Enhancing Field Issue Resolution Workflow for Compressor Components

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Abstract

Field investigations of compressor components are essential to maintaining aircraft engine reliability and fleet availability. However, investigation closure times are frequently extended due to incomplete intake data and sequential multidisciplinary engineering coordination. This study evaluated compressor component investigation workflows within a centralized aerospace engineering support organization using case reviews, stakeholder interviews, and workflow process mapping. Improvement initiatives were developed and implemented using an Agile sprint framework focused on intake data standardization and parallel engineering execution. The redesigned workflow is expected to reduce investigation closure time by approximately 25–35% while improving communication efficiency, technical consistency, and investigation visibility across engineering and customer support organizations.

Introduction

Compressor components operate under extreme mechanical and thermal conditions and are frequently involved in in-service events such as cracking, erosion, foreign object damage, and kinematic system malfunctions. Investigations of these events are typically conducted within centralized aerospace engineering support organizations coordinating multidisciplinary engineering teams, quality and safety personnel, customer support organizations, and external maintenance providers.

Despite strong technical expertise, investigation closure times often extend several months. Previous investigations indicated that delays were primarily driven by incomplete initial data, repeated clarification cycles, sequential engineering reviews, and limited cross-functional coordination.

The objective of this study was to improve compressor component investigation workflows by reducing closure time, improving data quality, enhancing multidisciplinary coordination, and increasing investigation visibility.

Literature Review

- ❑ Aerospace maintenance research identifies data completeness and evidence traceability as primary drivers of investigation efficiency
- ❑ Studies show that incomplete initial reporting leads to repeated data requests and extended engineering analysis cycles
- ❑ Engineering workflow optimization research demonstrates that standardized intake templates, centralized case tracking, and process mapping improve transparency and reduce rework
- ❑ Agile engineering management methodologies have been successfully applied to multidisciplinary engineering environments requiring rapid coordination, iterative improvement, and continuous stakeholder engagement

Methodology

- ❑ Selection and review of four representative compressor component investigation cases
- ❑ Evaluation of closure duration, failure descriptions, and intake data completeness
- ❑ Structured stakeholder interviews with engineering, quality, safety, and customer support organizations
- ❑ Development of current-state workflow process mapping to identify coordination dependencies and delay drivers
- ❑ Implementation of a two-sprint Agile improvement framework
- ❑ Development of standardized intake reporting templates and compliance checklists
- ❑ Introduction of parallel multidisciplinary engineering task execution
- ❑ Validation of redesigned future-state workflow through stakeholder review and baseline performance comparison

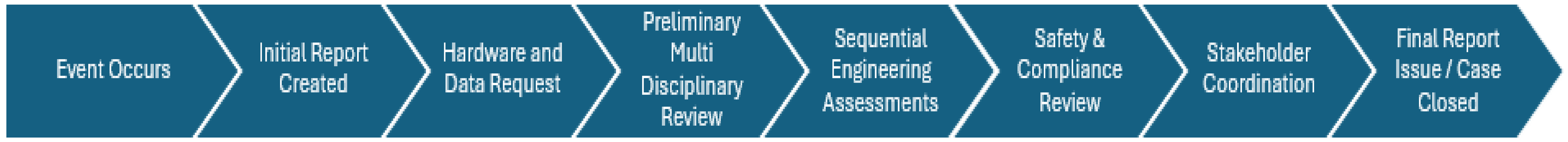

Figure 1: Current-State Compressor Component Field Investigation Workflow

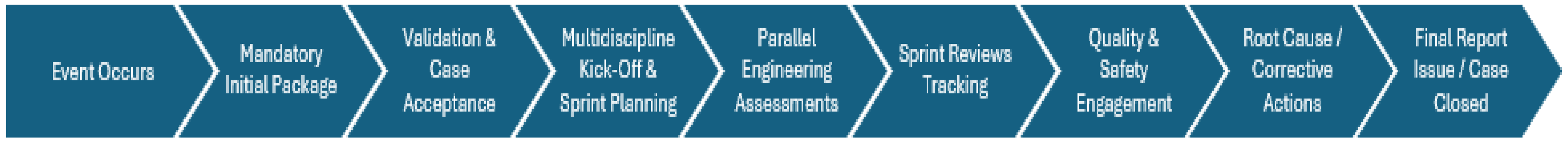

Figure 2: Agile-Based Future-State: Compressor Component Investigation Workflow

Results – Baseline Workflow Performance

Baseline investigation closure durations ranged from approximately three to six months, with an average closure time of approximately 4.6 months. The current-state workflow is illustrated in Figure 1. Investigations relied heavily on sequential engineering reviews and repeated data clarification cycles. Missing dimensional measurements, damage imagery, operating conditions, and maintenance history frequently delayed engineering analysis initiation. Table 1 summarizes baseline investigation performance characteristics across representative cases.

Table 1: Baseline Compressor Investigation Case Performance Summary

Case ID	Component Type	Closure Time (Months)	Primary Data Gaps	Major Delay Drivers	Root Cause Category
FI-CC-2024-01	HPC Case	6.0	Crack dimensions, internal imagery, operating temperature history	Sequential engineering review, supplier coordination delays	Thermal fatigue cracking
FI-FB-2024-02	Fan Blades	3.0	Impact dimensions, environmental conditions, damage imagery	Poor initial reporting quality, missing environmental data	Foreign object damage (bird ingestion)
FI-ST-2025-01	HPC Stators	5.0	Serial traceability, coating thickness data, maintenance history	Maintenance record retrieval delays, modeling turnaround	Environmental erosion
FI-KIN-2025-02	VSV Kinematic System	4.5	Actuator travel data, lubrication history, fault code snapshots	Multi-discipline coordination delays, dimensional measurement gaps	Progressive wear and contamination

Results – Sprint Improvement Outcomes and Future-State Workflow

Improvement initiatives were consolidated into a redesigned workflow shown in Figure 2. The future-state workflow introduces mandatory intake compliance validation, parallel multidisciplinary engineering task execution, early quality and safety engagement, and centralized investigation tracking. These improvements reduce sequential engineering dependencies and improve investigation transparency. Based on baseline trends and stakeholder validation, the redesigned workflow is expected to reduce investigation closure duration by approximately 25–35% while improving technical consistency and communication efficiency.

Conclusion

The Agile-based workflow improvement framework provides a practical approach for improving aerospace field investigation efficiency. Standardized intake data, parallel multidisciplinary engineering coordination, and centralized investigation tracking significantly reduce investigation delays and improve cross-functional communication. The proposed workflow supports improved fleet availability, maintenance planning efficiency, and engineering resource utilization.

These improvements support increased fleet readiness and reduce operational downtime across aerospace maintenance organizations. Future implementation should expand workflow adoption across additional engine modules and incorporate digital investigation management tools and predictive analytics capabilities.

Reference

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