Latest innovative technology trends in France in suborbital and air-launch systems

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COSPACE

A public-private initiative in France on Air-launch & suborbital aircraft systems

- Since 2015 in France, a Task Force co-chaired by DGAC and COSPACE, the French government-industry coordination committee on Space ;
- TF gathers all the relevant private and public stakeholders:
  - ✓ *Ministries (x 5), incl. those in charge of Transport (DGAC), Space, Defense, Foreign Affairs ..*
  - ✓ *CNES, the 'French Space Agency';*
  - ✓ *Industry and research organizations;*
  - ✓ *ONERA, the 'French Aerospace Lab';*
  - ✓ *Academia, universities & external experts as required ..*

- Periodic TF Plenary meetings + Ad'hoc sub-groups + Workshops and meetings with European & Int'l counterparts ;

- The TF works on all aspects: *potential regulatory & legal frameworks, safety, airworthiness & operation regulations, security issues, liability & insurance, environment, export control regulations, spaceports issues ...*

Open issues

- What are we (ICAO/UNOOSA) talking about?
  - *Suborbital and air-launch systems?*
  - *Only 'Local' operations? ('Point-to-point' in the scope as well?)*
  - *International operations or domestic Ops only ?*
  - *Very High altitude (VHA) RPAS, Stratospheric HAPS, HALE, Balloons ?*
- What to apply, "Air law", "Space law" or "Hybrid" *Sui Generis*?
- Who should regulate?
- How to protect occupants, air users & third parties on the ground?
- What safety level for the Vehicle/Op? *10^{-2} is not acceptable for manned Ops.*
- Liability and insurance issues?
- Legal robustness of the "Informed Consent"?
- How big is the market for: *manned flights / micro SATs to LEO*?
- Acceptance of third party licensing?
- Impact on aviation and potential Air traffic disruption?
- Export control issues (armaments): Wassenaar, MTCR, CIEEMG, ITAR?
- Accident investigation?
- Security against malicious acts, etc

France’s strong heritage

France has a long lasting and strong pioneering heritage in ultra-high performance aircraft starting in the **1940s** and **1950s**, *for example :*

Fig. SNCASO SO.9000 ‘Trident’
220 rocket flights
1953-1958

Fig. Dassault ‘Mirage III’, completed an unrivaled number of
20 000 rocket flights, with 99% observed availability.
Operated since 1955

Fig. Leduc with thermopropulsive nozzle (dropped by the ‘Languedoc’ SE-161 carrier-aircraft)
1946-1957

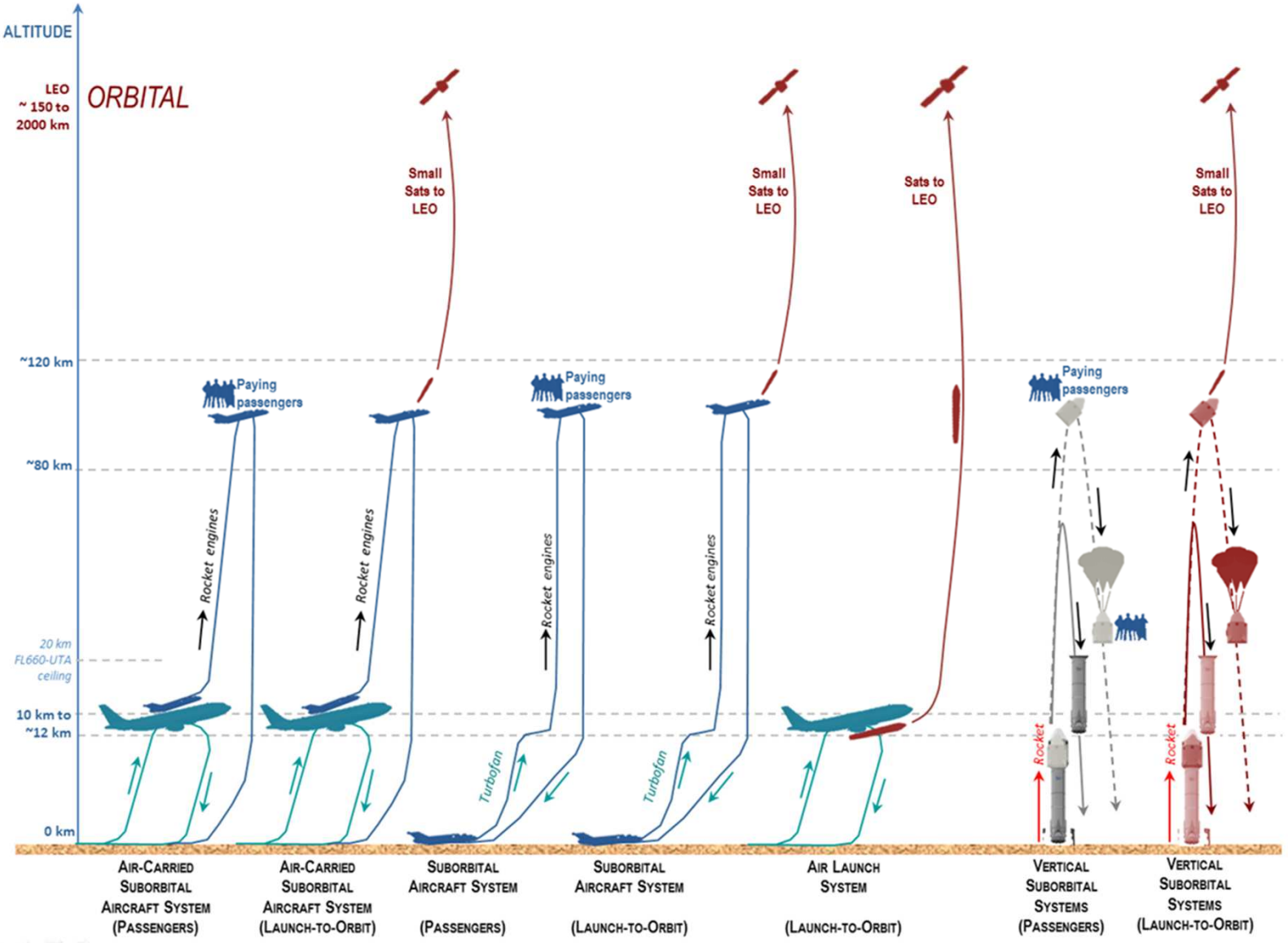
Today's Air-launch & Suborbital aircraft systems

Today, various innovative Air Launch and Suborbital systems are developped in France, amongst which:

- Suborbital Aircraft Systems (single or multi-stage, hybrid or not):
  - For manned operations (S&T, 'Discover space', astronaut training)
  - To launch small satellites into LEO orbit
- Air Launch Systems

French stakeholders also contribute to multiple aerospace projects and R&I activities in Europe and worldwide

Today's Air-launch & Suborbital aircraft systems / Various Systems and Scenarios



‘ALTAIR’ (ONERA)

- ALTAIR = ‘Air Launch space Transportation using an Automated aircraft and an Innovative Rocket’.
- European H2020 project coordinated by ONERA, the French Aerospace Lab (2016-2018); 8 Partners.
- Objective: demonstrate the economic and technical feasability.
- Target mission: 150 kg payload to LEO.

‘SpacePlane’ (AIRBUS)

- Airplane combining standard turbofan propulsion and certified rocket engine
- SpacePlane takes-off and lands from and to any (active and same) civil airport
- SpacePlane matches (current) environment related regulations : noise and emissions

SpacePlane, blending best of Aeronautics & Space

‘DANEO’ : a dedicated microsatellites airborne launcher

(DASSAULT AVIATION)

- **Market driven vehicle:**
  - 50 kg class up to SSO for a wide range of missions,
  - COTS technologies and reuse of existing facilities for an affordable cost.
- **Flexible air-launch concept:**
  - Native integration with air-traffic,
  - Launching from airports with multiple European launch sites,
  - On-demand configuration aircraft.
- **Closer to satellite manufacturers:**
  - Integration at the manufacturer facilities.

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DANEO = Design of an Airborne launcher concept for New Economic Opportunities

‘VEHRA’ : SUBORBITAL REUSABLE LAUNCHER FAMILY

(DASSAULT AVIATION)

- **Automated reusable aerospace transport system airborne by conventional commercial aircraft.**
- **A family of suborbital launchers for various missions:**
  - Vehra “Light”: demonstrator for risk reduction of the airborne concept and flying test bench,
  - Vehra “Medium”: to launch small satellites (250 kg) into dedicated LEO,
  - Vehra “Heavy”: to launch 7 tons into LEO.

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◂ *Vehra « Medium »*

VSH : MANNED SUBORBITAL VEHICLE

(DASSAULT AVIATION)

- **Manned suborbital vehicle derived from VEHRA:**
  - Airborne by a European civil transport aircraft,
  - Propelled by a rocket-engine.
- **Rapid aircraft (up to Mach 3.5) for short trip at the edge of space (or Karman line / 100 km).**
- **Missions:**
  - Private space explorers transport,
  - Aerospace applications (observation, science, etc.).

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Thank you

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