

Emergency Procedures

Pleaser refer to Raven TM, page 0027 00-1
NMNG UAS SOP, para 2-1d, 2-3c/e, 2-5d, 3-1a, 4-2c and 4-3.
Raven UAS Observer Training, Slides 15-38.

OPERATOR INSTRUCTIONS SMALL UNMANNED AIRCRAFT SYSTEM (RQ-11B) NSN 1550-01-538-9256 EIC: 1CB EMERGENCY PROCEDURES

GENERAL INFORMATION

Preventing AV loss or damage depends on early recognition of dangerous flight conditions or malfunctions followed by appropriate corrective action. Operators should memorize the immediate action items of each emergency procedure.

Accurate decision making depends on thorough understanding of system operation and behavior. Crew effectiveness in an emergency requires preparation. Mission planning must include alternative courses of action available for each phase of the proposed flight. To the extent possible, planned courses of actions for emergencies should be made before the flight begins.

Continually monitor data to notice anomalies as soon as they develop. During flight, both operators must maintain situational awareness and VO should always know which direction to fly to escape hazard. MO: Should always know AV position relative to hazards and be ready to give VO headings and altitudes to fly to safety.

IMMEDIATE ACTION ITEMS

Those steps that must be performed immediately in an emergency are underlined and in bold print. The operators should be able to perform these steps without referencing the checklist or manual. Non-underlined steps can be accomplished with use of the checklist.

Lost AV recovery procedures are listed at the end of this section.

LOSS OF DOWNLINK

CAUTION

DO NOT try to fly back within reception range by commanding HOME. Without downlink, there is no way to verify that the AV has received this instruction.

If unable to restore downlink promptly, delay in commanding LOL increases uncertainty of AV position and flight status.

Perform landing under VO control when able. Autoland by reaching Rally waypoint is not as accurate. Failure to comply may result in damage or loss of equipment.

NOTE

Do not inadvertently make inputs without functioning downlink to verify resulting action. Operate with a RVT whenever possible to provide an independent source of downlink. When video becomes unusable, the hand controller will automatically default to a black screen.

1. Check orientation of downlink antenna.
 - If video returns, continue mission.
2. Command turn and climb.
 - If video returns, continue mission.
3. Turn off GCS transmitter.
 - This will force loss of link rally mode.
4. If video returns, turn the transmitter back on.
5. Continue mission or recover AV as appropriate.

STRUCTURAL FAILURE

Loss of Components In Flight

1. Command Autoland.
2. Record Location.
3. Recover AV. See RECOVERY OF DOWNED AV.

EXTREME LOW AV BATTERY

1. Switch to MAN mode and control altitude with % power.
2. Select suitable landing area.
3. Autoland.
4. Record location.
5. Recover AV. See RECOVERY OF DOWNED AV.

LOSS OF UPLINK

1. Insure in route Rally.
2. Monitor uplink status bar.
3. If uplink reestablished, regain control of AV and continue mission or recover AV.

GPS FAILURE

1. Fly back azimuth from last known bearing to recovery site or continue mission in degraded mode using compass and dead reckoning.

HAND CONTROLLER FAILS

1. Disconnect hand controller.
 - This will force loss of link rally mode.
2. Monitor AV location (Falconview).
3. Replace with spare hand controller.
 - If VO takes control of AV by turning on transmitter the AV will be in the same mode as it was prior to failure.

NO HUB COM WARNING (AV IN LOSS OF LINK)

1. Immediately cycle power to GCS:
 - a. Disconnect batteries from Hub. Do not "Hub-swap".
 - b. Reconnect batteries to Hub.
2. Monitor AV location.
3. If safe to do so, resume VO control.
 - a. Deselect the Autoland command by entering desired flight mode (MAN, HOME, LOIT, NAV, ALT).
 - b. Turn on transmitter and observe restoration of link (link bar and clock symbol).

- c. Reenter desired flightmode (MAN, HOME, LOIT, NAV, ALT) and begin controlling AV (and observe In Route Rally message disappears).
4. If HUB COM warning persists, recover AV.

STEADY TURN DEVELOPS AT NEUTRAL STICK

1. Return to base (RTB) if able.
2. Command Autoland.

AV OSCILLATES UP/DOWN OR RIGHT/LEFT

1. RTB if able.
2. Command Autoland.

LOSS OF DOWNLINK DATA ONLY (VIDEO FUNCTIONING)

1. Turn transmitter off.
 - This will force loss of link rally mode.
2. Monitor AV location.
3. If downlink data restored assume control of AV and continue mission or recover AV.
4. If downlink data not restored, recover AV.

ALTITUDE HOLD FAILURE

1. Enter MAN mode.
2. Fly back to recovery site or continue mission in degraded mode.
 - a. Control attitude with (% power).
 - b. Assist with joystick if necessary.
3. Recover AV.

RECOVERY OF DOWNED AV

Preserve Data

Record all last good AV data before disconnecting GCS/RVT power. Make notes of operator's last actions and last observation of AV video. Save video recording for review.

GCS/RVT As Locator

The RQ-11B battery does not usually disconnect on landing. AV may continue to transmit downlink signal. AV nose disconnects on landing so video image will be black. Black video (not snow) indicates video transmission from AV with nose disconnected. Downlink antenna (directional) can be used as a direction finder. AV is towards direction that produces black video, not snow. If GPS is working, AV GPS position will be sent to searching GCS/RVT when within range.

INTRUSION OF AIRSPACE BY LOW ALTITUDE AIRCRAFT

Low altitude aircraft may intrude on operating airspace without warning. Due to the RQ-11B's low visual signature, the manned aircraft may not be able to see and avoid in time to prevent collision. To minimize unnecessary risk, AV operators should employ safe in route altitudes in areas with a high volume low altitude traffic. If low altitude aircraft unexpectedly approach mission area:

1. Estimate intruding aircraft altitude.
2. If aircraft is at or below AV altitude, climb immediately.
3. If aircraft is above AV altitude, maintain or descend.
4. Contact airspace control authority or aircraft on the air net as applicable.

2-1d. In the event of a UAS lost link, the aircraft shall be programmed to proceed to the approved launch and recovery site as specified in the approved COA for that system.

2-3c. Communications must exist between the controlling ATC agency for the COA airspace and units operating the UAS for the entire duration of the UAS flight. If communications are lost the UAS will be immediately recovered via the approved recovery route and altitude.

2-3e. In the event of an emergency or “lost link,” The controlling ATC agency shall be notified immediately and provided the following information:

- (1) Type UAS (Raven, etc...).
- (2) Last known position (Using latitude/longitude coordinates).
- (3) Last known altitude (MSL altitude).
- (4) Last known heading.
- (5) Programmed lost link procedure. (What the UAS was programmed to do in the event of “lost link” or Return home coordinates.)

2-5d. The NMNG Santa Fe, New Mexico (Army National Guard Aviation Operations and Air National Guard Aviation Operations/ Airfield Management Operations) standard lost link point is the takeoff point annotated on the flight plan in the designated airspace. Upon notification of lost link, the UAS unit will attempt phone or radio contact with units and/or aircraft to relay information. The UAS platoon will dispatch a vehicle immediately to the lost link point in the event of a lost link.

3-1. GENERAL SAFETY PROCEDURES.

a. No UAS operations will be conducted within the airspace unless positive and reliable communications between the UAS launch/control center and NMNG Counterdrug Operations and Army National Guard Flight Operations is maintained. If communications are lost, the activity will cease until communication is restored.

b. UAS will not be flown within 500 feet (slant range) of any domiciles or structures.

4-1c. If, at any time, the position of an UAS becomes unknown and the UAS fails to respond to programmed "lost link" instructions, and if design capability exists, the flight will be terminated in time to preclude the possibility of impact outside the approved designated flight area.
Reconnaissance.



Operating Procedures

Normal and Emergency

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Operations: Observer Positioning

A sufficient number of observers must be used in order to keep the UAS in sight at all times. Keep in mind the terrain, foliage, and weather.

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Operations: Observer Positioning

A detailed map recon should be conducted to select the most appropriate locations for observers along the most likely UAS route/ target area.

Site surveys will be conducted to confirm line of sight of each observer post and comms checks will be completed with the operator.

NOTE

Direct communication with the operators must be established. Relaying through another observer is not authorized. If either LOS or Coms are marginal adjust observers position to a more favorable site.

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Operations: Observer Positioning

The operator will mark locations of all observers on a topographic map or Falcon View with LOS references plotted as per unit SOP.

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Operations: Mission Planning

Now mission planning will be completed. Using the plotted observer positions adjust the flight plan to remain within LOS of each observer along the route/ target. Determine expected flight time and altitude required for the mission.

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Operations: Preflight

CAUTION

Detailed mission planning must be completed to avoid any known manned aircraft operations and ground hazards (e.g., Towers, buildings, wires, etc.).

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Operations: Mission Brief

Mission briefings will be attended by all observers and operators.

Training/demo flights should avoid heavily populated areas.

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Operations

Prior to launch, two way communication checks must be accomplished between the UAS operator and the observer(s) from the planned operator and observer location. Be aware of line of sight limitations of most two way radios. Standard rally terms must be used to avoid confusion.

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Operations

The observer will use a compass to orient to cardinal directions.

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Manned Aircraft Observed

Observed is defined as, "Manned aircraft in visual range but poses no hazard to UAS operations."

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Manned Aircraft Observed

Observer will maintain observation on both the manned and unmanned aircraft.

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Manned Aircraft Close

Close is defined as, "Manned aircraft at a range that **may** require maneuvering of SUAV to ensure safe operations of both air vehicles."

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Manned Aircraft Close

If at any time, manned aircraft appears to be heading towards the UAS at a similar altitude regardless of range, observer will immediately notify mission commander of the estimated range and cardinal direction from observer location. Observer will maintain observation and provide continuous reports.

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Manned Aircraft Close

Additionally, observer should provide turning instructions to operator to avoid a "Danger Close" situation:

- "Turn Left" (90° or 6 second turn)
- "Turn Right" (90° or 6 second turn)
- "Climb" (Climb 500' above current altitude)
- "Descend" (Descend 500' below current altitude)

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Manned Aircraft Danger Close

Danger Close is defined as, "Manned aircraft within a range that immediate action must be taken by the SUAV operator to avoid a mid-air collision."

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Manned Aircraft Danger Close

If manned aircraft and UAS are about to collide, the observer will immediately transmit one of the following to the operator:

- "LAND! LAND! LAND!" (Manned Aircraft is at or above UAS; Operator will immediately command AUTOLAND)
- "UP! UP! UP!" (Manned Aircraft is below UAS; Operator will turn and climb at full power)

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Loss Of Link (LOL)

Loss of Link is defined as, "Loss of digital link that results in loss of control of the UAS or forces the UAS into autonomous flight mode."

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Loss of Link (LOL)

Operator will state to observer:

"Loss of Link. State Raven position"

Observer will immediately reply with acknowledgement and UAS position:

"Roger, Loss of Link. Raven 500 meters Northeast of my position, time now"

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Loss of Link (LOL)

Observer will give constant updates on UAS general direction of flight and distance from observer location.

"Raven heading North"

"Raven turning left, heading West"

"Raven continuing South to your position. 800 meters West of my position, time now"

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Loss Of Sight

Loss of sight is defined as, " loss of visual reference to the SUAV by the operator and observer(s)."

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Loss of Sight

Upon losing sight of the Raven, the Observer will immediately notify operator that the Raven is no longer in sight by transmitting:

"NO JOY Raven, time now!"

Note: Observer should request range and bearing information from the operator to assist in reacquiring the Raven

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Loss of Sight

Observer will then provide last known range and cardinal heading from his location and last known direction of flight of the Raven.

“Last known 600 meters West. Raven heading North.”

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Loss of Sight

The operator will fly the UAS directly to the closest observer and loiter until UAS is visually reacquired. The Observer will state:

“TALLY Raven, time now! 600 meters East!”

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