**Purpose of this document is to draft up material before putting it into LaTex. Easier to read**

**Intro to fixed wing UAVs**

Unmanned Aerial Vehicles (UAVs) operate without an on-board pilot making them ideal for high endurance and dangerous missions. Remotely piloted aircraft can trade-off pilots when they become fatigued allowing the aircraft to remain in service for longer periods of time. UAVs do not have cockpits or life support systems which free up space for additional equipment and reduces costs. The lack of an on-board pilot and low system costs also allows a UAV to be expendable.

UAVs can be found in rotorcraft and fixed wing varieties. Fixed wing UAVs range widely in form factor and size, but typically fall under either hand-launched or large systems. Hand launched varieties can be carried on the back of a soldier and launched without the use of a runway and are typically battery powered. Large FWUAVs are typically gas powered and require a runway to take-off and land.

FIGURES

Hand-launched UAVs are primarily tasked with surveilling the immediate area for soldiers on the ground. Cameras on-board relay video to the ground allowing soldiers to identify threats prior to engagement. Large UAVs are tasked with surveillance and can be used for armed reconnaissance [ citation].

Missions can be described in terms of a path that a UAV is required to fly on. The paths are typically constructed from simple primitives such as straight lines connecting waypoints and circular loiter paths. Obstacle free and flyable paths are generated at a ground station prior to flight and sent to the UAV. The UAVs autopilot uses the path as a reference and attempts to keep the UAV as close to the path as possible. The relationship between a ground station and a UAV is discussed in more detail in the following section.

**Autopilot and Ground Station**

Autopilots and ground stations work together to form an Unmanned Aerial System (UAS). Autopilots are responsible for managing all systems on the aircraft by implementing guidance, navigation, and control algorithms. Ground stations are typically responsible for configuring vehicle settings and planning missions. Direct control of the UAV can be achieved by implementing a transmitter. The complete UAS system is depicted in Figure [UAS system].

Mission objectives are planned at the ground station which calculates a flyable and obstacle free path that is relayed to a UAVs autopilot over radio link. Information collected by the UAV may also be relayed back to the ground station

Autopilots are responsible for reducing the tracking error with respect to the desired flight path

UAVs are controlled by an autopilot that is responsible for navigating, guiding, and controlling the aircraft.

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Autopilots rarely operate in isolation and are commonly assisted by a ground station.

Certain tasks such as mission planning and vehicle configuration are typically performed off-board and require a ground station.

Mission objectives and paths are relayed to a UAVs autopilot which is responsible for executing the commands.

Ground stations are typically responsible for configuring vehicle settings and planning missions. Tasks such as waypoint navigation and loitering are assigned to points on a map and a path planner generates an obstacle free and flyable path.

Autopilots combine three systems consisting of guidance, navigation, and control to execute commands given by the ground station.

What are autopilots and ground stations

* Autopilots are devices that receive information from a ground station computer or a transmitter and generate actuator commands to control the UAVs motion
* Ground stations are computers that run mission management software that allow users to configure vehicles and program missions.
* Ground stations and autopilots work together to form a unmanned aerial system (UAS)
* Missions are planned at the ground station where high level mission objectives are assigned to points on a map such as waypoints and loitering maneuvers. The ground station software generates obstacle free and flyable paths that connect mission objectives and relays the path to the autopilot over radio link. Information collected by the UAV during a mission can be relayed back to the ground station for analysis.

What are autopilots

* Autopilots are devices that control the position and attitude of a UAV by implementing guidance, navigation, and control systems. Accelerometers, gyroscopes, barometers, and compasses measure the state of the UAV and are passed to the navigation system. The information measured is often noisy and must be filtered to provide a better estimate which is commonly done with Kalman filters.
* Sensors measure the state of the UAV and are filtered in the navigation system.