
A POSITIONING NAVIGATION AND TIMING (PNT) THREAT ENVIRONMENT MODEL FOR MILITARY AND CIVILIAN USE

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THE PNT ENVIRONMENT IS CONTESTED

ENVIRONMENT - PNT THREATS ARE REAL & GROWING MORE PREVALENT

Aug '2013

"Truck driver has GPS jammer, accidentally jams Newark airport"

(CNET)



Sep '11 – N. Korean Jammer Forces Down U.S. Plane



Army RC-7B ARL

South Korea issues warning over suspected North Korean GPS disruption March 31, 2016 (GPS World)

South Korea issued a warning Thursday after detecting satellite signal disruptions that appeared to be coming from North [...]



Oct '17 – "Spoofing in the Black Sea?" (GPS World)



Apr '18 – Russian military exercises disrupt GPS service in northern Norway...& disrupt cell phone service in portions of Latvia, Sweden & Norway (Resilient Nav & Timing Foundation)



APNT FOR CONTESTED ENVIRONMENTS

WHAT'S THE PROBLEM?

- Modern world has become highly dependent on Precision Absolute PNT
 - Civil Airspace & Transportation, Military Operations, Timing for internet, banking & commerce...
- The PNT threat environment has become more sophisticated
 - Forcing us to multi-sensor solutions with a mix of technologies that varies based on use case
- There are few, and inconsistent, definitions of the problem and threat conditions – making analysis of requirements and solution development difficult

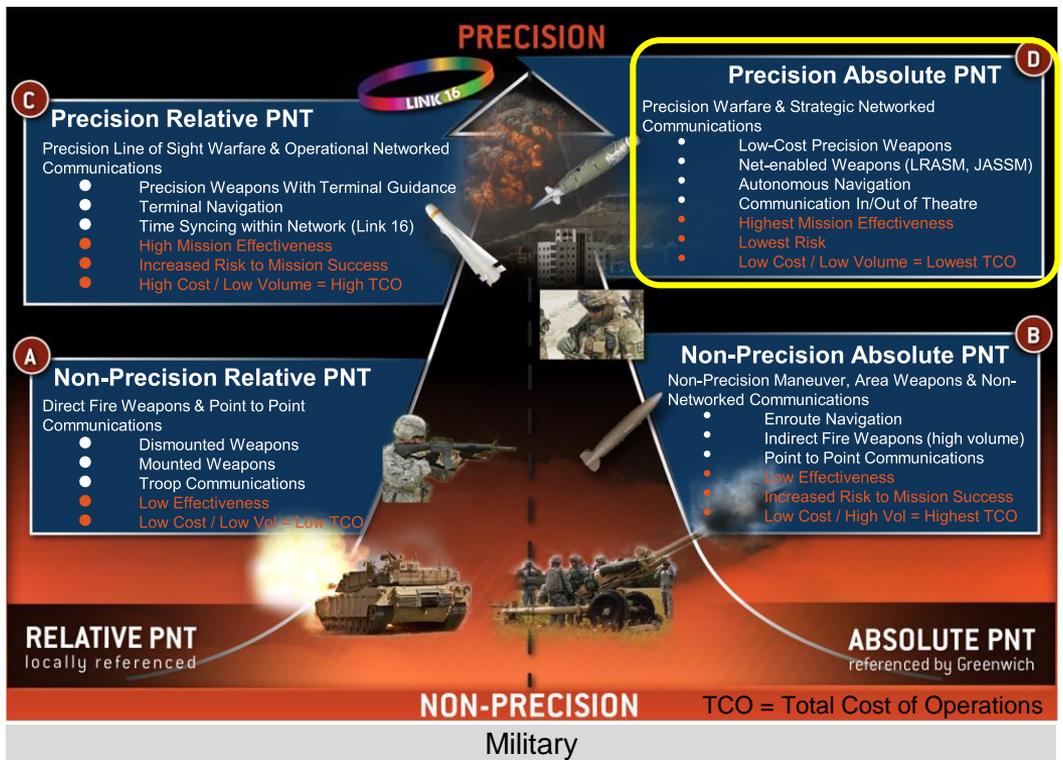


WHY DO WE NEED ASSURED PNT?

WHAT IS APNT'S JOB? – MAINTAINING ASSURED PRECISION ABSOLUTE PNT

- ILS Precision Landings
- RADAR Approach
- Optical Surveying
- Point to Point Timing Sync

- Non-precision Landings
- Following Sequential Directions to Navigate
- Timer/Stopwatch

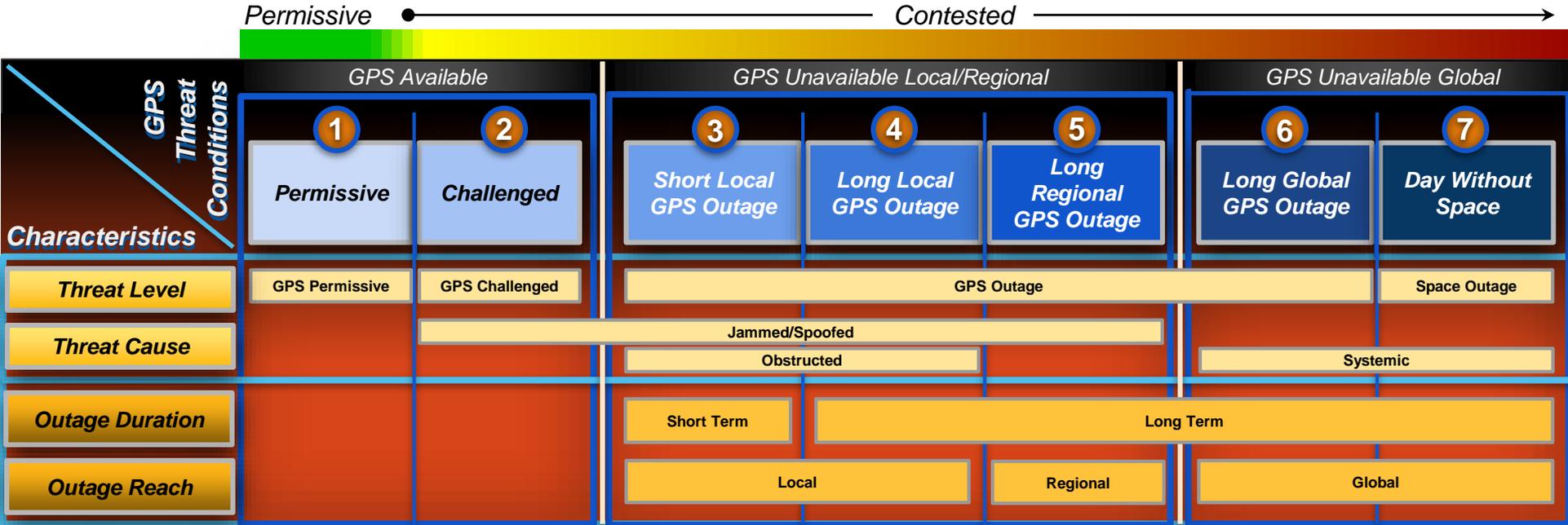


- GNSS Precision Landings
- Precision Agriculture
- Surveying & Construction
- Network Timing Sync
- Banking
- Network-dependent Commerce

- VFR flight
- Map
- Watch
- Sundial

A PNT THREAT ENVIRONMENT MODEL

ASSURED PRECISION ABSOLUTE PNT THREAT ENVIRONMENT – SEVEN THREAT CONDITIONS EMERGE



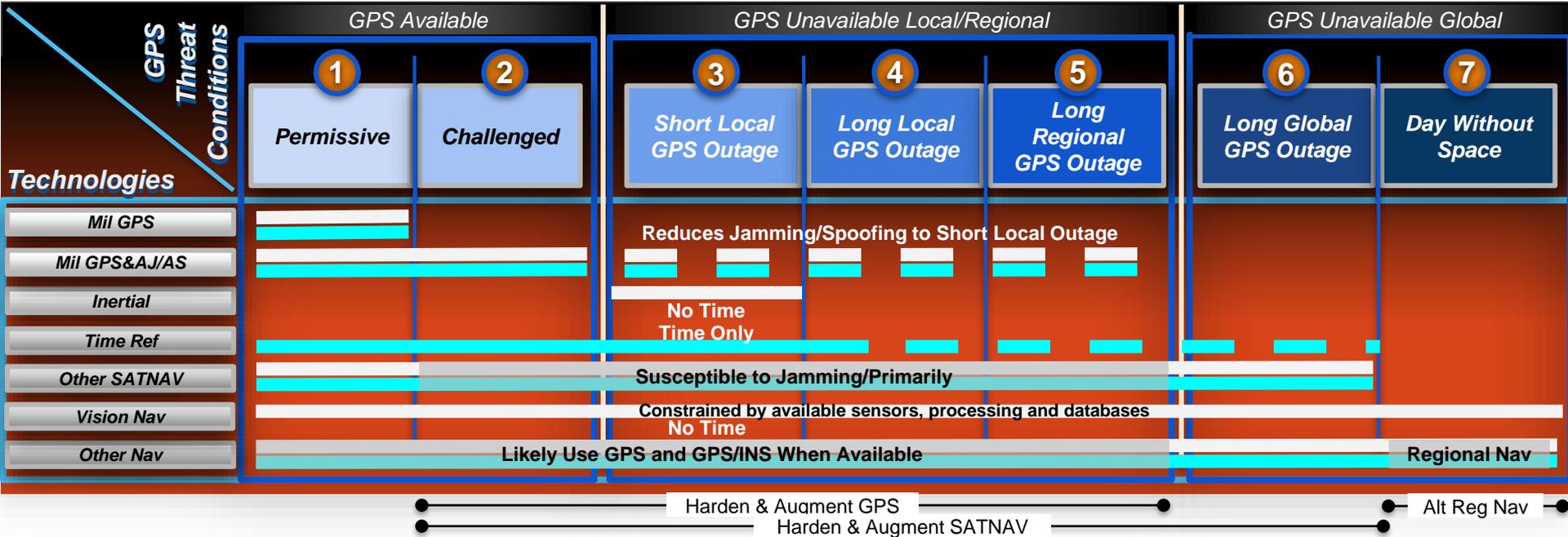
Analysis of Missions & Platforms in this model reveals Requirements

A MULTI-SENSOR APPROACH TO APNT

ASSURED PNT – APPLICABLE TECHNOLOGIES & SOLUTION SPACE

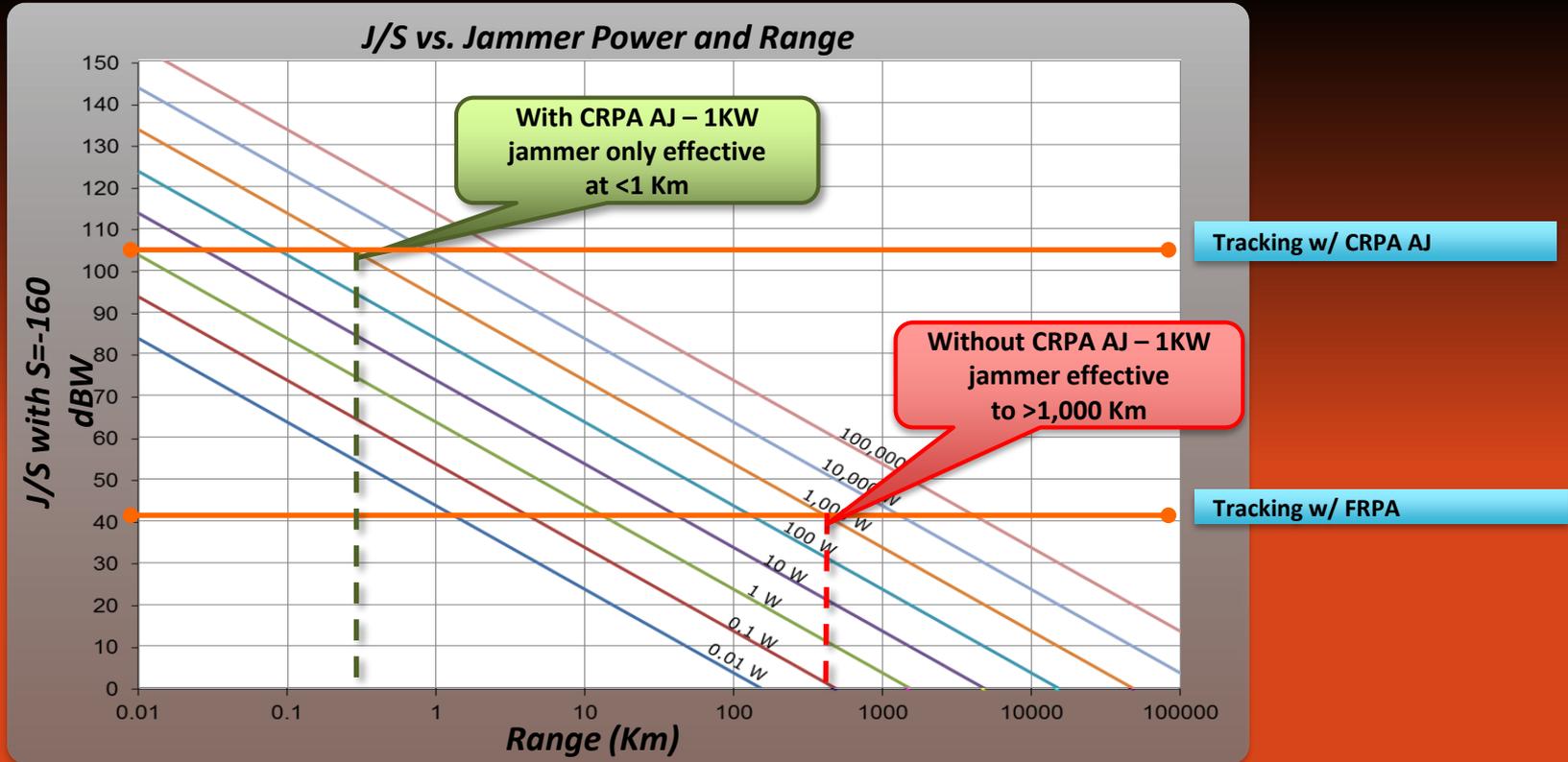
PVT Outputs

Position/Velocity 
Time 



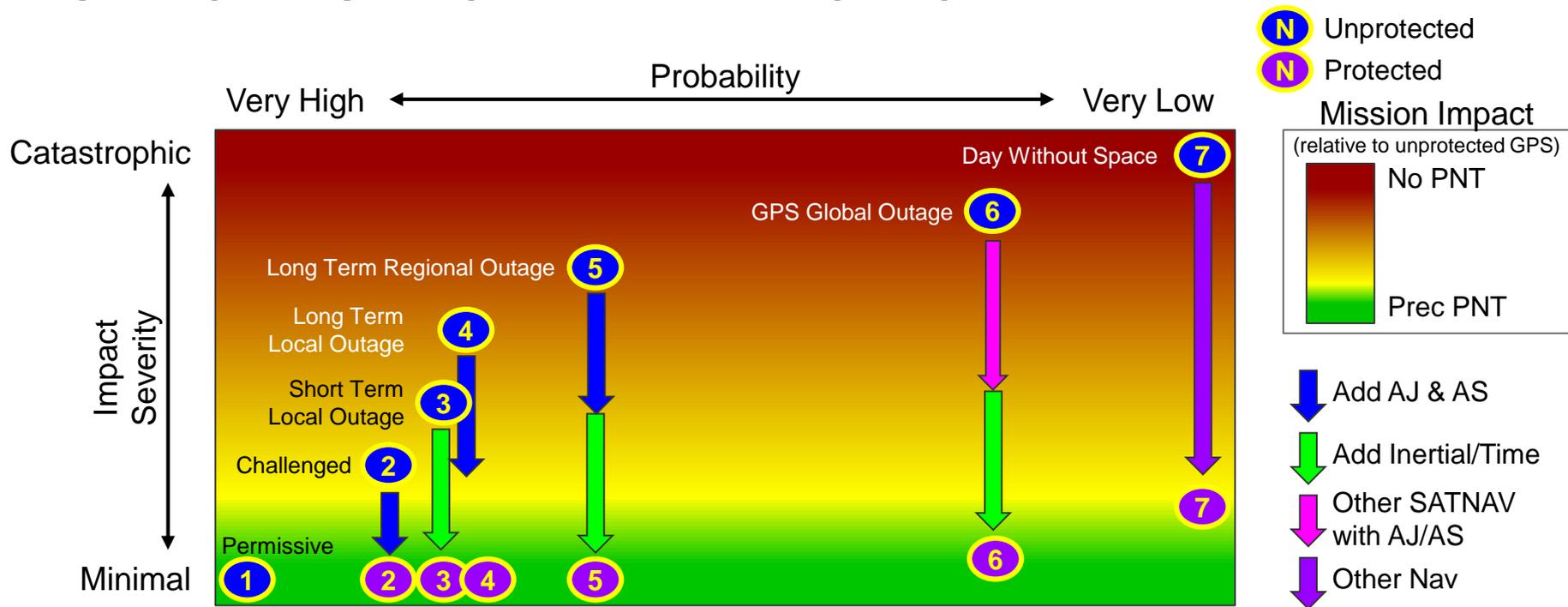
Technologies available today to address threat conditions 1-5; in the works for conditions 6-7

J/S (TRACKING) VS RANGE



AJ Reduces Jammer Threats to Local Threats

SPECTRUM OF THREATS TO PNT



Adversaries Working to Increase Probability - Augmentation Reduces Impact

SUMMARY

MAINTAINING ASSURED PRECISION ABSOLUTE PNT

- Modern world is dependent on Assured Precision Absolute PNT
- Threats to PNT are real and becoming more prevalent
- There is a strong need for a consistent threat model and definitions to enable analysis and requirements development
- There are technologies available today to solve the majority of threat conditions – GPS remains foundational to these solutions
- There are technologies in development to solve the threat conditions in which GPS is not available

Adoption of a Consistent Threat Model Enables Analysis of Requirements and Accelerates Development of APNT Solutions