



SESAR P12.2.2 progress & CDG campaign presentation



WakeNet EU 13/05/2014
Ph. Juge

◆ **Development and Validation in close cooperation with P06.08.01 (operational project)**

◆ **Validation in platform**

- System performances assessment
- Validation on specific scenario
- Human factors

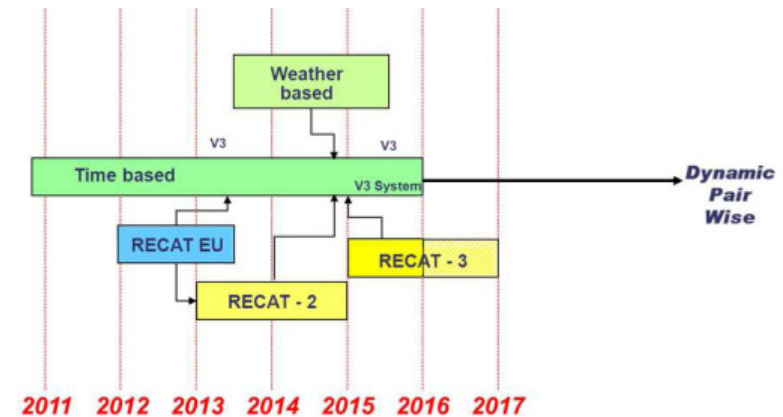
◆ **2 validation exercises planned**

- Time Based Separation + RECAT-EU+ initial RECAT2: Oct 2014
- Weather Dependant Separation + RECAT2 : Oct 2015

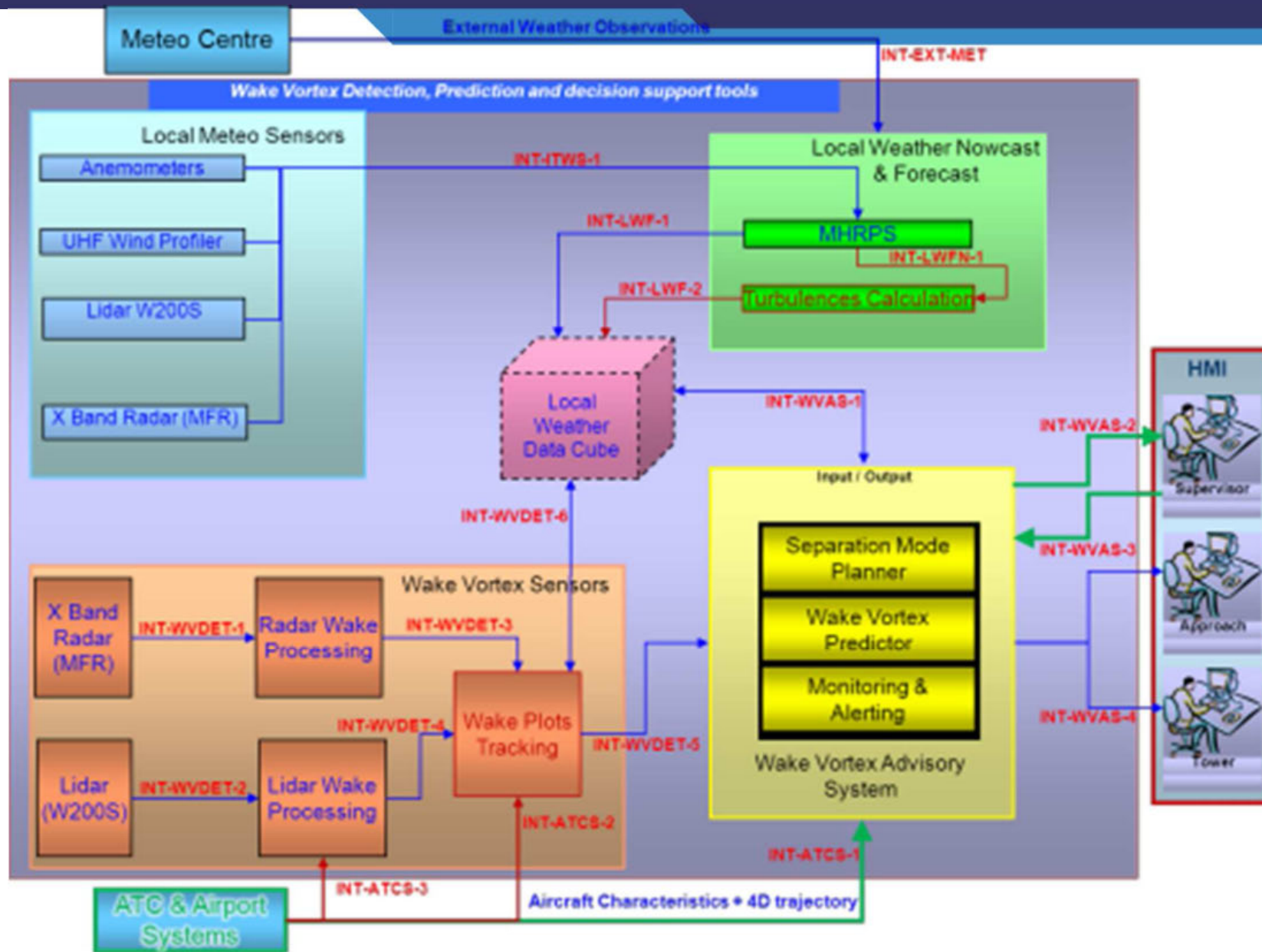
◆ **Large scale on field validation**

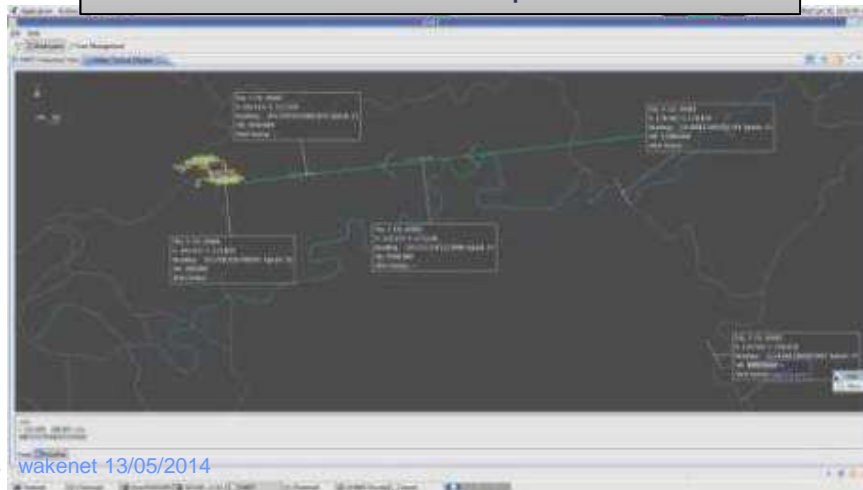
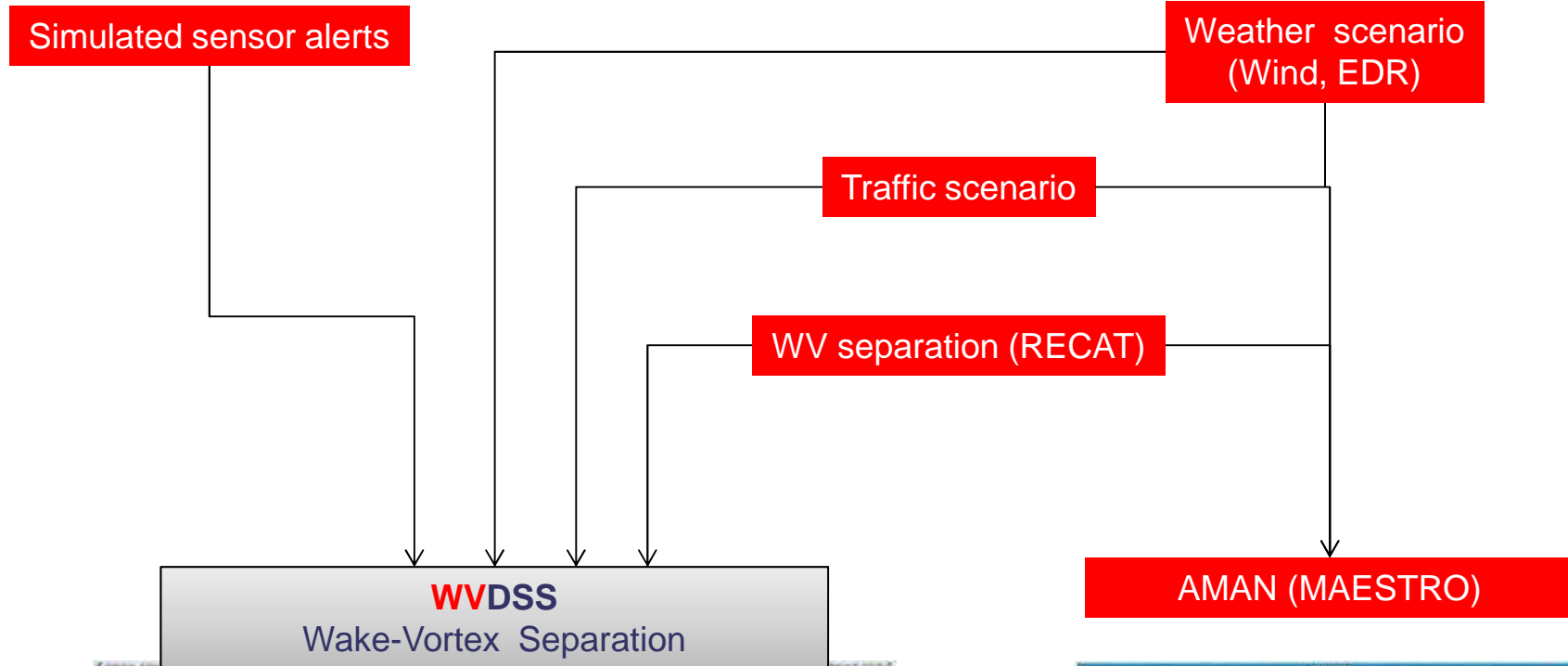
- Need to get enough data to build a statistic assessment
- Preparation of SPR
- Preparation of CBA

◆ **One year trials campaign in CDG: mid 2014 – mid 2015**

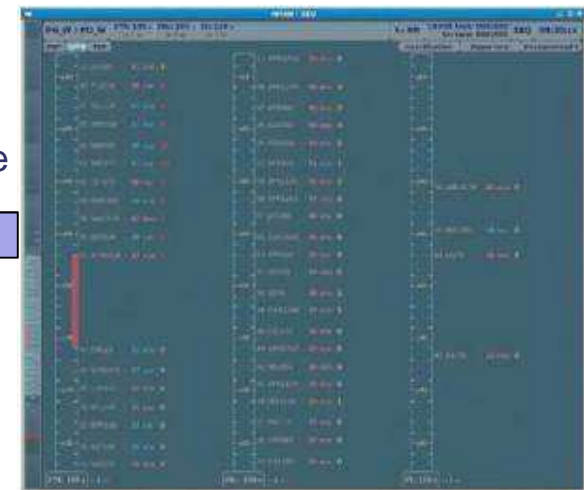


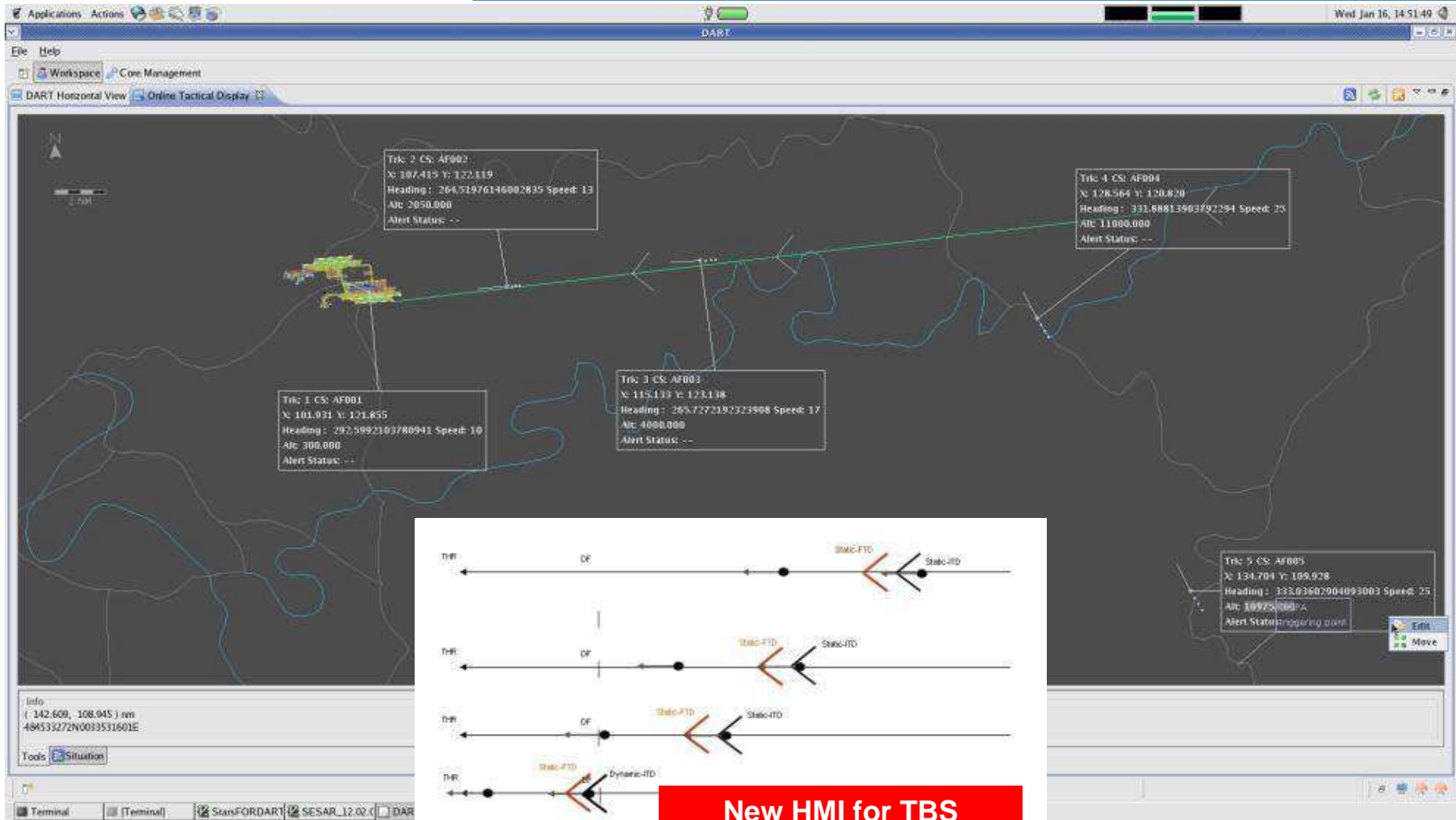
Wake Vortex Decision Support System (WVDSS) Architecture





Sequence





< FTD, Targeted Separation
< ITD, Current Separation

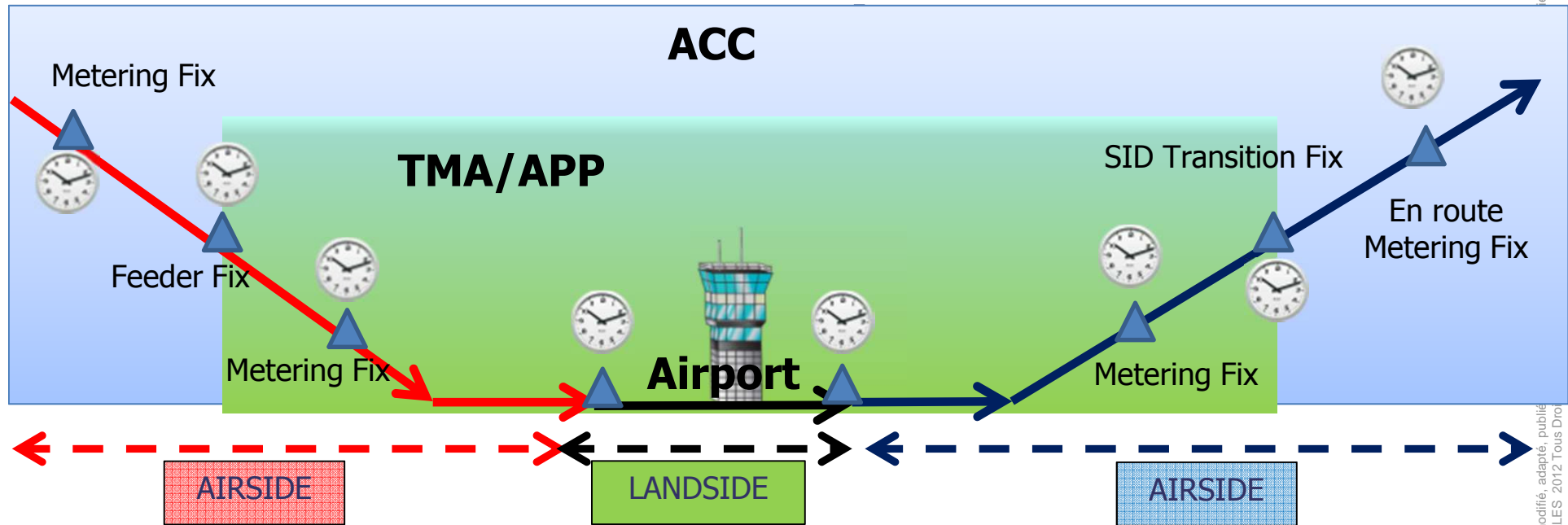
**New HMI for TBS
(Time Base Separation)
ORD concept**



Enhance the scope

7 / The global picture: Wake-Vortex & Runway Throughput

Solution to optimize traffic flow and capacity with same level of safety with automations



WVAMAN

Arrival Scheduling:
Optimal RECAT Sequencing coupled with P-Merge Procedure

WVDSS

Arrival Separation:
RECAT 1/2/3 Wake-Vortex Separation in the glide

WV SafetyNet

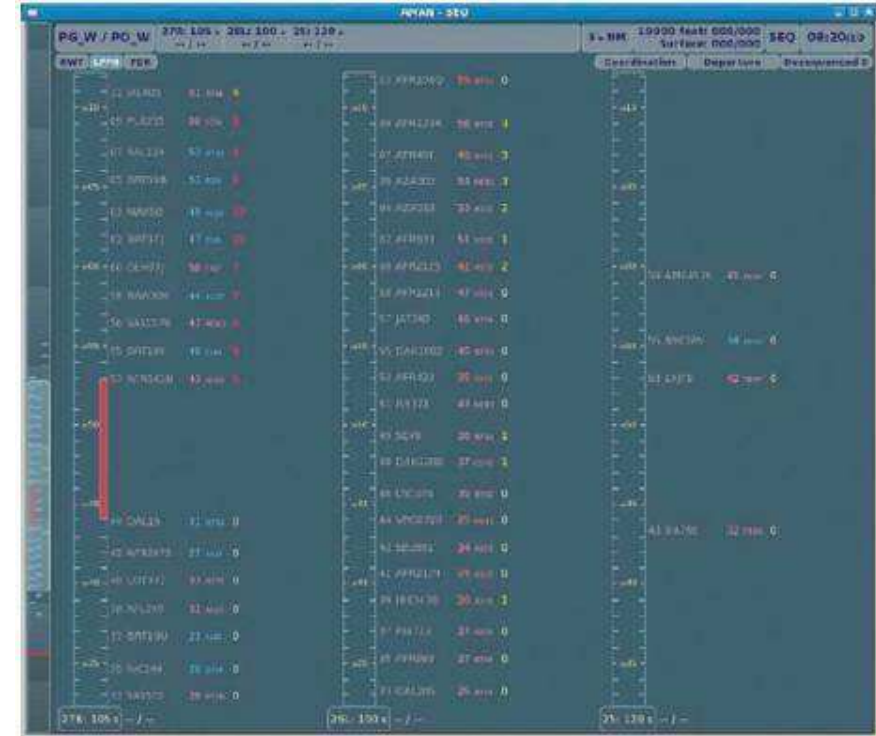
Alerts & Go-Around:
Wake-Vortex Monitoring (alt. < 100 m) and Wind/EDR Monitoring (alt. < 500 m)

WVDMAN

Departure Scheduling
Optimal Take off RECAT Sequencing at the runway coupled with Weather-Dependent Procedures

AMAN with Wake-Vortex constraints

- ◆ AMAN should take into account Wake-Vortex separations constraints (RECAT 1 / 2 & 3) to optimize Airport throughput
- ◆ THALES is developing advanced algorithm to optimize sequencing for airport capacity improvement
- ◆ This algorithm could be tested for different airport traffic mix and runways layout



AMAN & Optimal Sequencing

- ◆ Non coordinated A380 Arrivals could greatly trouble Airport Capacity
 - *Bad Sequence* : A380 – (7 NM) - A320 – (3 NM) - A380 – (7 NM) - A320 = 17 NM
 - *Good Sequence* : A380 – (3 NM) - A380 – (7 NM) - A320 – (3 NM) - A320 = 13 NM

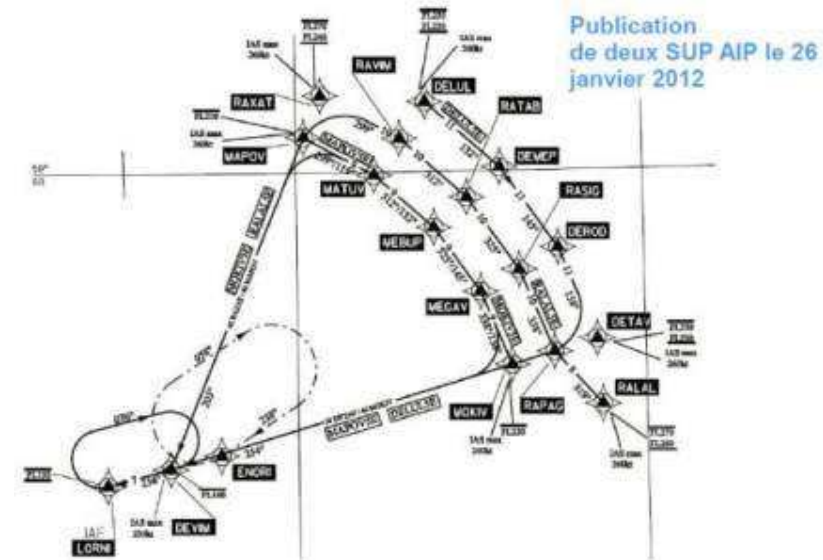
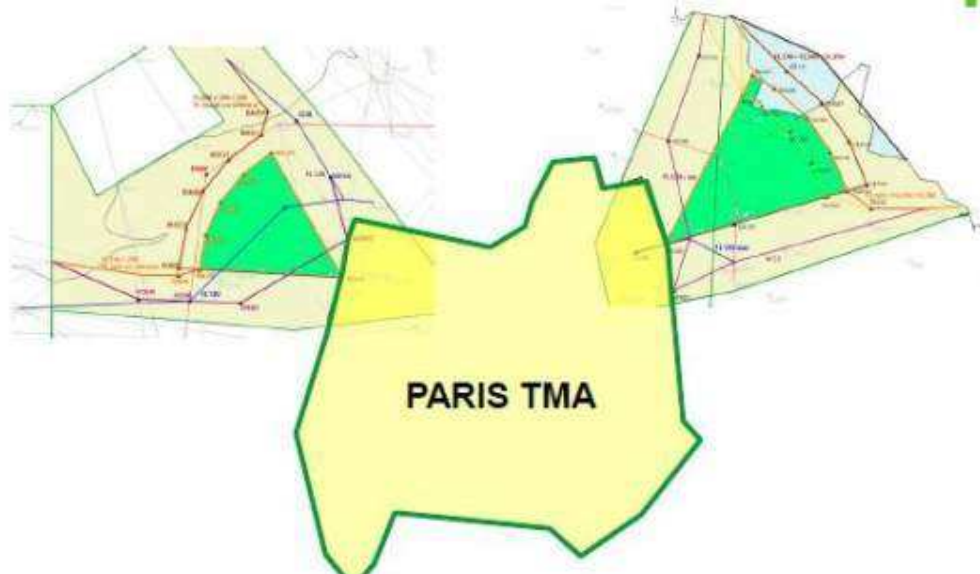
Initial arrival sequence

Callsign	WTC	Class	STA	Sep. min	ETA min	ETA max	Delay
UPM100	M	D	10:10:00		10:09:00	10:16:00	1'00
LIG001	L	F	10:12:00	120	10:10:00	10:15:00	2'00
SUH002	A380	A	10:13:30	60	10:11:00	10:18:00	2'30
LIG003	L	F	10:16:42	192	10:12:00	10:20:00	4'42
UPH004	H	B	10:18:12	60	10:13:00	10:20:00	5'12
LIG005	L	F	10:21:00	168	10:15:00	10:22:00	6'00
LOM006	M	E	10:22:30	60	10:20:00	10:28:00	2'30
		Length	12'30			TOTAL	20'24

Optimized arrival sequence

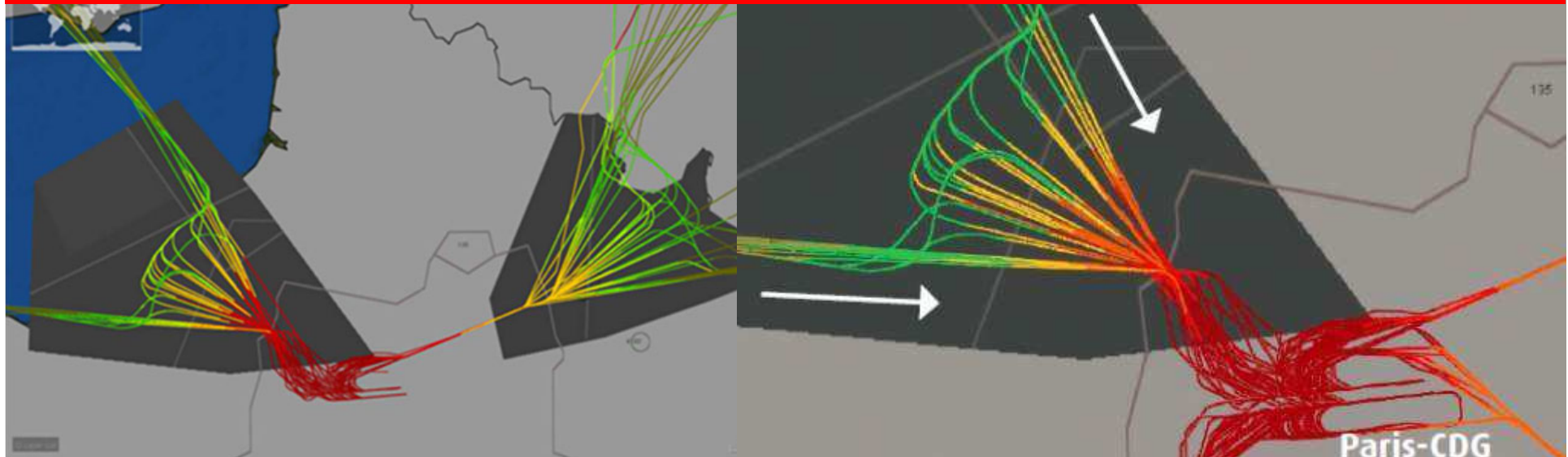
Callsign	WTC	Class	STA	Sep. min	ETA min	ETA max	Delay
UPM100	M	D	10:10:00		10:09:00	10:16:00	1'00
LIG001	L	F	10:12:00	120	10:10:00	10:15:00	2'00
LIG003	L	F	10:13:30	72	10:12:00	10:20:00	1'30
LIG005	L	F	10:15:00	72	10:15:00	10:22:00	0'00
SUH002	A380	A	10:16:30	60	10:11:00	10:18:00	5'30
UPH004	H	B	10:18:06	96	10:13:00	10:20:00	5'06
LOM006	M	E	10:20:06	120	10:20:00	10:28:00	0'06
		Length	10'06			TOTAL	14'06

Shorten the sequence without increasing the overall delay



conque façon, en tout ou partie, ni divulgué à un tiers sans l'accord

Paris ACC has implemented a high altitude approach procedure which is more efficient for handling North-West flights of the Paris region to Paris-Charles de Gaulle airport. This is a first in the Core Area which deals with the **most dense and complex traffic at the heart of Europe.**



◆ Runway Excursion (**Primary cause of accident**):

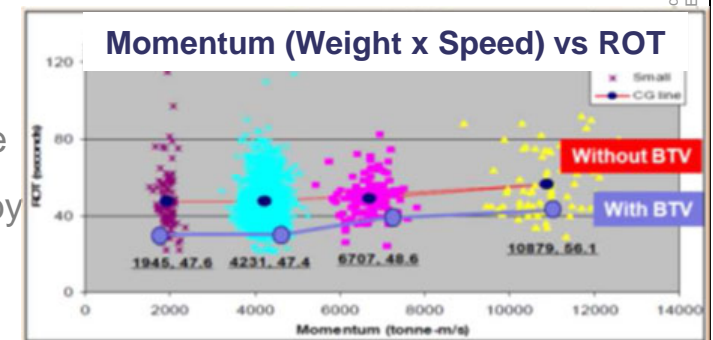
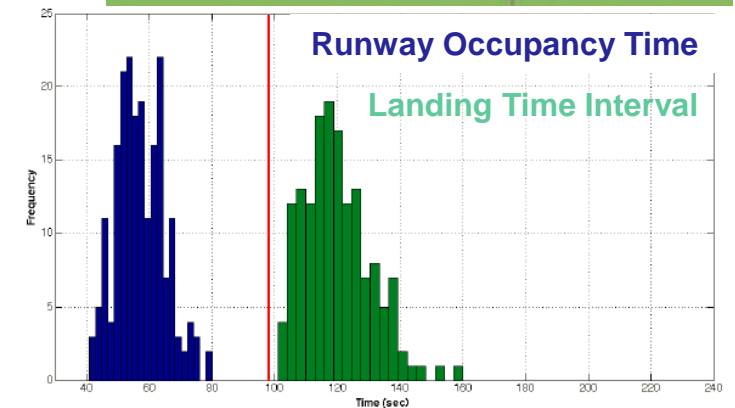
- An aircraft veering off the side of the runway (cross wind)
- Overrun at the very end of the runway

◆ Aircraft Braking Performance depend on:

- Runway Contaminant
- Runway friction
- Final Landing speed (dependent of Head/Tailwind)
- Aircraft Weight and Braking strategy

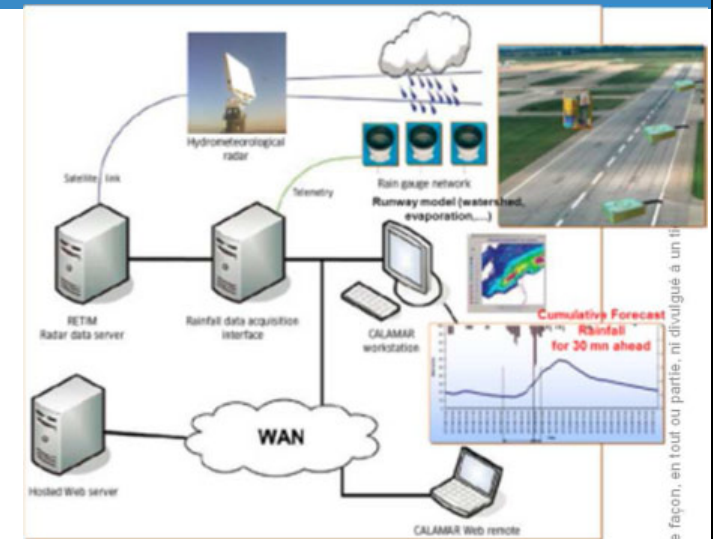
◆ and will impact:

- **SAFETY (Accident /Incident or Go-Around)**
 - Runway Excursion
 - Aircraft collision (Runway Occupancy Time < Landing Time Interval)
- **CAPACITY (movement per hour)**
 - Runway Throughput limited by Runway Occupancy Time
 - Braking distance not adapted to Exit Taxiway (selected by Controller/Pilot 30 m before landing)
- **Separation=Max(ROT, Wake-Vortex Separation)**

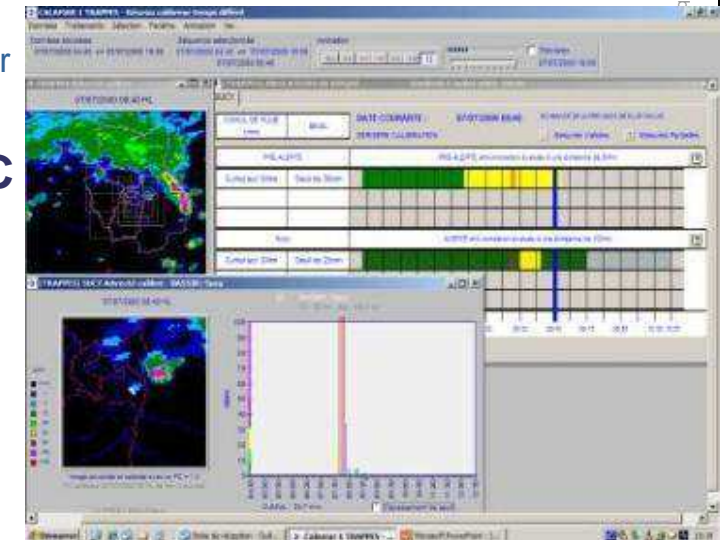


Cumulative Rain 30 min prior before landing

- ◆ **Rain Rate Retrieval around the airport**
 - THALES High Resolution (5 m) / High Speed (45 s) X-band Radar
 - BOSCHUNG Water Level IT-Sens® probes installed on runways
 - Rain gauges data deployed around the airport
- ◆ **Cumulated Rain Forecasting by RHEA CALAMAR**
 - Cumulative Forecast Rainfall based on data in 1 min increments for periods up to 30 mn /1 hour ahead
 - Forecast reliability by the supply of data from rain gauges/ Water level probes (calibration)
- ◆ **Runway Contaminant Forecasting by DGAC/STAC Water Run-off model**
 - 3D map of Runway defined by Laser scanning instrument
 - Run-off model based on cumulate rain and runway slope
 - Recommendations for ICAO Friction Task Force
- ◆ **Coordination with Airborne ROPS (Thales Av.)**



Probes/Sensors ingested in A-CALAMAR

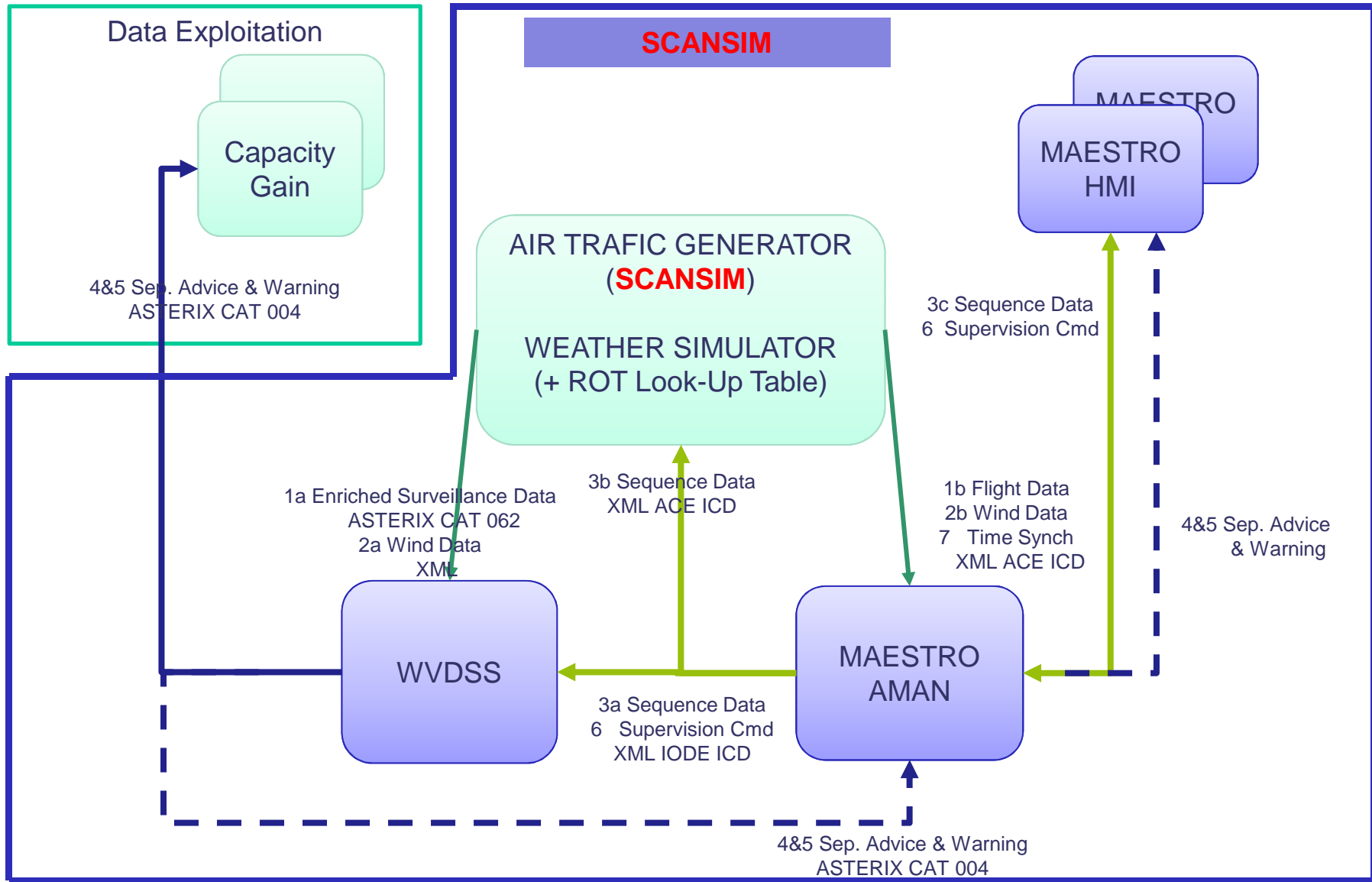


Cumulative Rainfall Forecast for 30 mn Ahead

THALES

1 SCANSIM WVS SIMULATION TOOL FOR AIRPORT CAPACITY STUDY

- ◆ THALES has developed a global “Wake-Vortex System (WVS)” simulator to assess airport capacity gain.
- ◆ This simulator integrates models of main factors and components impacting the runway throughput.
- ◆ This simulator includes:
 - Time of aircrafts on runways: Runway Occupancy Time (ROT) that is modeled statistically indexed by weather conditions (runway contaminant, head wind) and aircraft momentum (Maximum Landing Weight x Final Speed Approach)
 - Wake-Vortex Separation of aircrafts in the glide slope: WVDSS (Wake-Vortex Decision Support System) that monitor safe separation between aircraft in final approach phase taking into account new fixed procedures (ICAO, RECAT 1 and RECAT 2) or dynamical one (Weather dependent & Dynamic Pairwise RECAT 3)
 - Aircrafts sequence in the TMA: Wake-Vortex Constrained AMAN (Arrival MANager) that generates optimal time-efficient sequence of aircrafts in TMA taking into account wake-vortex pairwise separations constraints.
- ◆ The simulation is developed with SCANSIM that is a comprehensive and cost-effective ATC simulator suite for ATC training
- ◆ We could study Point-Merge procedure coupled with AMAN

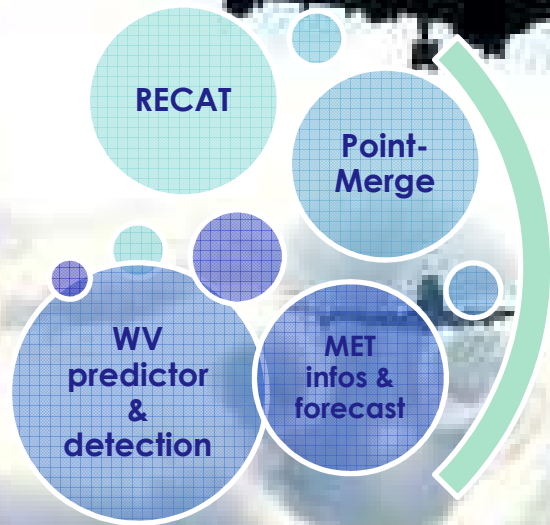


Ce document ne peut être reproduit, modifié, adapté, publié, traduit, d'une quelconque façon, en tout ou partie, ni divulgué à un tiers sans l'accord préalable et écrit de THALES - ©THALES 2012 Tous Droits réservés.

Today's offer

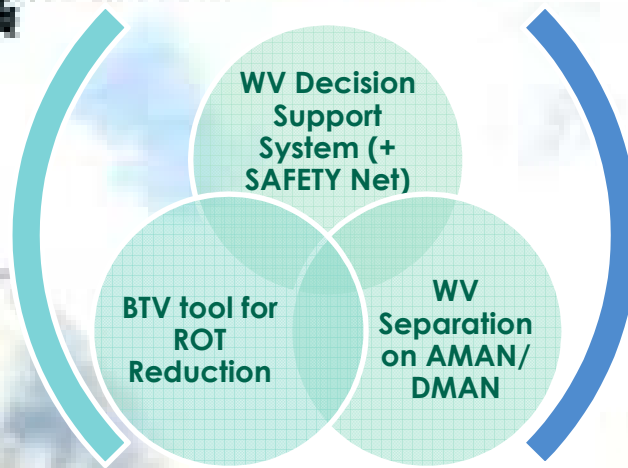
Tomorrow's offer

Sensors Maestro SCANSIM
TopSky - Safety Nets TopSky - Tower TopSky - ATC



Technologies

WV : Wake Vortex
BTV Break to Vacate
ROT : Runway Occupancy Time



Solutions

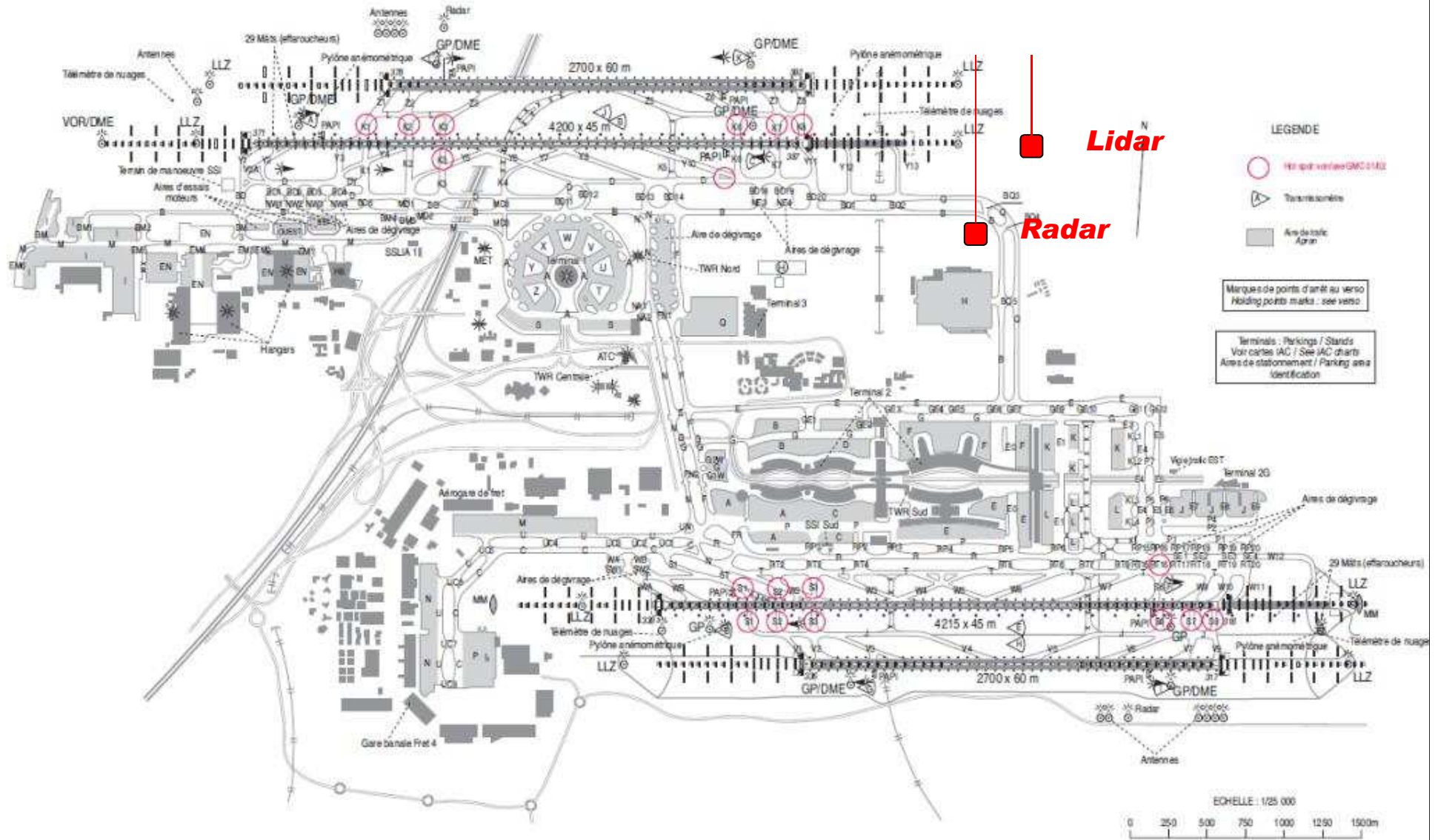


Answer

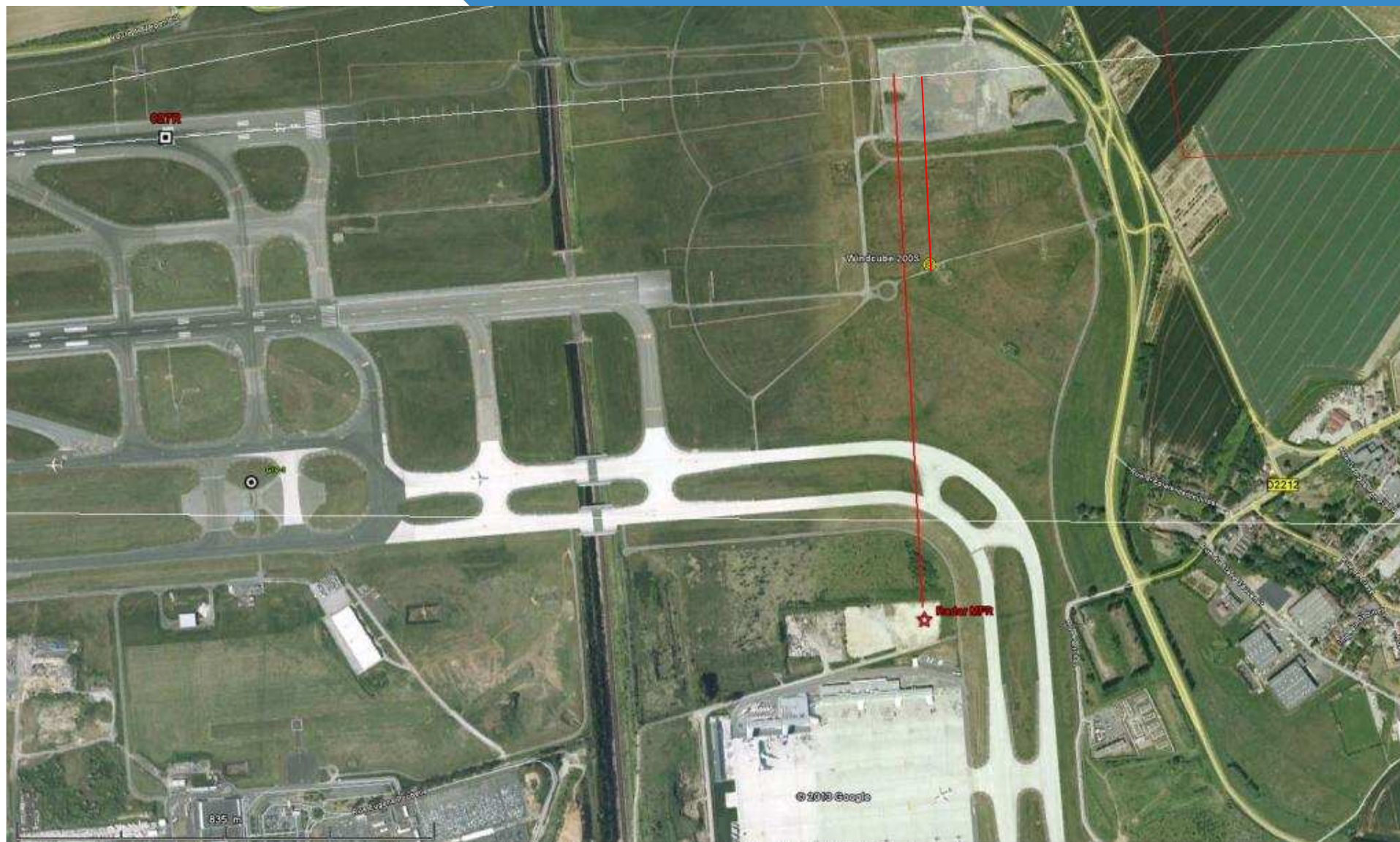


Presentation of trials campaign in CDG Airport

- ◆ In coordination with P6.8.1 deployment of X-Band radar and Lidar to perform wake vortex measurements.
- ◆ Objectives:
 - Gather data to feed the safety case and cost benefit assessment
 - Benchmark wake vortices tracking position and strength
 - Build a A380 WV measurement database
 - Increase Heavy WV database for RECAT2
 - Monitor RECAT-EU implementation
 - Work on WV severity by crossing WV measurements vs FDR data
- ◆ **Schedule**
 - Sensors deployment : from July 2014
 - Start of operational campaign : 1st September 2014
 - Duration : 1 year



WAKE-VORTEX RADAR SITE DEPLOYMENT ON CDG AIRPORT



◆ Radar/Lidar Combination

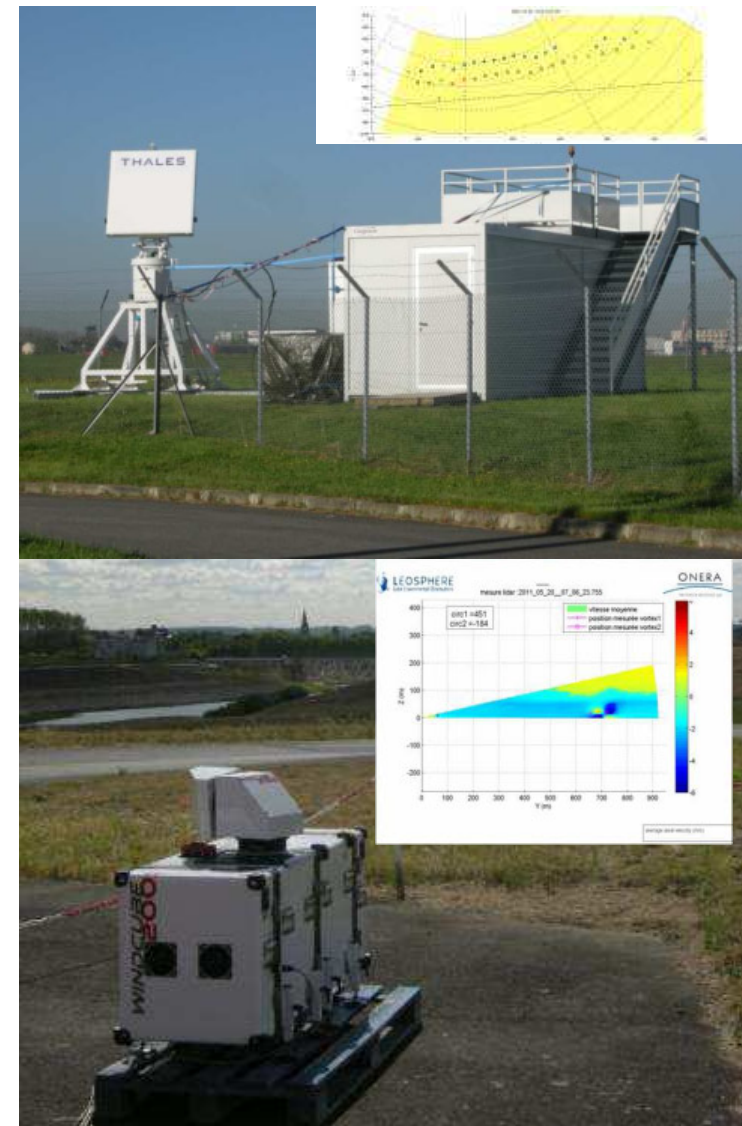
- X-band Radar in Wet /Foggy conditions
- 1.5 micron Lidar in Dry Conditions

◆ 3D scanner capabilities

- Multi-function sensors (modes interleaving)
 - Detection of wake-vortex (positions scanned every 7.5 s)
 - Wake-Vortex Strength Retrieval (Circulation in m^2/s)
 - Wind that induces Wake-Vortex Transport
 - Air turbulence by EDR (Eddy Dissipation Rate) that induces Wake-Vortex Decay
 - Rain Rate (Radar) for ground segment of ROT

◆ Additional functions

- Wind-Shear
- Wind Burst / Microburst



- ◆ **Collaborative Resources management**
 - Collaborative modes between Radar and Lidar according to weather conditions
- ◆ **THALES Radar/Lidar Sensors have been calibrated based on:**
 - Radar/Lidar Sensors simulators mixing EM/EO models and Fluid Mech. Models
 - Collaboration with AIRBUS on flight trials at Toulouse Airport
- ◆ **These sensors are operational to:**
 - **Develop a Wake-Vortex Database**
 - Feed Safety Cases for RECAT deployment
 - Support Airport Capacity study

The database structure could (should?) be discussed within the wake vortex community

Wake Vortex Solutions

Mitigating the Impact of Wake Vortices

