

IARC 5th Mission: *“Inside the Box”*

Abstract

The 5th mission for the International Aerial Robotics Competition (IARC) will move the challenge to yet a higher level of autonomous aerial robotic behavior. The past two decades have seen a revolution in navigation technologies for operations in the open, but there is still much to be done in the area of indoor navigation. The goal is to create a small aerial robot capable of fully autonomous flight through a confined environment. In performing this task, the state-of-the-art in indoor navigation, vehicle design and integration, and flight control will be pushed to a higher level.

The 4th Mission of the IARC required collegiate teams to create fully autonomous flying robots capable of negotiating urban situations from a significant stand-off distance of 3km. Each aerial robot had to independently find and enter a designated building in order to locate and relay specific target information back to its launch point. The new 5th Mission picks up where the 4th Mission left off by demonstrating the fully autonomous aerial robotic behaviors necessary to rapidly negotiate the confined internal spaces of a structure once it has been penetrated by an air vehicle.

Notional Mission

April 26, 1:23:44 hours Greenwich mean time. Let there be light: and there was light. A great fire ball illuminates the night followed seconds later by the sound of a thunderous explosion. A catastrophe of unknown origin and extent has occurred in Unit #4 of the Ukrainistan nuclear reactor complex. All that is seen now is the dull red glow of burning graphite from the KMBR-1000 reactor.



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There are no survivors within the facility. Radioactive elements of Iodine-131, Cesium-137, and Strontium-90 are present in lethal levels. A safe distance for human investigative teams has been determined to be no closer than three kilometers. Units #1 and #3 have apparently shut down automatically, but Unit #2 is still operating, possibly due to a fault in the control system that makes the emergency shutdown unable to function. Long distance aerial photography indicates that the overpressure from the explosion has blown out all windows in the facility.

An autonomous aerial robot (mother ship) carrying sensors and a miniature autonomous flying sub vehicle has been launched from a safe location (three kilometers distant from the complex) in an effort to enter the control room of Unit #2 which is identifiable by two great lights illuminating the Ukrainistani national seal over the main entrance. The mother ship has successfully located Unit #2 and has identified an opening in the building into which its aerial robotic sub vehicle can be launched. This small, fully autonomous aerial robot must now find and enter the control room to provide a picture of the main control panel gauges and switch positions so experts can see why Unit #2 has not shut down and assess the potential for a meltdown of this unit. The reconnaissance mission must be completed within 10 minutes from insertion into the building due to expected radiation-induced failures within the aerial robot's systems. The aerial robotic sub vehicle must transmit its picture(s) through the concrete walls of Unit #2 to the mother ship waiting outside whereupon the pictures will be relayed back to the human investigative teams outside the safety perimeter three kilometers away.

