Making Standard Parts Interoperability a Reality at Boeing

Log Number: IT-011712-RGG

Darwin Reed
The Boeing Company

February 8 – 9, 2012

Introductions

- Darwin Reed
  The Boeing Company, Product Standards Architect

- Richard Pollitt
  The Boeing Company, Product Manager

- David Dalling
  The Boeing Company, Information Technology

- Lawrence Cook
  The Boeing Company, Product Standards Office

Log Number: IT-011712-RGG

Outline

- **Boeing History:**

  Proliferation of Standard Parts

- **Realizing the Vision:**

  Update on our Progress

- **Lessons Learned:**

  Implementing at Boeing

Log Number:　IT-011712-RGG

Boeing History: Proliferation of Standard Parts

The question is, why should anybody care if the standards data is not digital and automated like the other design and manufacturing data?

Aerospace Manufacturing and Design, July 2011

Log Number: IT-011712-RGG

Boeing History: Proliferation of Standard Parts *(cont.)*

The answer is simple…

Hand-keyed data re-entry

Hand-keyed data re-entry

Hand-keyed data re-entry

Raw Material Mills

Hand-keyed data re-entry

Hand-keyed data re-entry

Potential for a subset of the billions of Product Standards to flow through this lifecycle over decades of time and program lifecycles.

In the aerospace world, standards often comprise roughly half of the product definition data. Having half-digital data and half paper data creates problems.

Aerospace Manufacturing and Design, July 2011

Log Number: IT-011712-RGG

Boeing History: Proliferation of Standard Parts *(cont.)*

The Product Standards data being consumed in the Product definition throughout the entire lifecycle is made up of two basic elements:

- Geometry

geometry

<div style="border: 2px solid blue;">

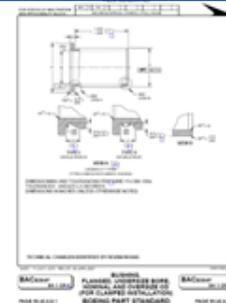**We have been using the CADENAS PARTsolutions products to focus on the Geometry element.**

</div>

- Engineering
  - Part Numbers
  - Material Notes
  - Spec Notes
  - Standard Notes
  - Engineering Notes
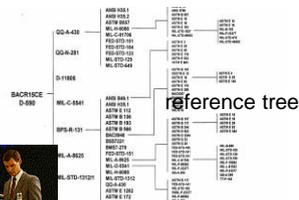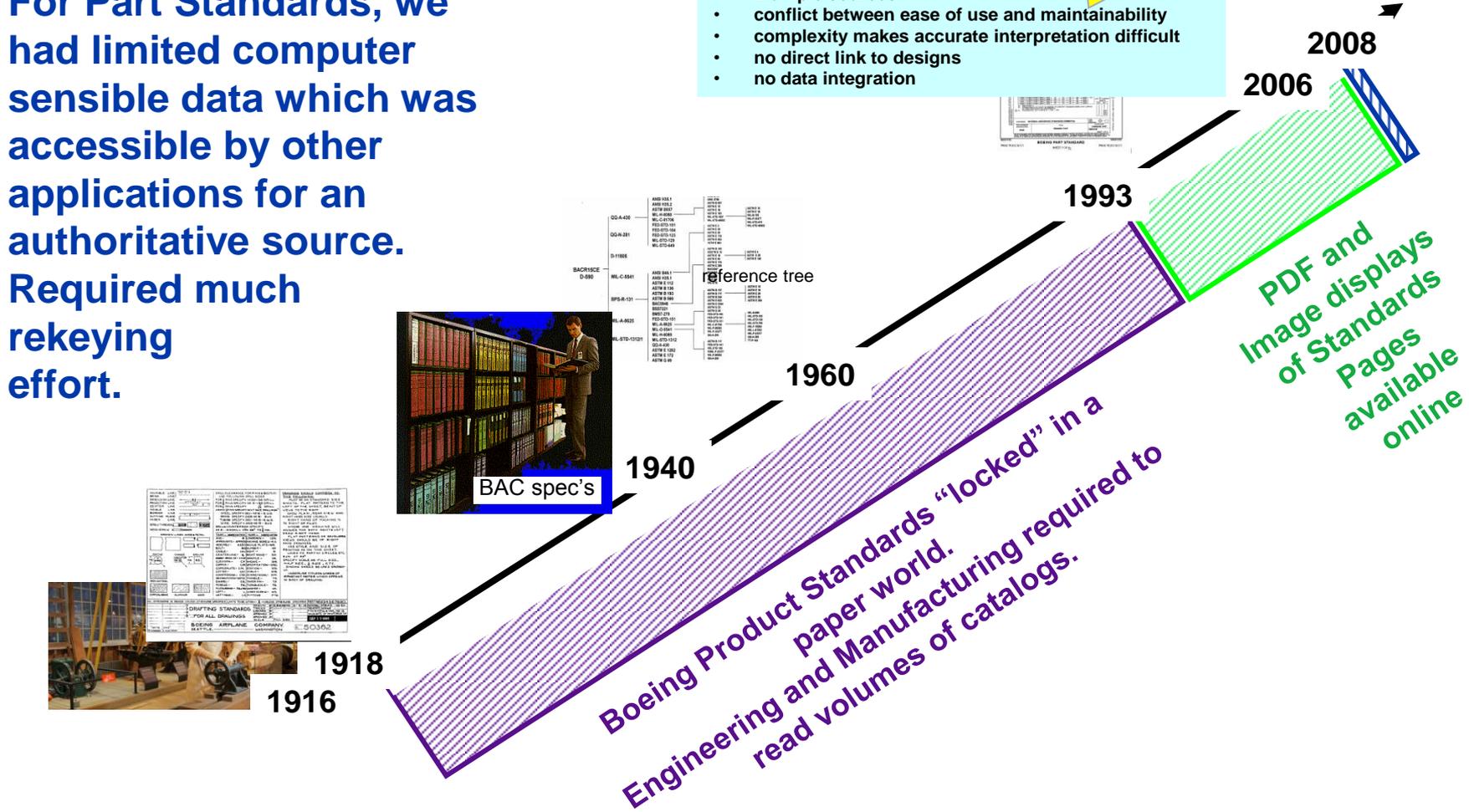
processes specs

material specs

part specs

tools specs

Boeing History: Proliferation of Standard Parts *(cont.)*

History of Product Standards domain…

For Part Standards, we had limited computer sensible data which was accessible by other applications for an authoritative source. Required much rekeying effort.

40 Billion part numbers

- multiple sources
- conflict between ease of use and maintainability
- complexity makes accurate interpretation difficult
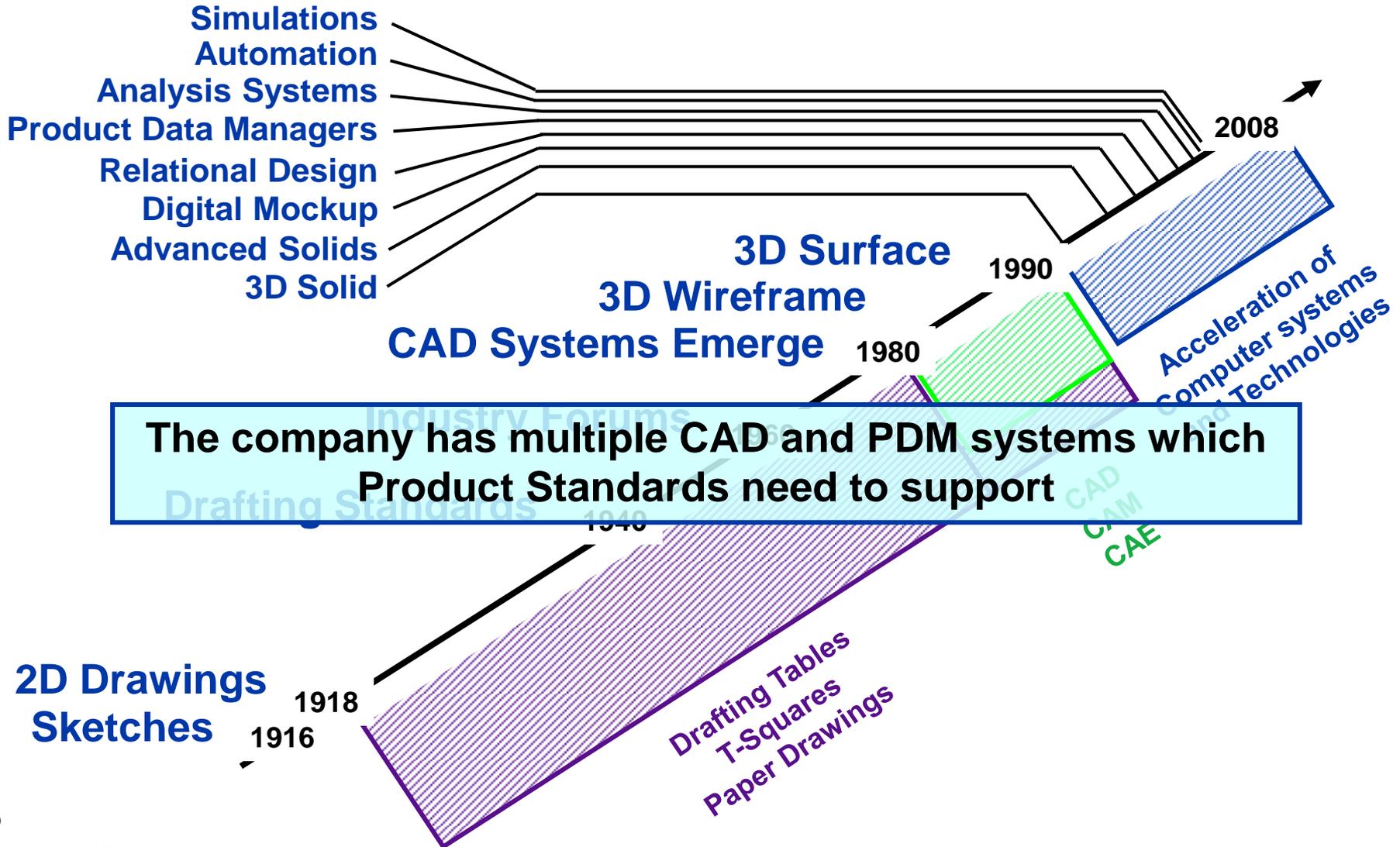- no direct link to designs
- no data integration

2008

2006

1993

reference tree

1960

1940

BAC spec's

1918

1916

PDF and Image displays of Standards Pages available online

Boeing Product Standards "locked" in a paper world. Engineering and Manufacturing required to read volumes of catalogs.

Log Number: IT-011712-RGG

Boeing History: **Proliferation of Standard Parts** *(cont.)*

History of Engineering and Manufacturing domains…

Simulations
Automation
Analysis Systems
Product Data Managers
Relational Design
Digital Mockup
Advanced Solids
3D Solid

2008

3D Surface
3D Wireframe
CAD Systems Emerge

1990

1980

Acceleration of Computer systems and Technologies

The company has multiple CAD and PDM systems which Product Standards need to support

Industry Forums

Drafting Standards

1940

CAD
CAM
CAE

2D Drawings
Sketches

1918

1916

Drafting Tables
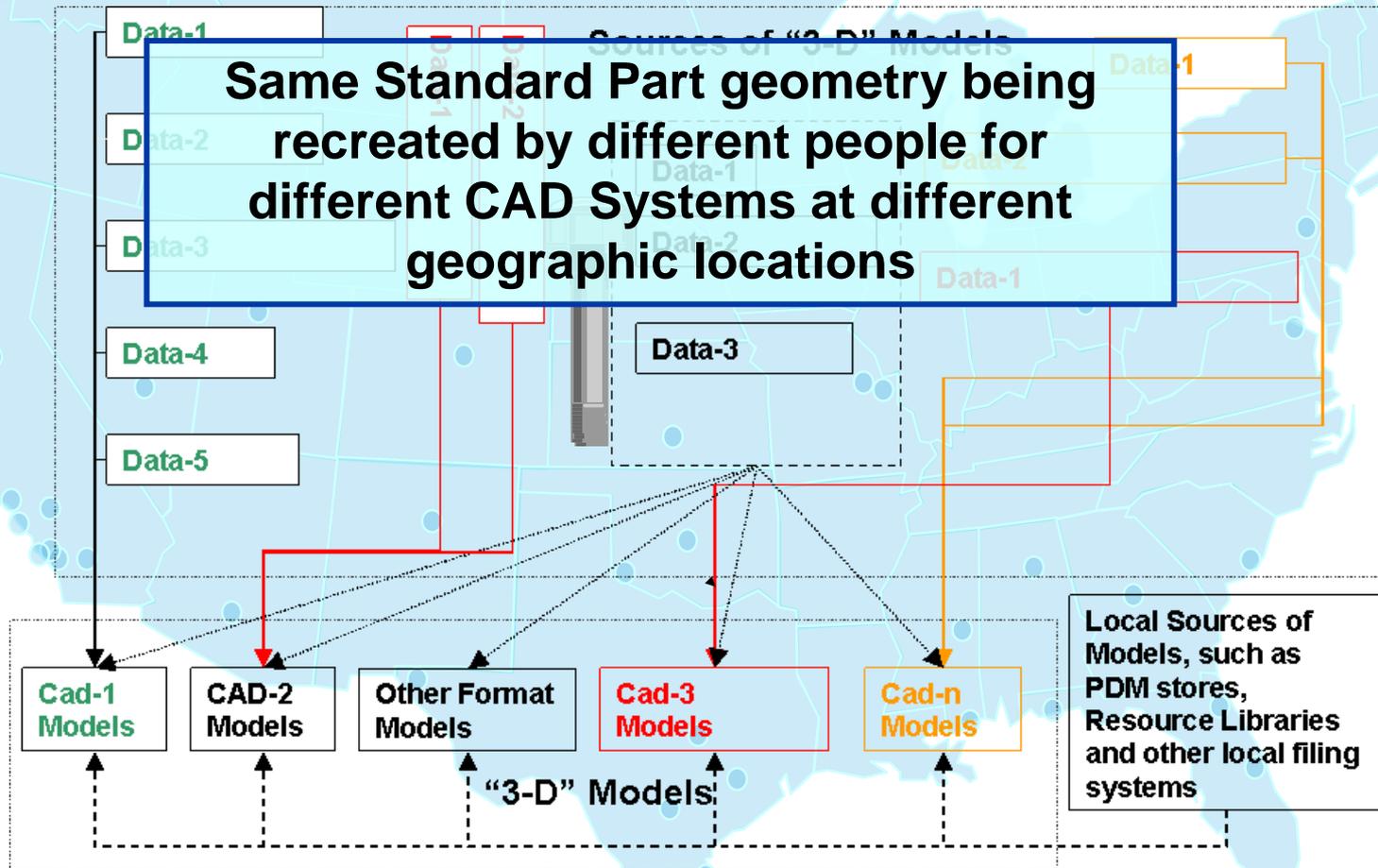*T-Squares*
Paper Drawings

Boeing History: Proliferation of Standard Parts *(cont.)*

Product Standards domain.

Part Standards did not evolved at the same rate as the Engineering and Manufacturing domains.

PDF and Image displays of Standards Pages available online

?

2008

Boeing Product Standards "locked" in a paper world. Engineering and Manufacturing required to read volumes of catalogs.

1990

1980

1975

Acceleration of Computer systems and Technologies

1960

1940

CAD CAE

1918

1916

Paper Drawings

Engineering and Manufacturing domains

Boeing History: Proliferation of Standard Parts *(cont.)*

Same Standard Part geometry being recreated by different people for different CAD Systems at different geographic locations

Data-1
Data-2
Data-3
Data-4
Data-5

Sources of "3-D" Models

Data-1
Data-2
Data-3

Cad-1 Models
CAD-2 Models
Other Format Models
Cad-3 Models
Cad-n Models

Local Sources of Models, such as PDM stores, Resource Libraries and other local filing systems

"3-D" Models

Log Number: IT-011712-RGG

The good thing is we realized change was needed to remain competitive.

We are making good progress towards implementing the required change.

Log Number: IT-011712-RGG

Realizing the Vision: Update on Our Progress

Log Number: *IT-011712-RGG*

Aerospace companies depend on product standards to control quality, ensure traveler safety, meet regulatory requirements, and work with global partners. Although Boeing has been an early adopter of digital engineering and manufacturing technologies, the process of managing standards data as documents was essentially unchanged at the company for 75 years.

This meant that, until recently, product data had to be continuously converted from documents into multiple digital formats, an expensive and time-consuming process.

PM100 Manufacturing Automation Awards, Special Edition - 2011

A Single Strategy

Five years ago, it became clear that the pieces that we had been creating needed to be integrated into a single strategy. We produced the Boeing Product Standards Long Range Strategic Plan. Key to the strategy is the goal that standards users will not need to access a PDF document for a standard. Instead, the optimum amount of specification information will be delivered in a role-based format to the point of use when needed with little or no manual intervention.

Aerospace Manufacturing and Design, July 2011

Log Number: IT-011712-RGG

Realizing the Vision: Update on Our Progress *(cont.)*

The strategy has also driven some other goals:

- Raise product standards technology to the level of product design technology (CAD, PDM, etc.)

- Ensure that the data is interoperable with other product definition data and systems

- Manage and deliver product standards from single authoritative source and automatically feed data to all delivery systems on publishing

- Never re-key data. Author standards data once and draw data from the single authoritative source

Aerospace Manufacturing and Design, July 2011

Log Number: IT-011712-RGG

Realizing the Vision: Update on Our Progress *(cont.)*

The strategy has also driven some other goals *(cont.)***:**

- Author standards as digital files using a schema that allows digital definition of standards data (numbers, formulas, conditions, logic, etc.) and allows publishing of the standards data in all necessary formats (PDF documents, CAD models, digital files, logical and conditional interpretations for smart systems, etc.)

- Encourage and support the development of a government and industry wide common data model and hierarchical ontology for product standards

Aerospace Manufacturing and Design, July 2011

Log Number: IT-011712-RGG

Realizing the Vision: Update on Our Progress *(cont.)*

Create digital authoritative forms of Product Standards data that can be consumed by all required downstream systems

(Deliver)

CAD

(Publish)

(Author)

Transformation by Stylesheet

Databases

Repository of Content Components

Internet and Intranet

Multimedia

Assembled Documents

Log Number: IT-011712-RGG

Realizing the Vision: Update on Our Progress *(cont.)*

A well managed kept-up-to-date process enabling publish and subscribe services

Integrated with the PDM environments so the portal, CAD, and PDM environments act like a seamless capability

Rich user experience blended into the context of the CAD environment

An Authoritative Single Source Repository providing services to deliver data to downstream processes

Geometry Service supporting build "just-when-needed"

Web-based Product Standards Portal providing a variety of selection methods

Central Standard Part Repository

Common Standard Part Data

Support Services

Updates

Standards Client

Product Standard Enterprise Selection Portal

CAD System

Program-1
Program Repository

PDM-1
BoeingInterface
Program-1
Program Repository

PDM-2
BoeingInterface
Program-1
Program Repository

Enterprise Geometry Service

Author

Standards Content

Solution is based on a framework of services to support future integration opportunities and interchangeability

Realizing the Vision: Update on Our Progress *(cont.)*

A key aspect of making this all happen from a standard part perspective is:

- **a core technology for authoring and indexing required standard parts,**

- **that provides the correct standard part that meets the product design requirements**

- **while reusing existing product standards.**

Log Number: IT-011712-RGG

Realizing the Vision: Update on Our Progress *(cont.)*

Retire existing processes and tools supporting creation of standard part geometry and replace with a single-source authoring.

CADENAS PARTsolutions tools support Single Source Neutral CAD Authoring
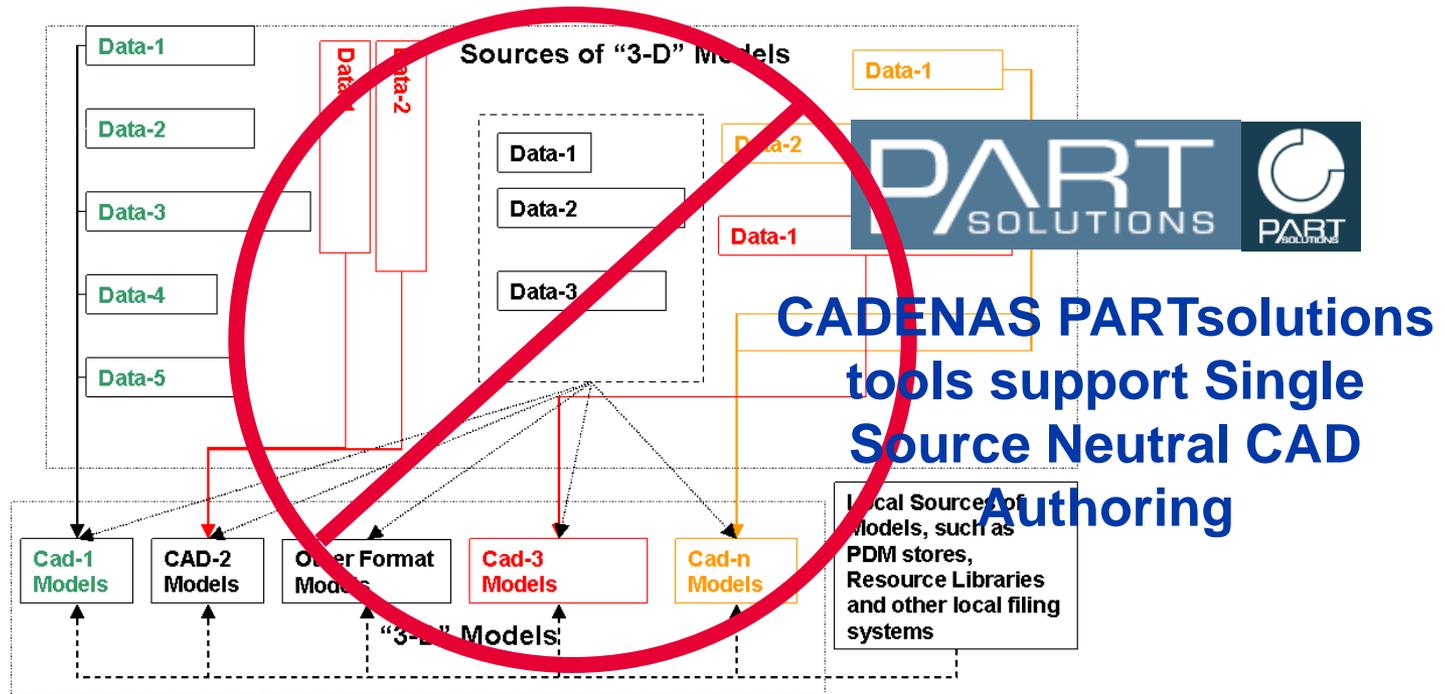
No unique repositories of data required for each CAD system. Vendor provides all CAD integrations to generate CAD NATIVE formats from a single seed model.

Log Number: IT-011712-RGG

Realizing the Vision: Update on Our Progress *(cont.)*

Implement the PARTcommunity Web Portal that uses the single source standard part catalogs
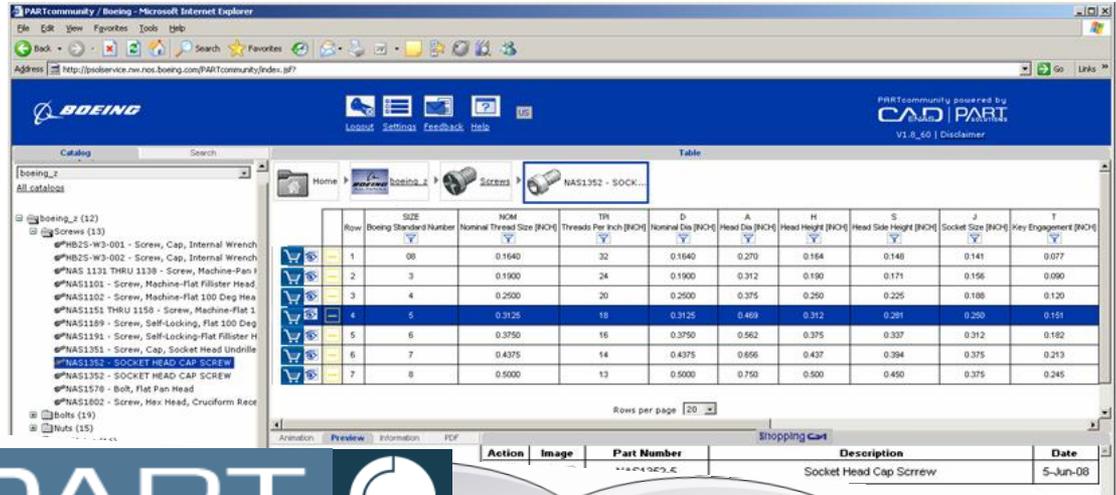
Availability to standards and strategic supplier content assists Boeing in realizing the full benefit of PARTcommunity Web

Log Number: IT-011712-RGG

Realizing the Vision: Update on Our Progress *(cont.)*

Expand the "*Geometric Search and Compare*" capability across The Boeing Company for highly reusable components to reduce the introduction of new parts
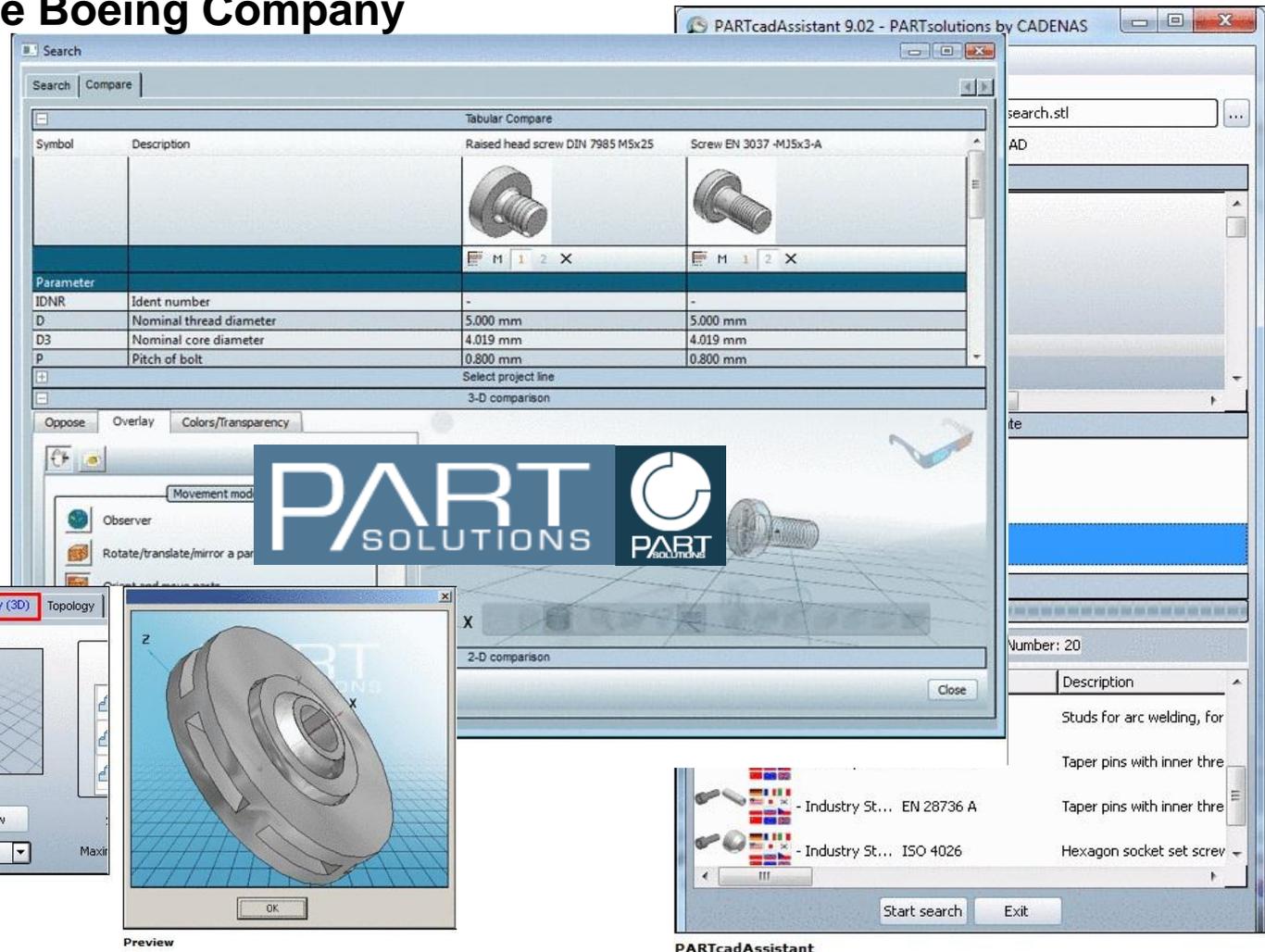
PARTenterprise
(PARTsolutions)

PARTwarehouse
(PARTdatacenter)

PARTcatalog
(eCATALOG)

PARTcommunity
(PARTserver)

- With interfaces to other systems

PARTcommunity
(Portal Interface)
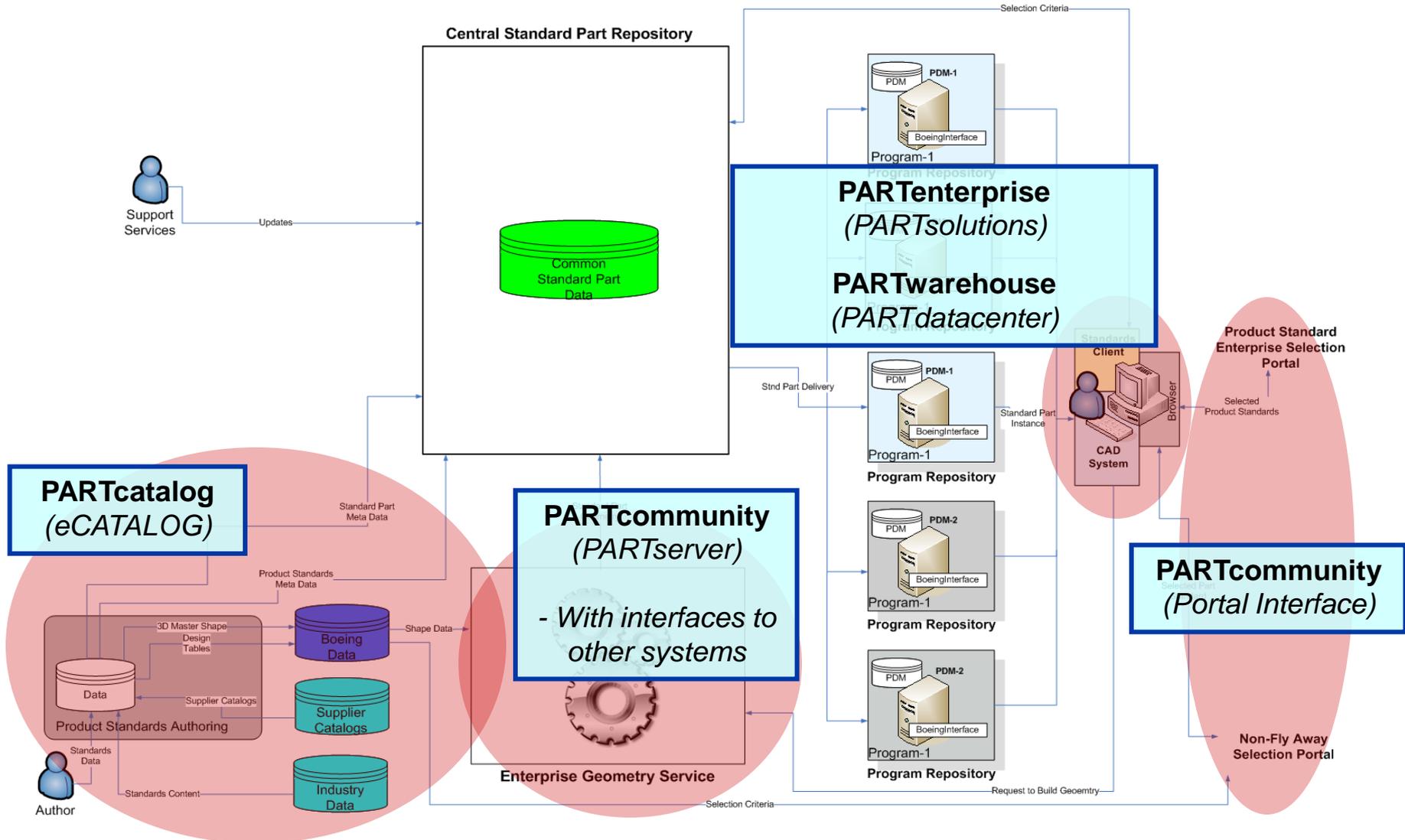
Log Number: IT-011712-RGG

Realizing the Vision: Update on Our Progress *(cont.)*

There is a business value to be gained by providing just the geometry file…

…BUT the real value comes

By delivering Parts, Materials, Processes, Specifications, Tooling, etc. as a composite Product Standards BOM and deliver as a single set to the customer at point of use.
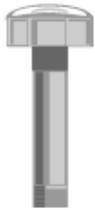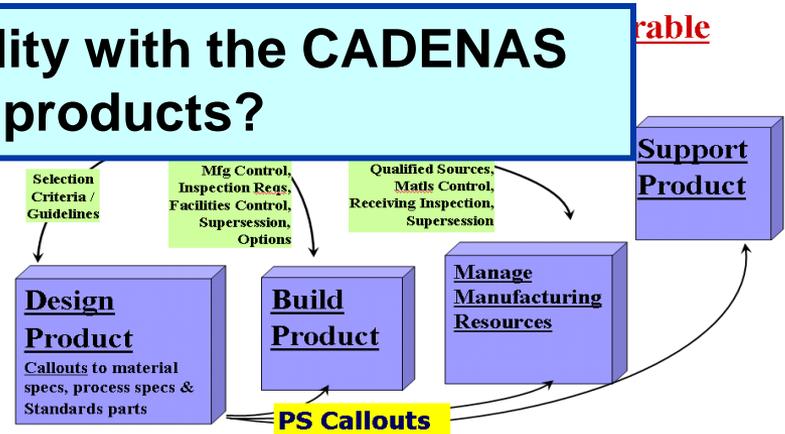
geometry specs
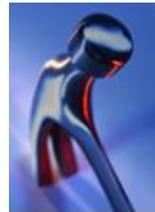
tools specs

material specs

part specs

How do we make that a reality with the CADENAS PARTsolutions products?

Selection Criteria / Guidelines

Mfg Control, Inspection Reqs, Facilities Control, Supersession, Options

Qualified Sources, Matls Control, Receiving Inspection, Supersession

Support Product

Design Product
Callouts to material specs, process specs & Standards parts

Build Product

Manage Manufacturing Resources

PS Callouts

Log Number: IT-011712-RGG

Lessons Learned: Implementing at Boeing

- Success in Enterprise Implementation requires paying close attention to the "devil in the details"

- Obtain stakeholder understanding and agreement of the project's capabilities upfront to ensure success

- Communication must be clear and requirements understood

- Accept that the Project *WILL* change – remain flexible and resilient

- An incremental approach helps achieve success in a stable manner – "one shot" approach will fail

- Software architecture and component structure of supplier doesn't necessarily match that of our company – latest technology not always approved to implement

Log Number: IT-011712-RGG

Lessons Learned: Implementing at Boeing *(cont.)*

- Need to account for impact of re-engineering when solutions don't work as expected/needed

- Emergent needs require at least twice the energy expense to accomplish in order to stay on schedule

- "Special interests" cause distraction

- Not everyone on the project speaks the same technical language or has the same understanding of terms

- Requirements must be discussed and understood

- "Scope/Feature creep" disables the schedule

Log Number: IT-011712-RGG

Lessons Learned: Implementing at Boeing *(cont.)*

We cannot do this alone. Boeing is part of a connected web of industry. We are working to convince other manufacturers that they can cut costs and improve quality by having standards data at the same level as PLM system data. Boeing only authors a portion of the standards that we use. We are working to convince other SDOs that there are new business opportunities in providing digital standards data as well as PDFs. As sharp as our IT folks are, Boeing is not a software company. We are working to convince software solution providers that there are opportunities for them in digital standards applications.

Aerospace Manufacturing and Design, July 2011

Log Number: IT-011712-RGG

Questions…

?

Thank You.

Log Number: IT-011712-RGG