



2021 Parts Competition Award Winners

Photos: Dallager Photography

PEOPLE'S CHOICE AWARD

Plastics Unlimited, Preston, IA

Hagie Sprayer Rear Engine Enclosure Assembly

Overview

This assembly is an engine enclosure for Hagie sprayers.

Features and Benefits

This is one of about a dozen different exterior engine enclosure panels that all fit together to create styling, air flow, and improved serviceability. These parts had to pass many different tests including 2000 hours of Xenon Arc UV, Accelerated Weathering Testing, high heat testing from the engine, turbos, and radiators. They also had to pass many other tests to ensure that they could pass everyday abuse, including scratches and dozens of aggressive chemicals that the sprayer applies on the crops.



The main enclosure material is custom colored Hagie Gray with smooth high gloss ABS with an acrylic cap with a starting thickness of .236" and it is bonded with fiberglass using our patented TEC (Tooless Engineered Composites) process. The fiberglass increases the rigidity, durability, and temperatures the assembly can withstand. The grill is thermoformed from black high temperature ABS/PC blended haircell textured material with a low gloss acrylic film with a starting thickness of .240".

This is a great solution for the customer that was struggling with difficulty to service the enclosures with the previous design because of the huge size. Our new parts also have much tighter tolerances and better fit.

One of the most impressive parts of this project was the extremely quick turnaround. We produced about 40 parts of each one of the dozen different exterior engine enclosure panels, all of the patterns, aluminum tools, trim fixtures, and assembly fixtures in about two months.

The design allows for hidden mounting brackets, allowing for easy, quick, and simple assembly by the OEM. We also add screens to improve airflow to reduce overheating of the engine. We worked with the customer to redesign the parts for thermoforming by eliminating die locks and to improve forming and trimming conditions.

The thermoformed parts of this assembly are formed using production single cavity cast aluminum with temperate control.

VACUUM FORMING - SILVER



Hammer Plastics, Mishawaka, IN

Dashboard

Overview

This is a dash assembly for Class A motorhomes.

Features and Benefits

Base is a custom color Low Gloss ABS. Decorative film is a selected brush aluminum with a polyurethane cap gloss surface.

Additional Information

Tooling layout and design accommodates for differentiation in shrink factors for the various components. Shipped as a complete assembly as presented.

VACUUM FORMING - GOLD

Plastique Art, Sainte-Claire, Quebec, Canada

Ventilator

Overview

This enclosure assembly of eight thermoformed parts houses a high-end intensive care unit ventilator. In response to the COVID-19 pandemic, our customer was awarded a contract of 10,000 units to be manufactured urgently.

Features and Benefits

In order to meet the extraordinary challenge of designing and manufacturing an enclosure for a brand-new ventilator in only three weeks with the intention to be production ready after approval, all parts were vacuum formed to provide the best aesthetic and functionality within this short time frame.

The other components of the device being developed simultaneously, daily collaboration with the OEM and designer was required to make recommendations and adjustments while keeping the same deadline. Our focus was to optimize the design for manufacturability while achieving the best fit of the



parts, knowing that they had to be thermoformed on male urethane molds which would be then utilized also for production.

The capacity of the supplier to deliver custom color sheets for prototypes under a week and on short notice for mass production was critical to the success of this project.

Assembly of the enclosure has been designed to minimize the attachment points. First, to reduce the time required for the OEM, but also to limit the contact points with the metallic substructure and avoid interferences that should come from unknown tolerance stack-up of all the other components.

By making the tools in-house with a staff fully dedicated to this project, we were able to meet the 10 days lead time for 11 devices ready for certification by a health agency.

Upon final approval of the device, we needed to ramp up the production quickly to make 10,000 devices in under 16 weeks. For this, multi-cavity, temperature controlled, aluminum moulds were required for all parts. Even though they were made quickly, in the meantime we still had to make around 2,000 parts out of urethane tools and maintain consistency throughout the program.

PRESSURE FORMING – SILVER

Profile Plastics, Lake Bluff, IL

Covers for Automatic Paint Dispenser

Overview

This is a two-part project that meets the target price points of the customer and serves as a durable yet easily removable cosmetic cover for an automatic paint dispenser.



Features

Tooling: Two machined aluminum tools, water cooled, acid etched texture

How did this part provide a solution? The customer was highly price-sensitive yet wanted to meet functional, cosmetic, field service and durability requirements. The final two-part solution met the desired specifications.

Primary challenges:

1) Designing a durable, yet easily removable part: For servicing the underlying equipment, the customer wanted a rigid yet highly cosmetic assembly that could also be removed easily by service technicians without being damaged.

Solution: Through extensive DFM collaboration with the customer's design team, we arrived at a cover system that can be conveniently taken off and easily put back on securely. This includes hidden fastening points to the frame.

2) Achieving desired thickness with minimum material: The deeper part geometry combined with the customer's cost constraints demanded working with a minimal starting gauge.

Solution: We developed the necessary processes to achieve the part cost requirements without sacrificing part rigidity and performance that the customer required out in the field. Several gauge and process trials were undertaken to realize this goal.

3) Surface Durability: The part needed to be able to withstand an environment in which excess paint from use needs to be removed with harsh cleaning agents.

Solution: Color-matched material was selected to eliminate the need for a painted finish on the part, which may have been damaged from normal use in the field.

PRESSURE FORMING – GOLD

Ray Products, Ontario, CA **Multi-Part Medical Cart**

Overview

This multi-part medical cart includes 12 highly-aesthetic and repeatable pressure formed parts. The assembly includes a combination of molded-in color and painted parts. With the cart originally manufactured using the urethane cast process, pressure forming was able to improve part-to-part repeatability and aesthetics without impacting the overall design of the cart.



Features and Benefits

This cart was previously manufactured using urethane casting which required painting every part and limited the production quantities to 25 pieces at a time. The urethane parts also required a 100% inspection using a full assembly check fixture and approved parts being kitted and shipped together as a unique set.

After switching to pressure forming, the medical device manufacturer was able to significantly reduce total project costs, improve their manufacturing speed, increase part durability, and was guaranteed part-to-part repeatability without the need of unique sets. The pressure forming process provided the customer with a total return on investment within the first 50 units produced, and additionally, had no issues meeting current and future customer demand.

By manufacturing the unit with the pressure forming process and using various molded-in features, including several undercuts, we were able to significantly reduce the number of purchased components that were needed to mount the urethane parts. This allowed for a significant reduction in total assembly time by our medical customer along with maintaining the tight tolerances they required.

TWIN SHEET – SILVER



TriEnda Holdings, Portage, WI **Battery Cell Cover**

Overview

This assembly secures the inner trays filled with fragile lithium-ion batteries.

Features and Benefits

Both the top and bottom clam shell pieces are twin sheet thermoformed components that are durable, yet light weight compared to prior wooden solutions.

Material is HDPE, .500 gauge formed on smooth tool surfaces with varying sheet starting gauges and different tool depths between the base and top. Two aluminum production tools ran concurrently, forming one full pack with each cycle. A total solution using additional materials and processes such as EEP foam and injection molded ABS trays.

The critical design requirements achieved include a longer lasting, impact absorbing, product protection from damage and short circuiting, pack weight reduction, and elimination of expendable packaging requiring special fillers in case of damage. Tested to DOT and UN standards for over the road and airfreight, success was achieved by the durability and flexibility of the outer shell in HDPE.

Current practice is shipping from overseas to the US in wooden crates that were used for one or two shipments. This solution is able to be utilized in many more return shipments, is fully recycle-able, and is accessible to be used with both OEM robotics and manual handling as needed.

TWIN SHEET - GOLD

Wilbert Plastics, White Bear Lake, MN

Over-the-Road Storage Shelf for Sleeper Area



Overview

Part is a storage shelf for the sleeper area of an over-the-road truck cab which was manufactured using the twin sheet process and completed using internal foam, hardware assembly, and electrical wiring.

Features and Benefits

Shelf body is formed using the twin sheet thermoforming process.

Mold surfaces are engraved with two different textures to create the customer's styling needs.

Shelf body is then edge trimmed along with mounting bracket openings, and then brackets and internal plates for structure are installed prior to foaming.

Low-pressure, two-part foam is added to fill the inner cavity of the Shelf to add structure. Mounting bracket locations are also confirmed at this stage.

Tie down bracket holes, wiring openings, and pockets for the switch and lights are then trimmed in a robotic cell.

Final assembly involves installation of tie down brackets, wiring of lights, power input and switch, surface mat, and then prepared for safe shipment.

Result

A structurally sound, aesthetically looking storage shelf that the customer can use as an option to replace the upper sleeping bunk in an over-the-road truck cab.

3D PRINTED TOOLING – SILVER

Plastics Unlimited, Preston, IA Guard

Overview

This is a guard produced from 3D printed tooling.

Features and Benefits

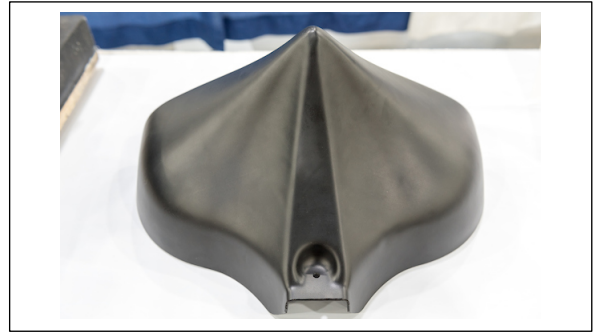
This is a guard used in an industrial application.

The starting material is black smooth HMWPE with a starting thickness of .187”.

This is a great solution for the customer to decrease tooling cost and be able to meet the tight timeline. One impressive part of this project was the extremely quick turnaround. We produced about 400 parts, the tooling, and trim fixture in about one month.

The design allows for hidden mounting brackets, allowing for easy and quick assembly.

The thermoformed parts of this assembly are formed using production three cavity 3D printed without temperate control.



3D PRINTED TOOLING – GOLD

Catalysis Additive Tooling, Columbus, OH Pallet

Overview

This 3D printed thermoforming production tool was used to form pallets, utilizing binder jet technology. The material formed over the tool was 0.250” HDPE for 1,000+ parts.

Features and Benefits

This tool provides many benefits over traditional metal tooling.

A one-two week manufacturing time offers faster manufacturing time, getting the tool into the hands of customers twice as fast as a machined metal tool.

This tool is half the price of a traditional metal tool. When creating a tool using additive manufacturing, complexity isn't dependent on machine time like typical subtractive manufacturing.

This tool is 100% porous, allowing the tool to pull a more consistent vacuum on the part. This tool manages to be porous, while also having a 100 Ra surface finish. The combination of the two make for a clean, well-formed part. The addition of blowoff holes in areas with a little amount of draft ensures the part comes off smoothly without damage to the tool or part.

The innovative design on the underside of this tool utilizes the full capabilities of 3D printing for thermal management and strength of the tool. On a shuttle system, this tool can maintain a consistent 170 °F.



The underside also doubles as a vacuum chamber. When paired with the porosity of the tool, a near-perfect pull on the material is possible.

This tool is able to withstand thousands of parts. This means that the longevity of a tool isn't dependent on price and lead time, which is the major drawback of other tooling materials such as wood and plastics.

Takeaways

Half the cost, half the time; 100% porous; able to pull thousands of parts; maintains consistent tool temp.

PARTS PRODUCED WITH AUTOMATION AND NEW TECHNOLOGY – SILVER

Plastics Unlimited, Preston, IA

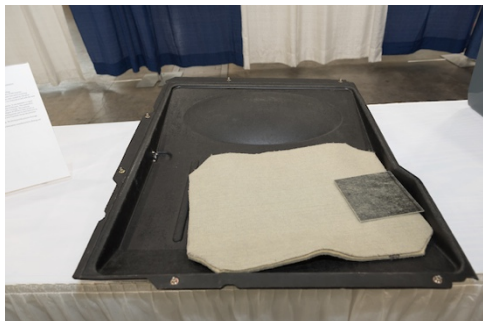
Hagie Sprayer Rear Engine Enclosure Assembly

See People's Choice Award description, page one.

PARTS PRODUCED WITH AUTOMATION AND NEW TECHNOLOGY – GOLD

Hagans Plastics, Grand Prairie, TX

Chinook Forward Drip Pan



Overview

This part replaces an aluminum pan due to both increased strength and weight reduction.

Features and Benefits

This part is made using oil temperature-controlled match metal aluminum tooling. The material is a PEEK/Kevlar non-woven fiber that must be formed in excess of 500 degrees. This panel was redesigned to include more head room for the navigator. Issues that were occurring included the current aluminum pan causing holes to appear in the helicopter skin caused by vibration. The time it took to change out the current pan due to the ridged structure was reduced in half with the new design and material selected.

The new material is able to be formed in a multitude of ways and thicknesses. It can maintain a ridged perimeter while still having some flexibility throughout the center section of the part. This material is completely resistant to all types of POL, (Petroleum, Oils, Lubricants) after forming. The material

throughout the testing phase was not adversely affected by the high degree of vibration that occurs in helicopters. It also provided the strength needed for additional mounting points and quarter turn fasteners to be attached. In addition, the weight reduction of this new part was over four pounds versus the previous aluminum part.

Prior to this project, the material had not been tested for forming. We developed the process through many trials.

This has now been approved to be included in all new Chinook Helicopters manufactured by Boeing and spares for existing helicopters currently in use.