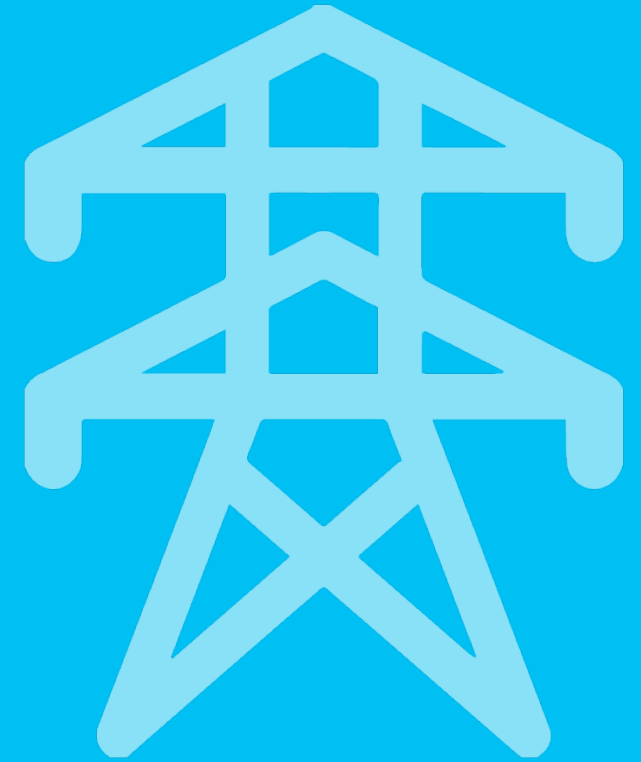


Asset Failure Data Collection and Analysis



1/10/2022

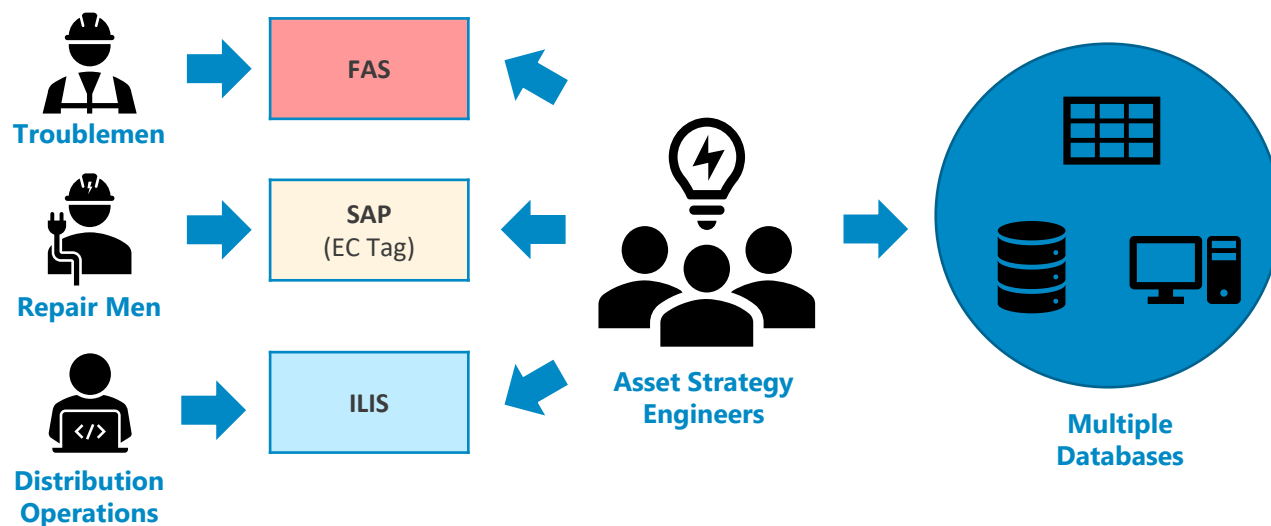


INTERNAL

- Project Overview – Current vs Future State
- Timeline
- Post-Pilot Data Collection – What are we collecting?
- Systems of Record for Asset Failure Data Collection

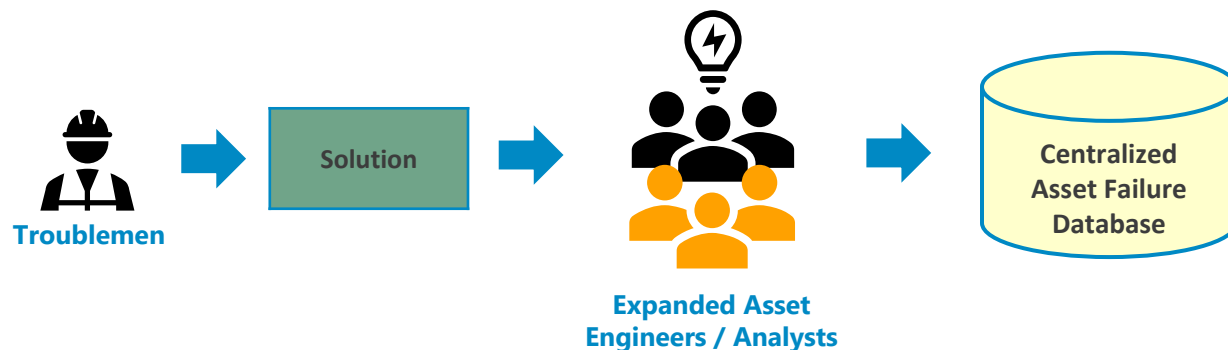
Project Overview – Current vs Future State

Current State



- No existing process and system that helps determine what failed and why
- Asset Engineers access a variety of systems that were built for other functions → no source of truth!
- No centralized location to store and access asset failure data

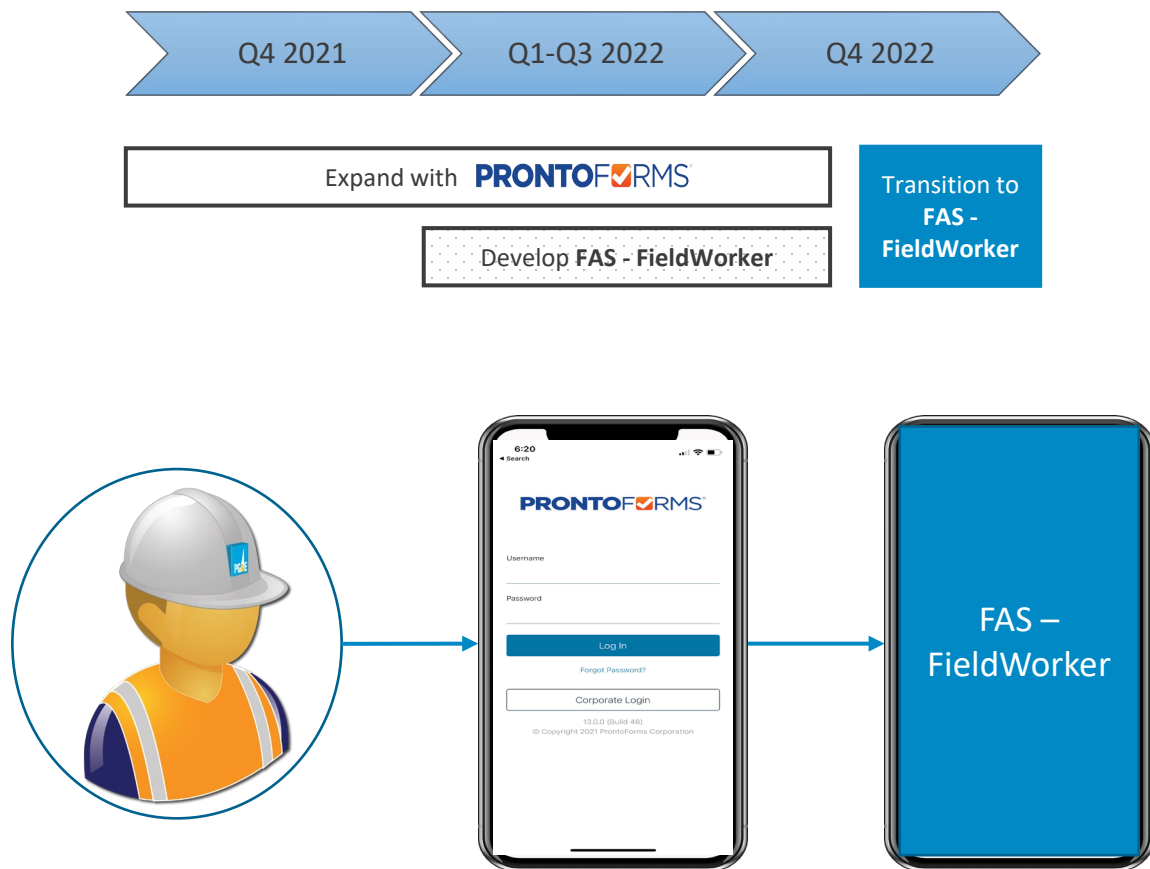
Future State



- Trained Troublemakers who capture key failure data
- Solution integrated into Troublemakers work processes that easily captures key data and photos
- Expanded team of asset engineers / analysts who review data and validate equipment failure causes
- Centralized database of asset failures in Palantir Foundry

Project Overview – Current vs Future State

Expand with ProntoForms until FAS - FieldWorker is Ready



Benefits

- Start collecting asset failure data and validating outages now!
- Discover process gaps while going towards long-term solution
- Ability to quickly refine questions

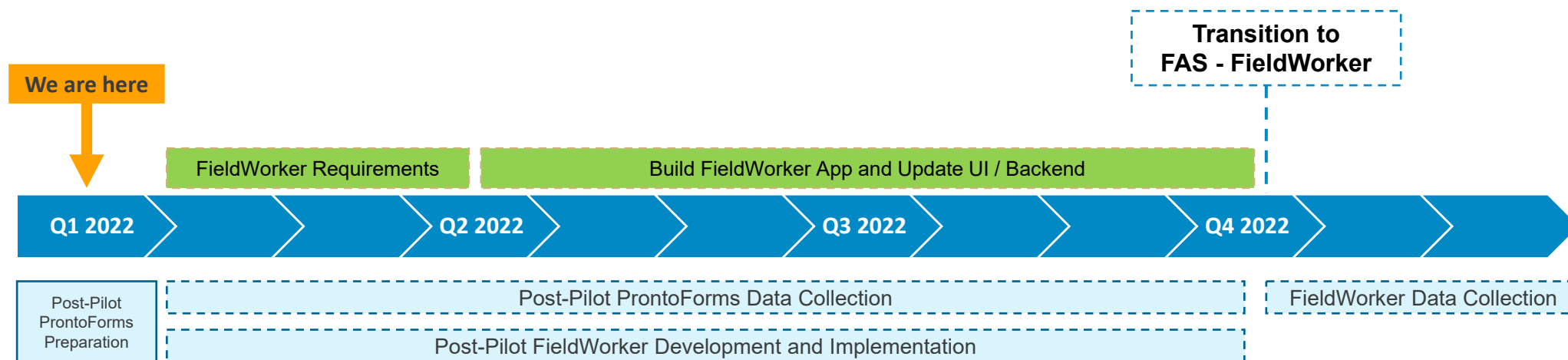
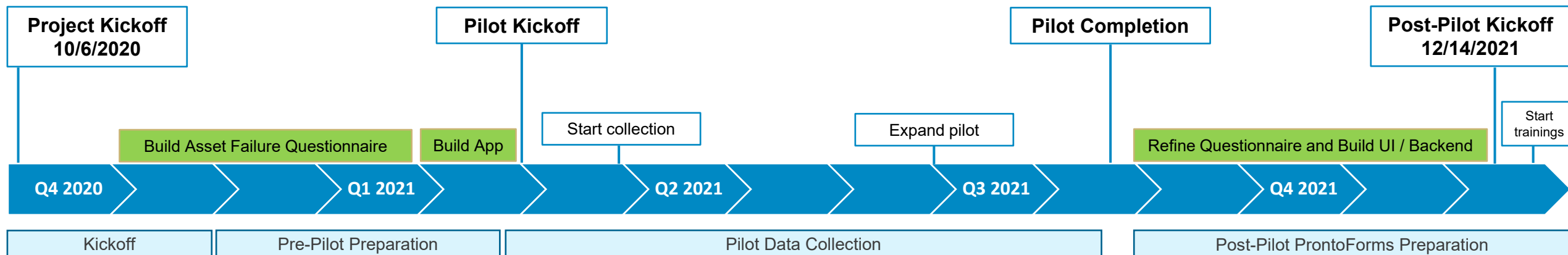
Support Needed

- Leadership sponsorship of Asset failure data analysis initiative
 - Drive support in all Field Operations areas
- **Project Resources:**
 - Solution development
 - Data processing team (Asset Engineers / Data Analysts)
 - Communications Specialist
 - IT Project Manager

Risks

- Troublemakers resistance to using ProntoForms
- Competing priorities, such as PSPS and emergencies

Timeline



Post-Pilot Data Collection – What are we collecting?

ProntoForms

- Involved Outage
- Suspected Equipment that Caused Failure
- Key data to validate suspected Cause of Failure



Outage Date/Time (Tap to Change)

January	10	2022	1	11
---------	----	------	---	----

Outage Location (Tap map icon to drop pin)

Tap to acquire location

Tap the map button to view your location on a map

SAP Pole ID (Type or Take Photo)

Tap to type answer

OIS # (Type or Take Photo)

Tap to type answer

What asset are you looking at *

Transformer

OH Primary Conductor

Connector / Jumper / Kearney

Pole

Cross Arm

UG Primary Conductor

Fuse (Did not operate as designed)

Capacitor

What conductor failure do you see?

Bird-Caging

Broken/Damaged

Floater

Sagging

Where did the conductor fail?

Connector / Jumper / Kearney

Conductor (mid-span)

Conductor (near pole)

Other

Tap to type answer

What was the largest contributor to the failure? (check all that apply)

Fatigue

Anything you want to share?

Tap to type answer

Upload Photos

Tap to choose photo

Palantir Foundry

- ProntoForms data integrated with Outage
- Form to desktop review Outage



21-0104971 - HAMMER 1102, 163301102 ☆

Outage

Ignition 0 Data flags 0 Review Project(s) All Links All fields (ILIS, C)

ProntoForms Data

This spreadsheet uses sources that are outside the spreadsheet's project scope. Syncs

#	Question	Answer
1	Date/Time	{ "provided": { "time": "2021-08-16T12:32:00-07:00" } }
3	What asset are you looking at	Pole
4	What is the pole class?	Pole - Wood
5	If pole is broken/damaged, where did the pole fail?	Ground
6	If pole is broken/damaged, what most likely caused it?	Garbage truck snagged CaTv line breaking pole
7	Does the pole have stubbing?	No
8	Is the pole marked for replacement?	Unknown
9	SAP Pole Equipment ID [choose one]	Type in Pole ID
10	OIS # [choose one]	Type in OIS #
11	SAP Pole ID	102139754
12	OIS #	1443859

Outage Review

Review Status: Select an option... Reviewed By: Steven Wang

Review Start Date: MM/DD/YYYY h:mm A Review Completed Date: 01/10/2022 1:28 PM

Questions

Suspected Equipment Failure: Select an option... Suspected Cause (TBD): Select an option...

Confidence Level: Select an option... Review Difficulty: Select an option...

Suspected Threat/Hazard Category: Select an option... Suspected Threat/Hazard: Select an option...

ILIS Correction Needed? Yes No Are photos sufficient? Yes No

What other data to determine cause? Search...

Notes

Systems of Record for Asset Failure Data Collection

Phase 1 using ProntoForms

- Asset failure data from ProntoForms
- Outage Desktop Review Tool built in Foundry

Data Component	System of Record
ProntoForms Data	ProntoForms
Outage Desktop Review	Foundry (?)

Phase 2 using FAS – FieldWorker

- Asset failure data from FAS – FieldWorker
- Outage Desktop Review Tool built in Foundry

Data Component	System of Record
FAS – FieldWorker	SAP (?)
Outage Desktop Review	Foundry (?)

Where we need help:

- *How do we confirm the appropriate Systems of Record?*
- *What's the sign-off process to move forward?*

Appendix



Project Overview

We need Asset Failure Data that enables us to understand what failed and why.

→ Partner with Field Operations to improve data collection for outages caused by PG&E equipment.

We have 5.5 million electric customer accounts.

We have 106,681 circuit miles of electric distribution lines.

Our system experiences over 30,000 outages each year.

From 2015-2019, over 7,000 outages caused by PG&E equipment failures.



Why is this important?

- Good asset failure data enables us to know why things fail and how to mitigate them
 - Equipment failure causal analysis for Electric Operations
 - Risk management and replacement prioritization of assets
 - Effective investments of grid capital

What are we doing?

- Optimize data collection processes and improve asset failure data quality to support asset management strategy with more data-driven decisions

What is the scope?

- **In:** Distribution equipment failures, unplanned outages, major events, outages stored in ILIS, momentary outages, sustained outages
- **Out:** Transmission, failures without outages

Before: What Is Our Challenge With Dx Asset Failure Data?



Inefficient data collection processes limit ability to determine what failed and why

ILIS

Integrated Logging Information System

EquipID Provides Equipment ID of the device that operated not the device that failed

Equipment Condition Limited drop-down options. Does not align with FMEA

Cause Why did it fail?

- Failure mode – leakage of oil protection, missing animal guard, non-insulated jumpers arcing, overload?
- Photos for validation
- Relevant characteristics, (e.g. make/model, type, serial number, age)?

Location Location of the device that operated not the location of the failed equipment

21-0008927			
Outages			
Circuit	182811103, SISQUOC-1103	District	Santa Maria
Type	Unplanned	Customer Minutes	Sus 1550 Mom 0 Adj Sus 1550 CAIDI 388
Customers	CESQ 4 CEMO 0 ADJ CESQ 4 Initial 4	Weather	Clear;32-90F
Active	NO	Fault Type	Line to Ground
Interval	Sustained	Action Required	No
EquipID	6489	Construction Type	OH
Equipment Type	Fuse	OIS Outage#	1210775
Equipment Condition	Transformer (OH), Failed/Faulted	Targets	
Crew Notified Time	01/15/21 09:29	Supervisor Notified	
Equipment Address	W/O TEPSEQUET CANYON RD N/O TAP TO CHANNEL 12	Fire Mitigation	No
Fault Location	CGC 513310752291		
Previous Switching			
Details			
Action Description			
Cause	Equipment Failure/Involved, Overhead	No Access Reason	
Distribution Wire Down	No	Wire Down Energized	No
Multi Damage Location	No	# of Operations	
Counter Read		Created By	J4WS
Outage Level	Distribution Circuit	Last Updated By	SMBATCH_FO
Responsible Organization	Distribution	Fault Location Info	Suspected Fault Location
GPS MA Data	No	Latitude & Longitude	34.91649,-120.23117
FNL	01/15/21 02:43	Reviewed By	Not Required
End Date	01/15/21 12:39	Reviewed By Date	

Before: What Is Our Challenge With Dx Asset Failure Data?



Data conflicts and inconsistencies between different systems

22% of wires-down outage causes are different in ILIS and SAP



Troublemakers

FAS

Conductor broken due to tree branch
• Veg management issue



Repair Men

SAP
(EC Tag)

Conductor broken due to tree branch
• Veg management issue



Distribution Operations

ILIS

Overhead conductor as cause of outage
• Equipment Failure

OIS-OMT: EESA

Outage Dispatch Tool (Read Only)

Version: (3/30)

OIS #: 820797 Fortuna (35)

Substation: 19238 (EEL RIVER)

Circuit: 192381102

Outage Dev.: (1899)

Dev. Addr.: HOWE CREEK RD 1 SPAN W/O BLUE SLIDE, FERNDAL

Level: DEVICE

Call Desc: Partial Voltage

Customers: 0

Start Time: 13:19 03/01/2020

Complete: 22:00 03/01/2020

1st Call: 13:19 03/01/2020

Addr.: 807 HOWE CREEK RD, FERNDAL

SSD: [Empty]

Outage Remarks: [Empty]

Repair Time: 0:00

Duration (HH:MM): 1 update

ETOR: 23:59 03/01/2020

IVR Cause: REPAIR WIRE DOWN

Access: Available

Assigned DO: WIRE DOWN

Contact: [Empty]

Comments for Customers: Our preliminary determination is that your outage was caused by an equipment issue in your area. PG&E Personnel are investigating the cause.

Find / Reset

Verify

Clear

Restore

Print

Trouble Reports

Save

Affected Customers

Exit

Upgrade to xfmr

Crew Information

Repair Crew Requested: 15:36 03/01/2020

Seq.#	Name	Type	Crew Size	Dispatch	Enroute	Onsite	Stop
1	WADE SWANSON	REPAIR	0	15:36 03/01/2020	18:32 03/01/2020	18:46 03/01/2020	22:26 03/01/2020
2P	BIONDINI, JUSTIN	T-MAN	0	13:20 03/01/2020	14:16 03/01/2020	14:31 03/01/2020	15:06 03/01/2020

FAS Crew Comments

FAS Crew Comments (Outbound): -LAT/LONG 40.51129;-124.16046, FUSE 1899-80H TYPE ELF-

FAS Crew Comments (Inbound): BIONDINI, JUSTIN 20 15:06 1 of 2 blown at 1899 patrolled found wire down due to tree branch 25 spans beyond 1899 made safe made t

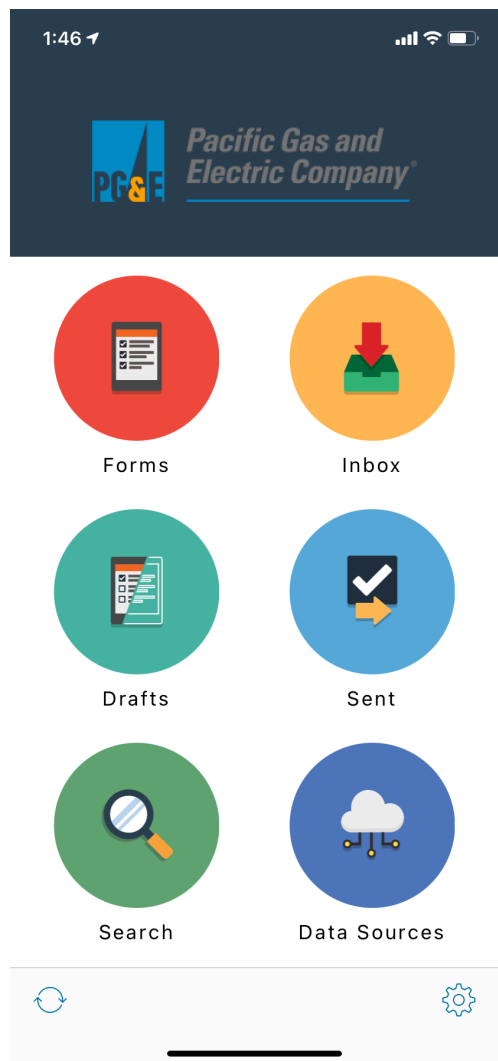
Repair Codes

Object	Damage	Cause	Activity
Conductor	Broken/Damaged	Tree Branch or...	Repair

20-0027529

Outages

Circuit	192381102, EEL RIVER-1102	District	Fortuna
Type	Unplanned	Customer Minutes	Sus 4906 Mom 0 Adj 4906 CAID 446
Customers	CESO 11 CEMO 0 ADJ 11 Initial 11	Weather	Clear, Strong Winds; 32-90 F
Active	NO	Fault Type	Line to Ground
Interval	Sustained	Action Required	No
EquipID	1899	Construction OH Type	
Equipment Type	Fuse	OIS Outage#	820797 PM Order#: 44226116
Equipment Condition	Conductor, Overhead, Broken, wire on ground	Targets	
Crew Notified Time	03/01/20 15:36	Supervisor Notified	
Equipment Address	HOWE CREEK RD 1 SPAN W/O BLUE SLIDE, FERNDAL	Fire Mitigation	No
Fault Location	25 POLES BEYOND 1899		
Previous Switching Details	WIRE DOWN		
Action Description			
Cause	Equipment Failure/Involved, Overhead		



1:46

[Close](#) AFA Data Collection - Asset Que... [Send](#)

Asset Questions

Location

Tap to acquire location

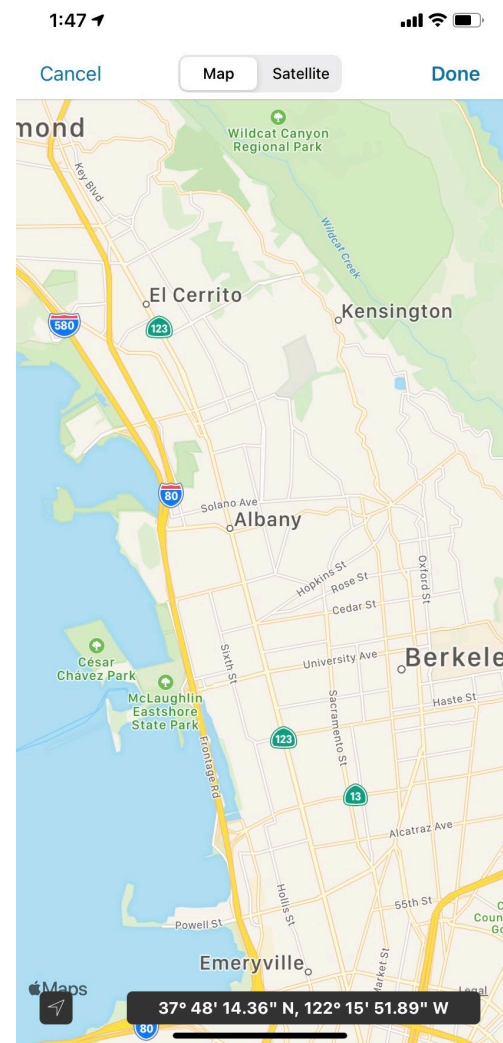
What asset are you looking at*

Transformer	<input type="radio"/>
OH Primary Conductor	<input type="radio"/>
Connector / Jumper / Kearney	<input type="radio"/>
Pole	<input checked="" type="radio"/>
Cross Arm	<input type="radio"/>
UG Primary Conductor	<input type="radio"/>
Riser Failure	<input type="radio"/>
Fuse (Did not operate as designed)	<input type="radio"/>

What is the pole class?

Pole - Wood	<input checked="" type="radio"/>
Pole - Composite	<input type="radio"/>
Pole - Metal	<input type="radio"/>

[Summary](#)



1:47

[Close](#) AFA Data Collection - Asset Que... [Send](#)

Anything you want to share?

Tap to type answer

Photo of SAP Pole ID

Tap to choose photo

Photo of OIS #

Tap to choose photo

Photo of outage cause(s) [up to 5]

Tap to choose photo

Photo of damage(s) [up to 5]

Tap to choose photo

Photo from base of pole looking up at wire configuration [up to 5]

Tap to choose photo

Other key photos [up to 5]

Tap to choose photo

[Summary](#)

Content

Optimizing asset failure data collection and analysis will provide **benefits across the company and customers.**



Field Operations Teams

- Streamline data collection processes and tools
- Reduce time spent validating data / investigating
- Maximize value when frontline teams' time onsite



Data Users

- Comprehensive data of what assets failed and why
- Reduce effort spent validating and compiling data
- Opportunities for analysis and risk-mitigation strategies



Company

- Reduce ignition risks caused by our electrical assets
- More effective spending based on data-driven risk models
- Maintain regulatory and compliance requirements



Customers

- Safer and more reliable electricity

Available Solutions

FAS (Field Automation System)		Inspect	MPR (Material Problem Report)	ProntoForms
Mobile Application (Windows)	Future: FieldWorker (iOS)			
<p>FAS is the existing tool Troublemakers get dispatch orders and perform work from.</p> <p><u>Today: FAS – Mobile Application (Windows)</u></p> <ul style="list-style-type: none"> Troublemakers currently use ruggedized devices (Windows laptops) <p><u>Future: FAS – FieldWorker (iOS)</u></p> <ul style="list-style-type: none"> Troublemakers migrating to iPads that will run new App 		<p>Inspect is a PG&E App that supports data collection and integrates into other PG&E datasets.</p> <p>Inspectors use app when performing equipment inspections.</p> <p>Inspect App is tied with existing processes.</p>	<p>MPR is a form/App for users to identify equipment issues, specifically manufacturer-caused.</p> <p>MPR developed by Supplier Quality.</p>	<p>ProntoForms is a third-party App that is used to create data collection questionnaires.</p> <p>ProntoForms is not integrated with PG&E systems and can be easily set up without regression testing.</p> <p>ProntoForms to be removed in future due to identified risks.</p>

Initial Comparison of Available Solutions

		Software Type				
		FAS Mobile Application	FAS FieldWorker	Inspect	MPR	Pronto
LOB		Tman	Tman	All LOBs	All LOBs	All LOBs
Accessibility	Built into job tools	✓	✓	✗	✗	✗
	Dynamic form support	✓	✓	✓	✗	✓
	Display relevant asset data	✗	✓	✓	✗	✗
Data Input	Picture functionality	✓	✓	✓	✗	✓
	Text and dropdown inputs	✓	✓	✓	✓	✓
	GPS location support	✓	✓	✓	✗	✓
Backend	System of record support	✓	✓	✓	✓	✓
	Links to outage data	✓	✓	✓	✓	✗
	Development time	✓	✓	✗	✓	✓

Legend:
 ✓ Good
 ✓ Medium
 ✗ Bad

Sponsor Requirements

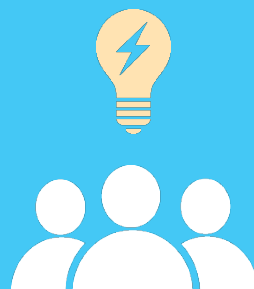
Project Phase	Behaviors	What Good Looks Like
PREPARE	<ul style="list-style-type: none"> • Ensure active and visible sponsorship, which is the top predictor for change success • Encourage direct and open two-way communication among the project lead, project team, and other sponsors • Support the project team members and subject matter experts to work on the project • Schedule and enforce the toll gate / review process • Align project against Executive Guidance 	<ul style="list-style-type: none"> • Attend project kick-offs to “set the vision” • Ensure project leads, change leads, and key project members are invited to critical meetings, and kept in the loop • Help free up time for project team to focus on the project (backfill roles and reassign responsibilities) • Review project plan with project lead and ensure key milestones are identified • Help craft a project vision statement that aligns the effort to company priorities
LEAD	<ul style="list-style-type: none"> • Work with your frontline leadership to be sure all impacted areas of the organization are supported • Encourage feedback, create a safe environment for raising concerns • Stay engaged throughout the duration of the project • Keep project team apprised of any changes to acceptance criteria 	<ul style="list-style-type: none"> • Promote efforts to provide support (training, backfill, resources, etc.) for front-line supervisors and Power Users • Conduct informal site visits to see and hear how employees and stakeholders are doing • Schedule 1:1 coffee chats with other leaders to surface any unspoken concerns • Make time to meet with the project manager and change lead for regular updates
SUSTAIN	<ul style="list-style-type: none"> • Continue to role model future desired behaviors • Continue to reward and incent future desired behaviors with employees • Celebrate successes as well as the gaps 	<ul style="list-style-type: none"> • Actively participate in Lessons Learned sessions to positively influence future improvement efforts • Communicate project successes in forums such as Town Halls and All Hands meetings • Organize a celebration event to recognize the project team and invite key stakeholders

Close the Communication Gap with Field Operations Regarding What's Working and What's Not Working



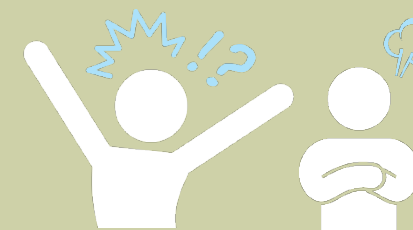
Field Operations Teams Identify Asset Failures:

- Bad designs
- Ineffective manufacturers or bad equipment models
- Poor quality of parts or equipment
- Parts that don't align with other equipment
- Engineering errors



Asset Strategy + SMEs Design New Systems:

- Utilize standards that have not been developed with the people doing the work
- Not sure what equipment is currently in the field
- Unaware of what is performing well in the field



Asset Failure Challenges Are Felt By Customers:

- Outages happen
- Field Operations fixes the same issues, *repeatedly*
- Customer frustrations occur as the communication gap persists