DESIGN-BUILD FOR AIRFIELD PROJECTS:

Origins, Requirements, and Results

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**Program Expertise** (30 years)
- Mission Operations Coordination (USAF, retired, 4,000 Hour Pilot)
- Project Design and Construction Phasing

**Education**
- B.S. Civil Engineering – Penn State
- M.S. Aviation Management – Embry Riddle

David A. Burgess, P.E., Lt. Col. (ret)
Electrical & NavAid Design, Burgess Engineering

**Program Expertise** (26 years)
- Airfield Electrical Design, USAF Civil Engineer
- Infrastructure Assessment

**Education**
- B.S. Electrical Engineering – Virginia Tech
- M.Eng. Construction Management – University of Maryland
Military Airfield Project/Design-Build Experience

Projects:

Edwards AFB, CA (DB)
NAS Jacksonville, FL
NAS Oceana, VA (DB)
NAS Patuxent River, MD
NS Guantanamo Bay (DB)
OLF Whitehouse, FL (DB)
Misawa AB, Japan (DB)
Moody AFB, GA (DB)
NAS Corpus Christi
NAS Kingsville

Andrews AFB, MD (DB) - 4
Columbus AFB, MS (DB)
Dover AFB, DE
Kandahar AB, Afghanistan (DB)
Lackland AFB, TX (DB)-2
Langley AFB, VA
Forney AAF, MO (DB)
Westover ARB, MA (DB)
NAS Pensacola
NAS Meridian
Outline

1. Origin & Requirements of Airfield Design-Build Projects
2. Why is Design Still Important
3. Specialized Design and Construction for the Airfield Environment
   a. Civil
   b. Electrical
4. The Consequences of Improper Scoping
5. Summary and Recommendations
Origin & Requirements of Airfield Design-Build Projects

1. Better, Faster, Cheaper

2. 2001 - The first “GWOT”

3. Contracting Trends and Challenges - One Contract to Execute Project

4. Specialized Design Required for the Airfield Environment
   - Averting Hazardous Infrastructure Design: Airfield Pavements, Obstructions, Electrical/Lighting/NAVAIDs
   - Phasing Requirements Place Restrictions on Contractor Production and Increase Construction but Reduce Operational Costs
Specialized Design

The airfield environment has design and construction requirements and constraints which are not readily apparent.

Consequence of failure is significant and potentially catastrophic.
Airfield Signage and Marking Related Catastrophe

Tenerife, Canary Islands
Lost Commercial Aircraft Mishaps

Tenerife, Canary Islands – 1977
Madrid – 1983
Detroit, MI – 1990
Taipei (Construction) - 2000
Milan – 2001
Lexington, KY (Construction) – 2006
Johannesburg --2013
Runway Obstruction Related Mishap

F-16 Aborted Takeoff

1998 Misawa Air Base, Japan
Runway Area Obstacles Remain

Duke Field, Eglin AFB, FL
Specialized Airfield Civil Design

- Beyond the Footprint of the Pavement Box
- Imaginary Surfaces are Real
Design Constraints Imposed by Imaginary Surfaces - Airspace
Design Constraints Imposed by Imaginary Surfaces
Lateral Clearance Areas

For additional and detailed information on grading within the runway lateral clearance zone, see Table 3.2.
Design Constraints Imposed by Imaginary Surfaces
Longitudinal Profile and Line of Sight
NAVAID Critical Areas

**Legend**
- VFR Hold Line
- Instrument Hold Line
- Glide Slope Critical Area
- Localizer Critical Area
- Precision Obstacle Free (POFZ) Zone

**Note:** Reference Only; not to scale.
Consequences of not Understanding Airfield Construction from an Operations Perspective

Iraq - 2004
Airfield Lighting System Components

Runway & Taxiway Lighting

Airfield Guidance Signs

Approach Lighting Systems

Airfield Lighting Control and Monitoring System

Constant Current Regulators (power distribution)
Runway & Taxiway Lighting

- Runway Edge Lights
- Runway Centerline Lights
- Taxiway Edge Lights
- Taxiway Centerline Lights
- Touchdown Zone Lights
Airfield Guidance Signs

- Runway Hold Signs
- Taxiway Guidance Signs
- Distance Remaining Signs
Approach Lighting Systems

- ALSF - 2
- ALSF - 1
- MALSR
- REIL
- PAPI
Airfield Lighting Control Systems

- Lighting intensity settings
- Operational segregation
- Circuit monitoring
- Energy usage recording
- Diagnostics
Constant Current Regulators (Power Distribution)

Stand-alone Format

- Any size airfield
- Easy to relocate
- Simple control contacts
- Lower initial cost
Constant Current Regulators (Power Distribution)

Switch-gear Format

- Larger airfields
- Less time to install
- Integrated control
- Higher initial cost
Lighting String Configurations

Parallel Lighting Circuit

Series Lighting Circuit
Lighting Circuit Ground Faults

Single Fault

Multiple Faults
What are the root causes of improperly scoped Airfield Electrical System projects?

1) Lack of airfield electrical design expertise & experience
2) Failing to coordinate airfield lighting and paving projects
3) Understanding that ‘meeting standards’ can still result in a poorly designed airfield lighting systems
4) Failure to properly consider the inputs of airfield operations and airfield maintenance staff
Expertise & Experience

1. Airfield lighting is highly regulated area of design
2. Close interrelationship of civil and electrical design
3. Cost of mistakes is very high in dollars, operational impact and project visibility
4. Design problems may not be apparent until months or years after substantial completion
5. Fast pace of technology change and regulatory impact requires familiarity with industry
Coordinated Pavement and Lighting Design
Minimum Standards Misses Opportunities

**DESIGN DIRECTIVE**

**Save on construction cost by using existing handhole/manhole duct bank system**

**DESIGN DIRECTIVE**

**Save on trouble shooting costs by implementing a pullcan plaza based duct bank system**
Field Example - Neglecting Input from O&M Staff

O&M Design Vacuum

Operational impact

2 wire sizes required

Improper equipment placement
Design from a Systems Perspective for Energy Savings

1. **LED airfield lighting fixtures**  
   (Savings: over 50% energy reduction)

2. **Properly sized Constant Current Regulators**  
   (Savings: 10% - 20% energy reduction)

3. **Airfield operations based lighting control system**  
   (Savings: 10% - 30% energy reduction)

4. **Duct bank system designed from an O&M perspective**  
   (Savings: reduced “collateral damage” by reducing maintenance and operational impact)
Edwards AFB, CA

Runway 4-22
Reconstruction
Design-Build
Andrews AFB, MD
Apron 6B
Reconstruction
Design-Build
Andrews AFB, MD: Apron Rehabilitation
Randolph AFB: Taxiway G Reconstruction, Design-Build
Consequences of Improper DB Project Scoping

1. Engineer Works for the Contractor
2. Short Term Repairs
3. Increased Costs
   - Project and Infrastructure
   - Operational Impacts
4. Shorter Infrastructure Life
Repair-Reconstruct Runway and Taxiway Pavement without Shoulder and Lighting Replacement
Results: 4 Different Pavement Surfaces and Ages
Taxiway W Shoulder Pavement - 2000
“Repaired” Shoulder Pavement – 2014
Summary and Recommendations

1. Airfield Design-Build project execution is likely to remain a contracting option and reality.

2. Most common element in failed project execution is improper scoping.

3. Be prepared with an Airfield Master Plan in order to assess, quantify, and prioritize improvement projects.
Develop an Airfield Master/Action Plan
Summary and Recommendations

4. Plan and Scope Projects from an Asset Management Plan Perspective
   - Operations Priority, Systems and Maintenance Perspective
   - Airfield Activity Manager is Key. Must be empowered and involved in project planning and coordination.
   - AFPD 32-10 Activity Management Plans

5. DB Project Team Must be Airfield Qualified and Experienced
DB Project Team Member Qualifications

Airfield Design-Build Projects requires the following team members:

**Owner:** Must have a Project Manager with a technical understanding of airfield design criteria and who will solicit input from operations and maintenance staff

**Design Engineer:** Must have specific project experience in airfield electrical & paving design

**Electrical Contractor:** Must have specific project experience in airfield electrical construction

**Pavement Contractor:** Must have specific project experience in airfield pavement construction

**Use UFC 3-260-11FA “Model Design-Build (D-B) Request for Proposal for Airfield Contracts”. Good information on formulating projects**
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