Liverpool John Moores University

Title:	Advanced UAV Technology and Operations
Status:	Definitive
Code:	**7002DRO** (120979)
Version Start Date:	01-08-2016
Owning School/Faculty:	General Engineering Research Institute
Teaching School/Faculty:	General Engineering Research Institute

Team	Leader
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Academic Level:	FHEQ7	**Credit Value:**	40	**Total Delivered Hours:**	80
Total Learning Hours:	400	**Private Study:**	320		

Delivery Options
Course typically offered: Semester 2

Component	Contact Hours
Lecture	30
Practical	40
Tutorial	10

Grading Basis: 40 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Essay	DT-AS4	Prepare a report (circa 2000 words) reviewing the state-of-the-art in one the area of one UAV component system including issues around its integration.	25	
Report	DT-AS5	Perform a structural and power assessment for a given payload lift and mission duration	25	
Practice	DT-AS6	Prepare a formal proposal in response to a supplied brief. Present it to a prospective	50	

Category	Short Description	Description	Weighting (%)	Exam Duration
		'client'. Go on to prepare a fully detailed mission plan around the proposal and demonstrate its delivery in actuality or simulation.		

Aims

To provide an in-depth, quantitative, qualitative and critical understanding of the technology deployed in UAV systems. To be able to model such systems and design elements of them. To fully comprehend the boundaries and limitations of such systems. To be able to safely deliver well planned UAV missions.

Learning Outcomes

After completing the module the student should be able to:

1 Make highly informed decisions on airframe and propulsion systems based on a sound knowledge of the inertial and aerodynamic forces experienced by those systems.
2 Demonstrate a sound understanding of static and dynamic stability with regards to UAVs and to able to use this knowledge in the optimisation of control systems.
3 Display a critical and deep understanding of all component systems within a UAV.
4 Integrate aerodynamic, propulsion, control and data systems in a UAV to create new systems.
5 Synthesise and harness all of the knowledge required to: assemble a complete, professional standard, mission proposal, prepare a full mission plan and safely deliver that mission.

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

Prepare a report	3	4
Perform an analysis	1	2
Prepare a formal proposal	5	

Outline Syllabus

Drone Systems Technology:
Structural considerations in UAV design, typical loading scenarios both static and inertial. Aerodynamics of rotary UAVs, ground effect, transitional flight and VRS. Aerodynamics of propellers and criteria of propeller selection. Static and dynamic stability in UAVs, the role, physics and function of stabilisation systems. Power systems, voltage profiles, battery system characteristics. Inertial navigation systems.

Datum and coordinate systems in GNSS. Factors effecting the accuracy of GNSS, differential GPS systems.
Payload Systems Technology:
Payload stability and security. Dynamic balancing of gimbal systems. Static and dynamic modelling of payloads. Data capture, logging and transmission systems. Limitations of 5.8GHz data links, calculating bandwidth requirements. Data security. Non-standard and potentially hazardous payloads. Collision avoidance systems and their integration into the control and navigation systems of the UAV. Synchronised UAV operations, modelling and implementation.
Drone Operation Technology:
Human factors in UAV operation. Meteorology. Use of telemetry for UAV system monitoring. Integration of control and payload data systems. Measuring altitude, ground speed and airspeed using sensors and GPS, relative advantages. Controlling positional path accuracy in waypoint flying. FPV flying, speed and stereo-systems for depth perception. Further practical instruction in UAV flying and operating skills.

Learning Activities

The module will be taught by a combination of lectures; practical laboratory based sessions, centred around setting up and maintaining drones, fitting and testing payloads; workshop sessions involving mission planning for way-point flying; fieldwork involving testing actual drones and mission plans in the field centred initially around basic exercises then expanding to mimicking typical operations.

Notes

This module provides an advanced understanding of UAV sub-system technology. Also a comprehensive skill set for the safe execution of more advanced operations.