ERCIP Resilience and Security Microgrid Project Scoping and DD1391 Development

Moderator: William (Bill) Biehl, PE, PMP | Black & Veatch

Speakers:

- Larry Almaleh, PE, PMP | Black & Veatch
- Kevin Miller, PE, LEED AP BD+C | Black & Veatch

May 15, 2024, 1:30 p.m.

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MODERATOR

Bill Biehl, PE, PMP

Black & Veatch

Senior Program Director

Fun Facts

- Completed Multiple Marathons
- Completed 7 Ironman Triathlons

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SPEAKER

Larry Almaleh, PE, PMP

Black & Veatch
Project Manager

Fun Facts

- Been with B&V a Very Long Time..
  - ü Did you use a mimeograph machine?
- Two “grand-dogs”

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SPEAKER

Kevin Miller, PE, LEED AP BD+C

Black & Veatch
Project Manager

Fun Facts

- K-State Grad, Big Wildcat Fan
- Hiked the Inca Trail to Machu Picchu (5 days, 26 miles)

Live Content Slide

Poll: Which authorizes MILCON DD1391 reprograming changes during the execution of project?

Live Content Slide

Poll: What Types of Microgrid Projects have you executed?

Live Content Slide

Poll: How does the DD1391 impact design proposals?

DD1391
Objectives

DD1391 Objective – *"The Bible"*

The DD Form 1391 is used by the Department of Defense for military construction projects to submit:

- Document requirements
- Program justification
- Support funding request to Congress

Document providing funding and project components limitations for the Project

DD1391 Objective – *"The Box"*

Document providing funding and project components limitations for the Project:

- Capital Cost Limitation (CCL)
- Equipment/Building Limitations
  - Generation Capacity/Type
  - Critical facilities
  - Utility modification
  - BESS
  - Building sq. footage

DD1391 Example

2022 93359 P REVISION DATE: 08 MAY 2020
Army ERCIP (AS OF 08/18/2020 AT 20:01:34) 30 APR 2018
ACF=0.96 UM=E

Fort Benning
Georgia

ERCIP
Construct a 4.8MW Generation Plant & Micro-grid Controls

Energy Resilience	811 17	93359				17,000
PRIMARY FACILITY						14,153
Battery Energy Storage System		KW	500	2,853		(1,426)
Microgrid Control System		EA	1	1253565		(1,254)
Electric Power, Gas-Fired		KW	4,800	1,902		(9,128)
Solar PV Array and Substation Upgrade		EA	1	2075100		(2,075)
Cybersecurity Assessment & Authorization		EA	1	270,190		(270)
SUPPORTING FACILITIES						1,156
Electric Service		LS	--	--		(110)
Water, Sewer, Gas		LS	--	--		(110)
Site Imp(811) Demo( )		LS	--	--		(811)
Information Systems		LS	--	--		(125)

ESTIMATED CONTRACT COST	15,309
CONTINGENCY (5.00%)	765
SUBTOTAL	16,074
SUPERVISION, INSPECTION & OVERHEAD (5.70%)	916
TOTAL REQUEST	16,990
TOTAL REQUEST (ROUNDED)	17,000
INSTALLED EQT-OTHER APPROPRIATIONS	(0)

Construct two (2) 2.4 Mega Watt (MW) natural gas generators connected to Dixie Road Substation. A paralleling switchgear is to be provided for paralleling and control of the generators and connection of the redundant feeders to the substation. Potential transformers will be provided for relaying and metering requirements on each way. Protective relaying will be provided to include source protection, feeder protection, and generation protection and synchronization. Modify Dixie Road substation by upgrading the relaying on the circuit breakers to provide synchronization with the generators. Upgrading the feeder breakers to provide operational compatibly with new switchgear and the main service.

Install two (2) 250 Kilowatt (kW) / 500 kilowatt per hour (kWh) battery energy storage system (BESS). The BESS includes but not limited to the following: controls, system balancing, breakers, and switches.

Install a microgrid control system that integrates with an existing Supervisory Control and Data Acquisition (SCADA) to match facility loads with available supply (in parallel operation and islanded mode). The microgrid control system will include but not limited to the following: transfer switches, interface relays, controllers, and fiber optic communication connections.

Upgrade inverters, relays, and controls for the existing Solar Photovoltaic (PV) substation to allow the use of approximately 3MW of PV generation.

DD1391 Objective – *"The Issues"*

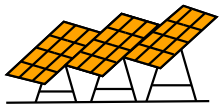
- **Scope of Work Definition**
  - *Does the document accurately define all project elements?*
- **Cost Estimate Accuracy**
  - *Is the cost estimate complete?*
  - *Did it consider supply chain issues?*
  - *Accurate construction period?*
- **Age of DD1391**
  - *Does the document consider recent escalation rates?*

DD1391 Scope of Services

Generation/Energy Storage Systems

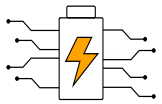
Reciprocating Generation

- Fuel type
- Size
- Number of units



Solar

- Onsite/Offsite
- Size
- Ground Mount/Rooftop/Canopies



BESS

- Type/Size

Other

DD1391 Scope of Services

- **Facilities Included**
  - Critical/Non-Critical
  - Facility Based/Feeder Based
- **Distribution System**
  - Government Owned/Operated
  - Privatized Utility
  - Grid Supplier
- **Existing Generation Assets**

What is the contractual arrangement between Utilities and Government!

DD1391
Best Practices

Best Practice

Allow additional time for program validation during preliminary design!

- Identify **intent and goals** of the project
- Identify **existing generation sources** onsite/off site
- Evaluate **Generation alternatives**
- Identify **Critical Facilities**
- Identify **Non-critical vs Critical loads** on individual feeders
- Determine **availability of system load** data
- Do **load studies** to **optimize generation requirements**
- Identify **Contractual arrangements** between Stakeholders

Generation Technology Evaluation Example

Evaluation Criteria \ Alternative Generation Technologies	Solar	Diesel Generators	NG Generators	BESS	Fuel Cells	Flywheels	Wind Turbines	Turbine generators	Ultra capacitors	Vehicle to grid	Distributed storage	Compressed Air Energy Storage
Generation profile	▼	▲	▲	■	■	■	▼	▲	■	■	■	■
Availability (total generation hours)	▼	■	▲	■	▲	■	▼	▲	■	▼	■	■
Rough order of magnitude cost ($ / kW)	▲	▲	▲	▲	▼	▼	■	▼	▼	■	▼	■
Operation and maintenance cost ($ / yr)	▲	■	■	▲	▼	▼	▲	▼	▲	■	■	▲
Reliability	▲	▲	▲	■	■	■	■	■	■	▼	■	■
Resiliency	▲	■	■	■	■	■	▲	■	■	▲	■	■
Footprint requirement	▼	▲	▲	▲	▲	■	▼	▲	▲	■	■	▼
Permitting requirements	▲	▼	■	▲	▲	▲	▼	■	▲	▲	▲	▼
Technology maturity	▲	▲	▲	▲	■	■	■	■	■	▼	■	▲
Energy Cost Management	■	■	▲	■	■	■	■	▼	▼	▼	■	▲

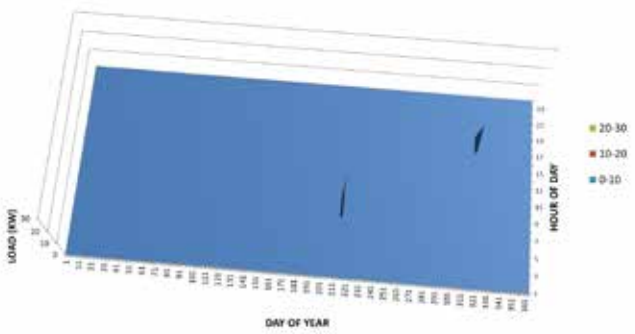
Legend
▲ - Positive
■ - Moderate
▼ - Weak

Note: The table above and resulting evaluation for these technologies was customized for the customer's location, utility, market, load profile, reliability/resilience requirements and risk profile.

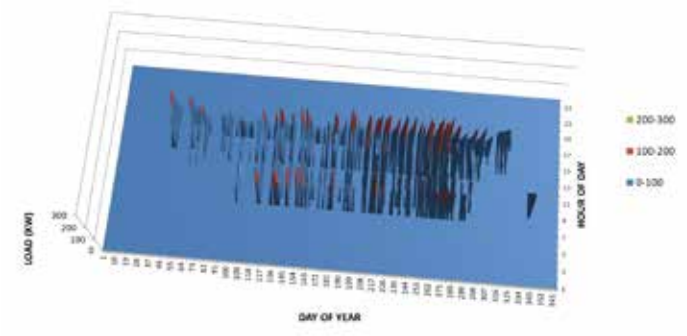
Why Does Load Matter?

1. Can I only cover important loads? Maybe, what does the existing system look like?
2. Does the mission require 24/7 electrical power, or can it handle a few outages?
3. The economics of non-outage time may drive the design.
4. Existing system configurations and spare connections also can drive project costs.
5. Load-shed requirements

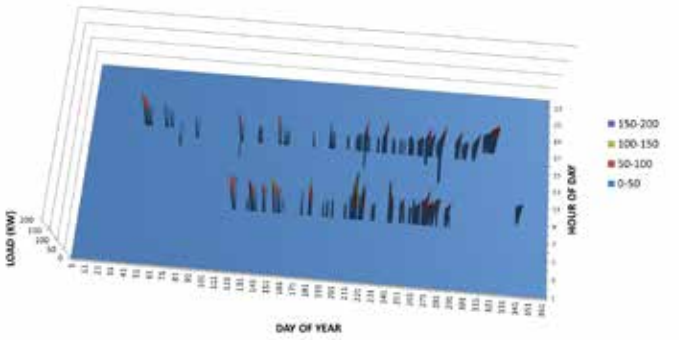
UNCOVERED PEAKS, **50%** LOAD REDUCTION, **1MW** Engine Generator with **1.2MW** Solar PV at 25%



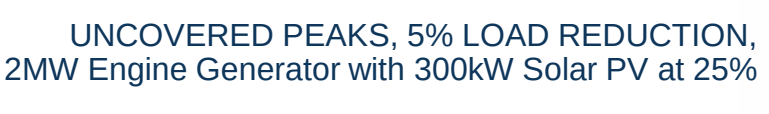
UNCOVERED PEAKS, 0% (NO) LOAD REDUCTION, 2MW Engine Generator



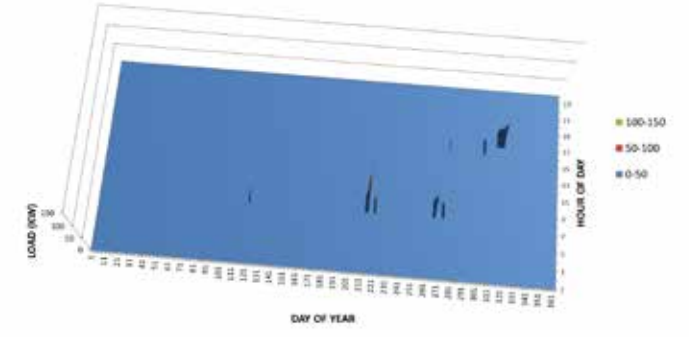
UNCOVERED PEAKS, 0% (NO) LOAD REDUCTION, 2MW Engine Generator with 300kW Solar PV at 25%



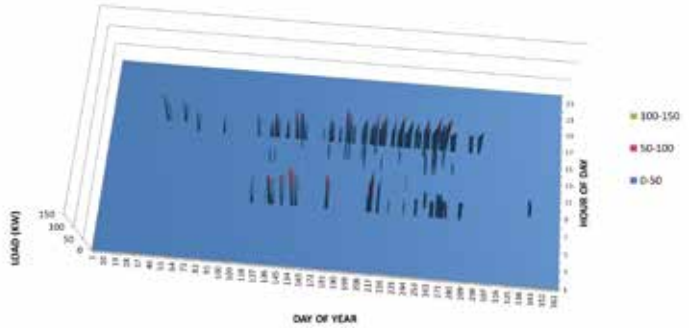
UNCOVERED PEAKS, 5% LOAD REDUCTION, 2MW Engine Generator with 300kW Solar PV at 25%

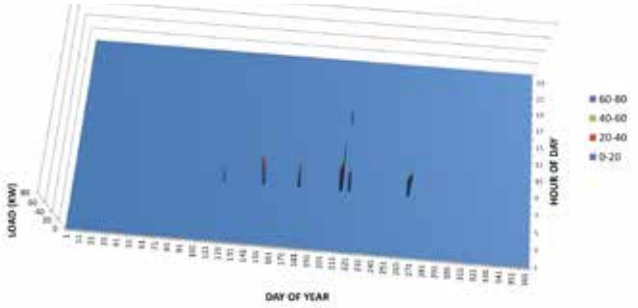


UNCOVERED PEAKS , 0% (NO) LOAD REDUCTION, 2MW Engine Generator with 300kW Solar PV at 100%



UNCOVERED PEAKS, 5% LOAD REDUCTION, 2MW Engine Generator





Best Practices

- Consider using the PCR process to verify project requirements and cost estimate
- Validate DD1391 – during ***PROPOSAL STAGE***!
  – market condition / SOW
- Allow additional time for program validation during preliminary design
- Validate equipment lead times and supply chain issues before and ***throughout design process***

Project Examples

#1
Best Practice

Project #1 – Zutendaal, Belgium – D/B/B Resilient Smart Microgrid System Concept Design and DD1391

- **Generating Assists:**
  - New 450-kilowatt (kW) solar PV field
  - New 500kW / 2000-kilowatt hour (kWh) BESS
  - Tie-in provisions for a backup generator
- **Critical Load:**
  - Estimated critical load is 280kW.
  - The microgrid can serve critical load for approximately 40% of the year
  - Backup generation and demand side management
- **Modes of Operation:**
  - Island mode
  - Grid-connected mode to provide economic dispatch and grid services support
- **Cost Estimate:** The total estimated contract cost for this project is $12.1M

#1
Best Practice

Project #1 – Zutendaal Program Development

Feasibility Analysis Results

The following feasibility analyses are performed to advise project development:

- **Energy Economic Analysis:** Guides the selection of major equipment and defines operational states of charge (SOCs) for subsequent analysis.
- **Power System Analysis:** Evaluates the operation of the microgrid in island and grid-connected mode to assure the integrity of the electrical system is maintained under contingency scenarios for loading and short-circuit analysis.
- **Life Cycle Cost Analysis (LCCA):** Quantifies capital investment and sustainment costs for the microgrid.

#1
Best Practice

Project #1 – Zutendaal Program Development

Develop General Project Criteria and Design Standards

- Discipline Design Criteria
- Unified Facility Criteria (UFC) standards
- Host Nation Criteria
- Existing Site Facilities Upgrade Requirements/Projects
- Permitting Requirement
- Cybersecurity
- Cost Estimating Criteria
  - Escalation
  - Construction Schedule
  - Supply Chain Equipment Schedule
- DD1391 Development

#1
Best Practice

Project #1 – Zutendaal Program Development

Field Studies

- Onsite Site Facilities Verification.
- UXO Survey
- Geotechnical Investigations
- Topographic/Utility Surveys
- Environmental Surveys

#2
Best Practice

Project #2 – Ft. Bliss Program Validation – Scope Overview

100% D/B/B Power Resilient Smart Microgrid System

- 4 separate sites, 4 separate projects, Original SOW
  - 93031 – 1.75MW NGG, 520kW PV, 1.5MW/1MWh BESS
  - 98799 – 8 MW NGG
  - 98991 – 5 MW NGG
  - 99008 – 5 MW NGG
- Privatized Utility Provider
- Site Improvements
- SCADA
- Estimated CCL $34.9M

#2
Best Practice

#2 – Ft. Bliss – Program Validation – DD1391

ISSUES

- Outdated DD1391s
- Did not include the full scope for the projects - SOW added PV and BESS to all sites
- Cost increases due to high recent escalation and supply chain issues

IMPACTS

- Additional scope was not authorized in DD1391s
- Projects could not be constructed within the CCLs
- Design effort exceeded the FAR limitations




#2
Best Practice

#2 – Ft. Bliss – Program Validation – DD1391

2020 DD1391	Generation (kW)	PV (kW)	BESS (kW)	DD1391 ($M)
Site 1	1,750	520	1,500	$ 6.0
Site 2	8,000	0	0	$ 8.1
Site 3	5,000	0	0	$ 10.8
Site 4	5,000	0	0	$ 10.0
			TOTAL	$ 34.9

Proposed	Generation	PV	BESS	BV DD1391 ($M)
Site 1	1,750	520	1,500	$ 15.8
Site 2	8,000	1,500	1,500	$ 23.8
Site 3	5,000	1,500	1,500	$ 25.6
Site 4	5,000	1,500	1,500	$ 23.1
			TOTAL	$ 88.3

Difference of $50M+

#2
Best Practice

#2 – Ft. Bliss – Program Validation – DD1391

RESOLUTION

- Provided ROM costs in the proposal
- Revised SOW to Include Development of new DD1391s in support of increasing the Programmatic Budget

BEST PRACTICE

- Validate the DD1391 at the start of the project to ensure that all requirements and features are included
- Issues with reprogramming will cause schedule delays (+3 months)

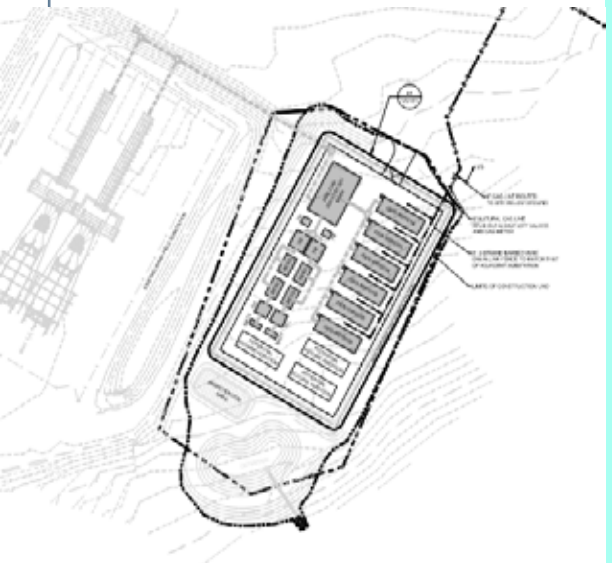
#3
Best Practice

#3 – Ft. Stewart – Program Validation – DD1391

OVERVIEW

- 100% D/B/B Power Resilient Smart Microgrid System
  - 10 MW
  - Existing 1.5MW Microgrid
  - Tie in Existing 30MW PV off site assets
- Privatized Utility Provider
- Site Improvements
- Tie-In to existing PUP Network
- Estimated $21.5M

#3
Best Practice



#3 – Ft. Stewart – Program Validation – DD1391

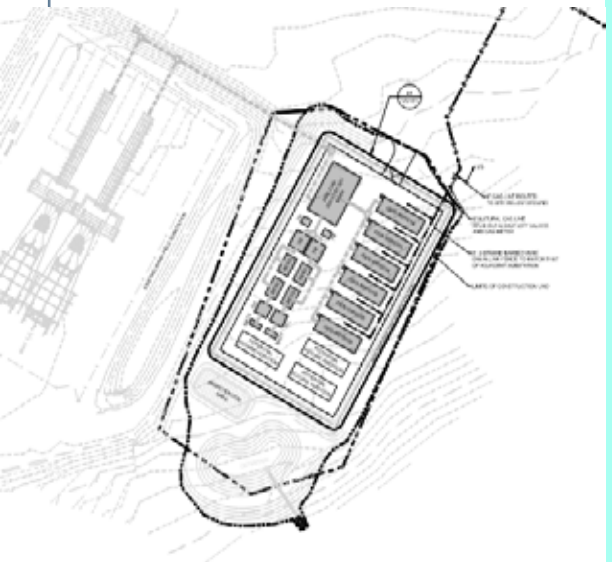
ISSUE

- DD1391 was overcome with events - Prepared pre-COVID
- Cost increases due to high recent escalation and supply chain issues

IMPACTS

- Project could not be constructed for the Program CCL
- Project Schedule Delays

#3
Best Practice



BLACK & VEATCH

12/21/2022

MEMO

To: United States Army Corp of Engineers
From: Black & Veatch Special Projects – Cost Engineering
Re: Ft. Stewart Microgrid Inflated Costs

Mr. Matson,

Since the COVID-19 ("Coronavirus") pandemic there has been several unforeseen impacts to many military projects globally. Additionally, the conflict in Ukraine has also imposed several impacts. Burdens include supply chain issues, labor shortages, commodity price increases, shipping delays, resource availability, and sharp increases in fuel prices. Attempting to capture these impacts are essential to ensure cost are adjusted to adapt to these evolving situations. In preparing the current working estimate (CWE), we have ensured that projects are utilizing regional fuel pricing, current estimate libraries which include MII's 2022 material cost book, 2022 equipment library, accessing local labor rates, and vendor quotations.

We have also collaborated with several branches of the military to use proper escalation and mark-ups on contractors as well as costs to the mid-point of construction. Industry wide indices, such as ENR's Construction Cost Index (CCI) have been used to understanding these impacts. CCI is a reliable tool for the benefit of capturing these cost increases. While we are starting to see some costs leveling out, inflation has impacted the construction market in general and based on location the increases ranges from 8-11% per year because of the market we are now experiencing.

The following lists are examples of project items that are driving the current working estimate above the DD1391 Programmed Amount:

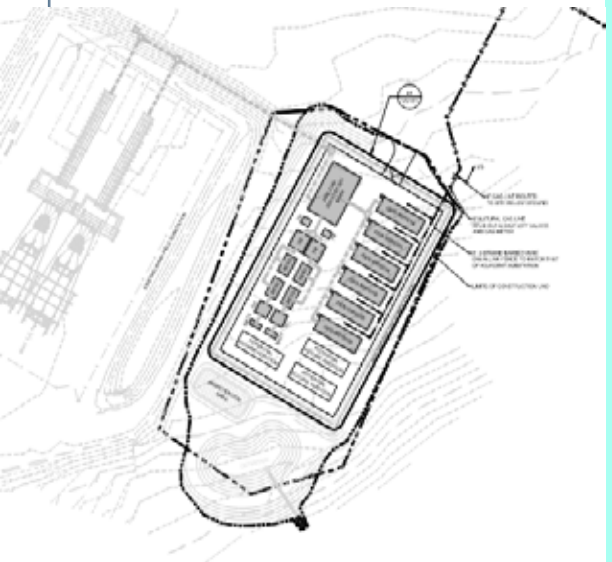
- Inflation was still occurring since programming and release of the DD1391. Costs have inflated 13.8% to current day (15 months).
- BV's current working estimate includes direct quotes with escalation for generators, transformers, breakers, ductbank runs, natural gas distribution, controls, communication, and other associated equipment are approximately 40.3% higher than the DD1391.
- Design schedule delays along with lead times for materials are impacting the project schedule and the mid-point to construction for escalation is approximately 14%.
- Project Supervision, Inspection, and Overheads (SIOH) is currently 6.5% which is up from 5.7%.

If there are any questions or comments regarding this explanation, please feel free to contact us.

Respectfully,

Chris Lamar, Senior Estimator
Black & Veatch Special Projects

#3
Best Practice



#3 – Ft. Stewart – Program Validation – DD1391

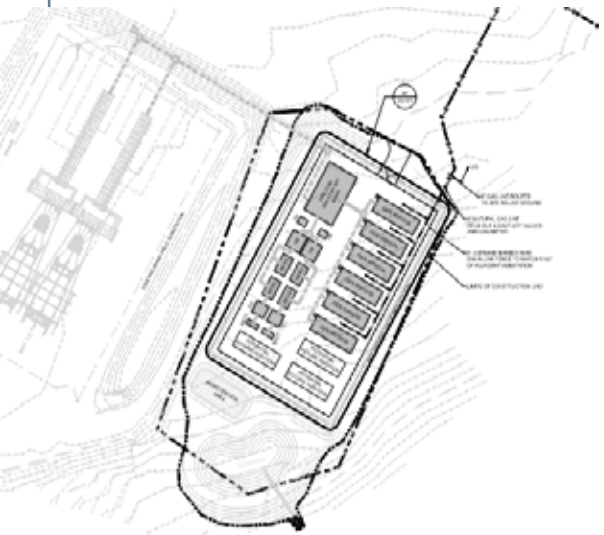
RESOLUTION

- Provided an CWE to support development of an updated DD1391
- Developed Memorandum to justify increase in Program Costs
- Developed schedule impact memorandum
- USACE applied for and received Program Change based on justifications submitted

BEST PRACTICE

- DD1391 must be reviewed and updated to meet current conditions
- Validate cost factors: Escalation, Equipment Costs, Lead Times, and Construction Schedule ***before and throughout the project!***

#4
Best Practice



#4 – Ft. Benning – Critical Facilities

ISSUES

- List of critical facilities was not clearly defined and changed throughout base studies
- Generation capacity was not coordinated with critical loads *and required non-critical loads* on feeders

IMPACTS

- Scope of critical facilities kept changing
- Impacted schedule considerably (~2 months)
- Required multiple iterations to maximize support of critical facilities with available generation

Critical Facilities

Revised DD1391

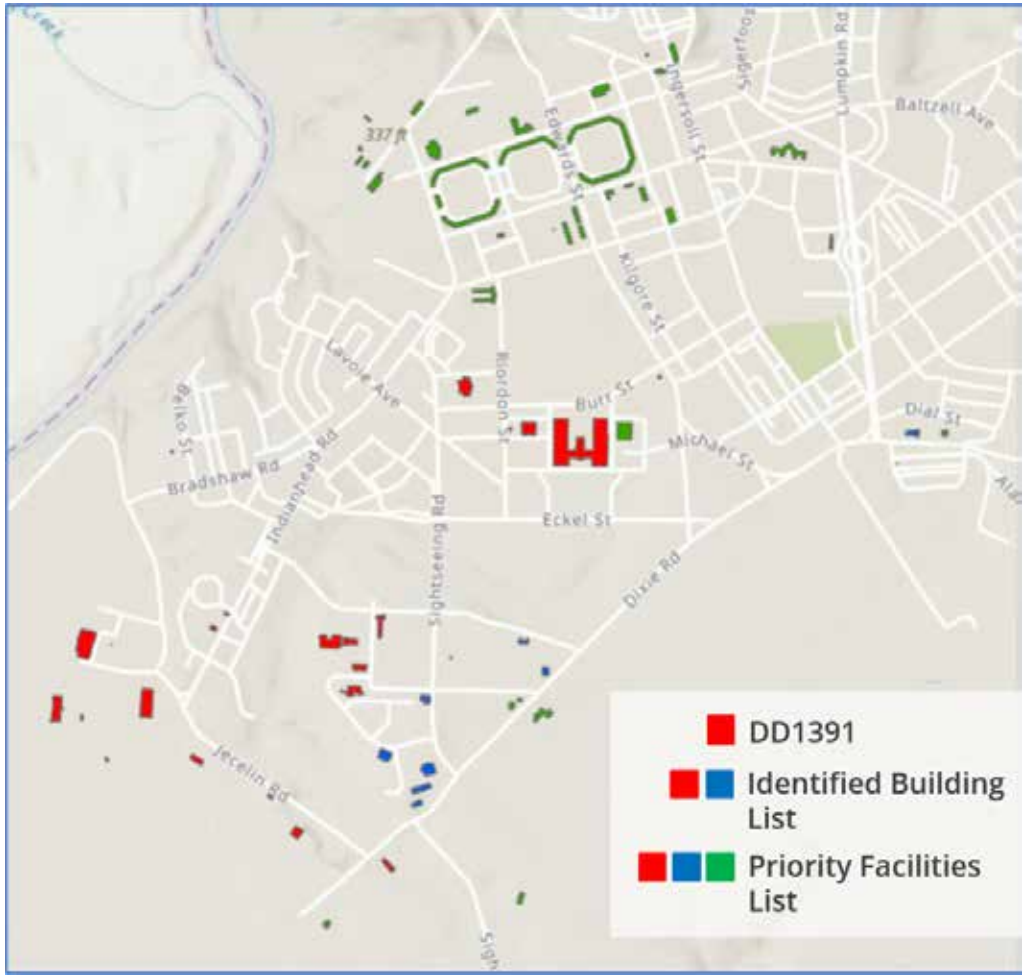
- ~20 Critical facilities listed
- Facilities located on multiple substations

Facility Identified Building List

- ~30 Critical facilities listed
- Inclusive of DD1391 list

Priority Facilities List

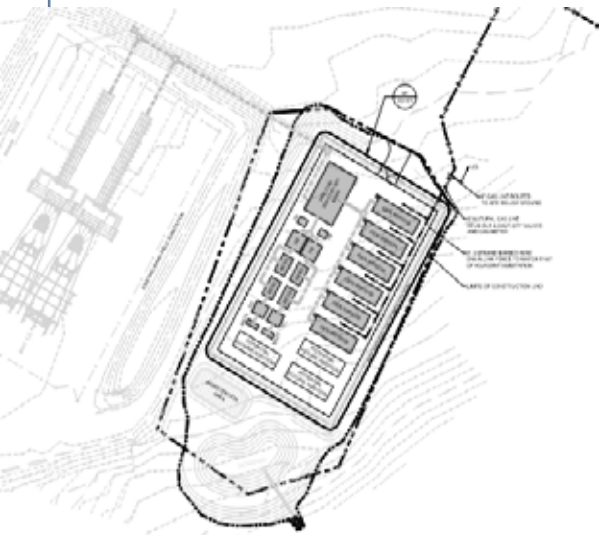
- ~540 facilities provided: Gov't instruction to focus on ~200 facilities
- Inclusive of first two lists provided



Value Add

- *Detailed modeling and analysis to map critical facilities*
- *Identification of Non-critical vs Critical loads on individual Feeders*
- *Optimize mission autonomy with available microgrid capacity*
- *Enable effective gov't decision making*

#4
Best Practice



#4 – Critical Facilities

RESOLUTION

- Developed a detailed GIS modeling and analysis to map critical facilities to individual Feeders (additional effort)
- Identified Non-critical vs Critical loads on individual Feeders
- Optimized Critical mission facilities supported with available microgrid capacity
- Enabled effective Gov’t decision making

BEST PRACTICE

- Identify intent and goals of the project
- Identify load requirements early in design (critical facilities, Distribution requirements)

THANK YOU

Please take a few minutes to complete a short survey about this session. Your feedback will help us improve future programming for JETC.

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ERCIP Resilience and Security Microgrid Project Scoping and DD1391 Development

- Bill Biehl | Biehlwh@bv.com
- Larry Almaleh | Almalehlj@bv.com
- Kevin Miller | MillerK2@bv.com