Black Box Design

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Overview

- Functions:
  - Video/Audio Recording
  - Vehicle Event Recording
  - On-Board Diagnostics
  - Internal Components Should Withstand 3400g and $1000^{o}C$
  - Mirroring for Fault Tolerance
  - Solid-State Disk for Reliability
  - Environmental Status
  - Tamper-Resistance: Encrypted Data, TPM
- Sensors:
  - Pressure Sensor
  - Cameras
- Communication:
  - Wireless monitoring through Satellite

Problem Statement

- Provide feedback about the status and health of the vehicle
- Record accident data
- Provide security of data
- Can be used by:
  - Field Technician Soldiers
  - Command Center Mechanic
  - Data Analyst
- Can Be Used At:
  - Field
  - Command Center

Potential Benefits

- Vehicle Tracking through GPS
- Remotely monitoring vehicle status
- Accident Prediction, avoiding catastrophic failure
- Detect and report the reliability of the vehicle
- Efficiency data to improve vehicle and overall system performance
- Modular versatility that allows integration into several types of vehicles

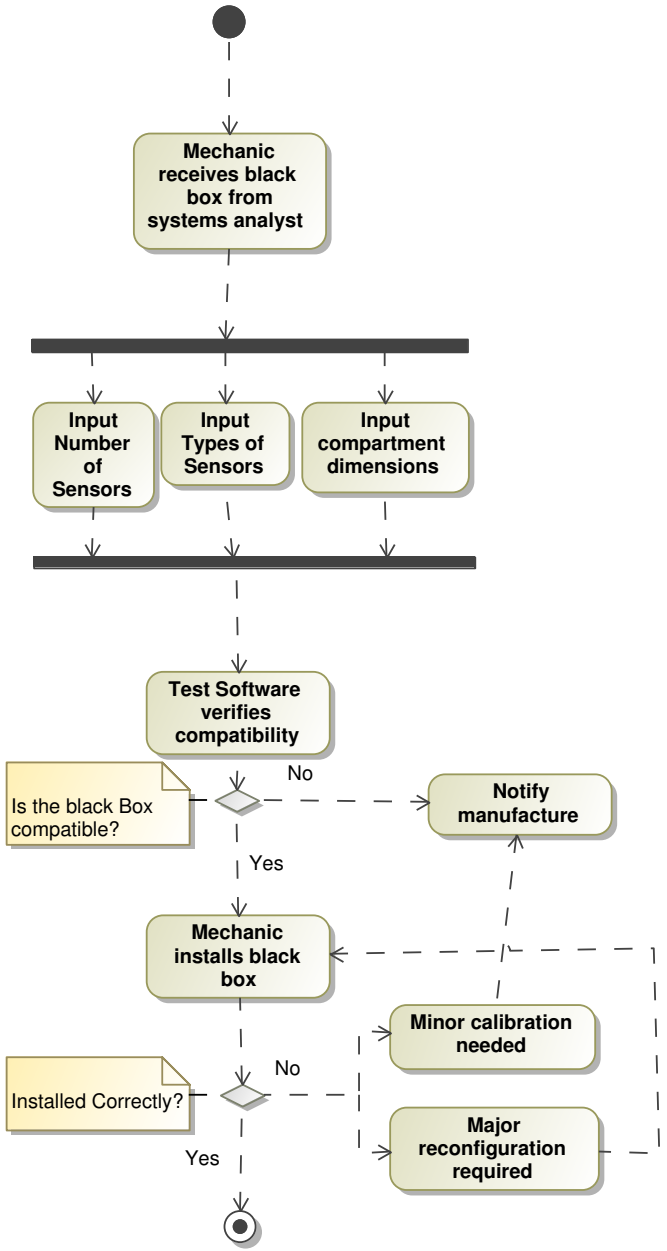
Project Stakeholders

- ENES489P Black-Box Team and Advisors
- Military Logistics Agency
- Soldier
- Budget
- Military Doctrine
- Manufacturers

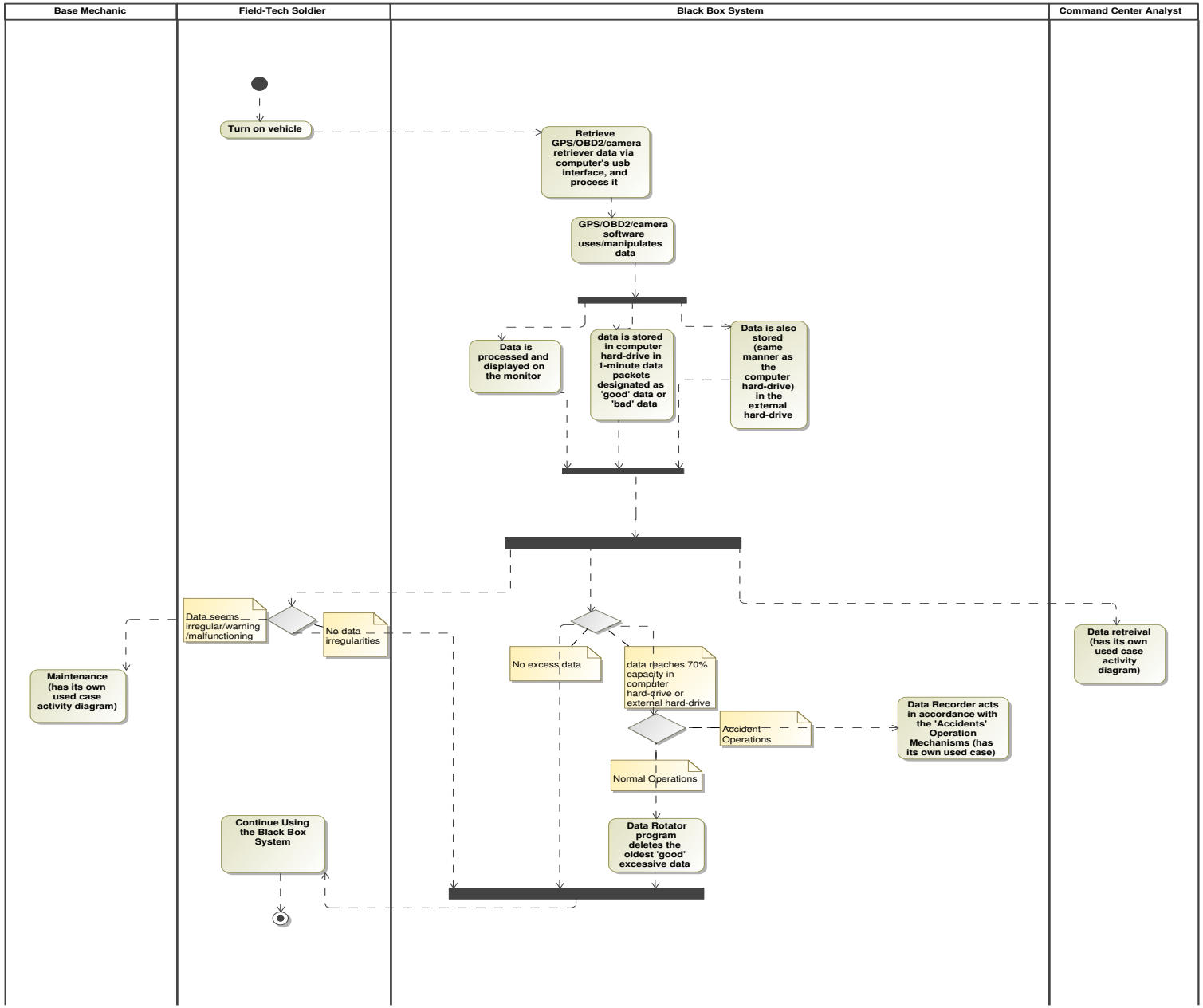
Use Cases

- Use Case 1: Installation and Testing
- Use Case 2: Operation
- Use Case 3: Retrieving Data
- Use Case 4: Threats to System/Reliability
- Use Case 5: Maintenance

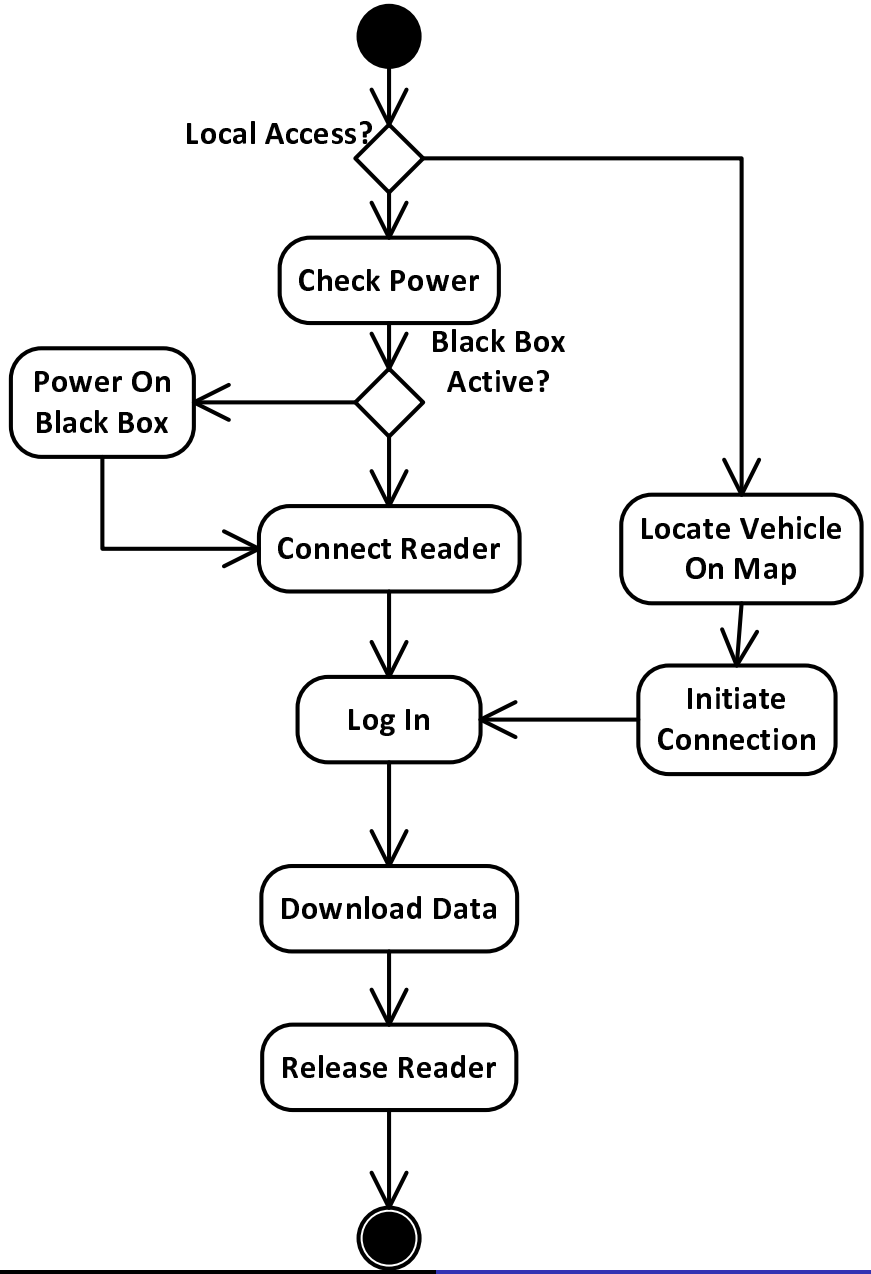
Use Case 1: Installation and Testing



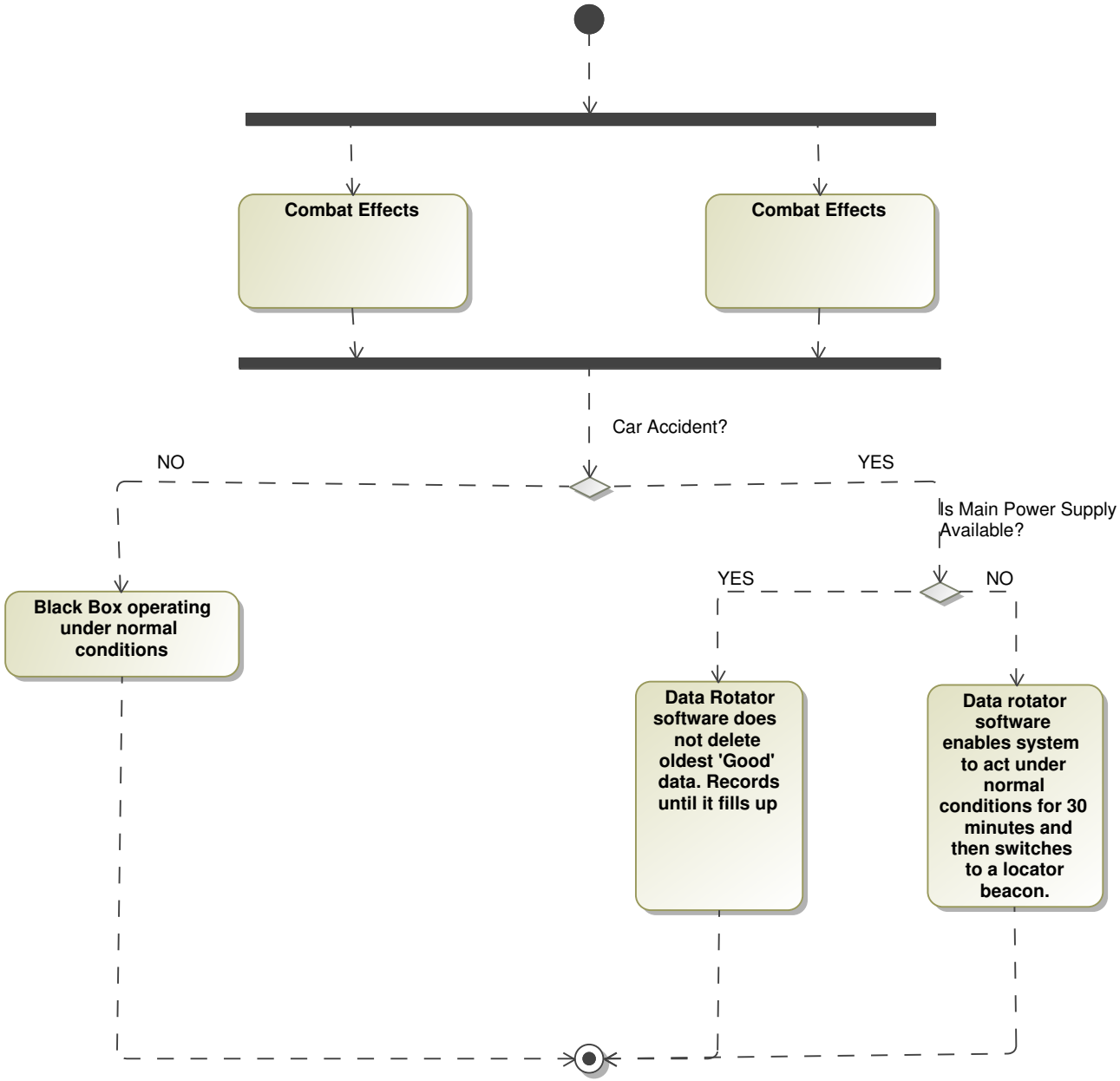
Use Case 2: Normal Operation



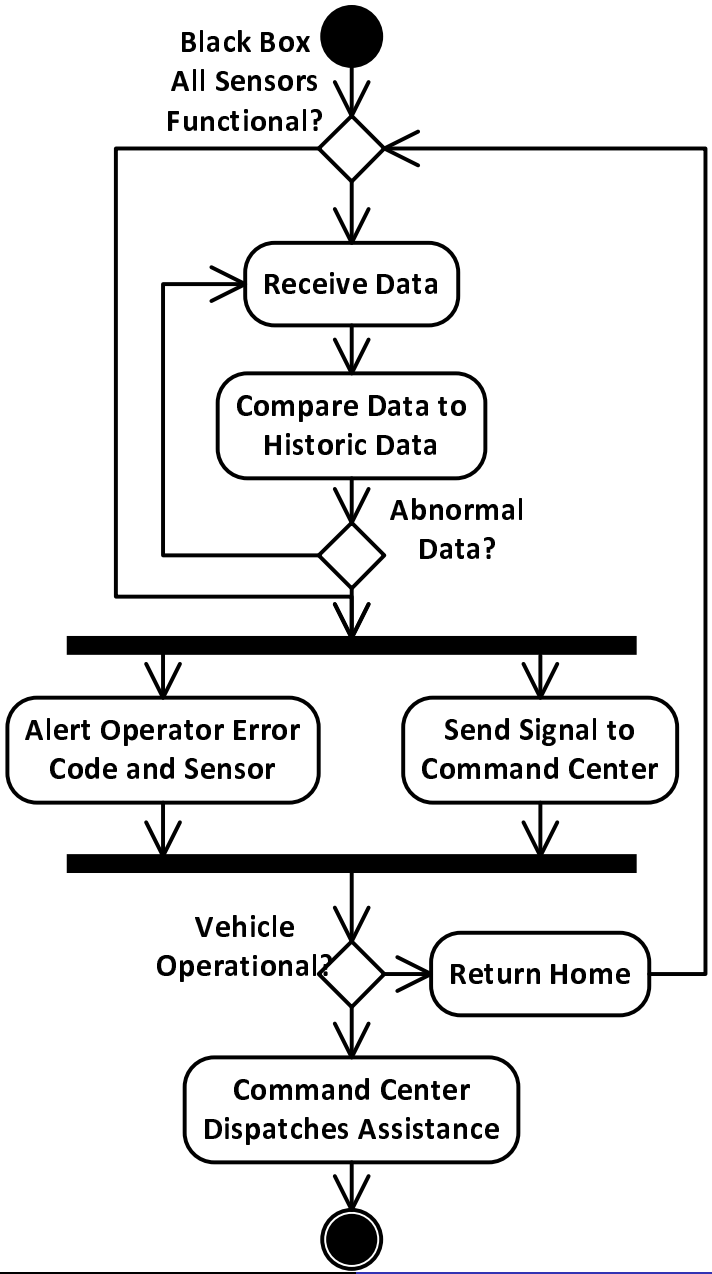
Use Case 3: Retrieving Data



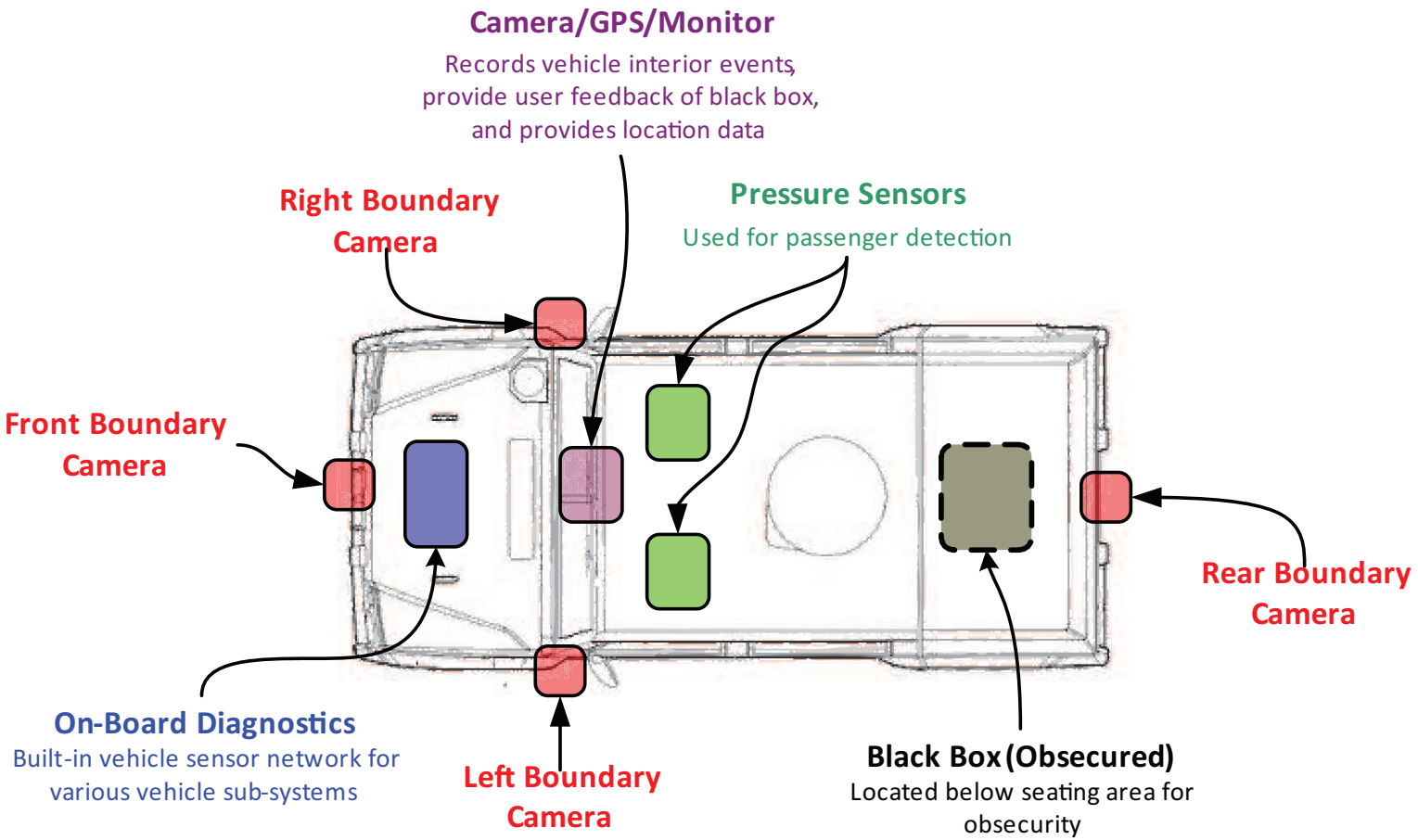
Use Case 4: Accident Operations/Reliability



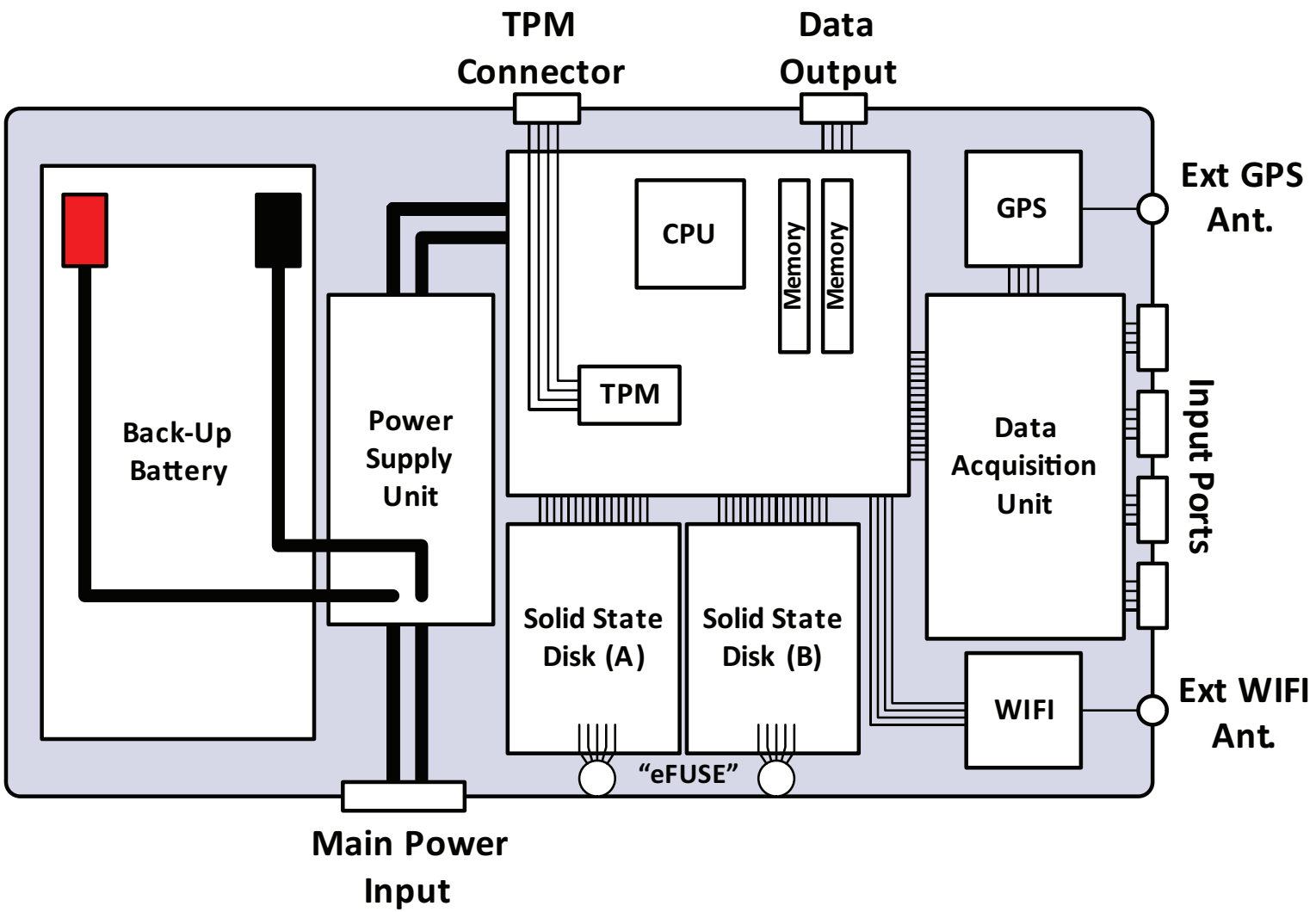
Use Case 5: Maintenance



System Design



Black Box Layout



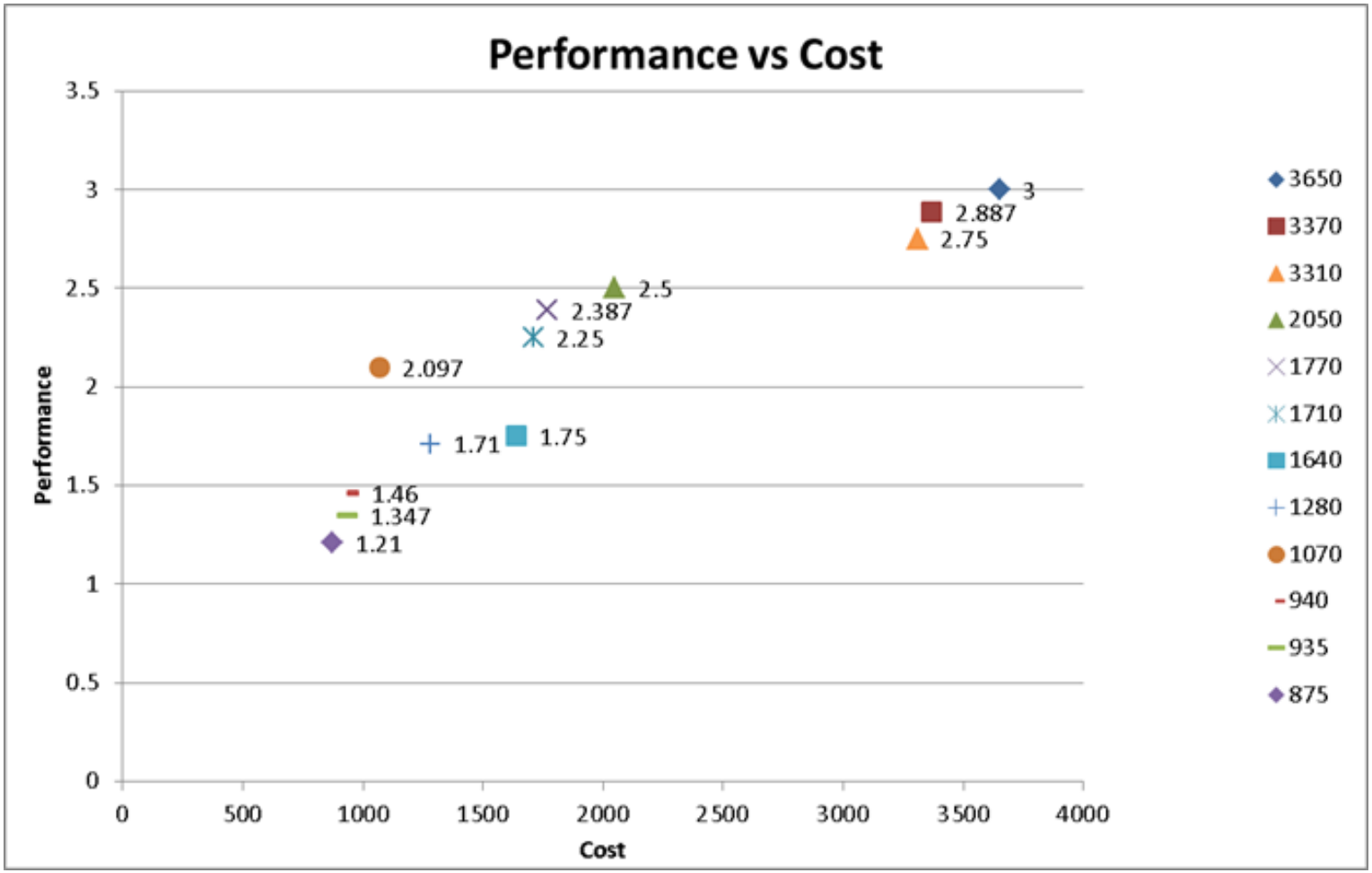
Requirements

High Level Requirements	
Requirement 1	Be as indestructible as possible
Requirement 2	Be mountable to army vehicles
Requirement 3	Store data from camera, vehicle sensors, and location (GPS)
Requirement 4	Have accessible data for army command and base centers
Requirement 5	Be tamper-resistant
Requirement 6	Accommodate accident-scenarios
Requirement 7	Have accessible data displayed for Field-Technician Soldiers

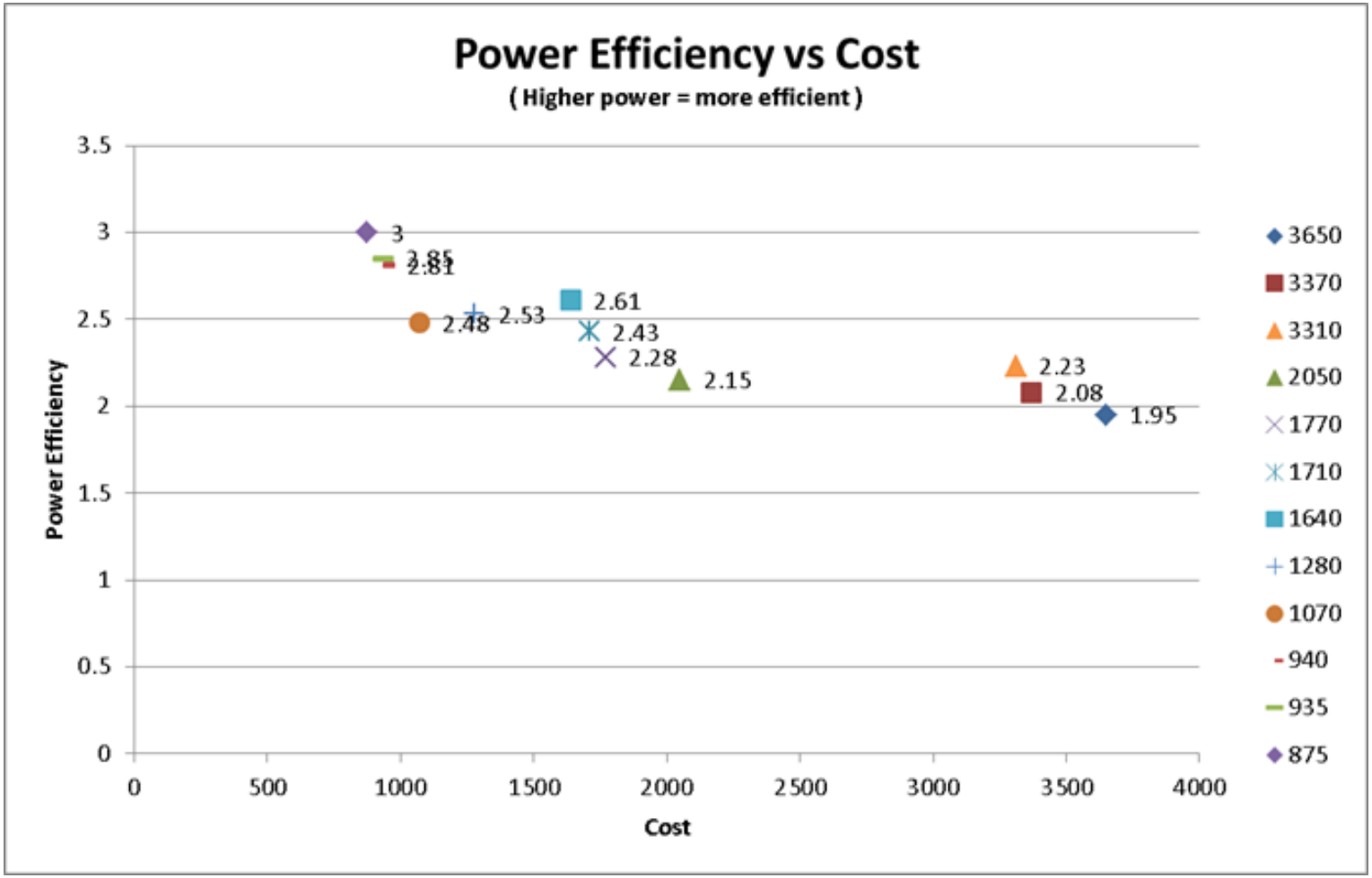
Traceability

Used Case	High-Level Requirement	Component Requirement	Description	Components
Normal Operations	Requirement 3	RAM 1, 2; PRC 1, 2, 3; CHD 1,2; EHD 1, 2	Black box must store data and it must do so as efficiently (eg speed, power) as possible.	Memory, Processor, SSD and Redundant SSD

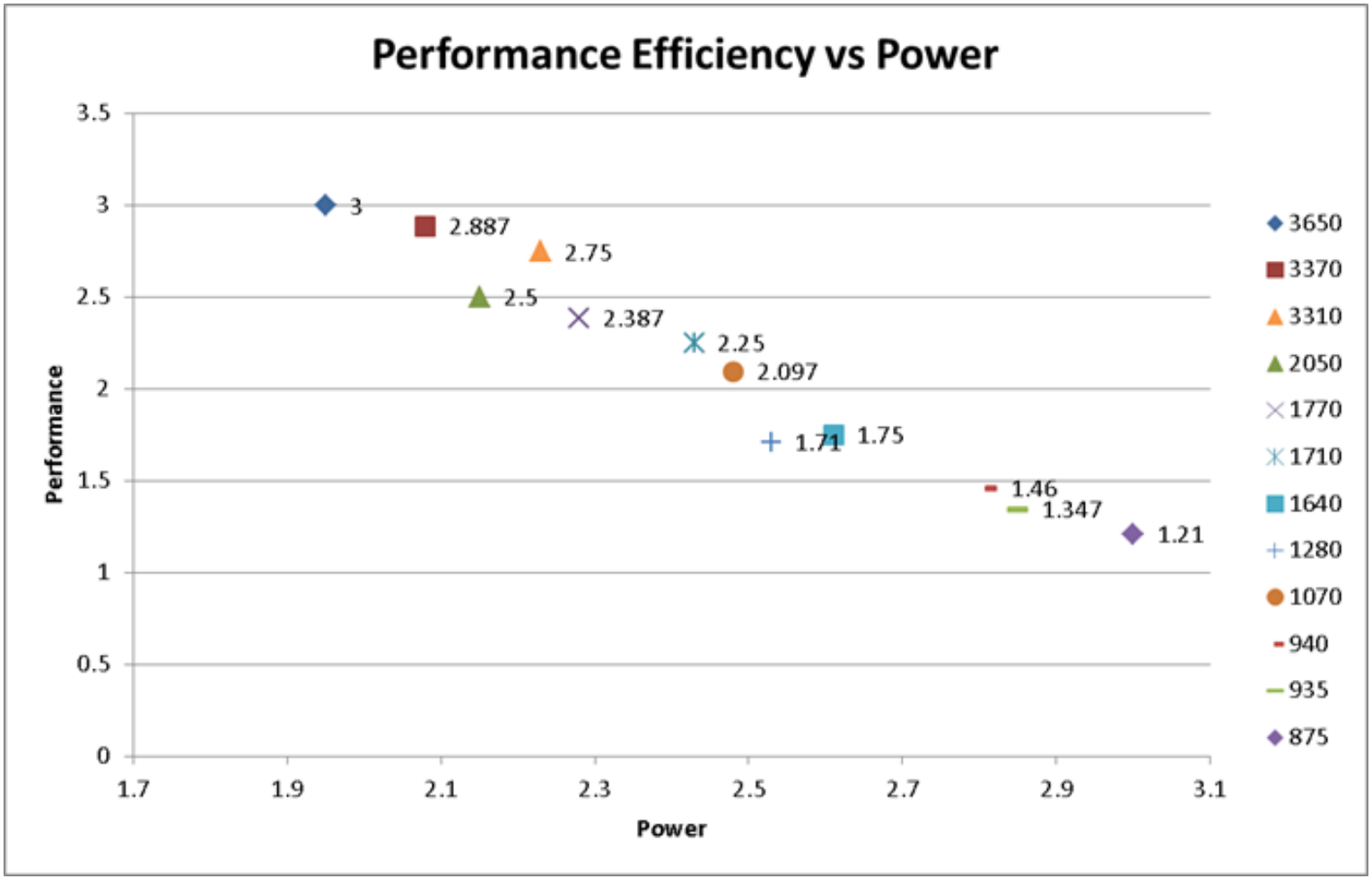
Trade-Off Analysis: Performance vs. Cost



Trade-Off Analysis: Power Efficiency vs. Cost



Trade-Off Analysis: Performance vs. Power Efficiency



Summary

Trade-Off Curve	Points of Interest
Performance vs Cost	22, 1, 10, 27, 17
Power Efficiency vs Cost	27, 22, 24, 17, 13, 1
Performance vs Power	1, 7, 27, 17, 22
All	22, 1, 27, 17