



Flight Logs – types and their importance in investigations

Presented by –

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3rd Sept' 25

Agenda

- ❖ Introduction to Drone Flight Logs
- ❖ Types of Logs
- ❖ Key Data Captured
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- ❖ Specialized Logs
- ❖ Tools & Analysis Methods
- ❖ Challenges & Best Practices
- ❖ Demo: Extracting & Analyzing Logs

Introduction to Drone Flight Logs

Drone flight logs are digital records of a drone's activity during flight. They serve as a detailed account of the drone's performance and behavior, capturing a wide range of data points throughout the flight.

- GPSData: Precise location coordinates, altitude, and speed.
- Telemetry Data: Real-time information about the drone's systems, including battery status, signal strength, and sensor readings.
- Battery Information: Voltage, current, and temperature of the drone's battery.
- Control Inputs: Pilot commands and actions, such as joystick movements and button presses.
- Flight Modes: The operational mode of the drone, such as GPS mode, altitude hold, or manual mode

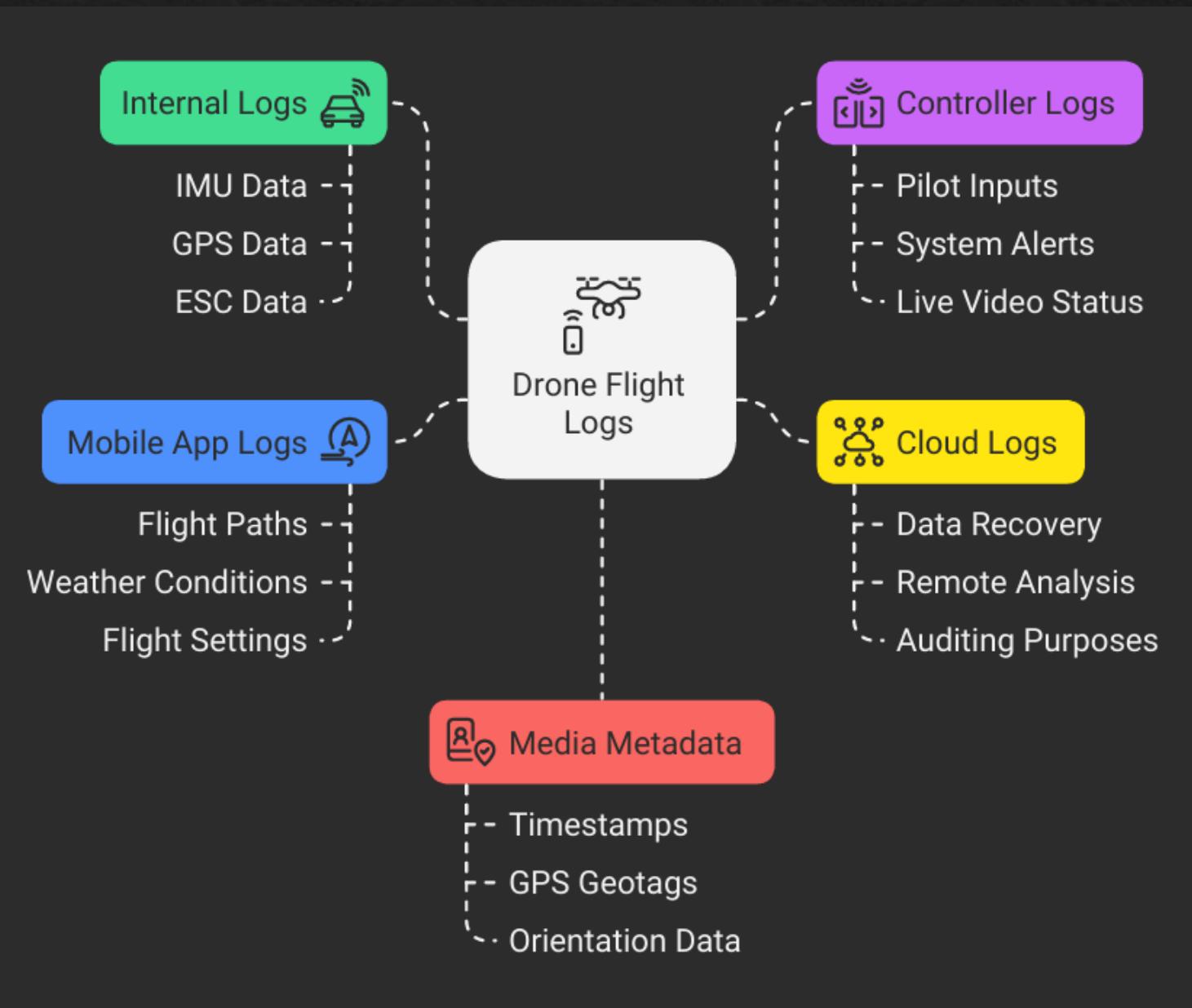
Why are they Important?

Drone flight logs are essential for several reasons:

- **Troubleshooting:** They provide valuable insights for diagnosing flight anomalies, crashes, or unexpected behavior. By analyzing the data, users can identify potential causes and prevent future incidents.
- **Accountability:** Flight logs confirm pilot actions and compliance with regulations and operational procedures. They can be used to verify that the pilot followed established protocols and adhered to airspace restrictions.
- **Forensics:** In the event of an incident, such as a crash, trespassing, or airspace violation, flight logs serve as critical evidence for investigations. They can help determine the sequence of events, identify contributing factors, and assign responsibility

Types of Drone Flight Logs

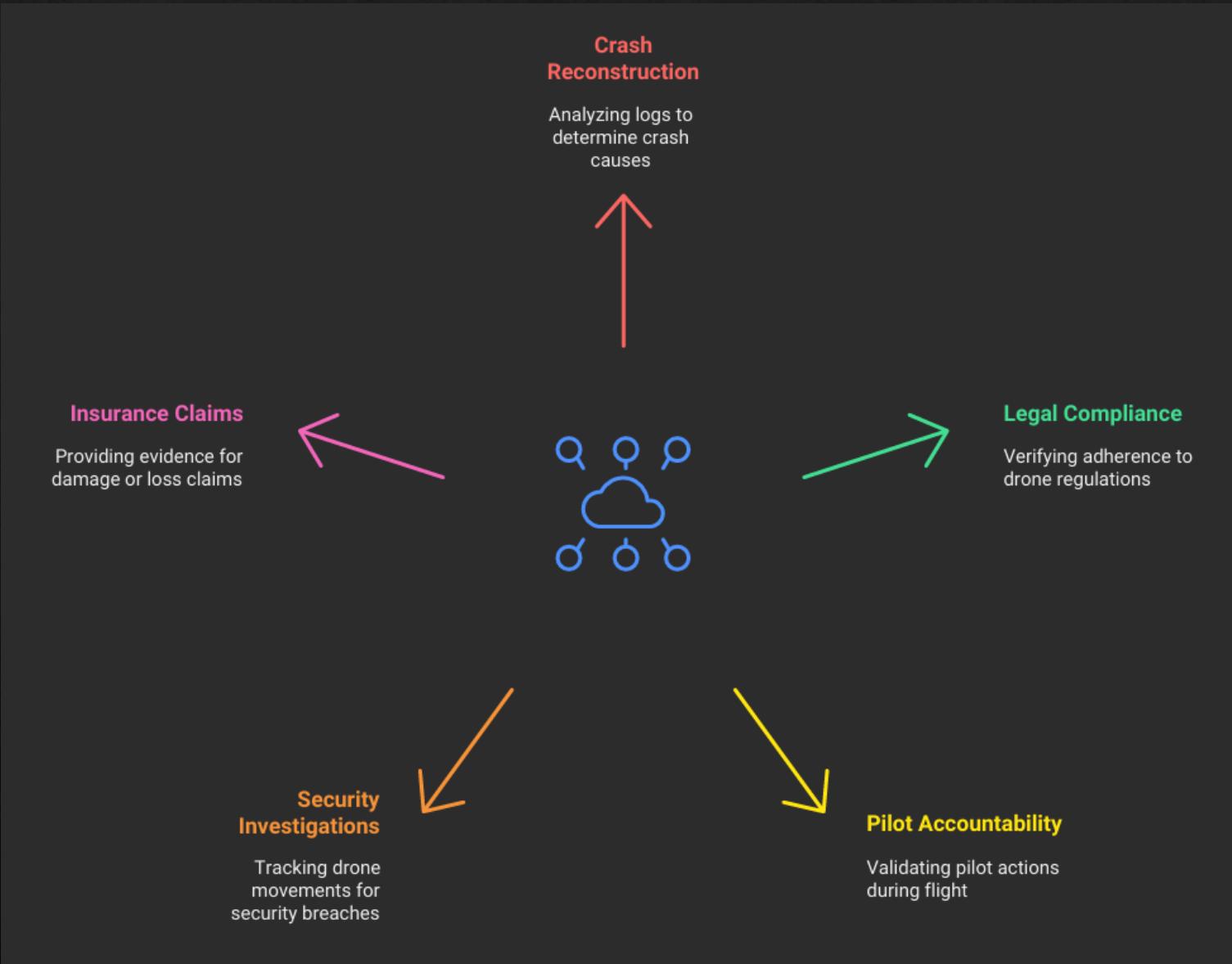
- ❖ Internal Logs: Stored in the drone's onboard memory, similar to a "black box" recorder. These logs contain high-resolution data from sensors like the IMU (Inertial Measurement Unit), GPS, and motor speed controllers (ESCs).
- Controller Logs: Stored on the remote controller (RC) or a connected mobile device. They capture pilot control inputs, system alerts, and live video feed status.
- Cloud Logs: Synced with the drone manufacturer's servers (e.g., DJI, Autel). These logs are useful for data recovery, remote analysis, and auditing purposes.
- Mobile App Logs: Generated by mobile apps like DJI GO or Litchi. They include flight paths, weather conditions, and flight settings.
- Media Metadata: Timestamps, GPS geotags, and orientation data embedded in photos and videos captured by the drone. This metadata is critical for verifying the authenticity and location of the media.



Key Data Captured in Logs

- GPS Coordinates, Altitude, Speed, Heading: Precise location and movement information.
- Battery Status: Battery levels, voltage, temperature, and discharge rates.
- Signal Strength (RC/GPS): Strength of the communication link between the remote controller and the drone, as well as the GPS signal quality.
- IMU Data: Acceleration, gyroscope readings, and compass data, providing information about the drone's orientation and movement.
- Pilot Inputs: Joystick movements, button presses, and other control inputs from the pilot.
- Flight Modes & System Warnings: The current flight mode (e.g., GPS, Atti, Manual) and any system warnings or errors that occurred during the flight.

Use of Logs in Investigations



Specialized Logs for Deeper Insight

1. **Battery Logs:** Detailed information about battery voltage per cell, charge cycles, and temperature, helping to identify sudden shutdowns or battery health issues.
2. **Sensor Logs (IMU, Compass, Barometer):** Capture detailed motion, tilt, and orientation data, allowing for the detection of instability, drift, or crash dynamics.
3. **Motor & ESC Logs:** Track motor RPM, amperage, and errors, which are key to identifying motor or ESC failures.
4. **Geofencing & NFZ Logs:** Record warnings, overrides, and unlock attempts related to geofencing and no-fly zones, helping to confirm airspace compliance.

Specialized Logs for Deeper Insight

5. Firmware & Update History: Track firmware versions and update timestamps, which is crucial for verifying compatibility and identifying known bugs.
6. System Errors & Warnings: Record system errors and warnings, such as "Compass Error" or "IMU Calibration Required," providing context to erratic or emergency behavior.
7. Communication Logs: Track RC signal strength, interference, and disconnection events, helping to investigate flyaways, failsafes, or signal loss.
8. Payload Logs (Camera, Gimbal, Sensors): Capture metadata from imaging systems, LiDAR, and multispectral sensors, validating mission output (e.g., survey or mapping accuracy).

Tools for Analyzing Flight Logs

- AirData UAV: A popular web-based log viewer with advanced analysis features.
- PhantomHelp Log Viewer: A simple and user-friendly log viewer for DJI drones.
- DJI Flight Log Viewer: DJI's official log viewer, providing basic analysis capabilities.
- Google Earth: Can be used to overlay KML/CSV files generated from flight logs, visualizing the flight path on a map.
- DroneLogbook, PX4 Log Analyzer: Open-source tools for more advanced analysis and customization

Challenges & Limitations

- Encrypted Logs: Some manufacturers, like DJI, use encrypted log files (.DAT), making it difficult to access and analyze the data without specialized tools.
- Data Loss: Logs can be lost due to crashes or data corruption, especially if they are not backed up regularly.
- Limited Access: Access to certain log data may be restricted without manufacturer tools or authorization.
- Technical Knowledge: In-depth analysis of flight logs requires technical knowledge and expertise.

Best Practices for Flight Logging

- Back Up Logs: Always back up logs after every flight to prevent data loss.
- Use Cloud Sync: Utilize automatic cloud sync features when available to ensure that logs are stored securely and accessible from multiple devices.
- Maintain a Logbook: Keep a digital or manual logbook to record flight details, observations, and any issues encountered during the flight.
- Regularly Audit: Regularly audit flight logs for legal and operational compliance, identifying any potential violations or areas for improvement.

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