Storyboard - Automated Cargo Flight

The concept for the automated cargo flight doesn't consider an operated, remote controlled (lie FPV) flight as realistic. The resulting load by multiple flights would lead to stress and not allow to scale. Furthermore the experience connected to one flight is error prone because it's boring and ineffective. Therefore the concept is based on an automated flight in pre-defined corridors and an incident management in case of unknowns or failure.

Preparation

Important medicine has to be delivered deterministically in a given timeframe measured in hours and minutes. The only feasible way is via the air, the only affordable way by UAVs. The nurse in duty uses the cargo flight application to check if UAV, Container and Service module are available. Furthermore the application offers a specific slot for the flight and checks weather conditions after selection of the slot. If weather conditions are appropriate, application fixes the slot and a flight corridor for the UAV to follow. Coincident of booking a contract is setup for commercial conditions, insurance and applying for monitor by the supervisory console.

The nurse takes the medicine, loads it into a standard container(instrumented container will indicate weight <5kg), and fetches a service module with Lipos. She loads a memory stick with the flight data (like filling in address and respondent) and potential SW updates on her PC and puts it into the service module. Ready to go.

Start

Arriving at the launch site she walks to the UAV and uses bottom or top load to install the Service module, monitors the UAV getting alive and loads the container, recognizing the click indicating save loading. She moves away from the UAV and pushes clearance for takeoff on the app on her smartphone. The UAV starts testing electronics components and engines and begins launching. Vertical movement is driven by the 4 vertical rotors up to a threshold below 300 feet. Shortly before the horizontal rotors start accelerating and transition to horizontal flight starts. Vertical rotors from this time only be involved in a stable flight position.

Flight

Based on it's sensors and telematic information the UVA finds it's way using the definitions of the assigned flight corridor. For every change of direction as part of the corridor, a tracking message is given to the supervisory board. Gain of space is monitored via GPS, consumption of energy and the forecast towards the destination is evaluated. A stereo camera monitors the space in flight direction on obstacles, the other sensors and operation control keep the UVA in the assigned corridor.

Incident

If obstacles appear in front of the UVA, an incident is sent to the supervisory console. Given the amount of time till a perceived collision the UVA monitors and moderates, if necessary, horizontal movements towards a controlled stop. Hovering in air the system awaits feedback from the supervisory console. If connected authorization will define the recovery action. If disconnected independent strategies to by-pass the obstacle will be activated. If these strategies are not successful or energy vanishes beyond threshold, the UAV takes an exit towards the closest point of save landing, notifying the supervisory console.

Landing

Arriving at the destination, the UAV transitions from horizontal flight to hovering above the landing point. The bottom camera is used to monitor the landing point and permission to land is requested with a view on the land from the supervisory console or local contact. After permission received, the UAV starts landing using the four vertical rotors guided by the horizontal ones. If the point has been marked recognizable, the UVA will meet the mark and safely touch ground. Engines will stop and the system will transition to self monitoring. Personell at the destination will confirm arrival to the supervisory console, the contract will be marked as fulfilled, insurance and other obligation for corridors etc. closed. Doing so personell will take over responsibility for the pay load and the Service module.

After flight is before flight

Personell will unpack the container, store it where foreseen, disclose the LiPos and connect them for charging. Other Service modules will be prepared to use and allow for the UAV to continue with the preparation and closing the circle of operation.