

PRESS RELEASE

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Swarm Systems ready for the MOD Grand Challenge

One year ago, the Swarm Systems team was one of six teams awarded funding from the UK Ministry of Defence (MOD) to prepare an entry for its 2008 Grand Challenge.

The challenge is “to create a system with a high degree of autonomy that can detect, identify, locate and report a comprehensive range of military threats in an urban environment.” This final will “give the teams one hour to send their systems, a mixture of flying and ground vehicles, into Copehill Down village to identify a range of threats which will be planted and recreated by a mixture of realistic props and actors.”

Rather than trying to shoehorn existing technology, Swarm Systems examined the Challenge’s real needs and created technology accordingly. The team identified four main elements to this solution: good visibility, hence airborne devices; flexibility in movement, hence devices which can both hover and perch; robust portability, hence the use of quadrotor air vehicles; and, finally, the need for providing consistent information in the face of enemy interference, which this team seeks to achieve through grouping these micro air vehicles into a swarm.

As Professor Owen Holland at the University of Essex explains: “Swarming has many proven advantages. Most importantly, it can survive unexpected events. If one vehicle is suddenly lost, then the swarm reconfigures itself to complete the task.”

The team’s concept is simple. It uses a swarm of eight quadrotors called ‘Owls’. Their operator uses 3D planning software to swiftly plan and rehearse routes for the Owls over Copehill Down village. The Owls then fly those routes, taking around one thousand high-resolution images. On return, these images are processed by a cluster of ten powerful multi-processor PCs, which analyse each image using the University of Surrey’s threat recognition software. Within minutes, the operator can produce a map of Copehill Down showing the location and type of all recognised threats.

Following a year of round the clock development, the team's entry is nearing readiness. In a remarkably short period, all aspects of a solution have been developed. Research Engineer, Richard Newcombe, now at Imperial College London, said: "New off-the-shelf components were announced by suppliers at an incredible rate. This meant that we could focus on integrating these together rather than developing all components from scratch, which would have been an impossible job in the time available." Research Engineer, Renzo De Nardi said: "The challenge for our group was developing the flight control software that stabilised the Owl in all conditions including GPS dropping out and quite strong winds; we have a unique approach that adjusts the motors almost 1,000 times per second, that I am glad to say works very well."

Dr Krystian Mikolajczyk of the University of Surrey said: "One of the keys to increasing threat recognition and reducing false positives is good training images. We have built a database of thousands of images of mock-ups of the threats that we are expecting at Copehill Down. Each training image is hand-annotated to show the location of the threat in the image. Our recognition software is particularly flexible at learning from these training images and correctly finding threats similar to but not the same as those annotated in the training images"

System Architect, Phil Hand was responsible for the ground station, Owl communications and the synthetic environment of Copehill used in planning, mission control, threat recognition and reporting. "We adopted a manual approach for planning similar to that used for moving characters through a 3D computer game. This made planning very fast and enables us to try out many different strategies. Having this manual planning experience will enable us to automate the planning and move it into the Owls, making our solution even easier for soldiers to use."

Operations Manager, Steve Hance spells out some of the issues of taking a technology from idea to competition so quickly. "Until my experience in Grand Challenge, I would never have believed that a technology could be developed from scratch in such a short time. We had time for two full prototyping cycles. During June, the components for our batch of fourteen Version 2 Owls arrived. Since then, I have put through almost 20 engineering changes on each Owl that have arisen from problems in testing. Even now, with less than a week to go, we are still trying to trace three different 'random' problems, each of which could cause an Owl to fall from the sky. On the day of the final, I will count them all out, and I hope to count them all back."

This week, the Swarm Systems team are travelling to Copehill Down on Salisbury Plain to compete against ten other teams for the RJ Mitchell Trophy.

The MOD website states the rationale for Grand Challenge: 'MOD is keen that the best solutions are developed quickly into equipment for UK Armed forces and will be working with the teams closely to identify the best systems and sub-systems that may be taken forward into further development.'

Swarm Systems team manager, Stephen Crampton, said: "From the start, Swarm Systems has set out not only to win the RJ Mitchell Trophy, but also to provide a solution that can be developed into equipment for use by our armed forces. We see a future where for every soldier in the field, there will be several autonomous vehicles providing support roles. Swarm Systems wants to develop the technology and become a prime supplier to this new market. If the MOD select our Swarm of Owls, we will move even faster to iron out the remaining issues and get this technology near the front-line for trials within a year."

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About the Swarm Systems team:

Swarm Systems Ltd (SSL) is a British company formed in May 2007 and based in London. It is developing a swarming technology that will lead to products in 2009.

SSL formed a team with the University of Essex, the University of Surrey and British SMEs: Orrcam Ltd, Ardware Ltd and Park Technical Services. Essex developed the quadrotor technology with Orrcam, Ardware and Park. Surrey developed the target recognition technology.

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