ATKINS

Aviation Electrical Infrastructure

Improved Management Processes for the Design, Construction and Maintenance of Airfield Electrical Systems

Presented to:
IESALC
2013 Annual Conference
Tucson, Az.

Today's program:

- Elevate the priority of Airfield Electrical Systems
- Discuss the importance of establishing processes and procedures
- Develop Process Improvement framework:
  - Plan
  - Design
  - Construct
  - Maintain
  - Evaluate

- Leverage planning and preventative maintenance practices
- Do you know where you want to go, or more importantly NEED it to be?

State of the Industry

- SAFETY is still #1
- Aging systems & infrastructure
- Reduced Funding / Rising Costs
- Improperly Configured Systems
- Existing Infrastructure Inadequacy
- Preventative maintenance shortfalls
- Evolving energy demands

!!! LETS TALK ELECTRICAL !!!

Outsiders View:

If it's not broken, don't worry about it…

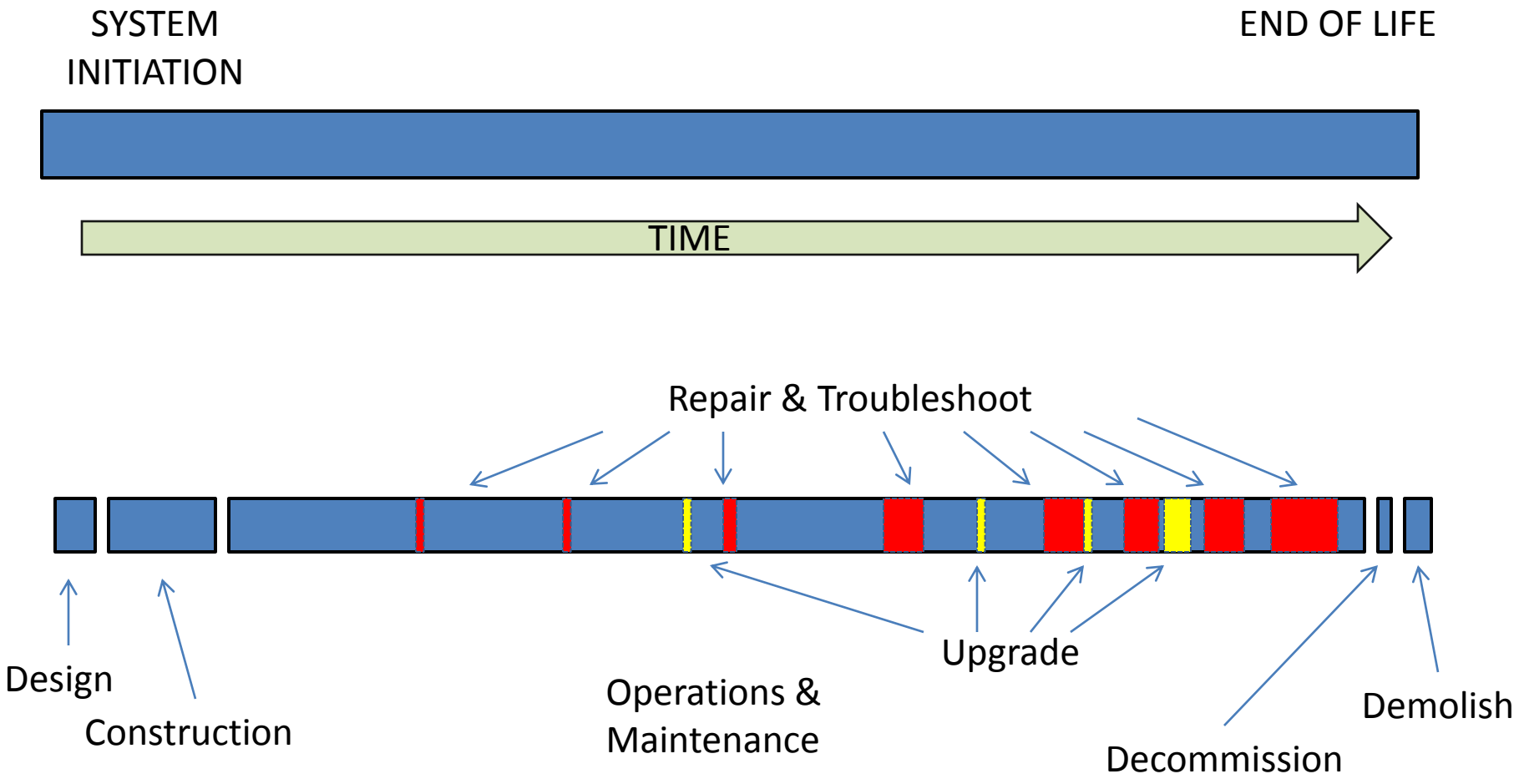
… BUT, when it fails…

HURRY UP AND FIX IT!

We propose…

… planning and forethought can alleviate the operational, logistical and emergency situations that interrupt the purpose of an airport … to fly.

ELECTRICAL SYSTEM LIFECYCLE

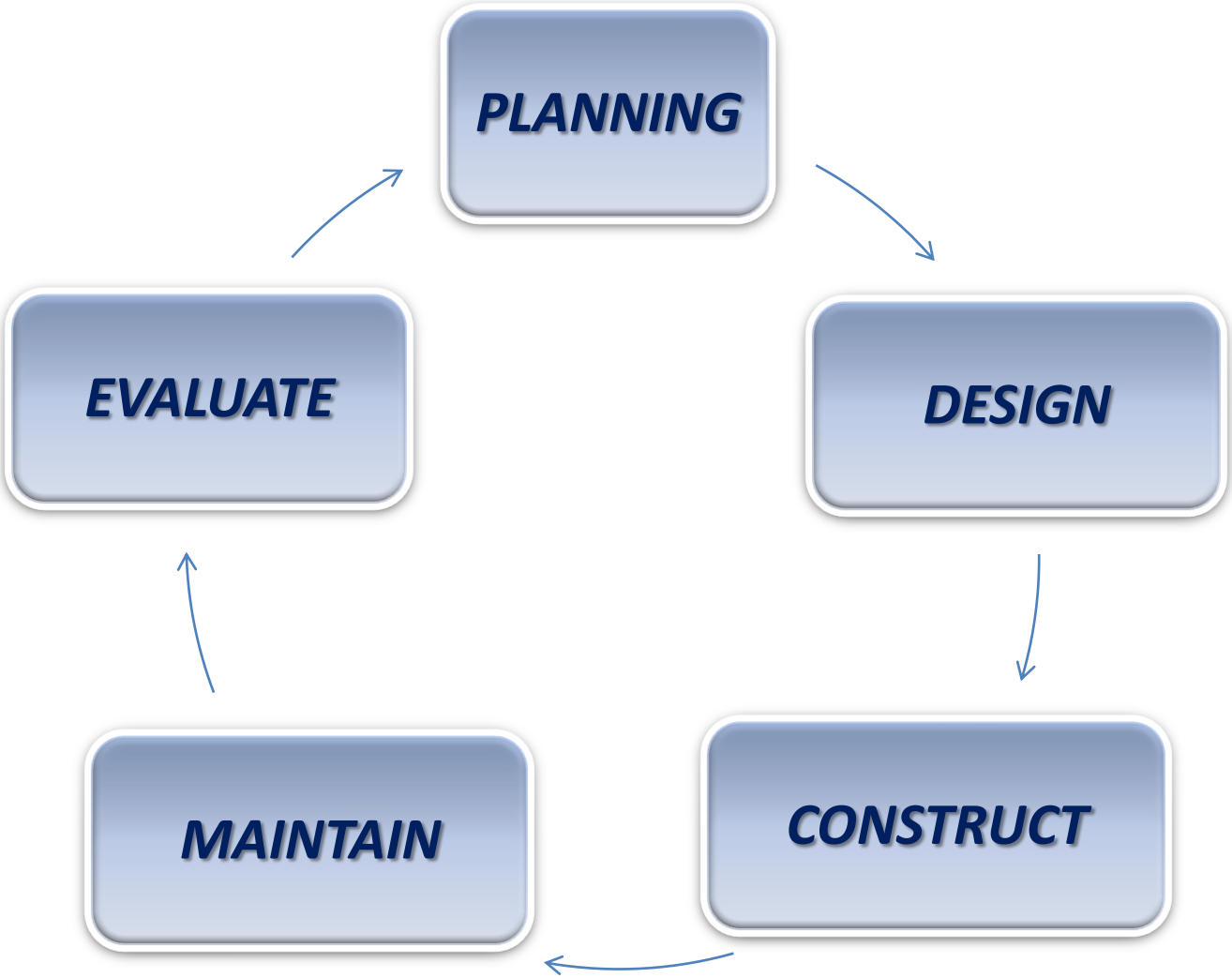


Communicating the Cost of Electrical Failures

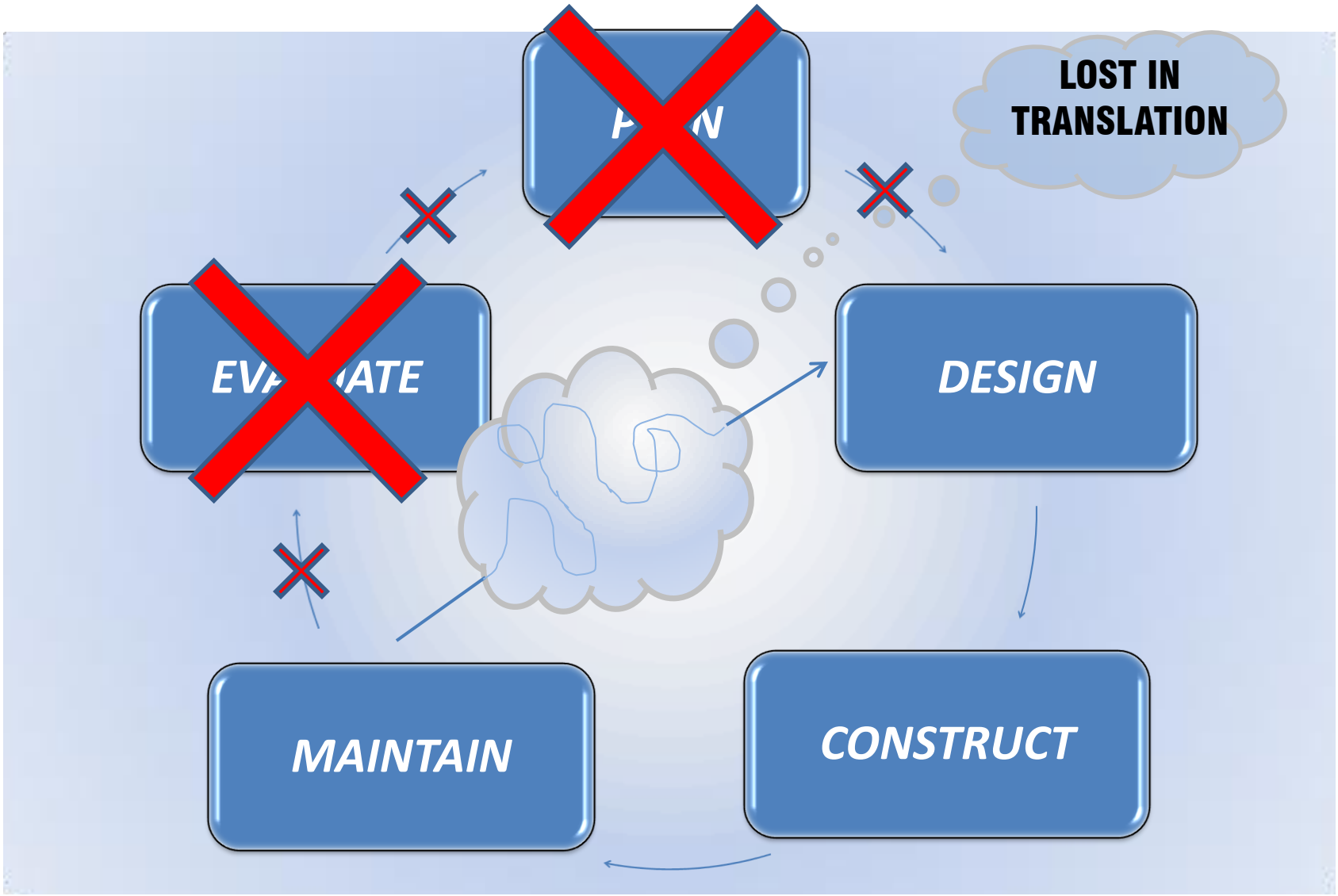
- Operational Safety
- Restricted, Delayed or Lost Operations
- Security Breaches
- Lost revenue generation
  - Parking, Concessions
- Public Reputation
- Actual Cost of Repairs (Material & Labor)
  - Scheduled and Emergency

FACILITATING IMPROVEMENT

Facilitating Improvement:



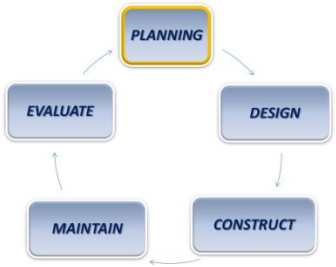
The “NOT-Facilitating” Improvement Model:



Facilitating Improvement:

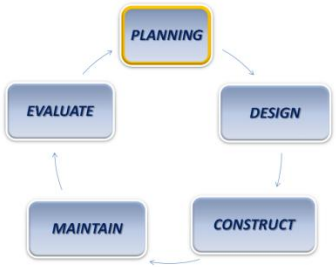
Master Plan the Electrical System Considerations:

- Look at the big picture
  - Buildings / Terminals / Hangar Development
  - Airfield Pavement Addition or Removal
  - Drainage Improvements
  - FAA Systems (NAVAIDS, FOTS, RADAR)
- Landside and Commercial Opportunities
- Water, Electric, Gas, Communications Utilities



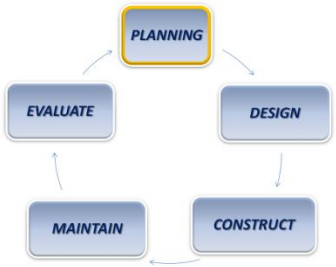
FAA Order 5100.38C – AIP Handbook 402. THE AIRPORT CAPITAL IMPROVEMENT PLAN (ACIP).

"A capital improvement program is the compilation of planned projects *for the next three to five years* including the priority, costs, and expected funding sources for each project. Capital improvement programming may be accomplished as a part of airport system or master planning projects and in a supplemental project."



Electrical Master Planning – Execution:

- Compliment the ALP
- Invest in As-Built audits / Utility Atlas
- For new projects, build in small, deliberate pieces over time
  - Key-in on operational needs
  - Hot spots or points of failure
  - Coordinated with ALP
- Maintain a critical project list with priority and budget cost



Example Development Plan

IESALC International Airport , Lowes Ventana, AZ
PROJECT SAMPLE PLAN
PROPOSED PROGRAM PROJECT COST OPINION

Revision Date: 10/21/13

Program Element #:	Proposed Improvement Projects	Budget				Contingency		TOTAL PROJECT BUDGET
		Engineering & Design Services	CM/ Resident Inspector	3rd Party Testing / Services	Construction / Contracting/ Equipment	%	$	
1	Comprehensive Existing Conditions – Airfield Electrical Utility Atlas	$ 65,000.00	$ -	$ 15,000.00	$ 25,000.00	10%	$ 10,500.00	$ 115,500.00
2	Home Run Duct Bank Reconstruction	$ 173,500.00	$ 58,450.00	$ -	$ 1,735,000.00	15%	$ 295,042.50	$ 2,261,992.50
3	Runway 6-24 Lighting and Cable Replacement	$ 61,890.00	$ 23,380.00	$ 5,000.00	$ 618,900.00	15%	$ 106,375.50	$ 815,545.50
4	Runway 1-19 Lighting and Cable Replacement	$ 12,330.00	$ 23,380.00	$ 5,000.00	$ 123,300.00	15%	$ 24,601.50	$ 188,611.50
5	Runway Signage Upgrades	$ 74,850.00	$ 40,915.00	$ 5,000.00	$ 748,500.00	15%	$ 130,389.75	$ 999,654.75
6	Taxiway Signage Upgrades	$ 24,950.00	$ 23,380.00	$ 15,000.00	$ 249,500.00	10%	$ 31,283.00	$ 344,113.00
7	New Elevated RGL System	$ 48,000.00	$ 23,380.00	$ 15,000.00	$ 480,000.00	10%	$ 56,638.00	$ 623,018.00
8	Taxiway A, A1, A2, A3 Lighting and Cable Replacement	$ 15,595.00	$ 23,380.00	$ 5,000.00	$ 155,950.00	15%	$ 29,988.75	$ 229,913.75
9	Taxiway B, B1, B2, B3 Lighting and Cable Replacement	$ 76,390.00	$ 17,535.00	$ 5,000.00	$ 763,900.00	15%	$ 129,423.75	$ 992,248.75
10	Taxiway C, C1 C2, C3 Lighting and Cable Replacement	$ 16,275.00	$ 17,535.00	$ 5,000.00	$ 162,750.00	15%	$ 30,234.00	$ 231,794.00
11	Taxiway D Centerline Lighting	$ 24,250.00	$ 46,760.00	$ 2,500.00	$ 242,500.00	10%	$ 31,601.00	$ 347,611.00
12	Home Cabling Relpacement /Upgrade	$ 64,000.00	$ 23,380.00	$ 5,000.00	$ 640,000.00	15%	$ 109,857.00	$ 842,237.00
		$ 657,030.00	$ 321,475.00	$ 82,500.00	$ 5,945,300.00		$ 985,934.75	$ 7,992,239.75

Electrical Master Planning

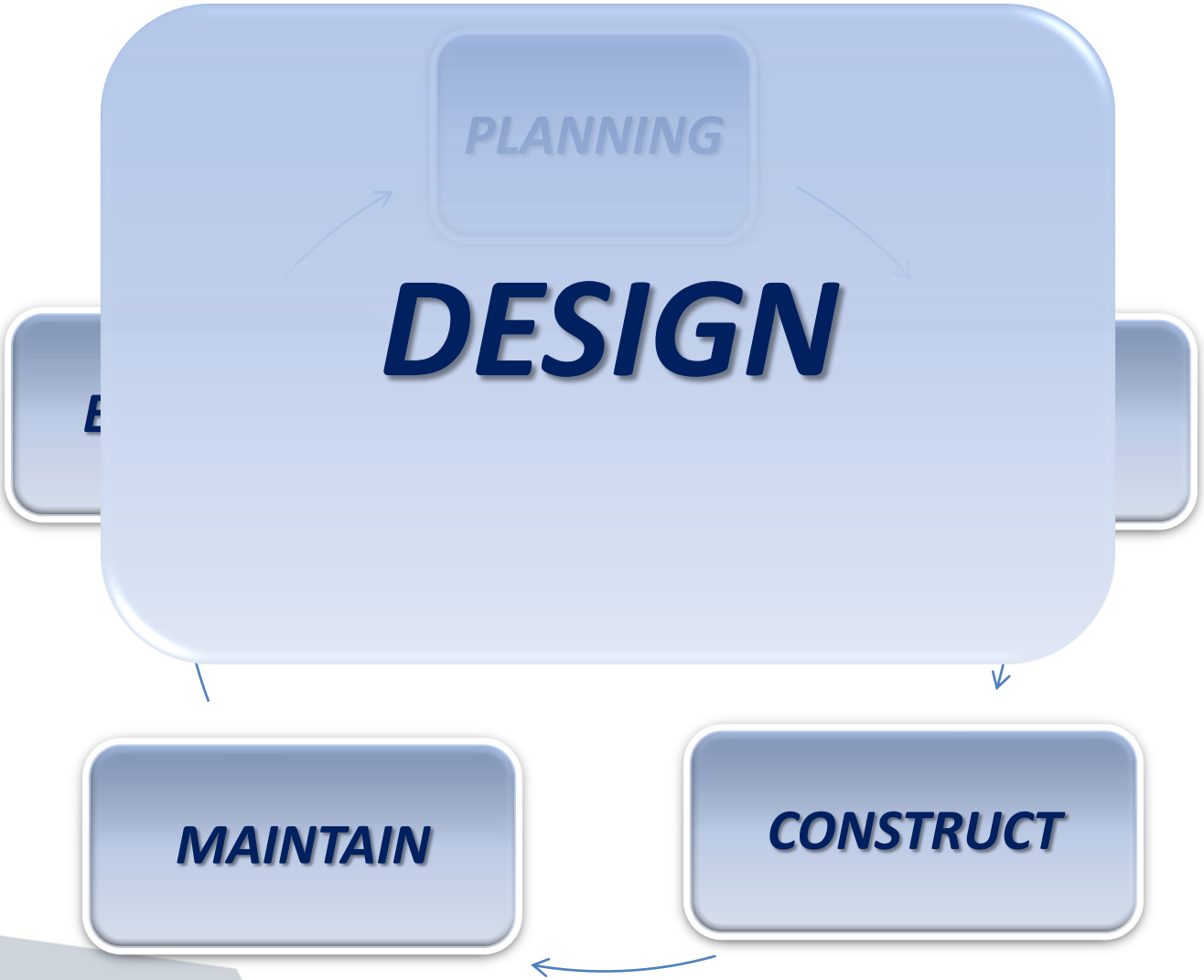
KEY TAKEAWAY:

INCLUDE 1 OR 2 ELECTRICAL INFRASTRUCTURE PROJECTS IN EVERY CIP CYCLE

TARGET:

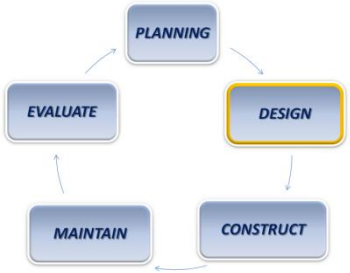
High Risk Problems and Maximized Cost/Benefit

Facilitating Improvement:



Design: Preparation

- Institute airport design standards
- Focus should be on operational planning
- Budget Conscious
- Schedule Sensitivity
  - Procurement, funding cycles, review periods, etc…



Design: Prepare Standards

33 West Monroe Street, Suite 1825
Chicago, Illinois 60603
Phone: 312.345.1400

CARD JV
CHICAGO AVIATION RUNWAY DESIGNERS

MEMORANDUM

Date: 4/15/11

To: Edward Balfe

From: Ben Goebel, CARD

Subject: North Airfield Load Calculation Design/ Loading Criteria – Rev 4.0
(FOR REVIEW AND APPROVAL)

As a follow up to the North Airfield Lighting / EALCV discussions related to the airfield circuiting segmentation and load calculation, CDA, OMP, HNTB (9C) and CARD (9R) have assembled the following design criteria / loading assumptions for the calculation of circuiting loads.

The intent of the document is to provide calculation guidelines for the engineering calculations, circuit segmentation and design of airfield circuits. The load values contained within document are sufficient to cover the potential manufactures that have certified FAA lighting and control products currently on the market. Manufacturer product data sheets and actual equipment loads will vary slightly from the values identified on these criteria.

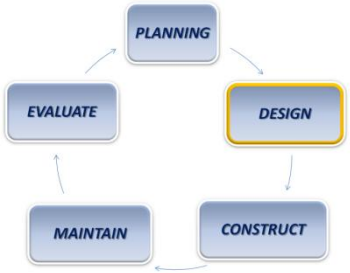
General Design Criteria, Safety Allowances, Spare Capacity Factors

- Include multiplier of 25% for spare capacity
- Include multiplier of 25% to account for a regulator safety factor
- A diversity factor of 25% will be applied when calculating generator and utility service sizing by the building electrical designer. This is based on the assumption that a maximum 25% of the regulators connected to the system could be in a ground fault condition at any one time.
- The target circuit loading to limit the voltage to 3000V per circuit at 6.6 or 20A.
- Maximum loads for specific regulator sizing can be found under the "CONSTANT CURRENT REGULATOR" of this document.
- All RUNWAY lighting at Chicago O'Hare is and will remain HIGH Intensity 20.0/6.6 amp format.
- All taxiway lighting at Chicago O'Hare is and will remain MEDIUM Intensity 6.6/6.6 amp format.

Airfield Lighting Equipment

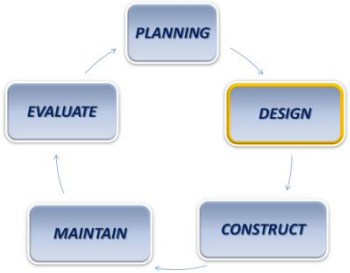
- **Airfield Lighting Fixture**
  - At present, all RUNWAY lighting at Chicago O'Hare is incandescent.
  - Taxiways edge lights are LED with Arctic Kits (heaters) to prevent snow and ice buildup.
- The design wattage allowance and desired isolation transformers per fixture type is as follows:
  - **RW Edge**
    - L-862 = 200VA, Quartz, Isolation Transformer : 200W 20A/6.6A
    - L-850C = 210VA, Quartz, Isolation Transformer : 200W 20A/6.6A

Standard excerpt courtesy of the OMP & Gene Gottlieb

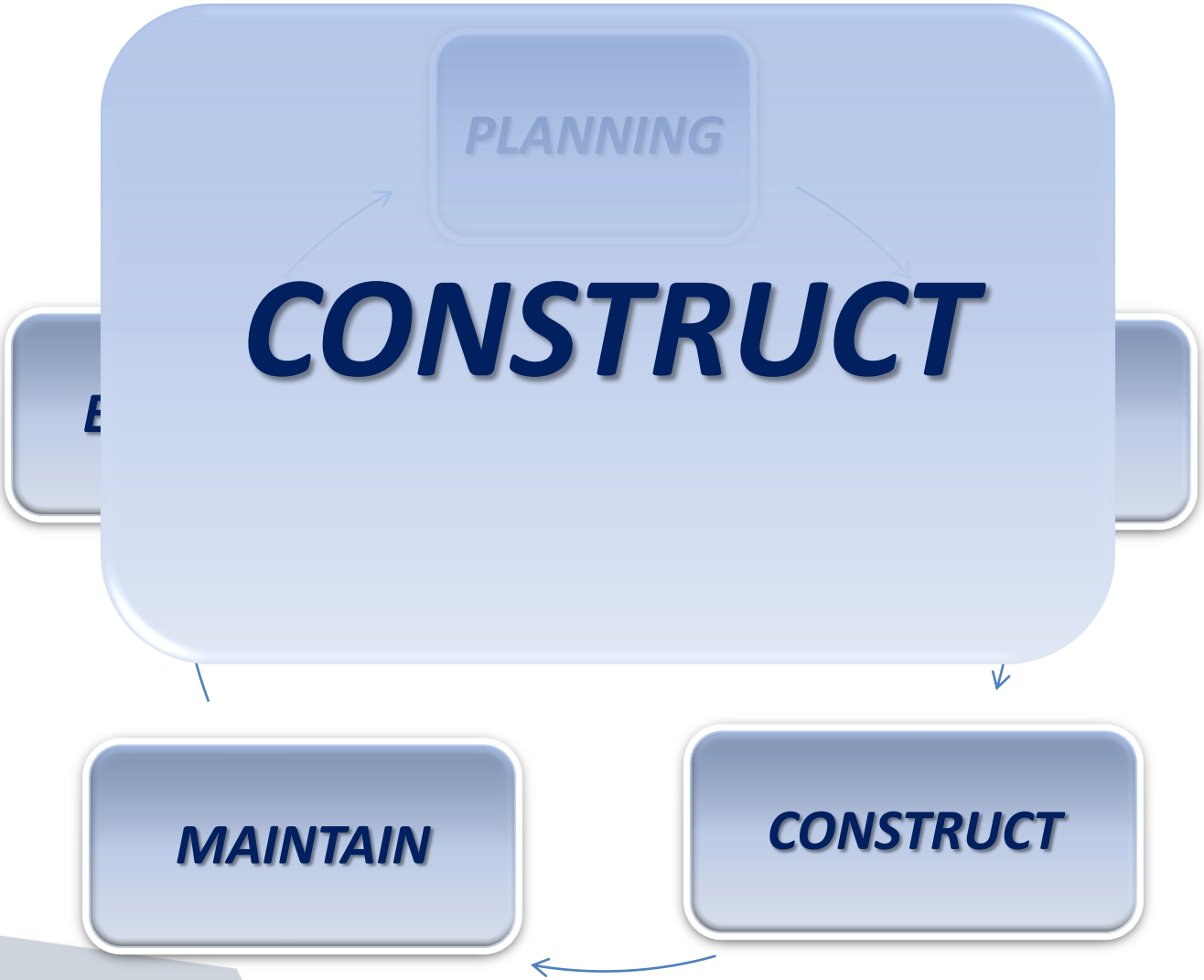


Design: Execution

- Reference the Master Plan / Program Plan
- Engage the FAA
- Airport and designers should review “lessons learned”
- Stick with the plan once you make it
  - Changes in design cost money and time…
- Make constructability a priority

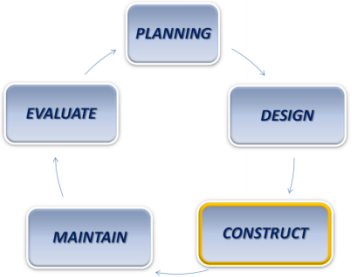


Facilitating Improvement:



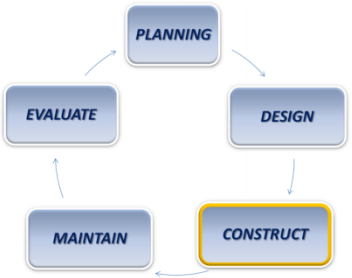
Pre-Construction:

- INVEST IN QUALITY CONTRACTORS
  - Low bids are really low for a reason…
    - Responsive
    - Responsible
- Specify minimum qualifications:
    - Airfield Experience
    - NAVAIDS Experience
    - Previous Projects
- Hire RPR/Field engineers that understand <u>electrical</u> construction



Construction:

- Allow for investigation of existing conditions
- Open lines of communications
- Be open to contractor and manufacturer suggestions:
  - Value Engineering
  - Alternate routings or installation methods
  - Improvements to designs & equipment
- Follow the plans
- Photograph the work
- Verify accuracy of as-built documents

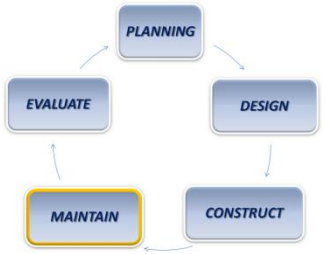


Facilitating Improvement:

Maintain

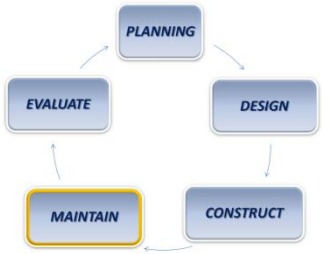
Maintenance is money well ~~spent~~ INVESTED:

- Training
  - Manufacturers
  - IES – Airfield Lighting Committee - Annual Conference
- Specialized Tools & Test Equipment
  - Insulation Resistance Testing (Meggers)
  - Torque Wrenches
  - Threaded insert jigs
- Attic Stock / Spare parts
  - Fixture parts (lamps, transformers, frangible couplings)
  - Termination kits



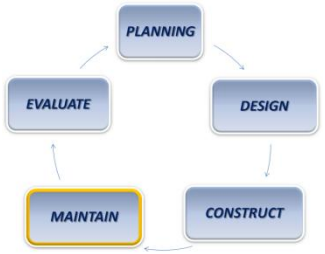
Preventative Maintenance Guidelines

- AC 150/5340-26 (Latest Edition) , Maintenance of Airport Visual Aid Faculties
- NFPA 70 – National Electric Code
- NFPA 70B, *Recommended Practice for Electrical Equipment Maintenance.*
- ANSI – American National Standards Institute
- NETA - National Electrical Testing Association
- Equipment Manufacturer O&M Literature



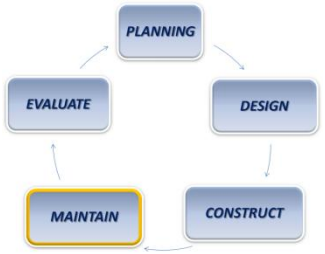
Preventative Maintenance

- **How often should we test electrical system?**
  - How critical an item is to your business
  - Operational considerations
    - Weather, Holidays, Presidential Visits
- **What should I test? & Why?**
- **How do we pay for it?**
  - Planned
  - Unplanned



Preventative Maintenance Planning, Funding and Execution

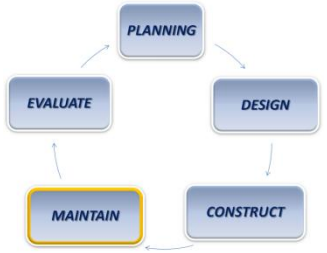
- Maintain a prioritized project list
- Set a plan
- Develop a budget
- *Communicate* the budget
- Schedule the maintenance
- Maintain records*



Maintain Records

AC 150/5340-26 (latest edition)
MAINTENANCE OF AIRPORT VISUAL AID FACILITIES
3.2 MAINTENANCE RECORDS.

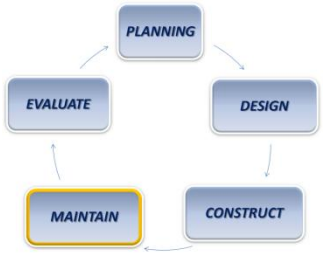
Maintenance records are an important part of an effective maintenance management system; they *provide a service history* of each piece of equipment, ensure regular maintenance without *duplication of effort*, and provide a data base *for statistical analysis of lighting system performance*. Without records, knowledge gained from regular inspections will not be retained, and preventive maintenance will be difficult. An effective records system should allow for the recording and retrieval of information with a minimum of effort. The records system should compile data that will *document the effectiveness of the maintenance program*. By checking the records, a manager should be able to determine whether a particular *maintenance task is being done too frequently or not often enough*. By such a trial-and-error process, a maintenance program uniquely tailored to the facility can be developed.



AC 150/5340-26 - 3.2 MAINTENANCE RECORDS

- Important take ways:
  - Provide a service history
  - Prevent duplication of effort
  - Provide statistical analysis of system performance
  - Document the effectiveness of the maintenance program
  - Maintenance task is being done too frequently or not often enough

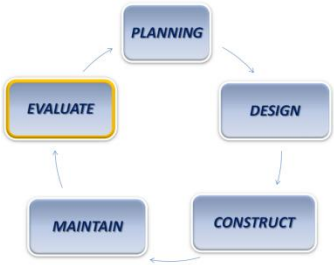
If you can't track it, you can't manage it….



Facilitating Improvement:

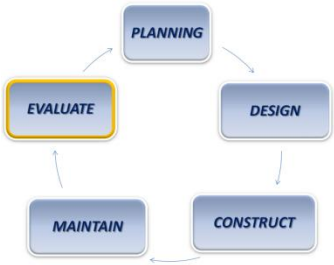
Evaluate

- Collect data
  - Test reports
  - ALCMS Logs
  - Incident reports
  - Utility bills
  - Manufacturer Recommendations
  - MAINTAINANCE RECORDS!!
- Prioritize Needs
  - Available funding
  - Operational impact
  - Planned Expansion
  - Upgrades



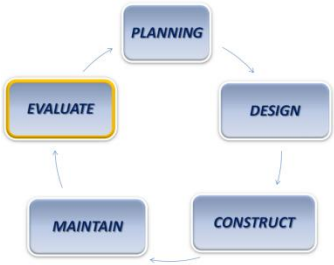
Evaluate

- Assemble a TEAM:
  - Design and Engineering
  - Operations
  - Maintenance
  - Stake Holders
- Identify Outstanding issues
  - Failures
  - Hotspots
  - Concerns
  - Liabilities (Impending failures)



Evaluate

- Let the data guide the process
  - Technical
  - Financial
  - Operational
- Prioritize needs
- Estimate cost & schedule
- Add to the CIP projects
- READY TO BEGIN PLANNING!!!



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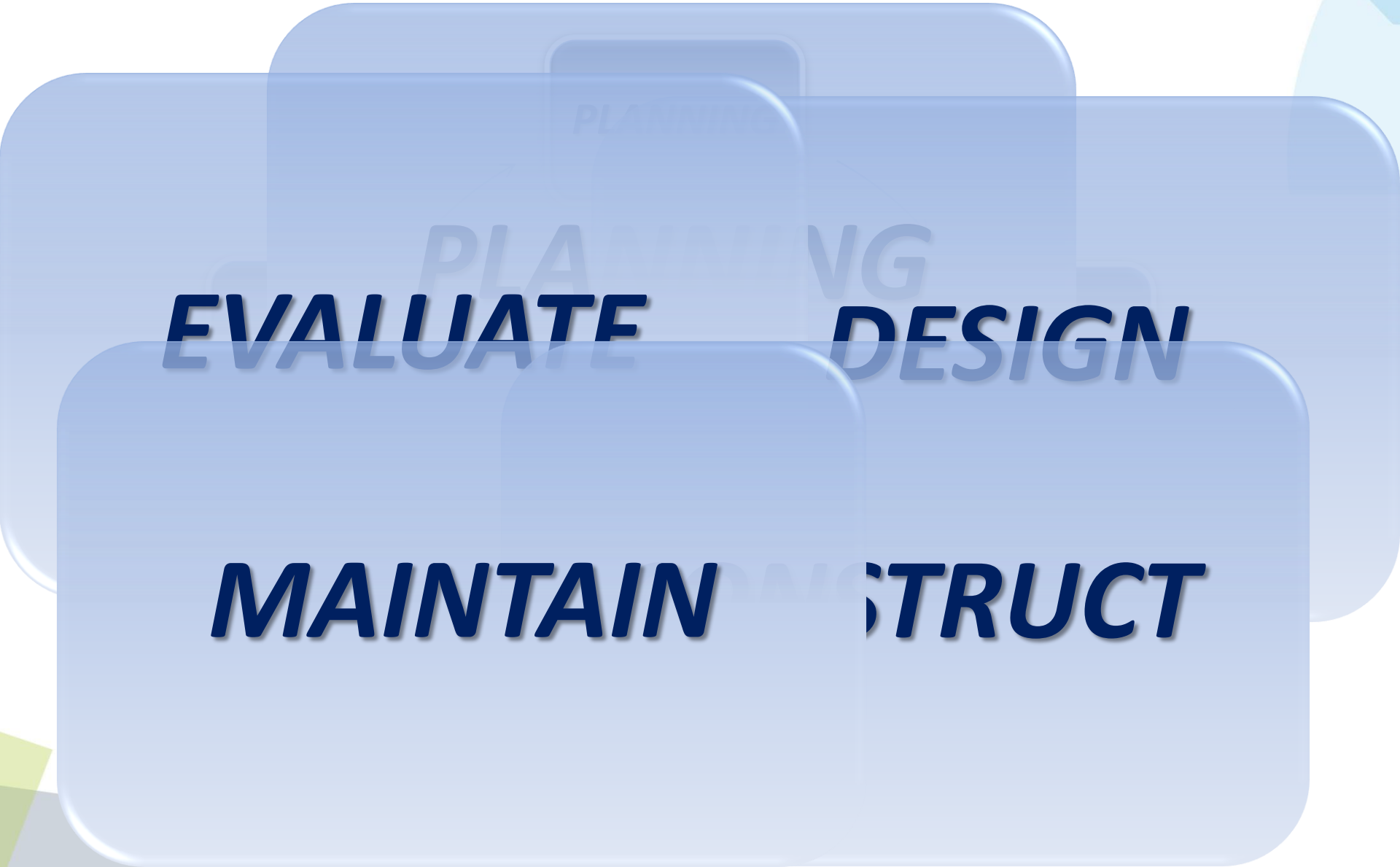

Facilitating Improvement:

- Maintain a list of development project and priorities
- Lobby for your cause
- Focus on system level improvements
- Include electrical projects in long term CIP plans
- Design and Construction is key to system longevity, Leverage engineer and contractors knowledge
- Quality Maintenance dramatically improves reliability & reduces cost

Aviation Electrical Infrastructure

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