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MODERN MASTERS

Artistic creation is one of the ways we distinguish ourselves from the rest of the animal kingdom. Having the ability to transform raw material from one form into another, adapt/ repurpose existing objects or design/build something never seen before sets human beings apart. This is possible because of some fundamental traits that separate humans from every other species.



Besides the discernable physical differences, humans enjoy episodic memory. Episodic memory is a trait that allows human beings to make sense of their existence, to share individual knowledge with others, and affect future behavior by communicating that knowledge. Humans possess the unique understanding of mortality and forethought (the ability to imagine the future in many possible iterations and then to actually create the imagined future). Forethought allows humans generative and creative abilities.¹

As a society, we tend to think of artists as individuals who compose, play an instrument, act, sing, dance, sculpt, design or perform in front of others. The Cambridge Dictionary defines an artist as a person who paints, draws or makes sculptures. An artist is also an actor, musician, dancer or other performer.² I can't imagine that many people think of engineers, scientists or the person on a manufacturers' assembly line as artists, but a close examination of a commercial aircraft should change your mind.

Airplanes first took to the skies over 116 years ago. Commercial air travel became viable soon after World War I. "Post-WWI, the aviation industry really started to grow and many commercial airlines began operating. The Contract Air Mail Act of 1925 directly contributed to the growth of airlines, and the Air Commerce Act of 1926 gave the government the responsibility for promoting air commerce, establishing airways, certifying aircraft, licensing pilots, and issuing and enforcing regulations. Commercial aviation grew rapidly to transport both people and cargo. Charter service developed during the 1950s and 1960s, and quickly became a major component of the aviation industry. By the mid-1960s, about 100 million passengers had traveled via jet.³

Early commercial air travel evolved from being a novelty reserved for the rich to a mass-market travel mode as aircraft design shifted from wood-and-fabric biplanes to sleek, fixed-wing aircraft. The introduction of new materials and technologies have driven modern aircraft design to places once considered pure science fiction.

- ¹ https://www.thoughtco.com/what-makes-us-human-4150529
- ² https://dictionary.cambridge.org/dictionary/english/artist
- ³ https://aviationoiloutlet.com/blog/early-history-commercial-air-travel

The people who build modern aircraft face challenges not unlike great artists from the past. They fuse a mixture of raw materials, performance criteria and design specifications into modern masterpieces.



Renaissance artist Michelangelo Simoni transformed charcoal sketches, blocks of marble and simple hand tools into stunningly life-like figures like David – 1504. Baroque sculptor Gian Lorenzo Bernini combined stucco, wood and marble into inspiring architectural and sculptural commissions like the St Peter's Basilica Baldachin – 1634.





Impressionist sculptor Auguste Rodin modeled clay and stone into depictions of emotionally charged physicality like The Thinker – 1902. These masters took simple elements and created forms that could transport the viewers' minds somewhere else; like a bridge to another realm.

Historians attest to the fiercely competitive nature of vying for artistic commissions from the Renaissance through the early 20th century. The competition to create the best in the aerospace industry is just as competitive today.

OEMs are under constant pressure to reduce their ever-increasing operational costs. Even a titan like Boeing answers to someone. In kind, The Gill Corporation answers to its customers, and Boeing is one of our largest; so, when Boeing talks, we listen.



In 2014, The Gill Corporation secured the B787 floor panel contract. The statement of work included over one hundred different machined titanium intercostals and fittings, with annual production quantities in the thousands. Intercostals are metal pieces in the shape of an I-beam that are fastened between pairs of longitudinal floor beams.

Titanium is one of the most common metals found on earth. It is lightweight, strong, and resistant to corrosion. It has good thermal conductivity, is non-magnetic, and non-toxic. At that time, machining titanium, especially in the volumes required, was new to The Gill Corporation which required a substantial investment in capital equipment, special fixtures, high-end cutting tools, trial/ error machining programming, and hiring/ training the line personnel. Watching raw titanium be machined into sleek aerospacegrade parts is a wonder to behold and a monumental task, but The Gill Corporation performed on cue, on time and as expected.

When Boeing engineers first designed the B787, they received aggressive weight-reduction targets. The use of carbon-skinned floor panels (Gillfab 4809) delivered the desired weight savings but increased the risk of galvanic corrosion from the carbon fiber's conductivity. The titanium components addressed that concern. However, the never-ending demand to reduce B787 production costs soon led Boeing engineers to investigate an alternative intercostal design utilizing lower-cost materials. Aerospace design engineers agreed that titanium was the optimal material, but it is very expensive. The clear alternatives are steel and aluminum. Titanium costs three times more than steel, roughly ten times more than aluminum, plus it requires significantly longer time to machine.

The major considerations for selecting an alternative material are:

- cost
- corrosion risk
- strength

Steel offers strength and moderate cost savings, but steel is dramatically heavier than aluminum. Since weight is a critical component of aircraft design, steel fell out of consideration.

Aluminum is extremely lightweight and easy to machine making it the best choice for the Boeing design engineers.

Once determined, the Boeing engineers and the Gill fabrication group had to address several issues before the transition from titanium to aluminum could occur.

Management at The Gill Corporation knew the implementation needed to be seamless; so, in Q1 2019 the fabrication group began preparations for the transition from titanium to aluminum.

Program Management analyzed make-orbuy options and realized that significant cost savings were possible by outsourcing the manufacture of the steel bushings, plastic isolators and anodize/primer application process. This meant adding two new critical suppliers to the Gill supply chain management while bolstering our relationship with a key existing supplier. Logistically, there were changes to the process. The titanium fabrication was completed in-house in three controlled steps:

- machine the parts.
- perform non-destructive inspection (NDI)
- perform final quality inspection.

The aluminum fabrication would be completed using an outside vendor and by adding an additional assembly step. Both may seem simple, but each step in either process is a critical part of building acceptable finished goods

A legitimate raw material concern with aluminum was the risk of corrosion and finished-part strength.

Preventing corrosion would require a multiple-step procedure. Initially, the aluminum parts are anodized and multiple coats of primer are applied. Next, steel bushings are "press-fitted" into the parts. Finally, plastic isolators are glued onto both ends of the part.

Machining aluminum is vastly different from machining titanium. As a result, all 100+ redesigned parts required new CNC programs and the corresponding first article inspections.

Aluminum is a relatively soft metal and prone to scratching, so quality engineers developed special handling procedures for our in-house personnel as well as our processing supplier. 3

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In addition, a concern arose about the vulnerable nature of the material finish during transport to and from the plant so we provided custom reusable crates with protective sleeves to the independent processing supplier.

Our mechanical engineers (MEs) devised custom holding fixtures to ensure the floor technicians install the bushings in a consistent, repeatable manner. The MEs also noted that the isolator material is extremely thin and the adhesive is difficult to apply and clean, so new written procedures and hands-on training were developed for the floor technicians to ensure successful completion of the scope of work.

The titanium to aluminum conversion process began in March of 2019. The first B787 shipset of aluminum intercostals reached Boeing in late September 2019. The Gill Corporation expects the transition from titanium to aluminum to be complete in Q1, 2020.

Responding to the customer is critical in a competitive business market.



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Adapting to changes in design, materials and process are part of being a successful supplier in the aerospace industry. The transition from titanium to aluminum is a perfect example of why The Gill **Corporation is** a master in the art of machining and customer service.



THE DOORWAY IS PRINTED ON 10% POST-CONSUMER RECYCLED PAPER AND SHOULD BE RECYCLED



Where does a mountain climber keep his plane?

In a cliffhanger.

Why did the airplane get sent to his room?

Bad attitude.

What do you call it when a giraffe swallows a toy jet?

"Plane in the neck."

Why don`t ducks tell jokes when they fly?

Because they would quack up!

What do you call a flying primate?

A hot air baboon!

Why don't programmers like nature?

It has too many bugs.



"Almost" is the longest word in English with all the letters in alphabetical order.

It actually takes 142.18 licks to reach the center of a Tootsie Pop.

All swans in England belong to the queen.

The "hashtag" key on your keyboard (#) is called an octotroph.

The Declaration of Independence was written on hemp paper.

A duck's quack doesn't echo, and nobody can figure out why.

There are more plastic flamingos in the U.S. than real ones!

315 entries in Webster's Dictionary were misspelled.

Because metal was scarce, the Oscars given out during World War II were made of wood.

Sherlock Holmes NEVER actually said, "Elementary, my dear Watson."

Ancient Egyptian priests would pluck every hair from their bodies.

M&M's actually stands for "Mars & Murrie's," the last names of the candy's founders.

It is estimated that millions of trees are planted by forgetful squirrels that buried their nuts.

Cats sleep for 70% of their lives.

The Vatican Bank is the world's only bank that allows ATM users to perform transactions in Latin.

The male seahorse carries the eggs until they hatch instead of the female.

More monopoly money is printed each year than real U.S. currency.



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