

Low-Cost Surface Surveillance Research

Surveillance of Non-Cooperative Targets in the Non-Movement Area

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Although a number of systems are available for surveillance in the aircraft movement area, such as surface movement radars, ASDE-X, and ADS-B, these systems depend mainly on transponders and provide reduced coverage in non-movement areas.





Non-movement areas, particularly those around the terminal present safety challenges where aircraft, vehicle, and ramp personnel interact.

The Low Cost Surface Surveillance (LCSS) program considers terminal safety as well as the reality that many airports can not afford the high cost of movement area surveillance radars.

With this in mind the LCSS program is examining a wide range of surveillance systems that might prove effective in the non-movement area and a smaller airports.

In this program the FAA's Airport Safety R&D Section, ANG-E261, has initiated a research program to address non-cooperative targets in the non-movement area.

CEAT has been supporting the LCSS program by reviewing sensor technologies and conducting performance assessments of commercially available technologies.

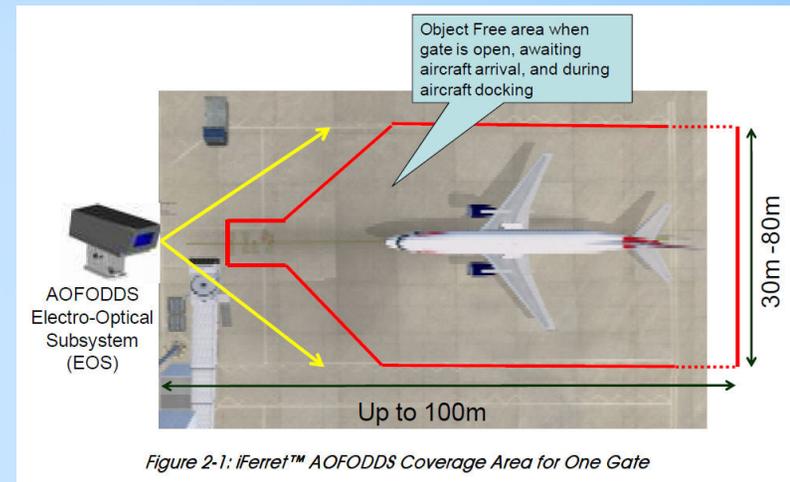


Figure 2-1: iFerret™ AOFODDS Coverage Area for One Gate

The CEAT efforts consider:

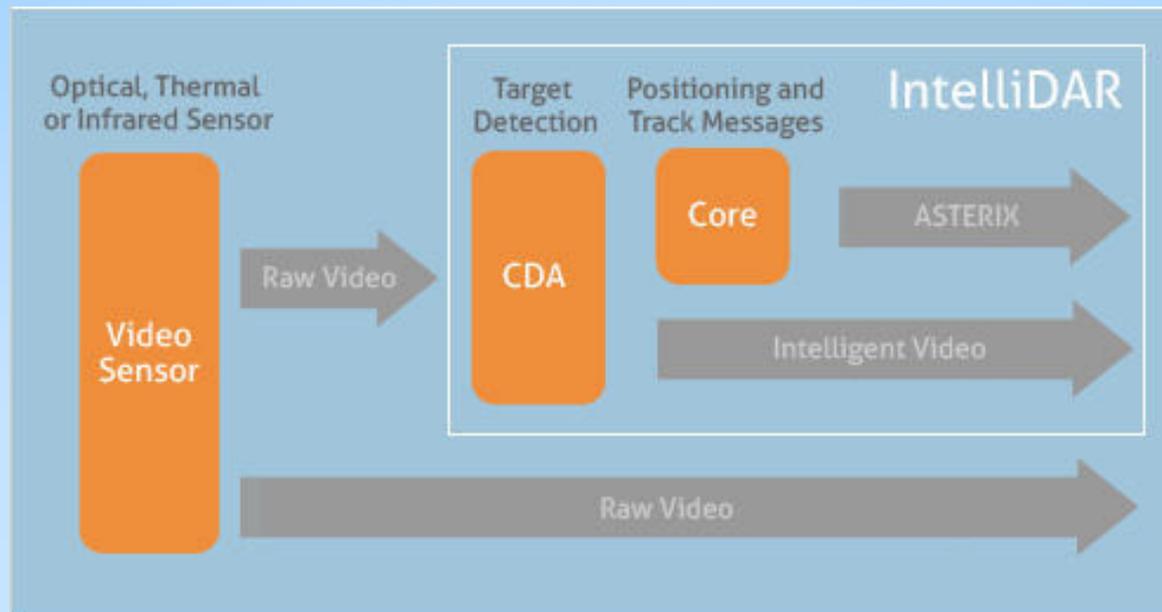
- Sensor type
- Multiple sensor, and sensor type integration/fusion
- Validity and accuracy of sensor information
- CONOPS
- System operations and maintenance

Passive sensors have been considered but no commercial systems, to date, are commercially available for airport use.

The primary CEAT's efforts is focused on optical/thermal sensors with some attention paid to radars.

The initial LCSS installation has been at Seattle Tacoma International Airport (SEA) where a surveillance system (IntelliDAR[®]) developed by Searidge Technologies in Ottawa Canada is being assessed.

IntelliDAR[®] is an intelligent video platform that supports airport surface management. The system processes video from a series of networked video sensors providing real-time target position. The video is processed with advanced computer vision algorithms to provide detection, tracking, position and other target attributes.



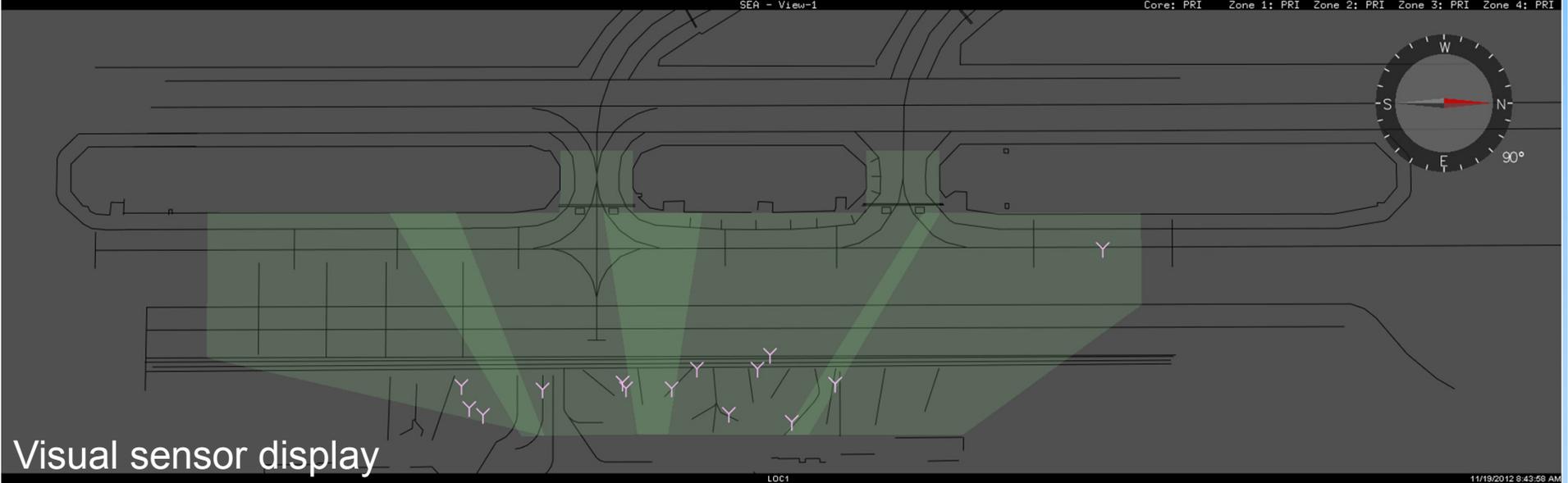
The first phase of the SEA assessment included both optical and thermal sensors. Recently we have added a radar sensor.

End-user display



Above: The camera stitched image view

Below: Detection map, with tracks (Y symbols) and detection zones (green polygons)



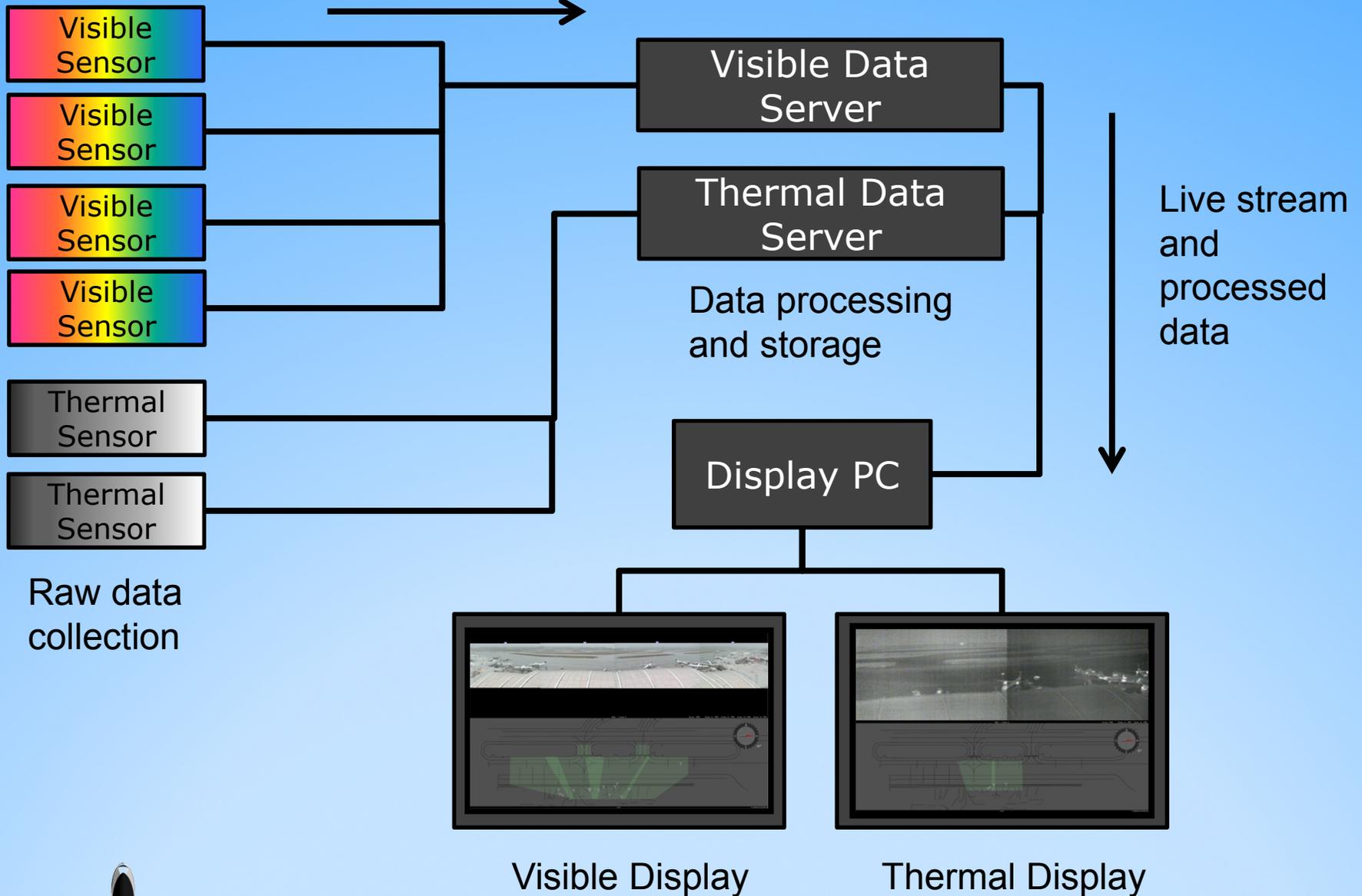
Visual sensor display

End-user display



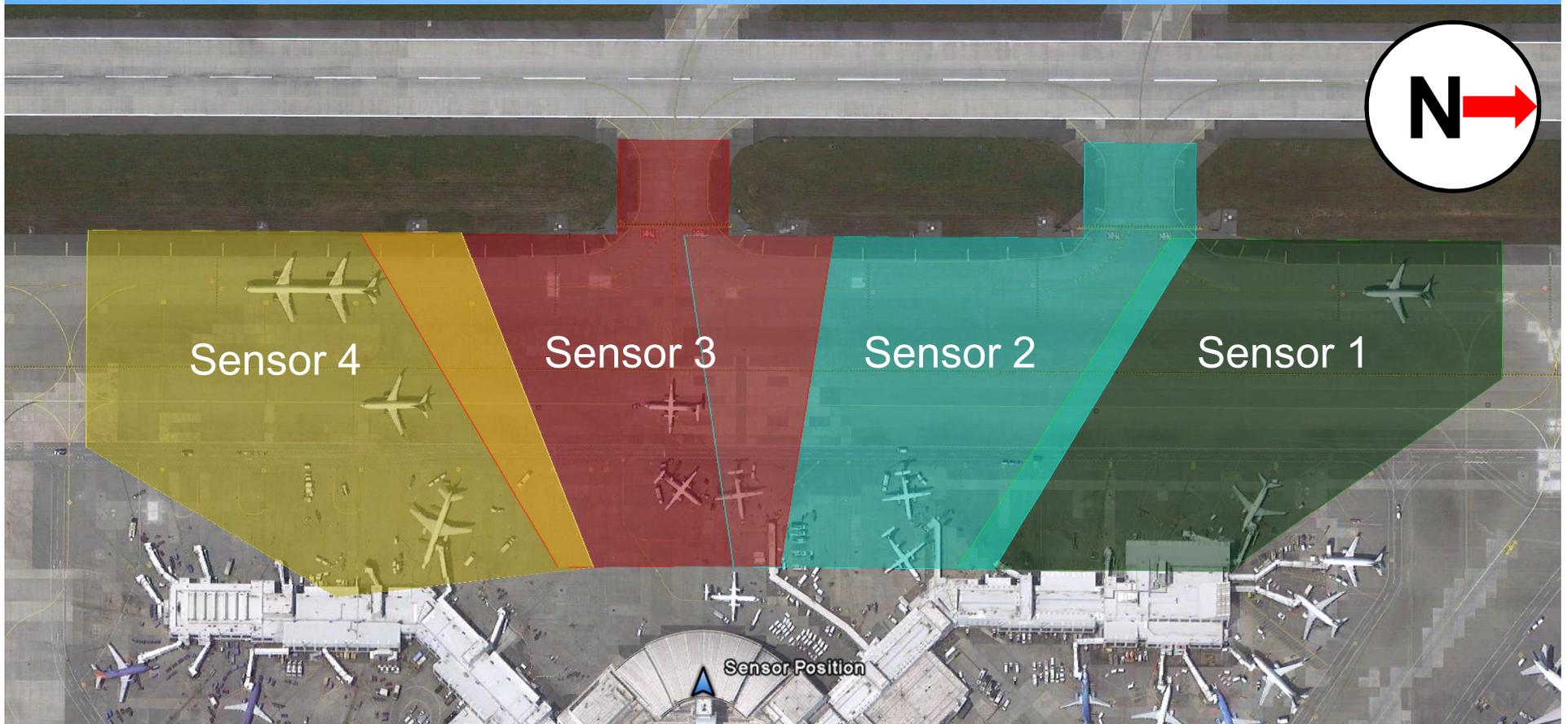
The IntelliDAR system

Raw data and live stream



Phase I Coverage

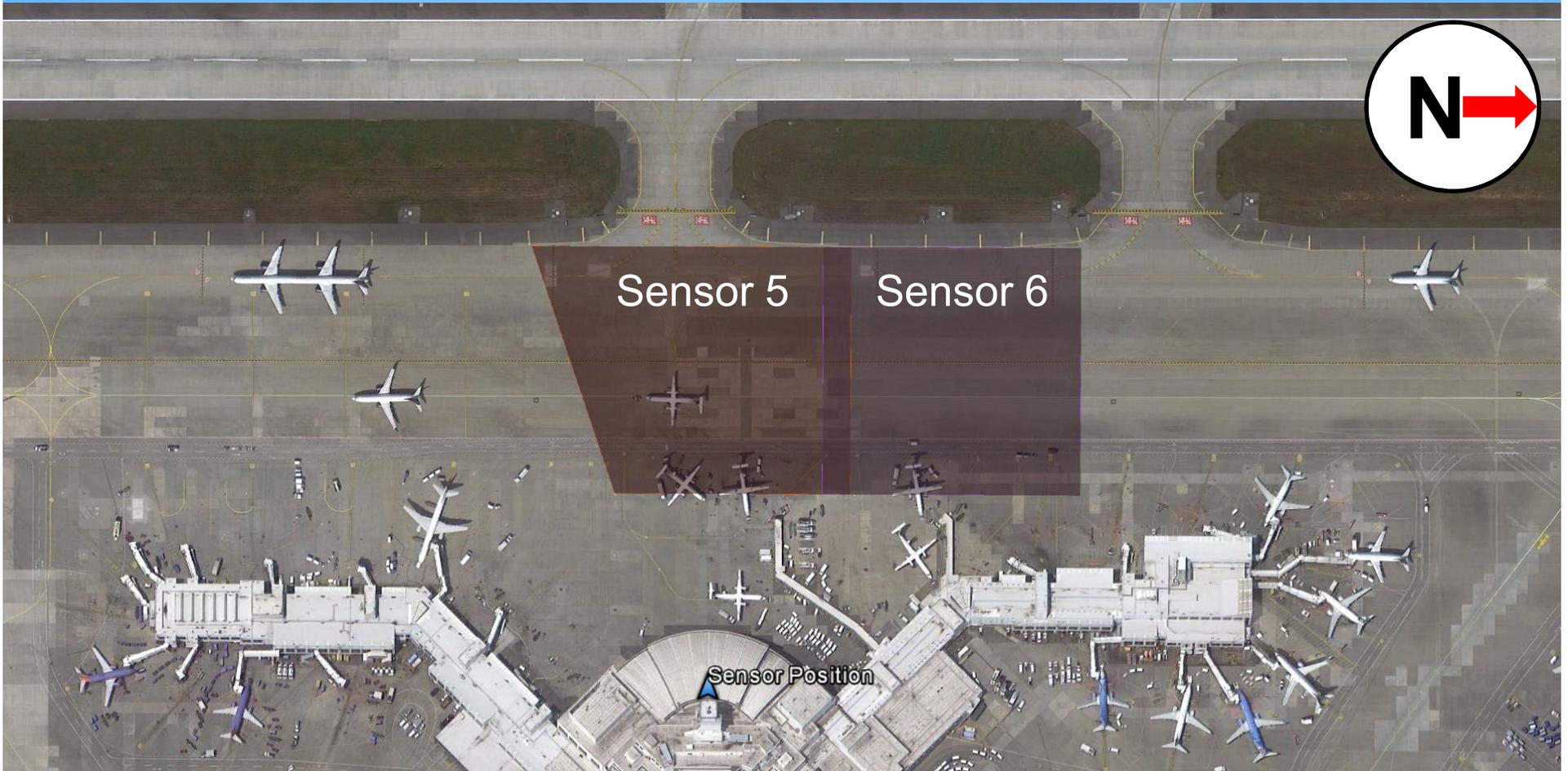
Visible Sensor Coverage



Sensors are installed in order to produce coverage overlap with neighboring sensors.

Phase I Coverage

Visible Sensor Coverage



CEAT has been developing and testing performance assessment procedures.

Assessments are focused on important surveillance criteria that include target detection, target tracking, and information management.

To accommodate sensor characteristics and typical targets CEAT developed a target vehicle with white, grey, and black covers.

The Optical Target

Black target

GPS device that provides accurate position information for the target is mounted on top, highlighted by the red box.



The Optical Target



White target



Grey target

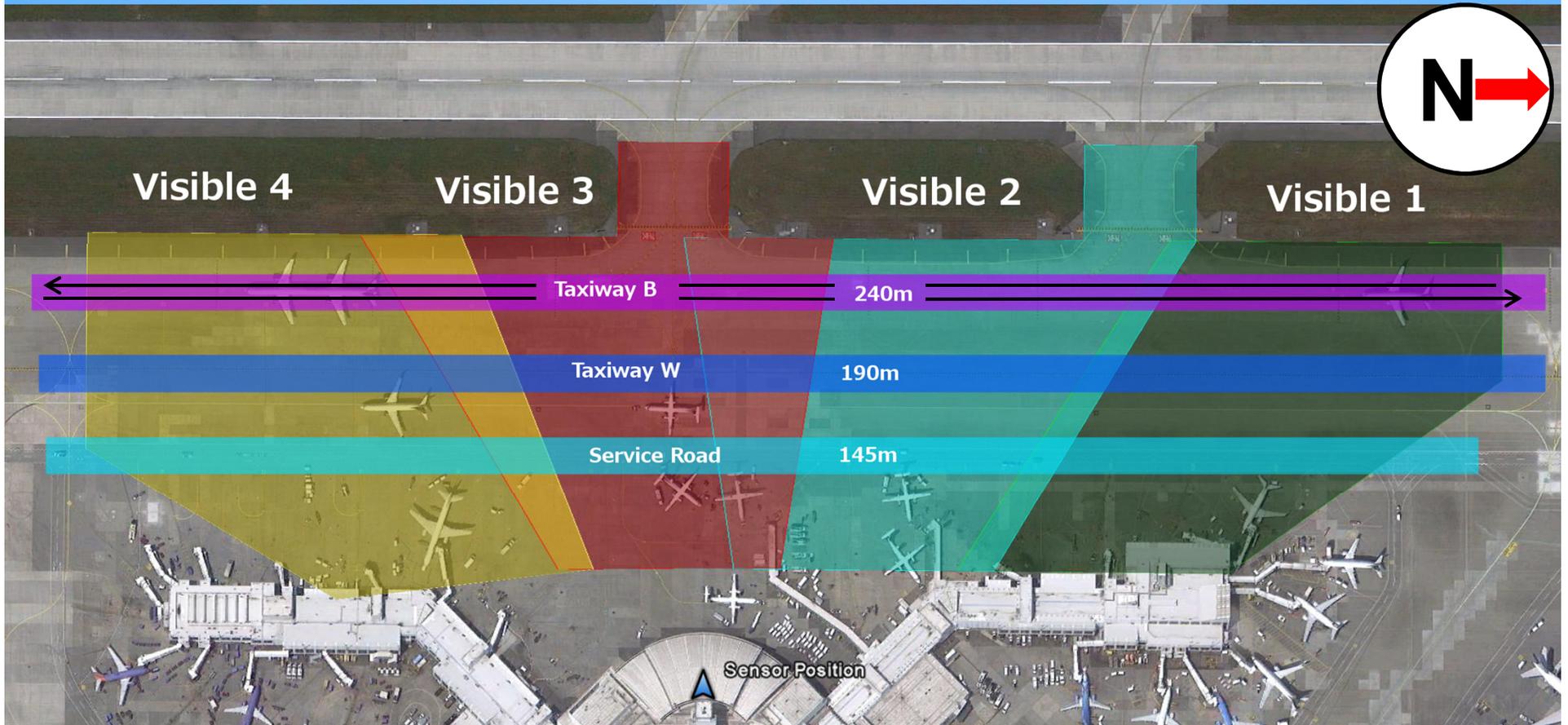
The Thermal Target



The thermal target was a 1 m² metal sheet that was heated by an oil fired salamander. This design is being perfected.

Testing included movement of the target through the field of view (FOV) of the sensors. Testing was conducted during normal airport operations. Although crossing and radial movement was planned, only crossing movements were possible.

Testing Routes



Each test route consists of the cart driving both directions down the route (illustrated by the arrows on taxiway B). Each test begins at the north end of each route.

The performance assessment procedures are being perfected.

Two test campaigns have been completed with procedural improvements made between the two campaigns.

Example of track update data from 07/24/2013, from the black target



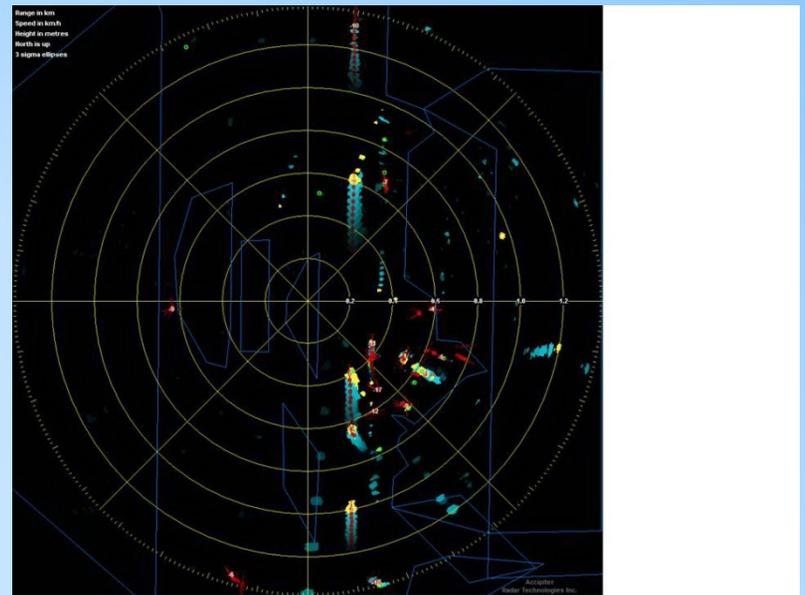
Each color represents a different track that represented the target

Example of matched track/GPS data from 07/24/2013, from the black target

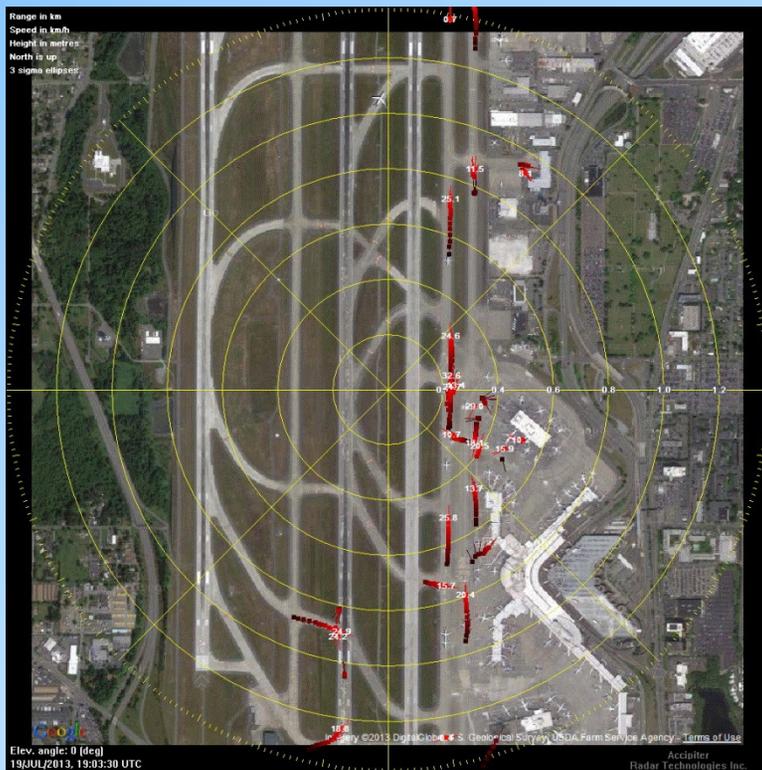


GPS data represented by the cyan circles, track data represented by yellow squares

CEAT has taken advantage of an existing avian radar installation to include radar surveillance. This provides multiple use for an existing avian radar.



The radar provides different information including track displays and track histories, which can improve information content of a LCSS.



CEAT is now installing Phase 2 at SEA, which will increase the number and coverage of cameras.

Issues of surveillance CONOPS and the integration of multiple sensors are also being addressed in the SEA installation.

Additional surveillance systems will be assessed at other airports.

QUESTIONS?