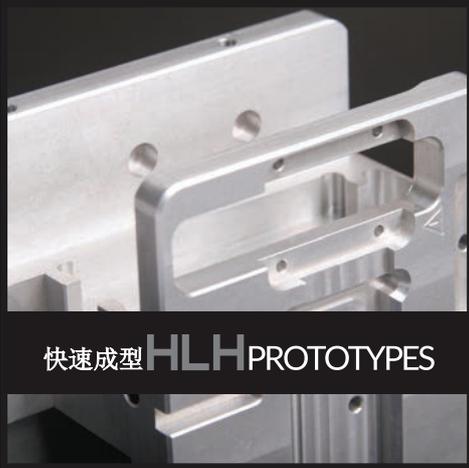


# Guide & Tips To Rapid Prototypes



## **HLH** | PROTOTYPES PROTOTOOL PRODUCTION

### Guide & Tips To Rapid Prototypes

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Services, Factory, Solutions

# Guide & Tips To Rapid Prototypes

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Rapid Tooling  
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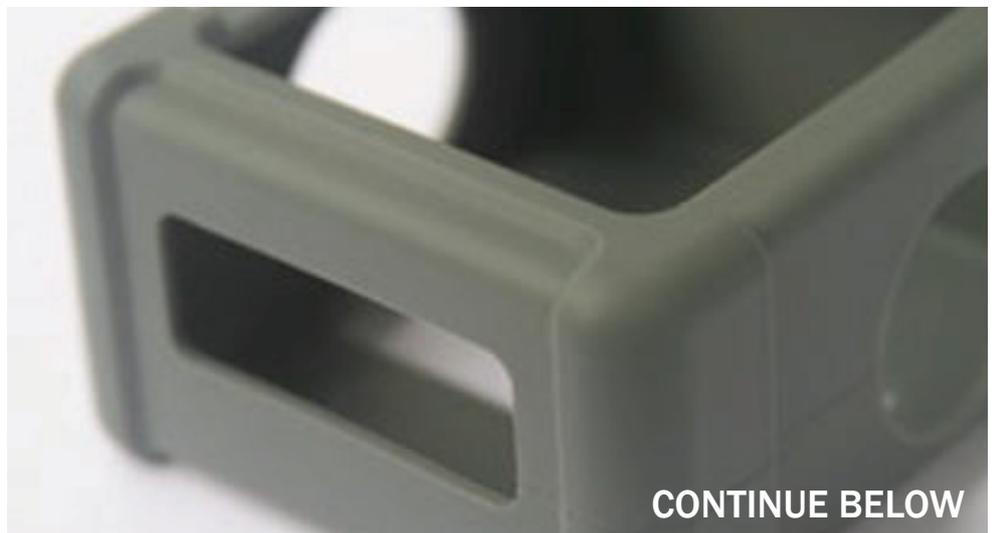
Vacuum casting or urethane casting is ideal for prototyping and low volume production runs of plastic parts. It is a versatile but often overlooked process so here is a quick look at how it works, what it is best for and where it falls down when compared to other processes.



Vacuum casting is labor intensive but still allows for fast turnaround times. **Step one** involves making a master model, often by SLA or CNC. These are then hand finished producing the desired surface, it is at this stage you can apply certain textures or polish for a very glossy look. **Step two** sees the master model suspended in a container and covered with liquid silicone which hardens to form the mold. The original is then cut from the tool to leave a cavity inside. **Step three** is to cast the parts. A wide range of polyurethanes are available. An A and B material are mixed together and then poured into the tool cavity, the whole thing is then cured in a vacuum to get rid of the air bubbles. **The final stage** is to remove and finish the parts which might have a lot of flash due to the soft tool material.



You can rerun the final two steps to cast further reproductions. Depending on the type of silicone used for the tools the tolerance and finish required and the geometry of the parts you can generally get between ten and twenty reproductions from each tool.



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As the tools are silicone, which is soft often complex geometries which could have meant splitting the parts for CNC machining become possible for vacuum casting. There are also soft, rubber like materials available so rubber parts and over-molding is possible. The tools are cheap so the initial investment is lower when compared to injection molding, allowing for low cost market testing and many rapid design iterations.



There are some disadvantages though, principally the material selection, which is limited to polyurethanes. PU materials are available in many different types which have characteristics similar to other plastics such as ABS, PP or acrylic but they are still PUs which as far as I understand are still not recyclable. The process is labour intensive so once you get into the high tens and hundreds of parts it might be better switching to rapid tooling which despite the higher tooling costs could be cheaper.

The parts can be self coloured but this pigmentation is generally done by hand/eye and means often the results are difficult to control. This means if you need an exact colour match you may still need to paint the parts. The silicone tools are soft and often the parts have a lot of flash that needs cleaning up, this can also affect the tolerances you can hold so it is not really a good fit where high precision is required.



Vacuum casting is great for prototypes and low volume production runs of plastic parts for development and engineering or market testing. It is a flexible process delivering good results and as long as you understand the limitations and select it only when it makes sense you should be safe.

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CNC machining is one of the most utilized manufacturing processes for prototypes and low volume production runs. It offers great advantages in terms of speed and range of materials available and is also fairly cost effective when compared to other processes. CNC is highly versatile and especially with 3, 4 and 5 axis machines the type of part and geometries able to be machined are varied. That said it also pays to be aware of certain design elements which could reduce the machining time, complexity and the cost of your job.



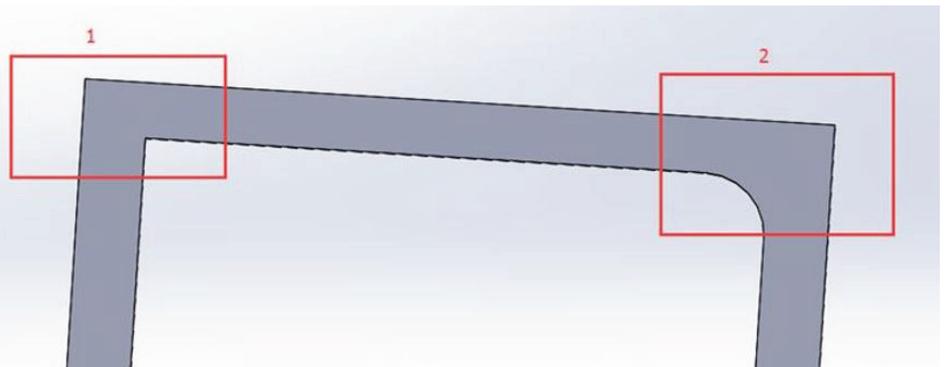
First and most simply the type of material has a big impact upon cost. CNC machines can cut everything from plastics to metals but there are some materials which are easier to work with than others. If we take plastics, first of all there are a number of common and easy to machine grades of plastic, ABS for example is cheap, versatile and very machinable.

On the other hand PP or POM is more difficult to cut and prone to warping, which means the manufacturing process is quite a bit more complicated increasing the costs.

Metal materials also offer different ranges of machinability, aluminium is a fairly soft metal and so easy to cut and quick to machine.

Steel is a much harder material and so much tougher on the machines, this is often reflected in the prices of the parts. The next thing to consider is the part geometry, here there are so many different aspects to consider it would be impossible to list them all but here is a quick summary of a few.

Corner radii, CNC machine cutter tools are circular, so even the smallest diameter cutter is going to leave a radius in the corner. If you need square corners this will require post process finishing either by hand on plastic parts or spark erosion on metals. If you can get away with radii, and the bigger the better, you can bring the costs of machining down a little.



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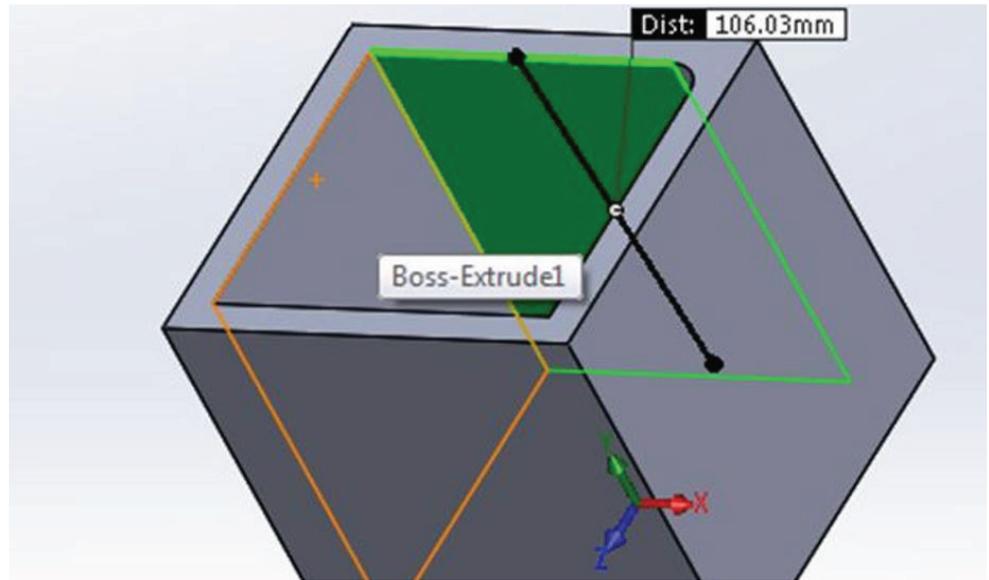
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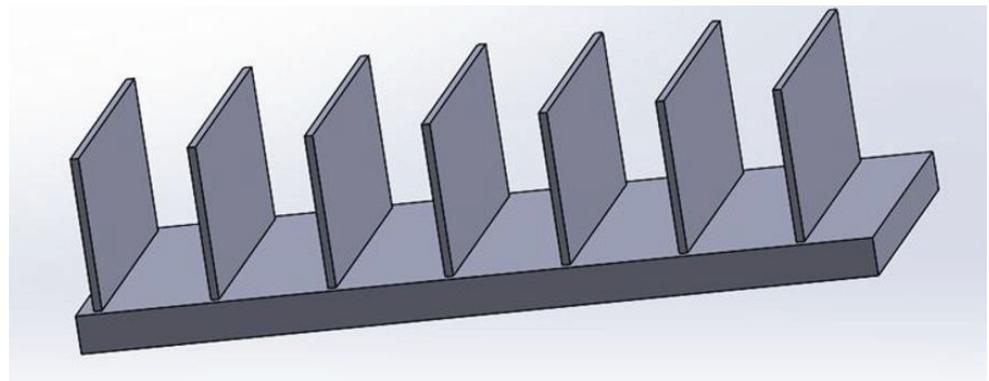
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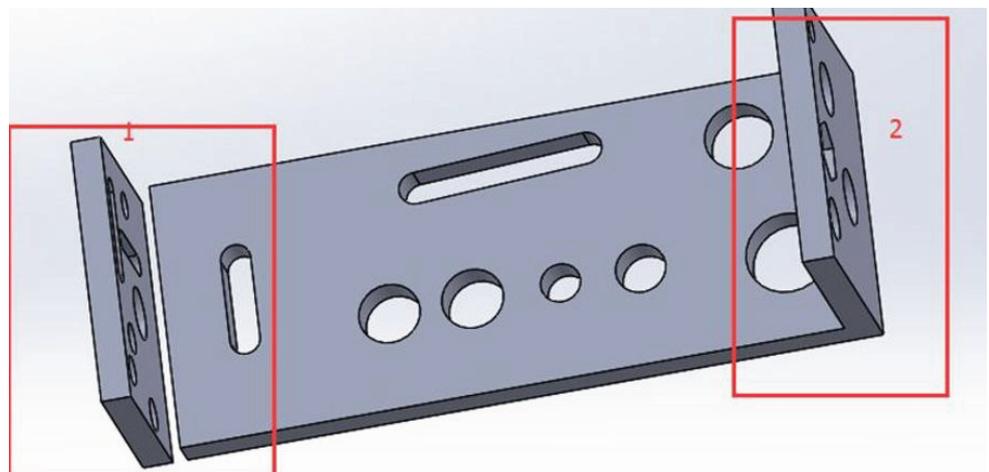
Deep pockets, these are also tricky to machine and often result in tool chatter leaving you with imperfect surface finishes. If you can do away with these kinds of features all the better, if not the best ratio between length to depth is 4:1.



Thin walled features are also tricky to machine and easy to become damaged so machinists generally don't like them.



For some parts it may also make sense to split them into several separate parts if they are to be machined. Where machining in one piece might have advantages in terms of strength and cosmetic benefits often if you can accept the part being split you can save some money. Compare areas 1 and 2 in the image below. In this instance it may make sense to split the part as area 2 makes the part more difficult to machine, increases the initial material costs and would require an additional machine setup.



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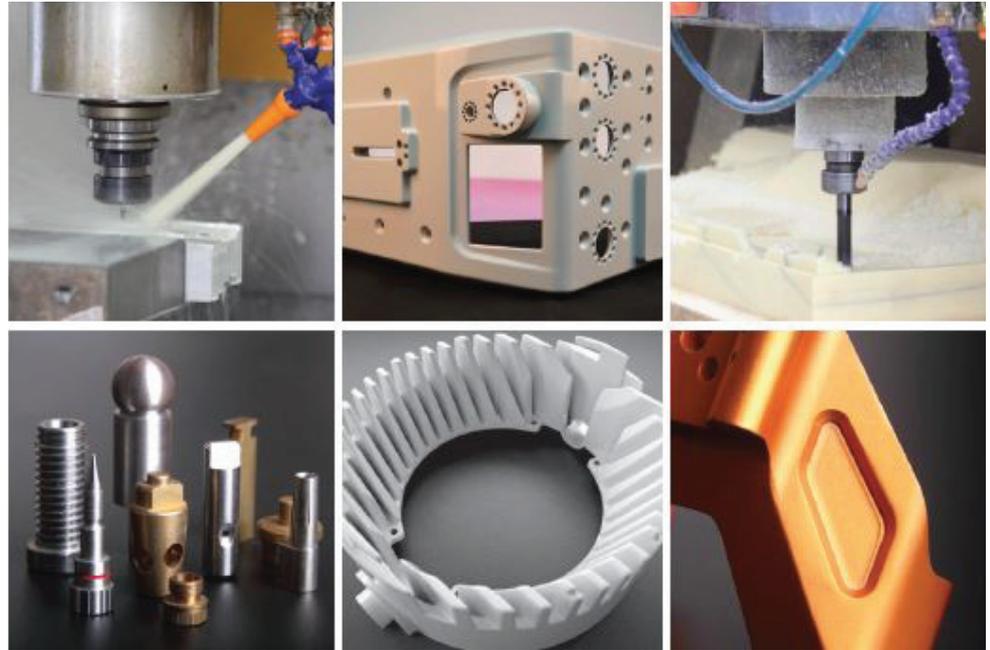
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Other issues which drive up costs are the tolerances required on the parts, obviously the higher the desired tolerances the more care and attention needed when machining the part. Very high tolerances on certain features may also require the manufacture of special jigs and fixtures to hold the work piece or even the use of specialized cutting tools which will all increase machining time and costs.

This is also the case for threads and tapped parts, if you do need threaded holes try as far as possible to stick to standard threads.

One way of driving individual part costs down a little is to order multiples. Once the tool paths for the part have been programmed the CNC machine can run the same parts over again allowing economies of scale. CNC machined parts offer versatility of material, high precision, great surface finish and speed.

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There are many choices when it comes to manufacturing parts and prototypes. Some are fast, some are good and some are cheap but no matter which you choose there are some key steps you should take and questions you should ask to ensure you get the parts you require.

The responsibility for quality is too often left entirely to the supplier and while the lion's share does lie with them quality is not entirely one sided. In order to deliver what you need the shop you are working with needs to know what you want. It is as important for you to provide as much information as possible up front as it is for the prototype shop to perform proper checks after manufacture.

Here are some simple steps to take to make sure everyone knows what is expected and will hopefully reduce surprises when your parts arrive.

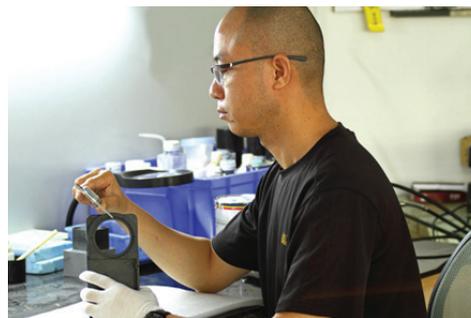


### Pre order steps to take;

1. Send 2D engineering drawings with critical dimensions and tolerances clearly marked.
2. Indicate clearly any holes that need tapping and as far as possible stick to standard threads.
3. Clearly specify surface finish and send a photo example if possible if you are not referring to an industry standard.
4. Send assembly drawings if applicable or as far as possible provide information about assembly especially if there are other mating parts you might not have sent to the shop for manufacture.
5. Offer as much information on fit and function as you can and feel comfortable with, the more your supplier know about the part the better they will be able to deliver.
6. Be as open and up front about what the part is, what is important and what you are looking for as possible.
7. Remember the time, price, quality triangle, and try not to expect all three. As long as you are clear about your priorities the prototype shop should be able to tweak their quote to fit.

### Questions to ask after manufacture and before delivery;

1. Do you have a QC report you can send?
2. How many parts did you check, one or all?
3. Are all threads present and correct?
4. Please send clear pictures of all parts, plus close ups of any suspect areas
5. Can you send a video of the assembly?



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Your quote has come back and the price meets your budget, awesome, but does the quote really reflect your needs, did your supplier really understand your project and will they really deliver on your project requirements? These are all communication based questions you should be asking yourself before committing to your newly found China supplier. Communication is one of the top, if not top factor to consider when you are qualifying a China supplier. If you cannot communicate properly with your China supplier there is a good chance that the parts/products delivered back to you will not match your expectations.



Below is a list of 5 communication tips when dealing with China suppliers.

1. Does your China contact have a university degree in English or business English or International Trade? Companies that work with Western customers should be hiring quality employees with a solid university background in English.
2. Can they speak, write and read English effectively? It is a good idea to test your contact to gauge their true language skills. Doing so will help determine if your contact comprehensively understands your needs.
3. Is your contact well versed in the technological language and specifications you are submitting to them? Do they understand the technological English terms you are using? Also, aside from English skills, do they have the other computer based skills necessary to read and understand the files you are submitting?
4. Does your China contact and China supplier have enough experience communicating with Western customers to truly understand your expectations? Or do they mainly serve the domestic China market? Finding a supplier that works predominantly with Western customers is a great way to increase the odds that your communication, and ultimately your project outcome, will be a success.
5. If you do run into any communication/project problems that your direct China contact cannot solve, does the company offer a secondary option to resolve communication/project problems? For example, does the company employ Westerners who are fluent in both Chinese and English?

We live in a 3D CAD world which definitely helps when dealing with someone whose first language is not your own. But let's face it, drawings are wrong all the time, exact finishing options can be hard to describe, time line expectation may not match....there are 101 reasons why any project can run into problems. The only real solution to ensure project success is to qualify your China contacts communication skills. Communication is the silver bullet to the success of any project.

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If you are in the engineering or product design world then you likely have some experience in qualifying manufacturing suppliers. You get a quote, you visit the factory, review their QA procedures, the part sample quality, check their service capabilities, check references and testimonials...all the normal things one would do when you qualify a supplier anywhere in the world.

But what about China suppliers? You have your quote, you love it and are ready to place the order, but you are a newbie to China so what else should you be doing to ensure your chosen China supplier is a good fit for you?



#### Location, Location, Location

**Air Travel** – Is your supplier located near an international airport? Is there more than one international airport nearby to choose from? Just about all business travelers can give a nightmare example of needing to quickly get home but instead they are stuck in a foreign country because of the location of their supplier.

**Visa Entry** – It may seem like a small point but having a supplier located near an entry point into China where you can get a Visa on arrival can come in very handy at times. Sometimes you have to fly out quick to check on your supplier, depending where you live you may not be able to obtain a China Visa before your flight leaves. This is where Visa on arrival can come in very handy.

**Travel From Airport** – Do you have to get a connecting flight to another regional airport? Do you have to take a train, bus or taxi? Sometimes you might have to do all of the above if your supplier is not located in a China manufacturing hub like Shenzhen. A supplier in an isolated location can add a full day of travel time or more.

**Transportation/Shipping** – What are the roads like near your chosen supplier for transporting your goods? What shipping port is nearby? How does winter affect the roads and ports near your chosen supplier? Does your supplier have suitable access to other suppliers for raw materials needed for mass production? The list can go on and on, each problem presenting you with additional costs.

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**Accommodations/Restaurants** – What hotel and restaurant options are available near your chosen supplier? Depending where you are in China a 3 star might work...but normally you will need 4 or 5 star options. Chinese food is excellent and the variety is superb, but some people can only handle western food options. For a quick trip we can all sacrifice and survive but for extended stays accommodations and food can be a real headache for some.

**Internet Access** – Business is conducted online these days and we take reliable internet access for granted. In many parts of China internet is not a problem, but it can be an issue outside of the major manufacturing hubs. \$50 roaming fee because you had to get two Emails out and no reliable WiFi...been there.



**Supplier Dependency** – If your chosen supplier is in an isolated part of China you are likely completely dependent on them for local transportation and anything in their community. This can be a major problem if conflicts arise. How do you move a tool when you are 500 miles from nowhere and at odds with your supplier? How do you visit and qualify other potential suppliers if you are isolated? How do you solve any problems that arise if your geographically challenged supplier cannot solve them for you?

**R & R** – If you are doing business in China it likely means long days for you. If your supplier is isolated it can be even worse. But, if you are in a city like Shenzhen there are a lot of day trips to be had in Shenzhen, Guangzhou or Hong Kong where you can take in some sites and recharge your batteries. It can't be all work, all the time. Try to enjoy what China has to offer outside of the factory, airport and hotel business travel life.

These are just a few of the location factors that can add hidden costs to your per unit manufacturing price, increase your manufacturing time lines and dramatically increase your travel costs. Price is a big factor in driving decision making, just make sure you factor in the true cost of your suppliers location before you commit.

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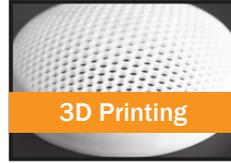
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Conveniently located in Shenzhen, China (next to Hong Kong), HLH provide bespoke project solutions that can be tailored to meet your specific project requirements. Highly flexible, value for money manufacturing services for all of your rapid prototype, rapid tooling (ProtoTool) and rapid production parts.



Paired with years of experience, expert engineers, massive capacity, stellar quality, technological diversity and highly competitive pricing HLH is your one stop partner for all your part/product fabrication needs.

At HLH our Western managed approach to quality control, customer service and speedy delivery helps our international clientele to consistently deliver projects on time and on budget. You can trust in HLH to deliver for you.

**At HLH, we make things for you.**

Whether you find us at the prototype, tooling or production phase of your project our varied and complementary in house services help to deliver the quality parts you need...FAST! Our MOQ is 1 but we also service a variety of low, medium and high volume part production services.



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"HLH, we make things for you"

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"real tools, real parts, real fast"

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"HLH, delivering tomorrow today"

NEW is the best word to describe 2016 for HLH. A NEW 12,000 sqm, 6 storey, high tech facility. Investment in NEW equipment for faster part and tooling fabrication capabilities. NEW expanded capacity in rapid prototyping, rapid tooling (ProtoTool) and rapid production. Trust in our Western managed operation to deliver for you.

