DEVELOPMENT OF A ROBOT FLEET FOR PEST MANAGEMENT

RHEA: Robot Fleets for Highly Effective Agriculture and Forestry Management
(NMP-CP-IP 245986-2 RHEA)

Participants:

Spain: *Centro de Automática y Robótica, CSIC-UPM; Instituto de Ciencias Agrarias, CSIC; Instituto de Agricultura Sostenible, CSIC; ETSIA, Universidad Politécnica de Madrid; Facultad de Informática, Universidad Complutense de Madrid; Soluciones Agrícolas de Precisión S.L.* **Italy:** *Università degli Studi di Firenze; Università di Pisa; CM Srl.* **France:** *CEMAGREF; CNH France SA.* **Belgium:** *CNH Belgium NV.* **Austria:** *CogVis GmbH; Forschungszentrum Telekommunikation Wien Ltd.* **Germany:** *Air Robot GmbH* ; **Switzerland:** *Bluebotics SA; Cyberbotics Ltd.* **Greece:** *Tropical SA*

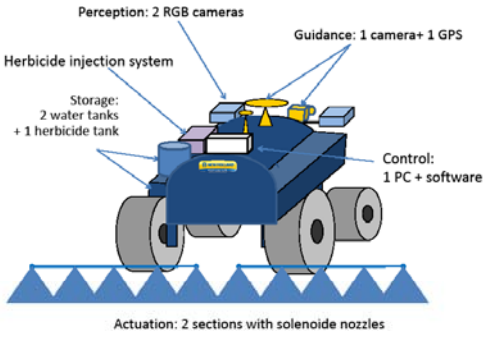
RHEA is a FP7 project devoted to the application of Precision Agriculture techniques. For that, RHEA is focused on the design, development, and testing of a new generation of automatic and robotic systems for both chemical and physical effective weed management in agriculture, covering a large variety of European products including various narrow and wide row crops and woody perennials. The consortium brings together the expertise and knowhow of 19 working groups belonging to 15 organizations from 8 European countries with a deep background in topics covering specific expertise in robotics, agronomy, perception and action, manufacturing of agricultural equipment and end-users.

Concept:

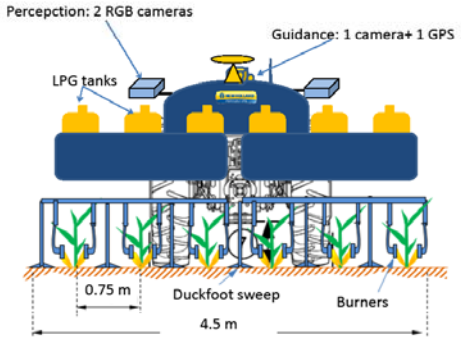
Robotic pest management will be conducted in two different scenarios. For weed control in annual crops, initial problem diagnosis will be conducted by periodic inspection of the fields using aerial units. This information will be georeferenced in order to make possible site-specific treatments. Computer programs will be designed for the decision-making process. Each individual tactic (chemical, mechanical or thermal weeding) will be assessed considering its efficacy, profitability and environmental effects. Online decisions will be based on stored information and on current weed status information. The distribution of all the ground units of the fleet and path planning for each unit will be planned. The actuation of all the fleet vehicles will be coordinated to achieve maximum weed control effectiveness, minimal crop damage and optimal cost/benefit relationships. Aerial units will monitor the overall mission status, identifying and solving any malfunction in the fleet and informing the operator. For insect/disease control in woody crops (agricultural or forestry) online spraying will be conducted using different types of air-blast sprayers controlled by sensors.
In order to achieve these goals, numerous innovations will be required in various fields: perception systems, vision systems for safety, actuation systems, communication and location, graphical user interfaces, etc.

Equipment specifications:

The aerial units will be based on quadrotors capable to carry and control small cameras that will monitor fields in order to acquire relevant data. Position estimation accuracy, payload and maximum flight time are the main parameters to be improved.



For chemical weed control in wheat, aerial units will generate weed infestation maps. This information will be provided to a fleet of autonomous medium-size sprayers. These vehicles will be equipped with GPS, sensors , control systems and leading edge injection systems and solenoid valves to spray diferentially various herbicides in different field aereas.



For physical weed control in maize, although aerial scouting will provide basic information on extent and location of weed patches, actual weed detection will be conducted with two cameras located in the front of the vehicle. This information will be provided online to a mixed, mechanical-thermal, actuation system. For non-selective mechanical control in the inter-row area, duckfoot type elements will be used. For selective thermal control in the row, Liquified Petroleum Gas (LPG) burners will be used,

For spraying olive canopies we will use a lateral “Oktopus Sprayer”. Inclination control of at least the two extreme diffusers (upper and lower) and start/stop of air (by a valve) on each pipe that give air to the diffusers will be controlled by appropriate sensors. For forestry applications we will use the “Cannon Boom” with only one big diffuser and tree different series of nozzles around the diffusers. In this sprayer the vertical pipe is telescopic to adjust height automatically and the diffuser is automatically inclinable in the vertical and horizontal planes.