

AirSpace Season 6, Episode 1: 99 Luftballons

*Please note: in the audio of this episode the German is overdubbed with an English translation. In this transcript the German will appear first, followed by the English.*

*Music up the under*

**Emily:** Welcome to AirSpace from the Smithsonian's National Air and Space Museum. I'm Emily.

**Nick:** I'm Nick.

**Matt:** And I'm Matt.

**Nick:** Ordinarily, a hot air balloon ride is lighthearted, fun, and not particularly hair raising. But what if a hot air balloon is your best chance of escaping into a better life?

**Matt:** And what if you're in 1970s East Germany and you have to figure out how to do all of this by yourself while finding all the materials and gathering them without getting caught by the authorities or seen by the neighbors that are most likely spying on you?

**Emily:** On this episode of Air Space, we're telling that story and also learning the proper way to make a balloon if you're doing it for fun instead of trying to escape an oppressive regime. Welcome to season six of Air Space, presented by Olay.

*Music up and out*

**Nick:** In 1978, this incredible escape story starts with a magazine, an illegal magazine delivered by a sister-in-law from the West into the hands of a man named Günter Wetzel.

**Günter:** “Ja, mein Name ist Günter Wetzel, ich bin 1979 am 16. September mit meiner und einen weiteren Familie mit einem selbstgebauten Luftballon aus der DDR geflohen.”

**Translator (Shane):** Yeah, my name is Günter Wetzel and on September 16th, 1979, together with my family and another, I fled from East Germany in a self-constructed hot air balloon.

**Matt:** We interviewed Günter in his native language of German. The English voice that you hear is translator Shane McMillan.

**Emily:** And in 1978, Günter took that illegal magazine article and showed it to a coworker named Peter Strelzyk. Before that, they had been talking and daydreaming about leaving East Germany. And really you had to be careful about who you had these conversations with because you never knew whether or not somebody was a spy or somebody was going to turn on you and turn you in to the authorities for even talking about the possibility of leaving.

**Matt:** Yeah, that's right, Emily. You know, if you found someone who you felt you could trust, if, you know, you, you sort of got the sense after a while that they were sort of a like minded person who you could confide in. You know, that's when those conversations could begin and people could discuss kind of sincerely how they felt about the regime and about their desire to leave.

**Emily:** So the magazine article that inspired them was about the annual balloon Fiesta in Albuquerque, New Mexico, which is still on my bucket list. And so they got the idea from this magazine article. And so they had to spend a lot of time and energy to try and find design ideas, design materials and any kind of information they could get about the physics of how balloons even worked.

**Nick:** Yeah, it's really grounding when you hear that part about the magazine article. The Albuquerque Balloon Fiesta is something that we've all seen pictures of, and the idea that leafing through a magazine is what provided the spark for this idea is really grounding in a way. You know? I kind of came to this story thinking that they knew how to build balloons,

**Emily:** Right? They had to teach themselves how to do this. And as you might expect, there was significant amount of trial and error. If you're a scientist, if you've ever done some experiments, maybe you're not a scientist, maybe you like to bake how many times does it take for you to perfect a batch of cookies? Right. Like just from a recipe that you have directions, right? You have written directions for? It still takes a couple of tries. They did it in three balloons, right? They built three balloons. And on the third balloon, they made their escape. That, to me is incredibly impressive, especially for two folks who are inspired by a magazine article and had incredibly limited

resources and incredibly limited access to any materials they could use to do this super dangerous thing.

And they did it in three tries that still, that kills me.

**Nick:** So when I when I hear about death defying escapes over from East Germany to West Germany, we always picture 1960s East Berlin. But that's not that's not where the story starts out.

**Matt:** Yeah. They were living in a very small town in East Germany. Out in the countryside, really in what was what had grown up from a kind of a medieval village in Germany. Not the most urban place, to be sure

**Nick:** And it sounds really picturesque and that's a lovely landscape to insert a hot air balloon story. But the thing that we shouldn't forget is that the Communist ruling party of the German Democratic Republic, sometimes called the GDR, was very much a present in their lives, no matter how far out into the countryside you went.

**Günter:** Du musst da natürlich ein bisschen unterscheiden zwischen dem privaten Bereich und dem öffentlichen Bereich. Privat war das Leben schön, es ging uns soweit ganz gut. Allerdings alles was mit Öffentlichkeit zu tun hatte wurde das dann schwierig. Man wurde beobachtet, man wurde bespitzelt, man musste Einschränkungen hinnehmen wenn man nicht mit dem System zusammengearbeitet hat, denn ich war dazu nicht bereit in die Partei einzutreten, ich war politisch nicht aktiv und das hat bei mir natürlich angekreidet. Dann kam dazu, als ich fünf Jahre alt war, hat jetzt mein Vater verlassen und ist damals schon in den Westen gegangen. Und das ganze hat für mich dann Probleme gebracht, obwohl ich nicht dafür konnte und wir kein Kontakt zu mein Vater hatten. Ich wollte noch die 12 Klasse nachmachen in der Abendschule, und wollte gern Physik studieren, und dann hiess es die 12. Klasse kannst du schon nachmachen, bloss ein Studienplatz gibts keinen weil der Vater im Westen ist. Und dann war ich natürlich zusätzlich nicht bereit in die Partei, die SED, einzutreten und musste dadurch alle mögliche Einschränkungen hinnehmen. Ich wär nicht weitergekommen beruflich oder sonst der Gleichen. Und das ist halt vielen, in ähnlicher Weise passiert und das zeigt schon mal wie die mit ihren Menschen angegangen sind. Und wer nicht bereit war mit diesem System zusammen zu arbeiten, der musste immer wieder Nachteile in Kauf nehmen.

Translator: Well, you have to differentiate between private and public life. In our personal lives, life was nice, things were good for us. But as soon as you moved into public life, things got hard. You were observed, and people spied on you, and you had to deal with restrictions. And because I was not willing to join the single ruling party and was not politically active, I was a marked man.

Furthermore, my father left us when I was five and went to the West. And this caused a lot of problems for me, even though I couldn't do anything about it and I didn't have any contact with my father. I wanted, for example, to repeat the 12th grade in night school so that I could study physics. And they said, 'yeah, you can repeat the 12th grade, but there won't be a spot at the university for you because your father is in the West.'

And because I, of course, did not want to join the party, the SED, I had to deal with all kinds of restrictions. I wasn't going to get anywhere with my career or anything else. And that happened, in one form or another, to many people, and really shows how they dealt with their people. Those who were not prepared to work with the system, were going to have to put up with the consequences.

**Emily:** So their first attempt. Right. So we said there's three attempts and their third attempt was successful but it's important to talk about the first attempts because there was a lot of trial and error involved in this because there wasn't a lot to go on. Right? So their first attempt really, in my mind, I think of it as figuring out the right fabric, because the fabric that they used in the first attempt wasn't airtight enough and so it couldn't hold enough of that hot air and so it couldn't actually rise. And so that's where they figured out the fabric that they choose to make the balloon out of really, really mattered because it needed to be able to hold all the air and that was actually going to inflate the balloon. And so that was kind of the big first lesson they had from balloon number one.

Nick: After the first attempt is a good time to know that we're talking about how isolated they are, and that's true. And how hard materials were to come by, also true they did get the inspiration for this from a magazine article, but these were capable guys. Günter wanted to be a physicist and they were isolated, but they had space. They had workshops and garages and things to tinker around with and work in. And that's how they were doing this trial and error.

They had so much space and so much ability that at one point Günter thought about building an airplane instead of a hot air balloon.

Matt: After the first attempt, the Wetzel family walked away from the project temporarily. And Günter started working on some other ideas, like the plane. And Günter wasn't really happy with the design of the second balloon because he thought it was too small for all eight of them. And as it turned out, it was too small. When the Strelzyks tried to fly the balloon on their own, it was too small even just for the four of them.

**Günter:** Dann hat im Juli, 1979, der Peter Strelzyk sich mit seiner Familie den Versuch gewagt mit der Ballon zu fliegen. Das Ganze hat aber nicht geklappt, denn es sich hier bestätigt dass der Ballon doch zu klein war. Wir haben Wolkenberührung bekommen, der Ballon ist dadurch schwerer geworden, und ist gesunken noch auf DDR-Seite und damit der Flucht verunglückt. Nach diesem missglückten Versuch kam Peter zu mir, ob ich nochmal mitmachen, den konstruiert und gebaut hab ich die Ballons. Und da ist es mir mittlerweile schon klar geworden dass mit dem Flugzeug wird wohl doch nix werden. Und es war auch klar, der Ballon funktioniert, es muss nur gross genug sein. Deswegen habe ich entschiede, da wieder mit zu machen.

**Translator:** Then, in July 1979, Peter Strelzyk and his family risked an escape with the balloon. But the whole thing didn't work, which confirmed that the balloon really was too small. The balloon touched the clouds and because of this took on weight and sank while still over East Germany. And with that, the escape attempt was unsuccessful. After this failed attempt, Peter came to me and asked if I would rejoin the effort, because I was the one who designed and built the balloons. And because it had become clear to me that it wouldn't work with a plane...and it was also clear that the hot air balloon worked, that it just needed to be bigger...I decided that I would rejoin them

**Emily:** We mentioned that the fabric was really, really important and that the fabric that they used for balloon number one was way too permeable. And so the second balloon was actually made out of taffeta, which was a fabric they could get their hands on and actually held the air the way they needed it to, but it was just too small. And so even though it was too small when the Strelzyks crashed in East Germany, they hadn't made it to West Germany. They were much more worried about getting caught than they were being able to lug this thing back with them. And so they left it there. Now, balloon number two is in the hands of the authorities, which leads us right into balloon number three.

**Günter:** Und in diese erste Woche gab es die erste kleine Dämpfer für uns: In unsere Tageszeitung „Volkswacht“ hat es sich genannt, waren ein Bericht drin, „die

Volkspolizei bittet um Mithilfe beim Begehen eine schweren Straftat, wurden von die Täter die Gegenstände hinterlassen.“Und dann war uns klar, die suchen nach uns. Allerdings war auch klar, wenn die was in der Zeitung schreiben, dann wissen die nix. Dann hätten sie sonst nicht reingeschrieben.”

Und das ganze war so unklar, das man ohnehin kaum was draus machen könnte. Und uns war dadurch ein bisschen Bewusst, dass die uns vielleicht unter Druck setzen wollten.

**Translator:** And in this first week, that is when the first small setback came: In our paper ,“Volkswach,t” The People’s Watch, that’s what it was called, there was a small report “the people’s police are requesting assistance, criminals left behind items during the perpetration of a high-level offense.”

So at that point it was clear, they were looking for us. But it was also clear that if they were putting this in the paper, they didn’t know anything. Otherwise they wouldn’t have written this. The whole thing was so unclear that one couldn’t really do much with this information anyways. And through that, it was also a bit clear that maybe they were trying to pressure us.

**Matt:** Yeah. So now the pressure is on. They know they have a fabric that works and they've basically got all of the principles down for building the balloon. But they know that. The authorities know that someone's doing this and they need to gather all of the materials to build an even bigger balloon and then launch it and fly safely across the border. So, you know, they have to get a lot of material and get it in relatively short amount of time so that they don't get discovered by the police. And so they have to basically kind of go out and buy little amounts of material a little bit at a time. Each person going to different stores until they have enough to build the big balloon.

**Nick:** Around that same time, Günter got basically a draft notice. He was told that he was going to need to report for military service and if there's anything worse than living under an oppressive regime, it's probably being a soldier that's helping to do the oppressing. So Günter had a bunch of vacay time saved up at work. He took leave and started working on this around the clock.

**Matt:** So the failed balloon launch was in July, 1979. In August, the newspaper ran the article which let them know that the authorities were on to them. And just a month later in September, they had the third balloon ready to make what they figured would be their last chance at a balloon escape.

**Günter:** Samstagabend um 10, war der Ballon fertig. Dann bin ich gemeinsam mit Peter nochmal in die Nähe auf dem Berg gefahren. Wir haben dann die Finger in der Luft, okay Windrichtung passt, und damit war klar, wir werden es in diese Nacht versuchen.

Translator: On Saturday evening at 10 p.m. the hot air balloon was finished. Then, together with Peter, I drove up to the nearby mountain. We put our fingers in the air, “okay, the direction of the wind will work,” and with that, it was clear that we would make an attempt on that night.

**Emily:** So kind of continuing on the theme of trying really hard to be inconspicuous, shoving eight people into one vehicle and trying to drive them further into the countryside into a proper launch site with all of your balloon supplies is probably not going to work out.

So what they did is they split everybody up to drive from their homes to the launch area that they had selected.

So they use their fan to inflate the balloon and heat the inside air. And then they climbed into their homemade basket attached to their homemade balloon

**Günter:** Das heißt die zwei Frauen jeweils in einem Eck, die zwei Söhne von S. in einem Eck jeweils, waren die 11 und 15.

Und meine zwei Söhne haben die zwei Frauen auf dem Schoß genommen. Und wir zwei Männer sind eingestiegen und haben uns in der Gondel gestellt, weil nicht genug Platz war für Anderes. Jetzt muss ich eine Information ein bisschen vorab geben, ab diesem Zeitpunkt, also wir loslegen könnten. Hatten wir im Grunde alle Gefühle ausgeschalten.

Wir habe eigentlich nur noch funktioniert. Peter hat jetzt Gas gegeben mit der Brenner und es war so ausgemacht, er kümmert sich ums Technik; ich kümmere mich um die Navigation. Jetzt hat die Gondel vom Boden abgehoben. So die Gondel hat abgehoben, um aber zu vermeiden das wir dich leichtem Boden Wind abgetrieben werden, hatten wir die Gondel mit vier Seilen am Boden verankert. Wir haben jetzt die erste zwei Seile diagonal durchgeschnitten, und jetzt hat sich die gesamte Kraft auf die verblieben zwei Seile übertragen.

Das hat dazu geführt dass ein Anker aus dem Boden gerissen wurde und nach oben geschneilt ist, und ist dem Frank Strelzyk auf dem Kopf gestossen, der hat geblutet. So, dadurch das der Gondel nur noch an einem Seile an der Ecke hing, hat sie sich zur Seite geneigt und durch diese Seitenneigung hat sich natürlich die Brenner zur Seite geneigt. Und dadurch ist die Flamme in der Ballonhülle geraten und die Ballon hat zu brennen angefangen. Der Stoff hat angefangen zu Brennen...

Ich hab mir gleich die Feuerlöscher geschnappt, den wir dabei hatten und hab den Brand wieder gelöscht. In der Zwischenzeit haben es die Anderen geschafft das letzte verbliebene Seil doch durch zu schneiden. Jetzt hat sich die Gondel wieder schön geradeaus gerichtet, und dann ging es sehr zügig nach oben, denn der Brenner hatte eine gewaltige Leistung gehabt. Allerdings hat sich der Ballon durch das schnelle steigen angefangen zu drehen, und dadurch habe ich ein bisschen die Orientierung verloren. Und wir wussten jetzt nicht wirklich wo wir tatsächlich sind. Wir sind davon ausgegangen dass die Grenze hell beleuchtet ist, das war es aber nicht, es war völlig dunkel. Und ich hab im Nachhinein von ehemaligen Grenzern erfahren das die einen Tarnbeleuchtung hatten, die hats zwar Waagerecht ausgestrahlt um eventuell jemanden zu sehen wenn jemanden läuft, aber der Boden würde nicht angeleuchtet. Das einzige was wir gesehen haben war die die Ferne, war ein hell erleuchteter Kreis, das war der Grenzübergang an der Autobahn.

Der aber zwölf Kilometer weit weg ist und da haben wir uns schon Sorgen gemacht ob wir das überhaupt schaffen so weit zu kommen. Dann ging plötzlich drei Scheinwerfer an, zwischen diese hell erleuchtete Kreis und uns, und diese drei Scheinwerfer haben versucht uns zu erreichen, die waren aber nicht stark genug, die haben uns nicht tatsächlich erreicht. So die Scheinwerfer sind nach kurzer zeit wieder ausgegangen was aber auch ausgegangen ist, ist unsere Brenner.

Da wir mittlerweile -8 C Temperatur hatten, wir waren auf 2,000 Meter Höhe, sind wir davon ausgegangen dass unsere Gas zu kalt geworden ist. Wir mussten dann feststellen, dass das Gas nicht zu kalt, dann alle ist...Und von diesem Augenblick ging es dann nur noch abwärts, wir könnten nicht mehr einwirken, denn die Flamme war aus. Dann habe ich nur noch unsere Landescheinwerfer eingeschaltet und hab um uns herum geleuchtet einfach um nur auf uns Aufmerksam zu machen. Und im letzten Augenblick habe ich noch ein paar Baumwipfel unter uns durchrutschen sehen, und dann hats schon gekracht, und dann waren wir am Boden.

**Translator:** The two women each took a corner, Peter's two sons each took a corner, they were 11 and 15 and my two sons were placed in the women's laps, and we two men climbed in and stood in the basket, because there wasn't space to do anything else. And now I have to give you a bit of information in advance: from the moment that we could take off, we all just shut off our emotions. We were just functioning.

Peter now turned up the gas on the burners because we had arranged that he take care of the equipment and I took care of the navigation.



And now the basket lifted off the ground. So the basket had lifted off the ground, but to prevent the balloon from being pulled away by a light wind, we had anchored the basket with four ropes. So we now severed two of these ropes, and now all of the force was transferred to these two remaining ropes. And then one of the anchors the ropes were attached to ripped up out of the ground, flew up, and hit Peter's son Frank on the head, which started to bleed.

And because the basket was now hanging by only one rope on one corner, the whole balloon started to hang sideways. And because of this the burner was also tipped, of course.

So the flame was thrown up onto the balloon's envelope, and the balloon started to burn.

*Translator : Also, der Ballon an sich? Der Stoff?*

Translator: So you mean the balloon itself? Like the fabric?

The fabric started to burn... I grabbed the fire extinguisher we had brought with us and put it out.

In the mean time, the others had managed to cut through the rope. And now the basket righted itself and we flew upwards very quickly because the burner had had a tremendous output. However, through this rapid ascent, we started to spin. And because of this, I lost our orientation. And we didn't really know where we were. We had assumed that the border would be lit up, but it wasn't, it was totally dark.

I later learned from former border guards that they used blackout lights which were projected horizontally, so you could see if someone was running, but they did not light the ground. All that we could see was in the distance, a brightly lit circle. This was the border crossing of the autobahn. But that was 12 kilometers away and we started to worry that we wouldn't make it that far.

Then three searchlights came on, between us and this brightly lit circle. And these three lights were looking for us, but they were not strong enough and didn't reach us. So after a while, they went off. But what also turned off? Our burner...

At this point it was -8 Celcius, we were at 2,000 meters in elevation, so we assumed that our gas had just gotten too cold. But then we figured out that the gas was not too cold, it was empty.

And from this moment on, we would only descend. We couldn't do anything else, the burner was empty. So I turned on our landing lights and flashed them around beneath us

trying to get attention. And then, in the last moments, we brushed over a few treetops, and then there was some cracking, and then we were on the ground.

**Nick:** And so the landing went as well as you would expect, a homemade balloon landing to go. Günter did injure his leg in the landing. He tore a muscle, but they started walking across the farm fields that they had found themselves in, trying to figure out which side of the border they'd landed on. And since the border wasn't lit from the air, that's actually more difficult. This is back when we remember we're not in Berlin. Eventually they left the kids and the wives hiding in some bushes, and they walked out onto a street.

**Günter:** Wir sind wieder ausgegangen auf die Straße und dann kann ganz langsam ein Auto auf uns zu. Hat angehalten und auf Standlicht geschaltet. Und da haben wir am Kühlergrill vier Ringe gesehen, und da wussten wir es ein ein Audi, damit war im Grunde klar dass wir es geschafft haben und es kam dazu das diese Audi war Polizeifahrzeug. Trotzdem sind wir an die Tür gegangen, die haben die Scheiben runter gekurbelt, und Peter hat die Frage gestellt, „Jetzt sind wir hier im Westen?“

Und da haben die gesagt „Ja natürlich, wo sonst?“

**Translator:** So we then, again, went out onto the street, and then we were approached very slowly by a car. It stopped and switched on the parking lights. And we could see four rings on the grill, and we knew it was an Audi, and with that we knew that we had made it, because this Audi was a police car. So we went around to the door, and they rolled down the window, and Peter asked “Are we in the West here?” And they answered “Well of course, where else would you be?”

**Matt:** So after all that work, after risking their lives and leaving everything behind, they made it.

**Emily:** So the relationship between Günter and Peter would have disintegrated a little bit after their heroic escape from East Germany to West Germany. And most of that had to do with how to tell the story and how to deal with the publicity surrounding the story. And so they didn't really see each other after their escape to West Germany. Günter trained as a mechanic and worked in the auto industry. But what I really liked about this part of the story is, you know, we had mentioned that there was initially some thoughts floating around in Günter's mind about maybe trying to build an airplane to

make this escape. And so after he reached West Germany, he learned to fly and got his pilot's license, but never actually got his balloon pilot's license.

**Matt:** Well, eventually, Günter moved back to East Germany and he moved back in 2019. And he's been living there ever since.

**Emily:** So we could've told you this story by doing the review of the more than one movie that was made about this escape. But we decided we wanted to give you the best factual rendition of this story that we could.

But if you want to go watch the movies and maybe tell us your movie review, you can watch one of two movies or both. You know, if you're feeling like you've got some extra time. There was one made in 1982 called *Night Crossing* and one made in 2018 called in German, maybe, *Ballon* has one less O than in English Günter also has a website that talks about this story and also has lots of photos and sort of detailed schematics of the balloon.

And that website is...

**Nick:** [ballonflucht.de](http://ballonflucht.de)

**Emily:** We're going to link that on our social, but just, you know, go, go follow our social and you'll find it there.

*Music button*

**Nick:** Successfully escaping East Germany and managing to find out how to build a hot air balloon under the nose of the Stasi is impressive. But we wanted to know just how impressive. So we found a modern balloon maker in New Jersey. That's where Keith Sproul and his group of helpers make and fly hot air balloons. Keith has a garage full of balloons, a big garage full of balloon

*Keith Ambi the lights because of cold will take a while to come up*

**Nick:** He owns many professionally manufactured balloons, like the special shapes that he's got, this dragon and a birthday cake, and he gets paid to fly those festivals but most of what Keith does with balloons is just for fun. He doesn't do any paid rides.

**Emily:** So he's kind of like some of the telescope makers that we've met in past seasons where they're really interested in a thing and they have professional grade ones, but then also for fun, like to grind their own mirrors and build their own telescopes. Is Keith sort of the same way? He has a bunch of professional balloons that he uses for business purposes, and then he's got his, like, side hobby where he likes to build them himself?

**Nick:** Yeah, yeah, yeah, yeah. And the infrastructure, Keith's infrastructure, when you see it, feels more like more than a hobby to me. But you hit the nail on the head there. A lot like telescopes where even if you own professional ones, once you know how they're built, some people just can't help themselves and have to make more. And that's that's what's going on in Keith's, in Keith's shop,

**Matt:** Yeah, there are some activities where it's like the word hobbyist or the word amateur just doesn't really seem to cut it. Right? This seems like one of those circumstances.

**Nick:** Yeah. So for Keith, it was a natural progression from being on a ground crew for hot air balloons to learning to fly them, to buying his own, to traveling with them. And now he makes his own. He's got a workshop in his house near Rutgers University, and visited him and saw how balloons get made

**Keith:** Upstairs as my workshop. This is what would have been a living room.

**Nick:** So I say workshop up, but it's actually it's a couple of different spaces. So he's got that enormous garage that I mentioned a minute ago where he stores a lot of his balloons. And then you come in in a side door to his house and there's this narrow carpeted staircase going upstairs. And then there's like this mother in law suite that he has taken over with his balloon manufacturing equipment. And there's what would be a really big living room type area. And it feels less expansive because of the gigantic work table in the middle.

**Keith:** This is my cutting a table. It is six foot by 12 feet. No, you don't have to have something as big as this, but it's convenient. And there's stuff everywhere

**Nick:** And at one end of the room mounted to the walls are big, big rolls of like windbreaker fabric, nylon fabric that just roll out onto the table. Which is a work table that's, you know, got a grid on it so you can see and measure things. And it's covered with

a couple of tools. And then the walls are lined with additional equipment and then books on the art and science of ballooning.

**Matt:** So what kind of equipment are we talking about here? Are we talking about like big sewing machines or like guillotines for cutting fabric? What are we what are we looking at?

**Nick:** So I'm glad you asked. A guillotine would have been exciting, but I don't know that it would have fit in the room. So there's the cutting table itself and then surprisingly little equipment like on the space. He actually said, 'hand me the pizza cutter, but don't touch the blade. It'll cut your finger off' and it's not an actual pizza cutter, but it looks like it. It's a it's a it's a rotary cutter. Same design as a pizza cutter, but much sharper. And that's what he uses to cut the fabric panels on the cutting table.

He said that he can operate all of this by himself, but it's much, much faster if he has a friend come and help. So there are boxes and all this stuff along the walls. But really, I think his level of mastery of this art is such that most of the time the way that it looks is just him pulling fabric across the table from these spools on the wall and then \*zip, zip, zip\* cutting up the panels.

**Keith:** See the seam right there? The white?

**Nick:** mmhmm, yes.

**Keith:** This is a half gore. The straight part is where the where the load tape runs up. So it is straight on that seam. And there's a curve, you can see it there good and there good. Where these come together. You see where the white is?

**Nick:** Yeah.

Keith: Okay. If I were to take my piece of fabric and lay it down this way and cut it, I'd have a fair amount of waste.

**Nick:** So the gore is the piece that runs all the way from the bottom of the balloon to the top and it's sort of banana peel shaped. And the piece that was missing in my mind that I didn't understand was that you don't cut the gore out of one big strip of cloth that comes off of the roll.

You cut out smaller panels so that there are horizontal seams along the gore in some balloons. This is really easy to see because the horizontal seams help build the colorful patterns.

**Emily:** So you're constructing a Gore, which is the long vertical piece out of the shorter horizontal pieces.

**Nick:** Mmmhmm. And by cutting the shorter horizontal pieces, you end up with less waste because you're not cutting these big vertical corners off the gore.

**Emily:** But where does it where does it all come from? I mean, what we think of today as a modern hot air balloon is sort of that kind of bulbous upside-down teardrop shape but balloons are old, right? Like hot air balloons are. It's not new technology. So what is what is Keith basing his designs off of and where is that all from? I mean, are we talking about Keith using patterns from the 1800s when people were first starting to mess with balloons? Like has that technology changed a lot over the years?

**Nick:** Yeah, it actually has. And I think it has less to do with like Auto-CAD level technology and more with like design optimization. So if you picture a modern hot air balloon like the ReMax Realty balloon or any traditional teardrop shaped balloons, the thing that you're not picturing is a net over the top of it. That's like the old, old timey, like 19th century version of the hot air balloon, the very early ones, and the net was there to kind of keep the thing in shape. But in the 1960s, a guy by the name of Justin Smalley kind of revolutionized balloon design. He was under contract with the U.S. Navy in the 1960s to try to figure out if balloons had military applications. But while he was doing that, through, kind of, trial and error and engineering experimentation, he came up with this design that's like the design of modern hot air balloons that eliminated basically all of the wrinkles.

**Keith:** This one right here. This is the exact design. This is a Smalley design balloon.

**Nick:** You can fly a hot air balloon with wrinkles, but it's not ideal so..

**Emily:** Wait, you mean like actual wrinkles in fabric? Not like wrinkles in the plan.

**Nick:** Yeah, yeah, yeah. Like wrinkles in fabric. So like when I when I went in to the workshop what I was kind of picturing was a globe. If you've ever seen a globe being made, the cuts, the strips of paper, that go on to the outside of a globe, go all the way from the top to the bottom. Well, that's not the best way to create a hot air balloon. You get wrinkles and wrinkles are areas of the balloon that are not lifting you up into the sky. So what Smalley did was really drill down and come up with a design that was Sigma

Zero, even pressure all the way throughout the entire balloon. So now you get the modern balloon shape that we're familiar with. It's the one that you see in the sky. And the one you have all the festivals where it's got the seams running up all the way from the top to the bottom, and then also horizontal seams that you can see, and that's the Smalley design.

**Emily:** So this is really interesting because I like to make maps. I like to look at maps and maps are really interesting because there's a lot of design that goes into them because making three dimensional objects like the Earth into two dimensional things like maps create mathematical wrinkles, taking two dimensional fabric and making it into a three dimensional object that doesn't have any pressure points, that isn't going to rupture or have additional points of stress on it. It's the same problem, but in reverse. And I hadn't thought about it before until we started working on this episode, that the reason this formula that Smalley came up with was so important and why wrinkles are a problem is that they can cause these stress points and cause points of failure. But there's a challenge in making two dimensional things into three dimensional things and vice versa.

**Matt:** But if you're a Günter and Peter, you don't really care if it's wrinkly as long as it flies and can carry you and your family out of East Germany.

**Keith:** Well, you just make a round balloon

**Nick:** Sure.

**Keith:** If you don't know what you're doing is the round and it'll work, it's got a little bit extra fabric. It's going to have stresses in places where, but you only have to fly the damn thing once

**Nick:** Right.

**Nick:** So homemade hot air balloons come in a lot of variety. Sometimes you're escaping East Germany, but sometimes you just want to fly around. The balloons that we saw Keith making are designed to fly for like 500 hours over the course of their life. Günter and Peter really only needed an hour or so out of theirs. So what we saw was a lot more sophisticated but who just wants to see balloons being made when you could potentially fly in one?

**Keith:** Good morning,

**Balloon pilot:** Looks like a great morning to fly

**Keith:** It's a freaking gorgeous morning

**Nick:** Not me, as it turns out. So I did not fly in the balloon that day, but I did ride in the chase van while our producer, Jen, went up.

**Balloon helper:** So how was the flight?

**Producer Jen:** lovely *laughs*

*All laugh*

**Nick:** So we we get up there at like Zero Dark 30 balloon launches or generally at dawn. And so we got up there around in the 5:00 hour. So we get there. It's a big empty field. That's that's where you launch balloons from. And Keith pulls up in this big red van that is completely kitted out. And he's got a trailer and he hauls a bag that's smaller than you would think out, and that's the balloon. And so we started unpacking it, unfurling it with a couple of his friends that had arrived. There was another group flying that day in a separate balloon. So we're doing this side by side and they bring out the big fan. And let me tell you, that morning got that much colder when they turned on that fan, but then warmer again when they started testing the burners.

**Matt:** So Günter and Peter, they designed their balloon to survive their one very important flight and they also really just had to fly up over and then down once they were across the border. But actual balloon flights and balloon technologies are a little bit different from, you know, that that one very important flight that that they made with their families.

**Nick:** Yeah. So like the burners that Günter and Peter were using probably put out like 6 million BTUs, which is lower, but still in the same ballpark, actually. The balloon that Keith flew Jen in and then I followed along in the Chase car, put out like 35 million BTUs. So it's enough. But that also kind of informs the flight pattern of the balloons,

**Emily:** Right, so rather than kind of going up and then back down, which is what Guenther and Peter and their families did, your sort of average balloon flight with professional balloon air and a professional balloon that is meant to fly at least 500 hours before the thing disintegrates with modern burners and all that are designed to kind of go in sort of the shallow waves. So they turn on the burner, they heat up the air, the air expands and gets less dense. The balloon rises, the higher up you go the colder that air gets. It condenses down again and you start to sink. And as you sink, just as you're starting to sink, they turn that burner on and the heat up the air again, right? So you're



kind of heating and cooling. And with your heating and cooling comes an up and a down and then back up and then back down. What that does is creates this sort of up and down or this sort of shallow wave. And by wave I don't mean waving with your hand. I mean like wave like in the ocean where you're kind of going up and down short distances, right? We're not talking about thousands of feet of altitude change, but you gain altitude and you lose altitude as you are moving with wherever the wind is taking you, which is the part of ballooning that makes no sense to me. And I would love to hear, Nick, your experience in the van because you're chasing a balloon which is not following the roads but you're in a van which requires roads. How does the balloon and the van meet up and not end up in Timbuktu?

**Nick:** Uh, lot of work and a lot of luck, I say with a lilt in my voice. GPS helps a whole lot, as you imagine. And we still would like turn down these wrong roads and the balloon and the wind would go in a different direction. And we had trouble turning around because we're this big red van and we have this big trailer and there is a special GPS program that they use and Keith actually helps maintain it and helps identify like landing zones and no go zones and things like that. But it was still kind of a wild chase through beautiful morning farmlands all over northern New Jersey. It was it was more exciting than riding in the back of a van through the countryside on a Saturday morning sounds. But yeah, there was kind of an element of chase. 'Can anybody see the balloon through the windows? Okay, no you've got them. No, I've got no, I've got them there. At 12 o'clock.' And we were just kind of try to keep in the general direction until the altitude started to reduce and we could tell that they were coming down.

**Keith:** I can teach you how to inflate the balloon and get up and fly fairly level on a couple of hours. It's the finesse of landing that's a lot harder.

**Emily:** So landing a balloon I'm assuming can't be necessarily the easiest because you can't just landed in some trees right. There, there's, there's a little bit more finesse to how you land a balloon that you would go up in as a leisure activity, *laughs* you know, because you don't want to be hitting the power lines or landing on somebody roof or, you know, trees where you could just, you know, fall down out of that tree.

So what was that experience like watching Jen's balloon land? Because this was you know, we heard Günter tell this story. You know, they landed in a tree. He hurt his leg. You know, they were really lucky that they didn't hit a house or they didn't hit a power line. They didn't hit anything dangerous on the way down because it's not trivial, right?

**Nick:** Yeah. Power lines. Very, very bad. Very bad. Trees actually have an important role to play, which I found out you actually can use them to slow down. Sometimes it looks like they're doing it by accident. And like I've been told, like the police are even called sometimes because they're like, 'Oh my God! the balloons crashing. No, sometimes they're just slowing down by brushing the treetops, gently brushing the treetops.

**Emily:** So did Jen's balloon hit any trees or hit anything on the way down?

**Nick:** So I'm told that, yes, they did. They did come down on top of a tree at first but I was not on the scene just yet. And so the balloon lands, some of the crew are already there helping to kind of secure it. Jen, is beaming, our stoic, Midwestern producer is lit like the morning sun and the dismounting the basket was more complicated than I realized. Like they start pulling the balloon down in one direction and the basket kind of goes with it. And you just got to do this tilt maneuver. And I was helping to tip over the basket. I didn't ride in the balloon, but I did push it over with assistance

**Emily:** I had no idea it was such a graceful process

**Nick:** Yeah, yeah

**Emily:** Let me just dump you out of the basket, your ride's over. Get out.

**Nick:** Precise. Precisely. Yeah. Which explains how Günter hurt his leg.

**Emily:** Yeah.

**Nick:** And they were talking about the postage stamp accuracy of this landing, and it wasn't until we deflated the balloon that I understood the true genius and sophistication of Keith's art. He had positioned it at the end of the driveway so that when they deflated the balloon, they could lay it straight out across this driveway, which was not big and broad, by the way, so that I could you not the balloon didn't touch the grass and get wet from the dew. Just to make packing it up a little easier.

*Music up and under*

**Nick:** Airspace is from the Smithsonian's National Air and Space Museum. It is produced by Katie Moyer and Jennifer Weingart. Mix by Tarek Fouda. Translation in this episode is done by Shane McMillan.

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**Nick:** Yeah, I'm, I'm picturing the scene from Goblet of Fire, where all of the wizard families meet on top of a hill in the predawn darkness so they can go to the Quidditch World Cup, but with infinitely higher stakes.

**Emily:** I feel like a portkey would have made all of their problems significantly easier. Yeah, I think of it more as the bewitched car from Chamber of Secrets, because that thing's got a secret charm on it because they shut the whole Weasley family in that thing.

**Nick:** Yeah, little bit of a TARDIS magic going on there. Harder to build, though. Harder to build. We already put enough on Günter and Peter.

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