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VDL 2 sub-band Status & MultiFreq Roadmap Discussion

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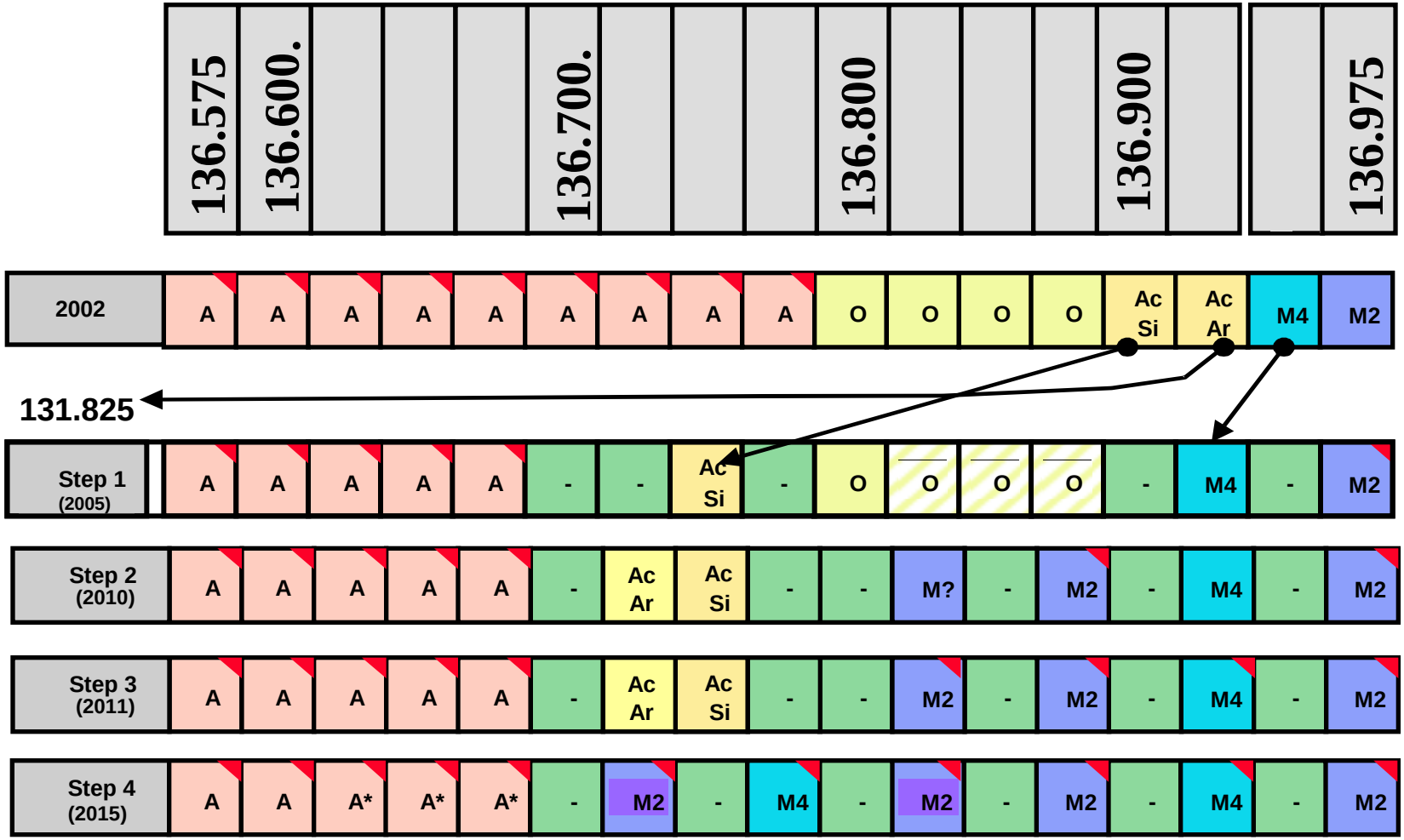
5th December 2013
RAFT meeting,
Eurocontrol Brussels

Agenda

- Recall on sub-band definition
- A few recent VDL traffic statistics
- Recent Multi-Freq Roadmap Discussions
  Definition of first MF step

VDL 2 sub-band deployment steps



A: protected voice; A:protected voice only for airborne traffic;M2:VDL Mode2;M4:VDL Mode4*

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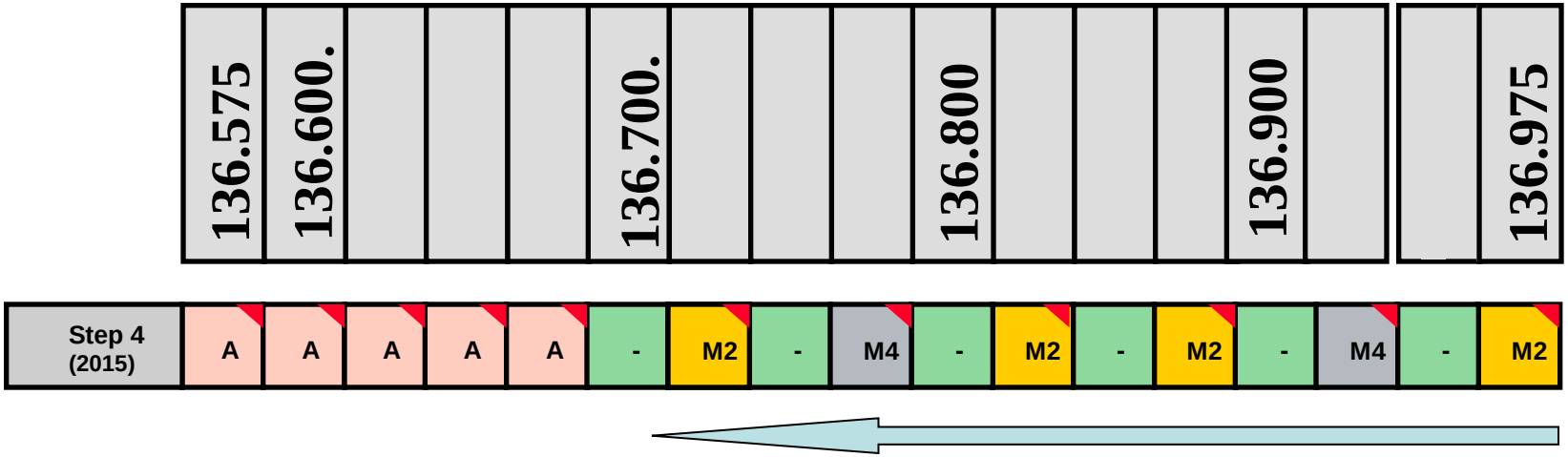
The likely allocation plan



- 1st Ch (already shared) : 136.975 MHz -VDL 2 CSC, to remain. CPDLC also running on it.
- 2nd Ch:136.875 MHz (now available): to be shared for airport (ground traffic only). To re-use at many places for unloading CSC and ENR channels.
- 3rd Ch: 136.825 MHz (available since end 2011): a shared channel for extension of CSC for ENR VDL 2 traffic - high performance required –
- 4th Ch: 136.725 MHz (available in 2015) : Shared, for airport ground traffic only.

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Draft VDL 2 deployment roadmap (Recall)

Date	Milestone or triggering factor	Description
..end 2013..? (CSC + F2)	Eg :Cooperative monitoring showing on A/G interface: • Remark :95%- End/End Rnd Trip delay is already above 16sec ! • **AVLC -round-trip delays peaks (eg for 95% figure, touching 6-or 8 ?- sec or more within peak hour)** • **Retransmission rates peaks(eg 50% uplink needs 2 or more Tx during peak hour)** • **CU average/min sensed from the ground and touching in peak hour the 40% or more**	**Deployment trigger** for F2 operation at major hubs by major ACSP(s) in place.
..end 2014..? (CSC+F2)	Maintain Rnd Trip End/End 95% below 16sec, and therefore (is this sufficient ?) • Maintain round-trip delays peaks (95% figure below 6 sec) • Maintain retransmission rates peaks(eg 50% uplink needs 2 or more Tx during peak hour) • CU average/min touching in peak hour the 40% or more …	**Operation of F2 starts** at major hubs by major ACSP. AOC and ATS (for CPDLC connection setups) set on F2 at terminals enables capacity increase on CSC in ENR sectors.
..2015..2016	Monitoring of CPDLC perform. in ENR dropping at some places	**Deployment trigger** for F3

Draft VDL 2 deployment roadmap (III)

Date	Milestone or triggering factor	Description
..2016..2017..?? (F1+F2+F3)	IR 29/2009 triggered more CPDLC deployment -by ANSPs -by aircraft retrofit	**Operation of a second ENR channel** on F3 is required in sectors with heavy CPDLC traffic. Aircraft balanced between CSC and this channel
??2018.... (F1+F2+F3+F4)	Traffic at some airports increase due to AOC + ATS requires a second terminal frequency	**Deployment of F4 as second ground frequency**

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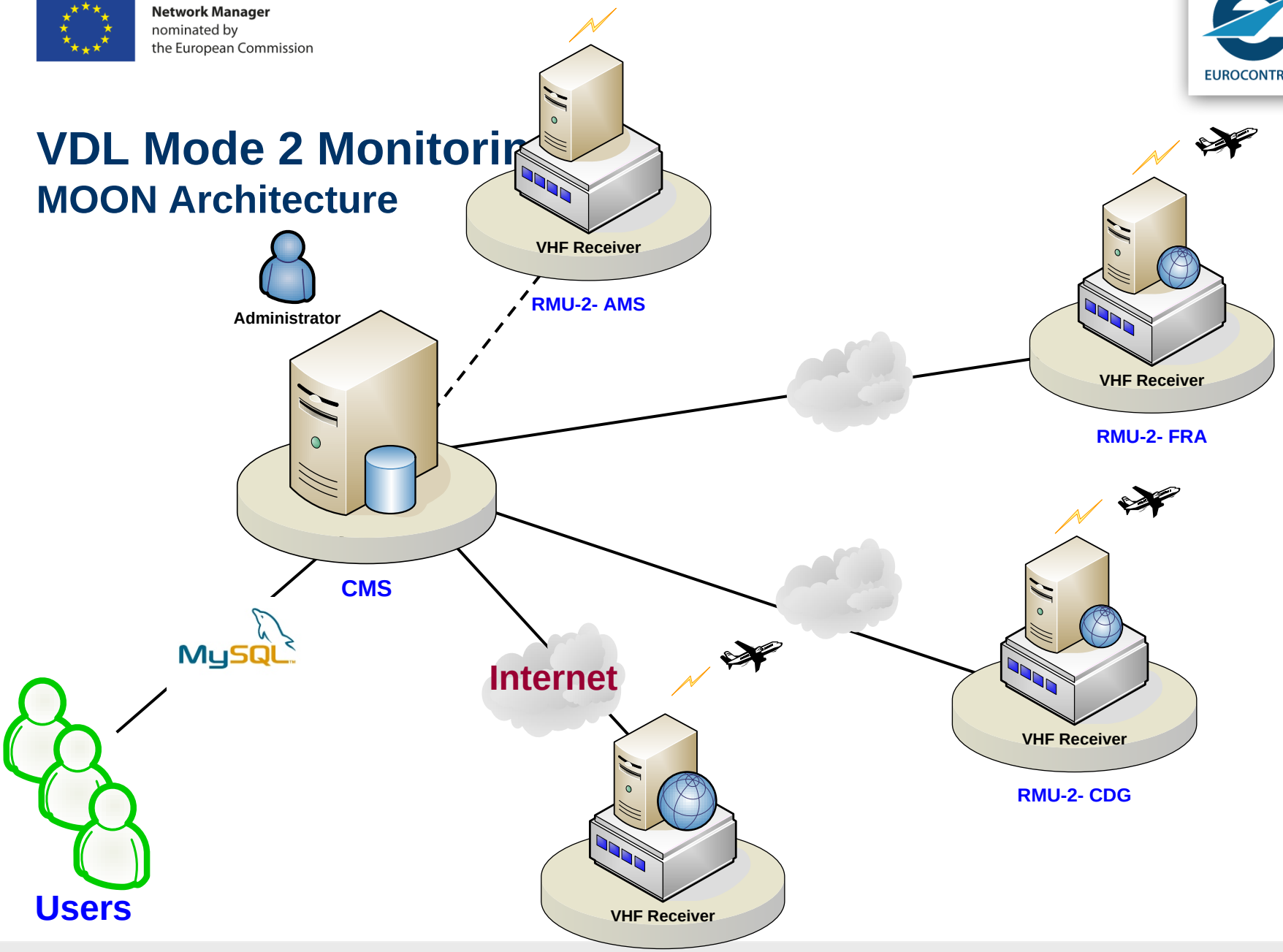
VDL Mode 2 Monitorin
MOON Architecture



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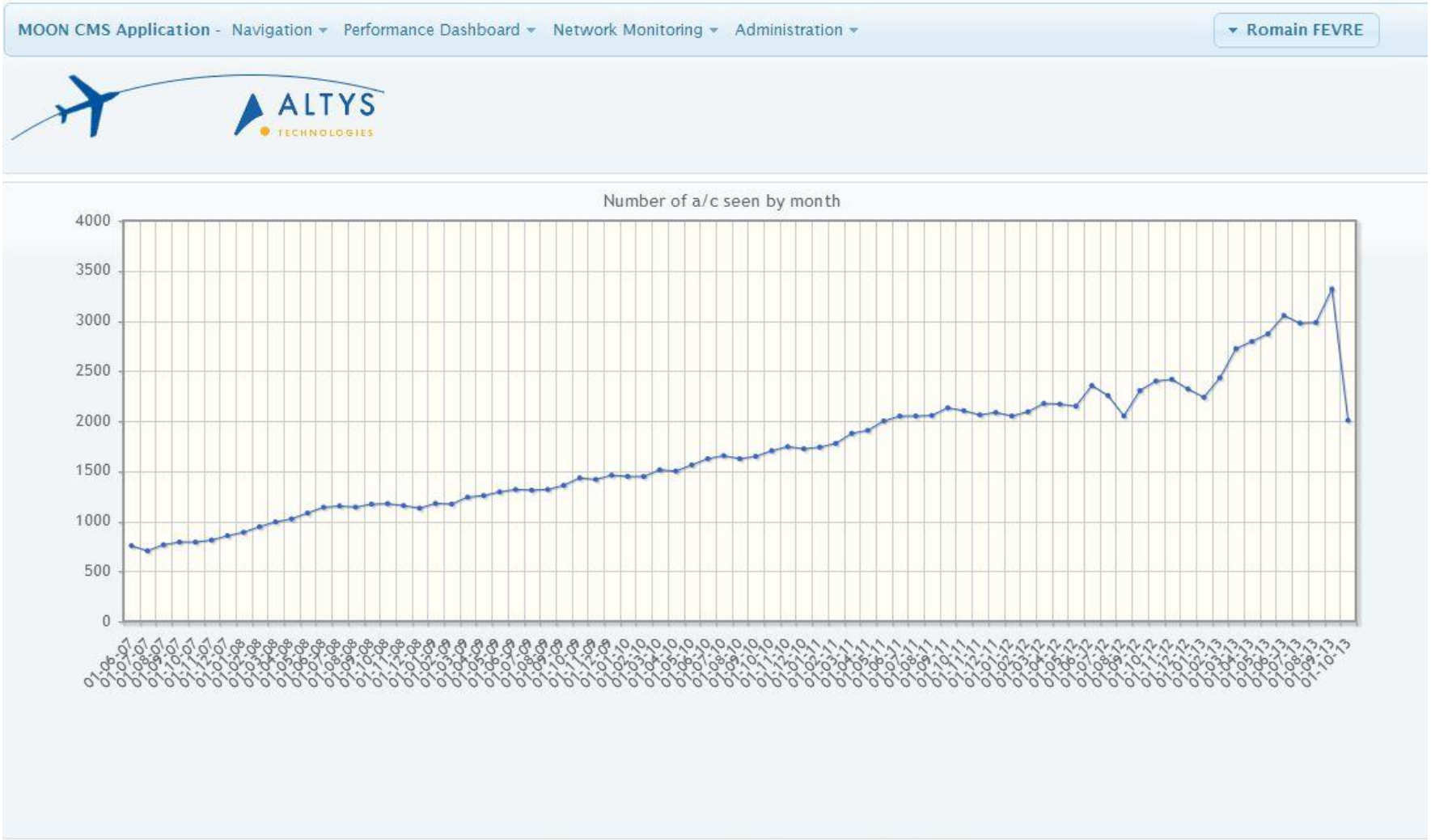
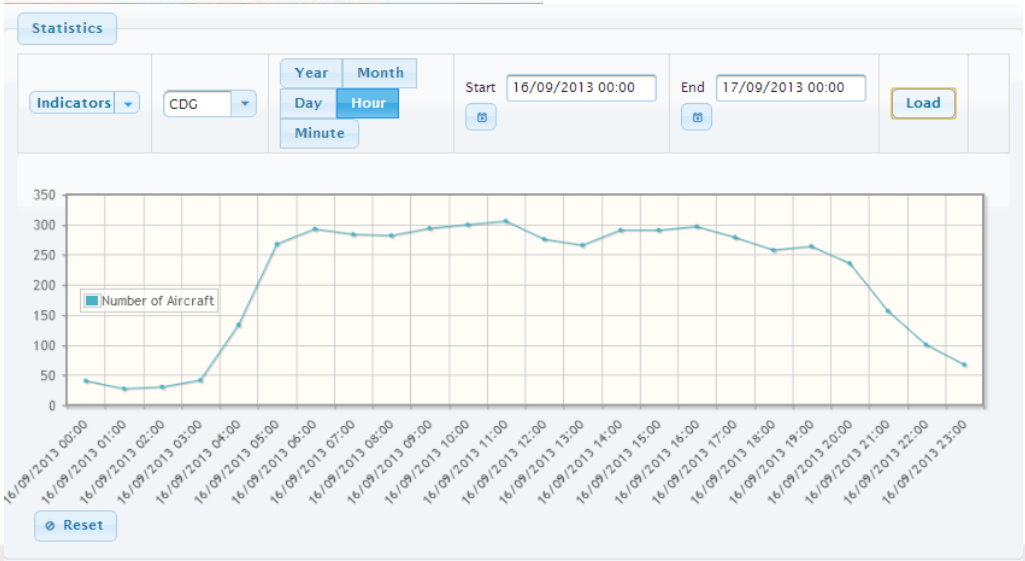
Moon automated statistics examples : # aircraft beyond 3000

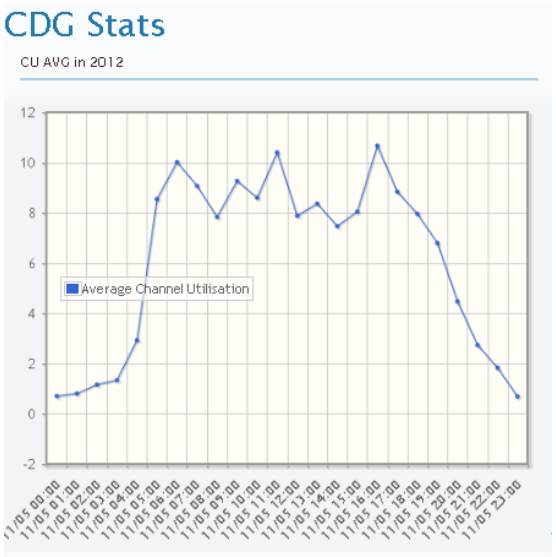


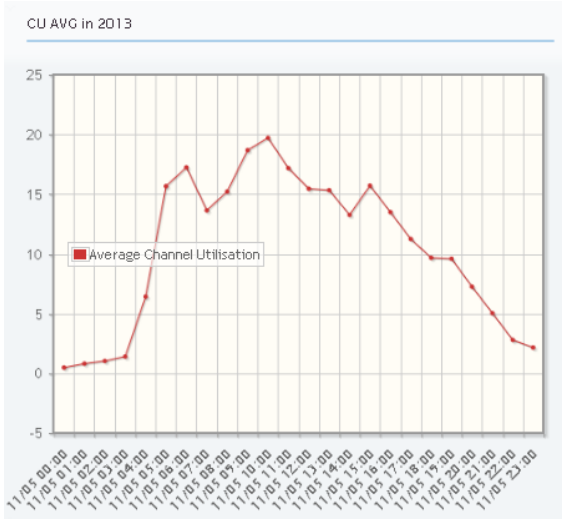
Aicraft volumes/hour seen by FRA and PAR(CDG) - RMUs

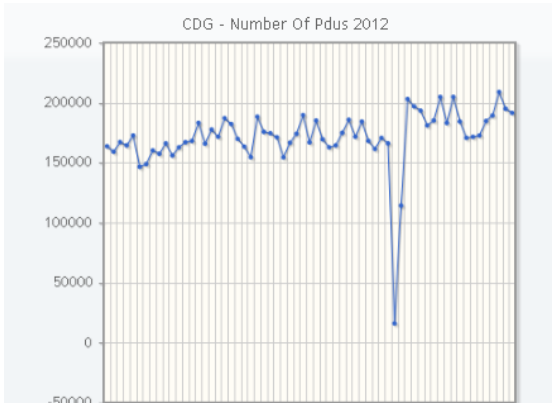


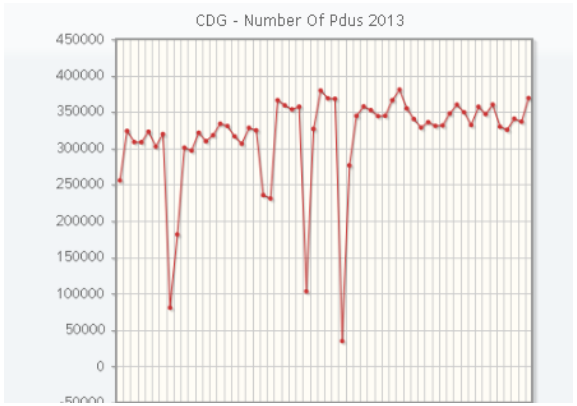
- Around 300-350 aicraft/hour around FRA and CDG – RMUs

Strong traffic increase observed from 2012 >> 2013





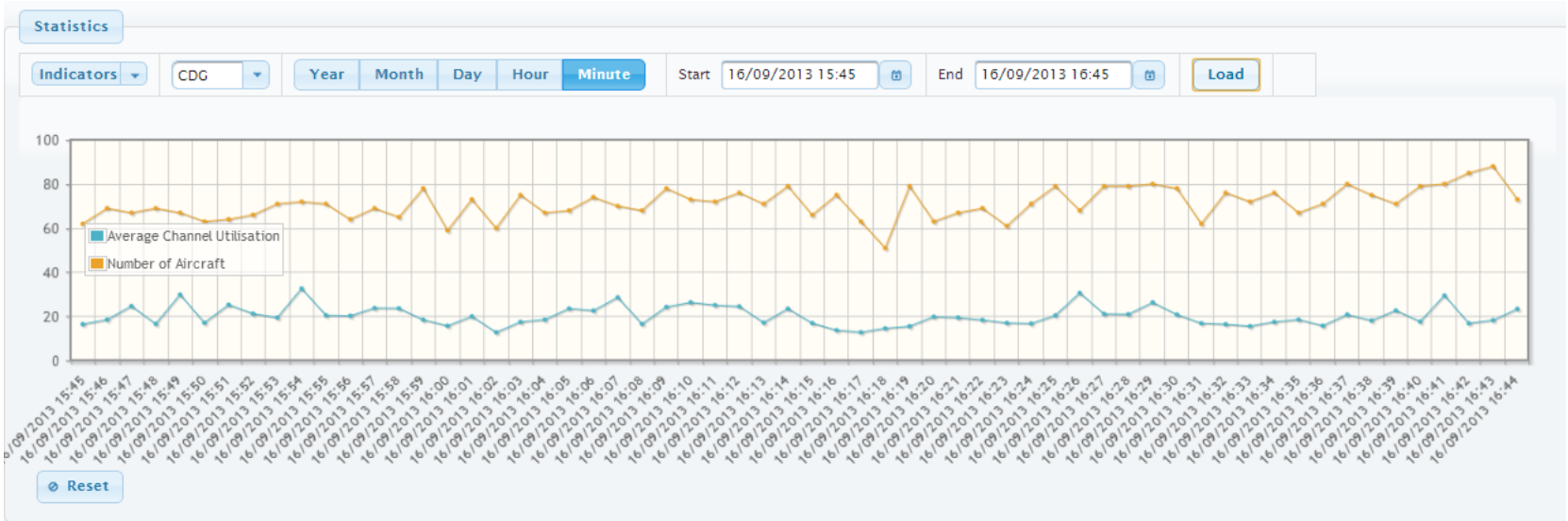




- Peaks from 10% to 20% (CU average/hour)
- Peaks from Av # PDU/day from 200 000 to 350 000

CDG during the peak hour

- CU between 20 and 30% (average/min)



CCRM – « Analysis of VDL 2 sub-band occupancy during year 2012 »

- Independent monitoring and measurements by CCRM*, belgian official body.
  (*Centre de contrôle des Radiocommunications des Services Mobiles)

- Located at ~20km south of Brussels. VHF antennas on mast with 60m height, with a VHF-view on UA beyond Belgium borders

- 2012 -report delivered about VDL2 (CSC) main channel traffic volumes

- The scanning is also detecting the VDL sub-band usage types: some non-compliant usages still observed in 2012

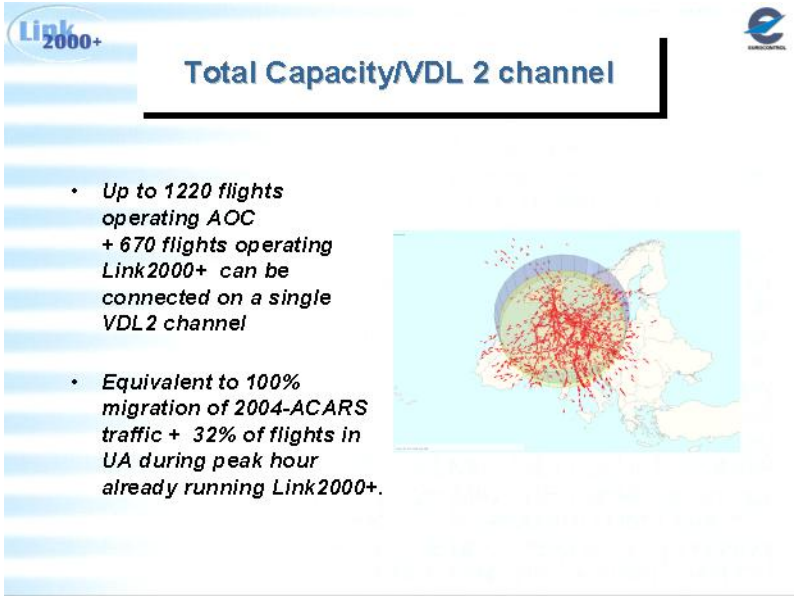
VDL 2 CSC (Main channel) (Cfr CCRM report)

- Confirming strong traffic growth :
  - Mean daily occupancy : Jan 2012: 2,51% – Dec 2012 4,49%
  - Hourly mean occupancies had a peak at 19% in 2012.
  - Predictions by extrapolation are forecasting recurrent hourly mean peaking at 17%+ from 2014 on.
    (with view on UA & Brussels airport)

Current Eurocontrol conclusions on traffic statistics

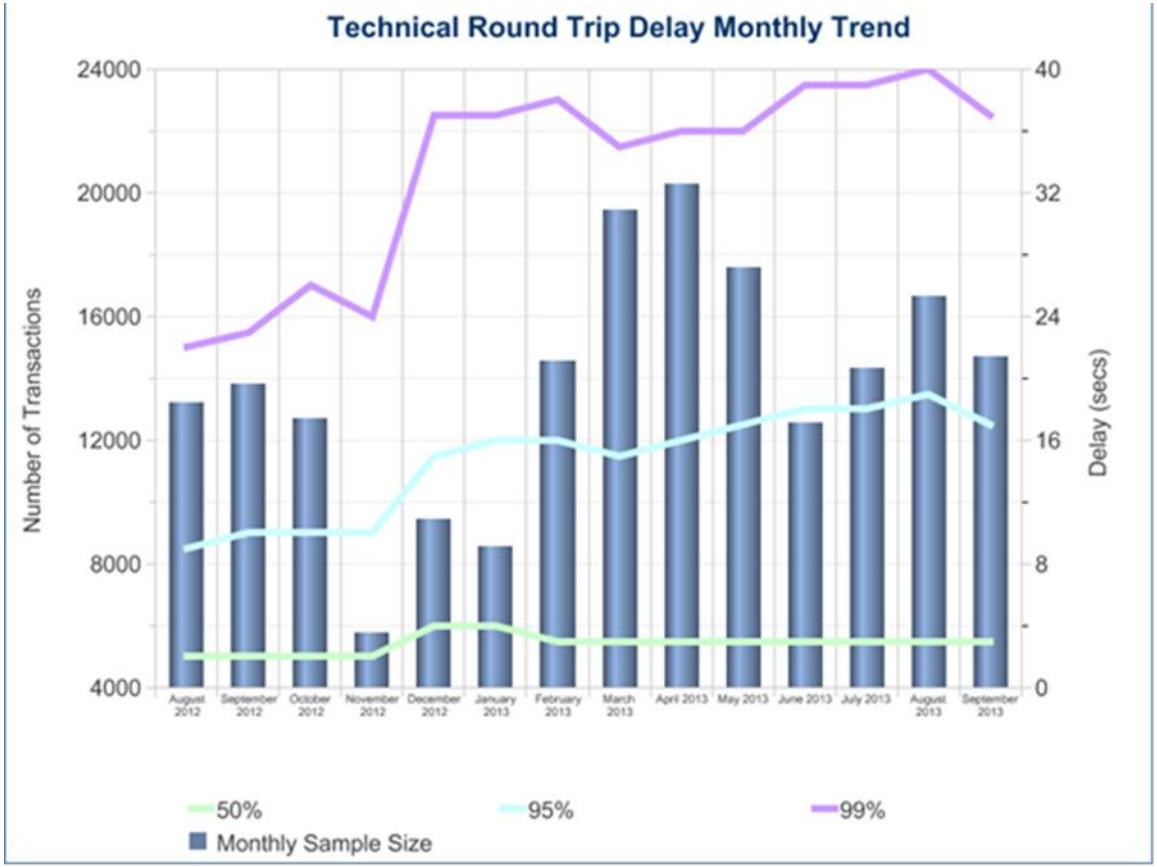
- Sustained equipage growth and total traffic growth in DLS IR areas
- Compared with simulations results of channel at saturation
  - #VDL 2- active aircraft /hour (300-350 viewed at CDG and FRA)
  - #frames/hour at CDG (50 0000 PDUs)
  - Total kbit/s exchanged at peak time at CDG (11 kBits/s average per min, on peak hour)

Entering in the traffic range where saturation is possible.



600 NM radius volume
1220 aircraft connected/hour
11,6 kbits/s average net throughput
~100 000 frames successful/ hour

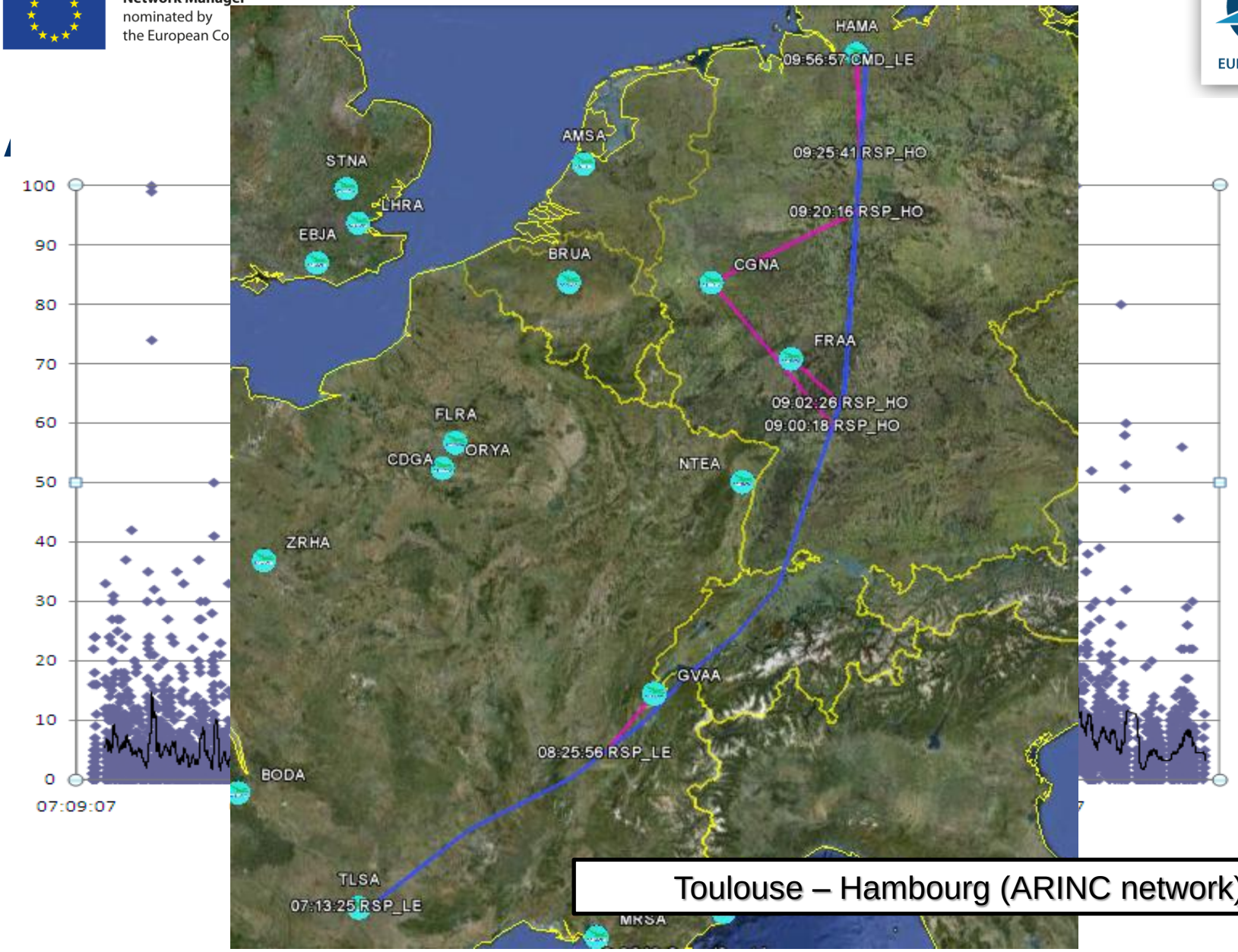
End to End performance to be watched !



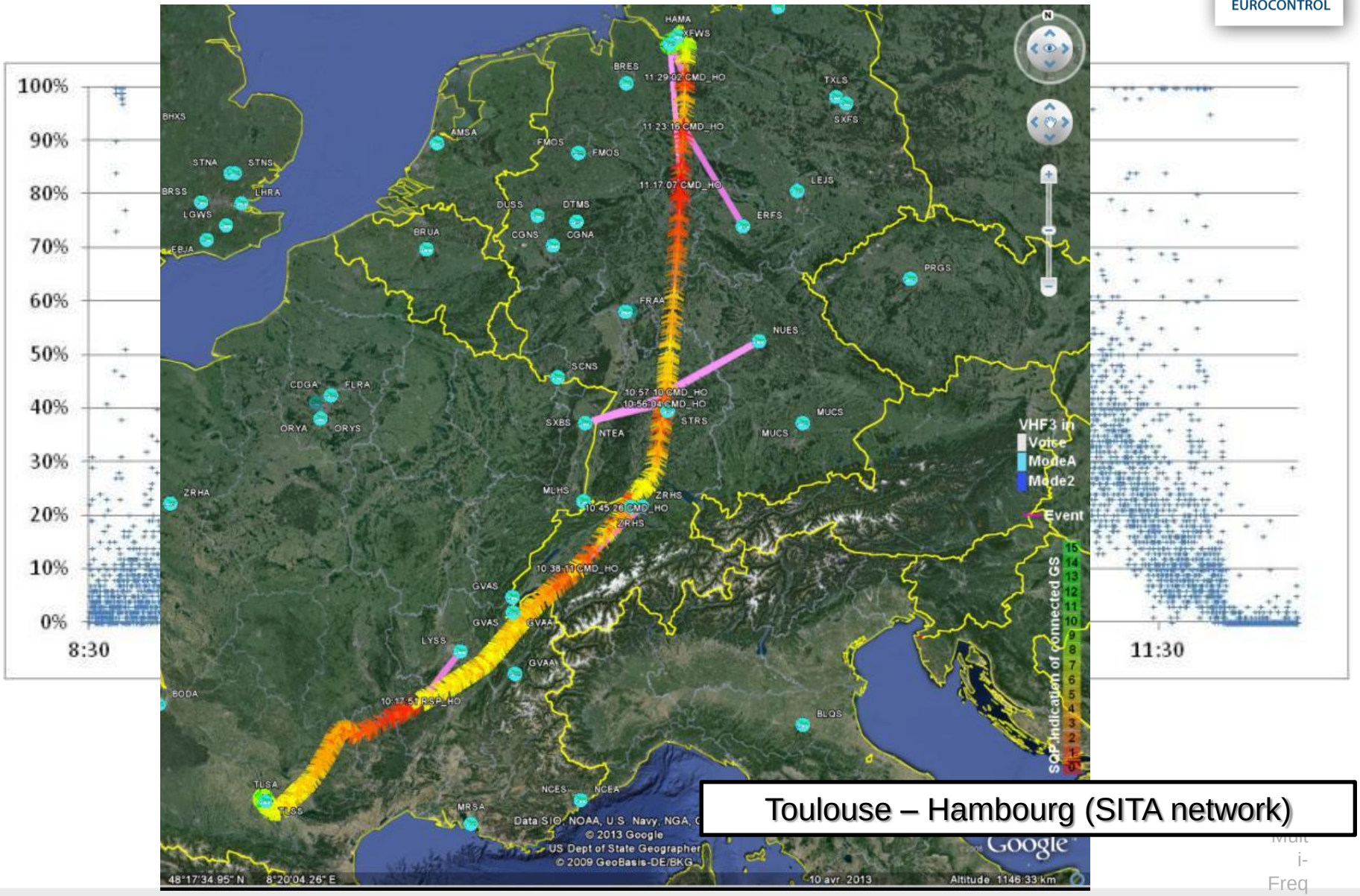
..and Multi-Freq roadmap developed !

Current Channel occupation (other sources)

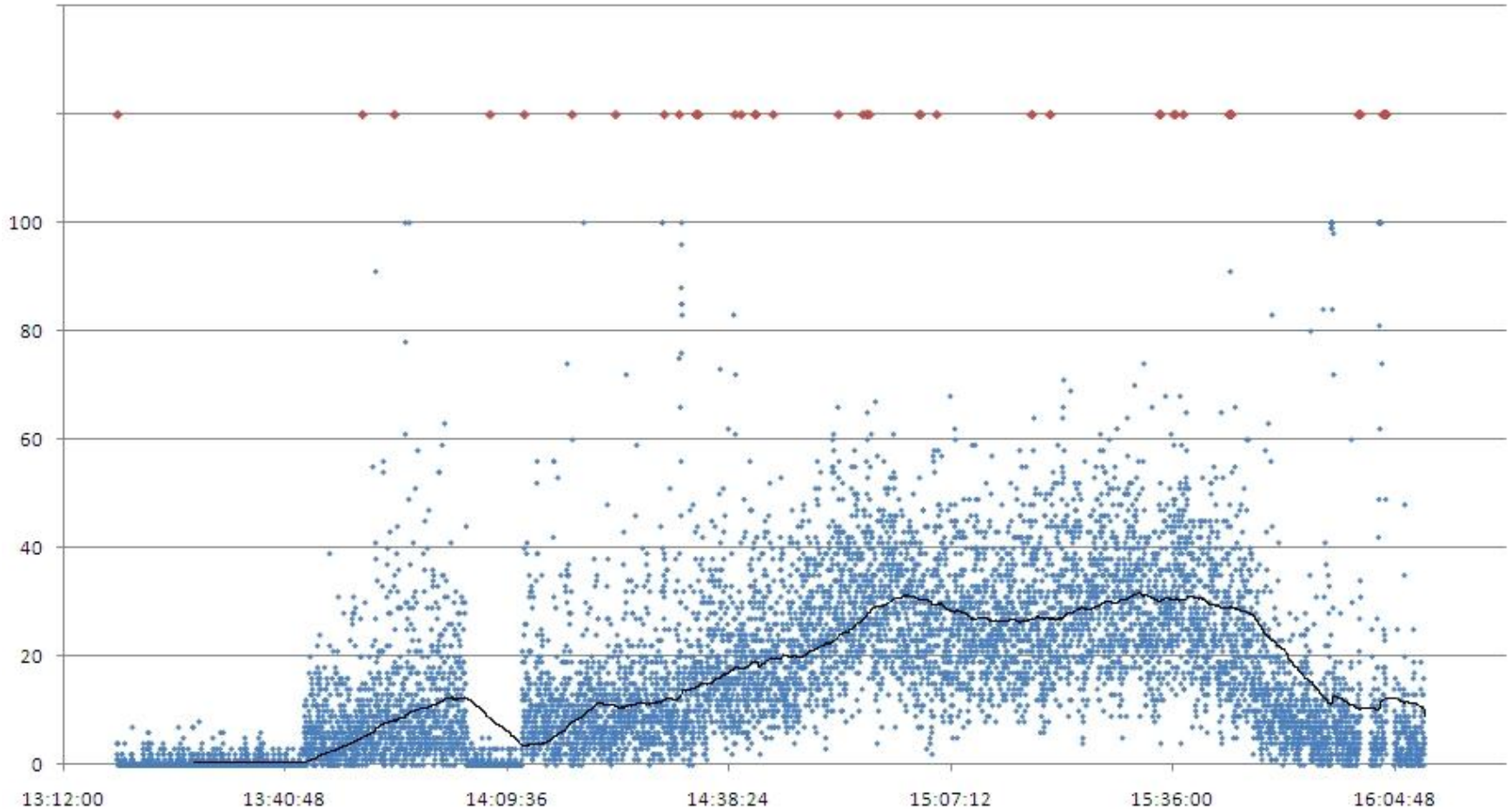
- ARINC and SITA :
  - Confirm measurements (also from the ground) with 20-30%+ CU at peak hours
- Honeywell avionics trials (in flight CU indications)
  « **In service CMU trace data indicates that VDL mode 2 traffic density is very high at times: 40-50% observed with peaks of 80%** »
- AIRBUS samples (next slides)



Toulouse – Hambourg (ARINC network)

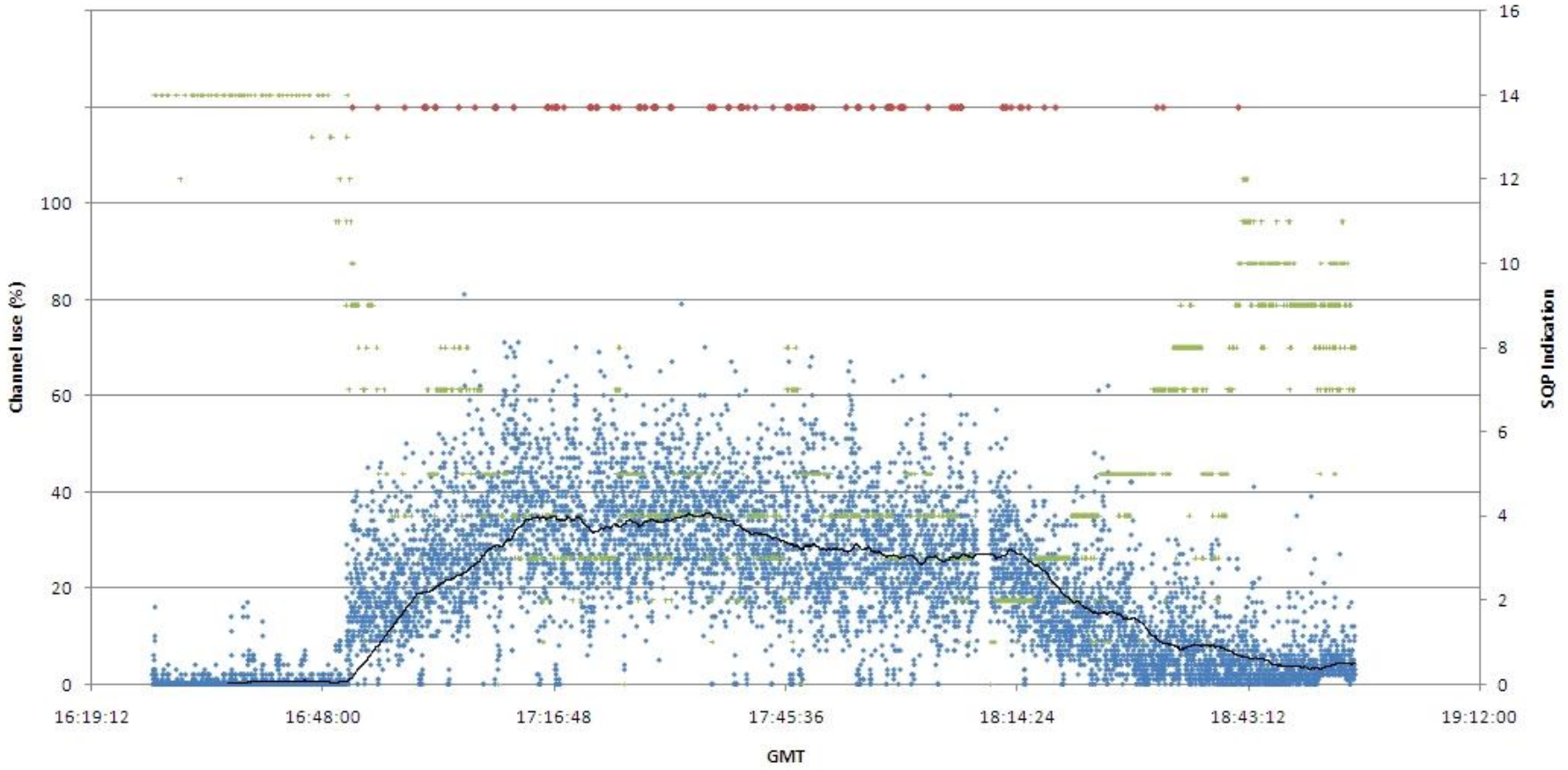


Toulouse – Hambourg (SITA network)



Toulouse – Hambourg via Nice (ARINC)

Airbus A320 FANS B+ (13 Nov 2013)



Hambourg – Toulouse via EDYY/EDUU/LSAZ/LSAG (SITA)

Under DLISG, the Adhoc VDL2 MF roadmap meetings considerations currently are

- High VDL 2 channel utilisation levels now observed over core Europe
- Current End/End performances for CPDLC are at the edge of desired levels
  - Unclear today : VDL2 saturation at some places = the main reason ?
  - (Too?) many VGS present (for availability reason) create instability and overload(?). Need for optimisation
- Clear agreement from ACSPs, ANSPs,… to work at MF preparation now!
  - Avionics MF readiness is a first question
  - The group will work at a strategy for progressive testing and operation of MF

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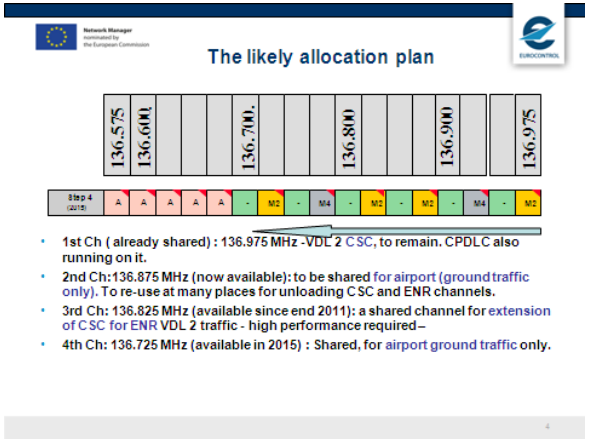
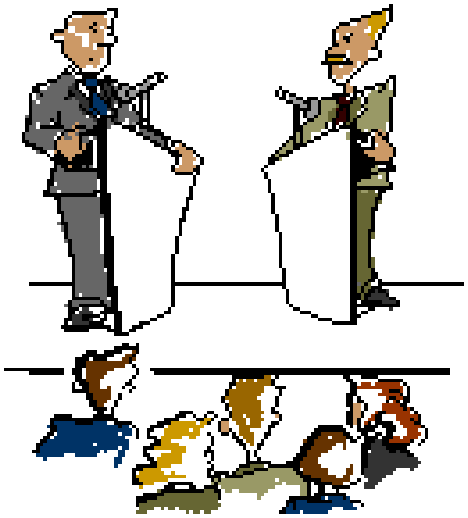


First step towards final validation and deployment of MF (to confirm)?

- To operate at a (a few) major airport(s) a F2 (136.875 Mhz)
- To switch selected fleets to ground-channel; selection = f(planned avionics readiness for MF)
- The ‘Autotune’ mechanism with a white list is thus required
- The CSC would be unloaded of (enough, in time?) voluminous AOC ground traffic; CPDLC performance to be closely monitored

Discussions time,
Questions time ,..

- **Let's discuss them here,**



- **Or by email also,**

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