Season 2, Episode 11

What's He Building

Nick:

Welcome to Airspace, I'm Nick.

Emily :

I'm Emily.

Nick:

And no one is Matt today.

Emily :

Matt is in Europe at a conference, right? It's a conference.

Nick:

I don't know, he tells us it's for work,

Emily :

Sure.

Nick:

But maybe it's a bluff... Today, you and I are going to be talking about fun stuff, right?

Emily :

I think it's super fun stuff. It's this really cool project that is an intersection between art and sculpture and science and technology that came together to produce the command module hatch from Apollo 11.

Nick:

So the hatch is the small door in the side of the spacecraft that the astronauts get into when the rocket is on the launchpad and then seal it behind themselves for the mission. It's as complicated as you would think the front door of a space ship can be, it looks like the inside of the mechanical watch.

In this episode, we're going to talk with Megan Dattoria. She worked on the 3D scanning of the hatch here at the Smithsonian. We'll also talk to Adam Savage and Jen Schachter who coordinated all of the artists who've built the individual pieces and then performed the final assembly.

Adam Savage:

Wow. Look at that one, that one's got fur on it. This one's got googly eyes.

Nick:

Project Egress coming up on this episode of Airspace from the Smithsonian's national air and space museum distributed by PRX.

Today, we're talking about Project Egress, which is a collaboration between us here at the museum and the Smithsonian's digitization program office who had 3D scanned the hatch from the Apollo 11 command module, and also Adam Savage and Jen Schachter who are famous for busting myths and making things in turn, and Jen had recruited this whole team of artisans to take the divided 3D scan data and fabricate their own versions of these hatch pieces, and then they shipped them all to the museum where Adam and Jen assembled it before... Oh my God, I get to use this phrase a live studio audience.

Meg Dattoria:

[Laughter 00:01:58].

So essentially this was a lively and creative collaboration that was really kind of: art project, technologies, demonstrations, culmination of what 40 odd maker spaces across the globe into this sort of social art project that was promoting a scientific and engineering achievement.

Nick:

This is new... This is a new kind of thing, somebody called you up on the phone one day and said, "Hey, you're a maker, I like your work, would you like to print a piece of an art object that's going to go into the Smithsonian?" This is like a new kind of public history, can you imagine how much more we would have paid attention to middle school if the teacher had said, we're going to print a spaceship today, you guys.

I mean, in this case, project egress, isn't a school project, but this is exactly the kind of thing that classrooms could be doing. All of the scan data is available online in this case, it's artisans from around the country, but it could just as easily be all of the students in a classroom.

Meg Dattoria:

It's bananas.

Nick:

All of this starts with data... With 3D scan data of a museum artifact, and we've got a whole office for that.

Meg Dattoria:

We do, which I just learned about a week ago, which I'm really excited about and Meg Dattoria from the Smithsonian's Digitization Program Office came and joined us in studio so that we could all geek out about her job.

Nick:

The Digitization Program Office... DPO, can we call you a DPO? Are we friends?

Meg Dattoria:

Yes, definitely.

Nick:

Can we say DPO?

Meg Dattoria:

Please.

Nick:

Okay. What do you guys scan. Scanning is primarily what your office does, right?

Meg Dattoria:

Yeah, our side 3D scans museum artifacts for view and download online.

Nick:

Like digitization could mean videotape, but that's not what you guys do.

Meg Dattoria:

Not our specific part of the department, we're in the 3D side, and I think that it's been nine-ish years.

Emily :

So new it's newish.

Meg Dattoria:

It's definitely cutting edge.

Nick:

We were in your office the other day, and there was this big laser scanner in the middle of the room just kind of whirling away.

What are some of the things that you have scanned with these tools? What do you say when people ask, what is it that you do?

Meg Dattoria:

We have a project with American History. We scanned a bunch of Ancient Near Eastern Coins. We also have one with Natural History, which has a bunch of coral specimens that I'm really excited about. The command module is a big one that I bring up because it really demonstrated all of our processes in one object, because there's a lot of different ways to 3D scan an object and we take different approaches depending on what the museum collection is. So the coins used a very specific, structured light process.

Nick:

What's structured light?

Meg Dattoria:

It projects a fringe pattern of light over the object and then there's a camera on the scanner that picks up how the light deforms over the surface.

Nick:

Like a grid pattern?

Meg Dattoria:

Yeah.

Nick:

Okay.

Meg Dattoria:

That's the structure to the light.

Nick:

And so the purpose of the structure is that it assigns something for the computer to bite into when it's stitching everything together or...?

Meg Dattoria:

It's so that the camera can pick up that light versus the rooms light.

Nick:

Okay.

Meg Dattoria:

And see how it's shifting over the object. That's what we used to digitize the coins because the lasers were bouncing off of them too much structured light does a little better with shiny surfaces. So we used that for the inside of the command module.

Emily :

Jen, did you guys get to climb into the command module?

Jen Schachter :

No... I got to stick a head inside.

Emily :

Ah, that's still closer than most of us have gotten.

Jen Schachter :

You basically have one flat-ish side that has a textured surface and then on the other side, you have just a bunch of exposed mechanical components and there's knobs and windy bits and occluded elements all over it.

Nick:

Hinges and handles and [crosstalk 00:05:58].

Emily :

It's like an activity mat that you would make for a toddler.

Nick:

There's a portal and

Emily :

But it is roughly rectangular, right? And how big is it, length and width?

Meg Dattoria:

Several feet wide.

Jen Schachter :

So like three-ish.

I'm holding my arms out, like I was going to hug a bear.

Emily :

Like if you were to hug a bear? [inaudible 00:06:14]

Nick:

Welcome to Airspace where our metaphors are off the rails and the numbers don't matter.

Emily :

Hey, we were measuring things on the moon and giraffes a couple episodes ago. So I think bears, bear hugs and hands that you guys can't see is more than acceptable.

Nick:

So from a complexity standpoint, this thing is more than a bear hug, right?

Meg Dattoria:

Yes.

Nick:

So just tons and tons of exposed machinery on the inside of this hatch.

Meg Dattoria:

Mm hmm(affirmative).

Nick:

And how long did that take to scan? Was that a special challenge? Was that a complicated...

Meg Dattoria:

Oh yeah... That was by far our biggest in size and scope, most complicated scan we've ever done. There's various ways to laser scan and they, all result in different resolution and have different benefits some work better getting into crevices. We use photogrammetry with different cameras just to see what

worked best and you can use regular light, or you can cross polarize your light to try to cut down on the glare.

I bring up the command module because we threw basically every technology that we had at it. I ended up with like seven different scanning techniques.

Emily :

Wow.

Meg Dattoria:

Yes. It took at least 10 people two weeks to do the scanning part and then months to process all of that data that was a huge amount of raw data I think it came in at over seven terabytes, far more than anything our computers could even open.

Nick:

Then it took months to process the data.

Meg Dattoria:

Yeah.

Nick:

For the hatch, for the hatch specifically, it sounds like scanning is only the first step. There's actually a lot more to it.

Meg Dattoria:

We processed the surface scans that we had and then we handed that off to engineering student, Andrew Barth, and he then reverse engineered the actual mechanical components that he could see in the exterior surface scan. So ultimately at the end of the project, we ended up with archival scan data and then the CAD modeled version with individual printable parts.

Emily :

I think it's a really cool intersection of art and engineering and education. Do you have any requests that come from the scientific community? People who...

Nick:

People who can't necessarily make it here to the Smithsonian.

Emily :

Or don't necessarily need to be in the collections to do their work.

Meg Dattoria:

Oh, definitely. That's a lot of what we do and that is kind of, that's the driving force behind the corals project that we're doing. We documented 80... 88 [inaudible 00:08:31] types, holotypes, type specimens of corals and we're going to put those online for researchers to download because the previous process

for a researcher wanting to take measurements from a museum artifact was either to come visit that artifact or to have it shipped to them.

Emily :

Right.

Meg Dattoria:

So there was a lot of damage of these, one of a kind defining specimens for a species that they're irreplaceable. So now we can share that scan data online for people to take measurements down to within a 10th of a millimeter accurate.

Emily :

Do you have a most requested that you haven't gotten to yet?

Meg Dattoria:

A lot of aircraft's

Emily :

A lot of aircraft?

Meg Dattoria:

Which are huge projects.

Emily :

Yeah.

Meg Dattoria:

Public.

Emily :

and you, that yeah. That one you don't get to ship.

Meg Dattoria:

No, you don't get to ship, and it's like digitizing a hundred objects all at once. Really just the control panel alone having to get around each and every knob is, it's huge.

Nick:

So it's kind of like how your phone does panoramas only instead of breadth it's depth and you're stitching together thousands of photos for detail instead of a dozen photos for the width of the horizon.

Meg Dattoria:

Right. Exactly.

Nick:

Okay.

Meg Dattoria:

Yeah.

Nick:

How do people get involved?

Meg Dattoria:

So all of our downloads are available on our website. It's 3D.si.edu, or you can just Google Smithsonian 3D.

Nick:

We mentioned at the top of the show that a bunch of this super complex scan data that Meg just described was used for this thing called Project Egress, which was the brainchild of project manager and engineered Jen Schachter and Adam Savage, who you may remember from MythBusters back in the day. Project Egress, re-imagined the Apollo 11 command module hatch in a really wonderful way.

Emily :

Right and I remember this went on really long. There was a live stream on Facebook from the museum and I had it on my other monitor.

Nick:

Oh yeah, it was like five hours long.

Emily :

It was really long.

Nick:

What were you seeing on your live stream for five long hours from the museum?

Emily :

Right, so Adam, Jen and Andrew were assembling all of these components into a replica or sculpture of the hatch.

Nick:

So the stage was just scattered with pieces and boxes and tools,

Emily :

Packing materials, papers, plans, lots of blueprint, looking things.

Nick:

We were basically watching somebody assemble a model or replica for several hours, but there were hundreds of people in the gallery.

Emily :

So many people.

Nick:

Watching them do this. One of the special things about this replica was that each piece had been machined or sculpted or printed by an individual artist.

Emily :

These aren't all traditionally 3D printed items, some of them are 3D printed but not necessarily 3D printed out of plastics. They're all sculpted or carved, or like you said, 3D printed out of whatever medium that individual was specializing in.

Nick:

So we invited Adam Savage and Jen Schachter from Project Egress, as well as all of their other myriad projects into the studio while they were here for the program to tell us a little bit more about it.

Adam Savage:

Project Egress is a collaborative exquisite corpse, calico quilt of a piece of Apollo hardware.

Nick:

Wow. That was lyrical.

Adam Savage:

That is not all mine. We've had many fans coming up with all sorts of wonderful nomenclature for this project. It is basically a very exacting replica of the Apollo 11 command module hatch with all of its mechanics intact except built by 45, separate maker spaces all over the world.

Jen Schachter :

In all different mediums and colors and it's yeah, it's definitely a quilt a calico representation.

Adam Savage:

Jen was, is the project lead on this, she's the one that's been wrangling all the cats from all around the planet to get all these parts here and they are all here and we are still not sure that they're all aligned with each other, but that's what we're going to figure out in the build.

Nick:

Why the hatch from Apollo 11's command module?

Adam Savage:

It struck all of us as a phenomenal opportunity to bring the amazing technology home and by home, I mean none of this is stuff created by a bunch of Albert Einstein's out there. It's created by people like us with lots of restrictions and difficulties and collaborations and institutional complications, and yet they got it across the line.

Nick:

Right.

Adam Savage:

And so in that way, the execution of Project Egress is a perfect analogy to me for the incredible feat that is NASA's achievement of getting us to the moon and back.

Jen Schachter :

And this one's a little bit different, so the last big community build that we did was a six foot tall sculpture of Rosie the Riveter that was fully 3D printed, about 750 contributors from around the world, 2,600 parts but they were all flat surfaces. They all... The occlusions were, just face-to-face glued together. So we had, flat geometries to glue together, not terribly complicated other than it was six feet tall, and we had to figure out the skeletal structure to support such a thing.

Adam Savage:

Tremendous amounts of weight.

Jen Schachter :

Yeah, but this one is totally different in its assembly and that it's a mechanical object. So there's bolts going through things, there's whole patterns, all of the part tolerances, there's many more occlusions and joints that we have to consider than just flat faces, so this'll be a new challenge for us.

Nick:

Way more complicated.

Adam Savage:

The file that we used was started as scans and then incredible modeler, andrew Barth actually turned it into a mechanically working model and then you had to take that in separate it into four, choose 45 sections in which to distribute to everybody.

Jen Schachter :

Essentially cold emailing and just saying, "hi, I'm Jen, you might've heard of Adam Savage. Would you like to build a part of this Apollo 11 hatch?" And most people aren't familiar with this as a machine even if they are historically. So to take all that information which is highly technical engineering information and translate it in a way that a maker can then bring into their own shop and manufacturer in their own medium, that makes sense to them.

Adam Savage:

CNC'd out of woods, CNC'd out of foam there's some cast aluminum parts, there's machined aluminum parts, there's wood, there's ceramic.

Jen Schachter :

There's a ceramic piece, there's lots of embedded electronics, some lighting, there's an NFC tag in of the pieces.

Adam Savage:

Right, right, right.

Jen Schachter :

Yeah, people really kind of took this and, how a piece of space hardware might be interpreted by a ceramicist or a jewelry maker is a really interesting concept.

Adam Savage:

To me it widens the story, obviously we're at the Smithsonian, we're here in a palace of stories about,

Nick:

I love that.

Adam Savage:

How we are with the way we are and the ways in which the world works around us, and it just, it's all about widening that story. So that to me some kid will look at this and think, Oh, this isn't something smart people do this is something I understand and I could do, because that dichotomy of this is something smart people do is a mistake I made when I started making MythBusters. I thought of science as something smart people did and by saying that to myself, I didn't realize I was placing myself outside that category.

Nick:

Right.

Adam Savage:

But I think a lot of people do that, and the goal here is to widen the effect of making this a more commonplace with people who might find it really interesting.

Nick:

This'll be in a museum fully assembled. What do you hope that people who see it on display take away from this hatch?

Adam Savage:

I think people who visit this museum plausibly have already seen another hatch or a hatch in a different location, and they'll look at this one and it's going to look weird. It was really purposeful, we asked each maker to choose their own fit and finish and polish. It's going to draw your attention as like, what was this? It's like the same reaction I imagine someone would have looking at dazzle painting for the first time, which is black and white zebra stripe camouflage from World War II, and as they move closer, the entire story of the hatches on the four plaques on its base. So it is a self-contained I think education unit I would say and I would hope that someone coming to engage with it and reading this would, "Oh, wow. Look at these 45 different maker spaces" and "Wow. Look at that one, that one's got for on it. This one's got googly eyes. This one's painted in a really weird way." That they would see themselves in the fun that is extant in the execution of the pieces of this.

Jen Schachter :

I've always been struck by when I go to an exhibit about a piece of space technology, for example, how different it feels and going to an exhibit about an anthropological piece of an artifact or something, because in those anthropological artifacts, you can see oftentimes you can see the hand of the person, the crafts person who made this object but when you're looking at stuff that was made by machines, you lose the connection to the human hand and the mind that conceived of this thing and actually manufactured it and so I think in a way, making the hatch and all of these different mediums and wonky colors and things brings it back home as seeing the hand of the builders and the mind of the people that made this.

Adam Savage:

That's lovely.

Jen Schachter :

And it connects you more to the humanity of this piece of technology than you would necessarily, you might take for granted looking at the actual artifact, because it's such a cold piece of machinery.

Adam Savage:

Yeah.

When you talk to NASA scientists and engineers, actually, frankly, when I talk to any working scientists, they love their job. They love their work. They find it endlessly fun and whether their work is collecting bat guano or fruit fly mating rituals, they are absolutely obsessed with that work and to me, I love to bang the drum that science is not an avocation, it is a vocation. That engineering is the same and that if we separate ourselves from these things, we're actually limiting what's possible. So I hope a kid can see this hatch assembled on the floor and see themselves in some part of it and allow a little bit more latitude with what explorations they might be interested in.

Nick:

That was Adam Savage and Jen Schachter from Project Egress, talking about the Apollo 11 command module hatch that they re-imagined and reassembled here at the National Air and Space Museum. I think this is the beginning of a really wonderful new way to experience public history and to experience the collection here at the Smithsonian.

Emily :

That's it for this episode of Airspace.

Airspace is produced by Katie Moyer, Jocelyn Frank and Michelle Harvin, mixed by Tarek Fouda.

Special thanks to Genevieve Sponsler and John Barth.

Nick:

On our next episode, we will talk about the real story of adventure behind The Little Prince, one of the best-selling children's books of all time.

Emily :

Follow us on Instagram at Airspace podcast.

Nick:

Adam Savage sat in Emily's chair.

Emily :

Why didn't you have him sign it?