# Architecture & Design of a System to Counter Improvised Explosive Devices with Automated Detection, Pattern Recognition and Human in the Loop for Decision-Making

## Sponsor: DASD(SE)


**By**

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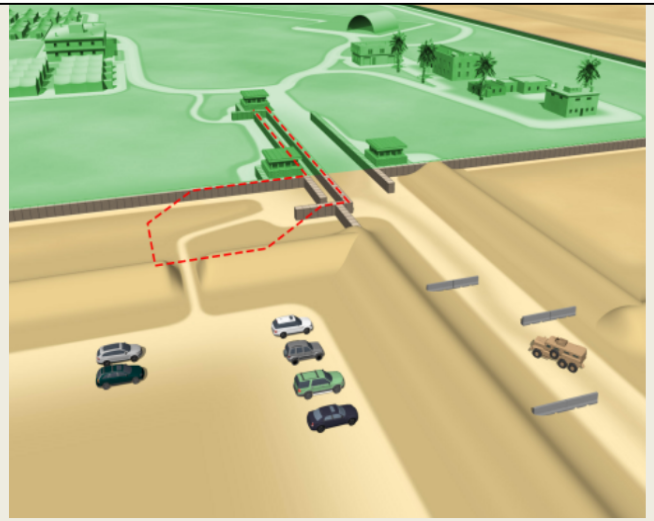
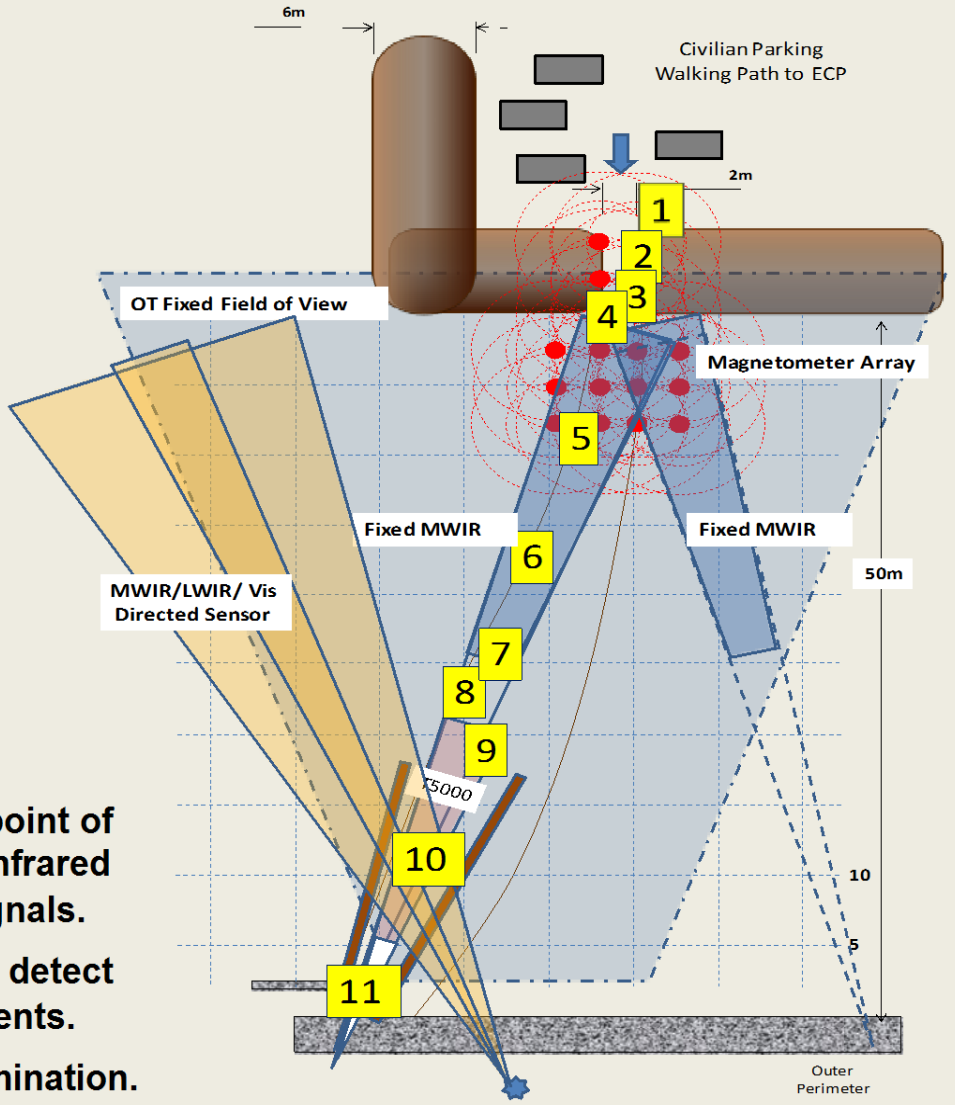
# System Architecture Description






## High Level Operational Concept

**Entry point at top of diagram.**

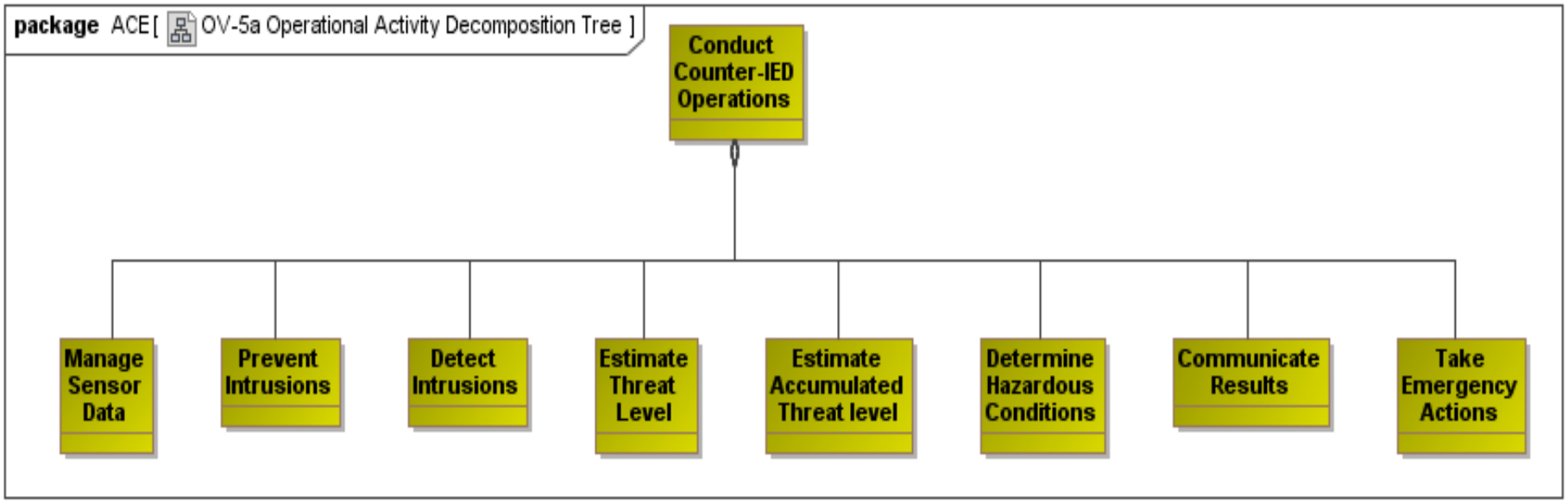
**As people enter the AoR they pass through magnetometers to look for shrapnel material.**

**Once cleared people proceed towards the entry point of the protected facility while long and microwave infrared cameras scan them for abnormal temperature signals.**

**CCTV visual cameras follow people in the AoR to detect abnormal walking patterns and/or erratic movements.**

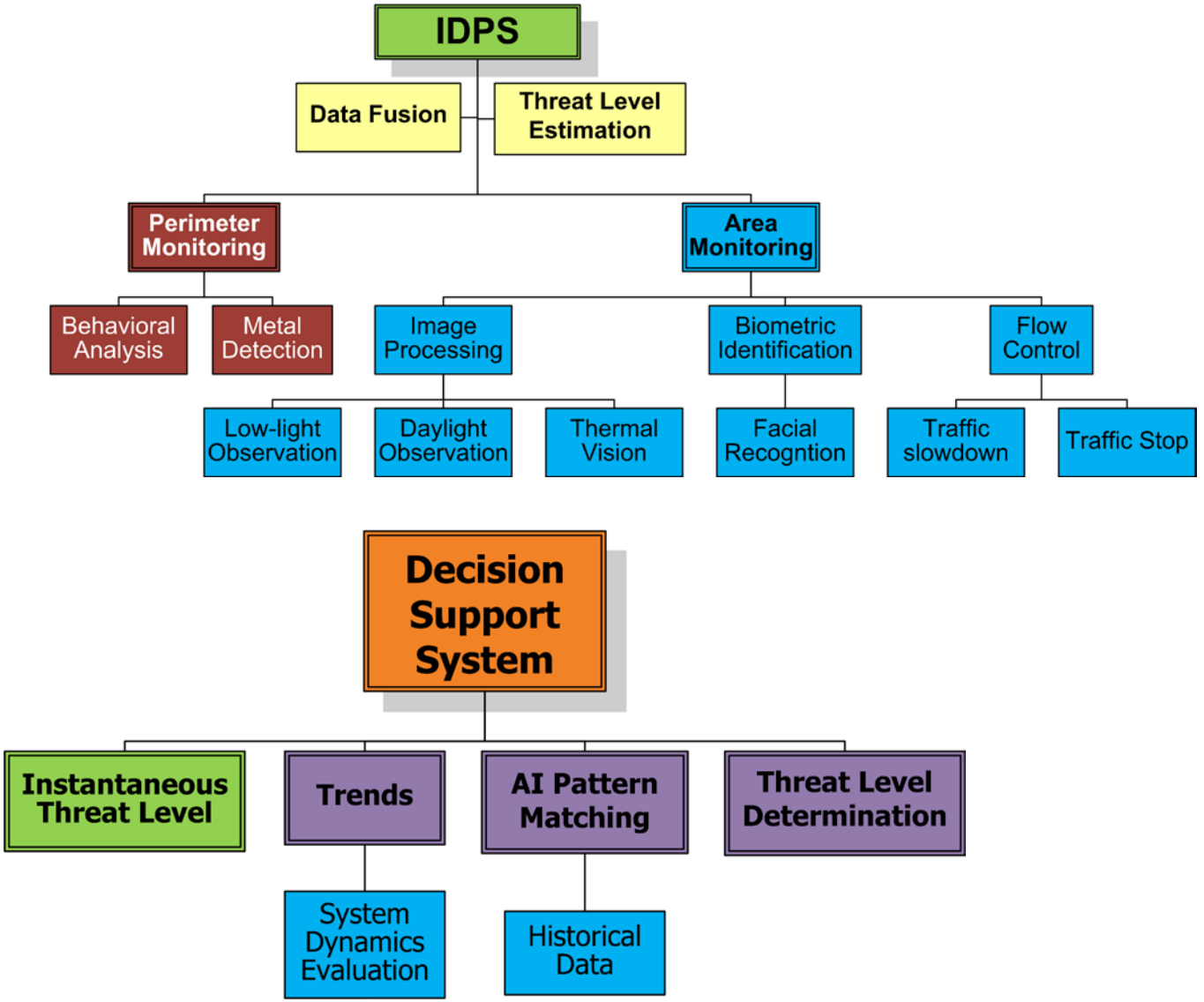
**The DSS fuses all data and issues a threat determination.**

# Operational Activity Decomposition Tree

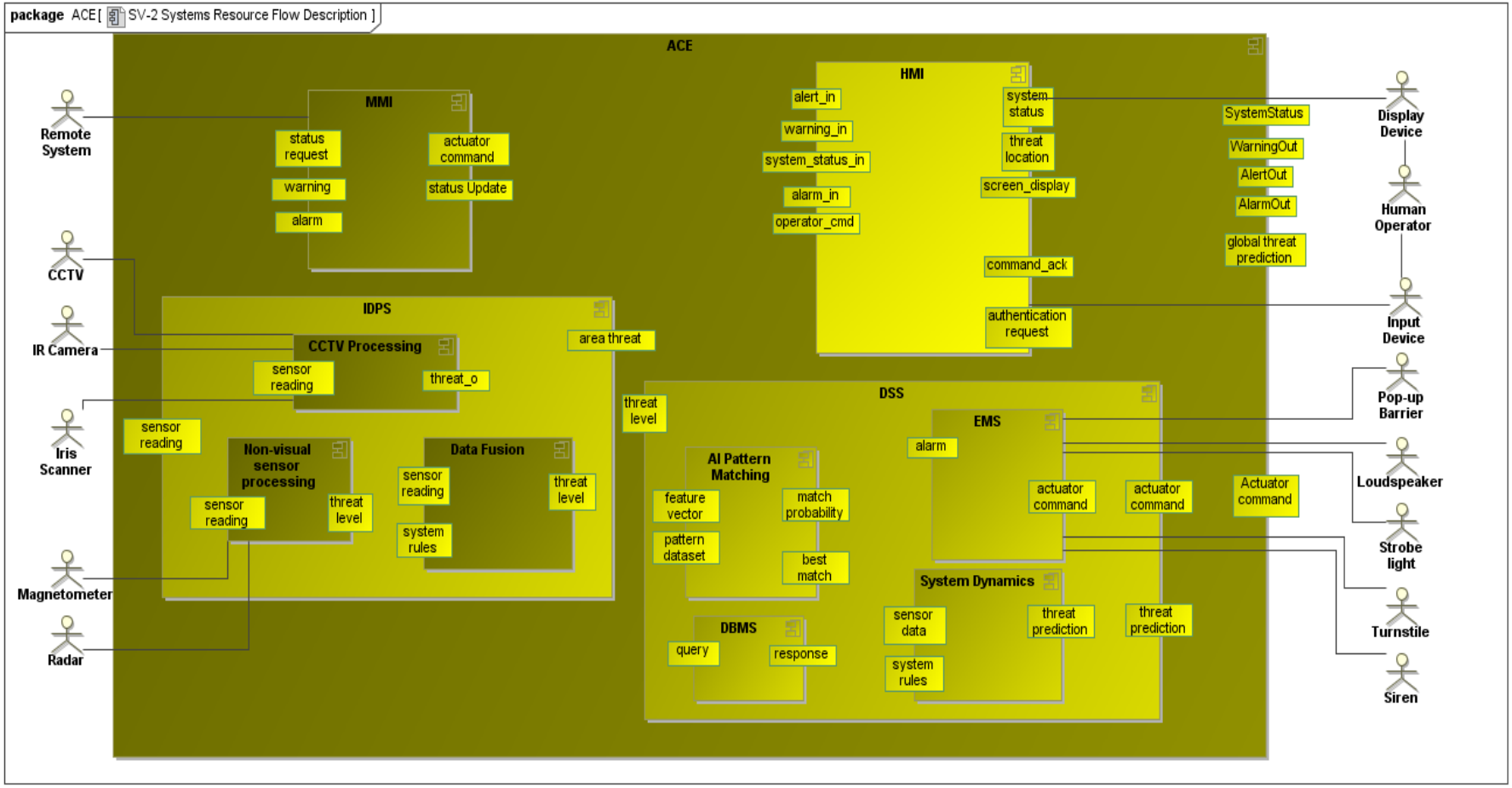



The Operational Activity Decomposition Tree describes the tasks that are normally conducted in the course of achieving a mission or a business goal, in this case countering improvised explosive device operations.

# Capability Taxonomy



# Systems Interface Description

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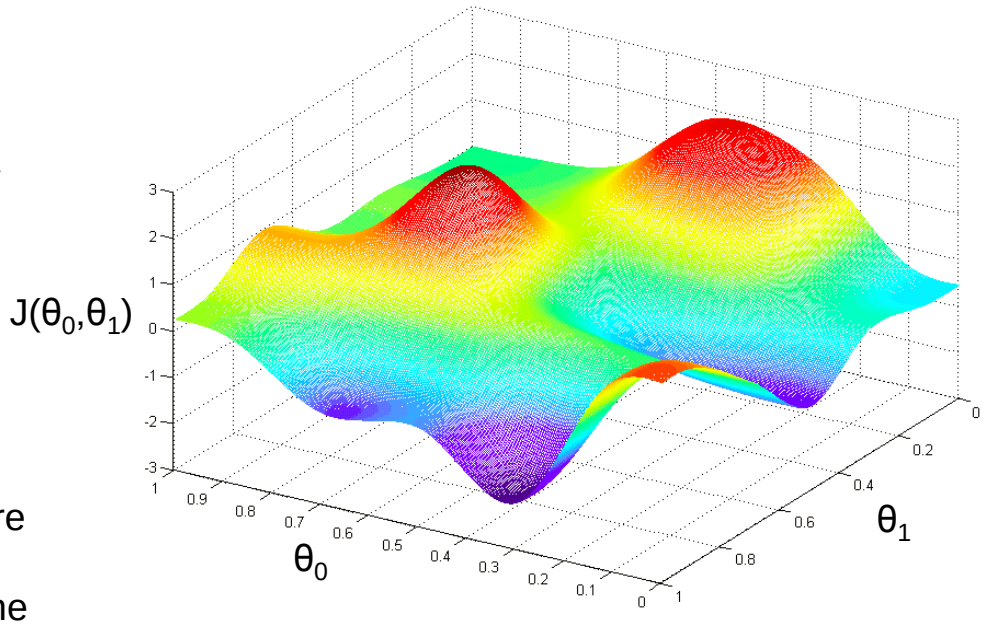
# What's Intelligent About It?

There are 2 kinds of "smarts" in ACE:

1) Static/Instantaneous: implemented via pattern recognition
2) Dynamic/Temporal Context understanding: implemented via a systems dynamic model.

Pattern recognition attempts to find explosives by matching their determinant features to known samples. Since there are many features in IED signatures, multivariate gradient descent techniques the Normal Equation are used to determine how good is the match.




A Dynamic Systems model is used to provide "understanding" of the contextual meaning of the sensor readings with the assumption that threat levels accumulate over time by the aggregation of explosive elements brought into the area of interest by people who enter at different times and intend to assemble the explosive on site. Threat are also assumed to "dissipate" as time passes with no appreciable detection of additional threat features over time.

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