French RPAS Integration experiments

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11th of September 2018

DGAC/DSNA

- French Air Navigation Service Provider
  - is responsible for delivering Air Traffic control services within the French metropolitan airspace (800.000 km2) and overseas dependencies
  - handles roughly 2.8 million flights a year with more than 80 control towers, 7 ACC (2 overseas, 5 in ECAC airspace).
  - contributes to the definition and upgrade of CONOPS, associated systems and services
  - has participated as a leader or contributor in more than 70 projects during SESAR steps 1&2 (2009/ 2013)

From RPAS accommodation to integration: step 1

2013-2015 → 2016 – 2019 (SESAR IR wave 1) → 2019 – 2022 (SESAR IR wave 2)

Demonstrators TEMPAERIS and ODREA to assess

- RPAS Behaviour
- Normal procedures
- Contingency procedures:
  - ✓ Radio Failure
  - ✓ C2Link Loss
  - ✓ GPS failure
- DAA.

Output: Concept feasibility and Safety cases
Demystification towards ATCos

From RPAS accommodation to integration: step 2

2013-2015 → 2016 – 2019 (SESAR IR wave 1) → 2019 – 2022 (SESAR IR wave 2)

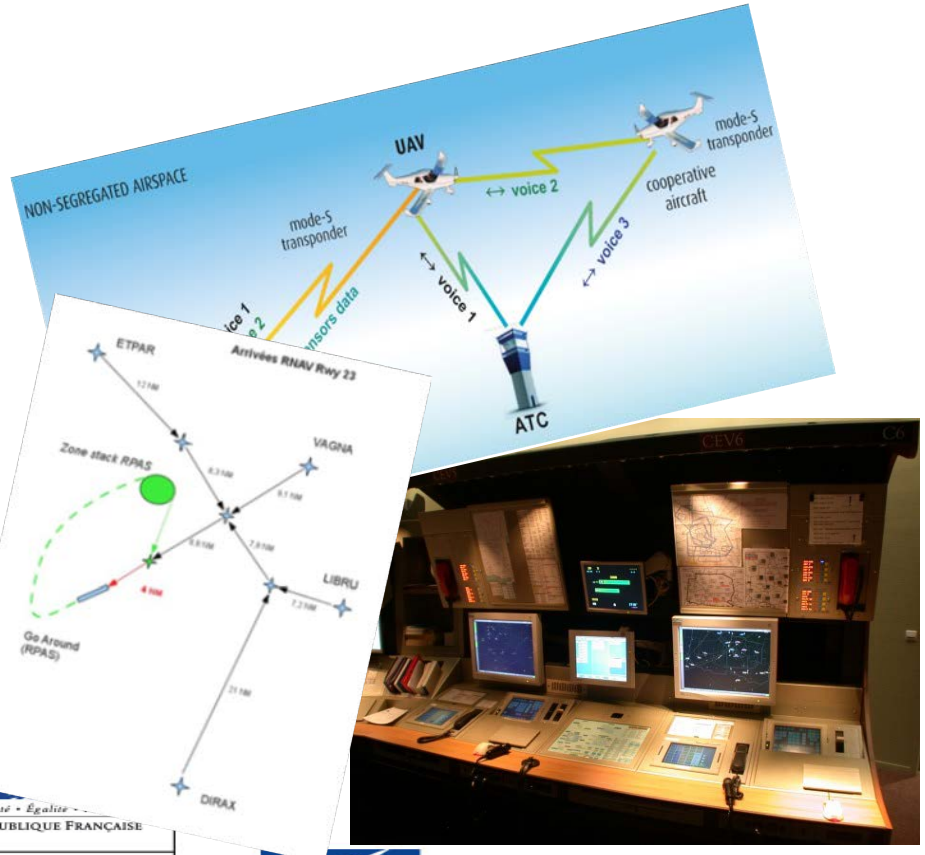
Live trials with a military Harfang RPAS to demonstrate

- ✓ Flight plan accommodation
- ✓ Operations in class C and D
- ✓ Multiple handovers
- ✓ ATC instruction and separations with IFR/VFR
- ✓ Procedure (STAR) in Carcassonne
- ✓ Contingency procedures: radio failure, C2Link loss

Output: More than 30 flight hours

From RPAS accommodation to integration: step 2

2013-2015 → 2016 – 2019 (SESAR IR wave 1) → 2019 – 2022 (SESAR IR wave 2)



Real Time simulations in Bordeaux TMA:

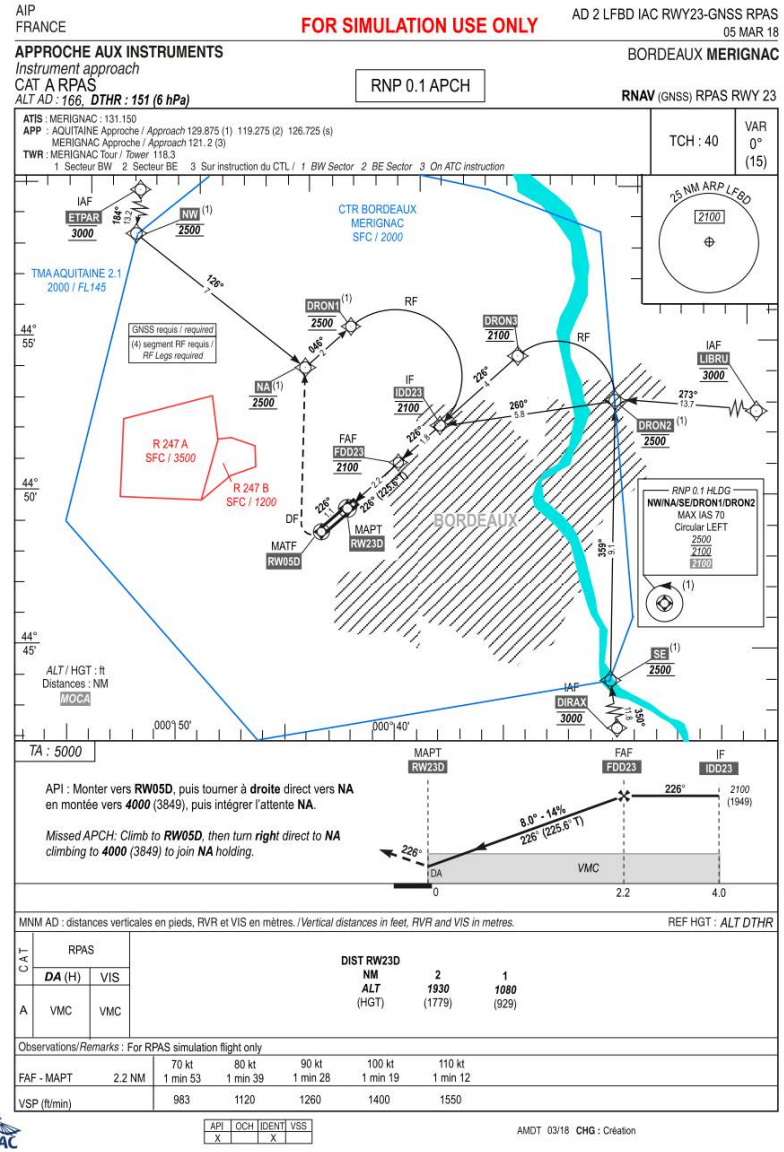
- ✓ OSED (Operational Service and Environment Definition) for TMA procedures, normal and abnormal
- ✓ Using real traffic (registered)
- ✓ 4 RPAS on arrival, departure, transit and specific operation
  - With 25 licensed Air Traffic Controllers
  - With pseudo Pilots and pseudo Remote Pilots
- ✓ GNSS approach followed by RPAS
- ✓ State RPAS following a car on the highway
- ✓ C2link loss

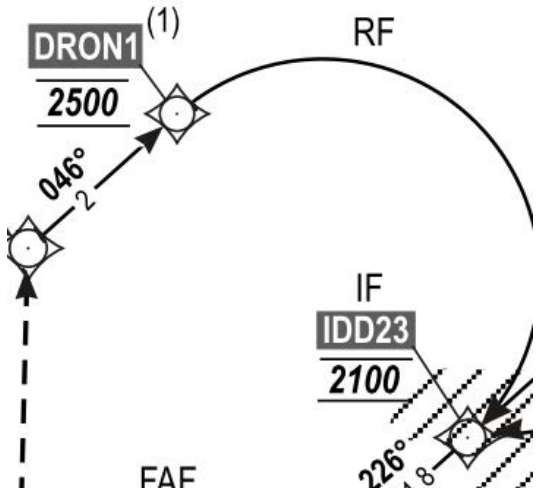
IFR RPAS tailored procedures

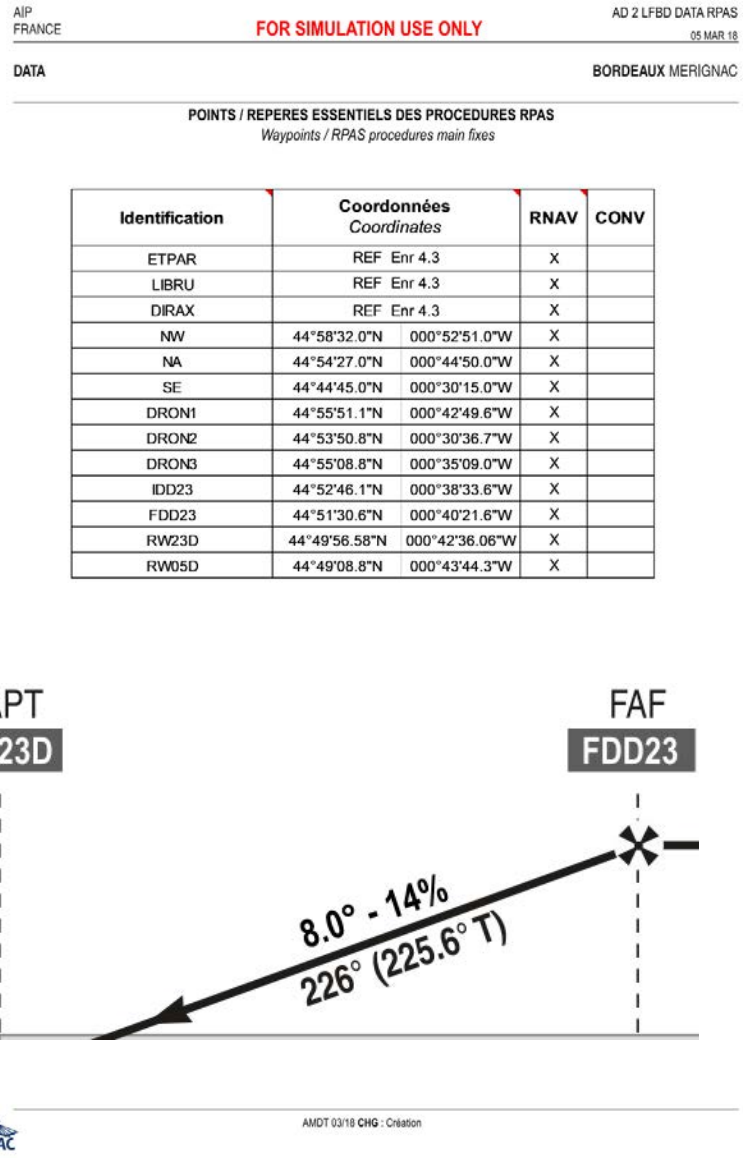
Proposals:

- Trajectories remaining into class C/D airspace to avoid unknown VFR
- Low flights (2500ft) to be separated from IFR departures and arrivals
- Use of Radius to Fix legs to avoid noise-sensitive urban area and reduce the dispersion of trajectories
- Use of brand new « circular shape holding » to separate RPAS from IFR
- Final approach steep angle and 1000m displaced threshold to reduce final approach time and avoid wake turbulence

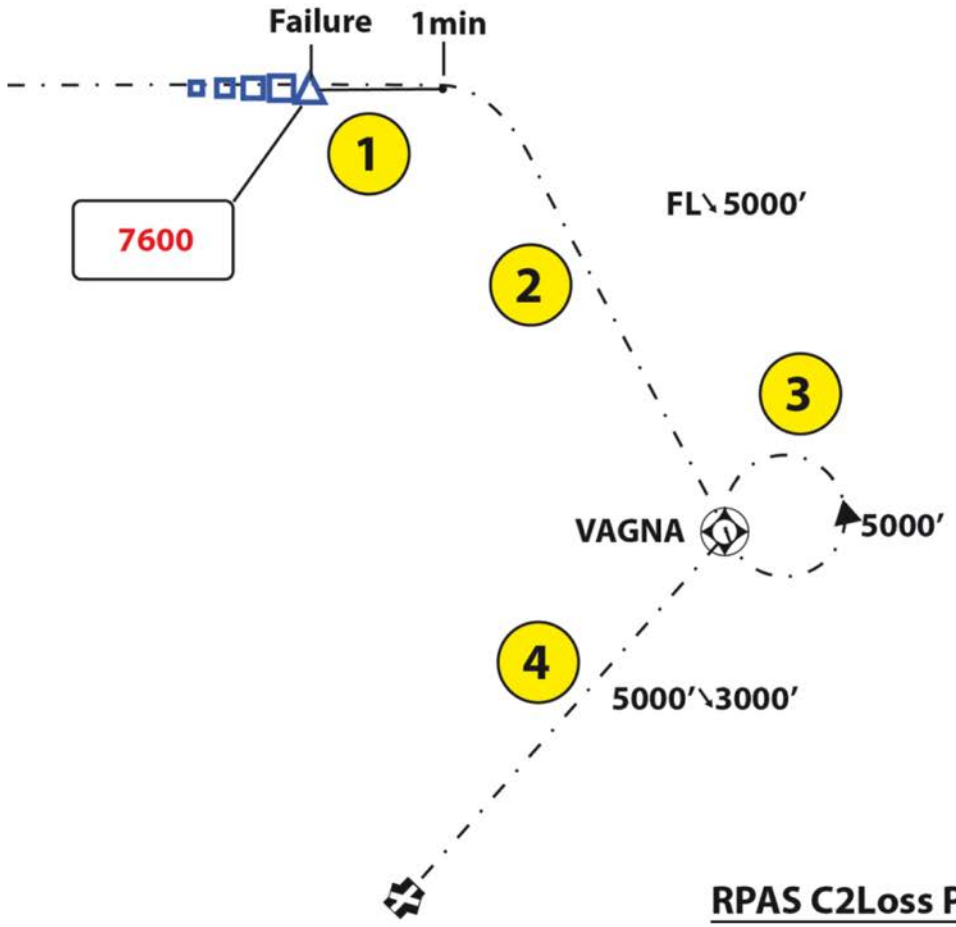
Experimental RPAS procedures in Bordeaux







IFR RPAS C2Link Loss Procedure



1. 7600 on transponder and continue on the last clairance 1min
2. Leave last Level cleared to 5000'
3. 1 circular Hold of 2min at 5000'
4. Depart on procedure

RPAS C2Loss Procedure

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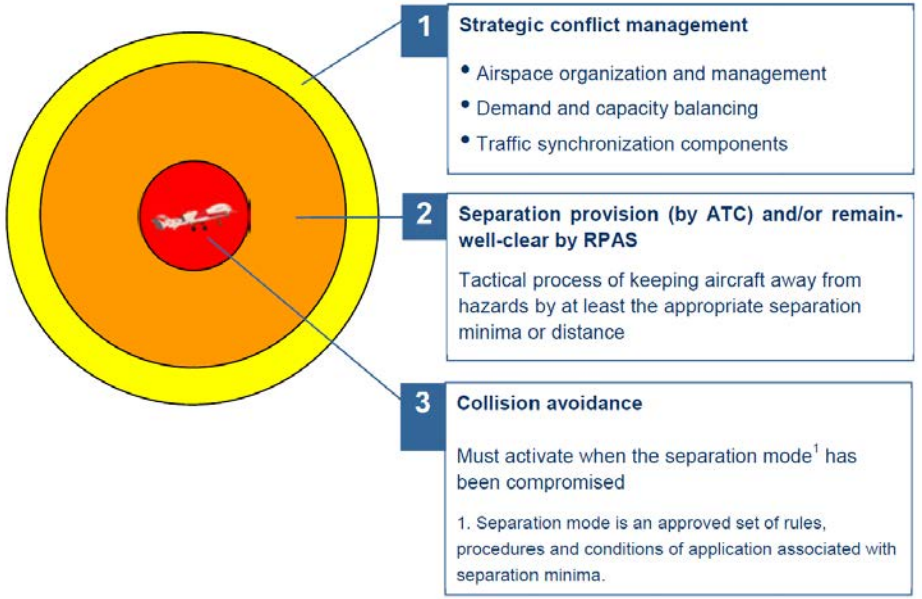

Fast Time simulations (on-going experiments):

- ✓ Using Eurocontrol traffic model (BADA 3)
- ✓ Testing ACAS Xu avoidance maneuvers
  - Vertical
  - Horizontal
- ✓ Manned aircraft equipped with TCAS
- ✓ Manned aircraft just equipped with mode S

IFR RPAS Integration, next steps

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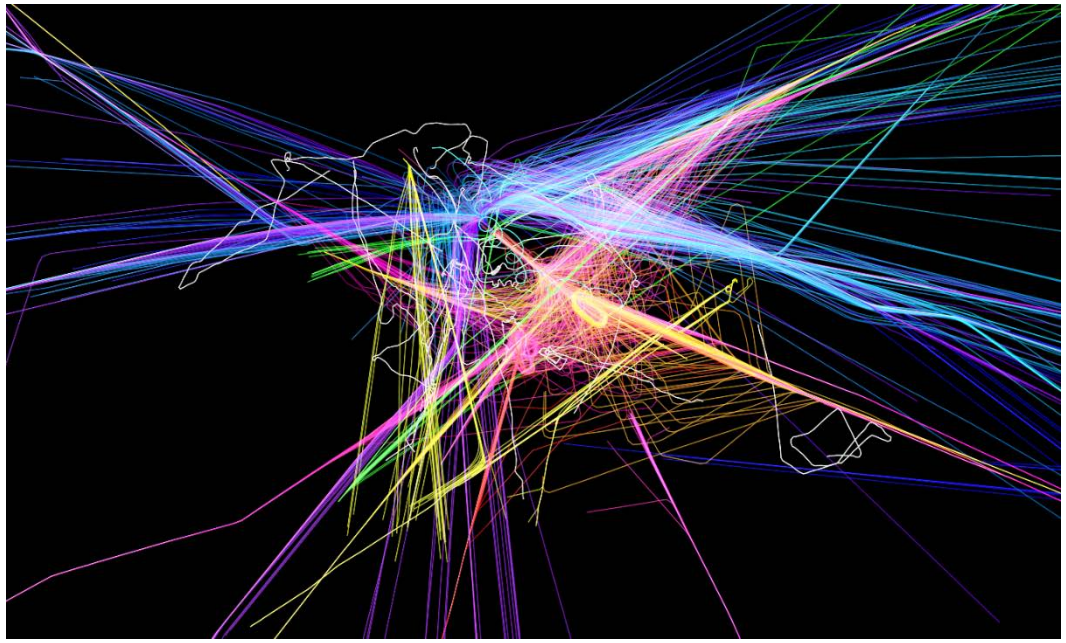

- Next steps in SESAR IR Wave 2:
  - RPAS integration with non cooperative aircraft
  - Improvement of operational procedures for versatile drones operations
  - Ground taxiing and airport safety nets for RPAS
  - ATCo training to be considered: Formation, Manex …
  - Remote Pilot formation and training
- Technological locks:
  - C2Link Performances
  - DetectAndAvoid capabilities

Conclusion

- Continue experimentations in order to feed the reflection on RPAS integration
- Develop collaboration with industrial people to unlock the potential of RPAS