

Improving the Supply Chain by Sharing Intelligent Technical Data Packages

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ABSTRACT

For many suppliers in the aerospace value chain, business commences when the customer shares the Technical Data Package (TDP) that defines the detailed requirements for a specific part. To convert the customer TDP into the necessary internal documentation, suppliers must expend large amounts of effort. This generally involves passing along copies of the TDP to each functional discipline, which not only results in redundant and laborious work, but it introduces technical risk.

There are now software tools available that enable an intelligent TDP that provides more value than just sharing a 3D CAD model. These tools electronically organize and integrate all elements of the TDP independent of the PLM software in use. The application of the intelligent TDP has enabled a 30% reduction in supply chain inefficiencies.

THE TECHNICAL DATA PACKAGE

The great majority of parts procured for aerospace systems are designed by one organization and manufactured by another. This relationship is typically referred to as “build-to-print” where the Technical Data Package (TDP) is defined by a prime contractor or original equipment manufacturer, and the TDP is subsequently shared between the buyer and the supplier (see Figure 1).

The Department of Defense (DoD) recognizes the importance of the TDP and has actually published MIL-DTL-31000, which defines the use of the TDP in weapon systems acquisition [1].

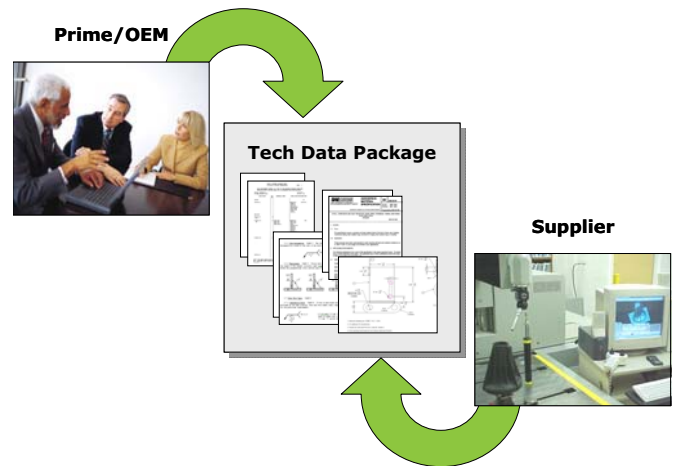


Figure 1 – The TDP in the OEM/Supplier Relationship

THE TDP AND THE SUPPLY CHAIN

COMPONENTS OF THE TDP - The TDP is the collection of product images and narrative documents that enable a production source to take an abstract design and convert it into a tangible product that meets performance, cost, and schedule requirements.

As shown in Figure 2, the TDP is typically called out by a part number on the purchase order (PO). The PO will directly or indirectly identify the pertinent CAD model and/or drawing. The model or drawing will then reference numerous specifications that define expected material properties and manufacturing processes. In addition, the PO, model, or drawing will often reference supplemental documents that define additional detailed requirements for the specific part.

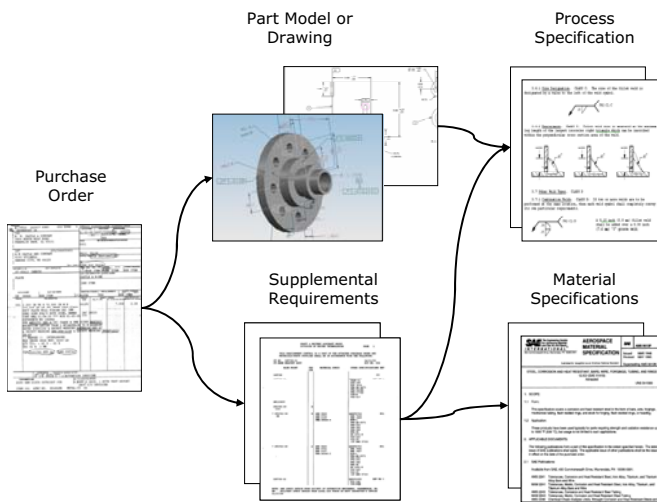


Figure 2 – Typical Components of the Tech Data Package

SHARING THE TDP - Historically, the buyers have shared the TDP in some combination of paper and electronic formats. There are still surprisingly large quantities of aerospace organizations that continue to provide hard copy TDPs. Oftentimes, the procurement organizations will only provide a portion of the TDP and the supplier will have to request a copy of the missing information. For example, many of the referenced items such as specifications are provided by standards organizations, such as SAE and ASTM. It then becomes the responsibility of the supplier to acquire the needed documents.

The introduction of the “model-based enterprise” and the sharing of the 3D CAD model have added to the complexity for many suppliers. While new standards such as ASME 14.41 have emerged to address the details of the 3D approach, the use of a model has an impact on business processes [2]. Whereas, their customers previously provided a final drawing to define expectations, some aerospace prime contractors are now sharing the 3D CAD model along with a reduced dimension drawing (RDD). This requires the supplier to further analyze the model and identify the requirements.

The expanded dependence on the supply chain has driven the importance of the TDP. This has in turn driven the need for tools to assist in the organization, interpretation, and documentation of information within the TDP.

ACTIVITIES DEPENDENT UPON THE TDP - For many small and medium enterprises, business starts when the customer shares the TDP during the RFQ or PO stage of the relationship. As shown in figure 3, the manufacturing supplier must convert the customer TDP into the necessary internal documentation. For example, the manufacturing and quality engineers create process and inspection plans from the TDP that must address the requirements for initial production and downstream process control.

One very time consuming, error-prone activity that is dependent upon the TDP is the first article inspection (FAI). The FAI involves the detailed verification of 100% of the part characteristics on the initial production part. An Air Force-sponsored analysis of the labor efforts within the aerospace supply chain revealed that it is not unusual for suppliers to perform 100 or more first article inspections annually and devote manpower equivalent to one and two full time engineers to the manual creation of FAI reports [3].

Another area highly dependent upon a well defined TDP is the creation of the manufacturing process plans. Process planning is typically defined as the effort involved in generating the comprehensive set of manufacturing instructions necessary for realizing the designed product. The result of process planning is creation of the “manufacturing planning” documentation. Process planning has long been recognized as a weak link in the product realization process and is a major source of inefficiency, duplicative steps, and errors. In fact, it is not unusual for engineers at the suppliers to spend days preparing the manufacturing planning for each order or part.

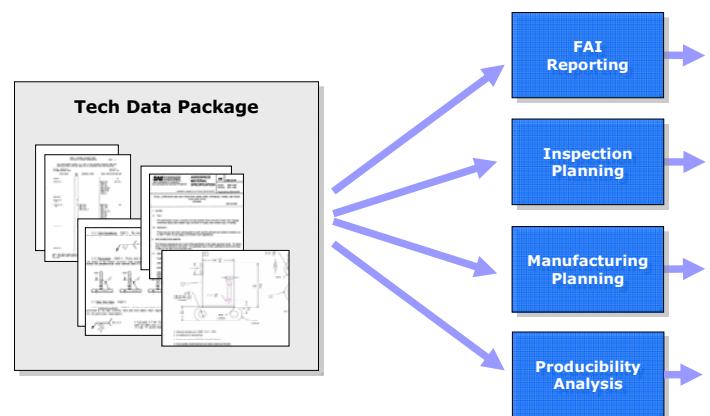


Figure 3 - The TDP Drives Many Downstream Processes

Within the supply chain, a study of small and medium enterprises in the aerospace and automotive industries indicated that over 70% of the companies use a formalized ERP system. However, manufacturing engineers use a variety of ad hoc tools to create the manufacturing planning [4]. A typical scenario for process planning begins when an engineer uses a complex and expensive CAD tool to analyze the part and extract pertinent details. The engineer then types notes and calculations in Excel and Word, and later uses standard desktop software tools such as PowerPoint or Paint to create manufacturing documentation. Finally, the engineer enters the necessary salient data (operations, work centers, durations, etc.) into the ERP system. This process, like the creation of FAIs, is resource intensive with a high likelihood of errors and omissions. Ensuring that every characteristic from the TDP is subsequently “consumed” and validated during production is an important objective of process planning—but it has remained an elusive goal.