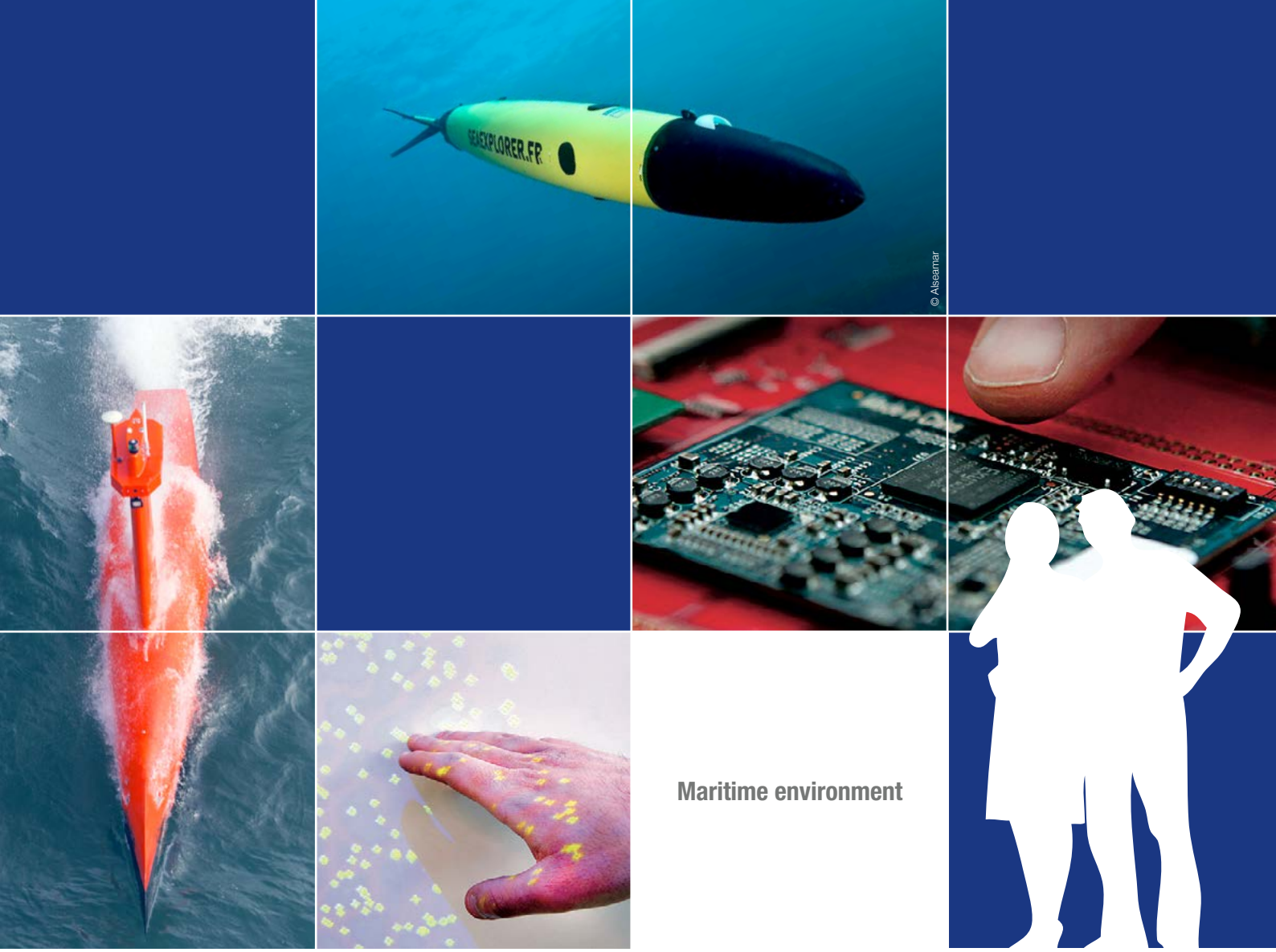


Maritime environment

MS® DEMAS:

Design and Exploitation of Autonomous Maritime System

École Nationale Supérieure
de **Techniques Avancées**

ENSTA
ParisTech

MS DEMAS (MASTÈRE SPÉCIALISÉ®)

The curriculum DEMAS aims at training technical specialists on the emergent theme of the design and exploitation of maritime autonomous systems, by giving a double expertise, on one hand in mechanical design for maritime systems, and on the other hand in software engineering, informatics skills for smart systems and cyber-security.

The program is held by both ENSTA ParisTech and ENSM. ENSTA ParisTech has a longstanding tradition in design maritime engineering for more than 200 years, while ENSM, based on the legacy of hydrogarphic schools founded by Colbert in the 17th century, is the key actor for the training of merchant navy in France.

OBJECTIVES

Autonomous systems are more and more appreciated and used in maritime engineering thus constituting an important vector for development. The first steps toward empowerment has been pioneered with ROV (Remotly Operated Vehicles) and AUV (Autonomous Underwater Vehicle) which are now routinely used in a number of applications ranging from maintenance to prospection. Nowadays, new ideas are emerging with the advent of autonomous surface vessels (USV : Unmanned Surface Vehicles) and the growing utilisation of artificial intelligence onboard (e.g. decision support), together with the existence of cartography services operated by gliders and/or remote operations.

The aim of this curriculum is to give a double competence to students, both in mechanics and informatics, so that they should be able to understand and cope with integrated developping programs on autonomous maritime systems. This core training is completed by a number of key notions in system engineering, exploitation challenges, maritime law and classification/regulation to complete the acquired knowledge with operational skills. The partnership between ENSTA ParisTech and ENSM is the vector for combining specialised technical competencies to professional use in order to train multitask professional profiles, specialised in autonomous systems.

PROSPECTS

Autonomisation of maritime systems is a broad movement that shares implications in all the fields that are related on one way or another to maritime engineering. Be it in transport sector (automatisation of container ships, ongoing projects for the development of a completely autonomous container feeder), energy area (monitoring and maintenance of oil wells, automated prospects, cartography), and in the military or civil domain (on the use of maritime drones for control monitoring, mine detection, ...) ; a number of opportunities will be given to students that will benefit from the double technical competence in order to grasp all the aspects of a maritime autonomous system.

The companies in the maritime field developping autonomous technologies range from petroleum and para-petroleum industries (e.g. TechnipFMC, Saipem, Doris Engineering, d2m, ...), marine energies companies (e.g. Woodgroup Kenny, Principle Power, EOLFI, ...) to the important groups of shipbuilding (e.g. Naval Group, STX, ...), certification and regulation companies (BureauVeritas, DNV-GL). The size of the companies varies a lot from large companies (TechnipFMC, Naval Group, STX, ...) to small or medium-sized enterprises (SME) engaged to niche markets for auton omous systems (e.g. SubseaTech, iXBlue, Sofresud, COMEX, ...) used with the goal of inspection, monitoring, maintenance, cartography or data collection in a broad sense.

> What is the duration of the training program ?

The training program lasts 13 months, from September.

September to February: more than 500 hours of lessons, tutorial and projects.

March: full month dedicated to a tutored project.

April to September: internship with a report and an oral defence.

> Where is the training program located ?

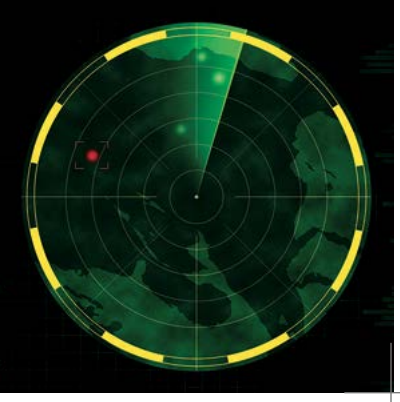
All the lessons are given at ENSTA ParisTech in Palaiseau, except for one training week in ENSM Marseille.

Support of professionals from the maritime sector

The courses are given by professors from ENSTA ParisTech and ENSM, as well as a number of professionals from the leading industries in autonomous systems: Bureau Veritas, Naval Group, Technip FMC, SAIPEM, STX Europe, GICAN, DNV/GL, ECA, SHOM, iXBlue et IFREMER.

Teaching language

All the courses are in english.



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PROGRAM

The main objectives of the DEMAS training program is to give the technical, operational, regulatory and economic basis for the design and exploitation of maritime autonomous systems, in order to prepare specialists, able to evolve in this emerging sector. The courses are divided into four main skill axes that are respectively:

1. **Design in maritime environment:** hydromechanics basis for the design of autonomous maritime systems (naval hydrodynamics, seakeeping, stability, propulsion).
2. **Decision-making autonomy and cyber-security:** system command, navigation system for mobile robotics, architecture of information systems and cyber-security.
3. **Exploitation of autonomous systems:** pros and cons, missions of an autonomous system, past, present and future of autonomy, prospective views in emerging area.
4. **Regulation, strategy and innovation:** national, european and international maritime regulations, industrial and innovation economics applied to autonomous systems.

MSE Mastère spécialisé®

Lessons	hourly volume	ECTS
Marine Hydrodynamics	**35h**	**4**
System approach and design in maritime engineering	**28h**	**3**
Underwaters robotics: design optimization	**24h**	**3**
Robotics	**23h**	**2**
Decision-making autonomy	**21h**	**2**
Location and navigation	**16h**	**2**
Cyber-security	**35h**	**4**
Introduction to ROS and Python	**21h**	**2**
Maritime environment	**27,5h**	**4**
Risk analysis	**14h**	**1**
Exploitation of autonomous systems	**38h**	**4**
Regulation	**34,5h**	**4**
Industrial organization	**21h**	**2**
Innovation economy	**21h**	**2**
Tutored project	**150h**	**6**
Internship	**6 months**	**30**

Useful **informations**

REQUISITE CONDITION OF ELIGIBILITY

- Master's degree
- Master of Science + 3 years of professional experience

APPLICATION FORM

Deadline and jury schedule are available on the website **www.ensta-paristech.fr**.

TIME SCHEDULE

- **13 months of training program**
  - > September to March: lessons and projects
  - > April to September: internship

COST OF THE TRAINING

- individuals in initial training: **7 000 €**
- continuous training with a company agreement: **12 000 €** plus **200 € of registration fee**

TRAINING LOCATION

ENSTA ParisTech
828, boulevard des Maréchaux
91120 Palaiseau
(scientific campus)

ENSM
39, avenue du corail
13008 Marseille
(one week training)

LANGUAGE

English.

CONTACT **ENSTA ParisTech**

> Cyril Touzé
Courriel : cyril.touze@ensta-paristech.fr

CONTACT **ENSM**

> Yann Vachias
Courriel : yann.vachias@supmaritime.fr

ENSTA ParisTech in a few words:

ENSTA ParisTech is a french engineering shool under the line minister of defence. It delivers engineering training and develops a high level fundamental and applied research, in connection with industrial partners.

ENSTA ParisTech is famous for its competences in the fields of transport systems, energy, and engineering of complex industrial systems.

ENSM in a few words:

ENSM (École Nationale Supérieure Maritime) trains navigational and maritime engineers since centuries. It welcomes students on four different locations: Le Havre, Saint-Malo, Nantes and Marseille.

ENSM trains engineers in Marseille, le Havre and Nantes depending on their speciality. In Saint-Malo are welcomed mechanic merchant marine officers.

ENSM is associated to numerous research projects in maritime and para-maritime areas.

École Nationale Supérieure
de **Techniques Avancées**

www.ensta-paristech.fr

ENSTA ParisTech

École Nationale Supérieure
Maritime

www.supmaritime.fr

ENSM
ÉCOLE NATIONALE SUPÉRIEURE MARITIME

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