Event Time Analysis in Multi Mission Scenarios with System Simulation Models

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Abstract

This paper presents an event time line analysis using system simulation models in multi mission scenarios

Radar resource usage is evaluated for the assessment of the multi mission capability of the combat system

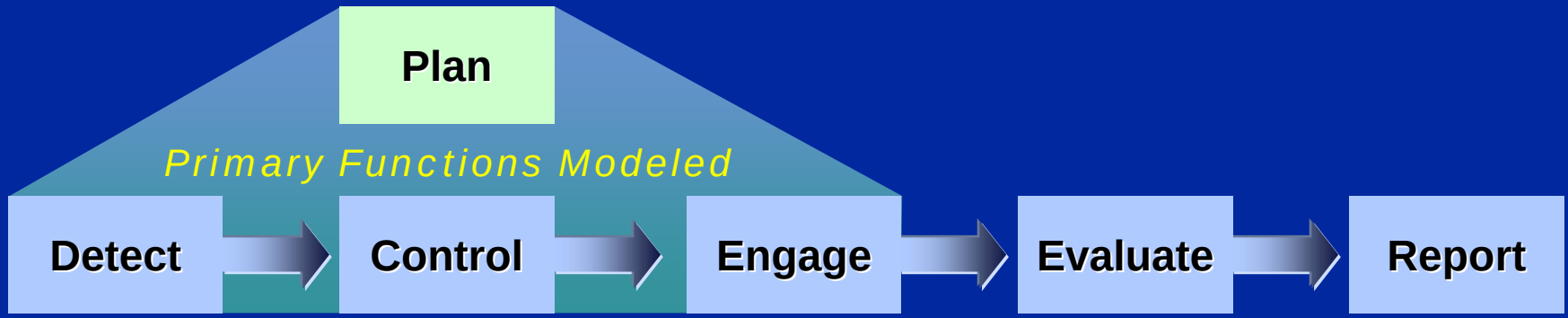
The impact of radar resource availability is evaluated in scheduling the events along the engagement timeline using the system simulation models

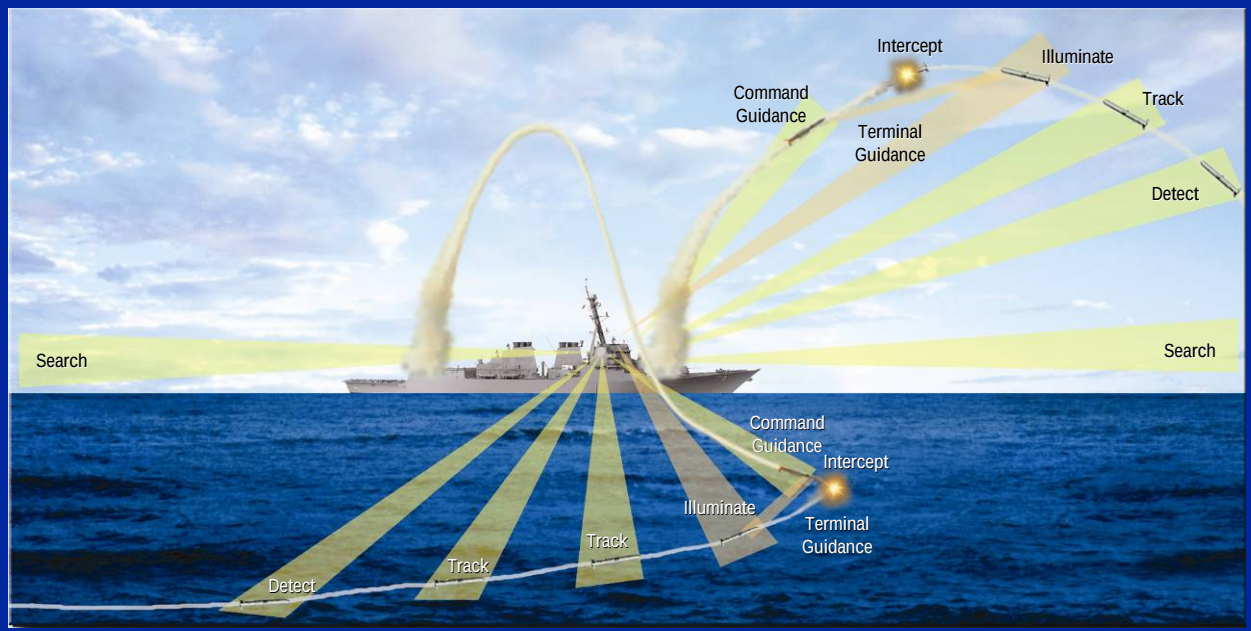
Definitions

- ***AAW – Anti Air Warfare***
- ***Sensors – Scanning and Tracking Radars***
- ***Multi Mission – Combined Missions requiring Simultaneous Tracking and engagements for Ballistic, Air or Surface Targets***
- ***Radar Resource Usage – Radar time required to schedule the beams for search and track***

Scenarios and Mission

General Engagement Timeline Model





Multi-Mission Scenario

- *Goal*
  - *Assess Naval Ship Combat System capability to simultaneously perform multiple Missions*
- *Typical Operational Scenario*
  - *A single ship is tasked with both mission A and a mission B*
  - *The ship will require management of radar resources to achieve both missions*

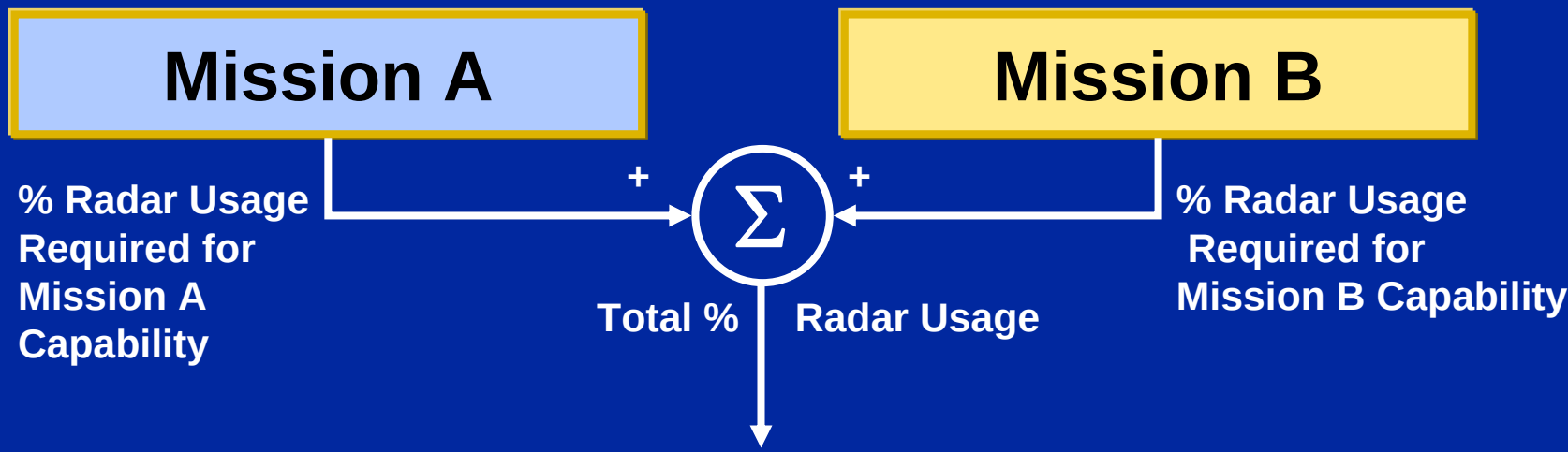
Analysis Methodology

- ***Mission specific system simulation models are used individually to determine individual mission performance***
- ***With post processing the radar resource usage is analyzed for combined event time lines of the missions***
- ***Alternate system concepts can be derived from the analysis***
- ***By managing priorities with some of the events, radar resources can be managed to provide capability for both missions***

Multi-Mission Capability Analysis Methodology

Raid of missiles arriving at a given interval inbound and in the vicinity of the ship while search is performed at a given rate

Raid of missiles arriving at a given interval from a given launch area impacting at a given distance from ownship



Combined analysis results for multi-mission scenario along the event timeline to evaluate whether a single ship system can simultaneously perform A and B missions

Simulation Models

- *System simulation models specific to missions were used*
  - *Event driven simulation models*
  - *High fidelity representation of radar and weapon systems in the models*
- *System simulation models were run individually for mission A and mission B*
- *Output data was combined for event time analysis*
- *Post processing of the data with MATLAB and Excel scripts*

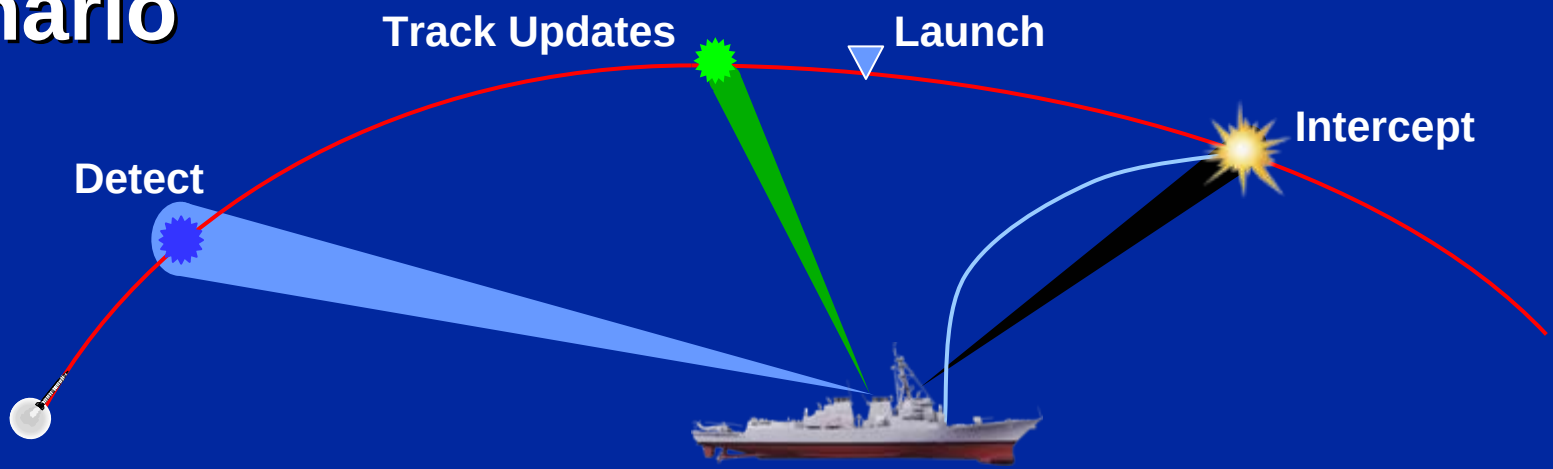
Resource Analysis Methodology

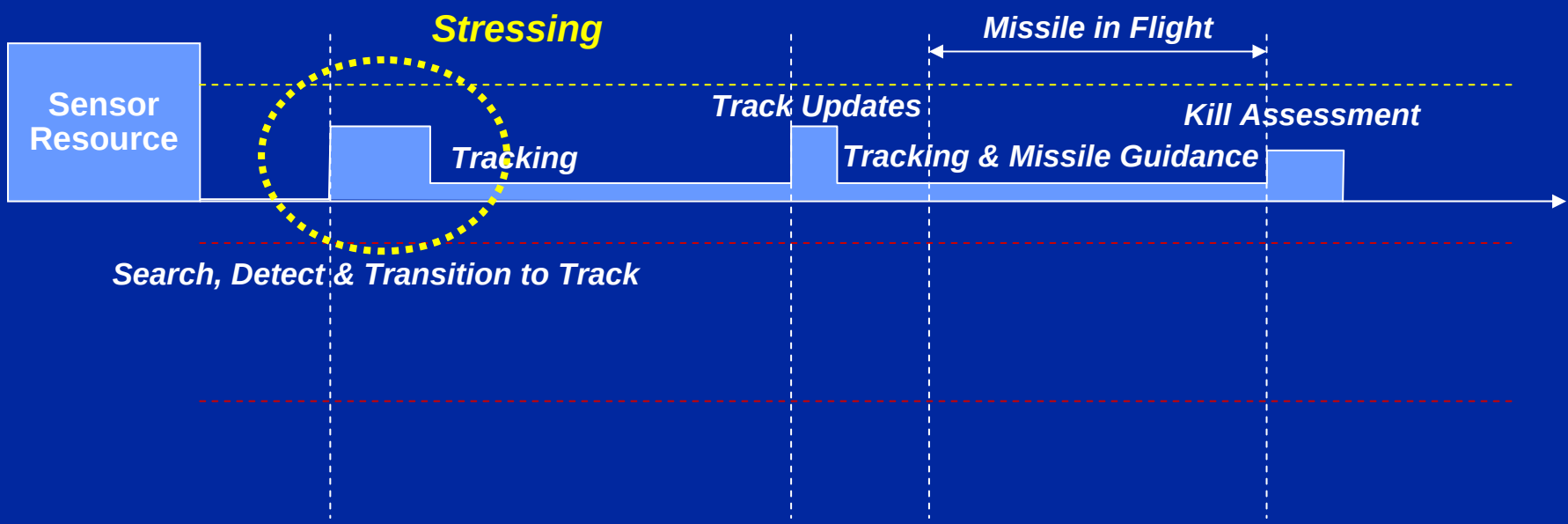
- *Event timeline versus available sensor resources*
- *Intersection of multiple events create stresses on sensor resources*
- *Analyze the initial intersection of events against mission priority to determine unsupportable events*
  - *Event set 1 is higher priority then event set 2*
  - *Event set 1 is given the system resources*
- *Determine baseline measurement of effectiveness*

Resource Analysis Methodology

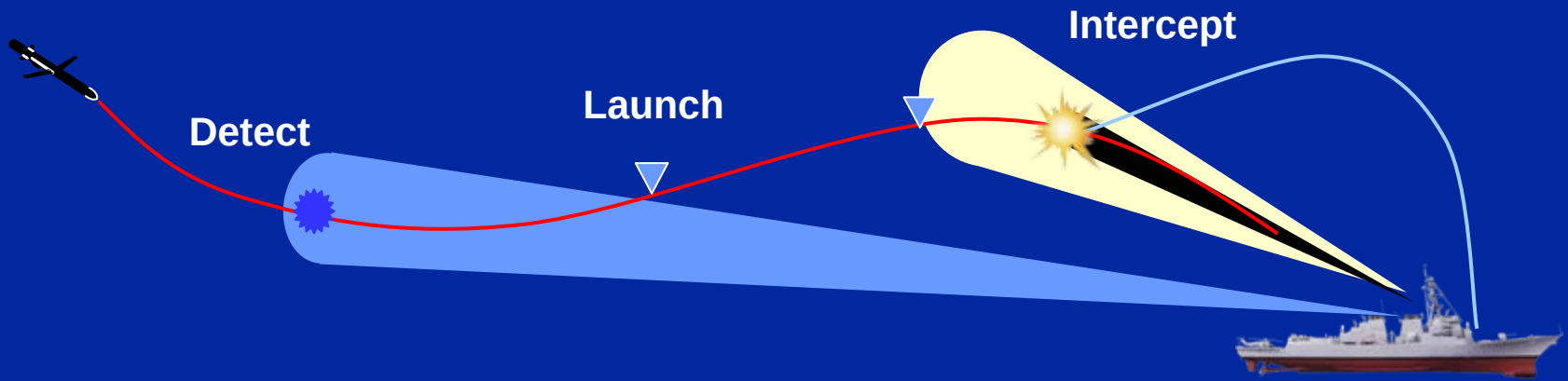
- ***Determine if sufficient time is available to reschedule an unsupportable event.***
  - ***If not reschedule-able, then event timeline is not supportable***
- ***Shift event data (apply system concept) and re-analyze remaining events***
- ***Determine applied system concept measurement of effectiveness***

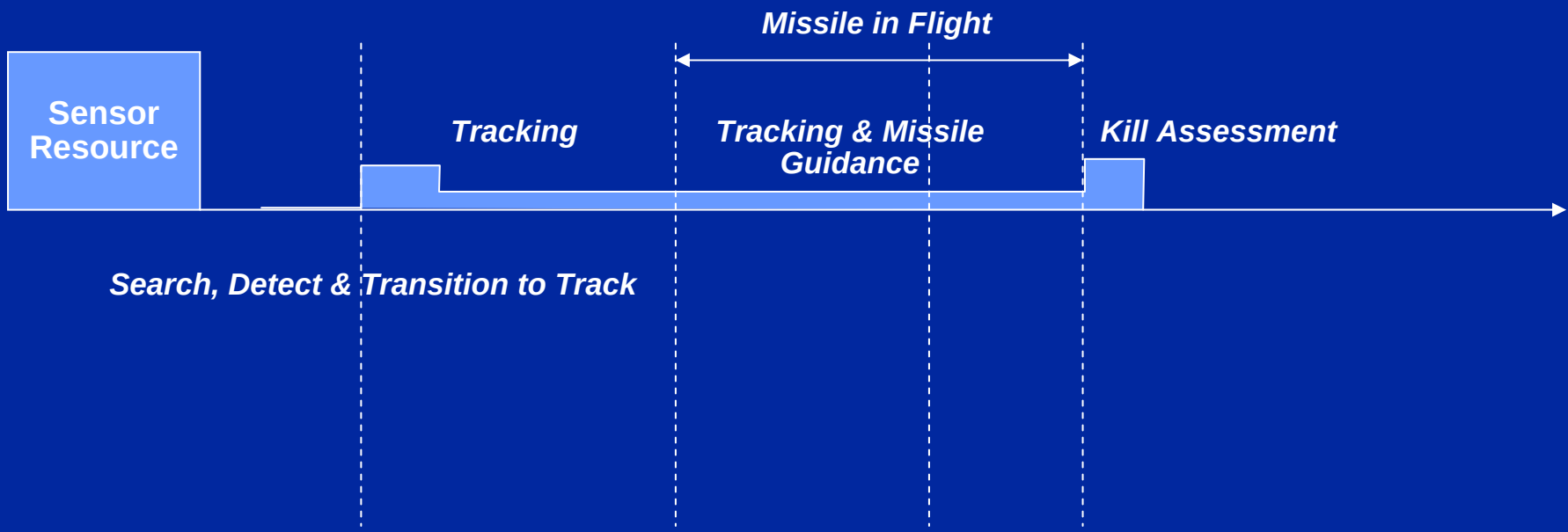
Radar Resource Usage in Mission A Scenario





Radar Resource Usage in a Mission B Scenario





Performance Metrics

- ***Radar resource usage along engagement event timeline***
- ***Number of supportable engagement events along the timeline***
- ***Number of targets not engaged due to resource limitations***

Derived System Concept

- *The engagement event time lines for the mission are built from the output data of the Monte Carlo Simulation runs*
  - *Determine peak supportable events and system resource usage*
  - *Determine total supportable event timelines allowing for rescheduling*
- *Derive observations on system concept functionality required to support a revised total supportable event timeline*

About the Authors

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