

2014

# Mastère Spécialisé

## Aviation Safety - Aircraft Airworthiness



## Syllabus



La référence en Aéronautique

[www.enac.fr](http://www.enac.fr) →

## CONTENT and OBJECTIVES

### AERONAUTICAL SERVICES SUPPLIERS AND CONSULTANTS:

- THALES
- AIRBUS
- EGIS-AVIA

### ENTRY REQUIREMENTS

- At least a 5-year higher educational degree in Aeronautics
- Master of Science in Aeronautical Engineering, Computer Science or equivalent
- Bachelor's degree in the same fields, with at least an additional 3-year professional experience

Candidates whose mother tongue is not English must prove their knowledge

of the English language by supplying the official result of their Test of English

as a Foreign Language (TOEFL) or equivalent.

The minimum acceptable score is 520 (paper-based) or 190 (computer-based).

The optimized management of the air traffic activities implies to go beyond the perimeter of the air traffic to encompass the aircraft flight crew as well as the activities of aircraft operators in their operational management of flights.

The purpose of the Advanced Master in “Aviation and Air Traffic Management” is to provide a comprehensive view on interactions of all aviation players at operational level. It aims at giving an operational know how of a quickly changing aviation world towards more collaborative activities.

The objective of this Advanced Master is to prepare students to be system engineer or project leader. They will have to manage or to work within interdisciplinary teams in charge of improving processes or developing new applications allowing overall optimization of the Air Traffic Management. It includes airline operations, airport operations, and air navigation services providers.

In this frame, it deals with technical enablers and develops the operational objectives of the major European program in that field, called SESAR, aiming at implementing in Europe an optimized air traffic management.

The Advanced Master Aviation and Air Traffic Management prepares students to integrate and manage interdisciplinary teams with a view to taking up the position of systems engineer or project manager in the firm.

### PROFESSIONAL PROSPECTS AND CAREER OPPORTUNITIES:

- Avionics systems manufacturers
- Air traffic management systems manufacturers
- Aircraft manufacturers
- Airlines
- Aeronautical telecommunication companies
- Air Navigation Service ProvidersD

MS ASAA

## PRACTICAL INFORMATION

### **Enrolment:**

Application forms are available from January 2014.  
Applications must be filed before 6th of June 2014

### **Selection:**

On the basis of the application, possibly with an interview.

### **Course fees:**

The tuition fees for the Mastère Spécialisé “Air-Ground Collaborative Systems Engineering” are 12,500€.

### **Information and contacts:**

#### **Information:**

Mr Michel CHAUVIN  
Info\_master@enac.fr

#### **Enrolment:**

<http://masteres-specialises.isae.fr>

#### **Course Director:**

Mr. Claude HAILLOT  
Claude.haillot@enac.fr

# Content

Module	Course Director		Duration	
			hours	ECTS
NAV01 Flight envelopes	Jacques VERRIERE / Jacques VERRIER	ISAE	30h	45
NAV02 Structural Operating Limits	Laurent MICHEL	ISAE	31h	
NAV03 Aircraft Architecture and Load Calculation	Xavier JOLIVET /Didier DELORME	AIRBUS ISAE	30h	
NAV04 Propulsion	Yves BLOT /Didier DELORME	SAFRASN ISAE	32h	
NAV05 Avionics: Part1	Christian LE ROUX /Didier DELORME	ENAC ISAE	24h	
NAV06 Avionics: Part2	Christian LE ROUX /Didier DELORME	ENAC ISAE	28h	
NAV07 Aircraft Systems	Marc ROLLIN /Didier DELORME	AIRBUS ISAE	30h	
NAV08 Qualification Tests for on-board equipment and Systems used in Civil Aviation	Nicolas BOUYSSSEL /Didier DELORME	DGA ISAE	30h	
NAV09 Certification of an airliner	Claude HAILLOT	ENAC	85h	
NAV10 Safety of Complex Systems	Jean TROUILLOUD / Claude HAILLOT	APSYS ENAC	45h	
NAV11 On-Board Software & Complex Electronic Hardware	Christophe DELMAS / Claude HAILLOT	THALES AVIONICS /ENAC	31h	
NAV12 Air Transport Safety and Human factors	Philippe GABON / Anne Marie SCHAAL	Paris Université Descartes ENAC	32h	
NAV13 Production Organizational Approval	Jan BELLMANN / Claude HAILLOT	OSAC ENAC	26h	
NAV14 Operating Procedures	Muriel GIZARDIN	ENAC	31h	
NAV15 Maintenance Procedures	Claude HAILLOT	ENAC	30h	
NAV16 Continued Airworthiness	Muriel GIZARDIN	ENAC	29h	
NAV17 Airworthiness of state aircraft	LCL Aymeric ROGER	EOAA	56h	
<b>Total</b>			<b>600h</b>	<b>45</b>
Intership	Enterprise ENAC Tutor		4 to 6 months	30



# NAV01 – Flight Envelopes

**MS ASAA**

**Duration:**

30 hours + 1h Written Exam

**Date:**

From September 29 to October 3, 2014

**Course Director:**

Jacques Verrière (ISAE)

**ISAE Contact:**

Didier DELORME

**Presentation**

When dealing with airworthiness of an aircraft, the first thing is to understand how flight is achieved. This module provides the basic knowledge relative to the main flight phases and identifies the associated limitations.

**Pedagogical objectives:**

To study the basic concepts of aerodynamics and flight mechanics and thus provide the knowledge which is essential to understanding the operating techniques and the aerodynamic behavior of an aircraft in its different flight envelopes

**Content:**

**Definitions:**

- The trihedra of aerodynamics and flight mechanics
- Aerodynamic coefficients
- Standard atmosphere
- Anemometry

**Reminders in aerodynamics:**

- Incompressible polar equation.
- Influence of compressibility: transonic, supersonic

**Basic principles : balance of forces and moments:**

- Control surfaces, primary and secondary flight controls, hinge moments
- Balanced polar equation

**Performance: basic concepts:**

- Level flight: thrust required for flight
- Climb / Descent: propulsion ceiling
- Turns and manoeuvres : lift ceiling

**Handling qualities:**

- Flight balance: static stability and handling
- Concept of aerodynamic centre and manoeuvring point
- Longitudinal and lateral modes (phugoid, incidence oscillation, Dutch roll, spiral mode) (basic concepts)

**Operational aspects: limits and flight envelope:**

- Take-off
- Landing
- Cruising
- Aspects discussed: limitations (weight, balance), engine failure
- Operational envelope

**Methods:**

Courses and practical works

**Lecturers:**

- Experts from ISAE
- Experts from AIRBUS
- Experts from Air France



# NAV02 – Structural operating limits

MS ASAA

**Duration:**

31 hours + 1h Written Exam

**Date:**

From October 6 to 11, 2014

**Course Director:**

Laurent MICHEL (ISAE)

**ISAE Contact:**

Didier DELORME

**Presentation**

This module presents the basis of mechanics of materials. It gives the theoretical background necessary to understand the structural behaviour of an aircraft.

**Pedagogical objectives:**

To be able to study and calculate the distribution of mechanical stresses and constraints in a material in order to define the operating limits of a structure or item of equipment.

**Content:****Resilience:**

- Stresses
- Distortions
- Stress - Distortion relationships

**Behavior of beams when subjected to elementary loadings:**

- Diagrammatic representation - Links - General stress diagrams
- General stresses
- Bending moment
- Shear stress
- Torsional moment
- Static failure criteria
- Buckling

**Behaviour of plates (Diaphragm action):**

- Traction and shearing
- Buckling
- Aircraft materials (metals and composite)

**Behaviour laws**

- Choice of materials

**Methods:**

- Courses and practical works.

**Lecturers:**

- Experts from ISAE
- Experts from AIRBUS
- Experts from Centre d'Essais Aéronautique de Toulouse CEAT

# NAV03 – Aircraft Architecture and Load Calculation

MS ASAA

## Duration:

30 hours + 1h Written Exam

## Date:

From October 13 to 17, 2014

## Course Director:

Xavier JOLIVET  
(AIRBUS)

## ISAE Contact:

Didier DELORME

## Presentation

This module presents the forces applied to an aircraft as well as the distribution of loads on the different parts of the structure which is essential when it comes to design. This module deals with the structural sizing of the aircraft, based on its predictable operational use.

## Pedagogical objectives:

To be able to use the methods and means of calculating load distribution in the various parts of an aircraft (wings, fuselage, landing gear, etc.), as a function of its multiple operating phases, in order to determine the sizing of the structure.

## Content:

### Architecture and calculation of structures:

- Wings and control surfaces.
- Fuselage.
- Assemblies.
- Design philosophy

### Calculation of loads:

- In-flight loads
- Flight envelope
- Symmetrical manoeuvres
- Dissymmetrical manoeuvres
- Gusts
- Ground loads
- Landing
- Ground manoeuvres

### Fatigue of aeronautical structures :

- Damage tolerance

## Methods:

- Courses and practical works
- Visit to the structures activity of Direction Générale de l'Armement techniques Aéronautiques (DGATA)

## Lecturers:

- Experts from Airbus
- Experts from Centre d'Essais Aéronautique de Toulouse (CEAT)



# NAV04 – Propulsion

**MS ASAA**

**Duration:**

32 hours + 1h Written Exam

**Date:**

From October 20 to 24, 2014

**Course Director:**

Yves BLOT, SAFRAN  
- SNECMA

**ISAE Contact:**

Didier DELORME

**Presentation**

This module provides the basics required for understanding the aero-thermodynamic operation of the various types of engine for the purpose of engine certification and for certification of the propulsion system on an aircraft.

**Pedagogical objectives:**

To be able to understand the basics of aerothermodynamics principles of the various type of engines.

To understand the main requirements for the certification of engines and powerplant.

**Content:**

1. Review of thermodynamics applied to engines
  - General operating principles of engines
2. Propeller turbines and gas turbine engines
  - Turbojet engines
  - Technological progress
3. Materials
  - Pollution
  - Noise
4. Electronic control systems
  - Aircraft / engine interface problems
  - Engine design constraints connected with airworthiness regulations
6. Powerplant installations : APUs
7. Airworthiness regulations and certification tests

**Methods:**

Courses

**Lecturers:**

- Experts from Isae
- Experts from Airbus, Snecma, Microturbo and Turboméca
- Experts from Direction de la recherche et technologie





# NAV05 – Avionics: Part1

**MS ASAA**

**Duration:**

24 hours + 1h Written Exam

**Date:**

From October 27 to 30, 2014

**Course Director:**

Christian LE ROUX  
(ENAC)

**ISAE Contact:**

Didier DELORME

**Presentation**

The modules NAV05 and NAV06 provide a comprehensive view of avionics systems airworthiness issues as a part of the qualification and certification process of aircraft.

This module presents theoretical aspects related to safety and dependability, methodologies for design and development of on-board systems, and regulations aspects and safety issues related to avionic systems.

**Pedagogical objectives:**

After completing this course, the student will be able to:

- Explain the main safety and dependability analysis techniques.
- Explain the current methods for design and development of on-board systems.
- Explain the airworthiness requirements and safety issues related to avionic systems, particularly for flight data recorder, aircraft monitoring and navigation systems

**Content:**

- Safety and dependability analysis techniques
- Methodologies for design and development of on-board systems
- Architecture and operations, and airworthiness requirements of
  - flight data recorder
  - man machine systems and aircraft monitoring
- navigation systems

**Methods:**

Courses

**Lecturers:**

- Experts from CNRS-LAAS,
- Experts from Airbus
- Experts from BEA

## MS ASAA

### Duration:

28 hours + 1h Written Exam

### Date:

From November 10 to 14, 2014

### Course Director:

Christian LE ROUX  
(ENAC)

### ISAE Contact:

Didier DELORME

### Presentation

The modules NAV05 and NAV06 provide a comprehensive view of avionics systems airworthiness issues as a part of the qualification and certification process of aircraft.

This module presents the evolution of avionic systems architectures over the past thirty years, their main characteristics together with the airworthiness requirements, and focuses on the automatic flight control systems.

### Pedagogical objectives:

After completing this course, the student will be able to

- Describe the architecture and operations, and explain the airworthiness requirements of the following avionic systems:
  - Electrical flight control system
  - flight management system
  - auto-flight system
  - CNS systems
  - Inertial reference system
- Describe FMGS A320 operations and ACAS operations
- Explain particular AFCS topics.

### Content:

- Flight control law design
- Flight management system
- Auto-flight system
- CNS systems
- CNS rules making process
- Inertial reference system
- Illustration through practical work (ENAC):
  - FMGS A320 operations
  - ACAS operations
  - AFCS topics
- Visit at Airbus: A380 "iron bird".

### Methods:

Courses, practical work and visit

### Lecturers:

- Courses : Expert from Airbus and ENAC
- Practical work: experts from ENAC (FMGS simulation + AFCS topics presentation) and DTI (ACAS demonstration)



# NAV07 – Aircraft Systems

**MS ASAA**

**Duration:**

30 hours + 1h Written Exam

**Date:**

From November 17 to 21, 2014

**Course Director:**

Marc ROLIN (AIRBUS)

**ISAE Contact:**

Didier DELORME

**Presentation**

A sound knowledge of the most important aircraft systems is necessary for any airworthiness activities. This module presents such systems for modern large aircraft.

**Pedagogical objectives:**

To study the various types of system (e.g. hydraulic systems) which exist on an aircraft, in consideration of the concepts of safety, by providing multiple networks.

**Content:**

**Air systems**

- Air production
- Air conditioning (thermal budgets, temperature control, forthcoming changes, weight and balance)
- Cabin pressurization
- Ventilation of electronic systems
- General distribution (cockpit, cabin, baggage compartments and bays; problems concerning comfort, humidity, filtration, ozone, etc.)
- Anti-icing - Presentation of control / indication and parameters in the cockpit

**Hydraulic systems**

- Performance objectives, safety and maintenance (with their consequences on the choice of general architecture)
- Resulting general architecture
- Design of a system
- Integration tests on a global test bed
- Presentation of control / indication and parameters in the cockpit
- Accessories, fluids used
- Forthcoming changes

**Landing gear systems**

- Airworthiness requirements : Ground loads, design and construction
- Retraction / extension systems
- Shock absorber
- Nose-wheel steering
- Braking system
- Cockpit equipments
- Overview of maintenance
- Pilot presentation

**Electrical systems**

- Performance and safety objectives (with effects on the choice of general architecture - redundancy and segregation)
- Resulting architecture
- Presentation in the cockpit - Equipment and accessories



## Fuel systems

- System functions
- Tanks (design and problems)
- The different systems
- Gauging system
- Pilot presentation
- Fuel specifications
- Installation of equipment and accessories

## Methods:

- Courses
- Visit to the Centre d'Essais Aéronautique de Toulouse DGATA
- Visit to Liebherr Aerospace Toulouse

## Lecturers:

- Expert from BF Goodrich
- Experts from Institut National des Sciences Appliquées INSA
- Experts from Airbus



# NAV08 – Qualification tests for On-Board equipment and systems used in Civil Aviation

**MS ASAA**

**Duration:**

30 hours + 1h Written Exam

**Date:**

From November 24 to 28, 2014

**Course Director:**

Nicolas BOUYSSSEL  
(DGA)

**ISAE Contact:**

Didier DELORME

**Presentation**

This module presents the tests to be carried out in order to obtain the certification of On-board systems with respect to the electrical, electromagnetic, Shock, vibration and climatic environments, particularly as described in DO 160 G, which is the reference document.

This course is oriented towards the new conditions dealing with electromagnetic aggressions.

**Pedagogical objectives:**

To be able to explain the main standards related to the qualification of on-board systems, as prescribed by the DO160 G.

**Content:**

**Context, DO 160:**

- Reminder of the general context of avionics evolution
- Electromagnetic phenomena
- Civil - military duality: DO 160

**Equipment / Accessory and systems tests**

- Current standards and test methods for equipment and system certification
- Acceptable methodology and method of demonstration
- Chicago Convention

**Electromagnetic aggressions**

- Direct effect lightning: zoning, etc.
- Indirect effect lightning
- High intensity radiated field
- Electrostatic discharges.

**Electromagnetic compatibility**

- Fundamental principles
- Emission
- Susceptibility

**Electrical test**

- AC and DC power supply
- Harmonic
- Ripple rejection

**Mechanical test**

- Shock
- Vibration
- Typical spectrum

**Climatic test**

- Temperature and temp variation
- Humidity
- Salt fog



## Specific tests

### Main electromagnetic protection systems

- Shielding
- Filtering
- Non-linear devices
- Common and serial rejection ratio
- Software aspect

### Methods:

- Courses
- Visit to the mechanical and environment EMC (Electromagnetic Compatibility) test laboratory
- Visit to the lightning test laboratory

### Lecturers:

- Expert from Direction Générale de l'Armement Techniques Aéronautiques
- Experts from Airbus
- Experts from DASSAULT AVIATION



# NAV09 – Certification of an airliner

**MS ASAA**

## **Duration:**

885 Hours (2 weeks + 3 day-project)  
+ 1h Written Exam +  
0.5 h Oral Presentation

## **Date:**

Lectures: From  
December 1 to 12, 2014  
Projects: From  
December 15 to 17,  
2014

## **Course Director:**

Claude HAILLOT  
(ENAC)

## **ENAC Contact:**

Claude HAILLOT  
(ENAC)

## **Presentation**

To ensure safety of passengers, crew and people on the ground, aircrafts have to be Type Certified (TC) before entry into service. To have this approval granted, procedures, process and technical requirements are defined by the airworthiness authorities and manufacturers have to comply with.

Then, aircraft have to be produced in series in conformity with the approved design (TC). Each individual aircraft shall have a Certificate of Airworthiness (CofA) delivered by the State of registry after verification of its conformity. TC and CofA have to be delivered according to international standards defined into the ICAO Annex 8 in order to allow international air transportation.

## **Pedagogical objectives:**

To know and understand international regulations and concepts and in particular how ICAO airworthiness principles are implemented in EU.

To know the basic principles used to guarantee the highest level of safety for Air Transport.

To know EU requirements, procedures and methods used for the Aircraft certification process, from design to production.

To have a clear understanding of a certification program management and the validation of foreign products.

To understand the certification process of aircraft systems.

## **Content:**

1. Introduction to the airworthiness of an airliner  
Safety objectives and current Safety level, ICAO Appendix 8 principles, TC, TC for Import, bilateral agreements, CofA.
2. European Aviation Safety Agency(EASA):  
EU Requirements, Structure, EASA missions
3. Part 21, Certification procedures  
General principles, structure, Design Organization Approval (DOA), guidelines for Production Organization Approval (POA).
4. The certification process  
Organisation of a Certification program, certification Basis, Means of Compliance, certification demonstrations, TC approval and associated documents.
5. Individual Certification  
Issuance of individual Certificate of Airworthiness
6. Certification of systems:
  - Powerplants
  - Structures
  - Avionics system
  - Hydromechanical systems
  - Electrical systems
  - In-flight tests, performances
  - Cabin safety



7. Specific Certification: ETOPS
8. Half-day visit to the Airbus in-flight test unit

**Bibliography/ ref. documents:**

ICAO Annex8, Part 21, CS-25

**Methods:**

- Courses, industrial examples, visit, project

**Lecturers:**

- Experts from EASA, DGAC and Flight Test Center CEV
- Experts from the ENAC Air Transport Department
- Experts from Airbus





# NAV10 – Safety of Complex Systems

**MS ASAA**

**Duration:**

From January 6 to 16, 2015

**Date:**

From January 6 to 16, 2015

**Course Director:**

Jean TROUILLOUD  
(EADS-APSYS)

**ENAC Contact:**

Claude HAILLOT

**Presentation**

The safety analysis of complex systems is a key point in large aircraft certification and is used to guarantee the safety throughout the entire life of the aircraft. This module presents the methods and tools used for such analysis.

**Pedagogical objectives:**

- To be able to explain the safety analysis concepts
- To be able to use the main methods and tools used for such analysis

**Content:**

3. Introduction and objectives
  - Introduction - Definition of basic concepts
  - Link with certification regulations
  - Interactions between the various analysis methods
2. Dependability techniques and tools
  - Fault trees, FMEA
  - Markov sequences
  - Functional analysis
  - Mathematical tools
  - Experience feedback, need for the approach and method used: collection, analysis, capitalization and transmission, calculated examples
  - Reliability of systems, standards, models of laws, statistical tests showing the appropriateness of these laws, connections between safety analysis and Certificate of Airworthiness, combined failures, use of fault diagrams versus Markov graph
3. Methods of reliability analysis
  - Fault configurations method
  - Analysis of particular risks (example of protection against engine burst), path model, risk minimization, identification of catastrophic cases, calculation of risk level.
  - Taking installations into account
  - Connection with maintenance, in-flight tests, ground tests
4. Evolution of analysis techniques and their application to other fields
  - Risk management concept

**Methods:**

courses, practical work, visit

**Lecturers:**

- Experts from APSYS
- Experts from AIRBUS





# NAV11 – On-Board Software & Complex Electronic Hardware

**MS ASAA**

## Presentation

Modern aircraft are equipped with many computer systems. Airworthiness requirements for embedded Software and Complex Electronic Hardware techniques are the scope of this module.

The module presents the concepts and objectives of standards EUROCAE ED-12 / RTCA DO-178 applicable to on-board software and EUROCAE ED-80 / RTCA DO-254 applicable to Complex Electronic Hardware, used on civil aircraft subject to a certification procedure. The aim is to carry out, at the same time, a review of the software and hardware techniques that are the most commonly used today in the creation of on-board computer systems. The module is enriched with experience from manufacturers and certification organizations, including concrete application examples from A380 and A400M experience.

## Pedagogical objectives:

To be able to understand the concepts and requirements of both DO-178 and DO-254, and to analyze software and hardware processes and techniques commonly used in the creation and for the certification of the on-board computer systems.

## Content:

### System safety versus software / hardware criticality levels

- Introduction to FAR / CS 25-1309 regulations and development assurance level.
- Determination of the hardware and software criticality levels
- Downgrading of the software criticality level according to the system architecture.

### General concepts for software and hardware engineering

#### ED-12/DO-178 and ED-80/DO-254 concepts and objectives

- Details of the software / hardware development requirements according to the criticality levels: development process and integral process, transition criteria, life cycle model, traceability, documentation, tools qualification, alternative methods.
- Details of software / hardware verification requirements according to the criticality levels: reviews, analyses and tests, functional and structural coverage, robustness, test environments, documentation.
- Details of configuration management requirements: identification of the configuration, management of modifications, category CC1 and CC2, documentation.

### Duration:

From January 19 to 23, 2015

### Date:

from 29th of September to 10th of October, 2014

### Course Director:

Christophe DELMAS,  
Thales Avionics

### ENAC Contact:

Claude HAILLOT



- Details of quality assurance requirements according to criticality levels: awareness, quality assurance and control, conformity review, documentation

### **Certification liaison and regulatory evolutions**

- Details of the certification liaison process: audits, documentation
- Structure, role and responsibilities of airworthiness authorities
- Recurring issues for certification : oriented object languages, formal methods, model based design, incremental certification, DO-178C versus DO-178B

### **Case studies**

- Overview of the general architecture of a critical on-board system and software
- Detailed analysis of a software module development and verification
- Detailed analysis of the certification of a Complex Electronic Hardware component

### **Methods:**

Courses and practical works

### **Lecturers:**

- Experts from THALES Avionics
- Experts from DGATA





# NAV12 – Air Transport Safety and Human Factors

**MS ASAA**

**Duration:**

32 hours + 1h Written Exam

**Date:**

From January 26 to 30, 2015

**Course Director:**

Philippe GABON, Paris Université Descartes

**ENAC Contact:**

Anne Marie SCHAAL

**Presentation**

More than 70% of large aircraft accidents are due to human errors. This module deals with this issue and point out the links between it and the design or operations of large aircraft.

**Pedagogical objectives:**

To be able to understand the human factors issues and theirs relationships with aircraft certification and design.

**Content:**

- The standard aircraft control concept. Pilot behavior under stress in abnormal situations
- Systems engineering safety
- The main principles of ergonomics applied to the design of complex systems.
- Navigation monitoring and human factors experience feedback.
- More specific problems connected with new technologies (automation of aircraft and of air traffic control).
- The relationship between aircraft design and crew training

**Methods:**

Courses

**Lecturers:**

- Experts from the French Civil Aviation Authority DGAC and Flight Test Center CEV
- Experts from Institut de Médecine Aérospatiale du Service de Santé des Armées IMASSA
- Experts from French Universities
- Experts from Airbus and Boeing



# NAV13 – Production Organisation Approval

MS ASAA

## Duration:

27 hours + 1h Written Exam

## Date:

From February 2 to 5, 2015

## Course Director:

Jan BELLMANN (OSAC)

## ENACContact:

Claude HAILLOT

## Presentation

The constantly increasing complexity of aircraft induces the need for the certification authority to adapt its airworthiness monitoring methods. Although it is still possible to carry out systematic checks on each and every airworthy product, airworthiness monitoring is actually oriented towards a concept based on the supervision of the organization which designed, manufactured and/or maintained the airworthy products. Approval of the product-organization pair is becoming a reference for carrying out efficient monitoring. Approval is therefore based on an organization which demonstrates that it knows the applicable regulations, that has full control over the quality of its manufacturing processes and that it implements the airworthiness follow-up of its products. Quality control is an essential component of the airworthiness process and of the design and operation of an aircraft. The concepts of quality are therefore defined in specific statutory requirements within the European regulations.

## Pedagogical objectives:

- To be able to explain the main requirements applicable to production
- To understand the constraints for any aircraft or equipment manufacturer

## Content:

- Missions of the States in Safety matters
- Quality management systems
- Practical aspects of aeronautical quality control
- EASA Form 1 (manufacturers) and Form 52
- International cooperation between states
- Part 21 approvals for production
- Product quality guaranteed by the manufacturer
- Monitoring of procured supplies
- The QUALIFAS System
- Monitoring Approval as seen by the Authority

## Methods:

courses, industrial examples, visit

## Lecturers:

- Experts from Organisme pour la Sécurité de l'Aviation Civile OSAC
- Experts from Airbus, ATR and EUROCOPTER
- Experts from Intertechnique



# NAV14 – Operating Procedures

**MS ASAA**

**Duration:**

: 32 hours (including 2 hours of flight simulator)  
+ 1h Written Exam

**Date:**

From February 9 to 13, 2015

**Course Director:**

Muriel GIZARDIN  
(ENAC)

**ISAE Contact:**

Didier DELORME

**Presentation**

Aircraft operations are also a key point for safety in civil aviation. This module deals with air operator certification, operating limitations and documentation.

**Pedagogical objectives:**

- To know the regulatory conditions to conduct commercial air transport operations and the airline organization necessary to comply with such rules
- To be able to explain the air operator certification process
- To know the main principles of airline fleet and flights management
- To be able to understand the aircraft operating limits
- To be able to describe the contents and values of operating documentation

**Content:**

**Introduction and regulatory aspects: ICAO annex 6, AOC, EU-OPS.**

**Operation and use of the aircraft:**

- Airline organisation and flight scheduling.
- Airline management.
- Flight operations, a/c limitations and in-flight performances.
- Flight simulators.

**Operational documentation:**

- Flight manual.
- FCOM.
- Operations manual.
- MMEL / MEL.
- Performance calculation software

**Methods:**

- Courses
- Computer based exercises
- Flight simulations sessions

**Lecturers:**

- Experts from the ENAC Air Transport Department
- Experts from Airbus
- Experts from Air France





# NAV15 – Maintenance procedures

**MS ASAA**

**Duration:**

31 hours + 1h Written Exam

**Date:**

From February 16 to 20, 2015

**Course Director:**

Claude HAILLOT (ENAC)

**ENAC Contact:**

Claude HAILLOT

**Presentation**

The maintenance of an aircraft involves the manufacturer, the airline and its maintenance organization. This module deals with the applicable regulations, the airline responsibilities for aircraft continuing airworthiness and the development of a maintenance program.

**Pedagogical objectives:**

Be able to explain the main requirements applicable to and constraints for any maintenance organization and to be able to explain the maintenance program development.

**Content:**

1. Introduction – Regulations – Objectives
  - Role of the Authorities. Bilateral relations and international agreements.
  - EASA regulations part M (responsibility of the operator in terms of maintenance) : CAME, Maintenance program, Technical log.
  - EASA regulations. Part 145, Part 147, Part 66.
  - Operator / workshop relations.
  - Maintenance Review Board.
  - Maintenance / certification interface.
  - Documentation.
2. MSG 3 and Manufacturer maintenance Program  
History of the method, choice of tasks, substantiation, presentation of the development of a maintenance program with two implementation aspects: systems on the one hand, and zone analysis on the other.
3. Reliability program
4. Maintenance within an airline  
Day-to-day management, implementation of maintenance teams at home base and at stopovers, forecasting, costs of maintenance for an airline.
5. Half-day visit to a Part 145 Maintenance Organisation

**Methods:**

- Courses, industrial examples, visit

**Lecturers:**

- Experts from the French Civil Aviation Authority DGAC
- Experts from Airbus and NDT Expert
- Experts from Air France Industries



# NAV16 – Continued Airworthiness

**MS ASAA**

**Duration:**

29 hours + 1h Written Exam

**Date:**

From February 23 to 27, 2015

**Course Director:**

Muriel GIZARDIN

**ENAC Contact:**

Muriel GIZARDIN

**Presentation**

During the Type Certification (TC) of an aircraft, a level of safety is determined. Once the aircraft have entered in service, it is necessary to maintain this level of safety and, if necessary, to restore it when an unsafe condition appears. Those objectives are covered by the continued airworthiness concept.

This module presents the monitoring methods, the reliability check and the airworthiness follow-up. The analysis of accidents and their consequences are also studied as a part of this course.

**Pedagogical objectives:**

- To explain the continued airworthiness concepts and their importance for the safety level.
- To know who plays a part in this process.
- To describe the different post TC activities.
- To understand how events are analysed and investigated.

**Content:**

1. Changes to Type Certificate
  - Derivative concept. CPR.
  - Approval of manufacturer modifications.
  - Approval of Supplemental Type Certificates.
  - Approval of repairs.
2. In service experience feedback
  - System of collection.
  - Reporting to the Authority.
  - Analysis.
  - Corrective actions and airworthiness directives.
3. Records of incidents within an operator
  - Method.
  - Utilisation.
  - Analysis of flights.
4. Accident investigations
  - I.C.A.O. Appendix 13.
  - Organization responsibilities.
  - Investigation.
  - Appraisals.
  - Investigation boards.
  - Investigation report and recommendations.

**Methods:**

- Courses

**Lecturers:**

- Experts from the ENAC Air Transport Department
- Experts from Airbus
- Experts from Air France and Airbus Transport International







# NAV17 – Airworthiness of state aircraft

**MS ASAA**

**Duration:**

57 hours ( 36 h cours +  
20h visites + 1h Written  
Exam)

**Date:**

From March 2 to 15,  
2015

**Course Director:**

Lcl Aymeric ROGER  
(EOAA)

**Presentation**

The aim of this module is to present French airworthiness regulation concerning of State aircraft (aircraft operated by governmental organizations for military, customs or civil defense purposes), as well as the procedures for insuring the continuing airworthiness, the operations and the continued airworthiness of those aircraft.

**Pedagogical objectives:**

The aircraft airworthiness must be certified and maintained in agreement with regulations.

The objectives of this module are to study and understand how the following topics are applied for state aircraft :

- concept of airworthiness
- regulatory system
- aeronautical concept of authorities
- French regulation relating to state aircraft.

**Content:**

This seminar introduces the concept of airworthiness, and the corresponding regulations as well as the concept of aviation authority.

Decree No. 2006 - December 07, 2006 1551 integrates and adapts to the French State aircraft (military or used by the State) the principles of airworthiness, regulations and authorities introduced by the Chicago convention.

The concept of aircraft airworthiness will be developed by the monitoring of State aircraft through:

- presentation of State actors and responsibilities for definition, production, certification and operation. State particularities of these processes will be highlighted,
- Practical examples “on the field” for maintenance, RH training, audit and case studies (A400M),
- Some references on airworthiness for state aircraft in other countries.

**Visits:**

- Visit of the “AIA” at CUERS – maintenance of State aircraft
- Visit of Eurocopter site (Marignane) – State helicopters
- Visit of Fly Test Center (Istres Air Base)
- Visit of C135FR Maintenance Unit (Istres air base)



## Industrial sequence (April to September)

**MS ASAA**

The course is completed with a 4 to 6-month internship in a professional environment either in France or abroad.

The internship is supervised by a tutor from the host organisation and by a scholarship tutor from ENAC.

The student is required to produce a professional thesis which he/she defends before a combined jury made of professors and professionals.





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