How to Get Started – MBE Assessment Tool

The MBE Capabilities Assessment Tool looks at a firm's individual MBE capabilities in terms of both technical ability and business practices. The bulk of the questions focused on the engineering capabilities of the companies, including how those engineering capabilities are integrated with production and other departments, and how they are utilized in interactions with customers and suppliers.

The full assessment can be found in the MBE Capabilities Assessment – for companies that did not participate in the 2009 MBE Capabilities Assessment, the questions found in this assessment can be used to self-assess your own capabilities and get a better understanding of the factors used to assess a company's MBE capabilities level.

ManTech MTO MBE Capability Level	MEP Project MBE Capability Level	Correlation and Notes
0: Model-centric drawings for design and manufacture, 2D drawing	1: 2D, drawing-based, mainly manual ops	▪ Operational basis is 2D drawings
1: Model-based manufacturing, 2D drawing and neutral CAD model	2: Can accept 3D, but 2D drawing oriented, some computer-driven ops	▪ Operational basis is 2D drawings, but have CAD capabilities, which implies 3D capabilities at some level
2: Native CAD based manufacturing, 2D drawing and native CAD model		
3: Model-based definition, 3D annotated model and light weight viewable	3: 3D-oriented, still use drawings, mainly computer-driven ops, some electronic data integration across company ops	▪ Operational basis is 3D models ▪ Still likely to see use of 2D data in operations ▪ Software systems assist in management and re-use of 3D model data across company operations
4: Model-based definition with data management, 3D annotated model and light weight viewable via PLM		
5: Model-based definition with automated technical data package, digital product definition package and TDP	4: 3D-oriented, no use of drawings, significant electronic data integration across company ops	▪ Operational basis is 3D models ▪ No 2D conversions ▪ Extensive electronic integration of data across company operations, most of which are automated
6: MBD with automated TDP and on-demand enterprise access, digital product definition package and TDP via the web	5: All ops based on 3D model, full electronic data integration across company ops based upon PDM/PLM hub	▪ Operational basis is 3D models ▪ Fully integrated company operations for asset visibility up and down the supply chain

Based upon the knowledge gained from a series of initial onsite assessments, which preceded the broader online MBE assessment, NIST MEP developed an MBE Capabilities Metric designed to serve as an accessible rating tool, applicable to any manufacturer. This MBE metric provides a quick snapshot of a manufacturer's capabilities to operate in an MBE environment from both a technical/engineering perspective and from a company operations perspective.

It is important to note that this metric deals with MBE Capabilities and not MBE Readiness. The MBE project team makes a clear distinction between capabilities and readiness – MBE readiness can only be assessed by examining MBE capabilities in conjunction with a company's broader business issues and plans. A higher level of MBE capabilities does not necessarily indicate that a company is ready to advance those capabilities to fully utilize MBE technologies. Conversely, a lower level of MBE capabilities does not indicate the absence of a desire and readiness to advance. Only the combination of both capabilities and readiness can determine the extent to which a manufacturer is willing, able, and ready to implement MBE more fully throughout their operations.

To Understand What a Ranking Level Means Read The Following Capabilities Ratings:

MBE Capabilities Rating: Level 1

MBE Level 1: 142/445 companies, 32% of total
MBE Level 1 Complete: 76 companies, 17% of total participants
MBE Level 1 Incomplete: 66 companies, 15% of total participants

Companies that participated in the 2009 MBE Capabilities Assessment and rated an MBE Level 1 were given this rating for one of two reasons, either:1. The company showed no signs of being able to utilize 3D technical data at any level of their production processes. These companies were considered MBE Level 1 Complete and made up 17% of participating companies. Or…
2. The assessment responses provided by the company were incomplete to the extent that an MBE rating could not be determined. These companies were considered Level 1 Incomplete and made up 15% of participating companies.

MBE Level 1 Incomplete Companies

MBE Level 1 Incomplete companies largely fell into 2 categories: a) companies that simply failed to provide the information necessary to be given an MBE rating either because they did not understand the questions, did not have the information available, or did not feel comfortable providing that information; or b)companies that determined the questions were not relevant for their business, for example defense suppliers that operate as distributors and therefore do not have production processes.

If you were rated an MBE Level 1 Incomplete because your business does not operate production lines in which MBE could be utilized (i.e. you are a distributor to defense customers), we would like to thank you for your participation in the MBE Capabilities Assessment and would suggest that you make an effort to stay informed of MBE developments, even though they may not directly impact your company's operations, because they are impacting your industry.

If you were rated an MBE Level 1 Incomplete because could not or chose not to provide the necessary information we would encourage you to self-assess your company using the Assessment Guide and MBE Capabilities Metric to find where your company truly falls in the MBE spectrum.

MBE Level 1 Complete Companies

MBE Level 1 Complete companies show no signs of 3D model utilization. Their production processes include little to no computer-driven or automated operations and are largely or fully based on 2D drawings. Level 1 Complete companies send and receive technical data in a .pdf or other 2D format. While some computer software is used to assist in business management functions (i.e. inventory management or payroll) there is very little, if any, electronic cross-department integration or re-use of data.

While we encourage companies to use available information and resources to determine which MBE Capabilities Level makes sense for their business, please keep in mind that because MBE Level 1 companies are unable to send and receive 3D technical data they will not be able to participate in an MBE environment, even at the most basic level. However, it should also be noted that the MBE technical data packages being developed are being designed in the .pdf format. This means that MBE Level 1 companies may still be able to access product information using these MBE technical data packages, but their capabilities will prevent them from being able to utilize the 3D models and realize the benefits of MBE.

If your company was rated an MBE Level 1 Complete and is interested in developing its MBE capabilities, we suggest starting with the following steps:

- **Increase your MBE literacy** – Use this website and other available resources to learn what MBE is, what the benefits of MBE are, and why the defense industry is investing time and money in becoming more MBE capable across the board. As you become more MBE literate you will be able to determine what level of MBE capabilities is appropriate for your company and if it makes sense to invest in your MBE development. Events, resources, and other opportunities to increase your MBE literacy will be posted on this website as they become available.

- **Increase your use of CAD/CAM/CAE (Computer-Aided Design/Manufacturing/Engineering) software** – An MBE Level 1 company will typically need to advance the sophistication of their engineering and/or production systems in order to advance their MBE capabilities. This often means the need for new computer-aided software systems. There are a multitude of CAD/CAM/CAE software products that can greatly increase your company's productivity and will allow you to more fully utilize technical data packages, including those with 3D models. However, companies should be thorough when researching and selecting which software product would be most beneficial to their operations.

- **Explore automation planning and training** – As you explore CAD/CAM/CAE software tools, develop an automation plan for your company that includes a training plan for your employees. New software tools can be a big investment, but if implemented well they can produce even bigger rewards – make sure that automation begins where the biggest benefits stand to be gained and that employees are involved and on board with these production changes.

MBE Capabilities Rating: Level 2

MBE Level 2: 143/445 companies, 32% of total

What Level 2 Means

MBE Level 2 companies use some 3D technical data, but use mostly 2D drawings in production – making them 2D oriented companies. In some cases this means that the company uses 3D models conceptually to foster understanding and familiarity or to assist in a design stage. In other cases, this means that the company is directly using 3D models in select applications, but not broadly across their operations. These companies tend to utilize both computer-aided and manual production systems in their operations.

MBE Level 2 companies are able to send and receive 3D technical data, but most often covert 3D models to 2D drawings at the operational level for various engineering, production, and other company functions. In these companies small amounts of cross-department integration and re-use of data begins to appear. MBE Level 2 is the lowest level at which a company can be considered ready to participate in an MBE environment.

If your company was rated an MBE Level 2 and is interested in developing its MBE capabilities, we suggest starting with the following steps:

- **Increase your MBE literacy** – Use this website and other available resources to learn what MBE is, what the benefits of MBE are, and why the defense industry is investing time and money in becoming more MBE capable across the board. As you become more MBE literate you will be able to determine what level of MBE capabilities is appropriate for your company and if it makes sense to invest in your MBE development. Events, resources, and other opportunities to increase your MBE literacy will be posted on this website as they become available.
- **Increase your use of CAD/CAM/CAE software systems and the overall automation of your production processes** – An MBE Level 2 company will typically need to advance the sophistication of their engineering systems and expand their use of these systems across the company in order to advance their MBE capabilities. This may mean updating your software systems or expanding your use of computer-aided production tools across your operation. MBE Level 2 companies are often able to consume 3D data at some level, but more often than not they convert these models to 2D when it comes to production. The next step in MBE development is to use these 3D models to directly drive manufacturing production systems, resulting in potentially significant time and cost savings, as well as reductions in errors and rework.
- **Explore Business Integration software (MRP, manufacturing resource planning/ERP, enterprise resource planning) training** – Business integration software, or MRP/ERP tools, allows companies to more fully integrate their business across different departments. In order to truly realize the benefits of MBE, the lines of communication – both across a company and throughout a supply chain – must be open so that the same models are re-used at every stage of production planning, execution, and delivery.
- **Don't forget automation planning and training** – As you explore new and updated production and business integration software tools, or perhaps just expanding your utilization of the software you already use, be sure to develop an implementation plan for your company that includes a training plan for your employees. New software tools, whether new to the company or new to a certain production line, can demand big investments of both time and money, but if implemented well they will position your company to operate more smoothly and effectively than ever before – be sure that employees are involved and on board with all production changes.

MBE Capabilities Rating: Level 3

MBE Level 3 Companies: 156/445, 35% of total

MBE Level 3 companies are 3D oriented companies. They use 3D technical data to drive the majority of their production processes. Most, if not all, of their processes are computer driven/automated. In an MBE Level 3 company planning and programming for manufacturing processes utilizes a combination of 3D models, 2D models, and 2D drawings. In many cases, MBE Level 3 companies will have only a select few applications still using 2D drawings for some technical or business reason.

In an MBE Level 3 company cross-department integration and data re-use is prevalent throughout the firm's operations. An MRP/ERP, or MRP/ERP-like, system exists to align and coordinate departments across the company and maximize the business's efficiency and effectiveness. A company at an MBE Level 3 is typically well aware of MBE and has already set down a path in which they utilize MBE technical data to their competitive advantage in both their technical and business systems.

If your company was rated an MBE Level 3 and is interested in developing its MBE capabilities, we suggest with the following steps:

- **Stay updated on MBE activity** – Use this website and other available resources keep up with the latest activities in the world of MBE – this could mean technological advancements or events and other opportunities that your company may be able to access. As a Level 3 company you have already shown a certain level of knowledge and progressiveness, but as you follow the MBE developments within the defense industry you will be better able to determine if it makes sense for your company to invest in continuing your MBE development. Events, resources, and other opportunities relating to MBE will be posted on this website as they become available.

- **Increase your use of CAD/CAM/CAE software systems and the overall automation of your production processes** – An MBE Level 3 company will typically already be utilizing relatively advanced engineering systems across the company's operations. In order to move from an MBE Level 3 to an MBE Level 4, these systems need to become more fully integrated and updated across the production floor. This may mean updating your software systems or expanding your use of computer-aided production tools across your operation. MBE Level 3 companies are often able to fully utilize 3D data in at least some of their production applications, but this utilization of 3D needs to be indoctrinated across all operations to realize the full benefits of operating in an MBE environment – 3D technical data, when available in a fully annotated format, should directly drive all production processes within the company.

- **Explore Business Integration software (MRP, manufacturing resource planning/ERP, enterprise resource planning) training** – In order to truly realize the benefits of MBE, the lines of communication – both across a company and throughout a supply chain – must be open so that the same models are re-used at every stage of production planning, execution, and delivery. MBE Level 3 companies already use some form of MRP/ERP software, however, further advancement in company integration will only further allow the company to fully use, and re-use, MBE technical data. The exploration of new, improved, or expanded MRP, ERP, PDM, or PLM systems can be the most viable means for a company to improve their operations integration. Investments in these software updates and/or expansions can be significant, so it is important that you choose the system that most appropriately suits your company.

- **Don't forget automation planning and training** – As you explore new and updated production and business integration software tools, or perhaps just expanding your utilization of the software you already use, be sure to develop an implementation plan for your company that includes a training plan for your employees. New software tools, whether new to the company or new to a certain production line, can demand big investments of both time and money, but if implemented well they will position your company to operate more smoothly and effectively than ever before – be sure that employees are involved and on board with all production changes.

MBE Capabilities Rating: Level 4

MBE Level 4 Companies: 4/445 companies, 1% of total

MBE Level 4 companies are among the most advanced in their industry. Less than 1 percent of suppliers that participated in the 2009 MBE Capabilities Assessment were rated an MBE Level 4. Companies that were rated an MBE Level 4 showed no signs of using 2D drawings in their processes. In an MBE Level 4 company, all manufacturing operations are planned and programmed based upon 3D technical data. If a company's responses displayed any use of 2D drawings, the highest they could be rated was an MBE Level 3.

In an MBE Level 4 company there is significant cross department integration and information is extensively re-used across departments via an MRP, ERP, or like software system. In MBE Level 4 companies we also begin to see some use of Product Data Management (PDM) or Product Lifecycle Management (PLM) systems.

If your company was rated an MBE Level 4, your company is already operating at an advanced technical and business level and is among the most advanced, large or small, in its industry relative to MBE capabilities. We would suggest that your company consider the following steps when it comes to MBE capabilities development:

- **Stay updated on MBE activity** – Use this website and other available resources keep up with the latest activities in the world of MBE – this could mean technological advancements or events and other opportunities that your company may be able to access. As a Level 4 company you have already shown an advanced level of MBE capabilities, but as you follow the MBE developments within the defense industry you will be better able to market your abilities and find new opportunities for your company. Events, resources, and other opportunities relating to MBE will be posted on this website as they become available.
- **Explore more advanced business Integration software, such as PDM and PLM systems**– In order to truly realize the benefits of MBE, the lines of communication – both across a company and throughout a supply chain – must be open so that the same models are re-used at every stage of production planning, execution, and delivery. PDM/PLM systems represent the next level of sophistication from MRP/ERP systems. Explore the benefits and possibilities these business integration system updates could provide your business and whether investments in these areas make sense.

MBE Capabilities Rating: Level 5

MBE Level 5 Companies: 0/445 participating companies

MBE Capability Level 5 is the ultimate in MBE embodiment – all manufacturing processes are planned and programmed using 3D models and 2D has become an inadequate and inefficient thing of the past. An MBE Level 5 company's operations are fully integrated and driven by a single 3D model. Product Data Management (PDM) or Product Lifecycle Management (PLM) software systems serve as a single integration hub for company operations. All departments are fully integrated from inventory to marketing, design to quality testing. In our 2009 MBE Capabilities Assessment we did not encounter any MBE Level 5 companies, nor did we expect to.

MBE Level 5 exists as an ideal – however, if your company has self-assessed and believes itself to be operating at an MBE Level 5, we would like to hear from you. At an MBE Level 5 your company's operations and production processes would be of great interest to our MBE team and could offer valuable insights to stakeholders working in the world of MBE.

This MBE Capabilities metric does not directly match the more detailed and thorough metric produced by a multi-organization team for the Army ManTech Program. It is not intended to replace, but rather to compliment, the Army ManTech metric. The MBE Capability Levels described here are defined in terms of the NIST MEP/BAE Systems MBE Capabilities metric – however, for clarity and reference, an appropriate correlation to the ManTech metric is provided in the following table:

MBE Capability Level 1	MBE Capability Level 2	MBE Capability Level 3	MBE Capability Level 4	MBE Capability Level 5
Very little computer-driven/automated /CNC ops

Most or all ops based upon 2D drawings

Receive, send electronic manufacturing files in .pdf or other 2D format

Use software to assist certain business/ management functions, but little or no electronic cross-dept integration/ re-use of data | Both CNC, manual ops

Can accept 3D models from customers, but convert to 2D drawings to drive manufacturing processes

Small amounts of electronic cross-dept integration/ re-use of info exists | Majority of mfg processes are computer-driven/ automated / CNC operations

Planning, programming for manufacturing processes is performed using combination of 3D models, 2D models, 2D drawings

Cross-dept integration exists via use of MRP system (or "MRP-like" software) | All manufacturing processes are planned/ programmed based upon 3D model info

Significant cross-dept integration, re-use of info exists via extensive use of MRP, ERP systems

Some use of PDM/PLM systems occurs | All manufacturing processes are planned/ programmed based upon 3D model info

All company ops are integrated, driven by the same 3D model info

PDM/PLM systems serve as the data integration hub for company ops |