

Pixel Perfect: Impossibly Realistic Aviation Art

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Corsair illustration by Ronnie Olsthoorn

In the increasingly sophisticated field of computer-generated imagery (CGI), even an aircraft in the earliest stages of development can take shape with a likeness that will be almost indistinguishable from the first prototype that will eventually roll out of the production facility. So advanced are today's digital images that, even for some with the most expertly trained eyes, it's difficult at times to tell a computer-generated image from a photograph of an airplane.

In addition to offering highly faithful renditions of aviation's present and near-future stars, CGI can also give aircraft of the past a rebirth in imagery that technology of former decades never could. Take, for example, a formation of Consolidated B-24s heading toward the port of Wilhelmshaven to conduct America's first strike on Nazi Germany soil during World War II. Scenes like these that could only rarely be captured on scratchy black and white film can now be re-created in the finest detail thanks to the advancements of CGI, providing viewers a window back in time with a one-of-a-kind visual experience of history.

SCULPTING AN AIRCRAFT FROM SCRATCH

England native **Adam Tooby** has made his life's work creating these visual experiences, churning out hundreds of images over the course of his career. Trained as a traditional artist in college, where he studied painting and a variety of other classic methods, the 41-year-old has spent the past 20 years working in the realm of CGI. Of those two decades, six years have been devoted specifically to creating aviation illustrations through his work with renowned U.K. model airplane manufacturer Airfix.

Every artist has his own unique process, but for Tooby, once he's selected an aircraft to illustrate, the creative journey begins with seeing that make and model in the "flesh." Whether it's visiting a rare warbird within the confines of a museum or heading out to a local airfield to catch a particular plane in its more fitting environment, he makes the trip in order to study the subject in detail and take hundreds of photos of it from every angle.

"I look at all the forms and compound curves, making notes of how they flow and also how the natural light falls upon the airframe," says Tooby, whose recent book *Warbirds: The Aviation Art of Adam Tooby* re-creates aerial scenes from World War I all the way up to the recent wars in the Middle East. "Another aspect I always look for is how it's weathered. It's important to get the feel of how the plane naturally gets worn when it's been used."

Armed with that photo documentation and a heightened sense of the aircraft, artists like Tooby head to the digital drawing board to construct a three-dimensional model of the design, which typically constitutes the most time-consuming aspect of the project. There are a few mainstream methods to create such a model, including the use of nonuniform rational B-spline (NURBS) surfaces, in which users construct smooth shapes through the manipulation of mathematically exact curves. The most popular modeling method, however, is the employment of polygons. In this technique an abundance of small shapes or "n-gons" — "n" representing the number of sides — serve as tiny building blocks that join together to create the 3-D shape of an airplane.

"It's a little bit like making a scale model, but completely on the computer," says **Ronnie Olsthoorn**, whose art has graced the covers of *Aviation Week*, *Model Aircraft* and a number of other publications. "It easily takes a number of weeks, or months in some extreme cases."

A typical 3-D aircraft model can be composed of tens of thousands of individual polygons, a testament to the intricacy involved in building a truly authentic depiction of one of aviation's marvelous machines. To get things right, artists rely heavily on detailed engineering drawings, along with user manuals, historical photographs and other sources of relevant details. Referencing those drawings as guides, artists manipulate polygons to construct the aircraft section by section.

"Think of a sculptor who has a block of clay and starts cutting at it and shaping his object. That's what I do, but on the computer," says artist David Finlay, who has created CGI for years in the gaming industry. "I'll have a cube, and then I'll just start cutting and cutting and slicing and pulling all those vertices and dots to make the shape of whatever I'm creating."

Little by little, portions of the aircraft — the fuselage, the wings, the nose — begin to become recognizable, culminating in a complete digital model that can be spun in any direction for a fully three-dimensional view.

THE DEVIL IS IN THE DETAILS

After the 3-D model is complete, next comes what artists term the "unwrapping" of the aircraft, in which the model is broken down into sections that are flattened into 2-D images in preparation for the addition of textures and colors in Photoshop or similar programs. Imagine an origami figure being unfolded and reverted back into a flat sheet of paper. In CGI, the folds would serve as the coordinates for what's called a UV texture map, which provides artists a means of adding precise and intricate details on a shape as odd as an airplane without the

associated warping or stretching that would otherwise accompany it. Once that's done, the paper is folded back into its original shape, but this time with seamless colors and hues covering each of its surfaces.

There are typically three or four types of texture maps used, and each pertains to a different aspect of the aircraft's coloring, whether it be the way light hits its surface, the depths of its differing sections, or whatever. Each of these layers is meticulously crafted to mirror the immense subtleties of a physical aircraft in the natural world, and when executed well they all work together to form one complex, harmonious image.

"First you draw all the panel lines and the rivets and you apply those to the model. Then you make various variations of it, which decides what areas are glossy and what areas are metal," says Olsthoorn. "You also have to set up the lighting and the environment. For example, a metal material will not look metallic unless there's something to reflect."

Whether it is a slight smudge of dirt on the leading edge of a wing or the variation of light as it flows across the fuselage, thorough attention to even the smallest items is key.

"Most of the detail can take quite a few days to apply. We look at all the rivets around the engine, all the wiring — everything is modeled as close as possible." Tooby says. "It's getting those tiny, tiny details that makes the difference."

SETTING THE STAGE

Executed well, a finished digital model airplane can be placed at any angle within a given piece of artwork. Granted, artists must take into consideration the numerous technical details associated with different airplane configurations, such as flap setting or aileron deflection. But when it comes to the scene or backdrop that makes up the remaining space around the airplane, options abound. It is in this stage that a model of relatively limited character evolves into a vibrant aircraft with a story to tell, and where artists can closely control the direction of the project. In some instances, particularly when re-creating a real event, the overriding goal is historical accuracy.

For example, Olsthoorn says that some of his favorite projects are those in which he is commissioned to reconstruct flying scenes for veterans.

"When possible, I look up combat reports, so for the artwork I know exactly what altitude the event happened at, what time of the year, the location, cloud coverage, all those kinds of details. I try to match my artwork as closely as possible to how it was," he says. "I look at as many wartime photos as I can find."

Like many artists, Olsthoorn says the best compliment he can ever receive for his work is for those veterans to say his art correctly depicts their past experiences.

Tooby, who primarily creates illustrations of warbirds, shares a similar goal.

"You're trying to make the images as impactful and dynamic as possible but also keep a mindful eye that you don't want it to be unrealistic. It's striking a balance between that realism and making it interesting to the viewer," Tooby says.

For other projects, however, crafting the environment around the aircraft provides the perfect opportunity for creativity as well as a chance to take advantage of the vast digital capabilities available today. Whether it's selecting the most aesthetically pleasing angle of flight or crafting an elaborate backdrop of terrain, the possibilities are endless.

"You can really push the boundaries in terms of detail that you wouldn't naturally be able to do by hand very easily," Tooby says. "You have better tools to explore lighting and perspective, which isn't quite as flexible when doing some artwork by hand.

INTO THE FUTURE

With every passing year, the hardware and software that make computer-generated imagery possible only continue to get better. With ever more powerful and efficient technology, the field is constantly evolving, expediting certain processes for artists while also delivering a persistent stream of new capabilities for them to explore. Only time will tell what the future of CGI will look like, but there are indicators of what lies on the horizon.

"Before, everything would have to be hand-modeled. You would just be pushing and pulling vertex by vertex. Now things are going toward parameterization, where you can basically just draw a line and then another line and say, 'I want this shape,' and it will create that for you automatically," Finlay says.

Perhaps more exciting is what great artistic minds will be able to do with these new capabilities, and what new forms of expression they will breed in the coming years.

"The real key word is 'more,'" Olsthoorn says. "When I started out it was all quite basic and not terribly realistic. The capacity of computers to deal with detail was quite limited. As computer power increases, you can put in more details and make more realistic images. It just becomes bigger and better."

[See some of their amazing illustrations in our photo gallery here.](#)

THE CRIME OF COMPUTER ILLUSTRATION

A photographer's perspective – By Robert Goyer



As you can see from the images in this feature, today's photo-realistic aviation art is gorgeous. For some of us, it's soul-crushing too. Let me explain. The art of air-to-air photography is special to *Flying*. For decades we've featured some of the greatest work in the world from aerial photographers hanging it all out to capture that perfect shot.

It's hard work and takes a lot of time to master. I know. For 25 years now, I've been teaching myself the craft of taking pictures of airplanes from another airplane. It's a strange calling and one at which I'm still in some ways a novice. There are only a couple of dozen really good air-to-air photographers in the industry. The real pros, like Paul Bowen, Russ Munson, Jim Koepnick and Mike Fizer, among others, are artists.

Russ is the best aviation photographer ever, a genius behind the lens. I sometimes leaf through old issues of *Flying* when he did most of our covers and stare spellbound. It was risky stuff, with the airplanes too close, the angles too odd and the lighting too strange. It all worked. Paul's photography, with jets creating whirls in the clouds or Caravans climbing on their tails out of too-short strips, is magic. And it's all real.

The work is hard and it's hazardous too. Up you go in the cold, doors and windows removed, shooting the subject plane in tight formation while you bounce and rumble along. It's a fiendish pursuit. You need to shoot at a slow enough shutter speed to make the prop flow like butter while still keeping the image from blurring. Too slow and the image gets soft. Too fast and the prop stops, looking, as we say in the trade, "stupid."

There's risk too. If the formation isn't flown properly, everybody could get killed. It's happened more than once, sadly.

Aviation computer artists stand at far less risk. They are unbound by time, place, history or weather, not to mention the vagaries of shutter speed and turbulence. Somehow it's just unfair.

My greatest fear, of course, is that there'll come a time when you won't be able to tell the difference between Kodachrome and Photoshop. If we're not there already, we're close. It's a great thing, and a little sad to those of us who take pride in doing it the old-fashioned way.