NWOC Maintenance Program

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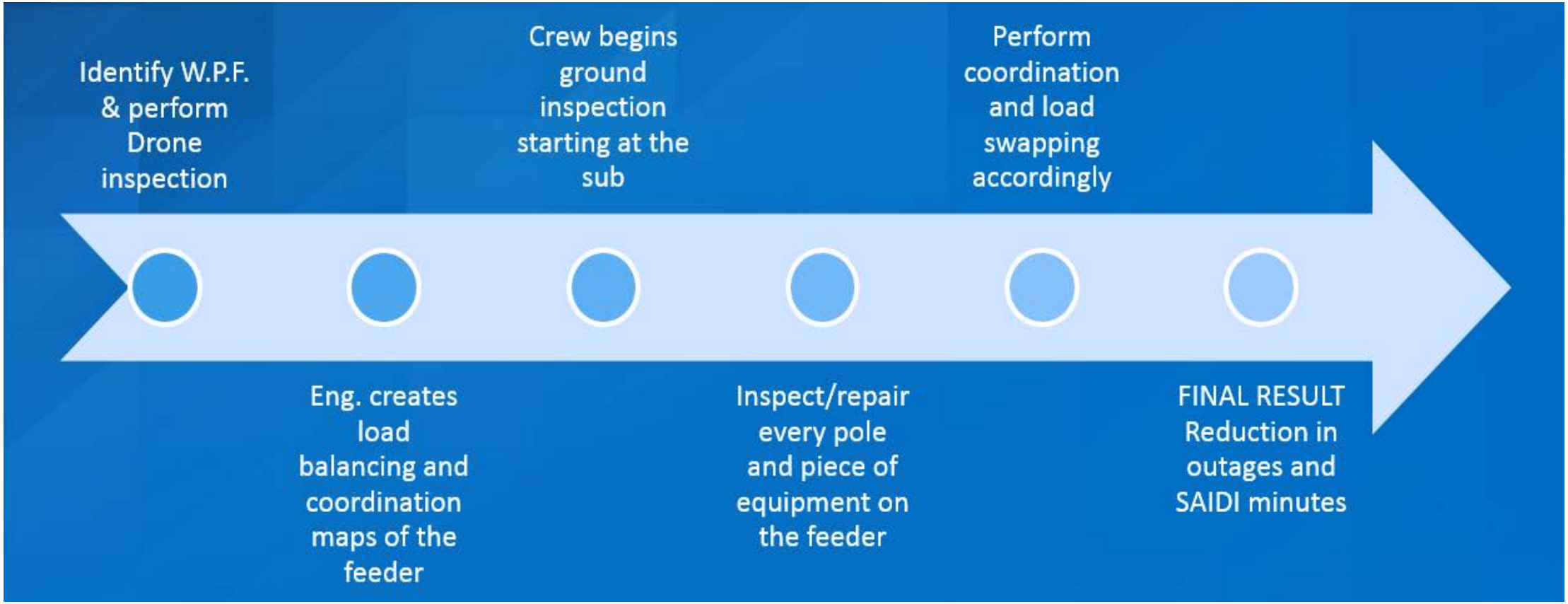
Overhead Feeder Maintenance Process



*Feeder Assessment

- Identify Worst Performing Feeders by SAIDI metrics while also monitoring SAIFI
- Coordinate aerial inspections with Technical Service including Robo calls to affected membership
- Districts use software to examine UAV inspections from a desk to create and report discrepancies. This will also be performed with ground inspection data for tracking purposes.

*Fusing and Coordination

- Work closely with Engineering to create both coordination and load balancing maps of the feeder
- Update mapping immediately as changes and corrections are made to the distribution system
- With approval from Eng. relocate equipment (fuses & protective devices) to easier accessible locations if needed

*Ops. Crew Inspection Process

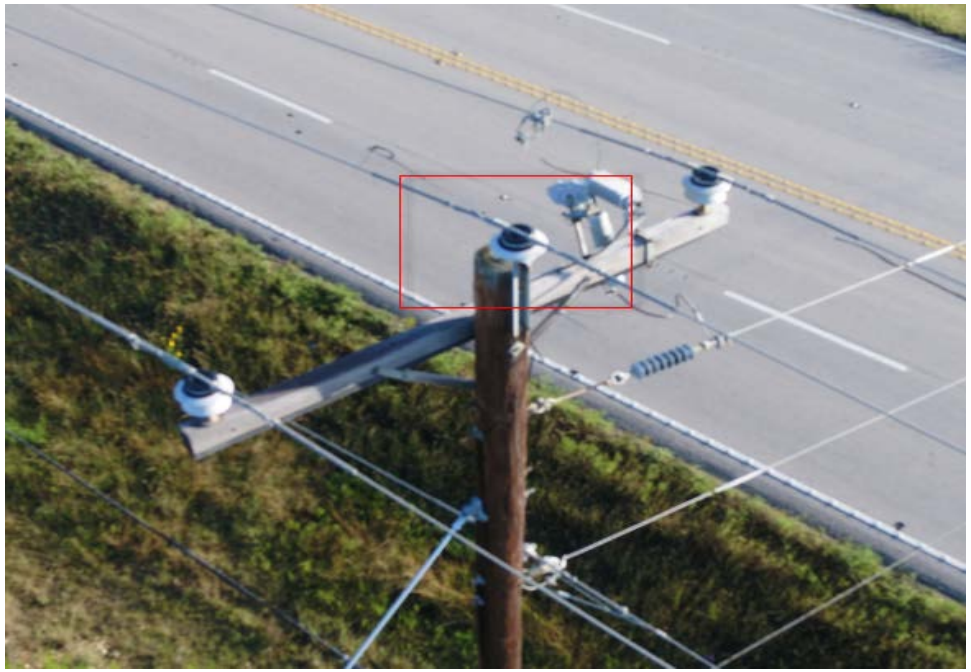
- Start at the Sub. and inspect every structure. Make repairs and Corrections as needs
- Tag all poles containing line protective devices with correct fuse size
- Inspect OCR's W/O controls at this time
- Remove and replace pole mounted arrestors with inline arrestors when possible

UAV (Drone) Inspections

- Pilot Program with Operations and Engineering
- NWOC Hosting District
- Top 5 worst preforming SAIDI feeders by district (2018 NWOC = 10)
- 3 phase feeder infrastructure inspections
- Analytics software organizes discrepancies
- Ops Maintenance Crews/Technical Service Crews execute repairs
- Inspection cost comparison reduced with UAV compared to boots on the ground

Examples Found To Date

- B/O Poles/Insulators
- Equipment Tracking
- Missing/Improperly Installed Equipment
- Failed or Deteriorating Hardware



Ground VS. Aerial Views

Estimated 5 days per feeder

Ease of Accessing ROW

Informing Vegetation Management of tree issues

Eliminate safety issues
Ex: Reduce fall risk

Allows crews to prepare proactively with material and equipment

Cost efficiency Bucket truck VS. Done

Maintenance Crew Responsibilities

- Install and maintain all specialized line equipment in our districts in coordination with Technical Services.
  - Ex: Regulators, Protective devices, Capacitors, Etc.
- Work with System Engineering to investigate and solve system issues
- Monitor and document SEL events and investigate causes, examine common problems
- Review Qlik software information for system reliability information
- Monitor monthly blink maps and address reoccurring issues
- Work with Design to correct and assure map accuracy
- Work with Design to create WO's to track cost to each feeder
- Use FLIR cameras to identify "hot spots"
- Provide technical training to employees on specialized equipment
- Investigate and preplan back feed scenarios with System Engineers
- Perform annual specialized equipment inspections within the districts coordinated with Tech. Services

Benefits

- Increased training and repairs will also help to reduce safety incidents prompted by faulty equipment or absence of knowledge on certain devices
- Specific WO's created by design will give the ability to capture costs by feeder or project and ensure cost are charged to the correct loan numbers
- Help monitor current equipment and material to communicate information to Standards Committee to improve efficiency
- If the top 5 PPF's are address this year with preplanned coordination, it should allow roughly 2.4 months of labor per feeder
- Improve quality of service to the members
- Quality Control and System Consistency throughout the NWOC

Results

2017 vs 2018

The SAIDI numbers listed below where derived from the Qlik Sense software (Feeder Reliability Excluded). Numbers were feeder specific to determine the impact by feeder.

- *Impact toward Feeder SAIDI minutes*

Paleface Sub.	*2017 vs 2018*	Copperas Cove Sub.	*2017 vs 2018*
PF-20	**18.23 vs 10.85 = 7.29**	**CC-40**	**14.56 vs 6.94 = 7.62**
PF-120	**15.91 vs 10.85 = 5.06**	**CC-30**	**4.82 vs 1.55 = 3.27**

The most substantial impacts to the overall Cooperative SAIDI numbers were the repairs and coordination improvements made to the Paleface 20 feeder (RB-20.) This number was calculated by the Control Center and demonstrates the impact feeder maintenance can provide to the overall system reliability.

- *Impact toward Cooperative SAIDI minutes:*

2017	2018
PF-20 = 0.73 Minutes	**PF-20 = 0.11 Minutes**

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