

# ***Design Considerations for Airfield Lighting Vaults***



**Richard Walls, P.E.**  
*NC Department of Transportation  
Division of Aviation*



# Design Criteria

- ✈ UFC 3-535 Visual Air Navigation
- ✈ National Electric Code
- ✈ Uniform and Local Building Codes
- ✈ FAA AC
  - ✈ FAA AC 150/5345-30F – Design and Installation Details for Airport Visual Aids
  - ✈ FAA AC 150/5345-40-56 - Specification for L-890 Airport Lighting Control and Monitoring System (ALCMS)
  - ✈ Field Order 6030.20 Electrical Power Policy



U.S. Department  
of Transportation  
Federal Aviation  
Administration

## Advisory Circular

Subject: DESIGN AND INSTALLATION  
DETAILS FOR AIRPORT  
VISUAL AIDS Date: 9/29/2011  
Initiated by: AAS-100 AC No.: 150/5340-30F  
Change:

1. PURPOSE. This advisory circular (AC) provides guidance and recommendations on the installation of airport visual aids.

2. CANCELLATION. AC 150/5340-30E, Design and Installation Details for Airport Visual Aids, dated September 30, 2008, is cancelled.

3. APPLICATION. The Federal Aviation Administration (FAA) recommends the guidance and specifications in this Advisory Circular for Design and Installation Details for Airport Visual Aids. In general, use of this AC is not mandatory. However, use of this AC is mandatory for all projects funded with federal grant monies through the Airport Improvement Program (AIP) and with revenue from the Passenger Facility Charges (PFC) Program. See Grant Assurance No. 34, "Policies, Standards, and Specifications," and PFC Assurance No. 9, "Standards and Specifications." The lighting configurations contained in this standard are a minimum acceptable to the Administrator to meet the lighting requirements of Title 14 CFR, Part 139, Certification of Airports, Section 139.311, Marking, Sign and Lighting. See exception in paragraph 2.1.2b (2), Location and Spacing.

4. PRINCIPAL CHANGES. The following changes have been incorporated:

a. Paragraph 2.1.2b(1)(c) is added to prevent mixing elevated and in-pavement light fixtures for runway threshold lights.

b. Paragraph 2.1.4(c) provides clarification for the application of retroreflective markers.

c. Table 2-2, Note 2 is clarified for the use of L-561SE light fixtures.

d. Paragraph 3.3(a)(1) reinstates longitudinal tolerance for runway centerline lights.

e. Paragraph 4.3, Taxiway Centerline, additional information is added to clarify the use of yellow and green fixtures.

f. Paragraph 12.5 reference: NFPA 780, Standard for the Installation of Lightning Protection Systems, is included to provide additional information for the installation of lightning protection systems on airfields.

g. Paragraph 12.6 adds additional information found in the National Electric Code (NEC) Handbook and NFPA 780 about grounding strikes.



# Design Considerations

## Kickoff Meeting

- ✈ Quantity, Location, Site Plan
- ✈ Vault Building Floor Plan
- ✈ Power Distribution System
- ✈ Airfield Lighting Control
- ✈ Rehab of Existing Vault
- ✈ Miscellaneous



# Quantity, Location and Site Plan

## ✈️ Number of Airfield Lighting Vault

- ✈️ Size of Airfield / Number of Runways
- ✈️ Geographical Divides
- ✈️ One Vault per Runway
- ✈️ Proximity to ATCT / ARFF



# Quantity, Location and Site Plan



## Location

### ✈ Airport Operating Area

- ✈ Secure Area
- ✈ Close Proximity to Airfield
- ✈ Non-Revenue Generating Property
- ✈ Higher Cost for Utilities Connections



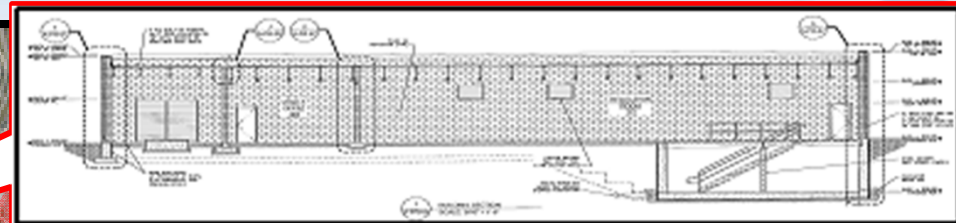
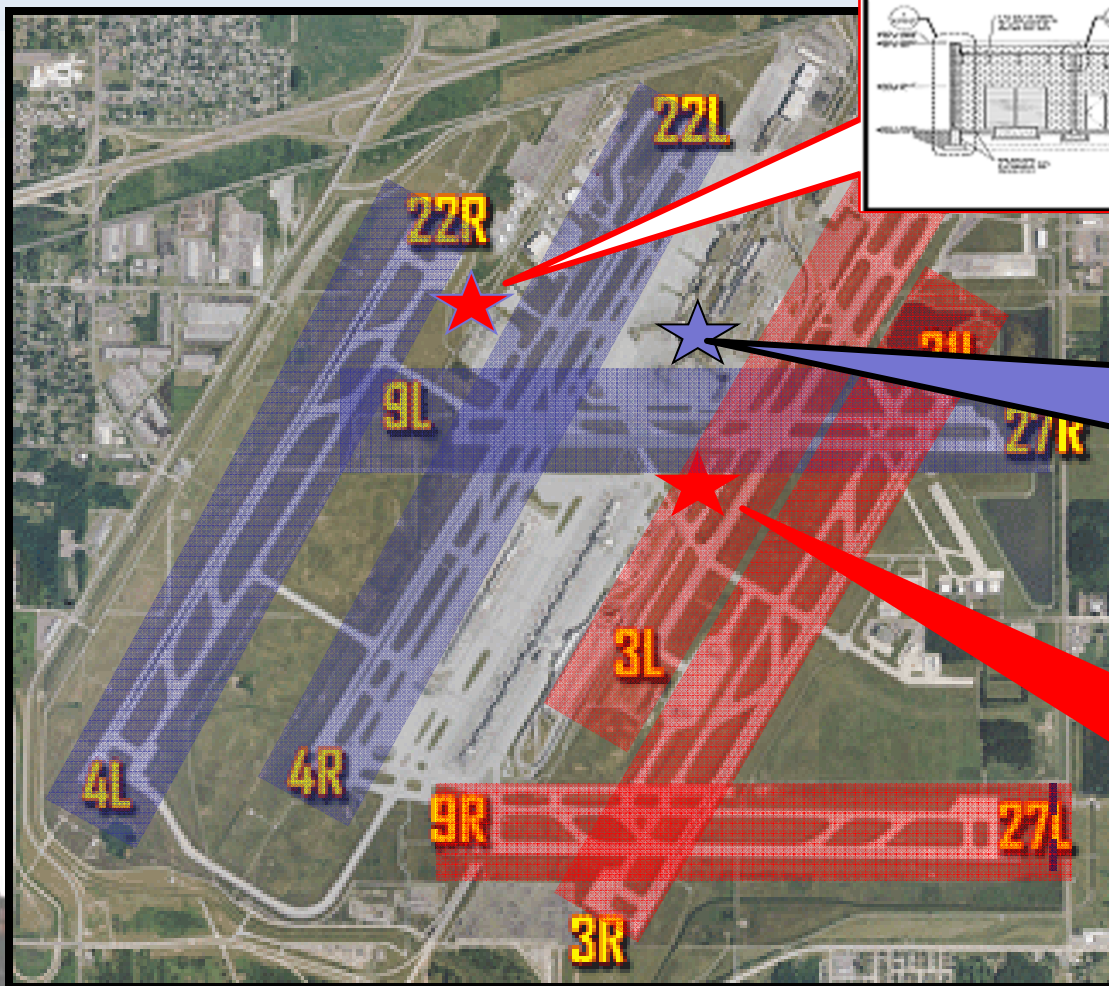
### ✈ Landside

- ✈ General Aviation



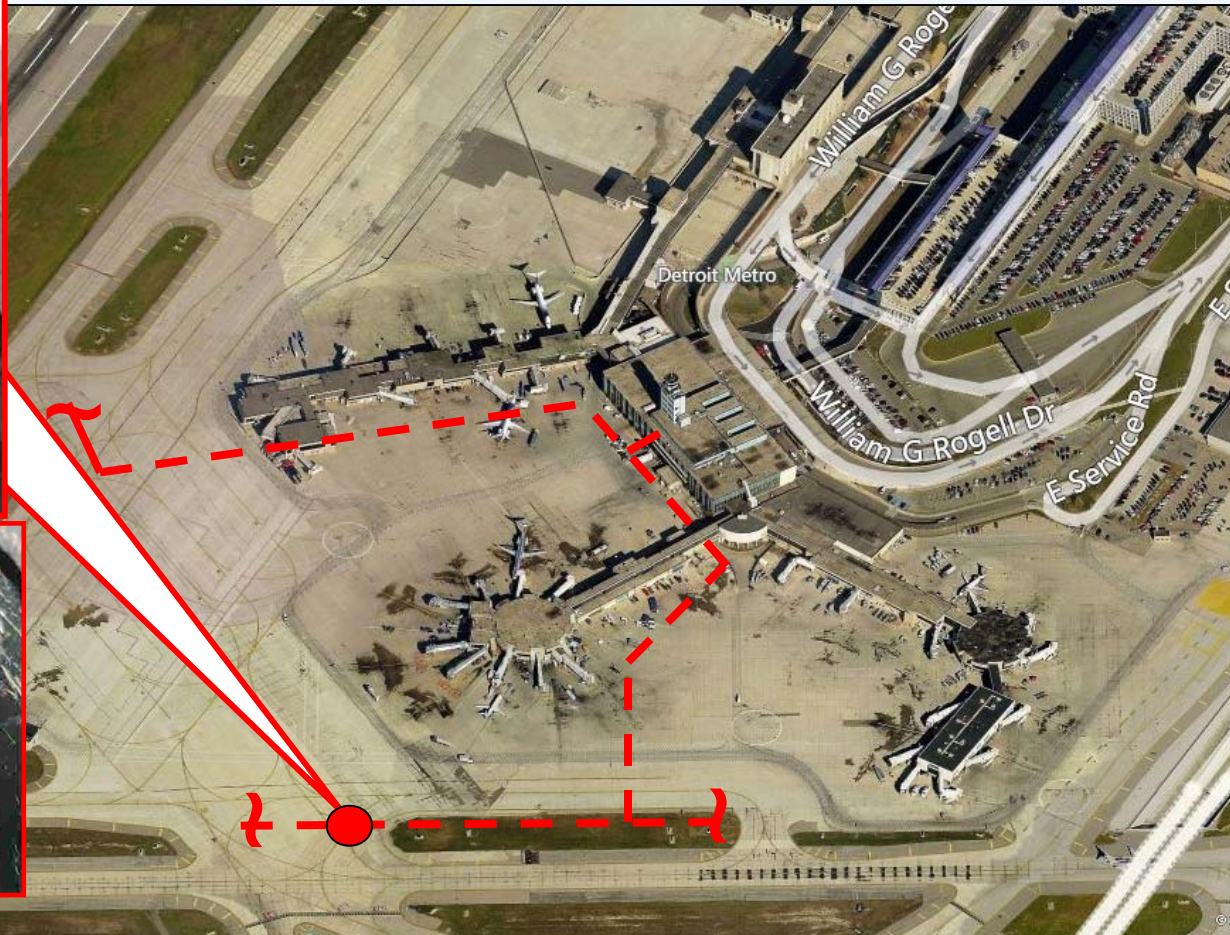
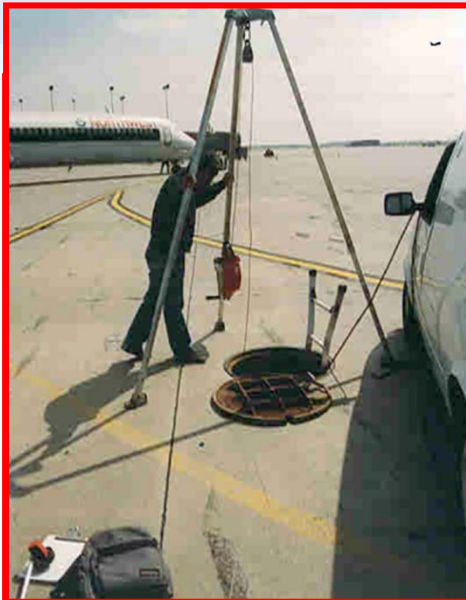


# Detroit Metro Airport



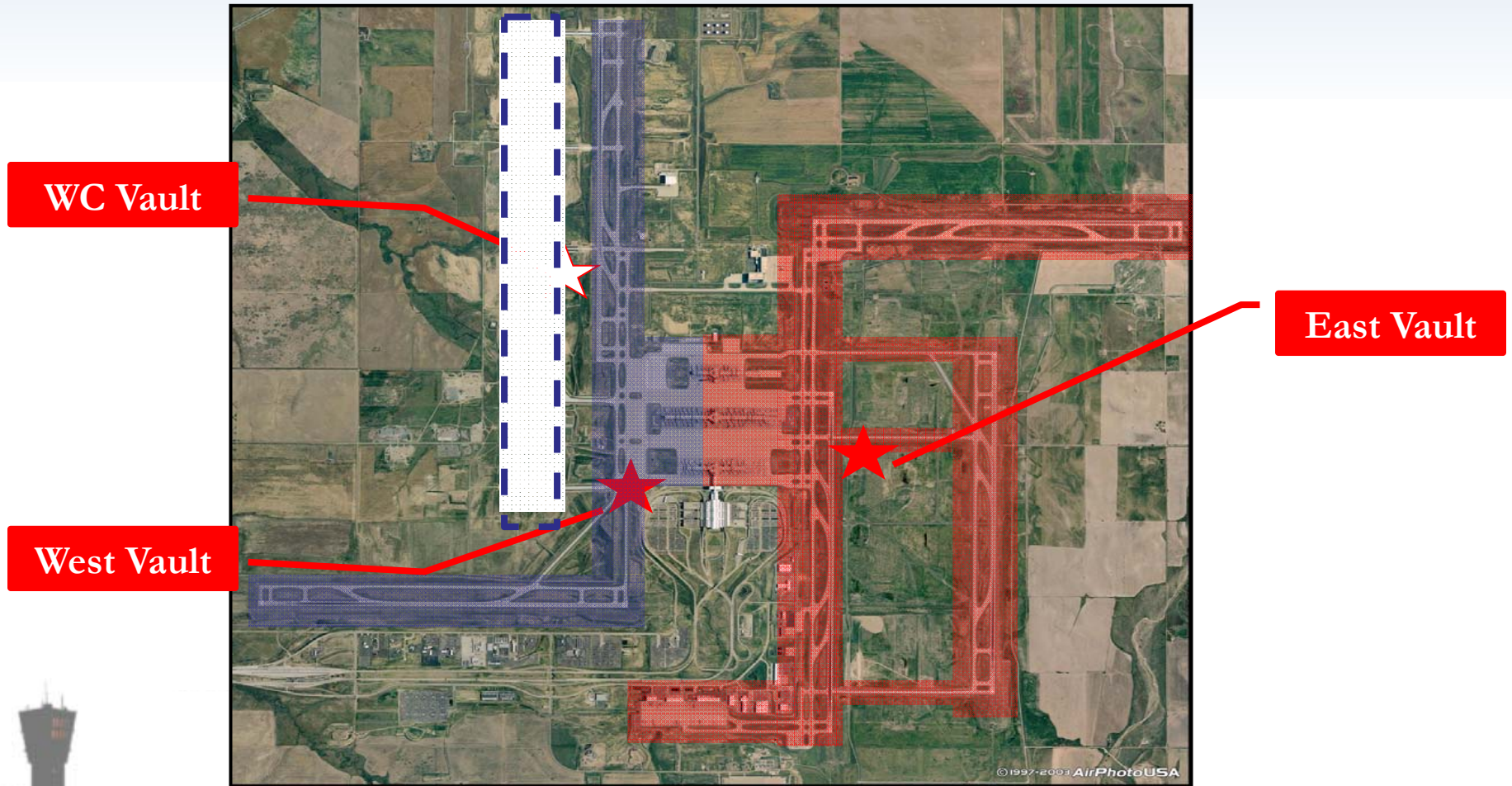
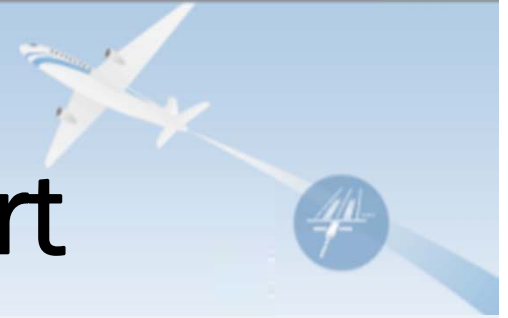


# Detroit Metro Airport





# Denver International Airport





# Denver International Airport



West Vault



# Denver International Airport



WC Lighting Vault



# Denver International Airport





# Denver International Airport



WC Lighting Vault



# Denver International Airport



Vehicle  
Drive Thru



WC Lighting Vault



# Denver International Airport

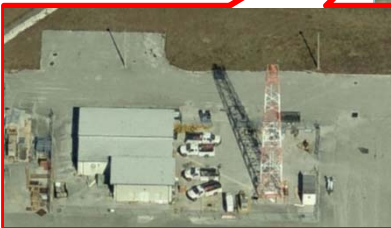
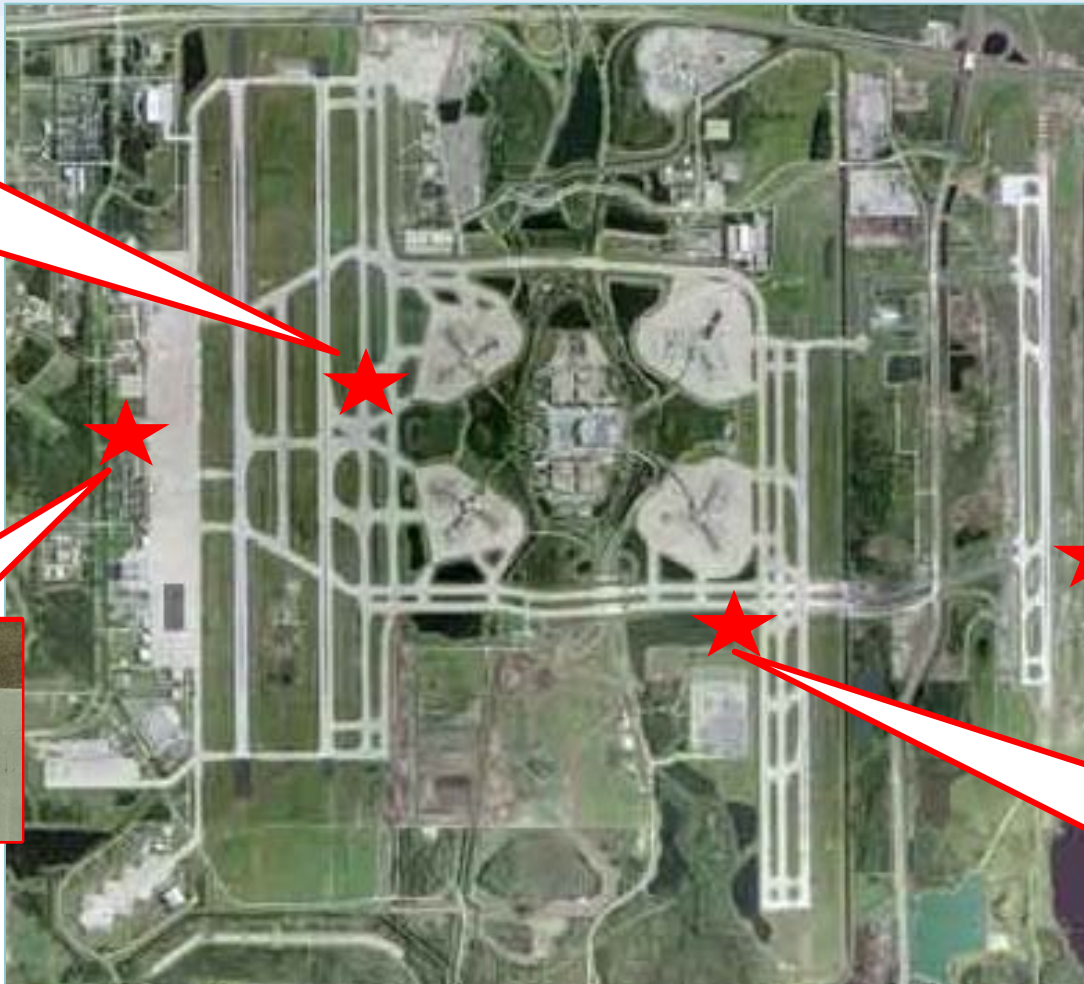


WC Vault

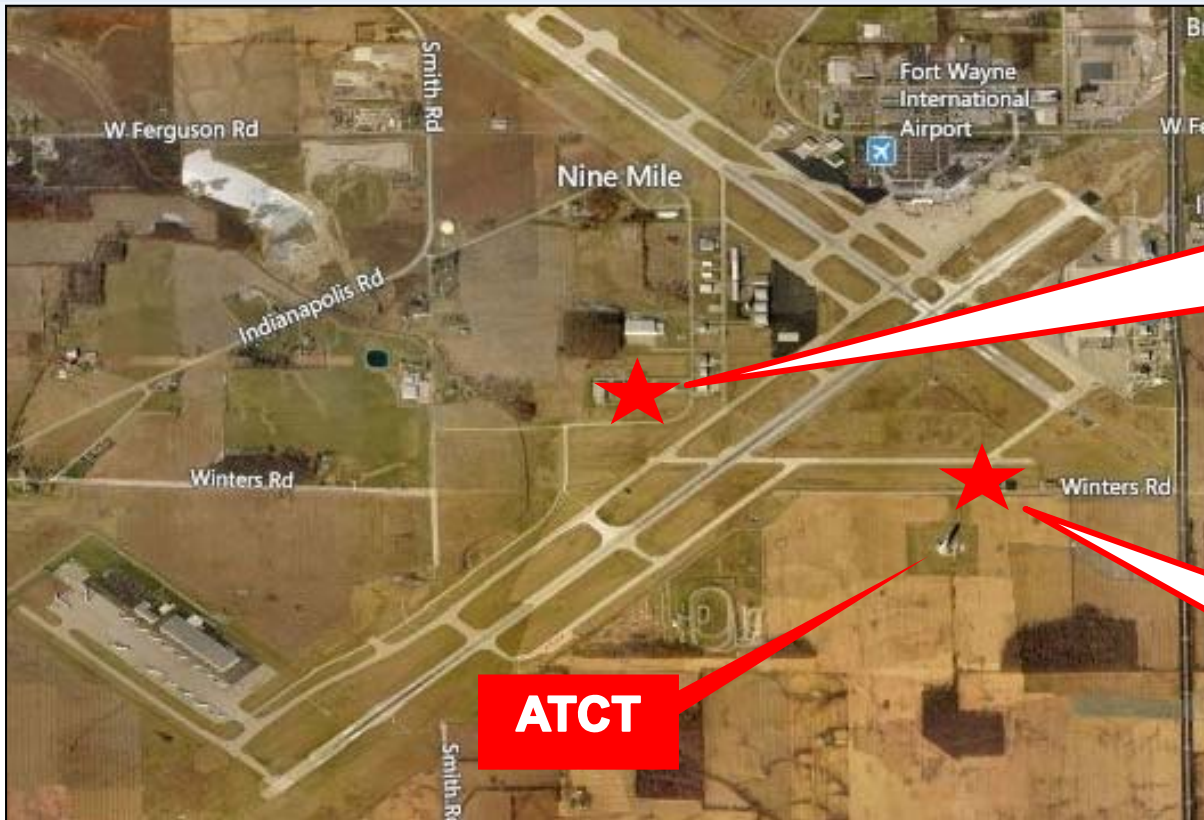




# Orlando International Airport



# Fort Wayne International Airport





# Fort Wayne International Airport





# Fort Wayne International Airport

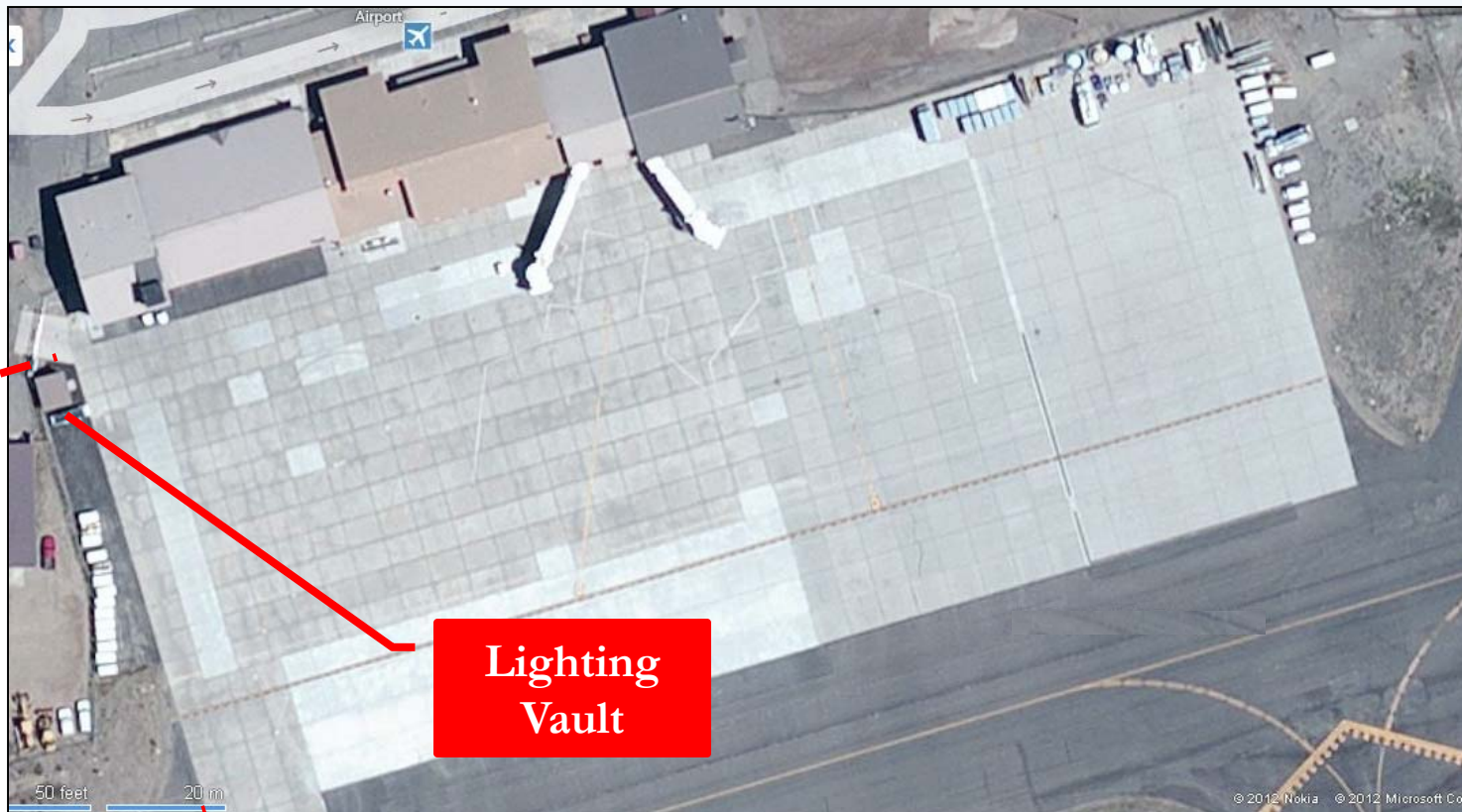


# Carson City Airport



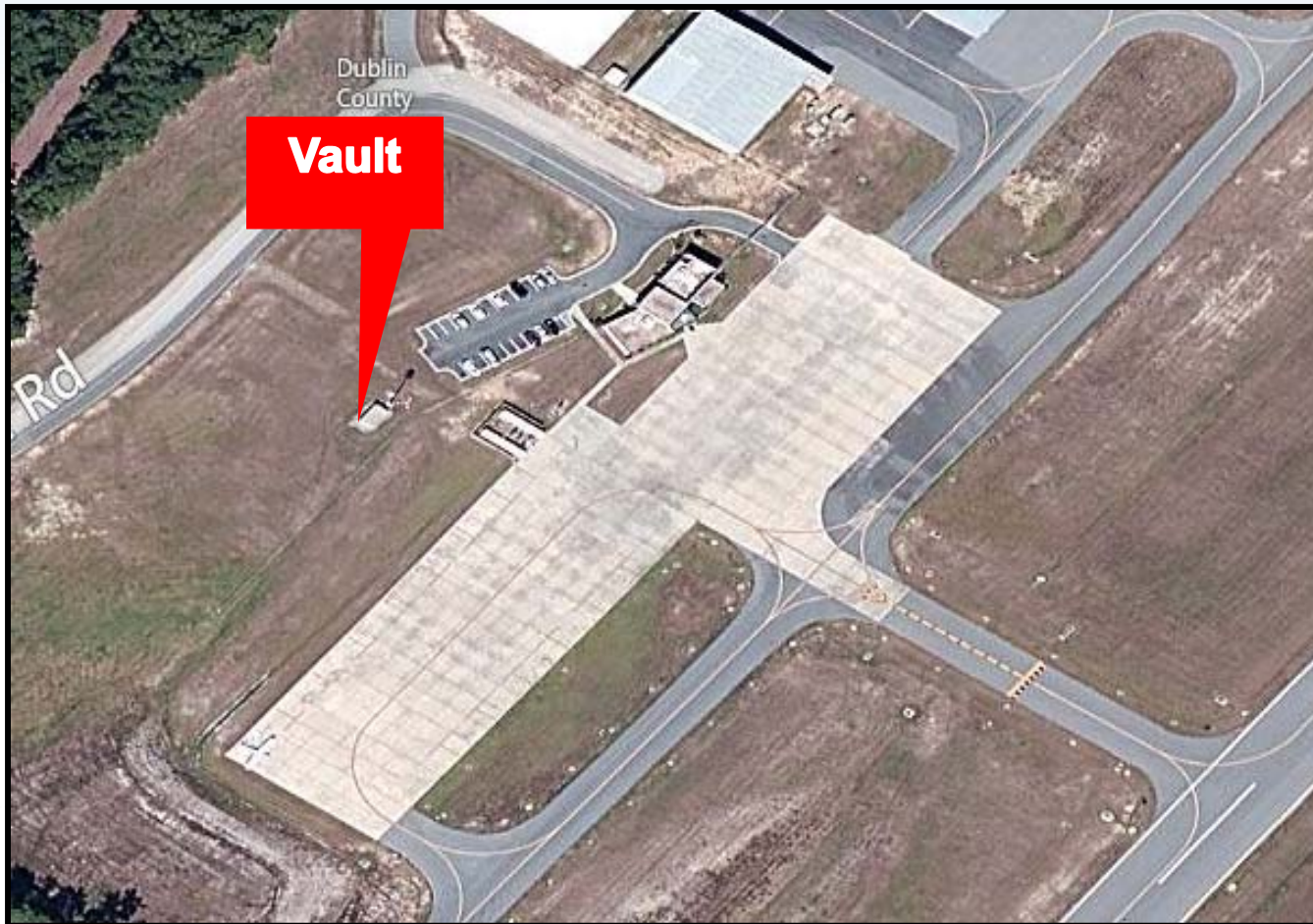


# Medium Size Airport





# Duplin County Airport

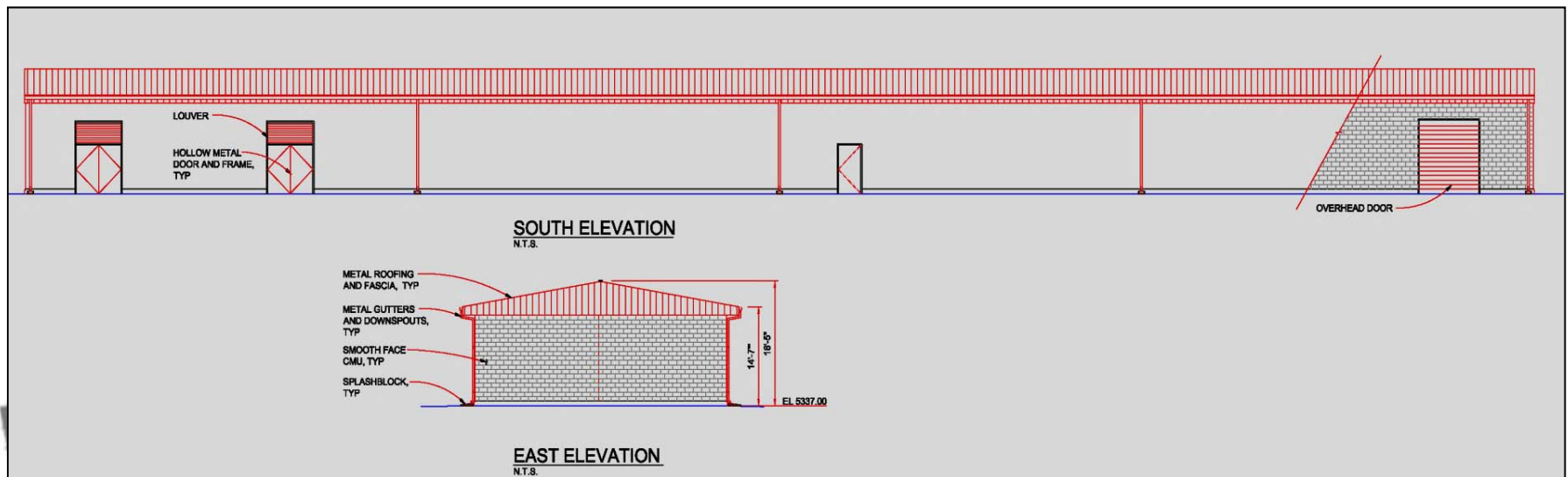
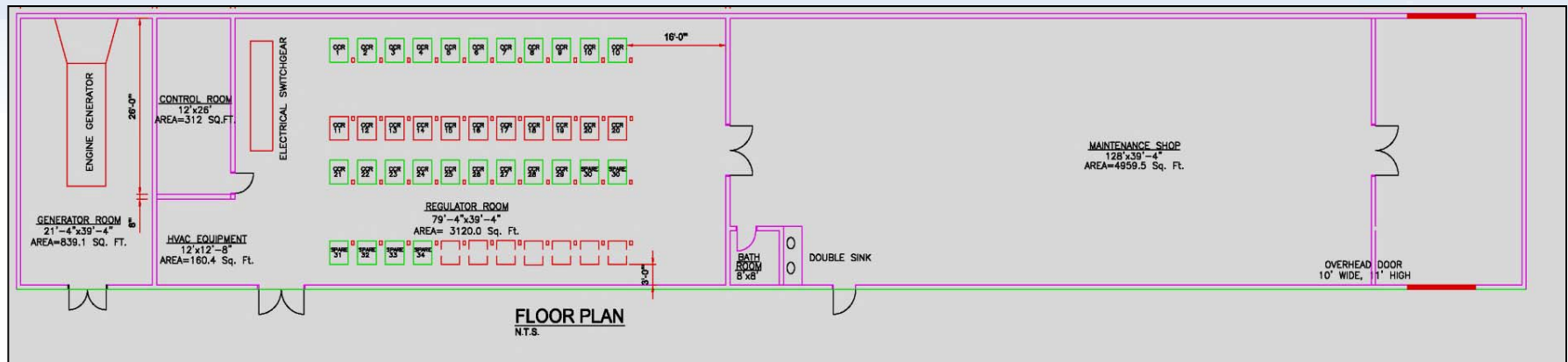


# Design Considerations

- ✈ Quantity, Location and Site Plan
- ✈ Vault Building Floor Plan
- ✈ Power Distribution System
- ✈ Airfield Lighting Control
- ✈ Rehab of Existing Vault
- ✈ Miscellaneous



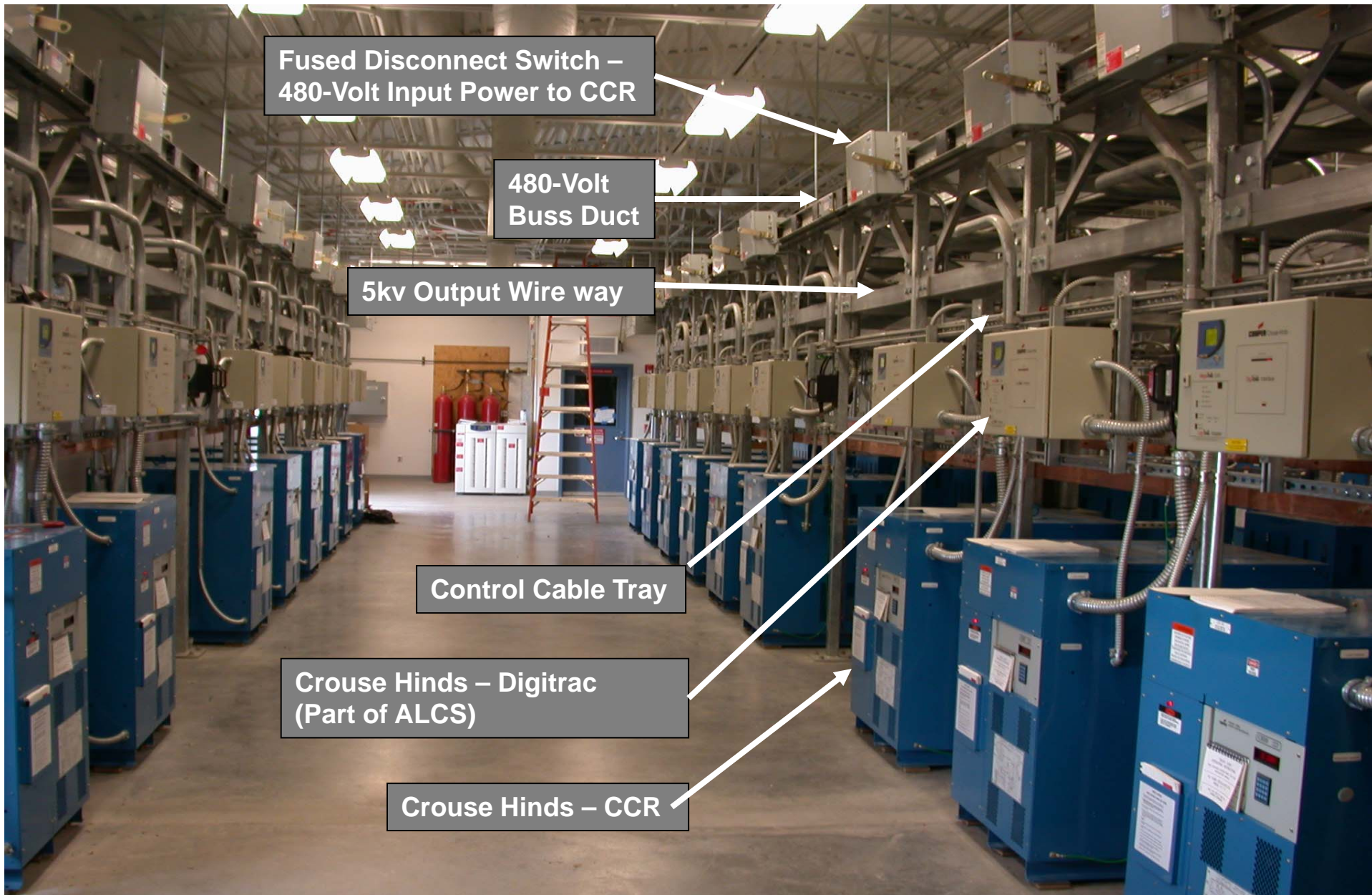
# Denver International Airport





# Maintenance Center





# Atlanta International Airport





# Atlanta Hartsfield Intl. Airport



L-828 30KW CCR in  
Regulator Room



# Atlanta Hartsfield Intl. Airport



POWER AND  
COMM.  
CANS

# Atlanta Hartsfield Intl. Airport



2400-Volt Bus Duct

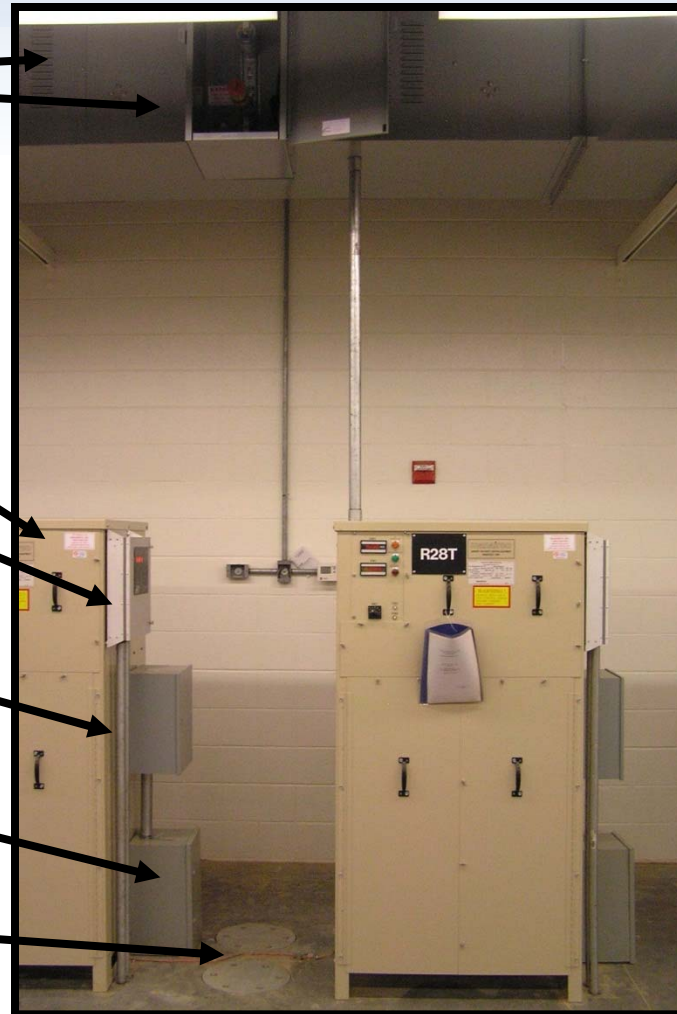
Manairco CCR

ADB ACE Unit

5kv Output Power  
To Airfield Box

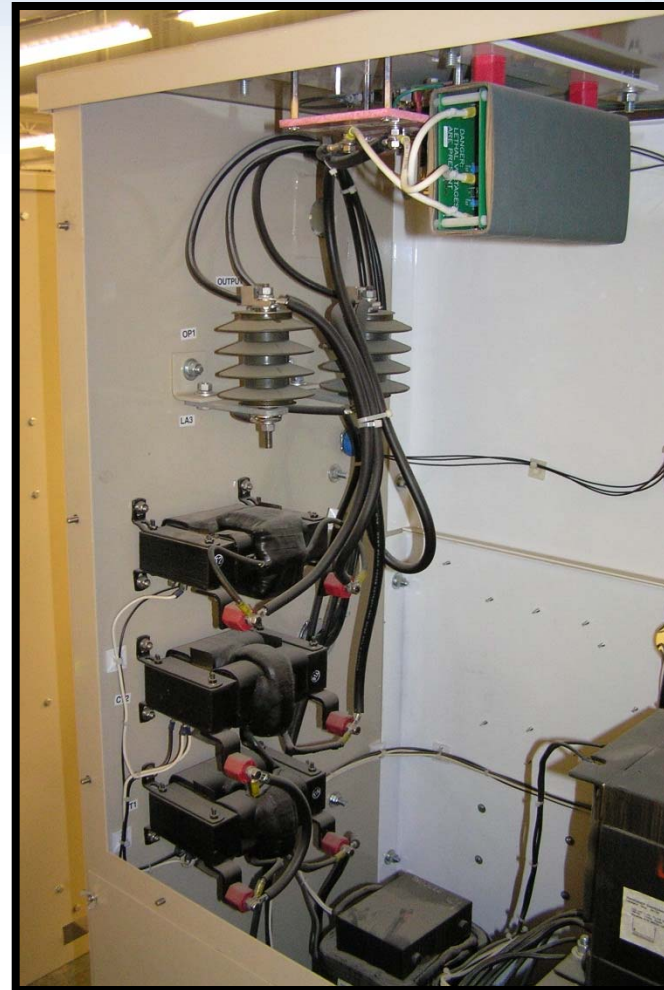
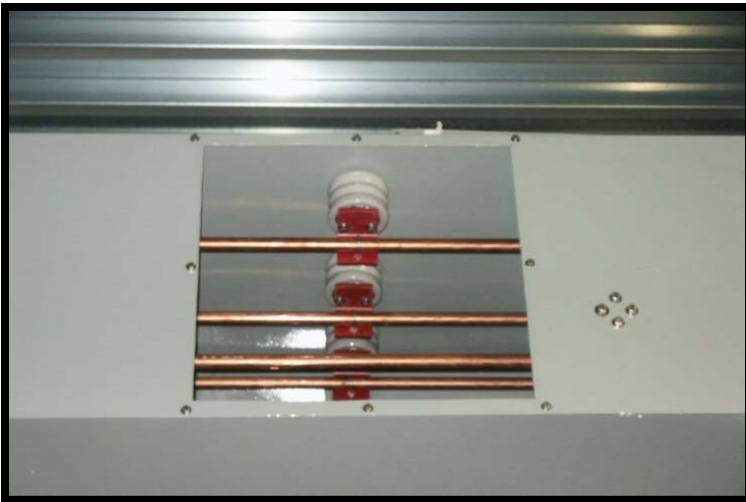
Comm Box  
To ALCS

Ground Lug





# Atlanta International Airport



# Atlanta International Airport



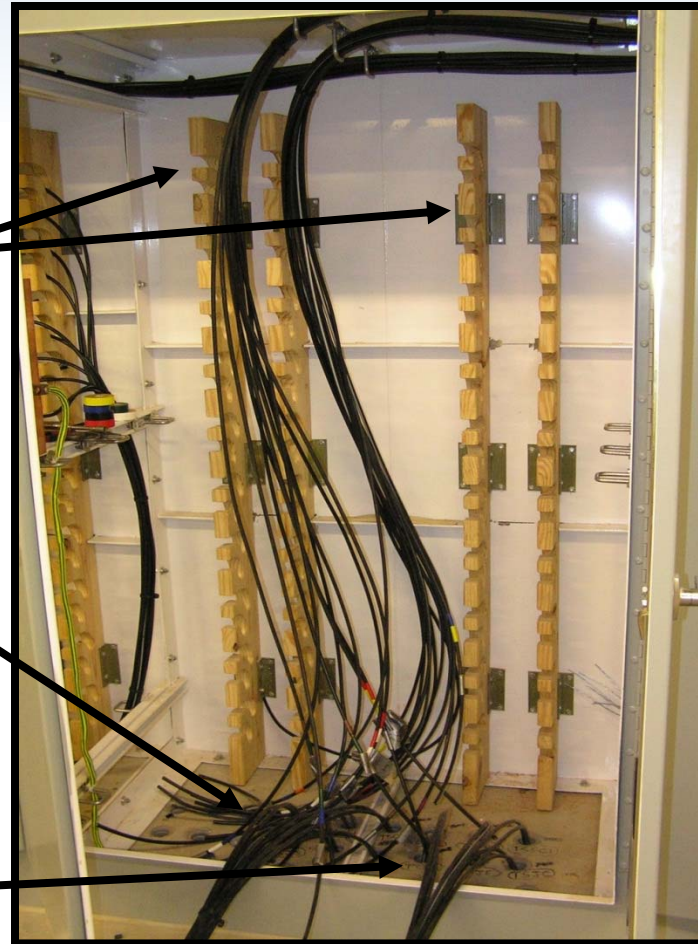
# Atlanta International Airport



**Custom Fabricated  
Wood L-823 Holder**

**Incoming  
Underground  
Duct From CCR**

**Outgoing  
Underground  
Duct to Airfield**

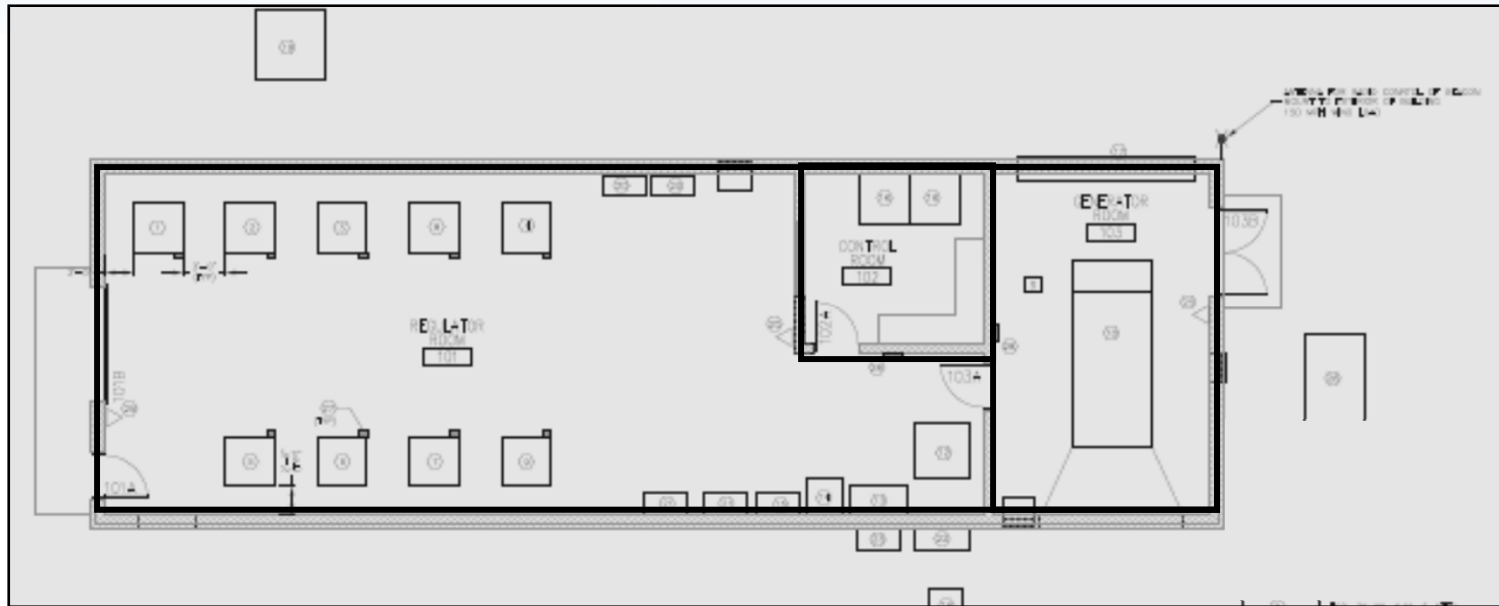




# Atlanta International Airport



# Ft. Wayne International Airport



New Airfield Lighting Vault



# Ft. Wayne International Airport



New Airfield Lighting Vault



Linked in



IESALC | Illuminating Engineering Society of North America  
Aviation Lighting Committee



# Ft. Wayne International Airport

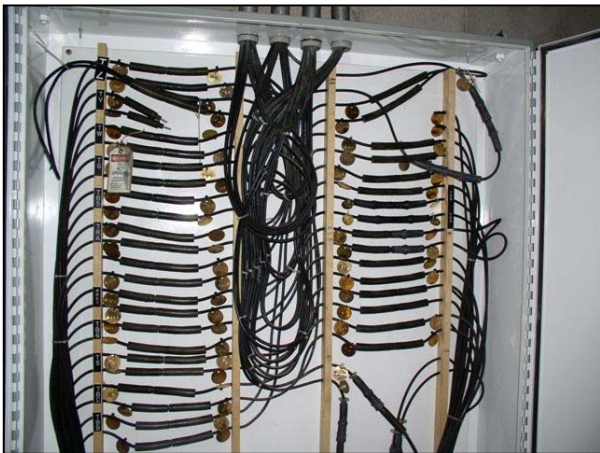


Linked in



IESALC | Illuminating Engineering Society of North America  
Aviation Lighting Committee

# Ft. Wayne International Airport



Break-Out Box



Computerized Airfield Lighting Control System (ALCS)



ALCS – Touch Screen



# The ill – Fated Vault



ALV-2

Pump  
House

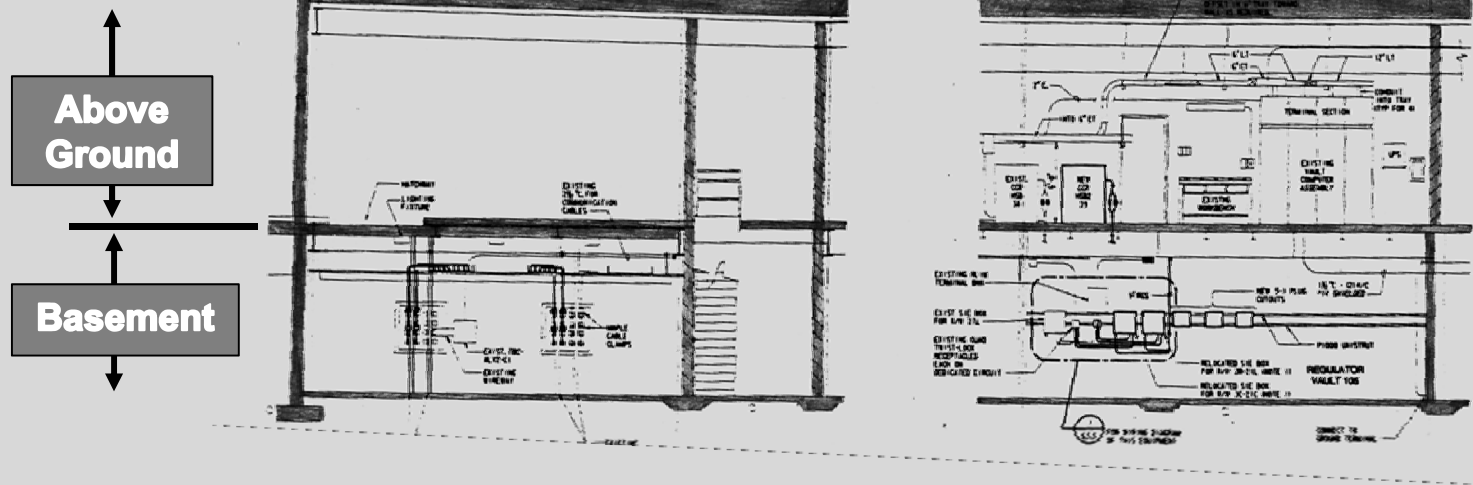
ALV-2



# Detroit Metro – ALV-2 (Demo)



# Detroit Metro – ALV-2 (Demo)



Airfield Lighting Vault – Plan View

# Detroit Metro – ALV-2 (Demo)



Regulator Room – Ground Level



# Detroit Metro – ALV-2 (Demo)



Basement



# Switchgear Type CCR

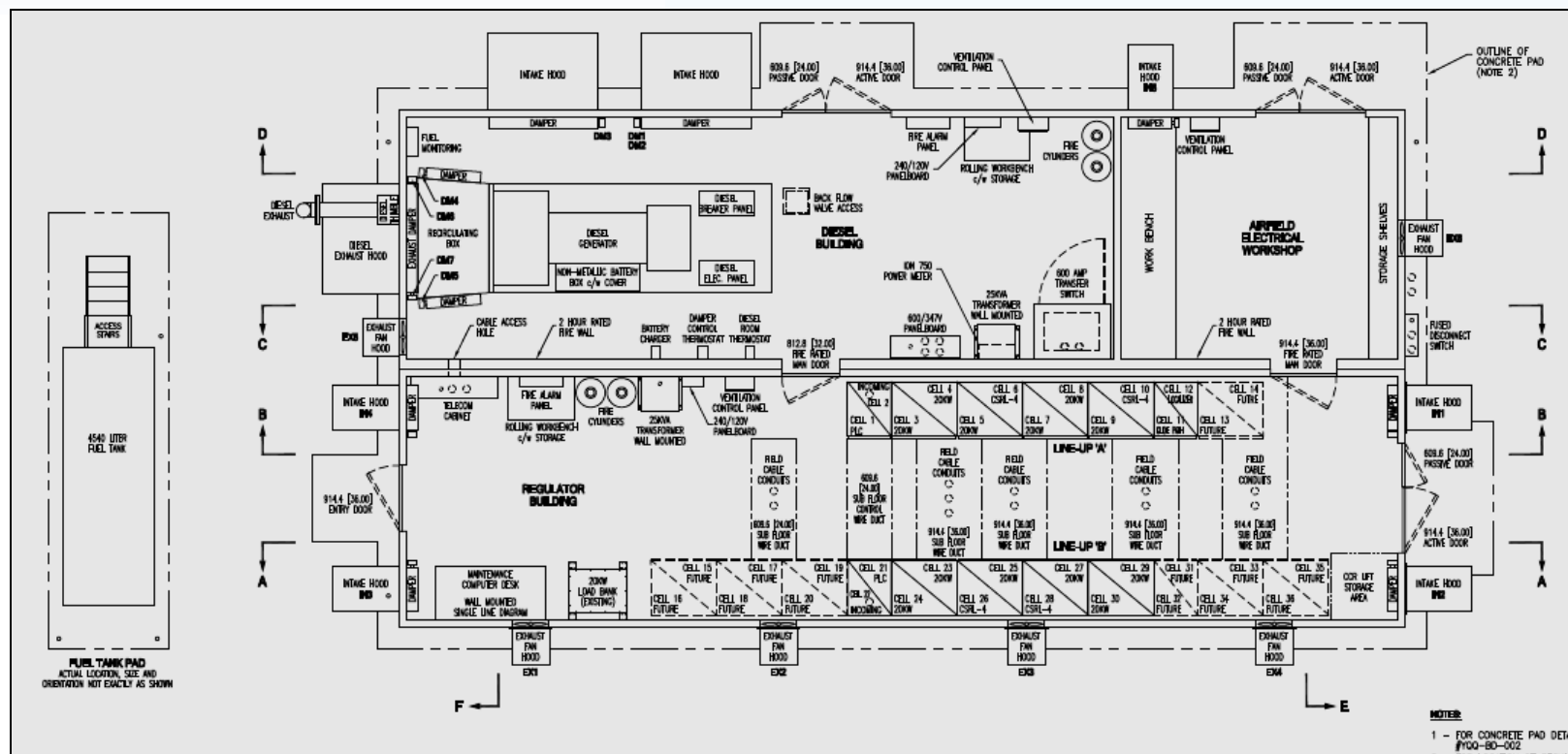
- ✈ Self Contained CCR Switchgear
- ✈ Reduced Floor Space
- ✈ S1 Cutout Cabinet
- ✈ Cost
- ✈ Compatible with Controls System



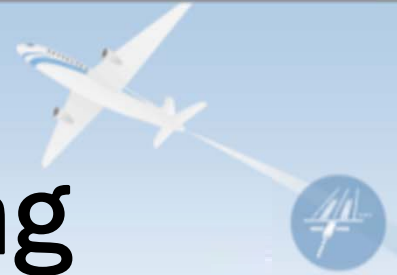
# Switchgear Type CCR

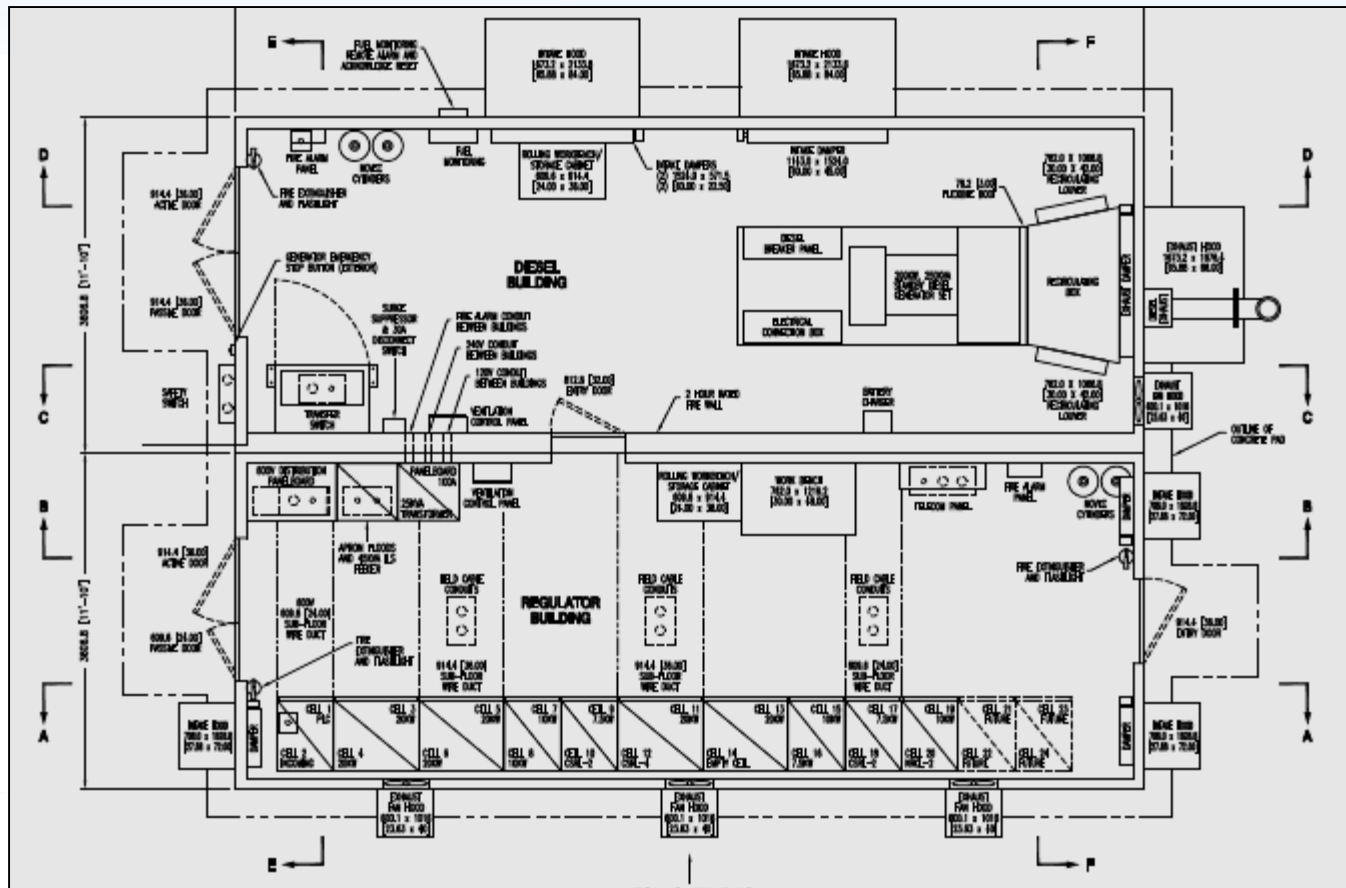






# Prefabricated Vault Building







# Goose Bay Airport



# Goose Bay Airport



# Goose Bay Airport





# Prefabricated Building



Carson City



IESALC | Illuminating Engineering Society of North America  
Aviation Lighting Committee

# Design Considerations

- ✈ Location, Quantity, Site Plan
- ✈ Vault Building Floor Plan
- ✈ Power Distribution System
- ✈ Airfield Lighting Control
- ✈ Rehab of Existing Vault
- ✈ Miscellaneous



# Power Distribution System

## ✈ Incoming Utility Services – Voltages / Amps

- ✈ Redundant Utility Feeds
- ✈ Completely Independent
- ✈ Separate Routing

## ✈ Distribution System

- ✈ Switchgear Type
- ✈ Automatic Transfer Switch

## ✈ Stand By Power

- ✈ Diesel
- ✈ Propane





# Criteria

## FAA Order 6030.20

- 53 Airports
- Maintain National Air Space
- Continuous Power for Lighting, NAVAIDS, Communications
- 4-hours Minimum

APPENDIX 1. CONTINUOUS POWER AIRPORTS AND CURRENT RUNWAY CODES <sup>1</sup>

Airport (Code)	Runway (Code)	Airport (Code)	Runway (Code)
Albuquerque (ABQ)	8	Milwaukee (MKE)	1
Andrews AFB (ADW)	1L	Minneapolis (MSP)	30L
Anchorage (ANC)	06R	Nashville (BNA)	2L
Atlanta (ATL)	9R	Newark (EWR)	4R
Baltimore (BWI)	10	New Orleans (MSY)	10
Bismarck (BIS)	31	New York (JFK)	4R
Boise (BOI)	10R	New York (LGA)	22
Boston (BOS)	4R	Oklahoma City (OKC)	35R
Chicago (ORD)	14R	Omaha (OMA)	14R
Charlotte (CLT)	36L	Ontario, California (ONT)	26L
Cincinnati (CVG)	36	Philadelphia (PHL)	9R
Cleveland (CLE)	6R	Phoenix (PHX)	8
Dallas/Fort Worth (DFW)	17C	Pittsburgh (PIT)	10L
Denver (DEN)	35R	Reno (RNO)	16R
Des Moines (DSM)	31	Salt Lake City (SLC)	34L
Detroit (DTW)	3R	San Antonio (SAT)	12R
El Paso (ELP)	22	San Diego (SAN)	9
Fairbanks (FAI)	1L	San Francisco (SFO)	28R
Great Falls (GTF)	3	San Juan (SJU)	8
Honolulu (HNL)	8L	St. Louis (STL)	30R
Houston (IAH)	26	Seattle (SEA)	16R
Indianapolis (IND)	5L	Tampa (TPA)	36L
Jacksonville (JAX)	7	Tulsa (TUL)	35R
Kansas City (MCI)	19R	Washington (DCA)	1
Los Angeles (LAX)	24R	Washington (IAD)	1R
Memphis (MEM)	36L	Wichita (ICT)	1L
Miami (MIA)	9L		



# Criteria



## FAA AC 150-5340-30

- **Continuous power facility – Operate with loss of commercial power**
- **Continuous power airports – Operate in area-wide prime power failure**
- **Uninterruptible power - power is not interrupted to the load during 15 second transfer**

## ICAO ANNEX 14

### Military

- **NAVAIR 51-50AAA-2 CAT II or III airfield, transfer in one second**
- **NATO - Defers to ICAO**



# FAA AC 150-5340-30



## **Configuration A – Emergency Power Unit**

- Normal Operations - 15 second transfer from prime power source
- CAT II Operations – 1 second transfer from prime power source
- Consist:
  - (a) Connection to a prime power source.
  - (b) Emergency power unit(s)
  - (c) Automatic transfer capability

## **Configuration B – Alternate Prime Power Source**

- Normal Operations - 15 second transfer from prime power source
- CAT II Operations – 1 second transfer from prime power source
  - (a) Connection to a prime power source.
  - (b) Connection to an alternate prime power source.
  - (c) Automatic transfer capability





# FAA AC 150-5340-30

**Configuration C – no standby power required but encouraged**

## Combined Configurations

- Two sources of power - Configuration “A” and “B”
- Normal Operations - 15 second transfer from prime power source
- CAT II Operations – 1 second transfer from prime power source



U.S. Department  
of Transportation  
Federal Aviation  
Administration

## Advisory Circular

Subject: DESIGN AND INSTALLATION  
DETAILS FOR AIRPORT  
VISUAL AIDS

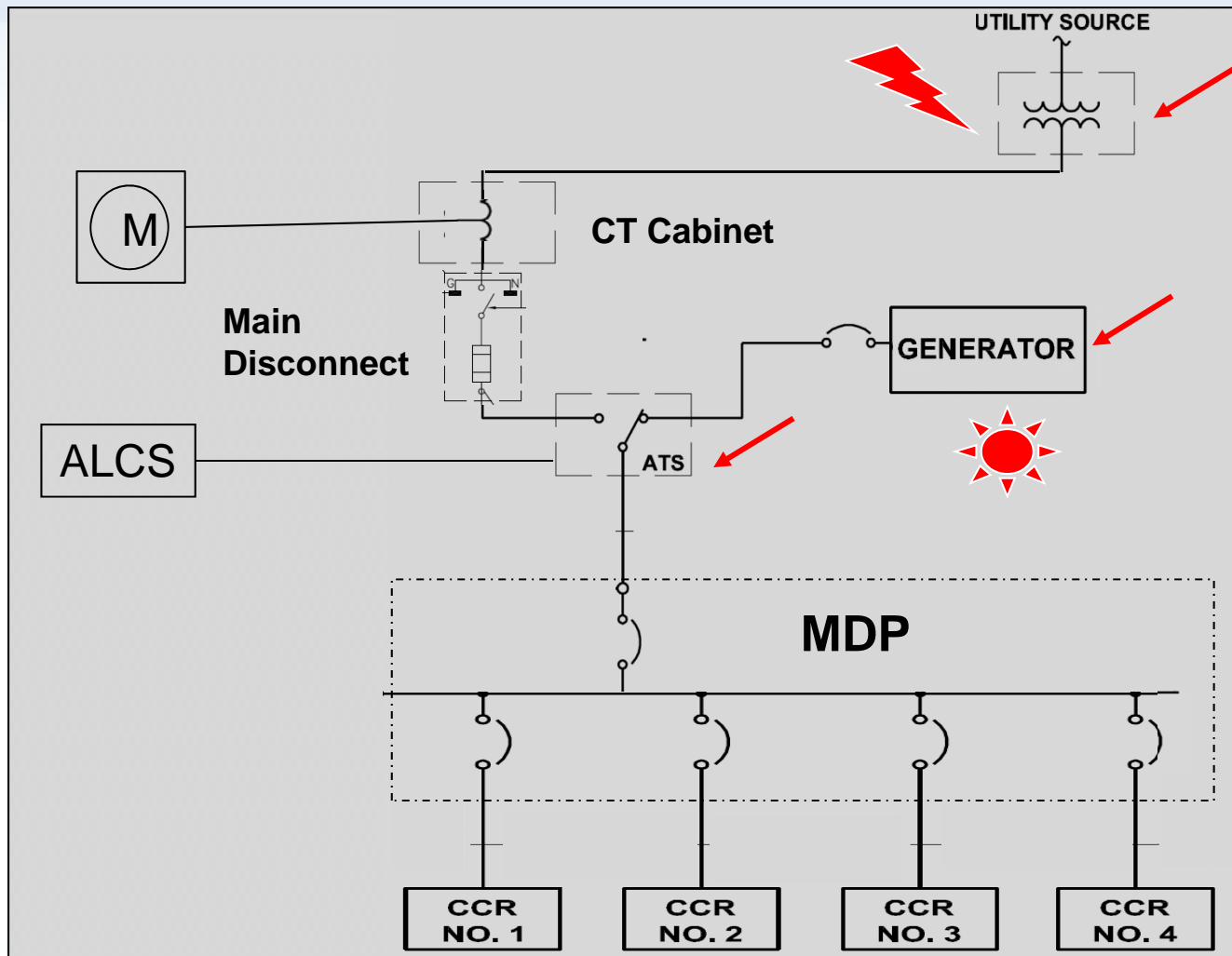
Date: 9/29/2011  
Initiated by: AAS-100

AC No.: 150/5340-30F  
Change:

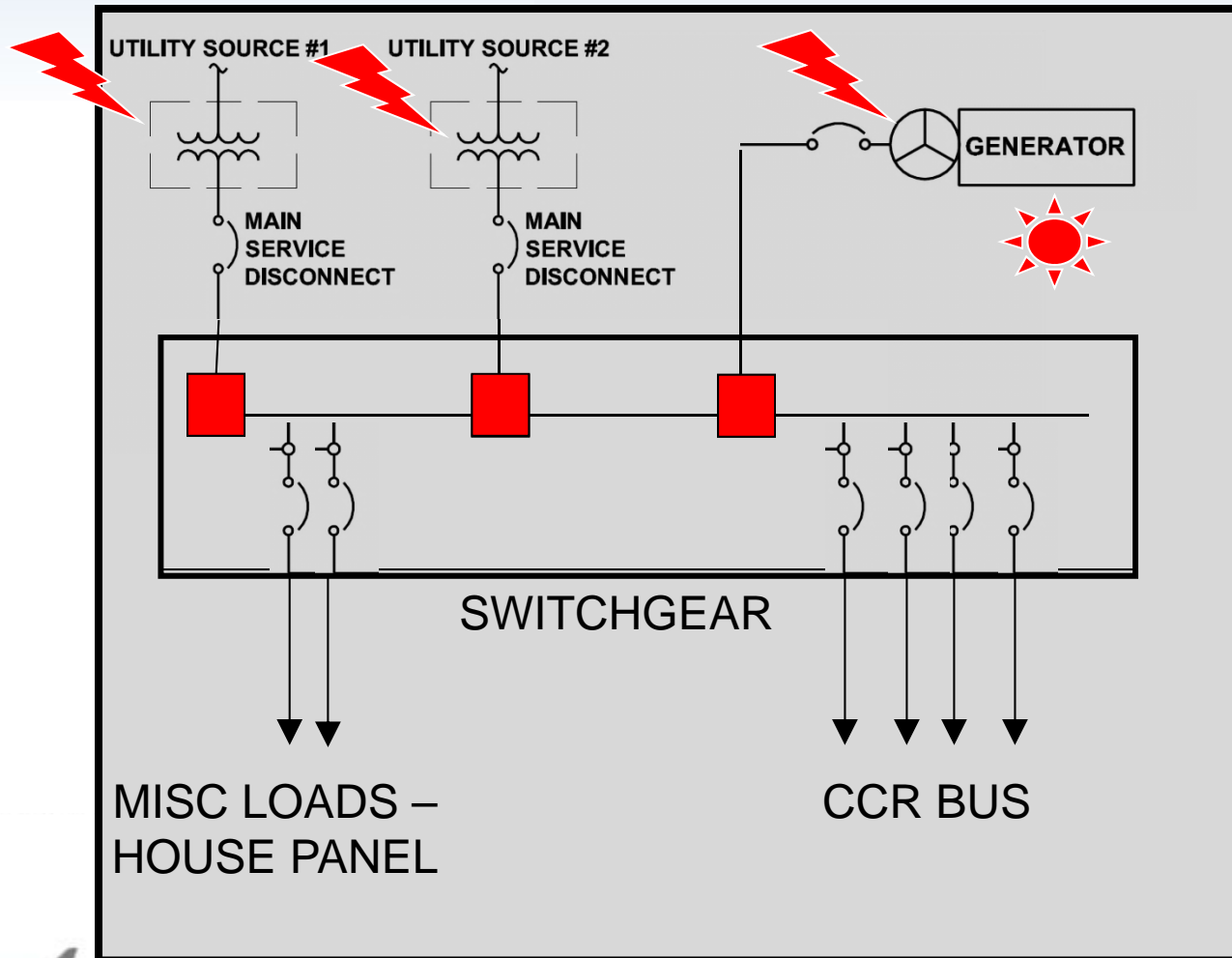
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4. **PRINCIPAL CHANGES.** The following changes have been incorporated:
  - a. Paragraph 2.1.2b(1)(c) is added to prevent mixing elevated and in-pavement light fixtures for runway threshold lights.
  - b. Paragraph 2.1.4(c) provides clarification for the application of retroreflective markers.
  - c. Table 2-2, Note 2 is clarified for the use of L-861SE light fixtures.
  - d. Paragraph 3.3(a)(1) reinstates longitudinal tolerance for runway centerline lights.
  - e. Paragraph 4.3, Taxiway Centerline, additional information is added to clarify the use of yellow and green fixtures.
  - f. Paragraph 12.5 references NFPA 780, Standard for the Installation of Lightning Protection Systems, is included to provide additional information for the installation of lightning protection systems on airfields.
  - g. Paragraph 12.6 adds additional information found in the National Electric Code (NEC) Handbook and NFPA 780 about grounding stakes.



# One-Line Diagram – Config. A



# One-Line Diagram – Config. A & B

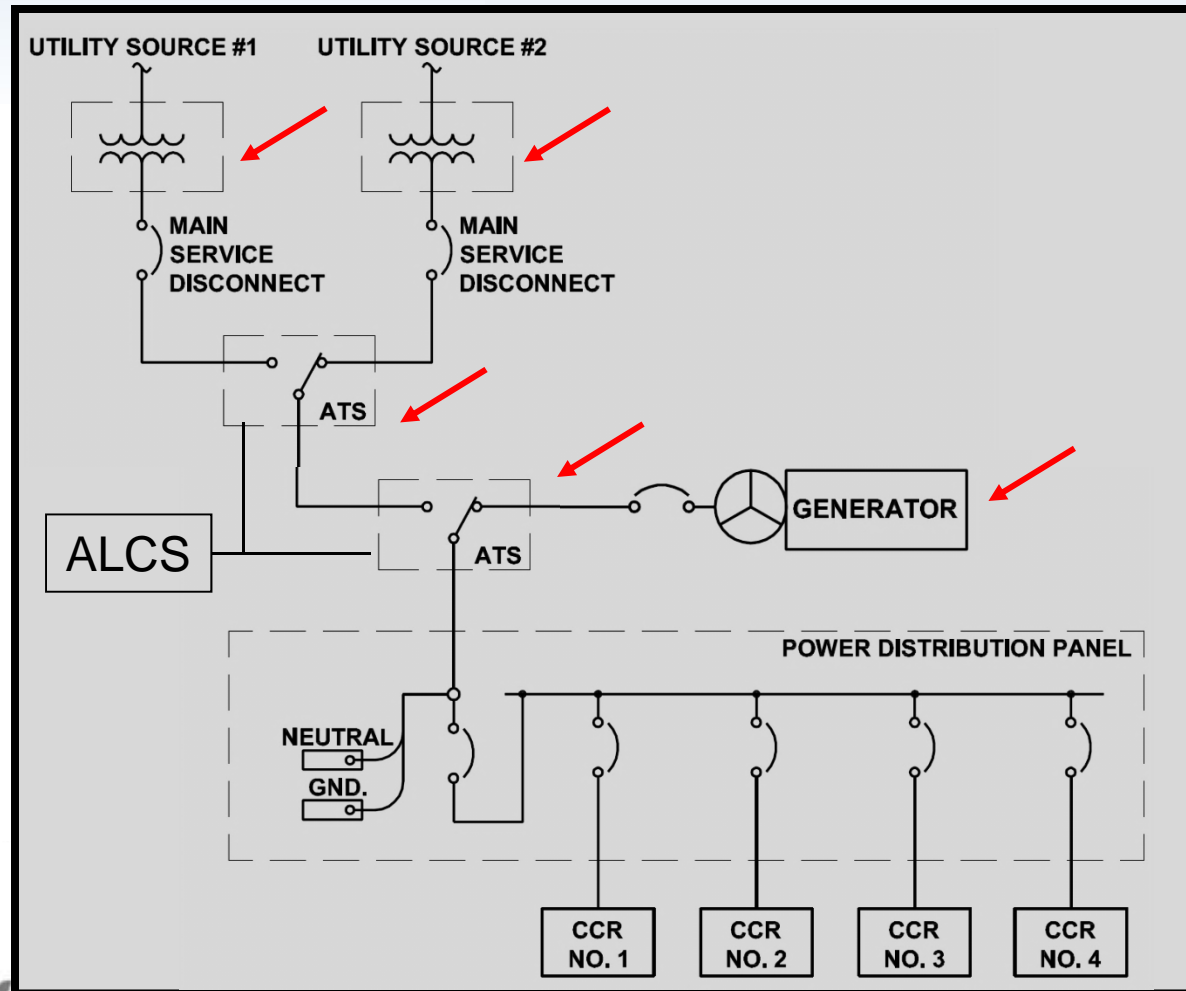




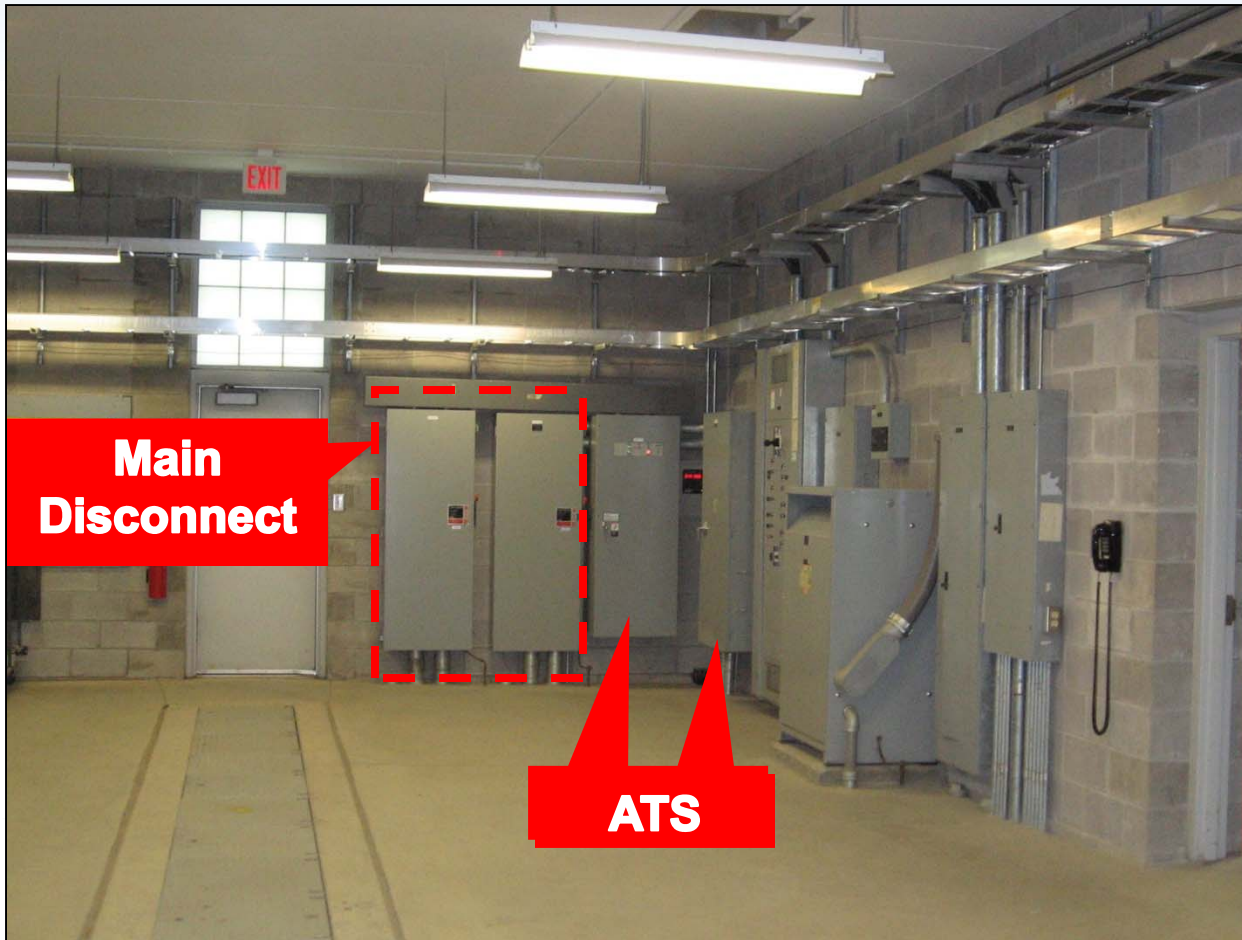
# Switchgear Distribution System



# One-Line Diagram – Config. B



# Port Columbus Intl. Airport



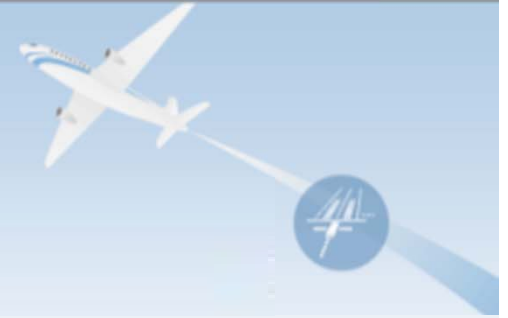


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- ✈ Miscellaneous



# Airfield Lighting Control



## ✈ CPU Based

- ✈ Specialized Equipment
- ✈ Touchscreen Control In ATCT
- ✈ Monitoring and Maintenance Functions

## ✈ PLC Based

- ✈ Non-Specialized Equipment
- ✈ Touchscreen Control In ATCT

## ✈ Toggle / Rotary Switch with Relay Panel

- ✈ Older Technology
- ✈ Reliable and Cost Effect
- ✈ Ties into Radio Controller



# Airfield Lighting Control



## ✈ Communication Links

- ✈ Fiber Optic
- ✈ Copper Communication Cables
- ✈ Wireless

## ✈ Routing of Communication Ducts

- ✈ Multiple Communication Lines
  - ✈ Segregated Communication
  - ✈ Segregated Ducts





# CPU Based – Star Configuration

## Communication Modes

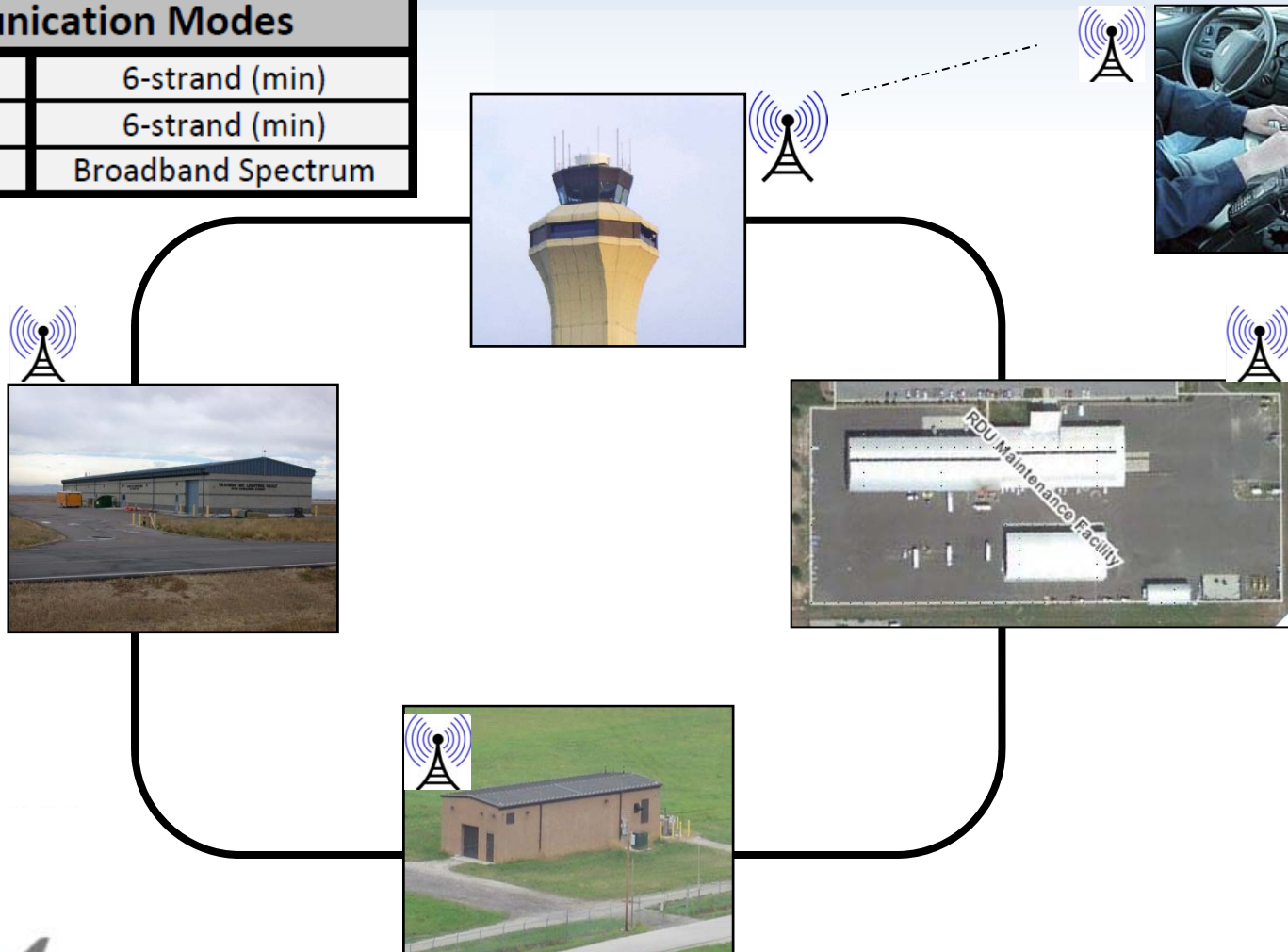
Fiber No. 1	6-strand (min)
Fiber No. 2	6-strand (min)
Radio Backup	Broadband Spectrum



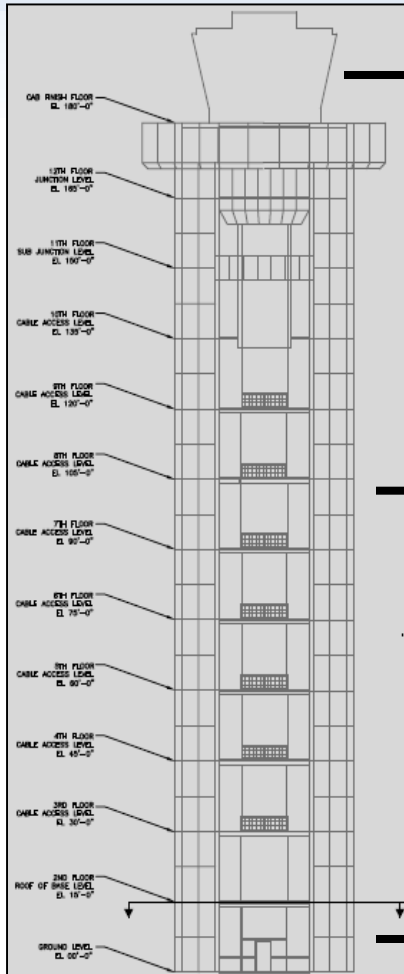
# CPU Based – Ring or Loop

## Communication Modes

Fiber No. 1	6-strand (min)
Fiber No. 2	6-strand (min)
Radio Backup	Broadband Spectrum

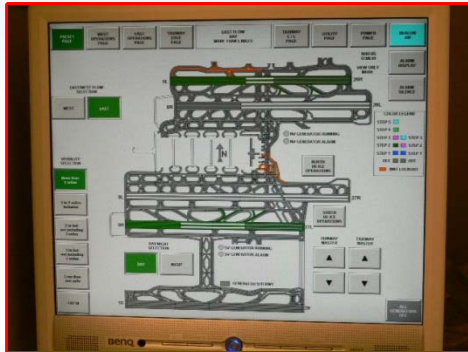


# ATCT





# Airfield Lighting Vault



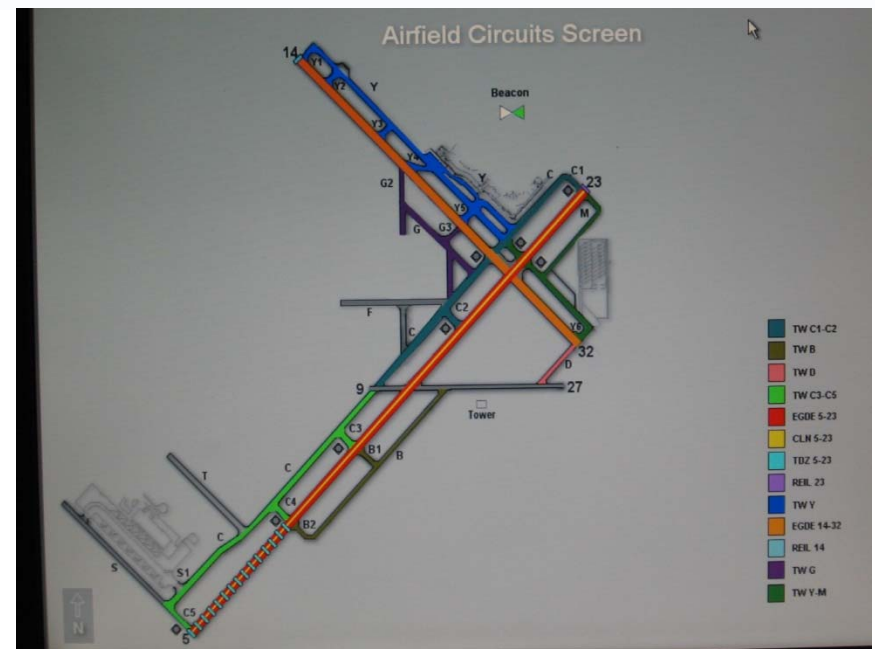
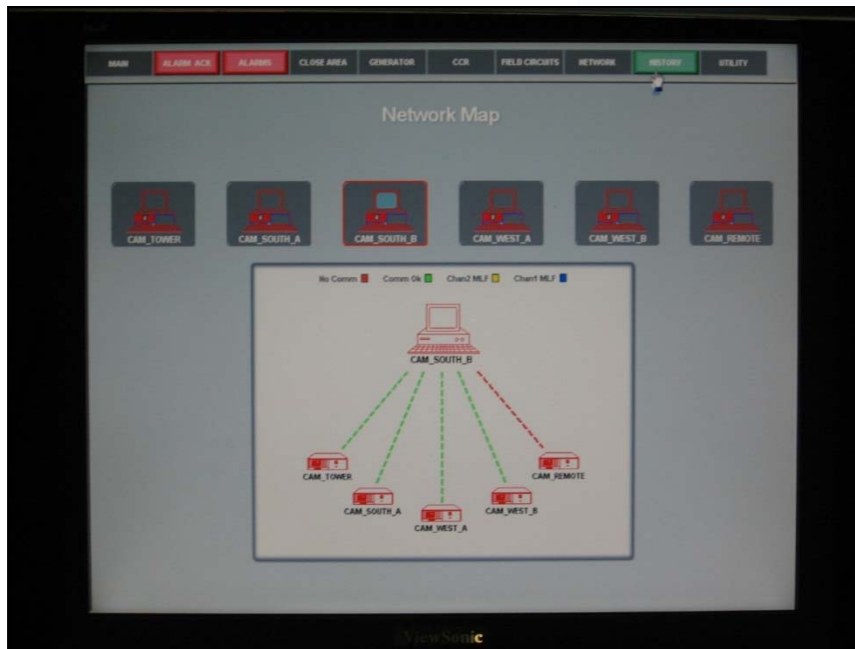
**Control Room**



**CCR Room**



# Airfield Lighting Vault

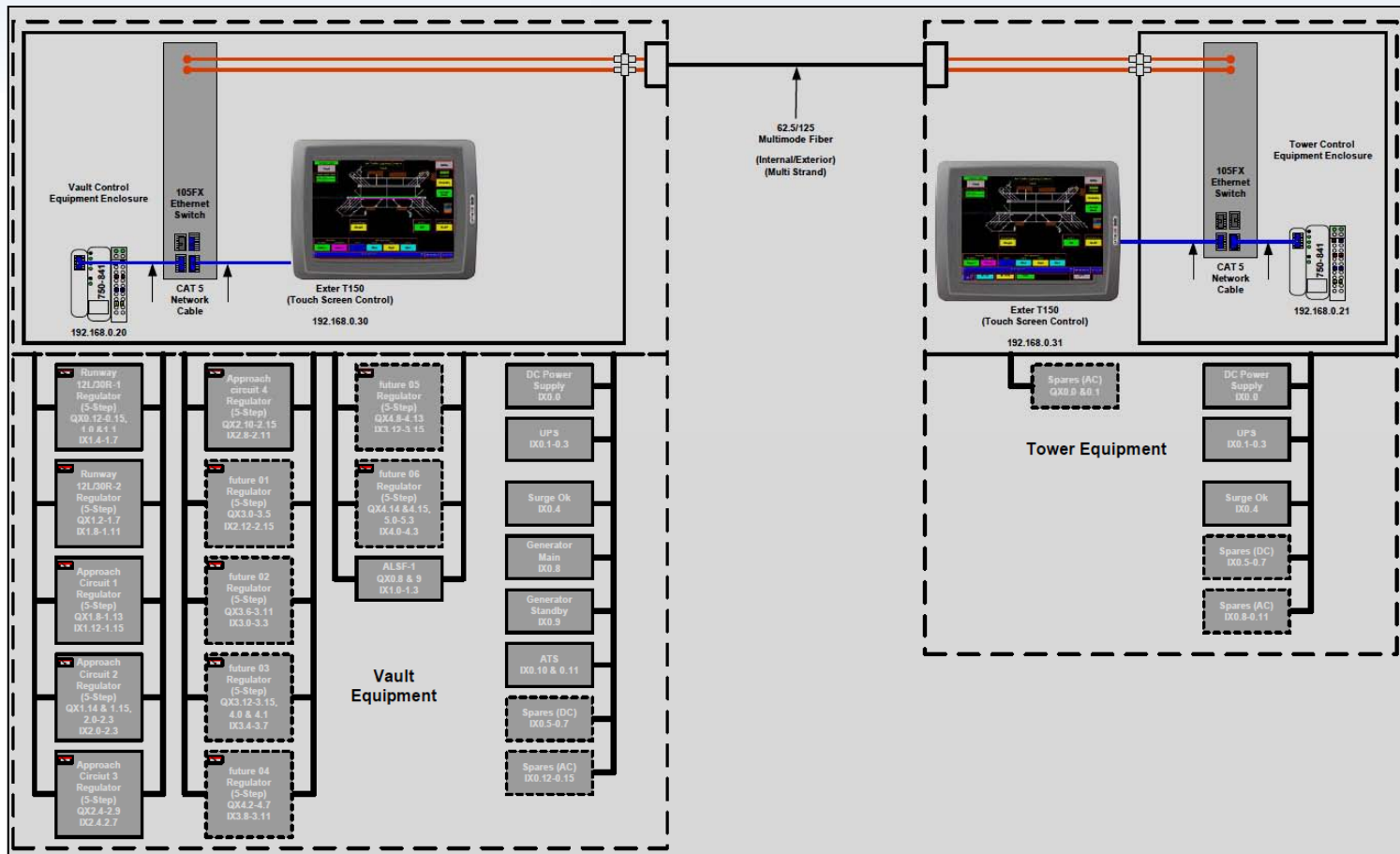


# PLC Based System

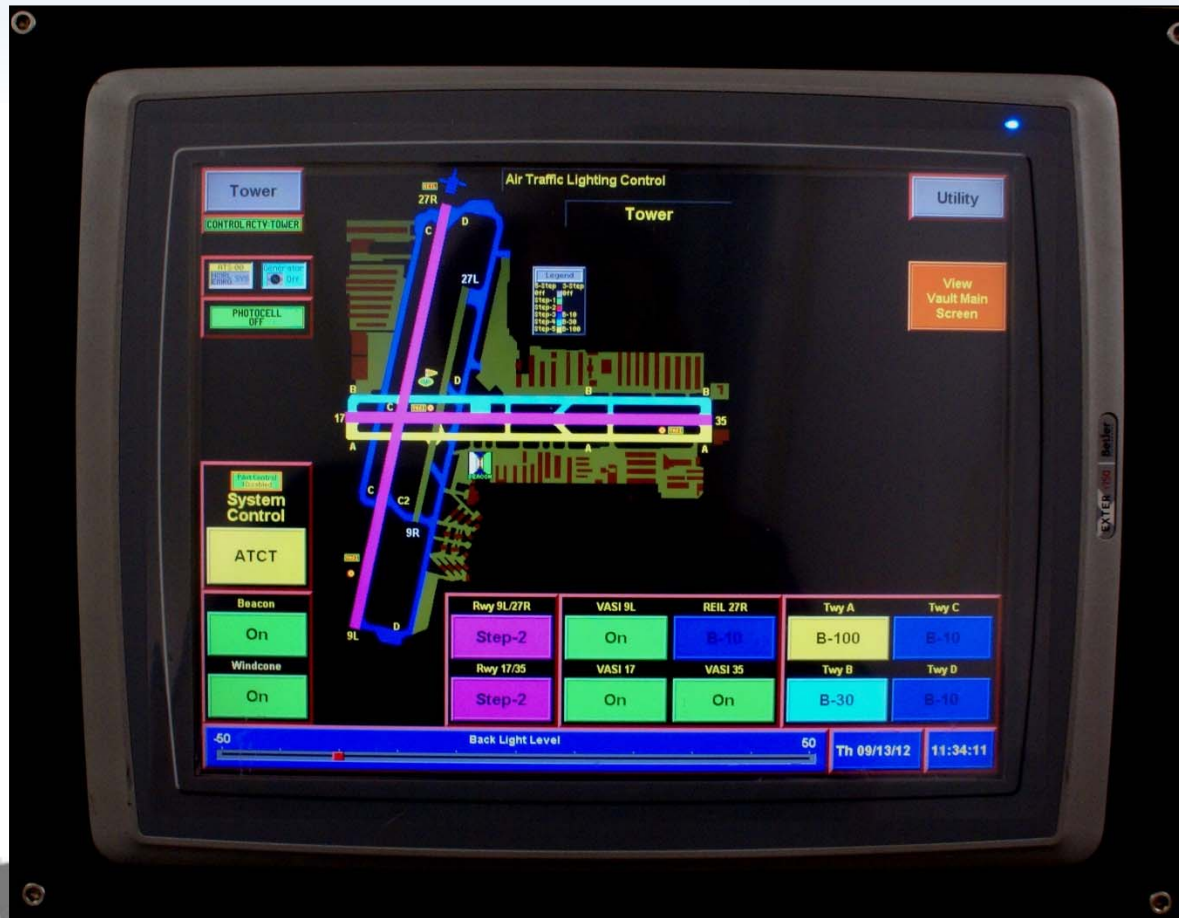
- PLC based system with fiber or wireless system
- Plug and Play between touchscreen and PLC cabinet
- Commercially available off the shelf hardware
- Easily expand the number of touchscreens
- Field programmable with flash drives and SD cards
- Active color graphics customized for each airfield
- Color touchscreens are available up to 21"
- Industrial PC touchscreens are available for the larger sizes (15"-21")
- Low maintenance cost
- Cost Effective and Reliable



# PLC Based System



# PLC Based System





# Rotary and Toggle Switch



# Design Considerations

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- ✈ Miscellaneous

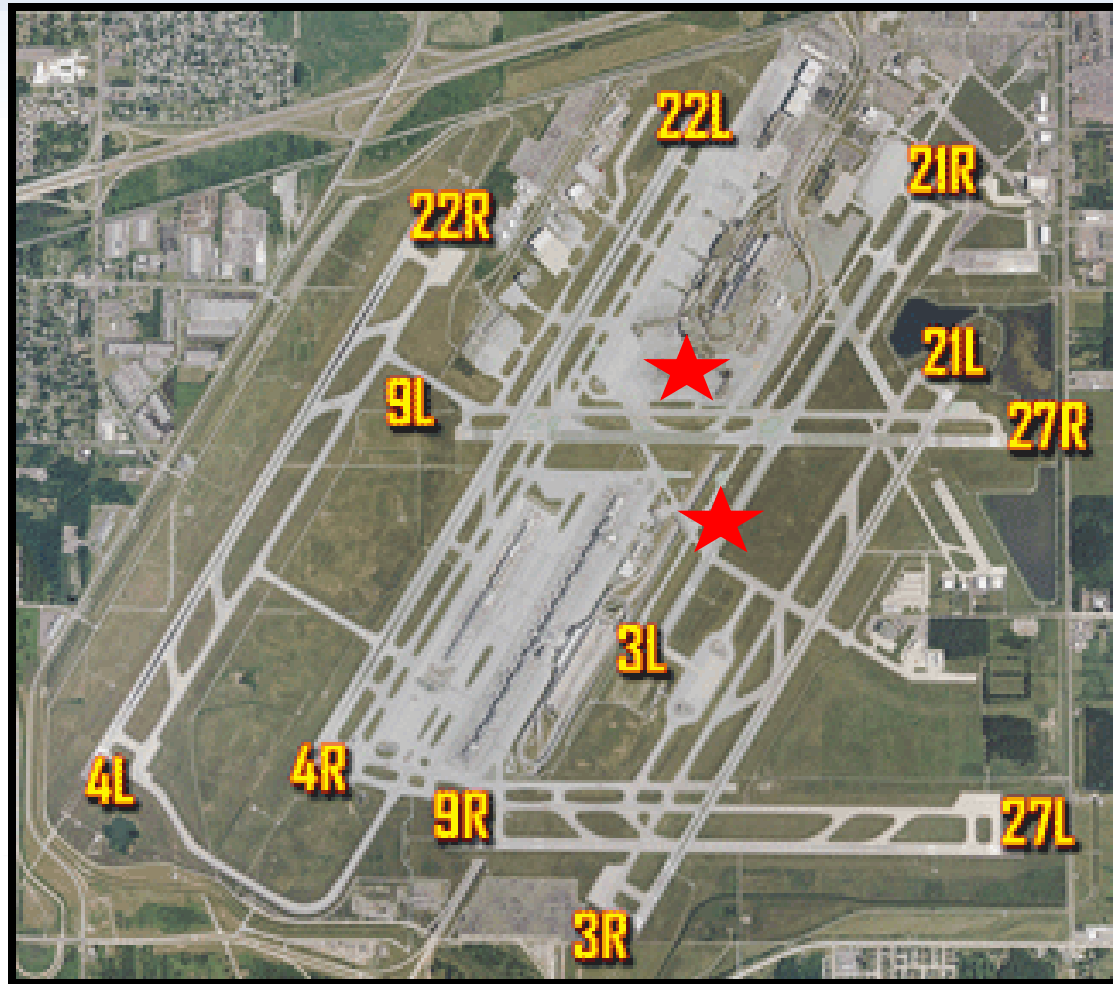


# Rehab of Existing Vault

- ✈ Phasing
  - ✈ Operational Airfield
  - ✈ Reliable Airfield
- ✈ Safety
- ✈ “Dust” Factor
- ✈ “Create” Floor Space



# Rehab of Existing Vault





# Design Considerations

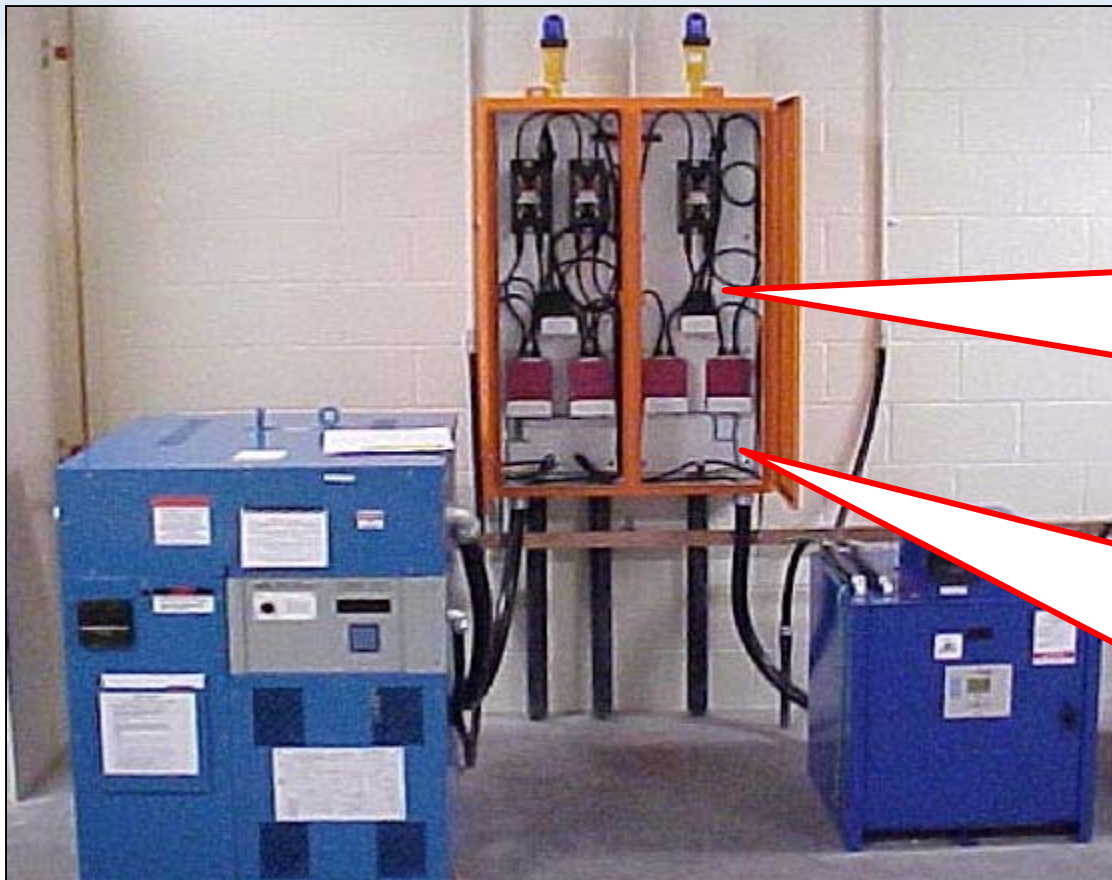
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# Charleston AFB



# Charleston AFB





# Load Balancing





# Room Lighting



# Stackable CCR





# Work Area

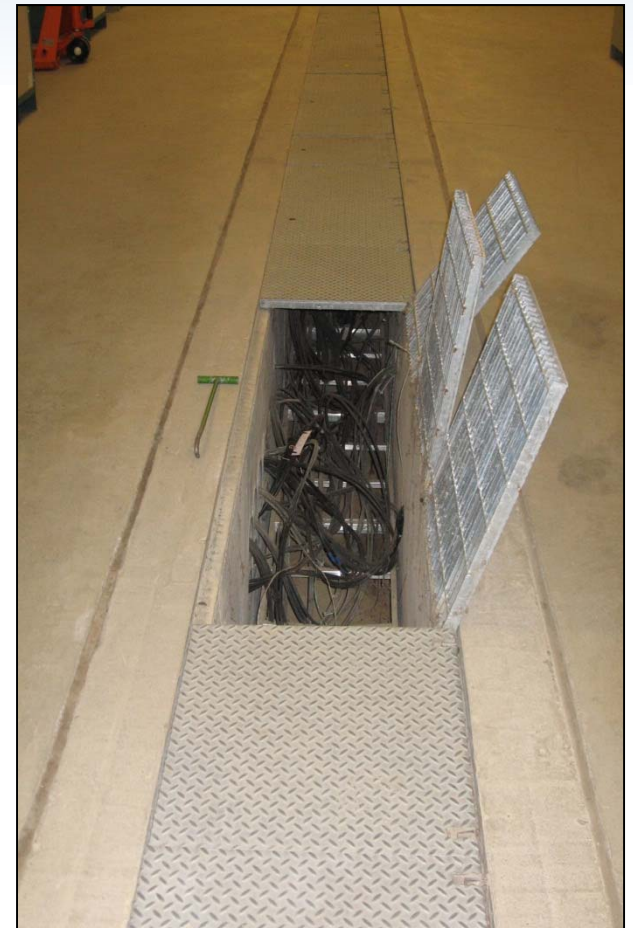


# Emergency Generator Plug





# Port Columbus Intl. Airport



# Loading Dock



Mr. Richard Walls, P.E.  
NCDOT  
rjwalls@ncdot.gov  
919.840.0112

October 2012  
St. Pete, Florida

Any  
Questions

