Determining Threat Equivalency of Navy Aerial Targets

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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

- SPY-1D(V) Radar
- SM-2 Blk IIIB and ESSM Interceptors
- WCS and C&D
- SLQ-32
Representative Ship Self Defense System

- SPS-48E, SPS-49A, & SPQ-9B Radars
- Mk-9 T/I
- 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.