus campaign location TBD) • Statistical analysis of aircraft data to assess Appendix D/P • Support to maturity demonstration of SP1 / SP4 technologies
Main Expected Results • Comprehensive characterization of High IWC regions & Assessment of the Appendix D/P • Demonstration in representative environment of the performances of the technologies developed as part of SP1 (instrumentation) and SP4 (detection system, radar)

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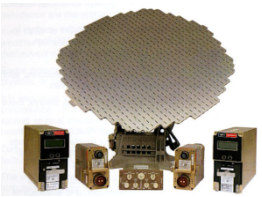
Objectives

- **To validate mixed phase and glaciated icing conditions awareness and detection technologies (SP4)** to alert the crew of flight in these particular icing conditions or to adapt the flight path well in advance in order to avoid such weather conditions.

Candidate Technologies - HAIC		
ZA, VKI, IRSN, CORIA	DLR	NRC
SEA	Honeywell 	

Candidate Technologies - Other	
UTAS	ZA

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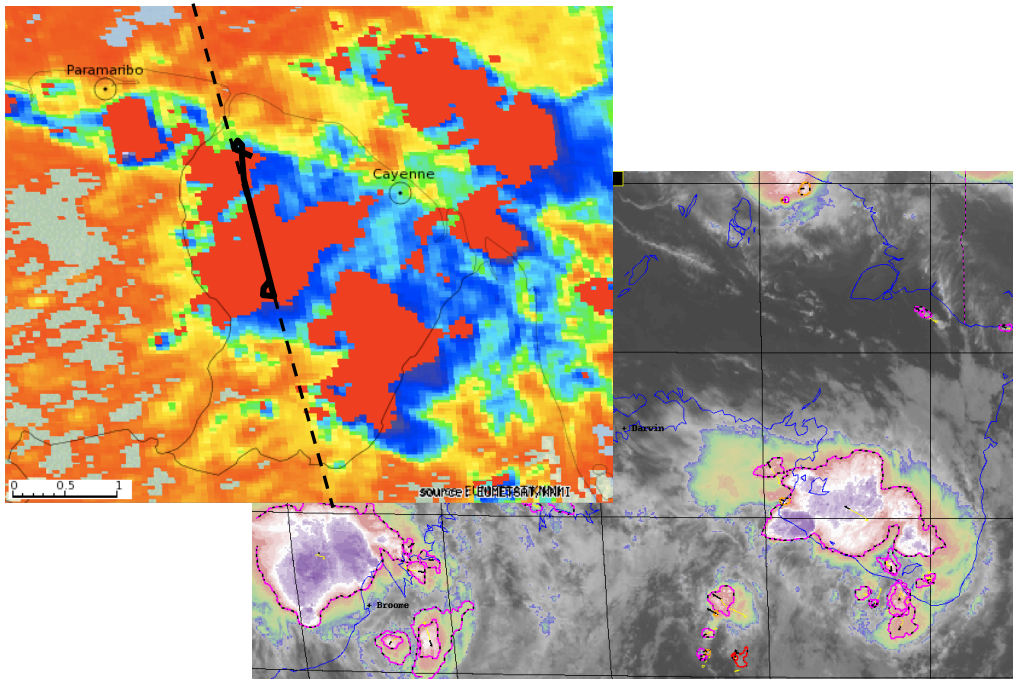
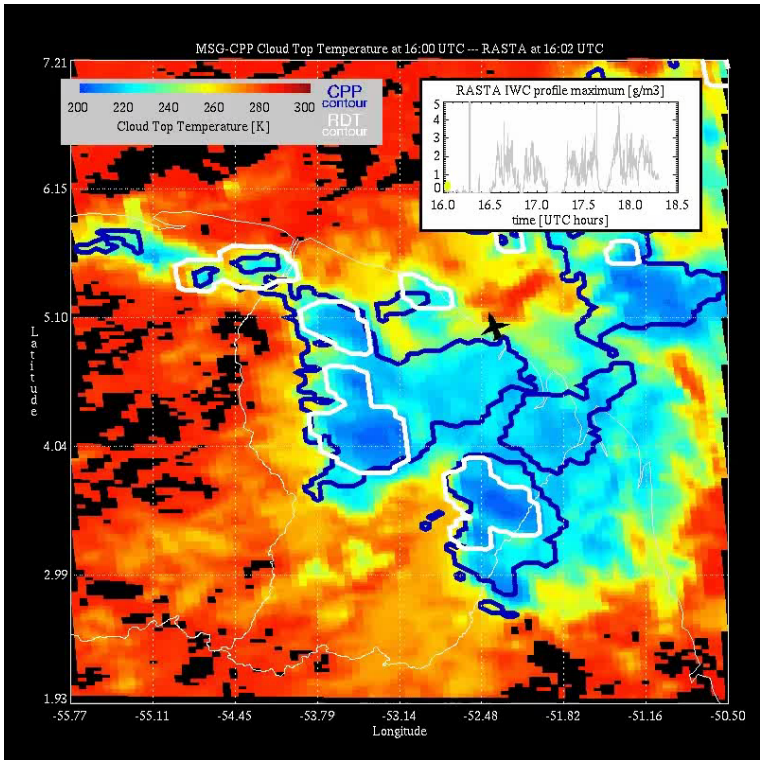
Objectives

- **To validate / further assess space-borne remote detection and nowcasting techniques (SP3)** to support the flight test campaigns and ultimately provide near real-time weather data through ATM as being studied as part of SESAR.



KNMI High IWC mask & MET-FR Rapid Development Thunderstorm products



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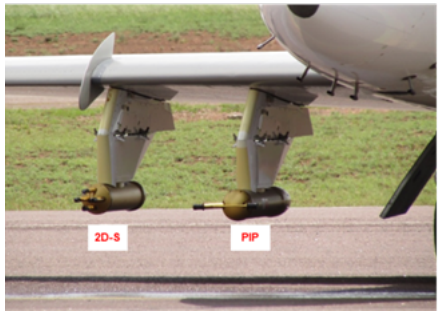
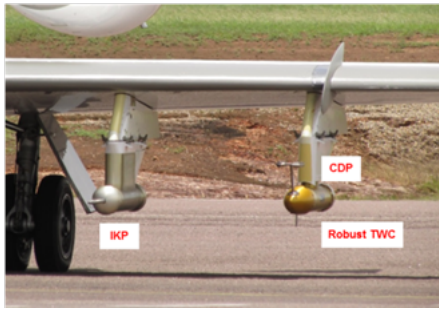
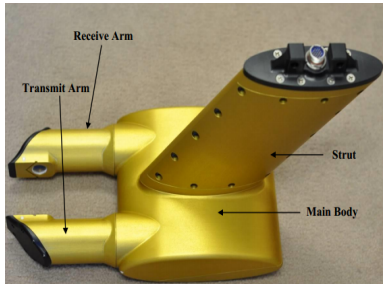
Objectives

- **To complement database for characterization of the atmosphere (SP2)**





Instrumentation selection for the 1st HAIC/HIWC field campaign



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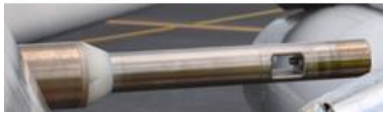
Deployed:

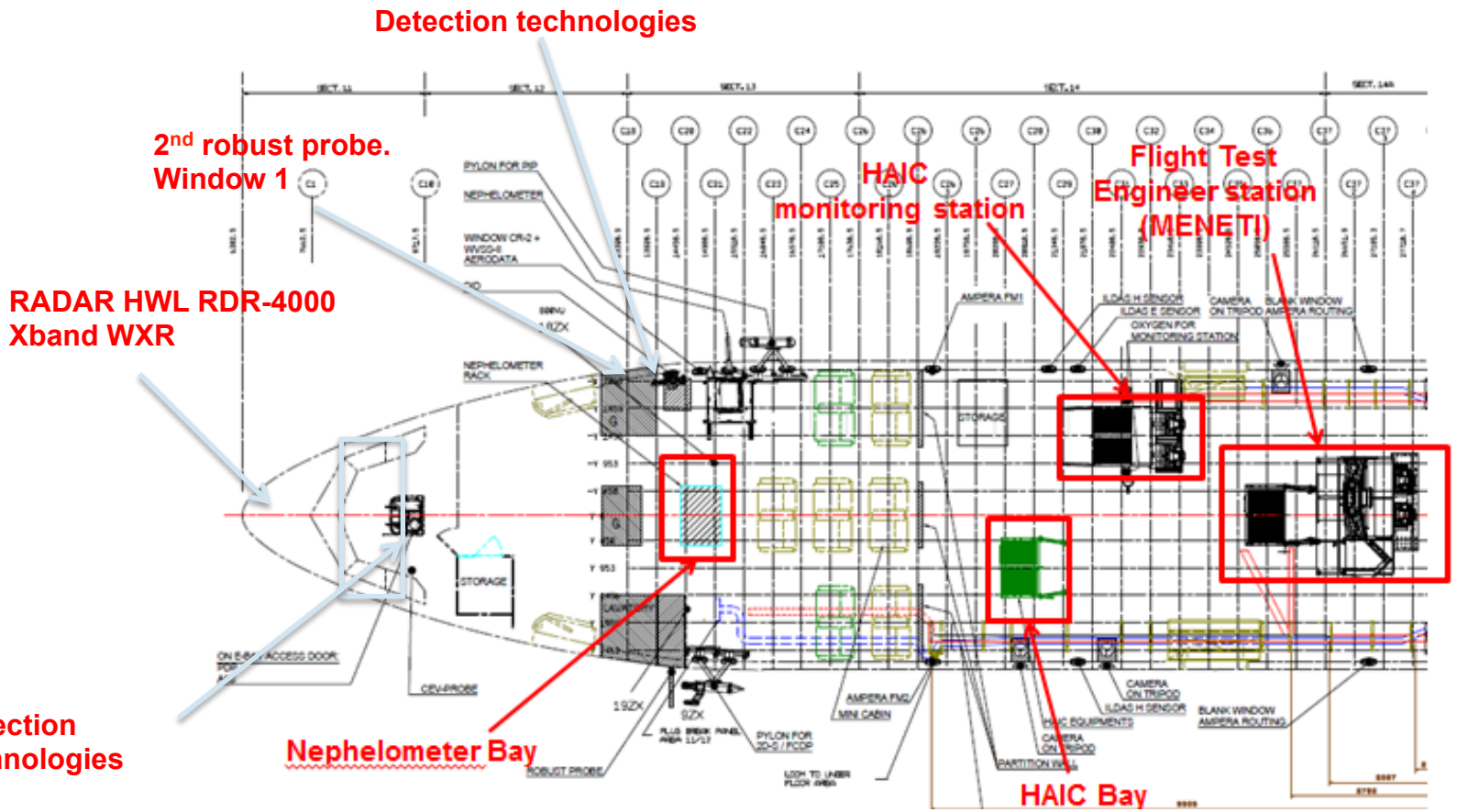


FTD HAIC
A340 MSN1

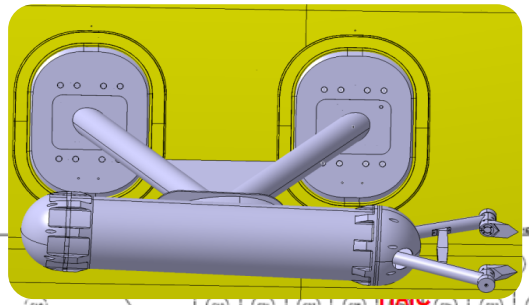
Model	A340-300
Engines type	4 engines CFM56 -5C4
Power supply available	4 * 75 KvA 115 VAC/400 Hz
Dimensions	Length: 63.9 m Height: 16.9 m
Operation limits	MMO = 0.86 VMO = 330 kt Max ceiling = 40000 ft Cruise speed = 0.82
Maximum weights	MTOW = 250 tons
Autonomy	13350 km
Radar	Dual Honeywell WXR RDR-4000 v2 with Hazard functions
SATCOM	Honeywell SSB mode C Max 430 kbits/sec

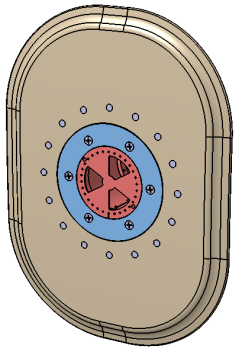
HAIC Flying Test Platform (large payload and long endurance Airbus flight test A/C)

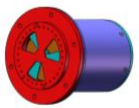
FTD HAIC
A340 MSN1 Layout

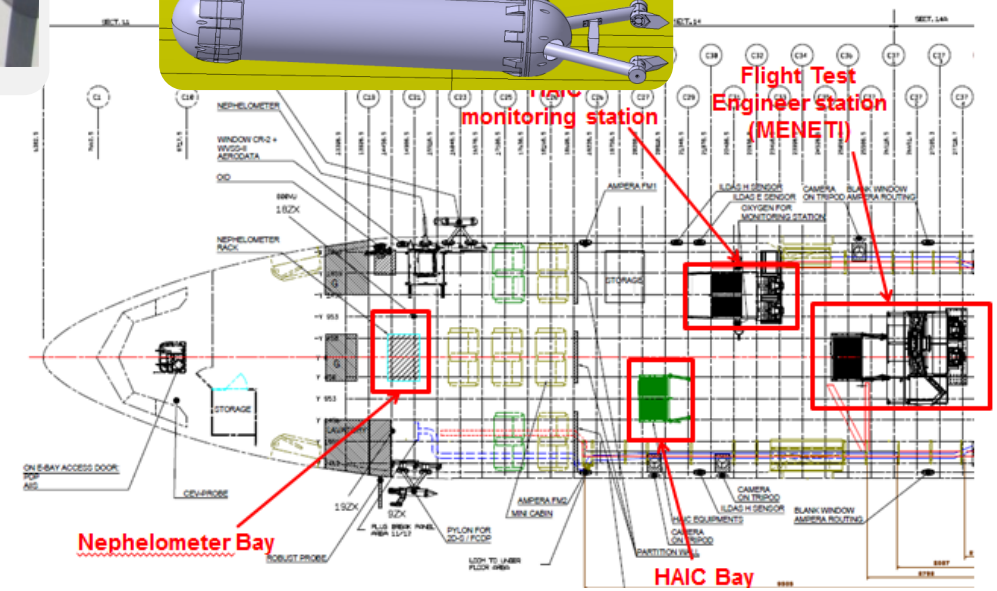


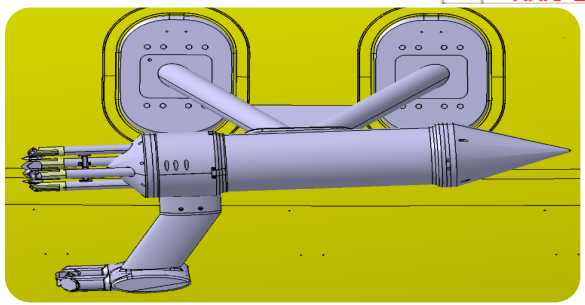
FTD HAIC
A340 MSN1 Layout



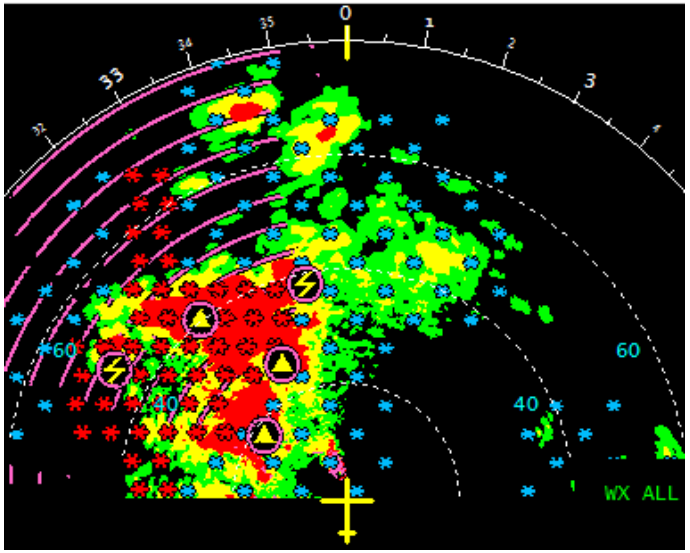


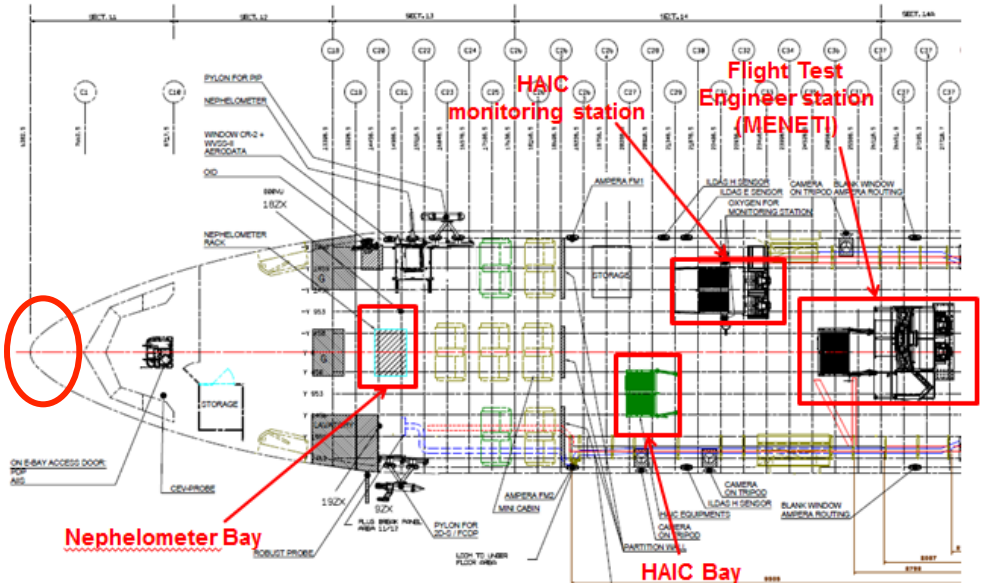






FTD HAIC
A340 MSN1 Layout

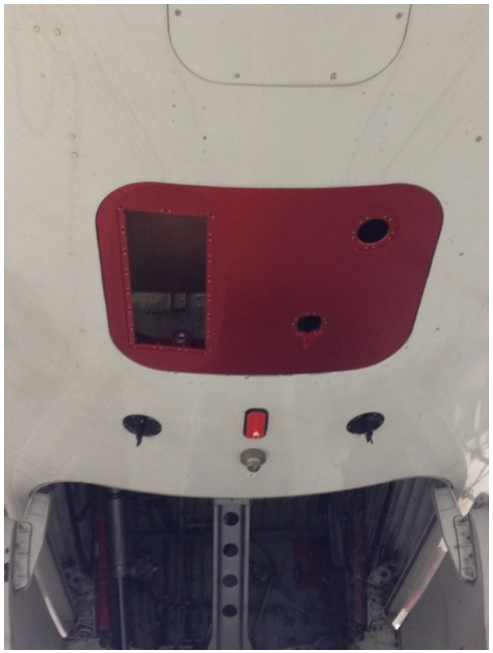


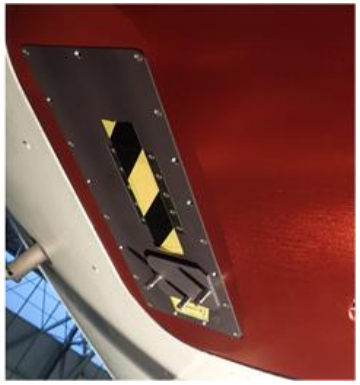


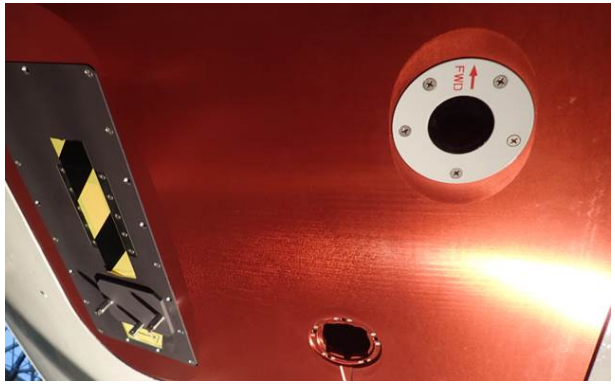
RADAR HWL RDR-4000 Xband :

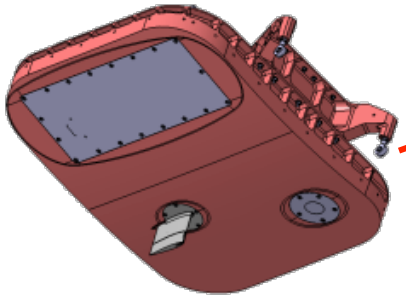
- Ice Crystals awareness function
- Two recorders installed in cabin with two PC at flight test engineer station & copy in flight deck for VD

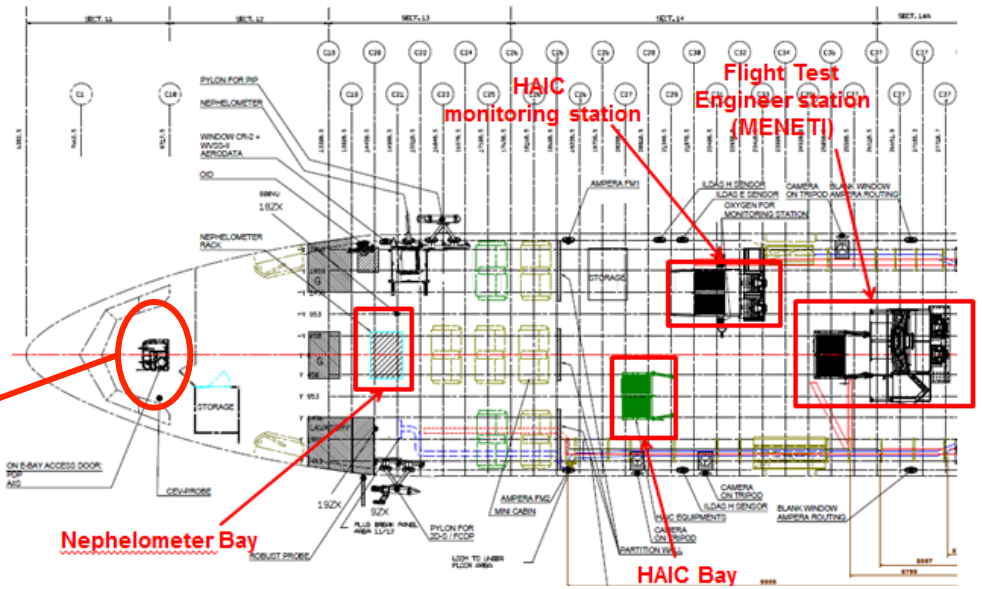
FTD HAIC
A340 MSN1 Layout











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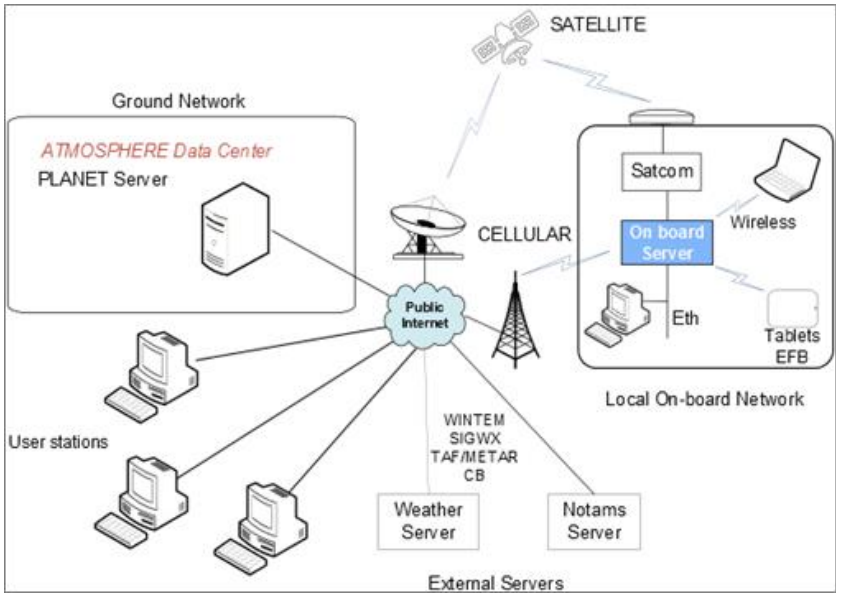
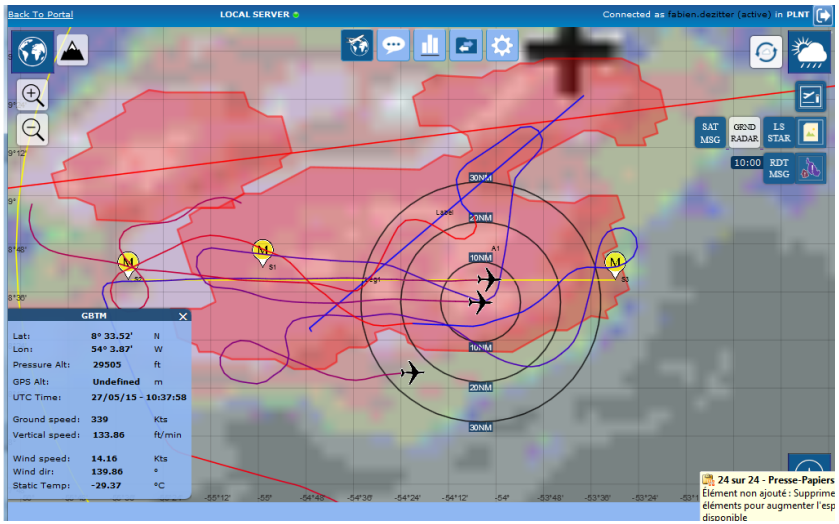
Flight Guidance

- Main tool for flight guidance is **PLANET** developed by ATM
- The PLANET solution provides:
  - **Flight Preparation** including upload of all regulatory information (METAR/TAF, SIGWx, WINTEM), NOTAMS on the ground.
  - Automatic **In flight update of weather and aeronautical information** (METAR/TAF, Weather Objects, NOTAMS).
  - **Messaging services** between the ground and the air or between aircraft.
  - **Monitoring (including tracking) for Flight Operation and Mission Management**, including avionics bus data downlink.



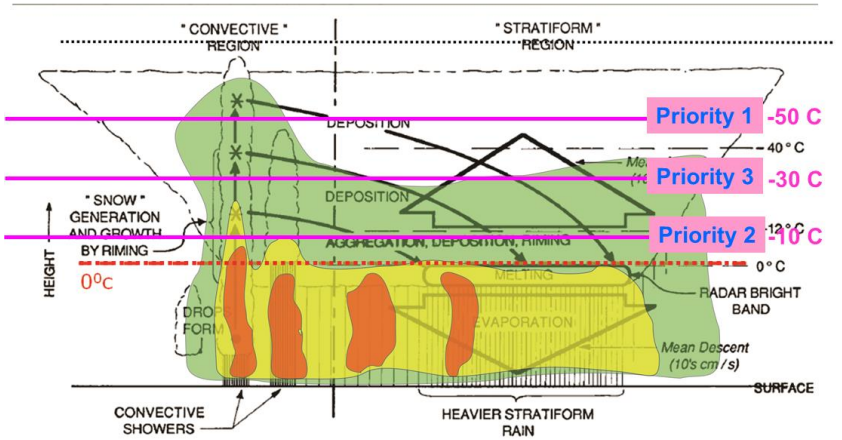


In-Flight Ice Detection System
FTD HAIC – Flight Test Program

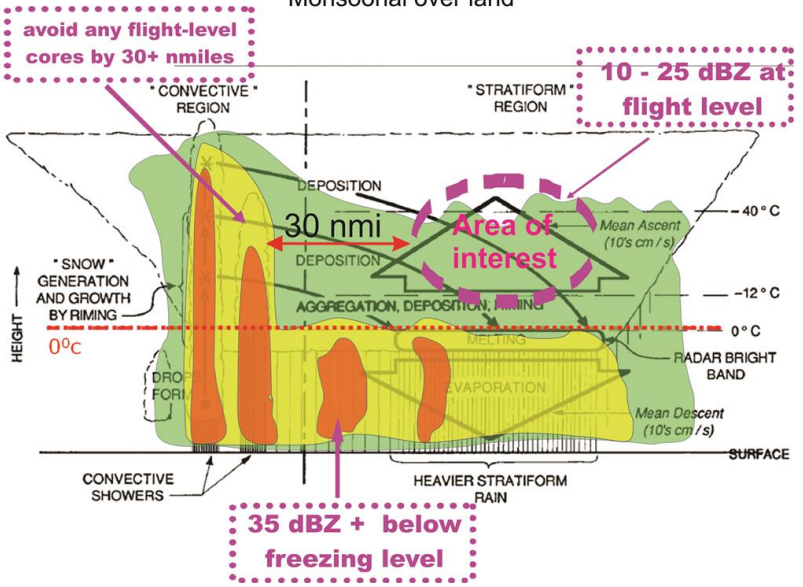
- **Two types of convection** :
  - Oceanic convection (primary focus ~80% of the F/H) : scales from ~10 Km to 500 km (tropical storms)
  - Continental convection (secondary focus ~20% of the F/H)
    - Quite vigorous, unlikely to sample in updraft areas, anvils only
    - Scales from ~10 Km to 200 Km (MCS)

- **Three flight levels** :
  - -50°C: a typical cruise altitude for commercial jet aircraft
  - -30°C: a mid-altitude with intermediate particle size and high IWC
  - -10°C: a low flight level to sample the cloud just above the melting layer (mixed phase icing conditions)

MCS Cross Section
**Monsoonal over water



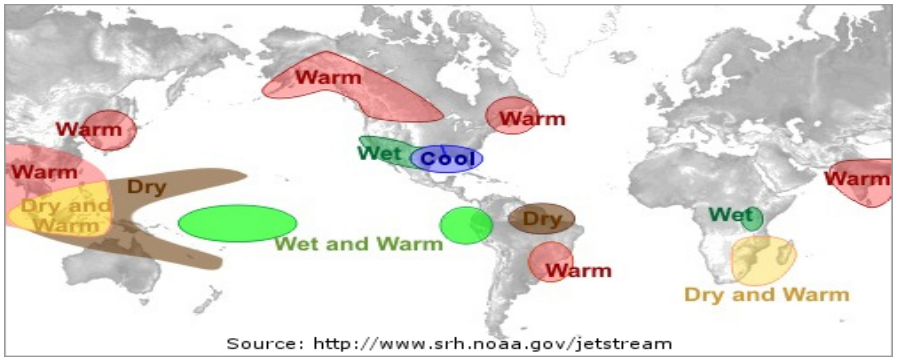
MCS Cross Section
Monsoonal over land

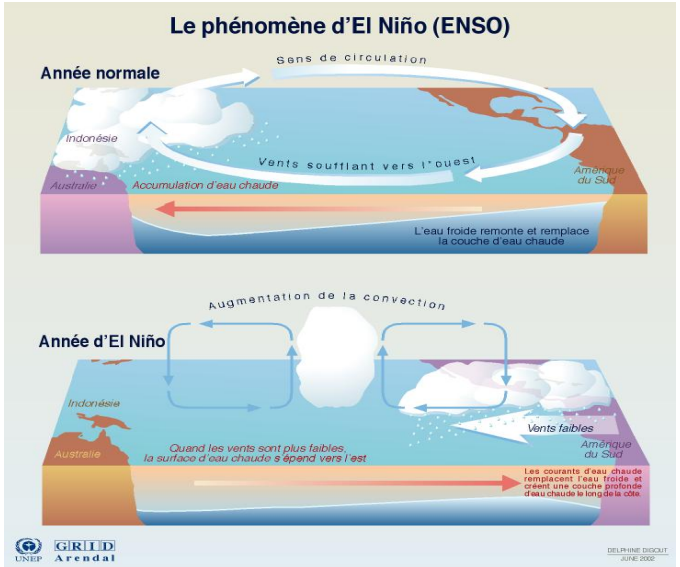


In-Flight Ice Detection System
Location

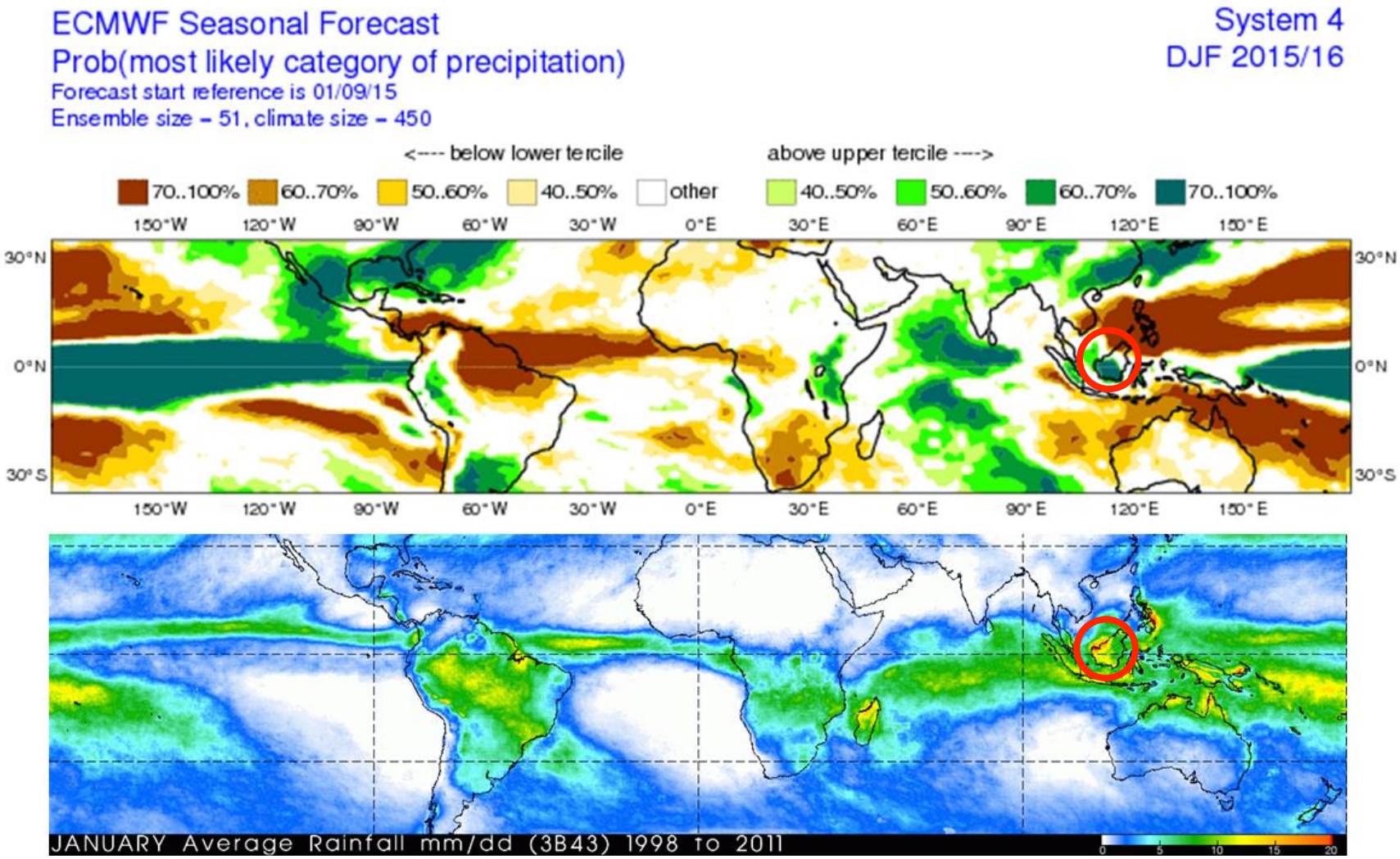
- **El Niño** conditions are present.
- Positive equatorial sea surface temperature (SST) anomalies continue across most of the Pacific Ocean.
- There is more than 90% chance that El Niño will continue through Northern Hemisphere winter 2015-16, and around an 80% chance it will last through early spring 2016

Typical El Niño Effects:
December Through February

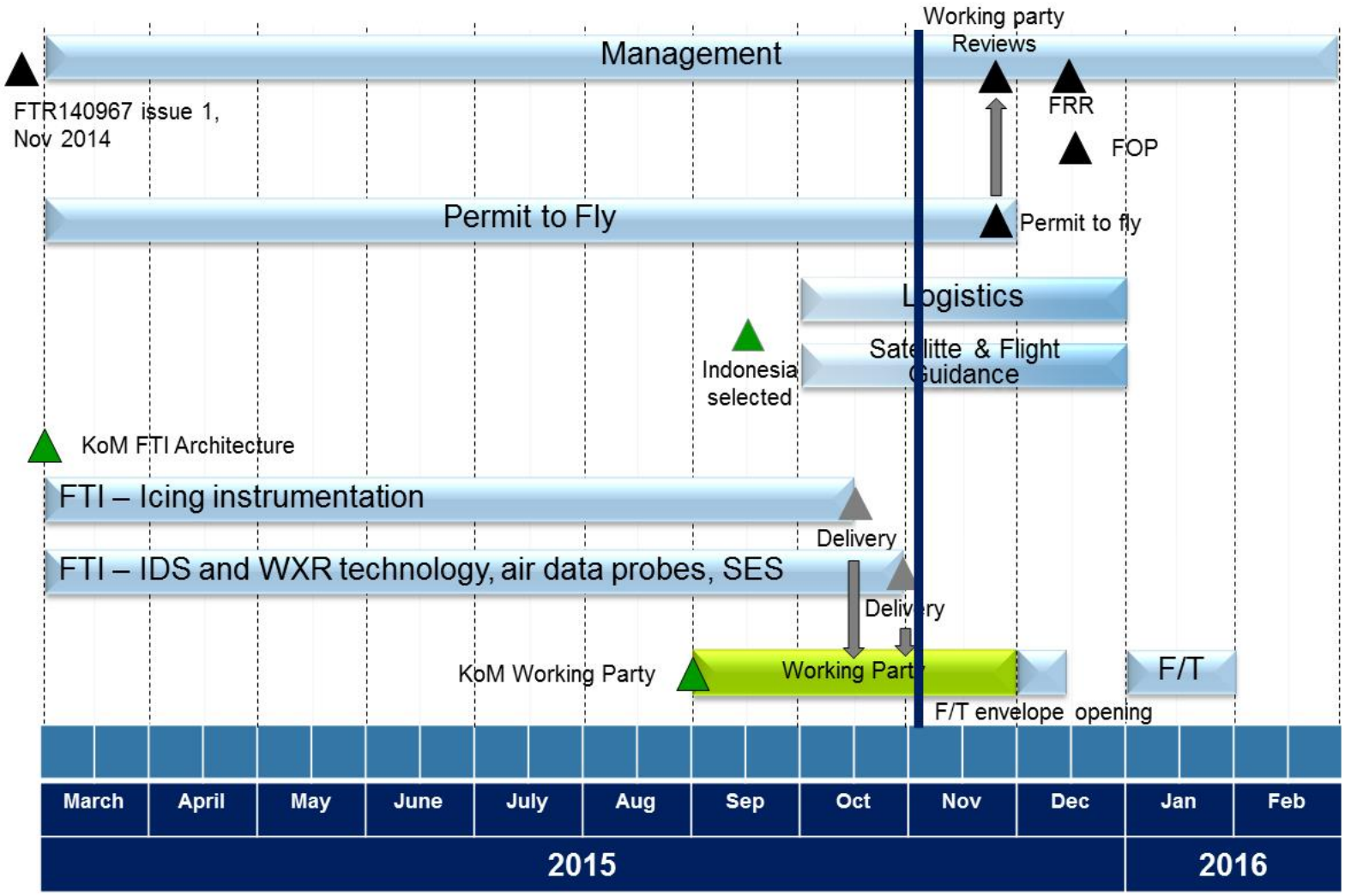




FTD HAIC
Location



FTD HAIC
Schedule



FTD HAIC
Schedule

- Working Party: 03/09/2015 – 30/11/2015
- First flight: 07-08/12/2015
- Second flight (option): 14-15/12/2015

- Field Campaign: 06-27/01/2016
  - 06/01/2016: Ferry Flight
  - 07-08/01/2016: Pods installation & A/C preparation
  - 09-24/01/2016: Field Campaign (30F/H)
  - 25-26/01/2016: Pods removal & A/C preparation
  - 27/01/2016: Ferry Flight

High Altitude Ice Crystals (HAIC, 314314)

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