

Attachment 9 Maritime Lost Link/Mission Procedures

The Insight A-20 UAS has a series of mission parameters that are physically loaded into the aircraft's flight control computer's memory prior to flight. These parameters define the locations of emergency runways, lost link flight plans, and timing and safety limits used by the UAS in the event of a lost link or lost-navigation event occurs. Although configurable in flight, these parameters are typically designated for a given launch and recovery site and are configured for the anticipated flight environment and mission(s). However, during maritime operations the coordinates for the way-points in the lost link route plan are updated as the ship changes position so if a lost-link mission is executed the aircraft returns to an updated, more recent, location rather than the location suitable for lost link prior to launch. Additionally, in maritime operations the coordinates for an emergency runway are updated periodically so the aircraft will ditch in the water a reasonable but safe distance from the ship rather than near where the ship was at takeoff. All holding points, belly landing points, and launch and recovery points are within the boundaries of the area requested in the COA application.

For this COA request the aircraft will be programmed to enter a ¼ mile diameter orbit approximately ½ mile to either the port or starboard side and ½ mile aft of the ship. These parameters will be updated just prior to launch, anytime the ship's location becomes a hazard (such as in the event of backing up the ship to ram ice) or when the points are more than 2 miles in error from the current ship location. Given the expected ship's cruise speed this will require the pilot to update these parameters every fifteen to twenty minutes. The update process takes less than 30 second to complete, and is not a significant workload for the pilot.

The Insight A-20 follows an autonomous lost-uplink procedure if communications from the control station fail. This procedure ends in a belly-landing at a specified location that was regularly updated if communications are not re-established by the predestinated time limits.

Insight A-20 Lost-Link Procedure	
1	The lost-uplink procedure begins after 60 seconds has passed without the aircraft receiving any messages from the ground. The aircraft then flies at approximately 50 knots true airspeed, holds its current altitude, and starts a periodic reset of its communications channels.
2	The aircraft continues tracking its current flight-plan for 60 seconds.
3	The aircraft climbs for 90 seconds towards the highest of three altitudes: its current altitude, a safe altitude of 1,500 feet MSL, or the altitude calculated for line-of-sight communications with the ground-station provided it is below the COA ceiling.
4	The aircraft continues tracking its current-flight plan for 60 seconds.
5	The aircraft flies directly to the nearest waypoint that is closer to home from its current location in the Lost Link Flight Plan. This flight plan will be a rectangular loiter pattern oriented aft of the ship approximately ½ mile. In addition this flight plan will have a "tail" that consists of at least two waypoints that are dragged along with the UAS during operations so that the return to the loiter location will avoid overflying the ship itself. The aircraft climbs to the new flight-plan altitude if it is higher than the current altitude.
6	After reaching the home holding pattern, the aircraft waits for (1) hour to allow the crew time to re-establish communications and/or prepare to recover the ditched aircraft. In other words, the UAS will continue to a loiter pattern for an hour prior to ditching if

communications are not re-established.

- 7 If communications have still not been re-established the aircraft selects an appropriate approach and touchdown point for a belly-landing aft of the ship. The approach direction will be determined based on the winds calculated by the aircraft.