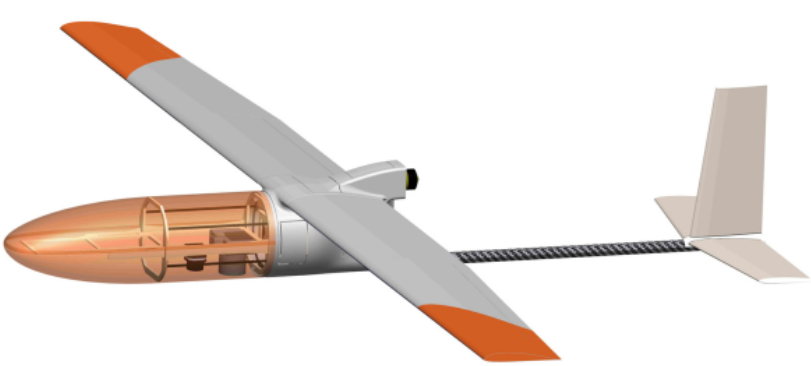
The SuperSwift UAS

An unmanned aircraft system built around the payload



BlackSwift TECHNOLOGIES

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Introduction

The SuperSwift™ UAS was designed by Black Swift Technologies (BST) for NASA science missions, specifically designed to aid in satellite calibration. The requirements from NASA include a robust, simple to operate, electric propulsion aircraft that is designed around a modular payload system. The NASA missions include mapping soil moisture with a radiometer, a calibration mission including 12 multispectral cameras, and a volcano sampling mission that involves difficult operations into the plume of an active volcano. BST is also working with NOAA to use the SuperSwift for the wildfire application.

The SuperSwift UAS is a fully autonomous aircraft that will fly a programed flight path for a visual or mapping mission and then return for a fully automated landing. It was designed with a modular, field swappable nose cone to make working with the payload easy. It also includes a precision laser landing system. The result is an aircraft system that can be easily learned in a few hours and mastered with a few days practice.

SuperSwift™ sUAS

The SuperSwift is a robust and reliable UAS that includes everything required for conducting survey missions, including the aircraft, batteries, ground station with tripod, tablet computer, field toolbox, carrying case, and RC handset. Unlike other systems, no additional computers or support equipment are required for conducting missions.

The SuperSwift™ is capable of conducting fully autonomous flights in unimproved areas. Take-off is fully autonomous and the advanced landing algorithm provides for robust and precise autonomous belly landings utilizing the laser landing system. The SuperSwift™ has a high operational ceiling, and has been designed for altitudes up to 20,000 ft for NASA science missions. It has primarily been employed for complex science missions, but the overall system will perform well in surveying work, land management, crop damage assessment, and large area ecological studies. The specifications for the SuperSwift™ are listed in the table below.

Figure 1: The SuperSwift™ aircraft with the nose cone removed.

Specifications

Coverage per flight	Up to 1100 acres
Maximum Flight time	120 minutes
Cruise speed	40 mph
Max Payload	5 lbs
Wingspan	10 ft
Propulsion	Electric motor

The SuperSwift™ utilizes the SwiftCore™ Flight Management System, comprised of the SwiftPilot™, SwiftStation™, and SwiftTab™ user interface, along with support electronics. The entire system is designed for ease of use along with accurate flight tracking, even in high winds. The SwiftCore™ is designed by Black Swift Technologies and is entirely made in the USA. The SwiftCore™ has been approved and used for major scientific missions by NASA, deployments by NOAA, and by a growing list of commercial companies.

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Payload System

The SuperSwift is an aircraft system that was designed around the payload. The nose cone contains a large volume to easily integrate new systems and allow easy access in the field. The SuperSwift nose cone also includes a payload protection system that provides an unobstructed view of the ground (important for thermal and multi-spectral cameras) that protects the payload for takeoff and landing with a retractable cover. This payload system provides a large volume, easy access, the ability to rapidly integrate new payloads.

The payload protection system was specifically designed to allow sensors an unobstructed view of the ground while protecting them from dirt and rocks on the ground. BST has developed a light weight, carbon fiber sliding tray that covers the payload during the takeoff and landing portions and opens it up during mapping missions. Figure 2 shows the payload protection system that was developed for the NASA mission requiring 12 multi-spectral cameras.

Simplified Photogrammetry Workflow

The SuperSwift™ system features a simplified workflow to go along with industry leading performance for a photogrammetry platform. This allows users to focus on the job of utilizing the orthomosaic images and point clouds rather than on operating the UAS or having to re-fly missions due to issues with the data.

The workflow is comprised of 4 mains steps shown in Figure 3: 1) Planning and Simulation, 2) Flight, 3) In-Field Check and 4) Data Processing. Mission planning prior to deployment allows users to have flight plans ready to go before deploying and minimizes time in the field. It should be noted that planning can also be done in the field or even while the SwiftTrainer™ is airborne if needed. The flight portion takes as little as 10 minutes to setup and launch, while the flight itself can take up to an hour depending on the size of the area to map. After that the images are tagged in the field and verification is performed to ensure quality and completeness of the data. The final step is to process the data, resulting in contour maps, 3D point clouds, and/or orthomosaic images.

About Black Swift Technologies

Black Swift Technologies (BST) is based in Boulder, CO and has been in operation since 2011. BST produces our own line of customizable autopilots, ground stations and supporting avionics. This affords control of the critical parts of our products, including the design of all electronics for both the avionics and ground systems, software, mechanical assembly, along with the QC process for all outgoing systems. All UAS sold by BST are built upon the SwiftCore™ FMS that includes the autopilot, ground station, user interface, and support electronics. Unlike many competing systems that rely on open-source and low-quality avionics, BST is able to guarantee quality, robustness, and supply of the most critical components of our systems.

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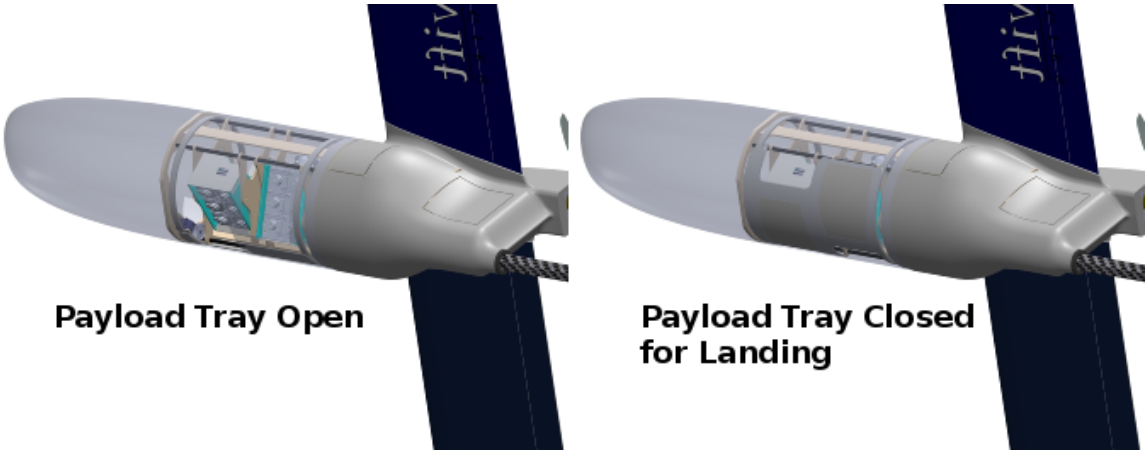

Figure 2: Payload protection mechanism shown for one of the NASA multi-spectral payloads

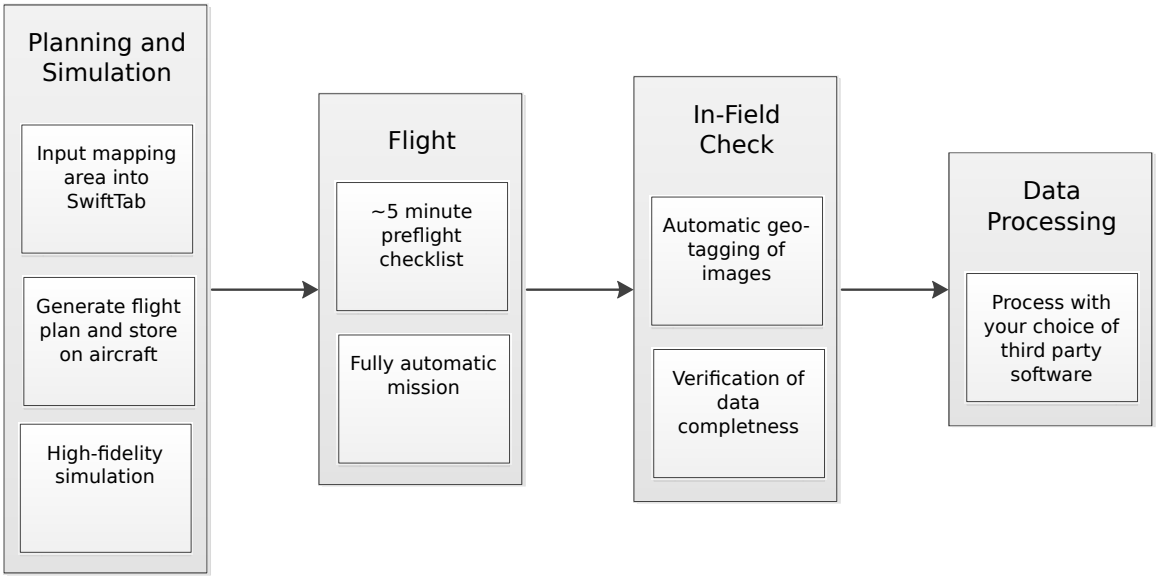

Figure 3: Simple and intuitive process that simply integrates into the existing workflow.

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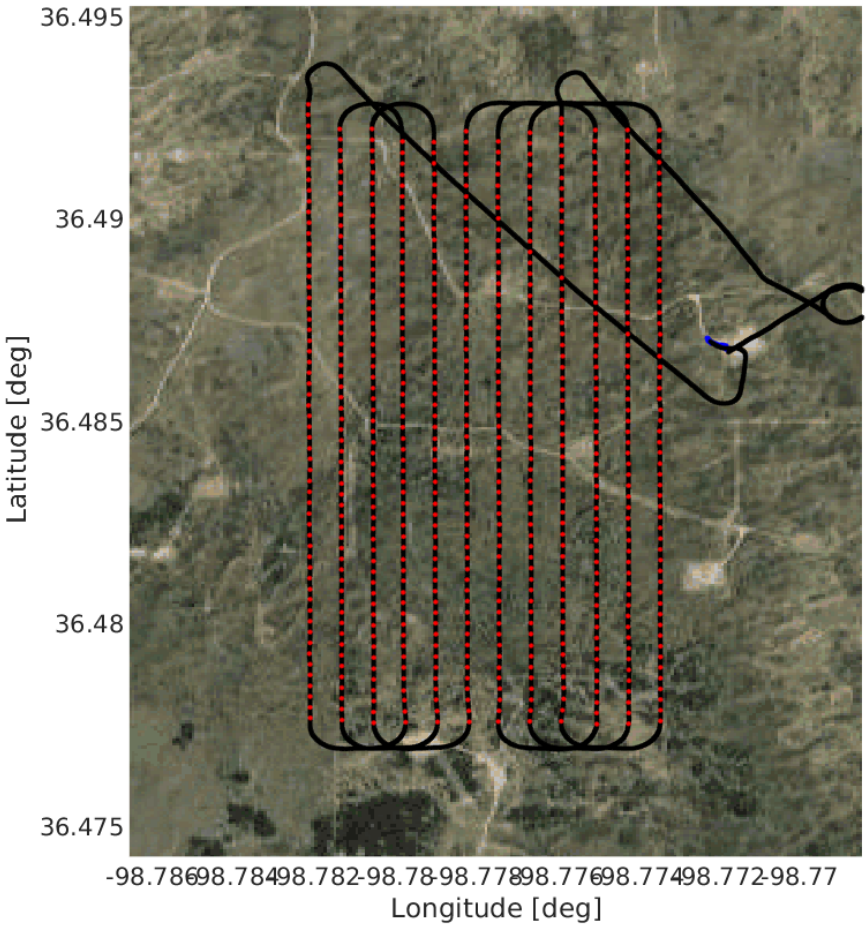

Figure 4: Path and photo locations (in red) from a flight utilizing the SwiftCore™ FMS.