Titre: ReSSAC Achievements and Perspectives : Autonomy, Dependability and Safety issues

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Résumé : The ReSSAC project at Onera achieved the development and demonstration of an autonomous helicopter equipped with embedded information processing capabilities and decision making algorithms. After the achievement of the project, ReSSAC has now become the name of the laboratory for Recherches et expérimentations sur les Systèmes de drones et systèmes embarqués Sûrs Autonomes et Coopérants, composed of fixed wing and Vertical Take-Off and Landing Uninhabited Air Vehicles equipped with autonomous decision-making functions and complex information processing algorithms. Current research projects at Onera are open to collaboration and presently cover the following :
- image processing for obstacle avoidance, terrain following and landing site characterization ;
- action and flight re planning in an uncertain and ill-known environment ;
- safety demonstrations and improvement of mission efficiency and system's adaptivity and robustness to the environment.
Developing such autonomy capabilities should not be considered as a goal in itself and must be replaced in a more global perspective and matched to more crucial issues : efficiency, reliability, and, last but not least, safety. Those feasibility demonstrations raised several questions, and brought corresponding answers, which drew a number of follow up projects at Onera. VTOL UAV will operate close to the ground and buildings in urban environments and therefore they need to become able to navigate in close vicinity to obstacles with robust detection and relative positioning capabilities, especially robust to a temporary loss of GPS-based navigation capability. The SPIDER project is dedicated to the development of image processing algorithms and vision-based control functions for such purposes. We present some preliminary results obtained using the ReSSAC VTOL UAV platform performing simultaneous visual-based air-to-ground target tracking and optical flow based ground speed estimation. VTOL UAVs might very well be operated in close cooperation with other robotic or software agents. The ACTION and ROSACE projects focus on robots and agents cooperating and communicating in a dynamic uncertain urban-like environment, thus projecting an interactive multi-asset version of the ReSSAC project. VTOL UAVs might very well be useful when operated in the vicinity of populated area, thus in compliance with very strict safety constraints and regulations. It will be particularly important to be able to prove the safety properties of embedded systems and especially regarding the flight, navigation and mission control avionics. The IDEAS project will study the proof tools needed for such purpose.

Biographie: Patrick Fabiani is the present Director of the Systems Control and Flight Dynamics Department (DCSD) of ONERA. He has been the manager of the ReSSAC autonomous helicopter project at ONERA and more generally in charge of the autonomous unmanned aircraft research and studies. His research activity is on models, methods, and tools for sequential decision making and planning under uncertainty with application to autonomy for UAVs.
He graduated from :
-        Ecole Polytechnique in Paris,
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He was a Visiting Scholar in the Computer Science Dept. Robotics Lab. At Stanford University working on autonomous mobile robots in 1997-99. He is teaching Tools and Methods for Decision Making at SupAéro.