

Closing The Loop Of The Digital Thread



Joe Pritchett



F-35 is Re-Inventing Aerospace Programs



This Program is Different.....

...VERY Different

Different in Everything We Do

- International Partnering
- Prime Contractor & Partners
- Multi-Service Platform
- Manufacturing Concept
- Commonality Across Versions
- Industrial Participation
- Communication
- Best Value Replaces Offset

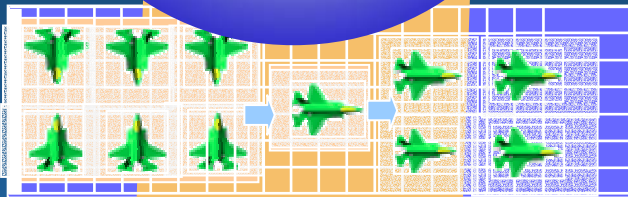




Environment – Radically Different Production Requirements



Next Generation Affordable Fighter



F-35 Rate Production System

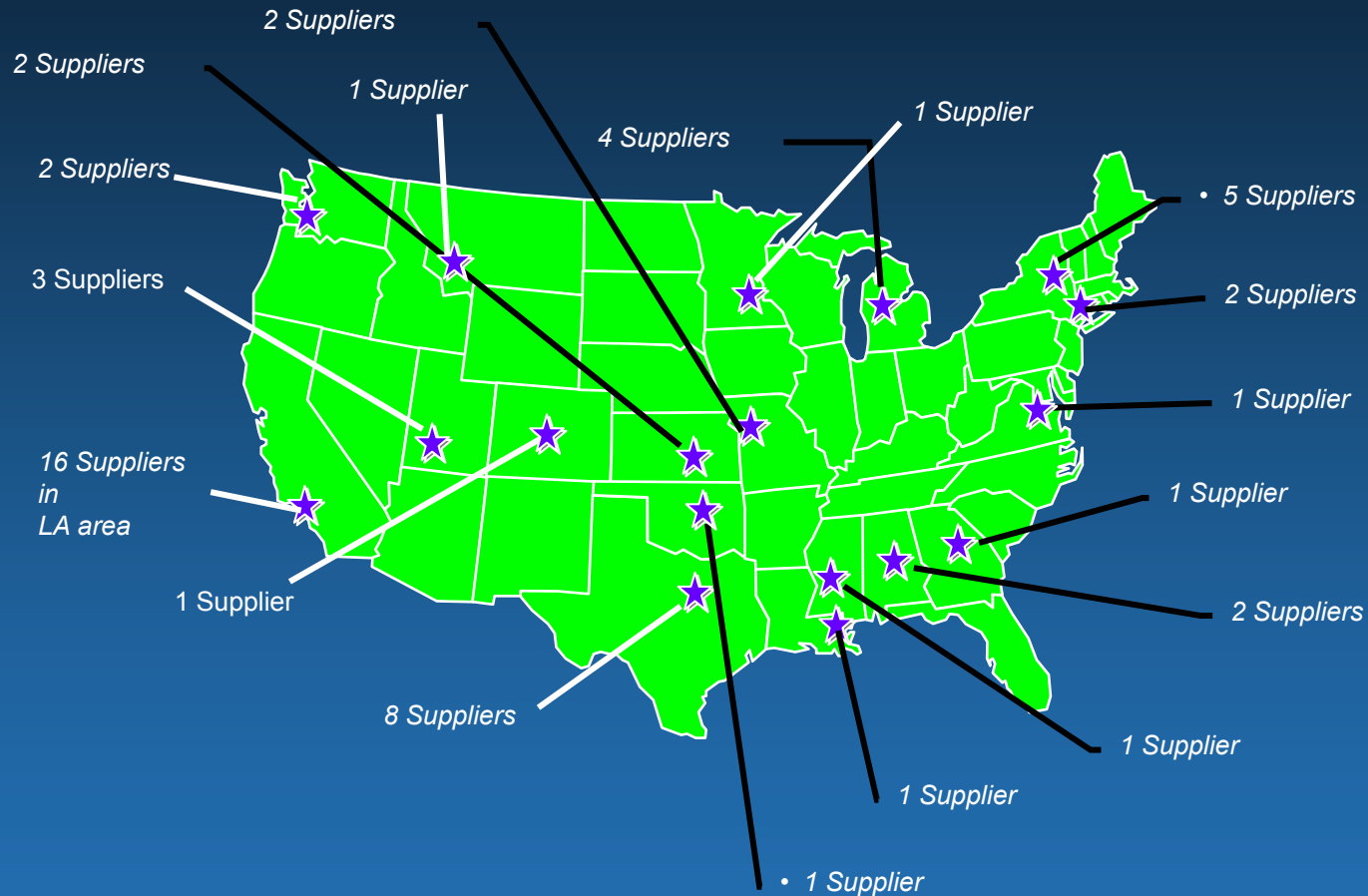
- 1 Day Takt Time
- JIT/Point of Use Delivery
- Standard Work Instructions
- Mixed Model Assembly Line

5 Month Assembly Span

- Standard Work for every task
- Snap Together vs. Hand Crafted
- Moving line in Final Assembly
- Predictable Supply Chain
- Predictable Detail Part Dimensional Control
- Product Designs Must Be Tolerant of Manufacturing Process Variations
- Supplied Parts Must Meet Assembly Requirements
- Processes Must Be Capable and Stable



JSF Airframe Domestic Suppliers



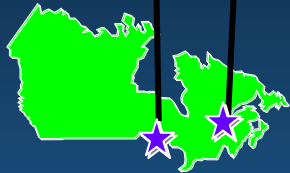


JSF Airframe International Suppliers



- Machining
Chicopee
- Machining & B/L
Door Uplock
Heroux Devtek

- CV Struct Test Dev
Bombardier
- Castings
Howmet



- Hardware Service Provider
Wesco

- DLF Service Provider
Gardner
- Metal Service Provider
Apollo
- Composites
Cytec

- Canopy Frame
Hamble Structures
- BSM Door Uplocks
Goodrich

- Harnesses
Fokker Elmo
- Actuated Doors & IPT
Support (C S & E)
Fokker Aero
- Machining
Philips Aero
- Tooling (C S & E)
ATS Kleizen
- Condas System
FCS



- Ti Forgings
Otto Fuchs

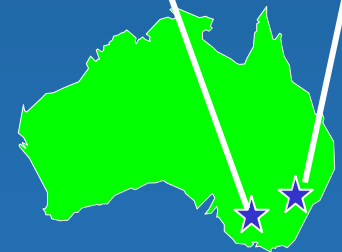
- Composite Core
Euro Composites

- IPT Support (C S & E)
Hawker D. Havilland

- Machining
Lovitt



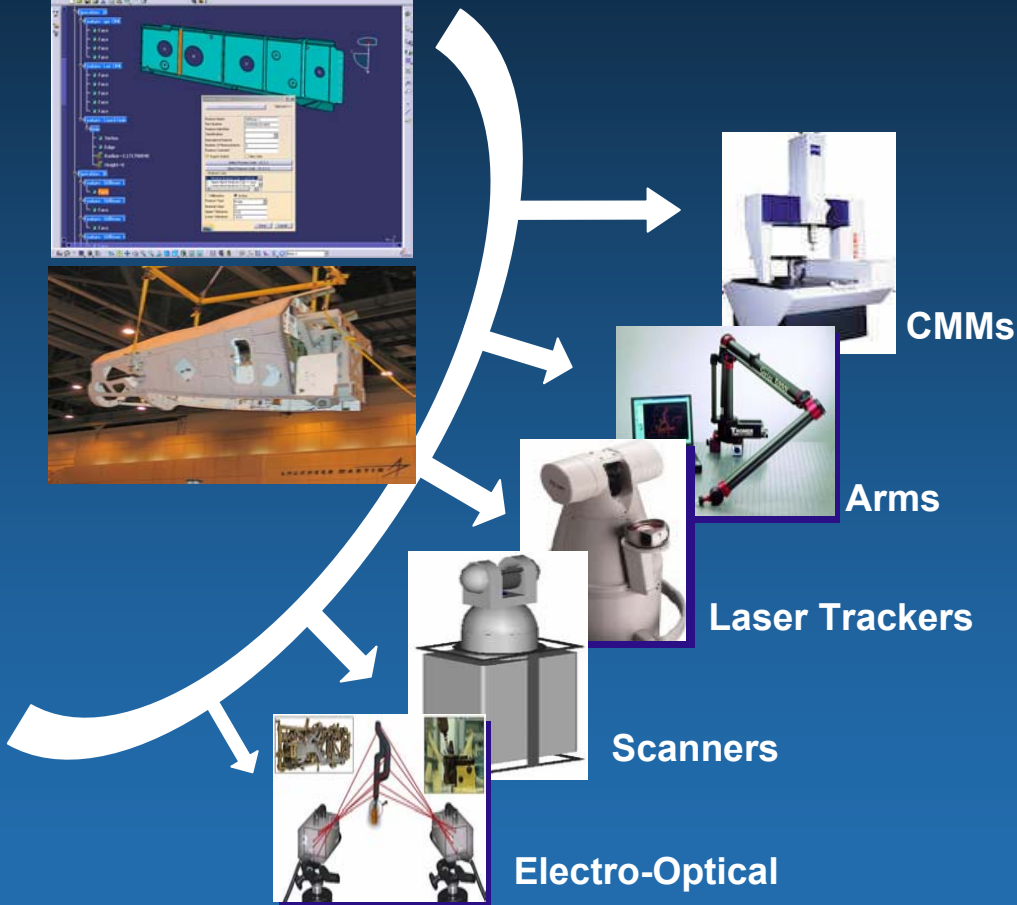
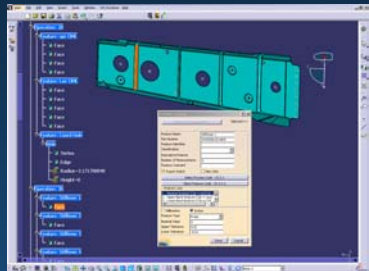
- Machining & Canopy
Actuation Components
TAI



- Wing & IPT Support
Alenia
- Machining & FFIPT Support
Piaggio



Measurement Plan



Design

- *Standardize Tolerances*
- *Standardize Datum Schemes*
- *Standardize KC Definition*
- *Standardize Inspection Plans*

Supplier

- *Communication*
- *Standardize Inspections*
- *Performance Assessment*

Quality

- *Standard Reporting & Metrics*
- *Standardize Supplier Feedback*
- *Influence Design & Source Selection*



Airframe KC Selection/Management Process



Producibility

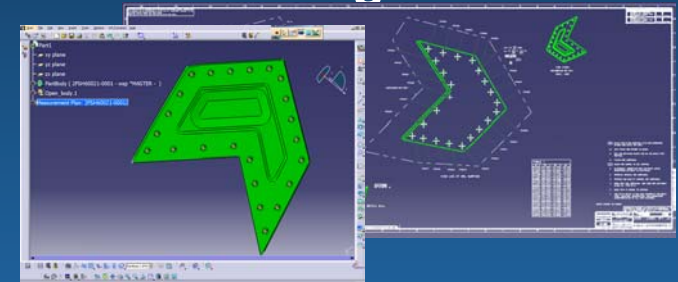
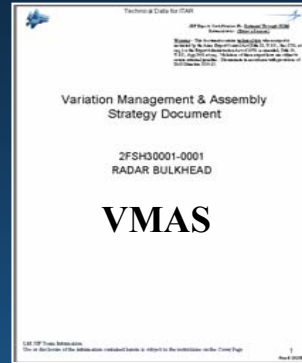
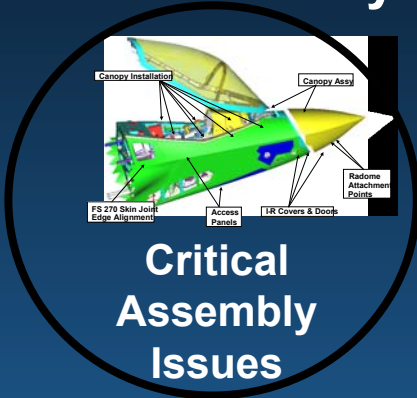
Manufacturing Engineering

IPT

Final KC's Identified

Candidate KC's Identified

Design



Process Capability Database

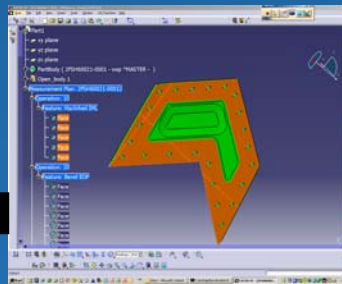
Quality Engineering

KC's Data Feedback

KC's Data Collection Rqmts

KC's Incorporated into BTP

Mfg. and Assembly Processes



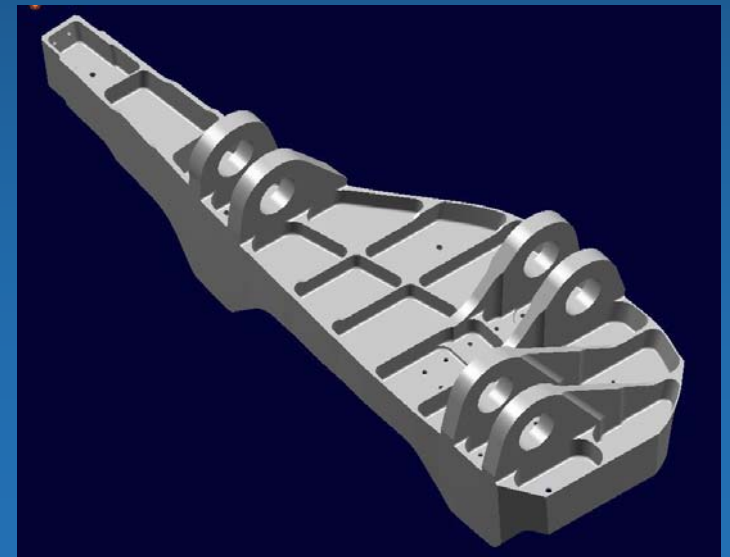
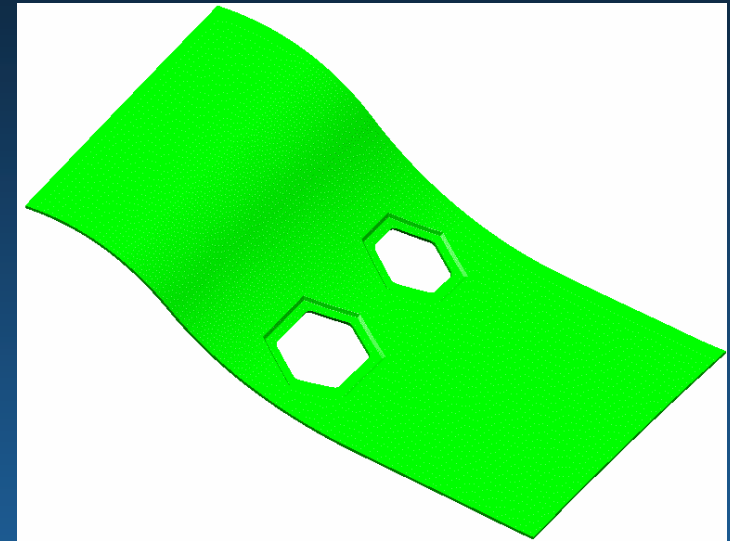
Measurement Plan



Challenge – Parts Must Meet Assembly Requirements

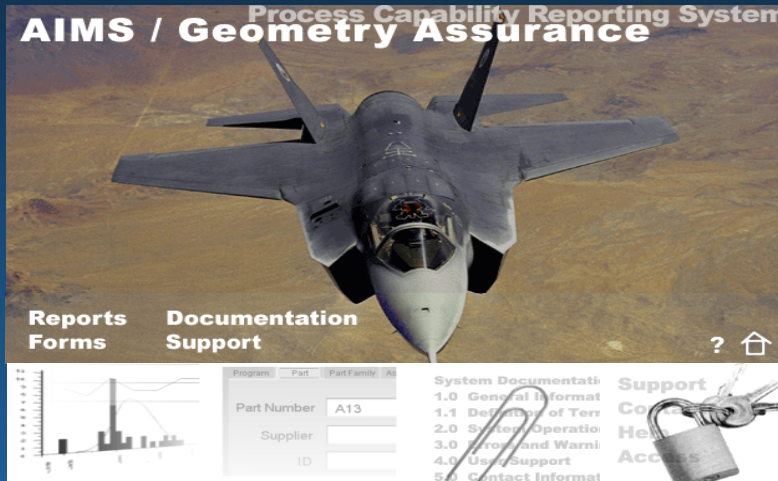


- Dimensional Integrity
- Many of the disruptions in the Assembly process are a direct result of part feature not meeting dimensional requirements.
- A complex part can have thousands of dimensional requirements, but how do you communicate what is important at Assembly?





Enterprise Process Capability Database



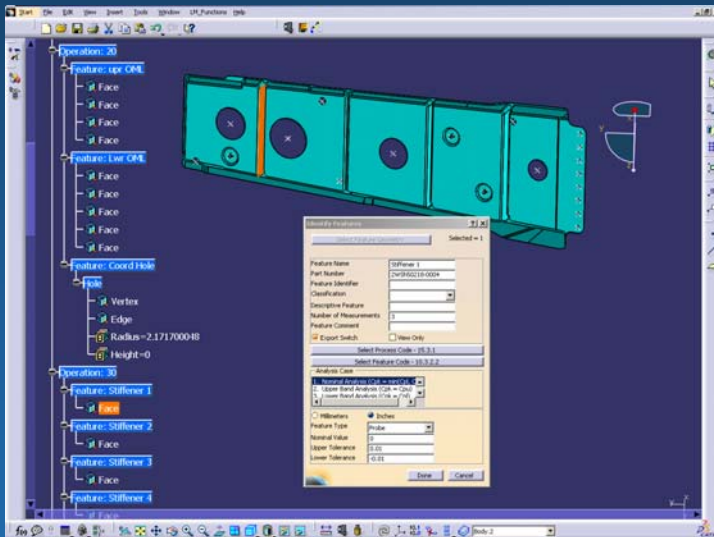
- Selected the AIMS suite developed by Boeing & Metronor
- Provides the ability group by Part Family, Part Number, Part Feature, Process, Program, and Supplier
- Reporting function provides basic management information type reports
- Reports are accessed via the Web

Collaboration — One Set of Shared Information



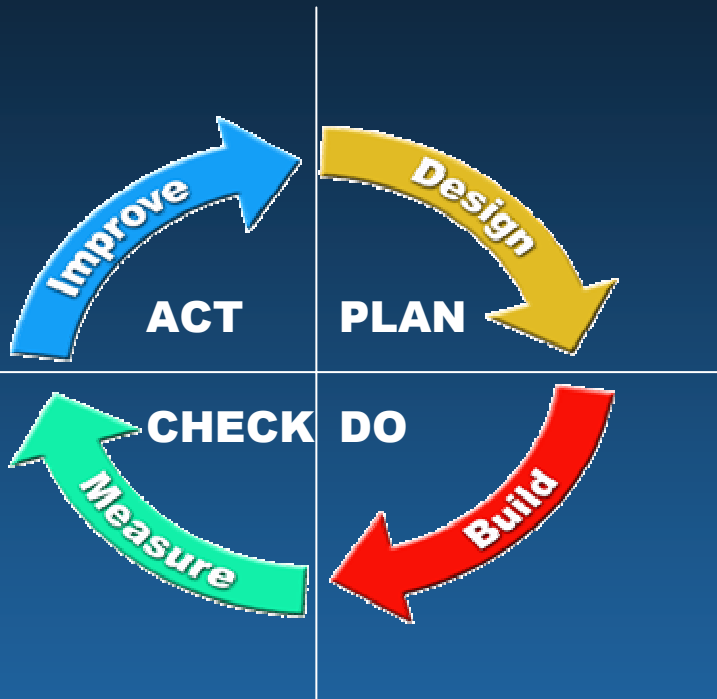
Measurement Plan

- Define a measurement approach to ensure that a part is measured the same way no matter where it is built
- Focus attention on Key Characteristics and assembly integration
- Require actual measurement result data to be sent in ahead of the part
- This allows us to efficiently populate a Process Capability Database
- Improves communication between design & build





Step 3 – Manage the Process to Improve



- Manage the processes proactively
“Information Rich not Data Rich”
- The Supply chain is a process; not just a subcontract management task
- Inspection/verification must be managed like any other process

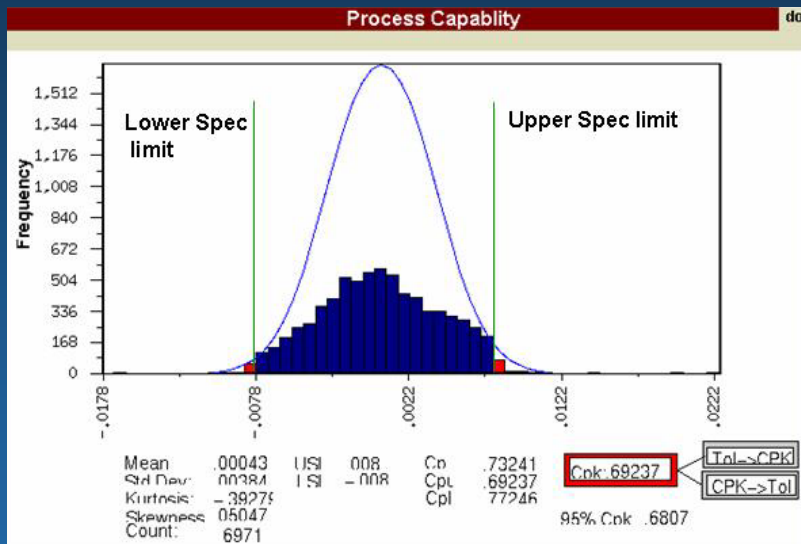
Stable and Predictable Supply Chain



Key Characteristics Data Usage



- Updates Machining Design Standard
- Trade study support for reducing designed in shim gap
- A-1 troubleshooting/problem resolution
- Reconciling Loss Function estimates with actual performance
- Getting initial insight to Supply Chain capabilities
- Data is available to support Corrective & Preventative action tasks for both Suppliers and Internally



More than simply a data collection exercise



Detail Part Process Capability Metrics - KC's

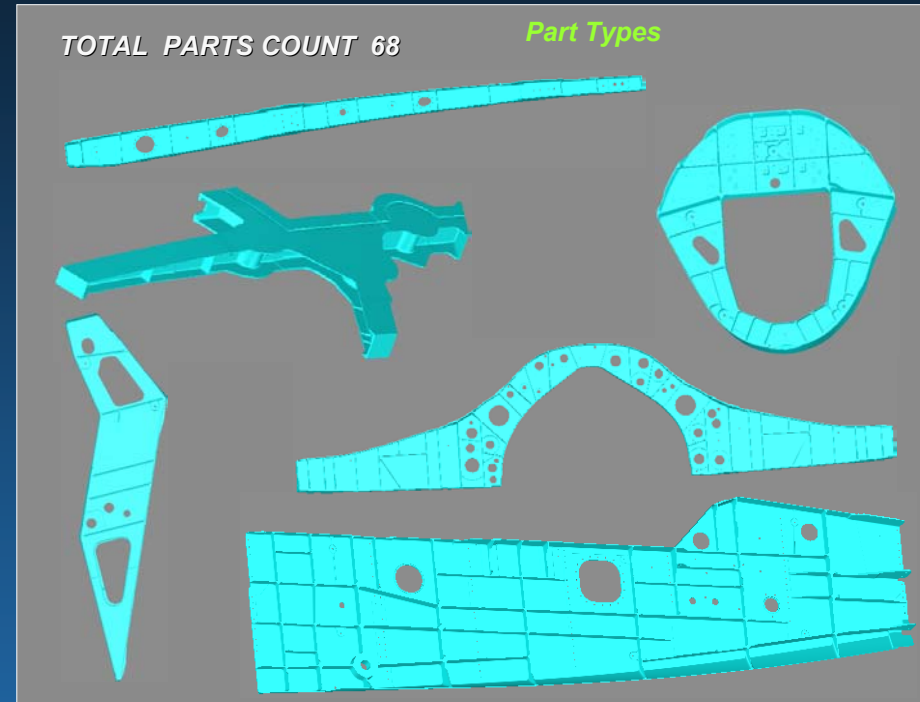


Supplier: All
Process: Multi-Axis Machining
Product Family: Detail Parts
Material: Aluminium/Ti
Date: March 2005

Status >99 ●
 based on >95 ●
 Yield <95 ●

S.D.D. KC Data
 Data Source: AIMS Database 03 / 2005

Ref	Key Characteristic	Tolerance	Range	Actual % Points Passed	Cp	Cpk	Status
1.	KC Feature A	0.016	0.0388	99.27%	.73	.69	●
2.	KC Feature B	0.020	0.0304	92.7%	.62	.48	●
3.	KC Feature C	0.016	0.0246	93.4%	.65	.39	●
4.	KC Feature D	0.020	0.0104	100%	1.68	1.54	●
5.	KC Feature E	0.020	0.0165	100%	1.15	.82	●
6.	KC Feature F	0.016	0.0159	100%	.85	.84	●
7.	KC Feature G	0.020	0.0114	100%	1.51	1.1	●

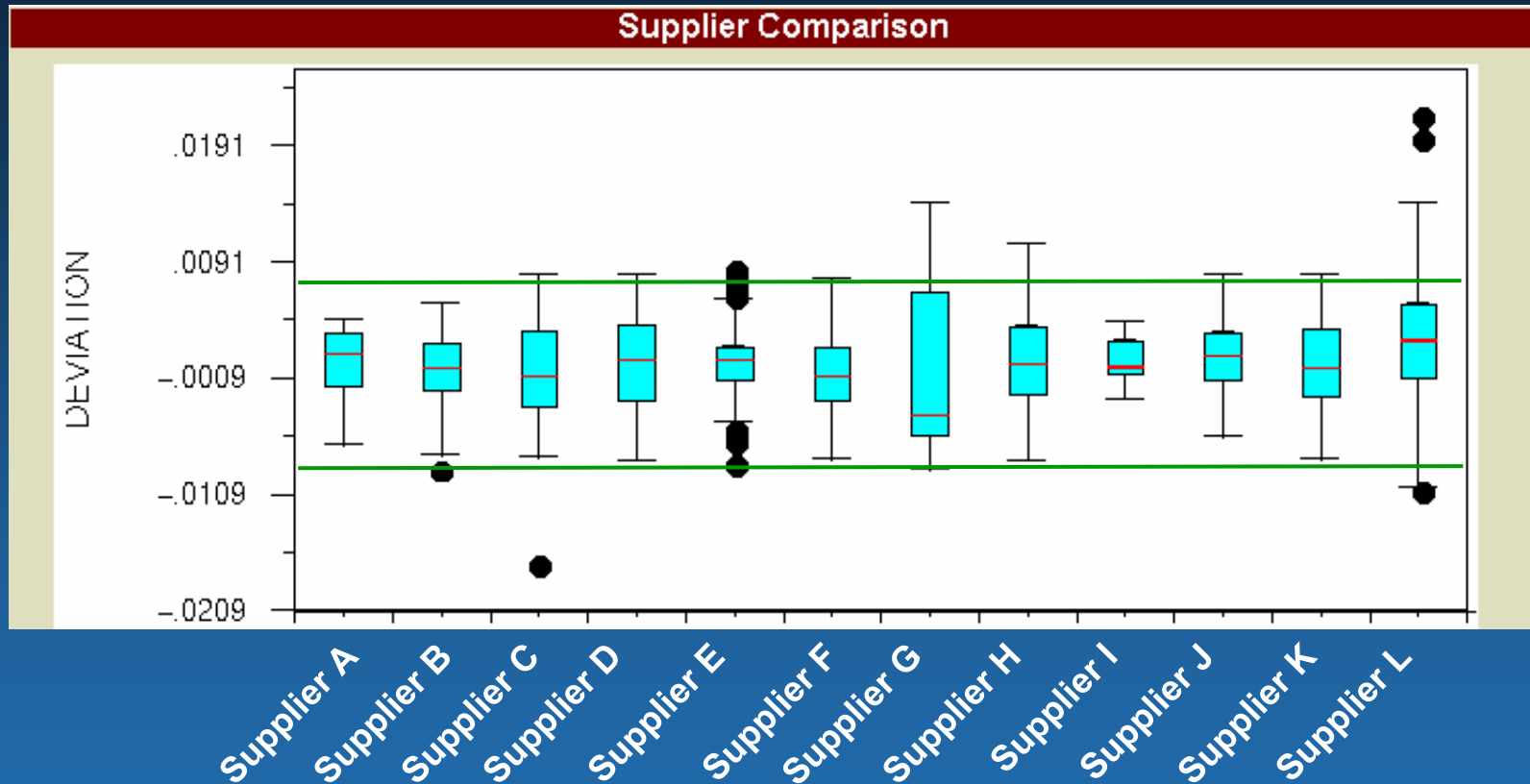


Corrective / Preventive Action

- Get Process Control Documents in place to identify process improvements
- Program to Nominal



KC Feature A - Profile Tolerance of 0.016



The **Green** line are Specification limits

Who do You want to support Your Moving Assembly Line?



X-35C
300



Questions