

## Lost Link Procedures

For Auto navigating UAV's:

Q. What happens when command link is lost?

A. Two command links are available normally; the 2.4 GHz (or 72 MHz) RC link and the 900 MHz link with the autopilot Ground Control System. In either case, the autopilot executes specific instructions. Loss of RC link (72 MHz), although never actually experienced in the over 600+ flights, has been exercised approximately 50 times, by actually turning the transmitter off, most recently May 18, 2005. The set of instructions can also be engaged from the Ground Control System for testing purpose. Typically the plane navigates a preprogrammed designated series of waypoints at 800 feet AGL. The 900 MHz GCS link is then used to change altitude, airspeed, and could be used to initiate an auto landing if desired.

In the event of autopilot loss of link (900 MHz), a safety switch, located between the autopilot flight computer and control surface servo output allows the pilot in command to manually switch to the 72 MHz command link. All autopilot flight operations including auto navigating will be done within line of sight of the pilot in command and within the safety boundary established for the flying site (Hazard Area).

Q. How does vehicle respond if link is never re-established?

A. Typically the plane circles a designated waypoint, within the Hazard Area air space, where it would be of no consequence if it exhausted all fuel and crashed. Alternately, an auto landing can be initiated after a designated timeout or number of circuits around the landing pattern with no communication.

Q. How does the vehicle recognize that loss of command link has occurred?

A. The airborne control system provides the failsafe function in the event of interrupted or loss of uplink ground command signal. A pre-programmed failsafe mode is automatically implemented by the receiver when ground command uplink (transmitter) communication is interrupted for more than 250 milliseconds. The failsafe commands include: engine(s) to idle, up elevator, right aileron, landing gear extended and all other channels to hold the current setting. These conditions will terminate the flight by directing the UAS to proceed into a downward spiral therefore, insuring the vehicle stays contained within the defined operations area. Failsafe mode will automatically reset should uplink command signal be established again. The 900 MHz link is similarly monitored.

Q. How does the UAV operator in the ground control station recognize loss of command link has occurred?

A. Status of the 72 MHz RC signal and the 900 MHz telemetry link is indicated on the Ground Control Station monitor screen.

Q. For non-auto navigating (strictly radio-controlled) UAV's?

A. In the event of data link / signal loss, the AirSTAR Project UAS failsafe programmed receiver software will activate. Upon failsafe program activation, the following three actions will occur: 1. landing gear deployment (immediate pilot visual indicator), 2. engine(s) to idle (reduces thermal and kinetic energy), and 3. climbing right turn command (flight termination maneuver). This produces descending spiral during loss of transmitter signal. This keeps the vehicle within the defined airspace region while allowing additional time to re-establish radio control. When radio link is established, the vehicle returns control to the pilot.

It is possible, under extreme conditions to quickly terminate flight by stopping the engine(s) and causing a deliberate crash within the designated operating area.