PRODUCT SPECIFICATION

CamStreamer PlaneTracker App

An edge-based ACAP application that fuses real-time ADS-B aircraft tracking and Remote ID drone tracking with live video, turning an Axis PTZ camera into an automated spotting tool for aircraft, drones and their operators.

01 Software Overview & Scope

The PlaneTracker App helps airports and secured premises track aircraft arrivals and departures, monitor emergency situations, and protect their airspace against drones. It integrates real-time aircraft tracking data (ADS-B) and drone tracking data (Remote ID) with live video, transforming a PTZ Axis network camera into an automated spotting tool that overlays flight information and automatically steers a Pan-Tilt-Zoom camera to follow aircraft, drones and their operators.

- **System purpose:** Provides real-time flight-data overlays and automated PTZ tracking of aircraft (via ADS-B) and of drones and their operators (via Remote ID), on a live or recorded video stream, including searchable metadata.
- **Operating environment:** Runs on outdoor-rated Axis PTZ cameras located near flight paths and around protected perimeters.
- **Key functionalities:** Integration with ADS-B receivers and Dronetag Scout Remote ID receivers, dynamic data overlays, aircraft and drone prioritisation, and automated PTZ positioning and focus.

02 System Architecture & Integration

The application is software running on the network camera. It acts as a data processor that uses external location data to control the pan, tilt, zoom and focus of the camera. Location data comes from an ADS-B feed for aircraft and from a Dronetag Scout receiver (Remote ID) for drones and their operators.

COMPONENT	ROLE	SPECIFICATION
Aircraft location source	ADS-B receiver	External network feed of aircraft location data

COMPONENT	ROLE	SPECIFICATION
Aircraft location protocol	Mode-S Beast	Configurable IP address and port
Drone location source	Dronetag Scout receiver	Remote ID reception; up to 4 directional antennas recommended
Drone location protocol	HTTP POST (push)	The Dronetag Scout pushes decoded Remote ID data directly to the app; configured on the Scout, not in the app
Flight data source	Flightradar24 or Radarcape database	External database
Processing unit	Axis network camera (edge)	ARTPEC-7 / 8 / 9
PTZ control	Internal camera API / SDK	High-precision absolute positioning
Graphics overlay engine	Internal camera API / SDK	Dynamic SVG / PNG rendering
Audio	ATC radio receiver	External network feed of audio data

Recommended hardware for drone tracking: a Dronetag Scout receiver (up to 4 directional antennas) for Remote ID reception, and an AXIS Q6225-LE PTZ camera whose 180° vertical tilt provides full sky coverage above the horizon.

03 Functional Capabilities

3.1 Location data acquisition

- **Receiver integration:** The app connects to a local or remote ADS-B receiver via an IP address and port.
- **Database integration:** The app connects to a database for additional information about aircraft, including flight number, origin, destination, call sign and file photo.
- **Remote ID integration:** For drone detection the app does not use ADS-B; it connects to a Dronetag Scout receiver and tracks drones and their operators from their broadcast Remote ID signal.

- **Geofencing:** Users define a "Detection Zone" (by radius and altitude) to ignore aircraft outside the area of interest.

3.2 Automated tracking

- **Calculation engine:** The app converts aircraft and camera coordinates into pan/tilt angles and zoom/focus values using spherical trigonometry. The tracking engine works independently of visual contact with the aircraft — it keeps tracking when the aircraft is obscured by clouds, dust, another aircraft or object, or at night.
- **Smoothing:** The software applies a smoothing algorithm that prevents "jittery" movement caused by low-frequency ADS-B updates (typically 1–2 Hz).
- **Homing:** The camera returns to a "Home position" when no aircraft are detected within the defined parameters, or follows a preset "Guard tour".
- **Prioritisation:** Users define prioritisation rules based on ICAO, blacklist, whitelist, detection zone, direction, speed, altitude, aircraft type and takeoff or landing where the required data is available. Aircraft sending distress squawk codes are automatically granted the highest priority.
- **Sun avoidance:** The app automatically prevents damage to the camera chip that could be caused by pointing the PTZ directly into the sun with high focus and open aperture.

3.3 Drone & operator tracking (Remote ID)

- **Remote ID source:** The app tracks commercial drones that broadcast a Remote ID signal (drones without Remote ID are not detected). For drones the app does not use ADS-B — it receives Remote ID broadcast signals through a Dronetag Scout receiver, calculates the flight path, and steers the PTZ camera to keep the drone — or its operator — continuously in view.
- **Drone & operator tracking:** Based on the mandatory Remote ID signal, the app detects the drone, identifies its type, and pinpoints the operator's location, allowing identifying details (physical appearance, nearby vehicles) to be recorded.
- **Perimeter range:** Drones and operators are tracked up to 1 km (0.6 mi) using the combined optical and digital zoom of the Axis camera.
- **Perimeter zones:** For drones the app uses an **outer perimeter zone** and an **inner perimeter zone** (in place of the aircraft Detection Zone) to classify how far an intrusion has advanced towards the protected site.
- **Friendly list & alarms:** Users maintain a friendly list of their own drones. Based on this list, the app generates alarms for intruding drones detected in the outer perimeter zone and in the inner perimeter zone, while friendly drones are excluded.

- **Prioritisation:** Whitelist / blacklist rules and zone priorities apply to drone and operator categories; drones can be prioritised over operators.

3.4 Audio

The app supports:

- ATC radio
- Audio captured by an external microphone
- Multiple audio sources embedded simultaneously into the video stream

3.5 Dynamic overlay

- The overlay includes the following metadata: ICAO, Altitude (ft/m), Speed (kts/kph), and Distance from the camera (ft/m).

3.6 VMS compatibility

- The app embeds metadata into the video feed for video management systems of major vendors, e.g. Axis, Genetec Security Center, Milestone.
- The output video stream is compatible with video management systems of major vendors.
- The app provides advanced integration with **Axis Camera Station Pro** and **Genetec Security Center**, where event detection can trigger automated actions on the video recordings and metadata.
- **Genetec plugin:** Operation of the app within Genetec Security Center is supported by a dedicated accompanying plugin, certified by Genetec (Product ID `GSC-1SDK-CAMSTREAMER-PT`).
- **Milestone:** Integration runs through the Bookmark API — the app creates bookmarks with metadata on selected cameras.

3.7 Configuration

- Configuration is available in a web-based user interface.
- Configuration is stored in a secured file directly on the network camera and is available for manual backup and restore.
- The configuration UI includes map tiles.

- The user interface includes a dashboard with the following items:
  - Live view of the output video stream
  - Map showing the location, current heading and field of view of the camera
  - Location of planes available for tracking, with the currently tracked plane highlighted and different aircraft categories distinguished by different icons
  - Information panel about the aircraft currently being tracked
  - Tools for manual tracking of aircraft
- The following parameters are configurable:
  - At least 12 zones with different tracking priorities, defined by polygon
  - Whitelist — list of relevant planes to track
  - Blacklist — list of planes to ignore
  - Maximum tracking distance
  - Overlay size and position
  - Zoom level — target size of the aircraft in the scene
  - PTZ Guard tour used when there are no planes to track

04 Software Logic & State Machine

The app runs a high-speed polling loop that keeps tracking accurate relative to the aircraft's ground speed. It operates across four states:

SCAN

The app listens to the ADS-B feed for any aircraft entering the "Detection Zone".

LOCK

Once a target is identified and chosen for tracking, the app calculates the vector and sends the first movement command.

TRACK

Continuous loop:

1. Receive new GPS packet.
2. Calculate predicted position based on current velocity.
3. Update PTZ coordinates (Pan, Tilt, Zoom) and Focus value.

> LOST / TIMEOUT
> If data is lost for more than 5 seconds, the app stops tracking to avoid "searching" empty sky.

05 Network & Security

- **Local traffic:** Communication between the ADS-B receiver and camera can run on a dedicated VLAN to minimise latency.
- **Authentication:** Access to the configuration UI is protected by the camera's admin credentials over HTTPS.
- **Offline operation:** Tracking functionality remains available even without internet connectivity, including for extended periods of time.

06 Performance & Validation

The app is validated against the following criteria:

STABILITY
168 h
Continuous operation without interruption.

ACCURACY
1 km
The aircraft remains within the video frame during a fly-by at this distance.

LATENCY
< 200 ms
Delay between ADS-B packet arrival and the start of PTZ movement.

CAPACITY
100 aircraft
Parses a concurrent feed without crashing, even when only one is being tracked.