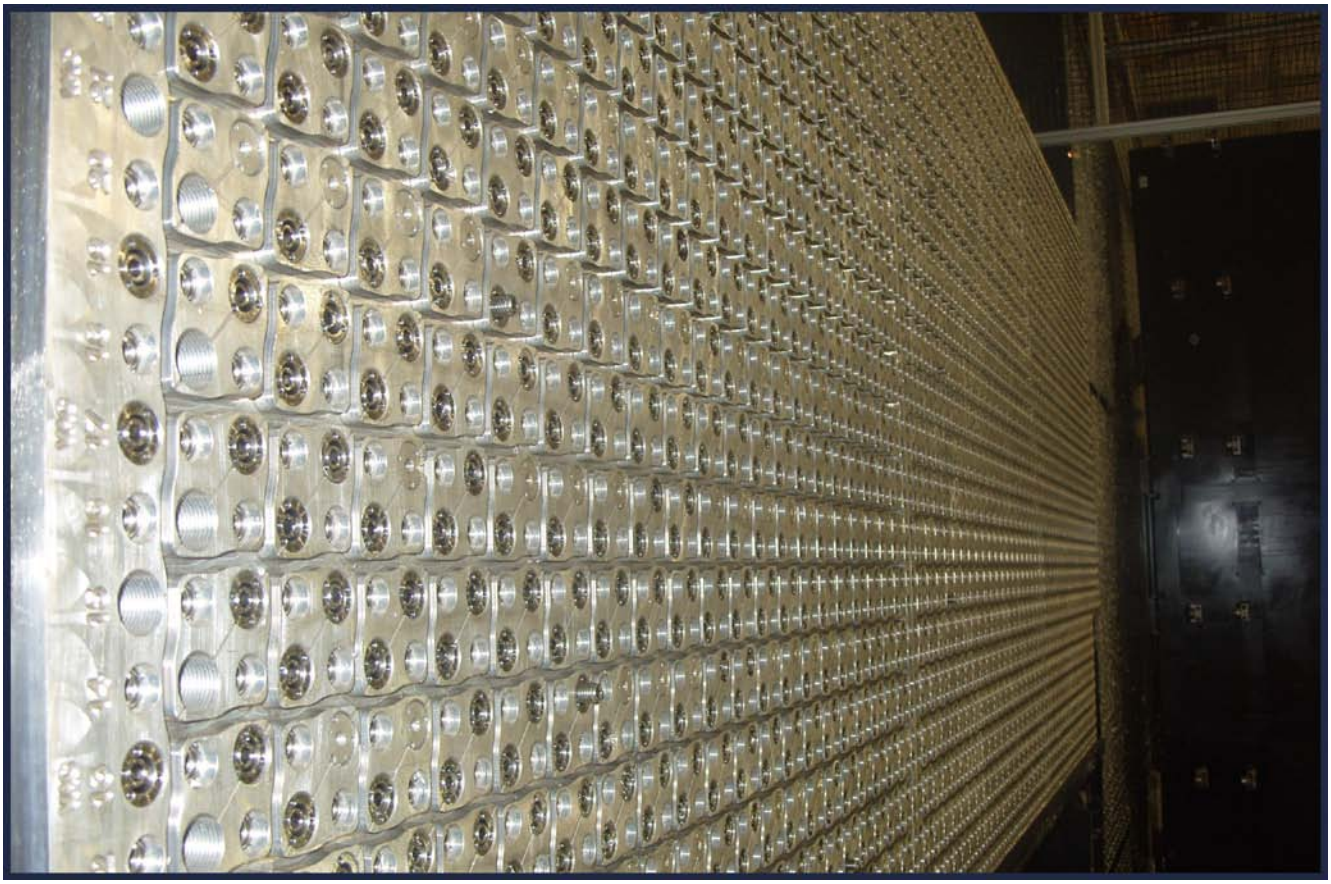
ELIJAH TOOLING INC.

Simple. Easy. Right. Tooling for Today's Manufacturer



Elijah Tooling is a North Texas manufacturing company that specializes in bringing lean tooling solutions to mid-size to large manufacturers, especially in the Aerospace segment.

Our product line is centered around modular tooling fixtures that incorporate 6 basic features - the patented Invert-A-Bolt™ fastener, multi-purpose locator holes, hold down locations, plate to sub-plate locator, lift holes and row/column designators. This simple, yet efficient fixture is used to eliminate dedicated fixturing, while vastly improving setup times and providing great flexibility in producing low quantity, high-mix, aerospace parts.

In addition to our signature modular fixtures, we provide the modular components that are used with and in these fixtures so that our customers are empowered to make their own fixtures if desired. By means of our web-site, www.invert-a-bolt.com, we supply extensive information to our customers and prospects in the creation of these fixtures as well as providing CAD models for most of our offerings.

Our products are primarily found in the tooling of complex aerospace parts machined on **high-speed, horizontal machines**. Thanks to the ***small footprint*** and ***high holding power*** of the

patented Invert-A-Bolt™ fastener, Manufacturers opt for this type tooling to create the most stable holding solution available with a minimal risk of damage to the high-speed spindles in their machines.

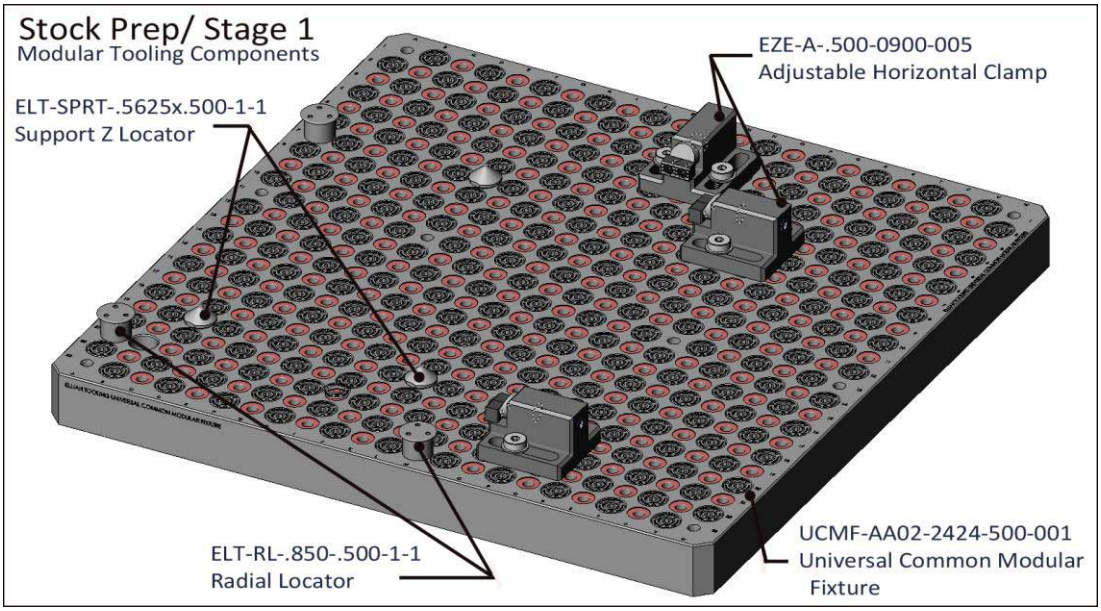
We have supplied workholding systems to some of the largest companies in the world. Bombardier Aerospace (C-Series), Spacex (Falcon-9), Heroux Devtek (JSF), Hawker Beechcraft and GKN Aerospace (UCAV) all enjoy the benefits of our lean manufacturing tooling systems. In addition, we supply tooling for Boeing aircraft via Spirit Aerosystems (787), Primus International, and Contour Aerospace. We also supply tooling for smaller aircraft, such as Cessna and Gulfstream (G650). In all, **we have over 250 Aerospace customers**.

Interestingly, one of the major machine tool builders in the world, and supplier of high-speed machines, Makino, is one our customers. Not only do they use our fasteners to produce their "show" parts, they recommend the fasteners to their customers. Why? The real question is, Why not? If you spent several million dollars on a high-speed machining center, wouldn't you want to produce at the highest levels? By incorporating a simple, low-cost, product that facilitates optimum operating conditions in a high-speed machining cell, our customers (and their machine tool builder) show that they are smart about getting the most out of their investment. In fact, the high-speed machining experts at Blueswarf, the vibration analysis company that specializes in high-speed machining optimization, recommend just two tooling products for high-speed machining, ours being one of them.

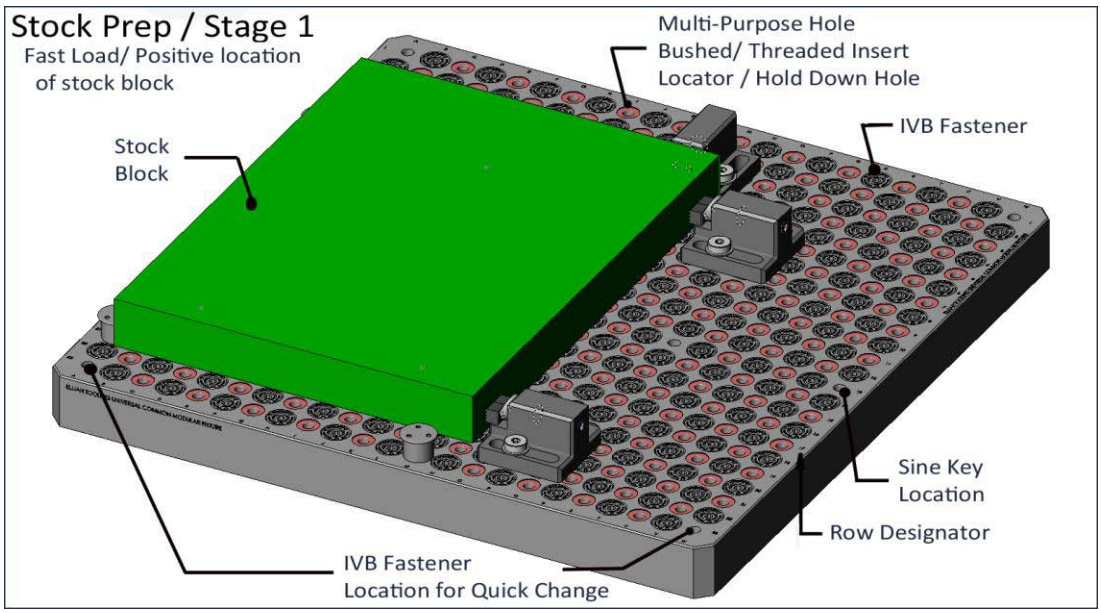
In an effort to fully support our customers, we supply design to build services, made to order products, and quick change tooling solutions. By incorporating Invert-A-Bolt™ Precision Locators or the Zipfixture™ concept of quick-change, our customers are able to take advantage of the benefits of fast change-overs on their machines as well.

Universal Common Modular Fixture (UCMF)

Here shown is an example of an UCMF with the signature elements found that create a standardized method of work-holding. These elements facilitate the positive location and holding of both the tooling plate ***AND*** the machined piece while also making quick changes possible. The benefits of such a modular fixture are many and include:



- ✓ Reduction or elimination of tool design & manufacture of dedicated fixtures
- ✓ Built-in flexibility facilitates hold down using IVB fasteners, locator screws, and/or regular screws; facilitates location with Xzerts™ retractable screw-in locators, dowel pins & similar locators, locator screws, radial locators and supports as shown above. Facilitates location/hold down of off-the-shelf modular tooling components.
- ✓ One-of-a-kind holding with the patented Invert-A-Bolt™ Fasteners – get more from high speed machining by creating the most stable setup and ideal harmonics for optimal speeds/ feeds
  - Ease of programming
  - Reduced setup times
  - Reduced obstruction to machine mitigates against spindle crashes and related cost of repair
- ✓ Elimination of storage/ maintenance of dedicated fixtures
- ✓ Elimination of tool rework for engineering changes to the part definition
- ✓ Establishment of standardized work-holding methods
- ✓ Opportunity to benefit from quick-change pallet on/ pallet off solutions



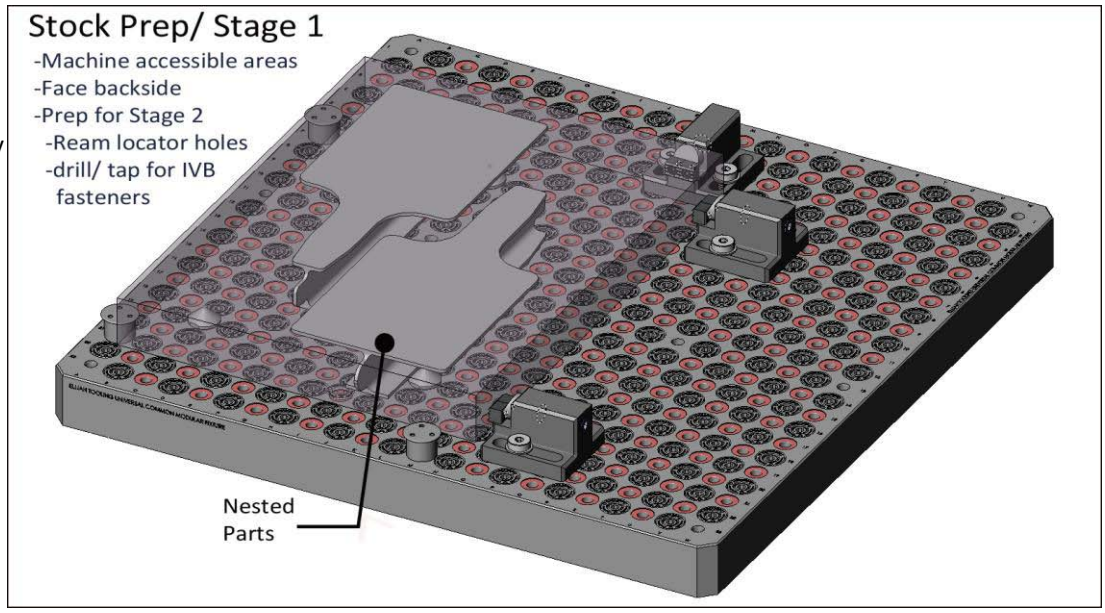
Stage 1
Example to the left shows the extremely fast load of stock material using the ***patent pending*** ELT radial locators & supports for edge location with ½ turn horizontal clamps for pushing against the stops. This setup allows for fast change over's in addition to one-time zeroing of the setup. Stage 1 machining consists of facing the stock material, prepping for

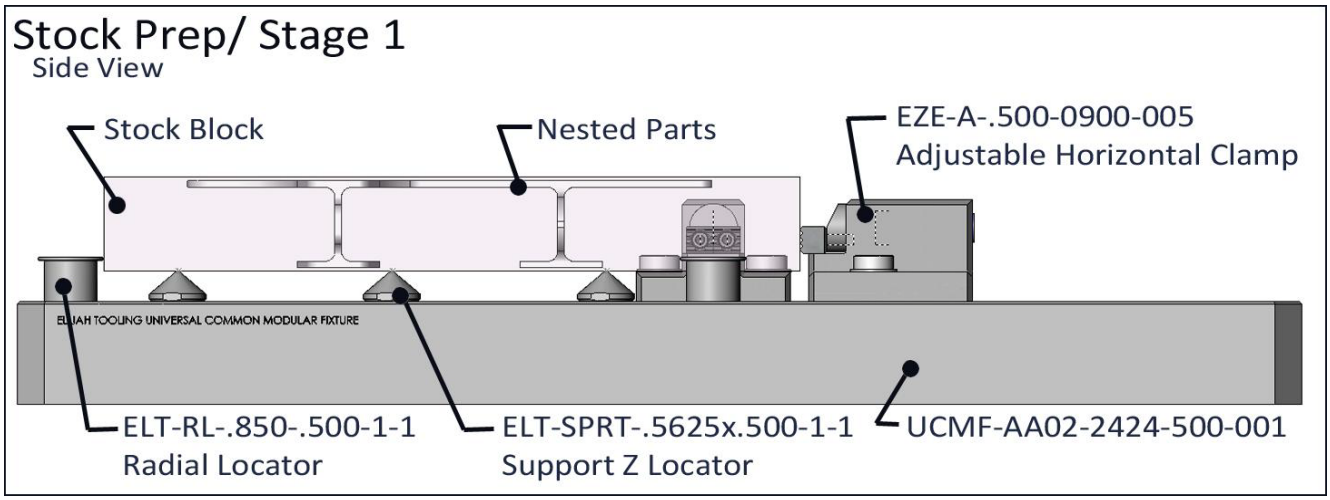
Stage 2 hold/location, and machining whatever areas are accessible.

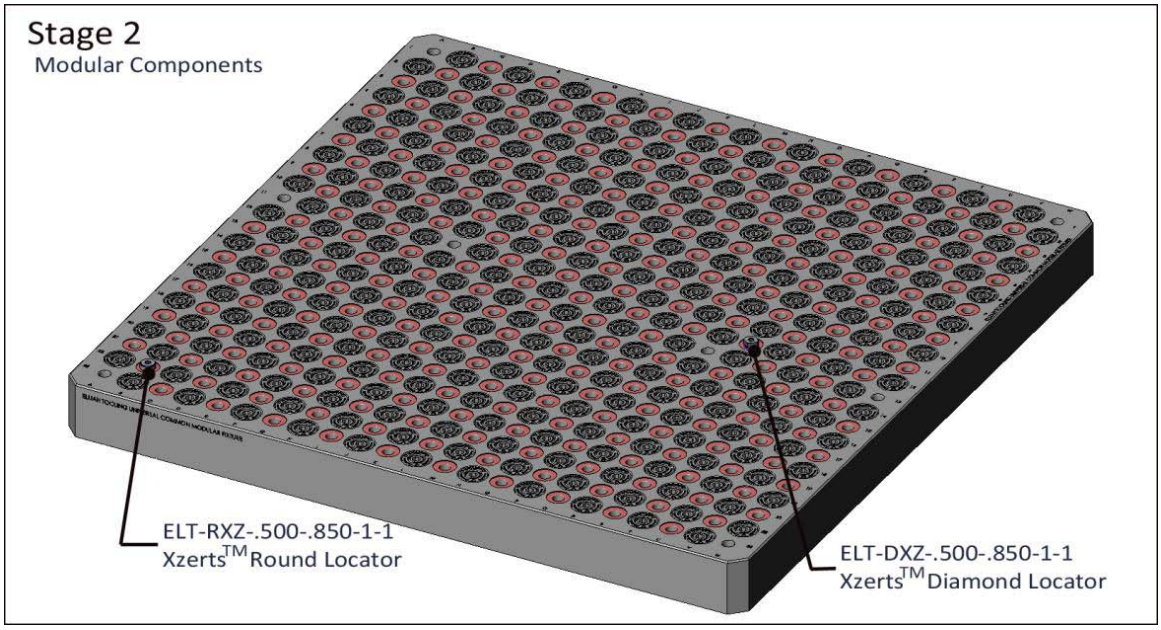
Also shown are the signature elements found in UCMFs:

- Sine Key holes for positive location of the fixture to the sub-plate – may be substituted with IVB Precision Locator receiver holes
- IVB fastener receiver holes for holding the fixture to the sub-plate
- Multi-purpose, locator/ hold-down holes for attaching modular components and for location of the work-piece
- IVB Fasteners for holding the work-piece
- Row/Column designators used to define for the operator/ programmer which holes are to be used
- Lift holes on edge (not shown)

In this example two parts are nested together in one block of material. They will be machined as if they were a single part and will only be separated at the very end of the process.







Stage 2

The UCMF, prior to loading the part from Stage 1 is almost completely without any obstructions of any kind. It is located/ held to the sub-plate from beneath. The UCMF incorporates a standard pattern (usually 2") in which the MPH's & IVB Fasteners are in-line. In this example the stock material is used as a "frame" to locate/ hold the work-piece during the Stage 2 machining process. Prior to load, the Xzerts™ patent-pending retractable locators are screwed up for locating of the stock block that has been previously prepped for this stage of machining. Once the part has been loaded, and the fasteners raised into the work-piece, the part is ready for machining. The machining process is performed, machining multiple parts as if they were one. To finish the operation, the base profile is machined, leaving a very thin foil between the parts. The thickness of the foil should be less than .002". This will allow the removal of the piece, and their separation by running a scriber along the edge to break the parts free.

The method of manufacture shown is only one way an UCMF can be used to reduce setup times, improve efficiencies, and encourage standardization. By incorporating MPH's in conjunction with the unique holding solution of Invert-A-Bolt™ fasteners and precision locators, these fixtures are ideal for many applications and tooling scenarios.