COMPANY/ORG PROFILE

• The Boeing Mesa site’s core competency is the assembly, integration, and testing of rotorcraft.

• The AH-64E Apache Helicopter is combat-proven with combination of performance and technology – US Army and customers around the globe
Boeing Mesa History

• 1948 – Howard Hughes launches first helicopter program, the XY-17 flying crane
• 1963 – Hughes OH-6A, forerunner of MD 500 Series, makes first flight
• 1975 – First AH-64 Apache prototype makes first flight
• 1982 – Hughes Helicopters, Inc. opens Mesa, Arizona facility
• 1984 – McDonnell Douglas Corporation purchases Hughes Helicopters, Inc.
• 1986 – McDonnell Douglas moves helicopter headquarters from Culver City, CA to Mesa, AZ
• 1993 – McDonnell Douglas Helicopter Company becomes McDonnell Douglas Helicopter Systems
• 1997 – McDonnell Douglas merges with The Boeing Company
Boeing Mesa Facility

- Opened in 1982
- 4,000+ employees & 300 contractors
- 2 million square feet
- 41 Buildings
- 348 Site Acres
Boeing Mesa Products & Services

- AH-64E Apache
- S-100 unmanned aerial vehicle
- Global Security Operations Center
- Phantom Works
- Global Services
- Centers of Excellence
  - Electrical
  - Composites
  - Metals
- Boeing Test & Evaluation
TEAM MEMBERS / INDIVIDUALS

• Jason Destories
  – Manufacturing Research & Development (MR&D) Engineer

• Talmadge Ryan-III
  – Repair/Mod Technician (Safety Champion)

• Israel Limon
  – Manufacturing Research & Development (MR&D) Technician

• Stu Lange
  – Production Manager Flight Test

• Jeff Mieth
  – Environment, Health and Safety Sr. Manager

• Parvin Wallum
  – Mesa EHS Hearing Conservation Program Coordinator

Other team members- Erik Knutesen, Chris Allen and Dylan Barber
Background – Overview

- Apache Environmental Control System (ECS)
  - Air conditioning system used to keep electronics and cabin cooled.
  - 4 ducted fans run at high RPM to move air across the condenser. The noise levels range from 84 to 104 dBA*

* Study results provided by Mesa EHS
Describe the Problem

- The Apache ECS creates high pitch sound when running >100 dBA at the source.*
  - Operated for avionics cooling
- Hearing protection is required but makes communication between crew members difficult.

* Study results provided by Mesa EHS
Describe the Problem (Continued)

- Engineering controls were evaluated in late 1998. At that time, the controls were not economically feasible.
- Cost effective engineering controls were needed to reduce noise.
- In 2012, improving workplace safety became a top priority.
- The Safety Champion program was launched.

External customers have built sound suppression equipment - $58k/set
Explore Solutions

• Rapid proof of concept (same day)
• Leverage existing ideas
  – External customer solutions
  – Off the shelf noise reducing solutions
Test Proposed Solutions – Hush Kits

- Review Solutions, $58K Capital Proposal
- Build Prototype
- Entrepreneurial mindset, take smart risks.
- Test Prototype
- Design Testing
- Design
Apache Hush Kits

- PVC Pipes
- Welded Polypropylene Enclosure
- Pipe Insulation
- Swivel Bearing Aligns to Any Surface
- Sound Absorbing Foam
- Height Adjustable
- Steel Base for Ballast
EHS Noise Reduction Study

• Noise measurements made with and without the Hush Kits
• The overall noise reduction ranged from 5 dBA to 12 dBA.
  – Percent Reduction of Amplitude ranged from 37% to 72%
  – The noise measurements were validated by a third party (APEX/Associates in Acoustics)
Acoustical Engineering / Noise Control Survey
Conducted by Apex Companies, LLC
June 2019

**FIGURE 1**
COMPARISON OF AVERAGE SOUND LEVEL WITH AND WITHOUT HUSH KIT ON ECS EXHAUST

- **Bldg 520: Final Assembly, Sick Bay**
  Evaluation of hush kits

- **Hush Kit attenuation = 11.5 dBA**
  as measured at 3 feet from 3.4-Right

All measurements conducted 3 feet from 3.4-Right ECS exhaust with the ECS compressor panel in place.

- The 500 Hz pure tone due to ECS compressor.

- The 2,500 Hz pure tone of the ECS exhaust is completely attenuated.

- **AVERAGE SOUND LEVEL, dBA**

- **1/3 OCTAVE-BAND FREQUENCY, Hz**

- **Hush Kit in place, 82.3 dBA**
- **Hush Kit not in place, 93.8 dBA**
FIGURE 2
BACKGROUND AVERAGE SOUND LEVEL WITH AND WITHOUT HUSH KIT ON ECS EXHAUST

- Bldg 520: Final Assembly, Sick Bay Evaluation of hush kits
- Hush Kit attenuation = 7.2 dBA as measured in pedestrian aisle

All measurements conducted ~12 feet back in the main pedestrian aisle with the ECS compressor panel in place.

The 1,000 Hz pure tone is due to something outside the immediate area.

AVERAGE SOUND LEVEL, dBA

1/3 OCTAVE-BAND FREQUENCY, Hz

- Ped. Aisle with Hush Kit, 78.6 dBA
- Ped. Aisle w/o Hush Kit, 85.8 dBA
Apache Hush Kits Video

Hush Kits before and after sound effect
Scale and Implement the Solution

- **Positive feedback** from all teams including adjacent employees
- The Hush Kits were distributed to production areas
- Cost savings
  - $2,300 per aircraft based on 4 hush kits
    - Significantly less than original estimate of $58,000
    - Currently, 10 hush kits have been delivered
Next Steps

• Build additional Hush Kits for production
• Customer awareness of the innovation
• Leverage the Award to communicate to other teams within Boeing for future innovations
• Inspire other employees to become engaged and take action
LESSONS LEARNED

• Working together and collaborating can lead to cost effective innovations
• One employee’s idea can lead to a significant improvement
• Innovation is needed when the solution is not obvious or is costly
• Team Based Business Initiatives (TBBI) are encouraged for Employee Involvement Teams
SIGNIFICANCE OF THE AWARD

• Award will raise awareness of the importance of engineering solutions to control noise
• The award will create recognition within Boeing and with other stakeholders
• Boeing will continue to innovate to improve workplace safety
Future - Hearing Protection Standard

• One of Boeing’s safety standards includes the Hearing Protection Standard (HPS)
• The ultimate goal of HPS is to reduce risk of hearing loss
  – Mandatory hearing protection for specific tasks regardless of frequency, duration, and sound level measurements (dBA)
  – Develop and implement a High Noise Control Plan
Future - Hearing Protection Standard (Continued)

– Maximum noise levels for new and refurbished equipment installations must be:
  • At operator station(s) 80 dBA
  • At any point three-feet from any exterior surface of the equipment 80 dBA
– Employees new to Mesa HCP must receive individualized fit evaluation
– All Standard Threshold Shifts (STS), both age and non-age corrected, must be followed up.
Future - Hearing Protection Standard (Continued)

Individualized Fit Evaluation Quantitative

Site: Mesa, AZ
Task: Hearing Fit Test
CONTACT INFORMATION

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