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STRATEGIES FOR SHORTENING DESIGN CYCLE TIMES WITH INNOVATION CONTAINERS

Executive Summary

This white paper explores strategies for shortening design cycle times using Innovation Containers. By leveraging digital libraries and reuse strategies, manufacturers can reduce part proliferation, streamline product development, and improve overall efficiency. Key benefits include reduced costs, increased productivity, and enhanced product quality.

Why Reuse Matters Now

As we've counseled product development organizations through digital transformations over the past 30 years, a common goal of our clients has always been to implement digital tools in ways that help them decrease design cycle times, increase engineering productivity, and improve product quality. All of these factors are not only related but can be impacted by the simple techniques that will be described in this paper.

The True Cost of Part Proliferation

Taking a step back, we often hear from our clients that corporate goals such as growing market share and improving profitability are of prime concern, and shorter design cycle times are certainly a large aspect of that strategy – but how does one make them actionable and provide value in the short term? We know from studies done by organizations such as McKinsey that introducing a single average industrial machinery part can range from $20,000 to $50,000 depending on factors like part complexity, material requirements, and production volume, while the typical medical device part can easily cost over one million dollars to introduce due to the stringent regulatory requirements, design validation, and production setup. When one factors in the additional expenses related to tooling, assembly validation, and quality assurance testing, the actual cost of a part can be many times the original design, development, and materials costs. Focusing on cost itself, certainly some comes from the materials used to manufacture the part, but often the labor and process costs outweigh the material costs by orders of magnitude.

Thus, we arrive at the notion that one of the most effective tactics a manufacturer can employ to drive toward reducing design cycle time is to reduce part proliferation – the best part is one that didn't have to be introduced at all. While many factors influence the need for new parts, one of the most effective is to create and execute an effective data reuse strategy. In this work, we will lay out an effective, actionable plan showing how careful implementation of digital libraries and reuse strategies can help achieve the goals.

Next, we will explore how libraries, which we call Innovation Containers, can be leveraged as part of an industrialization process. Innovation Containers are digital repositories that facilitate data reuse and streamline the product development process. By organizing and managing reusable components, these containers help manufacturers reduce design cycle times and improve efficiency.

Digital Libraries: More Than Just Fasteners

Libraries in and of themselves are nothing new, as all manufacturers use standard components in the design of their products. While the prevalence of standard components varies from sector to sector, the natural inclination is to incorporate as much standard content as possible to streamline design and verification activities. This naturally leads to conversations about what the "real" purpose of a digital library is and what distinguishes a library from a product container, often made more complex by topics such as platform design, model-based engineering, and digital threads.

This work describes several scenarios for how libraries may be leveraged as part of an "industrialization" process, increasing data reuse while simultaneously setting the stage for more ambitious model and digital thread initiatives. It's critical to emphasize that a reliable digital thread is based on data in which you have a high degree of confidence, and that should begin with the data you use to start your new product development process. While there are many aspects to data integrity, this paper focuses on reusable information typically found in system libraries.

Now, let's examine the Save As process and its impact on design cycle times. In the broad definition of CAD, PDM, and PLM, the term "Library" refers to a digital repository in which data is placed into a repository by a select group of users for inclusion and reuse by a much larger group of "consumer" users. The classic example is fasteners – once an 8mm x 25mm socket head cap screw is drawn or modeled, depending on whether 2D or 3D, it is reviewed and placed in a library for read-only access from there forward since, by definition, it is a standard part that cannot be altered.

The Innovation Container Strategy

A single repository for fasteners is not, however, the goal of a library and industrialization strategy. The real goal is to facilitate and improve data reuse so that innovation can be shared, and new product development velocity increased. This naturally indicates that step one is to examine your organization's existing container strategy and then modify or enhance it based on efficient library use and to broaden the view of "library parts" from commodity parts like fasteners and bearings to "industrialized" parts that can be used as standardized content in many designs. Interestingly, this thought begins with a "Save As" operation coming out of a design review process as shown in the figure below.

Notice in this process, we kick off the project with a technical design review. While there are many aspects of a technical design review, one of the key activities is to evaluate the existing design information in relationship to the approved requirements. Assuming we follow the "No" path, we then face the decision as to whether to revise the product or create a new product based on the existing design, which is the path we will follow beginning with the creation of a new part through the Save As process shown in the image below.

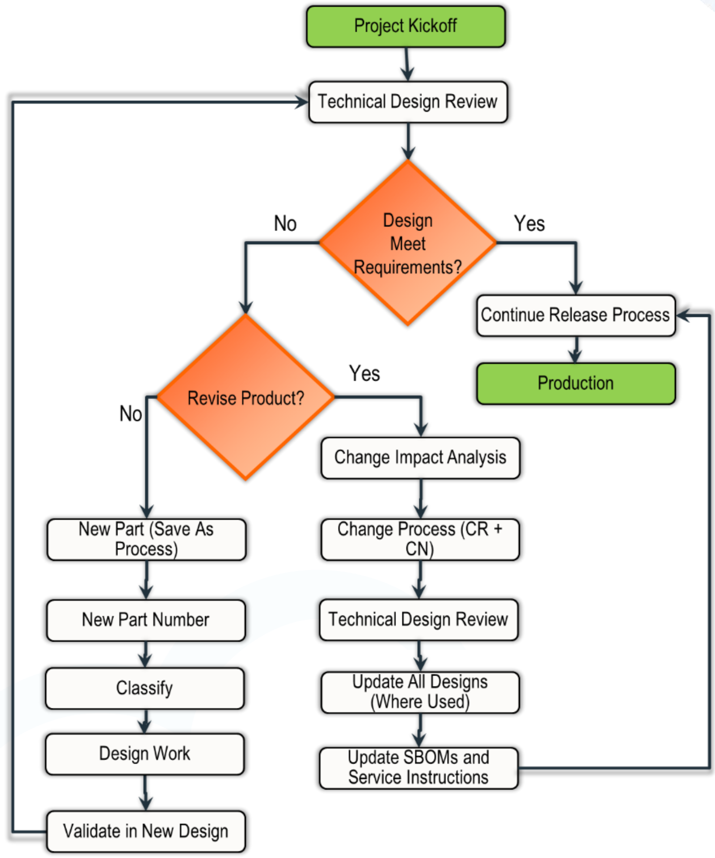


Figure 1 - New Part Introduction Process, highlighting key concerns involved in the decision of whether or not to introduce a new part.

This process is shown schematically in the image below

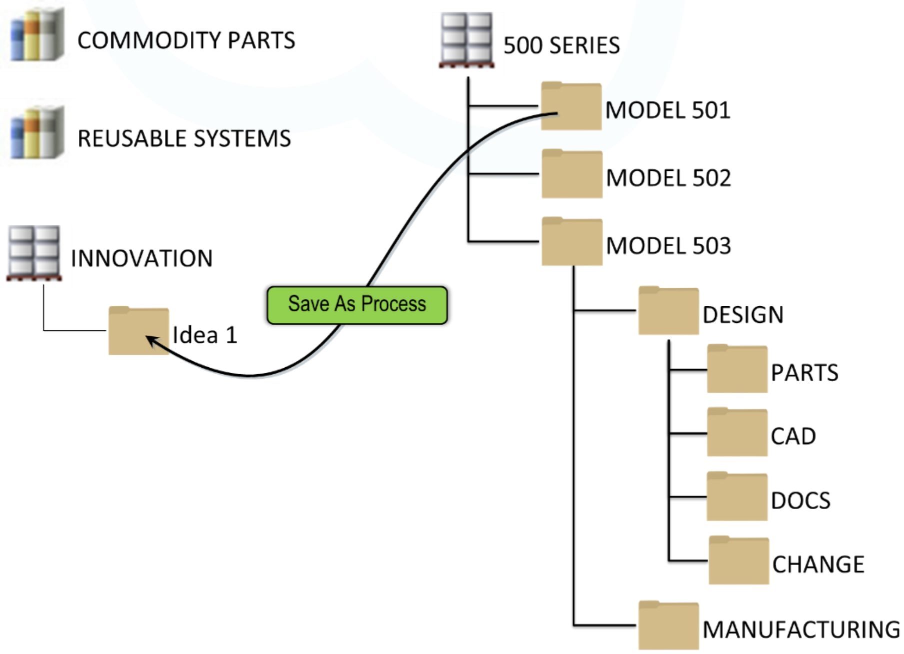


Figure 2 - Extracting Data for Reuse - This figure shows how data is extracted for reuse during the Save As process.

Maximizing the number of related objects collected during a Save As process results in the fastest time for your new design. PLM systems offer different levels of collecting capabilities during a “Save As” operation. Ideally, you can collect the full Part Structure, all related CAD parts, CAD assemblies, CAD drawings, and documents in the same Save As operation and then change the desired portions of your design. This results in a newly created structure with newly created components/subassemblies that only need to be modified, versus created, assembled, then detailed.

In the example shown below, we wish to create a new Model 503 that has an improved Actuator design. We can see the existing design with all related CAD and Documents. The existing Actuator is shown inside the highlight box:

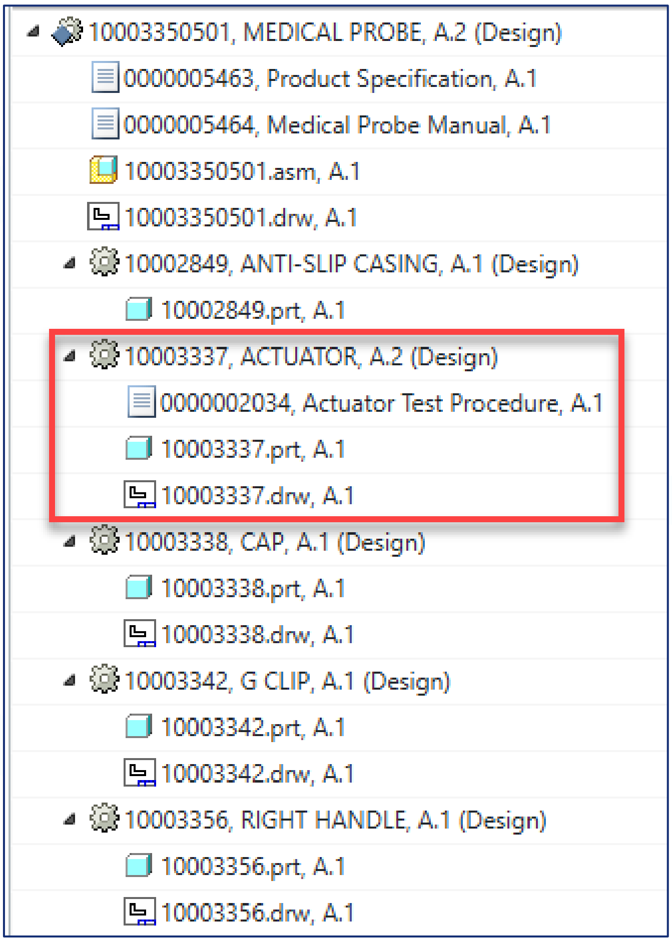


Figure 3 - View of BOM - This figure provides a view of the Bill of Materials (BOM) for the new design.

In the Save As operation, only the desired objects are selected for saving as new. Notice the “greyed out” areas for objects not changing and new Part Numbers and Document numbers for those objects that will be newly created:

Number	New Number	Name	New Name
10003350501	10003350503	MEDICAL PROBE	MEDICAL PROBE, GEN 2
0000005463	(Generated)	Product Specification	Product Specification, Med Probe, Gen 2
0000005464	(Generated)	Medical Probe Manual	Medical Probe Gen 2 Manual
10003350501	10003350503.ASM	MEDICAL PROBE	MEDICAL PROBE, GEN 2
10003350501	10003350503.DRW	MEDICAL PROBE DRAWING	MEDICAL PROBE GEN 2
10002849		ANTI-SLIP CASING	
10002849.		ANTI-SLIP CASING	
10003337	10006785	ACTUATOR	ACTUATOR, GEN 2
000000020	(Generated)	Actuator Test Procedure	Actuator Gen 2 Test Procedure
10003337.	10006785.DRW	ACTUATOR DRAWING	ACTUATOR, GEN 2
10003337.	10006785.PRT	ACTUATOR	ACTUATOR, GEN 2
10003338		CAP	
10003338.		CAP DRAWING	
10003338.		CAP	
10003342		G CLIP	
10003342.		G CLIP DRAWING	
10003342.		G CLIP	
10003356		RIGHT HANDLE	
10003356.		RIGHT HANDLE DRAWING	
10003356.		RIGHT HANDLE	

Figure 4 - Save As Command – This figure illustrates the insertion of new parts to create the new variant design.

Result of the Save As:

- 10003350503, MEDICAL PROBE, GEN 2, A.1 (Design)
  - 0000005523, Product Specification, Med Probe, Gen 2, A.1
  - 0000005524, Medical Probe Gen 2 Manual, A.1
  - 10003350503.asm, A.1
  - 10003350503.drw, A.1
  - 10002849, ANTI-SLIP CASING, A.1 (Design)
  - 10003338, CAP, A.1 (Design)
  - 10003342, G CLIP, A.1 (Design)
  - 10003356, RIGHT HANDLE, A.1 (Design)
  - 10003358, SHUTTLE, A.1 (Design)
  - 10003359, TRIGGER, A.1 (Design)
  - 10006785, ACTUATOR, GEN 2, A.1 (Design)
    - 10006785.prt, A.1
    - 0000005525, Actuator Gen 2 Test Procedure, A.1
    - 10006785.drw, A.1

Figure 5 - Save As Results – This figure shows the results of the Save As operation in the form of a new BOM.

In this case, we are saving into a Product container called "Innovation" rather than into the "Model 503" Product folder. This technique allows us to segregate the new part creation process into an area with unique access controls, providing the freedom for the design team to work outside the constraints of the normal container structure. The goal of the design team is to create a "clean" product definition (Parts, BOM, CAD, etc.) that can be used again as a standard product or system.

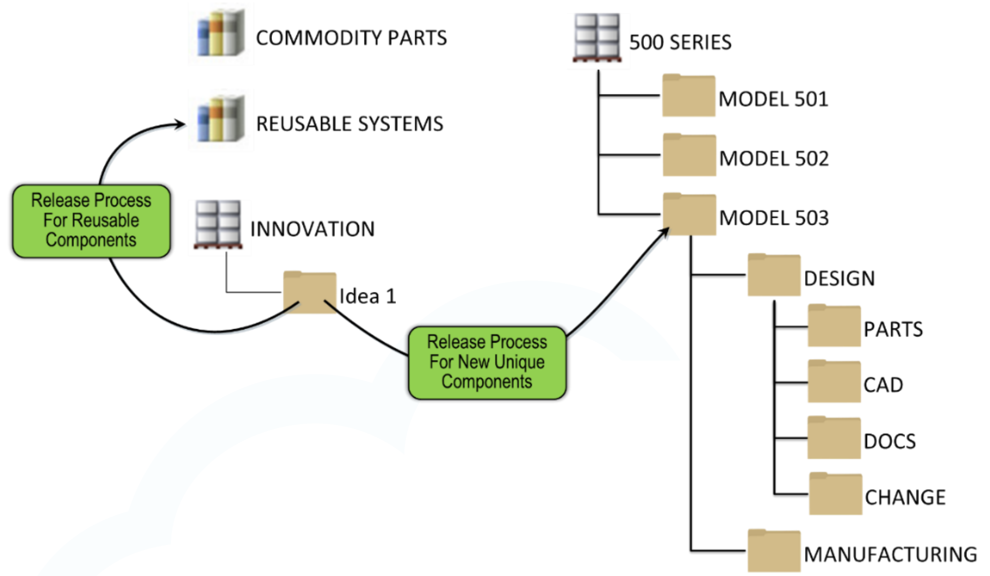


Figure 6 - Innovation Container Output - This figure illustrates how new components are released to the Product container while reusable components go into a Library.

To set up this new system as a "standard," reusable system we will follow a typical release process, with all the expected technical gates and processes, moving the system into a "Reusable Systems" Library container upon release process approval. Doing so creates a standardized, predictable system that may be securely accessed from the Library. The Innovation container can still contain intellectual property that can be gradually matured for other purposes, hopefully, to be released into the Reusable Systems Library when it is ready.

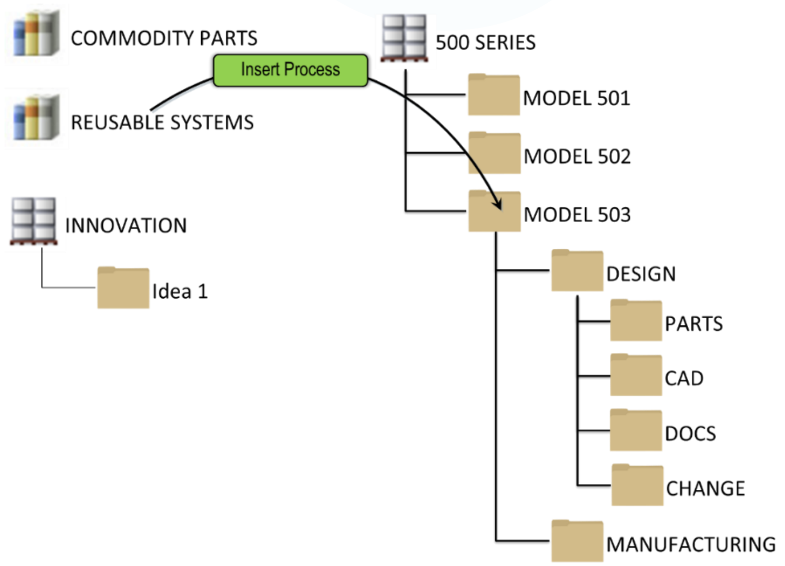


Figure 7 - Inserting Reusable Components into Product

This naturally brings us to where the new system is "inserted" into the developing Model 503 design. The "industrialized" component may be "referenced" into any number of products in a general product container environment, used to design products by multiple design teams.

Of course, some data created in the Innovation container may be new and unique to the Model 503 design. This data may be simply moved from the Innovation container to the Model 503 container as shown in the image below, or it may be "moved" through a release process promoting from a concept state in the Innovation container to a later state in the Model 503 container.

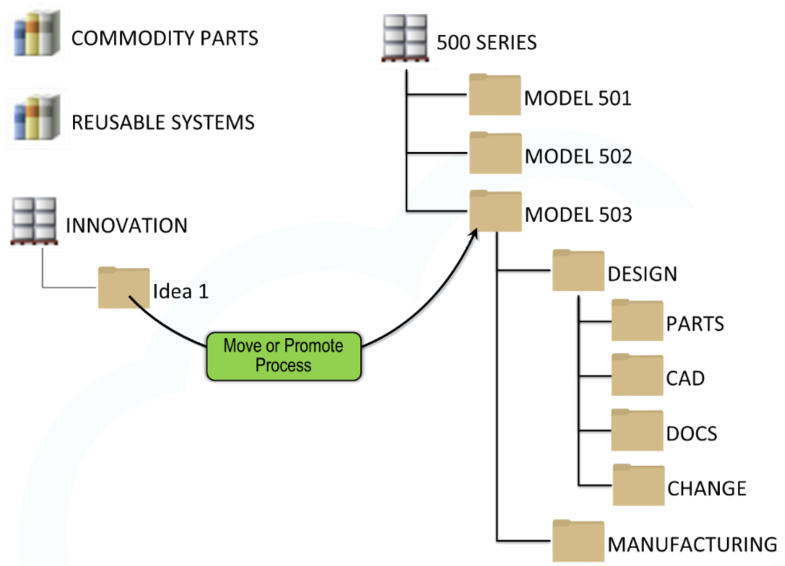


Figure 8 - New Components into Product

Another significant advantage of this method is that change impact analysis becomes easier since more data can be traced back to a single version of the truth, enhancing the integrity and reliability of the digital thread. To continue with this theme, the existing Model 501 and Model 502 designs could be evaluated through a change impact analysis process and, if worthwhile, updated with the standardized system that already exists in the Model 503 product.

Finally, we will address the importance of data remediation in ensuring reliable and consistent design information.

Real-World Example: Data Remediation Challenges

We recognize that the path forward may not be so simple, since the design information in the Innovation container needs to be reliable and consistent. Our experience is that each organization struggles with this to some degree, so creating a solid data remediation plan is generally another logical aspect of this Innovation Container strategy. In many organizations the quality of the data varies greatly, often simply based on the natural evolution of processes and technology. For example, if a part was modeled, checked, and released by your organization over a short period, it can be considered "good" and will be very easy to manage and use reliably. Unfortunately, that is rarely the case. Articulated below is the converse, illustrated based on an example from a real client in greatly sanitized form.

The products in the “500 family” have been created and matured over a period of time, shown below along with interesting details about the CAD data as a point of interest.

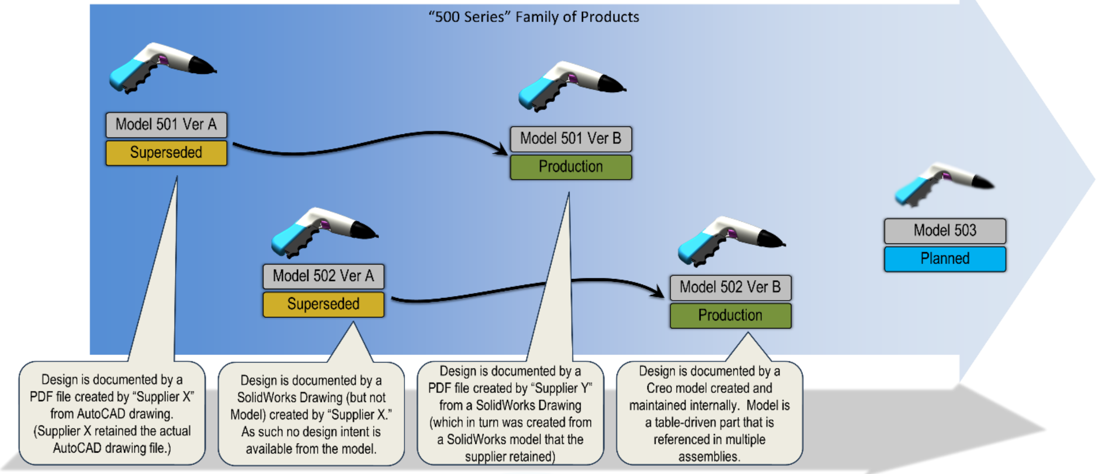


Figure 9 – The Family of Products managed by an organization.

The table below describes the more details of the CAD data along with the typical problems and challenges that may be encountered while implementing an Innovation container and Library strategy.

Product	Data Format	Source	Problems/Challenges
501, Version A	PDF created by a supplier from AutoCAD drawing. (Supplier retained the actual AutoCAD drawing file.)	Supplier X	▪ No actual CAD data exists ▪ PLM’s CAD Integration doesn’t support PDF as a CAD format ▪ The initial release treated the PDF as a “document” rather than a CAD object, so classification is incorrect
502, Version A	PDF created by a supplier from a SolidWorks Drawing (which in turn was created from a SolidWorks model that the supplier retained)	Supplier Y	▪ Same as above, but from a different Supplier
501, Version B	SolidWorks Drawing (but not Model)	Supplier Y	▪ The drawing geometry exists but not the model from which it was created, meaning the design intent is not available.
502, Version B	A table-driven Creo Model	Internal	▪ Table-driven parts, if referenced in numerous assemblies, are always under revision leading to churn ▪ Leads to conflicts with the definition of what a “Product” is and how it is integrated with ERP systems

Table 1 - History of a Part's Documentation

Thus, the second step in an industrialization journey is to examine your data and determine standard processes for cleansing and remediation necessary to get the data into a sufficient level of "good enoughness" to be reliably used from a library. Leading organizations adopt the position that before a component can be placed in a library it must meet the current "PLM Model Standards" which are a 3D CAD model, with proper classification attributes, linked to a Part (or other appropriate business object) in the PLM system, and the change process is often the trigger for such reviews of existing data.

Manufacturing Reuse and the Digital Thread

The reason for a sustained focus on data quality is that PLM, as a fundamental aspect, becomes more effective as all the data on the digital thread improves. Let us consider what can happen once the design engineering aspect of product definition is underway, and Manufacturing Engineering collaboration can realize similar time savings with downstream Save-As processes.

Similar to the process of gathering related Design objects, we should maximize the reuse of Manufacturing data with additional Save-As functions. Determine and utilize all tools provided by PLM for the replication of mBOMs, Process Plans, and Work Instructions. Ideally, the newly replicated Manufacturing objects will retain relationships to the previously created Design objects.

In the example shown below, the eBOM, mBOM, and the associated Process Plan are shown in the "before save as" condition. The relevant objects are highlighted in the red boxes.

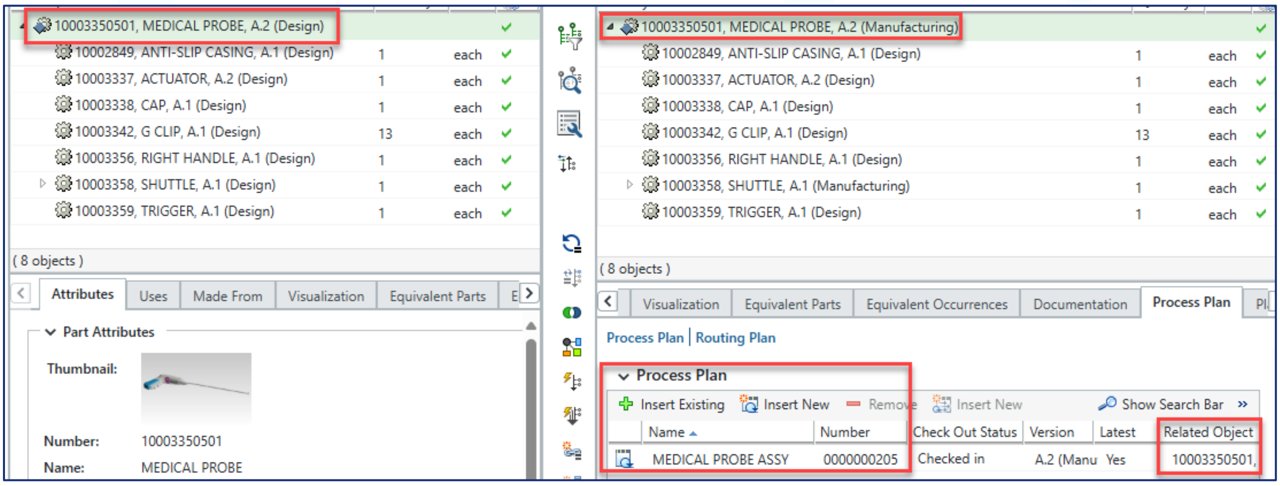


Figure 10 - Associated BOMs Before Save-As

After fully utilizing the available PLM tools, a Saved As mBOM and its related Process Plan are created with all relationships intact. As with the Design objects, the starting point for the newly created Manufacturing objects presents significant time and accuracy savings. See below for the eBOM, mBOM, and Process Plan.

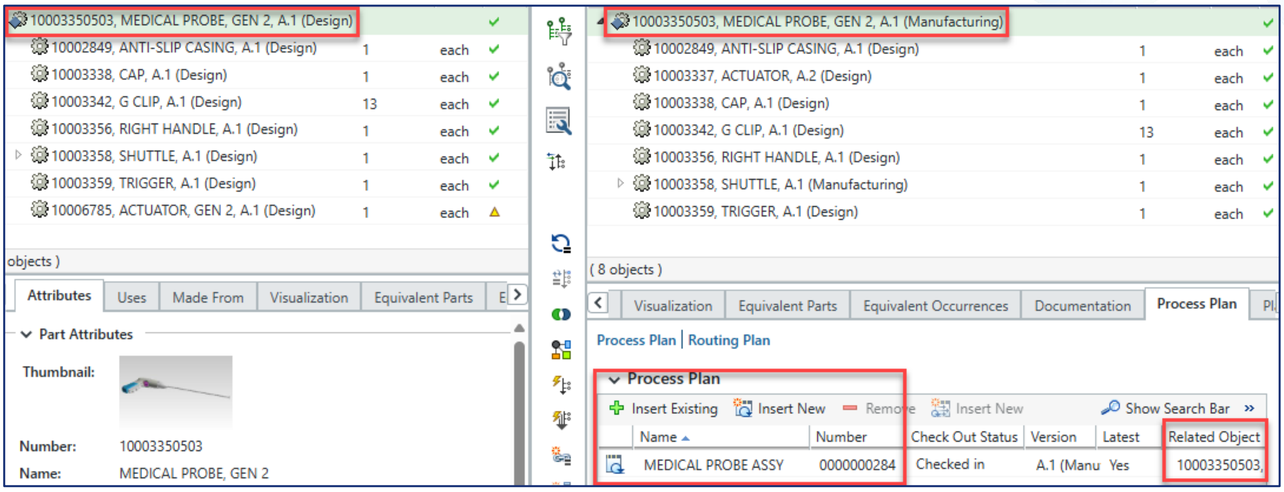
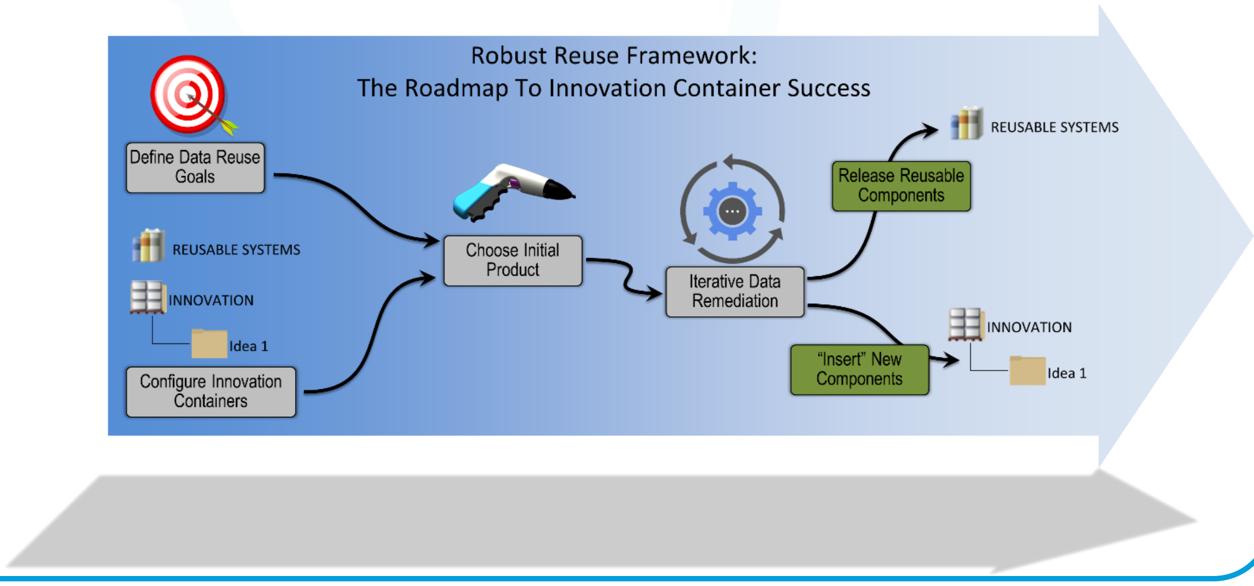


Figure 11 - Associated BOMs After Save-As

Conclusion and Next Steps

In today's competitive landscape, speed, efficiency, and product quality are no longer trade-offs — they are requirements. As this paper has shown, strategically reducing part proliferation and increasing digital reuse through standardized libraries, containers, and PLM-integrated processes enables faster innovation, lowers product development costs, and strengthens your digital thread. These aren't just process improvements : they're enterprise-level advantages.

The roadmap to success with these initiatives can be quite simple, as shown below.



Keys to success often come down to organizational alignment that part reuse is a strategic advantage and acknowledging that investing time in data remediation will yield long-term benefits on an enterprise performance level – the rest are very simple techniques

Thus, we may conclude, that by adopting the Innovation Container strategy and implementing a robust reuse framework, organizations can:

- Cut engineering cycle times by reusing proven components
- Slash costs by avoiding redundant validation, tooling, and compliance steps
- Improve cross-functional collaboration by creating a single source of digital truth
- Enhance change impact analysis and downstream process efficiency

At **DxP Services,** we specialize in turning these concepts into measurable outcomes. Whether you're early in your PLM journey or ready to scale reuse across product lines, we'll help you design and implement a strategy that drives real business impact — faster launches, lower costs, and higher confidence in every design decision.

Let's talk about how we can turn your data into your competitive edge. Contact us today to accelerate your product development with smarter reuse.

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Mark is a Principal Architect at ITC Infotech with 35 years of experience in digital transformations. He is a Subject Matter Expert in New Product Development and Quality Management Systems for Medical Devices. A SAFe 6.0 Certified Practitioner, Mark holds a bachelor's degree from Milwaukee School of Engineering and a master's degree from Gonzaga University. He has authored numerous articles for CADALYST Magazine, served as a Technical Editor for the AutoCAD 3D for Dummies Workbook, and developed highly rated courses on Project and Change management in New Product Development.

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DxP Services is an ITC Infotech specialized business unit focused on the implementation and adoption of PTC's industry-leading Windchill®, Product Lifecycle Management (PLM) software, as well as Cloud and Windchill+® SaaS offerings. Created through the acquisition of PTC's PLM implementation services division, DxP Services is the largest global PTC PLM ecosystem. The combination of PTC Heritage and ITC Infotech Power means that DxP Services is uniquely positioned to help accelerate customers' digital transformation initiatives.

Our portfolio of services augments value at every step of Modern Industrial Evolution; covering Consulting, Implementation, Deployment, and Migration. DxP Services' team of PLM Professionals are trusted advisors to our Customers during their Digital Transformation.

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