

Best Practices and Lessons Learned Applying CAST

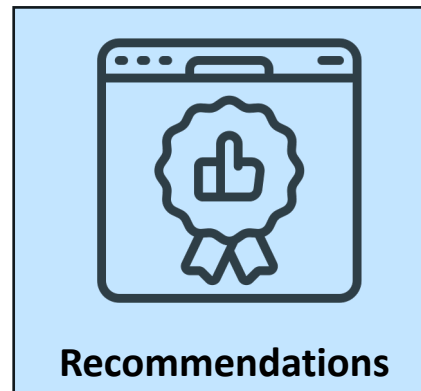
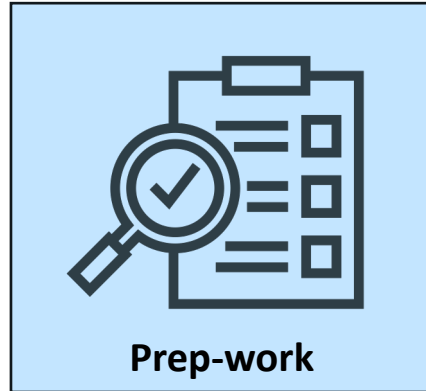
Stephen Palyok

Manager, Safety Systems Engineering | American Airlines
Stephen@aa.com



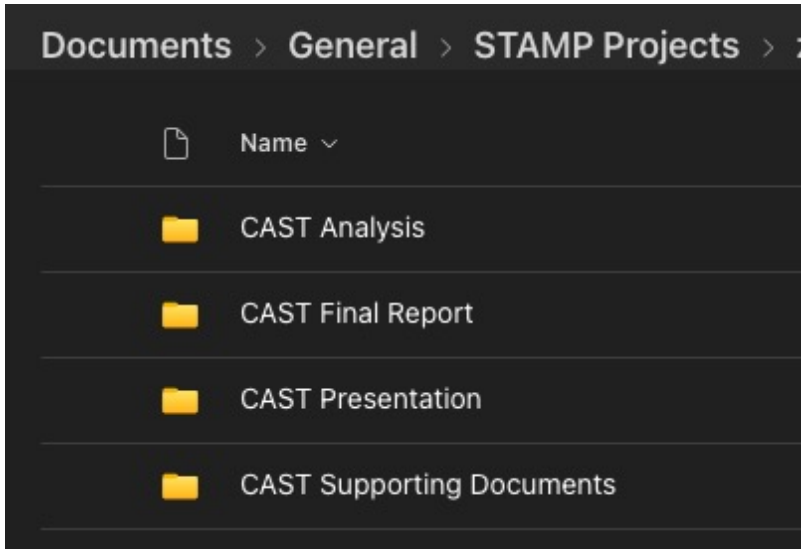
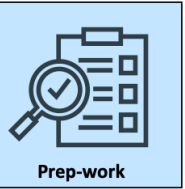
CAST Structure

30,000 ft. Overview



Documentation

Prep-Work



Shared-Folder for all documentation
(established templates)

[Physical Controls]
Responsibilities (Safety Constraints):
 Provide physical protection against hazards (protection for employees and others within the vicinity)
 R-1. Provide a method of indicating to APGs that work is being conducted

Physical Emergency & Safety Equipment (controls):
 What physical safety controls are in place to prevent this kind of accident / loss
 ESE-1. Parts Bag [R-1]
 ESE-2. Streamer [R-1]
 ESE-3. Lock Out Tag Out (LOTO) Tag [R-1]
 ESE-4. Operation Permit Required Tag [R-1]

Physical failures and inadequate controls:
 What physical component failed or did not work as intended?
 IC-1. Parts Bag [ESE-1]
 IC-2. Streamer [ESE-2]
 IC-3. Lock Out Tag Out (LOTO) Tag [ESE-3]
 IC-4. Operation Permit Required Tag [ESE-4]

Contextual Factors:
 What other factors could have made the actions appear reasonable? Consider feedback, prior experience, instructions from higher-level controllers, etc.
 CF-1. Parts bag is attached to engine, and out of sight if TR is closed [IC-1]
 CF-2. Streamers are one-time use and no standard length or placement [IC-2]
 CF-3. LOTO and Operation Permit tags look similar [IC-3,4]
 CF-4. When TR are closed, all controls cannot be seen (parts and streamers) [IC-3,4]

Recommendations:
 REC-1. Create a "Lock Out Tag Out" for TR latches when borescope plugs are removed from aircraft [CF-1,2,4]
 REC-2. Establish and implement a standard length of streamer that will not be hidden by TR when closed [CF-2,4]
 REC-3. Remove Operation Permit Tags from production to eliminate confusion (in-progress by [CF-3]

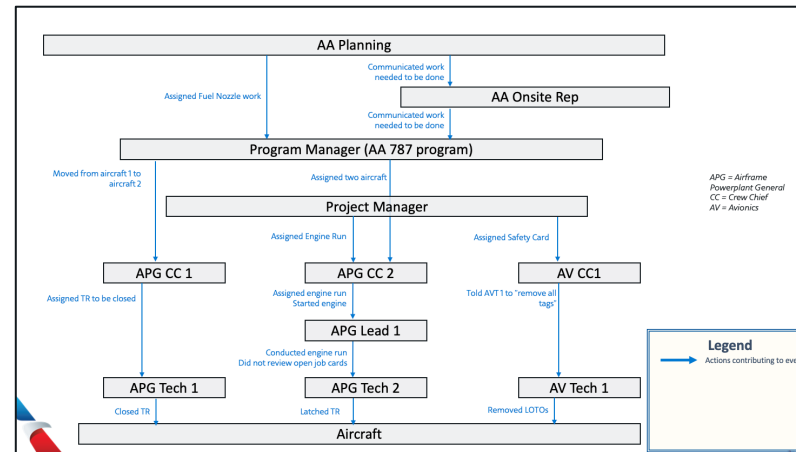
Avionics Technician [AVT 1]
Responsibilities and Safety Constraints:
 Responsibilities of the controller for safety of the operation
 R-1. Responsible for performing the 2nd half of the safety card for aircraft
 R-1. Responsible for removing certain CB tags

Contributing Control Actions and Decisions:
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 CCA-1. Removed the Fuel Control (FC) and Engine Start (ES) Lock out Tag Out (LOTO) tags that were tied to the Engine Borescope plugs (as tied in the LOTO book) on 1 [R-1]

CAST Analysis Document



Manuals, Job Cards, etc.

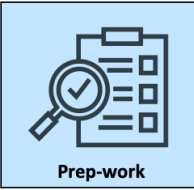


PowerPoint Presentation



Project Sponsors

Prep-work



Identify Key Stakeholders

Schedule Kick-Off Call

Set Expectations

How to plan for an ONSITE VISIT

Interviews

- Identify all interviewees and time that they are available to meet.

Checklist

- Date of Arrival and Departure
- Arrival/Departure Flights
- Transportation
- Hotel
- In Brief
- Out Brief
- Communication Methods

Escort

- Identify who the escort will be.
- Are any badges required for entry?
- Coordinate where and when to meet the person with escort access.

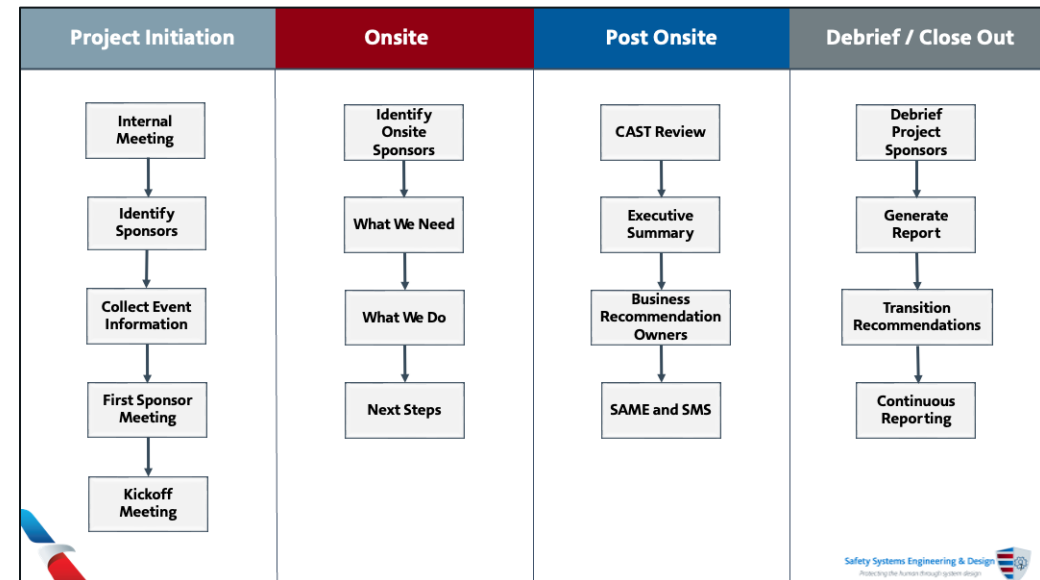
Union

- Should the Union be involved?
- Do we need a union representative to assist in interviews?
- Coordinate with a person onsite who can fill this role.

Conference Room

- Where will the interviews and meetings be held?
- Does the room need to be private?
- Reserve conference room ahead of visit.

Safety Systems Engineering & Design



On-site visit checklist

30,000ft overview of CAST Process



Immersed in Operations



Understand the environment in which work is conducted

Engage front-line team members to gain perspective

Identify differences between manuals/training vs *actual* operations



Interviews



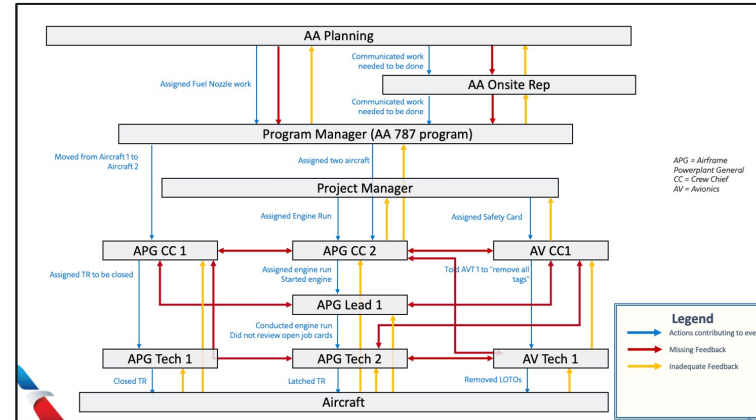
Create the control structure together

Union partnership is imperative

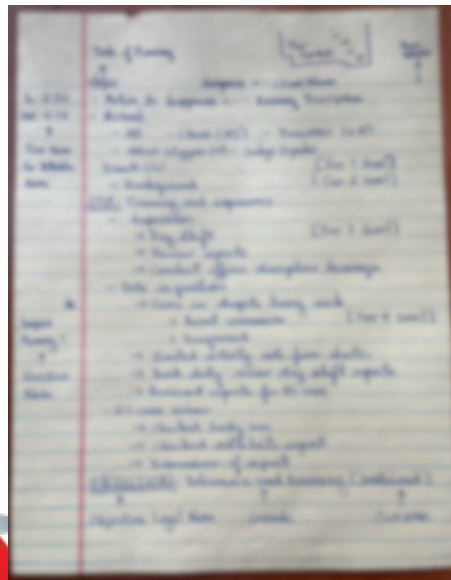
Don't pretend like you know what their job is



Analyzing the Information



Turn your interview notes and control structure drawing into CAST



(Physical Controls)
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 ESE-3 Lock Out Tag Out (LOTO) Tag [R-1]
 ESE-4 Operation Permit Required Tag [R-1]

Physical failures and inadequate controls:
 What physical component failed or did not work as intended?
 IC-1 Parts Bag [ESE-1]
 IC-2 Streamer [ESE-2]
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Contextual Factors:
 What other factors could have made the actions appear reasonable? Consider feedback, prior experience, instructions from higher-level controllers, etc.
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Recommendations:
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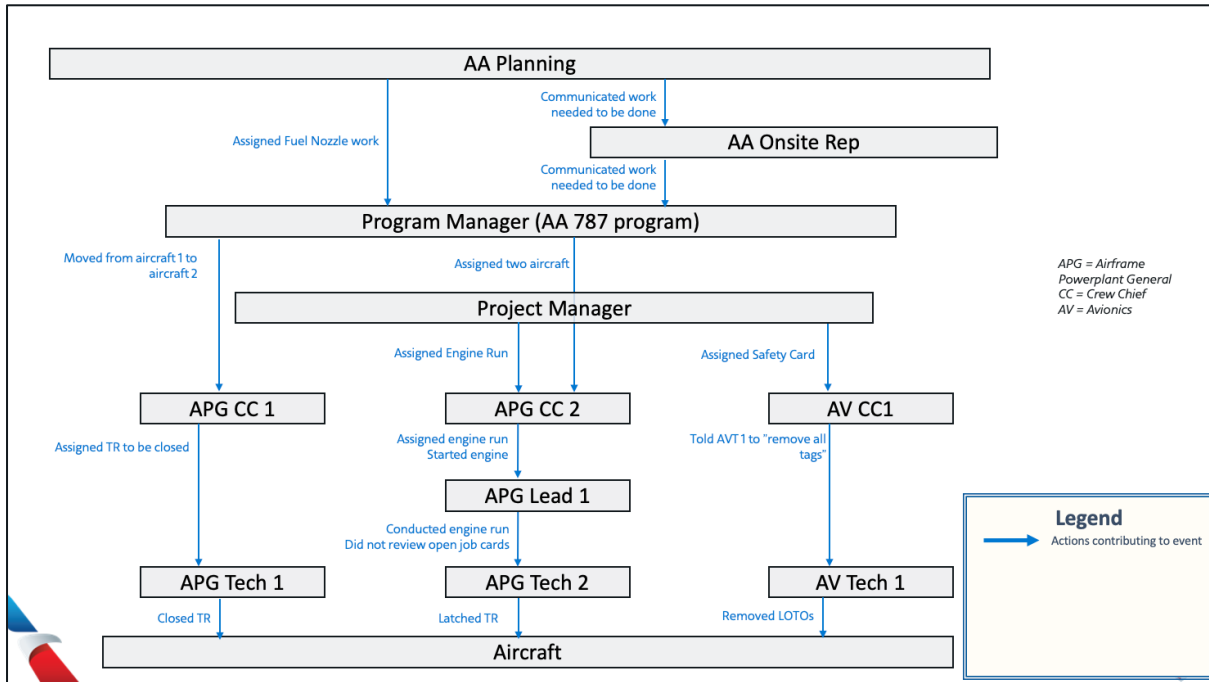


Now that we have completed the onsite and conducted our analysis - what's next?

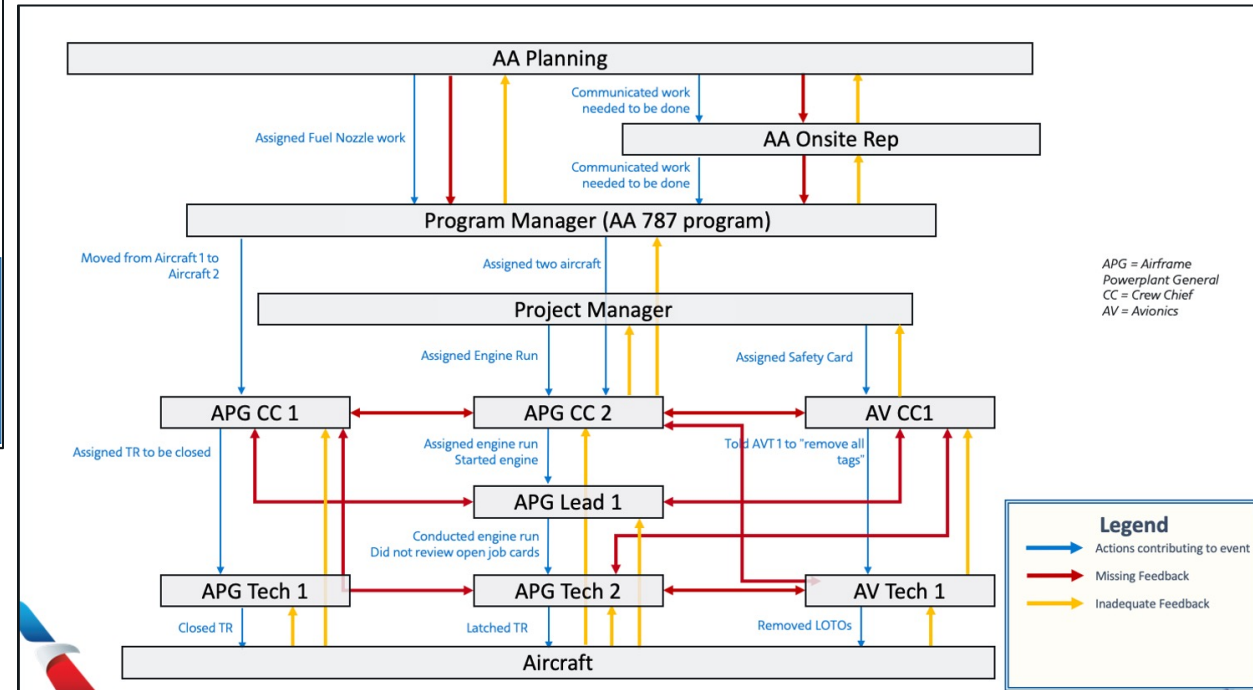


Control Structure

Leadership De-Brief



Show actions that contributed to the event
(contributing control actions)



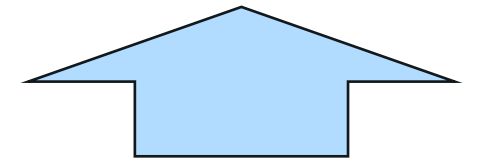
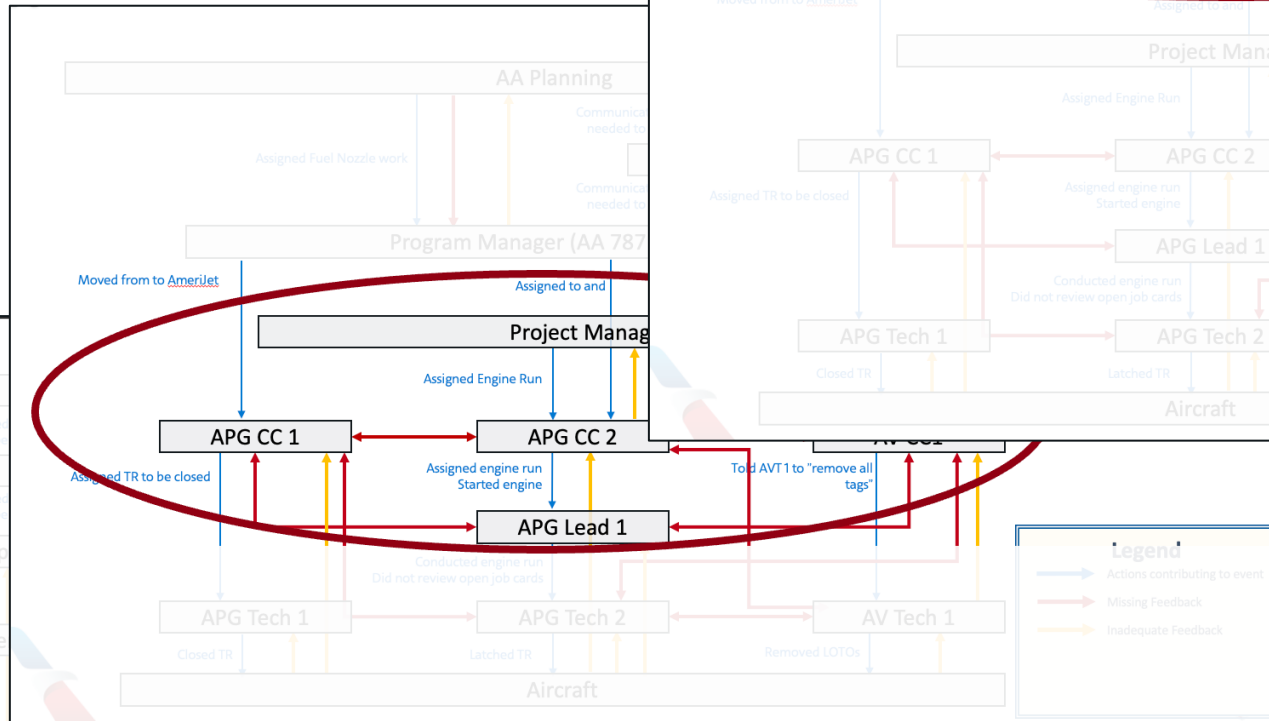
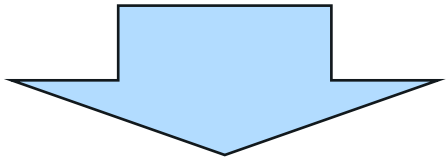
Shows the missing and incorrect
actions and feedback



Control Structure (continued)

Leadership De-Brief

The physical level (Aircraft, equipment, etc.)



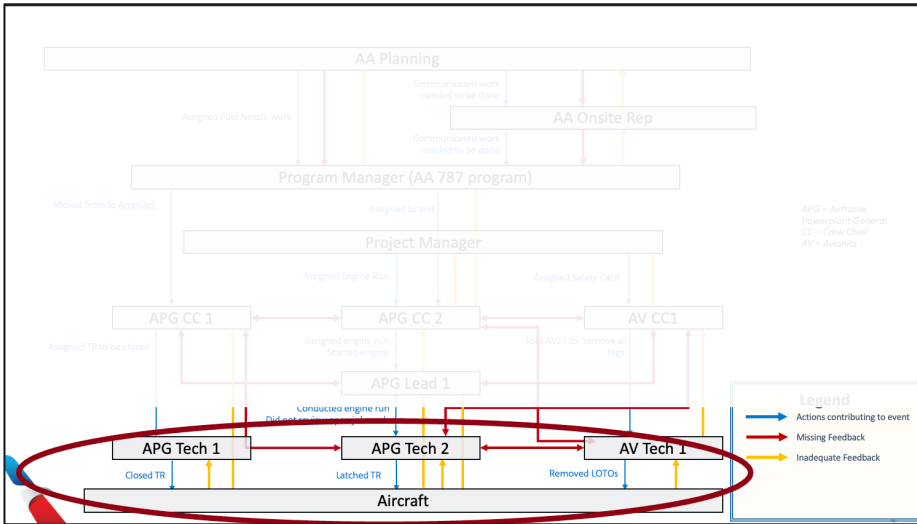
The "Decision Makers" aka leaders

The "Doers" aka front-line



Physical Level

Leadership De-Brief



Ineffective Feedback on Engine



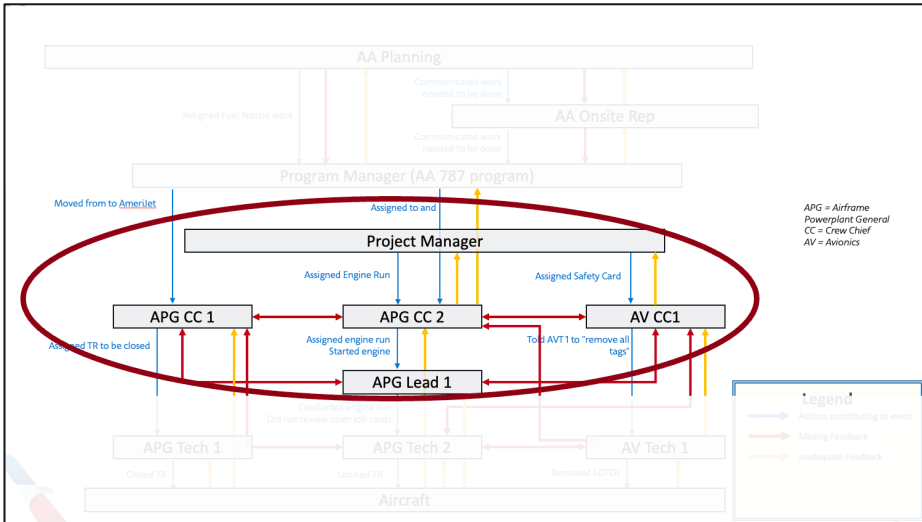
No visible feedback on engine

Ineffective Feedback In Flight Deck



"The Do'ers"

Leadership De-Brief



Work Oversight

No formal debrief of open work between Crew Chiefs during leadership change

Crew Chief and Lead were both new to role (within 3 months)

No formal training for Leads or Crew Chiefs

Insufficient feedback for open safety critical work

MROs do not have access to AA QC Sharepoint. This breaks control of work card oversight



"Dock" where job cards are located for aircraft BOW

LOTO Control Log

Lockout Tag Out (LOTO) Control Log					
SKYLOK® VIRTUAL CIRCUIT BREAKER WARNING LOCKOUT TAG CONTINUED FROM ANOTHER PAGE	<input type="checkbox"/>	COLLAR TAG NUMBER	AIRCRAFT #	ALL ITEMS IN THIS SECTION MUST BE CLEARED PRIOR TO ACTIVATION	
LOCATION INSTALLED (i.e. PANEL & FWD CARGO, ESE)	SYSTEM DEACTIVATED AND CB NUMBER (IF APPLICABLE)	REASON FOR DEACTIVATION	NRC # TC # OR NUMBER	JOB	INDIVIDUAL INSTALLING INITIALS EMP # & DATE
Campit	Fuel control	Safety		7526	
				Borescope Inspection Card	



AA Lock Out Tag Out (LOTO) Tag



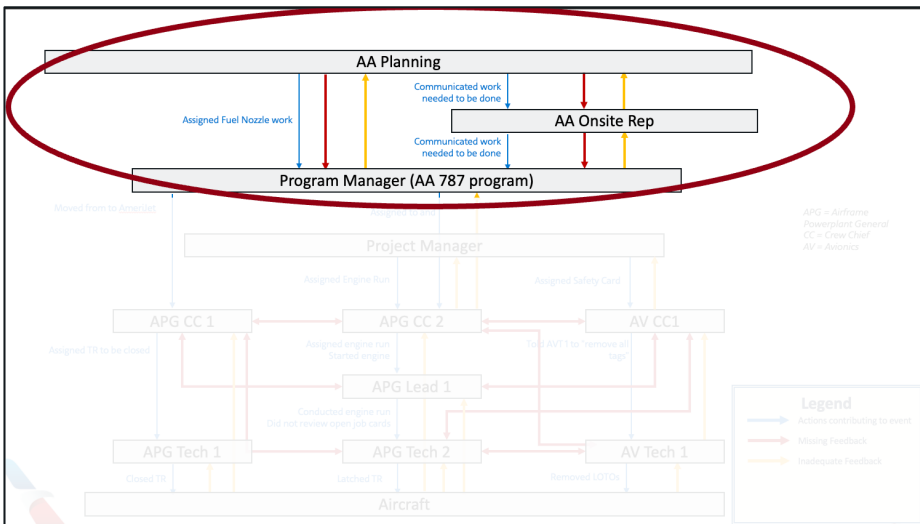
Permit Tag

"The Decision Makers"

Leadership De-Brief

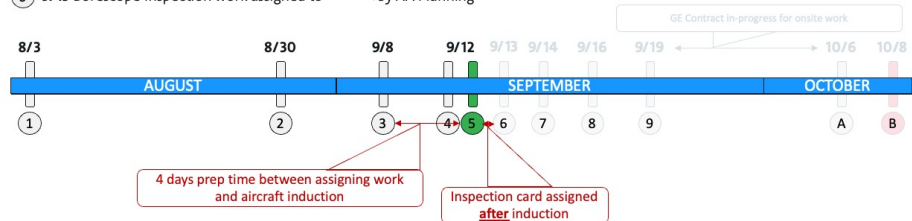


De-Brief



Timeline - Decisions Made

- 8/3 Draft Bill of Work (BOW) submitted to [redacted] by AA Planning
- 8/30 Final BOW submitted to [redacted] by AA Planning
- 9/8 Fuel Nozzle work assigned to [redacted] by AA Planning
- 9/12 [redacted] rejects the fuel nozzle work due to high risk
- 9/12 Aircraft inducted into [redacted] (East bay Hangar 7)
- 9/13 Borescope Inspection work assigned to [redacted] by AA Planning
- 9/14 Borescope plugs removed from aircraft
- 9/16 Borescope inspection complete. Results sent to AA QC
- 9/19 NRTs generated for fuel nozzles. AA begins contract talk with GE for onsite work
- 10/6 Contract with GE to perform fuel nozzle work finalized
- 10/8 High-power engine run performed, while engine borescope plugs are removed. Resulting in engine overheat/fire



How do we track system-improvement recommendations generated from CAST?



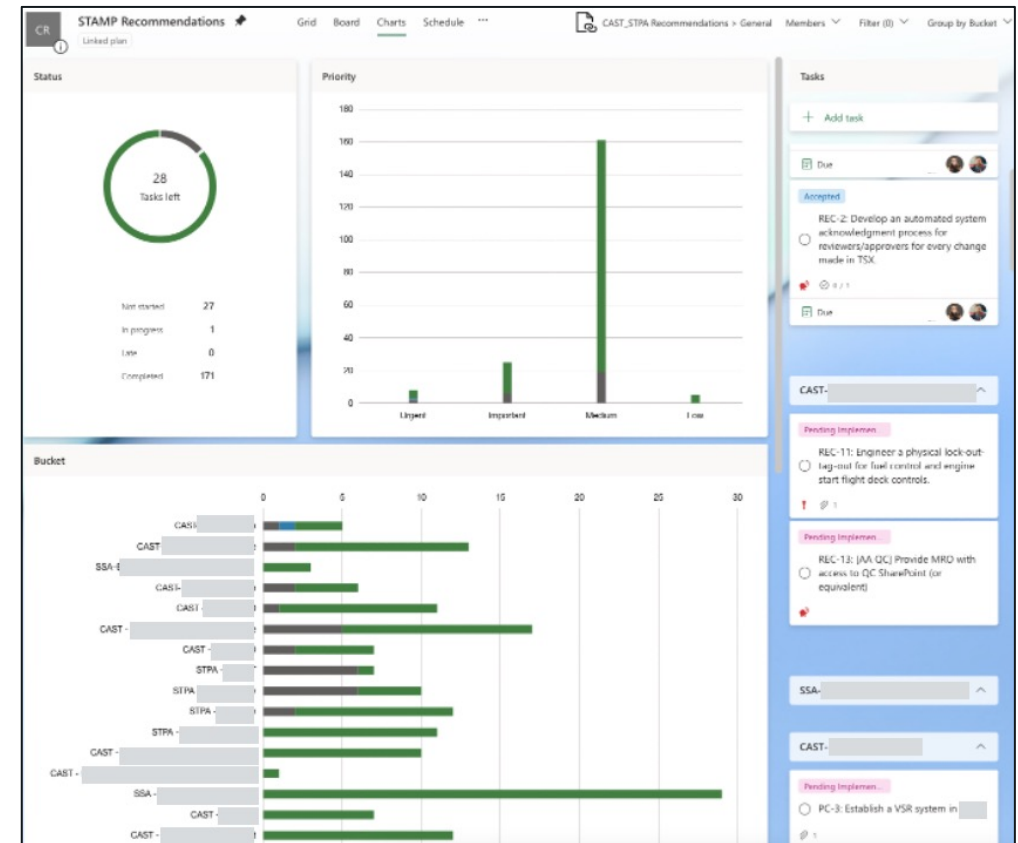
Tracking & Accountability

Recommendations



Name	Modified	Modified By	File size	Sharing
REC-1 Streamer (Complete)	January 15		4 items	Shared
REC-10 AA Planning (AA)	December 4, 2023		0 items	Shared
REC-11 Fuel LOTO (Complete)	January 17		3 items	Shared
REC-12 AA TR Lock (AA)	January 15		0 items	Shared
REC-13 QC Inspection report (Complete)	January 15		2 items	Shared
REC-2 EGR Checklist (Complete)	January 15		1 item	Shared
REC-3 LOTO (Complete)	February 13		4 items	Shared
REC-4 Operation Permit Tags (Complete)	January 15		4 items	Shared
REC-5 Dock Job Board (In-work)	January 15		3 items	Shared
REC-6 Crew Chief Re-assign (Complete)	February 13		8 items	Shared
REC-7 Crew Chief Turn-Over (Complete)	January 15		4 items	Shared
REC-8 Training Leads & Crew Chief (Co...)	February 13		6 items	Shared
REC-9 New CC,Lead Oversight (Compl...)	February 13		7 items	Shared

Sharepoint that hosts all recommendations for CAST
(owned by business)



Project Planner board to track recommendation status
(Safety Systems Engineering Owned)



Analysis Output

Recommendations



(Physical Controls)
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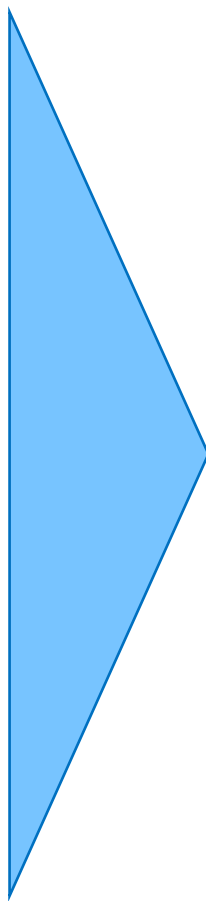
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Project Title: CAST – Engine Fire

AA Safety Systems Engineering Project Lead: [REDACTED]
On-Site Coordinator: f [REDACTED]

Project/Event Background/Summary
On [REDACTED] during a high-power engine run of 787-8 aircraft [REDACTED], the #1 and #2 engines caught fire. Six engine borescope plugs on each engine were not reinstalled prior to the engine run up, causing flames to erupt from the open borescope ports. Extensive damage was sustained inside and around the engine and thrust reversers.

Recommendations
Below is a summary of the project recommendations.

REC-1: Establish a minimum streamer length streamer that cannot be hidden when thrust reversers / cowlings are closed.

- **Rec Context:** Currently there is no standard length for streamers when borescope plugs are removed. This leads to no visibility when the thrust reversers are closed. [See Appendix A]
- **Business Owner:** AA – [REDACTED]
- **Status:** Implemented
 - **Date:** TBD

REC-2: Create a checklist to be conducted to inspect engine prior to any engine run ups (Post Maintenance, Pre Engine Run Check List)

- **Rec Context:** The high-power engine run was assigned while the borescope plugs were removed. The thrust reversers were closed and unlatched which was insufficient feedback to the ground crew that the aircraft was unsafe to start engine.
- **Business Owner:** AA – [REDACTED]
- **Status:** Implemented
 - **Date:** TBD

REC-3: Update the Lock Out Tag Out program to enhance oversight of safety critical tags, including responsibilities for removing tags. Include verification of work cards against LOTO to ensure work has been completed for the tags they are removing.

- **Rec Context:** Current LOTO process is manual and requires searching through binder of hundreds of papers. Also, current LOTO tags are paper and taped to critical systems in the flight deck. Current policy and procedure is to throw away paper tag after signing it back in, which eliminates any oversight or controls. [See Appendix C]
- **Business Owner:** AA – [REDACTED]
- **Status:** Accepted

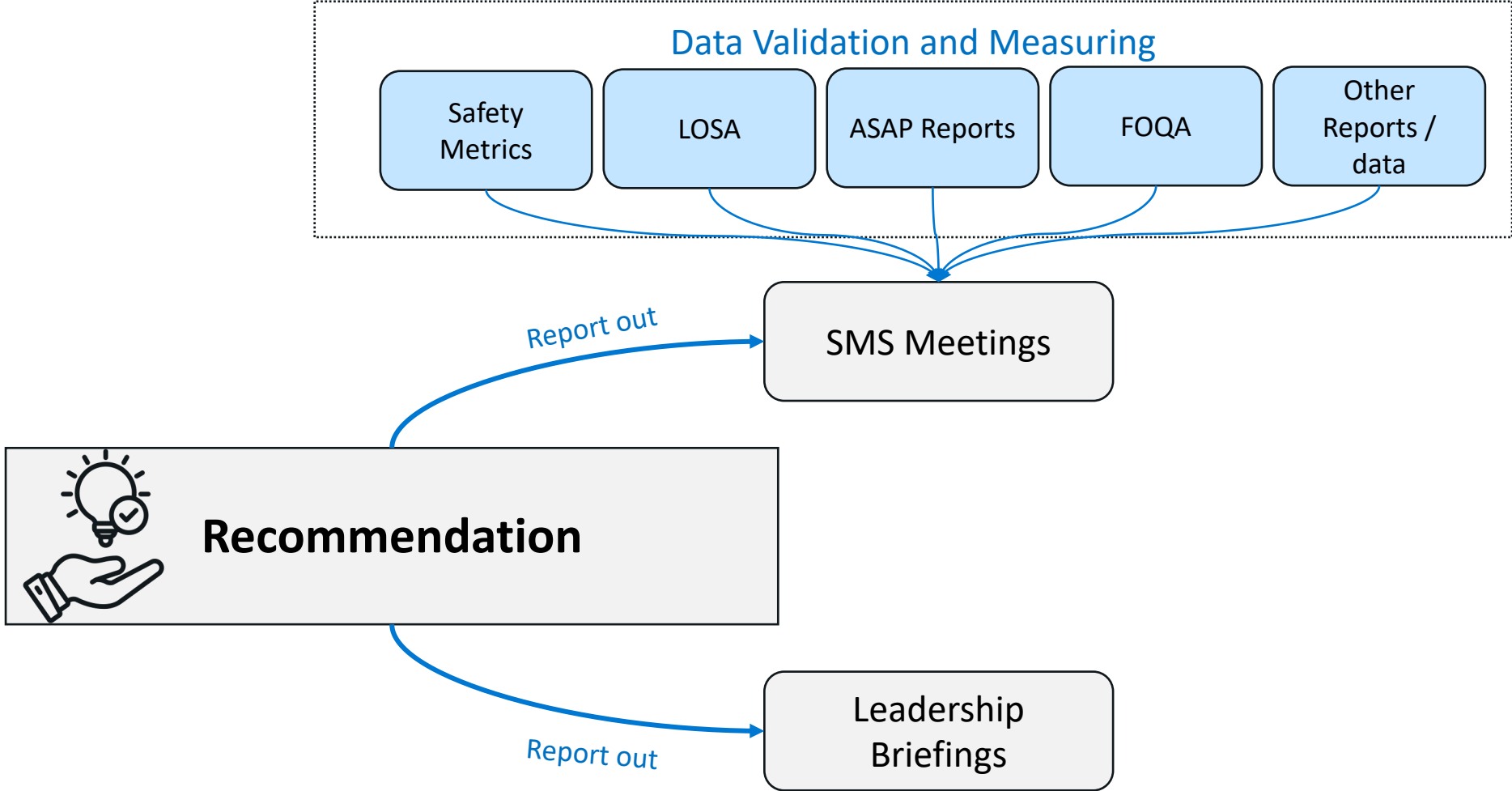
CAST Analysis Document

Executive Summary



Recommendations – SMS Flow

Monitoring for Effectiveness



Managing Perceptions

“What is the Root Cause”?

“We could have learned that without CAST”

“We need action taken now”

“The employee still didn’t follow procedures”



Questions?

StaySafe.



Stephen@aa.com

