



SEA-21A

Over the Horizon Surface-on-Surface Engagement in the Contested Littorals

Final Progress Review

5 Jun 2015





This presentation is
UNCLASSIFIED





The U.S. Navy should invest in **unmanned aerial vehicles** (UAVs) operated from within a tactical, offensive, independent Surface Action Group to facilitate **organic over the horizon** (OTH) first strike capabilities in an anti-access/area-denial (A2/AD) environment.

"The surface force is taking the offensive to give the operational commander options to employ naval combat power in any anti-access/area-denial (A2/AD) environment."

VADM Thomas Rowden
Commander, Naval Surface Forces



SEA-21A Tasking Statement

OPNAV N9I:

SEA 21A Tasking Maritime ISR in the Contested Littorals

"Design a fleet **system of systems** and concept of operations for employment of a cost effective and resilient **maritime ISR** system capable of **collecting, fusing, and disseminating** critical environmental and threat information in **a contested littoral area** in the 2025-2030 timeframe. Consider manned and unmanned systems in all domains to provide sufficient information to support effective **tactical offensive operations**. Consider employment requirements, operating areas, **bandwidth and connectivity, interoperability, sensor data processing, transfer and accessibility**, logistics, and basing support in **forward areas** or from CONUS bases. Generate system requirements for platforms, sensors, and communications in **a challenging EM environment**. Evaluate **swarm concepts** for inclusion in your solution. Then develop alternative architectures for platforms, sensors, manning, **command and control, intelligence collection/dissemination and consumption**, communication and network connectivity, and operational procedures. Address the costs and effectiveness of your alternatives."



SEA-21A Tasking Statement

- Revised:

Over-The-Horizon Surface-on-Surface Engagement in the Contested Littorals

Design a maritime ISR&T system of systems and concept of operations capable of detecting, classifying, and engaging targets in support of organic over-the-horizon tactical offensive operations in a contested littoral area in the 2025-2030 timeframe.

Consider the following:

- Manned and unmanned systems with an IOC by 2020
- Requirements, limitations, operating area, bandwidth and connectivity, EM degradation, interoperability, compatibility, logistics, and forward deployment
- Alternative architectures and their comparative effectiveness and costs



Present Day

U.S. Navy surface combatants currently lack the organic capability to find, fix, track, target, engage, and assess (F2T2EA) another surface vessel over the horizon (OTH) in a contested littoral environment.

RGM-84D (1C)
75 NM

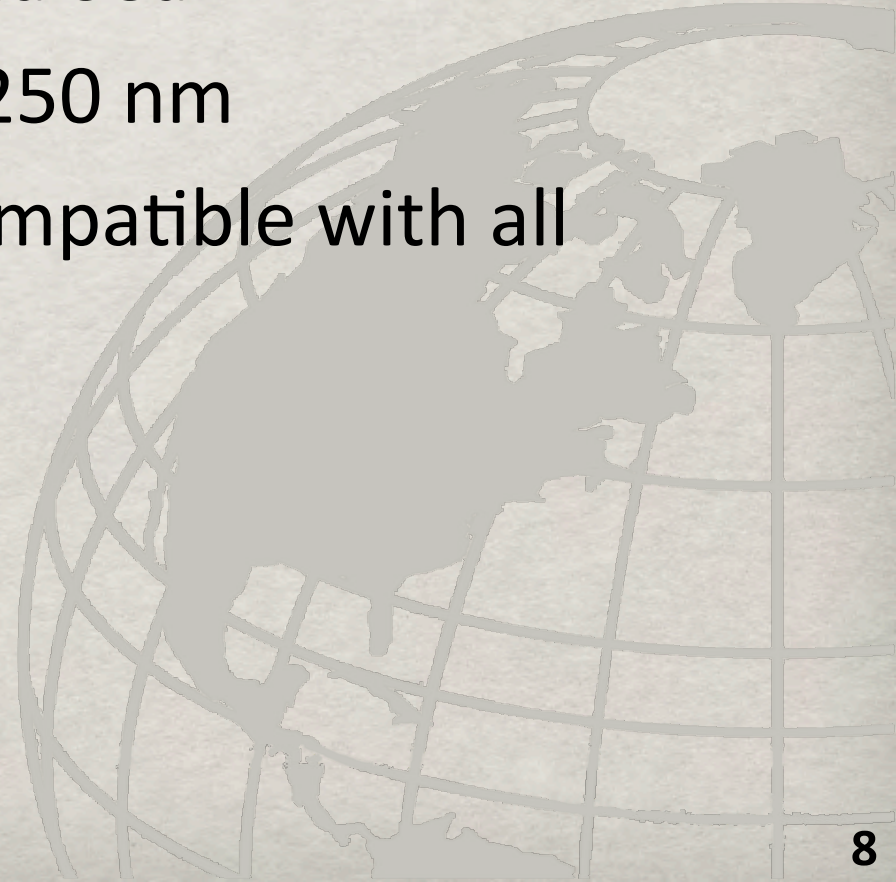
YJ-12 ASM
250 NM





Over the Horizon Targeting: 2025

- A2AD: The denied use of an aircraft carrier and its assets
- Littorals: The South China Sea
- Enemy's Target Range: 250 nm
- OTH-capable missile: compatible with all architectures





Selected Architectures

Unmanned Aerial Vehicle (UAV)



Prepositioned Network (PPN)



Key Performance Parameters (KPP)

- Performance
- Mobility
- Deployability
- Adaptability
- Vulnerability
- Compatibility
- Interoperability



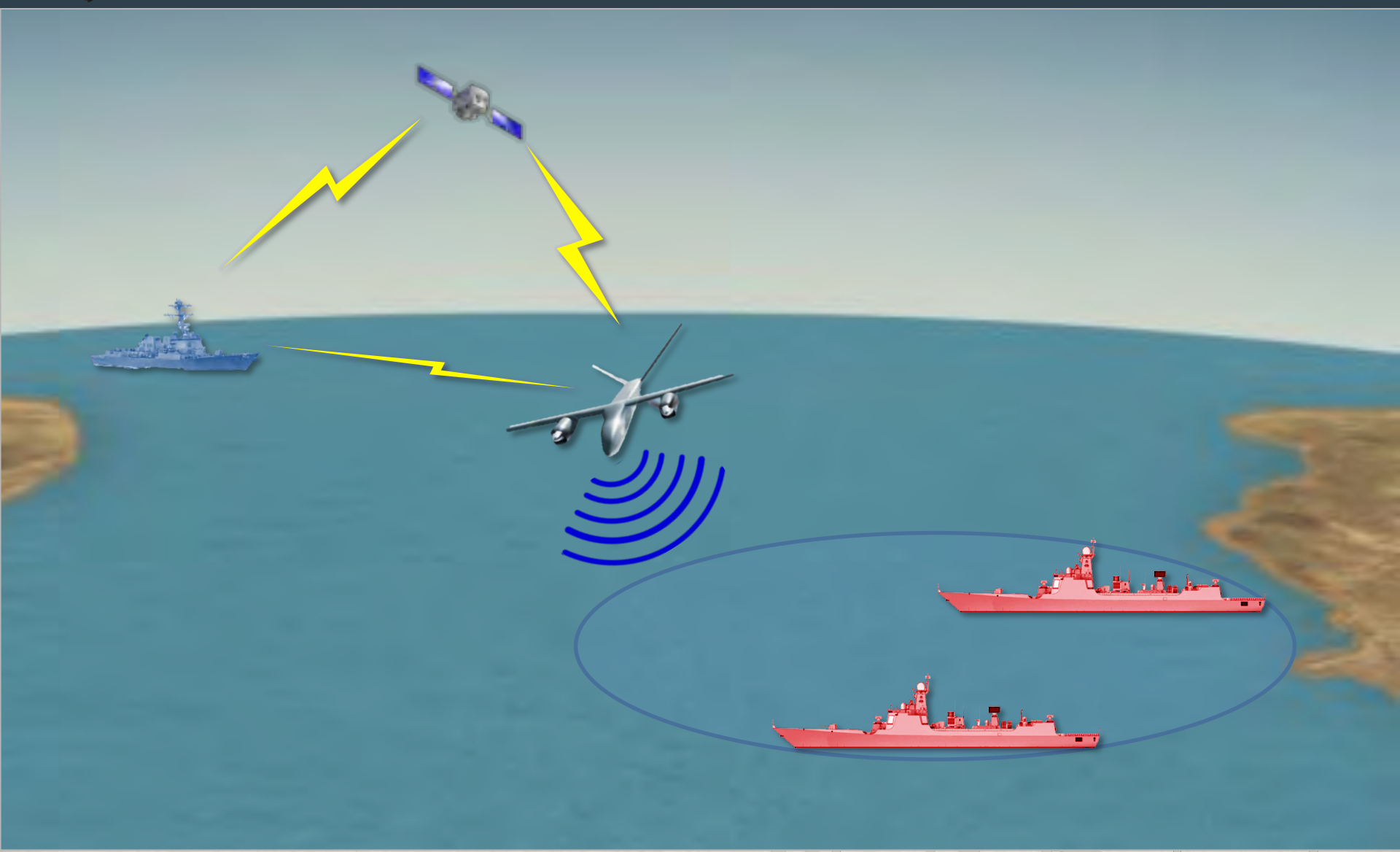
Unmanned Aerial Vehicle



- **Purpose**
 - Organic OTH targeting
 - Far-reaching
 - Individual CO initiative
- **Expectations / Limitations**
 - SAG awareness through multiple lines
 - UAV is single point of failure
 - 1 UAV – 1 platform



Unmanned Aerial Vehicle CONOPS





Prepositioned Network

- **Purpose**

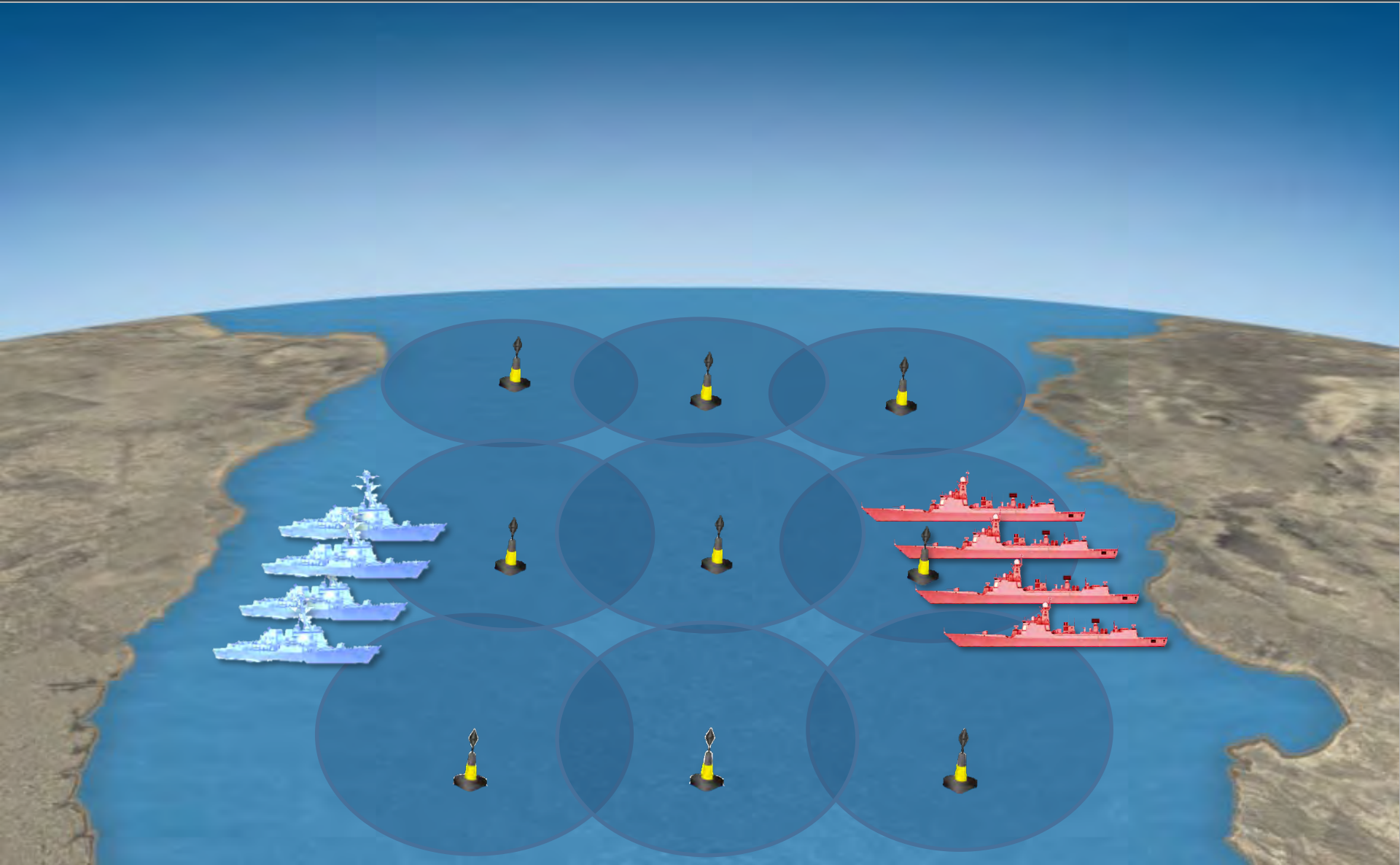
- Networked information and targeting data on demand
- Consistency for targeting platforms through continuously updated information
- Persistent coverage

- **Expectations/Limitations**

- 24/7 availability
- Demonstrated reliability over the domain area
- Access coverage sea dominance
- Maintenance



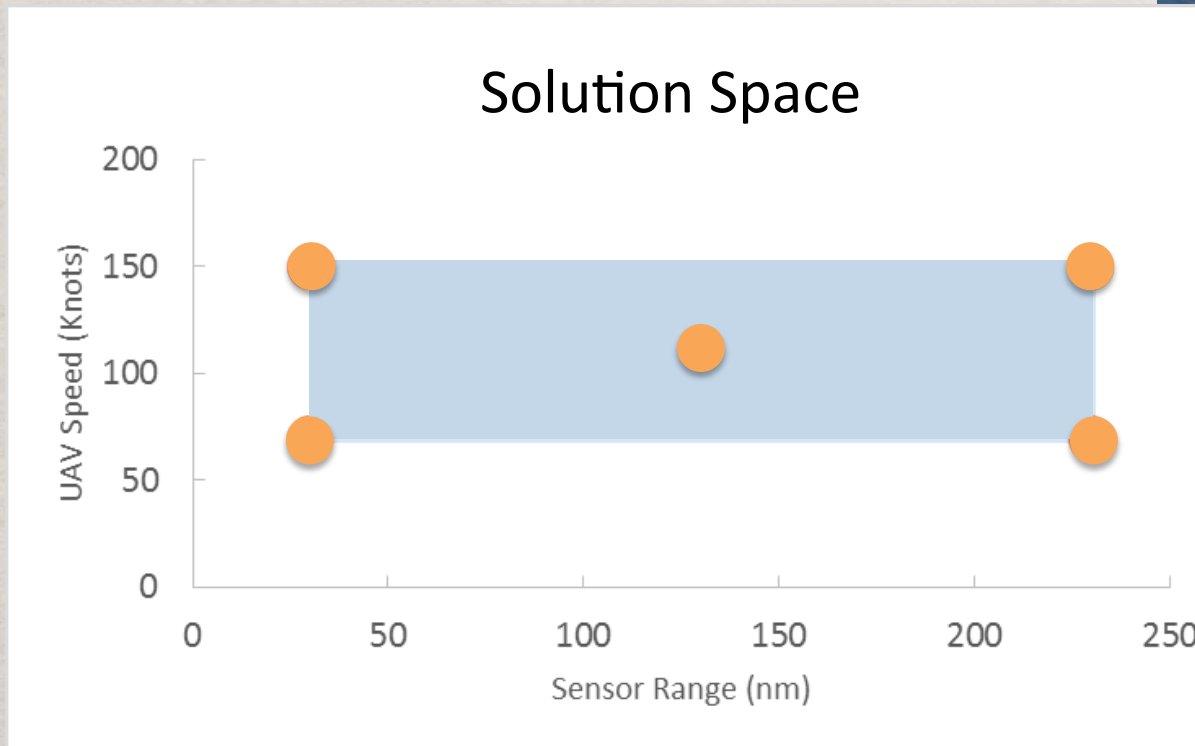
Prepositioned Network CONOPs





Representative System Configurations

- UAV Architecture:



Triton



ScanEagle

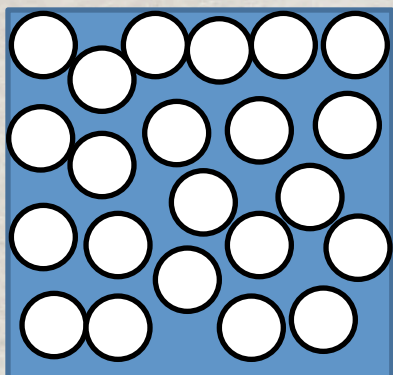


Tern

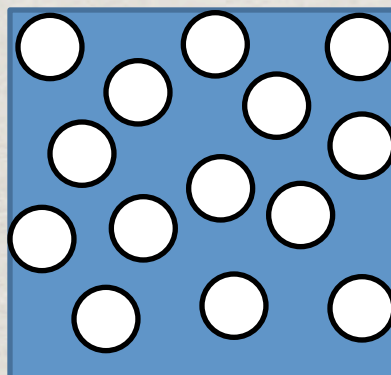


Representative System Configurations

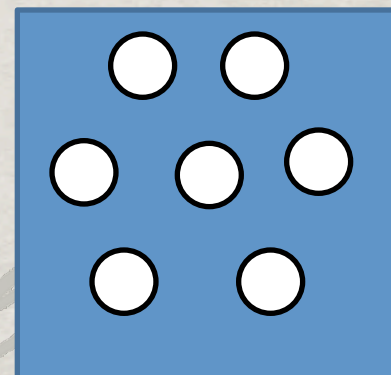
- PPN Architecture:




PPN 1
95% coverage
53 sensors

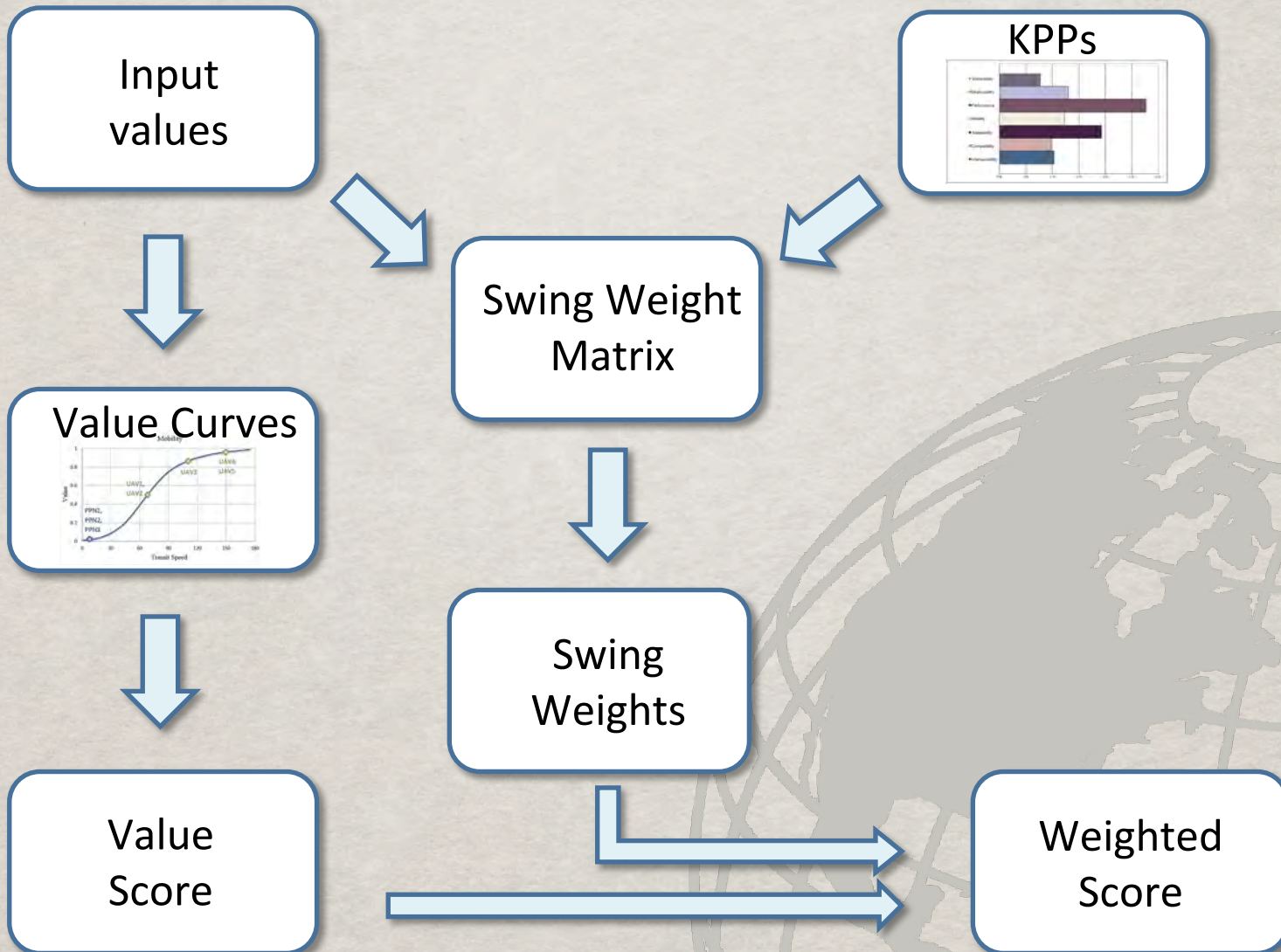


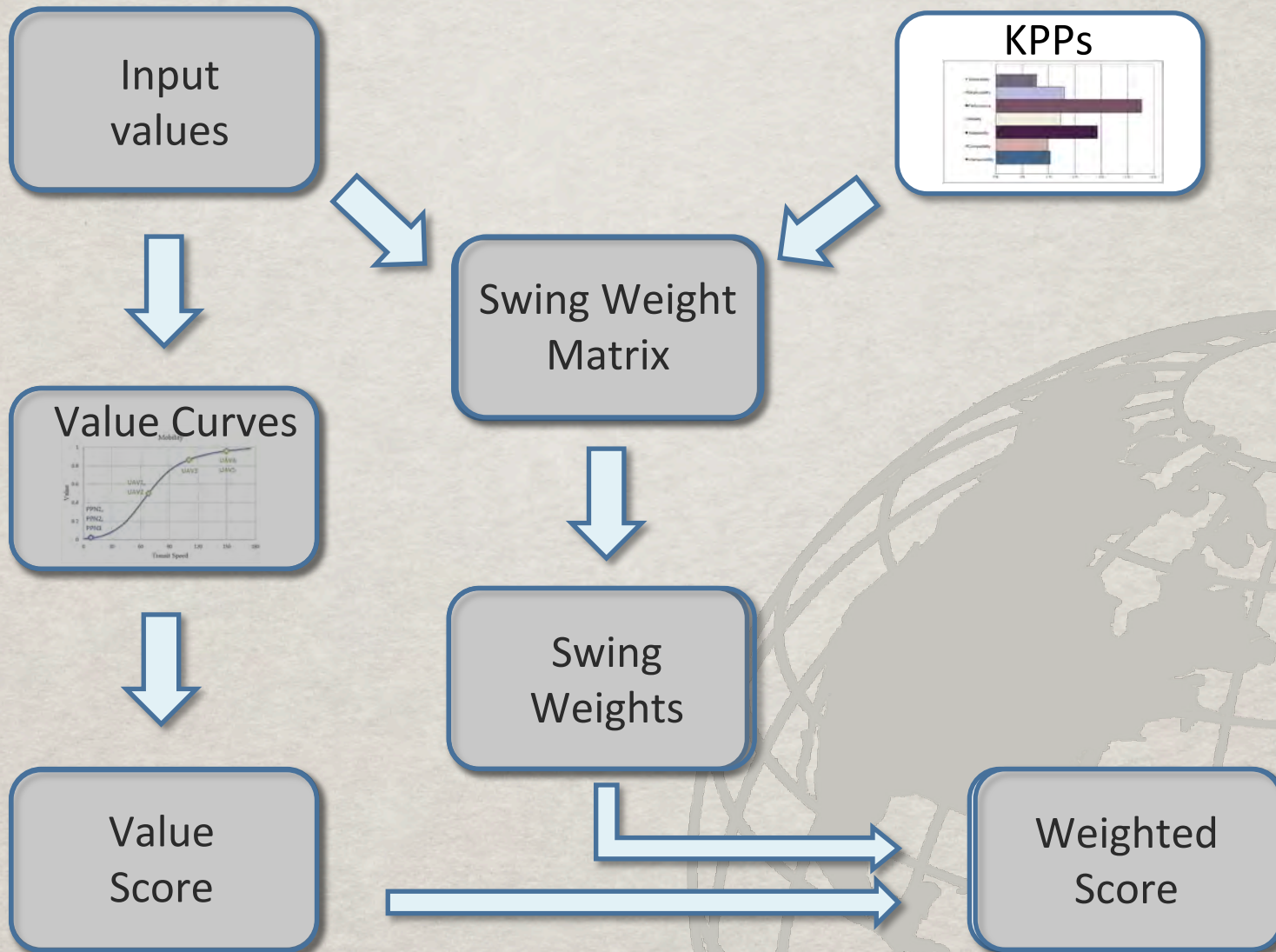
PPN 2
66% coverage
37 sensors



PPN 3
33% coverage
19 sensors

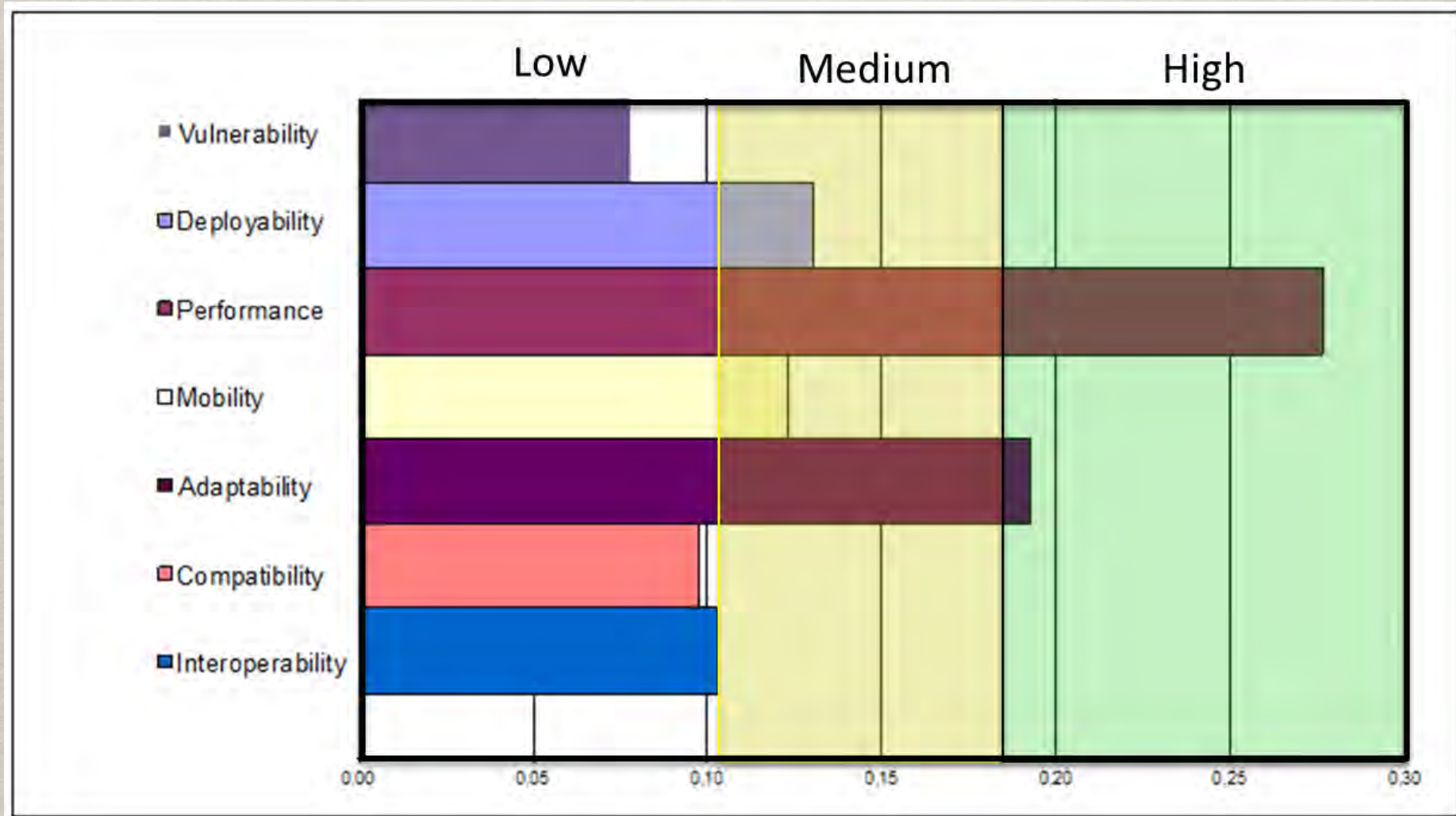
 Sensor footprint

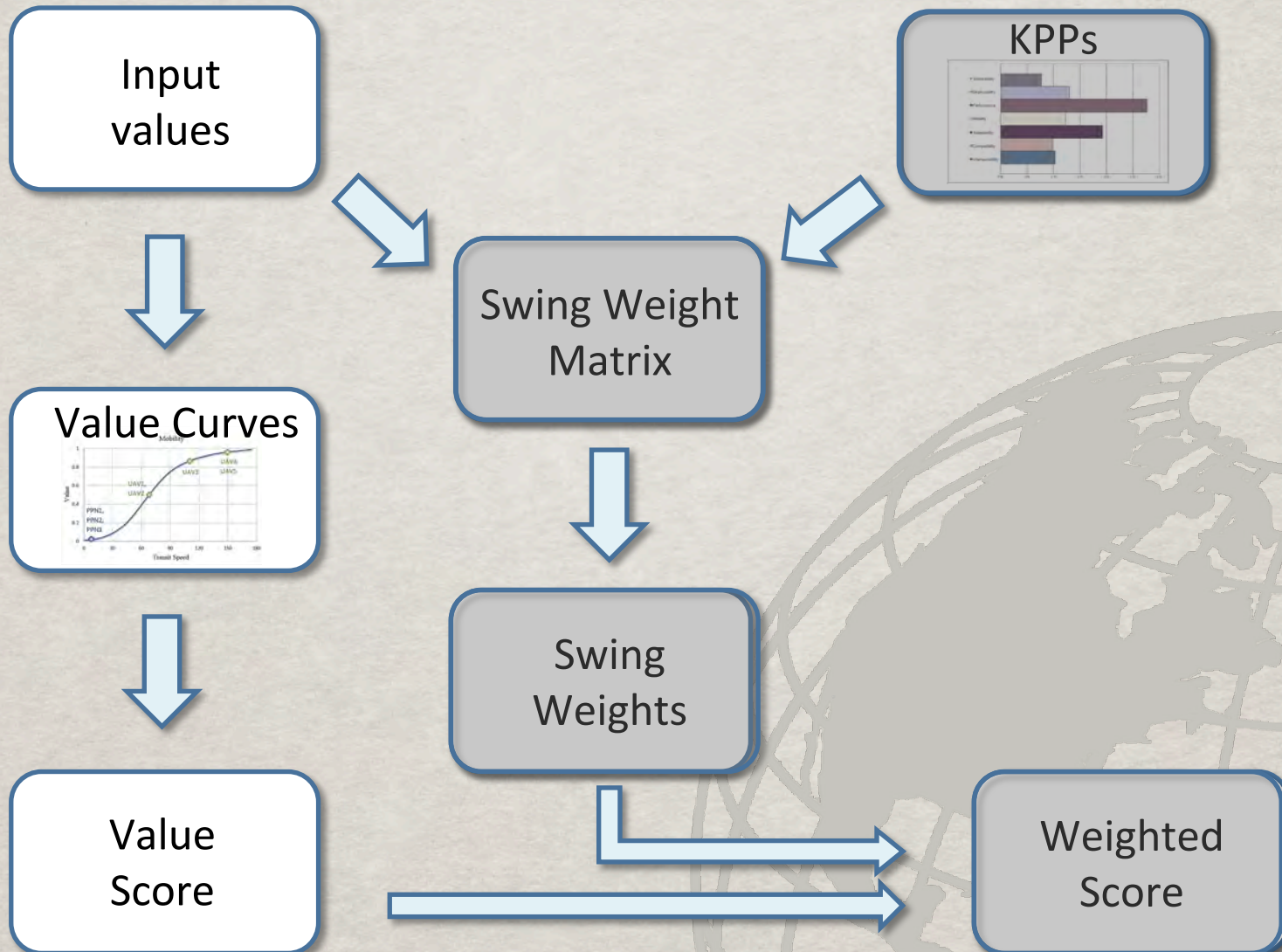






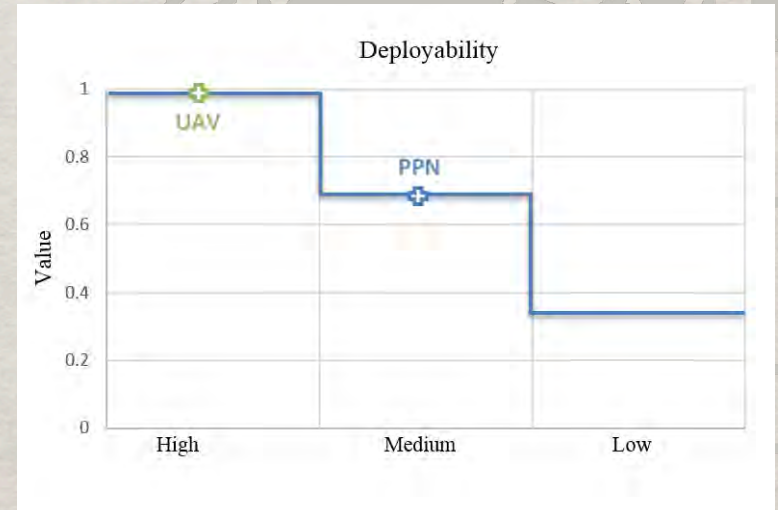
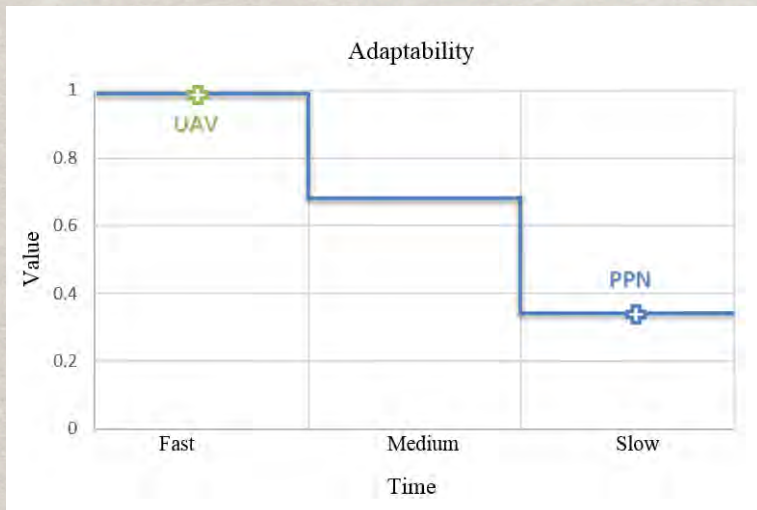
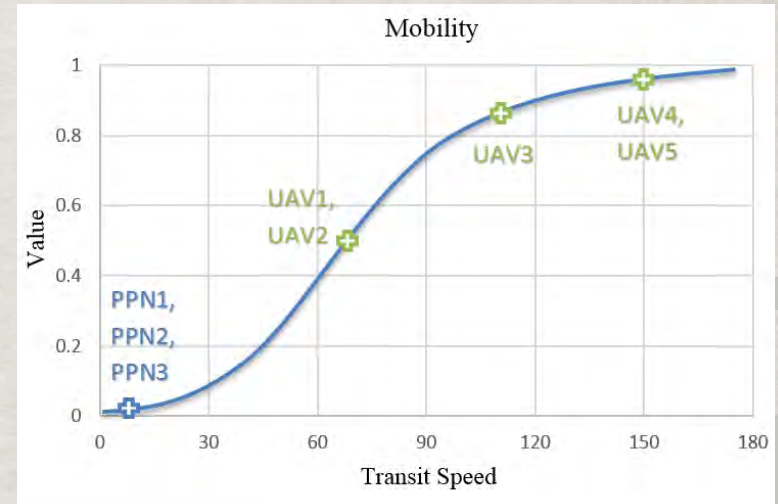
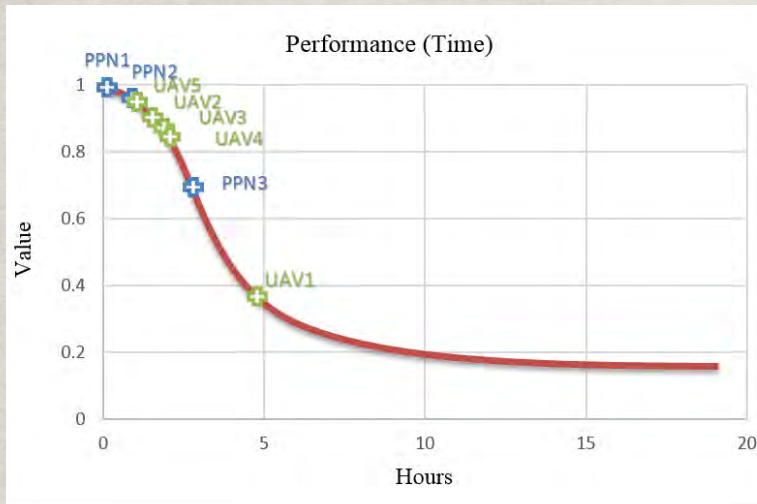
Identifying Significant KPPs





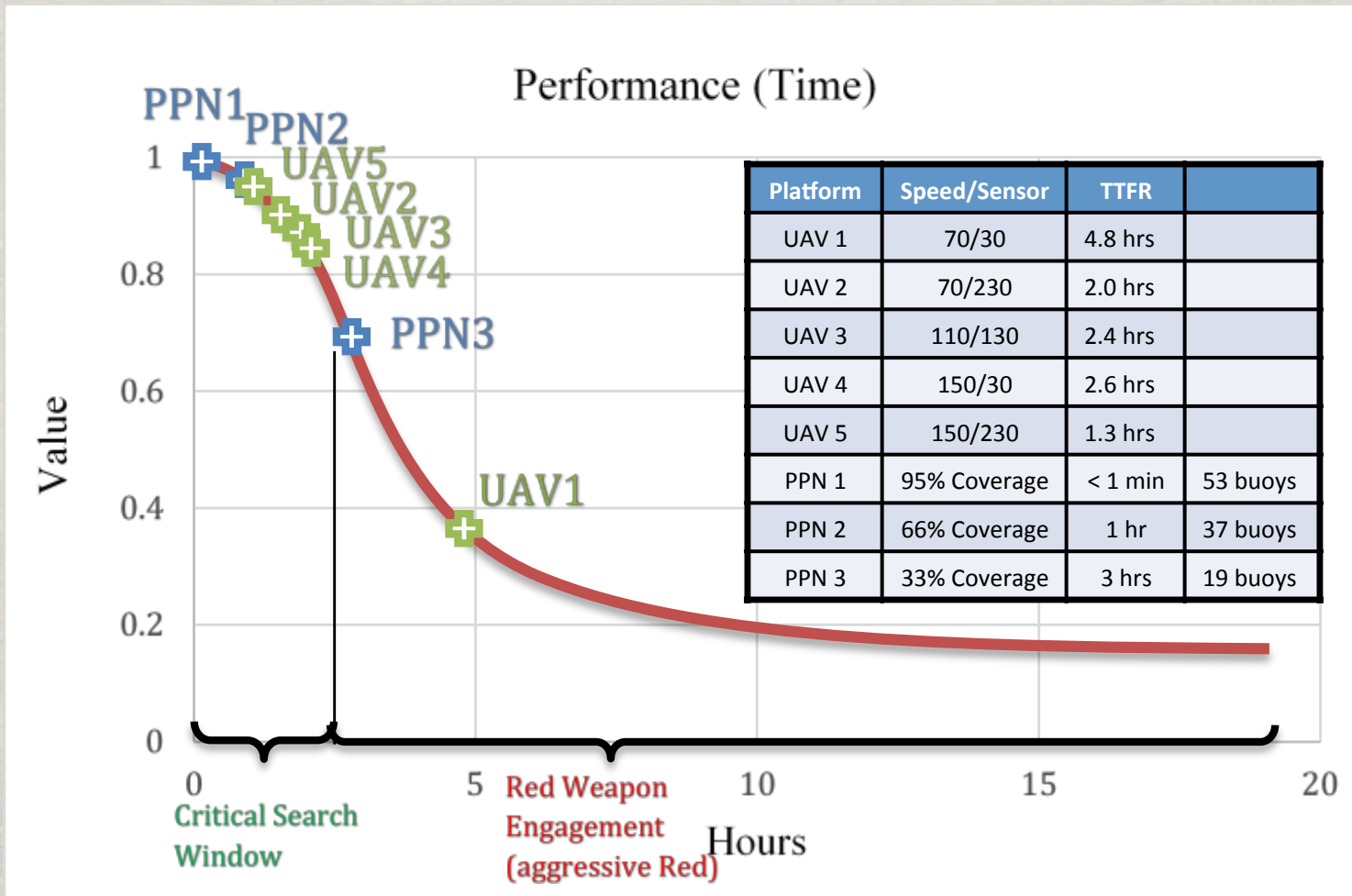


Defining Value Curves



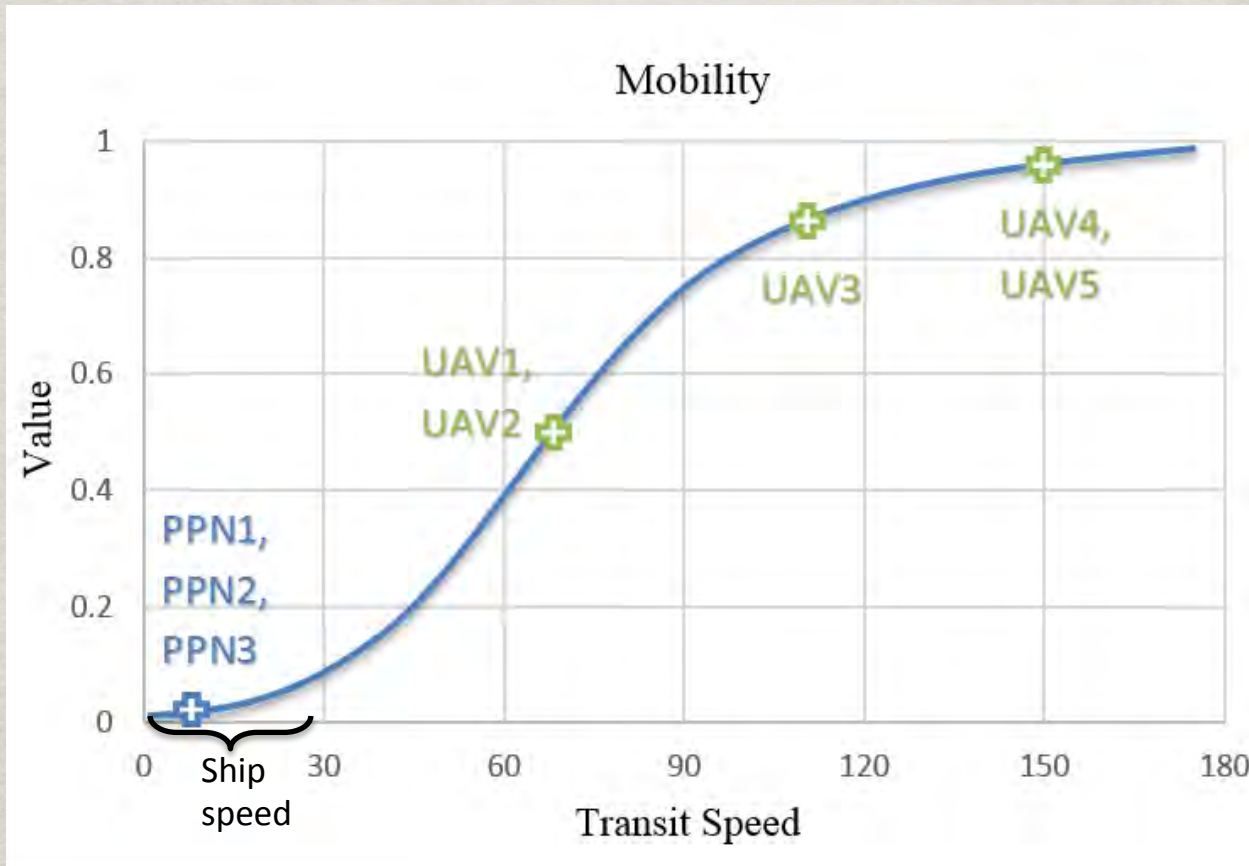


Value Curves: Performance



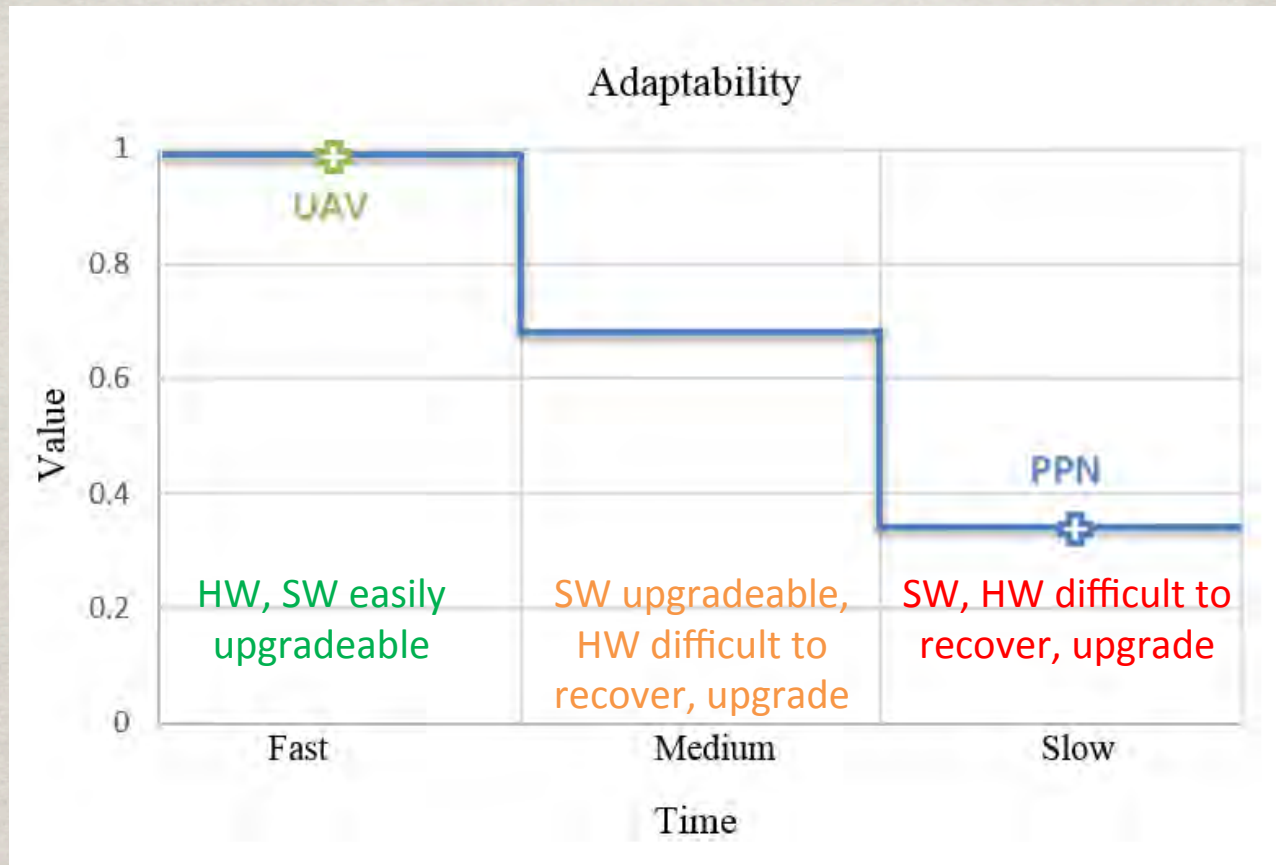


Value Curves: Mobility



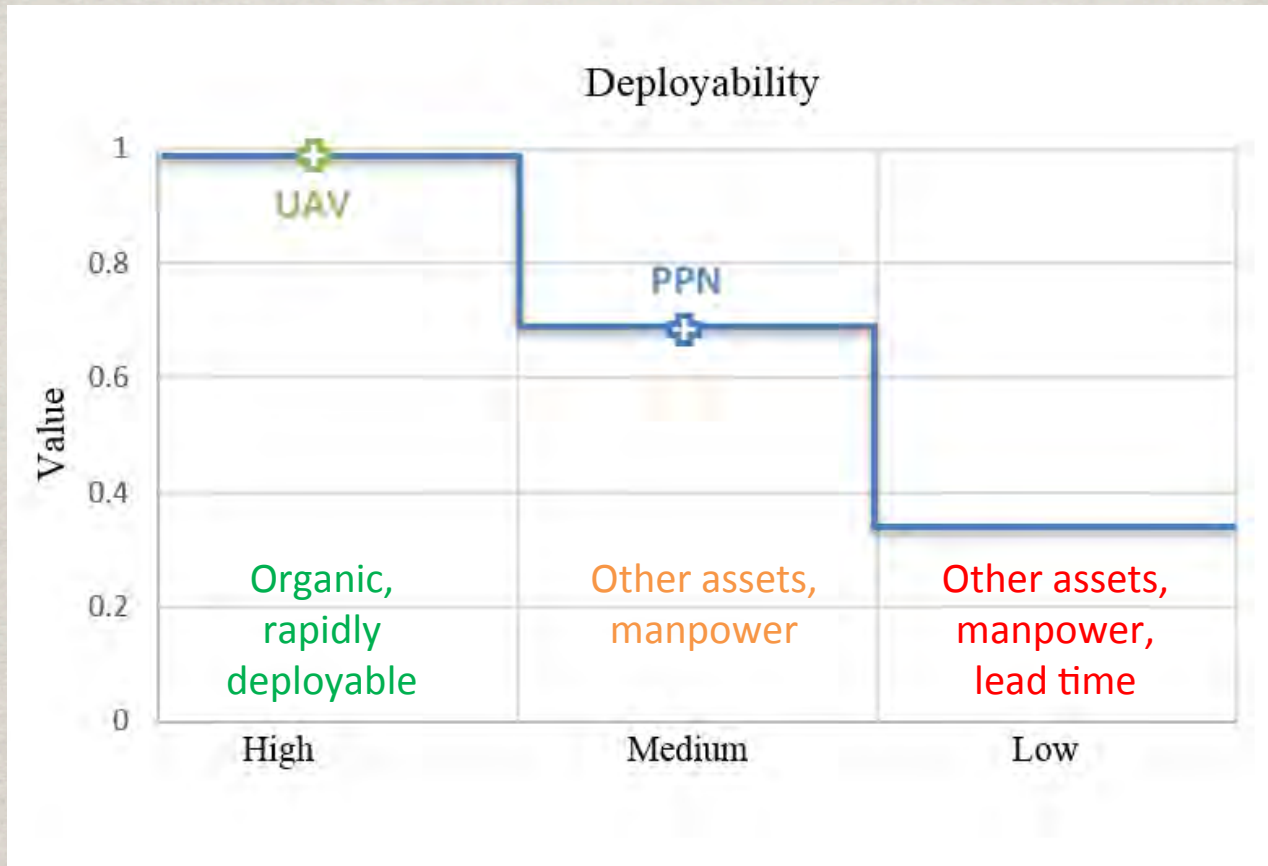


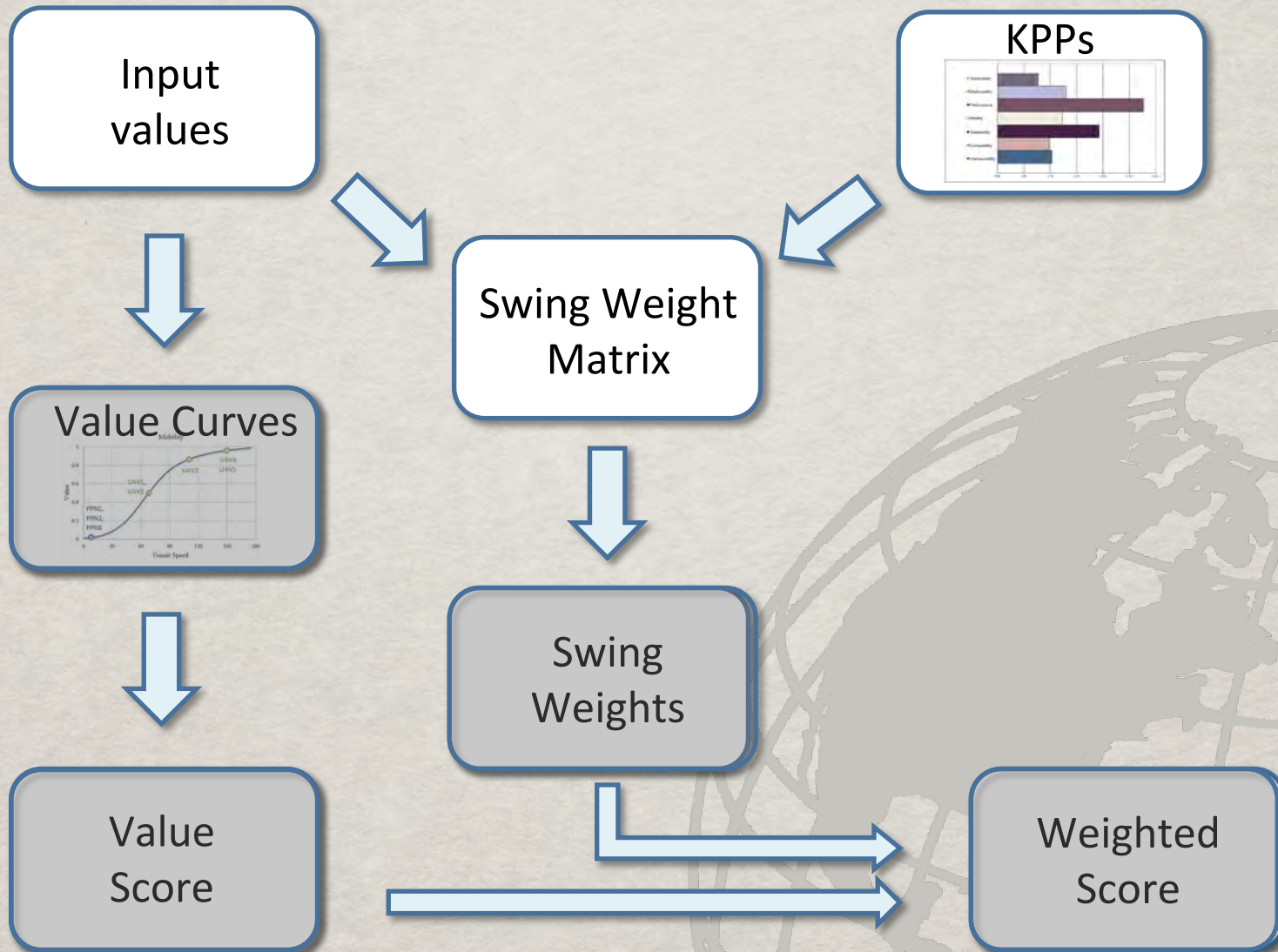
Value Curves: Adaptability





Value Curves: Deployability





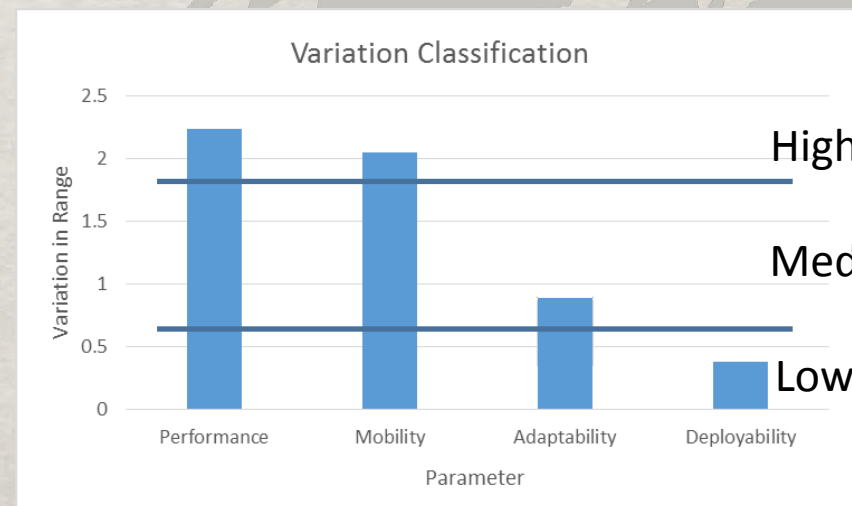


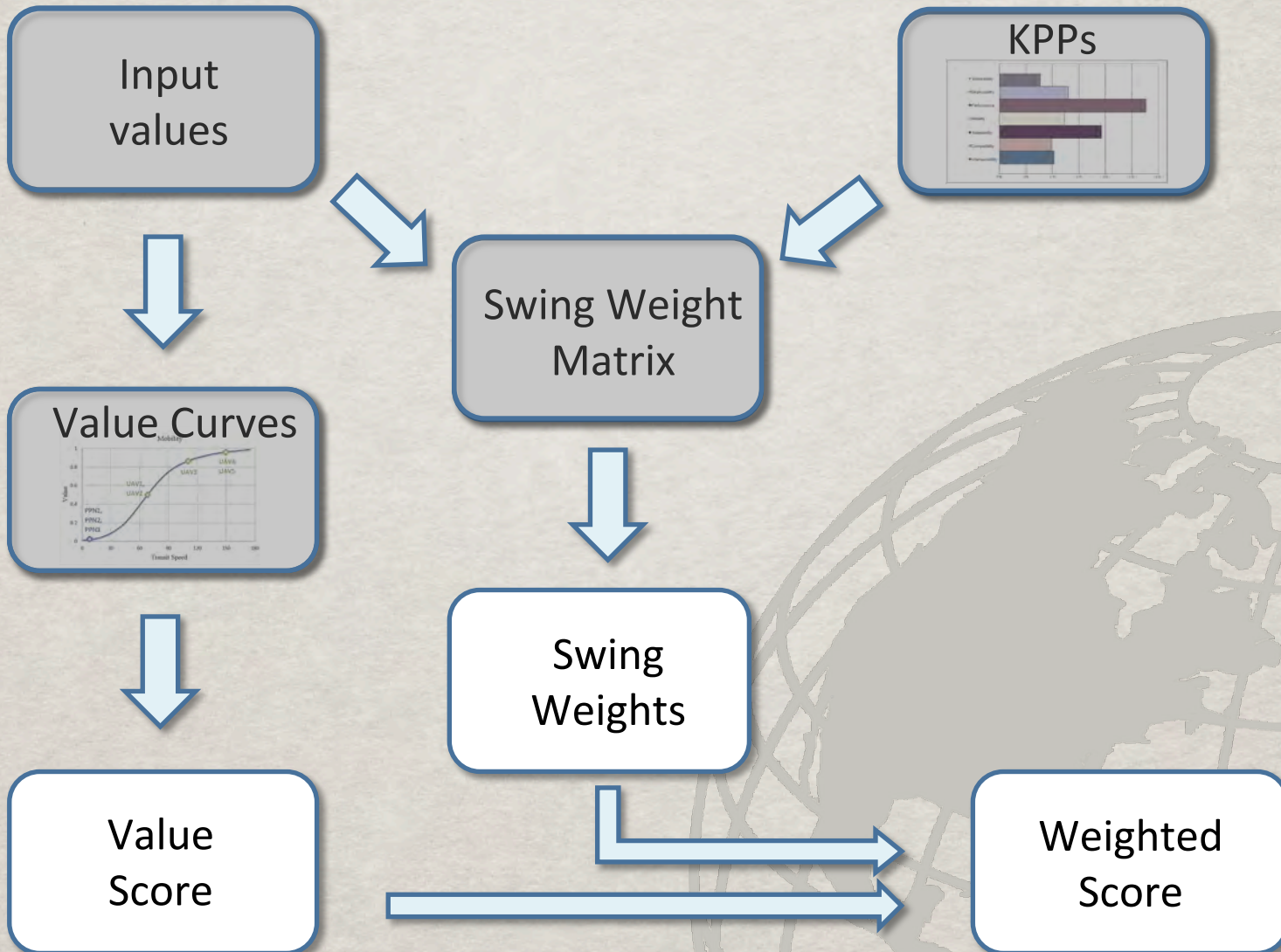
Swing Weights

Evaluation Measure	PPN1	PPN2	PPN3	UAV1	UAV2	UAV3	UAV4	UAV5	Var in Range	Var Class
Performance (hours)	0.02	1.0	3.0	4.8	2.0	2.4	2.6	1.3	2.23	High
Mobility (knots)	5	5	5	70	70	110	150	150	2.05	High
Adaptability (fast-med-slow)	33	33	33	99	99	99	99	99	0.89	Med
Deployability (high-med-low)	66	66	66	99	99	99	99	99	0.38	Low

$$\text{Var in Range} = \text{Max} - \text{Min} / \text{Avg}$$

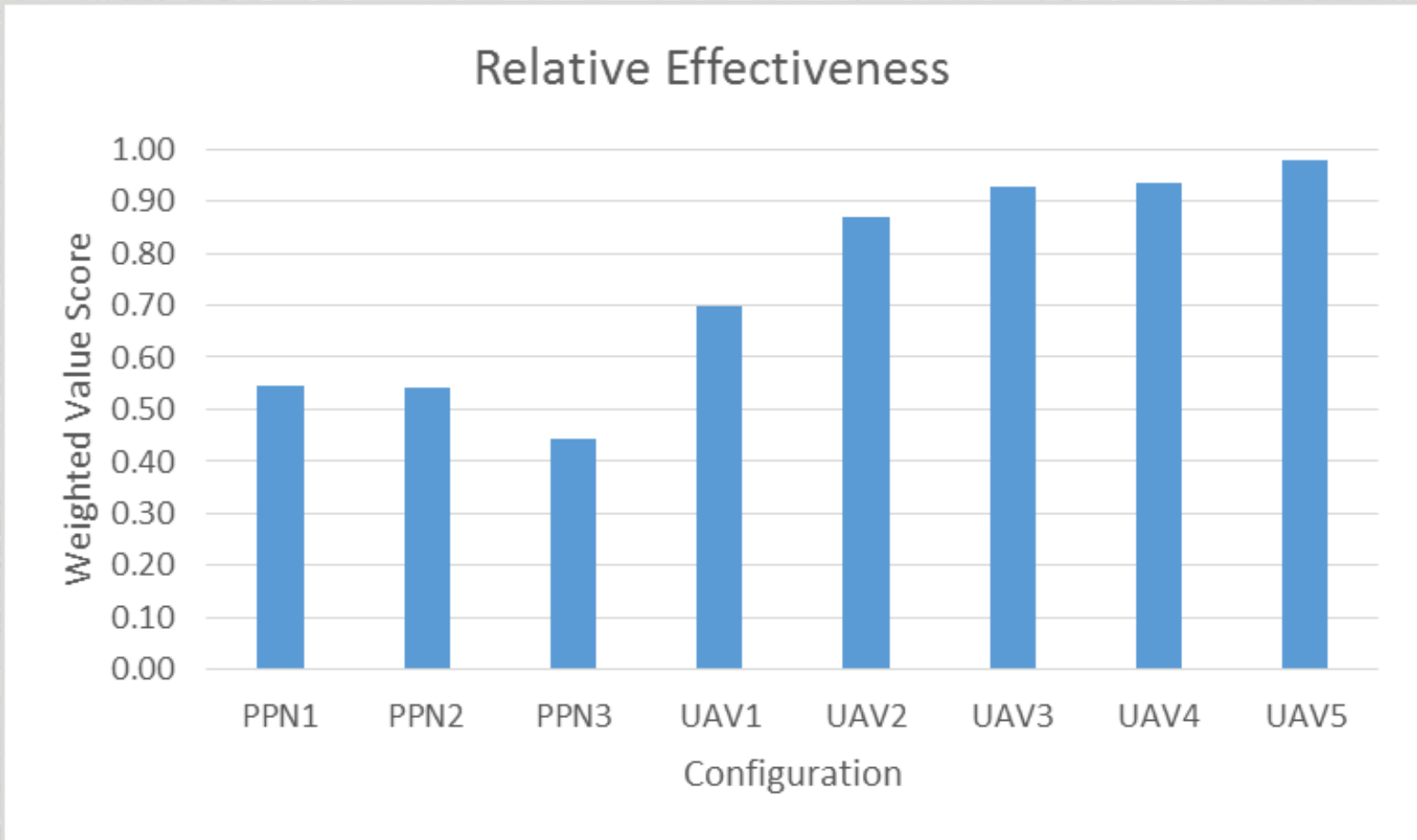
Variation in range	Importance		
	High	Medium	Low
High	9 Performance Adaptability	6	3
Medium	8	5 Mobility	2
Low	7	4 Deployability	1







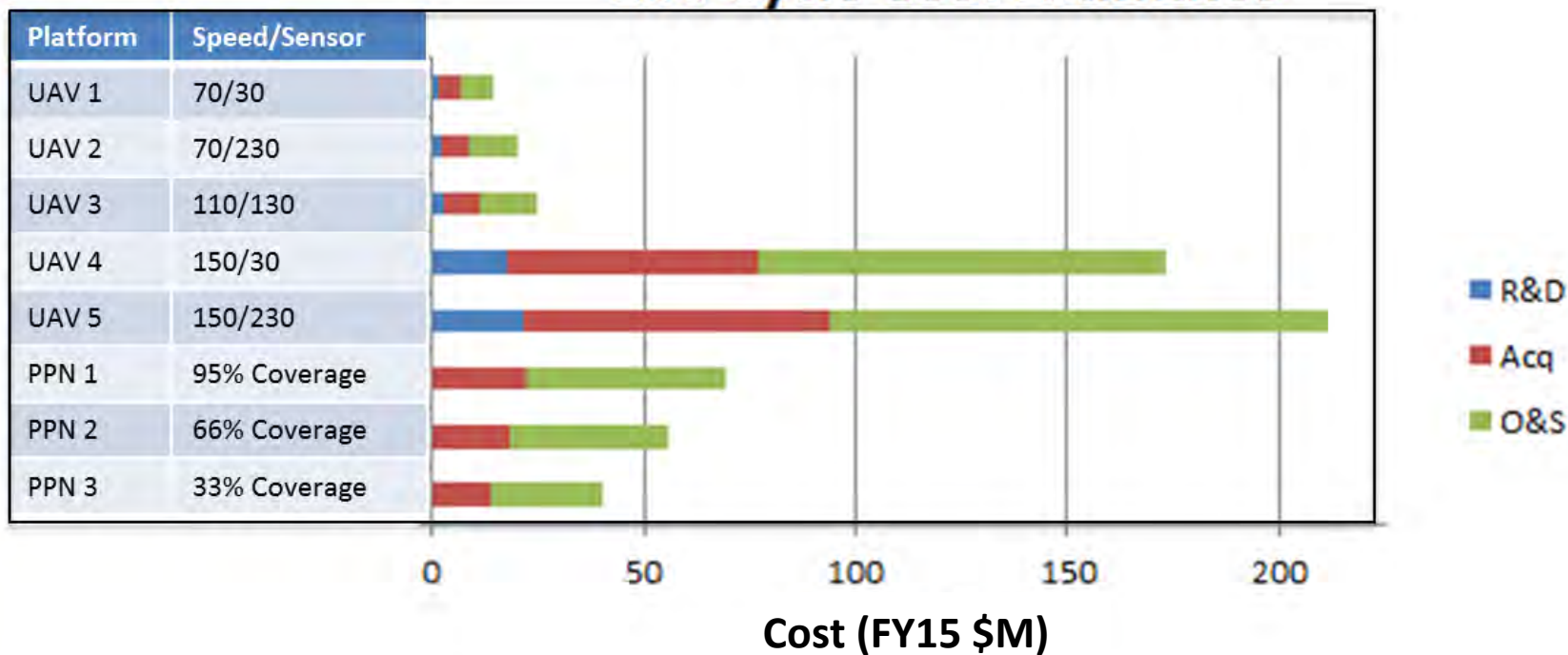
Weighted Scores





Cost Analysis

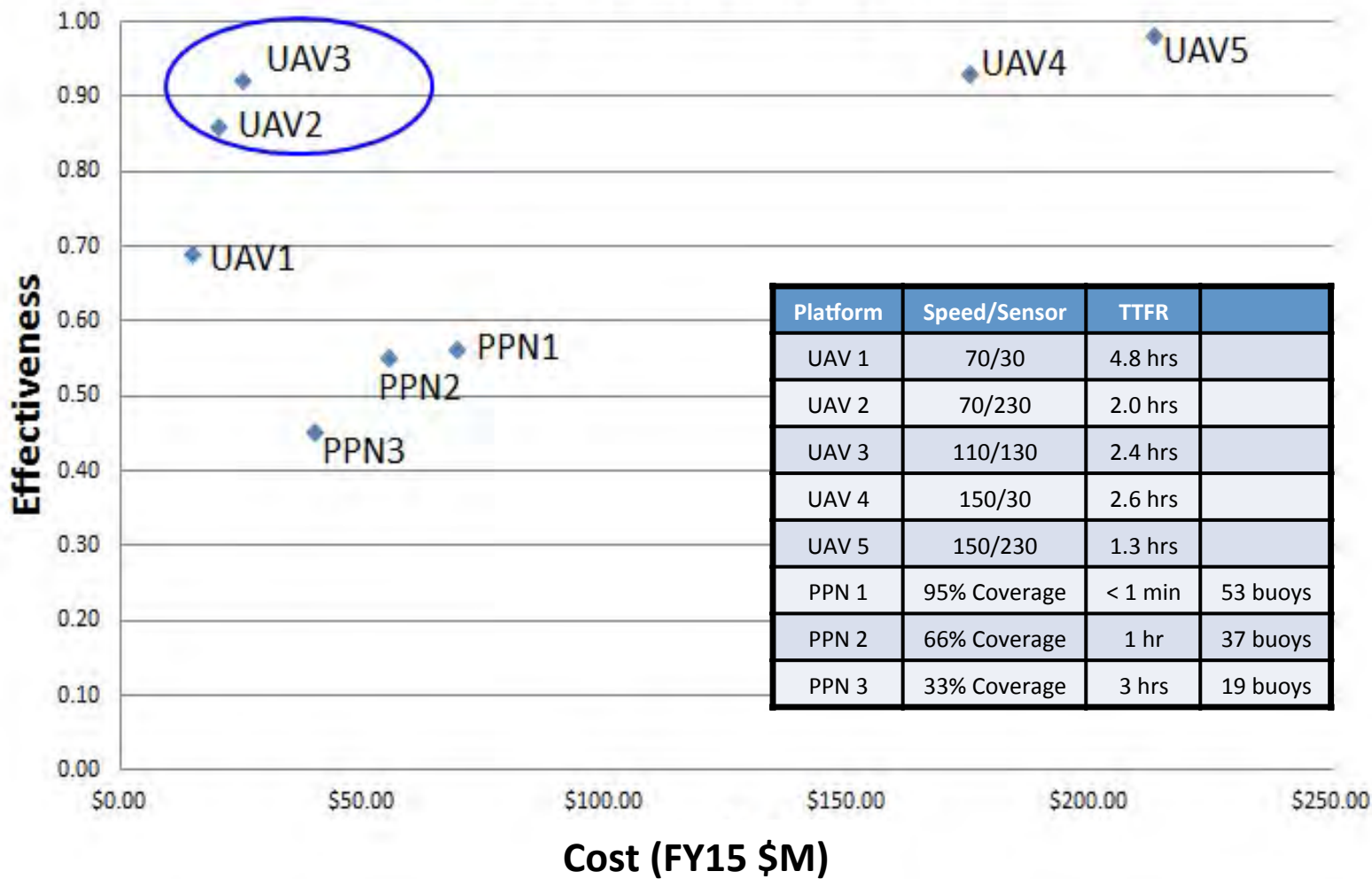
Life Cycle Cost Estimates





Cost vs. Effectiveness

Cost - Effectiveness Plot





Recommendations (1/2)

- Address ship-launched UAV integration challenges:
 - Hardware and software integration
 - Manpower and training
 - Launch, recovery, and logistics
- Pursue enabling technology for improving speed and range of ship-launched UAVs
 - Advanced materials
 - Energy storage
 - Component miniaturization



Recommendations (2/2)

- Encourage fleet engagement and experimentation to accelerate UAV adoption and employment
 - Early investment to elicit fleet input
- Engage with NWDC to develop CONOPS for organic employment of UAV systems
 - Integrate with ship-launched long-range ASCM



Areas for Further Study

- Explore additional modeling scenarios and architecture configurations
 - Hybrid PPN and UAV alternatives
- Assess impact of recommended solutions on Phase 0 operations
 - Persistent ISR coverage
- Anticipate adversary's technology advancement
 - Increased ASCM range





SEA-21A Capstone Project Team



sea21a@nps.navy.mil