

DCA24MA063

**MANUFACTURING RECORDS AND HUMAN
PERFORMANCE**

Group Chair's Factual Report - Supplemental
Addendum
March 13, 2025

A. SUMMARY

The addendum is a supplement and revision to the Manufacturing Records and Human Performance Factual Report dated July 3, 2024.

Section 1.1 Manufacturing Records and Human Performance Group Activities.

Add additional group activities:

- j. On July 9-11, 2024, the Group interviewed several Boeing Executives in Renton, WA.
- k. On July 16, 2024, the Group interviewed two Boeing Executives in Charleston, SC.
- l. On October 2-3, 2024, the Group interviewed an Ex Boeing-Executive and three other managers

Section 2.4 Fuselage Production of Line 8789

Additional Information: Drawing Rigging Procedures - Pressurized Fuselage Door Plug

The Drawing explained the rigging procedures for pressurized fuselage door plugs. Sheet 17, Section 5.2 Final Inspection Criteria and Section 5.2.1 Operational Check notes the inspections were to be checked with aircraft at a minimum on its landing gear (not jacked) and operate the completed plug and verify it operated smoothly while clearing all body structure.

Spirit designed the MED plug and had Drawing responsibility for the design. Spirit Installation plan (SI) calls for the installation and operational check of the MED during manufacturing per Drawing. Spirit stated the final rig and operational check of MED plug cannot be accomplished until the airplane is on the ground with landing gears installed. The rig and operation check were accomplished at Boeing.

During Boeing's review of the Manufacturing Documents after the accident, Boeing documented a nonconformance in April of 2024, when it was noted no 737 Boeing Installation Plan (IP) contained the MED-Plug operational check found on the Drawing Sheet 17- item 5.2.1. Additionally, it was noted the operational check cannot be performed, as the MED-plug was not operable in its final installed state. Boeing determined it was acceptable to omit the MED-

Plug operational check, as the MED-Plug was not intended to be operable in the final installed configuration and cannot be used for egress. Boeing had documented its acceptance to omit the MED-Plug operational check via a Multi-Unit Disposition Required NCR that was effective to all MED-Plug equipped 737s that will be manufactured until the Drawing was updated. As changes to the drawing was the responsibility of Spirit AeroSystems, Boeing and Spirit AeroSystems were in discussions regarding the drawing update. The subject drawing was updated in October 2024 and section 5.2.1 was deleted.

The Boeing Multi-Unit Disposition Required NCR, and its related NCO, documented Boeing's acceptance to omit the MED-Plug operational check. These documents showed that the previously completed rig verifications that omitted Section "5.2.1 Operational Check" from rig checks of the MED plug were reviewed by Boeing engineering, found to be acceptable, and no rework was required. As the MED plug operational check was not included in a Boeing IP operation, no IP operation/step was mis-stamped.

Subsequent to the NCR, a Suspect Discrepancy Report (SDR) was created to document if corrective action was required for delivered airplanes. The SDR documented that Boeing Engineering's investigation found the condition related to the multi-unit NCR was acceptable for the service life of delivered airplanes.

Section 3.2 737 Door Personnel Duties and Responsibilities

Footnote 8 states Investigators were unable to interview the Door Manager at the time Line 8789 was being manufactured in the factory due being on long term Medical Leave.

Through the Door Manager's representatives, the NTSB was able to get a statement from the Door Manager. See Attachment 1.

Section 3.4 Line 8789 Manufacturing Process

Revised to add additional information to IP-OK to Install Blankets - STA 727-887-, STR17L-17R Upper:

Revise:

IP-OK to Install Blankets was completed on September 20, 2023.

Change:

IP-OK to Install Blankets was started and short stamped¹ on September 1, 2023, and completed on September 20, 2023.

Section 3.4.2 Missing Removal Documentation/Record

Add the following information as 3rd paragraph of section.

Boeing review of all work associated *OK to Install Blankets*, associated NCRs/NCOs, *Installation of Insulation Blankets Sec 46, LH Sidewall*, and *Install LH Interior Sidewalls*, for line 8789 revealed the following:

- The procedures relating to the Quality Short Stamps (some operations) and nonconformance /discrepancy were correctly documented.
- Shortcomings to the following were identified:
 - Some short stamps did not clearly define the work remaining
 - Removals not documented for access – required removals
 - Removal for MED Plug removal and installation
 - Removal(s) for Blankets
 - OK to Install Final Operation step contrary to training expectations
- Boeing actions in work:
 - Comprehensive Product Safety and Quality Plan Actions
 - Update Installation Plans to align order precedence of *OK to install* and *Blanket Installation* plans
 - Update BPIs *Apply Electronic Stamps in the Common Manufacturing Execution System* and *Perform Product Conformance* for additional clarity on short stamp application and “OK to” operations
- See Attachment 2 - Line 8789 Manufacturing Process – IP OK to Install Blankets – STA 727-88, STR 17L-17R Upper.

Section 3.11 Boeing Quality Alerts

The Original Factual Report dated July 3, 2024, stated the following:

A communication method used by Boeing to re-emphasize process requirements to manufacturing and personnel was Quality Alerts. These alerts were typically sent to affected Boeing employees via company e-mail. An

¹ Application of stamp that indicates a portion of an operation or process has been completed.
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electronic confirmation that the alert had been read was required from each affected employee.

The section should now read as:

A communication method used by Boeing to re-emphasize process requirements to manufacturing and quality personnel were Quality Alerts. These alerts were typically sent to affected Boeing employees via company e-mail. The upper right-hand corner of a Quality Alert indicates to personnel if the Quality Alert is Information Only, or if Action Required, or if a Read & Response is required.

In the same section, the bullet noted the following:

- Short Form versus Long Form Requirements – Three Quality Alerts were issued to address personnel not properly selecting the correct removal templates within CMES.

The section should now read as:

- Short Form versus Long Form Requirements – Two Quality Alerts were issued to address personnel not properly selecting the correct removal templates within CMES.

Addition of Section 3.14 and Attachments

Section 3.14 Verification Optimization on Line 8789

Beginning in 2018 and concluding in 2021, Boeing initiated a strategy to focus on the methods to verify completed work throughout the production system. Formally referred to as "Verification Optimization" (VO), the initiative was intended to reduce redundant inspections and allow quality inspectors to focus on the areas of production most in need of additional inspection. The strategy was part of a broader shift toward "designed-in" and "built-in quality," which included implementation of technology capabilities and a focus on "error-proofing" engineering requirements.

The implementation of VO resulted in streamlining of certain secondary inspections for processes which were reviewed for performance and stability. The intent was to allow quality inspectors to focus on critical or higher risk processes, new or unique build processes, and processes that resulted in higher rates of defects according to data. In some areas, it resulted in changes to inspections to sampling-based methods, and in other areas, the work was

verified by manufacturing personnel who were experts in the work being performed. Redundant inspections for safety critical processes were not eligible for VO consideration.

Based on feedback from the FAA and internal stakeholders, from late 2020 through 2021, Boeing ceased Verification Optimization activities and beginning then, significantly increased the total number of inspections. Specifically, the number of inspections on delivered MAX aircraft currently is higher than it was prior to Verification Optimization. In 2017, Boeing performed more than 12,000 inspections per 737 delivered; today it is more than 15,000 inspections.

Boeing states the company has more quality inspectors working on the 737 than before Verification Optimization. During the years of VO, there were no plans to reduce the number of quality inspectors due to the reduced inspections; rather, VO anticipated redeploying quality personnel to focus on critical inspections and efforts to proactively identify issues and prevent defects throughout the build process. In February 2019, Boeing and the IAM entered into an agreement ensuring that no IAM employee would be laid off as a direct result of VO. Since the end of VO, due to the increased number of inspections, Boeing has increased the number of inspectors.

The Manufacturing Records and Human Performance group identified the Installation Plans that were associated with the MED Plug installation when Line 8789 was manufactured in 2023 and requested that Boeing conduct a review of the Installation Plans' Baseline Inspection Histories. Boeing performed the review and tabulated the Installation Plans' quality inspection counts for the periods of time "Prior to-VO," "During-VO," "Post-VO," as well as the number of quality inspection operations for Line 8789. Attachment 3 provides the tabulated data and other information.

Below is a summary of the Installation Plans for which the inspection counts had changed During-VO or Post- VO (further details can be seen in Attachment 3). The number of Post-VO quality inspection operations performed for these Installation Plans is equivalent to the number performed during the manufacture of Line 8789.

- Installation Plan - OK to Install Blankets (FD1)
 - Inspection counts from Prior to-VO to During-VO remained at 7 inspections.
 - Post-VO, in 2021, the work instructions included in this Installation Plan were divided among the original Installation Plan

and four new Installation Plans. The work was divided by fuselage sections. Following the division, the original Installation Plan contained 4 inspections, and each of the new Inspection Plans contained 3 inspections, for a total of 16 inspection operations.

- Installation Plan – Check Plug Rigging for FD 1-3.

- This Installation Plan was created Post-VO and contains 9 inspections.

- Installation Plan – Mid Exit Door Plug Fit and Fair (FD-9)

- Inspection counts from Prior to-VO to During-VO changed from 6 inspections to 5. In 2018, an inspection at the Forward Entry Door was changed from a quality inspection to a manufacturing verification. No inspections were removed or changed for the MED Plug.

- Installation Plan – Pre-Flight Low-Pressure Test (aircraft outside).

- This Installation Plan was created in 2023 and contains 5 inspections.

- Installation Plan – Aircraft Protection Requirements

- This Installation Plan was created During-VO and contained one inspection.

- Boeing added an additional 8 inspections Post-VO, for a total of 9 inspections.

Additional Information

1.0 Manpower Manufacturing Experience and Production Changes

Boeing Commercial Airplane (BCA) company senior level executives reported that in 2018 and 2019 following two 737-8 MAX accidents, the company decreased its production of the aircraft, which necessitated the reallocation of personnel and halted hiring and the backfilling of personnel lost through natural attrition². The subsequent global pandemic in 2020 saw the loss of even more workforces

² See Boeing Executive Transcripts pg 40
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particularly amongst those who had longevity with the company and were retirement eligible.

NTSB staff interviewed multiple executives and touch labor³ who reported the previous Boeing accidents and the pandemic resulted in changes in prior manufacturing experience and skill⁴ for employees working production. During a post-accident interview, the general manager for the 737 line stated "...10 years ago we were closer to 50% of employees with more than 10 years [experience]. Today I would say we are at 25 or 30%..., [a]nd so certainly a shift in you know, tremendous experience level."⁵ The workforce experience demographics were not unique to BCA as their major supplier, Spirit AeroSystems was similarly affected.⁶

After the MAX accident groundings and during the height of the pandemic slowdown, 737 production were less than 10 airplanes a month; down from the 52 a month prior to 2018.⁷ To increase production to pre-2018 levels, BCA had to hire to compensate for the employment changes described above. This meant Boeing had Boeing hired people with varied backgrounds and many employees did not have previous manufacturing experience.⁸

Prior to the accident occurring, Boeing used a host of metrics designed to provide information about production effectiveness. The company conducted an assessment on whether to increase their productivity, but the senior vice president of quality for BCA was not aware if a risk assessment on workforce experience was accomplished.⁹

2.0 Manufacturing Workforce Training

Prior to the accident, new hires on 737 production line initially attended foundational training where they would be required to have proficiency checks prior to being released to on-the-job training for the job series for which they were intended.¹⁰

³ Touch labor are those workers who have direct access to the production assembly process as part of their respective job series.

⁴ See Boeing Executive Transcripts pgs 40; 219-222; 368; 448 and see Additional Interview Transcripts pg 37-38; 448-449 and See Boeing Personnel Transcripts pg 42

⁵ See Boeing Executive Transcripts pg 368

⁶ See Transcript – Investigative Hearing DCA24MA063 Day 1, pg 78

⁷ See Boeing Executive Transcripts pgs 30-31; 292-293

⁸ See Boeing Executive Transcripts pgs 30-21; 292-293; See Boeing Personnel Transcripts pgs 121-122, 325-326, 500-571, 670

⁹ See Boeing Executive Interview Transcripts pg 41

¹⁰ See Boeing Executive Transcripts pg 229

Specialized training such as that required to remove, install and rig 737 airplane doors was largely on the job.¹¹ Prior to the accident, there was no task list, grading structure, or training documentation required for Boeing 737 door crew members doing OJT.

NTSB staff interviewed five door crew personnel who confirmed their job series relied heavily on OJT.¹² 737 door technicians were trained on specific door rigging tasks that had to be accomplished for every build.

A 25-year veteran of the 737 door crew stated he routinely works on the jobs assigned to him, provided guidance when others requested his advice, and provided OJT¹³. In addition, he believed he was the only person proficient in working all the 737 doors. He said he was the one typically tasked with and the most knowledgeable on opening the plug in the rare occurrence removal was required, however he was on leave the day the task of opening the MED plug came in and therefore was unable to assist. Other 737 door crew members confirmed the veteran was the most knowledgeable on all the doors and was relied upon to provide direction when needed.

3.0 Quality Management System

A Quality Management System (QMS) is a structured system of policies, procedures, and processes that helps a manufacturing organization ensure their products meet quality standards.¹⁴ BCA's production certificate (PC 700) contains their authorization to manufacture type-certificated products and was active at the time of the accident.

Boeing's QMS covered several elements of the production process and included a section that covered quality escapes. A quality escape is a product or article that did not conform to its approved design and has been released from Boeing's quality system.¹⁵ The *Quality Escapes* section of the manual describes how to identify, control, document and disposition a product that does not conform to specifications. The manual does not provide specific identification and mitigation strategies for when an escape is the result of human error.

¹¹ See Boeing Personnel Transcripts pgs 387; 675;

¹² See Attachment 4:737 Door Crew Member Training; Also See Boeing Personnel Transcripts pgs 168, 210, 334, 380

¹³ See Boeing Personnel Transcripts pgs 378-382

¹⁴ See International Organization for Standardization <https://www.iso.org/quality-management/what-is-qms>

¹⁵ See DCA24MA063 docket 11-I Manufacturing Records and Human Performance Attachment 8- BCA QMS Quality Escapes Excerpt
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4.0 Instructional Guidance

An interview with a functional test technician¹⁶ revealed he manipulated the plug from a fully opened to “hanging” position to facilitate the aircraft moving to an exterior location.¹⁷

At the time of the accident, BPI 1581 instruction was more than 50 pages long and contained 12 hyperlinks to various other instructions. The guidance had undergone 11 revisions between 2013 and 2023 which resulted in it listing more exceptions about when a removal was *not* needed, rather than providing clear guidance on when it was. Two of the 12 BPI-1581 revisions were related to removal exceptions. In 2015, an exceptions appendix was added to the document and in 2018, the appendix was expanded.

5.0 Oversight

At the time of the accident, there were five FAA ASIs assigned to the Boeing 737 program. The ASIs were responsible for ensuring the company complied with FAA regulatory standards for aircraft manufacturing.

The ASIs said that, prior to the accident, their surveillance findings typically consisted of tool and foreign object control violations, routine deviation from work instructions, and training deficiencies.¹⁸ An example of a common training deficiency was a worker not knowing how to find the manufacturing documents needed for a specific job. These categories typically generated the most corrective actions and non-compliances.¹⁹

The process to investigate and address compliance issues was managed by Boeing’s Regulatory and Quality System Oversight (RQSO) organization. Together with the FAA, the team developed resolutions and prescribed various corrective actions. The FAA then had to either accept or reject the corrective action. Examples of actions include, but are not limited to, revising/updating the process, retraining of personnel, and communication devices such as the quality alerts. As mentioned earlier, the Boeing parts removal process had been through multiple revisions, had been the subject of several quality alerts, and there were also workshops and training sessions dedicated to ensuring its usage. Each of the corrective actions were accepted by the FAA and implemented.

¹⁶ Functional Test Technicians are responsible for removing and installing tooling, fall protection, damage and environmental protection for the airplane as it moves through production.

¹⁷ See Boeing Personnel Transcripts pg 465

¹⁸ See FAA Personnel Transcripts pgs 18, 138, 191,

¹⁹ A corrective action is any set of actions taken to rectify or change a process that causes errors or nonconformance issues. A non-compliance is a deviation to a regulatory standard.

6.0 Boeing's Voluntary Safety Management System

The FAA SMS program advisor who helped Boeing develop their VSMS said the program was accepted because it established the process and procedures necessary for an SMS. He said the FAA had witnessed the execution of those processes and procedures, and the company was actively working towards a mature program.²⁰ Because the Boeing VSMS was voluntary, however, inspecting had not yet started on its integration into the Boeing QMS. Most of the ASIs interviewed had not yet attended SMS training and therefore were not knowledgeable about what the program entailed or what their requirements would be for oversight.²¹

Like a regulatory SMS, a VSMS structure is composed of four pillars: safety policy, safety risk management, safety assurance, and safety promotion. Further, because there was no regulatory requirement for an SMS at the time, FAA ASI did not conduct surveillance specific to the program. At the time of the accident, BCA was still actively working to bridge their QMS and VSMS processes.

NTSB Staff reviewed the VSMS manual dated October 23, 2023. It stated the program's ultimate goal of being able to identify, assess, and control hazards, and mitigate risks based on a thorough understanding of the systems, processes, human factors, and operating environment.²²

6.1 Safety Risk Management

Safety risk management (SRM) is a formalized process for identifying hazards and the risks associated with them.²³ Boeing executives said that their company was new to applying SRM to hazard and risk identification under the SMS construct²⁴ although they routinely applied a modified SRM to their rate readiness review.

According to Boeing, their rate readiness process evaluates the health of the production system. The evaluation is performed by reviewing several factors including: (1) analyzing the health of the current production system; (2) establishing a baseline schedule for the proposed rate change; (3) identifying all impacted elements, stakeholders, and requirements; and (4) assessing the risks associated with the production rate changes.²⁵

²⁰ See FAA Personnel Transcripts pg 757

²¹ See FAA Personnel Transcripts pgs 48, 152,

²² See Attachment 4: Boeing Enterprise Safety Management System Manual

²³ See FAA Introduction to Safety Risk Management, <https://www.faa.gov/newsroom/safety-briefing/introduction-safety-risk-management>

²⁴ See Boeing Executive Interview Transcripts pgs 116, 120

²⁵ See Attachment 4: Boeing Comprehensive Readiness Rate Review
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Boeing senior leadership had been previously notified there was an issue with the parts removal process and via an VSMS board meeting, it was determined an SRM would be convened to determine what the issue was and what actions might be taken. There was also an SRM in work dedicated to training and to specific reports registered through the Speak Up feedback mechanism before and immediately after the accident occurred.^{26,27}

6.2 Safety Assurance

Under safety assurance, the effectiveness of the hazard identification and risk control strategies are continuously measured.²⁸ Prior to the accident occurring, Boeing used KPIs to measure production health for the 737 production line. Quality control metrics such as nonconformances, supplier conformance, how long an aircraft took to progress through the build, escapements, and regulatory compliance were routinely assessed at multiple tiers of leadership.²⁹ However, Boeing was still working to implement safety assurance components in their QMS.

Post accident, the FAA mandated BCA produce a comprehensive plan as to how they were going to address their quality control *and* safety issues.³⁰ Boeing selected six key indicators they felt would be best representative of their quality *and* safety health.³¹ The metrics they chose were employee proficiency, notice of escapes, supplier shortages, rework hours per airplane, travelers at factory rollout, and ticketing performance. The KPIs were already part of a larger body of metrics Boeing repeatedly monitored under their QMS and were refined under collaboration with the FAA so that they were more risk focused rather than production focused.³² According to a Boeing website, “each KPI has defined criteria that help identify areas of potential risk to our operations and trigger corrective action through our Safety Management System (SMS). These metrics have helped Boeing conduct more targeted safety risk assessments in priority areas and maintain production health.”

²⁶ See Boeing Executive Transcripts pgs 32, 57, 99, 176

²⁷ Both SRMS were still underway and at varying stage of completion at the time of the investigation.

²⁸ See FAA Safety Assurance,
https://www.faa.gov/about/initiatives/sms/explained/components#safety_assurance

²⁹ See Boeing Executive Interview Transcripts pgs 15

³⁰ See “Updates on Boeing 737-9 MAX Aircraft, February 2024,
<https://www.faa.gov/newsroom/updates-boeing-737-9-max-aircraft#:~:text=February%202024%3A%20FAA%20Administrator%20Mike,how%20the%20company%20does%20business.>

³¹ See Boeing Executive Interview Transcripts pg 22 also see <https://www.boeing.com/strengthening-safety-and-quality#acsaa>

³² See Boeing Executive Interview Transcripts pg 21

6.3 Safety Promotion

Most of the workers associated “safety culture” with maintaining occupational safety and health standards.³³

Out of those interviewed, only one technician stated the environment was “shady” and the management was nothing but “push, push, push³⁴” referring to the drive for the work to get done in shorter and shorter time. In his opinion, the entire leadership team for the 737 line, from his manager to the CEO of the company, needed to be let go.³⁵ The technician was under investigation for his involvement in relation to the MED plug removal at the time.

Personnel that were interviewed were a relatively small sample size of a much larger workforce. Information gathered during the investigation was at the same time the Boeing company was under scrutiny from multiple industry and government agencies.

B. LIST OF ATTACHMENTS

Attachment 1 - Door Manager Statement

Attachment 2 - Line 8789 Manufacturing Process - IP OK to Install Blankets - STA 727-88, STR 17L-17R Upper

Attachment 3 - Boeing Presentation - Verification Optimization on Line 8789

Attachment 4- NTSB Memorandum for Record

Submitted:

Pocholo Cruz
Aerospace Engineer

Sabrina Woods, Ph.D.
Human Performance Investigator

Nils Johnson
Maintenance Investigator

³³ See Boeing Personnel Transcripts

³⁴ See Boeing Personnel Transcript pgs 159, 176, 182, 223

³⁵ See Boeing Personnel Transcripts Memorandum for Record Interview Summary
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Attachment 1 - Door Manager Statement



June 11, 2024

Eric M. Johnson
Attorney Advisor
Office of General Counsel
National Transportation Safety Board
490 L'Enfant Plaza SW
Washington, D.C. 20594


Re: NTSB Investigation DCA24MA063
Questions for 

Dear Mr. Johnson:

Thank you for email of May 29, 2024 providing written questions for . I have reviewed the questions with  and we are able to provide the responses below in *italics* to the NTSB's questions, which are also restated below.

Per Boeing Processes, who (which Production Team) would typically work any issues with regards to Mid Exit Door Plugs?

The door crew would typically work these issues, although other teams did work on issues with regards to Mid Exit Door Plugs as well.

After reviewing the data for barge records for Line 8789 on September 18, 2023, showed that you shielded in at 8:46 am and shielded out at 9:02am.

- Per Boeing Production documents (IP/NCR/Statements/Photographs/Text/SAT), the L/H MED Plug was opened on September 18, 2023, between 7:58 am and 10:53am on Line 8789:

- 1) Who did you asked to open the LH MED Plug on Line 8789? Did you follow up to ensure that the plug was opened?

 *does not have an independent memory of asking that the LH MED Plug be opened on Line 8789, nor does he recall following up to ensure the plug was opened.*

- 2) Did you see the LH MED Plug opened between 8:46 am through 9:02 am?

██████████ *does not recall whether he saw the LH MED Plug on Line 8789 opened at any time period, including the period listed above.*

- 3) Per Boeing Process, why was a removal record not generated for the opening of the L/H MED Plug on Line 8789?

██████████ *does not know why a removal record was not generated for the opening of the L/H MED Plug on Line 8789.*

- 4) What happened to the LH MED Plug assembly hardware once the Plug was opened?

██████████ *has no recollection of seeing the LH MED Plug assembly hardware once the Plug was opened and likewise does not know what happened to the LH MED Plug assembly hardware.*

- Per Boeing Production documents (IP/NCR/Statements/Photographs/Text/SAT), the L/H MED Plug was closed on September 19, 2023, between 5:09 pm and 6:39 pm:

- 1) Were there any Door crew personnel working the second shift on September 19, 2023? If so, who?

There were not typically door crew working on second shift.

- 2) Do you know who closed the L/H MED Plug on Line 8789?

██████████ *does not know who closed the L/H MED Plug on Line 8789.*

Eric M. Johnson
June 11, 2024
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Sincerely,

Davis Wright Tremaine LLP



**Attachment 2 - Line 8789 Manufacturing
Process - IP-OK to Install Blankets - STA 727-88-,
STR17L-17R Upper**

LN 8789 FD1 Blanket IP Timeline

- **Ok to Install Blankets**

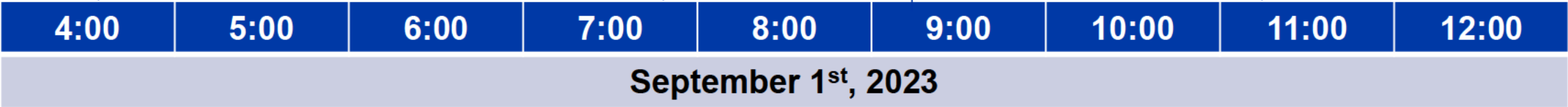
IP- [REDACTED]

OK TO INSTALL BLANKETS - STA 727-887, STR 17L-17R UPPER LOBE

- **Blanket Installation**

- IP- [REDACTED]

INSTALLATION OF INSULATION BLANKETS SEC 46, LH SIDEWALL UPPER LOBE, STA 727-887



● 04:38 – Work begins on IP - initial shop stamps applied

● 07:32 – Operation 20/30 **Quality short stamp** C/L “c/l 6 open holes. Shop is fixing them right now.”

● 07:46 –Operation 20/30 stamped by QA and ready for customer review.

● 09:17 – Operation 999 - **Shop short stamp** C/L P/U

● 11:03 –Operation 30/10 stamped airline customer accept / ref CNS [REDACTED]

● 11:04 – Rework Order [REDACTED] written for tool mark c/t LH mid exit door edge frame

● 11:14 – Rework Order 145-8789-RSHK-1296-002NC (N1450292531) written for (5) damaged rivets

● 11:18 – Operation 999 FINAL **Quality short stamp** C/L P/U

● 11:30 – IP- [REDACTED] stamped complete

Note: Order of precedence section states to work order IP- [REDACTED] before this order.

IP- [REDACTED] was previously the OK to install blankets for the upper 43 section, but only applied to STA360-540 on LN8789

* Timeline based on CMES, SAT, and other records provided to NTSB

LN 8789 FD1 Blanket IP Timeline

- **Ok to Install Blankets**

IP- [REDACTED]

OK TO INSTALL BLANKETS - STA 727-887, STR 17L-17R UPPER LOBE

- **Blanket Installation**

- IP- [REDACTED]

INSTALLATION OF INSULATION BLANKETS SEC 46, LH SIDEWALL UPPER LOBE, STA 727-887

- **Sidewall Installation**

IP- [REDACTED]

INSTALL LH INTERIOR SIDEWALLS



* Timeline based on CMES, SAT, and other records provided to NTSB

Terms & Definitions

- C/L – Complete Less
- IP – Installation Plan
- P/U – Pickup
- Operation 999 – Hard-coded final operation on CMES orders. Final authority media cannot be applied until all prior operations are stamped and all exceptions have been cleared.
- Order Precedence - order or sequence in which the work will be performed
- Short stamp – Application of stamp that indicates a portion of an operation or process has been completed

Summary

■ What procedures were followed correctly?

- Quality short stamps followed BPI-█████ “Apply Electronic Stamps in the Common Manufacturing Execution System”, Section █████ on some operations
- Nonconformance records for tool mark and rivet discrepancy attached as exceptions to Ok to Install installation plan

■ What procedures were not followed correctly (if any)?

- Some short stamps did not clearly define the work remaining
- Removals not documented for access – required removals
 - Removal for Mid Exit Door Plug removal and reinstallation
 - Removal(s) for Blankets
- Ok to Install 999 Operation contrary to 2020 training expectations for inspection responsibility

■ Key Boeing Actions

- Comprehensive Product Safety & Quality Plan actions (BPI-1581 “Perform Emergent Part or Assembly Removal” updates, BPI-█████ “Apply Electronic Stamps in the Common Manufacturing Execution System” updates, additional training and system controls for removals and stamping, etc.)
- Update of installation plans to align order precedence of Ok to Install and Blanket Installation plans (in work)
- Update BPI-█████ “Apply Electronic Stamps in the Common Manufacturing Execution System” and BPI-█████ “Perform Product Conformance” for additional clarity on short stamp application and “Ok to” operations (in work)

Comprehensive Safety and Quality Plan Update

Execution on plan

Status



Invest in workforce training

Improve training and proficiency

- ✓ All employee Safety & Quality training
- ✓ Growth in Foundational Training student population
- ✓ Introduced new curriculum
- ✓ Launching feedback loops



Simplify plans and processes

Simplification of processes and procedures

Improve Installation Plans (IPs)

- ✓ Completed phase 1 of simplified command media – mapped requirements for multiple governance documents, Initiating Phase 2 activity to develop future state document architecture
- ✓ Implemented stamping changes
- ✓ Revised removals BPI to simplify & clarify requirements
- ✓ Drafted new Quality manual
- ✓ Design Build Audits launched on all programs
- ✓ Began installation plans (IPs) simplification
- ✓ Released IPs with inspection standard work on multiple programs



Eliminate defects

Reduce incoming defects from the supply chain

Production system compliance

- ✓ Deployed Work In Progress (WIP) part control at multiple sites
- ✓ Launched tool corrals in multiple factory locations
- ✓ Continue reducing defects at their source; including reduction of Spirit 737 fuselage defects
- ✓ Implemented FOD prevention tactics in critical work areas



Elevate safety and quality culture

Implementing SMS across our production system

Advance culture with engagement and communication

- ✓ Deployed Move Ready Safety Risk Assessment (SRA) at multiple factory sites
- ✓ Continuing Leaders in Foundational Training (LiFT) across all BCA programs, launching module 2
- ✓ All Employee Involvement (EI) Teams implemented across BCA

**Attachment 3 - Boeing Presentation -
Verification Optimization on Line 8789**

Installation Plan – Baseline Inspection History*

Installation Plan Title	Inspection count prior to VO** (before 2018)	Inspection count during VO (2018-2021)	Inspection count post VO (2021+)	LN 8789 Quality inspection operations	Notes
Load Fuselage (FD 1) IP- [REDACTED]	-	-	-	-	This installation plan is performed by Tooling organization
OK to Install Blankets (FD 1) IP- [REDACTED]	7	7	4	4	This IP works in conjunction with IP- [REDACTED] noted below; in 2021, IP was split, and only covers STA 360-540
OK to Install Blankets (FD 1) IP- [REDACTED] (STA 727-887, STR 17L-17R upper)	N/A	N/A	3	3	New Installation Plan created in 2021 – was created from IP- [REDACTED]
OK to Install Blankets (FD 1) IP- [REDACTED] (STA 178-360 STR 17L-17R upper lobe) IP- [REDACTED] (STA 540-727, STR 15L-15R upper lobe) IP- [REDACTED] (STA 887-1040)	N/A	N/A	3 3 3	3 3 3	New plans created from IP- [REDACTED]
Check Plug Rigging (FD 1-3) IP- [REDACTED] (Verify Rigging starting at LN8634)	N/A	N/A	9	9	IP created from IP- [REDACTED] Mid Exit Door Plug Fit and Fair (FD 9)
High/Low Blow (FD 7) IP- [REDACTED]	5	5	5	5	
Mid Exit Door Plug Fit and Fair (FD 9) IP- [REDACTED]	6	5	5	5	1 operation changed in 2018 from Quality to Manufacturing
Pre-Flight Low-Pressure Test (aircraft outside) IP- [REDACTED]	N/A	N/A	5	5	IP created from IP- [REDACTED] in 2023
Aircraft Protection Requirement IP- [REDACTED]	N/A	1	9	9	IP created from IP- [REDACTED] in 2018
Customer Paint Inspection Requirements IP- [REDACTED]	4	4	4	4	
Installation of Insulation blankets Sec 46, RH IP- [REDACTED]	-	-	-	-	Works in conjunction with IP- [REDACTED] Ok to Install Blanket Installation Plan (FD 1)
Installation of Insulation blankets sec 46, LH sidewall IP- [REDACTED]	-	-	-	-	Works in conjunction with IP- [REDACTED] Ok to Install Blanket Installation Plan (FD 1)

IP- [REDACTED] Ok to Install Blankets IP History

120	10	INSPECT - OK TO INSTALL, I HAVE VERIFIED AREA IS FREE OF FOREIGN OBJECTS AND DEBRIS. NOTE: REVIEW CUSTOMER INSPECTION REQUIREMENTS. IF APPLICABLE, RE-OFFER TO CUSTOMER FOR RE-INSPECTION AND ACCEPTANCE. (Stand Text IJZRB) OK TO INSTALL BLANKETS STA 178-360, STR 17L - 17R UPPER LOBE. REVIEW CUSTOMER PICKUP HISTORY AND ENSURE CONDITION DOES NOT EXIST FOR IRS: 3001-31 https://cns.web.boeing.com/cns/PUAirplane.aspx.
140	10	INSPECT - OK TO INSTALL, I HAVE VERIFIED AREA IS FREE OF FOREIGN OBJECTS AND DEBRIS. NOTE: REVIEW CUSTOMER INSPECTION REQUIREMENTS. IF APPLICABLE, RE-OFFER TO CUSTOMER FOR RE-INSPECTION AND ACCEPTANCE. (Stand Text IJZRB) OK TO INSTALL BLANKETS STA 360-540, STR 17L - 17R AND STA 540-727 STR 15L - 15R, UPPER LOBE. REVIEW CUSTOMER PICKUP HISTORY AND ENSURE CONDITION DOES NOT EXIST FOR IRS: 3001-32 https://cns.web.boeing.com/cns/PUAirplane.aspx.
160	10	INSPECT - OK TO INSTALL, I HAVE VERIFIED AREA IS FREE OF FOREIGN OBJECTS AND DEBRIS. NOTE: REVIEW CUSTOMER INSPECTION REQUIREMENTS. IF APPLICABLE, RE-OFFER TO CUSTOMER FOR RE-INSPECTION AND ACCEPTANCE. (Stand Text IJZRB) OK TO INSTALL BLANKETS STA 727 - 1040, INCLUDING PRESSURE DOME, (FOR FLAT PANEL BULKHEADS USE STATION 1042), STR 17L - 17R, UPPER LOBE. REVIEW CUSTOMER PICKUP HISTORY AND ENSURE CONDITION DOES NOT EXIST FOR IRS: 3001-33 https://cns.web.boeing.com/cns/PUAirplane.aspx.
999	10	INSPECT - WITHOUT DISRUPTING THE PREVIOUSLY INSTALLED PARTS/COMPONENTS. INSPECT AND/OR VERIFY LISTED PARTS, ASSEMBLIES AND/OR OPERATIONS PER ENGINEERING DRAWINGS AND PROCESS SPECIFICATIONS AS PLANNED. REVIEW THE PLANNED OPERATIONS. ENSURE THAT ALL OPERATIONS AND STEPS HAVE BEEN COMPLETED INCLUDING DATA ENTRIES, IN-PROCESS INSPECTIONS AND LOGGED ITEMS. (Stand Text INSZQ)



Operation moved to IP-[REDACTED]



Operation split:

- STA 360 - 540 remained on IP-[REDACTED]
- STA 540 - 727 moved to IP-[REDACTED]



Operation split:

- STA 727 - 887 moved to IP-[REDACTED]
- STA 887 - 1040 moved to IP-[REDACTED]



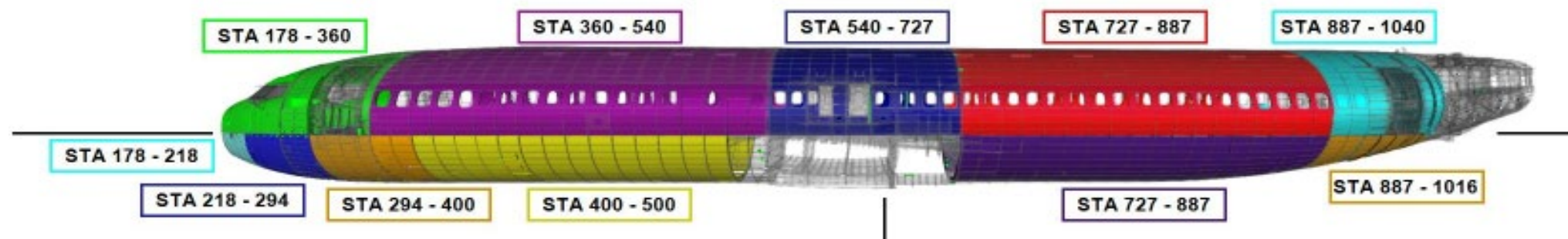
Operation remained on IP-[REDACTED]

IP- [REDACTED] Mid Exit Door Plug Fit and Fair IP History

70	1	INSPECT (Stand Text WKZFF) VERIFY FWD ENTRY DOOR FLAPPERS ARE INSTALLED TO MEET THE COUNTOUR OF THE SEAL PLANE PER DWG [REDACTED] ----- APPLY SHOP ACCEPTANCE XXXXXX 08/02/2018 11:37 APPLY QUALITY ACCEPTANCE XXXXXX 08/02/2018 11:45 -----	No	No	XXXXXX 08/02/2018 Shop Acpt	XXXXXX 08/02/2018 Q Acpt
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70	1	MFG VERIFY VERIFY FWD ENTRY DOOR FLAPPERS ARE INSTALLED TO MEET THE COUNTOUR OF THE SEAL PLANE PER DWG [REDACTED] ----- APPLY SHOP ACCEPTANCE XXXXXX 09/14/2018 19:38 -----	No	No	XXXXXX 09/14/2018 Shop Acpt	XXXXXX
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Quality inspection operation (Operation 70) on Forward entry door flapper changed to manufacturing verification.



Attachment 4 - NTSB Memorandum for Record

Memorandum For Record

Doug Brazy
Air Carrier and Space Investigations

Date: 3/4/25

Subject: DCA24MA063, Alaska Flight 1282 Mid Exit Door Plug Separation,
Portland OR 1/1/24 - NTSB factual report data collected from Boeing
Documents

From: Boeing Response to NTSB Inquiry about on the job training (OJT),
12/27/24:

- Before 2024 there was no documented OJT training for 737 Door Crew Members
- In 2024, Boeing implemented a documented OJT training requirement
- OJT requires each new 737 Door Crew Member perform identified tasks

For each task, the Door Crew Member must:

- 1) Witness the task
- 2) Perform the task with assistance
- 3) Perform the task under supervision 10 times (10 touches)

From: Boeing Enterprise Safety Management System Manual Rev B (10/23/23)
page 4:

The ultimate goal of the SMS is to identify, assess, and control hazards, and mitigate risks based on a thorough understanding of the systems, processes, human factors, and operating environment. Safety Risk Management (SRM) and Safety Assurance (SA) are the engines within the SMS wherein the hazards are identified, assessed, and controlled.

From: Boeing Response to NTSB Inquiry about rate readiness process,
12/19/24:

This evaluation is performed through a careful process reviewing and evaluation a number of factors, including: (1) analyzing the health of the current production system; (2) establishing a baseline schedule for the proposed rate change; (3) identifying all impacted elements, stakeholders, and requirements; and (4) assessing the risks associated with the production rate changes.