

AirRobot AR-100 Launch and Recovery

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For a launch and recovery procedure the flight team will use the flight protocol defined by Pratt et al. (2009). This flight protocol is a four step flight operations procedure consisting of *site selection*, *planning and rehearsal*, *flight*, and *data review*. The procedure is:

- Safety review of site and landing zones selection. The Flight Director should be in charge of site selection and primary staging of the equipment, though all crew members are involved. Site selection consists of determining adequate launch and landing zones that provide a line-of-sight viewpoint to the SUAS over the desired areas around the structure, confirming restricted access from bystanders, and projecting a flight path that reduces the possibility of flying near civilians.
- Planning and rehearsal. After the site selection, the Pilot should lead a short flight planning and rehearsal session at the landing zone. Any potential flight problems are discussed, such as flying into the sun or in the interior of structures, and *safe zones* of operation would be established. Likewise, any potential *team access hazards* should be identified by the Flight Director and mitigated; for example, by providing personal flotation devices when working on piers. The platform and payloads checks would be conducted by the Pilot and Mission Specialist, along with a scan of the airspace for other aircraft.
- Flight. The flight path itself will be dynamically generated as the Mission Specialist begins to view the damage. The Mission Specialist and Pilot stand in easy communications range and cooperatively find the right altitudes and angles for collecting the requisite data. In the case of any sort of anomaly, such as unexpected high turbulence or a temporary loss of communications, the vehicle would be grounded. Likewise, the SUAS should be immediately grounded if a bystander or a manned aircraft are

spotted and perceived by the Flight Director or any member of the team to pose a safety risk.

- Data review. Once on the ground, a review would be conducted of video and stills recorded in-flight with the structural expert. If any data was missing or needed a better photograph, the flight should be reflown.

The AR-100 is a small, rotary-wing Unmanned Aerial System (UAS). Both launch and recovery of the vehicle are Vertical Take Off and Landing (VTOL) operations which can be performed in any unprepared, off-airport location. To launch the vehicle the following steps are performed. Once the control station and vehicle batteries have been inserted and communications established, the pilot holds the throttle to the minimum position. When the vehicle receives the minimum throttle command it enables the motors and begins a self-check and calibration. After the self-check is complete the vehicle emits a single audible *beep* to alert the pilot. Once they have heard this confirmation, the pilot simply increases the throttle until the vehicle becomes airborne and the flight begins (if the pilot moves the throttle off the minimum stop before the calibration is completed the self-check is cancelled, the motors are stopped, and the calibration must be reinitialized). Landing the vehicle is a similarly simple operation: the pilot hovers over the chosen landing site, reduces throttle until the vehicle touches down, and then holds throttle at the minimum stop and presses the *Engines Off* button. As a safety precaution, if the *Engines Off* is pressed when the throttle is not minimized (the vehicle is still airborne), it has no effect.

References

- Pratt, K. S., Murphy, R. R., Stover, S., and Griffin, C. (2009). CONOPS and autonomy recommendations for VTOL SUAS based on hurricane katrina operations. In Singh, S., editor, *Journal of Field Robotics*. Wiley InterScience.