

Development of a Specialised UAV (Unmanned Aerial Vehicle) for Remote Coal Mine Exploration

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This presentation provides an update on the research project regarding the development of a specialised Unmanned Aerial Vehicle (UAV) for Mines Rescue deep penetration exploration post explosion. An early stage report was provided in Germany in 2015.

Whilst ever we continue to have coal mine explosions combined with non-resilient communication and gas monitoring systems, having the capability of safely entering a mine to determine atmospheric conditions and searching for any survivors without placing additional rescue personnel at risk, needs to be pursued.

NSW Mines Rescue, using funding from the NSW coal industry, has embarked upon developing a UAV ('quad-copter' or drone), suitable for use in hostile underground environments. The technology will have the ability to search multiple mine roadways, not only in the horizontal plane but also vertically, by having the ability to navigate ventilation shafts giving the rescue team full three dimensional remote search capabilities.

Stage 1 proved the capability of a UAV being flown underground by a remotely located pilot (external to the mine) utilizing live stream video transmitted over a specially designed Wi-Fi mesh node system. At the same time as delivering visual and thermal images, the UAV could additionally relay gas levels.

Two important barriers were identified that need to be overcome:

1. The time lag of video transmission, and
2. The ability of the UAV to be "self-sustaining" if the control signal is lost.

Stage 2 will develop a "self-conscious" UAV with the following technology as a minimum:

- LIDAR based terrain scanning – such that the UAV is aware of its current location relative to surrounding walls
- Ultrasound collision avoidance sensors – to position the UAV in the center of the available space
- Fail safe programming to maintain position if signal is lost
- Full surround bump/intrusion protection
- Develop a UAV control system whereby control is achieved utilizing a very simple interface, i.e. up/down, forward/back, left/right, thereby enabling flight by a non-specialist pilot.

Stage 3 will combine the developed UAV with updated and refined Wi-Fi nodes (from 1st Stage) into an intrinsically safe package that will deliver a complete deep mine penetration capable UAV based exploration system.

Stage 1 has provided confidence that the vision of a 10km deep penetration is within reach and the learnings and current vision of this important project will be shared.