

## ***Attachment 5: Procedures: Lost Link, Communications, & Emergency Procedures***

*Reference: FAA COA Checklist Item 12, 13, 14, Lost Link, Communications, & Emergency Procedures*

The INL unmanned aircraft are either remotely operated or use the Cloud Cap autonomous waypoint navigation system with optional remote operation.

The following table lists responses to typical off normal events. It should be noted that all safety features for loss of communications and GPS are tested (cause and effect end to end) each time prior to launch and are part of a preflight checklist.

Note the last possibility, colliding with a structure or power line, is very improbable given that the UA is always available for positive control and in line-of-sight. Flight paths are always at least 200 feet above power lines, and no substantial structures are within miles of the UA runway environment. It is possible a crash can occur while flying near structures, for instance for overhead surveillance. Therefore the INL UA team policy is to not deliberately overfly persons, vehicles, nor structures.

<b><i>Aircraft Type</i></b>	<b><i>Control Mode</i></b>	<b><i>Event</i></b>	<b><i>Response</i></b>	<b><i>Consequence</i></b>	<b><i>Safety Issue?</i></b>
Fixed Wing or Rotorcraft	Remotely Operated	Lost Link, or lost battery	Brief uncontrolled flight and crash	Lost UA	No
		Engine Failure	PIC dead sticks to landing	None to minor damage	No
		Structural Failure	Crash	Lost UA, airframe type grounded	No
		Extreme weather	Up to Crash	Lost UA, flight rules adjusted for type	No
		Bad launch	Crash	Minor to major damage	No
		Bad landing	Crash	Minor to major damage	No
	Auto launch	Mechanical failure of launcher or UA upon launch	Crash	Major damage	No

	Waypoint navigation	Lost GPS	UA will shut engine down and set extreme control surface deflections	Stall/spin/crash, possible fire if using gasoline	No
		Lost link	UA flies to lost comm waypoint and orbits	Stall/spin/crash, possible fire if using gasoline	No
		Lost PIC communications with ATC	Immediate return of UA for landing	None	No
		Lost battery	No GPS, no link, autopilot shutdown	With self stabilization lost, expect brief flight then crash	No
		Collide with structure or power line			Possible

*Table 1. System Failure Analysis*

*Note:* If Lost Link occurs and Link cannot be reestablished within two minutes the UAS will automatically execute lost link procedures and RTB and orbit until link is reestablished or fuel exhaustion occurs with associated consequence.