BEYOND BALLISTIC MISSILES?
MISSILE DEFENCE IN AN ERA OF GREAT POWER COMPETITION

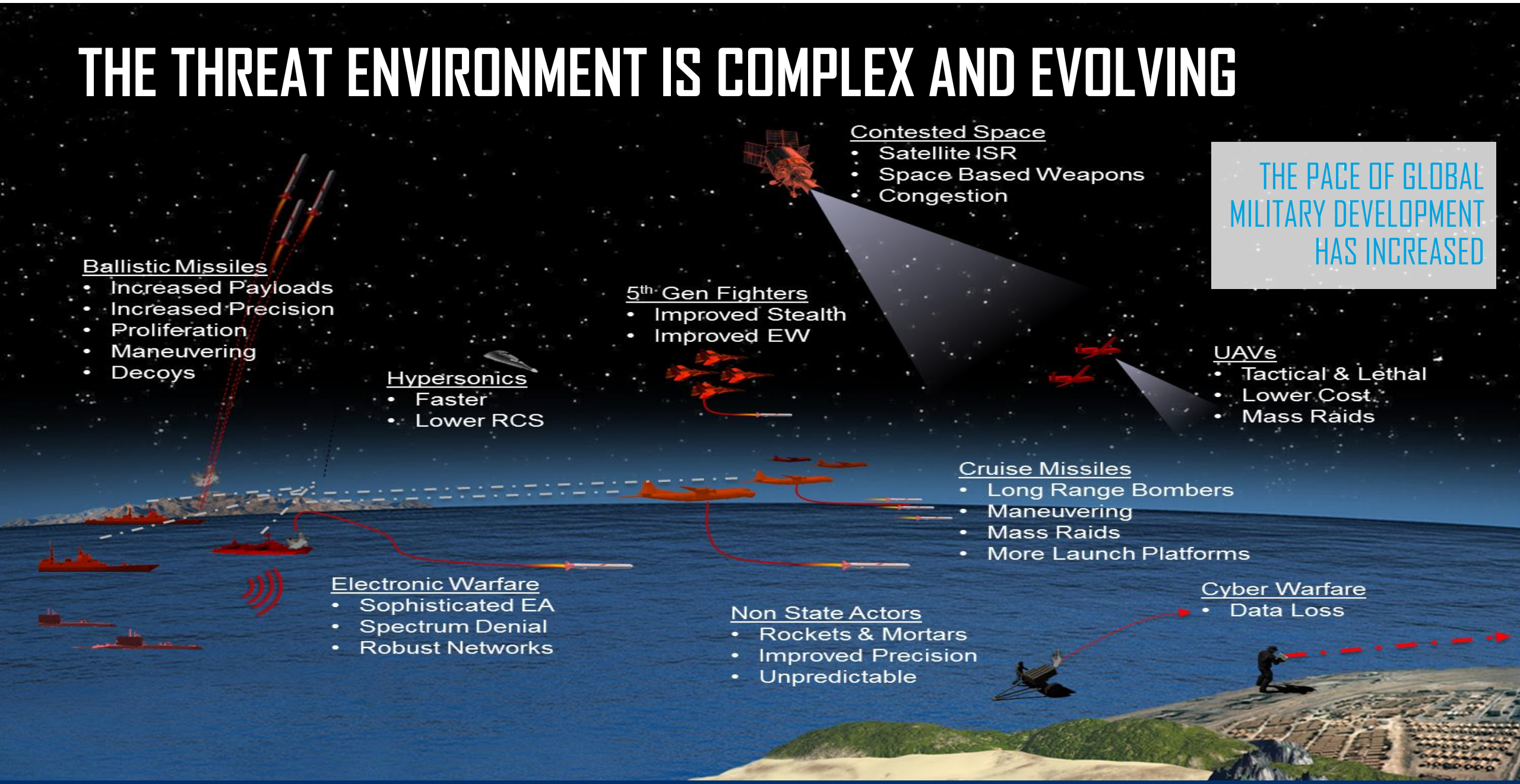
RUSI
www.rusi.org

MISSILE DEFENCE CONFERENCE 2019

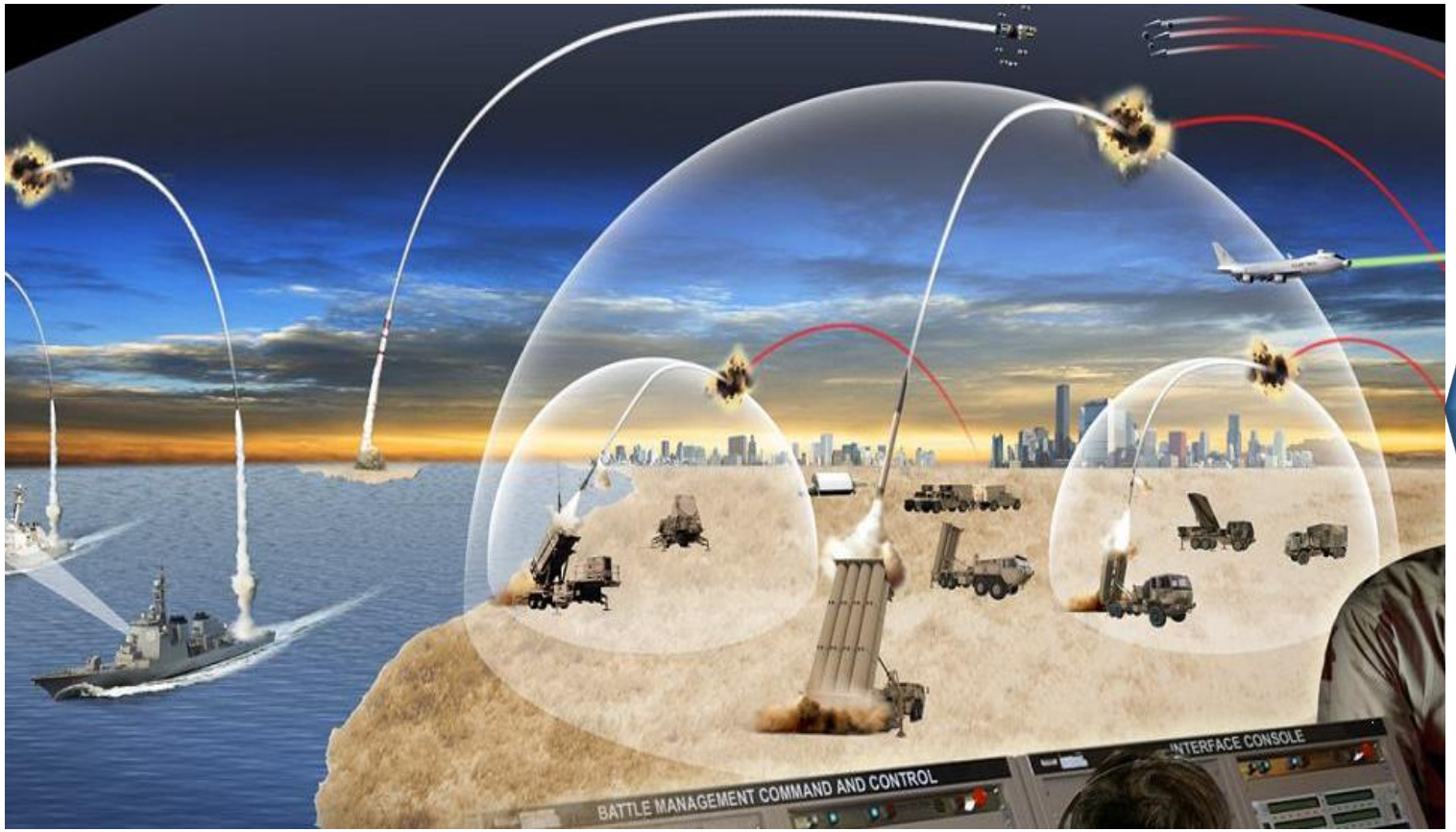
Feb 2019

LOCKHEED MARTIN

THE THREAT ENVIRONMENT IS COMPLEX AND EVOLVING



REAL THREATS OPERATING IN CHALLENGING ENVIRONMENTS



AIR WARFARE
LOWER SIGNATURES
LOWER FLIGHT PROFILES
MANEUVERABLE
FASTER
ECM

HYPERSONIC GLIDE VEHICLES

BALLISTIC MISSILES
LONGER RANGE
DEPRESSED TRAJECTORIES
LOWER SIGNATURES
COUNTERMEASURES
MANEUVERS
ECM
DEBRIS
RAIDS

HYPERSONIC DEFENSE GAP ANALYSIS

- **Hypersonic Threats present new challenge to BMDS Elements**
  - Low flight altitude versus detection range
  - Traditional High Power Ground Based Radars reduced to terminal phase value
  - Overhead Persistent IR (OPIR)/BMD OPIR Architecture (BOA) information, timelines to C2BMC are challenged
- **Threat Maneuverability**
  - Impact Point Prediction more complicated than BMD Kepler
  - Divert G-Forces require advanced interceptor designs
  - Redesign of Weapon System/Interceptor Trades; Engageability, Track Filter, Way Pt calculations, seekers, etc.
  - Velocities and trajectories reduce Reaction Time will require MI and system automation, SoS integration
- **Threat Interceptability**
  - BMD Space based intercept is now HMD Glide phase intercept
  - HMD Terminal Phase intercept will require Kinetic and Non-Kinetic Zone Defense from advanced capability designs of all portions of the overhead sensors, weapon systems, and effectors

MISSILE DEFENSE IN IAMD HAS ANOTHER DIMENSION WITH HYPERSONICS

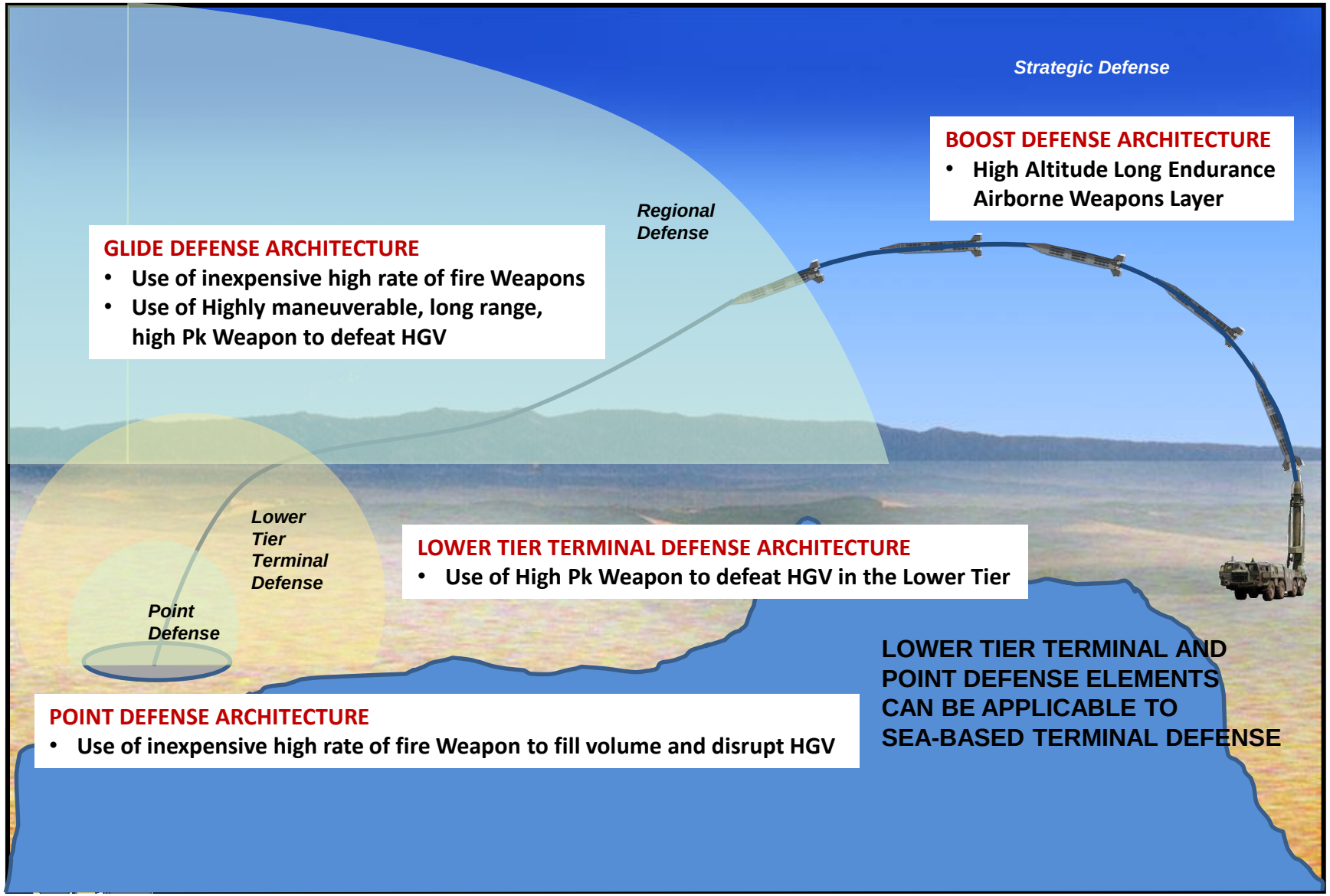
KEY COMPONENTS OF A HYPERSONIC DEFENSE ARCHITECTURE

- **Sensor grid robustness**
  - Expansion of capabilities in space layer
  - Longer-range discriminating radars, Solid State maritime radar upgrades, and Gap Filling tracking radars
  - Improvement of information distribution networks including C2BMC
- **Integrated fire control expansion**
  - Expansion to full set of effectors
  - Advanced multi-sensor discrimination and fusion algorithms
- **Integrated planning and engagement coordination**
  - Expansion of distributed weapon engagement capability
  - Expansion of engagement coordination algorithms
- **Expanded effects options**
  - Acceleration of Kill Vehicle technologies
  - Development of Cost Effective Endoatmospheric Hypersonic Defense Interceptor
  - Acceleration of non-kinetic technologies

CRITICAL ENABLERS FOR A HYPERSONIC DEFENSE ARCHITECTURE

MDA/DIS Case No. MNC-FD-USA5-17; 16 Oct, 2017

NOTIONAL HYPERSONIC DEFENSE ARCHITECTURE



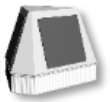
ARCHITECTURE AGAINST HYPERSONIC THREATS REQUIRES INTEROPERABILITY AND INTEGRATION ACROSS PHASES OF FLIGHT

END-TO-END CAPABILITY ACROSS THE KILL CHAIN

Sensors
Programs of Record (PORs)

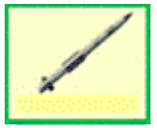

Ground-based BMD


Sea-based BMD


Ground-based BMD

....

Effectors
Programs of Record (PORs)

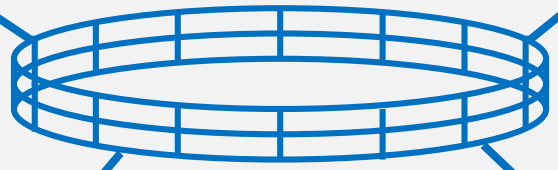


Short/Long-Range

....

Advanced Sensor Concepts ....

Advanced Effector Concepts ....

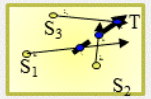
C-Hypersonic Battle Manager



Central Intelligence
Decentralized Control

Threats
- State Vector
- Cross-section
- Multiple threat types

Discrimination/ Sensor Fusion



Phenomenology-Based Discrimination

Fire Control Algorithms

Cross-Sensor/Effector Fire Control

Key:

Algorithms

HYPERSONIC DEFENSE REQUIRES MULTI-DOMAIN CAPABILITY ACROSS THE KILL CHAIN

MDA/DIS Case No. MNC-FD-USA5-17; 16 Oct, 2017

SUMMARY

- Emerging Complex Threats pose significant challenge to Integrated Air and Missile Defense Capabilities
- Critical technology enablers required
- Multi-domain Interoperability and integration across the kill chain key

CAPABILITY AGAINST HYPERSONIC THREATS REQUIRES END-TO-END LAYERED MULTI-DOMAIN ARCHITECTURE WITH DISRUPTIVE TECHNOLOGY ENHANCEMENTS


LOCKHEED MARTIN