The Evolution of the DSU-33 C/B Proximity Sensor, A Success in Customer-Contractor Partnership

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"I am always doing that which I can not do, in order that I may learn how to do it."

Pablo Picasso

Agenda

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DSU-33 Overview

DSU-33C/B Development Goals

DSU-33 C/B Design Description

- Approach
- Technologies

Testing Completed

Performance

Questions

DSU-33 Description

System Description

- Radar Proximity Sensor
- Provides Height of Burst (HOB) fire pulse signal to the fuze for JDAM and GP bombs (FMU-139 & FMU-152A/B Fuzes)

Performance Parameters

- Height of Burst: 5 – 35 Feet (80%)
- Multiple Weapon Release: 2 or more
- Operational Life: 200 Seconds
- Storage Life: 10 Years

DSU-33 History

Circa 1970's a desire arises to improve and combine the performance of the Mk 20 and Mk 43 Target Detectors

DSU-33/B is developed and evolves into the DSU-33A/B

1990-1995 Motorola produced DSU-33A/B's for the U.S. Air Force

1998 DSU-33B/B JDAM design upgrade is completed

2000 ATK begins production of DSU-33B/B's

DSU-33C/B Timeline

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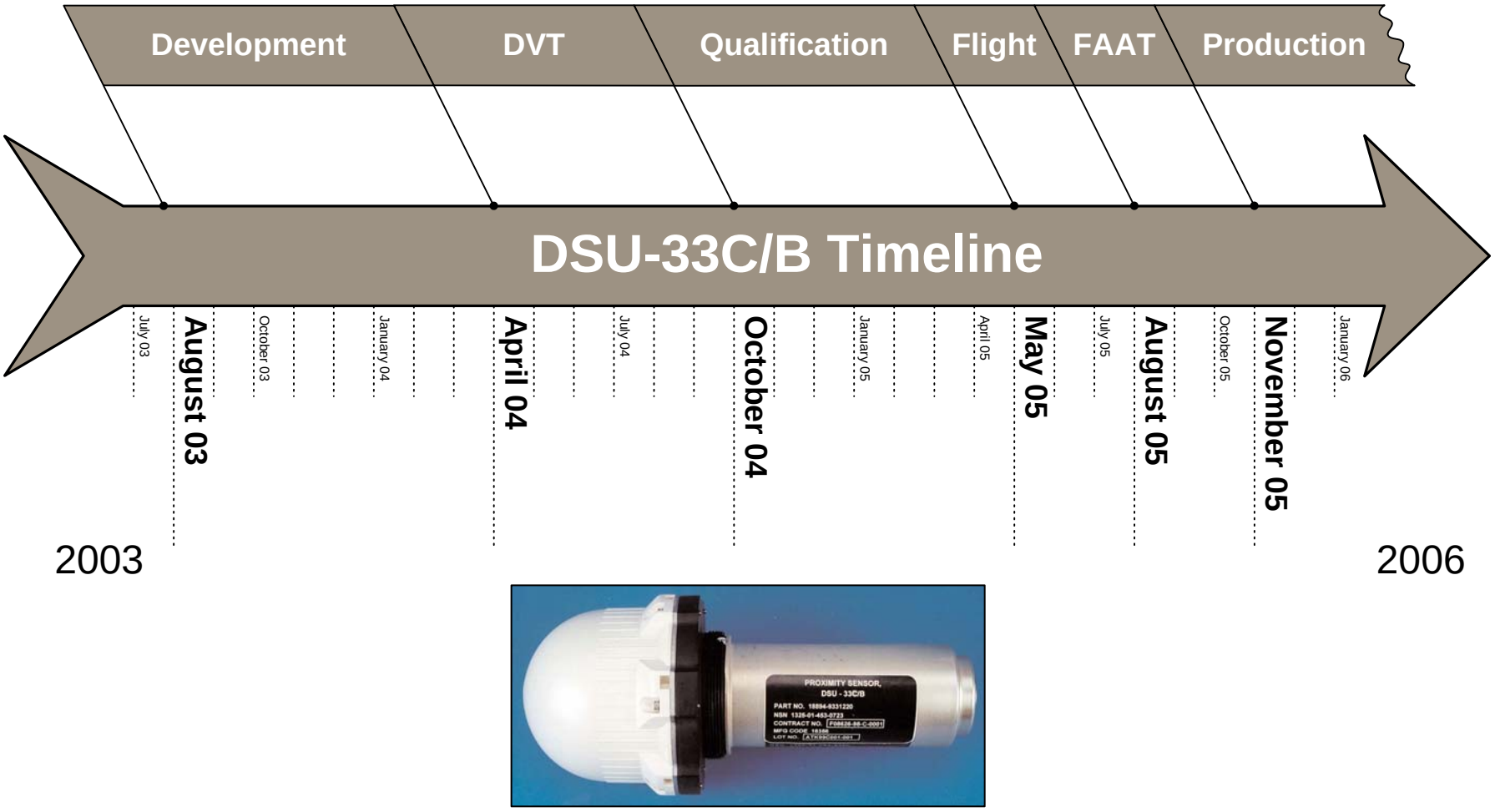

DSU-33C/B Development Goals

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- ✓ **DSU-33 C/B Performance ≥ DSU-33 B/B Performance**
- ✓ **DSU-33 C/B ICD = DSU-33 B/B ICD**
- ✓ **DSU-33 C/B UPC << DSU-33 B/B UPC**

DSU-33C/B Development Objectives

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Address Parts Obsolescence

Improve HOB Accuracy

Reduce the Material Cost

- Eliminate Parts
- Use Lower Cost Parts
- Lower the Cost of Current Parts

Reduce Labor Cost

- Fewer Parts to Assemble
- Easier to Assemble
- Less Rework
- Less Test Time

Customer – Contractor DFMA

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When

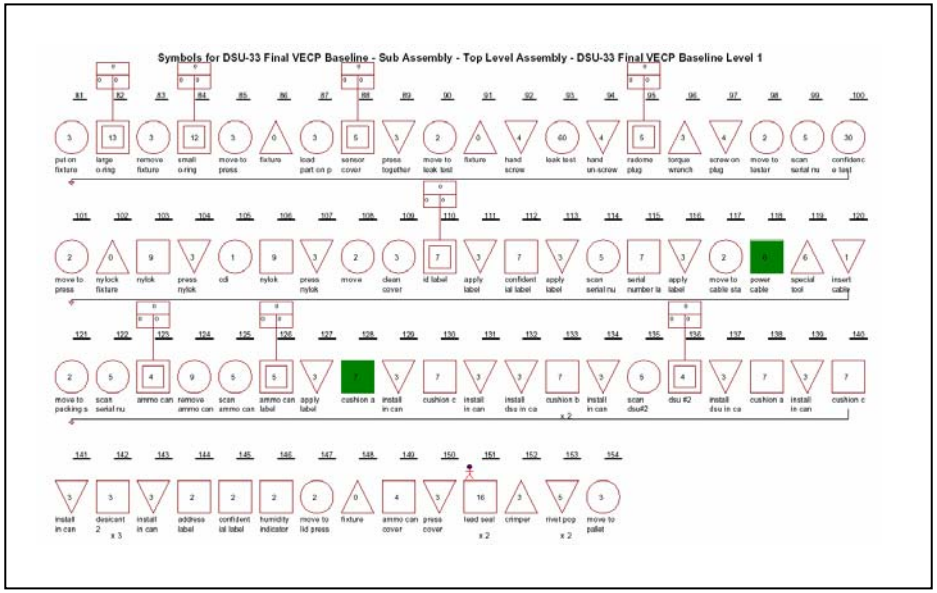
- Prior to the PDR

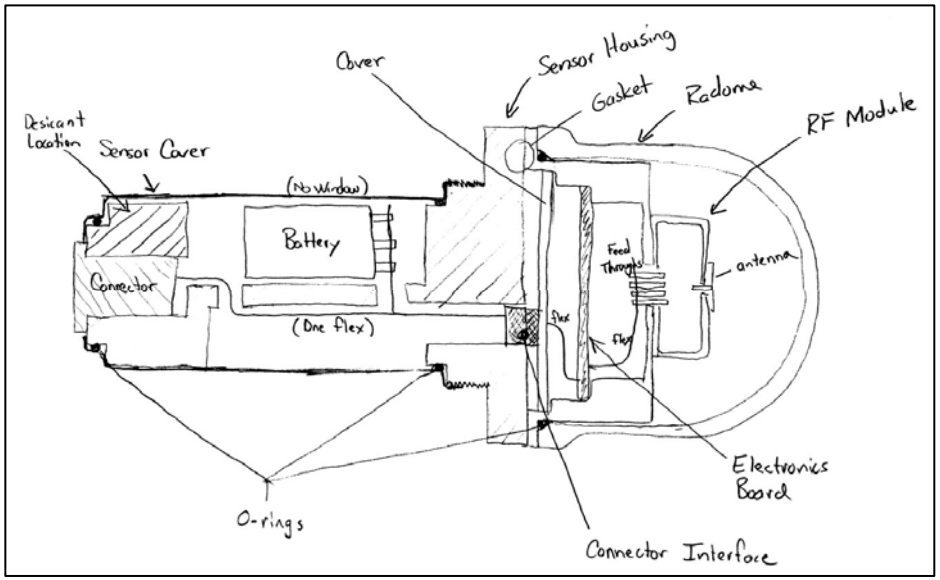
Benefits

- Customer involvement
- Production involvement
- Disciplined look at design approaches and costs
- Cross-functional exchange of ideas

Results

- Improved ease of assembly
- Reduced Material Cost





RF Module Producibility Improved

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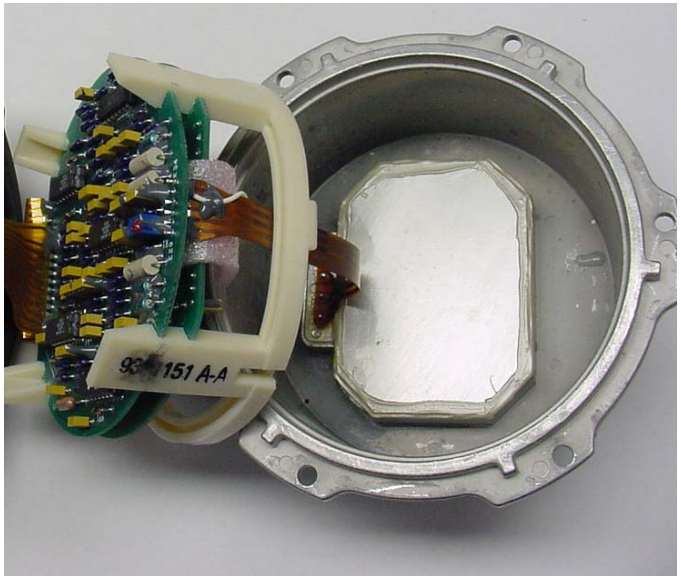


DSU-33B/B RF Design:

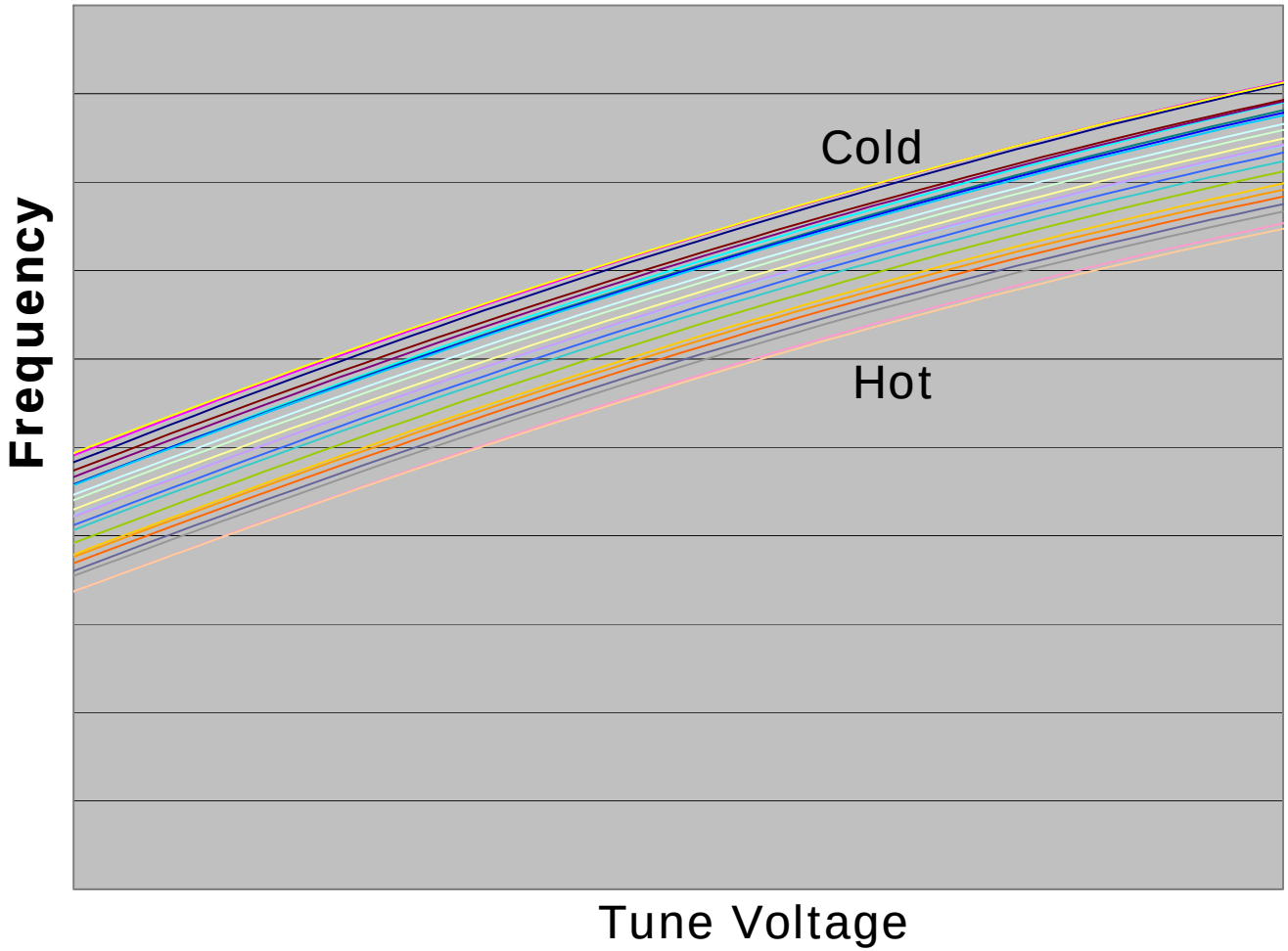
- 26 Components
- Discrete Oscillator Design
- Hand Assembled in Electronics Housing

DSU-33C/B RF Design:

- 7 Components
- GaAs MMIC Chip Transceiver
- Removable from Electronics Housing for Solder Reflow Oven

RF linearity C/B

RF Tuning Curves Over Temperature



Electronics Reduced to One SM CCA

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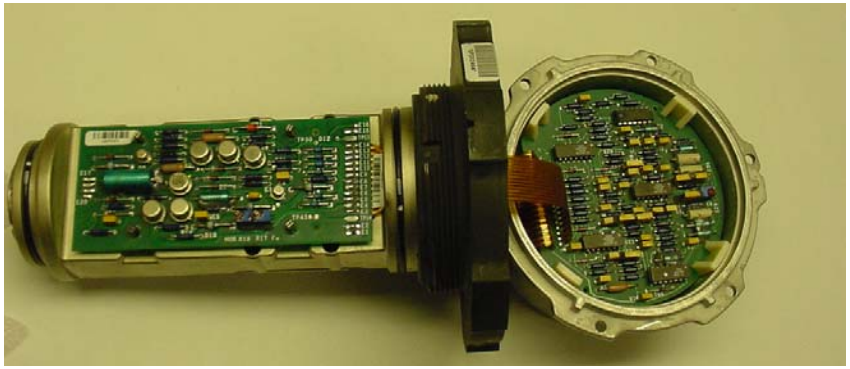
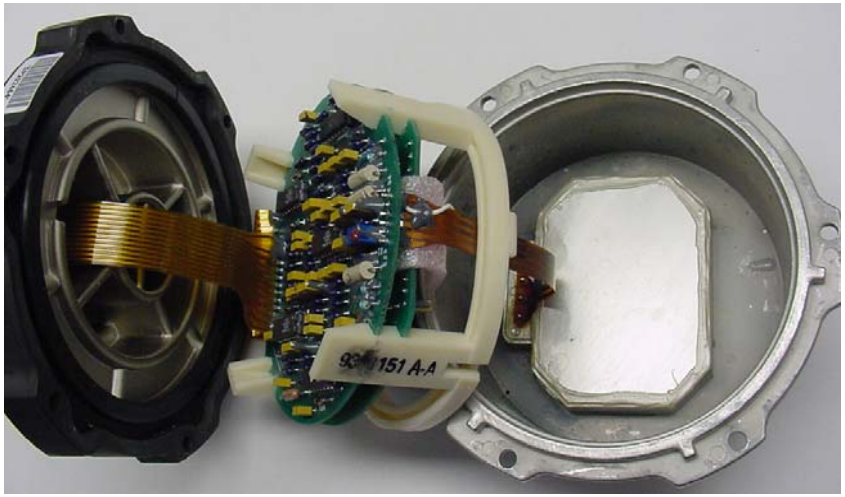
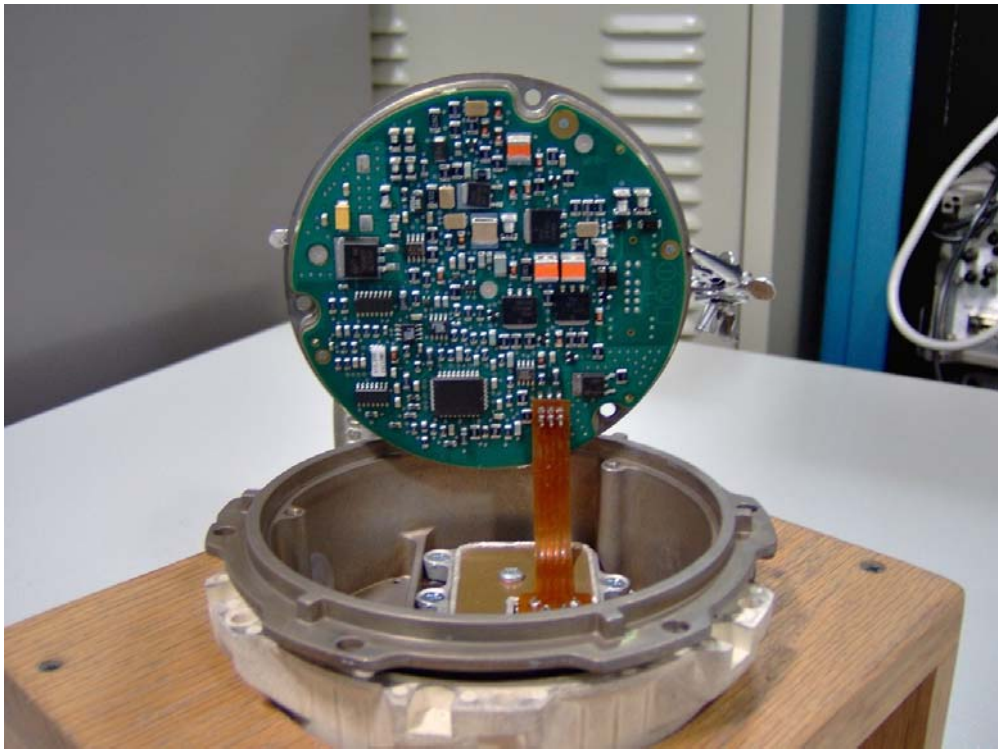
B/B Electronics (3 Boards)





C/B Electronics (1 Board)



DSU-33C/B CCA is Manufactured on an Automated Pick-and-Place Machine.

DSU-33C/B Designed for Testablility

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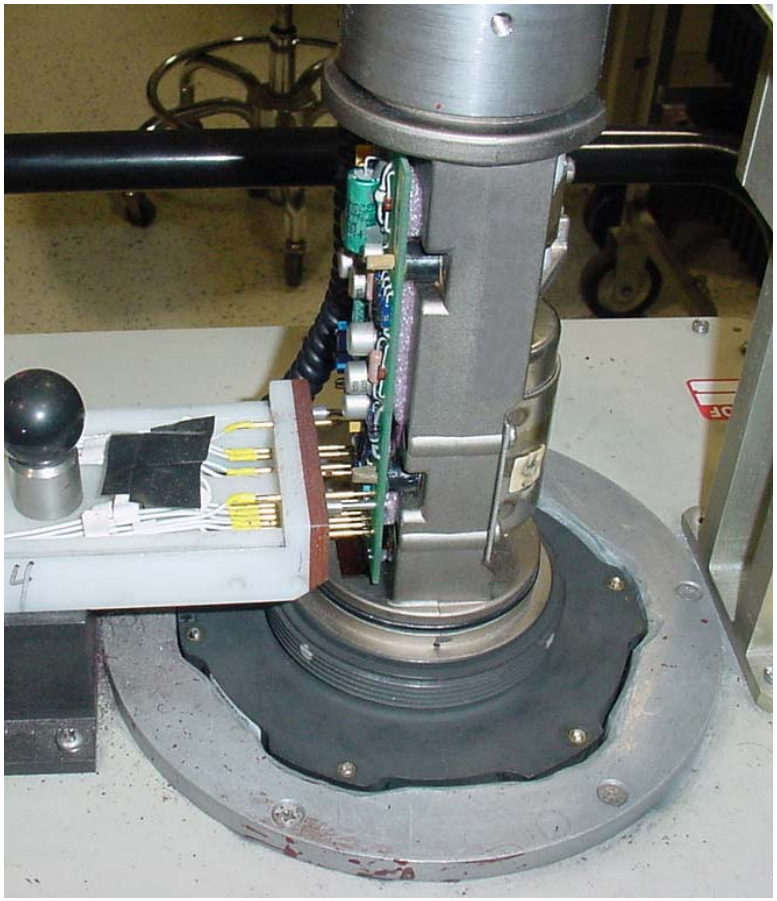
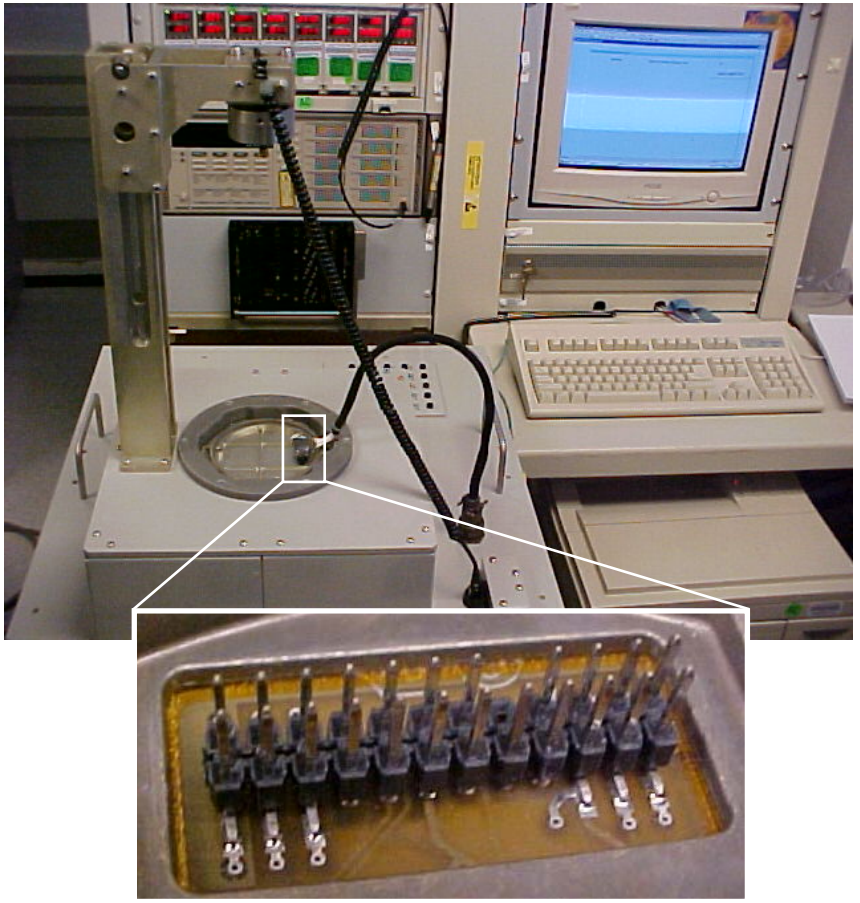
B/B Test Interface



C/B Test Interface



DSU-33C/B Test Interface is More Reliable and User Friendly.

DSU-33 Completed Testing

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- ✓ Design Verification Testing
- ✓ Full Contractor Qualification
- ✓ Flight Testing
- ✓ First Article Acceptance Testing

HOB Process Capability

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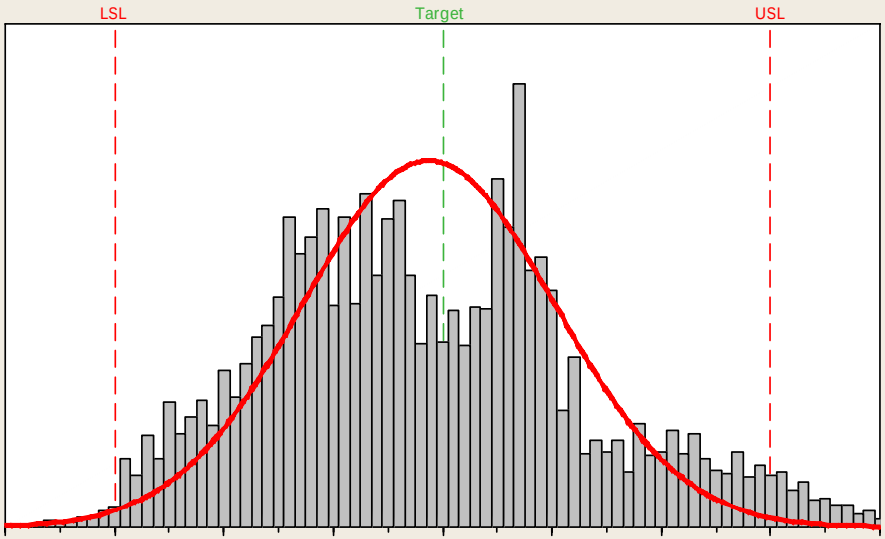
Process Capability of BB Over All Temp and Reflectivity



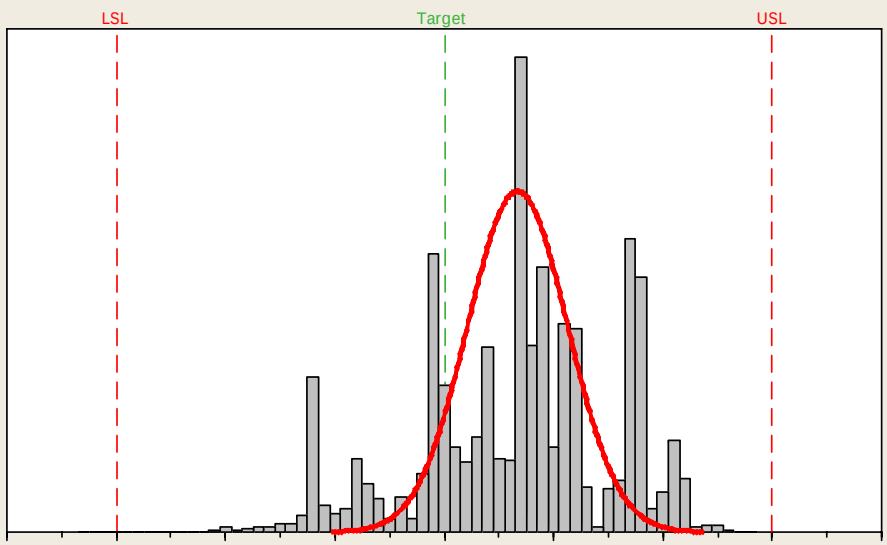
DSU-33B/B Performance:

- Mean is more than 2.5 standard deviations away from nearest spec limit (Requirement is 2).
- 99.6% Between Limits
- 1,672 Units in Sample

DSU-33C/B Performance:

- Mean is more than 5 standard deviations away from nearest spec limit (Requirement is 2).
- >99.9999% Between Limits
- 1,845 Units in Sample

Process Capability of CB Over All Temp and Reflectivity



“If you think of standardization as the best that you know today, but which is to be improved tomorrow; you get somewhere.”

Henry Ford

QUESTIONS