



Air Force Civil Engineer Center



Air Force Energy Resiliency Planning Approach

Nov 2017



Purpose



Outline AF approach to energy resiliency



Overview



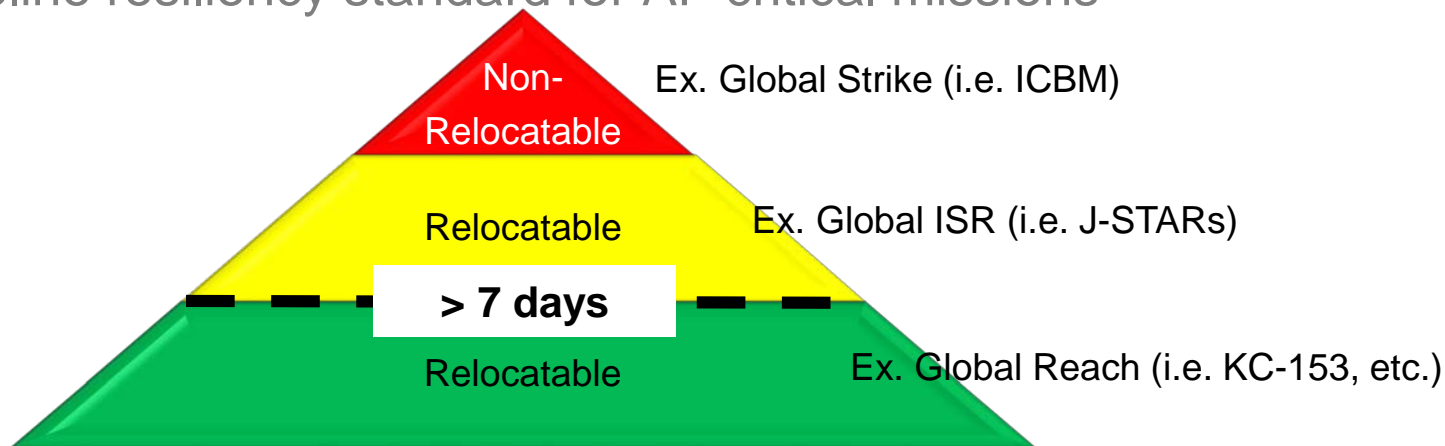
- **Topic(s) of Interest**
 - Current Air Force Policy Directive (AFPD)
 - Major Activities for Mission/Energy Assurance
 - “Draft” Assurance Framework
 - Mission/Mission Platform assured
 - Critical Nodes (e.g. MCF, TCA) meet min. Resiliency Criteria
 - Enabling Systems meet or exceed Performance Standards
- **Recommendation & Way-Ahead**
 - Build Resiliency Criteria
 - Develop Performance Standards



AFPD 90-17 Para 2.6

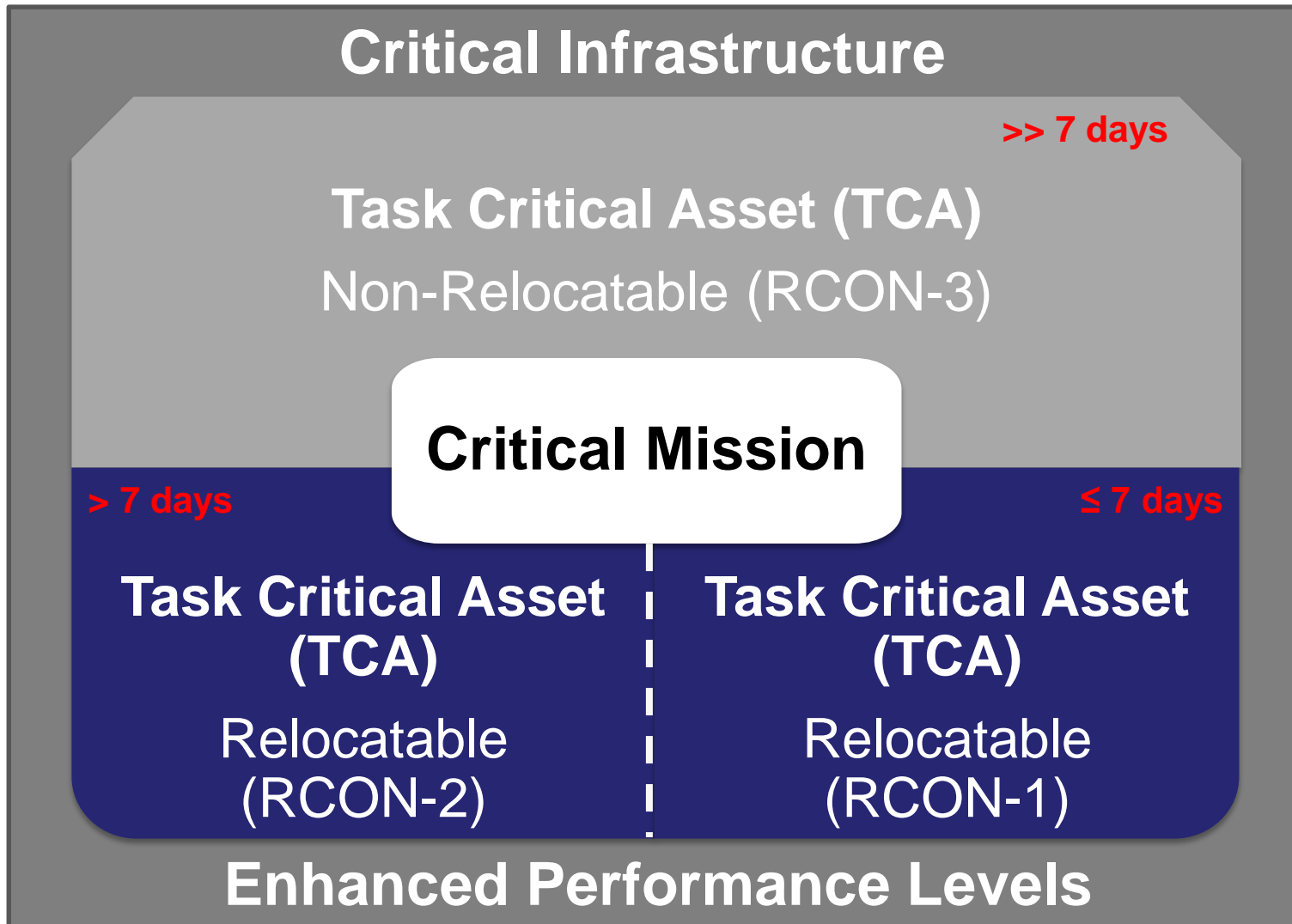


- Power any critical infrastructure to meet mission requirements, indep. of the grid for:
 - 1) The period of time to relocate the “mission”
 - a) Condition 1: Not relocatable (i.e. unconstrained); worst-case
 - b) Condition 2: Relocatable, greater than 7 days; few
 - c) Condition 3: Relocatable, less than or equal to 7 days; most
 - 2) Or for at least seven (7) days, whichever is longer.
 - Baseline resiliency standard for AF critical missions





AFPD 90-17 Para 2.6 (cont.)





AFPD 90-17 Para 2.6 (cont.)



- **Caveats:**

- 1) The “mission” is intangible, but critical nodes and enabling systems are tangible**

- Mission is the work done to achieve a desired end state
- May consist of facilities or specific assets, which can be characterized as critical nodes
- Node is the tangible entity that can be either relocated or not
- Critical Nodes are supported by infrastructure (i.e. enabling systems) with specific and measurable RAM-C goals

- 2) Some nodes within a mission may be able to be relocated, while others may not**

- Sufficient mission decomposition/thread analysis is necessary to identify specific nodes that can or cannot be relocated
- Significantly influences infrastructure resiliency requirements



Major Activities



- **SAF Mission Thread Analysis (MTA)/Decomp.**
 - Lead is SAF/IEE (Facility Energy)
 - Work with A3 Community to holistically analyze and profile an AF mission (VOLPE/INL Support)
- **Energy Strategic IPT**
 - Lead is AFCEC/CN (Energy Directorate)
 - Reorganize toward Mission/Energy Assurance (MEA) to gain alignment with SAF/IE effort
- **Holistic Utility Systems Working Group (HUSWG)**
 - Lead is AFCEC/CIU (Privatized Utilities Branch)
 - Coordination of resiliency across AF utilities



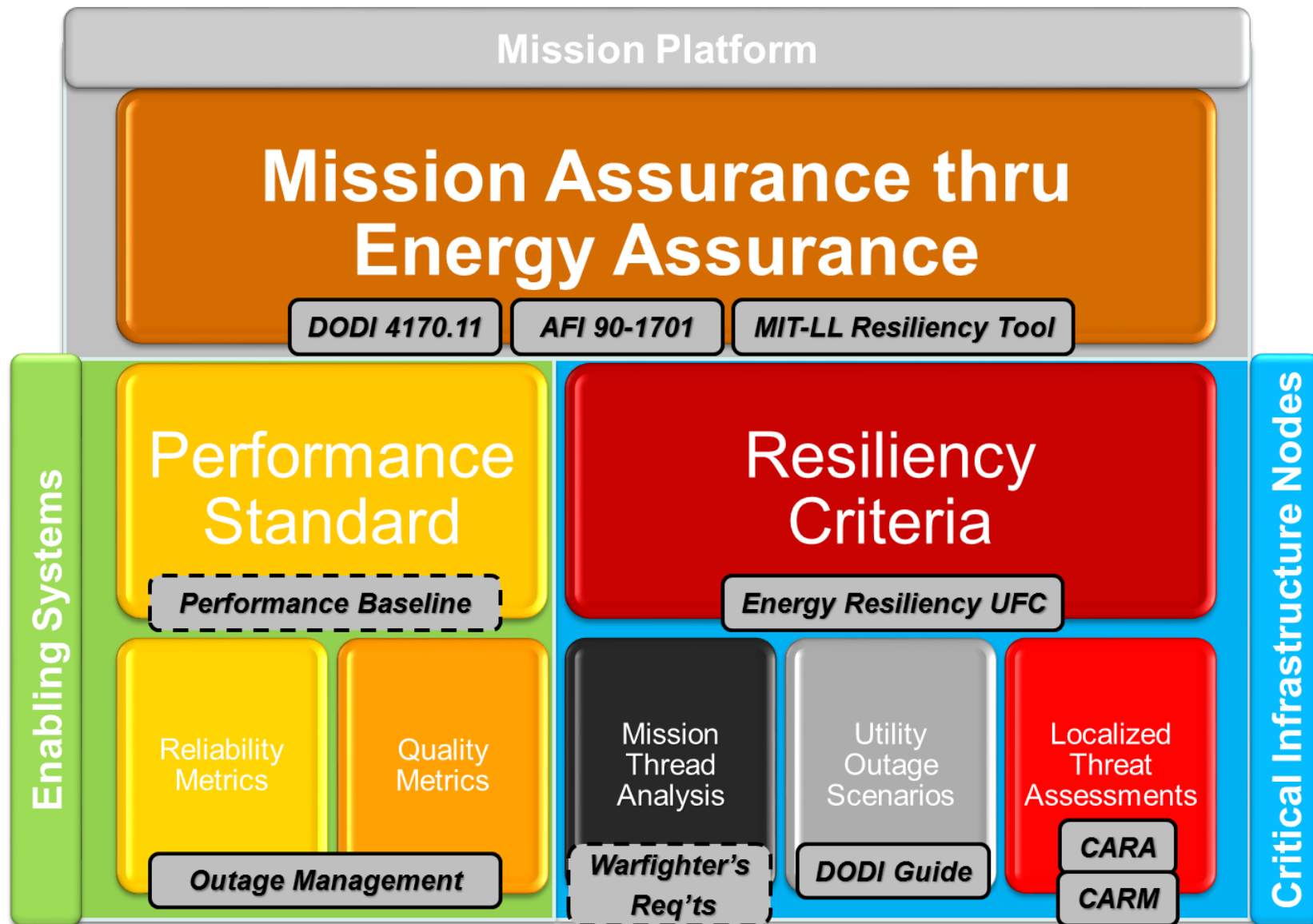
Major Activities (cont.)



- **AFCEC Power Studies & Outage Tracking**
 - Lead is AFCEC/COS (Engineering Division)
 - 5yr periodic field-walk of installations to investigate power system, calculate sys reliability
 - New automated tool, USORT, under development for tracking outages
- **Energy Resiliency Planning UFC**
 - Lead is AFCEC/COS (Engineering Division)
 - Identify suitable resiliency criteria and best practices for installation energy plans/projects



Draft Assurance Framework





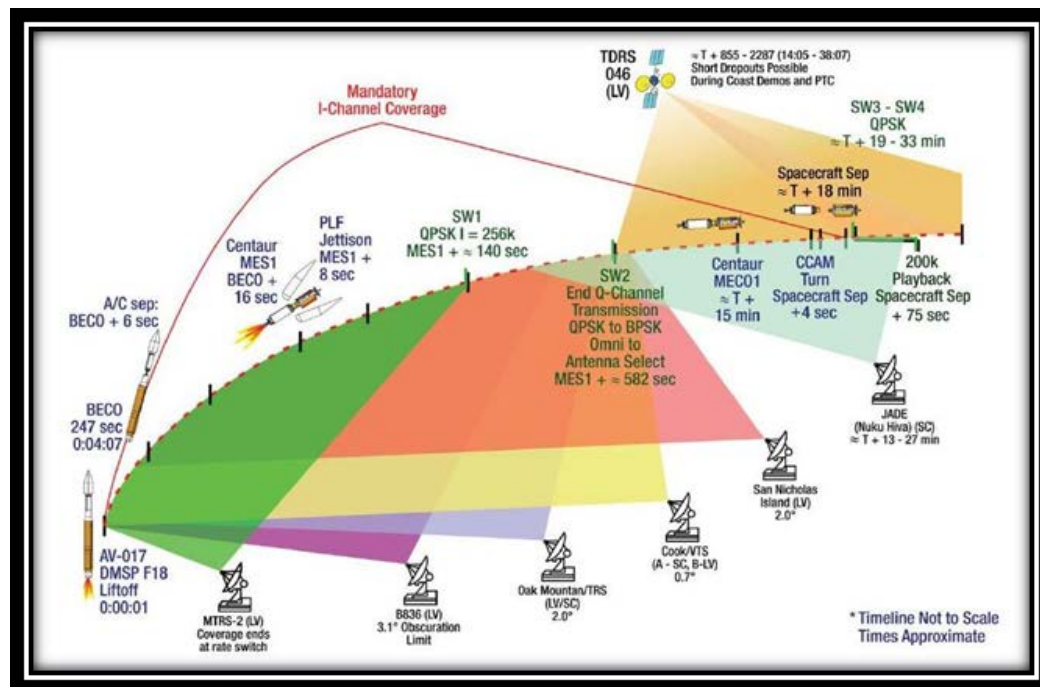
Draft Assurance Framework



- OPR: Warfighter
- Examples:
 - Mission System or Platform
 - Develop “1-n List” of MCF/Assets
 - Identified “Resiliency Levels” for AF missions



VAFB Satellite Launch System

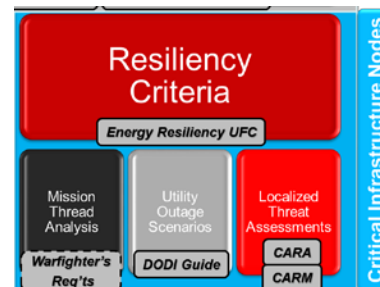




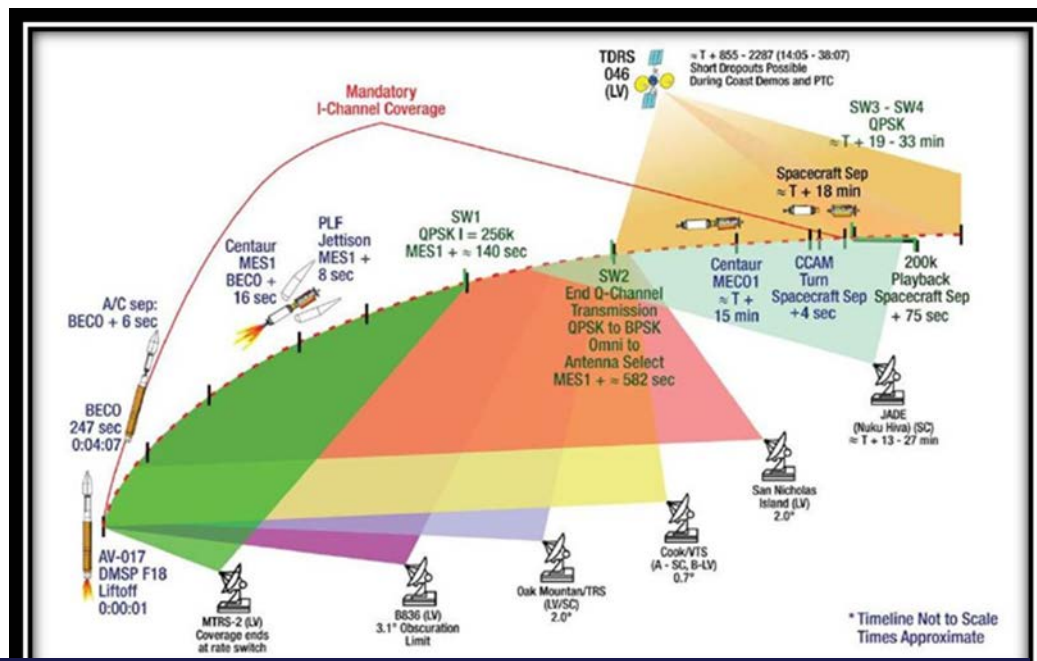
Draft Assurance Framework



- OPR: Warfighter
- Examples:
 - Critical Nodes w/ Back-up Systems
 - Redundant Mechanical/HVAC Systems
 - Uninterruptable Power Supply
 - On-site Fuel Tanks
 - Back-up Power Systems (e.g. Generator)



Tracking Antenna 1 - 6



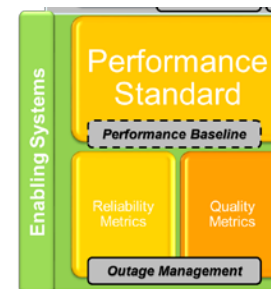
Back-up/Redundant Sys at Nodes are last line to assure mission



Draft Assurance Framework



- OPR: Engineers
- Examples:
 - Elect Dist Sys
 - X transformers
 - X switchgear
 - X miles OH
 - X miles UG
 - X reclosures
 - Water Dist Sys
 - X miles of piping
 - X cross-connects
 - LNG Dist Sys
 - X miles of piping



Add Visuals of VAFB Dist Sys

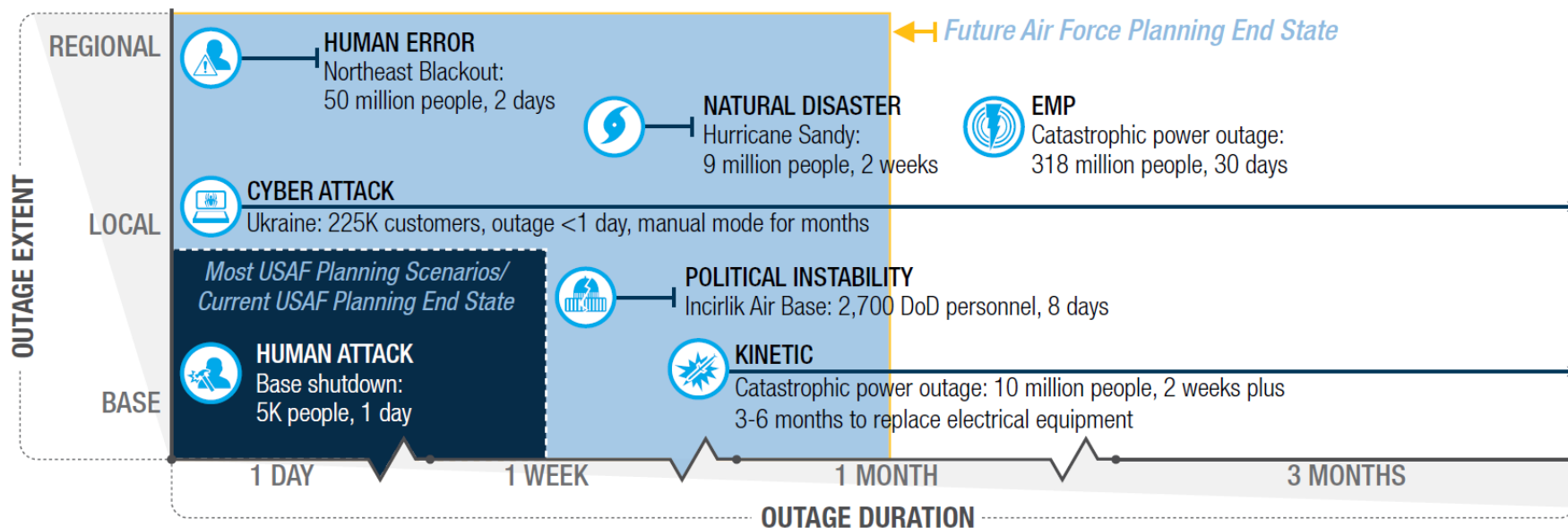
Enabling Systems are first line to assure mission



Resiliency Paradigm Shift



- **Existing Approach: Fixed Time Horizon, Single-level**
 - Specific window, 3-7 days; Mission Owner Decision Maker
 - Primarily Spot Generation, Diesel Gensets
 - 24 to 72 hours Refueling and O&M Planning
- **New Approach: Variable Time Horizon, Multi-level**
 - Broader (but tailorable) window, up to 30 days “target”
 - Divided into ½ day increments; Mission Owner & Engineers Decision Makers; “1-n” Integrated Project List
 - Primarily Distributed Energy Resources & Microgrids
 - Refueling and O&M Planning can be curtailed w/ Renewables





New Criteria “Focal Points”



Attributes (The 5R's)

– Robustness

- Visibility
- Modularity
- Survivability
- Cybersecurity

– Redundancy

- Elim. Single Points of Failure
- Multi-fed “N+x”
- Looped Configuration
- Hardening

– Resourcefulness

- On-Site or Nearby Resources
- Reduced O&M Planning Window
- Energy Storage

– Responsive

- Automated
- Self-healing
- Forecasting

– Recoverable

- Spares Inventory
- Damage Assessment
- Replaceable Parts / COTS



Balanced Capabilities & Strategy



*Installation-wide Microgrid
Incorporates multiple RAs*

Mission Reliability

"Fight-thru-Attack"

Assure Mission

Minimize Downtime

Suitable for Short Outages

"Energy Where/When Needed"
Assure Supply
"Wheeling" power as needed
Suitable for Long Outages

Grid Flexibility

*Campus Microgrids
Combines multiple MCFs*

*Spot Generators
Individual MCFs*

AF "Core" Characteristics
for Energy Projects



Key Considerations

- Implementation Cost (\$)
- Mission Threat (% Prob.)
- Allowable Mission Downtime (min)
- Relocatable Condition (1,2, or 3)
- Performance Goals (# of 9's)

Mission-owner perspective is what matters!

