InstantEye Mk-3 GEN4-D1

Product Manual

Revision M1.2
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THE InstantEye Mk-3 GEN4-D1 IS A Small UNMANNED AERIAL SYSTEM (sUAS) CAPABLE OF CAUSING PROPERTY DAMAGE AND BODILY HARM TO THE OPERATOR AND OTHER PERSONS IF NOT OPERATED RESPONSIBLY. THIS PRODUCT IS NOT DESIGNED FOR RECREATIONAL OR SPORT USE. An improperly maintained aircraft can fail without warning. In manual mode, the InstantEye Mk-3 GEN4-D11 will not hold position without constant corrections by the operator. Therefore, the operator must use extra caution in this mode to ensure the aircraft remains under control to avoid property damage or bodily harm.

High-capacity rechargeable lithium-polymer (Li-Po) batteries are the main power source for the InstantEye Mk-3 GEN4-D1 system and can cause fire if handled improperly. Proper handling techniques and precautions must be taken in order to avoid creating a hazardous situation. READ AND UNDERSTAND THE BATTERY SAFETY INFORMATION CONTAINED WITHIN THIS MANUAL BEFORE YOU ATTEMPT TO CHARGE OR USE THE SUPPLIED BATTERIES.

This manual is a supplement to Federal Aviation Administration (FAA) regulations and other guidelines applicable to unmanned aerial vehicle (UAV) operators. Operators should be familiar with 14 CFR91.111, Operating Near Other Aircraft, 14 CFR 91.113 Right-of-Way Rules, 14 CFR 91.155 Basic VFR Weather Minimums, and any other applicable regulations. Additionally, UAV operators may be subject to Department of Defense (DoD) micro-unmanned aerial system regulations or other installation-specific regulations.

Certificate of Authorization

It is the responsibility of the operator to obtain necessary authorizations, certifications, licenses, or permits from the Federal Aviation Administration and local authorities and jurisdictions as applicable. These agencies may have rules that limit or prohibit the use of UAVs. Further, the Federal Communications Commission (FCC), state, and local authorities may have rules prohibiting or limiting the use of video and/or radio communications equipment.

Limitation of Liability

Your use of the InstantEye system is entirely at your own risk. InstantEye Robotics, a division of Physical Sciences Inc., will not be responsible to you or to any third parties for any direct or indirect, consequential, special, or punitive damages or losses you may incur in connection with the InstantEye system, your use thereof, or any of the data or other materials transmitted through or residing within the InstantEye system, regardless of the type of claim or the nature of the cause of action.
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1. System Overview

The InstantEye Mk-3 GEN4-D1 sUAS is part of a family of high-performance, low-cost, autonomous aerial systems that can be hand-launched/recovered by a single operator. The GEN4-D1 leverages the combat-proven GEN3 and GEN4 systems’ ease of use and survivability, combined with an encrypted software-defined radio, to provide an almost silent, small, on-demand, local (approximately 3000 meters) situational awareness. As a soldier’s end-user device, the InstantEye Mk-3 GEN4-D1 enhances force protection and mitigates operational risk to everyone within its range.

The aircraft has integrated, gimbaled electro-optical (EO) and Long Wave Infrared (LWIR) cameras. The aircraft’s small rotor span in flight makes it ideal as an entry robot, providing the first eyes into an otherwise GPS-denied space. The system typically has approximately 30 minutes endurance, which is affected by weather conditions (especially wind, heat, and humidity), and any payload in use. The system is capable of flying in inclement weather, including winds up to 35 mph, heavy rain/snow, altitudes up to 12,000 feet above mean sea level (MSL), and temperatures between -10°F and 120°F.

The system’s autopilot, flight controls, and human/robot interface have lineage from the combat-proven InstantEye Mk-2 GEN3 and Mk-2 GEN4 systems. These earlier systems have thousands of documented flight hours, have Air Worthiness Releases from Army Special Operations Aviation Command, and are authorized for fielding and use by Headquarters Department of the Army.

An InstantEye Mk-3 GEN4-D1 (MIL) system consists of the following elements (Figure 1):

- Aircraft, InstantEye Mk-3 GEN4-D1 (MIL) – QTY 2
- Two-Handed Controller (GCS-D) D1 (MIL) – QTY 1
- Ruggedized Ground Control System (GCS) Display (8J) – QTY 1
- GCS Cables w/ USB host adapter (8J) – QTY 1
- Transit (Hard) Case, InstantEye Mk-3 GEN4-D1 System– QTY 1
- Soft Case, InstantEye Mk-3 GEN4-D1*– QTY 1
- Battery, 1.3 Ah- QTY 2 /5.7V– QTY 2
- Battery Charger, InstantEye Mk-3 GEN4-D1 – QTY 1
- Charger Interface Cable for BA-5590 & BB-2590, 4-Pin – QTY 1
- Spares Kit, InstantEye Mk-3 GEN4-D1 – QTY 1
- InstantEye Mk-3 GEN4-D1 sUAS Technical Manual (MIL) – QTY 1

* Soft cases are available in multiple colors.
1.1. Aircraft

The InstantEye Mk-3 GEN4-D1 aircraft is a small, all-electric hand-launched/recovered unmanned quadrotor aerial vehicle (Figure 2). It comes standard with a gimbaled two-camera (EO/IR) video camera pod. See Section 7. Payloads (pg. 54) for details on each payload.
1.2. Ground Control System

The InstantEye Mk-3 GEN4-D1 Ground Control System (GCS) comprises a two-handed controller (GCS-D), a ruggedized viewing device, and associated cabling with USB host adapter. The viewing device in the standard configuration is an 8-inch Android-based viewing device in a ruggedized case with a sunshade (Figure 3). The system is operable with Nett Warrior and Android Tactical Assault Kit (ATAK). Video from the aircraft can be recorded directly to the GCS-D memory.

Figure 3. InstantEye Mk-3 GEN4-D1 Ground Control System.

1.3. Transit (Hard) Case

The transit case (Figure 4), made of high-performance injection-molded plastic with customized foam inserts, is designed to carry the full InstantEye system and has provisions for additional batteries, payloads and spares. This ruggedized, water-resistant case is designed to protect the system during shipment.

Figure 4. InstantEye Mk-3 GEN4-D1 system transit case.
1.4. Soft Case

There is one soft case provided (Figure 5). Each zippered, nylon case comes with customized padding to protect its contents. The case is designed to carry one aircraft, the GCS-D, the tablet and cables, and up to six batteries. The case minimizes weight for field operations, while still providing protection from damage. The cases are available in a variety of colors, based on the application: multicam, coyote, and black.

![Figure 5. InstantEye Mk-3 GEN4 soft case – shown in MultiCam.](image)

1.5. Batteries, 1.3 Ah & 5.7 Ah

The InstantEye Mk-3 GCS-D batteries are Lithium-Polymer (Li-Po) batteries. The 1.3 Ah battery (Figure 6) is used in the operation of the InstantEye GCS-D. The 5.7 Ah battery (Figure 7) is the GEN4 aircraft battery.

![Figure 6. InstantEye Mk-3 1.3 Ah GCS-D battery.](image)
1.6. Battery Charger
The InstantEye Mk-3 GEN4-D1 battery charger consists of a charge module, AC/DC module, battery charging cradle, battery balancing cable (x2), and a battery charge adapter (Figure 8).

Figure 7. GEN4-D1 5.7 Ah aircraft battery.

Figure 8. InstantEye Mk-3 GEN4-D1 battery charger.
1.7. Charger Interface Cable for BA-5590 & BB-2590

This interface cable (Figure 9) enables the InstantEye batteries to be charged directly from a user-provided BA-5590 or BB-2590 battery instead of the 12 V / 5 A power supply provided as part of the system.

![Figure 9. BA-5590 and BB-2590 charger interface cable.](image)
1.8. Spares Kit

The InstantEye Mk-3 GEN4-D1 spares kit (Figure 10) provides spares for those components that can be easily replaced by the operator in the field. The kit consists of:

- Replaceable motor assembly “O” (QTY 2)
- Replaceable motor assembly “X” (QTY 2)
- Motor screw (QTY 16) *note these come pre-installed in the motors
- Propeller kit (QTY 1)
  - Propeller “O” (QTY 2)
  - Propeller “X” (QTY 2)
  - Propeller nut (QTY 4)
- Screwdriver, #1 Phillips (QTY 1)
- Nut Driver, 10 mm (QTY 1) for ISR; 8mm for HL

Figure 10. InstantEye Mk-3 GEN4 spares kit. Note that the motor screws ship installed on the motor assemblies, so they aren’t shown separately above.
2. Safety

2.1. General Operations Safety

The InstantEye Mk-3 GEN4-D1 system should never be used in a scenario where it could imperil the safety of manned aircraft.

All FAA rules and regulations must be observed while flying in civilian airspace, and all Department of Defense (DoD) and installation-specific rules and regulations must be followed in military airspace. Do not fly in controlled airspace or over property without prior permission from the manager/owner of that airspace/property.

For detailed information about possible emergency scenarios during flight and the standard recovery procedures, refer to Section 4. Warnings and Emergency Procedures (pg. 41).

2.2. Aircraft Safety

The aircraft is equipped with four hard-composite propeller blades that spin at or above 6000 RPM. Keep hands and face clear of the propellers at all times while the aircraft is powered. Loose clothing and long hair could become entangled in spinning propellers and should be constrained before operation of the aircraft. The aircraft should not be flown near tree branches, hanging wires, or other obstructions that could catch in the propellers. When the motors are on the operator must always be able to reach the MOTOR button located on the GCS to immediately shut them off in an emergency. Never leave the GCS outside of arm’s reach while the motors are running.

Although the aircraft can maintain position and altitude autonomously, the operator should never leave the GCS unattended, except to service an unrelated emergency and should resume operation of the GCS immediately thereafter.

The aircraft is capable of high-speed travel and could cause bodily harm and/or damage to property should it collide with a person or object in flight. No one should operate the InstantEye Mk-3 GEN4-D1 system without proper training. Personnel should wear safety glasses and head protection during training.

If a crash is imminent, turn off the motors as quickly as possible to minimize damage. A crash with the motors on is much worse than a crash with the motors off. Avoid flying in close proximity to people and high-value property.

The aircraft is not designed to fly in winds in excess of 35 mph. It is dangerous to fly in these conditions, as the flight controls may be adversely impacted. Although the aircraft can fly in rain, for the operator’s own protection, it should never be flown when there is lightning in close proximity.

Using pre-flight checklists, inspect the aircraft for damage before and after every flight, and especially following hard landings. Replacement of damaged parts, if possible, should be done immediately and only with those replacements supplied by the manufacturer. When flying the aircraft again for the first time after a crash, the operator must be especially attentive in case of a controls malfunction due to hidden damage.
2.3. Battery Safety

Both the aircraft and the GCS are powered using high-capacity lithium-polymer (Li-Po) batteries. As with all Li-Po batteries, the following scenarios should be adhered to:

- Stay within the specified temperature range
- Avoid mechanical damage
- Never connect the batteries to any other charger other than those provided by the manufacturer
- Batteries that appear swollen or have been mechanically damaged must be disposed of in accordance with local and Federal regulations
- Never leave a battery in a parked vehicle in the sun on a hot day

Use only the batteries provided with the InstantEye Mk-3 GEN4-D1 system and only charge them with the supplied charger. Batteries should always be monitored while charging and kept away from flammable materials.

Charge aircraft batteries after every use. Charge the GCS-D battery after every two aircraft flights, or as indicated by the boot-up screen. Continued use of discharged batteries can cause permanent damage. Never allow a Li-Po battery to short circuit.

If the battery life of the aircraft runs out during flight, the aircraft will descend rapidly without input from the operator. If a serious crash occurs, inspect the Li-Po battery from the aircraft on a non-flammable surface. Look for swelling of the battery or significant damage to the wiring insulation. If either of these conditions is present, the battery must be disposed of properly.

Continuing to use a damaged battery could result in a fire. InstantEye’s batteries will function in temperatures between -10° to 120° Fahrenheit (-23°C to 49°C), but for optimal performance should be kept between 15° and 100° Fahrenheit. A battery pack at a temperature of less than 15°F (-9°C) can show noticeably poorer performance until it warms up with use. In wintertime or in cold climates, store packs in a heated indoor living space or in contact with your body heat. For outdoor use in cold climates, you should pre-warm your packs to room temperature by storing in clothing pockets or a heated vehicle.

⚠️ CAUTION! Never launch an aircraft with a battery that has been stored at a temperature below 15° Fahrenheit (-9°C).

⚠️ CAUTION! Li-Po batteries should never be exposed to temperatures in excess of 140° Fahrenheit (60°C).

Shipping Li-Po batteries must be in accordance with the U.S. Department of Transportation's (DOT's) Hazardous Materials Regulations (HMR; 49 C.F.R., Parts 171-180).
3. System Operation

3.1. Overview

The InstantEye Mk-3 GEN4-D1 system is capable of supervisory (normal) and manual (emergency) flight, depending on the flight mode selected by the operator. Typical flight operation is more like positioning a camera in the sky than flying an aircraft. The operator unpacks and powers the system, sets a flight altitude, and launches the aircraft. While in the air, the aircraft maintains its altitude and position until the operator commands a change with the GCS-D. The operator can toggle the current camera feed that is sent down and displayed on the tablet.

3.1.1. Aircraft

The InstantEye Mk-3 GEN4-D1 aircraft is a quadrotor configuration, vertical takeoff and landing (VTOL), small unmanned aerial system (sUAS) designed for single-user operations. The aircraft consists of two major assemblies: a plastic and carbon-fiber frame, and a plastic-enclosed electronics body. See Figures 11 & 12 for labeled pictures of the major aircraft components.

![Aircraft Diagram]

Figure 11. InstantEye Mk-3 GEN4-D1 aircraft components – top and bottom views.

The top surface of the body above the cameras contains the GPS antenna. This region of the aircraft must be kept clean and free of tape or decals. Hook-pile tape straps are provided on the bottom of the body for secure attachment of the 5.7 Ah battery.
3.1.2. Ground Control System

The Ground Control System for the InstantEye Mk-3 GEN4-D1 consists of an Android viewing device, a two handed controller (GCS-D) with battery, and the associated cables connecting the GCS-D to the viewing device. The GCS-D is weather-resistant and connects through Series 80 Mighty Mouse Connectors and cables. Additional power can be provided by a 10 Ah Li-Po battery soldier’s conformal wearable battery (CWB, not included). See Figure 13 for a labeled picture of the major GCS components. More details on the control interface are provided in Section 3.1.3. GCS-D Control Interface (pg.17), and more details on the display of the viewing device are provided in Section 3.1.5. GCS On-Screen Display (pg.19).
3.1.3. GCS-D Interface

The GCS-D interface can be broken into three main groups: joysticks (QTY 2), wheel (QTY 1), and buttons (QTY 10). Each of these interfaces (Figures 14 & 15) is described below.

![GCS-D Interface Diagram](image)

*Figure 14. GCS-D button, wheel and joystick configuration – front and back views.*

*Figure 15. GCS-D button, wheel and joystick configuration – top view.*
3.1.3.1. **Joysticks**

There are two, four-position joysticks used to reposition the aircraft once it is airborne:

- The left joystick is the translation joystick. Pushing the translation joystick forward moves the aircraft forward. Likewise, pushing the translation joystick rearward, moves the aircraft backward. Pushing the translation joystick left or right moves the aircraft laterally, left and right.

- The right joystick is the yaw/altitude joystick. Pushing the yaw/altitude joystick left or right rotates the aircraft heading (yaw). Pushing the yaw/altitude joystick forward increases the aircraft altitude and pushing the yaw/altitude joystick rearward decreases the aircraft altitude.

3.1.3.2. **Camera Wheel**

There is a wheel on the left underside of the GCS-D. This wheel gimbles the camera.

3.1.3.3. **Primary Control Buttons**

The ten control buttons and their function are as follows:

- **ALT** button enables and disables Altitude Control mode
- **NAV** button enables and disables Navigation Control mode
- **CAMERA** button toggles the current video feed that is displayed on the GCS
- **MOTOR** button turns the aircrafts motors on and off
- **HOME** button enables Home mode
- **UTILITY 1** button tilts the gimbaled camera upward
- **UTILITY 2** button tilts the gimbaled camera downward
- **UTILITY 3** button controls payload functions
- **UTILITY 4** button controls payload functions
- **POWER** button turns the GCS-D on/off

3.1.4. **Flight Modes Overview**

A brief description of the flight modes is given below to provide context for describing other aspects of the aircraft. A full description of the modes will follow in the section titled “Flight Modes.” Note the three standard, user-defined modes are shown throughout this document with black text with green background.

- **Navigation** – Navigation, or **NAV**, mode activates the GPS translational position controller.
- **Altitude** – Altitude, or **ALT**, mode activates the vertical position controller.
- **Home** – Home, or **HOME**, mode commands the aircraft to return to its home location.
- **Landing** – Landing mode lands the aircraft at its home location during lost communications. Landing mode can be activated by holding down the HOME button.
- **Lost Communications** – Lost communications mode is enabled automatically when the aircraft fails to receive commands from the GCS. Note, this is not a user-activated mode.
3.1.5. InstantEye Application On-Screen Display

When the InstantEye application (app) is enabled, the on-screen display (OSD) provides the operator with important data from the aircraft and GCS in a visual format. This information is displayed in several graphics, each of which is shown in the following example image (Figure 16). In this section, the function of each graphic is explained in detail.

![Figure 16. Ground control system on-screen display with graphics.](image)

3.1.5.1. Range/Bearing

The Range/Bearing graphic (Figure 17) is in the upper left of the display screen. It displays the distance from the GCS to the aircraft in meters, the direction of the aircraft from the GCS, and the bearing of the aircraft relative to the operator.

![Figure 17. Range/Bearing graphic.](image)
When the aircraft has a GPS fix, a number followed by the unit “m” (meters) will appear inside the inner circle. This is the approximate range from the GCS to the aircraft. If the range is less than 5 meters, “<5m” will display. If the aircraft does not have a fix, an “X” will display in the center of the inner circle.

The line drawn from the outside of the inner circle to the inside of the outer circle indicates the direction to the aircraft from the GCS. It “points” in the direction of the aircraft (Figure 18). If the aircraft does not have a GPS fix, the direction cannot be calculated and the line will not be displayed.

![Figure 18. Range/Bearing graphic example.](image)

The line drawn starting from the outer circle indicates the bearing of the aircraft relative to the operator. If the aircraft is “facing” away from the operator (i.e., if it were to be moved forward, the range would increase), this line will form a continuation of the other line. If the aircraft is pointed back towards the operator, this line will “fold back” in on the other line.

**Note:** Should the operator move with the GCS while it does not have a GPS fix, the range and direction information will be incorrect. The further the operator moves from the aircraft launch location without a GCS GPS fix, the greater the error in the displayed information.

**Note:** Upon startup, if the Range/Bearing graphic gives an erroneous range or direction, wait for the GCS GPS fix to improve before launching.

3.1.5.2. Heading

The Heading graphic (Figure 19) indicates the aircraft’s magnetic heading in degrees. The scrolling text above the numerical heading inside the grey box mimics a compass card and allows the operator to discern quickly what bearing may be achieved by yawing left or right.
3.1.5.3 Battery Life

The Battery Life graphic (Figure 20) displays the approximate amount of flight time remaining given the current charge state of the aircraft battery. As the battery discharges and the time remaining decreases, the time left will turn from green to yellow and then red. When the time remaining is low, bring the aircraft home and land. Flying or climbing fast, as well as flying upwind, diminishes the battery more quickly. Monitor these factors to ensure adequate flight time to recover the aircraft.

Figure 20. Battery Life graphic.

3.1.5.3 Zulu Time

The Zulu Time graphic (Figure 21) displays the current Coordinated Universal Time (UTC) date and military time in the format \[day of month\] \[hours\] \[minutes\] \[month letter abbreviation\] \[last 2 digits of year\].

This information is supplied by GPS satellites and so may not display if the GCS GPS has no satellites in view. If the GCS does acquire a valid time, the GPS battery backup will maintain it for a number of hours regardless of whether any satellites are in view.

3.1.5.4 Camera Orientation

The Camera Orientation graphic (Figure 22) displays the orientation of the camera currently being used. The aircraft has two cameras in the standard gimbaled video camera pod, which can be set at 5-degree increments over 90 degrees. Once set, the camera remains stabilized in the pitch axis.
3.1.5.5. Flight Modes

The Flight Modes graphic (Figure 23) highlights currently active modes in green. If selection of a particular mode is not available for any reason, an “X” will appear over the mode in the respective mode’s box.

3.1.5.6. GPS Coordinates

The GPS Coordinates graphic (Figure 24) displays the aircraft’s current location if the aircraft has a GPS fix. If the aircraft has yet to acquire a GPS fix, dashes will display instead of coordinates. However, once a fix is acquired, the graphic will continue to show the last valid GPS coordinates received from the aircraft. The format of the GPS coordinates can be toggled (in the “Overlay” menu) between MGRS (default), latitude and longitude in decimal minutes, and latitude and longitude in decimal degrees.
3.1.5.7. **Altitude**

The Altitude graphic (Figure 25) displays, inside the gray box, the aircraft’s current altitude above ground level (AGL), measured in feet from the launch point (not from the ground). If the aircraft is in ALT mode and is 3 or more feet from the operator-requested altitude, the requested altitude will also display. If the requested altitude is greater than the aircraft’s actual altitude, the requested altitude will display above the gray box. If the requested altitude is lower than the aircraft’s actual altitude, the requested altitude will display below the gray box. An arrow indicates the direction in which the aircraft is correcting in order to move to the requested altitude.

![Figure 25. Altitude graphic.](image-url)
3.1.5.8. **GCS GPS Fix Indicator**

The GCS GPS Fix (Figure 26) Indicator graphic is only displayed to inform the operator when the GCS GPS does not have a fix. As soon as the GCS acquires a GPS fix, the graphic is erased. Should the GCS subsequently lose that fix, the graphic will reappear.

![GCS GPS Fix Indicator graphic](image)

*Figure 26. GCS GPS Fix Indicator graphic.*

3.1.5.9. **Warnings**

Warnings are displayed in the center of the screen in yellow text (Figure 27). They inform the operator of crucial information regarding the status of the aircraft and GCS and should be given attention whenever they appear on screen. It is possible that several warnings may display at once. A detailed list of the warnings, what they mean, and how to address them is provided in Section 4. **Warnings and Emergency Procedures** (pg. 41).

![Warning graphic example](image)

*Figure 27. Warning graphic example.*

3.1.5.10. **Directives**

Directives appear in white text in the center of the screen at the start of flight operations and walk the operator through the typical procedure used to begin a flight. They are not binding and will disappear after the motors are engaged for 10 seconds.

3.1.6. **Radio Frequencies**

The InstantEye Mk-3 GEN4-D1 system contains two transceivers, one on the GCS-D and one on the aircraft. The GCS-D transmits command and control (C2) to the aircraft and the aircraft transmits both flight data and video to the GCS-D.

The InstantEye Mk-3 GEN4-D1 is equipped with a pico digital data link (pDDL) system, a 256-bit American encryption standard (AES) encrypted waveform. Upon start up, the GCS-D scans for the frequency with the least interference. The GCS-D then chooses this frequency and uses it for the duration of the flight.

The key specifications for the vehicle data/video frequencies are as follows:
- Transmitter Type: Digital
- Modulation and Coding: COFDM
- Minimum Transmit Frequency: 1813 MHz (GEN4-D11),
- Maximum Transmit Frequency: 1850 MHz (GEN4-D11)
- Operational Transmit Frequency: Channelized with 1 MHz spacing at 4 MHz bandwidth
- Peak Possible Power to Antenna: 0.5 W
- Average Power to Antenna: 250 mW
- Encryption: 256-bit AES

3.2. Pre-Flight

Pre-flight activities are key to successful and safe operations. The following sections outline the procedures from initial conditions checks to turning on the individual system components.

3.2.1. Conditions Check

The following four conditions are important to check before beginning operations: weather, obstructions, interference sources, and compass error sources. Each is described below.

3.2.1.1. Condition 1: Weather

InstantEye Mk-3 GEN4-D1 is able to fly in most inclement weather including wind speeds up to 35 mph, precipitation, altitudes up to 12,000 feet MSL, and temperatures ranging from -10°F to 120°F (-23°C to 49°C). Endurance will be adversely affected by harsher conditions. The flight time remaining graphic on the GCS (Figure 20, p. 22) will adapt and give a relatively accurate reading, but it should be monitored frequently to ensure sufficient time is allotted to land the aircraft safely.

3.2.1.2. Condition 2: Obstructions

The aircraft depends on GPS satellites to hold its position in NAV mode. The GPS fix time and fix quality are affected if the sky is obstructed by trees, buildings, terrain or other objects. The fix quality of the aircraft is indicated on the screen directly below the GPS Coordinate graphic. See Section 3.1.5. GPS Coordinates (pg. 23) for a detailed description of this graphic. If the fix quality is low, the aircraft will have some difficulty maintaining its position with accuracy. In this case, move to an area where the sky is less obstructed.

3.2.1.3. Condition 3: Interference Sources

The GCS-D and aircraft transmit the C2/data and video link in the L-band. If the specific frequencies selected are being jammed or there are any sources of interference in these bands, the system will not operate properly. If jammed in flight or a significant source of interference is encountered, the aircraft will enter lost communications mode, allowing it to be safely recovered. Some examples of interference sources include: cell towers, radio towers, and powerful WiFi networks.
3.2.1.4. **Condition 3: Interference Sources**

The aircraft uses an internal electronic compass for navigation. The aircraft compass will read incorrectly if placed near large metal objects or large electromagnetic sources such as power generators. Standoff distances as much as 30 meters may be required to avoid compass heading error. The tablet displays “**Warning: Compass Heading Error**” if this problem occurs. If the error occurs in flight, immediately navigate the aircraft away from the affected area to prevent loss of **NAV** mode control.

The system is particularly susceptible to magnetic interference on initialization and launch. If the aircraft or GCS is initialized in close proximity to a metal object, such as a vehicle, errors may occur. Proper launch and recovery techniques, particularly operation in or around ground vehicles or boats, are taught during operator training.

3.2.2. **System Inspection**

Both the aircraft and the GCS (GCS-D and tablet) should be inspected for damage before operating the system. Ensure that each battery connector is not bent. Inspect the aircraft in general, and specifically look for damaged, loose, or misaligned propellers; loose motors; and cracked motor supports. The GCS should also be generally inspected looking especially for broken or loose antenna connections; cracked screen; and broken or loose joysticks.

3.2.3. **Battery and Antenna Orientation**

After removing the aircraft and GCS-D from the waterproof case, securely install the batteries. Attach the aircraft battery to both hook-pile tape strips which should be oriented such that it runs lengthwise along the aircraft and (Figure 28). It should be centered and strapped in tightly to prevent it from shifting or detaching in flight. The battery is labeled to help ensure proper alignment of the battery. The GCS-D battery should be connected and placed in the battery socket on the rear of the unit (Figure 29).

![Figure 28. Aircraft battery installation.](image)
3.2.4. Antenna Positioning

The GCS-D antenna should remain in a vertical configuration, as shown in Figure 30 (left). Ensure the aircraft video antenna is securely connected and oriented directly down, as shown in Figure 30 (right). If the aircraft is flown with the antenna removed, there is a risk of damaging the video transmitter on the aircraft, limiting the effective range of the system.

3.2.5. Video Output

The GCS-D outputs H264 video through a USB cable on the bottom of the unit. The video contains graphics data for display on an Android device with the InstantEye app, ATAK or Automated Pilot Advisory System (APAS).

3.2.6. Power On / Pairing

- Connect the viewing device and the GCS-D with the provided cables (see Figure 13, p. 16). The USB host adapter MUST be inserted between the cables as shown in Figure 13 for the GCS-D to communicate with the tablet, and the GCS to pair with the aircraft.
- Turn on the GCS-D by pressing the POWER button. Do this before powering on the aircraft.
- Power on the aircraft by pushing the POWER button. This will allow the GCS-D and the aircraft to pair. Powering the aircraft quickly minimizes the possibility of cross-pairing with other GCS-Ds in the vicinity.
• Pairing with the aircraft begins with the GCS-D scanning the frequency band and determining the best open channel to select. Once this is complete, it transmits a pairing request to the aircraft. This process is complete when flight data and video are displayed on the tablet screen.

• Turn on the tablet and activate the InstantEye app. The tablet screen will display the main application screen, detailing the current pairing stage (Figure 31, left). Successful pairing between devices is indicated with green arrows.

Ten, tap the VIEWER button (eye icon) to see the flight screen that briefly shows the charge state of the connected battery (Figure 32 right). The GCS-D battery indicator shows “Good” when the battery is sufficiently charged for a normal flight. If it reads “Low” or “Change” swap the battery for a fully charged unit.

3.3. Initialization

After pairing with the GCS-D, the aircraft begins an initialization process to confirm the onboard sensors are functioning properly. During this time, the tablet displays “Initializing.” The specific steps for initialization check are:

• Ensure all flight modes are disabled
• Ensure aircraft and GCS-D are separated by approximately 36 inches (Figure 32)
• Hold aircraft firmly, level, above your head, and free of obstacles (Figure 32)
• Power on motors
• Tilt the aircraft in four cardinal directions. Aircraft should resist hand movements, trying to maintain level. This also serves to check that the propellers are installed correctly.
• Power off motors
• If the aircraft does not maintain level, it is an indication that it has not initialized properly. It must be power cycled, and the initialization procedure repeated
• Ensure the aircraft has an adequate GPS fix. If a green or yellow bar is shown below the grid location/GPS coordinates, the GPS fix is sufficient to operate. If a
red bar is shown, do not fly unless an emergency requires flight. Try shifting your location to improve GPS fix. Note, GPS fix usually improves once the aircraft is airborne and the GPS antenna has a clear view of the sky.

Conduct the initialization check each time the system is unpacked. An initialization check is not required before each flight, but it is recommended after a hard landing has occurred, when operating in a new area, or after any maintenance activities.

![Figure 32. Proper technique for performing the initialization test.](image)

### 3.4. Launch

Once initialization is complete, the GCS prompts the user to enable the **ALT** and **NAV** modes.

- Enable **ALT** mode by pressing the ALT button.
- Press the yaw/altitude joystick forward to set a desired initial altitude clear of obstructions.
- Enable **NAV** mode by pressing the NAV button.

For launch, the aircraft can be held aloft or placed on the ground, as long as the propellers are clear of obstructions and there are no metallic objects in close proximity to the aircraft, which could cause a magnetic compass error. Once **ALT** and **NAV** modes are enabled and the altitude is set clear of obstructions, launch the aircraft by pressing the **MOTOR** button. The motors will momentarily spool up slowly at first to balance thrust and then reach the launch rotation rate.

**CAUTION!** Be prepared when turning the motors on. The launch operation can be aggressive and is designed to launch vertically to clear obstructions by climbing straight up at high throttle until within 10 feet of the desired altitude. The InstantEye Mk-3 GEN4-D1 aircraft consumes the battery quickly during hard climb out. For best flight time, the user should set the initial altitude to clear obstacles and then gradually climb to the desired altitude will transitioning towards the desired location.

### 3.5. Flight

**CAUTION!** Maintain a safe distance from people and objects during operation of the aircraft to minimize the risk of potential unexpected failures. The operator should avoid flying over people and property such as vehicles and buildings to further reduce risk.
During normal flight operations, control of the aircraft is simple and straightforward, with minimal input required of the operator. While flying in ALT and NAV mode, no input is needed from the operator for the aircraft to maintain position (GPS and compass required). It will hover in position until commanded to a new position. The altitude, heading, and location can all be changed simultaneously by the operator using the joysticks.

Provided in the sections below are some general guidelines and helpful hints on specific aspects of flight operations.

### 3.5.1. Endurance

The aircraft has a typical hover flight time of 24 to 30 minutes. The nominal 24 to 30-minute endurance will be affected by external factors such as wind, temperature, distance traveled, hard climbs or maneuvering, and payload weight, requiring close monitoring of the flight time remaining graphic. Due to the inherent characteristics of the Li-Po battery, the user should use EXTREME CAUTION WHEN THE FLIGHT TIME REMAINING GRAPHIC INDICATES LESS THAN 2 MINUTES OF BATTERY LIFE REMAINING. When the indicated time is less than 2 minutes, maneuvering capabilities (bank, climb, drive) of the InstantEye Mk-3 GEN4-D1 are diminished. The user must incorporate this into flight planning. To maintain stability, the system will limit the rate at which the user can maneuver home and climb under 2 minutes of battery time. PLAN TO RETURN TO THE DESIRED LANDING ZONE WITH AT LEAST 3 MINUTES OF REMAINING TIME. THE INDICATED REMAINING TIME IS FOR HOVER FLIGHT AND DRIVING OR CLIMBING WILL RESULT IN SHORTER TIME REMAINING THAN ACTUALLY INDICATED. The indicated time does NOT have a built-in safety buffer.

### 3.5.2. Range

It is important to maintain line of sight (LOS) with the aircraft to receive the best video feed on the GCS and to sustain the C2 link (Figure 33). LOS can be achieved by increasing either altitude or standoff distance from an obstruction. The aircraft will have 300 to 3000 meters of video range, depending on conditions. To maximize range, the aircraft should either be launched from high ground so clear LOS can be maintained over longer distances, or the aircraft should maintain an altitude that is higher than local obstructions.

![Line-of-sight (LOS) diagram.](image)

### 3.5.3. Altitude
The aircraft performance allows operation up to 12,000 feet with little to no degradation in performance other than a slight decrease in endurance. Operational AGL altitudes typically range from 50 to 600 feet. This maximizes the target resolution while still remaining undetected.

3.5.4. Video Feed

In its standard configuration, the aircraft is equipped with a gimbaled camera payload pod. The stabilized cameras have a range of 0 to 90 degrees, in 5-degree increments. The camera position is controlled by the camera wheel on the left-underside of the GCS-D.

The vehicle transmits both EO/IR feeds to the GCS at a time. Camera views can be toggled using the CAMERA button on the GCS-D. Once it is initialized, the camera gimbal assumes a 45-degree angle and the EO camera video is transmitted to the GCS. Note, when the aircraft is powered down, the camera gimbal assumes a 90-degree angle (pointing downward). A single CAMERA button press toggles to the IR camera. A second press toggles back to the EO camera.

While using the gimbaled cameras, the camera aim point displays a grid at the center of view when it is possible to calculate the ground position. The camera aim point points to an estimated GPS location on the ground. When the gimbaled camera is in a near-horizontal position, no camera aim point is shown and the location is of the aircraft is shown as indicated by A/C in place of the camera aimpoint in the GPS bar.

3.5.5. Modes

The aircraft enters and exits modes as a result of both GCS inputs and internal logic.

3.5.5.1. Navigation

NAV mode activates the translational position controller. While outside, the controller uses both GPS satellites and the onboard sensors to determine position. The mode is directly enabled and disabled by pressing the NAV button and indirectly enabled when HOME or lost communications mode is enabled. Additionally, NAV mode is disabled if the aircraft’s GPS signal is significantly degraded and “Warning: Aircraft lost GPS; NAV mode disabled” will be displayed on the screen.

3.5.5.2. Altitude

ALT mode activates the vertical position controller. Both barometric pressure sensors and accelerometers are used to determine altitude. It is enabled and disabled directly by pressing the ALT button and indirectly enabled when HOME or lost communications mode is enabled.

3.5.5.3. Home

HOME mode activates the translational position controller and commands the aircraft to return to the location of the GCS. If the GCS GPS is not fixed, the aircraft will return to the last known location of the GCS or the launch point. This mode is enabled directly by pressing the HOME button while not in indoor mode, and indirectly when the aircraft enters lost communication mode and again, while not in indoor mode. It is disabled by
using a joystick or by pressing the NAV button to disable NAV mode. The user should only enable HOME mode when the vehicle is at least 50 feet higher than the surrounding obstacles. The vehicle is not aware of obstacles and will not avoid obstacles on the way home that may be in the way. Due to discrepancies between the vehicle GPS and the GCS GPS, the home location may be in error by as much as 35 meters in poor GPS conditions and as little as 5 meters in good GPS conditions.

**Note:** The HOME mode should only be enabled when all systems are operating normally. It should not be used as an emergency procedure.

### 3.5.5.4. Landing Mode

Landing mode activates the vertical position controller and commands the aircraft to slowly descend. Landing mode is automatically initiated when there is a loss of communication and the aircraft has returned to its home location without regaining communication with the GCS. This mode can also be entered while in indoor mode. While in indoor mode, pressing the HOME button will initiate the landing mode. Loss of communications in indoor mode will automatically initiate the landing sequence. Activate landing mode by pressing and holding the HOME button.

### 3.5.5.5. Lost Communications Mode

Lost communication mode is enabled when the aircraft fails to receive commands from the GCS. This mode changes depending on the state of indoor mode. While not in indoor mode, both the translational position controller and the vertical position controller are activated, allowing the aircraft to climb to a safe altitude and return to the home location. If the aircraft regains the C2 link in the process of returning home, the operator will once again have full control. In indoor mode, lost communication mode commands the aircraft to enter Landing mode. If C2 is regained during the aircraft’s return to HOME, the operator can wiggle the left joystick to regain control of the aircraft and resume piloting.

### 3.5.5.6. Camera Aim Point

Camera aim point mode is automatically enabled when the GCS is powered up. While any selected camera is looking downward, a cursor appears at the center of the field of view. While this cursor appears on the screen, the GPS location will be calculated at this point on the ground. In this mode, the location graphic at the bottom of the tablet display contains the coordinates of the center of the displayed video feed. A small reticle is generated at the center of the display to aid in pinpointing targets. The indicator has no information about the ground topography and ASSUMES FLAT GROUND in its calculation of latitude and longitude. The error in the indicated coordinates will grow with aircraft altitude and uneven terrain of the underlying ground. Potential error is as great as twice the size of the indicating reticle box over flat ground and worse over uneven terrain. When the error is too high, such as when viewing the forward camera feed, the location graphic will revert to indicating the aircraft location over ground. This is indicated by the abbreviation “A/C” to the left of the location graphic and the disappearance of the reticle.

### 3.5.5.7. Rescue

Rescue mode is utilized if the GCS-D is unintentionally powered off midflight by pressing the POWER button, disconnecting the battery, or depleting the battery. Rescue mode
enables the GCS to skip the pairing configuration steps at boot-up and reinitialize the original pairing of the aircraft, even if that aircraft is in flight. This mode is enabled by pressing the \textit{UTILITY 2} and \textit{HOME} buttons at the same time while the GCS-D is powered on.

3.6. Landing

Depending on range, once remaining flight time reaches 4 minutes, the operator should be planning to land the aircraft. \textit{Section 3.5.1 Endurance} (pg. 30) stresses the criticality of landing prior to 2 minutes remaining. Allowing extra time for landing helps to ensure that battery life is available for emergencies that could occur during landing. Return the aircraft to the home location by pressing the \textit{HOME} button and thereby enabling \textit{HOME} mode, or fly the aircraft back using the joysticks. Before pressing the \textit{HOME} button, ensure that there are no obstacles between the aircraft and the home location. If there are any obstacles in the way, adjust the aircraft to an altitude free of obstacles. Once the aircraft has reached the home location and is loitering above, slowly decrease the altitude with the yaw/altitude joystick until the aircraft is approximately 1 foot above ground, and then allow it to settle. When the aircraft appears stable, push the yaw/altitude joystick all the way down and hold it down until the aircraft touches down, and then turn off the motors.

\textbf{Note:} It is recommended to orient the aircraft relative to the operator so the camera faces away from the operator during landing. With the aircraft and camera facing away from the operator, the aircraft will move in the same direction as the joysticks are manipulated to minimize confusion.

3.7. Post-Flight

Once the aircraft has landed and the propellers have come to a complete stop, power down the aircraft and then power down the GCS-D. After each flight, inspect the system for any damage, particularly if there was a rough landing or if any strange behavior was noted during the flight. If any damage is observed, the component must be replaced before the next flight. If the damage is unrepairable by the operator, contact the manufacturer for instructions. If the system is in full working order, prepare for the next flight or repack the system for storage / transportation. Clean and dry all components before stowage.

3.8. Video or Snapshot Playback

High-resolution snapshots can be taken at any time during flight using the camera button by pressing and holding \textit{(UTILITY 3)} on the GCS-D. The \textit{GCS-D SNAPS} button on the main application screen, shown in Figure 34, allows the operator to view the snapshots taken and stored on the GCS-D. Alternatively, this feature can be accessed directly from the flight screen with the \textit{RECENT SNAP} button, where the snapshots can be viewed frame in frame, as shown in Figure 35. By using a swiping action, snapshots taken earlier can be displayed. The snapshots come up in the center of the flight display (Figure 35) and can be manipulated while still viewing critical flight data. Digital zoom up to 100x on the 5Mp images can be controlled with the operator’s fingers on the touch screen. Playback of previously recorded videos is available at any time using the tablet by going to the main application screen and hitting the \textit{GCS-D VIDEO} button shown in Figure 34. The operator can also view current live video with the \textit{VIEWER} button, and see videos and snapshots that have previously been saved to the tablet with the \textit{TABLET}
SNAPS/VIDEO button.

Figure 34. InstantEye main application screen with RTB, waypoint mission and snap/video viewing options.
Figure 35. The RECENT SNAP button on the flight screen of the viewing device is shown with a red arrow.

3.9. Optional Return-to-Base Waypoint Entry

The home location for the aircraft, by default, is the GPS location of the GCS. If the GCS does not have a GPS location because of a poor GPS signal in its location, then the aircraft home position becomes the aircraft launch position. If the operator would like the aircraft to return to an alternate home location, a new Return-to-Base (RTB) location can be manually entered prior to launching the aircraft. RTB location entry is done by pressing the SET RTB button at the bottom of the main application screen (Figure 36 through Figure 38).

- Programming an alternate RTB point will allow the aircraft to go to a designated waypoint if:
  - HOME button is pressed
  - Aircraft goes into lost comms mode
  - RTB point is valid

- Waypoints must be valid for the capability of the aircraft. If not, a warning will appear, which says “RTB Upload Fail: Check RTB” upon attempting to upload the waypoint to the aircraft.
Figure 36. Left: SET RTB button in InstantEye application. Right: waypoint entry.

Figure 37. Left: waypoint entry. Right: waypoint saving.

Figure 38. Left: upload RTB point to the aircraft. Right: example of an invalid waypoint, which must be reentered.
Points to remember prior to RTB programming:

- The GCS-D must be paired to the tablet and to the aircraft
- The aircraft must have a GPS fix
- The aircraft motors must be off

3.10. Optional Preprogrammed Waypoint Mission Entry

Waypoint missions can be generated and executed prior to launch (motor start). A preplanned waypoint mission of up to 15 waypoints can be entered in the InstantEye application. Waypoints can be entered in MGRS 10-digit grid format or in latitude/longitude format. Each waypoint mission can be named and saved for future recall and execution. To start the creation of a waypoint mission, press the CREATE MISSION button at the bottom of the main application screen (Figure 39 through Figure 42).

![Image](image.png)

Figure 39. Left: start mission planning by pressing CREATE MISSION button. Right: add first waypoint using PLUS button.

![Image](image.png)

Figure 40. Left: enter mission name. Right: first waypoint using 10-digit grid.
3.11. Execute Preprogrammed Waypoint Mission

Once a mission has been saved to the GCS-D, it can be accessed on the InstantEye application flight screen when the tablet is connected to the GCS-D and the aircraft. If the mission status lights are not shown on the left or bottom of the screen, press the 3-DOT button, which calls up the mission status indicators. Then press the SINGLE-DOT button (in the upper left corner of Figure 43) to pull up the list of available missions saved. If there is a connection between the aircraft, GCS-D and the tablet, and the aircraft has a good GPS fix, a mission can be highlighted and uploaded to the aircraft using the UPLOAD TO AIRCRAFT button. The aircraft will then analyze the data to ensure the waypoints are valid for the current location of the aircraft. If all waypoints are valid then the “Warning: Mission Upload Complete” will be displayed. If the system doesn’t meet the upload requirements or there is an invalid waypoint, the message “Warning: Mission Upload Fail, Check Mission” will be displayed (Figure 43 through Figure 46).
Figure 43. Left: hit the 3-DOT button to expand the mission status bar then hit the SINGLE-DOT button (shown by right arrow) to bring up the saved mission screen. Right: highlight the desired mission to be uploaded to the aircraft and hit the UPLOAD TO AIRCRAFT button.

Figure 44. Left: example of an upload failure due to an invalid waypoint or the aircraft not meeting the upload requirements. Right: example of a successful upload to aircraft.
Figure 45. Left: mission uploaded and aircraft ready for launch. Right: aircraft launched hovering and ready for mission execution by hitting the PLAY button.

Figure 46. Mission executing; can be paused at any point with movement of joysticks or a push of the PAUSE button on the tablet.
4. Warnings and Emergency Procedures

The InstantEye Mk-3 GEN4-D1 system was designed with a focus on safety. The system has numerous warning messages built into the software to indicate when a potential problem exists. These warnings help identify when emergency procedures need to be initiated. A complete list of the system's warning messages and descriptions of the emergency procedures are provided below. All operators should make sure to familiarize themselves with these procedures and periodically review them to ensure they are prepared to rapidly respond in the event of an emergency. Many emergency situations are remedied using the same few key emergency response actions.

4.1. Warning Messages

Provided in Table 1 is a summary of all of the potential warning messages that an operator may encounter, along with a further description of the message and/or recommended response to each.

<table>
<thead>
<tr>
<th>Warning Message</th>
<th>Description and Recommended Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warning: Storage is full</td>
<td>Use InstantEye app to delete previously recorded videos</td>
</tr>
<tr>
<td>Warning: Possible button; error try releasing</td>
<td>Release button or ensure no buttons are engaged</td>
</tr>
<tr>
<td>Warning: Aircraft overheating</td>
<td>Land immediately / do not launch</td>
</tr>
<tr>
<td></td>
<td>Can cause loss of altitude control – exit ALT mode if needed</td>
</tr>
<tr>
<td>Warning: Home mode enabled</td>
<td>Notifies user that aircraft is headed to home location</td>
</tr>
<tr>
<td></td>
<td>If user engaged HOME mode, this is just informational</td>
</tr>
<tr>
<td></td>
<td>If user did not engage HOME mode, this indicates lost communications – regain control when data begins to update</td>
</tr>
<tr>
<td>Warning: Aircraft is landing</td>
<td>Notifies user that the aircraft has entered landing mode</td>
</tr>
<tr>
<td>Warning: Compass heading error</td>
<td>Gain altitude to clear affected error</td>
</tr>
<tr>
<td></td>
<td>If aircraft circles or behaves erratically, disable NAV and use video to pilot the aircraft home</td>
</tr>
<tr>
<td></td>
<td>If error is displayed prior to launch, do not launch and move away from possible magnetic interference</td>
</tr>
<tr>
<td>Warning: GPS fault detected; waypoint reset</td>
<td>GPS signal may be erratic – pilot aircraft home using video and DO NOT engage HOME mode</td>
</tr>
<tr>
<td></td>
<td>Check range/bearing graphic – range may be incorrect</td>
</tr>
<tr>
<td>Warning: Aircraft lost GPS; NAV mode disabled</td>
<td>Use video to pilot aircraft home</td>
</tr>
<tr>
<td></td>
<td>DO NOT engage HOME mode</td>
</tr>
<tr>
<td></td>
<td>Range/bearing graphic will not work</td>
</tr>
</tbody>
</table>
### Warning Message

<table>
<thead>
<tr>
<th>Warning Message</th>
<th>Description and Recommended Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warning: Sensor error; ALT mode unavailable</td>
<td>Recover aircraft to home location manually</td>
</tr>
<tr>
<td></td>
<td>Be aware that altitude control is now equivalent to throttle control –</td>
</tr>
<tr>
<td></td>
<td>estimate altitude via video</td>
</tr>
<tr>
<td>Warning: GCS battery critical</td>
<td>Allows for time to bring aircraft home and land</td>
</tr>
<tr>
<td></td>
<td>Use RESCUE mode if needed</td>
</tr>
<tr>
<td>Warning: Aircraft battery low</td>
<td>Begin landing procedures</td>
</tr>
<tr>
<td>Warning: Aircraft battery critical; land now</td>
<td>Land immediately</td>
</tr>
<tr>
<td>Warning: Damaging aircraft battery; land now</td>
<td>Land immediately</td>
</tr>
<tr>
<td>Change aircraft battery</td>
<td>This indicates a depleted battery prior to launch</td>
</tr>
<tr>
<td></td>
<td>Replace battery with a fully charged battery before launch</td>
</tr>
<tr>
<td>Aircraft battery not fully charged</td>
<td>This is an informational warning, indicating the battery</td>
</tr>
<tr>
<td></td>
<td>is not fully charged prior to launch</td>
</tr>
</tbody>
</table>

#### 4.2. Loss of Video

**Indicator:** Video signal is too weak to be usable or consists entirely of static, but aircraft OSD data continues to update and **Warning: Weak C2 link** is **not** displayed. If aircraft OSD data is not updating and/or **Warning: Weak C2 link** is displayed, then the C2 link has been lost as well – refer to Section 4.3. Weak C2 Link (pg. 42).

**Response Action:** Increase the altitude of the aircraft and after reaching a safe height, move it closer to the GCS. If the aircraft is not in GCS line-of-sight, the operator must regain LOS if possible. Ensure the GCS-D video receiver antenna is pointed in the direction of the aircraft. If the aircraft video feed still does not reappear, ensure the vehicle is at an altitude clear of potential obstructions and press the HOME button to return it to the home location.

#### 4.3. Weak C2 Link

**Indicator:** **Warning: Weak C2 link** is displayed on the screen. Aircraft OSD data, such as the heading and altitude graphics, have stopped updating. Often video reception is poor or non-existent as well.

**Response Action:** Increase the aircraft altitude and after reaching a safe height, move it closer to the GCS. If weak C2 link persists, the vehicle will enter lost communication mode after 10 seconds. It will climb to an altitude of approximately 300 feet AGL and then begin to fly back to the home location. If control communications are regained en route to the home location (indicated by the disappearance of the “Weak C2 link” warning and resumption of aircraft OSD data updates), the operator may wiggle the left joystick, reestablishing control of the aircraft and redirect it by using the joysticks.
4.4. Loss of Aircraft GPS Fix

Indicator: As GPS quality degrades, the color quality bar will shrink and change color, and position hold will become less accurate. These effects are amplified when operating in windy conditions. When the quality bar below the GPS coordinate is empty (completely gray) for 4 continuous seconds, the aircraft has lost operational GPS and a warning is displayed: “Warning: Vehicle lost GPS; NAV mode disabled.” NAV mode is automatically disabled without operator action. The aircraft ceases to automatically hold position. The last known GPS coordinate is displayed in the location graphic.

Response Action: If NAV mode is not automatically disengaged, manually disengage it. Ensure that ALT mode is engaged. The aircraft will maintain altitude while the operator can focus on controlling the lateral motion of the aircraft manually using video. When aircraft position has stabilized, climb to a safe height above obstructions and fly the aircraft toward the home location. Use the video feed to navigate, as the range/bearing graphic relies on GPS to function properly and may not provide accurate information. When over an optimal landing location, slowly decrease the aircraft’s altitude while maintaining lateral position. Once a GPS fix is acquired, it should be safe to re-enter NAV mode. Note that in the absence of a GPS fix, Lost Communications mode is disabled.

4.5. Compass Heading Error

Indicator: “Warning: Compass heading error” is displayed. Position hold in NAV mode may become erratic; the aircraft may move in successively larger circles.

Response Action: If the problem persists and the aircraft seems to circle or otherwise move erratically, disable NAV mode and increase altitude to a safe height clear of obstructions while focusing on controlling the aircraft’s lateral position manually. At a higher altitude, the compass heading error warning will likely disappear, indicating it is safe to re-enter NAV mode. Do not return to the area where the error initially occurred, as it likely contains strong magnetic fields that disrupt aircraft sensors necessary for autonomous flight.

4.6. Flight Time Remaining is Critically Low

Indicator: “Warning: Aircraft battery critical; land now” is displayed. There is less than one minute of flight time remaining.

Response Action: Use the video feed to locate the closest feasible landing zone given the severe time constraint. Slowly bring the aircraft down to the ground in ALT and NAV mode, and turn the motors off when less than 1 foot above ground level (judging from downward video, not the altitude indicator, which shows altitude above/below the launch point). If video reception is lost before this point, continue to descend while watching the altitude graphic to determine when to turn off the motors. Make sure to leave the GCS powered on so that the aircraft location graphic and range/bearing graphic (Figure 17, pg. 19) can be used to assist in aircraft location and recovery.
4.7. Collision Imminent and Unavoidable

**Indicator:** The operator has determined that a collision is imminent and is not possible to avoid through aircraft maneuvers. There is no on-screen warning indicator for this.

**Response Action:** Press the **MOTOR** button to shut down aircraft motors. The aircraft’s low terminal velocity and mass reduce the likelihood of damage as long as the motors are turned off. Locate the aircraft and collision site as soon as possible to assess any damage. Leave the GCS powered on so that aircraft location graphic and range/bearing graphic can assist in location of the crash site. Power down the aircraft immediately upon recovery.

4.8. GCS-D is Powered Off While Aircraft is in Flight

**Indicator:** The GCS-D power is turned off, either due to the **POWER** button being pressed, removal of the battery, or low battery voltage.

**Response Action:** If the GCS-D shut down due to low battery voltage, replace the dead battery with a charged one. Put the GCS-D in rescue mode by pressing and holding the **UTILITY 2** and **HOME** buttons while powering on the GCS-D. Rescue mode enables the GCS-D to skip the pairing configuration steps at boot-up and reinitialize with the flying aircraft, and then full control can be regained.

4.9. High Wind

**Indicator:** Aircraft is unable to hold position or make headway against the wind. There is no on-screen warning indicator for this.

**Response Action:** Land immediately using video from camera pointed in downward-facing position. Leave the GCS powered on so that aircraft location graphic and range/bearing graphic can assist in location of the crash site. Power down the aircraft immediately upon recovery.
5. Stowage

Perform a post-flight system inspection to verify that the aircraft and GCS are undamaged and will be ready for the next flight. Inspect the aircraft in general and specifically look for damaged, loose, or crooked propellers, loose motors, and cracked motor supports. Also inspect the GCS (GCS-D and tablet) for broken or loose antenna connections, cracks in the screen, and broken or loose joysticks. Wipe the motors and body dry before stowing to prevent corrosion.

Proper orientation of the aircraft, GCS, and accessories when stowing them is critical to ensure maximum survivability of the components. Never stand or sit on the loaded InstantEye system transit case. The following figures show the proper configuration of stowed components.

The bottom layer of the case (Figure 47) includes: one aircraft, all battery charging components, spare propellers and up to six batteries. When packing the aircraft, check that all of the propellers are aligned in the foam to prevent them from being crushed. Fold the video antenna off to the left side so it does not prevent the aircraft from sitting down flat. The top layer of the case (Figure 47) is the packed soft case and a foam block with spaces to store the tablet charger, the tablet charging USB cable, and the Charger Interface Cable for BA-5590 & BB-2590.

![Figure 47. Proper orientation of stowed components – bottom layer.](image-url)
The soft case (Figure 49) includes: one aircraft, tablet, GCS-D and up to six batteries. When packing the aircraft, check that all of the propellers are aligned to avoid the walls of the case.

Figure 49. Proper orientation of stowed components in the soft case.
6. Maintenance

The InstantEye Mk-2 GEN4 D1 system should be properly cared for to minimize the likelihood of malfunction and maximize the life of the system. A very small amount of maintenance will ensure the system continues to remain fully functional. Each system includes a spares kit with replacement parts for the InstantEye Mk-3 GEN4 D1 aircraft.

6.1. Aircraft Maintenance

Prior to each flight, check for any damage to the aircraft. Aircraft propellers and motors can become damaged after a hard landing or a crash. If a propeller blade is chipped or cracked, it is best to replace it immediately. The aircraft can still fly if the damage to a propeller is minimal, but with decreased endurance. To check for damage to a motor, rotate it manually. If there is any difficulty turning the motor or if it makes a clicking sound, the motor is dysfunctional and should be replaced. It is much less likely for a motor to break than for a propeller to chip. Periodically check to make sure that all motor and propeller screws are in place and secure. Check for cracks in the aircraft frame that could reduce the aircraft’s structural integrity.

Conduct a periodic check for motor performance during maintenance. First, ensure the system has no modes enabled then hold the aircraft firmly above your head and away from others (head and eye protection is suggested). Next, press the MOTOR button and let the motors run for approximately 10 seconds to ensure everything, including the onboard motor electronics, are functioning properly. If one or more motors cuts out or slows down, replace the faulty motor(s) before flying the aircraft.

Before replacing propellers or motors, it is important to understand the proper rotational direction of the blades. Propeller blades marked with an “O” in black writing rotate clockwise (Figure 50). Propellers marked with an “X” in black writing rotate counter-clockwise.

![Figure 50. Propeller rotation directions](image-url)
When replacing a damaged motor, if the propeller is undamaged, remove the propeller and save it for future use. To remove the damaged motor, use the Philips head screwdriver provided with each kit to remove the four 2-56 Phillip head screws from the bottom of each motor assembly. You may wish to save the screws holding the motor; however, each spare motor is supplied with a set of screws, and it recommended to use new screws with each change of the motor.

Plug the correct motor onto the frame. The marking on the motor (O or X) should match that on the frame to which the motor is installed (Figure 51). **Installing a motor in the incorrect position will result in uncontrollable flight behavior of the vehicle.**

![Figure 51. Motor replacement.](image)

Secure the motor with the four supplied Phillips head screws, making sure that the motor sits flat against the frame (Figure 52).

![Figure 52. Motor screws.](image)

To replace the propeller on the motor, first remove the propeller using the supplied nut driver. The marking on the propeller must match the marking on the motor (i.e., X to X and O to O, Figure 53). **Installing a propeller in the incorrect position will result in uncontrollable flight behavior of the vehicle.** Secure the propeller with a new lock nut provided with the spare (Figure 53). When no new lock nuts are available, a lock nut may be reused, but it should be monitored for tightness due to degradation of the thread lock coating. The propeller should sit flat on, and tight to the motor housing.
6.2. GCS-D Maintenance

Periodically check that the command and control antenna is secure and tight. If operating the GCS-D in dusty or wet environments, make sure to clean/dry the GCS-D as soon as possible after use. As with any electronic device, care should be taken not to drop the GCS-D.

Check the joysticks for damage prior to each flight. Gently press straight down on a joystick. There should be no vertical movement in the joystick; if there is, do not operate system and return for repair.

6.3. Battery and Battery Charger Maintenance

Lithium-polymer (Li-Po) batteries are high-capacity, high-performance power sources, and are sensitive to misuse. Before charging a battery, do a visual check to verify it is in good condition. Only charge the 1.3 Ah Li-Po GCS-D batteries and the 5.7 Ah Li-Po aircraft batteries included with the InstantEye Mk-3 GEN4-D1 system using the supplied InstantEye charger (Figures 54 & 55) specifically designed to charge Li-Po batteries. Batteries should always be monitored while charging and kept away from flammable materials. If a battery ever becomes very hot while charging, disconnect it from the charger immediately.

When charging and using batteries, never connect the batteries to anything other than the battery charging cradle or the battery receptacle in the GCS-D or aircraft. The batteries should never be allowed to get hotter than 140°F (60°C); this will result in permanent damage.
Charge aircraft batteries after every use. Charge the GCS-D battery after every two aircraft flights, or as indicated by the boot-up screen. Continued use of discharged batteries can cause permanent damage. Never allow a Li-Po battery to short circuit. The charger may refuse to charge a battery that has been discharged beyond maximum allowable limits.

After a serious crash, always inspect the battery for severe damage, such as a large amount of swelling or damage to the housing. Do this on a fireproof surface. If either condition is present, the battery is unusable and unsafe, and must be disposed of properly. To properly dispose of Li-Po batteries: discharge the battery completely (check the remaining voltage with a multimeter) and take it to a battery recycling center, located at many retail stores.

The charger supplied with the InstantEye Mk-3 GEN4-D1 system can be powered using an AC/DC module that plugs into a standard 110V AC North American power outlet or a BA series (e.g., BA5590/BA2590) battery using the included cable.

To charge batteries:
- Plug the battery charge adapter and battery balancing cable into both the charging cradle and the charge module.
- Connect the charger to a power source via the AC/DC module and allow the LEDs on the charge module to cycle before inserting a 1.3 Ah battery into the charging cradle for charging (Figure 54).
- For 5.7 Ah aircraft batteries, connect the charger to a power source via the AC/DC module and allow the LEDs on the charge module to cycle before connecting the battery balancing cable and battery adapter cable to the battery (Figure 55). Note: the black and red power cable must be connected to the battery first and then the white balancing cable. Failure to do so can permanently damage the charger.
- The charger will indicate that it is ready to accept a battery for charging by illuminating one red LED (NO BATTERY) and one blue LED (READY).
- When the charger is ready, insert a battery into the charging cradle. Once the battery is properly inserted to the charging cradle, the blue LED (READY) will go out and the yellow LED (CHARGING) next to the blue LED (READY) will illuminate.
- At minimum charge, the yellow charging LED (CHARGING) will remain and the yellow LED (MIN CHARGE) next to the green LED (CHARGED) will illuminate; at this point, it is safe to remove the battery from the charging cradle for use on the aircraft or GCS. (Note, this minimum charge state will not provide for the full system endurance.)
- At full charge, both yellow LEDs will go out and the green LED (CHARGED) will be illuminated. At this point, the battery can be removed from the charging cradle for use, and the charger will begin to cycle (~10 seconds) again to ready itself for the next battery. For the 5.7Ah battery, unplug the white balancing cable then the red balancing cable. Failure to do so may damage the charger.
- If at any time, two red LEDs are illuminated, this indicates a charger error. In this case, remove the battery, check all connections, power cycle the charger and restart the process. If the fault persists, there may be a battery fault or the supply power may be out of voltage range. Attempting to charge a known good battery will help
identify if the fault is with the charger or the battery.

• Note: It is good practice to temporarily mark the battery (such as a piece of tape over the battery plug), to avoid confusion between charged and discharged batteries in the field.

Summary of the charging sequence:

1. Assemble and power charger
2. Wait for the LEDs to cycle to one blue and one red
3. Insert battery into charging cradle or connect battery in the order or Red/Black and then white balance.
4. Monitor charging
5. Unplug from cradle or disconnect in reverse order (white then red/black). After removing battery, wait for lights to cycle before charging the next battery

Summary of what each LED on the battery charger indicates, in the order of the LEDs on the charger:

• RED (outside) – Battery error
• RED (inside) – No battery
• RED (both) – Charger error
• GREEN – Battery charged
• YELLOW – Minimum charge
• YELLOW – Charging
• BLUE – Charger ready

A battery pack at a temperature of less than 15°F (-9°C) can show noticeably poorer performance until it warms up with use. In the winter or in cold climates, it’s best to store packs in a heated indoor living space or in contact with your body heat. For outdoor use in cold climates, pre-warm battery packs to room temperature by storing in clothing pockets or a heated vehicle.

⚠️ CAUTION! Never launch an aircraft with a battery that has been stored at a temperature below 15°F (-9°C).

⚠️ CAUTION! Li-Po batteries should never be exposed to temperatures in excess of 140°F (60°C). Never leave batteries inside a parked vehicle sitting in the sun during hot weather.
Figure 54. The InstantEye Mk-3 battery charger set up for the GCS-D battery.

Figure 55 - Battery charger set up with GEN4 aircraft battery and GEN4 aircraft battery adapter wire (Black and Red, 2 conductor) and the balancing adapter (Black receiver with white plugs for battery balancing cable).
6.4. Tablet Charging

The standard 8-inch Android-based tablet provided with the InstantEye Mk-3 GEN4-D1 system is charged through the Glenair USB cable using a simple USB power supply and the supplied USB-to-Mighty Mouse cable. Plug the charging cable into the USB power supply and then disconnect the GCS-D USB cable and connect the charging cable as shown in Figure 56. Leave plugged in until tablet indicates a full charge.

![Figure 56. Tablet set up for charging.](image)
7. Payloads

Each InstantEye Mk-3 GEN4-D1 aircraft is equipped with an integrated, gimbaled camera pod (Figure 57), with two video cameras: a 5 Mp electro-optical (EO) camera and a 160 x 120 pixel infrared (IR) thermal imager.

![Camera pod on the InstantEye Mk-3 GEN4-D1 aircraft nose.](image)

7.1. Tactical Standoff Payload (ISR Variant)

The Tactical Standoff Payload (Figure 61, left) is a plug-and-play gimbaled EO/IR payload that provides high-zoom electro-optic and long-wave infrared (thermal) imaging capability with variable-pitch control and stability.

![Tactical Standoff Payload (left), integrated into an InstantEye Mk-2 GEN4 aircraft (right).](image)

The Tactical Standoff Payload utilizes InstantEye universal payload mount to attach the payload to the aircraft (Figure 61, right). Figure 62 depicts the installation procedure for this payload. The universal mount is integrated into the underside of the aircraft’s frame.
To install the payload:

- Slide the Tactical Standoff Payload over the dovetail joint on the universal mount
- Plug the payload interface cable into the payload port, making certain to align the polarity markings on the cable and the aircraft
- Secure the battery to the aircraft using the hook-pile tape strap, and plug the battery cable into the aircraft’s power cable

The GCS and aircraft may now be powered according to standard flight operations. Upon powering the system, the user will notice a small rectangular box on the left-hand side of the screen indicating the aircraft has recognized a Tactical Standoff Payload (camera is stabilized and will attempt to hold point angle). The two cameras on the payload (EO and IR) are added to the set of cameras selectable by toggling the CAMERA button on the GCS. Depending on the angle of the payload relative to the ground, these cameras will enumerate as forward, angled, or downward cameras, similar to the three cameras integral to the InstantEye aircraft. By default, when an aircraft is equipped with a Tactical Standoff Payload, the thermal video footage is the image first to appear on the GCS following pairing.

When the video feed from either of the payload’s EO or IR cameras is displayed, the payload graphic will appear on the left side of the GCS LCD (Figure 63). This graphic
displays the function of the Utility buttons on the GCS. By default, \textit{UTILITY1} and \textit{UTILITY2} control the pitch (or “tilt”) of the payload. Pressing \textit{UTILITY1} tilts the payload up, eventually moving it to a “forward” view. Pressing \textit{UTILITY2} tilts the payload down, eventually moving it to a “downward” view. The Utility buttons must be pressed and released – holding them down does not move the payload. While flying, the payload attempts to maintain the angle of the payload cameras relative to ground. Pressing \textit{UTILITY2} past the fully downward position of the camera will disable the tilt of the payload, causing it to remain fixed in a downward position until the tilt is reengaged by pressing \textit{UTILITY1} to tilt the payload up.

\textit{Figure 63. Tactical Standoff Payload GCS display, showing payload graphic (left) and payload menu (bottom).}
By pressing the *MENU* button, the user may bring up the “THERMAL CAM” payload menu, which provides additional options for controlling the Tactical Standoff Payload. Pressing *Button 1*, labeled “NUC” pre-flight, allows the user to calibrate the IR (thermal) camera. If vertical lines appear in the thermal video feed or the feed is otherwise blurry, a calibration may improve image quality. When calibrating, first disable the camera gimbal by continuing to toggle the *UTIL2* button until the menu indicates “DSBL”. Then place a hand over the thermal camera lens and press the “NUC” button. The thermal camera uses the uniform temperature of the hand to properly calibrate. After a few seconds, the calibration is complete, and the thermal camera image should improve. The operator will know the calibration is complete when the writing on the screen stating “To NUC: cover lens with hand” disappears.

When in flight, the label on *Button 1* changes to “GAIN”, which allows the user to cycle through a number of presets for thermal camera settings. Settings such as AGC, midpoint, and plateau level are changed in concert to provide different profiles that may give a clearer image depending on environmental conditions.

*Button 2*, labeled “CHNG UTL”, allows the user to switch the functions of the GCS Utility buttons. After pressing “CHNG UTL”, *UTIL1* will control the thermal camera digital zoom and *UTIL2* will control the thermal camera color palette. The new functions of the Utility buttons will be displayed on the payload graphic. Pressing *UTIL2* cycles through 1x, 2x, 4x, and 8x digital zoom. Pressing *UTIL2* cycles through White Hot, Black Hot, and Orange Hot color palettes (see Figure 64, pg. 59). To revert to control of the payload pitch/tilt, press “CHNG UTIL” again.
Figure 64. Payload graphic when controlling tilt/pitch (left), and payload graphic when controlling thermal camera zoom/color palette (right).

Care should be taken during aircraft recovery when the Tactical Standoff Payload is installed, as the force of landing may cause the payload to detach from the payload mount. If this occurs, simply re-insert the payload strap dovetail into the mating slot on the payload.
8. Troubleshooting

Before troubleshooting a problem, ensure that the aircraft and GCS-D have fully charged batteries, the tablet is fully charged, and everything is properly connected and powered on.

8.1. Motor Does Not Spin

If a motor is not spinning, ensure that the black connector on the motor circuit board is firmly connected to the pins on the aircraft’s foot and that the motor assembly is screwed down tightly. If the motor is still not working properly, follow the instructions in Section 6.1. Aircraft Maintenance (pg. 47) for replacing it.

8.2. Motor Shakes Violently

If a motor shakes violently, check for a loose or missing screw in the aircraft foot holding the motor. These screws are located directly underneath the motor and should be kept tight at all times. A severe chip or crack in the connected propeller blade could also cause a motor to shake. If damage to the propeller is discovered, refer to the instructions in Section 6.1. Aircraft Maintenance (pg. 47) for the procedure to replace it.

8.3. Flight Time is Much Lower Than 20 to 30 Minutes

If the flight time is much lower than 20 or 30 minutes, check that the propellers are not chipped or cracked and replace the battery with a fully charged one. Inspect the used battery for damage. These are the most likely reasons for uncommonly low endurance. If propellers are damaged, refer to Section 6.1. Aircraft Maintenance (pg. 47) for instructions on replacing them. Remember that aggressive maneuvering, especially rapid ascents, will drain batteries at a high rate.

If the batteries in the InstantEye Mk-3 GEN4-D1 system have gone through a large number of charge cycles, it is also possible that their capacity has decreased and that this is a contributing factor in unexpectedly low endurance. See if a newer battery remedies the issue.

In hot weather, the motors can overheat after consecutive flights; allow them to cool between flights for an increase in total flight time. It is also possible that a worn-out motor is negatively affecting flight times. As described in Section 6.1. Aircraft Maintenance, spin the motors manually and note if there is any resistance. If a motor does not spin freely, it should be replaced as detailed in Section 6.1. Aircraft Maintenance.

8.4. Increased Wobble During Flight

If the aircraft appears to “wobble” excessively, or if it appears less stable in flight than normal, first check to make sure all propellers are in good condition. If any propellers are chipped or cracked, replace them with spares by following the directions in Section 6.1. Aircraft Maintenance (pg.47).
This behavior is also characteristic of an extremely low battery, so double-check to make sure the aircraft battery has a good charge. Check for debris such as grass or mud stuck to the aircraft and clean off as necessary.

8.5. Aircraft Is Louder Than Usual

If the noise signature of the aircraft seems louder than normal, first check the propellers. Start with the propeller that appears the most damaged/scuffed and replace it as detailed in Section 6.1. Aircraft Maintenance. If the aircraft continues to be louder than usual, replace the next most damaged propeller. Also, check to make sure no propellers are contacting the thermal management devices on the aircraft.

8.6. Aircraft Does Not Pair with GCS

If the aircraft does not pair with the GCS, as always, check that both the GCS and aircraft have good connections to fully charged batteries, and check that the aircraft, GCS-D and tablet are all powered on. The tablet will display the application screen when powered on, and the aircraft camera gimbal will position itself at 45 degrees and there will be a red light in the center of the aircraft power button to indicate that the aircraft is powered on. The camera gimbal will slew to the forward-facing position when the aircraft is ready to pair and will return to the 45-degree position when it is paired.

The GCS will have a green LED visible when powered on. Check that the C2 antenna (black stick on the top of the GCS-D) is screwed on tight. If the tablet displays “Ready to pair with aircraft”, then it is attempting to pair with an aircraft but is not receiving a response. It is possible that the radio channel on which the aircraft and GCS-D attempt to pair has an unusually large amount of interference. Try cycling power on both the aircraft and GCS-D to re-initiate the pairing process. Try pairing the system with the aircraft and GCS-D in very close proximity to one another.

8.7. Limited Video Range

If a limited video range is being experienced, check that the GCS-D video antenna/C2 antenna] (on the side of GCS-D) is securely connected. Always point the GCS-D in the direction of the aircraft for maximum video range. RF clutter in densely-populated areas, as well as tall obstructions that prevent line-of-sight operation, could negatively affect the system’s video range.

If the aircraft was left powered on without the video antenna connected for an extended period, the video transmitter on the aircraft could be severely and permanently damaged, resulting in very low video range. If troubleshooting indicates damaged video transmitter, contact manufacturer.

8.8. GCS-D Powers Off Without Pressing Power Button

If the voltage on the GCS-D battery runs extremely low, the GCS-D will automatically power down in an attempt to keep the battery from becoming permanently damaged. To prevent this from happening, always change the GCS battery when directed to do so in the boot-up screen. The small LED near the power button indicates the power status of the
8.9. Aircraft Pulls to One Direction Consistently
If the aircraft pulls to one direction consistently, check the joysticks for damage as described in Section 6.2 GCS Maintenance (pg. 49).
9. Quick Start Guide

⚠️ WARNING! Use these instructions only AFTER you have fully read this manual and completed the training sections.

The user is responsible for compliance with all Federal, State, local and FAA regulations regarding use of micro unmanned aerial system, including but not limited to regulations surrounding invasion of privacy.

9.1. Prepare Tablet For Use

1. Power on the tablet
2. Open the InstantEye application
3. Power on the GCS-D
4. Connect the tablet to the GCS-D via the Mighty Mouse Series 80 mm cable connectors, ensuring the host adapter is inline in the connection

9.2. Wait for System to Pair

1. After approximately twenty seconds, the GCS-D will connect and communicate with the tablet. This is indicated by the connection symbol between the controller icon and video screen icon changing from a red cross to green arrows (see icons in upper-right corner, Figure 65).

2. The InstantEye Mk3 GEN4-D1 aircraft and the GCS-D take approximately 60 seconds to pair. This is indicated by the connection icon between the controller icon and quadrotor icon turning from a red cross to green arrows (see icons in upper-right corner, Figure 66). At this point is possible to view the video stream from the aircraft.

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Figure 65. GCS-D communicating with Tablet

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9.3. View Video Feed

1. Once a connection has been established between the InstantEye GEN4-D1 aircraft, GCS-D and tablet, the video feed can be viewed by pressing the VIEWER button at the bottom right of the main application screen.

9.4. Fly the System

1. Once the video feed is streaming, follow the on-screen instructions to fly the InstantEye system
2. Enable ALT mode with the ALT button on the GCS-D
3. Set altitude above obstructions with the yaw/altitude joystick on the GCS-D
4. Enable NAV mode with the NAV button on the GCS-D
5. Enable motors to launch with the MOTOR button on the GCS-D
10. WARRANTY

Without prejudice to any applicable statutory warranty, if any, Physical Sciences Inc. (PSI) warrants that the InstantEye Mk-3 GEN4-D1 System (Product) will be free from defects in material and workmanship for a period of 12 months commencing upon the date of shipment to first retail customer, as demonstrated by the shipping document, except batteries which are warranted for 90 days from original ship date to the first retail customer. During the contractual warranty period, any defective Product should be returned in its original packaging to the reseller or PSI’s after-sales service. After inspection of the product, PSI will, at its sole discretion, either refund the full purchase price, repair or replace the defective part or product, excluding any other indemnification of any nature.

Product warranty does not cover the following:

- Field-replaceable components, including propellers, except those found to be defective upon initial inspection or first use
- The gradual loss of capacity of the rechargeable battery over time, which does not constitute a defect in material or workmanship
- Defects due to damage caused by an accidental collision or fall
- Defects due to system operations outside of flight envelope detailed in operations manual and program of instruction (POI)
- Defects due to abnormal use of the product or if spare parts have been installed without following the recommendations and instructions provided by PSI or if the Product has been customized by the end-user
- Defects caused by non-approved repairs carried out by the end-user or an unauthorized third party
- Defects due to the use of non-approved components, payloads or spare parts
- Defects caused by any reason other than a defect in material or workmanship

If upon technical tests being carried out, any product is found non-defective (in particular, an analysis of the flight data stored on the vehicle – results available upon request), PSI reserves the right to return such product to the sender at the sender’s cost and to levy a charge to cover PSI’s technical test fees.

Upon expiration of the 12-month warranty period or if the defect is not covered by the warranty, any defective product can be returned to PSI’s after-sales service to be repaired or for a defective part to be replaced at the sender’s costs. Repair will be carried out only after acceptance of the corresponding quotation.
11. Revision Log

Provided below is a summary of the revisions made to this document.

<table>
<thead>
<tr>
<th>Revision #</th>
<th>Revision Date</th>
<th>Description of Revisions Made</th>
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<tr>
<td>M0.5</td>
<td>October 16, 2018</td>
<td>Draft version of Mk-3 GEN4 product</td>
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<td>February 14, 2019</td>
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<td>July 31, 2019</td>
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<tr>
<td>M1.2</td>
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<td>Formatting update</td>
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</table>
12. REFERENCE MATERIAL

Provided on the following pages are materials for quick and easy reference, including:

- RMA form
InstantEye Robotics
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