

3.7 ONBOARD STORAGE CAPACITY

The **onboard storage capacity** of a drone refers to the amount of data the drone can store locally during its operations. This storage is essential for recording high-resolution images, videos, sensor data, and flight logs, especially when drones operate in areas without reliable wireless connectivity.

Key Aspects of Onboard Storage in Drones

1. Types of Onboard Storage

- **MicroSD Cards:**
 - The most common storage medium for consumer drones.
 - Drones typically support microSD cards ranging from 16GB to 512GB, depending on the model.
 - Easily removable, allowing data to be transferred to other devices for processing or storage.
- **Internal Storage:**
 - Some drones come with built-in storage, typically ranging from 8GB to 128GB.
 - Internal storage is non-removable and designed for quick access, sometimes used in conjunction with external cards.
- **SSD (Solid-State Drives):**
 - High-end professional drones often have SSDs for faster read/write speeds and larger storage capacities (up to several terabytes).
 - Used in drones that require storing large amounts of high-quality video footage, such as in filmmaking or industrial inspections.
- **Hybrid Storage Systems:**
 - A combination of internal storage and removable media like microSD cards or SSDs.
 - These systems allow for flexibility in data management, where internal storage can serve as a backup or overflow for external storage.

2. Storage Capacity Requirements by Application

- **Photography and Videography:**
 - High-resolution cameras (4K, 6K, 8K) generate large video files.
 - A 4K video recorded at 30fps (frames per second) may require around 1GB per minute of footage. Therefore, a 64GB microSD card could store approximately 64 minutes of 4K footage.
- **Mapping and Surveying:**
 - Drones used for mapping or surveying collect high-resolution images and LiDAR data, which can quickly consume storage.
 - Projects involving large areas may require storage capacities of 128GB or more, depending on the resolution and duration of the flight.
- **Industrial Inspections:**

- Inspections using thermal cameras, high-definition video, or multi-spectral imaging require large storage capacities to capture detailed data.
- For long-duration flights or missions involving continuous data collection, drones with 256GB or more of storage might be needed.
- **FPV (First-Person View) Racing:**
 - FPV drones usually record HD video for review or for entertainment purposes.
 - Since FPV footage is often recorded at 1080p or 2.7K resolution, storage needs are lower compared to professional filming drones, typically requiring 32GB to 128GB storage.

3. Storage Format

- **File Systems:**
 - Most microSD cards and internal storage are formatted in **exFAT** or **FAT32**, which support large file sizes and are compatible with a variety of devices.
 - **NTFS** and **APFS** may be used in SSD-based systems on high-end drones, providing greater performance and security features.
- **Compression Formats:**
 - Some drones use file compression to save storage space. For instance, video may be compressed in H.264 or H.265 formats to reduce file size without significantly compromising quality.
 - RAW photo formats, such as DNG, are larger and uncompressed, offering greater flexibility in post-processing but requiring more storage.

4. Storage Management

- **Data Overwrite:**
 - Some drones feature automatic data overwrite systems, where the oldest data is deleted to make space for new recordings when the storage is full. This is common in drones with limited storage capacities.
- **Cloud Syncing:**
 - Certain advanced drones can upload data directly to the cloud via a 4G or Wi-Fi connection. This allows for offloading data mid-flight, ensuring that storage never becomes a limiting factor during long missions.
- **Dual-Recording Modes:**
 - High-end drones often feature dual-recording, where lower-resolution copies of footage are stored alongside the high-resolution versions. This provides an option for quick access or streaming, while the high-quality version is saved for post-processing.

5. Upgrading Storage

- **MicroSD Card Expansion:**
 - Many drones allow users to upgrade storage by using higher capacity or faster microSD cards. Cards with fast write speeds (UHS-I, UHS-II) are essential for recording high-bitrate video and continuous data capture.

- **SSD or NVMe Storage:**
 - For professional drones, SSDs can be upgraded for larger capacities. NVMe (Non-Volatile Memory Express) drives, which offer faster transfer rates, are often preferred for real-time 3D mapping or high-resolution video recording.

6. Data Transfer and Offloading

- **USB-C or Thunderbolt Ports:**
 - Many drones offer direct data transfer options via USB-C or Thunderbolt ports, allowing fast offloading of large data files to a computer or external storage device.
- **Wi-Fi/4G Connectivity:**
 - Some drones have wireless data transfer capabilities, allowing files to be sent to cloud storage or other devices without needing to physically remove the storage media.

7. Data Redundancy and Backup

- **Dual-Slot Systems:**
 - Certain high-end drones have dual microSD or SSD slots, allowing data to be recorded on two storage devices simultaneously for redundancy. This is crucial for applications like filmmaking or critical infrastructure inspections where data loss is unacceptable.
- **Backup to External Devices:**
 - Some drones support real-time data backup to an external device, such as a hard drive or NAS (Network-Attached Storage) system, during or immediately after a flight.

Examples of Onboard Storage in Popular Drones

- **DJI Inspire 3:**
 - Supports up to 1TB SSD storage, enabling the recording of 8K video footage with high data rates.
- **Autel EVO II Pro:**
 - Comes with built-in 8GB internal storage and supports microSD cards up to 256GB, ideal for 6K video recording.
- **DJI Phantom 4 Pro:**
 - Supports microSD cards up to 128GB, used for 4K video capture and large-scale mapping missions.

Considerations for Selecting Onboard Storage

- **Video Resolution and Format:** Higher resolution and uncompressed formats (e.g., RAW video or images) demand significantly more storage.
- **Flight Duration:** Longer flight times, especially in industrial or mapping operations, require more storage to avoid running out mid-flight.

- **Data Transfer Speed:** Fast write speeds are essential for drones recording high-frame-rate or high-resolution video. Using slow microSD cards can result in dropped frames or lower-quality recordings.

Conclusion

The onboard storage capacity of a drone is a critical factor that depends on the specific use case, such as filmmaking, surveying, or industrial inspections. Choosing the right storage medium, whether it's microSD, SSD, or a hybrid system, is essential for ensuring smooth operations and data reliability. For professional applications, redundancy and fast data transfer are equally important considerations.