Introduction to
Bills of Material (BOMs)

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Engineering Bills

- Bill of Systems

- Bill of Materials

- Bill of Characteristics

- Bill of Process

- Bill of Substance

Planning

Procurement / Supply Chain

Inspection

Design for Manufacturing (DfM)

Development for Environment (DfE)
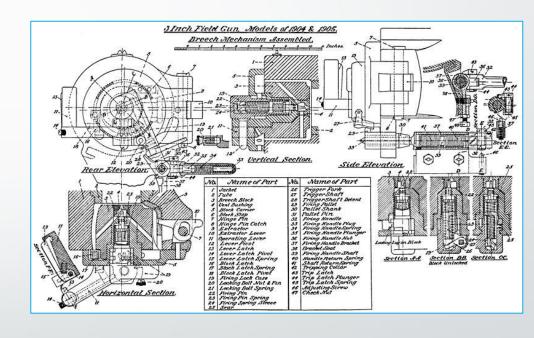
Standard BOM Types

- eBOM   Engineering

- mBOM   Manufacturing

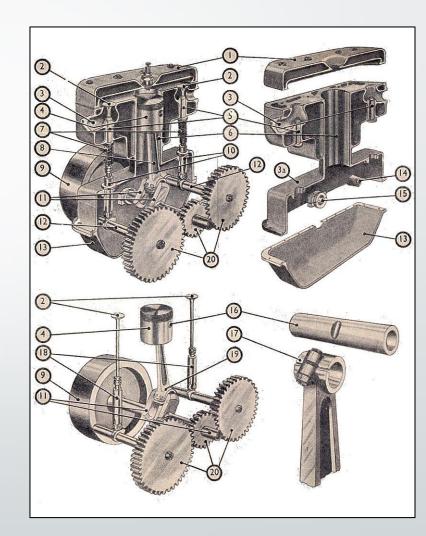- pBOM   Purchasing / Supply Chain

- finBOM   Finance / Planning

Engineering BOM (eBOM)

- Reflects design approach to product development

- Comes from CAD (Computer Aided Design) model

- Updated automatically on check-in to Windchill

- "Upstream" source for deliverables

Manufacturing BOM (mBOM)

- eBOM contains too much detail to be used by others (e.g., composite plies, cable harness wires)

- Reflects how product is manufactured / assembled / integrated

  - For example, Engineering may organize the assemblies by type (Structural, Electrical, Hydraulic, Mechanisms) but Manufacturing needs the assemblies organized by location.
  - Different mBOMs for different plants / facilities

- Created by transforming eBOM

  - Restructuring
  - Replacing / reducing
  - Deleting and adding

- Input to Manufacturing Process Planning (MPP)

Purchasing BOM

- Customer is Procurement / Supply Chain

- Can be similar or even identical to mBOM

- Restructure based on how items are procured

  - Composite structures

  - Cabling and Piping

  - Commercial Off the Shelf (COTS) components

- Input to Manufacturing Resource Planning (MRP) / Enterprise Resource Planning (ERP)

Finance BOM (finBOM)

- Customer is Financial Planning and Accounting

- Used for planning and cost projections

- Provides a true cost of the product

- Calculation

  - Product Cost (component cost x quantity)

  - Labor Cost (man hours x labor rate)

  - Administrative and Overhead Costs

BOM Errors

Largest sources of errors according to International Electronics Manufacturing Initiative:

- Completeness
  - Omitted components (e.g., fasteners)
  - Approved Manufacturers List (AML) / Approved Vendors List (AVL)
- Correctness
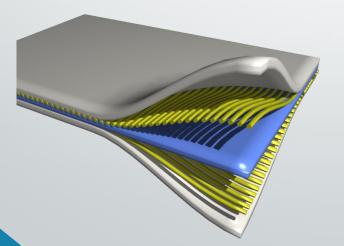 - Discrepancies from eBOM
- Consistency

Why can't everyone use eBOM?

Introduction to BOM Management

Composite Parts

- Components made of composite materials are often modeled in CAD as assemblies, with each ply modeled as an individual part. Each ply may be a dash number in the assembly.

- They often come as single fabricated unit from composite manufacturers.

- Subassemblies can / should be replaced by a single line item in work instructions, mBOMs, and/or pBOMs.
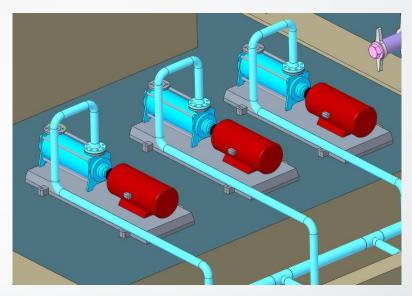
Cable Harnesses

- Cable harnesses contain connectors and a cabling part – at least 3 components.

- This number is often higher, as cables often have multiple branches, and may also include backshells, terminators, sheathing, and other accessories.

- These cables should often be replaced by a single line item in the mBOM.

- COTS cables have the same part number in the real world (e.g., a standard USB cable). But in CAD model they usually need different part numbers to be routed in the assembly.
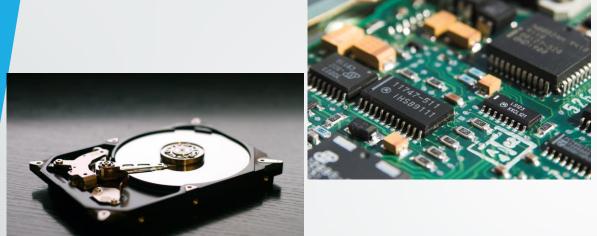
Piping

- In the CAD model, a piping assembly can contain flanges, fitting, elbows, valves, reducers, and multiple pipe solids.

- If these are fabricated separately, the piping assembly for a particular pipeline may need to be reduced to a single line in the mBOM, pBOM, and/or finBOM.

COTS Components

- In CAD and eBOM, many Commercial Off the Shelf (COTS) components must be modeled as subassemblies containing multiple parts.

- In the real world, these COTS components would be a single line in the mBOM, pBOM, and finBOM.

BOM Transformation Process

Introduction to BOM Management

Windchill Objects

- CAD Documents – created in Creo

  - CAD Parts

  - CAD Assemblies

- Windchill Parts – created in Windchill

  - Parts

  - End Items

  - Manufacturer Parts (for Approved Manufacturer Lists)

  - Vendor Parts (for Approved Vendor Lists)

Why we need Windchill Parts

- Represent items not modeled in CAD

  - COTS components you don't / can't model

  - Documents (e.g., manuals, warranty cards)

  - Packing and shipping materials

- Manipulate BOM without changing CAD

  - Rearrange

  - Consolidate and substitute

- So we can create additional BOMs

  - mBOMs, pBOMs, finBOMs, etc.

  - Mission Kits and Delivered Kits

  - Replacement Parts and Spare Parts

- **As Built and As Maintained Configurations**

Additional BOM Functionality

- Replacements
  - Alternates: can replace in any assembly
  - Substitutes: can replace in a specific assembly
  - One-way or two-way
- Supplier Management
  - Approved Manufacturer Lists (AML)
  - Approved Vendor Lists (AVL)
  - Sourcing Status: Approved, Preferred, Do Not Use, Single Source
- Configuration Management
  - Serialization – unique identifiers
  - Allocation – identify serialized components in serialized End Item
  - Reference Designators – identify specific instances of components that appear multiple times in a product

eBOM Transformation

1. Open eBOM in Manufacturing Product Structure Explorer (MPSE)

2. Create Downstream "Manufacturing View" from Upstream "Design View"

3. "Slice and Dice"

   - Replace with New or Existing Windchill Parts

   - Insert New or Existing Windchill Parts

   - Remove Assemblies and Move Up Child Parts

   - Create New Downstream Part Number

   - Cut / Copy and Paste

   - Delete

4. Check In to Windchill

5. Release via Promotion Request

eBOM Maintenance

- eBOM needs to be checked for accuracy

  - Links between CAD Documents and Windchill Parts can be broken accidentally during Revise, Set State, Promote, etc.

  - CAD Document and Windchill Part can become out of sync by editing Windchill Part (e.g., mass props, supplier info, export info)

- Tools

  - Compare CAD Structure to Part Structure

  - Build Part Structure (repair and resync)

mBOM / pBOM Maintenance

- mBOM and pBOM may be initiated before eBOM is released and the engineering model continues to evolve.

- After eBOM is released it may be revised and changed.

- Therefore changes to eBOM need to be updated in downstream BOMs

  - Components added or deleted

  - Assembly restructured

  - Metadata (data about the data) changed – e.g., components renamed

- Windchill Tools

  - Comparison Reports

  - Update Equivalence Links

  - eBOM – mBOM Transformation tools

Thank You!

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