Closing The Loop Of The Digital Thread

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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
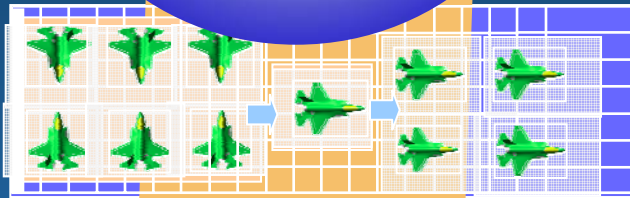- Best Value Replaces Offset

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Environment – Radically Different Production Requirements

Next Generation Affordable Fighter

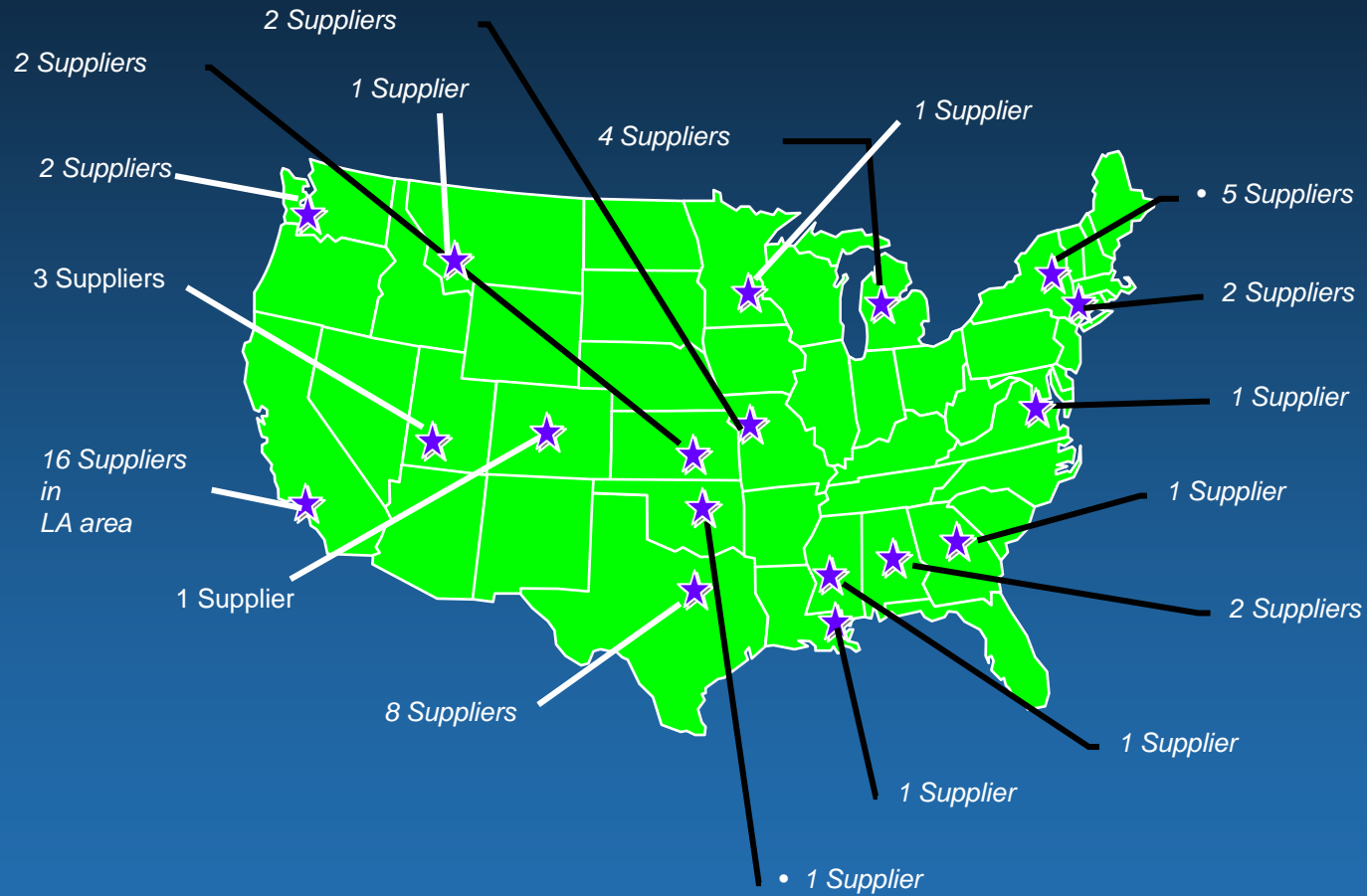**F-35 Rate Production System**

- 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
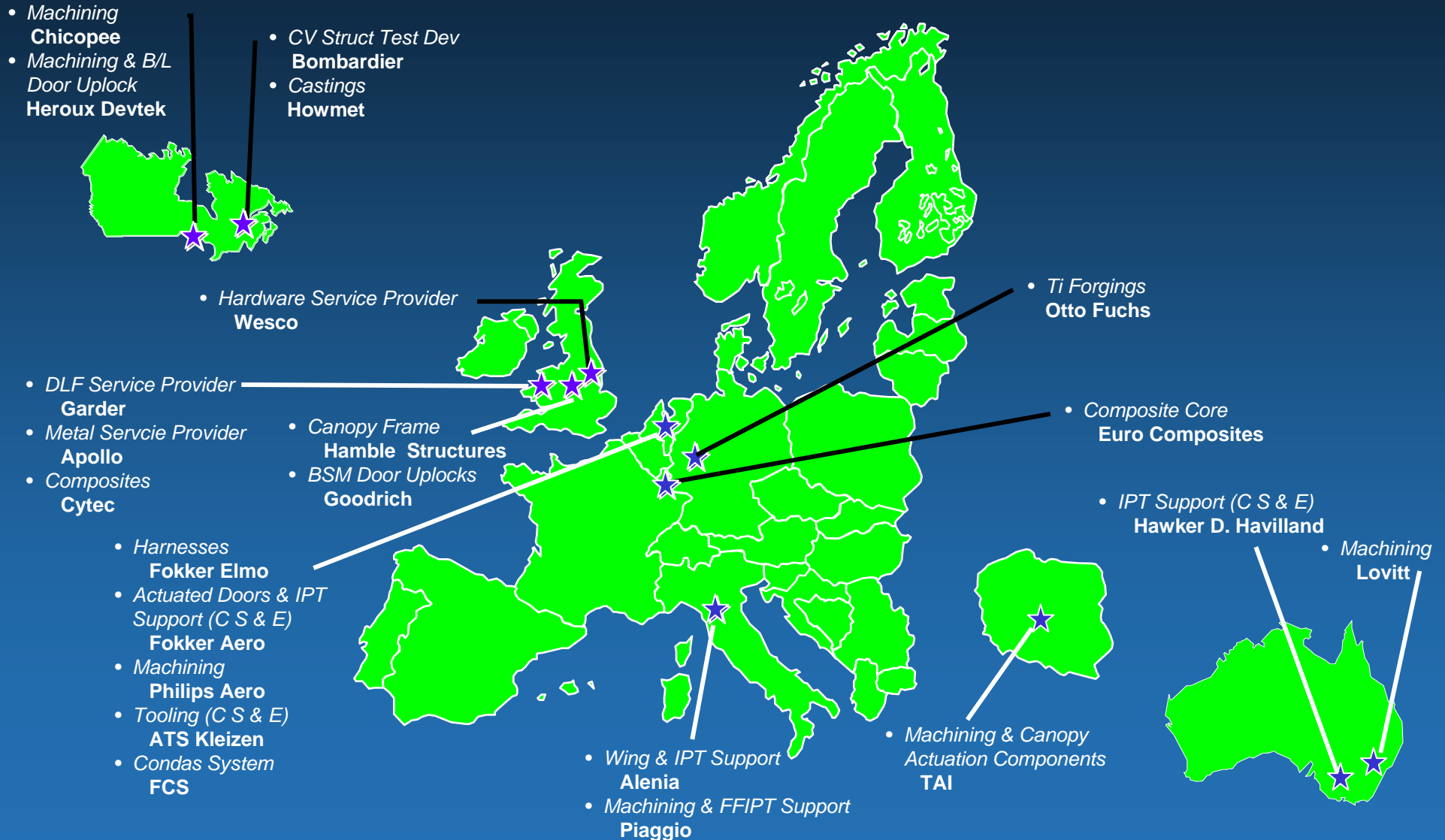
- Processes Must Be Capable and Stable
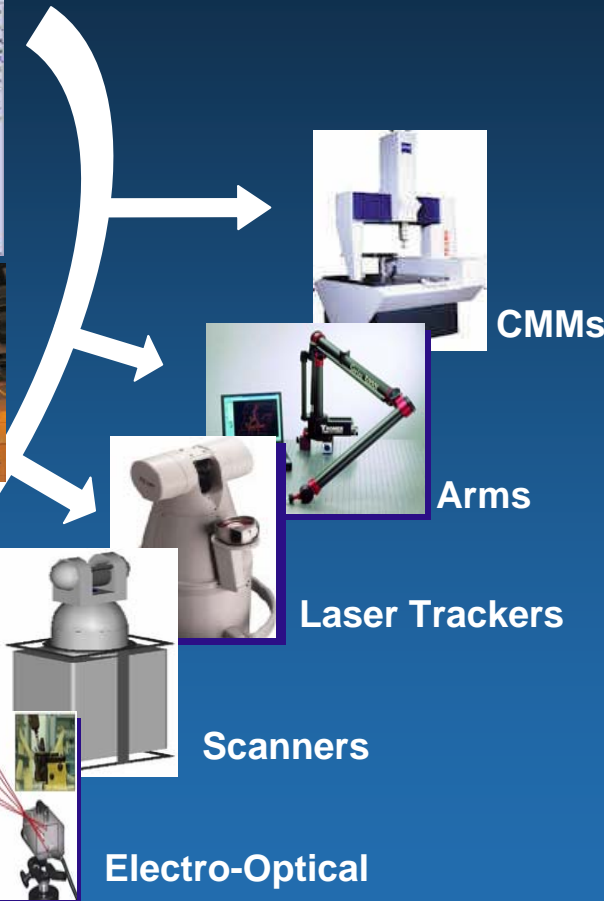
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JSF Airframe Domestic Suppliers

2 Suppliers

2 Suppliers
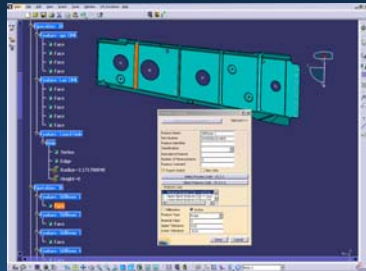
1 Supplier

4 Suppliers

1 Supplier

2 Suppliers

• 5 Suppliers

3 Suppliers

2 Suppliers

1 Supplier

16 Suppliers
in
LA area

1 Supplier

1 Supplier

1 Supplier

2 Suppliers

8 Suppliers

1 Supplier

1 Supplier

• 1 Supplier

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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*
  Garder
- *Metal Servcie 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

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

- *Machining & Canopy Actuation Components*
  TAI

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Global Standardization Challenge

Measurement Plan

CMMs

Arms

Laser Trackers

Scanners

Electro-Optical

Design

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

Supplier

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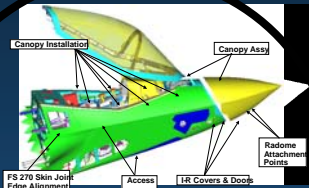- *Standardize Inspections*
- *Performance Assessment*

Quality

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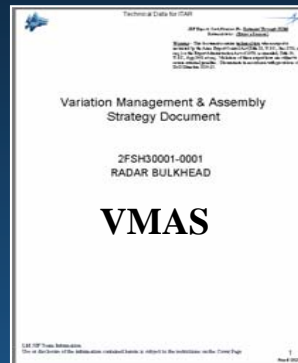- *Influence Design & Source Selection*

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Airframe KC
Selection/Management Process

Producibility

Manufacturing Engineering

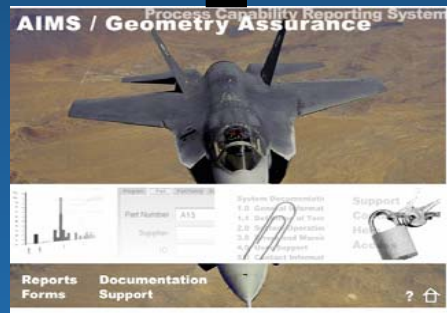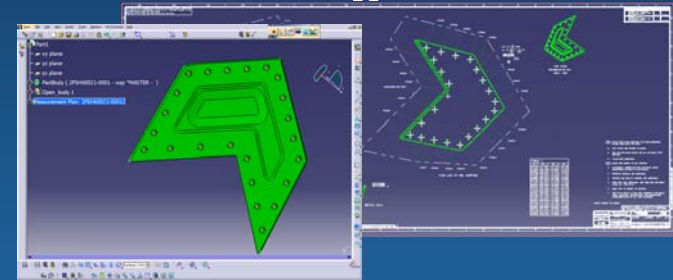**IPT**
Final KC's
Identified

Candidate
KC's Identified

Critical
Assembly
Issues

Variation Management & Assembly
Strategy Document

2FSH30001-0001
RADAR BULKHEAD

VMAS

Design

Process
Capability
Database

**Customer
Quarterly
Performance**

Quality Engineering

KC's Data
Feedback

KC's Data
Collection
Rqmts

KC's
Incorporated
into BTP

**Mfg. and Assembly
Processes**

Measurement Plan

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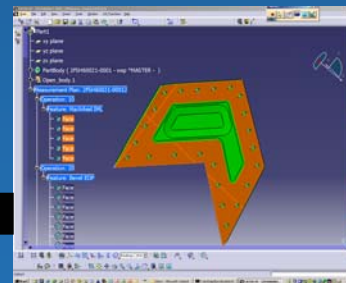
- Dimensional Integrity

- 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?
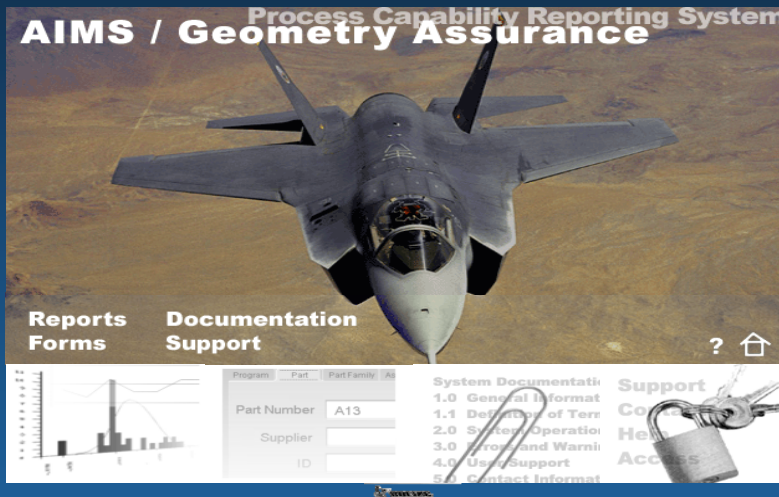

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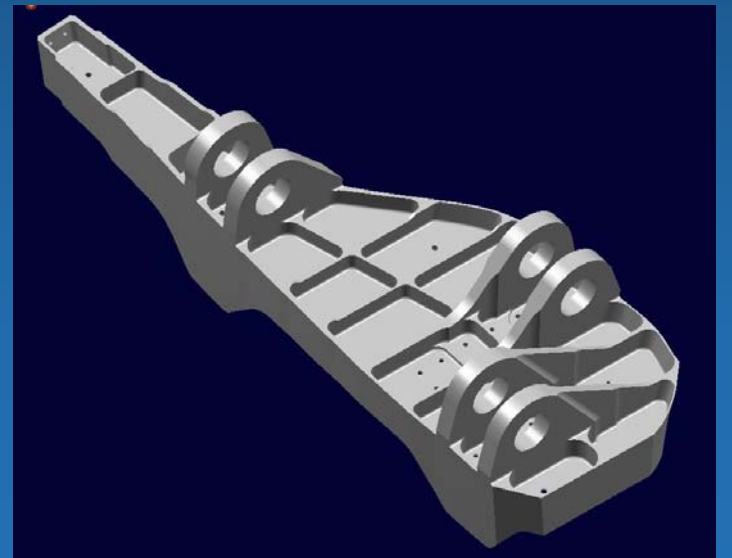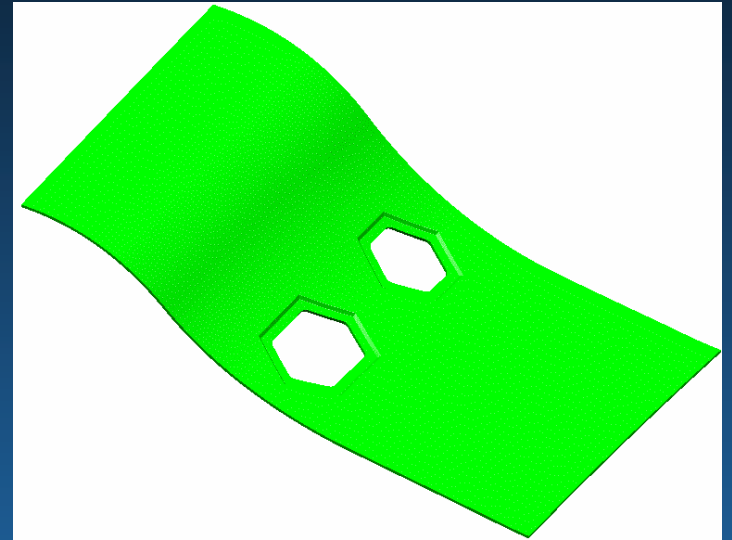
Enterprise Process Capability Database

- 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

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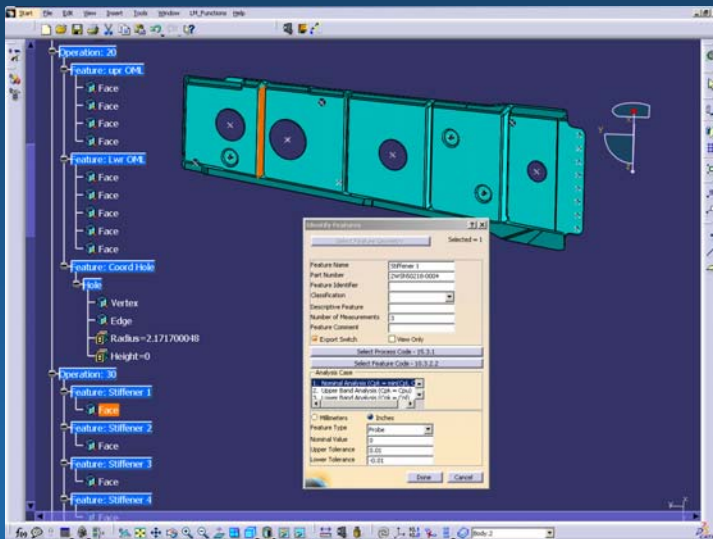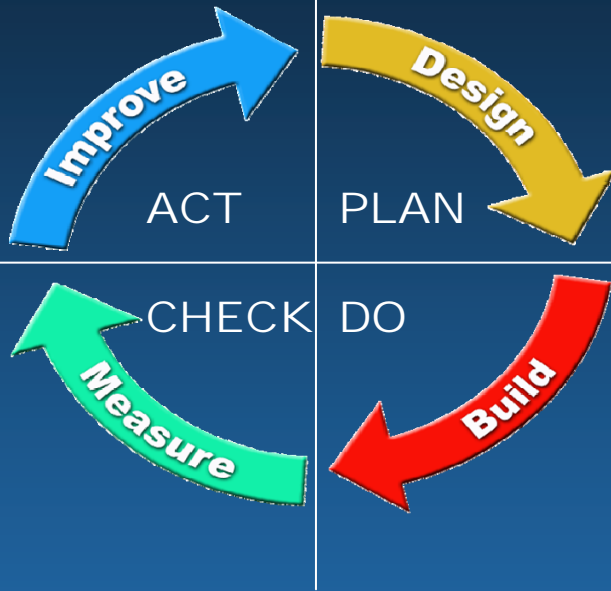
- Manage the processes proactively "Information Rich not Data Rich"

- 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

- *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*
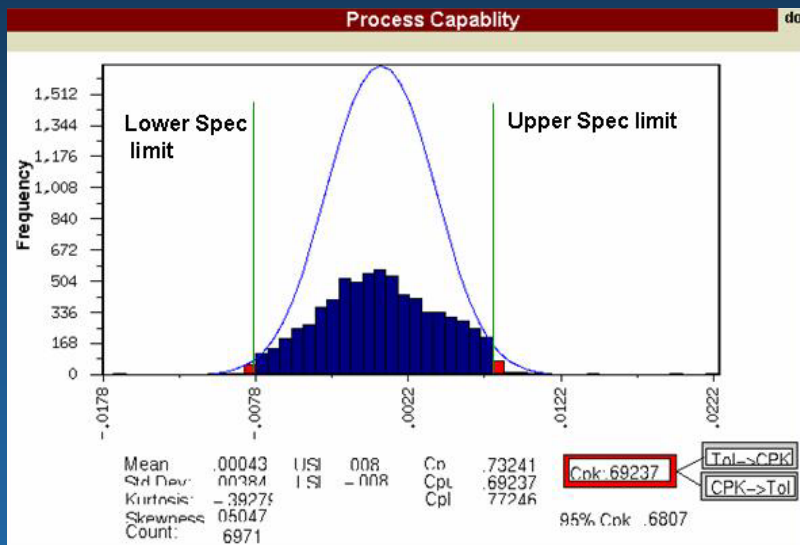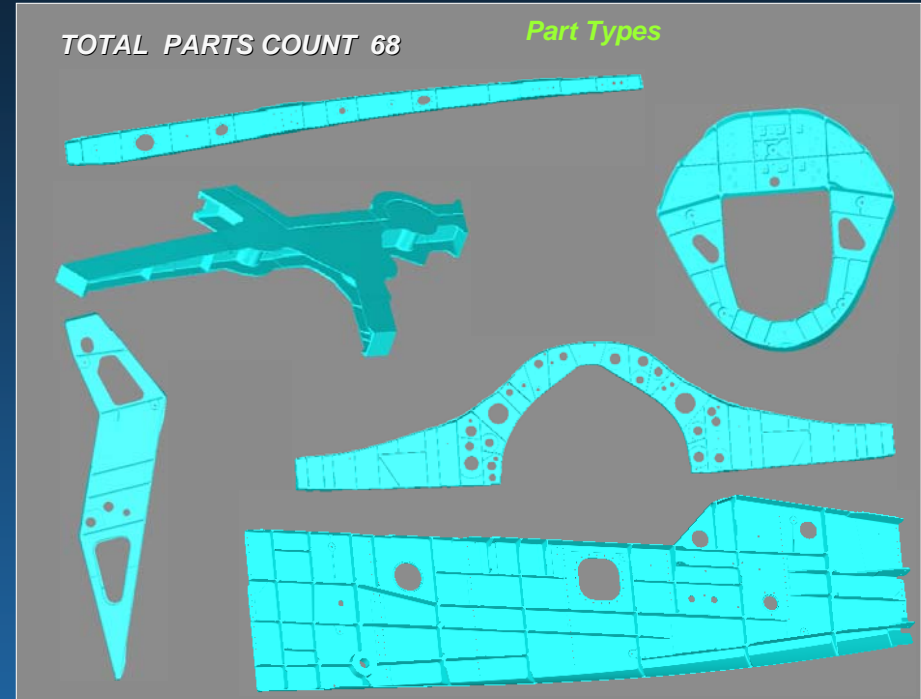
More than simply a data collection exercise

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Detail Part Process Capability Metrics - KC's

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

Status based on Yield		
>99	🟢	
>95	🟡	
<95	🔴	

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

TOTAL PARTS COUNT 68 *Part Types*

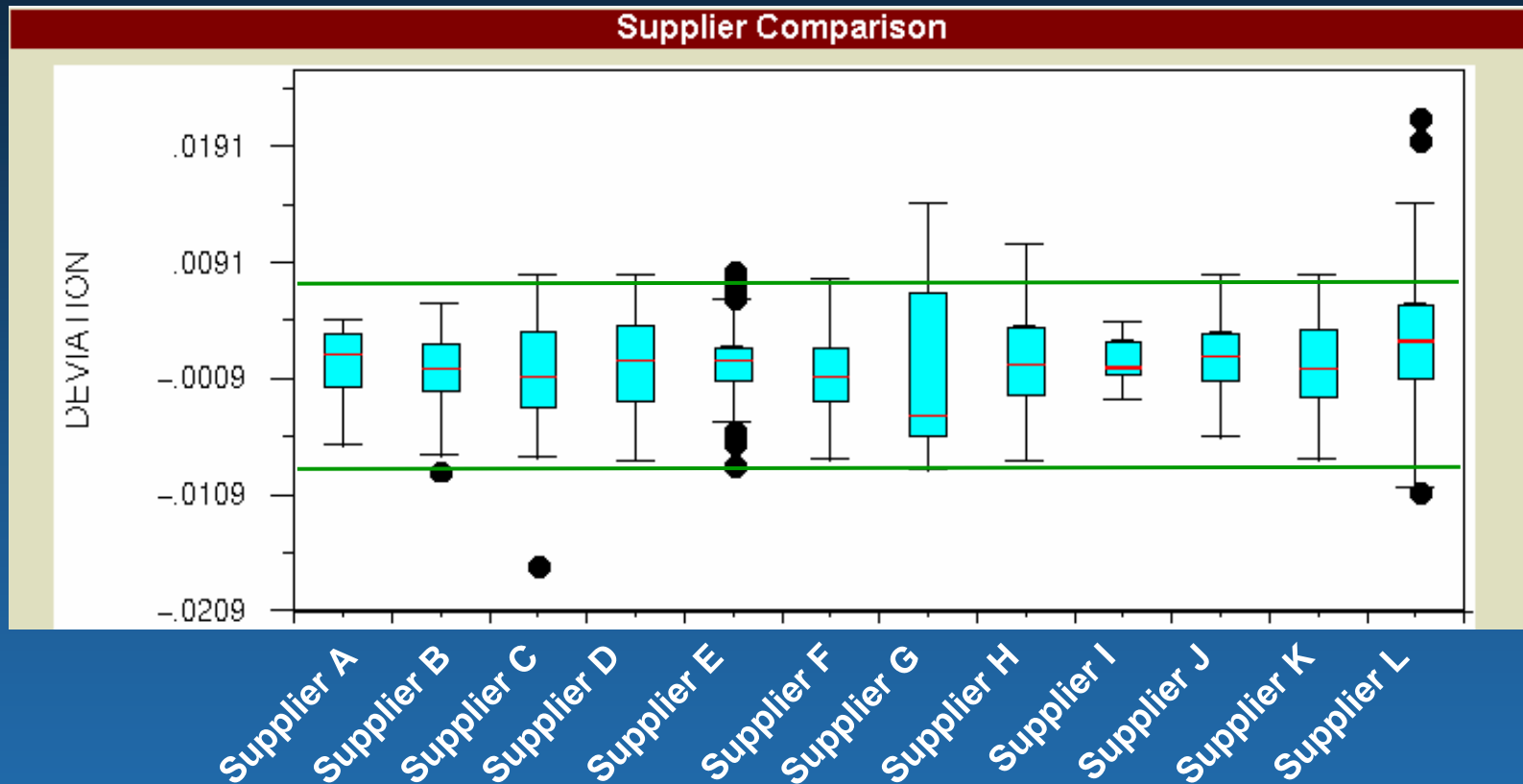| Ref	Key Characteristic	Tolerance	Range	Actual % Points Passed	Cp	Cpk	Status
1.	KC Feature A	0.016	0.0388	99.27%	.73	.69	🟢
2.	KC Feature B	0.020	0.0304	92.7%	.62	.48	🔴
3.	KC Feature C	0.016	0.0246	93.4%	.65	.39	🔴
4.	KC Feature D	0.020	0.0104	100%	1.68	1.54	🟢
5.	KC Feature E	0.020	0.0165	100%	1.15	.82	🟢
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**

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KC Feature - Supplier Comparison

KC Feature A - Profile Tolerance of 0.016

The Green line are Specification limits

Who do You want to support Your Moving Assembly Line?

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X-35C

JOINT STRIKE FIGHTER
JSF
F-35
LETHAL · SURVIVABLE · SUPPORTABLE · AFFORDABLE

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