

Determining Threat Equivalency of Navy Aerial Targets

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APL

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Threat Equivalency

- **Representative aerial targets are needed to show that ship combat systems meet their requirement to defeat specified missile threats.**
- **To do this, a target must be similar enough to the threat so that performance of all aspects of the combat system are equivalent against the threat and the target.**
 - **e.g. Sensor tracking, engagement timelines, interceptor P_K**

The Importance of Threat Identification

- **Previously, threat ID was nothing more than “subsonic” or “supersonic.”**
- **Today, combat systems are relying more heavily on identifying the incoming threats in order to plan and carrying out engagements.**
 - **Matching speed, signatures, RF emissions, etc. become more important to differentiate between similar systems**
- **Failure of a target to be identified as the threat it is emulating could result in unrepresentative engagements**

However...

- **A target does not need to match the performance parameters of the threat if the combat system responds the same way as it would to the threat.**

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How close to each threat does the target need to be for it to be threat representative?

The Analysis

- **Through simulation, we determine the response of combat system elements to the threat and the notional targets for a range of target performance parameters.**
 - **Speeds, altitudes, radar and IR signatures, etc.**



Representative Aegis Combat System



**SM-2 Blk IIIB and
ESSM Interceptors**

SPY-1D(V) Radar

WCS and C&D

SLQ-32

Representative Ship Self Defense System

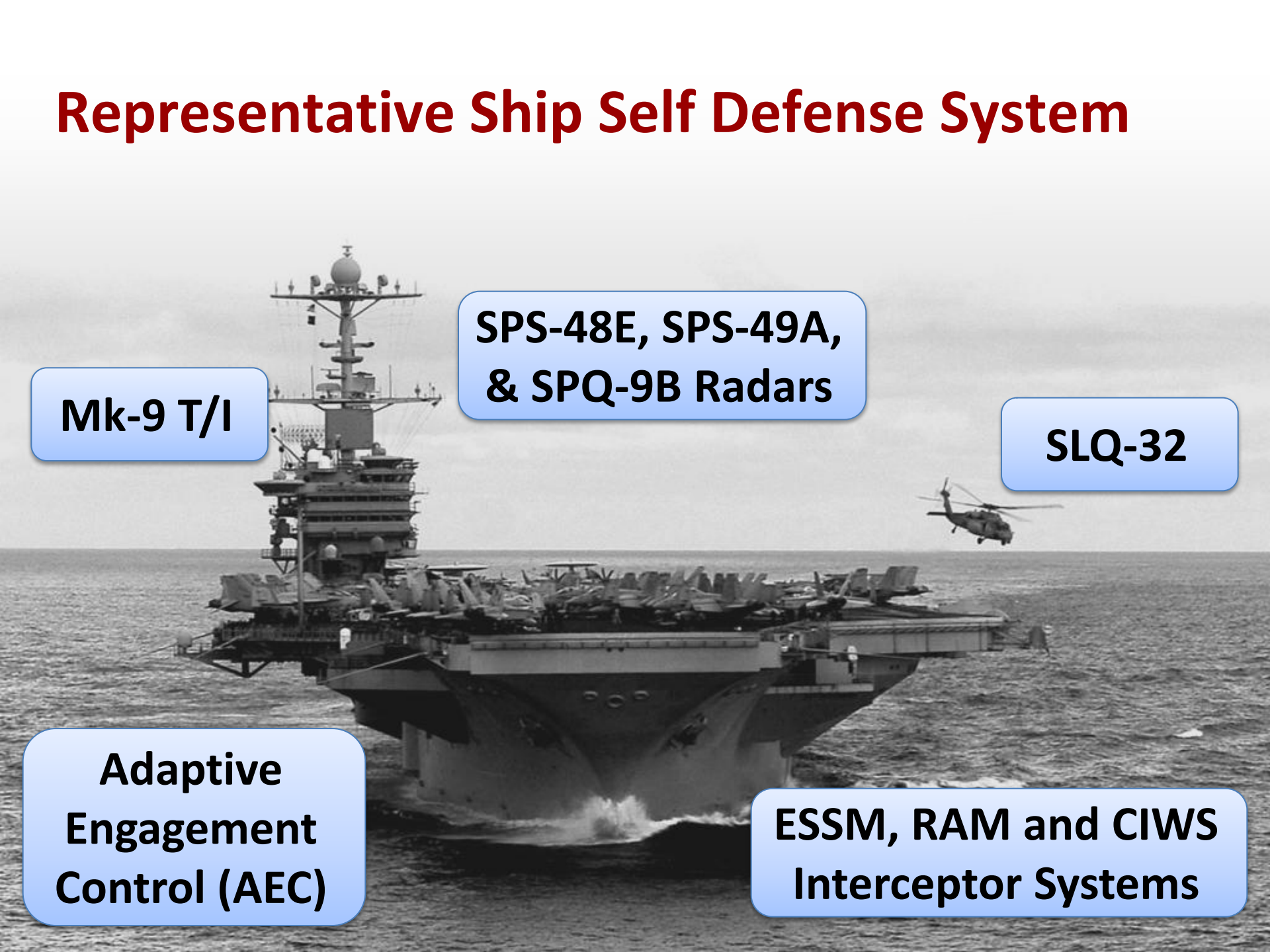
Mk-9 T/I

**SPS-48E, SPS-49A,
& SPQ-9B Radars**

SLQ-32

**Adaptive
Engagement
Control (AEC)**

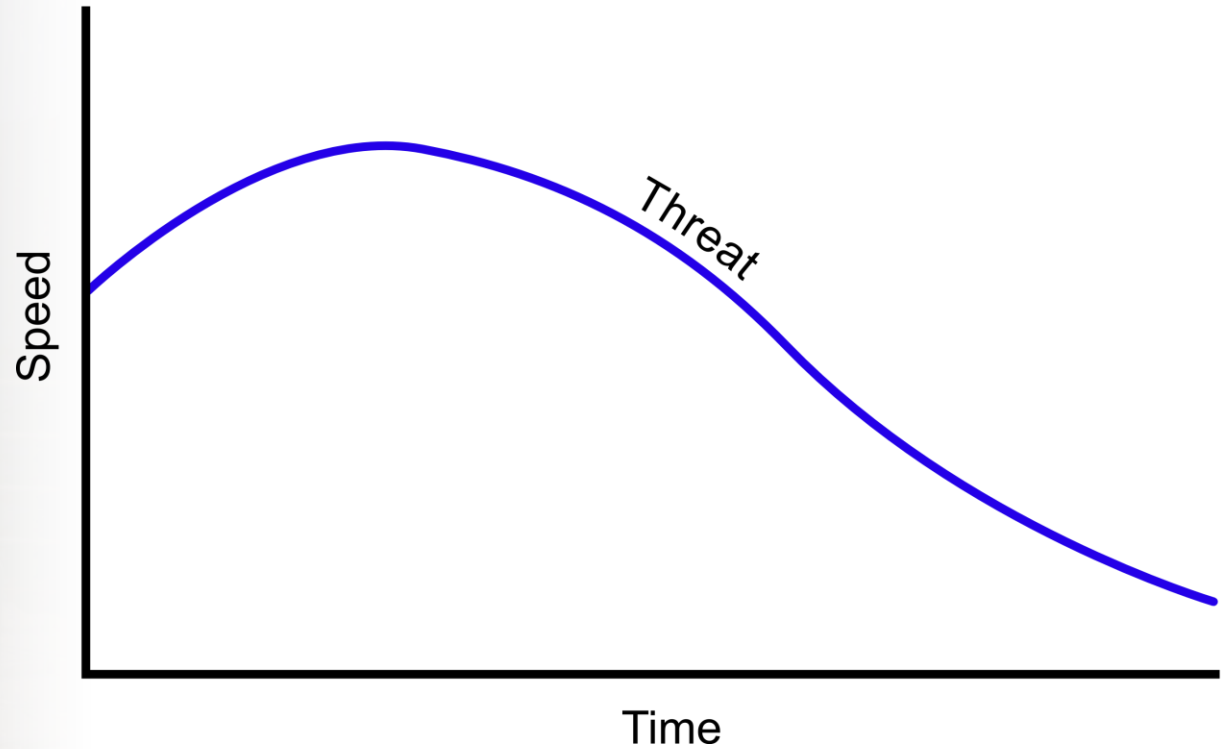
**ESSM, RAM and CIWS
Interceptor Systems**



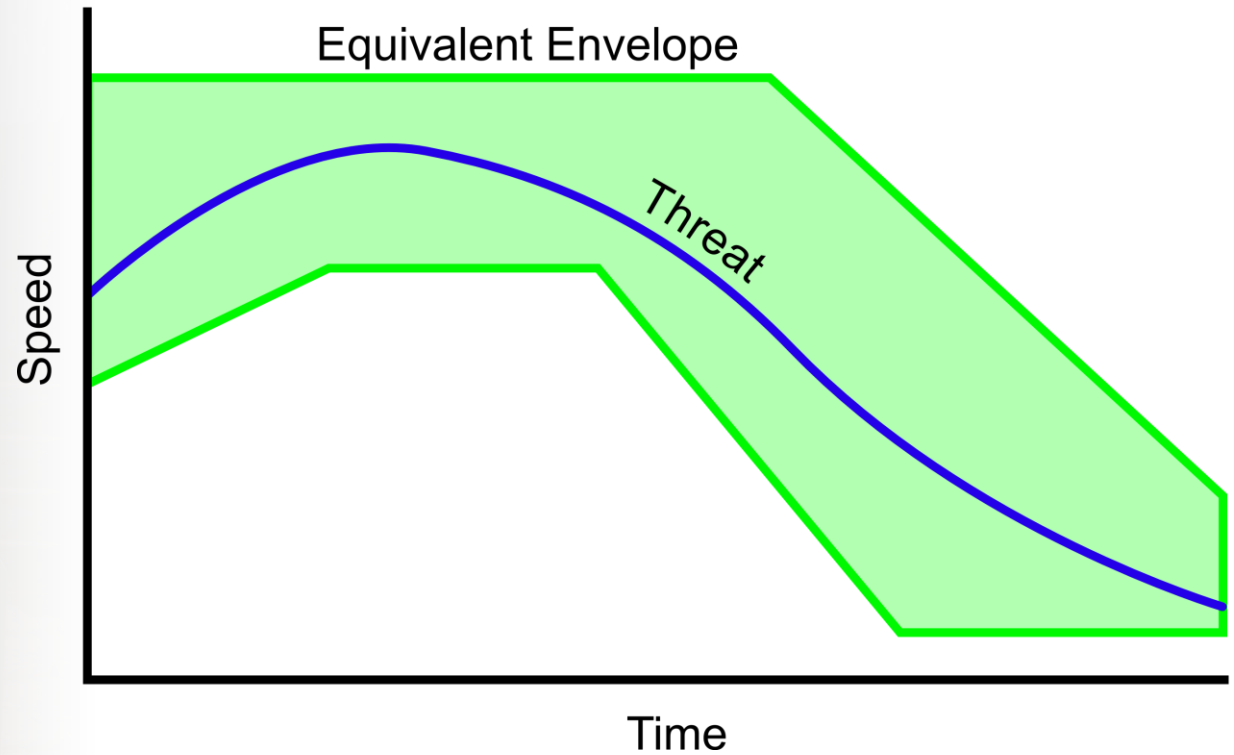
The Process

- **Compare output of simulations for each metric**
 - Target ID
 - Probability of detection
 - FirmTrack range
 - Interceptor probability of kill
- **Make determination of threat equivalency boundaries**
- **Identify target systems that satisfy these boundaries**
 - If none exist, use results to identify requirements for new system

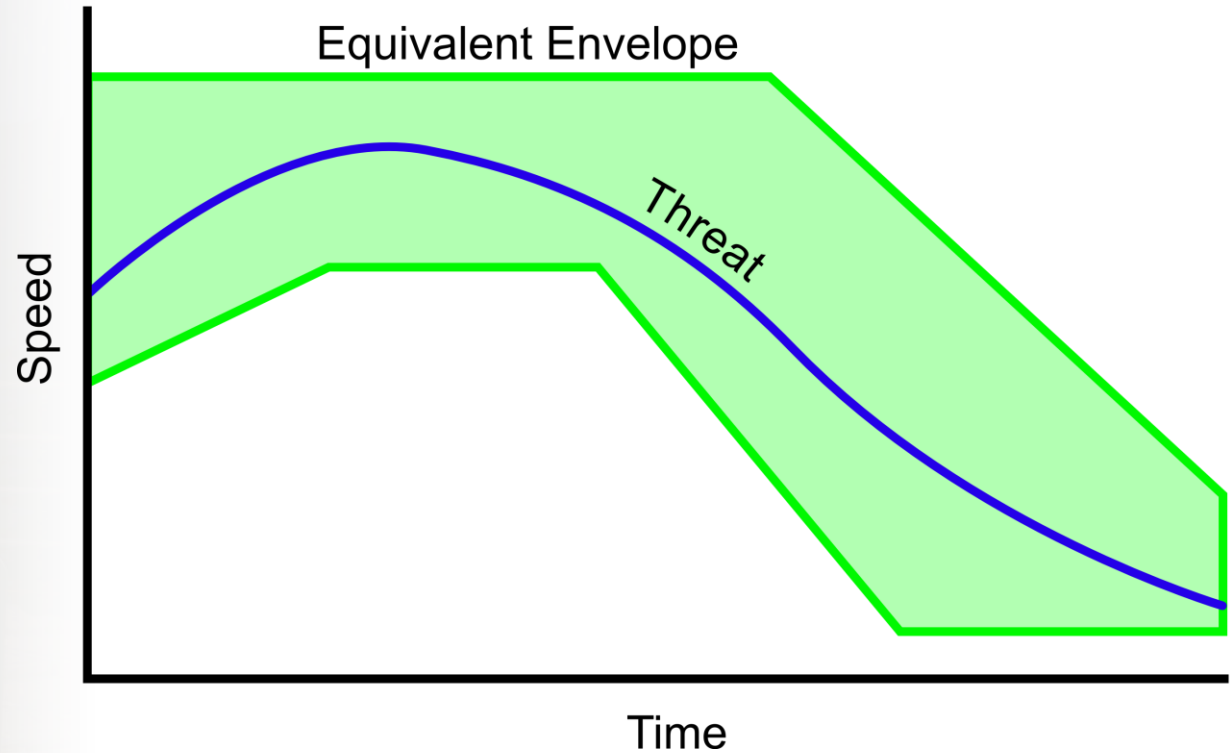
Performance Boundary Example



Performance Boundary Example



Performance Boundary Example



Target is equivalent to threat inside of envelope.

The Studies

- **Studies can be done for each class of weapon system.**
 - e.g. Subsonic threats, supersonic sea-skimming threats, high diving threats
- **APL has conducted a study for the Multi-Stage Supersonic Target, the Subsonic Aerial Target, and is currently conducting a high diving equivalency study.**



Conclusion

- **Combat system simulations can be used to assess how well aerial targets emulate missile threats and to identify target performance requirements.**
- **These equivalency studies ensure that the Navy's defense systems are tested against threat representative targets.**