From Our Experience

MERCURY PLM Services

Large Assembly Mgmt Best Practices

Managing large assemblies effectively is critical. Bad modeling and assembly practices cost engineering teams time due to waiting on long fetch and load times. But the downstream effects can be more pronounced. This includes inefficiencies within tech pubs, manufacturing, or marketing when developing product launch support materials. Large assembly management techniques should be applied to all CAD-based development inside, and outside of product development. Examples outside of product development include tool and fixture assemblies, or machine design assemblies.

There are three complimentary elements to good large assembly management: BOM structure, configuration control, and CAD practices. This article will provide suggested best practices within each category, starting with large assembly management.

Large Assembly Management

Even with well-established CAD design standards, bill of material structure is often overlooked. Structure can vary across projects, products, and platforms, which causes downstream user (outside of engineering) frustration when locating common components between products. Implementing a common large assembly management structure across similar products will solve these problems. Benefits of a well-organized large assembly management strategy include the following:

- Provide a standard practice for digital product development processes by aligning with current product database management system and customer expectations.
- Standardize using one design methodology throughout R&D facilities to achieve a common goal.
- Following standard practices and processes to create large CAD assemblies is key to the success of a Product Lifecycle Management initiative.
- Designers and engineers using common data between plants and following a common standard is critical to data reuse and management.

Better CAD assemblies improve many existing issues such as interference, supplier collaboration, assembly bill of materials management etc.

Large Assembly Management Objectives

- Standardize Design Methodology within the CAD system.
- Standardize Assembly Data Management Methodology within the PDM system.
- Better CAD Assembly creation.
- Improve cross-functional communication with internal and external users.
- Better interpretation of assemblies between designers and its downstream usage.
- Standards, roles, and responsibility definition for people involved with both the product design phase and sustaining phase.

Goals of Large Assembly Management

- Process to create a separate 3D CAD assembly for each future end model.
- Maintenance of 3D CAD assemblies that accurately represent each design build to verify its form and fit during Product Development.
- Methodology to maintain a large number of end models.

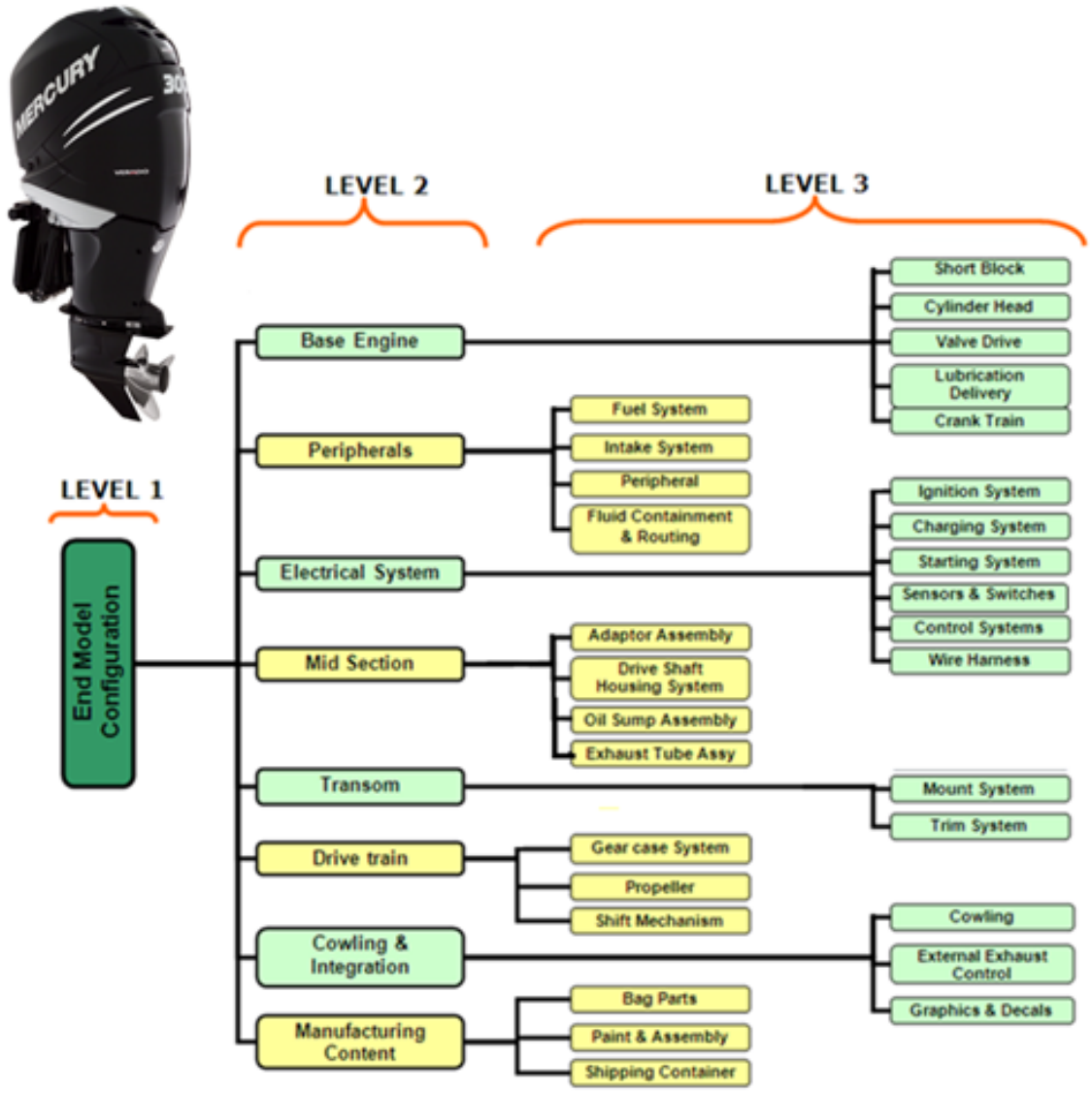
- Defined roles and responsibilities for design engineers and integrators pertaining to Large Assembly Management.
- Defined cross-functional communication strategy used throughout the product life cycle.
- Strategy for Supplier Collaboration and communication.

“To help achieve these goals, one recommended methodology is to have pre-defined Engineering Bill of material levels within the CAD assembly product structure,” suggested Bala Shetty, Solutions Architect: CAD/CAM/PLM Systems at Mercury Marine. For example, Level 1 may be the product top-level item that contains the entire end-model product structure. Level 2 generally contains placeholders (phantoms) for major functional systems such as cooling, base engine, electrical, drive system, etc. Level 3 will typically contain phantom items representing major sub systems under each Level 2. Physical sub-assemblies or items that are ordered or produced typically reside from level 4-X.

“Implementing a well thought-out Large Assembly Management initiative will provide the organization with a common engineering bill structure for product groups, making it easier for downstream consumers to understand and reuse the design information”, emphasized Shetty. “It also provides a consistent process for engineering to interact between functional design departments and roles because project participants understand how their work contributes toward increased efficiency for the entire project.”

Reuse of modular designs on future new products or iterations is another benefit.

Sample Product Structure



Other business benefits outside of engineering such as reduced search time, improved cross-functional communication, and reduced errors just to name a few.

Release Process and Configuration Control

In addition to managing the product structure, release process and configuration control are also important. The release status becomes increasingly important as the product design matures. For example, once the CV design has been established, it should be locked down and managed separately from the latest working design. Each design milestone (CV, DV1, DV2, PV1, PV2, and Production Release) builds should be locked down in order to manage and track data better.

Item ID	Item Revision	Status
8MXXXXXXXX	01	Pre-Production
8MXXXXXXXX	02	CV-Released
8MXXXXXXXX	03	DV1-Released
8MXXXXXXXX	04	DV2-Released
8MXXXXXXXX	05	PV1-Released
8MXXXXXXXX	06	PV2-Released
8MXXXXXXXX	A	Production

One common use case for this design management philosophy occurs during build execution. For example, when the procurement group purchases the parts to build DV1 prototype, a locked version of the DV1 design must be created independently from the latest working, or evolving design. This ensures that procurement is buying the correct version of each part for the DV1 build.

"Failure to follow this philosophy results in total chaos because when procurement checks the only design (latest working) while it manages the supplier relationship, it is likely that the part has been deleted from the design, incurred a revision change, or been replaced with another part," said Shetty. "The resulting confusion between engineering and downstream consumers such as procurement or manufacturing is likely to significantly slow down the continual design evolution of the product, which causes the development budget to bloat with cost and time overruns."

It also increases the likelihood of a costly mistake such as tooling cut against the wrong design revision, or ordering the wrong part revision that causes expensive build delays.

Effective CAD Design Standards

Efficient CAD design can make the difference between success and failure during new product development. If CAD models are inefficient and bloated, they are time consuming to open, and much more difficult to modify and use, unnecessarily extending the product development timeframe. In extreme cases, top-level models containing the entire design may not open at all.

"Downstream users may also be affected, because tooling design and CAM applications are typically based upon the engineering design models," stressed Shetty. "It is also important to enforce the same CAD modeling best practices within areas outside of engineering that consume and develop CAD models to support production."

It is recommended to establish a policy that requires all new Product Development in CAD to be done using a common measurement system, whether Metric or English units.

We recommend that supplier models used within the product

design should be in Pro/E format (native or imported) and contain all standard parameters and layers. The model should be solidified. The following sections reveal methods for handling supplier models:

Supplier Model in Native Pro/E Format

- Save the model as a supplier item type in a PDM such as Teamcenter
- Merge the supplier model into a new model (using a start part)
- Save the new model to a parent assembly item; which is used within the design

Supplier Model is Not in Pro/E Format

- Create a new model using a Start part
- Insert the supplier model as an imported feature (Insert>Shared Data>From File…)
- Models with imported geometry must have Pro/E native features for assembly reference (Example: mating plane, aligning axis) and these features must not be children of imported geometry. Under a new revision, imported geometry can be replaced with a revised model from a supplier without causing the assembly to fail.

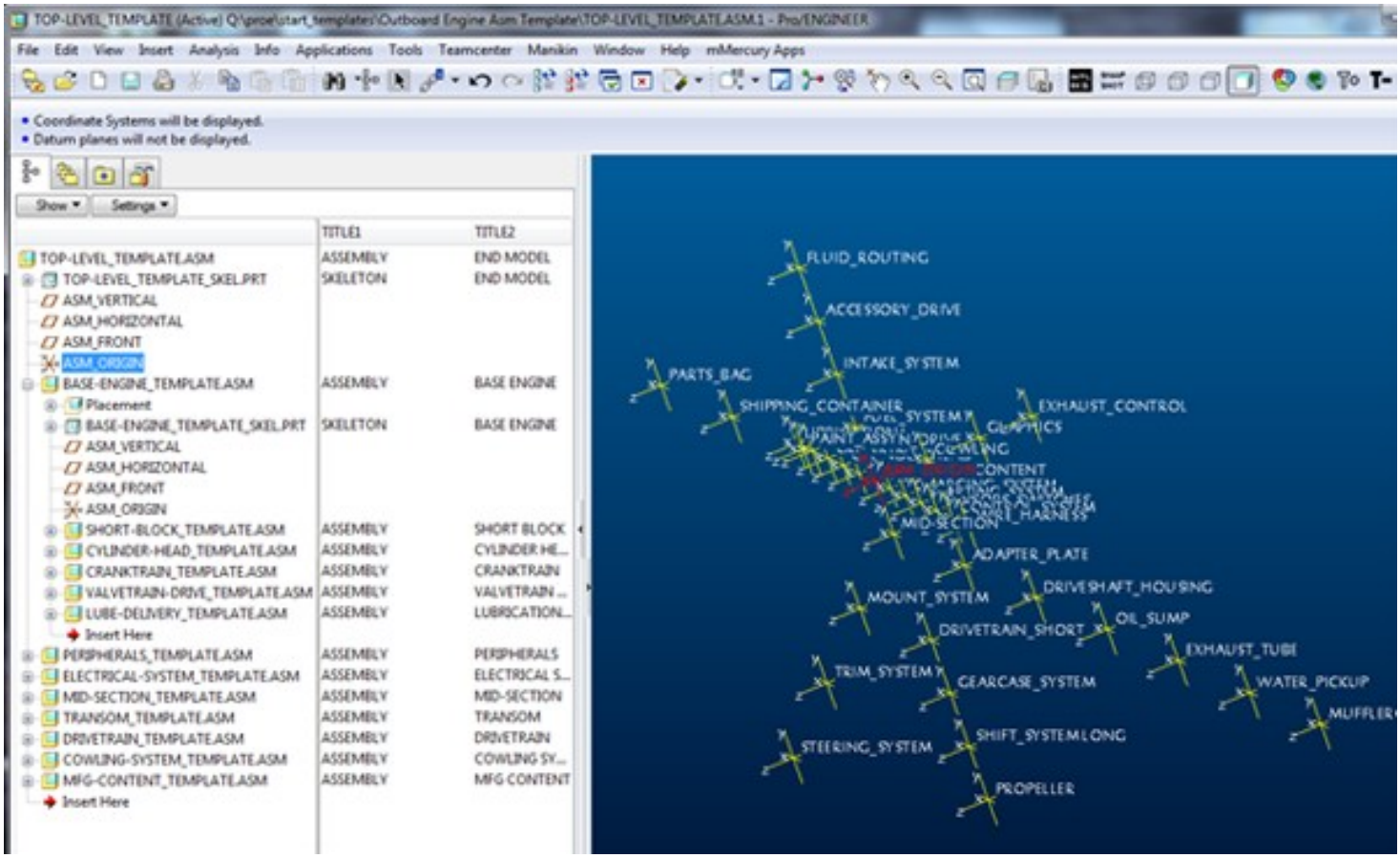
Best practices suggest that all supplier assemblies should not be used as assemblies. Generally, supplier items are treated as one item, though functionally as an assembly. It is advantageous to convert the supplier assembly to single part file, which is easier to handle and maintain revisions. There may be cases where we need to have an assembly model. The need for an assembly model should be justified by answering the following questions:

- Does it need to move (mechanism)?
- Does the organization service any portion of the supplier assembly?
- Is there a need to display internal components with cross-sections?

If the answer to any of these questions is “Yes”, then individual parts are required.

Another consideration is how to manage manufacturing assemblies created for CNC Programming and Die/Mold design.

Typical Product Structure Template file in Pro/E



“Ideally, the teams responsible for manufacturing data will use similar methodologies and disciplines as the engineering team”, said Shetty. “By providing a common framework based on standards and best practices, groups outside of engineering should be able to comply.”

Developing standard CAD/PDM attributes for engineering and manufacturing use cases, naming convention, as well as developing a process map to enhance the communication between engineering and manufacturing to better manage design changes helps with the overall data management.

Mercury PLM Services Unique Perspective

Mercury’s differing approach concentrates on understanding your process as a must for success. A process-centric approach requires businesses to review and question existing work streams to understand “why,” “what,” and “how” work should be done to establish efficient cross-functional work flows that are consistent, repeatable and scalable for growth.

Mercury also offers a unique perspective for helping organizations that are considering a Product Lifecycle Management implementation because Mercury lives and breathes PLM from a manufacturing business user’s vantage point.

Because Mercury works in a dynamic, global product-development environment that supports a worldwide manufacturing footprint, Mercury has a user’s perspective that helps drive results and realize improvements. Several of Mercury’s experts also have been deeply involved with our ISO 9000 certification effort, as well as configuration management, and engineering document-management practices. ■

Sample Die Design in Teamcenter