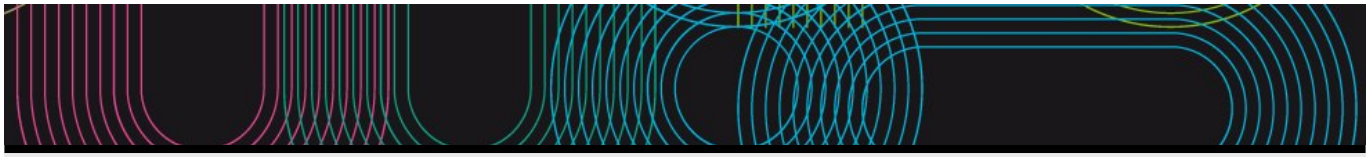

IDENTIFYING DATA				
Active sensor-based payloads				
Subject	Active sensor-based payloads			
Code	O07M174V01202			
Study programme	Máster Universitario en Operaciones e Ingeniería de Sistemas Aéreos no Tripulados			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Optional	1st	2nd
Teaching language	Spanish English			
Department				
Coordinator				
Lecturers				
E-mail				
Web	http://aero.uvigo.es			
General description	This subject shows the principles of operation of LiDAR and RADAR sensors, calibration procedures and data processing. International students may request from the teachers: a) materials and bibliographic references in English, b) tutoring sessions in English, c) exams and assessments in English.			

Training and Learning Results	
Code	
A3	That the students be able to integrate knowledge and face the complexity of formulating judgments from information, which being incomplete or limited, includes reflections on social and ethical responsibilities linked to the application of their knowledge and judgments
A4	That the students know how to communicate their conclusions - and the latest knowledge and reasons that support them - to specialized and non-specialized audiences in a clear and unambiguous manner
A5	That students have the learning abilities that allow them to continue studying in a way that will have to be largely self-directed and autonomous
B3	That students acquire the capabilities to analyze the needs of a company in the field of unmanned aerial systems and determine the best technological solution for the same
B4	That the students acquire the knowledge to develop unmanned aerial systems or to plan specific operations, depending on the existing needs and to apply the existing technological tools
B5	That students know and be able to apply the principles and methodologies of research, such as bibliographical searches, data collection and analysis and interpretation thereof, as well as the presentation of conclusions, in a clear, concise and rigorous way
D2	Ability to communicate orally and in writing in Galician
D6	Ability to work as a team
D7	Capacity for organization and planning
D8	Ability of analysis and synthesis
D9	Capacity for critical reasoning and creativity

Expected results from this subject	
Expected results from this subject	Training and Learning Results

Know the different active sensors existent, LiDAR and RADAR.	A3 A4 A5 B3 B4 B5 D2 D6 D7 D8 D9
Understand the procedures of calibración of sensors.	A3 A4 A5 B3 B4 B5 D2 D6 D7 D8 D9
Learn to integrate sensors mechanically, implementation of boresighting, utilization of gimbal and synchronization.	A3 A4 A5 B3 B4 B5 D2 D6 D7 D8 D9
Know different techniques of LiDAR and RADAR data processing and the algorithms for operations of segmentation, classificaiton and generation of digital terrain models.	A3 A4 A5 B3 B4 B5 D2 D6 D7 D8 D9
Know how to integrate LiDAR and RADAR data in geographic information systems.	A3 A4 A5 B3 B4 B5 D2 D6 D7 D8 D9

Contents
Topic
LiDAR sensors.
RADAR sensors.
Sensor synchronization and range calibration
Orientation calibration. Boresighting.
UAS-LiDAR system for data acquisition.
Data processing I. Registration and geopossitioning.
Data processing II. Filtering.
Data processing III. Rasterization and voxelization.

Data processing IV. Classification.	
Results integration on geographic information systems.	

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	10	0	10
Mentored work	7	63	70
ICT suppoted practices (Repeated, Dont Use)	22	22	44
Report of practices, practicum and external practices	0	10	10
Problem and/or exercise solving	3	13	16
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	Presentation of the contents using audiovisual media. The contents will be downloaded from the online platform.
Mentored work	Small projects that students should implement will be considered.
ICT suppoted practices (Repeated, Dont Use)	Practices will be carried out using computers in which the students will have to program a LiDAR data acquisition or perform the processing of LiDAR point clouds.

Personalized assistance	
Methodologies	**Description**
Lecturing	Face to face tutorials. Attention by email.
ICT suppoted practices (Repeated, Dont Use)	Face to face tutorials. Attention by email.
Mentored work	Face to face tutorials. Attention by email.

Assessment					
	Description	Qualification	Training and Learning Results		
Mentored work	The student will have to deliver problems solved by the professor	40	A3 A4 A5	B3 B5	D2 D6 D7 D8 D9
ICT suppoted practices (Repeated, Dont Use)	The student will have to deliver reports for each of the practices carried out	60	A3 A4 A5	B3 B4 B5	D2 D6 D7 D8 D9

Other comments on the Evaluation

Students to pass must submit all practice reports and problems. Everyone must individually achieve a minimum grade of 5.

In the July evaluation students must submit all reports of practices and problems that do not individually reach a minimum grade of 5.

Sources of information

Basic Bibliography

Light detectiong and ranging (LiDAR), Portland State University,

Jamie Carter et al., **An introduction to LiDAR technology, data and applications**, National Oceanic and Atmospheric Administration,

Francesc Rocadenbosch, **Introduction to LiDAR remote sensing systems**, Universitat Politecnica de Catalunya,

Frank A Ranking, **LiDAR applications in surveying and engineering**,

Demetrios Gatziolis, Hans-Erik Andersen, **A guide to LiDAR data acquisition and processing for the forests of the Pacific Northwest**, United States Department of Agriculture,

David Jenn, **RADAR fundamentals**, US Navy Postgraduade School,

RADAR range equation,

RADAR tutorial,

Andy Myrick et al, **Synthetic Aperture RADAR (SAR)**, Lincoln Laboratory - MIT,

Complementary Bibliography

Recommendations
Subjects that continue the syllabus
External internships/O07M174V01205
Final Dissertation/O07M174V01206

Subjects that it is recommended to have taken before
Fundamentals of unmanned aerial systems/O07M174V01101
Unmanned aerial systems operations/O07M174V01102
On-board sensors/O07M174V01104
Radio communication and navigation systems/O07M174V01103
Sistemas de control/O07M174V01105