

To Spool is Cool! Design to Fabrication for Ducts and Piping

Presenter: William Spier – Autodesk, Inc.
Co-presenter: Kevin Durham – Autodesk, Inc.

CR5415 If you want to know what the industry has to offer to help you convert BIM mechanical, electrical, and plumbing (MEP) models to manufacturer-specific content, or you may even want to start designing that way, then this is the class for you. Learn what is out there and what are some of the best tools available to help you automatically convert designs into spool-ready and CNC (sheet metal for ductwork) ready files, and in some cases, even coordinate that back into the original model. Even more importantly, you will learn about the value this adds to the overall design and construction process and industry, such as how to go modular. Instead of worrying about losing your shirt in the process, learn how to use these tools to add value and mitigate risk for you and your clients, and place your name at the forefront of the industry.

Learning Objectives

At the end of this class, you will be able to:

- Identify the different levels of fabrication (field fab., pre-fab, and modular fabrication & installation), and understand how can you leverage each one.
- Recount numerous different values to be gained (ultimately by owners) when fabricators, contractors & even designers use fabrication software.
- Identify what software options you have available to you and know how to determine which one's best for you –as a contractor, a fabricator, or a designer, and both for Revit based designs and AutoCAD based designs.
- Be current on the latest developments in the design to fab software industry.
- This class and paper are **not** intended to provide in depth coverage of the design to fabrication solutions, but to give you an overview, and a wealth of resources to secure more information on the products that interest you, that you feel might suite your needs best. And when you find one you like, try the software out. All Autodesk products have a free 30 day trial period, and many other vendors also provide similar free trial periods.
- At the end, you should know what you need, have seen something that piqued your interest, and be able to find your way to the solution that will be the best one for you. Be sure to use/see the class PowerPoint as well since they both complement each other.

About the Speaker

William is an MEP Technical Specialist with Autodesk. He got his start as a plumbing designer with a consulting engineering firm in Seattle, where he worked on a high-end, national department store chain account. During his seventeen years in the industry, he has gained experience power and lighting design, HVAC, as well as architectural & energy design. William has worked in several disciplines within the AEC industry, including O&M design work on a major pharmaceutical account for Johnson Controls, Inc., as well as plumbing and piping design coordination for a major mechanical contractor in Kansas City where he also currently resides with his wife Wendy and their five children. william.spier@Autodesk.com

Class Goals

The first goal of this class is to introduce prefabrication to those who have not employed prefabrication yet, and to adduce more options to those who have. Moreover it's to get us all thinking outside the box to the realm of what prefabrication makes possible – whether we're already doing prefab or haven't yet started. The second goal is to familiarize everyone with what prefab software solutions exist, what their strengths are and where you can go to find out more about them and actually try them out.

Why is prefabrication back?

Prefabrication and modularization are not new, but in the past five years have seen a resurgence primarily because they are the natural progression and beneficial results of BIM. They are easily produced/generated from a BIM environment. In other words...

BIM was the catalyst for prefabrication.

And the key value from prefabrication and modularization is **productivity gain**. Productivity was and is the top driver of prefabrication/modularization use across all firms [interviewed for [2011 SMR](#) (SmartMarket Report)].

Three Types of Fabrication

The three types of fabrication are field fabrication, prefabrication and modular prefabrication.

Field fabrication

Field fabrication has been around forever and simply assumes no (or neglects any) better possibilities exist to construct whatever needs assembling or building, other than in the field. It is the most expensive, least productive, and most susceptible to risk and being impacted by weather.

Prefabrication

Prefabrication assumes that some degree of assembly and construction of building components need not necessarily be performed in the field, but can be done in a controlled shop environment that may or may not be collocated with the project site. It takes into account that the work environment (temperature and lighting), the availability of materials, tools and machinery will all remain a constant. And it assumes that in such a conducive environment, less man hours will be needed. And it assumes that the finished products – sub-assemblies and/or assemblies, can be transported.

Modular Prefabrication

Modular prefabrication looks for the greatest degree of assembly and construction of building components to be performed in a controlled shop environment. This means not only sub-assemblies are considered, but larger assemblies are considered, up to whatever size can be transported. I.e. the controlling factor in modular prefabrication is transportation limits. Therefore, typically the largest assembly is a room module, since it can be shrink wrapped and transported by flatbeds on typical roadways.

Business Values of Field Fabrication, Prefabrication & Modular Prefabrication

Field Fabrication – Least Value

Time & Resources -

Whatever fabrication that doesn't get done in advance will wind up being fabricated in the field. And it will be done only as quickly as field condition will allow, which is never faster than can be accomplished in a controlled, shop/fabrication environment. Think about it, you're never waiting in a shop for the crane to hoist up that one missing box of materials that you need to get the job done. And field fabrication is not only more time consuming, but uses more resources including both transportation resources (e.g. crane lifts of materials), and human resources or labor, to assemble something on a jobsite that could be done by half the labor in a controlled environment. It is also more wasteful because there was no electronic pre-planning for nesting lengths of materials for reuse (like nesting a three foot stick of no-hub piping from a four foot leftover stick, that you *planned* to reuse).

Risk & Weather

What happens to your Gantt chart when you get a day of snow? You have to double up the man-hours that were wasted shoveling snow. Now you lose a day of productivity that you have to make up with added labor hours. Hot days, cold days, wet days, windy days, etc. all have a negative impact on productivity. Additionally, rainy & icy working conditions not only slow the rate of fabrication, but they increase the risk of injury. And making fourteen trips up & down a ladder to assemble six pieces of pipe involves more risk than one trip up a ladder to install one spool of all six pieces.

Prefabrication – Increased Value

Time & Resources

Time & resource wastes, and the impact that weather and risk have are mitigated to the same degree that construction entities are prefabricated. A prefabrication shop provides materials, supplies and tools in their place so you don't have to walk all over the place looking for them, provides jigs to hold things, CNC equipment to cut materials accurately, adequate lighting so

you don't have to string lighting, etc., etc. All this reduces assembly time, and the number of people that would be needed to fabricate the same assembly in the field. And if your skilled tradesmen can get all that field work done in the shop (faster as already mentioned), and you just ship the spool or assembly out to installers in the field, you're now not paying for travel & per diems for your tradesmen to go to the work because you brought the work to them. So prefabrication even equates to direct dollar savings.

Risk & Weather

And of course while all this streamlined workflow is now in progress indoors, outside at the jobsite it can be dark or light, raining, snowing, or 110°F in the shade, while inside at your home office shop the conditions are constant – constantly comfortable that is. So there are no more hours or days wasted planning for or fighting weather conditions – time that should be spent on productivity. So check weather contingencies off the list! So now we know it's possible to eliminate weather risk.

What about other risk mitigation? Well for starters, everything you fabricate on a shop floor is on the ground floor, i.e. it's not two or more stories up in the air – places people can and sometimes still do fall from. And during fabrication, almost all of the tradesman's time is spent with feet on the floor – not on a ladder and climbing up and down one. More work is performed on a horizontal plane, over a bench or jig, with feet on the floor. This is a safer, healthier work environment that even insurers recognize on their premiums.

Modular Prefabrication – Most Value Potential

Time & Resources

The act of prefabrication or modular prefabrication is almost identical. The most outstanding difference between them is the *extent* of the fabrication – how much more material is used. Otherwise the difference in benefit between just prefabrication and modular prefabrication is just a matter of degree of value. And as mentioned above, the limiting factor on how much/what degree can be prefabricated is the capacity of the transporter.

The only other limiting factor on modular prefabrication is “Does this project lend itself to modular prefabrication?” Room to room symmetry makes modular prefabrication more tenable. So if you're building a city hall/courthouse, then modular prefabrication is probably not a good choice since a courthouse has more disparate room & space types than most any other commercial construction type, having judge's chambers, courtrooms, jail cells, offices, cafeteria, etc. And more & more often these are organic building shapes – a factor that further removes them candidacy for modular prefab. A school has one classroom after the next that are symmetrically consistent and by design lend themselves to modular prefab. But they may still not be good candidates because of...size. You cannot transport a classroom on a truck, but perhaps you could if you modularized the rooms into split elements.

So what *are* good candidates? Hospitals, hotels and dormitories are all great candidates since patient rooms, hotel rooms and dorm rooms are all made up of identical categories, and almost all are small enough to be transported.

The more material that can be prefabricated and transported, the more it furthers the potential savings of doing the work in the field. Ultimately, if you could transport whole floors with systems, then it stands to reason you could prefabricate entire floors in a giant shop, ship each one to the site and then lift them into place and make final connections. But since room modules and exterior wall elements are about as big as trucks can deliver, typically they are the extent of modularized prefabrication.

What is the value add over just prefabrication? Well, I'm glad you asked – that means you're paying attention! Simply put, you pay more dollars for the same level of completion in the field than you do for the same level of completion in the shop. So the more stuff you make in the shop (that you can transport), the more you save. And making modules is making more stuff than just making subassemblies.

And although room modules are made up of a lot of architectural elements like walls, doors, cabinetry and lots of architectural elements, they also are comprised of lots of mechanical, electrical and plumbing elements, almost all of which can be prefabricated. All restroom elements, kitchen elements, lighting and power elements, supply, return and exhaust terminal air elements can all be installed, shrink-wrapped, shipped, hoisted, unwrapped, rolled into place, leaving only final connections to made in the field.

To see what others are doing, look at the cruise ship industry. All their rooms are prefabbed modules shipped (dry)dockside and hoisted & rolled into place. Miami Valley hospital in Ohio was a great example in the AEC world of the use of modular prefabrication. See PowerPoint for class.

Design to Fab Software Solution Value

For Mechanical & Plumbing Designers -

Designing duct & piping in real world content allows designers to design to fabrication level detail – that is, to using manufacturer specific parts & assemblies with real world tolerances & clearances, accurate engagement lengths & weld gaps, etc. all while in the CD phase, or sooner if necessary. Designers can also generate BOMs if & when they need to, and using real world fittings results in more accurate designs. It affords more exact clash detection (e.g. duct flanges that you don't normally propagate with more generic geometry typical of CD designs), and overall reduces the rework typically required by the subcontractor & fabricators. Note that the preceding is true, and is a value add for designers ***if and only if*** designers learn how actual fittings and components actually assemble (and how they do not) in the real world. Otherwise all you wind up providing is real world content put together incorrectly, and the contractors go back to the tradition of redesigning everything correctly.

For contractors and fabricators -

Using design to fabrication software provides all the real world content needed to produce spoolable and ticketable entities from the more schematic designs typically received from the design side. Once converted to real world content designs, automatic takeoffs can be performed, precluding manual takeoffs (easier extraction from design files), as well as those files being easier to leverage for other tasks like estimating, field layout, spools, plasma cutting, etc.

Design to Fab Software for Fire Protection

Getting in the BIM/IPD ballgame -

Before fire protection designers will realize value from leveraging design to fabrication first string collaborators, like architects, MEP consultants and structural designers have been. Until recently, fire protection consultants would typically get 2D AutoCAD exports from Revit, somewhere in the CD phase of a project, at which time they would do the hydraulic calculations and layouts, and then provide back a 2D fire protection plan that could be linked back into the BIM project file, but it never lent itself to full, 3D coordination that other 1st degree collaborators were able to provide.

The main reason for all this was Revit MEP did not perform hydraulic calculations, and now, it still does not. But what has changed is 3rd party developers like [Hydratec](#) with their [HydraCAD](#) product, and [SprinkCAD](#) with their products [SprinkCAD](#) & [BIMport](#). These products enable fire protection designers to import a 2D Revit background (plan view) into their application, locate their pendants with flow, and then their software will not only develop the correctly size piping and branches, but it will also then port that over to Revit MEP where it will develop actual, Revit native piping, hanger and pendant geometry.

Recalling that the key driver behind fabrication is productivity, if the fire protection designers can trust their level of coordination, then now they too can take advantage of prefabrication and use one of the design to fabrication software offerings to fabricate their sprinkler piping, pendants and hangers.

Three major MEP design to fabrication software providers

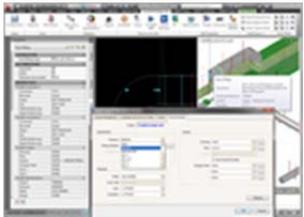
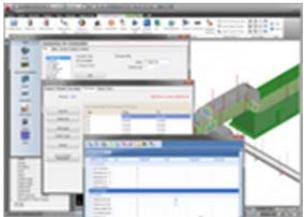
QuickPen – a division of Trimble

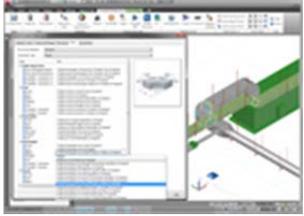
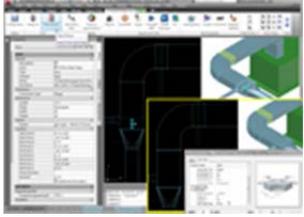
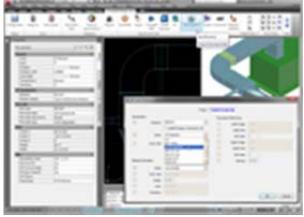
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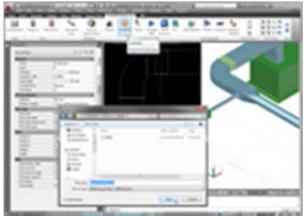
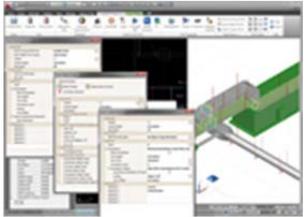
Currently, QuickPen’s offerings include design to fabrication solutions only for AutoCAD based (dwg file format) design files.

Trimble Design Link is an AutoCAD® object-based application for MEP contractors. It utilizes a shared database with [Vulcan](#) cutting software to link shop standards with the AutoCAD® duct software. The database comes preloaded with industry standards and is flexible enough for your customization.

Trimble Design Link also offers linking to several applications that are typically used throughout the phases of a BIM project. In addition to [Vulcan](#), the product offers links to [AutoBid](#), [SheetMetal](#), [Trimble MEP](#) and [Tekla](#). The product is a great example of merging technology, experience and partnerships in a forward looking BIM world.

| Features | Benefit | |
|--|---|---|
| Shared database with Vulcan | With the shared database approach, your CAD department and shop are quickly integrated. Construction standards and specifications do not have to be rebuilt for use with AutoCAD MEP. |  |
| Vulcan Fabrication data and Specifications | Access your shop's fabrication data from CAD for fitting and duct fabrication defaults and size break points as well as materials, insulation, seams, connectors, reinforcing, and vanes. |  |

| | | |
|----------------------------------|--|---|
| <p>AutoCAD MEP functionality</p> | <p>Advanced routing, collision detection, 3D insulation, flow calculations, connectivity, annotations, and schedules.</p> |  |
| <p>AutoCAD MEP catalogs</p> | <p>Native AutoCAD MEP catalogs to integrate Trimble functionality better with your current knowledge of AutoCAD MEP. These catalogs can also be used by engineers to improve the flow of BIM modeling.</p> |  |
| <p>Straight fitting breakup</p> | <p>This tool can be used on single runs or the entire drawing to quickly apply standard straight duct lengths to runs of ductwork.</p> |  |
| <p>Eliminate short joints</p> | <p>After breakup, this tool helps the user to optimize the run and eliminate wasteful short pieces by merging the straight into other fittings.</p> |  |
| <p>Fitting modifications</p> | <p>Edit or override fitting specifications, scopes and connectors after they have been drawn into the model.</p> |  |

| | | |
|--|--|---|
| <p>Links to Vulcan</p> | <p>Internally transfer the drawing or a selection of the drawing to a project within the Vulcan database. The shop can process the fittings immediately without importing from external files.</p> |  |
| <p>Links to AutoBid®</p> | <p>Export the drawing for post bid cost reporting.</p> |  |
| <p>Links to Trimble® MEP</p> | <p>Quickly place and export Field Points for use by Trimble® MEP. These points can be used with the model within Trimble® MEP to lay out the system on the job site.</p> |  |
| <p>Links to Tekla® Structures and BIMsight</p> | <p>Fabrication data is added to the IFC export providing IFC file handler with additional data that may be important to coordination.</p> |  |

EastCoast CAD

General Overview -

EastCoast CAD offers an AutoCAD based solution for piping and ductwork, and a Revit solution for ductwork alone.

Fabrication for AutoCAD MEP Sheet Metal

EastCoast CAD/CAM's Fabrication for AutoCAD MEP Sheet Metal contains all the design and fabrication requirements for professionals who create, manufacture and install sheet metal systems. With AutoCAD MEP Sheet Metal, you have complete control over the detail,

manufacturer specifications and shop standards needed to create and fabricate duct systems inside of [AutoCAD MEP](#), and have the tools at your fingertips to take your design work into fabrication systems with efficiency and accuracy.

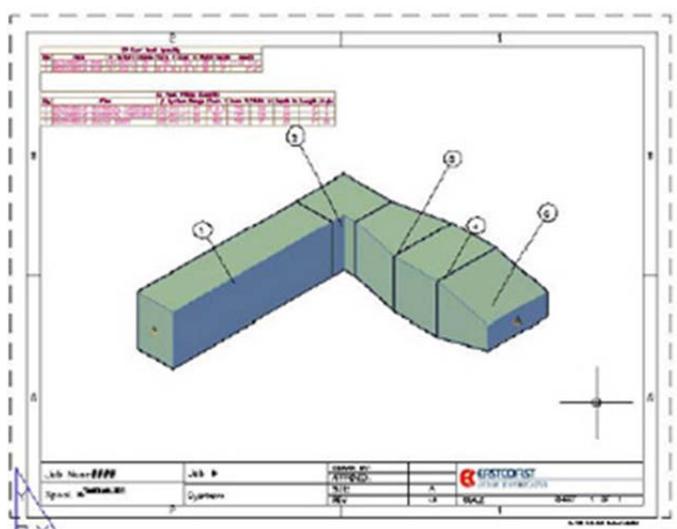
Shops add their own customization to the rectangular, oval, round ducts, and taps and vanes provided, adding their own specifications for materials and non-dimensional settings, and manufacturer defaults for dimensional sizing of fittings, tailored to specific project needs and shop standards. Rules and formulas add flexibility to the definition of manufacturer defaults, adding greater control to fitting dimensions. Once the setup of your shop standards is complete, the system is fully automated, drastically reducing input time.

With Fabrication for AutoCAD MEP Sheet Metal you can design a mechanical system using true dimensional parts and fittings. Build duct systems by routing, placing fittings piece by piece, or by using combinations of the two workflows.

Draw and design duct systems with real spec-driven content.

Fabrication for AutoCAD MEP Sheet Metal's powerful editing tools save time and resources. If a change in the design is needed, you can quickly change your specifications for the whole drawing in just one operation. Duct specification overrides can be changed for an individual specification setting, such as a connector type or gauge, within an easy to use dialog box. Lock and unlock duct segments to control the elements of the routable duct and duct sections you need to modify. The Duct Break command maximizes your standard length duct segments, and helps to avoid placing taps on joints. Break your duct into standard sheet sizes with ease.

Generate duct spool drawings with isometric views and schedules of the entire system, or a sub-system you specify using a window selection. Spool drawings can be updated on the fly after a change is made to the design.



Fabrication for AutoCAD MEP Sheet Metal automates the process of detailing - saving time and resources.

Fabrication for AutoCAD MEP Sheet Metal supports project data collaboration. Transfer your design data to the Trimble Total Station tool, and generate Quickpen Vulcan CAM pickoffs. You can be assured of one-to-one mapping of each duct fitting with pickoffs generated for use with [DuctMaker](#) for pre-fabrication, as both systems use the same fittings library.

For more information see: [\(ECC/CAM\) Design to Fabrication Software Workflow](#)

MAP (Micro Application Packages, Ltd.)

Offering -

MAP offers a variety of solutions that convert both Revit and AutoCAD MEP based mechanical and piping designs into manufacturer specific content that can then be fabricated. You can also design directly with CADduct or CADmech and as a designer, produce a real world content, realistic, coordinated mechanical and piping designs. MAP's is the only design to fab offering that converts Revit MEP piping and duct entities to real world content, and it also can reverse engineer those entities back into a Revit MEP file format.

After acquisition by Autodesk, MAP's product lineup was simplified as follows:

MAP Core Software Simplification

- [CADmep+](#) – provides the tools MEP contractors need to create fabrication level detail models. CADduct and CADmech features are now included as standard in CADmep+. A variety of additional features are also now available in CADmep+ at no additional cost. CADmep+ CAD Software is supported by MAP Software's comprehensive 'Real World' fitting libraries, CADmep+ will enable users to generate accurate, attribute rich BIM models in a fraction of the standard time. CADmep+ content can be accessed from MAP Software's dedicated content website, [Building 3D Content](#). MAP Software work continuously to add new content ranges from leading Manufacturers and Suppliers in the Global Building Services Industry. New content can be downloaded directly into CADmep+, reducing downtime in the distribution of new ranges within your CAD\Design teams. CADmep+ fully integrates will both Estimating (ESTmep+,ESTduct, ESTmech) and Manufacturing (CAMduct) Solutions from MAP Software. A common database results in seamless integration between all departments involved in the project lifecycle.

For more information, [Download CADmep+ Brochure](#)

[FABmep+](#) – provides MEP contractors using BIM, the features they need to create fabrication level detail models.

FABduct and FABmech features are now included as standard. A variety of additional features are also now included at no additional cost. FABmep+ - Autodesk Revit MEP conversion Software enables a Design Intent model to be transferred into MAP Software's native formats. This conversion process enables Building Service Models generated in Revit

MEP to be constructed with manufacturer specific fittings for co-ordination and installation phases of the project. FABmep+ allows the Reverse Engineering of MAP Software Models, to import into Autodesk Revit MEP. For clients who require the Building Services Project Models in Revit Format, FABmep+ is the ideal Software Solution. Convert Ducting Services drawn in Revit MEP, then transfer straight to CAMduct for Automatic Nesting and Manufacture. FABmep+ will help save hours of costly labor time in re-drawing 3D CAD models. Imported Revit MEP Models can be checked for duplicates, open ends, continuity, connectivity, and integrity. FABmep+ highlights areas of the imported model for errors, saving hours of time in manual verification. Extensive functionality to break up imported Autodesk Revit MEP Piping runs into individual, detailed 'Spool' sheets. Increase workflow with detailed Pre Fabrication information, containing accurate dimensional and item data.

[Typical FAB-MEP Report Book example](#)

For more information, [Download FABmep+ Brochure](#)

- **CAMduct – fitting libraries, flat sheet development, interactive item entry, Green nesting, etc.**

CAMduct provides an unparalleled database of ducting fittings, available in Rectangular, Round and Oval Libraries. 3D parametric ductwork fittings can be previewed before insertion to the job. Applied dimensions are updated so the user has an accurate visual representation of the component. Manufactured items have associated 'Flat Sheet' developments, saving hours of labor over traditional manual calculations and part 'reworks'. CAMduct offers interactive 'Job Entry' making the process of inputting Ducting & HVAC Fittings, Simple. Manufacturing data can be automatically applied through the use of Specifications\Pressure Classes such as DW144 & SMACNA. MAP Software has made significant improvements to the Nesting Routines in all manufacturing applications. Green Nesting provides better Sheet Utilization, less waste and faster processing times. CAMduct provides all the tools required to produce associated Manufacturing Documents, Reports, Labels & Worksheets display an extensive array of Part & Job Information. Improve Workflow and efficiency of Job information through accurate documentation, Reports can be generated at the click of a button as part of a predefined 'Process'. CAMduct is compatible with wide range of CNC machine tools for Decoiling, Cutting, Folding & Seaming. MAP Software work closely with CNC Machine Manufacturers to provide 'Post Processors' to interface with a wide variety of cutting tools. Bespoke 'Post Processors' are available on request. CAMduct fully integrates will both Estimating (ESTduct, ESTmep+) and CAD (CADduct, CADmep+) Solutions from MAP Software. A common database results in seamless integration between all departments involved in the project lifecycle.

For more information, [Download CAMduct Brochure](#)

- **ESTmep+** –provides MEP contractors with the estimating and project lifecycle cost analysis tools they need in one offering.

ESTduct and ESTmech features are now included as standard in ESTmep+. Plus a variety of additional features. ESTmep+ provides multiple methods of item takeoff through Keyboard, Tracing or Digitizer interfaces. A user friendly graphical interface allows for fast entry of Fittings, which is Specification\Pressure Class driven to comply with industry standards. These unparalleled methods of Item entry enable the accurate & efficient generation of MEP Project Estimates. ESTmep+ Estimating Software provides the functionality to generate complete MEP item rate breakdowns covering material costs with wastage, ancillary, fabrication and installation times with any overheads that are applied. ESTmep+ has unparalleled tools for creating quick MEP Estimate Tender drawings, file formats such as DWG, PDF, DXF can be imported as an underlay. The imported underlay can then be traced using MAP Software's unique "Design Line" tools, enabling existing 2D MEP sketches to be transformed into 3D models. The result is faster output of tender drawings for MEP projects. ESTmep+ Includes list prices for major MEP manufacturers and suppliers together with dimensionally correct product ranges and industry standard installation times. These flexible price lists can be easily discounted or adjusted to suit requirements. MAP Software provide the most comprehensive range of 3D parametric components for all MEP project requirements. ESTmep+ provides an extensive set of reporting and summary tools to quickly view information regarding the MEP Project. The Estimate Summary interface allows the quick view of base Nett values and enables the mark-up of jobs using various methods giving you Gross profit. Reports can be generated such as Bill of Quantities or Schedule of Rates or alternatively exported to MS Excel etc. ESTmep+ allows Variation tracking to be applied to the quotation using 'Add and Omits', proving a history of changes that are recorded, costed and then reported out for the MEP project.

For more information, [Download ESTmep+ Brochure](#)

MAP Additional features:

- [CAMlite](#) – Manufacturing Software Solution for Rectangular, Round & Oval Ducting
- [ProfileMaster](#) – Profiling Software Solution for CNC Laser, Plasma & Water Jet Sheet Metal Cutting
- [RemoteEntry](#) – MAP Software's on site takeoff solution
- [Trackit](#) – a modular add-in that enables the user to track items through the complete lifecycle of a project. Achieved with the application of user defined status changes, Trackit allows users to a maintain total accountability over any item. Using only statuses that are relevant to a particular job or project, users can scan and update projects at all stages, including; Drawing Office, Approved, Manufactured, Loaded, Delivered On-Site, Installed, Tested, Valued & Completed.

MAP Simplification Matrix:

| Product Simplification Matrix | | | | |
|---|----------------------------------|----------------|---|--|
| Migration of products <i>(Example: A user with a license of CADduct will now be fulfilled with a license of CADmep+)</i> | | | | |
| CAD Products | Manufacturing Products | | | Estimating Products |
| CADduct CADmech CADelec CADmep+ | FABduct FABmech FABmep+ | CAMduct | P/M Level 1 P/M Level 2 P/M Level 2 ADV P/M Level 3 P/M Level 3 ADV | ESTduct ESTmech ESTelec ESTmep+ |
| CADmep+ | FABmep+ | CAMduct | Profile Master | ESTmep+ |
| Migration of options/modules <i>(Example: Barcode Printing now an inclusive feature with no need to purchase as an add-on option)</i> | | | | |
| Option/Module | Feature Enabled in Core Products | | | |
| | CADmep+ | FABmep+ | CAMduct | ESTmep+ |
| EST Connect / Costing in CAD | √ | | | |
| Job-Site / ONSite (Trimble Output) | √ | √ | | |
| Barcode Printing | √ | √ | √ | √ |
| Ductboard (Patterns + Processing) | √ | √ | √ | √ |
| Scripting | √ | √ | √ | √ |
| Database Output | √ | √ | √ | √ |
| Trace Take Off / Estimating | | √ | | √ |
| Ceiling Grid Layout | | √ | | |
| Constructicad | | √ | | |
| Orbitor Validator | | √ | | |
| Coil Line / Decoiler Output | | | √ | |
| Job Costing | | | √ | |
| Pmcut | | | √ | |
| Additional Post Processor(s) | | | √ | |
| Surveying | | | | √ |
| Additional Product Simplification Information | | | | |
| Remote Entry, TrackIt, and CAMlite continue to be made available as stand alone offerings | | | | |
| Profile Master inclusive of the following features: Manual Nesting, Automatic Nesting, Advanced Multi-Torch Nesting, Chain+Bridge Cutting, Sheet Management (Plate & Remants), Shear Nesting, Raster to Vector Convertor, DSTV File Import | | | | |

Summary:

It is my hope that this paper and class have provided you with:

- a) an understanding of the **value** of design to fabrication for both designers and the contracting industry,
- b) **why it's seen a resurgence** in the last five years, but just as importantly,
- c) also provided you with the **knowledge of what design to fabrication solution options are available** out there.

This class and paper are not intended to provide in depth coverage of the design to fabrication solutions, but to give you an overview, and a wealth of links to get more information on the products that interest you, that you feel might suite your needs best. And when you find one you like, try the software out. All Autodesk products have a free 30 day trial period, and many other vendors also provide similar free trial periods.

Now you should know what you need, have seen something that piqued your interest, and can now find your way to the solution that will be the best one for you.

Thanks for joining us!

William Spier