ROBOTIC PATCH SPRAYING IN WHEAT: A FIELD DEMO

January 30, 2014, 10.30 a.m. Everything was prepared in The Poveda, a CSIC Research Station located 25 km east of Madrid, to start the first field demonstration of the RHEA project. During the previous three days practically all the participants in the project had been working on site to test all the equipments and programs. On the day before the demo, a preliminary aerial mission was conducted with the drones flying at 60 m to take images of the experimental area. Considering that image processing (mosaicking, weed detection) may take several hours, it was decided to use the information provided by those images to generate the herbicide spraying plans of the following day.

1. Experimental field

A 2400 m² experimental field was planted with winter wheat in November following the standard practices in the area. Simultaneously, nine weed patches (3 m x 3 m) were established artificially by planting mustard (Sinapis arvensis) seeds, maintaining the rest of the field free of weeds with a pre-emergence herbicide treatment.

2. Aerial mission and weed detection

The aim of this part of the demo was to show how the aerial fleet and the perception system work and to assess if the proposed objectives could be achieved. A fleet of two AR-200 drones equipped with two different types of cameras were managed by the participants involved in this part to explore the whole field. Real time raw images and processed images from the previous day were shown to the consortium. The fleet flight and all the associated activities took place without any major problem; the nine weed patches were clearly visible in the images and, apparently, they were in the right positions. In the coming weeks a detailed analysis will be conducted in order to assess the agreement between the content of each individual grid in the aerial image and in the ground.
3. Herbicide patch spraying mission
The aim of this demo part was to check how the planning program (MISSION MANAGER), the ground vehicle (GMU-3 based on the CNHI Boomer T3050 CVT), and the experimental sprayer (a 6-m boom sprayer equipped with a herbicide injection system and high-speed solenoid valves) performed the assigned mission. This task was to spray site-specifically the weed patches present in the field according with the information provided by the previous aerial mission. Strips of paper covering the whole length of each patch and individual paper cards distributed throughout the field area were used to assess if target and non-target areas were correctly sprayed (sprayed water was tinted with a dye). In addition, we assessed possible deviations of the ground vehicle from the route plan. A visual assessment of the performance of the system was conducted.

4. Fleet mission
In this case, the aim of the demo was to show the whole system (two New Holland ground units and one Case unit) performing a simulated mission computed by the MISSION MANAGER. Unit 3 performed a real treatment while the two other units faked the process. As in the previous case, a visual preliminary assessment was conducted.
5. Safety system
Finally, a short demonstration showed how the safety system of the ground units worked. One of the two components of the system, a laser, was tested to detect a ISO3411 standard obstacle and a human person with a ground unit at normal working speed. As expected, the test was successful.

At the end of the day, in the group picture, everybody looked quite satisfied with the results of the demo.

DISSEMINATION ACTIVITIES
1. Agritechnica 2013
Hannover Fair (also known as Agritechnica) is the world’s largest agricultural fair. Last November it joined 2,900 exhibitors and 449,000 visitors, with a strong presence of farmers, farmer’s associations and agricultural machinery manufacturers. RHEA presented a stand that included a scale model of the ground unit and a real aerial unit, as well as videos, posters, leaflets and a press dossier. Numerous people, including some potential “buyers” and many press representatives, visited the stand and were interested in its content. As a result, a total of 23 articles have been published on the best specialized technical media of 13 different countries in Europe and North America.

2. FIMA 2014
The International Fair of agricultural machinery (FIMA), celebrated in Zaragoza, is the largest fair of this sector in Spain and one of the largest in Europe. The last edition, that took place in 2012, joined 1,200 exhibitors and 210,000 visitors. The current edition, with 1,250 exhibitors, is expected to beat the previous one. RHEA presented a stand that included the ground vehicle (GMU-3) equipped with the specially designed patch sprayer. Numerous videos of the RHEA fleet in action and of its individual components were presented.

PROJECT MEETINGS
The twelve scientific and technical meeting of the RHEA project took place in Arnsberg, Germany, on August 26-27, 2013 and was hosted by AirRobot (AR). Activities carried out in the various Work Packages were reviewed and a General Assembly was celebrated.
On January 30-31, 2014, right after the field demo, a project meeting took place in the School of Industrial Engineering of the Polytechnic University of Madrid. The major aim of this meeting was to assess the demo, identifying problems and proposing actions to improve the system. In addition, some attention was devoted to plan and organize activities for the final project demonstration that will take place next May.