HAD1 - UAV systems

From the MS HADA
(Helicopter, Aircraft and Drone Architecture)

Highlights

- Designing Unmanned Aerial Systems
- EO/IR sensors for UAVs
- UAS airworthiness & traffic management
- Quadrotors architecture & modelling

Key elements

Period: **Mid-January to early February**

Estimated duration: **80 hours**

For whom:
recent graduates, jobseekers and experienced employees

Location:
ISAE-SUPAERO, Toulouse

Language: **English**

This certificate provides insight on the various payloads and sensors embedded on UAVs fitting with operational missions.

It also presents how UAS (Unmanned Aircraft System) airworthiness is managed depending on the operation and how the air risk can be mitigated with UTM (UAS Traffic Management).

It eventually gives the basic notions regarding drone safety & airworthiness, as well as drone guidance & navigation.

Learning objectives

After completing this course, participants will be able to:

- Analyze a full Unmanned Aerial System (UAS) in response to technical requirements.

- Have an overview of the control and guidance architecture of drones.

Prerequisites

- Basic knowledge in Aeronautics
- System design knowledge

Information and registration

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Course content

HAD500 – Drone systems: design & mission (25h)
- UAS markets, missions and roadmaps
- Overview of UAS in the world
- Short-range UAS, VTOL UAS, MALE, HALE, UCAV
- Civil Drone: surveillance, inspection, delivery, Taxi…
- Consumer and prosumer drones
- Optionally-piloted vehicles (OPV)
- Introduction to UAS design
- Safety challenge and regulations
- Flight avionics
- Mission system & data links: LOS, BLOS, SATCOM, RVT, LTE
- Sense & avoid capabilities
- Payload selection
- Ground control station

HAD501 – Payload & sensors for UAVs (22h)
- Introduction to usual sensors and payload for UAVs
- Review of EO/IR sensors, radars…
- Review of laser range finders, LiDAR, laser imaging techniques…
- Review of passive imaging techniques
- Image processing
- Autonomous navigation based on visual sensors: an introduction to navigation through vision and SLAM
- Payload and sensors for UAVs: Applications
- Visit of DELAIR company

HAD502 – Drone safety & airworthiness (15h)
- ICAO & EASA UAS regulation
- JARUS (Joint Authorities for Rulemaking on Unmanned Systems)
- SORA (Specific Operational Risk Assessment) methodology
- UTM/ U-space
- Tutorials on SORA methodology and management of the air risk.

HAD503 – Drone guidance & navigation (22h):
- Architecture of quadrotors : actuators, sensors, embedded systems, control systems
- Quadrotor modelling
- Quadrotor control architecture
- Fundamentals of control theory
- Design and tuning of inner loops control
- Overview of UAS in the world

Teaching methods

Teaching methods	Yes
Lectures / tutorial	X
Collaborative learning	
Flipped classroom	
Blended learning (online and face to face)	
Learning by doing	X
Project-based	
Simulation	X
Case study	X

Assessment

- **HAD500:** Oral exam
- **HAD501:** Written exam
- **HAD502:** Oral presentation and practical session
- **HAD503:** Lab report & Oral exam