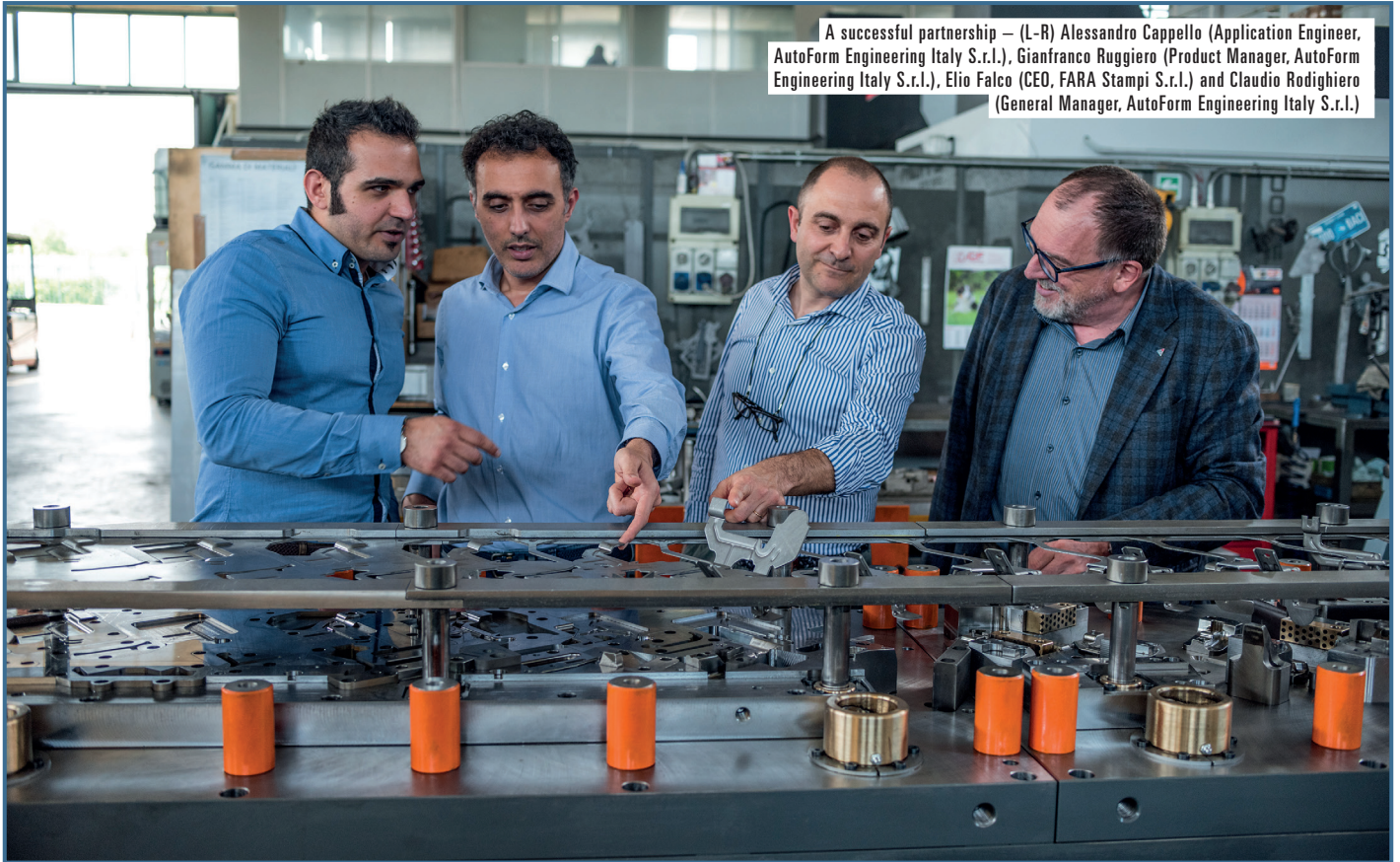A successful partnership – (L-R) Alessandro Cappello (Application Engineer, AutoForm Engineering Italy S.r.l.), Gianfranco Ruggiero (Product Manager, AutoForm Engineering Italy S.r.l.), Elio Falco (CEO, FARA Stampi S.r.l.) and Claudio Rodighiero (General Manager, AutoForm Engineering Italy S.r.l.)

PARTNERS FOR PROGRESS

FARA Stampi S.r.l. simulates progressive die stamping applications with AutoForm software

"AutoForm solutions applied to progressive die design has allowed us to evolve from handcrafted processes to an industrialised method," explained Elio Falco, CEO at FARA Stampi S.r.l.

FARA Stampi S.r.l. (FARA) specialises in progressive die design and construction. Its plant is at Nichelino (Turin), Italy. Founded in 2008, it produces and maintains dies for FARA Industriale S.r.l., which is based at Nichelino (Turin), Italy, and produces and assembles parts for the automotive industry, including bodywork and chassis elements, battery trays and piping supports. FARA Industriale is well known in the automotive market as a part supplier to automotive OEMs such as FCA, PSA OPEL and MAGNA.

> FARA Stampi S.r.l. (FARA) specialises in progressive die design and construction

FARA has adopted AutoForm products as its software solution in process simulation. During a recent visit to FARA's plant, AutoForm received an overview of its engineering and tryout process for progressive dies, top to bottom. As a thorough introduction, it went through its entire process chain for two particular parts (a tank filler hole-support, shown in Figure 1, and a radiator piping-support, shown in Figure 2). The exploration started at the bidding phase and supported the design of the process, as well as closely following the actual tryout.

The feasibility analysis

Once FARA receives the part geometry, the first thing it does is to run a feasibility analysis.

Elio Falco, CEO, FARA Stampi S.r.l., commented: "When running the feasibility

ISMR SAYS:

"FARA Stampi S.r.l. has reduced tryout loops with new simulation software"

check, the first thing we look at is the development on the plan for the entire part. This step is crucial because we can look for critical areas and determine trim lines. Based on this information, we can already start to 'see' the full strip: define the plan, lifters and holders' position (inside, outside) etc.

"AutoForm speeds us towards this goal, because 99% of the time we not only deal with linear flanges (for which we could use our CAD product) but also with stretch flanges and, most the time, we do not develop those flanges (and determine trim lines) on a plan but rather on a drawn or tilted area. In this case, without AutoForm we could not easily get the right shape of the flattened part in a short amount of time and consequently determine the most appropriate pitch and the most efficient nesting. Without this information, we could also not determine material consumption and therefore evaluate the final cost."
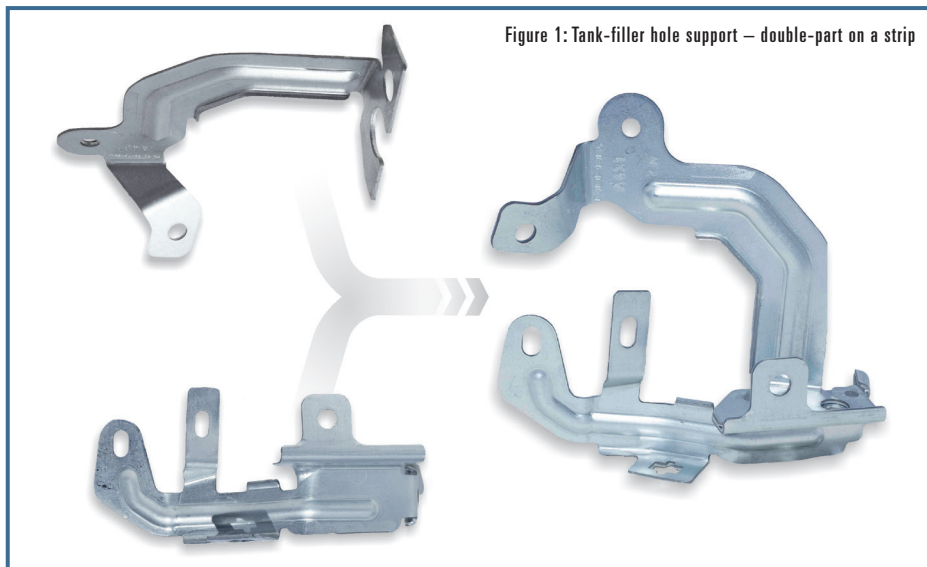
Figure 1: Tank-filler hole support – double-part on a strip
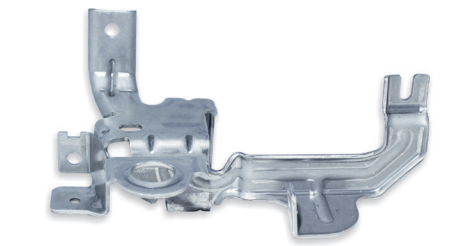
Figure 2: Radiator piping support – single part production

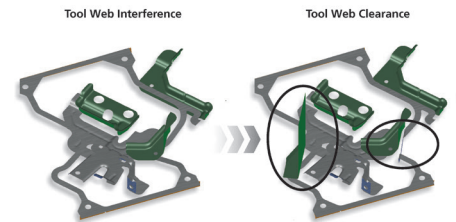Tool Web Interference   Tool Web Clearance

Figure 3: Example – tool-web interference issue detection and solution

> **We now produce parts we could never have produced without AutoForm simulation in short amounts of time**

"If we realize that the part is not feasible, and trust me this happens more often than many imagine, we then have to ask for a part modification. Whenever critical areas can't be fixed and a part can't be produced according to the way it has been designed, we have to talk to the customer and justify the request for changes, and here it's particularly important that we can back it up with a feasibility study produced by AutoForm as evidence of an alternative. Time is always a factor. The sooner we have that study the better, especially when bidding in an auction. AutoForm greatly helps us to achieve this goal and saves us from any trouble later down the line."

This underlines the importance of taking the right approach from the very beginning. Proper planning aims to avoid under-/over-estimation; which could either result in losing a bid or costing it too high. Bids can be lost by overpricing a product (due to faulty estimation of the costs and the consequent limit to a possible discount that can be offered to a customer).

Elio Falco continues: "Truth be told, thanks to AutoForm, we expanded the variety of parts we produce today, and thus extended our market. The software supported and still supports us in making decisions when working on particular parts where we have very limited, or even no, experience at all. We now produce parts that we could never have produced without AutoForm simulation in short amounts of time."

Moving to CAD

At this point, drawing all the tools directly in the CAD environment starts.

Sergio Siragusa, Senior Designer, FARA, explained: "The option of importing and quickly replacing tool geometries at any time in AutoForm^{plus} allows us to generate the tools of each station/operation, one after the other. To validate the process, we can start simulating just a few stations, for example, so that there is no need to draw all the tools to simulate the entire process and then realise that something is wrong and make changes. With a limited amount of time spent on CAD, we can start validating the tool geometry (see Figure 4), and we know that it won't take too long to apply any modifications that might be needed."

Process engineering and process design proceed in near parallel, and this allows users to evaluate different solutions in a short time-frame and ensure that, at the end, the process works. A few adjustments (limited re-cuts) which do not require any additional virtual validation can be directly applied during the tryout loops.

Sergio Siragusa added: "Simulating a process with an incremental solver also means accurately simulating the movement of the tools and detecting possible interference. For example, during the simulation of the single part die, we realized that one of the forming tools was hitting the web before actually forming the part (Figure 3, above). To maintain the plan as it was already defined, we introduced a tool to the previous station that actually flanged the web so that the forming tool at the next station could work correctly (see Figure 5).

"Without this simple but accurate check, we would have found the problem only upon arriving to tryout; it goes without saying the kinds of problems that we would have faced…….."
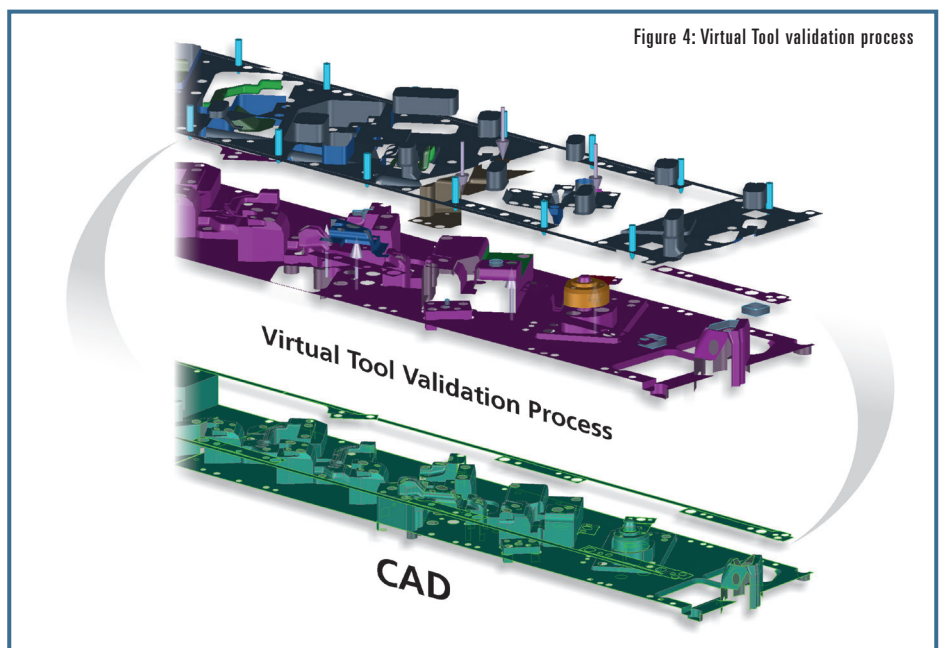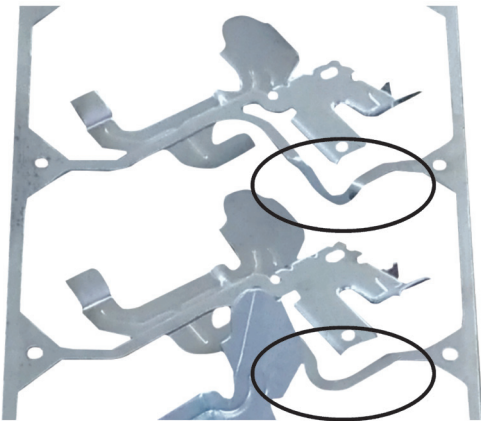

Figure 4: Virtual Tool validation process

Virtual Tool Validation Process

CAD

Figure 5: Solution – web flanging visible on the 'real' strip

Figure 7: Qualitative comparison of process timing

Saving time and cost

The tool geometries are then released for milling.

"We mill the tools exactly as validated by AutoForm. We keep 100% to the results we get from simulation and we cut the tools accordingly, and that's what really pays off at the end – this is where we save time and reduce costs," said Elio Falco.

"Since introducing AutoForm into our engineering process for all parts (before doing that we used to outsource engineering of the most complicated parts), we have seen total working hours (from the day we get the part to delivering the die) drop by 30% in average, and tryout loops have dropped by 50%! Where we needed five to six adjustment loops in the past, now we spend two, and a maximum of three loops, making small adjustments by re-cutting the tool through CNC – never by hand. After that, the die is ready."

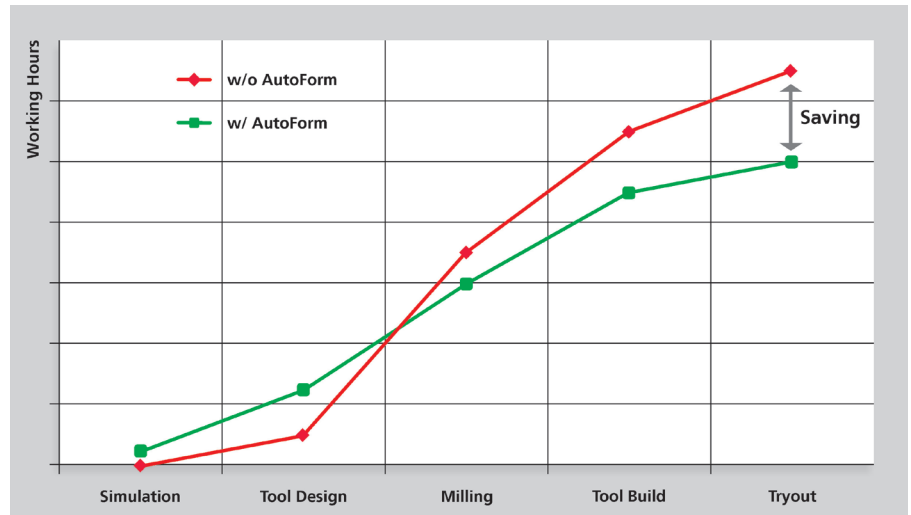Figure 6 below summarises the process. The 'Virtual Tool Validation' process (loops) is designed to drastically reduce the chances of having severe issues in tryout, which would otherwise lead to a re-design of the entire strip and a re-cut of all tools. Just a few loops are needed for small localised adjustments, which at FARA are always applied through CNC machines. Changes are first applied in CAD and then transferred to the milling machine through CAM.

By following this process, the total working hours needed to deliver a die, to mass production, is drastically shorter, as opposed to not following the simulation. Figure 7 above charts the 'break-even' points between the two processes. The data is clear; a greater number of hours spent in simulating the process will save time, from the milling phase onwards. The milling hours include time spent on re-cutting tools during tryout.

The reduction of tryout loops depends upon the accuracy of simulation results, so how close to reality are the results provided by AutoForm?

Elio Falco explained: "As already mentioned, we are really close. We know that we cannot have a 100% match for different reasons. Firstly, the input to the software does not exactly match what we have in reality: for example, let's talk about material properties. To comply with our requirements, we ask our suppliers to deliver material with characteristics that are within a certain range, and we test the material for acceptance. In simulation, we always try to consider the worst-case scenario from a springback point of view (higher yield stress).

"Yet, it may be that the real material is actually closer to the lower value of the range, and because of the combined effect between material and part shape we can experience cracks or splits, in reality. But these are rare cases, as we typically do not face this kind of problem. Another important aspect is the trim lines – the final part might not be within acceptable tolerances but we are always really close."
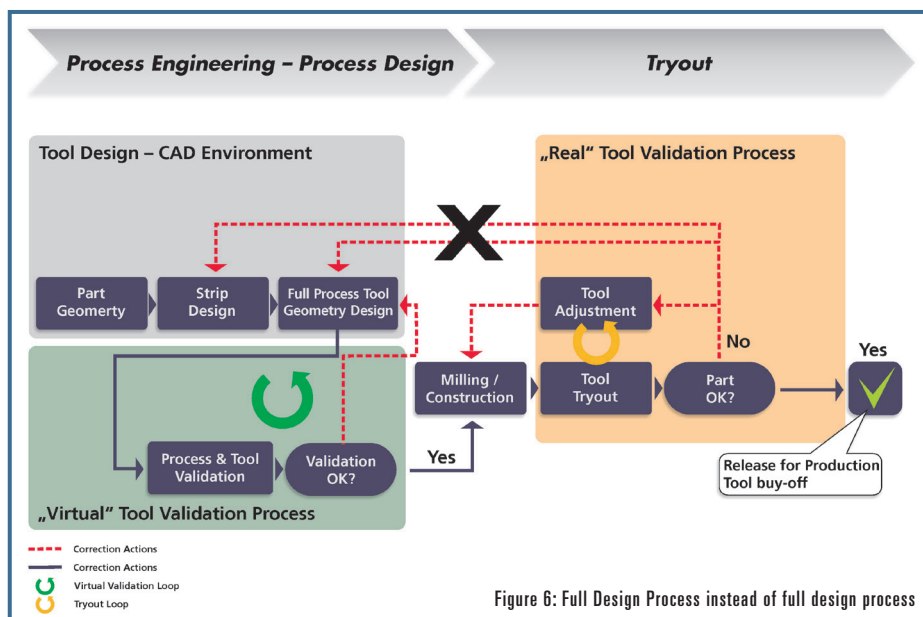
In conclusion

FARA and AutoForm have a strong relationship, developed through a decade of collaborative project work and implementation, so what comes next?

"Naturally, we work hard to increase our business which, of course, is strictly focused on the automotive industry - the more our business increases, the more AutoForm becomes important. No matter what happens, I can definitely say that AutoForm is an integral part of the DNA of our company, and will always be part of it, as long as this company is in business," concluded Falco. ■

Figure 6: Full Design Process instead of full design process