

ASTRONAUTS



Women on the Final Frontier

JIM OTTAVIANI & MARIS WICKS

From the creators of the *New York Times* bestseller *Primates*

THE U.S. MAY HAVE PUT THE FIRST MAN ON THE MOON,

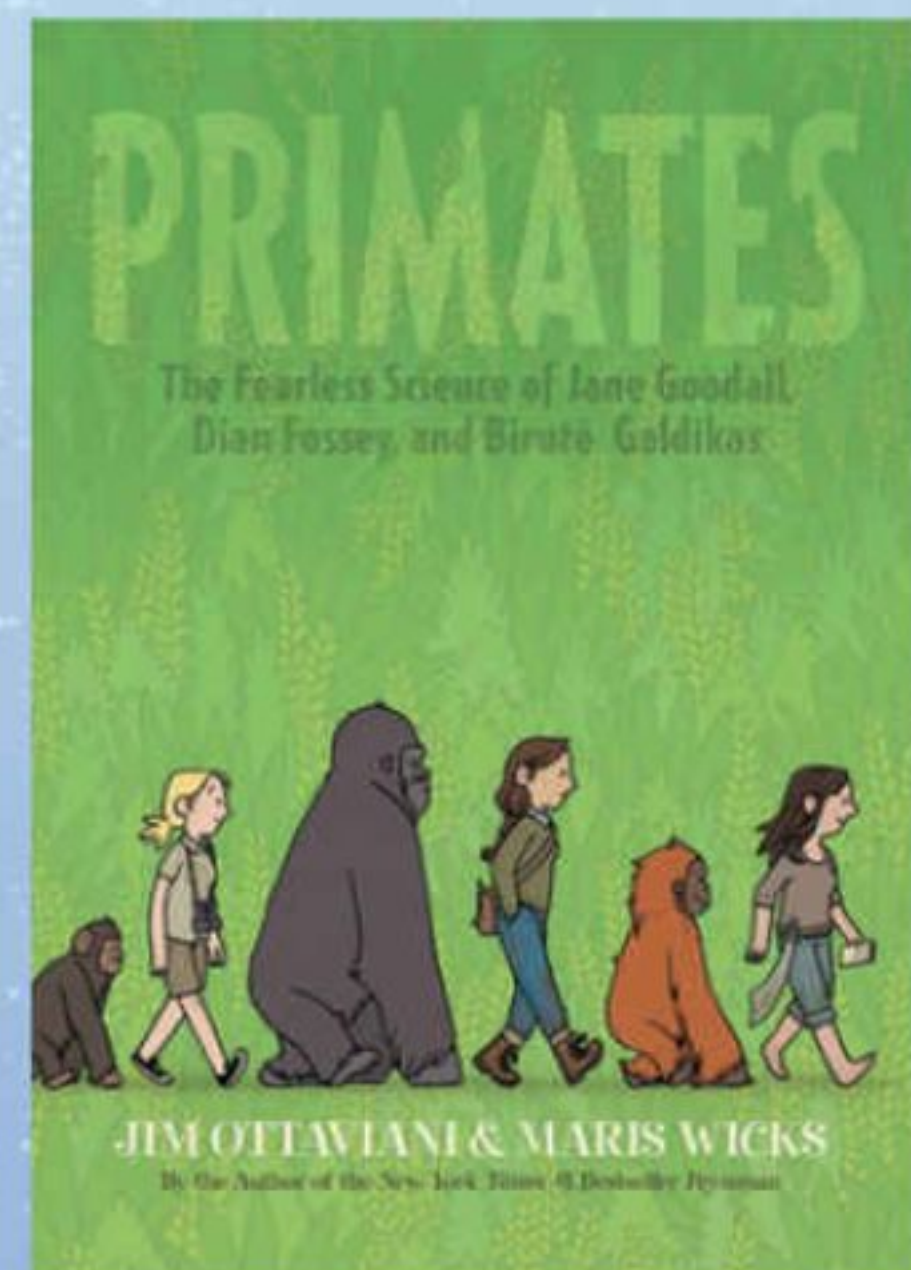
but it was the Soviet space program that made Valentina Tereshkova the first woman in space. It took years to catch up, but soon NASA's first female astronauts were racing past milestones of their own. The trailblazing women of Group 9, NASA's first mixed-gender class, had the challenging task of convincing the powers that be that a woman's place is in space, but they discovered that NASA had plenty to learn about how to make space travel possible for everyone.

In *Astronauts: Women on the Final Frontier*, Jim Ottaviani and illustrator Maris Wicks capture the great humor and incredible drive of Mary Cleave, Valentina Tereshkova, and the first women in space.

JIM OTTAVIANI is the *New York Times*-bestselling author of over a dozen graphic novels about scientists. His most recent books are *Hawking* (a biography of the world-famous cosmologist and Simpsons guest star), *The Imitation Game* (a biography of Alan Turing), *Primates* (a book about Jane Goodall, Dian Fossey, and Biruté Galdikas), and *Feynman* (a biography of the Nobel Prize-winning physicist, bongo-playing artist, and raconteur Richard Feynman).

MARIS WICKS is a space cadet. At nine years old, she took her grandpa's telescope and pointed it at the brightest star in the night sky. Looking into the eyepiece, she didn't see a star . . . It was Saturn, with its magnificent rings! Thirty years later, Maris is still looking into space, hoping that her illustrations will encourage others to do the same. She has previously worked with Jim on the *New York Times* bestseller *Primates*, and her own books *Human Body Theater* and *Science Comics: Coral Reefs*.

ALSO AVAILABLE



“[Ottaviani and Wicks] succeed in conjuring the feel of extraordinary science. And they do so not by manufacturing fake emotion, but by sticking to the reality of being a scientist.”

—CARL ZIMMER,

The New York Times Book Review

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Cover design by Andrew Arnold



First Second
New York

FIRSTSECONDBOOKS.COM

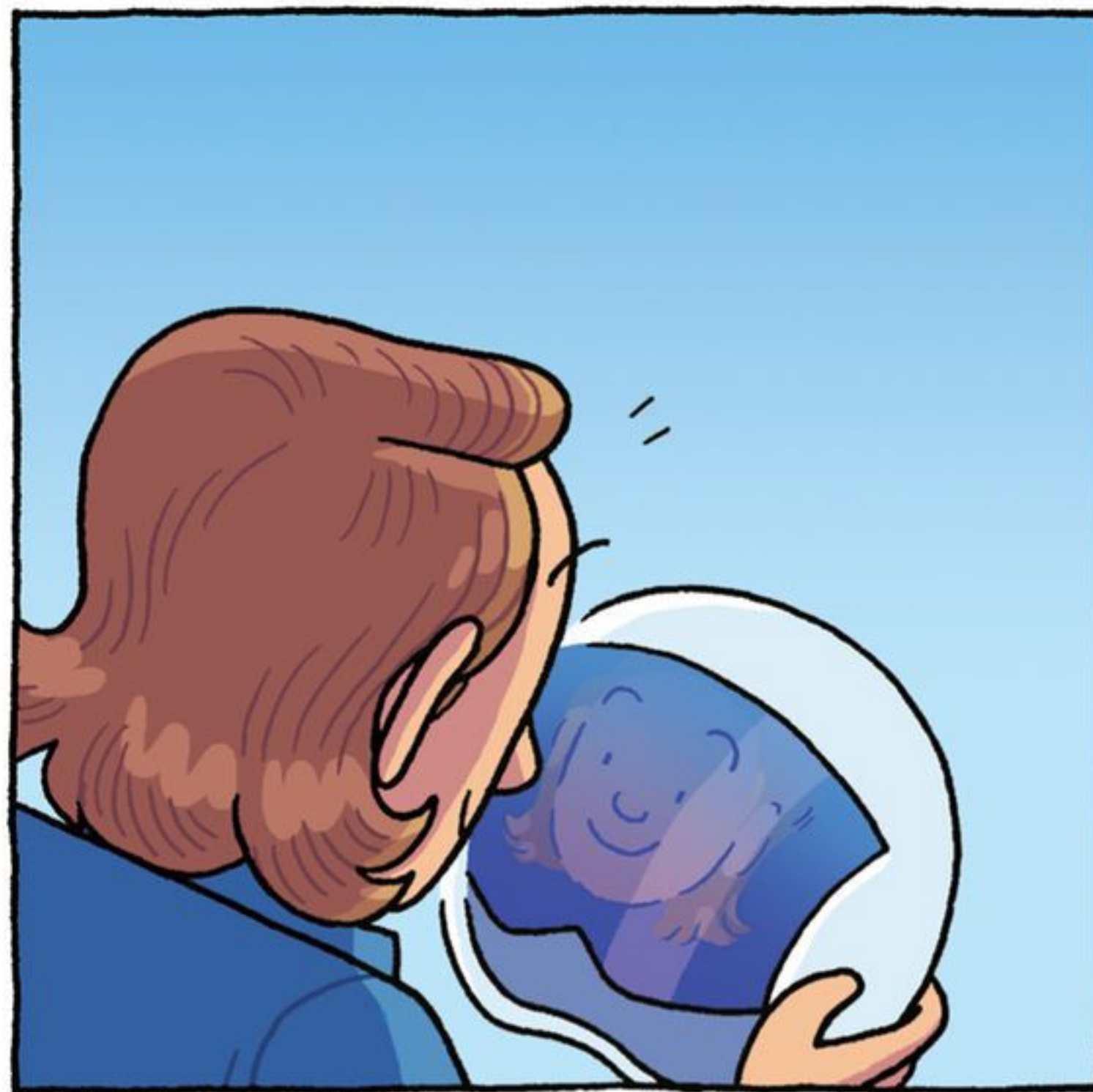
ASTRONAUTS

ASTRONAUTS

Women on the Final Frontier

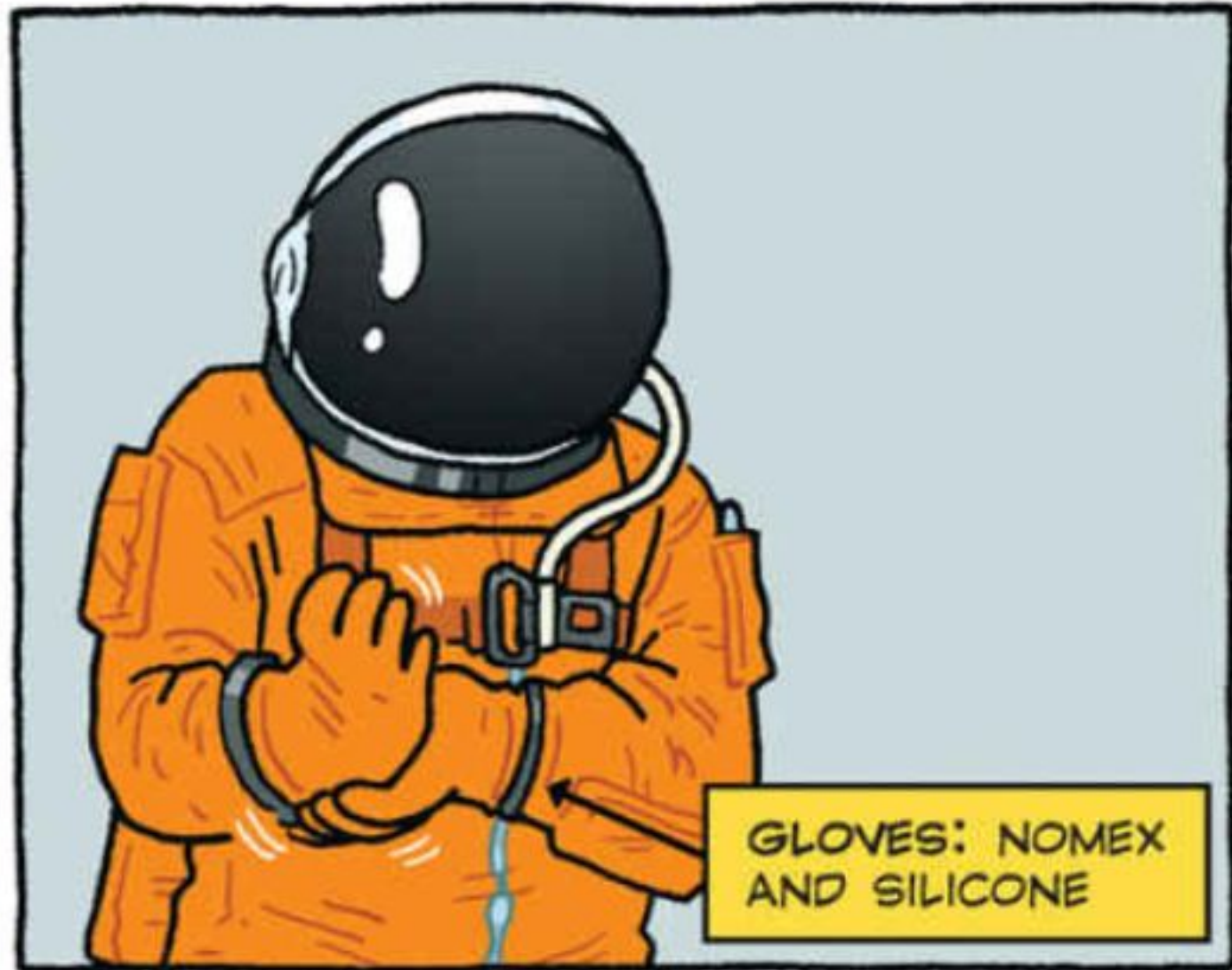
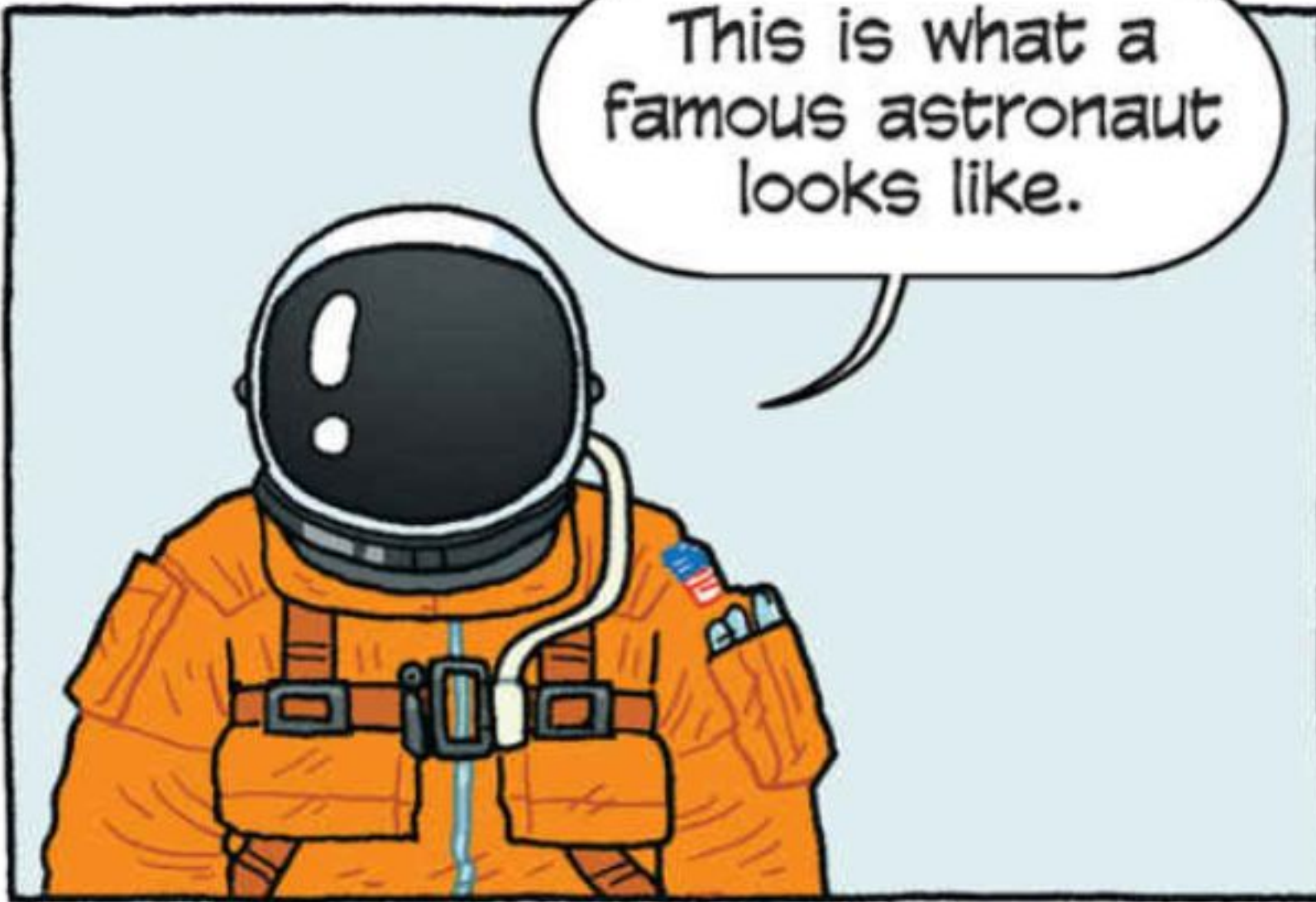
Written by
JIM OTTAVIANI

Artwork by
MARIS WICKS

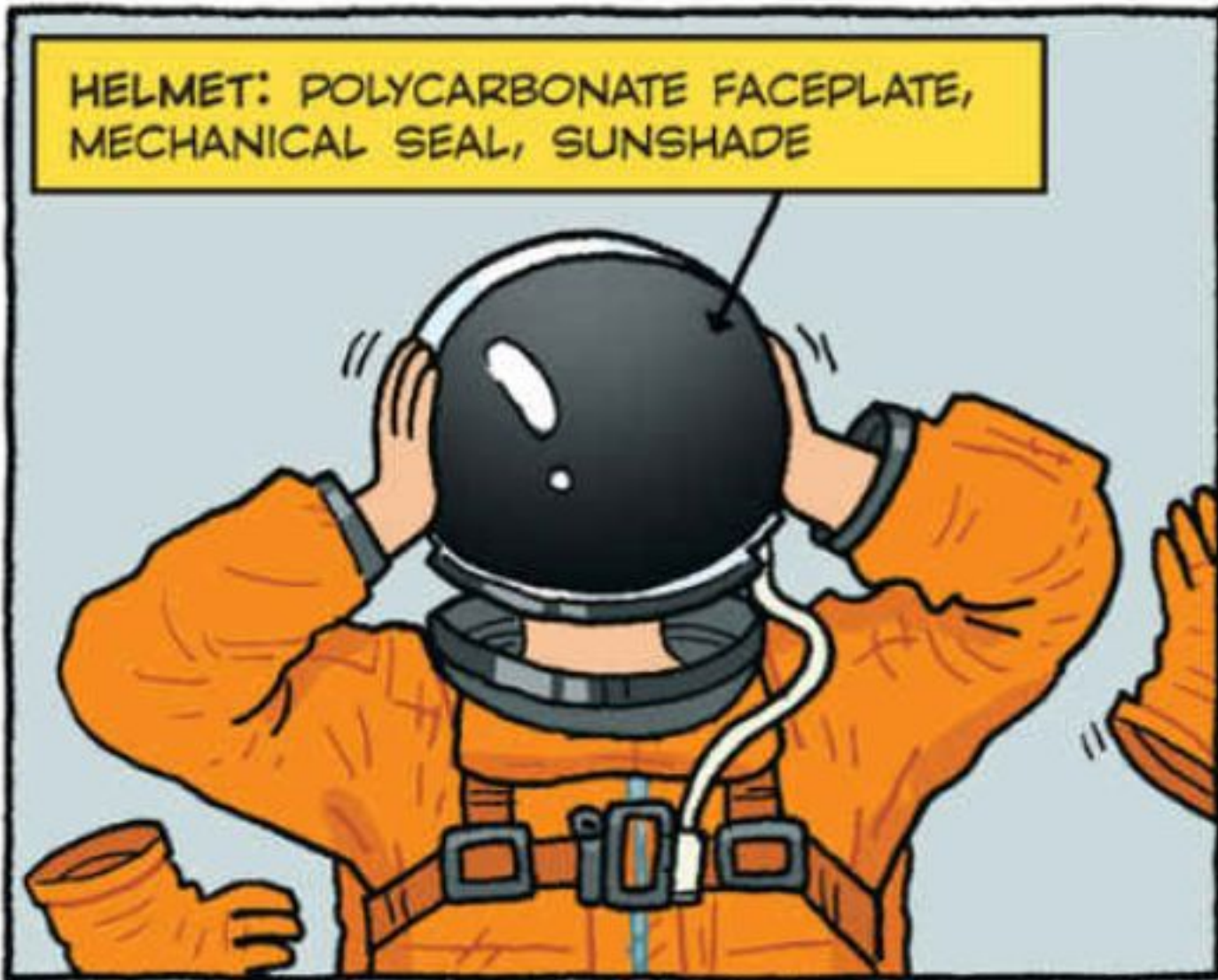


:01
First Second
New York

This is what a famous astronaut looks like.



GLOVES: NOMEX AND SILICONE



HELMET: POLYCARBONATE FACEPLATE, MECHANICAL SEAL, SUNSHADE



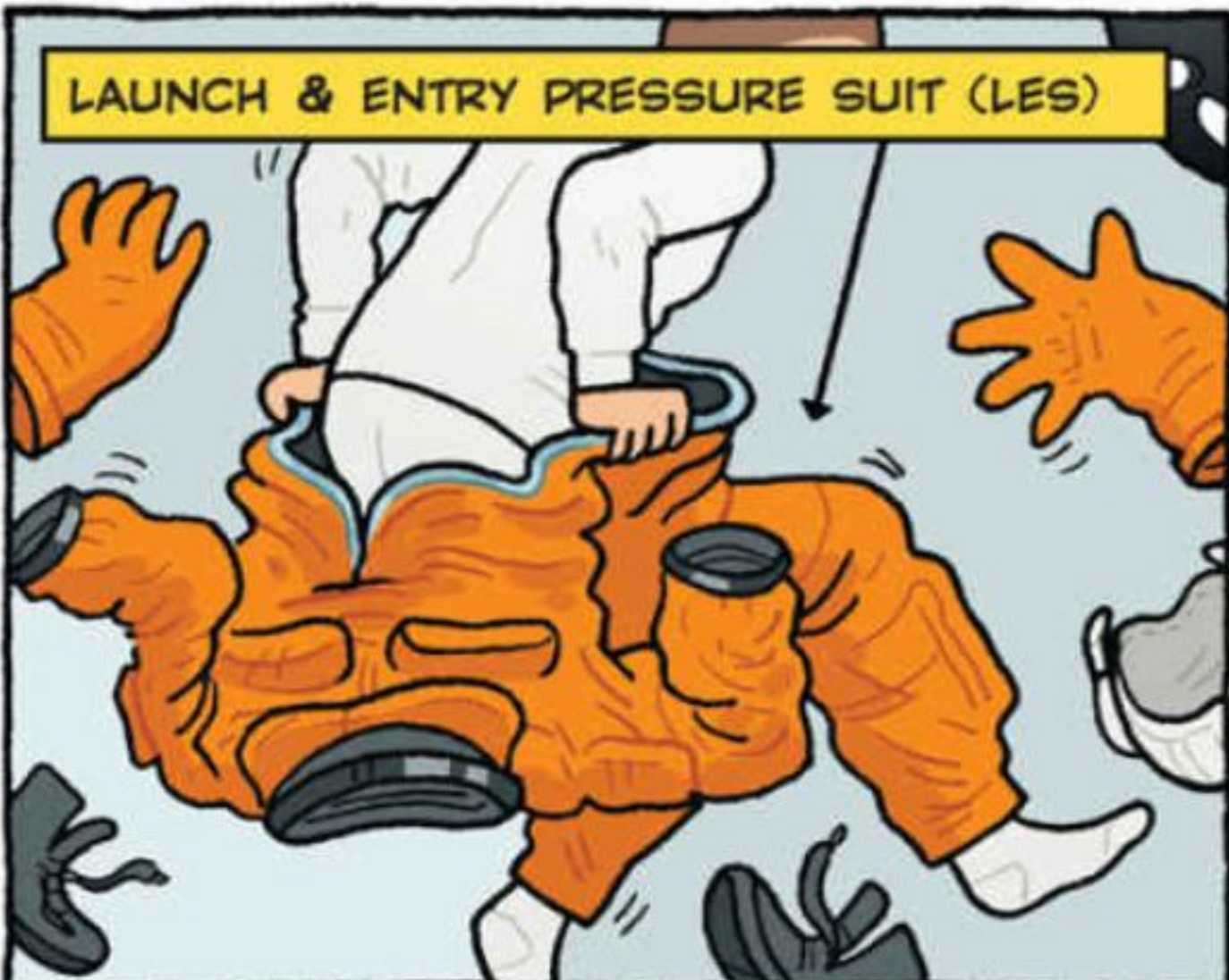
COMMUNICATION (SNOOPY) CAP



SURVIVAL BACKPACK: PARACHUTE, LIFE RAFT, SURVIVAL GEAR, 30-MINUTE SUPPLY OF OXYGEN



PARATROOPER BOOTS



LAUNCH & ENTRY PRESSURE SUIT (LES)



LONG JOHNS: COTTON



So is this.

ASTRONAUT: FAMOUS



Maybe not so famous.



Back on Earth, I can walk down the street and only my friends would know to ask for my autograph.

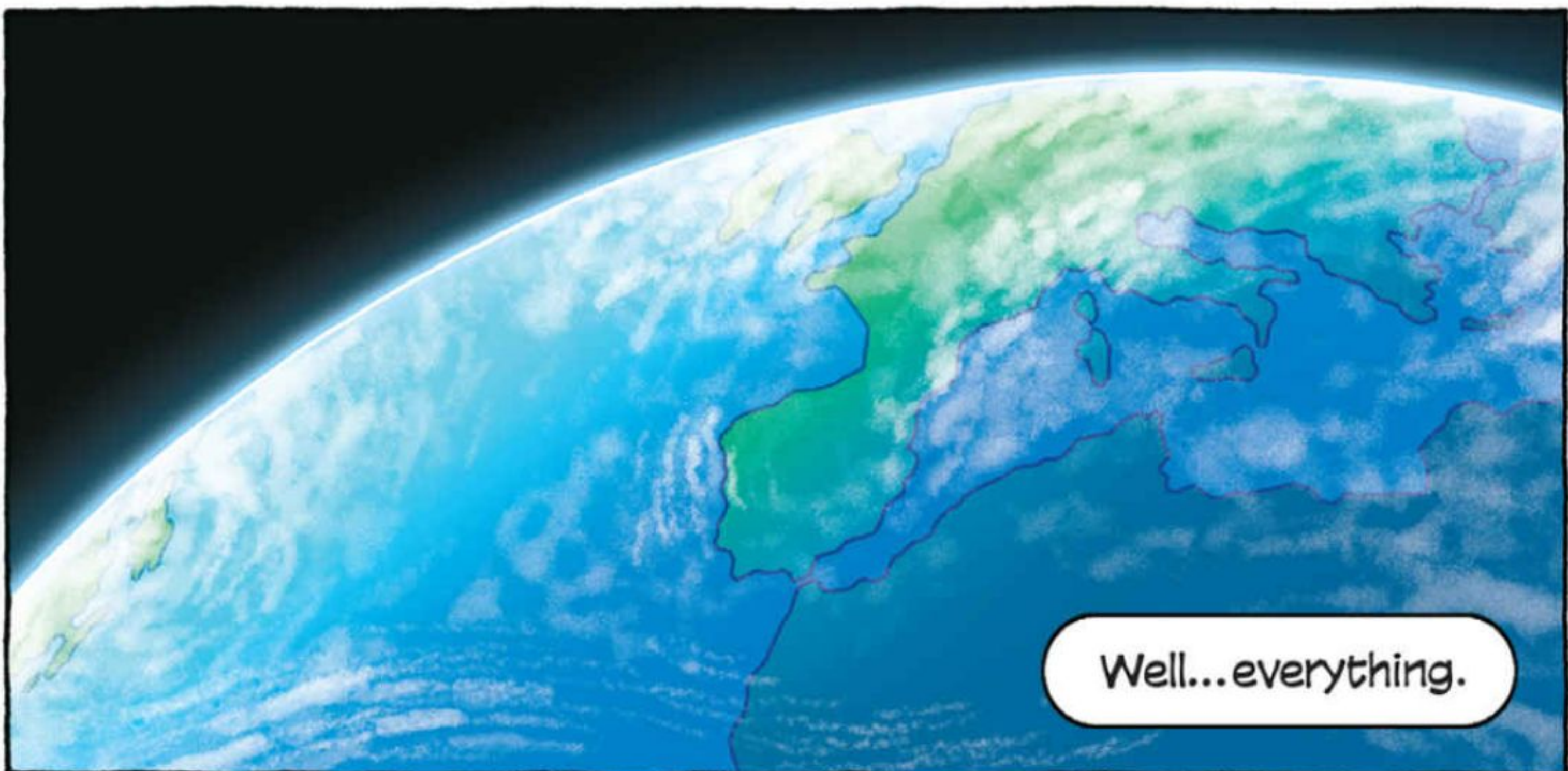
And they're my friends, so, ya know...they don't. To them I'm just Mary.



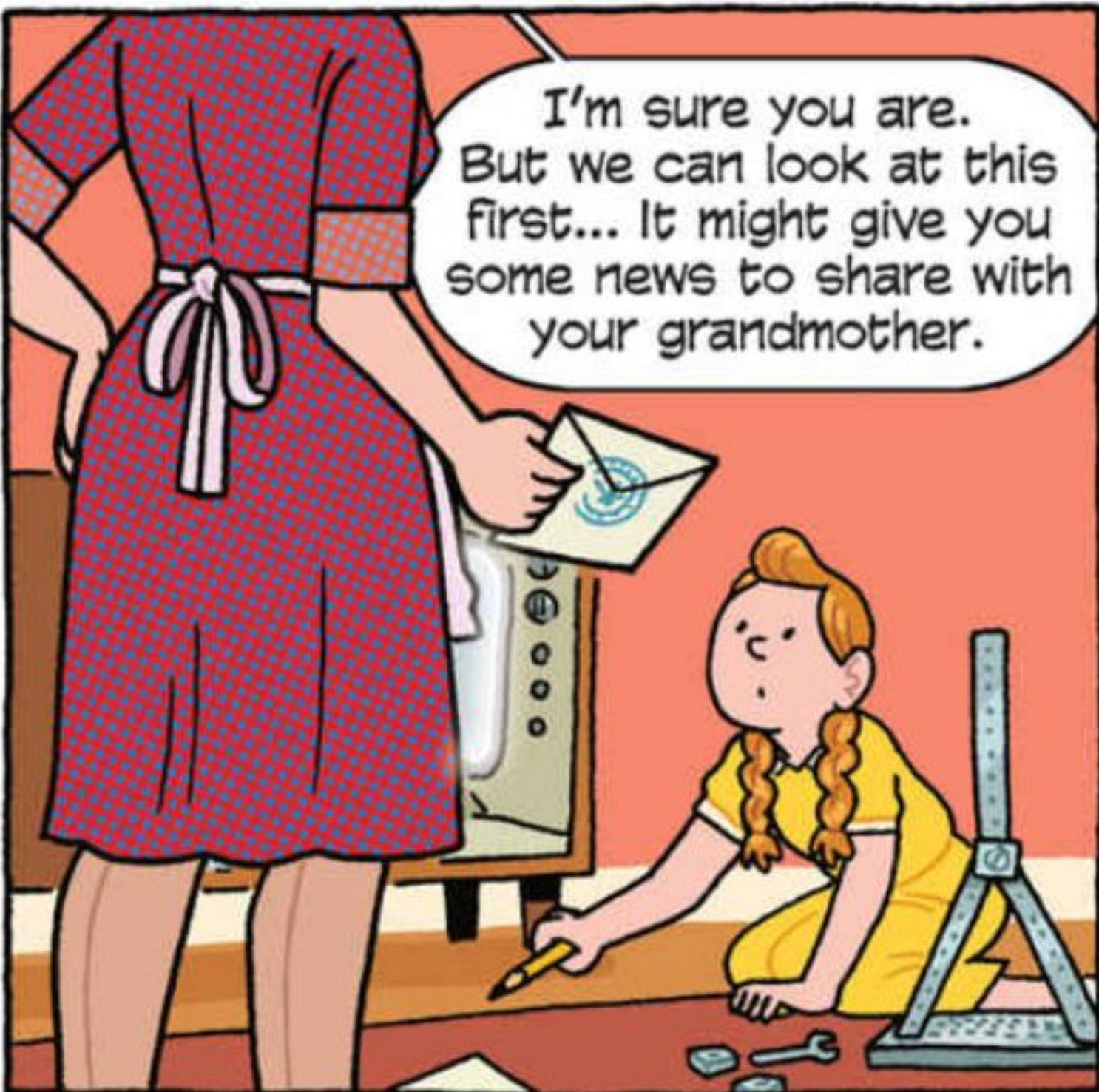
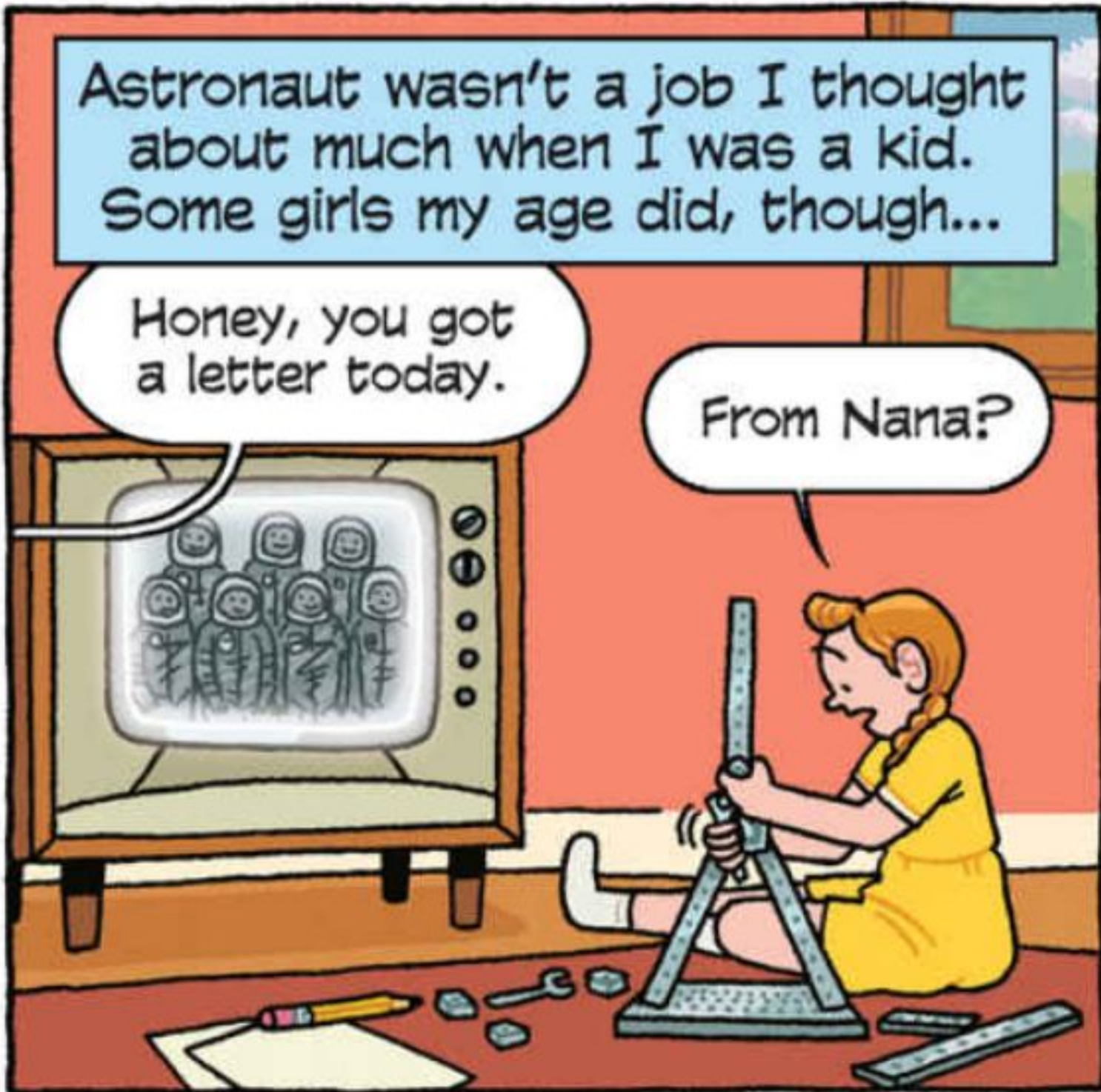
For me and my crewmates, it's not about fame anyway.

It's a job.

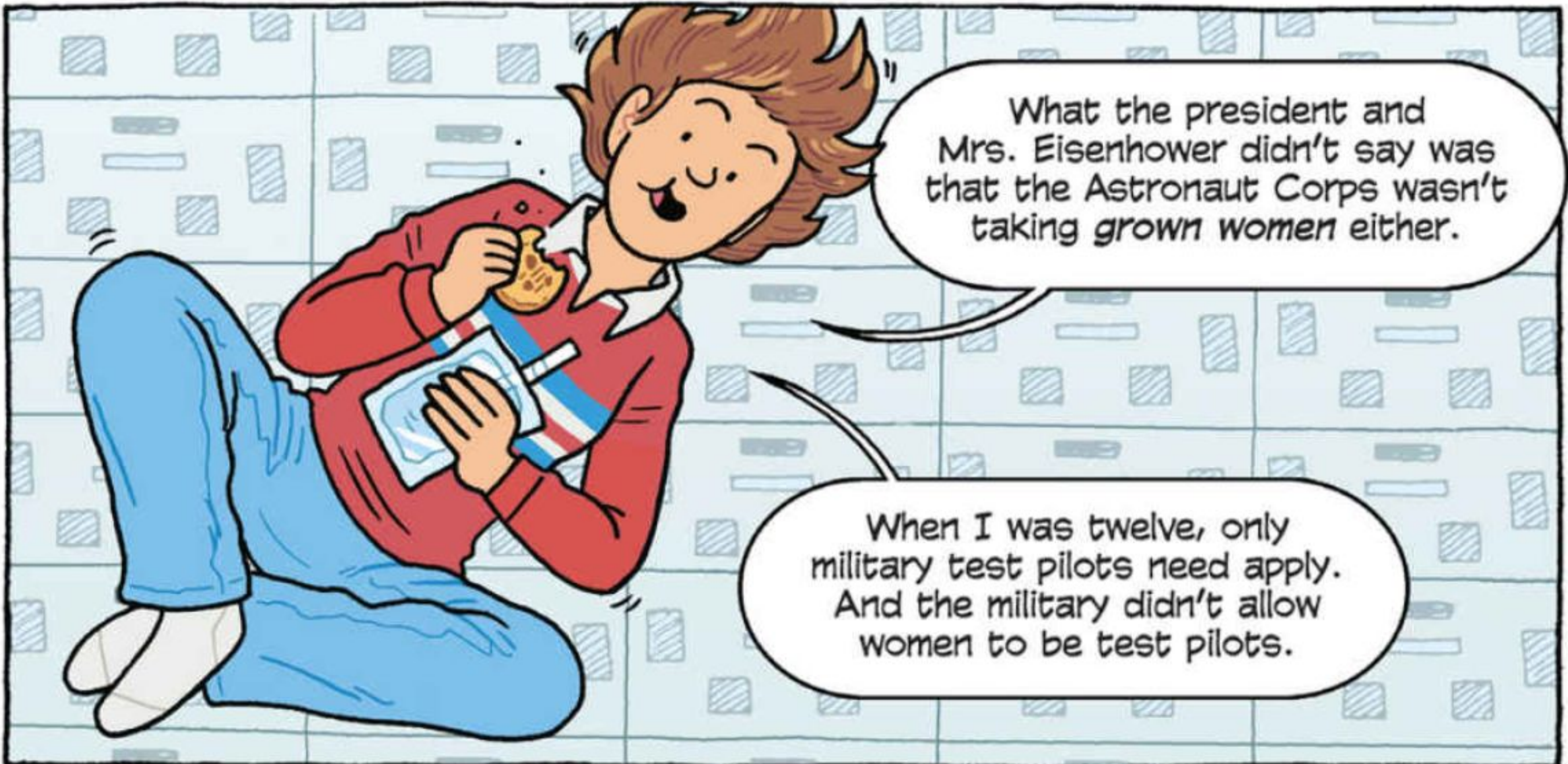
A great job, and one with a corner office that looks out on...



Well...everything.

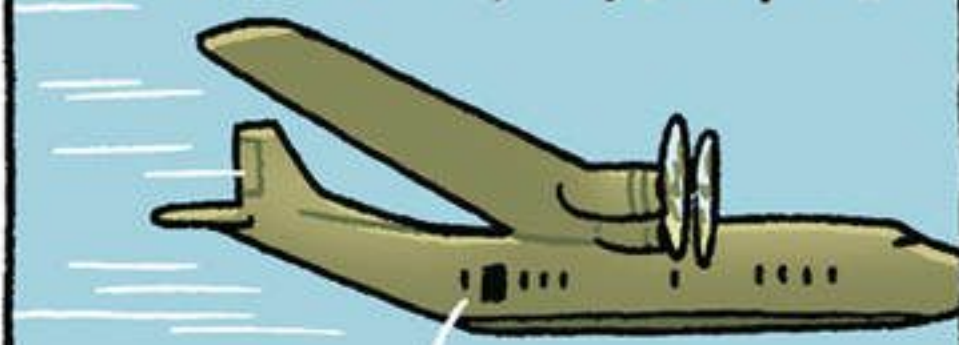
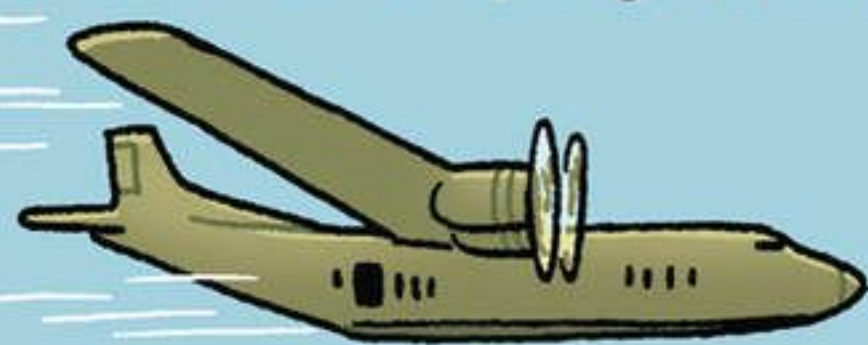






She was a little older than me, lived a long way away, and her first experience with free fall...

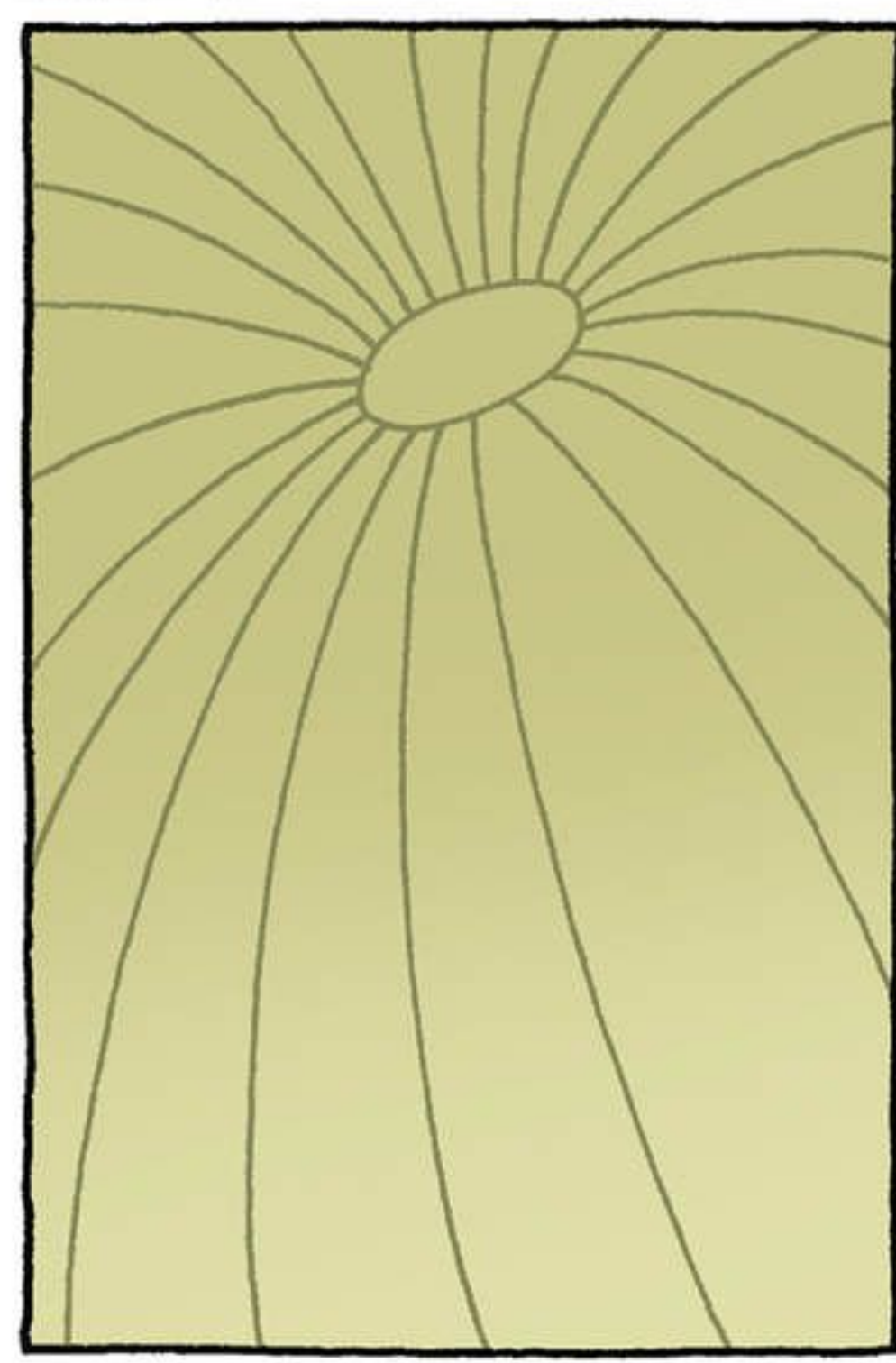
WVRRROOOOM OOOOMMMMMMM



She said she had her eyes closed at the beginning.

FWUMP

...was not in space.



Even so, Valentina's first parachute jump didn't last long enough. She wanted to go back up right away.



And every day after.

That was in May 1959, at the Yaroslavl Aero Club.

WHAT HAS HAPPENED?
YOU LOOK SO STRANGE
TODAY, VALYUSHA.

NOTHING, MOTHER.

FWUMP

FWUMP

FWUMP

She didn't open her eyes
until her fifth jump.

And she didn't tell her
mother what she was up to
until much later.

YOU. ARE. DOING. WHAT?



I—I...FORBID IT!

CLICK

She later said that in her school
days, whenever she did something
her mother didn't approve of, she
concluded her mother was right.

Usually.

NOT THIS TIME,
THOUGH.

YOU ARE LATE,
COMRADE TERESHKOVA.

YES, COMRADE
KHAVRONIN! I'M SORRY,
SIR, I WAS DETAINED!



Valentina made hundreds more jumps
before being selected as one of
Russia's first cosmonauts.

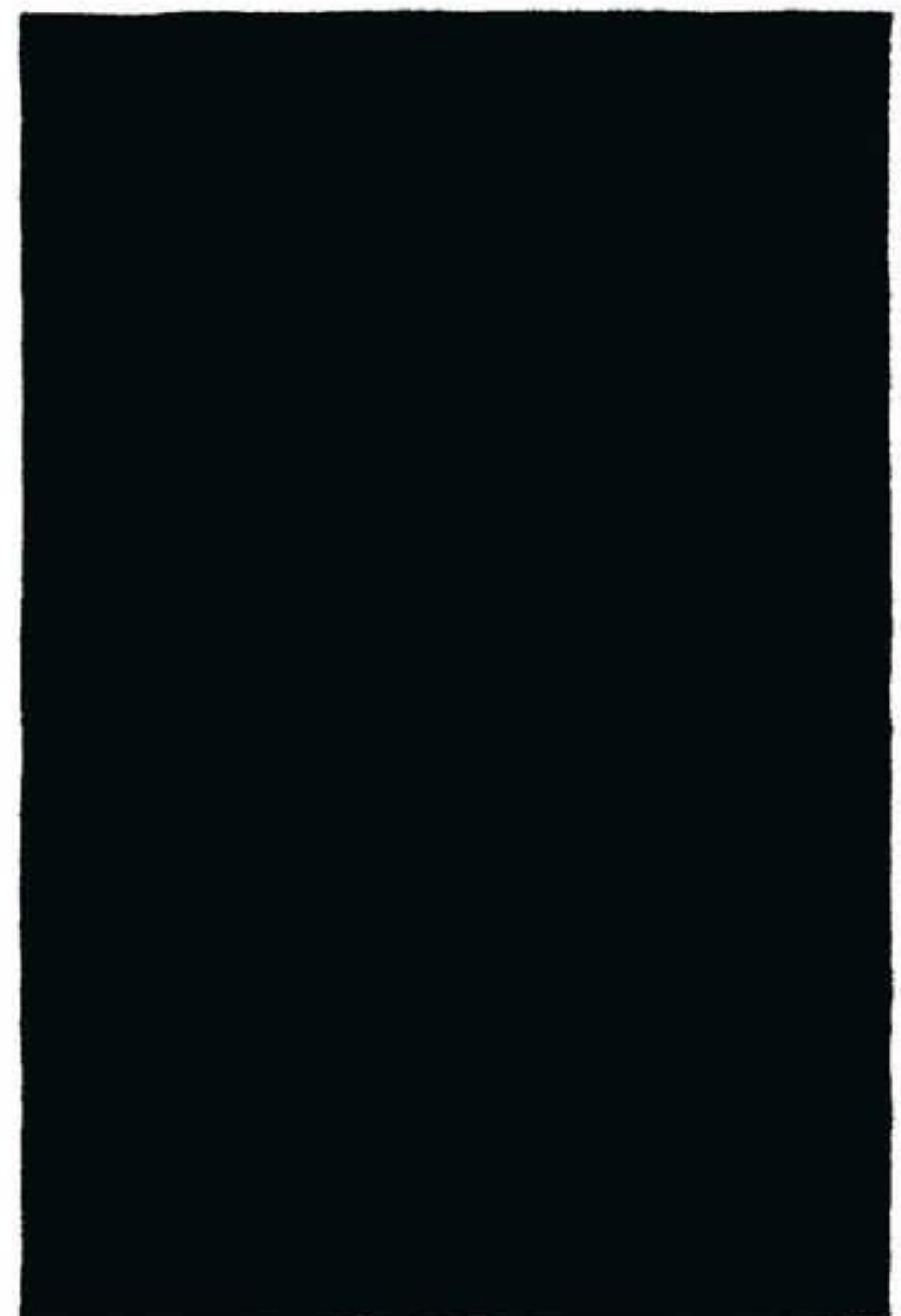
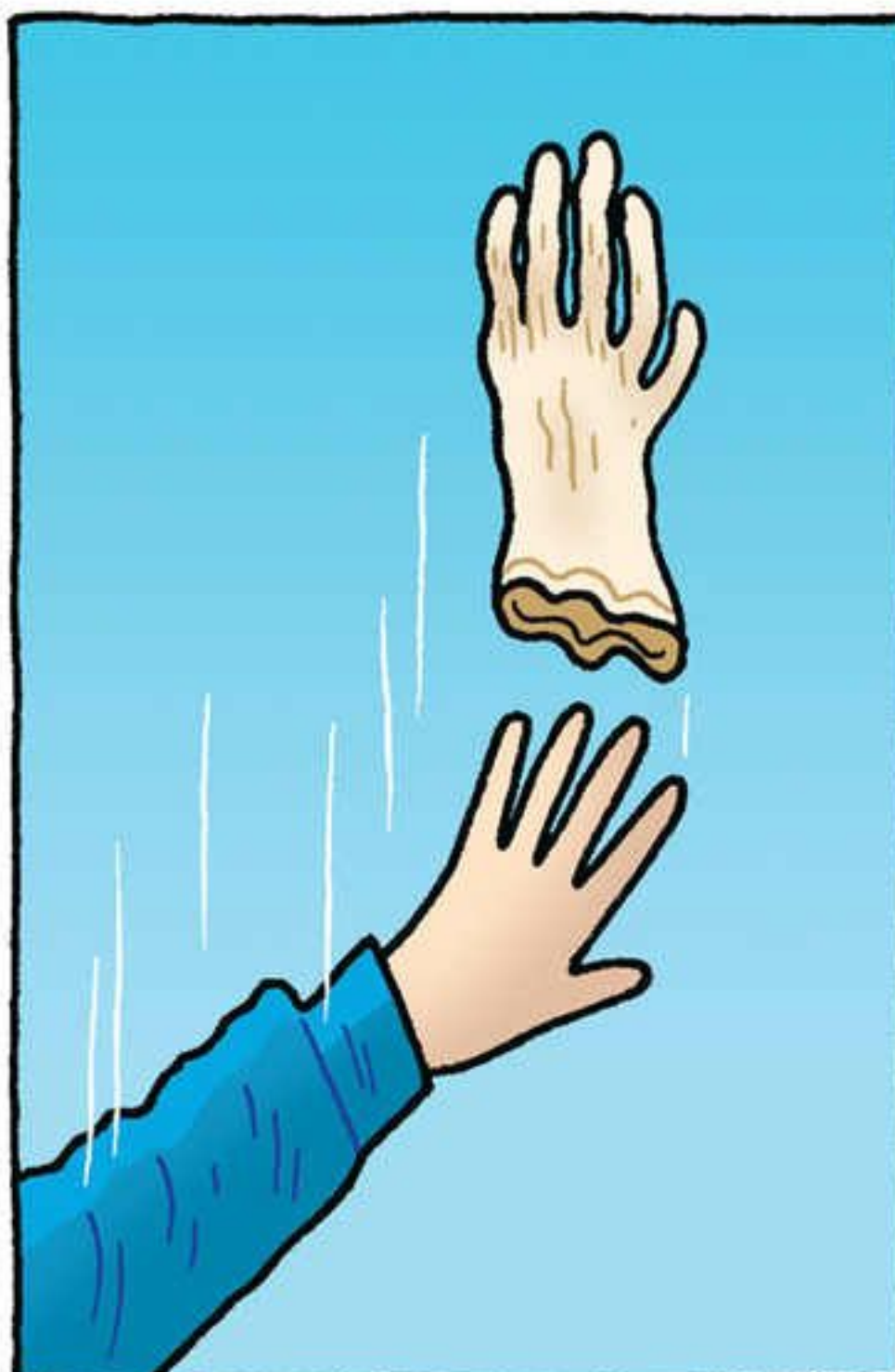
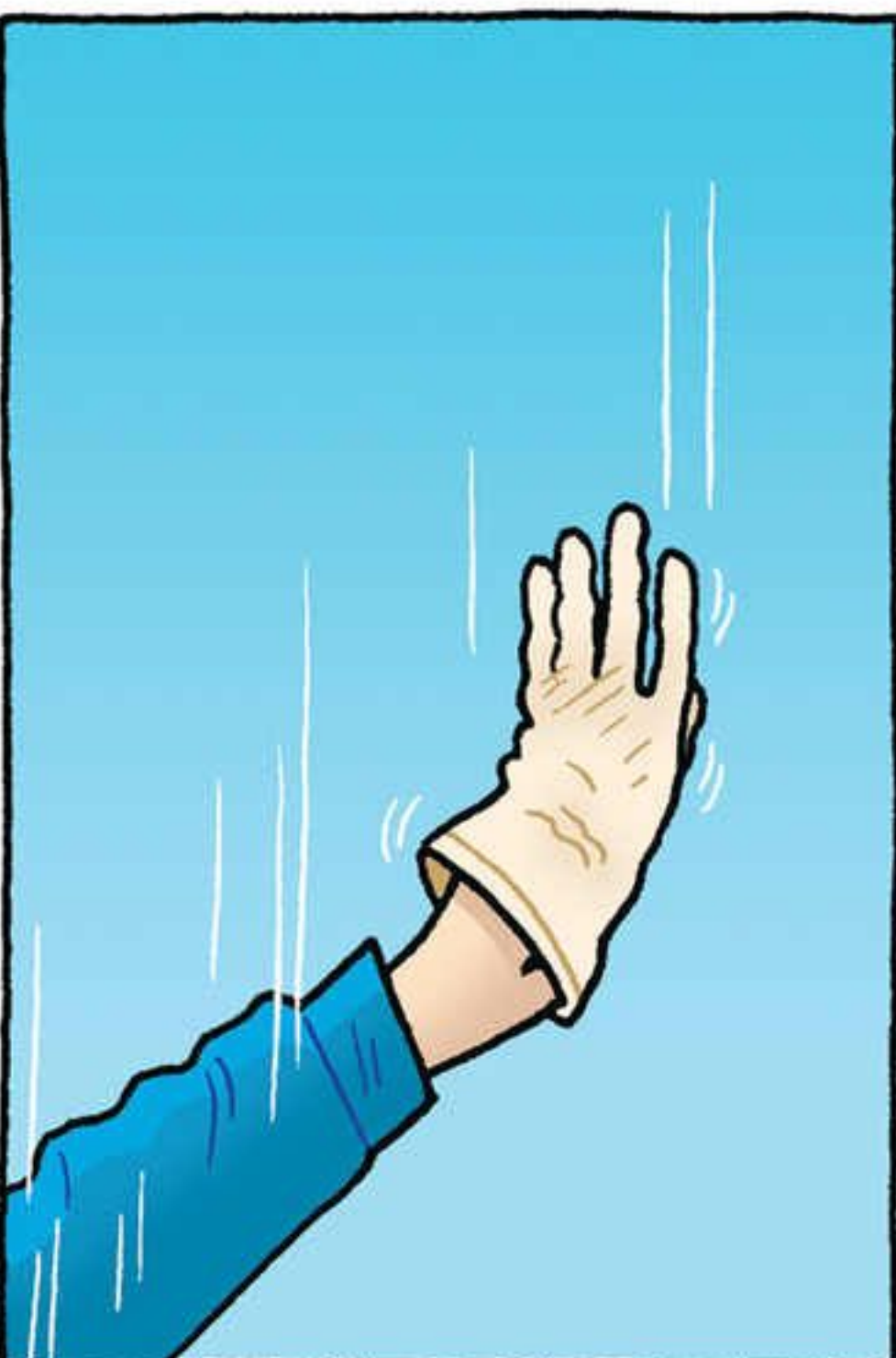
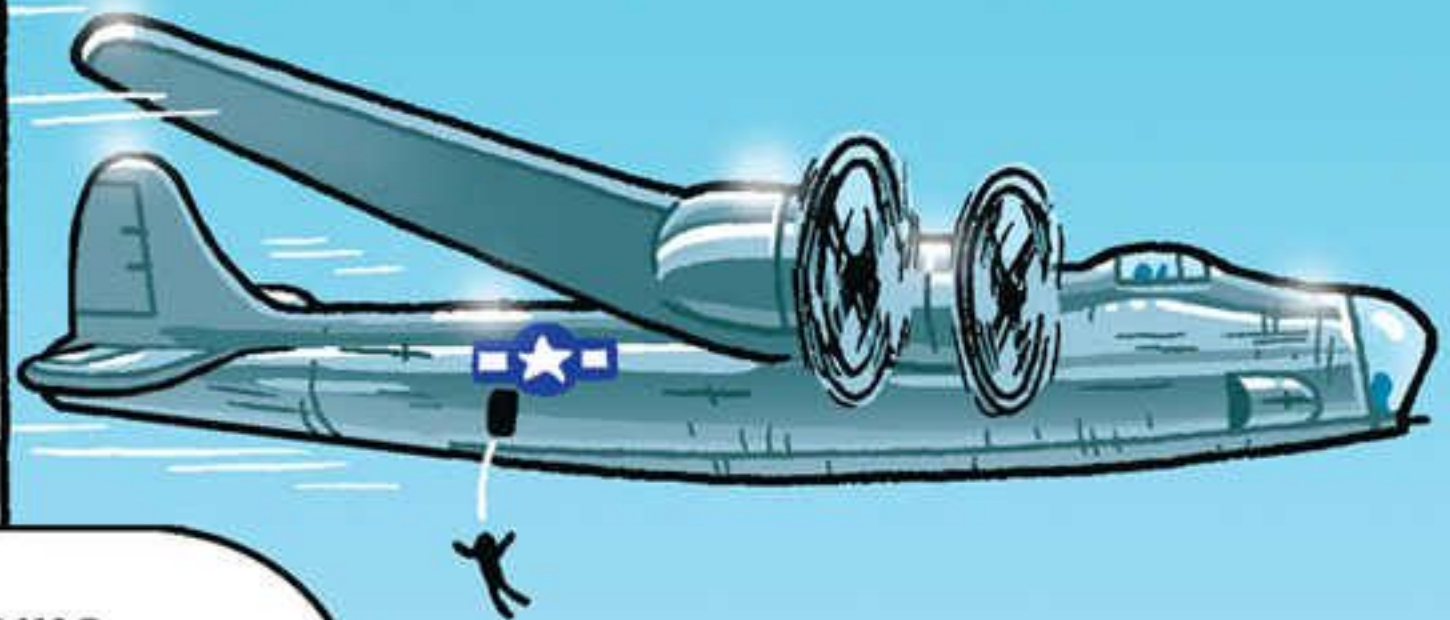


The U.S. was selecting its first
astronauts too right about then,
and the doctor who was key to
that selection process was
Randy Lovelace.



He'd done some
parachuting too, but he
only ever jumped once...

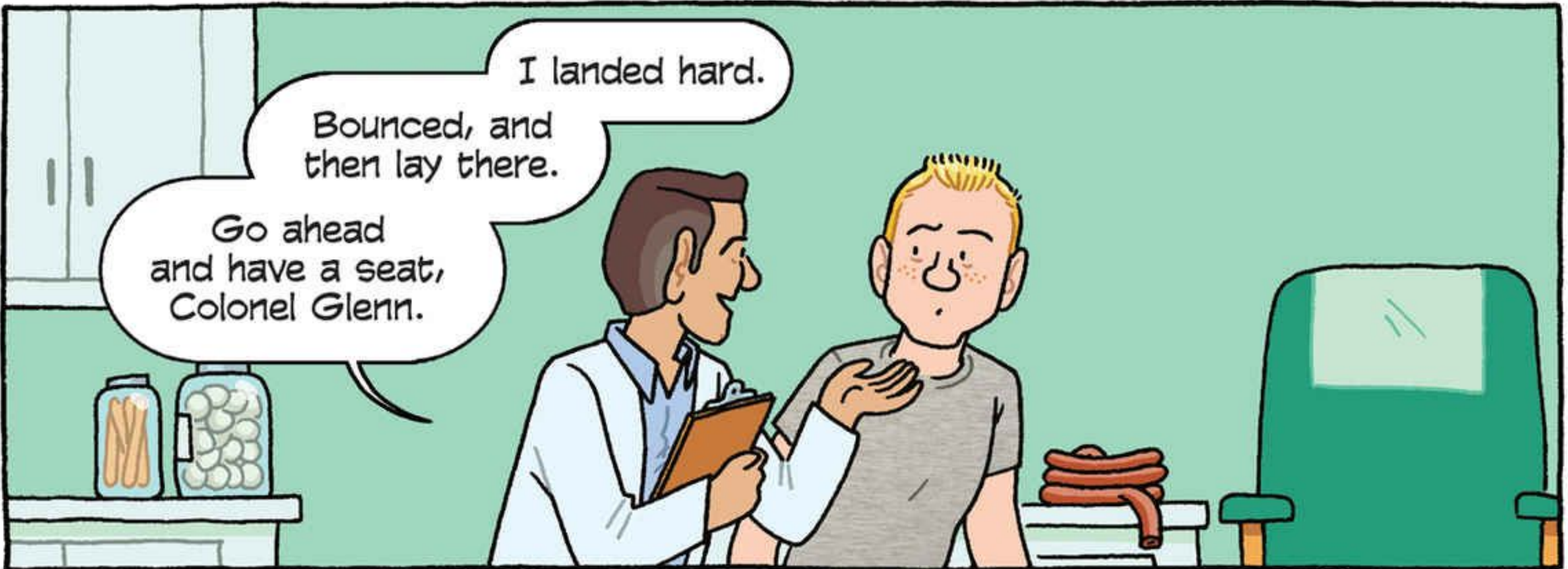
...and he did it from 40,200
feet, as a medical experiment in
high-altitude escape.





I felt a tremendous jerk— it was an 8-g shock when the parachute opened. Knocked the air out of my lungs, and I blacked out.

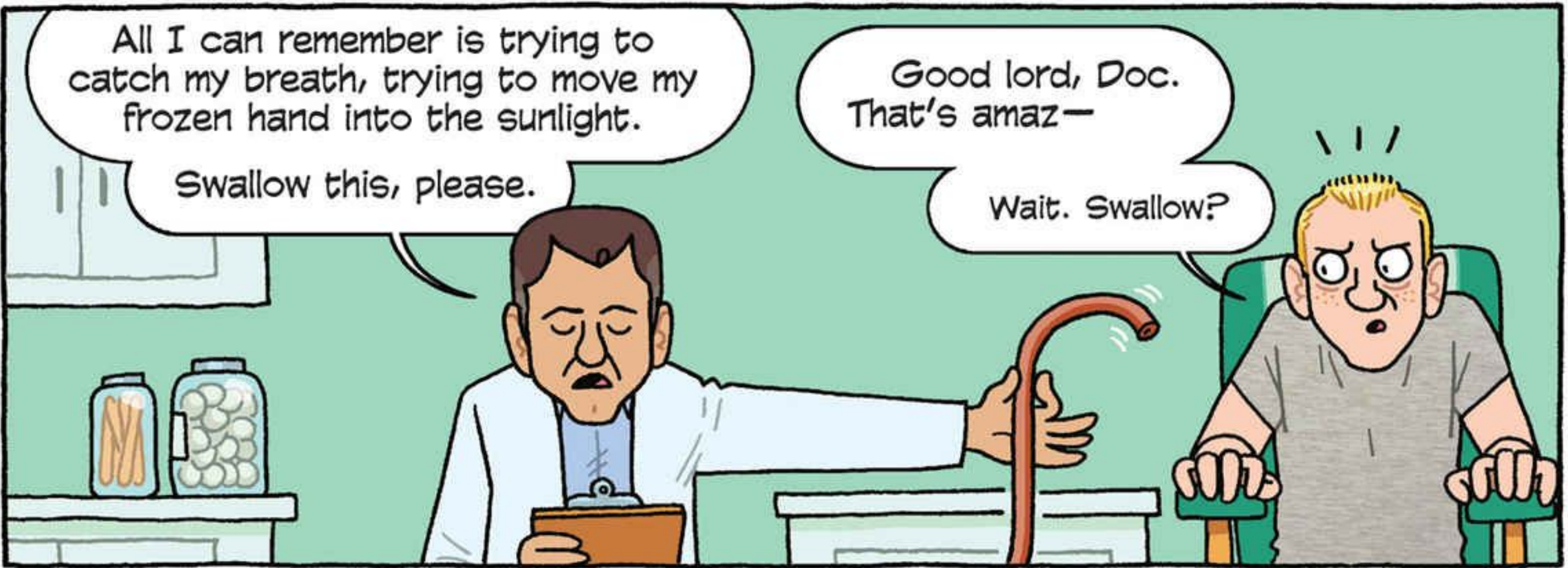
Seems like a dream now, seeing those gloves shooting away through space.



I landed hard.

Bounced, and then lay there.

Go ahead and have a seat, Colonel Glenn.



All I can remember is trying to catch my breath, trying to move my frozen hand into the sunlight.

Swallow this, please.

Good lord, Doc. That's amaz—

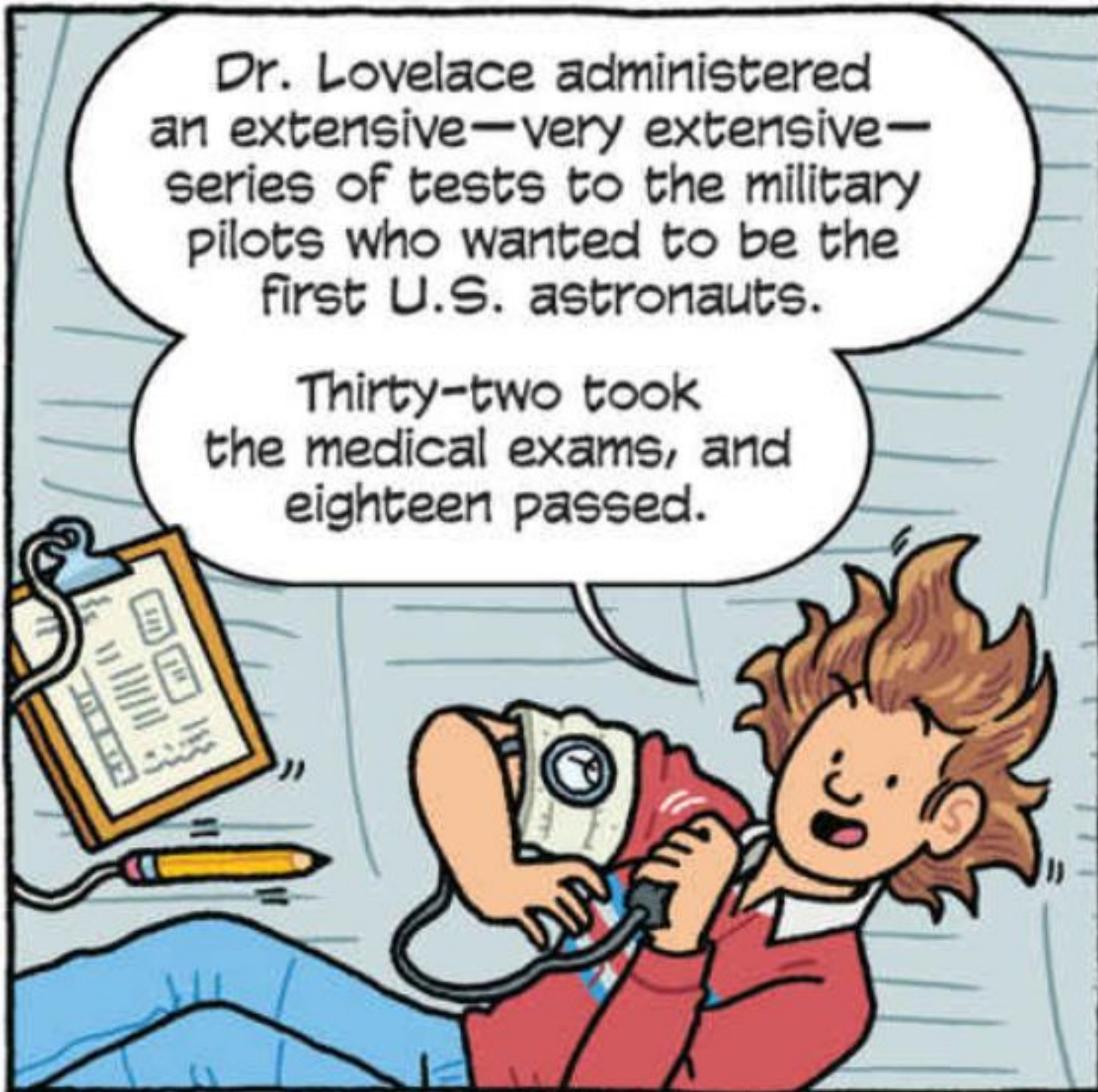
Wait. Swallow?



Yes, we need you to hold it in there while we get some stomach acid samples.

If my experience is any indication, it might cause some discomfort...

Discomfort. Right.

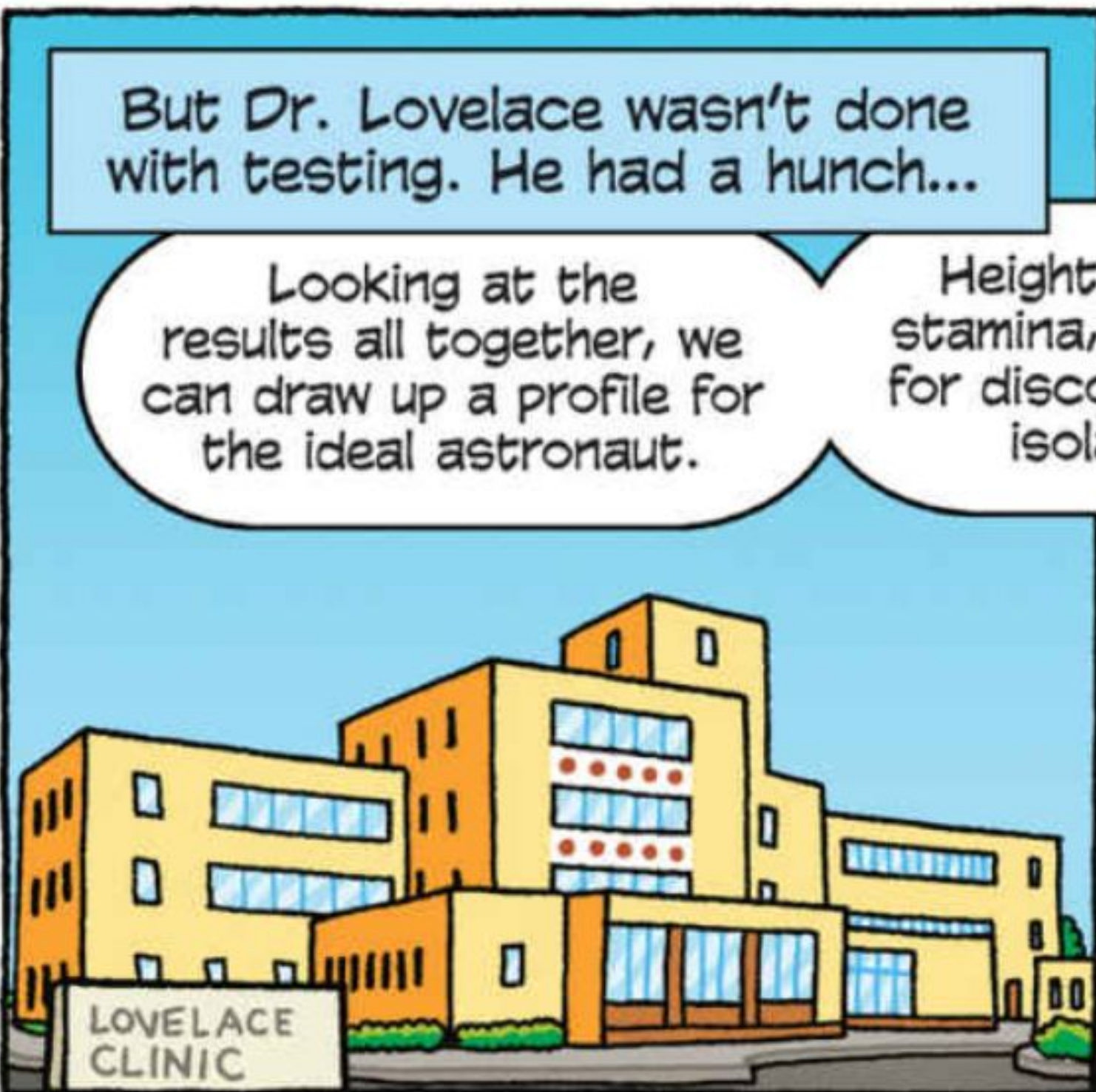


Dr. Lovelace administered an extensive—very extensive—series of tests to the military pilots who wanted to be the first U.S. astronauts.

Thirty-two took the medical exams, and eighteen passed.



In the end NASA selected seven to be America's first astronauts.



But Dr. Lovelace wasn't done with testing. He had a hunch...

Looking at the results all together, we can draw up a profile for the ideal astronaut.

Height, weight, stamina, tolerance for discomfort and isolation.



We now have a pretty good idea of the type of person NASA needs for the space program.

That's excellent to hear. This way we can prescreen the men who apply and...



That's the thing. Look at the data, and you'll see there's no reason to limit your candidate pool to men.

Women should be just as capable.



That's, um... interesting to hear. But...

Not that we've tested any.



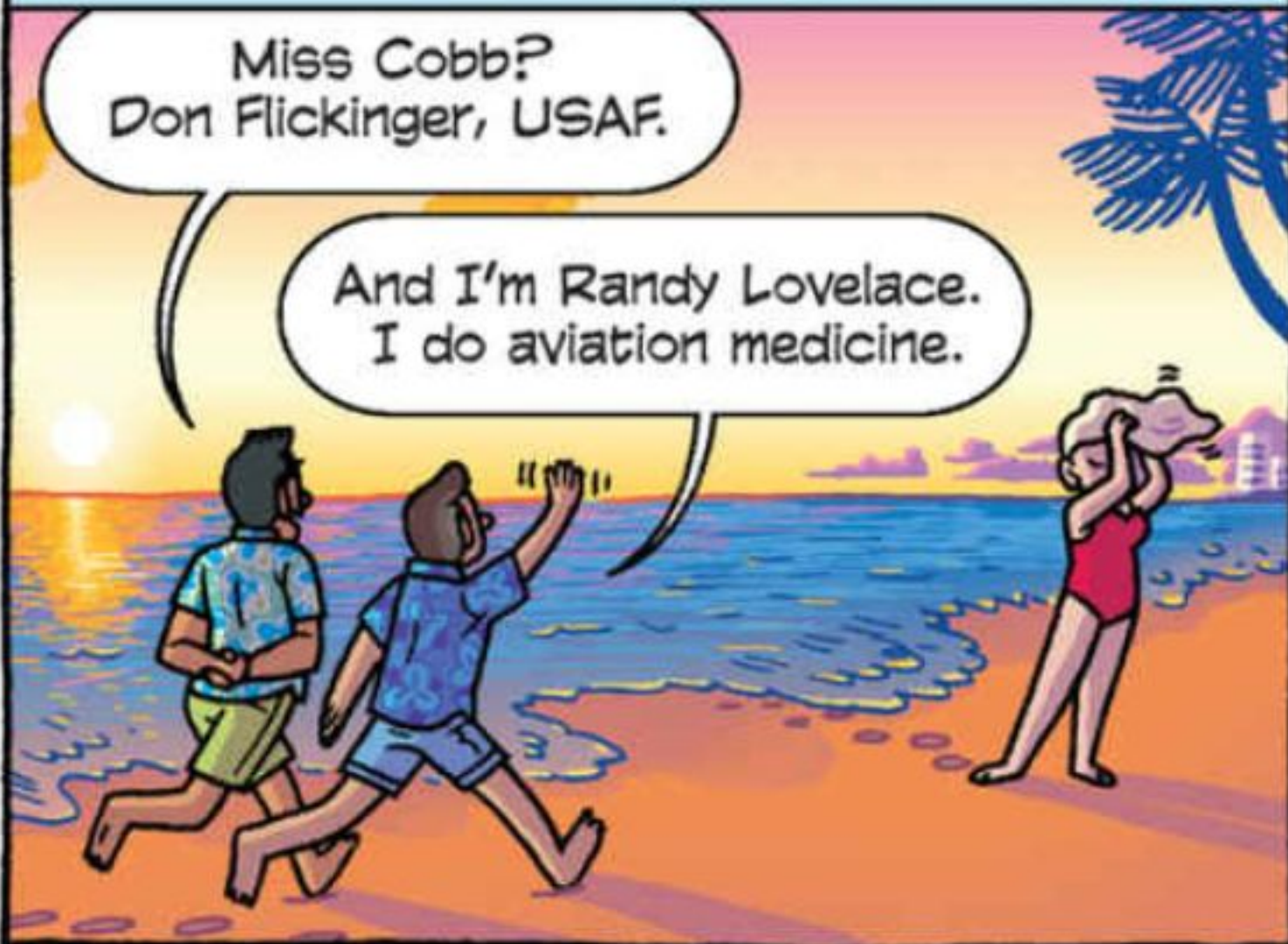
That's great. But, I mean, there's no need to spend money on that.

Plenty of qualified candidates already, you know.

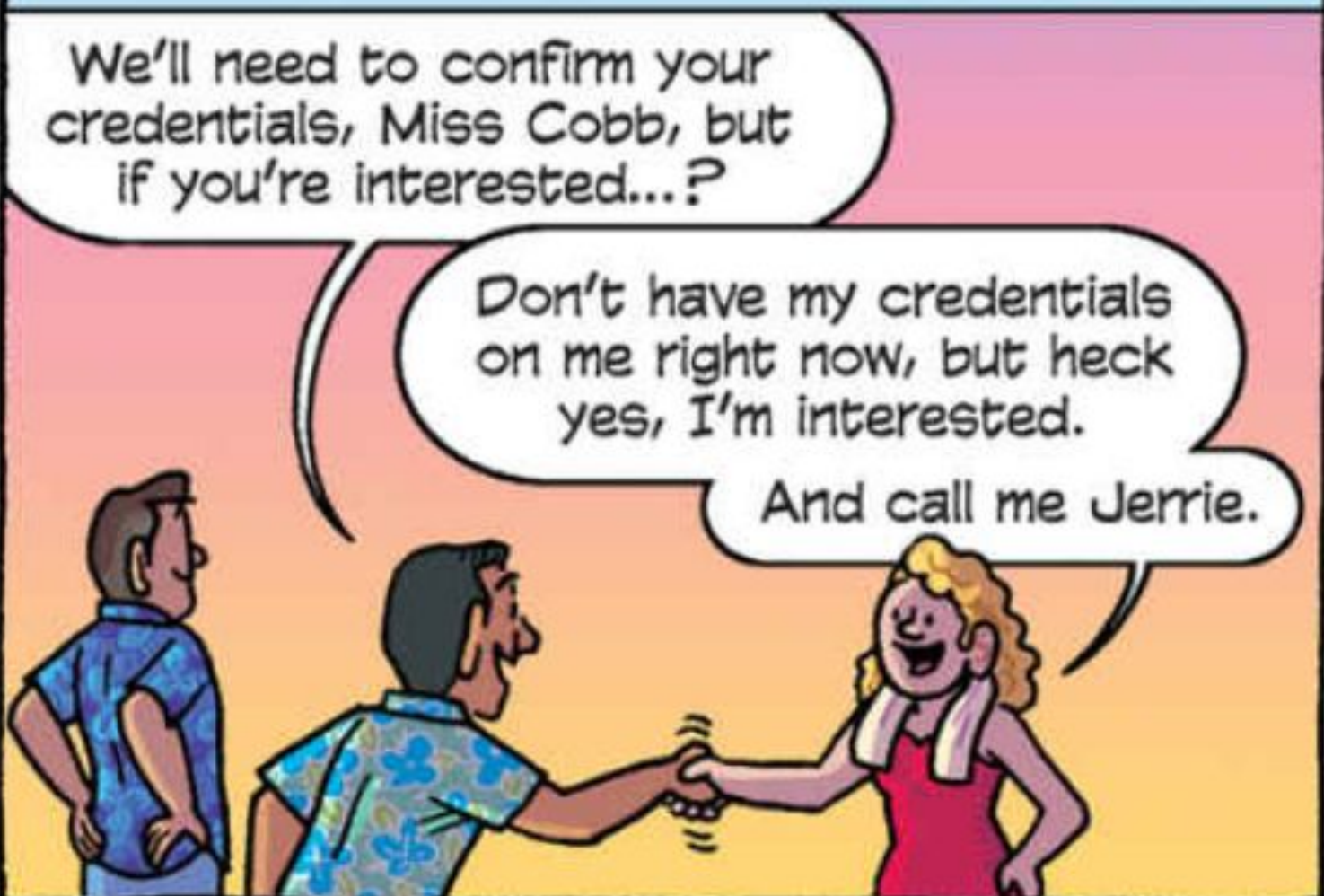


Brigadier General Don "Flick" Flickinger was part of the Air Force's Research and Development Command, and a friend of Dr. Lovelace's.

The general liked science and liked taking chances. So in September 1959, they met "Unit 1, Female" on Miami Beach.



They were in town for an Air Force Association conference, and all had just been for a swim. Flickinger and Lovelace told her what they had in mind...



Jerrie Cobb had commercial flight experience and flying records (including an altitude record), and...

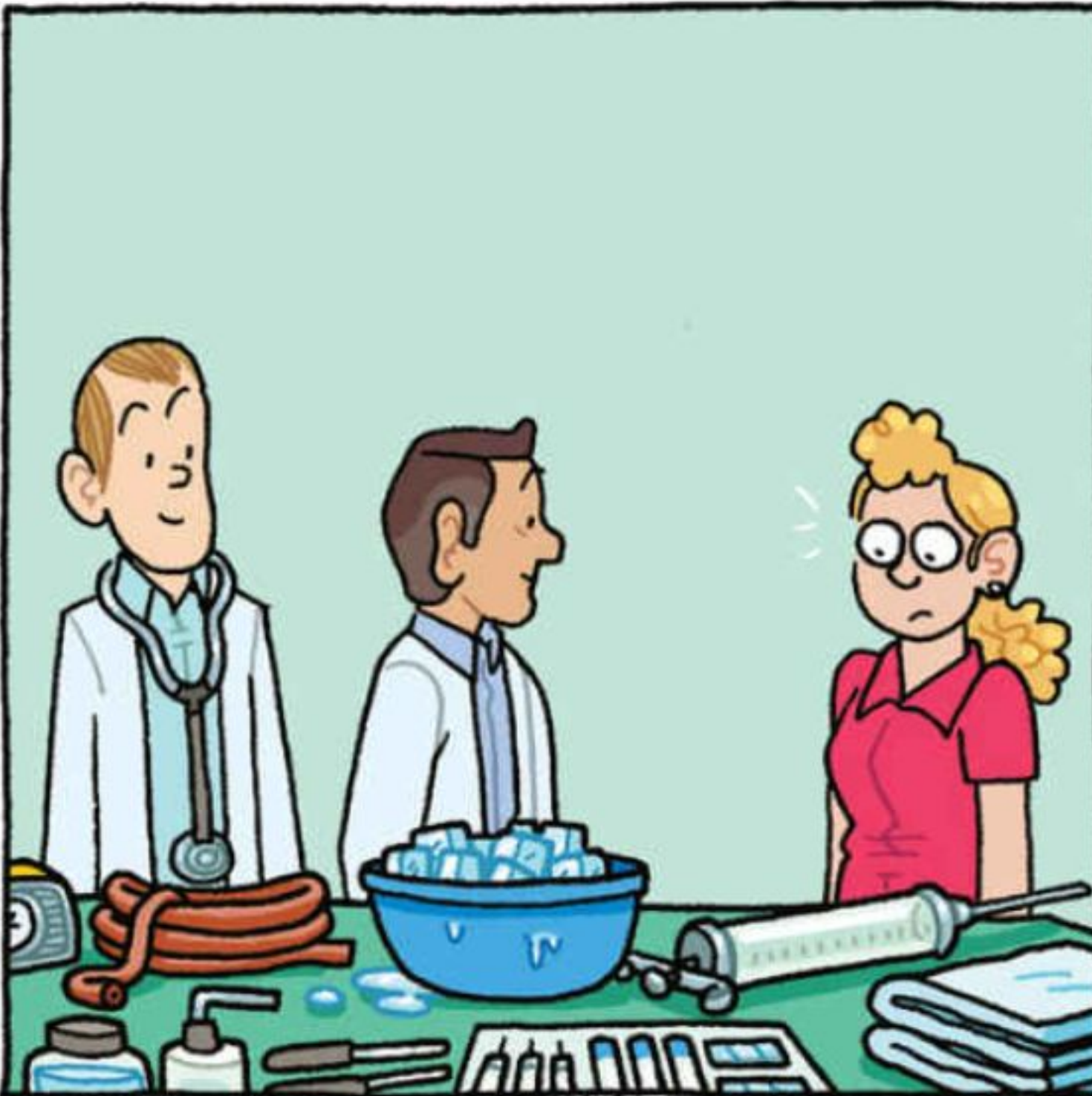


That kicked off the Women in Space Earliest (WISE) program in February 1960.

Okay, Miss Cobb. Are you ready?



You bet! Let's get started.



The Air Force had already pulled its support—in part because they said making pressure suits to fit women would be too expensive—but Lovelace's clinic took over.

And so WISE became WISP (Women in Space Program), Jerrie Cobb got a little famous, and Jackie Cochran got involved.



Yes, Randy, I'm reading about her right now. And yes, I'm interested.





Jackie had piloting records herself, and training experience with the WASPs in the Second World War. She had fame, and money too.

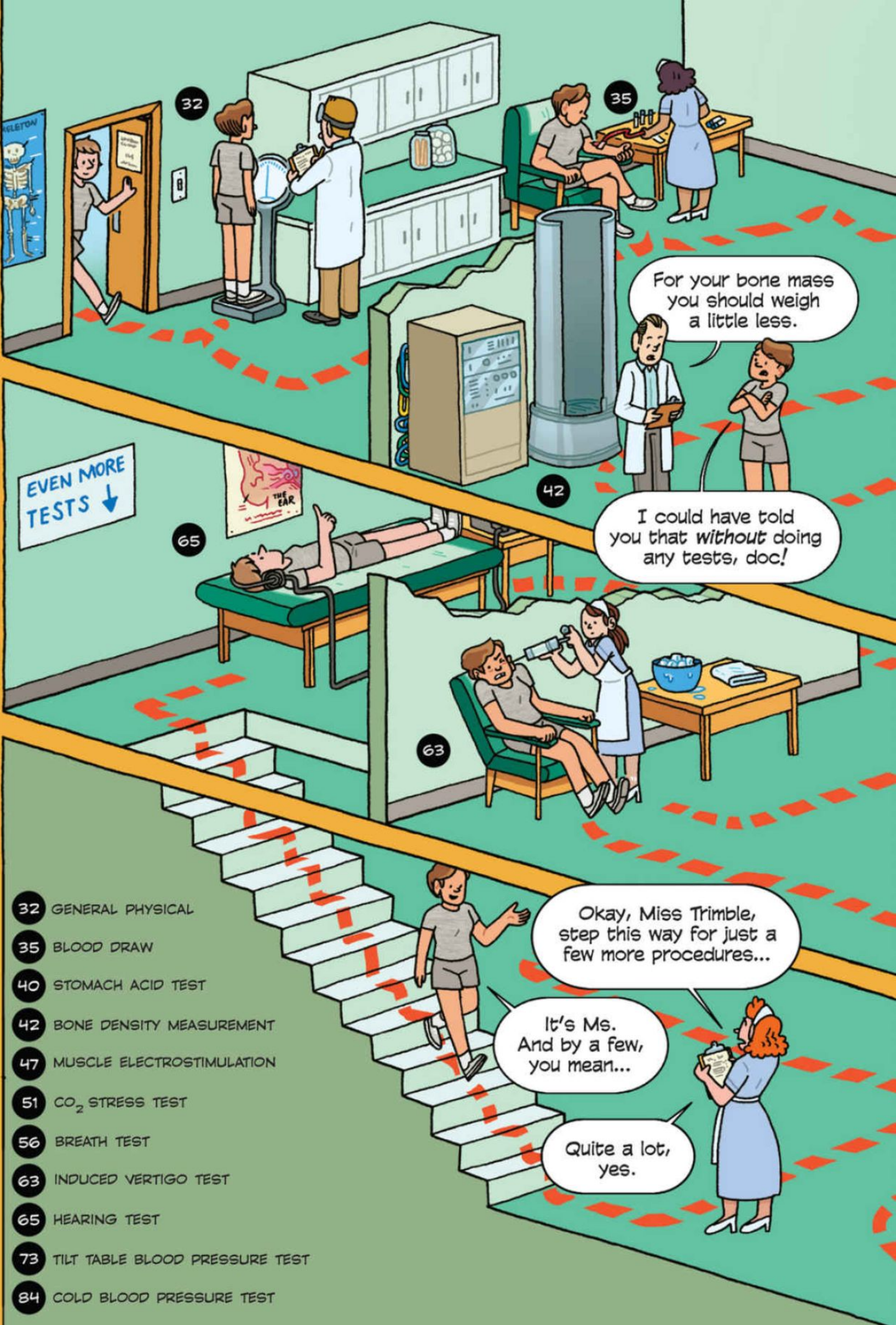
She also had ego and ambition, and wanted to be part of the Women in Space Program, but...



She still agreed to supply funds for more women to undergo testing—most couldn't afford to take time away from their piloting and family to spend a week in the lab.

They came to the Lovelace Clinic separately and anonymously, but were tested in pairs.





For your bone mass you should weigh a little less.

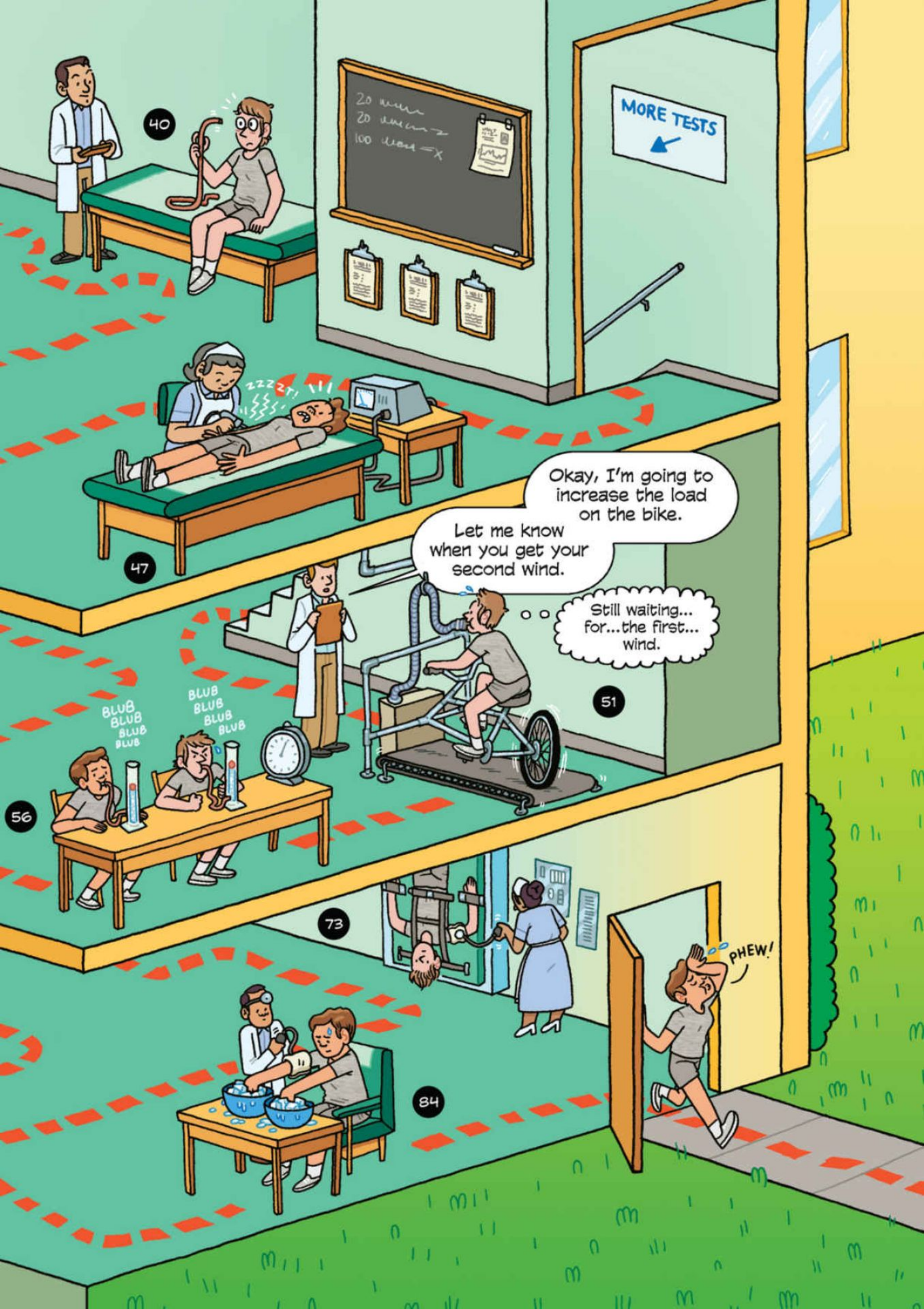
I could have told you that *without* doing any tests, doc!

Okay, Miss Trimble, step this way for just a few more procedures...

It's Ms. And by a few, you mean...

Quite a lot, yes.

- 32 GENERAL PHYSICAL
- 35 BLOOD DRAW
- 40 STOMACH ACID TEST
- 42 BONE DENSITY MEASUREMENT
- 47 MUSCLE ELECTROSTIMULATION
- 51 CO₂ STRESS TEST
- 56 BREATH TEST
- 63 INDUCED VERTIGO TEST
- 65 HEARING TEST
- 73 TILT TABLE BLOOD PRESSURE TEST
- 84 COLD BLOOD PRESSURE TEST



40

20 min
20 min →
100 min = X

MORE TESTS
←

47

Okay, I'm going to increase the load on the bike.

Let me know when you get your second wind.

Still waiting... for... the first... wind.

51

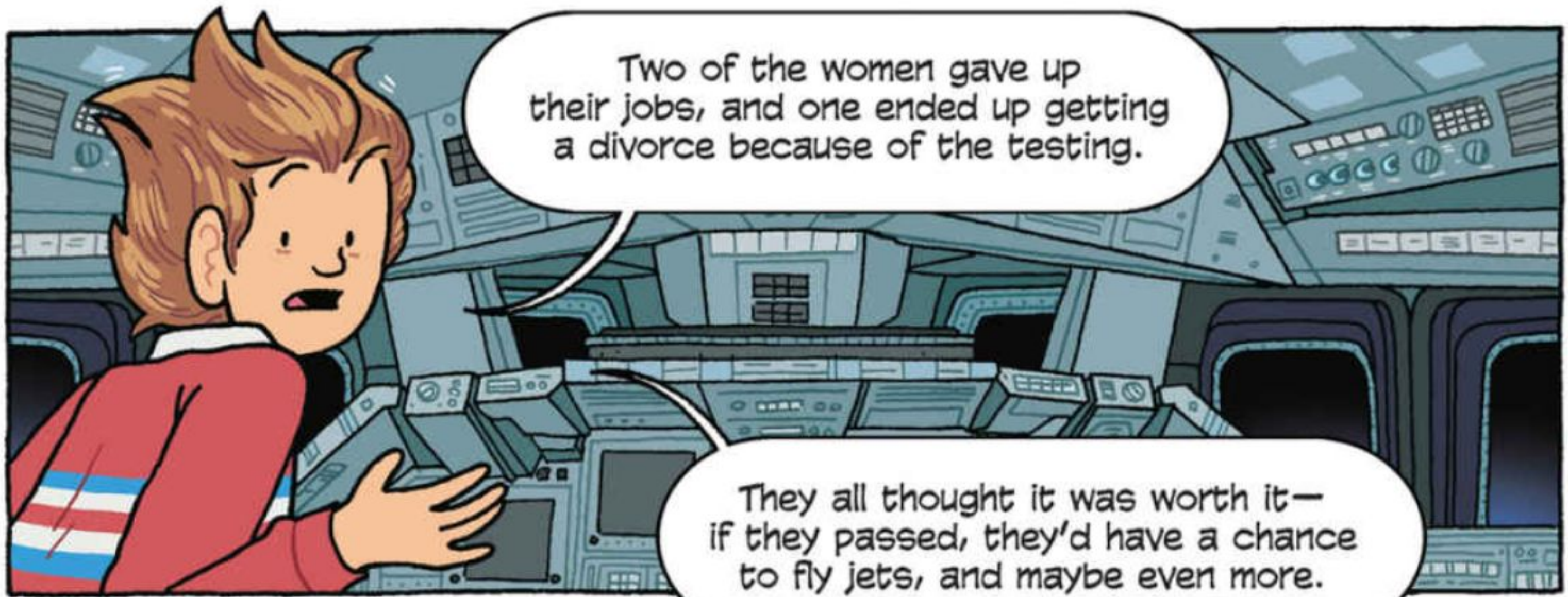
56

BLUB
BLUB
BLUB
BLUB

73

84

PHEW!



Two of the women gave up their jobs, and one ended up getting a divorce because of the testing.

They all thought it was worth it— if they passed, they'd have a chance to fly jets, and maybe even more.



MYRTLE CAGLE

JERRIE COBB

JANET DIETRICH

MARION DIETRICH

WALLY FUNK

SARAH GORELICK

JANEY HART



JEAN HIXSON

RHEA HURRE

GENE NORA STUMBOUGH

IRENE LEVERTON

JERRIE SLOAN

BERNICE TRIMBLE

And thirteen did pass. But the jets?



That's not what happened.

You want to determine the...

Getting the Mercury 13 into jets so they could have their brain waves measured under realistic conditions needed Pentagon approval.



...the difference between male and female astronauts?

First, astronauts?

Second, if you don't know the difference already, we refuse to put money into the project.

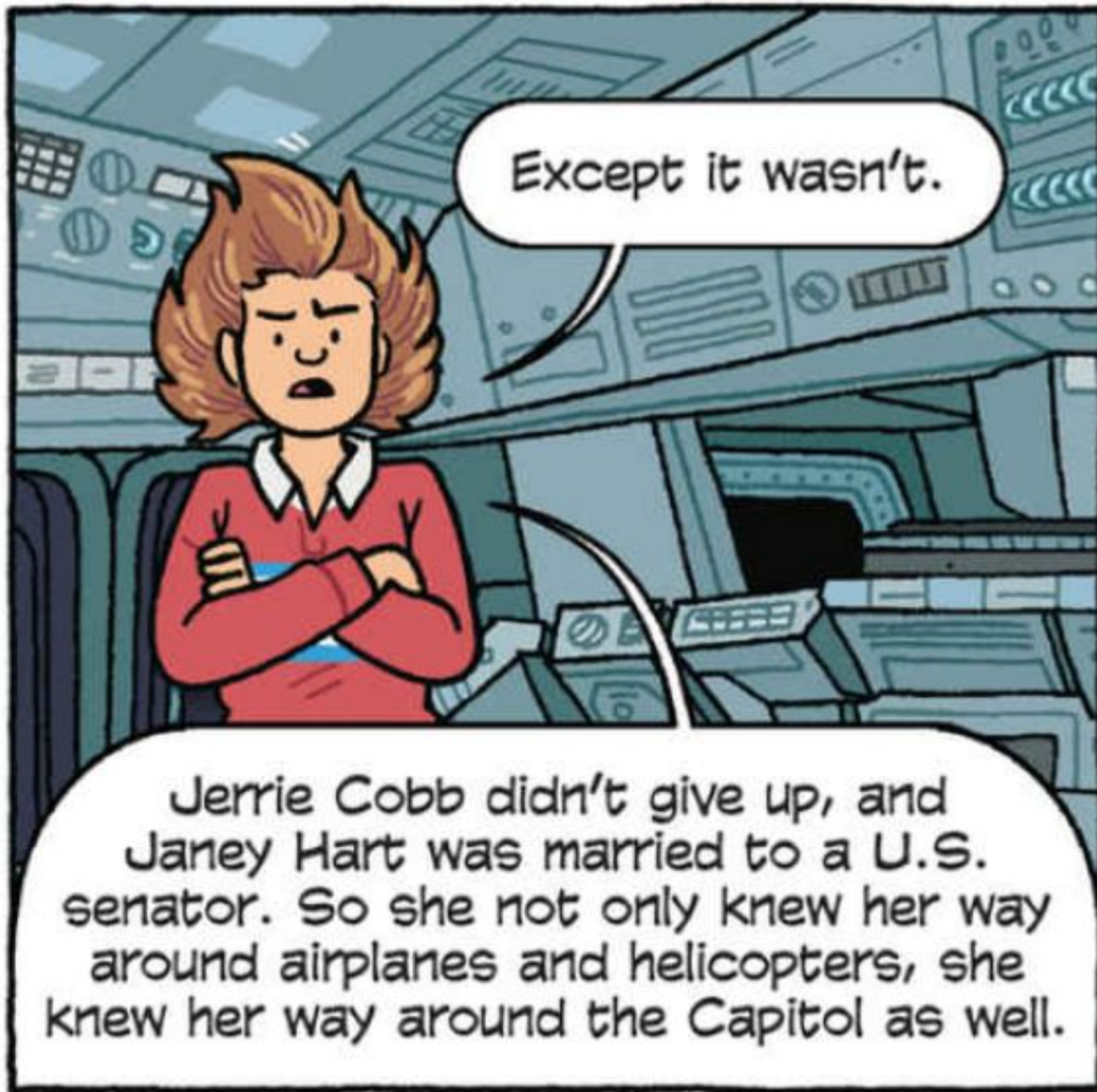




I'm pulling your leg, Doc, Mrs. Cochran. Tell you what—you get the Navy boys in Pensacola to go along with it, and we'll help you out.

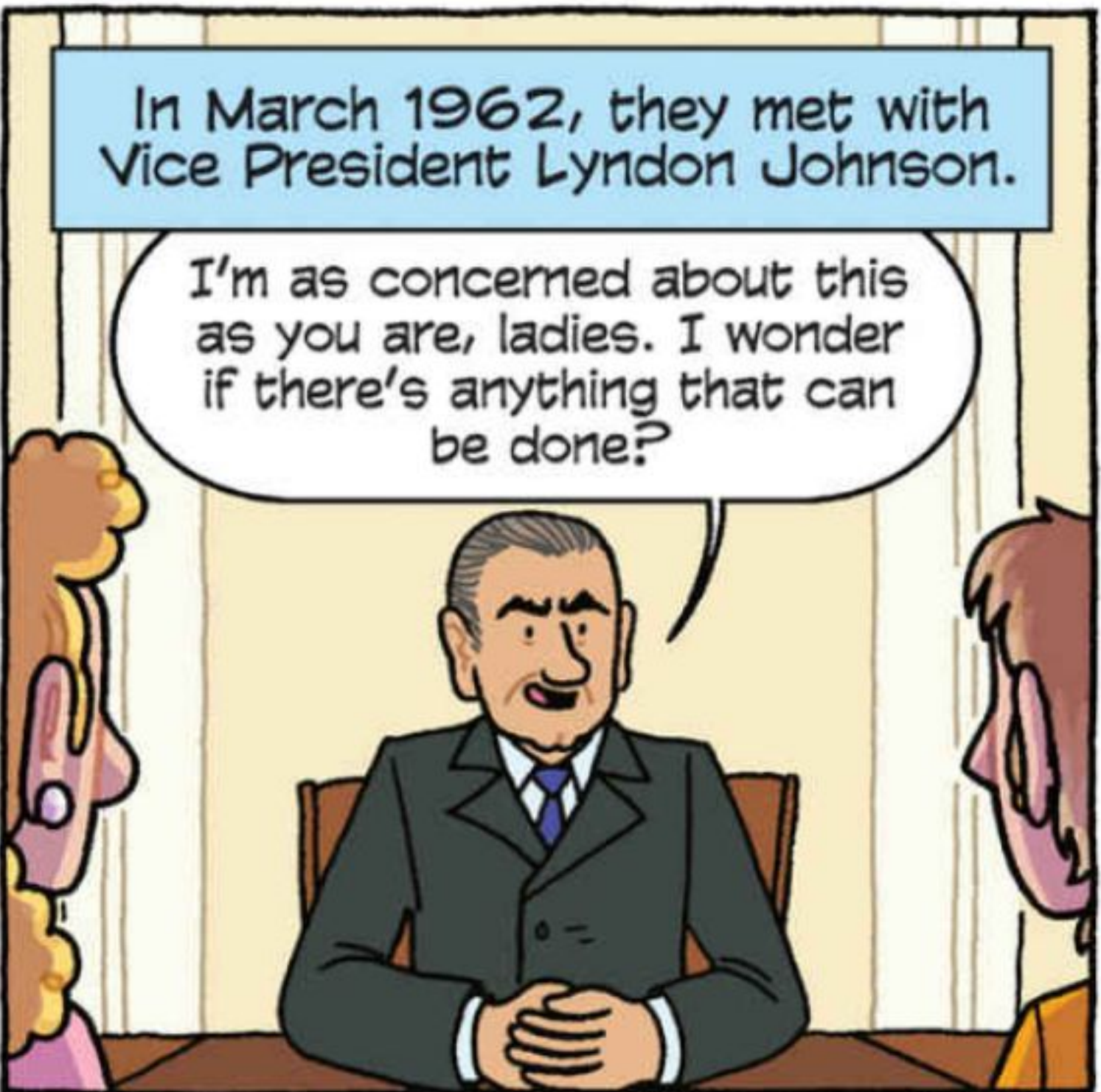
The Navy boys in Pensacola didn't go along with it, and that was that.

DENIED



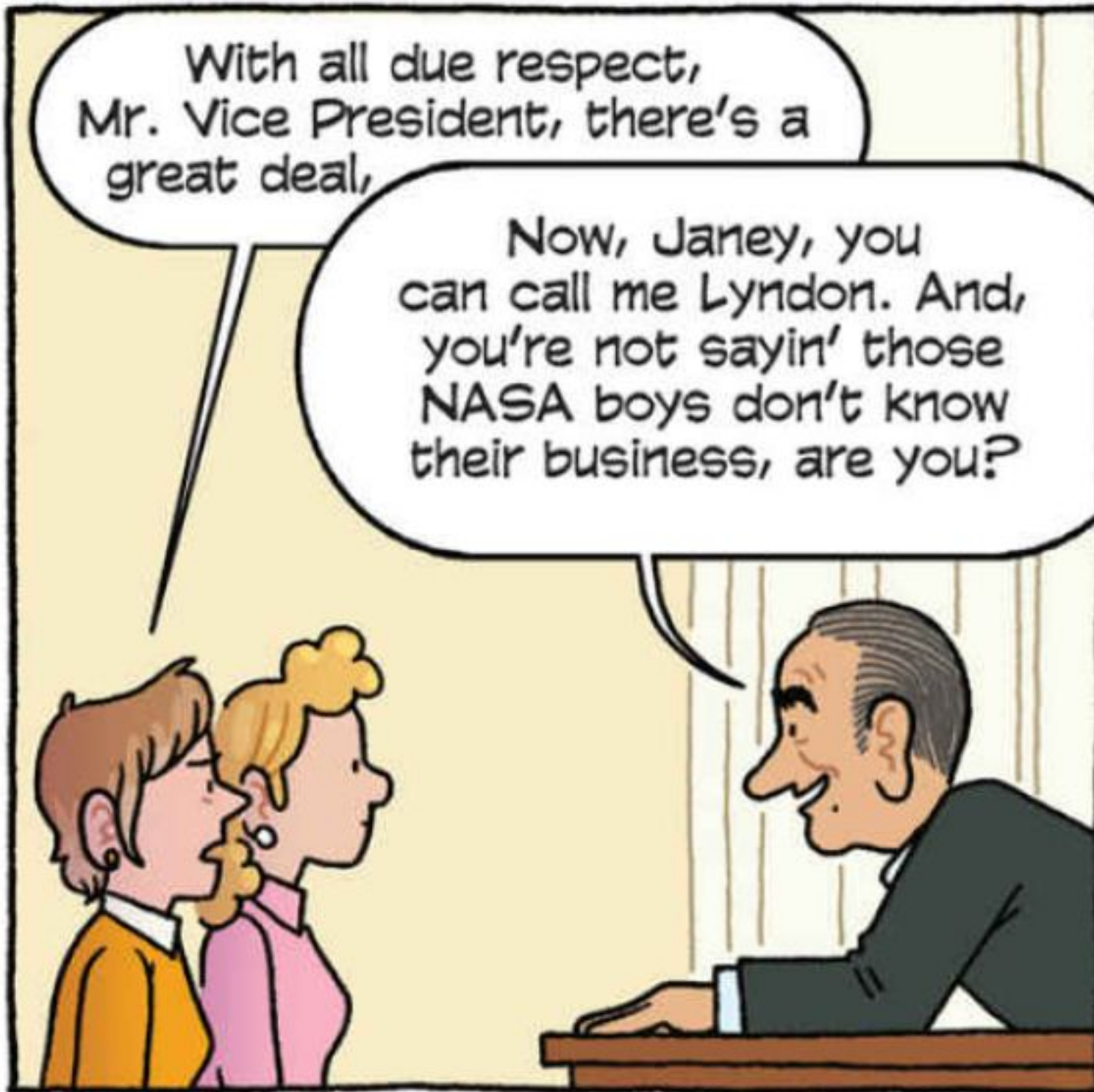
Except it wasn't.

Jerrie Cobb didn't give up, and Janey Hart was married to a U.S. senator. So she not only knew her way around airplanes and helicopters, she knew her way around the Capitol as well.



In March 1962, they met with Vice President Lyndon Johnson.

I'm as concerned about this as you are, ladies. I wonder if there's anything that can be done?



With all due respect, Mr. Vice President, there's a great deal,

Now, Janey, you can call me Lyndon. And, you're not sayin' those NASA boys don't know their business, are you?



Well, we're sure they do, but they're not seeing the big

I'm pleased as punch we see eye to eye on that. And I'm sure they don't want a fella like me—a politician—stickin' his nose into scientific matters.



They weren't done. In July 1962 they got themselves a congressional hearing. This was their big chance to make the case for women astronauts.



What does your husband, Senator Phil Hart, think about your petition to Congress?

I've never asked him. Now, if you'll please—



...excuse us?



The topic of the hearing was "Qualifications for Astronauts."




There were other special guests.

John Glenn and Scott Carpenter had both just flown in space. They were Famous American Heroes, and that's with a capital F, capital A, and capital H!




When things settled down, Jerrie Cobb was the first to testify.

A-almost three years ago, Dr. Randolph Lovelace and Air Force Brig. Gen. Donald Flickinger asked me to be the first woman to undergo the Mercury astronaut tests at the Lovelace Clinic.



When my qualifications checked out, I passed them all, and as a result, it was decided to test a whole, um, group of woman pilots.

Famed pilot Jacqueline Cochran paid the expenses of many of us who underwent these tests.




After twelve other women had p-passed, I was sort of, well, drafted to be spokesperson for all of us. As you can tell, it certainly wasn't because of my speaking ability.

HA HA HA HA HEH HEH HA HA




Now, there are sound reasons for using women as astronauts.

Women weigh less and consume less food and oxygen than men, important when every pound of humanity and life support systems is a grave obstacle in the cost of space vehicles.



Women are more radiation-resistant and less prone to heart attacks, and are less susceptible to monotony, loneliness, heat, cold, pain, and noise.




We have seen the pride of the entire free world in U.S. astronauts like Glenn and Carpenter.

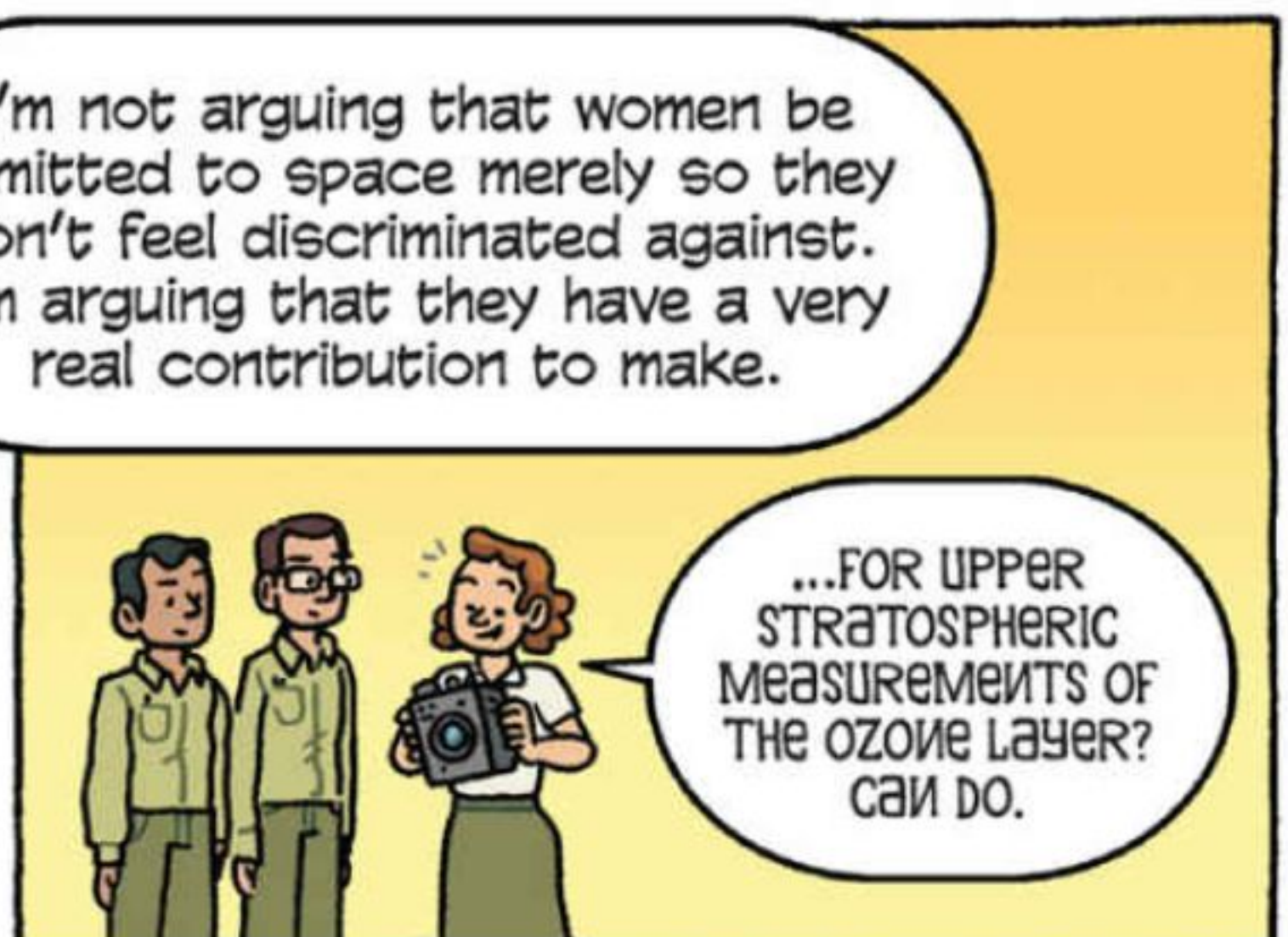
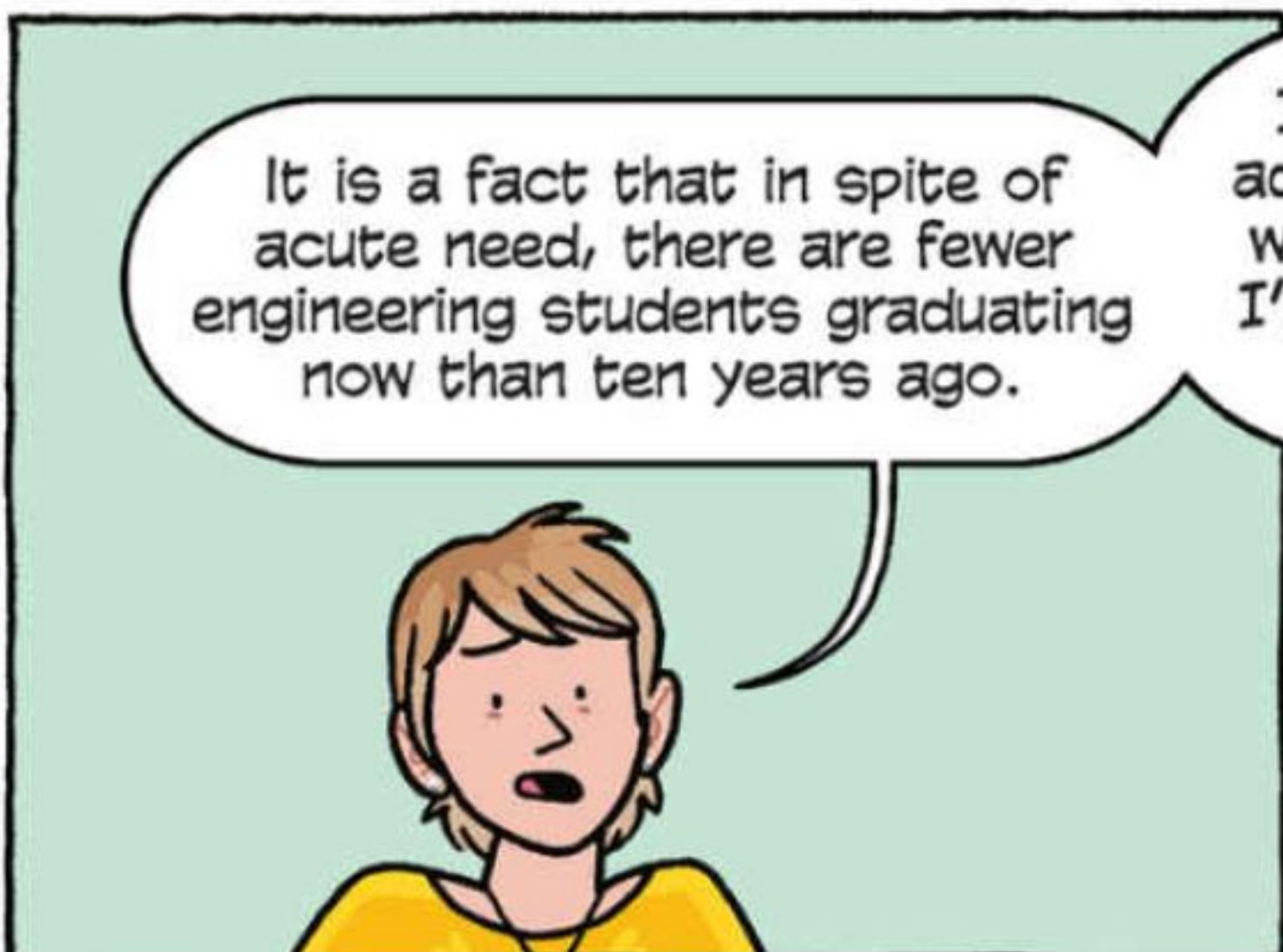
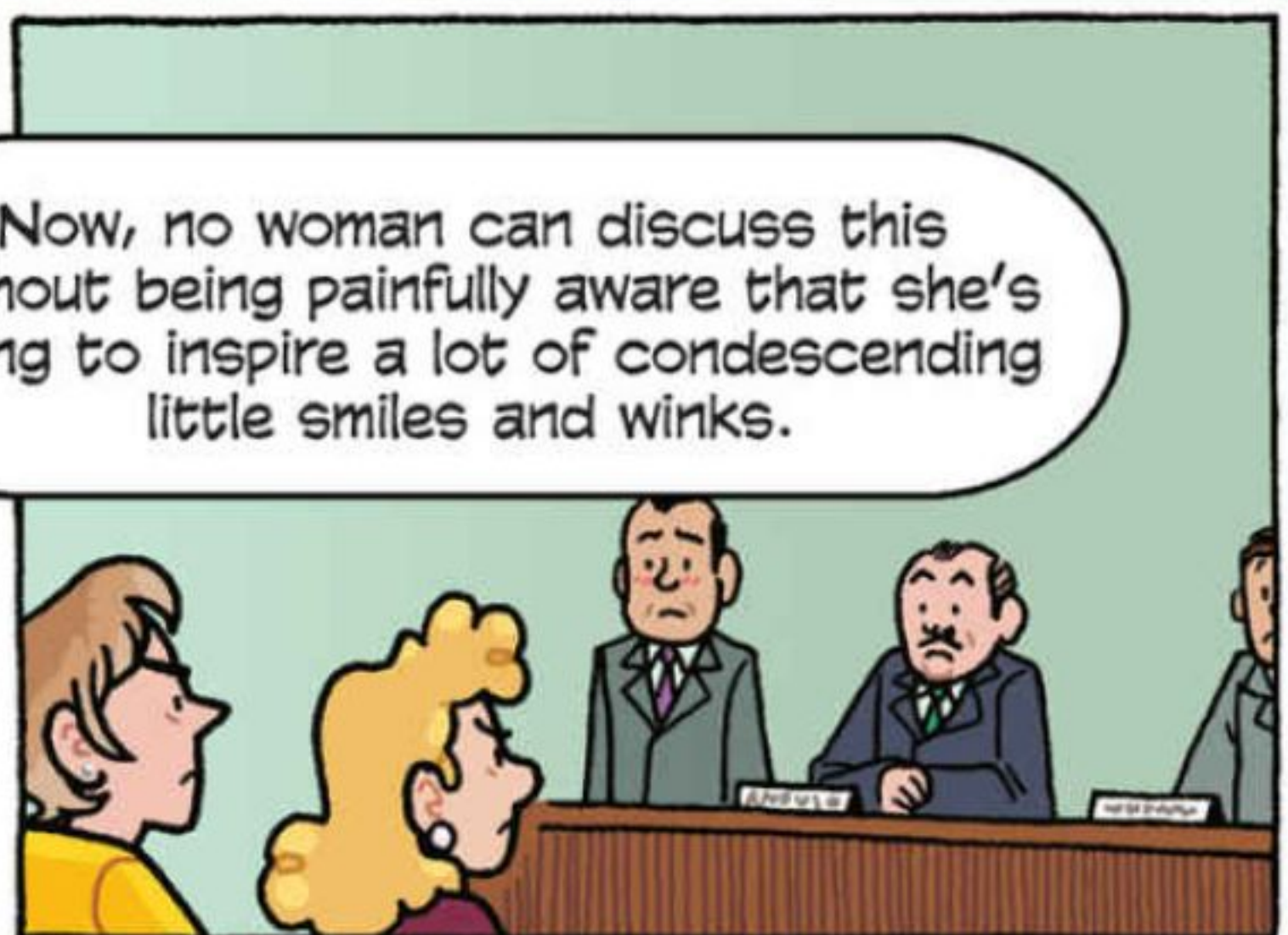
UNDER NO CIRCUMSTANCES SHOULD AN AMERICAN BECOME THE FIRST WOMAN IN SPACE. THAT WOULD BE AN INSULT TO THE FEELINGS OF SOVIET WOMEN.

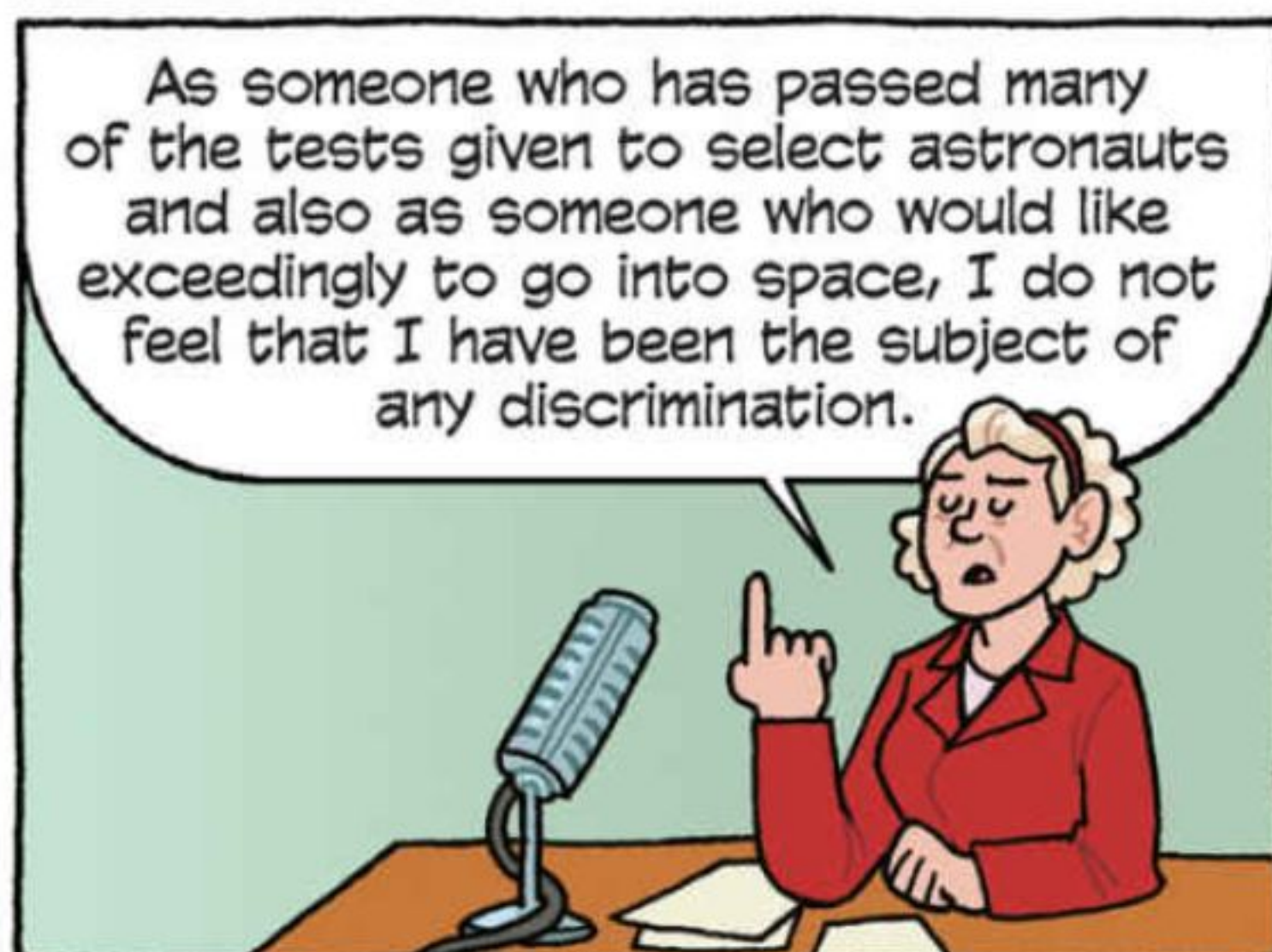
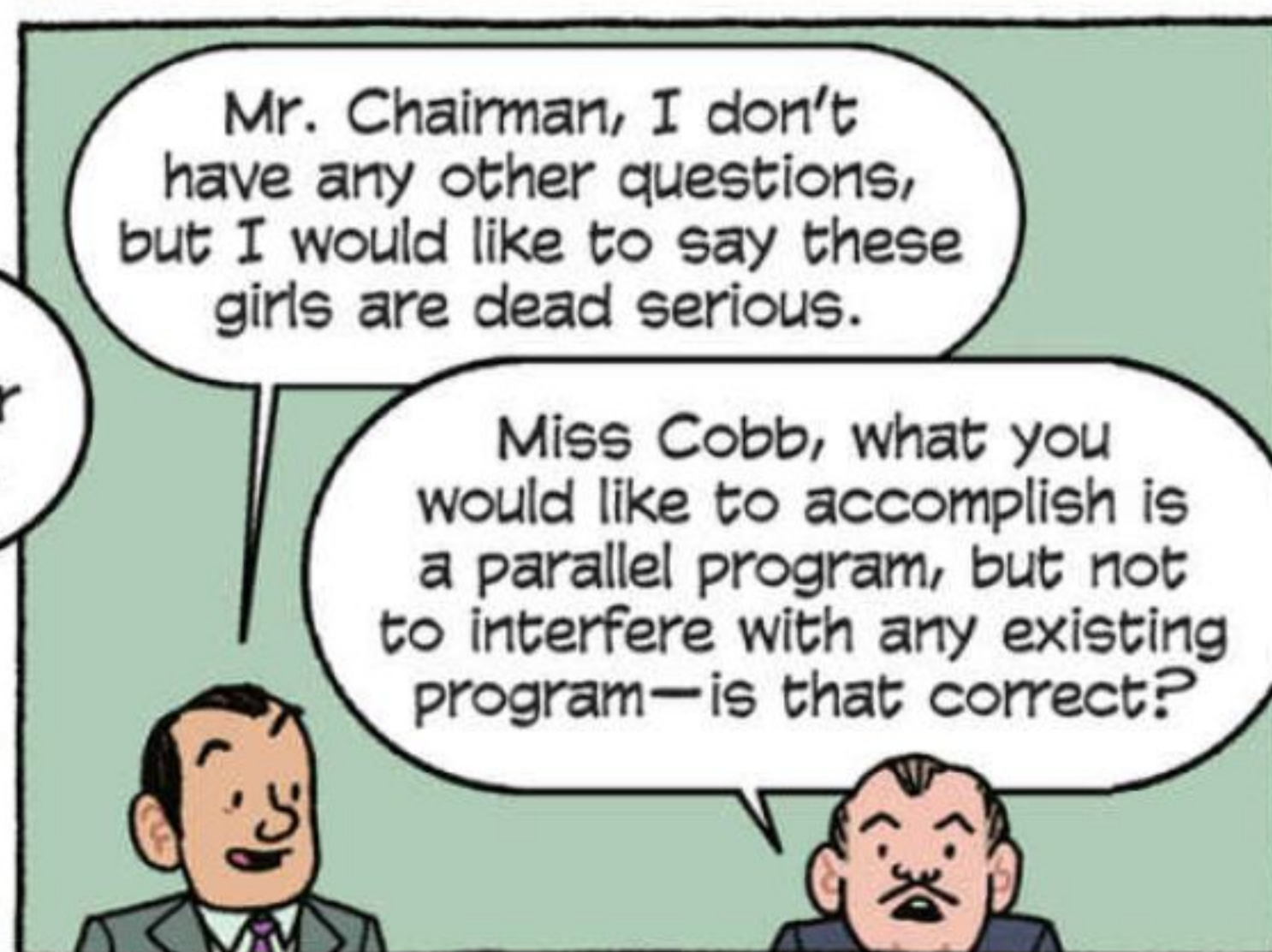
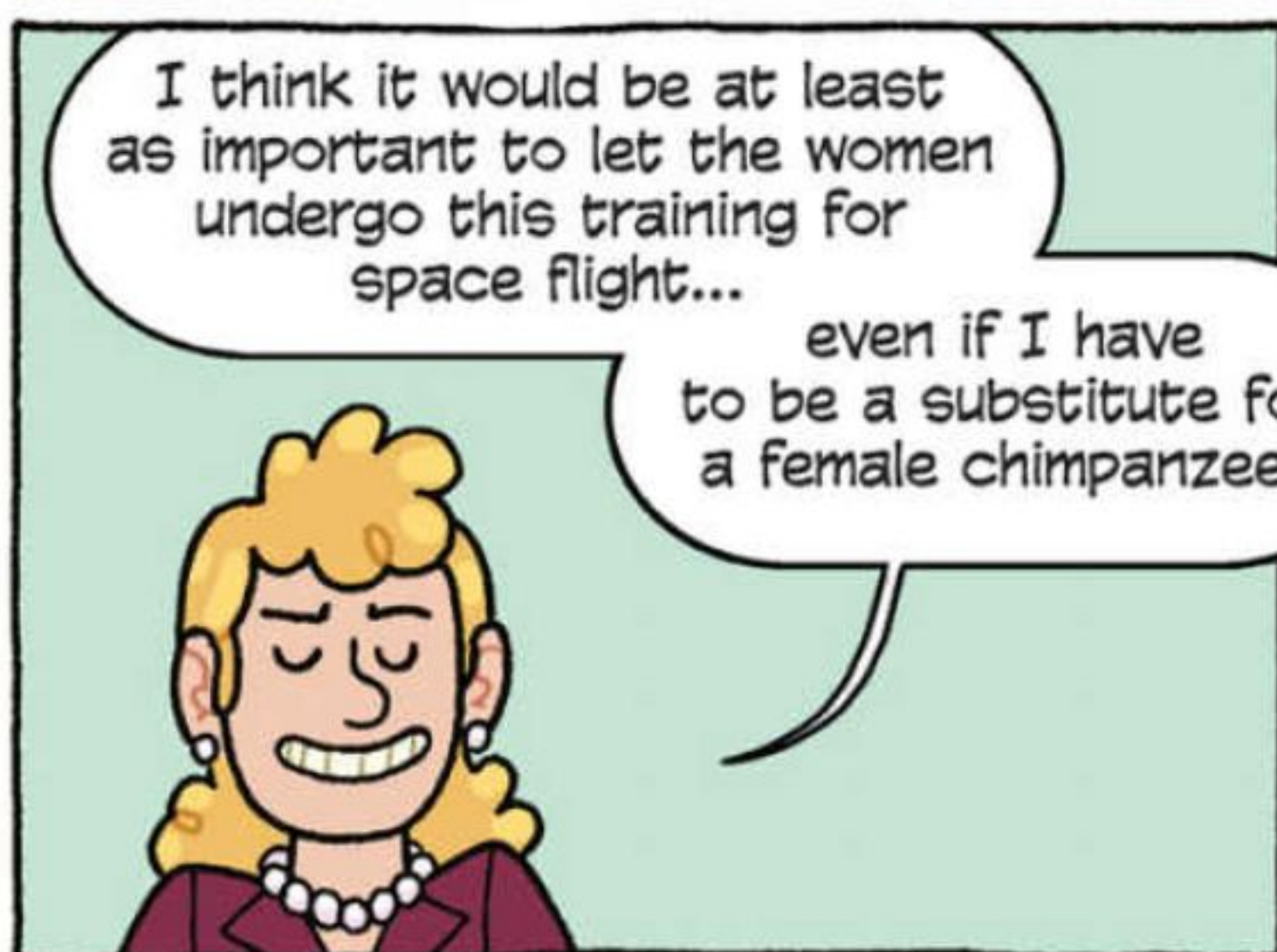
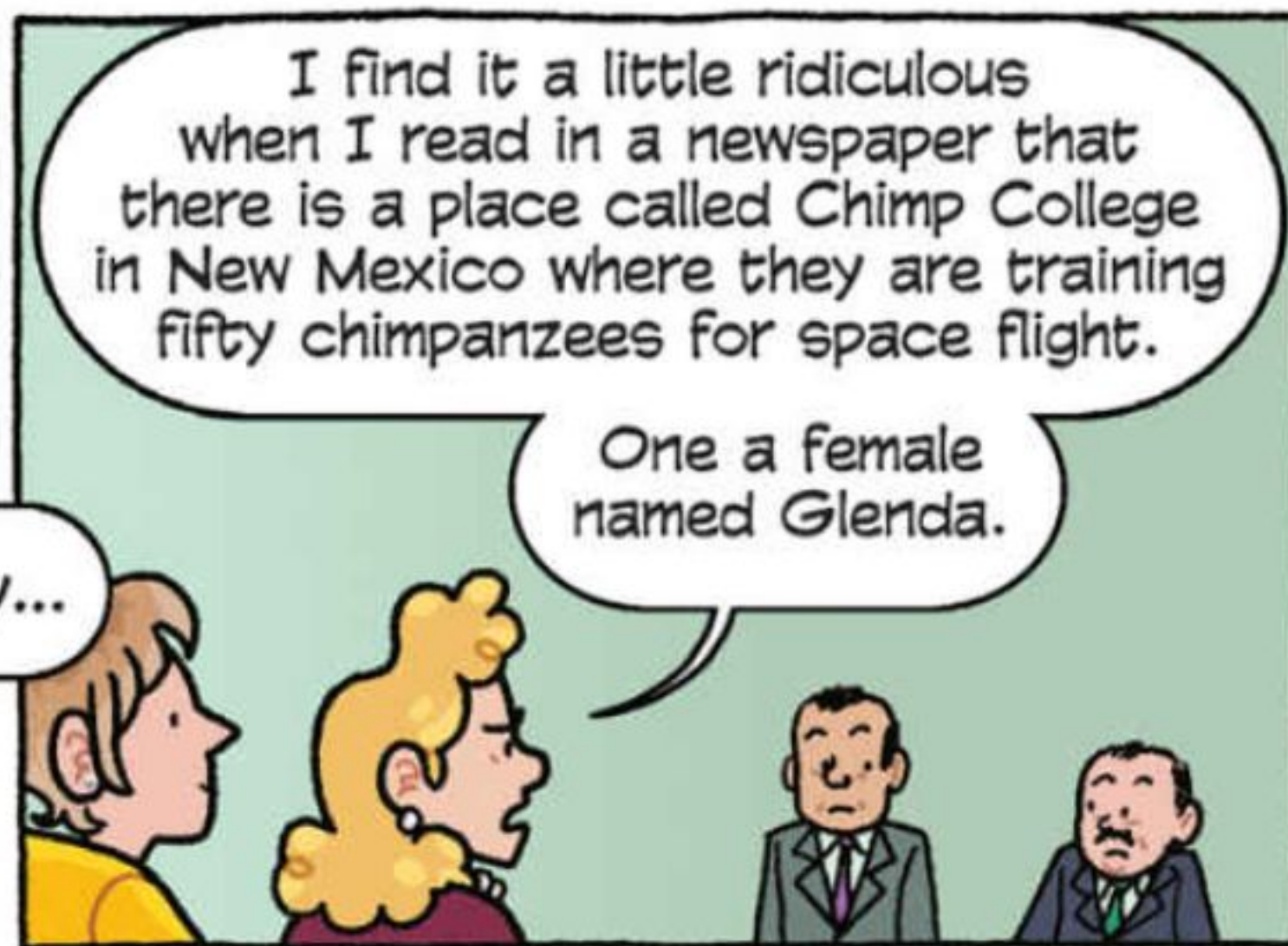


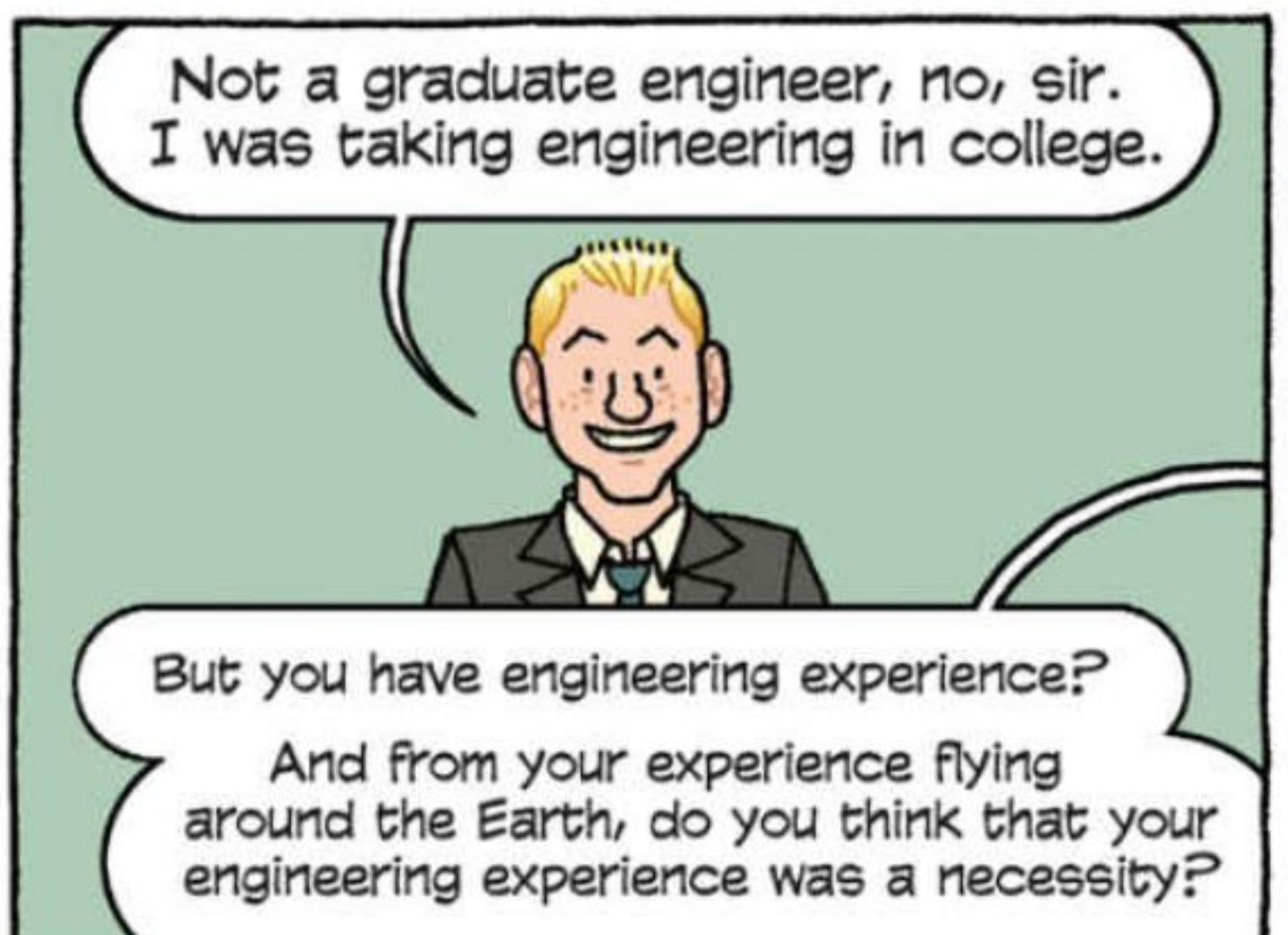
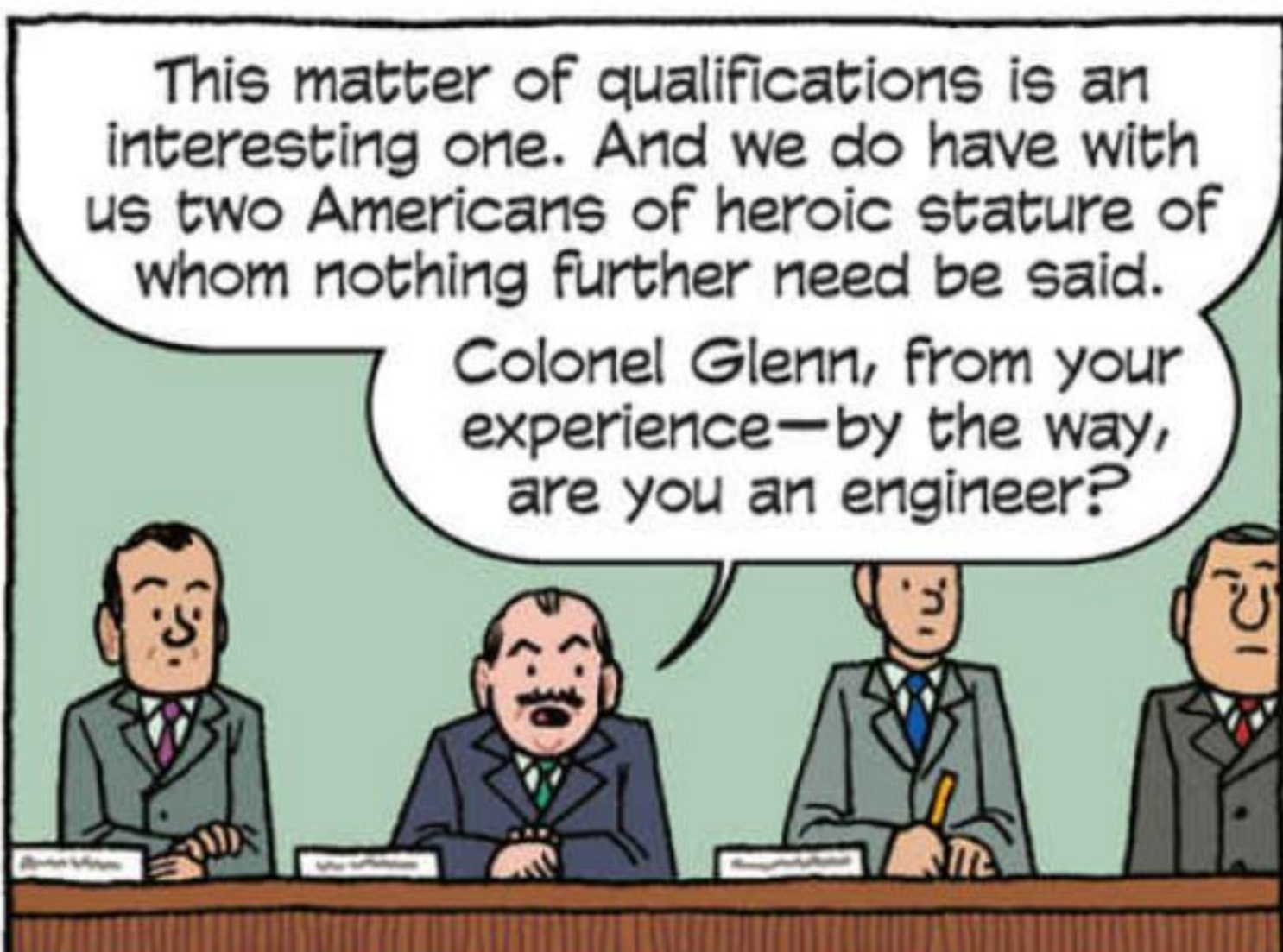
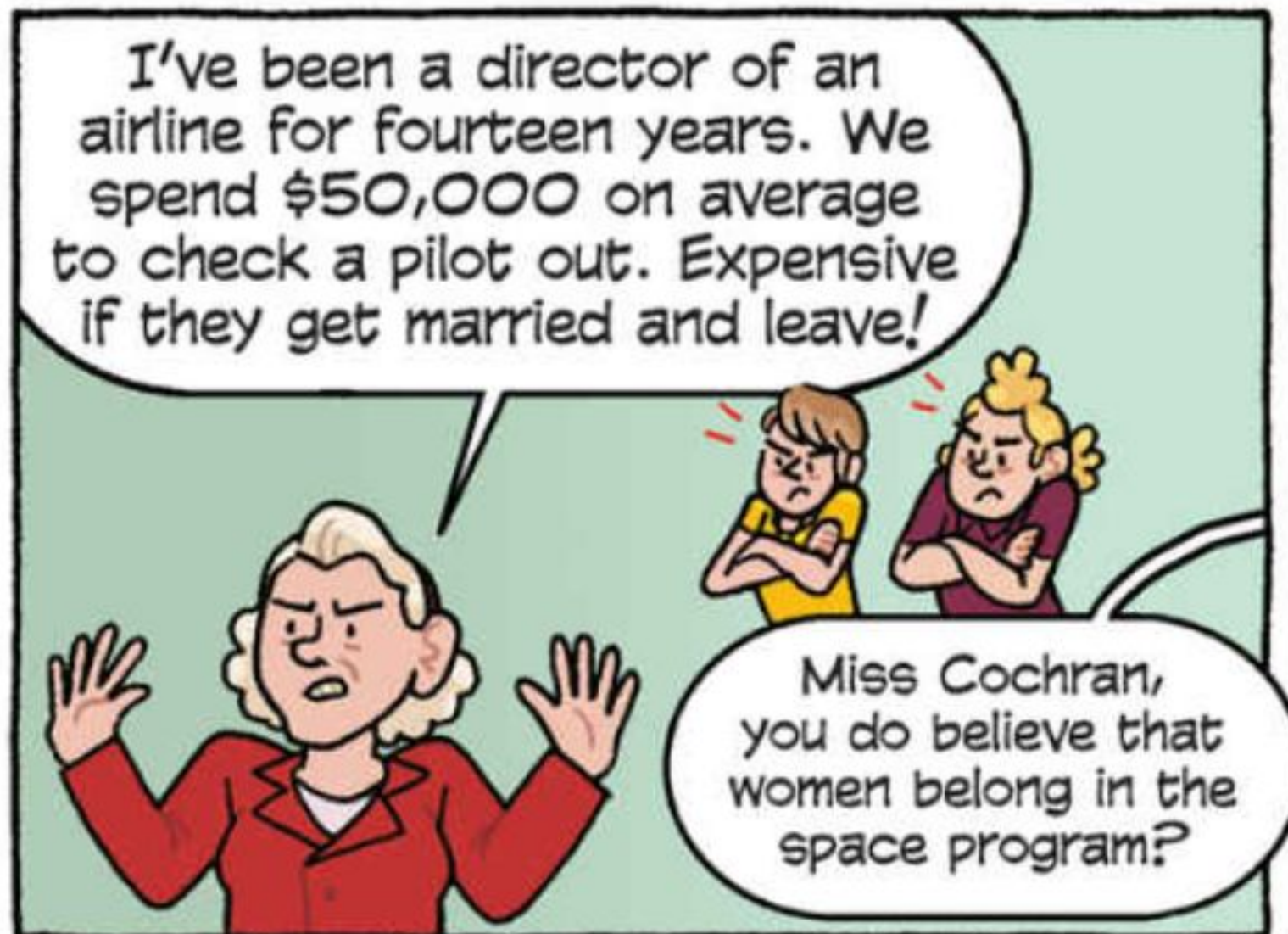
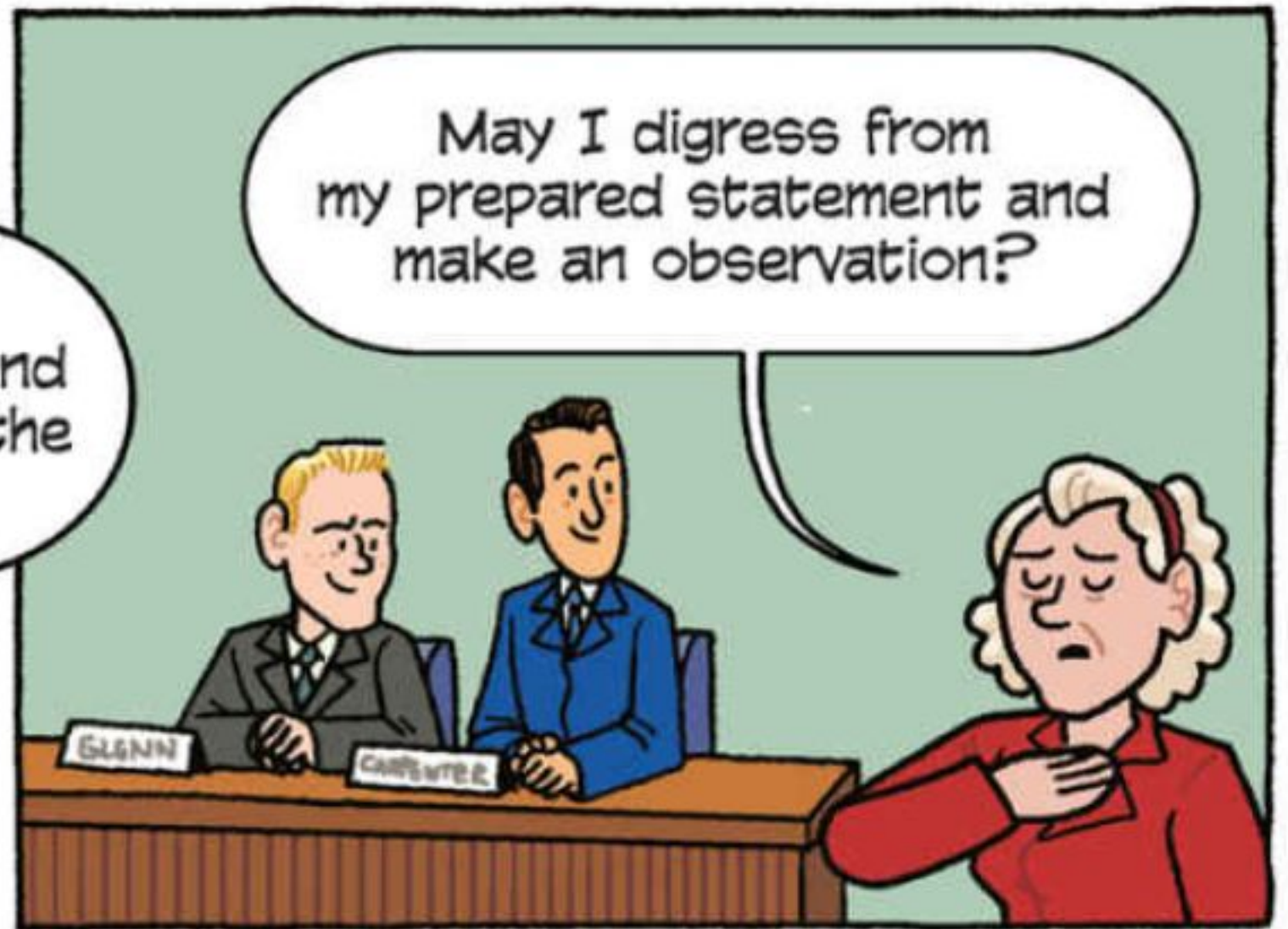
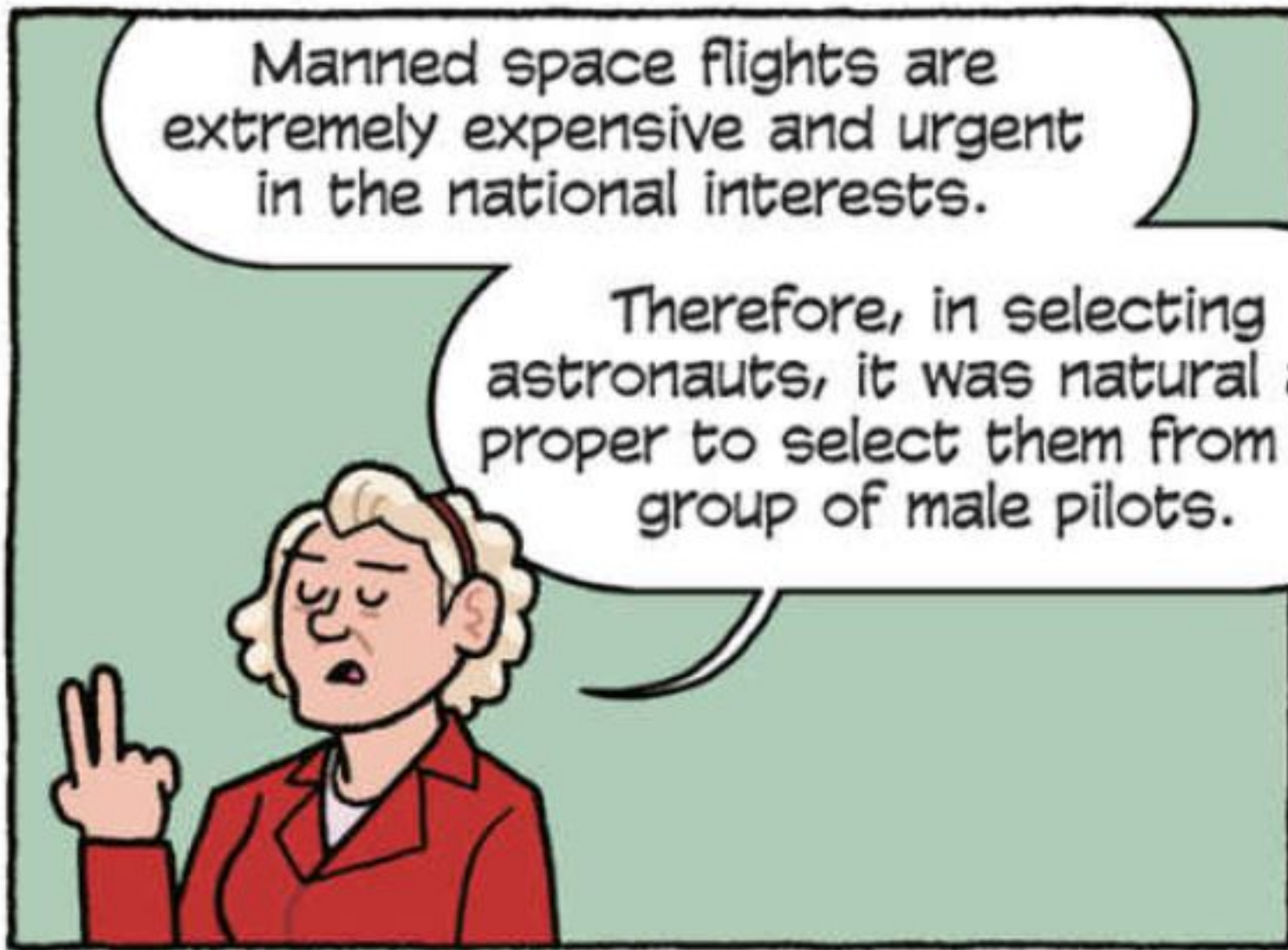
But no nation has yet sent a human female into space.

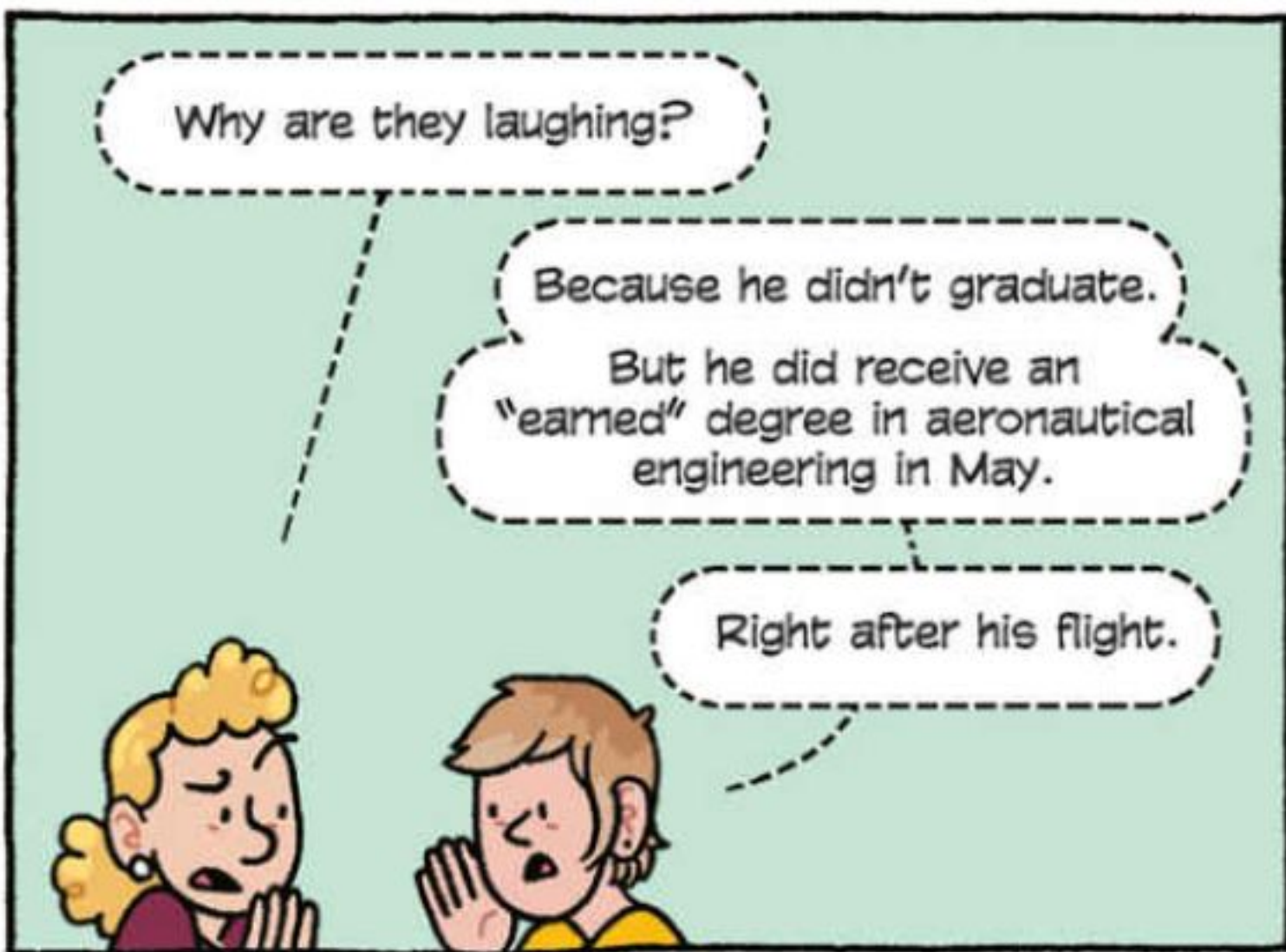
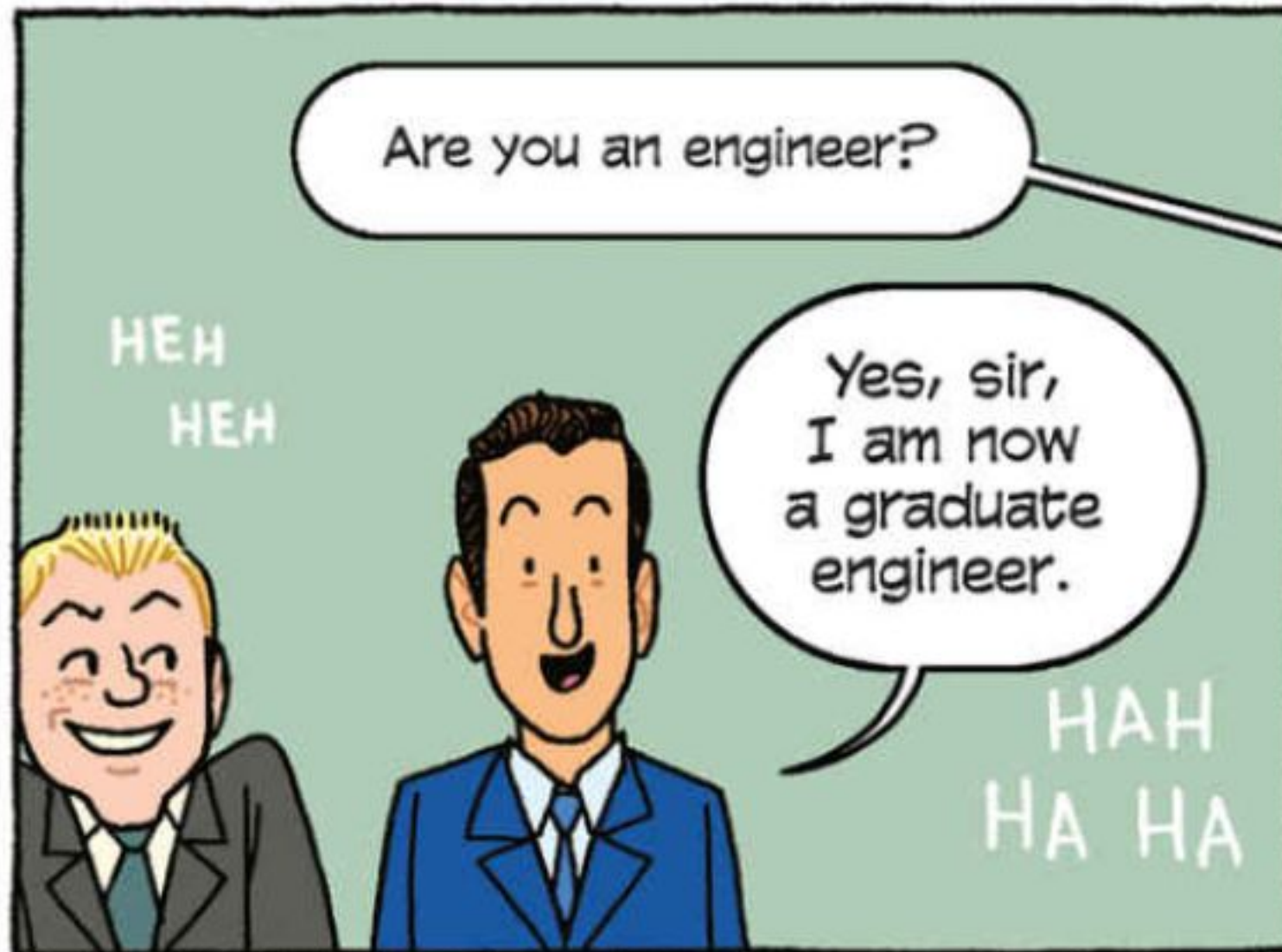
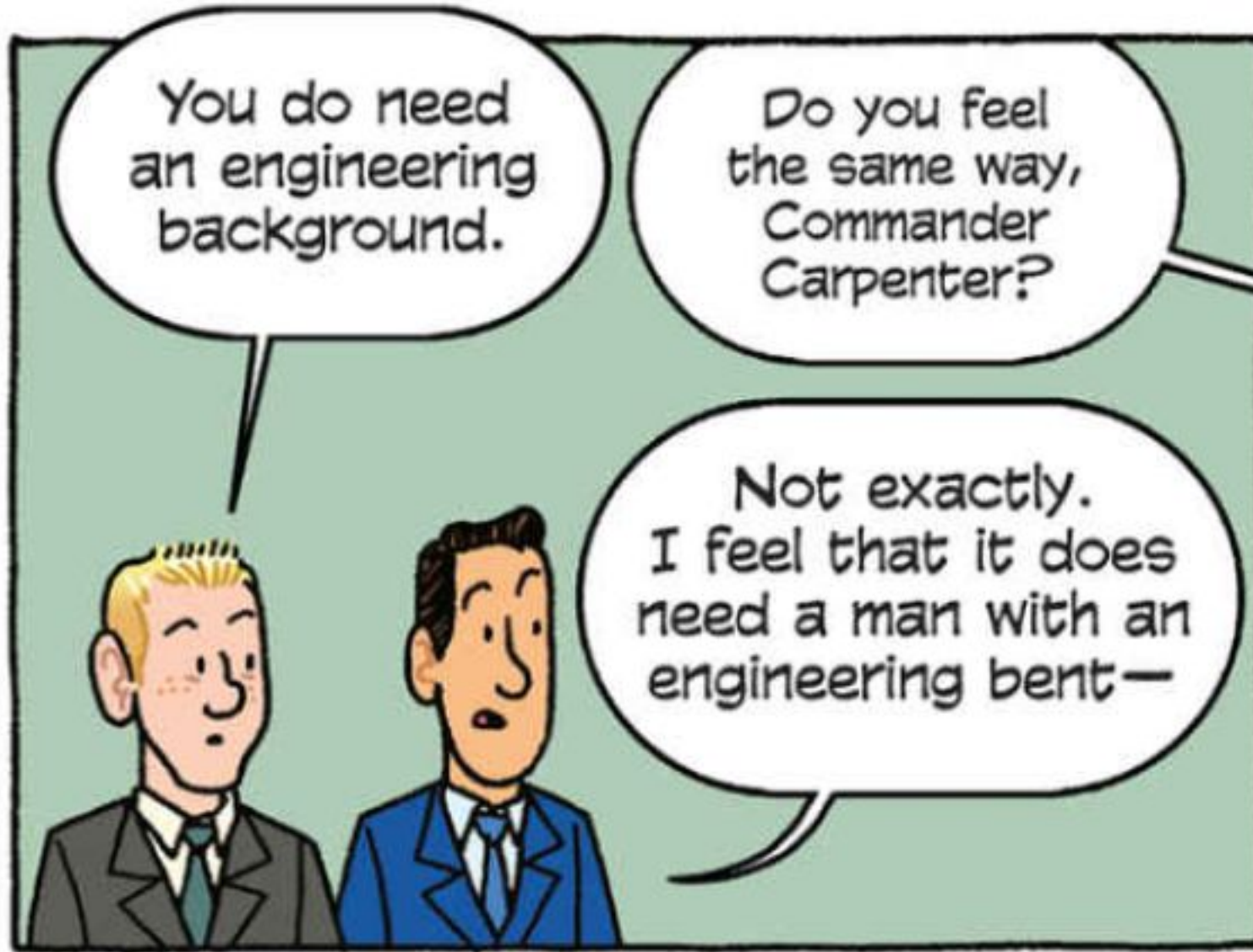
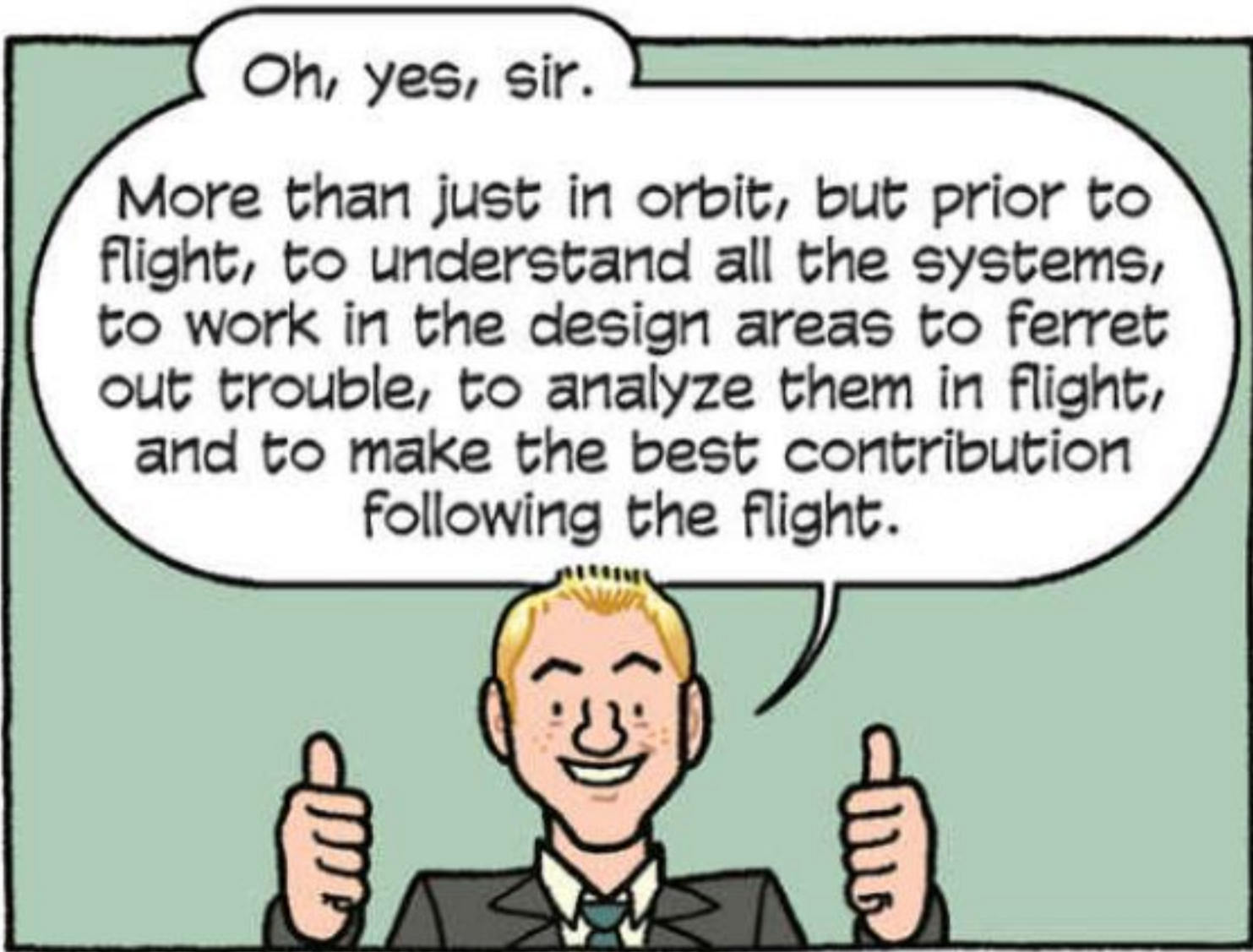
Miss Cobb, that was an excellent statement. I think we can safely say that the purpose of space exploration is to someday colonize other planets.

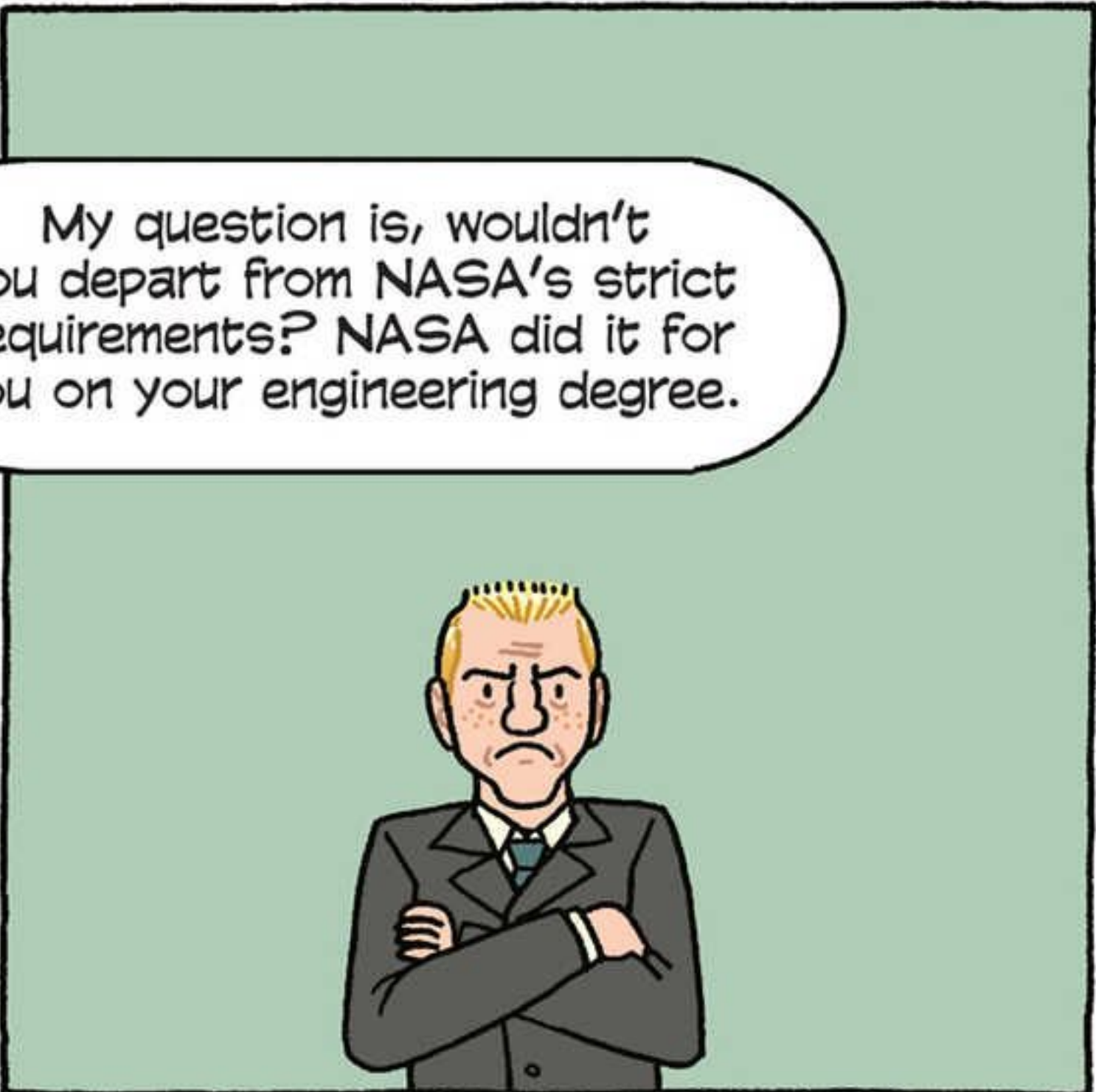
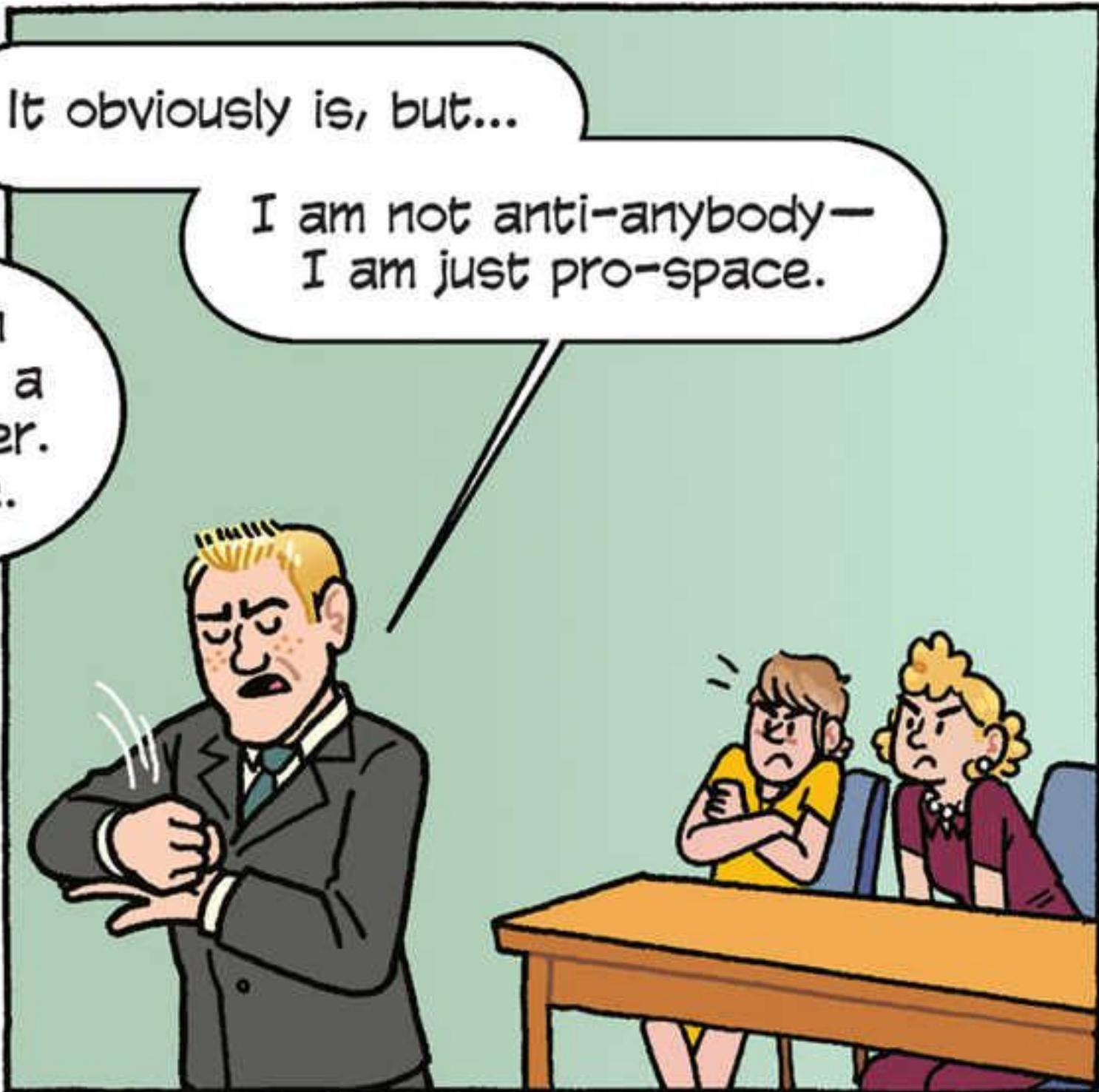
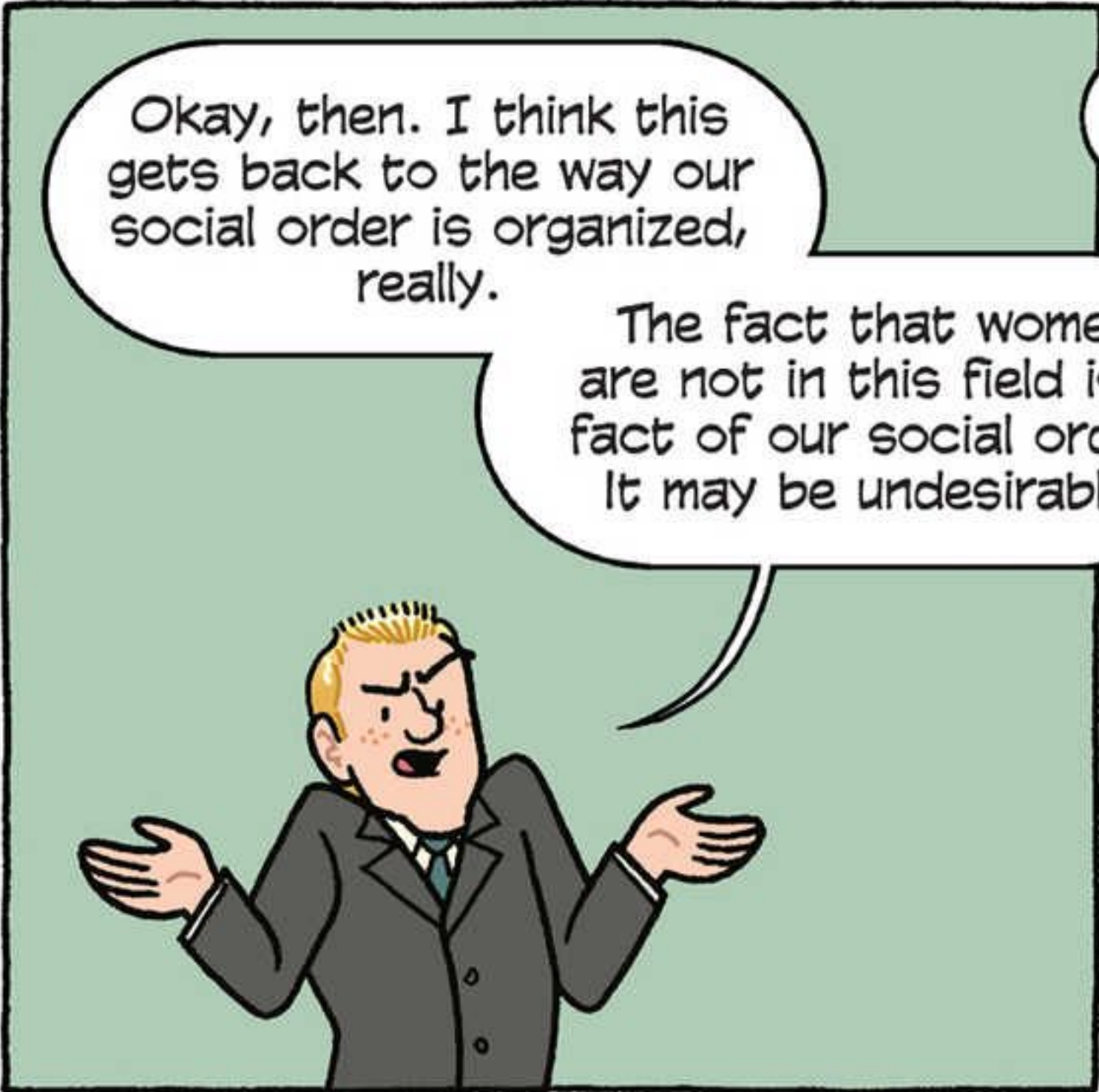


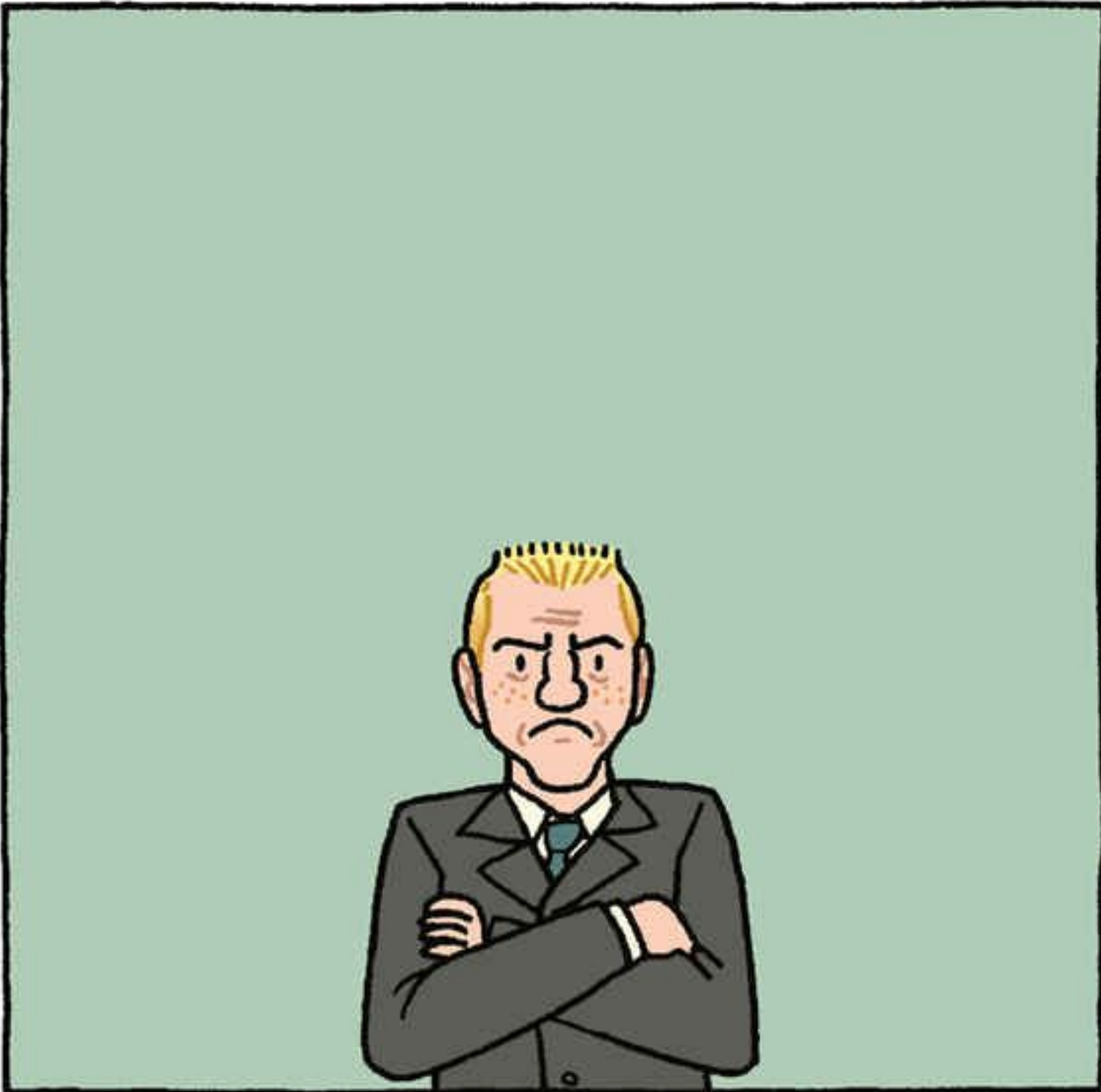












No. I see no requirement to do this.
To spend many millions of dollars to additionally qualify other people, whom we don't particularly need, regardless of sex, creed, or color?



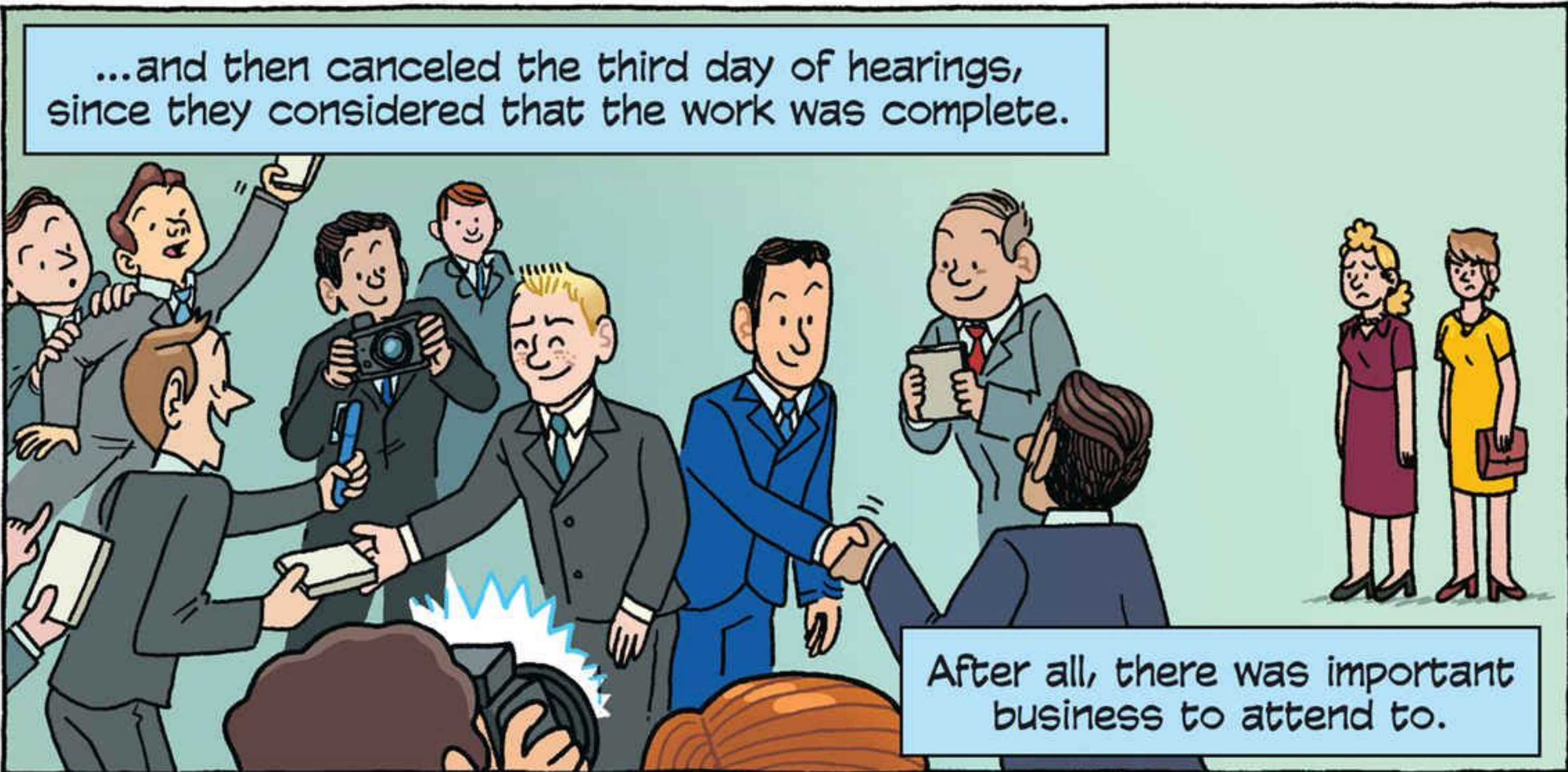
It doesn't seem right, when we already have these qualified people.

COMRADES YERKINA, KUZNETSOVA. WELCOME TO THE COSMONAUT CORPS. NOW WE ARE FIVE OF US!



And that was pretty much it. Everybody congratulated everybody else...

VAGGONNER ANFUSO GLENN



...and then canceled the third day of hearings, since they considered that the work was complete.

After all, there was important business to attend to.

Both Scott Carpenter and John Glenn left the astronaut program within two years.



They were already married, so *that* wasn't the reason. They just wanted to do other things. For Glenn, it was politics...



The reporters didn't help. One science writer said, "Let them vote. Let them wear pants. Let them shoot pool. But please, Mr. Vice President, don't let them get into space."



He imagined a conversation between women astronauts and Mission Control this way: "The little thingamabob has jiggled off the gizmo."



The Mercury 13 didn't know it, but the fix was in even before the hearings.



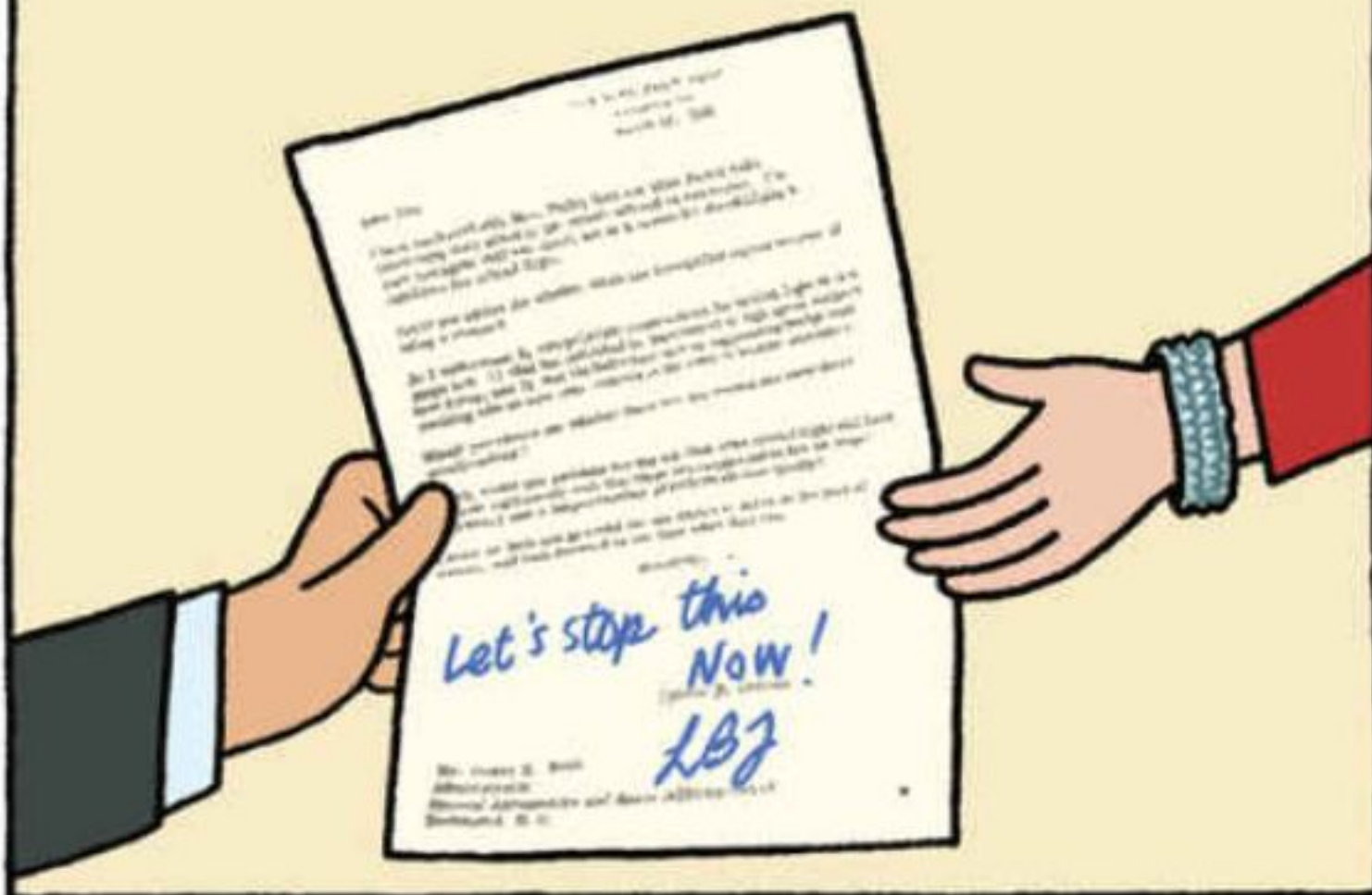
Not only did NASA require engineering degrees—sort of, sometimes—they definitely required that astronauts be test pilots.

That wasn't unreasonable, given the state of the technology. But only military pilots could be test pilots...



...and only men could be military pilots.

Months before the hearing and minutes after Hart and Cobb met with Vice President Johnson, LBJ wrote a memo about this.



So the Mercury 13 had no chance, and no allies.

The Women in Space Program was done.

But only for now...

I mean then...

and only in the U.S.



As for Women in Space Earliest? A gift from us to the Russians.

CAPITALISTS OFFER WOMEN CONSUMER GOODS AND THE OPPORTUNITY TO STAY HOME TO USE THEM.

WE PROMISE EQUAL OPPORTUNITY IN CAREERS LIKE MEDICINE AND ENGINEERING.



It became clear pretty early on in their program, though, that it wouldn't be Russian women in space. Just one.

That meant competition...

GENERAL KAMANIN, INTRODUCE US, PLEASE.

OF COURSE, CHIEF DESIGNER.



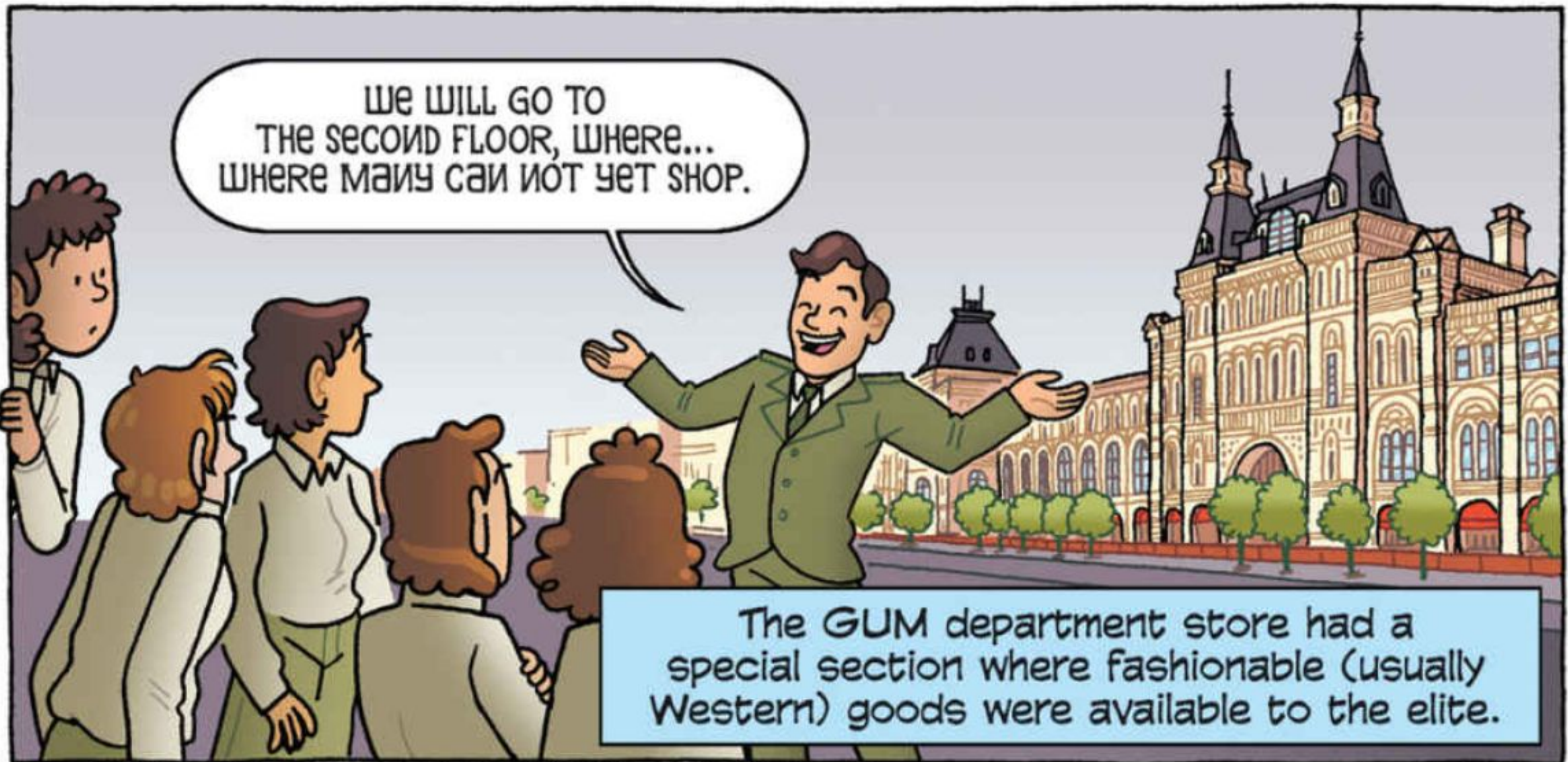
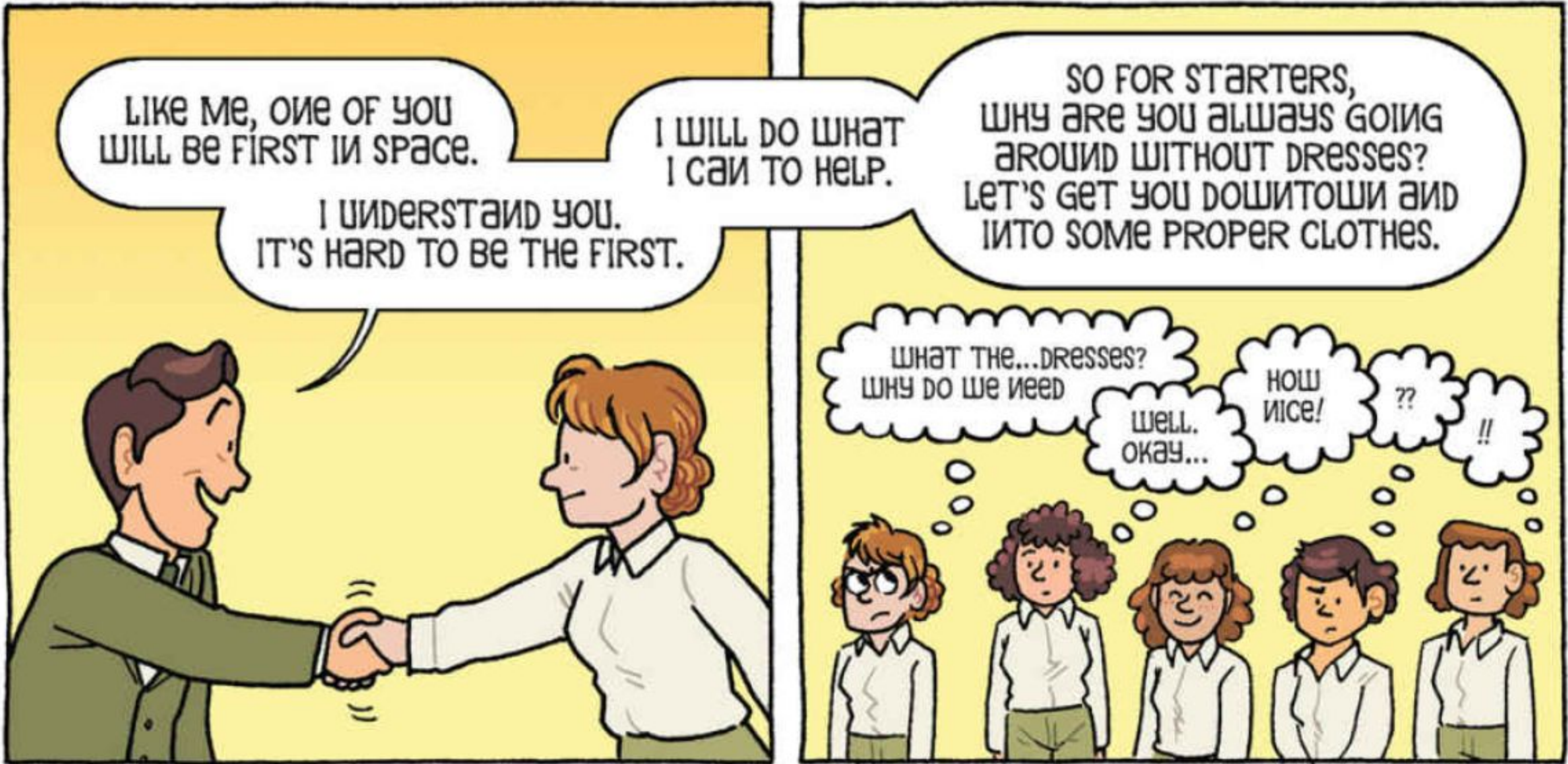
WITH ME TODAY ARE CHIEF DESIGNER SERGEI KOROLEV, THE MAN WHO BUILT THE VOSTOK CAPSULE THAT ONE OF YOU WILL RIDE INTO SPACE.



AND I BELIEVE YOU ALL KNOW, OR KNOW OF, COLONEL GAGARIN?

LADIES, IT IS A PLEASURE! I AM YURI ALEKSEYEVICH.

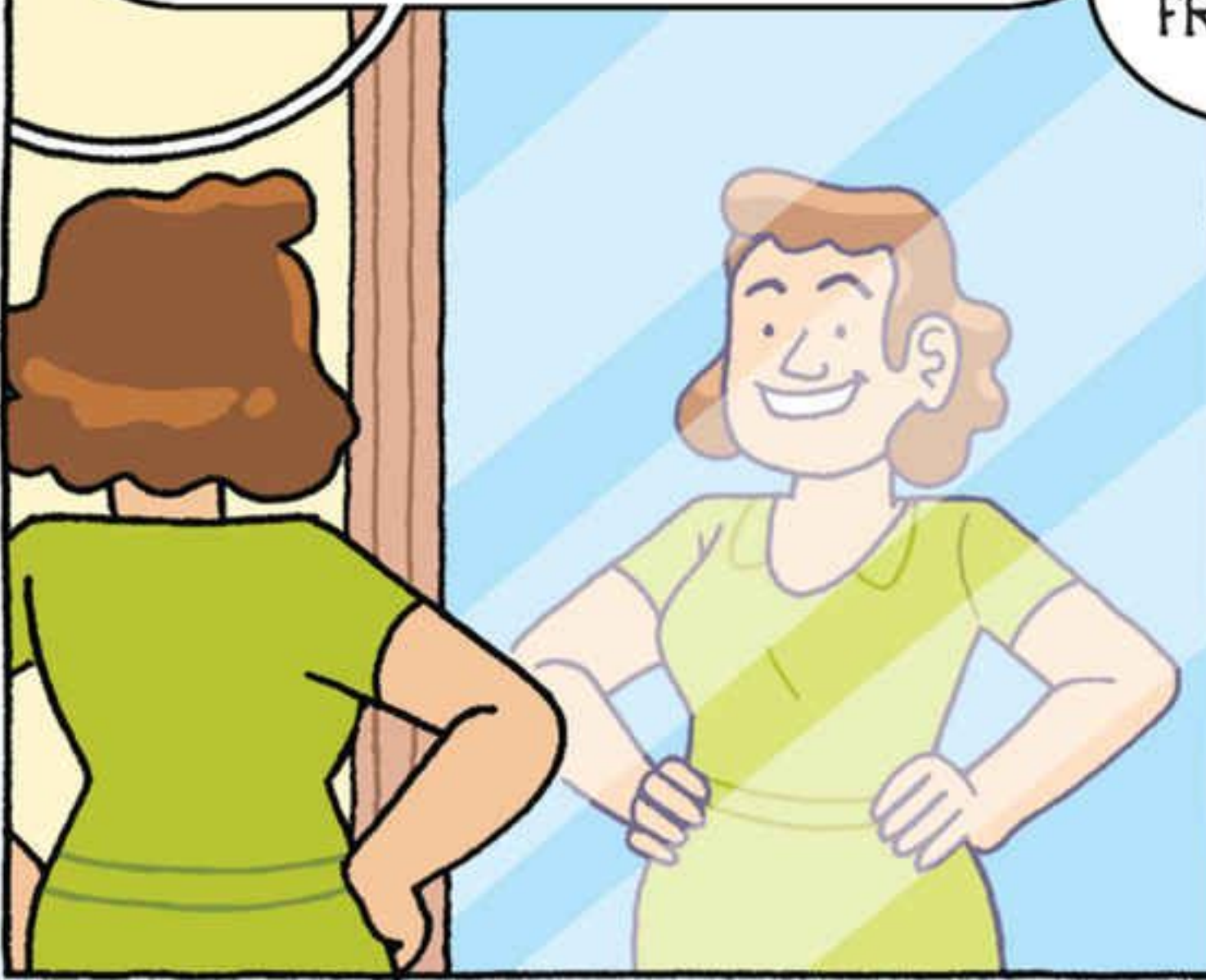




VALENTINA TERESHKOVA,
PARACHUTIST AND TEXTILE WORKER.

AND VALENTINA POIOMARYOVA,
PILOT AND ENGINEER, WITH A DEGREE
FROM MOSCOW AVIATION INSTITUTE...

AND LIKE THE OTHERS, FUTURE
COSMONAUT. BUT NOT ANOTHER
WORD ABOUT THAT, YES?



MIG 25: UTI TRAINER



PULL A LITTLE LEFT,
VALERY FYODOROVICH.



PARACHUTING: 80+ JUMPS



CENTRIFUGE: 10 G

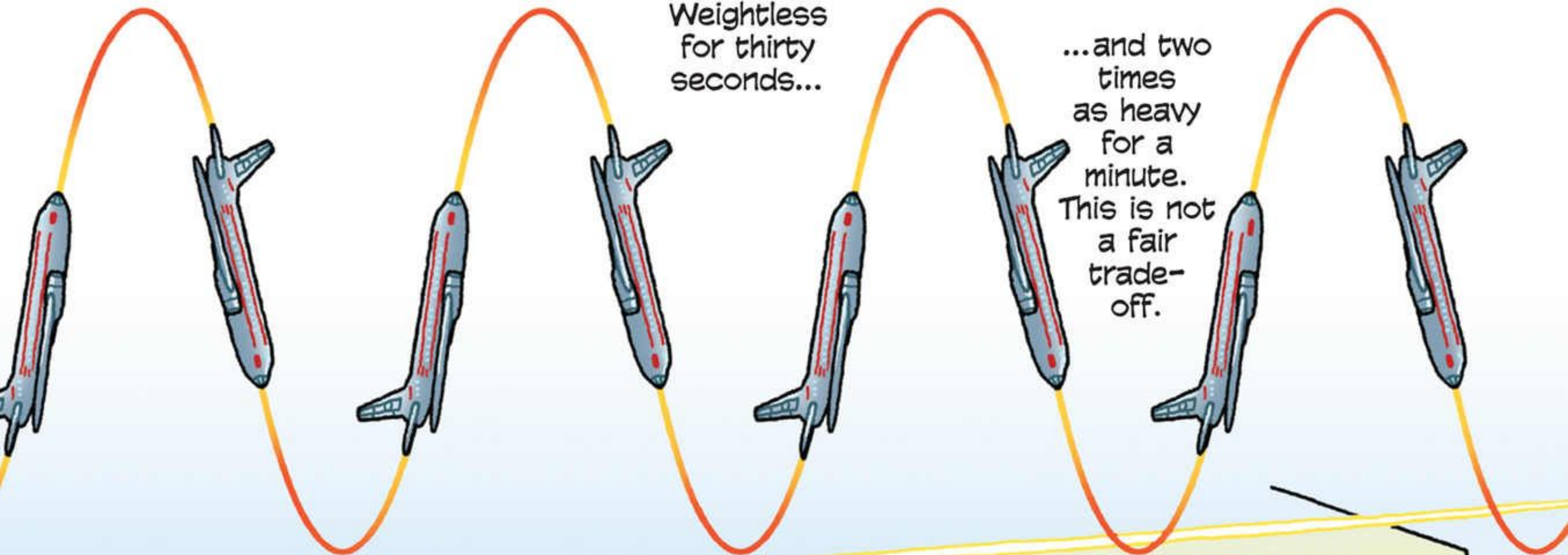


TRAINING: SURVIVAL AND PHYSICAL



The Soviet space program was secret and moving fast and there was a lot of training to do.

● TU-104:
RUSSIAN VOMIT COMET

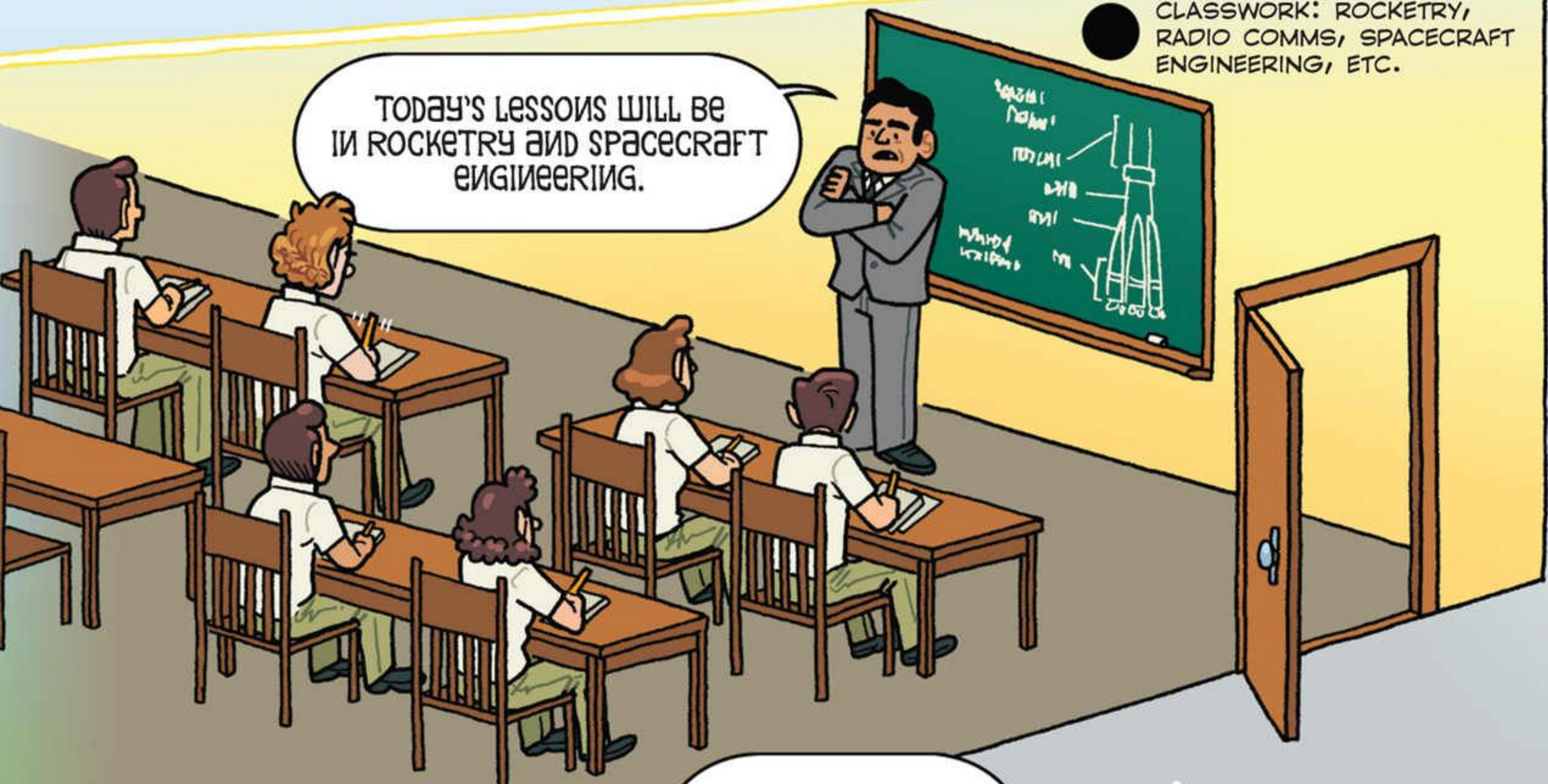


Weightless
for thirty
seconds...

...and two
times
as heavy
for a
minute.
This is not
a fair
trade-
off.

TODAY'S LESSONS WILL BE
IN ROCKETRY AND SPACECRAFT
ENGINEERING.

● CLASSWORK: ROCKETRY,
RADIO COMMS, SPACECRAFT
ENGINEERING, ETC.



WHOSE TURN
IS IT NEXT FOR THE
ISOLATION CHAMBER?

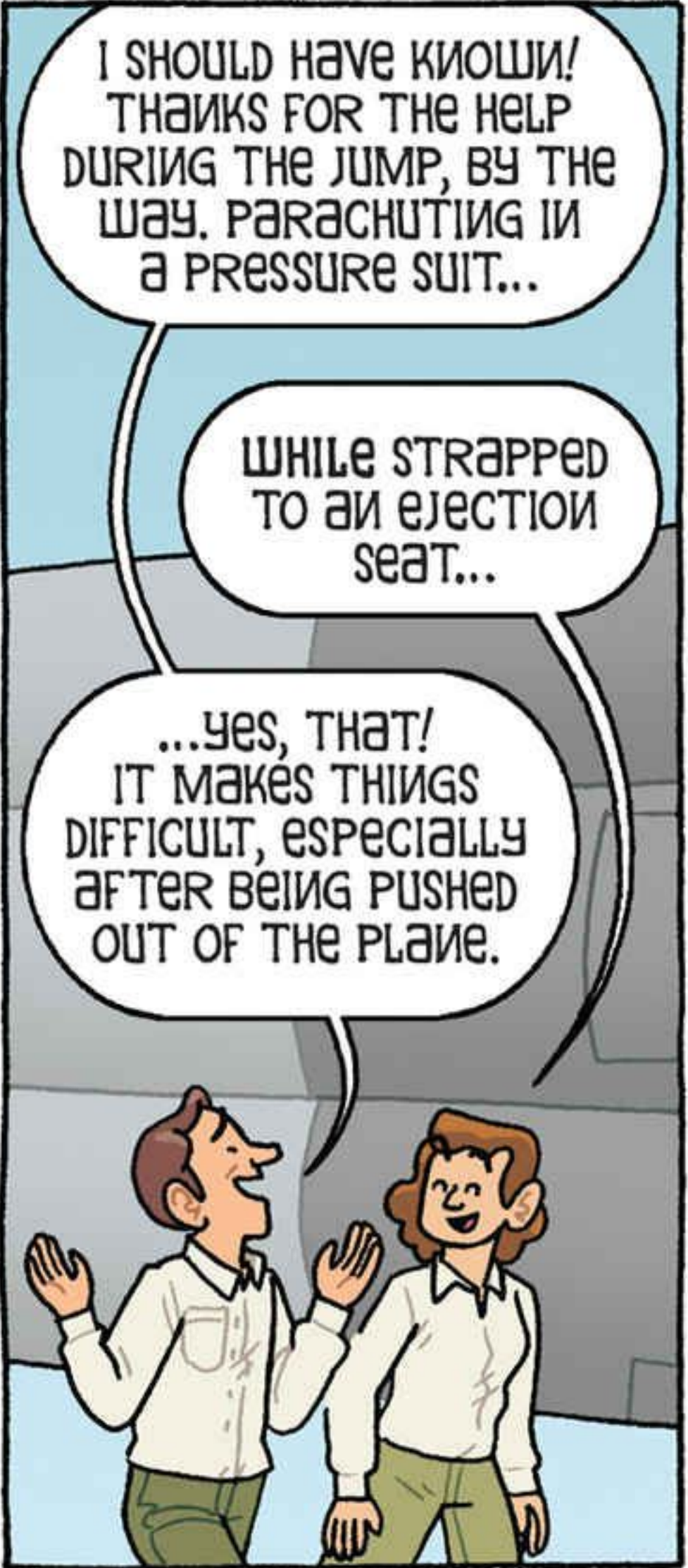
SURDOKAMERA

● SURDOKAMERA:
ISOLATION CHAMBER



WHILE ISOLATED IN THE SURDOKAMERA? I DREW CARTOONS. WHAT DID YOU DO?

I SANG.



I SHOULD HAVE KNOWN! THANKS FOR THE HELP DURING THE JUMP, BY THE WAY. PARACHUTING IN A PRESSURE SUIT...

WHILE STRAPPED TO AN EJECTION SEAT...

...YES, THAT! IT MAKES THINGS DIFFICULT, ESPECIALLY AFTER BEING PUSHED OUT OF THE PLANE.

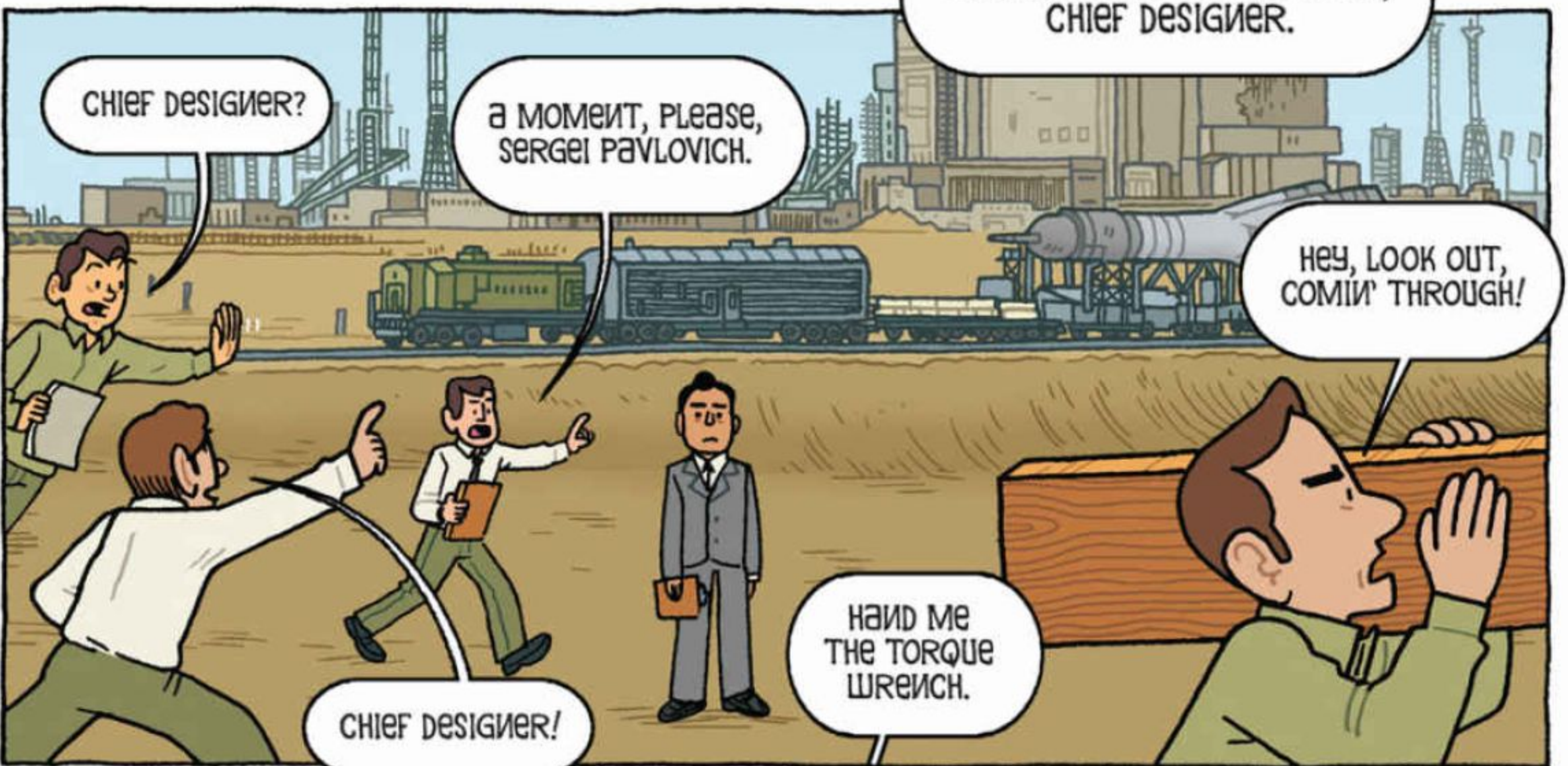
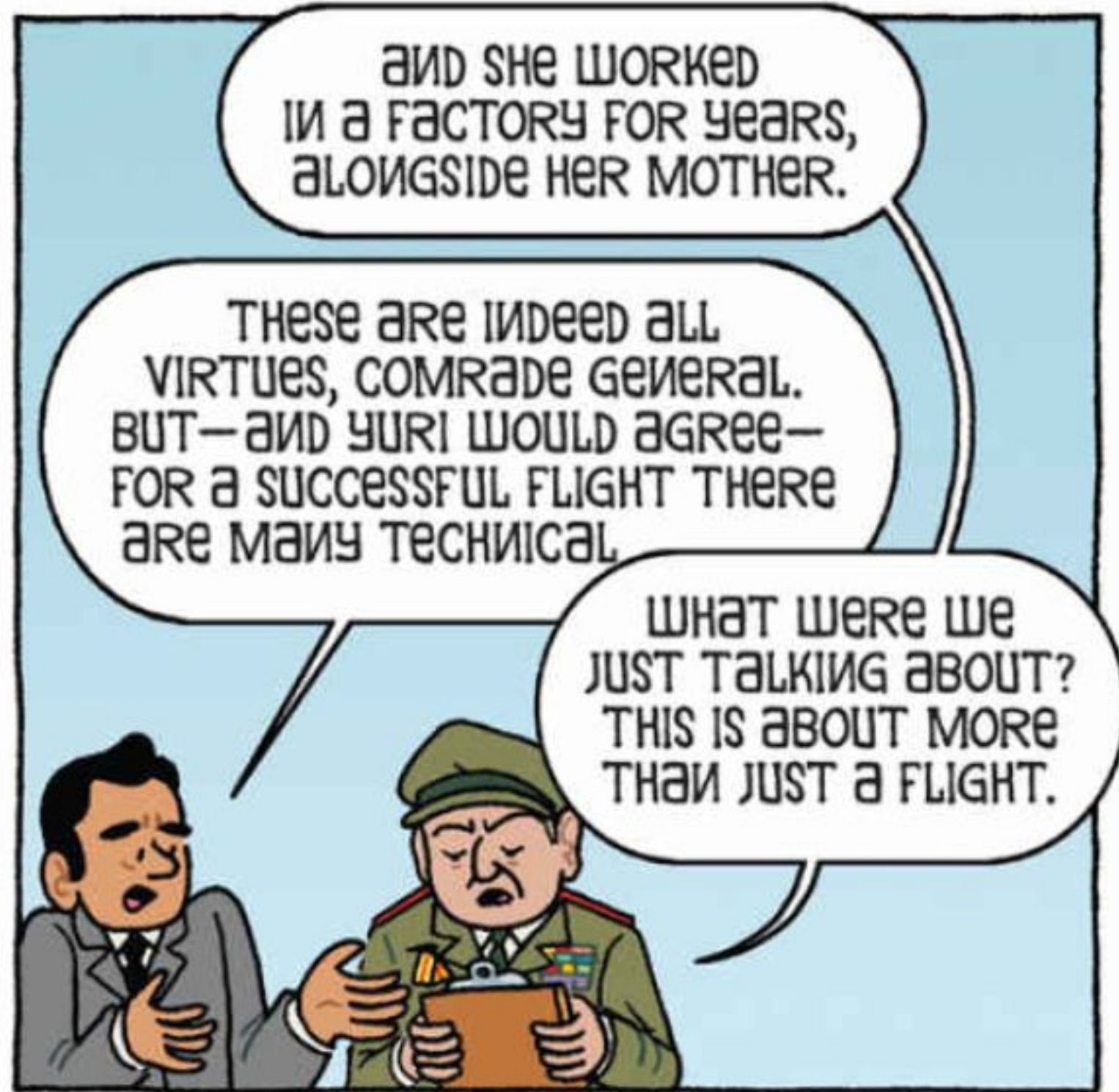


I KNOW! THE ROAD TO SPACE... IT IS NOT DECORATED WITH FLOWERS.



HAH. IT CERTAINLY ISN'T.





So, soon after...make that *unreasonably soon* after...Gagarin was convinced and Valentina Tereshkova was selected for the flight.



There were many preparations to make before her 1963 launch. Not all were technical...

OKAY, IN THE WEEK BEFORE MY FLIGHT, PLEASE SEND ONE LETTER A DAY TO MY MOTHER.



SHE THINKS I'M DOING PARACHUTE TRAINING AND WILL BE HOME AGAIN SOON.

VALENTINA, COME ON. WE'RE NEEDED OVER AT THE CAPSULE TESTING AREA.

I HOPE THE PART ABOUT GOING HOME IS TRUE, AT LEAST!



Most of it was technical, though.

НO НO НO!

WE DO NOT HAVE ANOTHER WEEK. YOU WILL FIND AND FIX THAT GYROSCOPE PROBLEM TODAY.

OR TONIGHT. BUT IT WILL BE DONE TOMORROW.



...and the road to space is not decorated with flowers.

I'M SORRY, VALERY. WE REALLY MUST DELAY LAUNCH UNTIL THE SOLAR FLARES SUBSIDE.



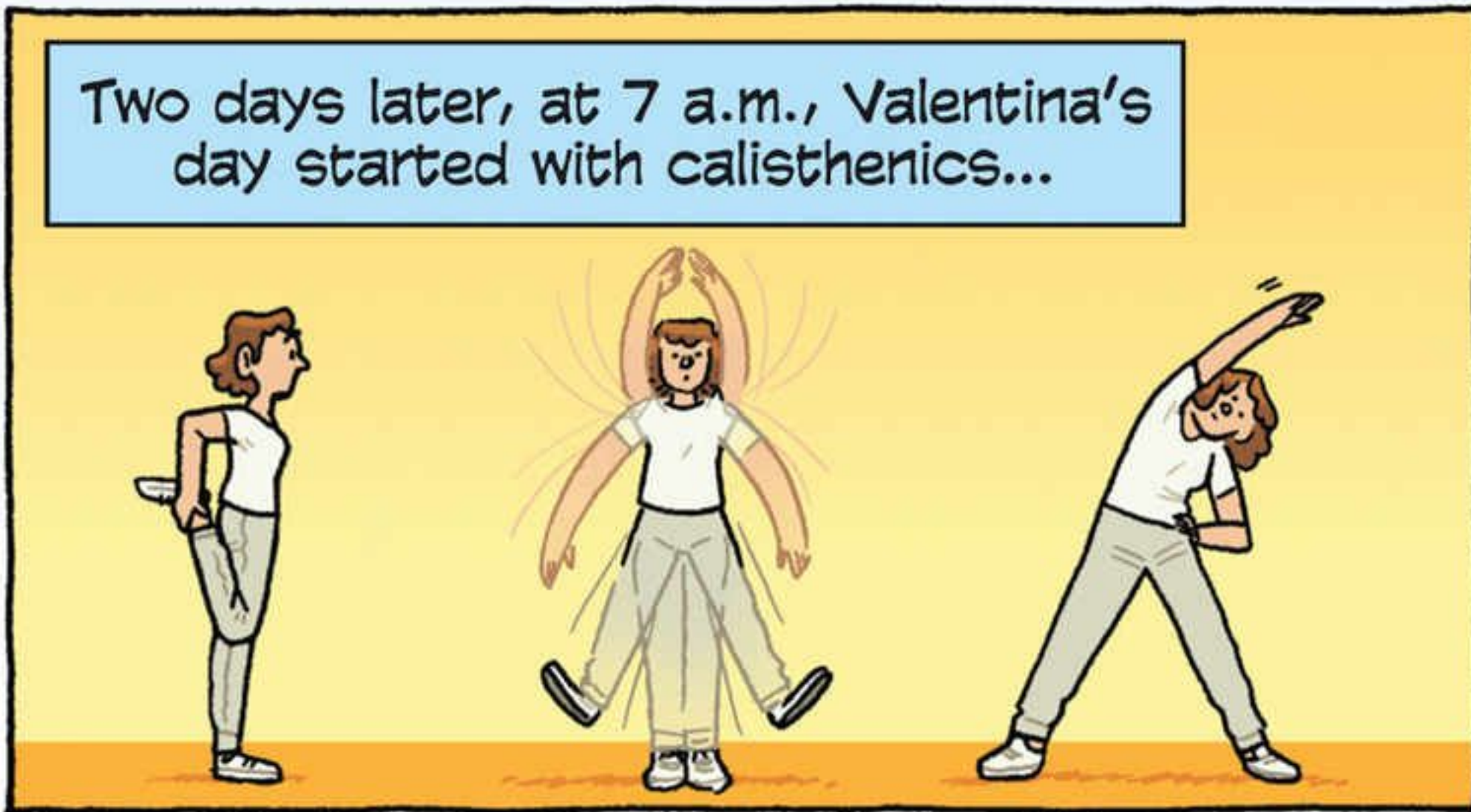


A SLIGHT FURTHER DELAY,
YASTREB, WHILE WE REPAIR
THE GYROSCOPE.

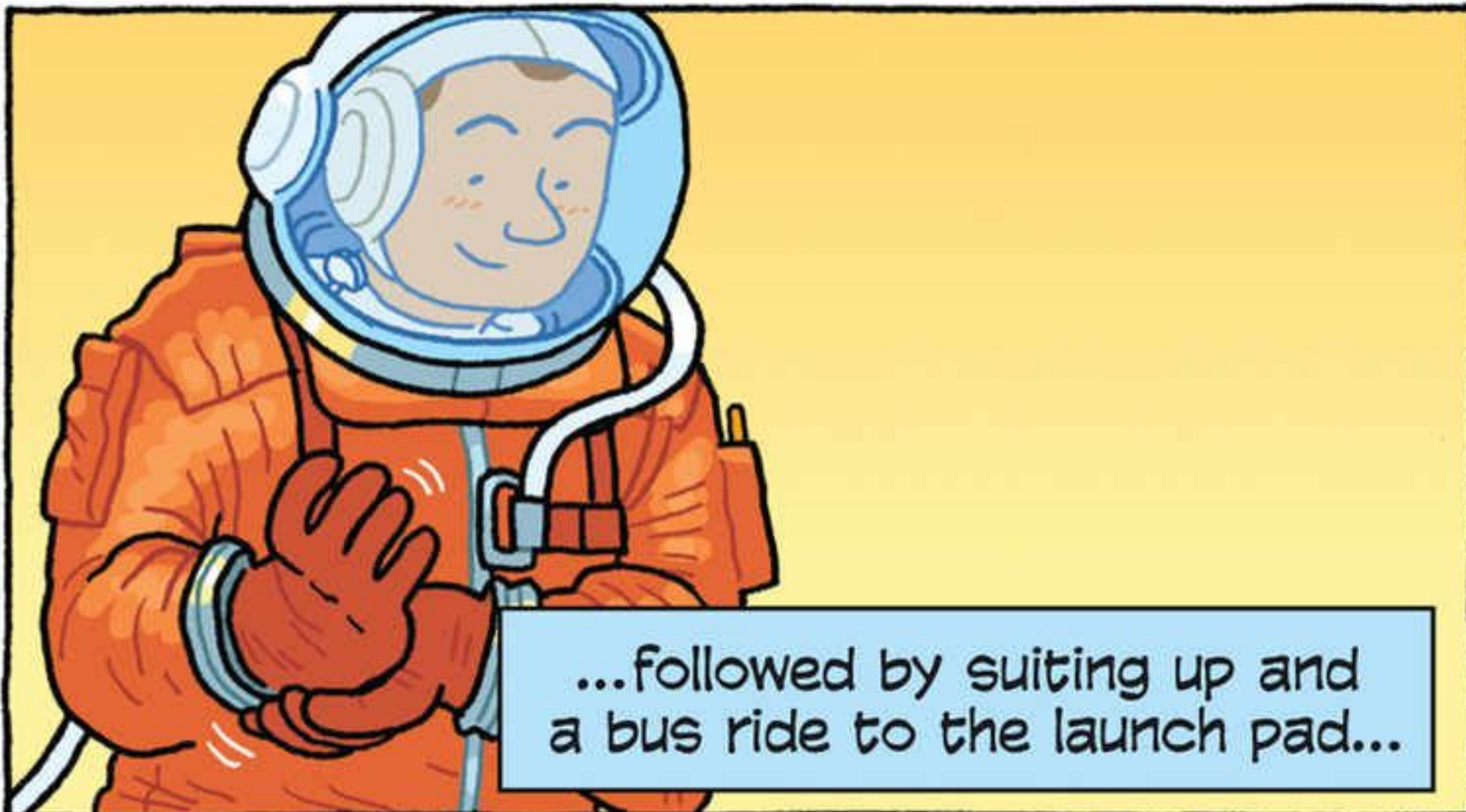


T-MINUS
3...2...1...0.
LIFTOFF!

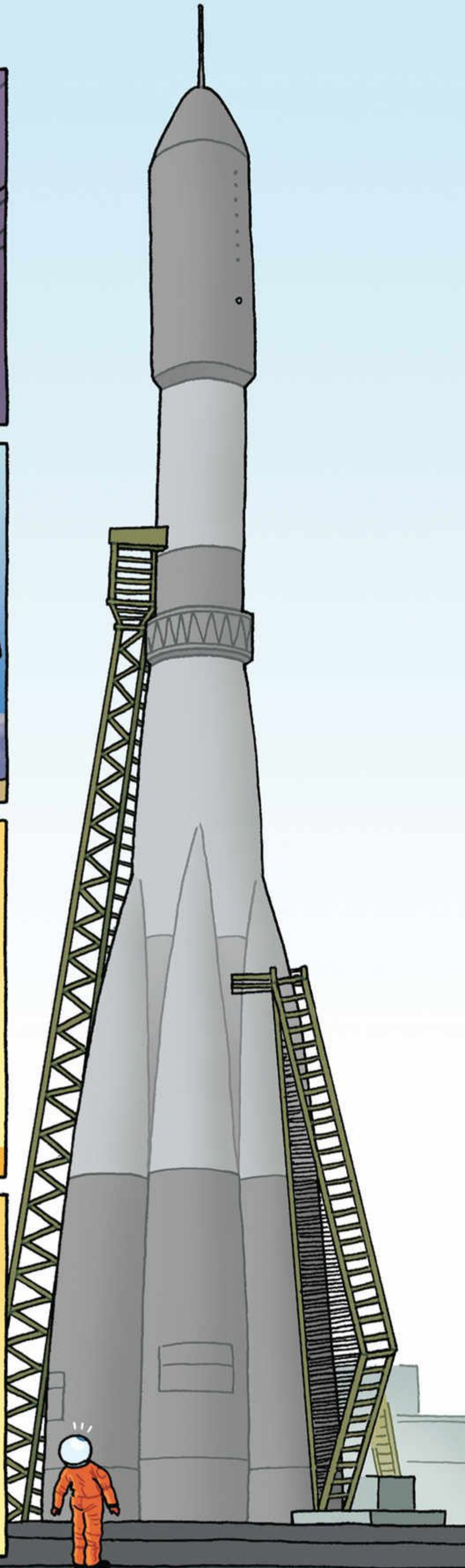
On June 14, three days
behind schedule, Vostok 5
launched Valery Bykovsky—
call sign Yastreb "Hawk"—
into space.



Two days later, at 7 a.m., Valentina's
day started with calisthenics...



...followed by suiting up and
a bus ride to the launch pad...



And on June 16, 1963, after a short delay on the ground during which Yuri Gagarin arranged for some in-capsule entertainment...



...the first woman went to space. Her call sign was Chayka. "Seagull."

rrrrruuumbble
rrrrruuumbble

RRRRRRRRRR

ROAR

And just like that, back in the U.S. the Mercury 13 were, in NASA lingo, OBE.

"Overtaken by Events."

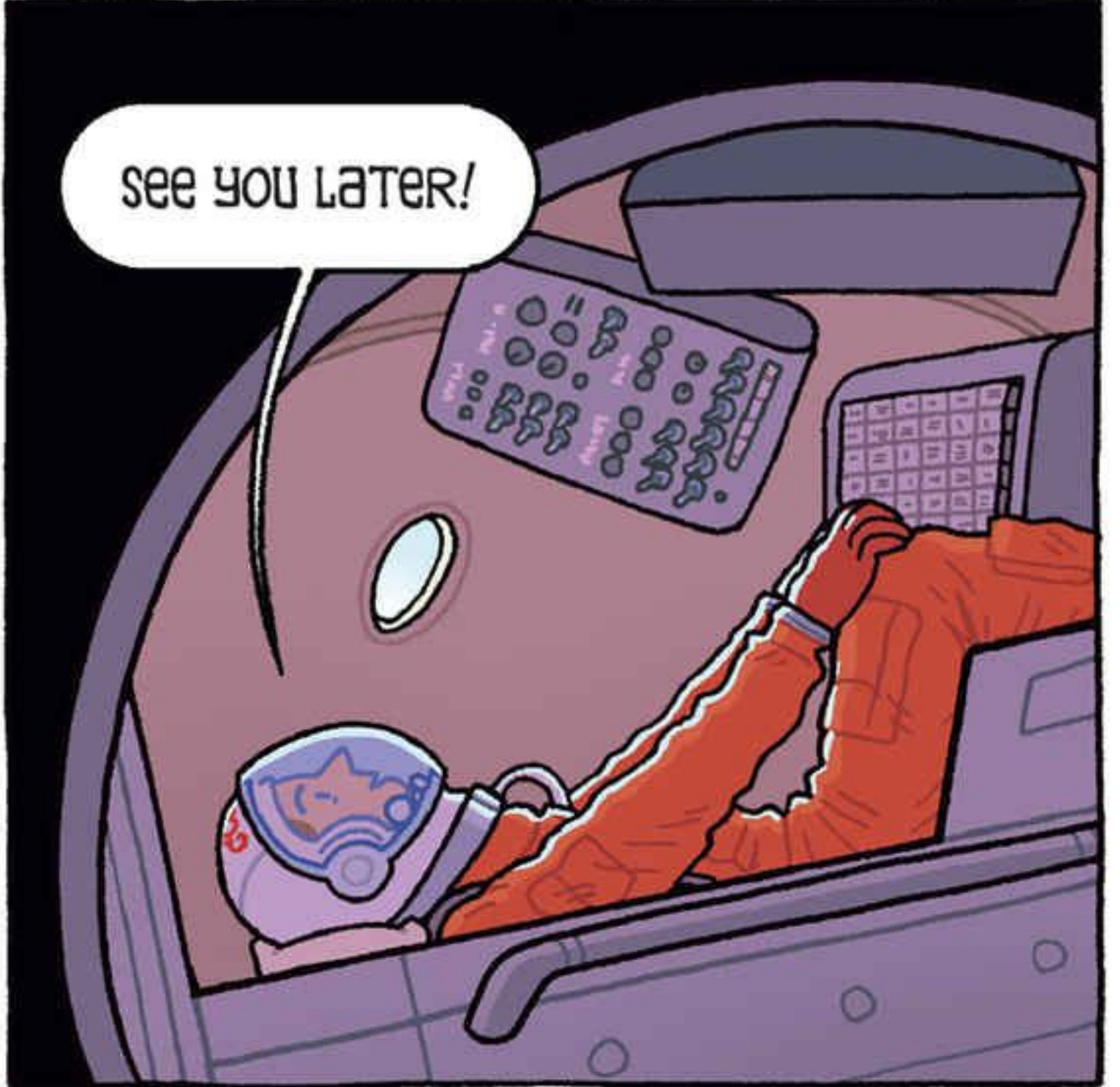




Her ground contact
was Yuri Gagarin—
call sign "Cedar."

MAIN STAGE LIFTOFF!
GOOD LUCK, VALYUSHA,
BOY VOYAGE! WE'RE
ALL WITH YOU.

WE'VE LEFT,
DEAREST HOMELAND,
WE'VE LEFT.




SEE YOU LATER!



SHIVERING LIKE A
THIN TREE IN THE WIND!

THE VEHICLE'S MOVING SMOOTHLY,
VEHICLE'S MOVING SMOOTHLY.



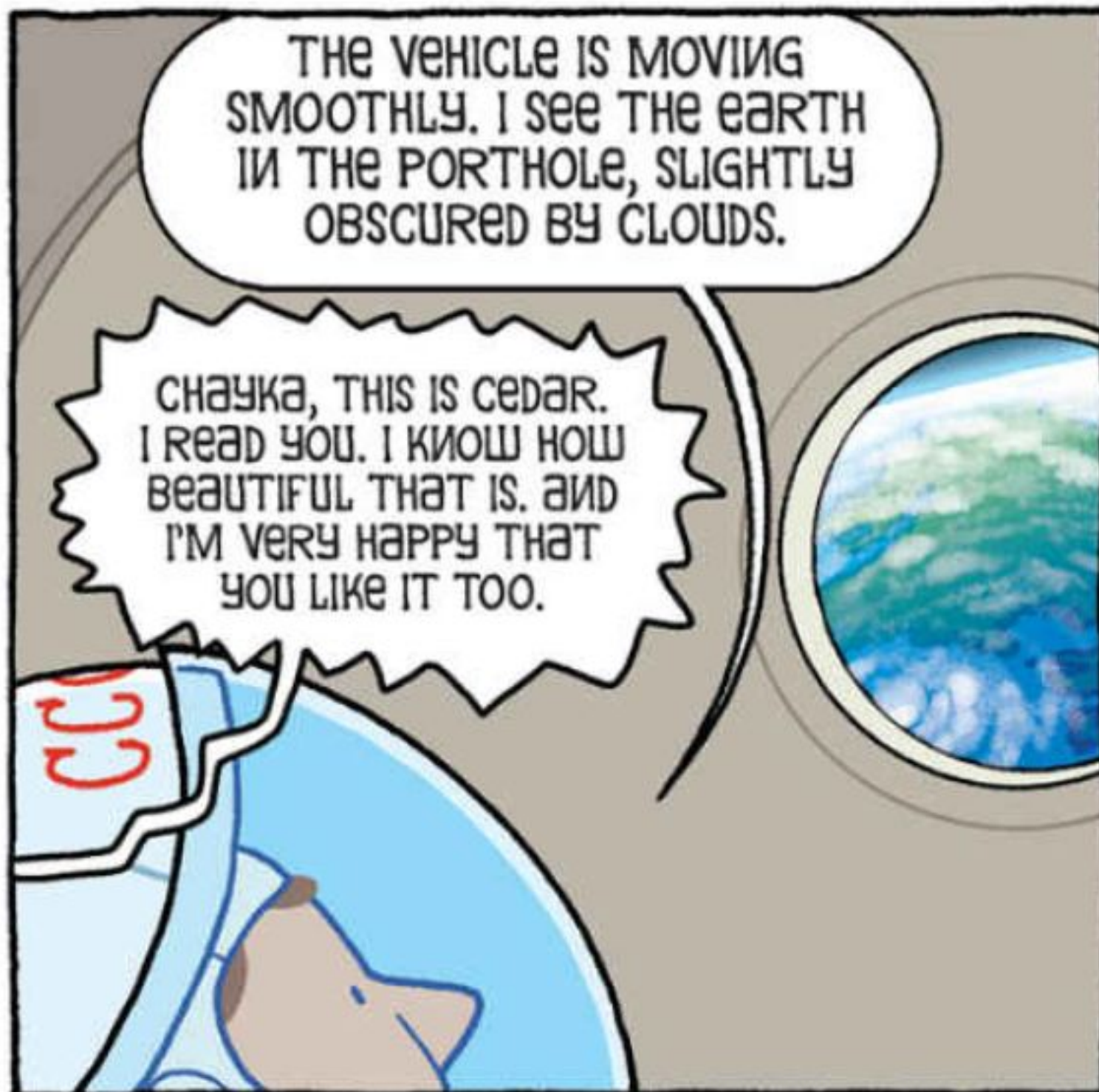
THE VEHICLE IS
MOVING WELL, FLIGHT IS
PROCEEDING EXCELLENTLY.
ALL NORMAL.

LOAD'S INCREASING.
I FEEL GOOD.



THE VEHICLE IS
WORKING EXCELLENTLY.
EVERYTHING IS ON
TRAJECTORY.

BE HEALTHY!
HAVE A GOOD TRIP!



THE VEHICLE IS MOVING SMOOTHLY. I SEE THE EARTH IN THE PORTHOLE, SLIGHTLY OBSCURED BY CLOUDS.

CHAYKA, THIS IS CEDAR. I READ YOU. I KNOW HOW BEAUTIFUL THAT IS. AND I'M VERY HAPPY THAT YOU LIKE IT TOO.



I HEAR YOU EXCELLENTLY, I HEAR YOU EXCELLENTLY.

ALL SYSTEMS ON THE SHIP ARE WORKING EXCELLENTLY, I FEEL EXCELLENT.

SEE YOU SOON...



THE HORIZON— FIRST THERE'S A DARK BLUE STRIP, THEN ORANGE AND YELLOW, THEN IT BECOMES LIGHT BLUE AND DARK BLUE AGAIN.

I AM SEEING SUCH A BRIGHT STAR. IT'S NOT REALLY SIMILAR TO A STAR, BUT SOMEWHAT ELONGATED...



IS THAT PERHAPS YOU, VALYERKA? THE LITTLE "STAR" I SAW DISAPPEARED, WASN'T THAT YOU?

BOI VOYAGE. DON'T GO FAR FROM ME, MY FRIEND.

Early on in the flight, Tereshkova's Vostok 6 and Bykovsky's Vostok 5 came within about 5 km of each other.



That's not very close, and Bykovsky didn't even see Tereshkova. But from Earth, they looked very close indeed.

YASTREB PASSES WARM GREETINGS TO ALL OF YOU.

I SANG SONGS FOR HIM.



EVERYTHING'S IN ORDER HERE. I FEEL EXCELLENT. I'LL USE EVERY EFFORT TO FULLY COMPLETE THE FLIGHT ASSIGNMENT.

HUGS TO YOU...

So NASA worried—at least for a little while—that the Soviets had already figured out how to dock two spaceships.



НИНДЕТЕЕН HOURS, TWENTY-FIVE MINUTES.
THE FLIGHT'S GOING WELL.

HERE NOW, THE SHUH...THE SUN
SEEMS SO ORANGE, NOT RED.



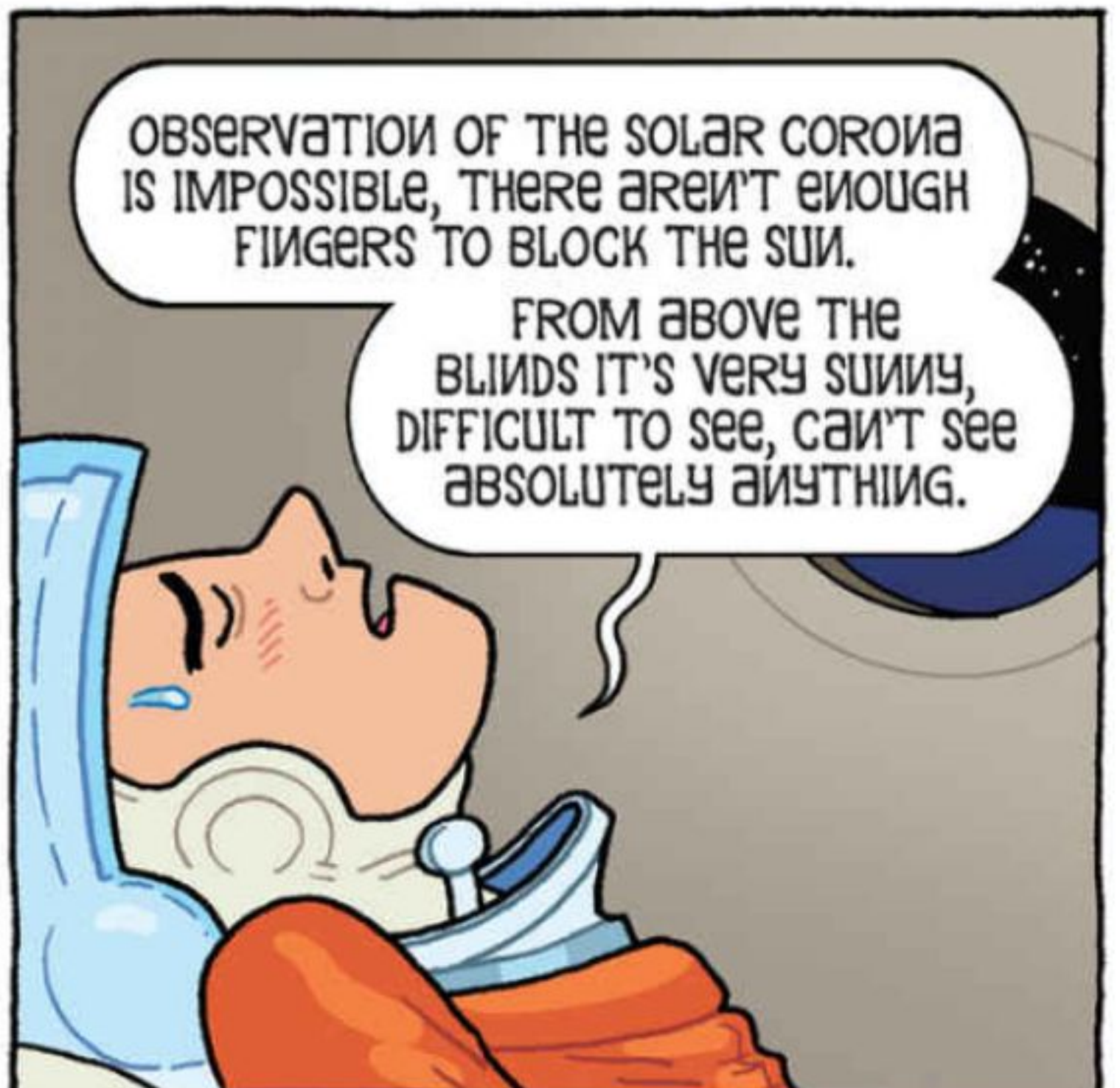
I'M ALSSHO...
ALSO...FEELING
EXCELLENT.

IN THE PORTHOLE THE HORIZON
IS VISIBLE. IT'S A VERY BEAUTIFUL
SIGHT - AT FIRST IT'S LIGHT BLUE,
THEN LIGHTER, THEN DARK...



FROM THE VOSTOK 6 SPACESHIP:
SOVIET WOMEN! GREETINGS TO ALL.
I WISH YOU PERSONAL GOOD LUCK AND
GREAT SUCCESS IN YOUR WORK FOR
OUR BELOVED MOTHERLAND.

WOMEN OF THE WORLD!
GREETINGS FROM SPACE.
I WISH YOU GOOD LUCK
AND SUCCESS...



OBSERVATION OF THE SOLAR CORONA
IS IMPOSSIBLE, THERE AREN'T ENOUGH
FINGERS TO BLOCK THE SUN.

FROM ABOVE THE
BLINDS IT'S VERY SUNNY,
DIFFICULT TO SEE, CAN'T SEE
ABSOLUTELY ANYTHING.

On the second day, she had more work to do, but...

PARAMETERSSSSH:
CABIN PRESSURE 1.15;
HUMIDITY 61 PERCENT,
TEMPERATURE 23 DEGREES C.

THE TEMPERATURE SWITCH
ISSSS IN POSITION... CARBON
DIOXIDE 0.1; OXYGEN 250.



NAGGING PAIN IN RIGHT SHIN.
HELMET OBSTRUCTS ME AND PASSES
AGAINST SHOULDER. EARPIECE PASSES
AGAINST LEFT EAR AND SENSOR ON
MY HEAD MAKES ME ITCH AND
GIVES ME HEADACHES.



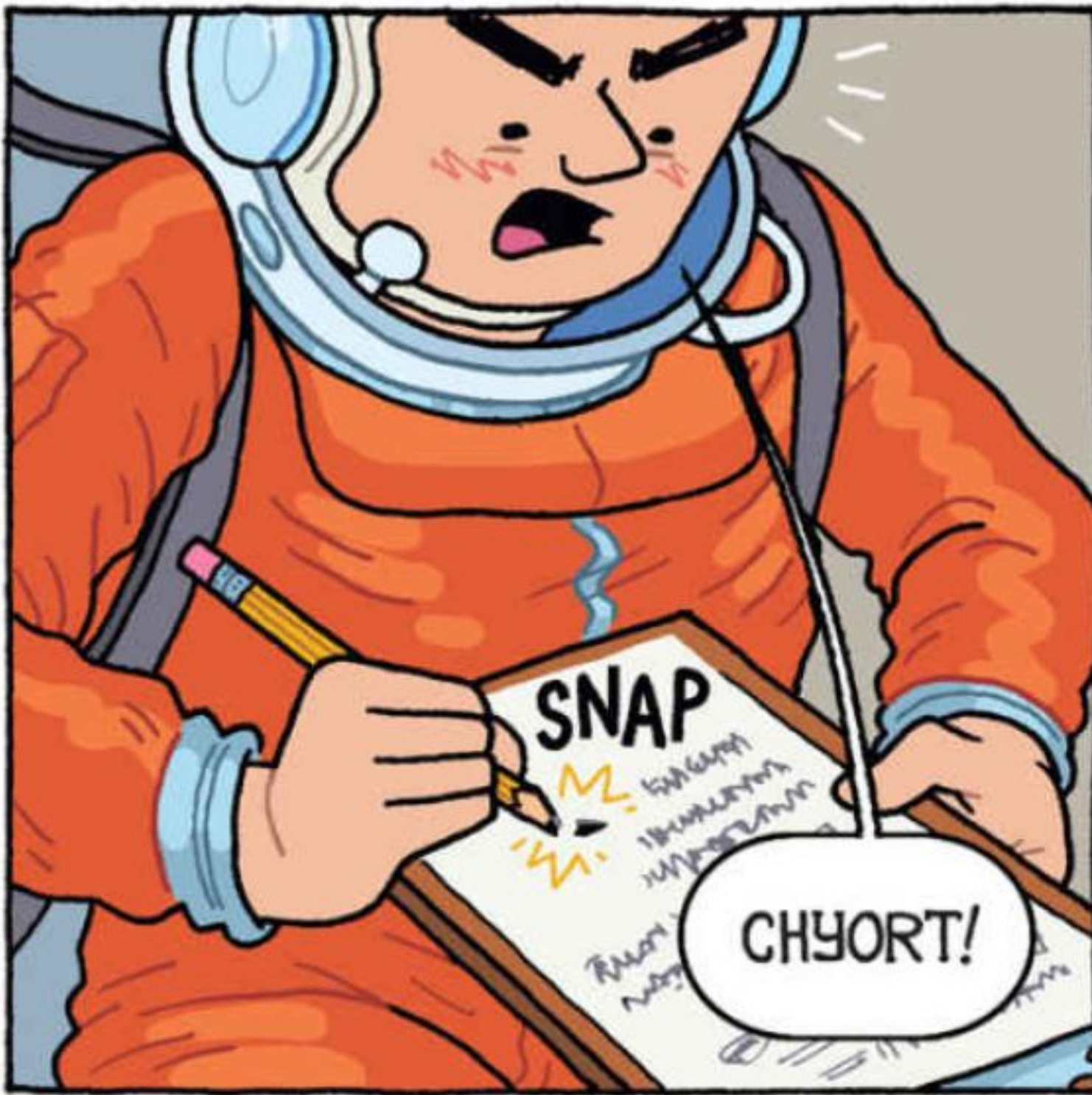
YURI— I MEAN, CEDAR—

I HOPE TO FULLY COMPLETE
THE FLIGHT ASSSSH PER THE PLAN...
I DON'T FEEL TIRED BECAUSE I'VE
TAKEN FREQUENT BREAKS.



SNAP

CHYORT!



AMMM NOT GETTING
THE PHOTOMETER TO WORK.
I'VE ATTEMPTED SSSHSEVERAL
TIMESSSSSH.

DON'T WORRY,
I'LL DO EVERYTHING IN
THE MORNING. DON'T
WORRY ABOUT ME.



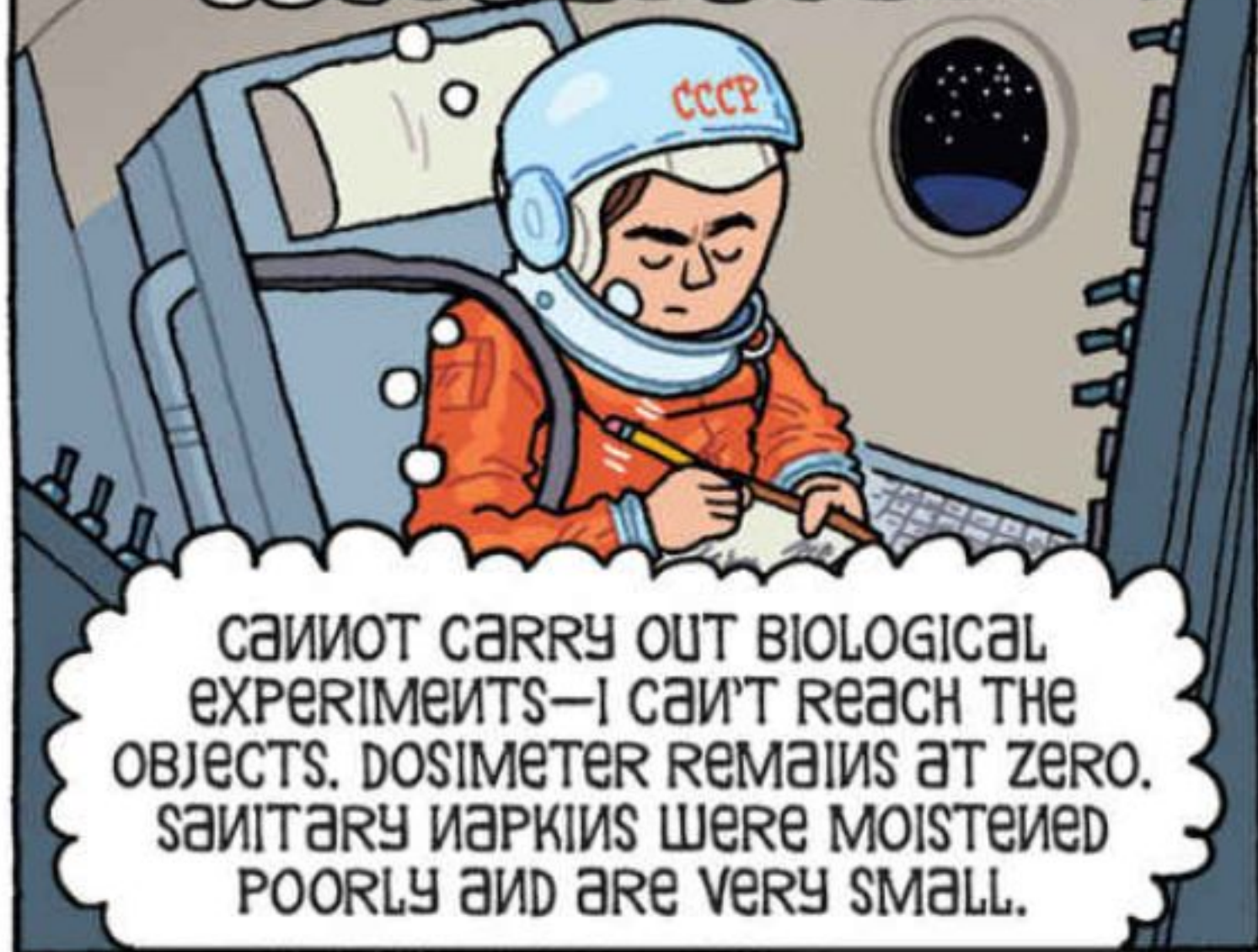
By the last day in orbit, "20th"—code name for Chief Designer Korolev—was starting to worry about her health, and preparations for returning to Earth.

COMMUNICATE TO 20TH THAT I'M SHART...STARTING TO ORIENT FOR LANDING MODE.

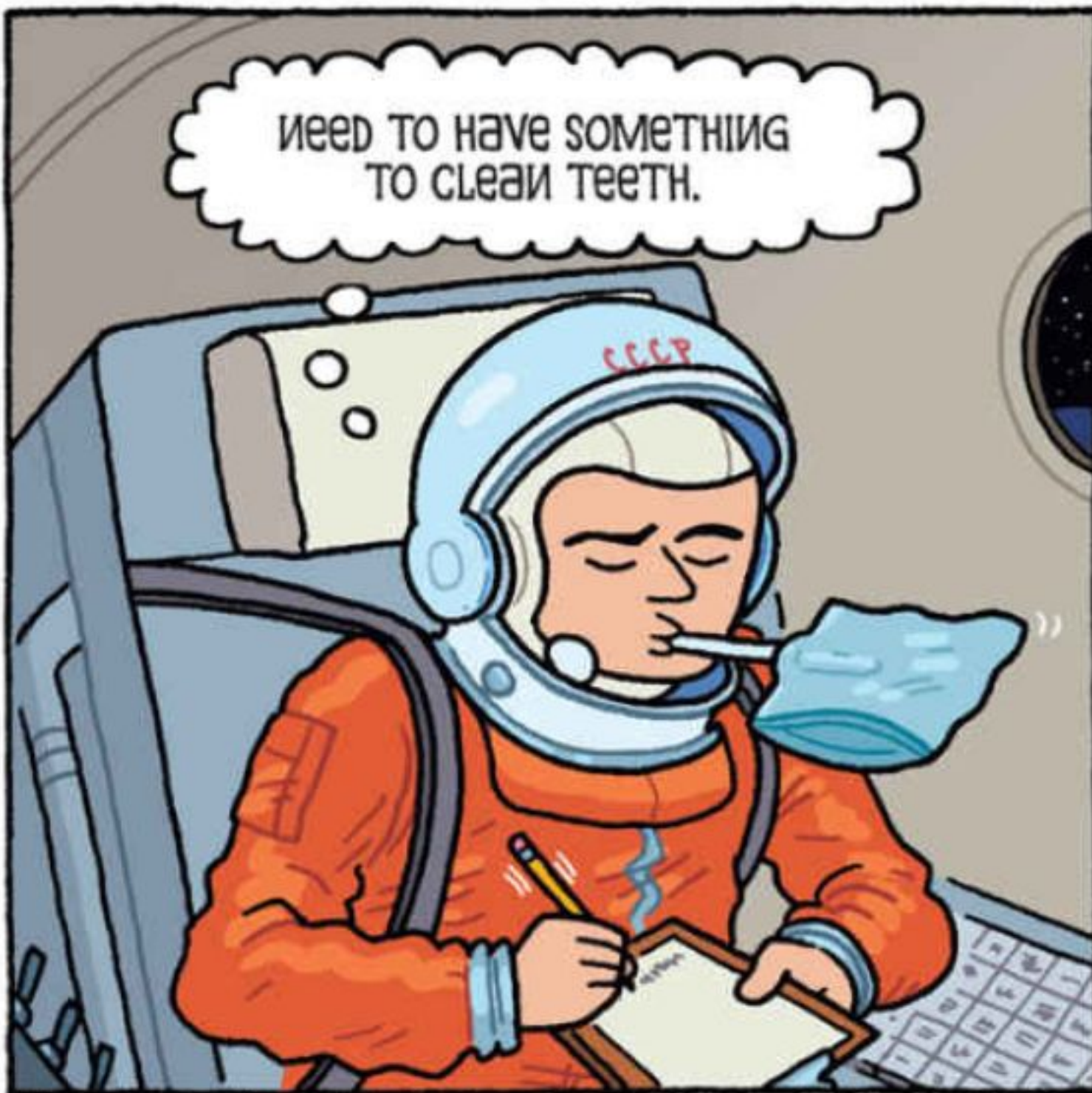


WORKING WITH THE EQUIPMENT DIFFICULT: I CANNOT REACH GLOBUS AND OTHER INSTRUMENTS...

CANNOT CARRY OUT BIOLOGICAL EXPERIMENTS—I CAN'T REACH THE OBJECTS. DOSIMETER REMAINS AT ZERO. SANITARY NAPKINS WERE MOISTENED POORLY AND ARE VERY SMALL.



NEED TO HAVE SOMETHING TO CLEAN TEETH.



AND A WAY TO SHARPEN PENCILS. THAT'S MY LAST ONE.



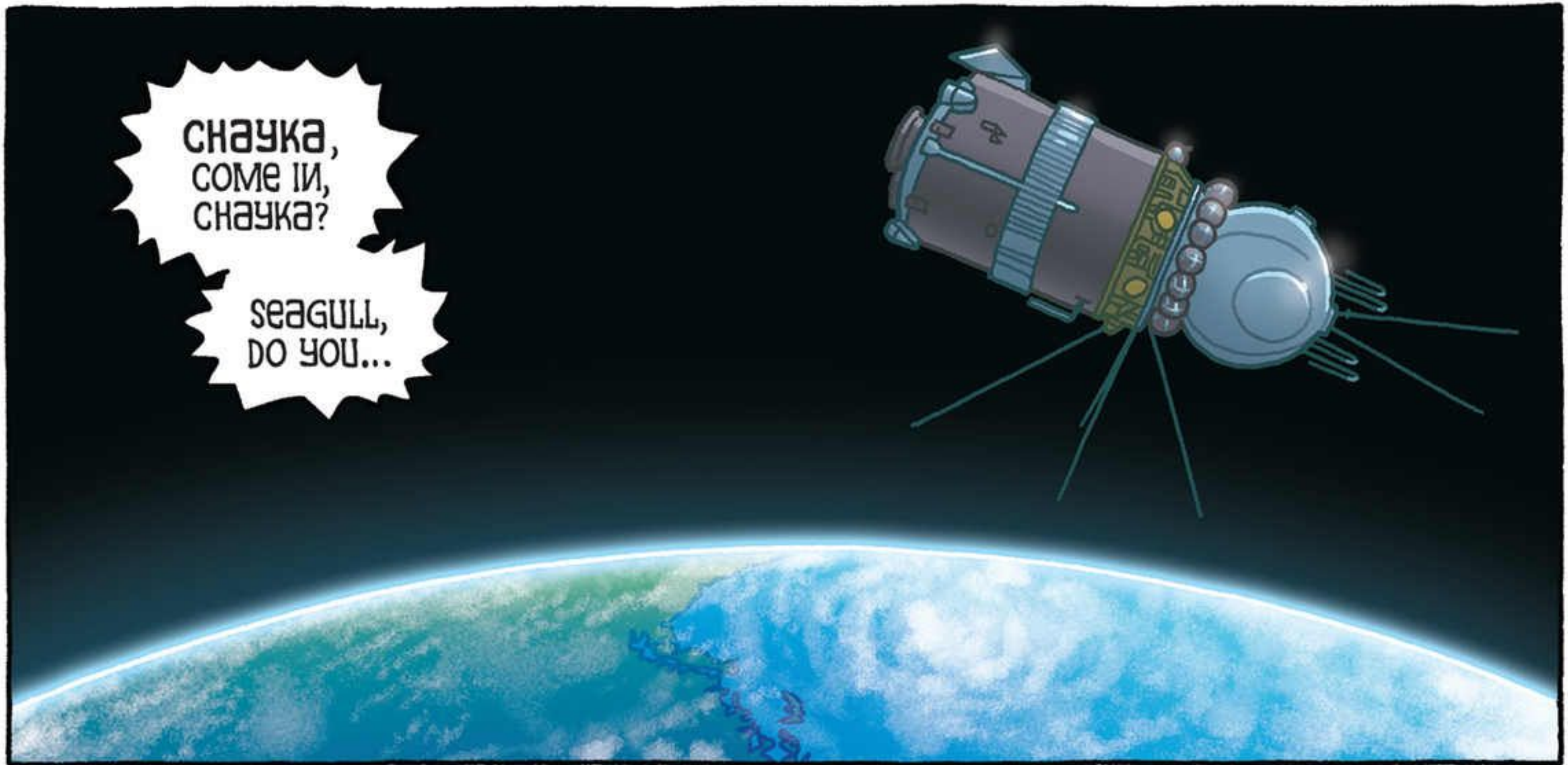
ZZZ



VOSTOK 6. ЧАЙКА.
VOSTOK 6. ЧАЙКА.
COME IN, ЧАЙКА.

ZZZ





ЧАУКА,
COME IN,
ЧАУКА?

SEAGULL,
DO YOU...



DO YOU READ...

CEDAR, I FELL ASLEEP...
BUT AM ALREADY WOKEN UP.



SHE DIDN'T COMPLETE THE
ATTITUDE CONTROL EXPERIMENT,
AND I DON'T SEE HOW

DON'T WORRY,
I'LL DO EVERYTHING
IN THE MORNING.

I'M DRINKING
A LOT.



DON'T BE CONCERNED
ABOUT MY HEALTH—I FEEL
FULLY WELL.



COMPLETELY
WELL.





IN MY FIELD OF VISION,
I SEE THE BURNING SHIP.
SUCH REDDISH LIGHT, REDDISH.
THE SHIP IS TURNING
AND BURNING.



LIKE A PENDULUM
IT'S TURNING AND BURNING,
BURNING. IT'S SWINGING,
SWINGING, BURNING. BURNING
VIGOROUSLY. IT'S BURNING
VIGOROUSLY.



SWINGING AROUND THE AXES,
SWINGING AROUND THE AXES.
IT'S SHAKING, IT'S SHAKING.
CRACKL...

KRKKKSHSSSH



Vostok 6 and Valentina landed in Kazakhstan
at 1120 hours Moscow Time on June 19.



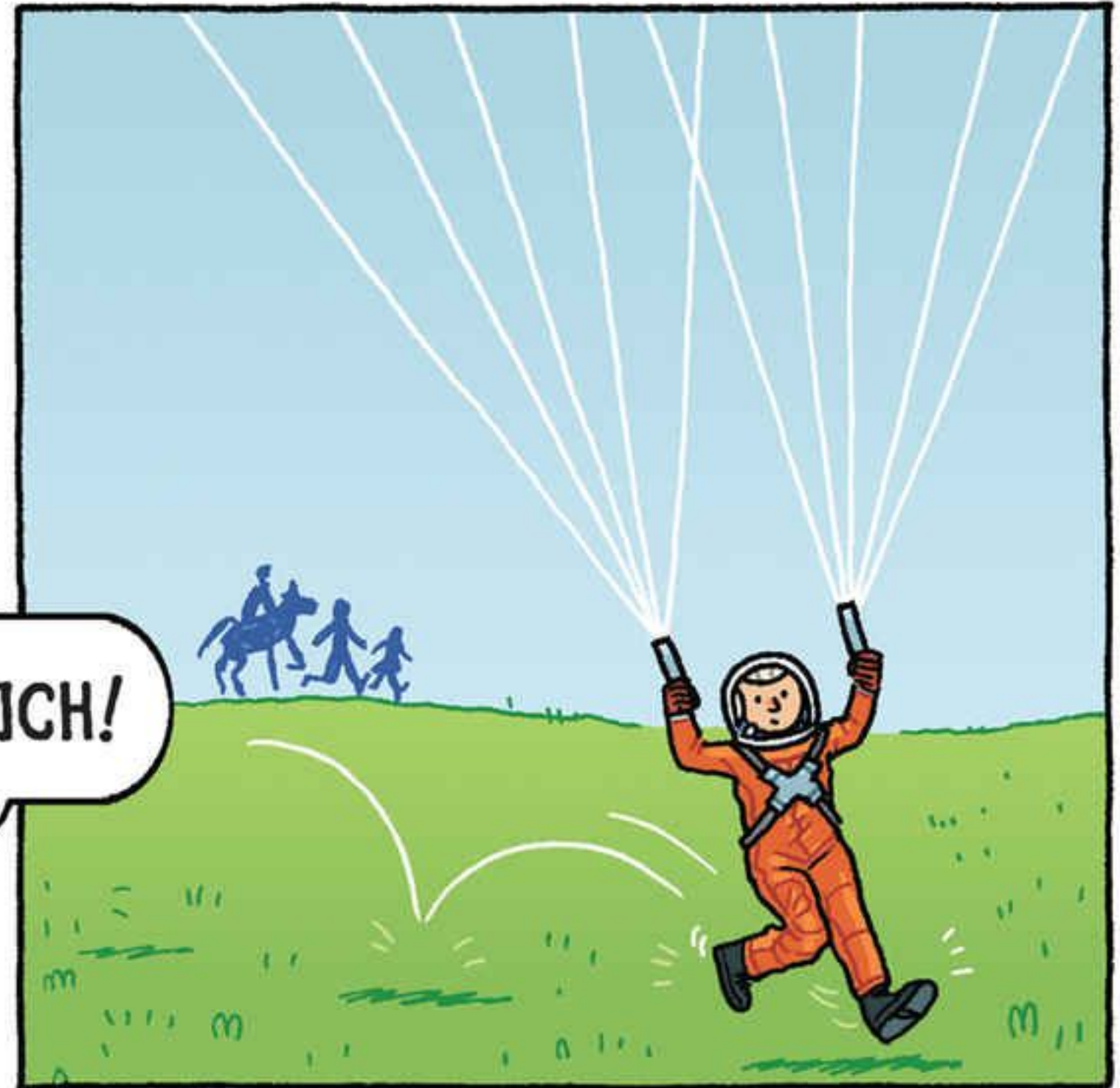
She was in orbit for two days,
twenty-two hours, and fifty minutes.

At 6.5 km above Earth, she ejected from her capsule.

She went against her training and looked up at the parachute, and a piece of metal hit her straight on the nose.

SMACK!

OUCH!



People from a nearby kolkhoze—a collective farm—rushed to greet their surprise guest.



KUMISS?

CHEESE?

LEPESHKI?

FERMENTED MARE'S MILK

SWEET BISCUIT-LIKE CAKES



She wasn't supposed to eat anything upon landing...



And she was also supposed to keep her leftover tubes of food so the doctors could better assess her...



...well, her input and output while in space.

I COME FROM A FARMING COMMUNITY.

IT IS BASIC COURTESY TO EXCHANGE GIFTS OF FOOD.



TSK
TSK

So she got in some trouble for this, because in later reports she didn't share all this information.

VALYA, YOU COMPLAINED ABOUT THE FOOD WHILE IN ORBIT, BUT IT WAS ALL GONE WHEN WE PICKED UP THE CAPSULE.



yes, THE BREAD WAS LIKE RUBBER AND THE MEAT WAS VERY TOUGH.



BUT YOU ATE IT ALL?

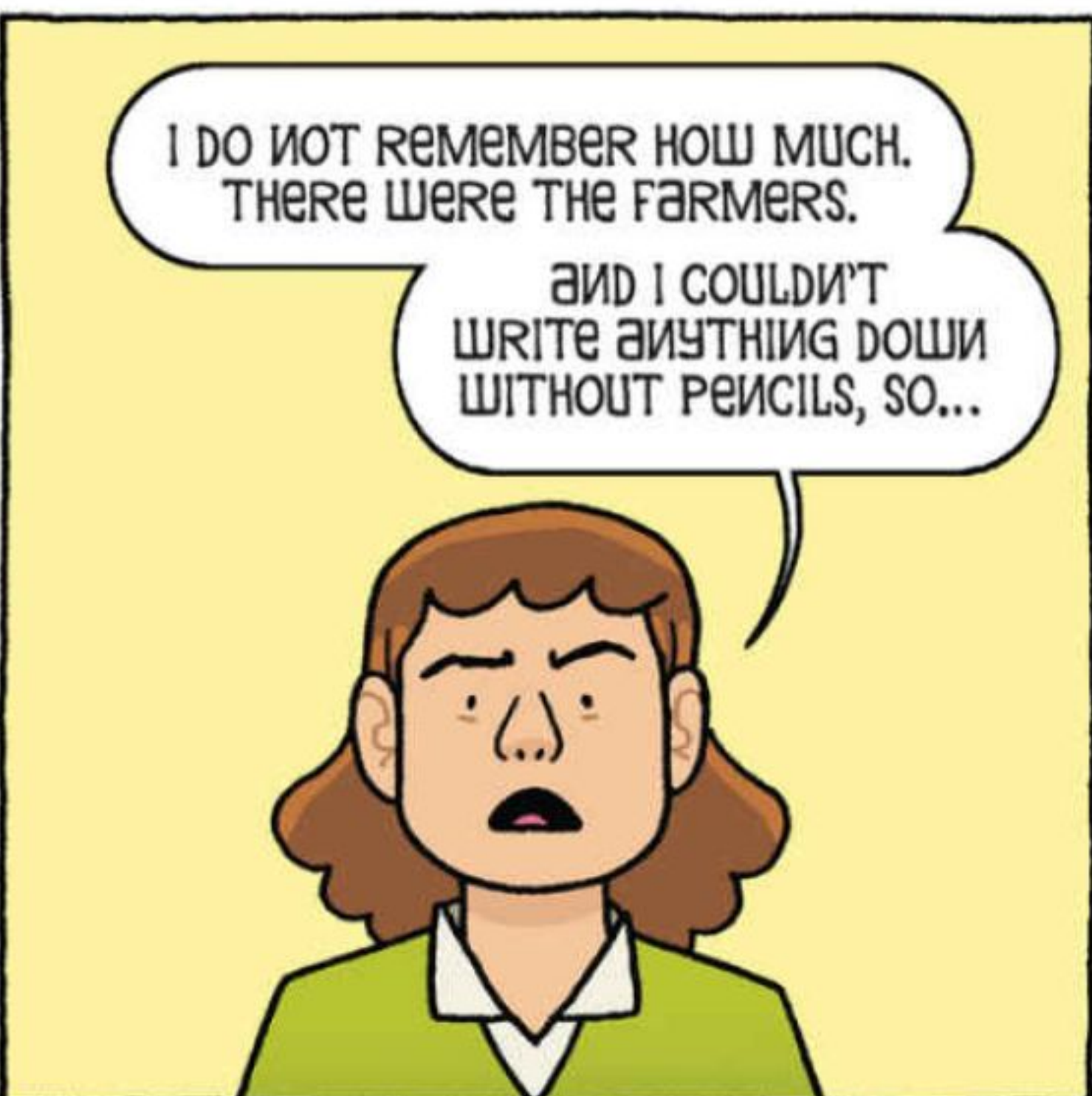


WELL... NO. NOT ALL, NO.



I DO NOT REMEMBER HOW MUCH. THERE WERE THE FARMERS.

AND I COULDN'T WRITE ANYTHING DOWN WITHOUT PENCILS, SO...



SO WE DON'T HAVE GOOD DATA FOR FUTURE FLIGHTS.

DISAPPOINTING, VALYA. QUITE DISAPPOINTING.



I'M. I'M VERY SORRY, CHIEF DESIGNER.





WELL?

THEY'RE NOT HAPPY WITH ME. HE'S NOT HAPPY WITH ME.

WELL, I UNDERSTAND KEEPING THINGS FROM THE MEDICS. FLIGHT DOCTORS CAN TAKE YOU OFF FLIGHT STATUS FOR ANY MINOR INFRACTION. BUT THE CHIEF DESIGNER IS DIFFERENT.



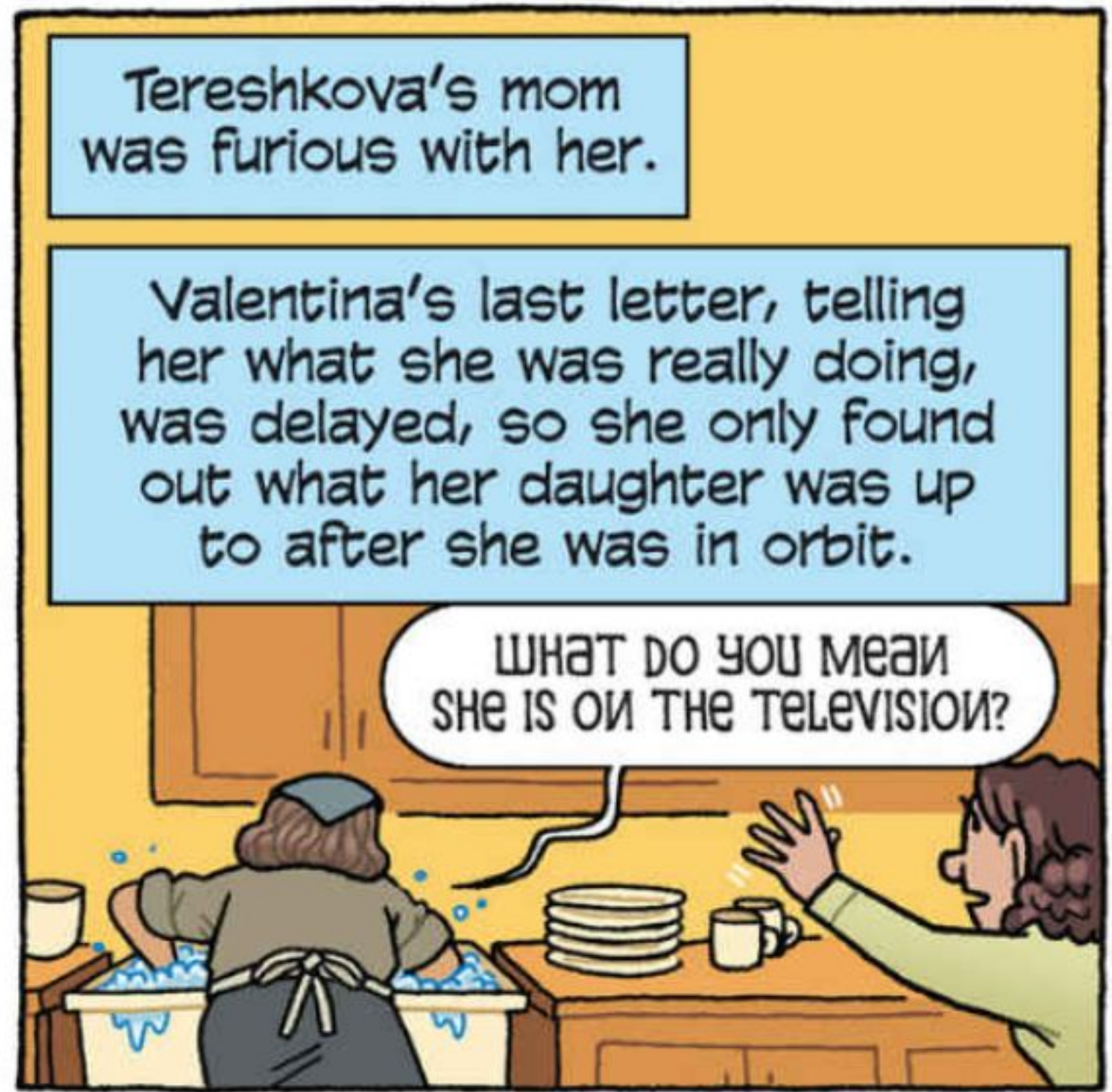
BUT DON'T WORRY! YOU AND I AREN'T GOING TO FLY AGAIN ANYWAY. WE'RE HEROES.

SYMBOLS.



WOULD YOU MIND TELLING THAT TO MY MOTHER?

HAH. PARENTS. SORRY, I CAN'T HELP YOU THERE. THEY ARE WORSE THAN FLIGHT DOCTORS!



Tereshkova's mom was furious with her.

Valentina's last letter, telling her what she was really doing, was delayed, so she only found out what her daughter was up to after she was in orbit.

WHAT DO YOU MEAN SHE IS ON THE TELEVISION?



I HAVE A LETTER FROM HER RIGHT HERE, SAYING SHE'LL BE BACK FROM THE LAST STAGES OF HER PARACHUTE TRAINING IN A FEW DAYS.

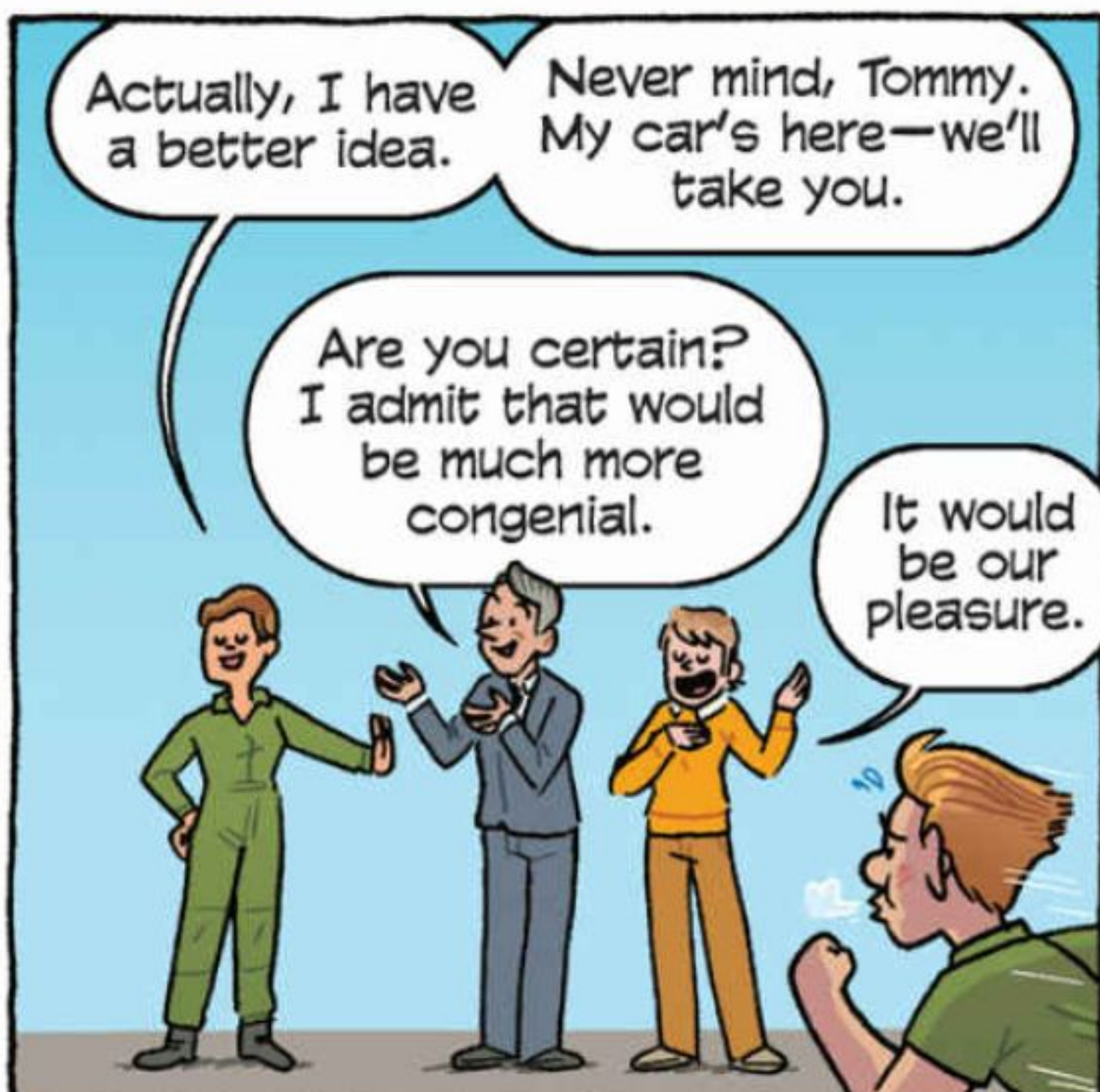
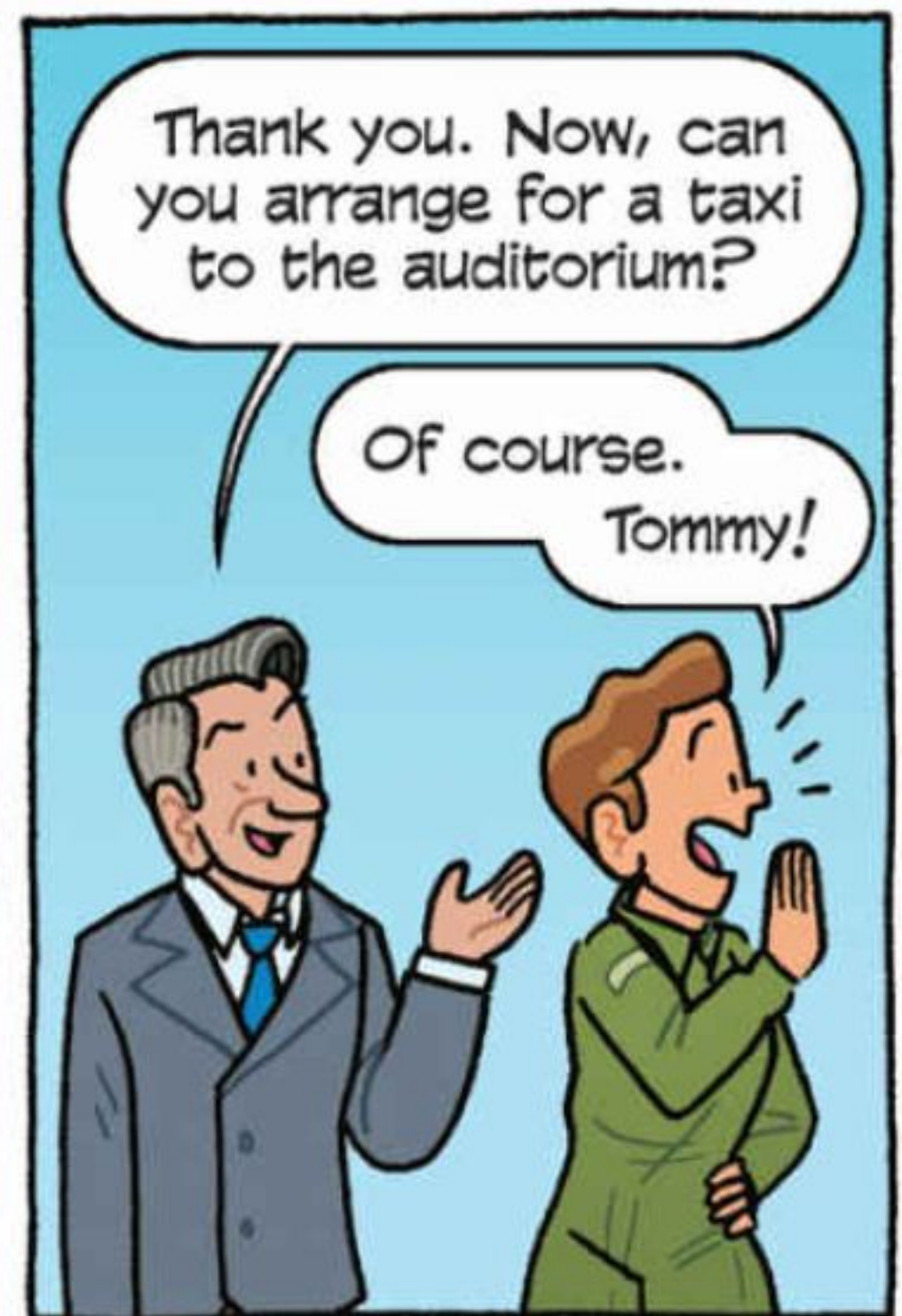
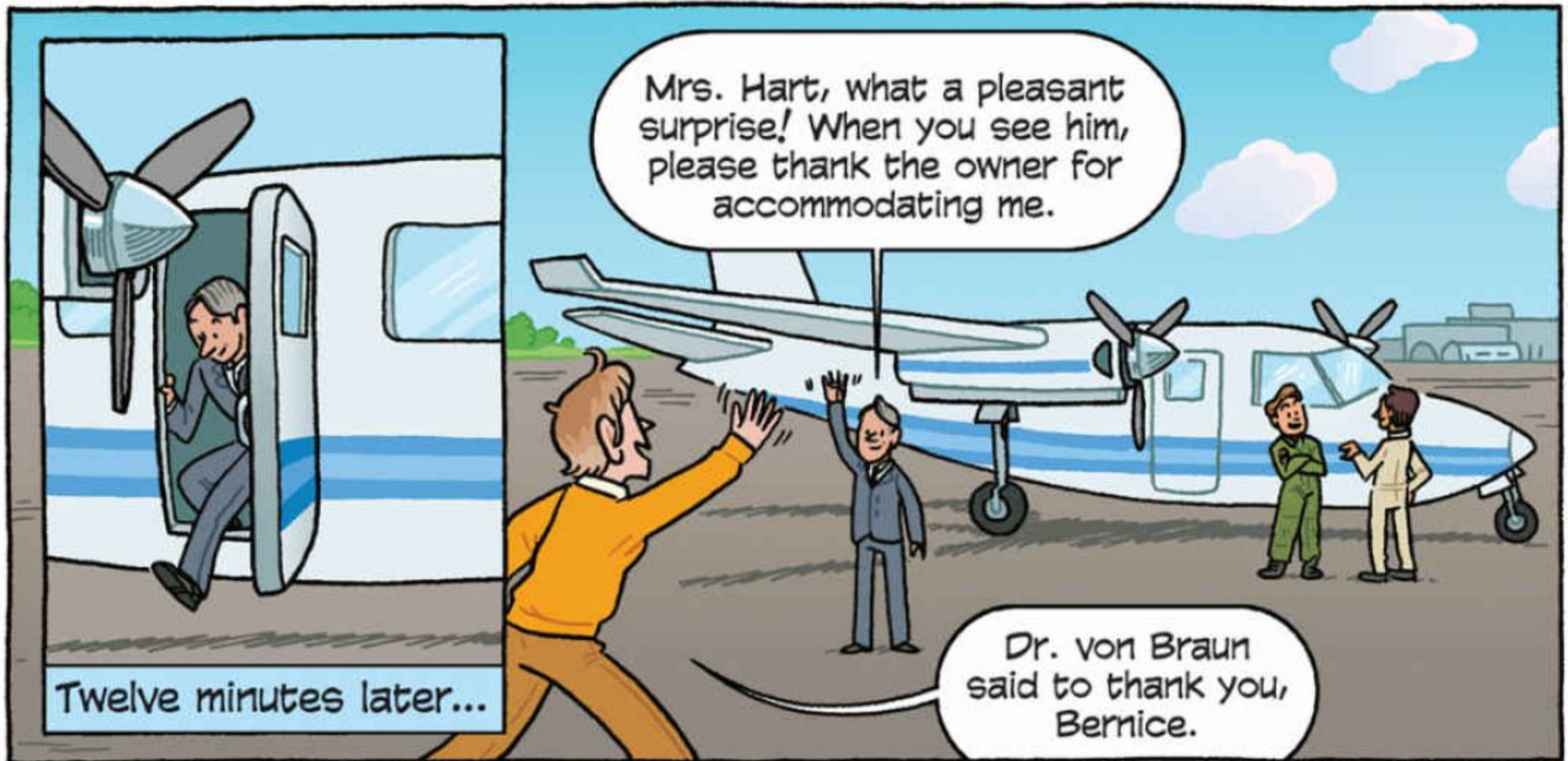
ELENA, IT IS HER.

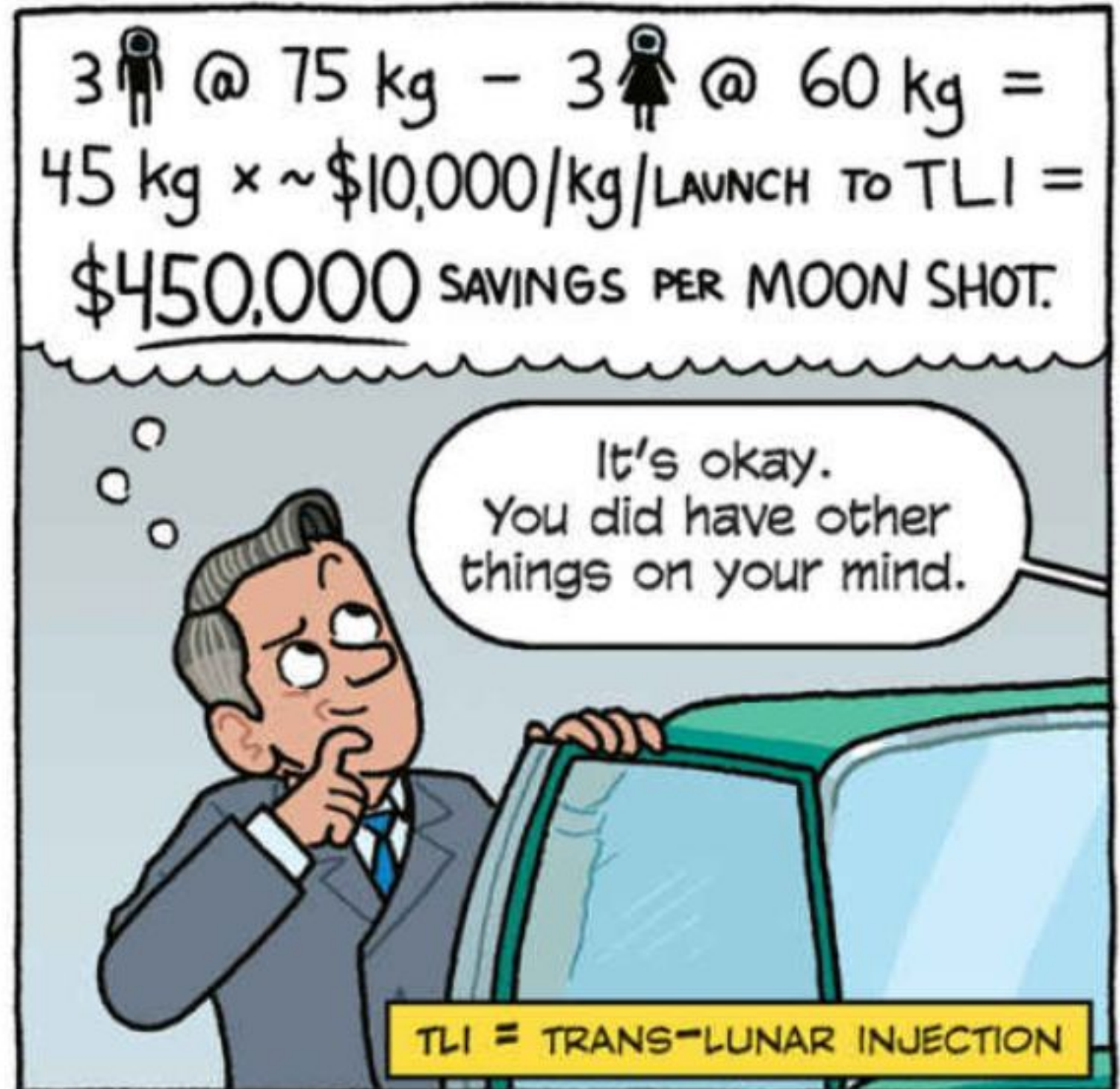
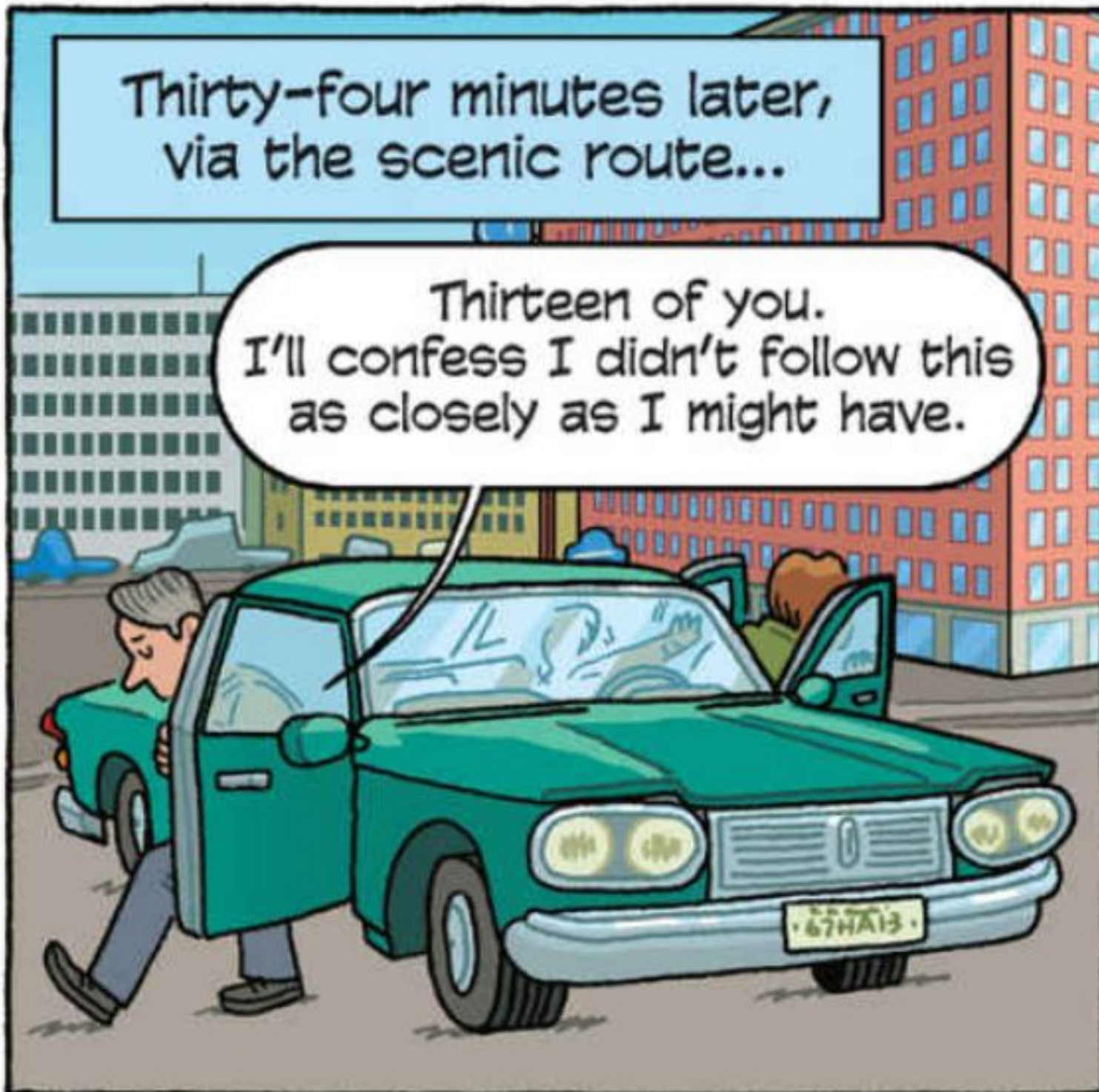
COME SEE.













Nonsense.

If you are not in attendance, I will not be either.

In we go.



Dr. von Braun, it's an honor. We are so glad you could take some time from your busy schedule.

And we were worried when the cab companies had no record of picking you up, but I see all is well.



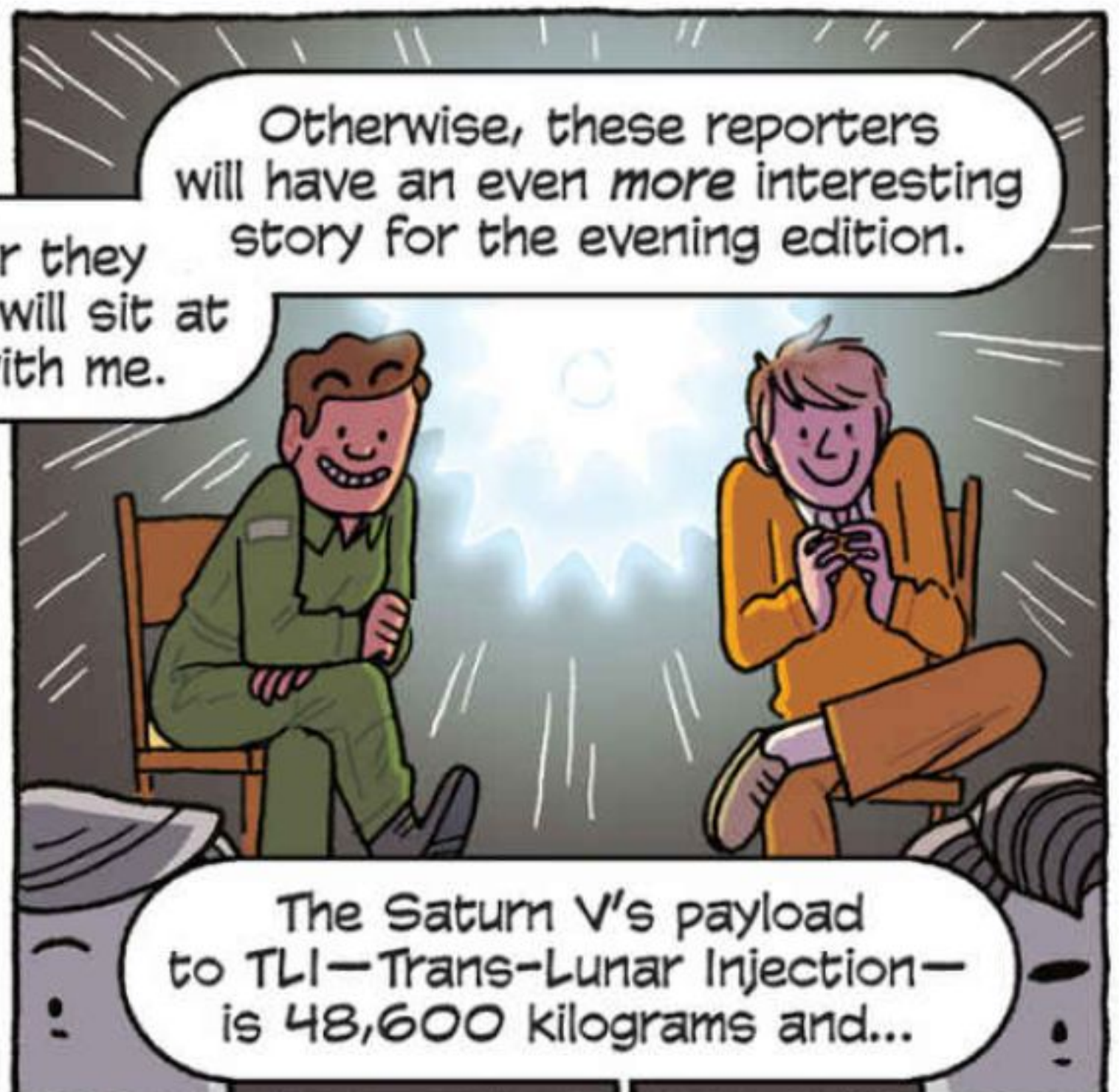
We'll take it from here, girls.

No, no. They will be staying. And I believe I know what you're going to say, so please allow me to save us all some time.



Okay, look. How about they sit in the back by the film projector?

But if you prefer they did not, then they will sit at the head table with me.



Otherwise, these reporters will have an even *more* interesting story for the evening edition.

The Saturn V's payload to TLI—Trans-Lunar Injection—is 48,600 kilograms and...

And here's where I come into the story. While Hart and Trimble crashed the stag party in Flint, I was in high school in New York. And didn't know much about the Mercury 13.

Not many did. They weren't front-page news for long.

Not like Valentina's Vostok 6 flight was.

I was curious about that, because it seemed very strange. In those days...you know, going to space wasn't really a possibility.

I mean, reading about Valentina was sorta like...

Ooh, that's interesting.

It would be neat to fly a spaceship, wouldn't it, Walt?

Sure, but you're working on a license for things with wings right now, so let's do the preflight and get us up there.

So, what's first?

Cabin. Control Wheel Lock—remove it.

Correct. And then?

Ignition switch: Off.
Master switch: On.

I started flying when I was fourteen because I was a strange little kid that kept playing with model airplanes and...anyway, my parents were great.

My mother's brother was a pilot, and was killed in World War II. He was the only flier in our family.



But you know, I liked airplanes, and when I said I wanted to fly, my parents did a smart thing. They let me.

It's expensive...

so if you want to do this, make some money. Whatever you make, we'll match.



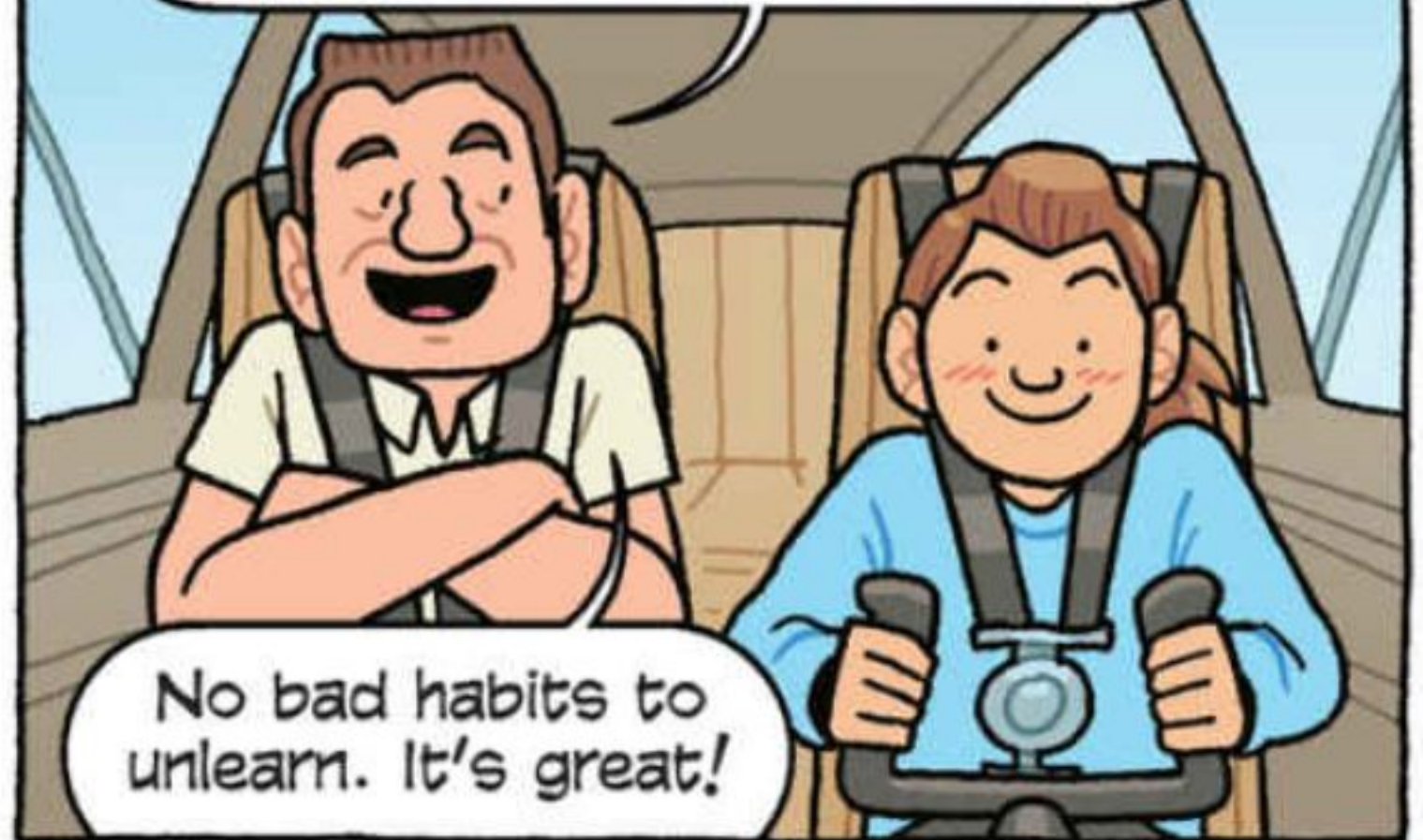
So I started babysitting and giving baton-twirling lessons and making money. My parents matched it, and I met Walt.



NO ACTUAL BABIES WERE SAT UPON, OR TWIRLED

Walt was an Army Air Corps pilot and an instructor. We had the *best* time.

I've never taught someone to fly that couldn't drive a car.



No bad habits to unlearn. It's great!

It was great. But when I did finally get into a car the first time in driver's ed., I scared everybody half to death.

Sorry, sorry. I gotta fight this... this feeling.



What feeling?

That I should be steering with my feet.



I loved flying anything I could get my hands—and feet!—on. So when the job with NASA came up, it sounded interesting.



But I'm getting ahead of myself, and maybe giving the wrong impression too. While flight experience is a bonus, astronauts don't *have* to be pilots anymore.

Science is the ticket...



So I didn't spend *all* my time babysitting and twirling batons and flying.

I studied and I read.

And not just Nancy Drew and Robert Heinlein. Though a lot of that, as well as E. B. White.

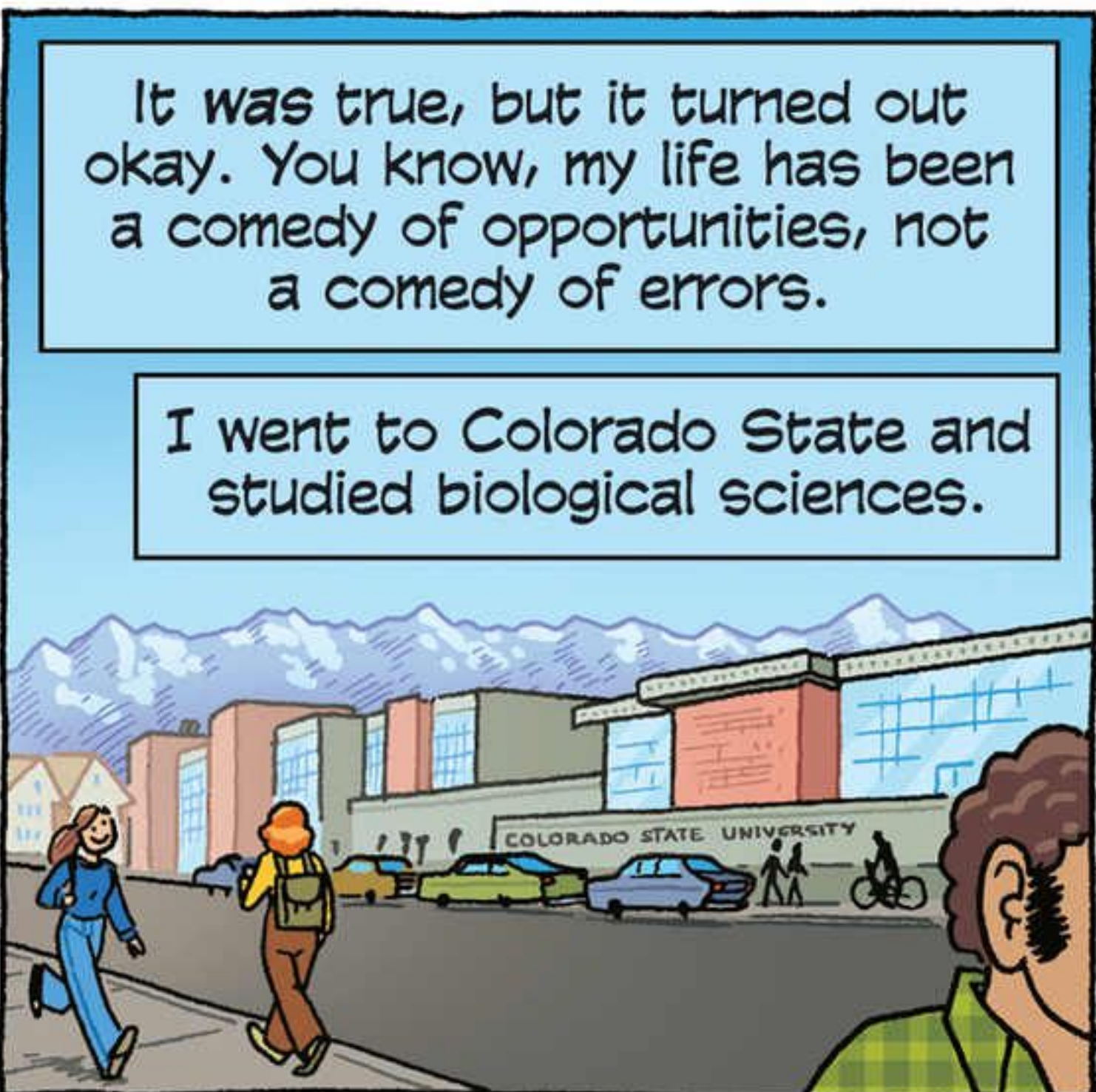
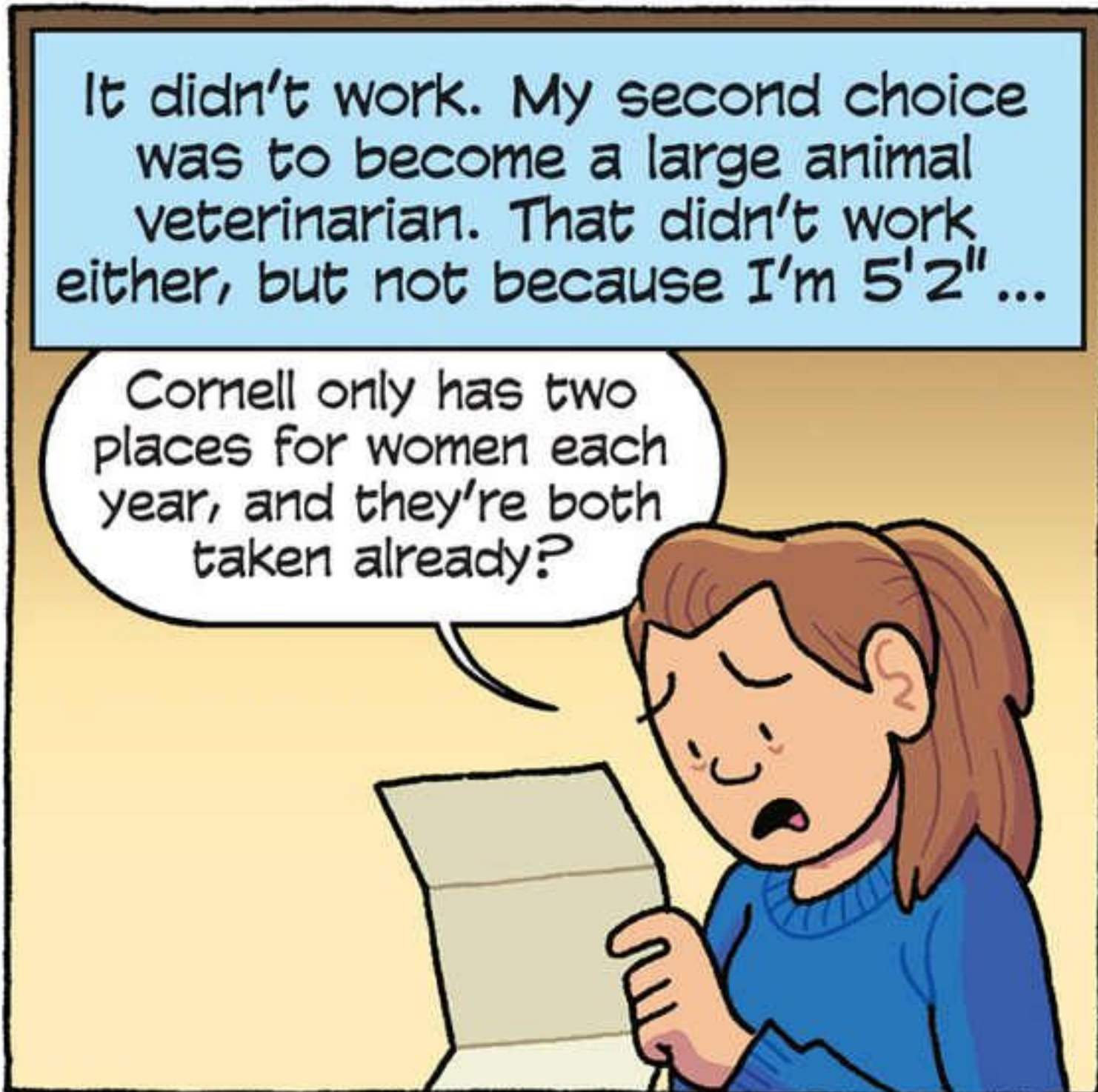


I did well in school, and went to college. I wanted to become a flight attendant after graduation, but I was too short.

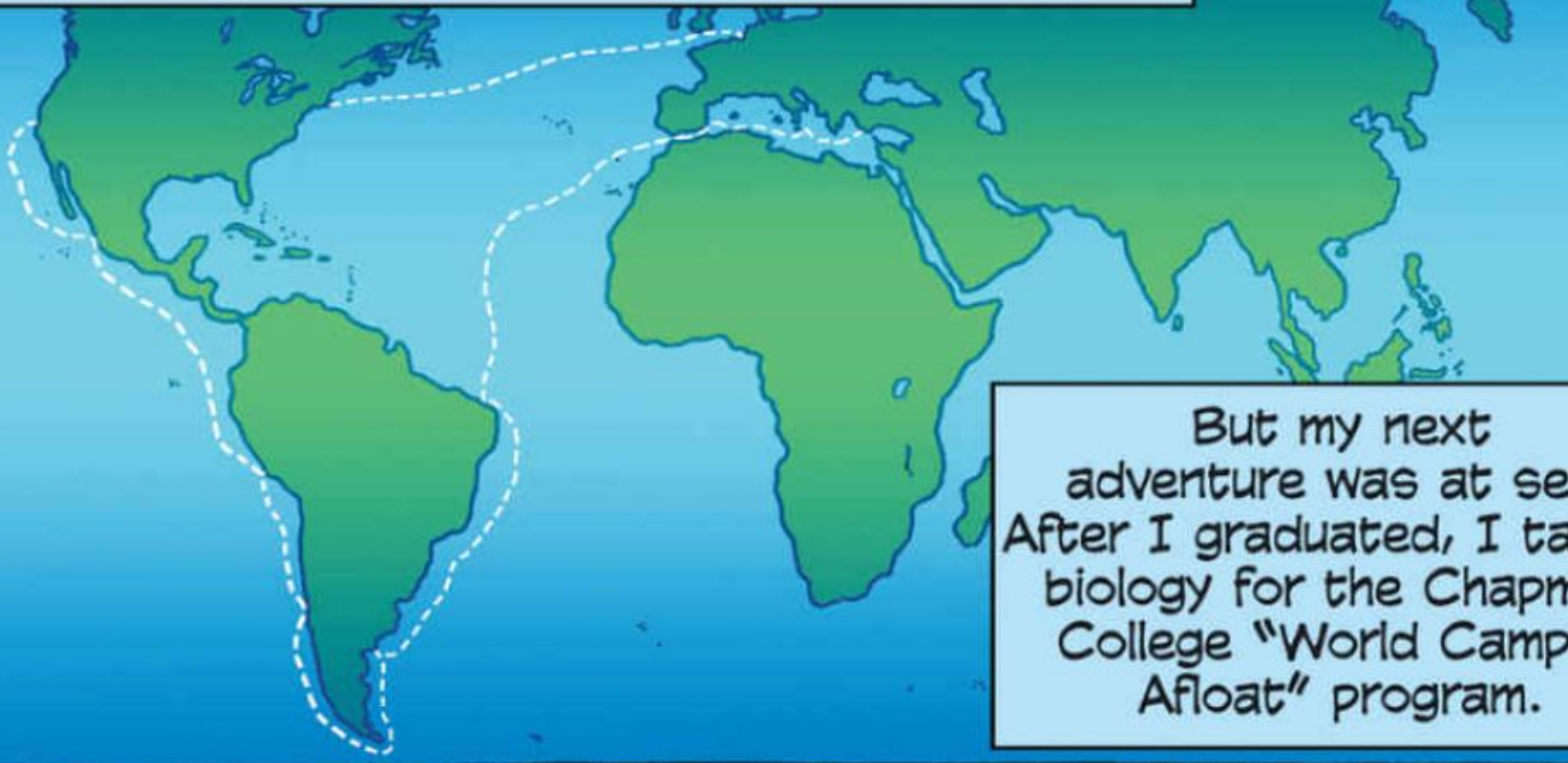


That's not gonna work, you know.





Skiing really is the closest thing to zero g you can get on the planet. Besides a vomit comet airplane.



But my next adventure was at sea. After I graduated, I taught biology for the Chapman College "World Campus Afloat" program.

I got interested in water quality and algae on that trip, and decided to go back to school.

I'm going to get my master's degree in microbial ecology.

Gonna be a phycologist.



Thanks.

Wait, how do psychology and algae...?



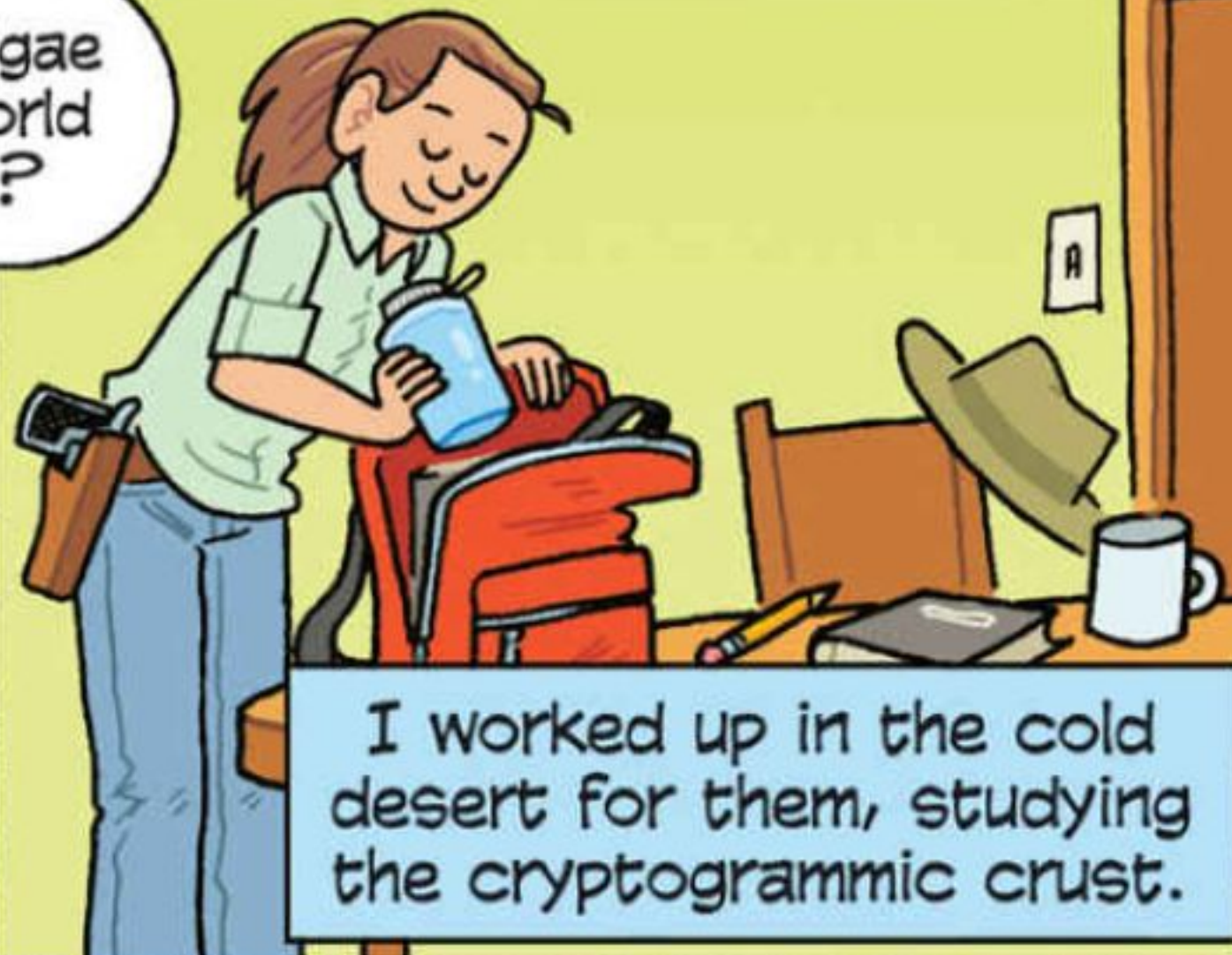
Hah! They don't... and I don't have a lisp!

It's *phycology*.
Green slime.

Because water and algae are what make the world go round, you know?



I followed up my master's with fieldwork for the Utah Water Research Lab.

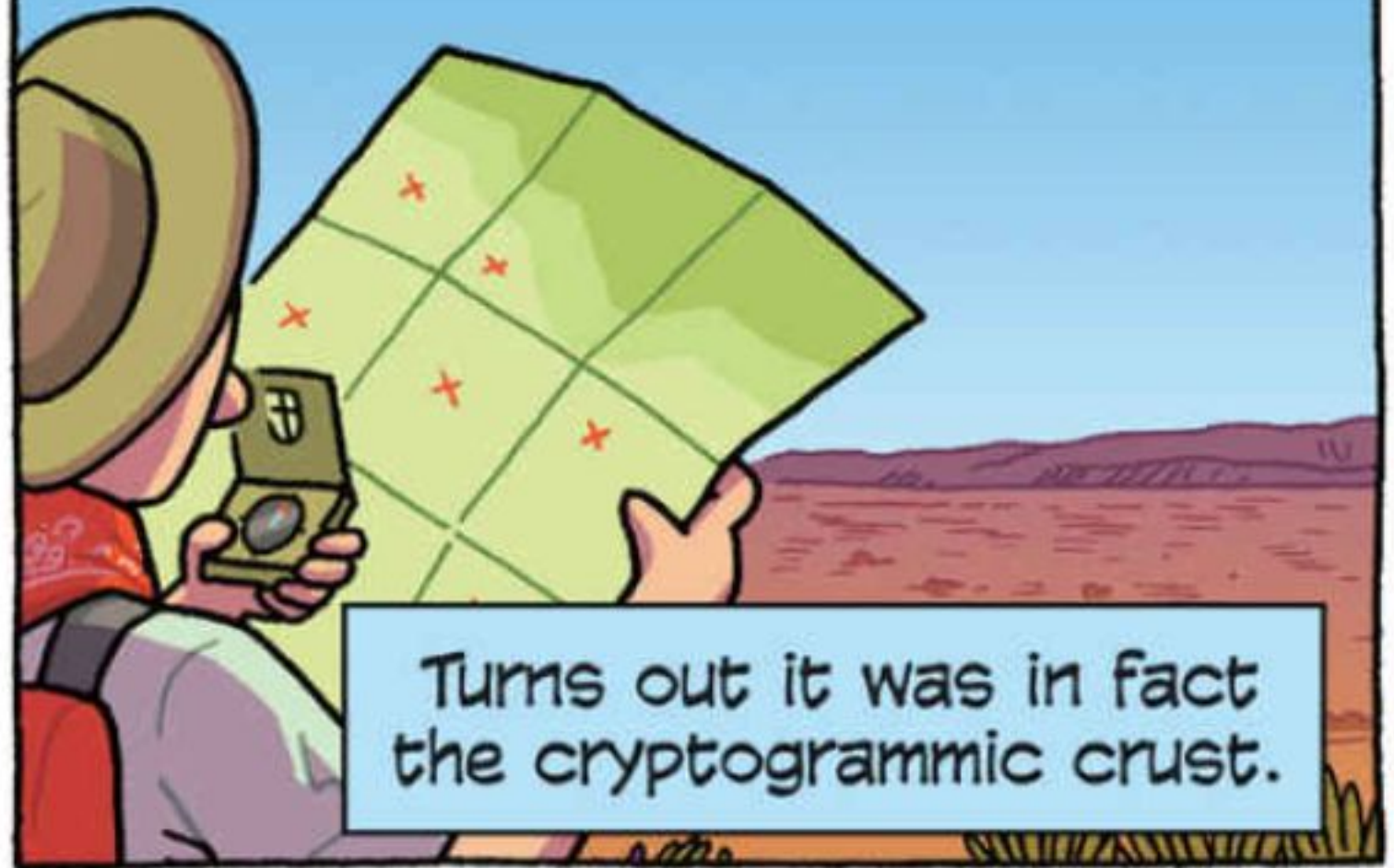


I worked up in the cold desert for them, studying the cryptogammic crust.

That's the black stuff you see out there.



We were trying to figure out where all the carbon dioxide emitted by nearby cities was going. It was getting sucked up by plants, but we didn't know which ones, or where.



Turns out it was in fact the cryptogammic crust.

This stuff is mostly dormant, but if it rains it's up and chugging full speed in twenty minutes. I mean, it's really amazing.



We set up these little research instruments all over, and protected them with a piece of plywood.

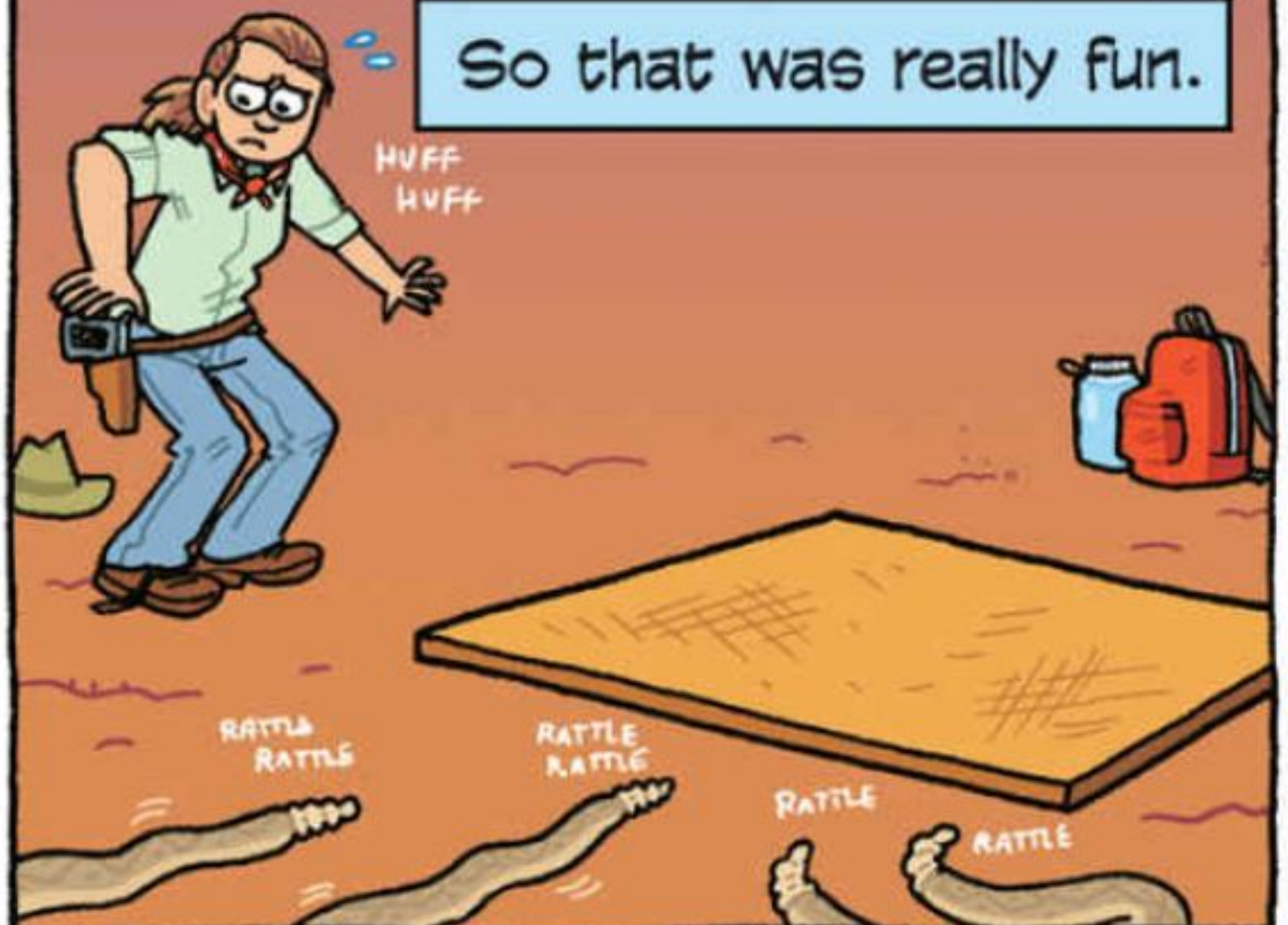


Every time!



I actually carried a six-gun filled with snake shot on my hip when I was doing that work.

So that was really fun.



But I realized that if I wanted to clean up the environment—and I did—I'd need an engineering degree.



A professor of civil and environmental engineering contacted me. Times were changin'—he didn't have any female graduate students, and he needed some!

So the question was, do I want to spend the next four years with my nose inside cryptogrammic crust shooting at rattlesnakes...

...or do I want to spend them floatin' on the Colorado River?

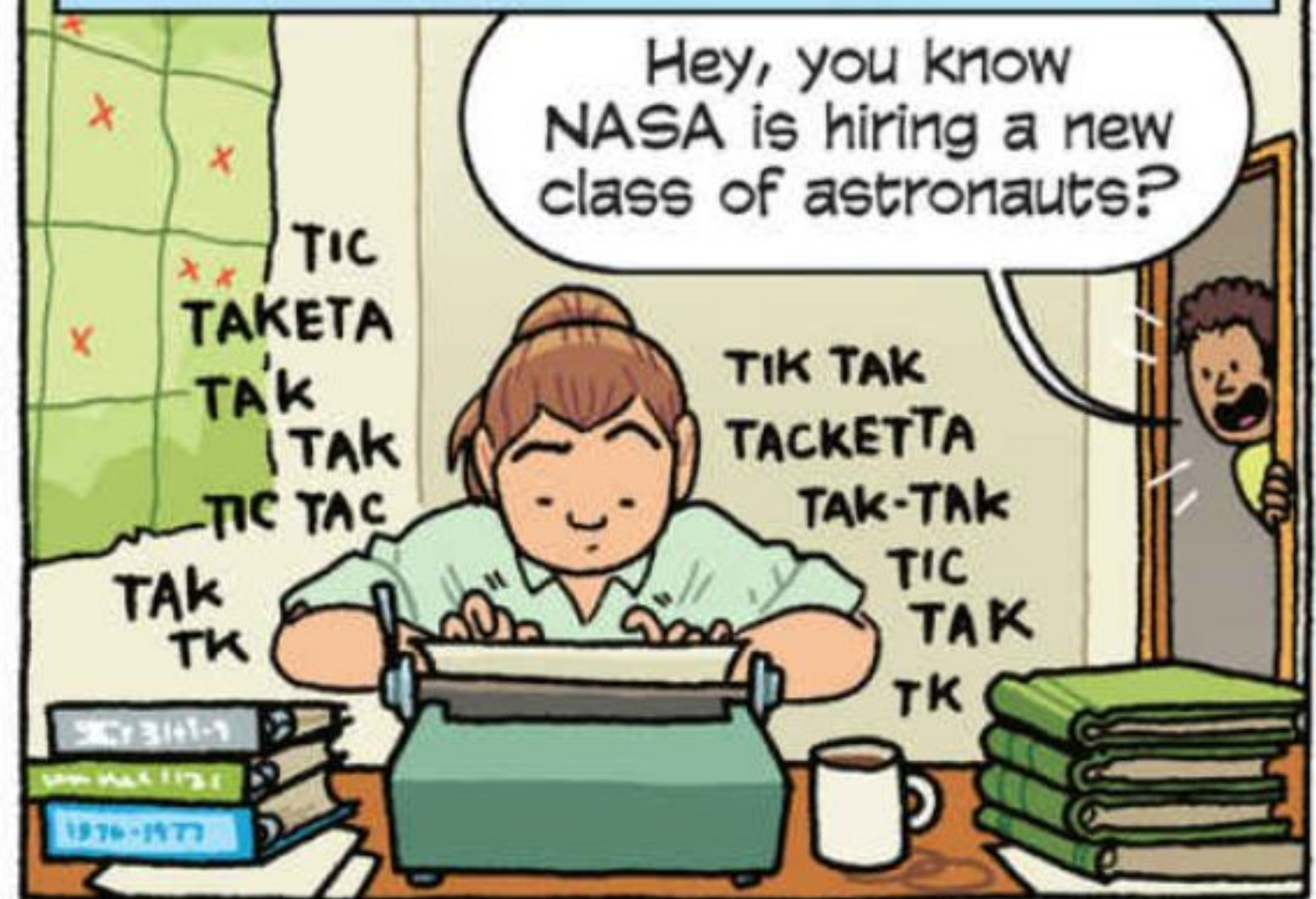


I mean, which one would you choose?



Opportunity, right? And as I was finishing up my dissertation, a friend told me about this notice he saw at the post office...

Hey, you know NASA is hiring a new class of astronauts?



I couldn't find it at first.



And when I found out that you get to—had to!—fly in T-38s as part of your job, it was like....

Oh yeah.

This is my chance to get in a high-performance jet.

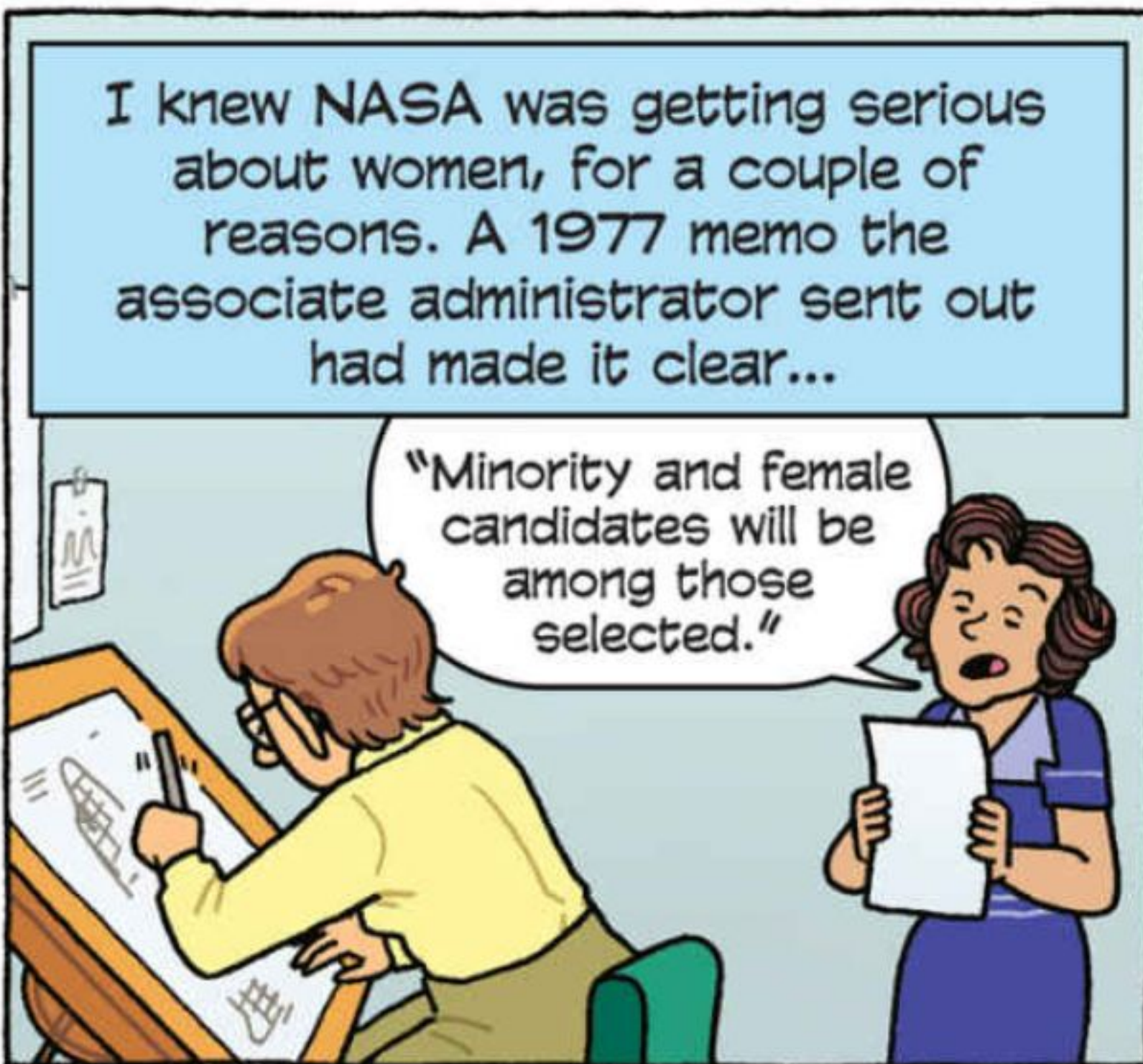




For me, it wasn't all about going into space—it was about flying a plane with an afterburner.



I mean, flying in a spaceship was great, but it wasn't my primary motivator. So I applied.



I knew NASA was getting serious about women, for a couple of reasons. A 1977 memo the associate administrator sent out had made it clear...

"Minority and female candidates will be among those selected."



"Will," huh? It's about time. You going to apply, Dottie?"

Nah. I'm pretty happy here in design.

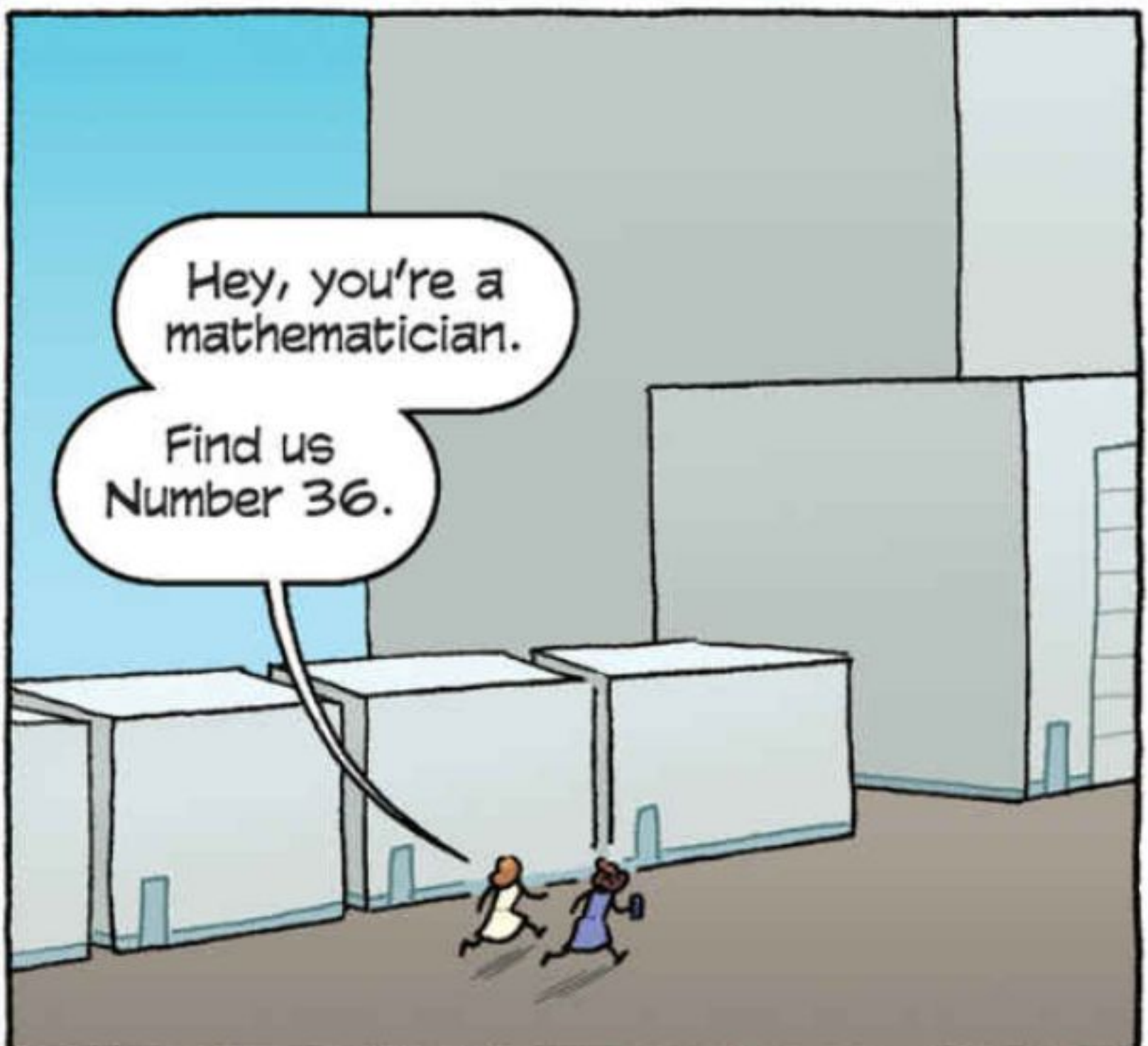
There were already a few women engineers, like Ivy Hooks and Dottie Lee, on staff. They had been there from day one of the shuttle...



...which was April Fools' Day, 1969.

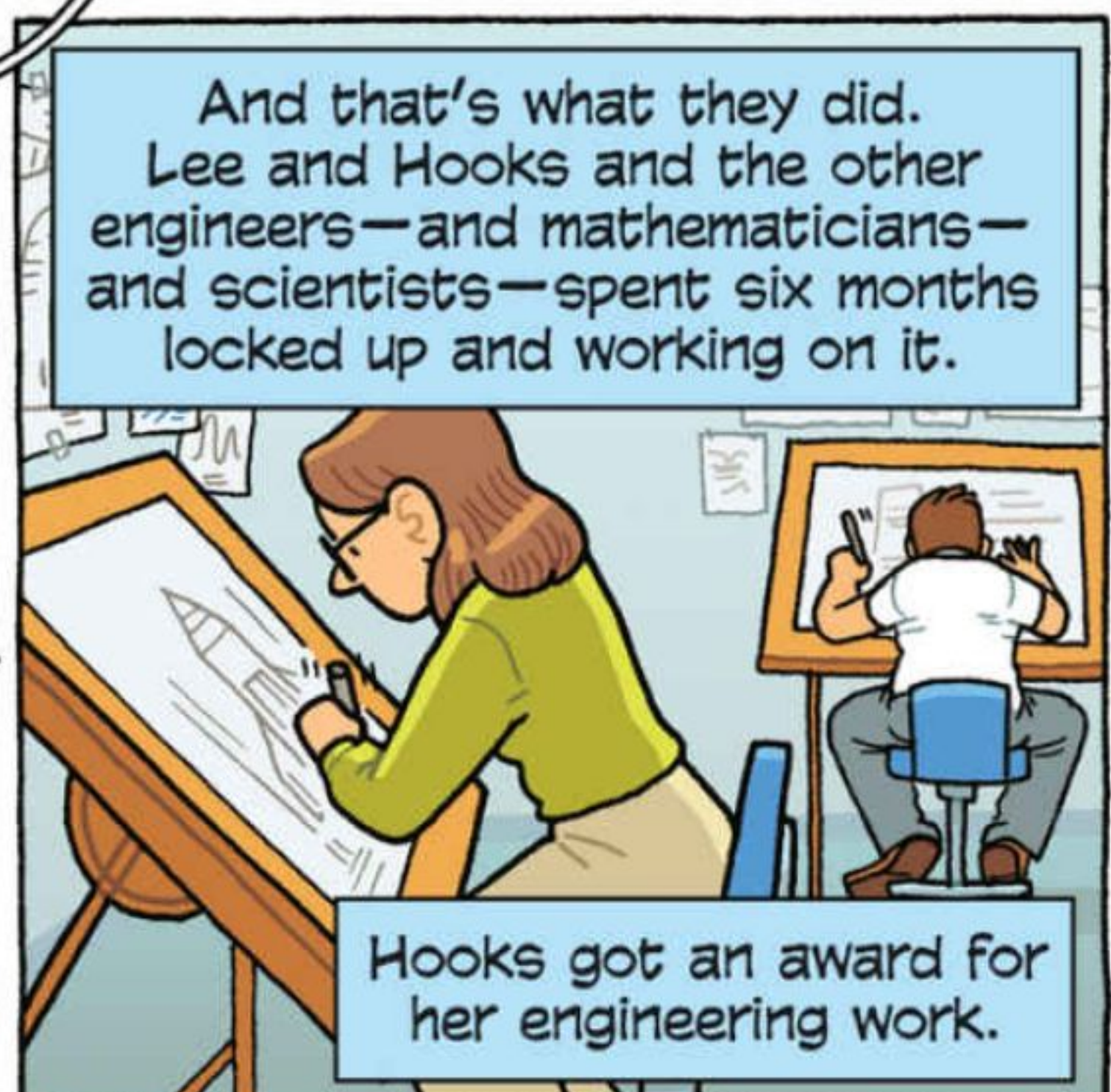
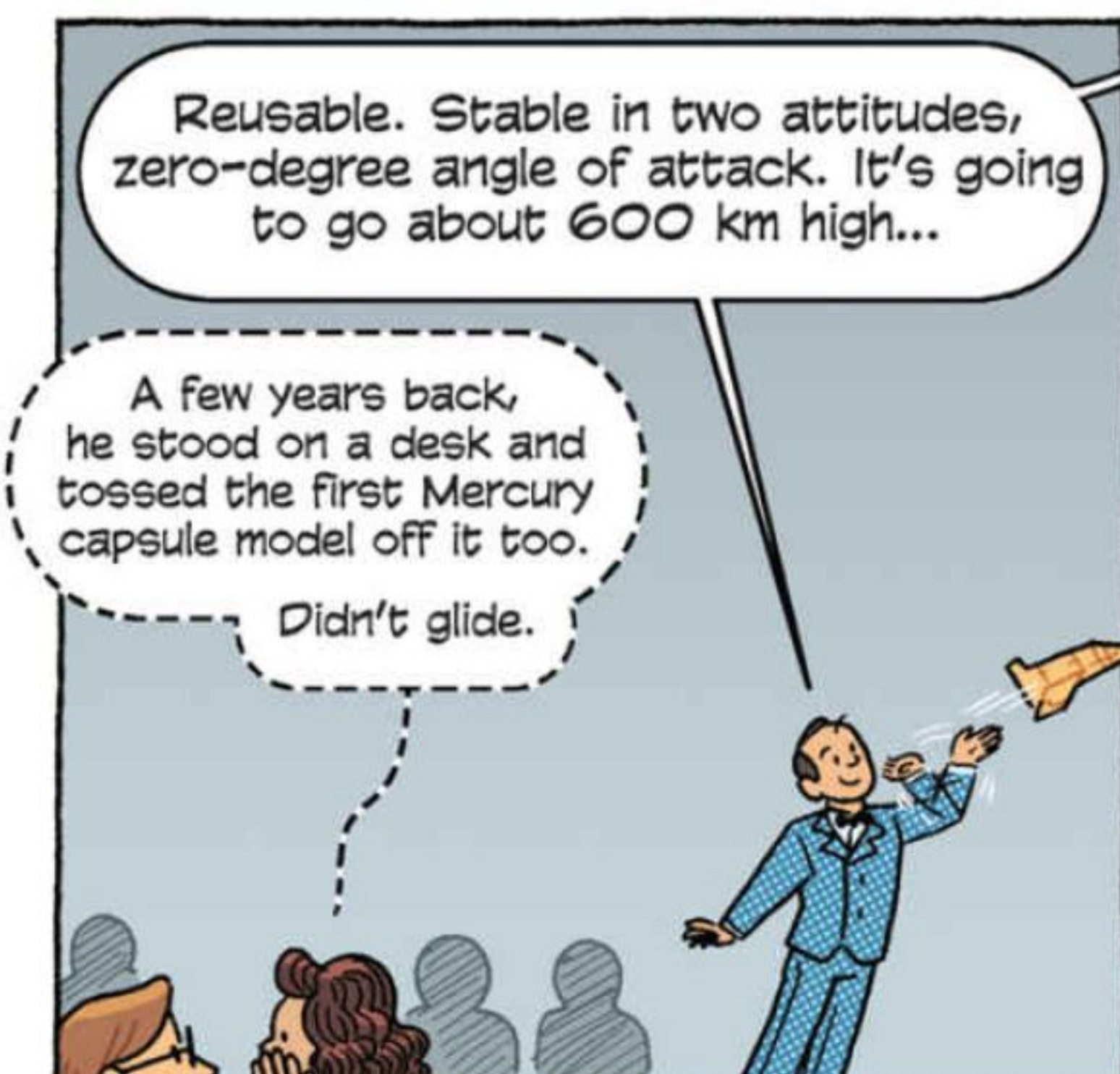
I dunno, this might be an elaborate joke.

I don't even know where we're going.



Hey, you're a mathematician.

Find us Number 36.



Lee redesigned the nose—the pointy one on the original model wasn't going to work for reentry.

Are you sure?

Yup. I did the math and made an engineering judgment.

$$\frac{\partial u}{\partial t} + u \cdot \nabla u = -\frac{1}{\rho} \nabla p + \nu \nabla^2 u + \mathbf{f}$$

$$\frac{Dv}{Dt} = -\nabla p + \frac{1}{\rho} \nabla^2 v + \mathbf{f}$$

...okay, then.

So the shuttle ended up with what everybody called "Dottie's Nose."

The team spent six months in one room, with one telephone, one secretary, and no windows.

Anyone need a lift to the moon landing celebration?

That six months took them past Apollo 11 and the first moon landing.

Busy.

Busy.

Busy.

No thanks.

Maybe later.

Busy.

Busy.

Well, we landed.

That's wonderful. We'll celebrate when they make it back.

They didn't make it to the splashdown party either. Still busy.

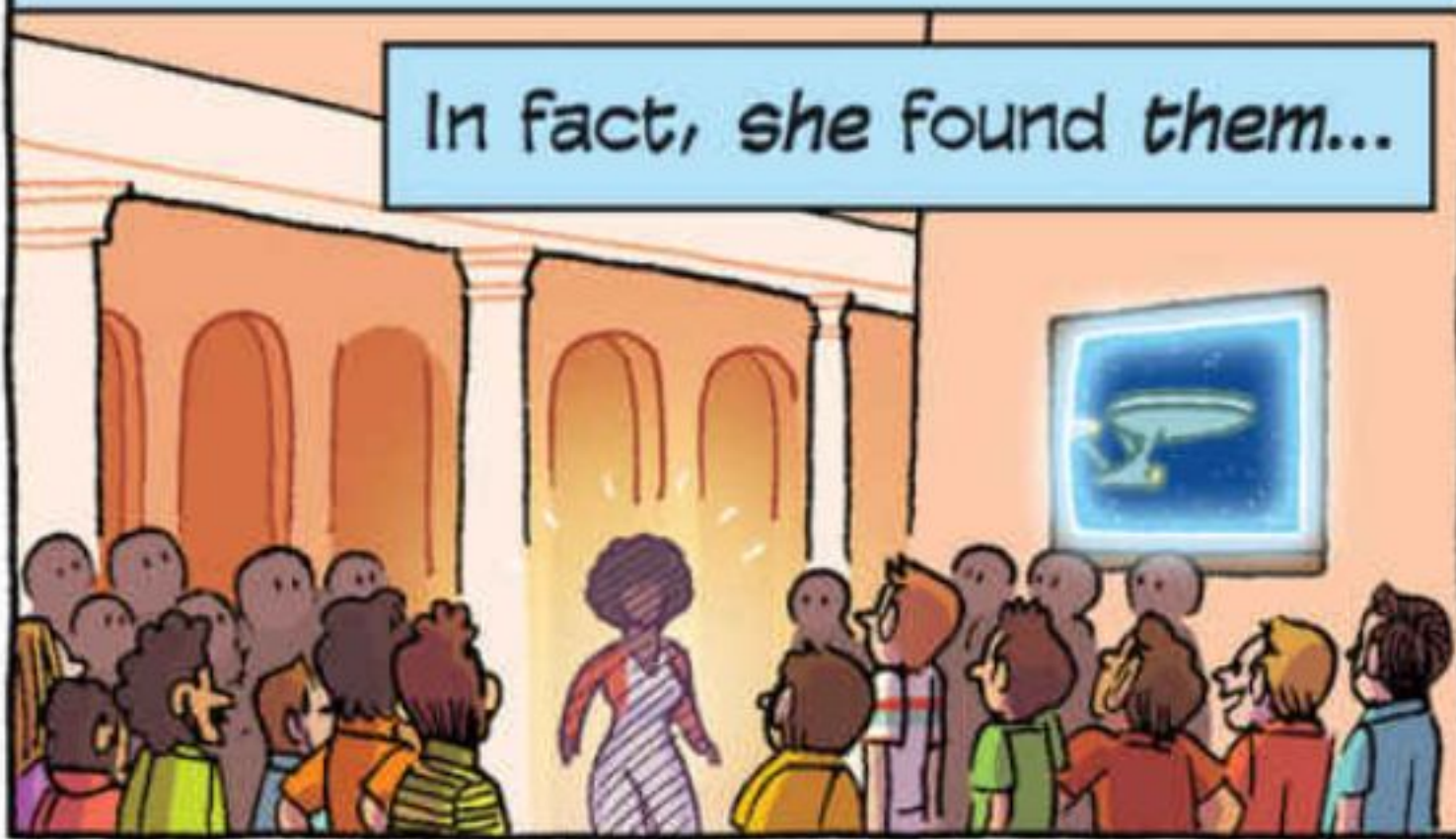
There were other parties. We landed on the moon five more times, Apollo-Soyuz was a great joint mission with the Russians, Skylab went up—and came back down—and we made progress.

But even as the shuttle got closer to launch, not enough women believed—official memo aside—that NASA was progressive. Women engineers were still rare.



And astronauts? They needed help with that, and found just the person.

In fact, she found them...



...at a *Star Trek* convention. Or rather, the night before one, in 1975.

Guys, tomorrow I'm yours, but tonight I'm not Uhura. I'm not even Nichelle Nichols.

I'm just a fan who wants to hear what NASA's been up to lately.



Hey, I just saw Kirk and Scotty get in that elevator!



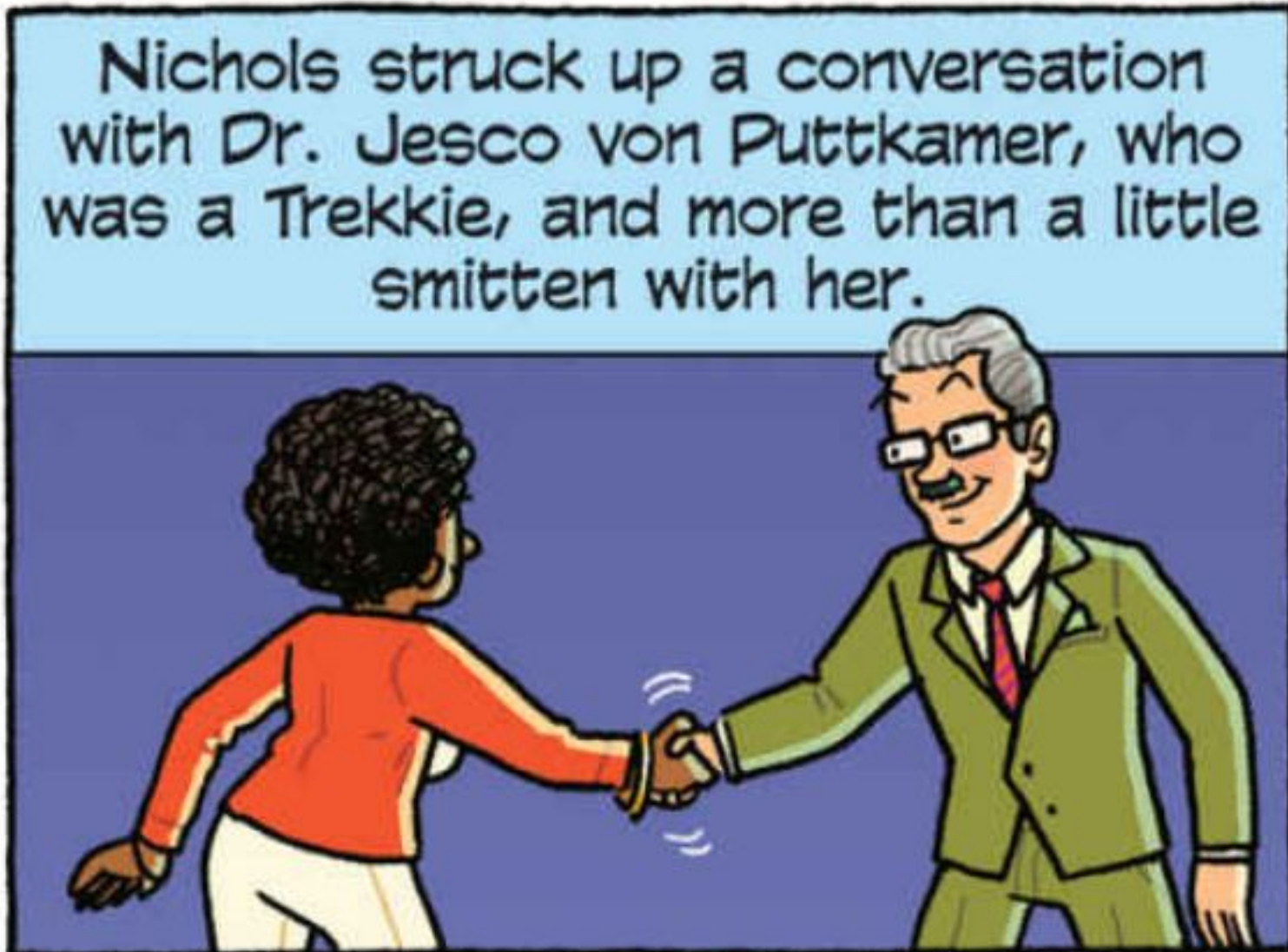
And we're happy to share with you these exclusive early photos of the space transportation system.



CLAP CLAP CLAP
CLAP CLAP CLAP
CLAP CLAP CLAP
CLAP CLAP CLAP
CLAP CLAP CLAP
CLAP CLAP CLAP
CLAP CLAP CLAP
CLAP CLAP CLAP
CLAP CLAP CLAP
CLAP CLAP CLAP

Also known as the shuttle.







I will be your worst nightmare.





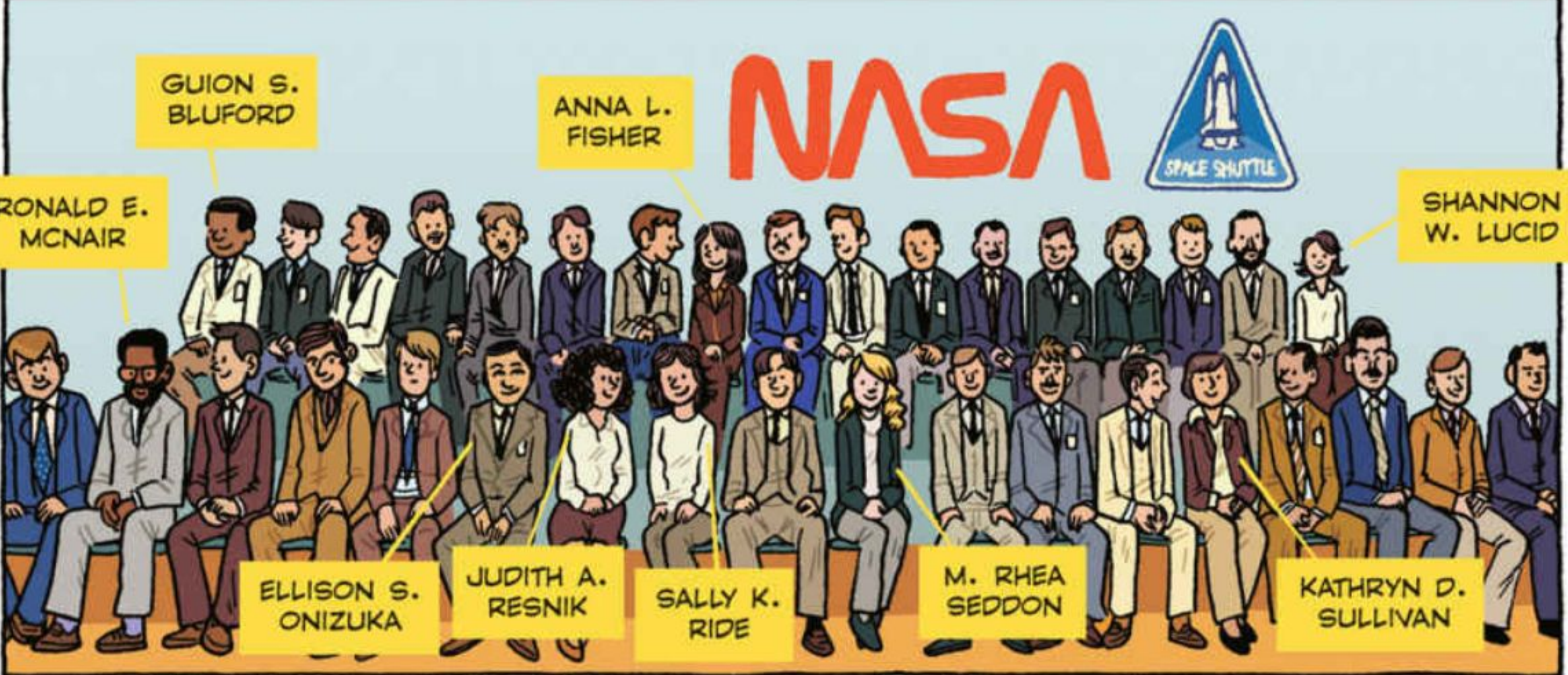
...I didn't make the cut.

Maybe it's because I haven't finished my degree.



All right. Okay. Pretty soon I'll be "Dr. Cleave"...

It really was okay. I mean, that was the astronaut class that included Sally Ride, Judy Resnik, Ron McNair, Guy Bluford, and Ellison Onizuka.



GUION S. BLUFORD

ANNA L. FISHER

NASA



SHANNON W. LUCID

RONALD E. MCNAIR

ELLISON S. ONIZUKA

JUDITH A. RESNIK

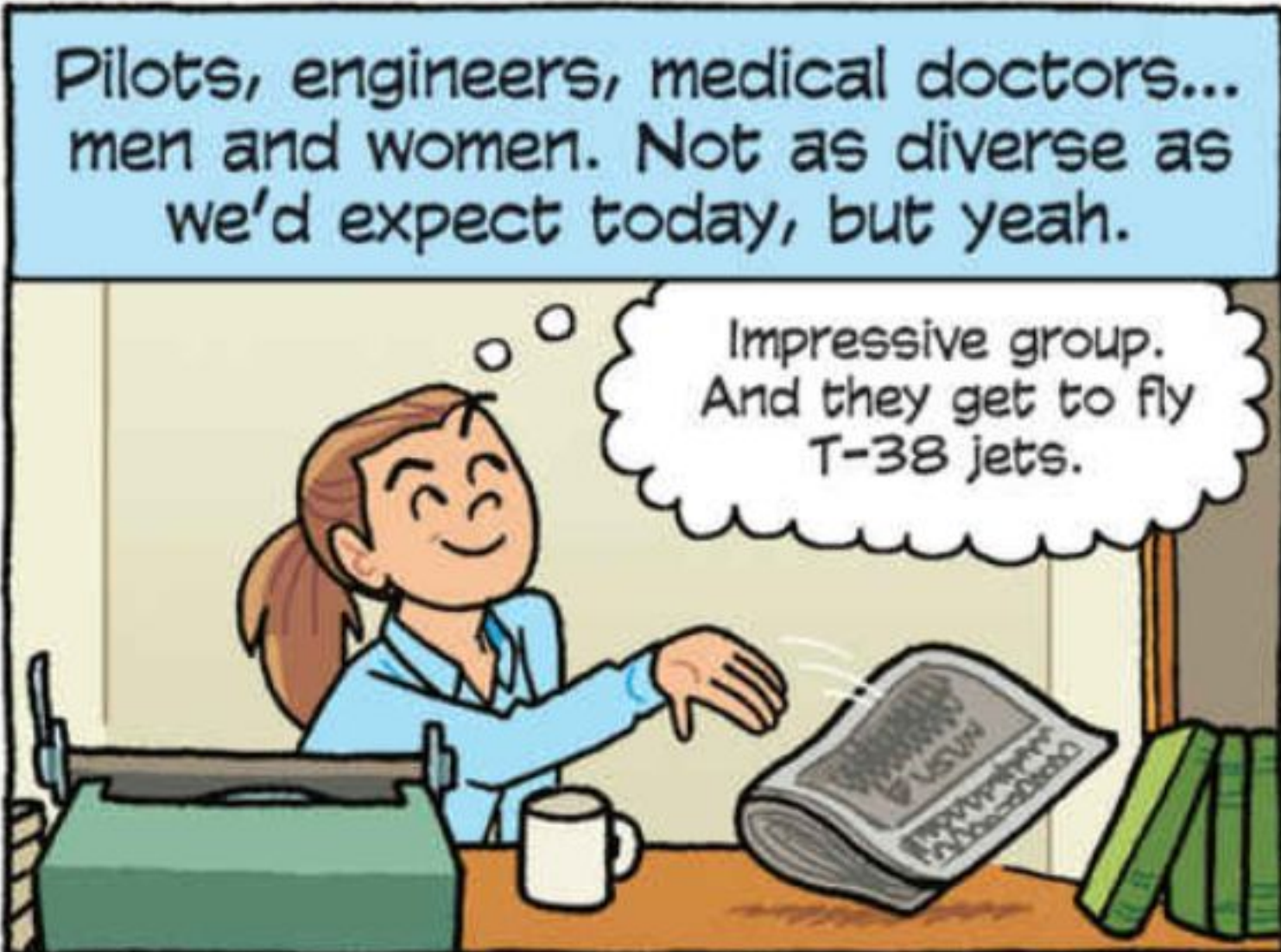
SALLY K. RIDE

M. RHEA SEDDON

KATHRYN D. SULLIVAN



And thirty others. Twenty-six white guys and nine...well...people who were not. Pretty diverse, for NASA.

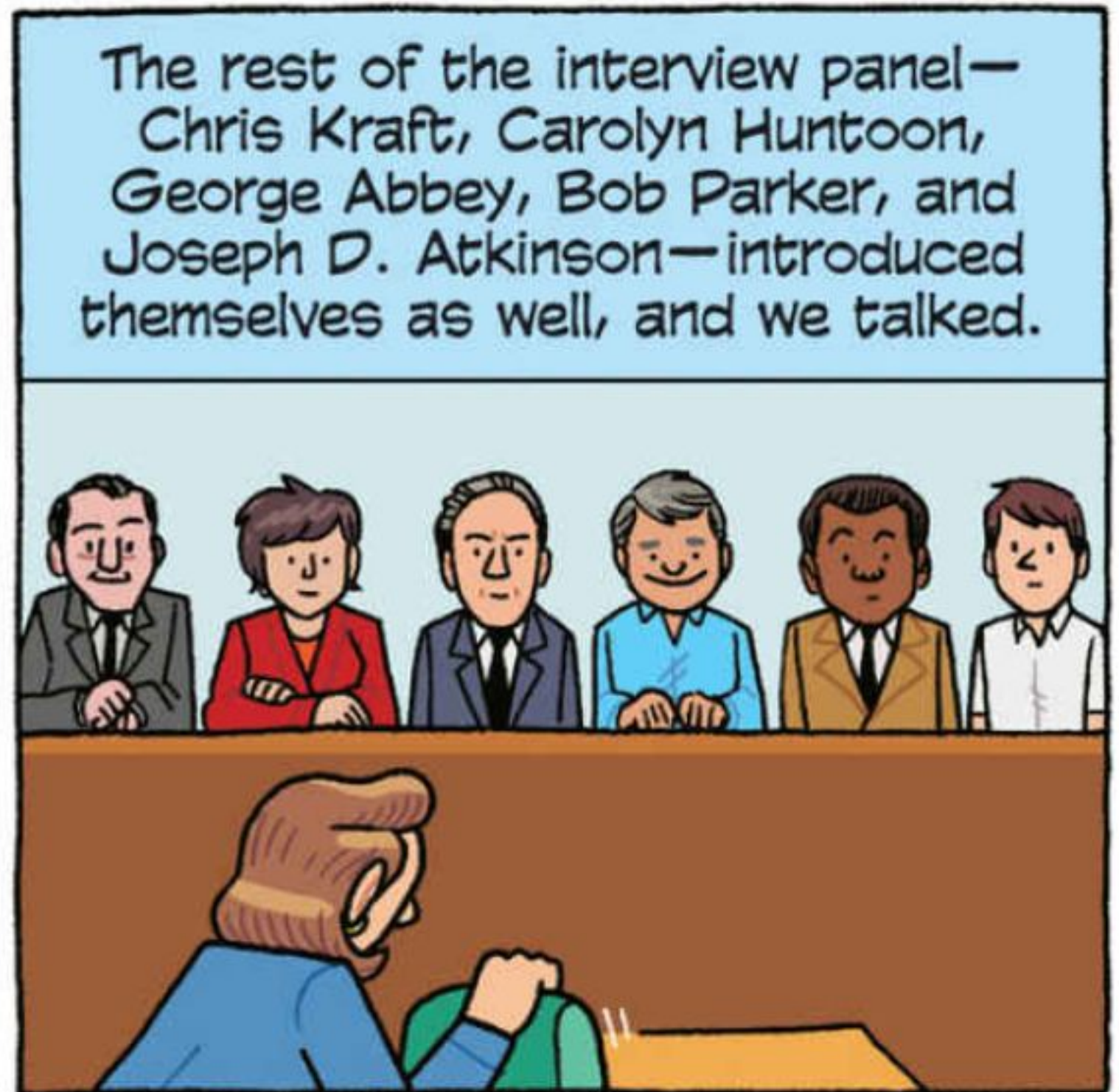
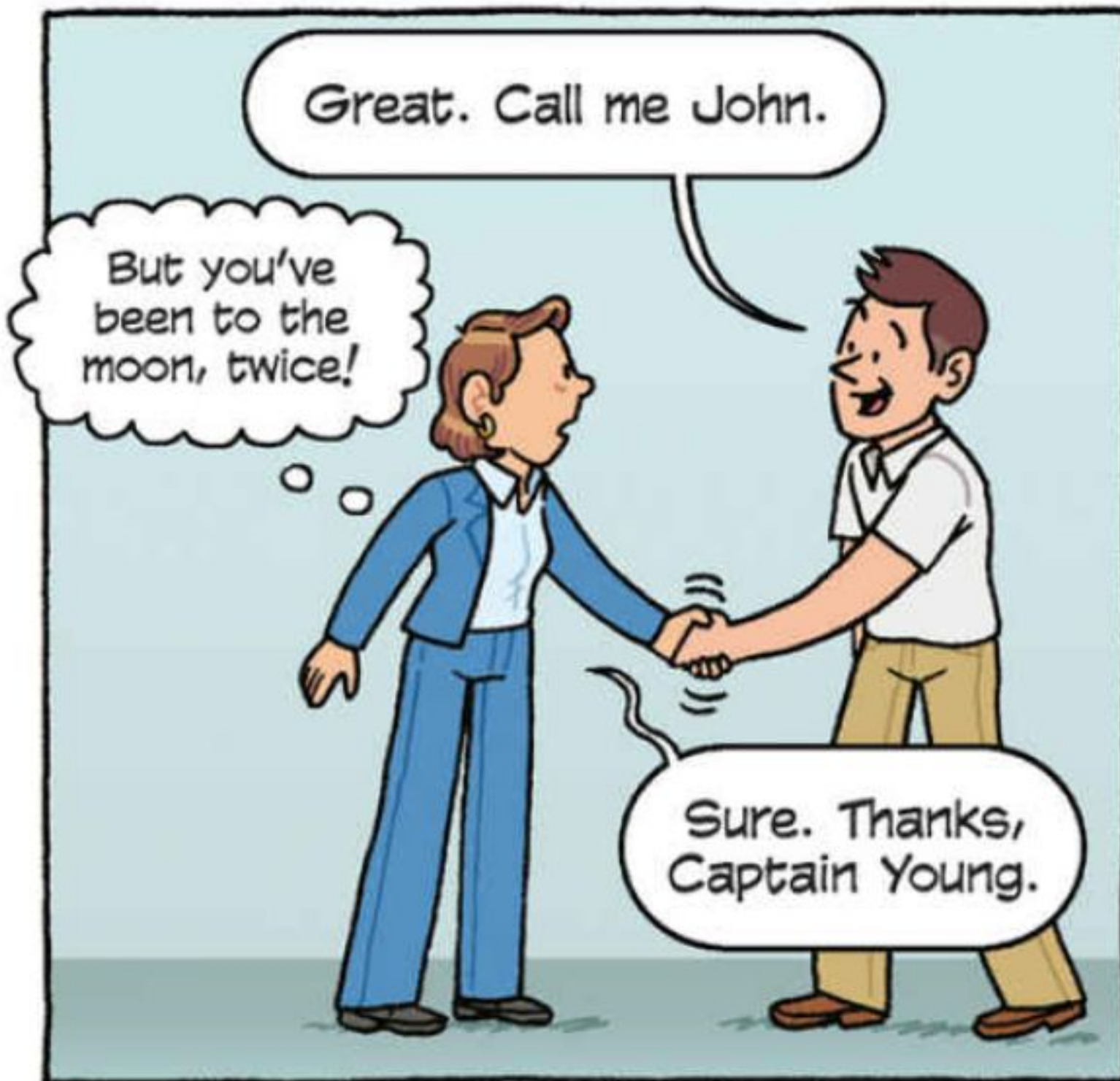
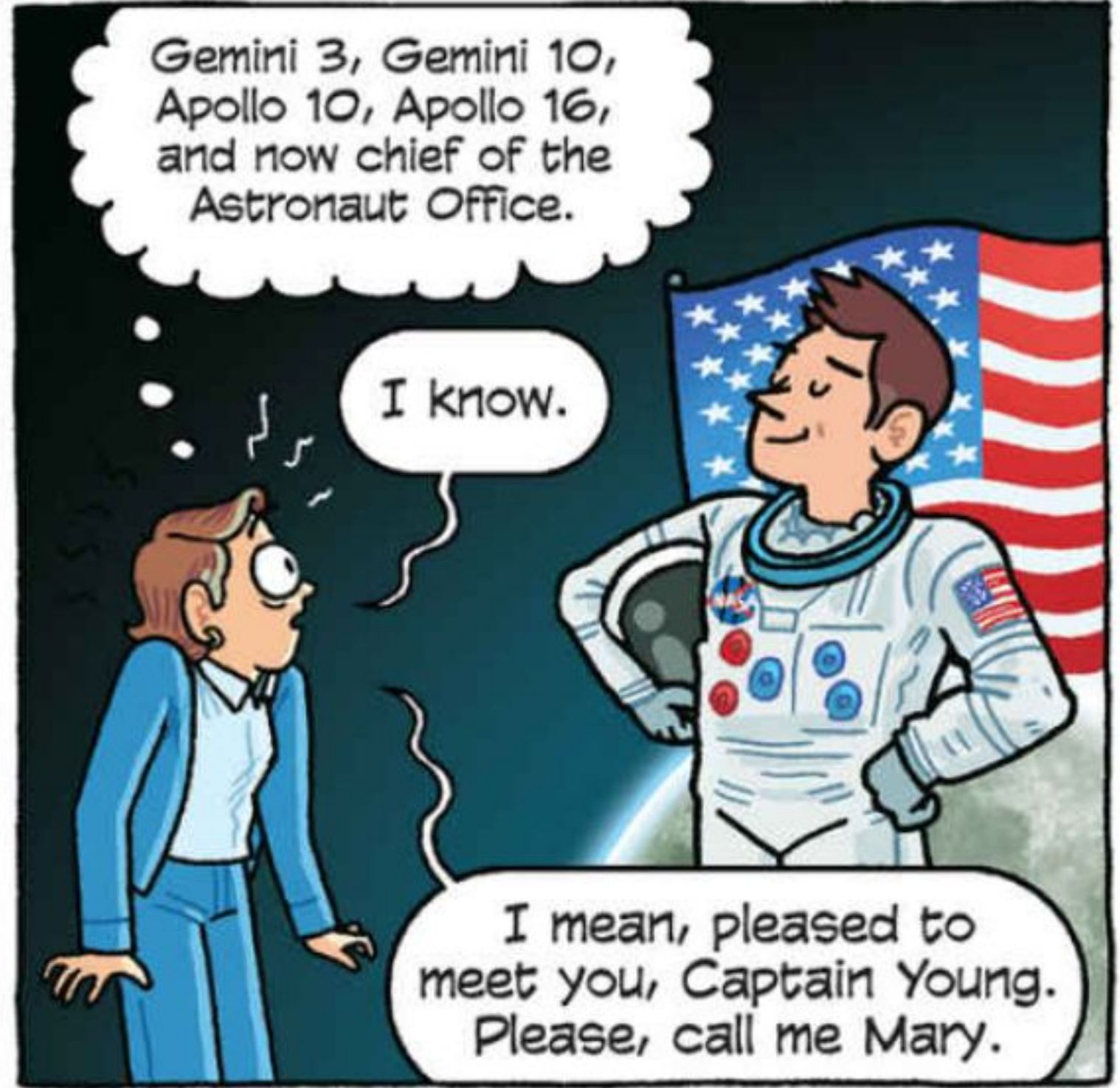


Pilots, engineers, medical doctors... men and women. Not as diverse as we'd expect today, but yeah.

Impressive group. And they get to fly T-38 jets.



So I applied again. And...



I can give you an *almost* full brain for half the payload price.



Oh great, be flippant with a guy that walked on the Moon.



I wanted to just grab it and...



I can give you an almost full brain for half the payload price.



Okay.

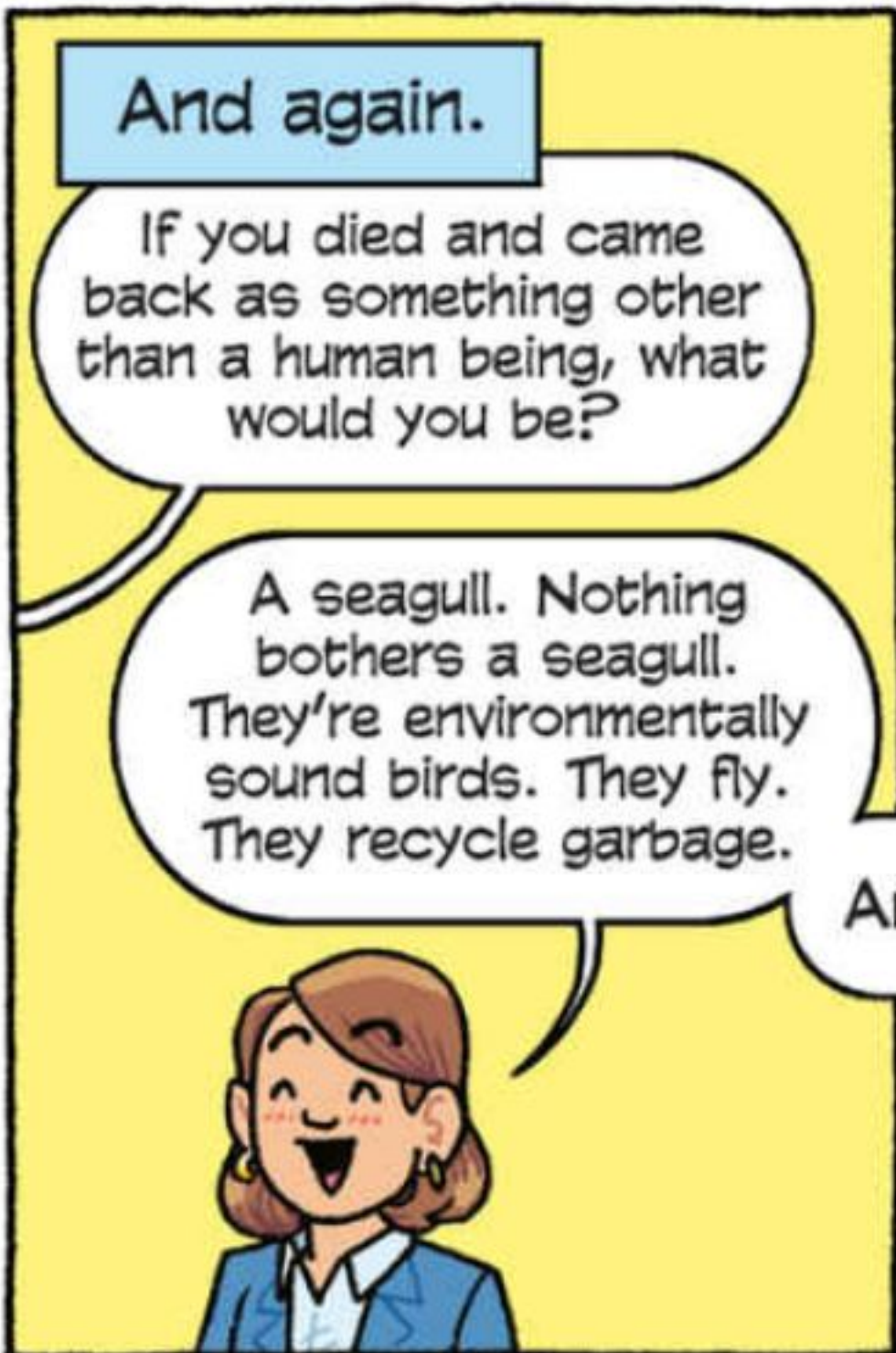
But he was polite.



And then I did it again. Different person.

And why do you want to join the Astronaut Corps?

Because I want to cross-country ski on the martian ice caps.

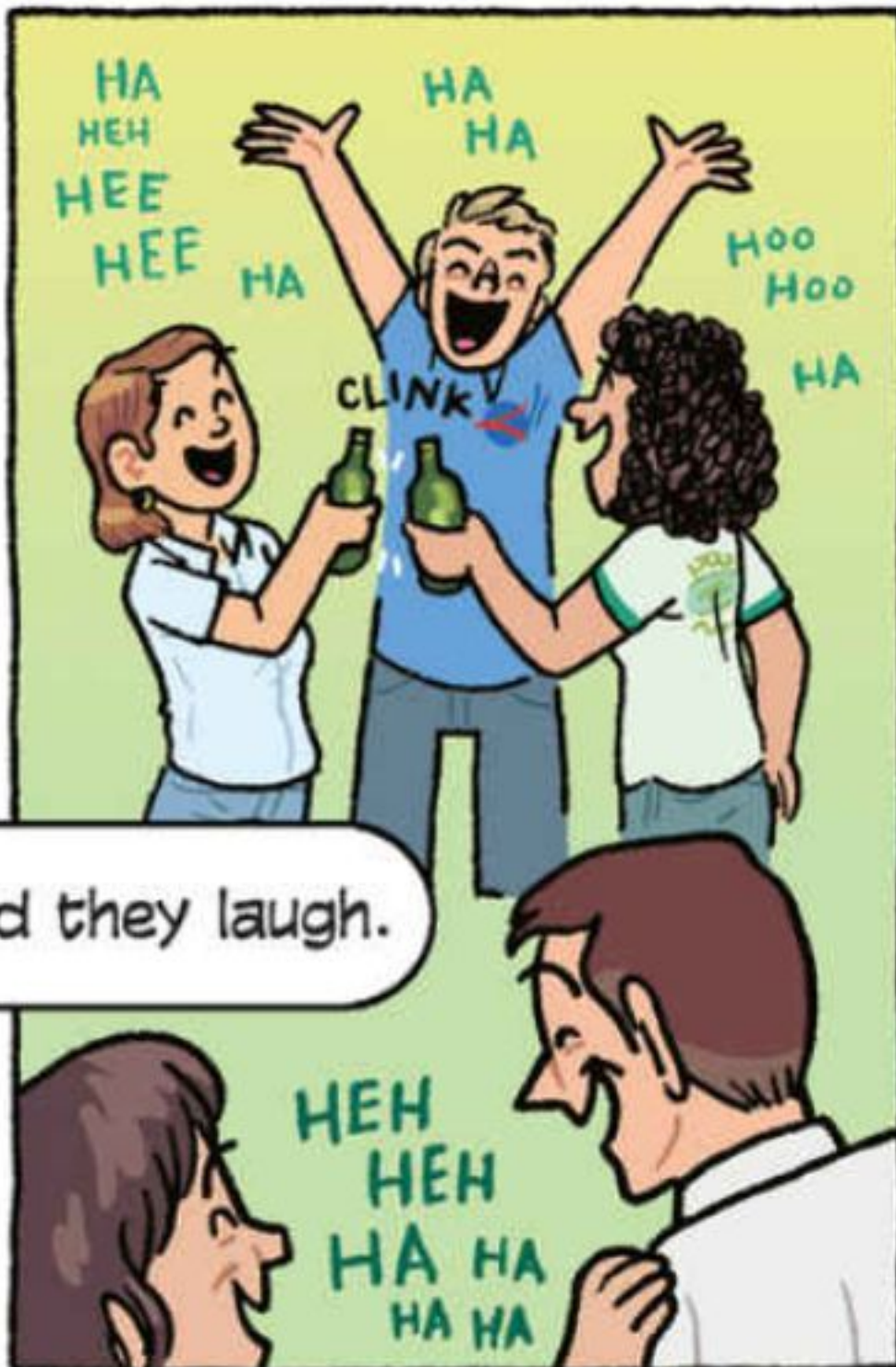


And again.

If you died and came back as something other than a human being, what would you be?

A seagull. Nothing bothers a seagull. They're environmentally sound birds. They fly. They recycle garbage.

And they laugh.



HA HEH HEE HEE HA HA HA HOO HOO HA

HEH HEH HA HA HA HA HA



There were lots of social events too. Everything had a purpose, I think.

...sure, they asked me if I wanted to be an astronaut. That was years ago, but the timing was wrong for me, personally and professionally.



If they'd asked a few years earlier, sure. But things are working out well. I get to select you lot!

Do...



Dr. Huntoon, do people blurt out stuff they don't mean to? Often?

Well, the military guys are much more "Yes, ma'am," "Yes, sir."

Only answering what they're asked, that sort of thing.



Scientists and engineers are a different story, particularly the nonmilitary ones.

You all often tell us a lot more than you need to.

Oh, um...



It's okay. We get it. You're nervous. And it's not just about what you say to the interview board.

You met lots of people that week. When they had an impression, we usually got feedback about it.



I'm not saying we selected or didn't select anybody based on it, but it was helpful.

We weren't foolish enough to think that what we saw on the board was all there was.

seagull



We look for people who have the personality to get along with other people.

On paper, some candidates just looked like...my word, like they hung the moon! And then you get 'em in and interview them and...



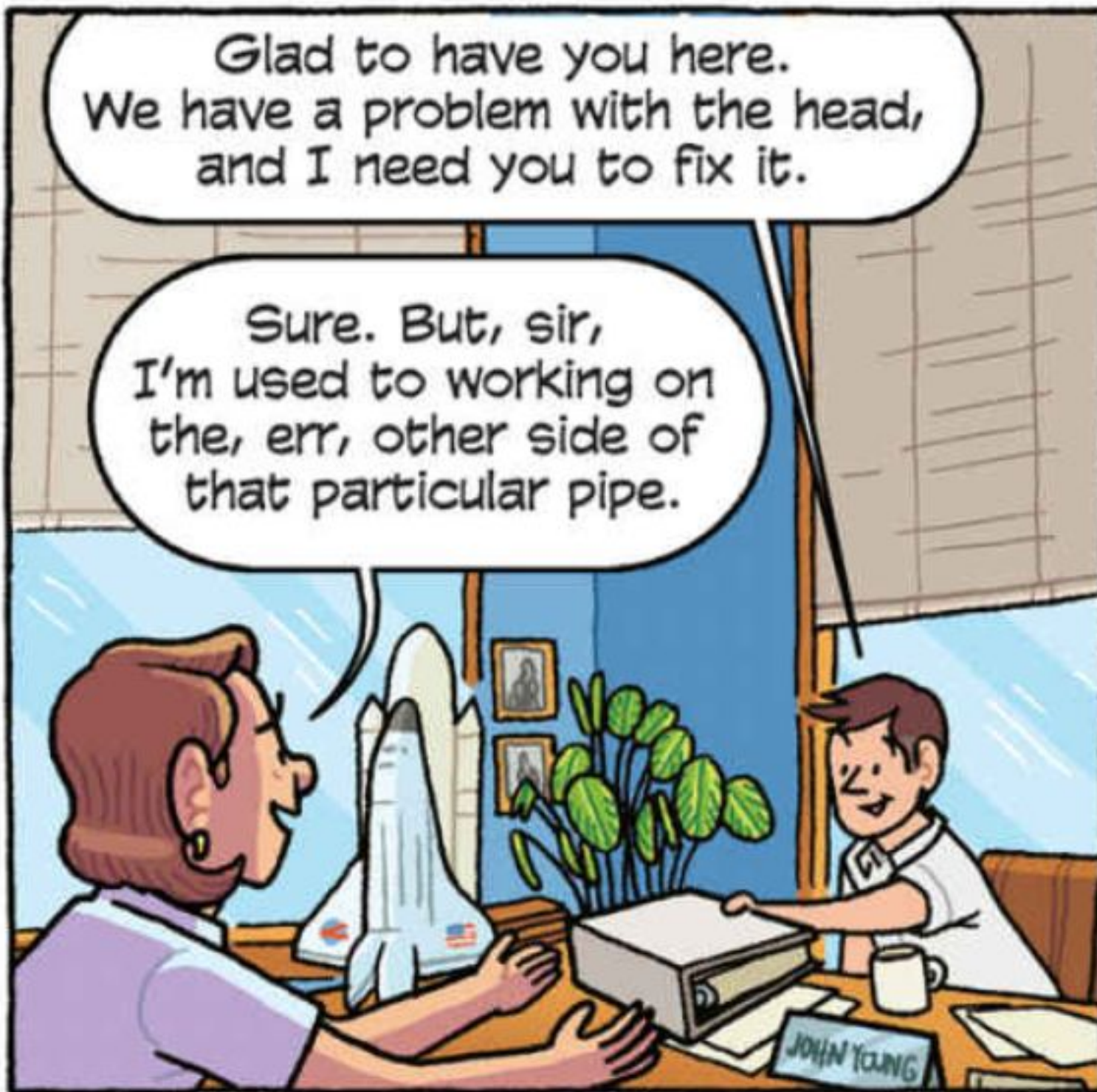
Well, you couldn't imagine how they'd work on a team, or what they'd do if the commander told them to go clean out the toilet. It's common sense, really.

So in you go. I'll see you later.



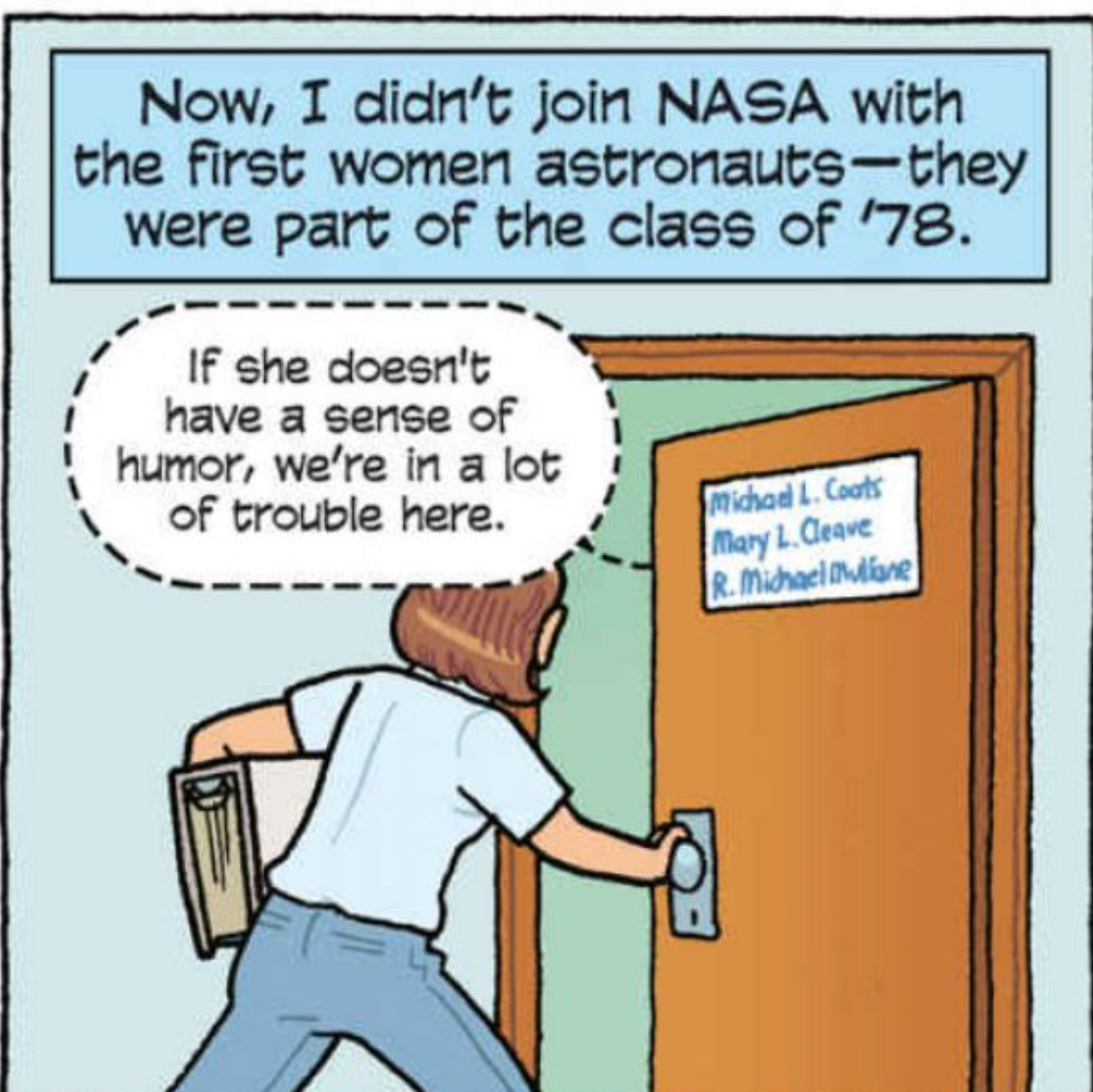
You already figured out I got the job, right? And no, I didn't have a beer just before going to John Young's office for my first assignment. But things really did seem to happen that fast.

Hey, Mary.



But yes, Carolyn really did use cleaning the toilet as an example of how astronauts have to work as a team, and yes, my first assignment was fixing the space shuttle's toilet, aka "the head."

On the ground, John had just been the commander on the shuttle's maiden voyage, and fixing it in space is much more of a pain in the...



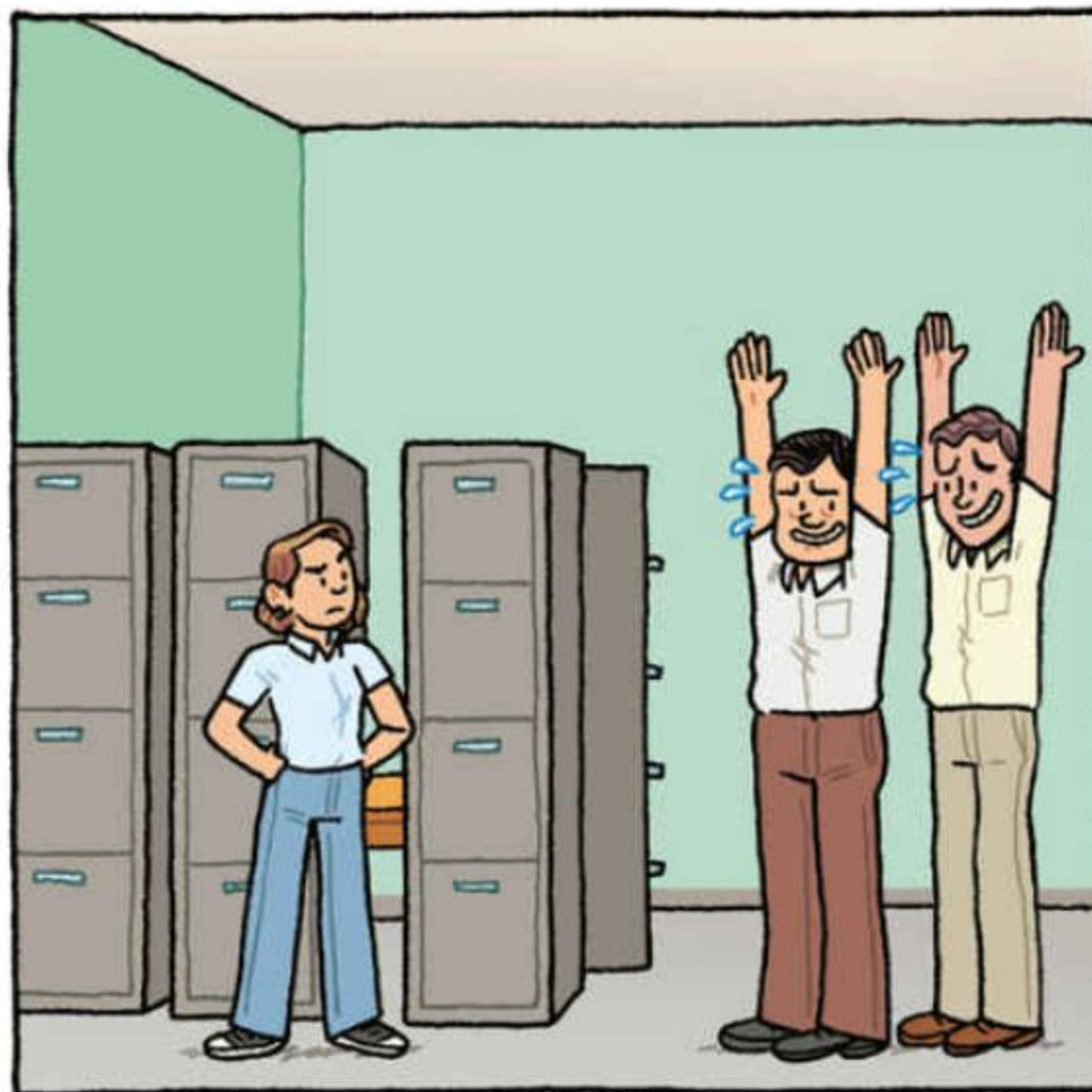


Is that...

Is my desk
under all that?



Welcome!



Hah!
I'm going to
fit right in.



And you asked for it...
we're gonna get rid of this
junky government furniture
and redecorate in, I dunno,
French provincial.

I got one more welcome gift.
Nicknames, thanks to my
assignment and my degree.

Sometimes my fellow astros
called me "Sanitary Fairy,"
sometimes "Crap Com."

Not the best joke, but then,
their group—the first with women
astronauts like Sally—was
nicknamed the TFNG.



"TF" stood for "Thirty-Five" at
NASA, but for something different
to military pilots, where New Guys
weren't always so welcome...and the
F didn't stand for "Funniest."

So I didn't complain, and we all got along great. Which was good, because like Carolyn said, we spent a lot of time together.

So really, a shuttle flying through air is just like, I don't know, like...



...like flow through an inside out sewer pipe.

Cleeee-eeeeeave.

Show some respect for fluid dynamics!

YEEESH

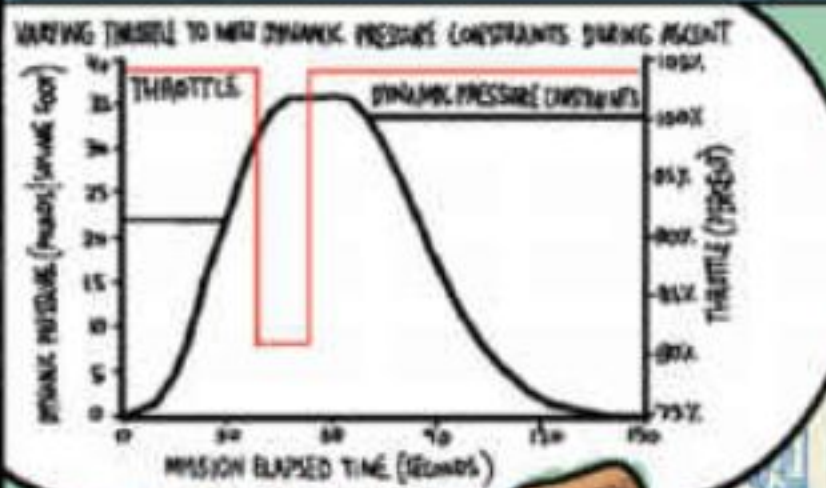
That's the worst metaphor I ever heard.

Yuck.

You mean analogy.



I had some trouble in aerodynamics. Test pilots knew this stuff, but I had to learn it fresh. But you know, John was mostly right. I'm a smart woman and I figured it out.



Wait, go over that again, wouldja?

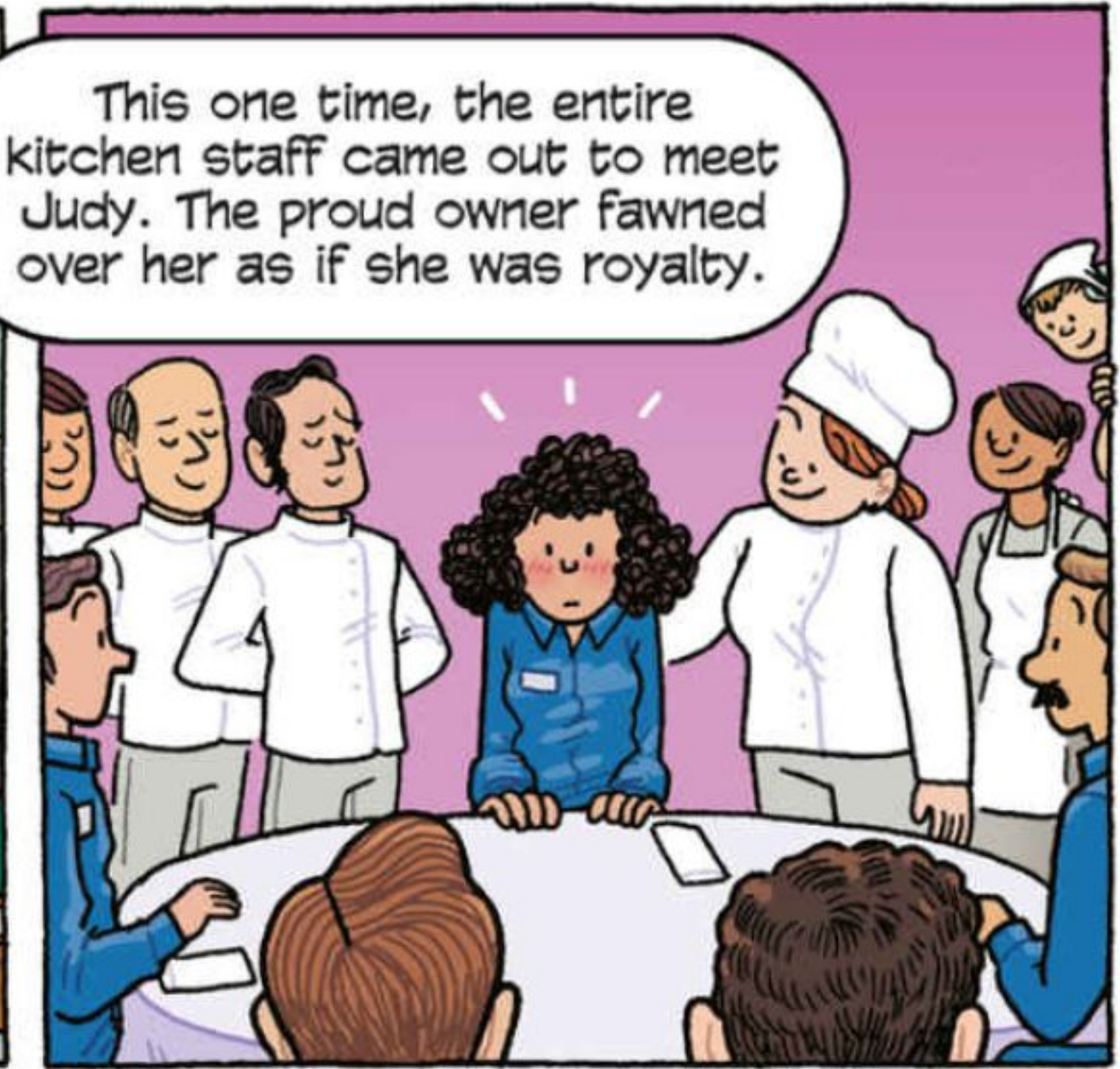


And I had room to do it. Bonnie Dunbar and I, because we were in NASA's second group of women, didn't have the same pressures on us as the first six.



Sally, Judy, Shannon, Rhea, Anna, and Kathy really bore the brunt of being the first. Especially from the media.







It wasn't always funny. In fact, it was mostly annoying. And when Sally was selected to be the first American woman to go into space, the pressure on her only increased.

Do you have time to date?

How does Neil Armstrong feel about women in space?

Any fashion tips for aspiring astronauts?

What's NASA like for a woman?



Great, not really, make sure your helmet fits, and you'd have to ask him.

Now, guys, thanks, but I have to get back to training.

Press conferences weren't a normal thing for any of us, and Sally became *the* woman astronaut in the eyes of the world.



She didn't want to be treated differently by anybody. Not the press...

Not her fellow astronauts.



She handled it well. And made sure we were treated as equals.



Mostly by being more than equal.

Housework on the shuttle? Sure, only too happy to do windows...

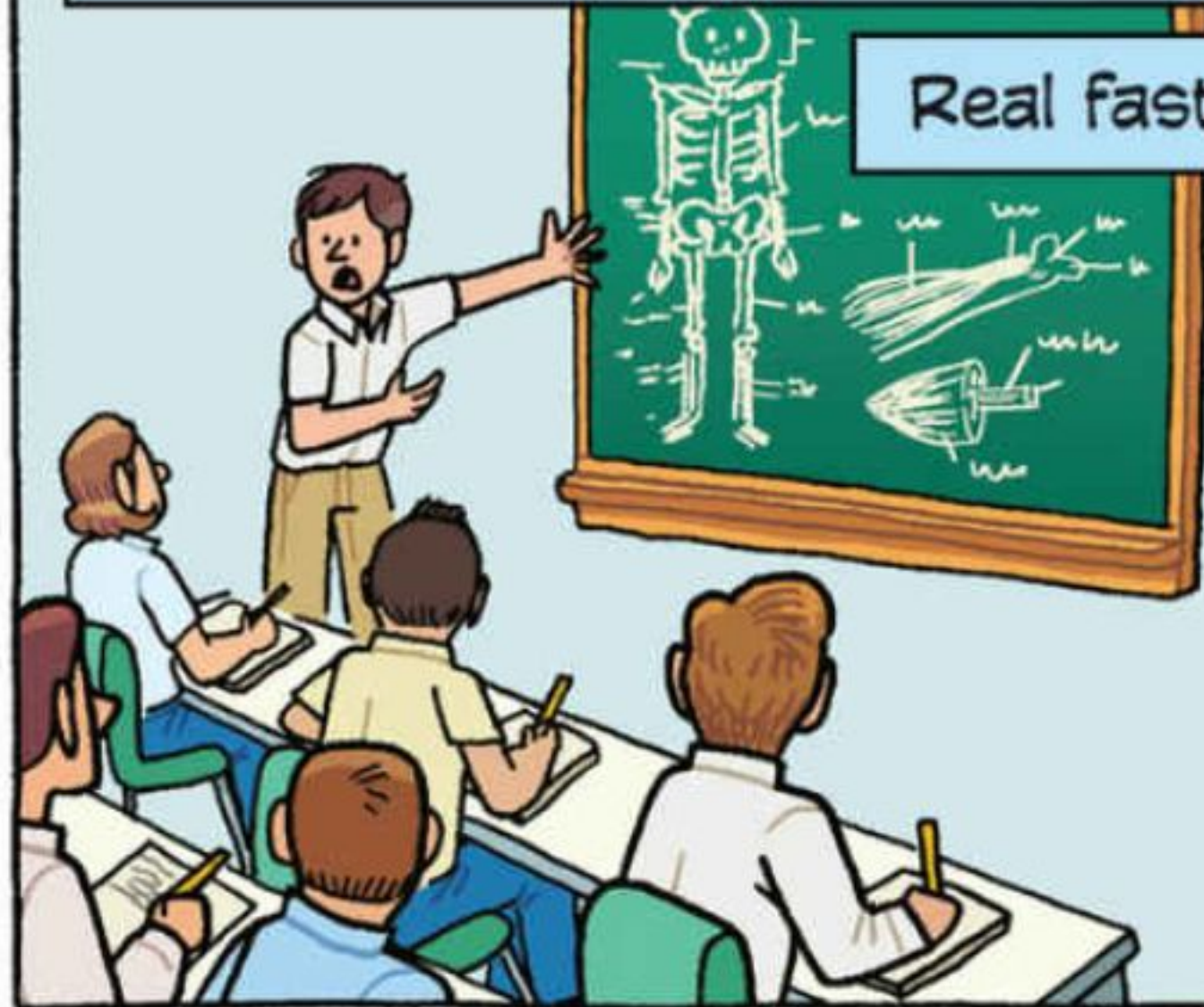
...but only from the outside.

And now, like Sally, I have to get back to work.



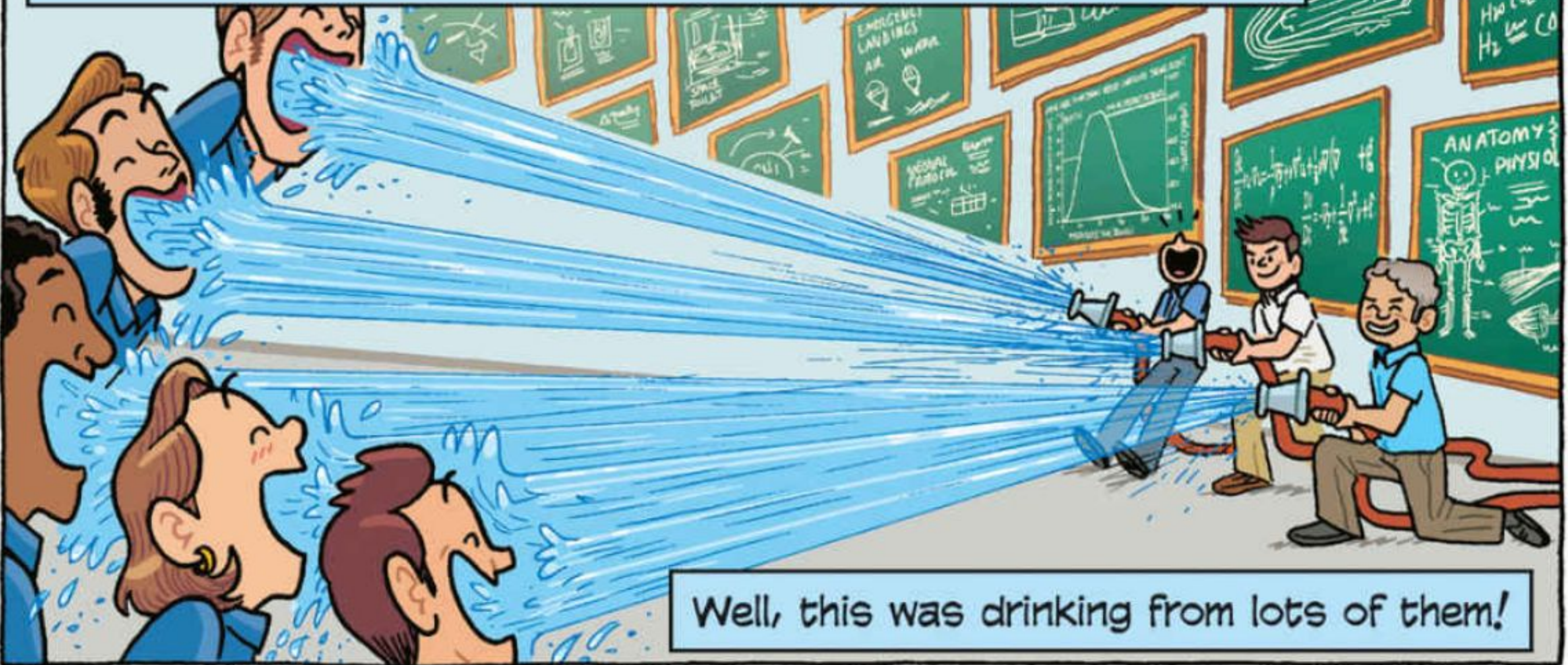
A few years later, Kathy Sullivan became the first American woman to walk in space.

There was a lot to do. The classroom work was like getting a bunch of master's degrees.



Real fast.

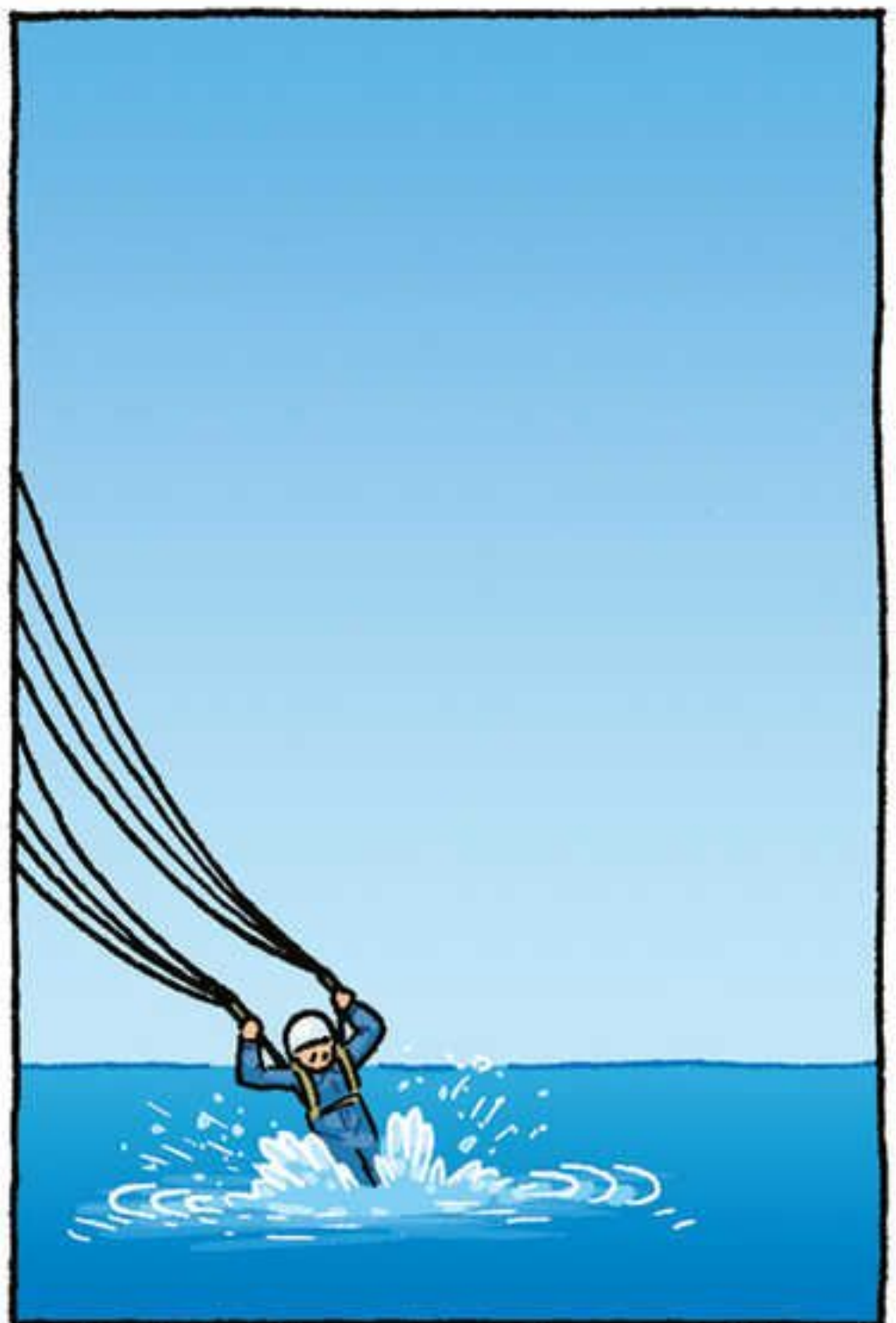
You've heard the phrase "drinking water out of a fire hose"?



Well, this was drinking from lots of them!

We also did physical stuff. Land emergency training...





We did stuff underwater too. You have to be scuba certified to train for extravehicular activities. EVAs in NASA-speak, and what everybody else calls "space walks."



Underwater work is *almost* perfect training for EVAs. Jerry Ross got to do one on our flight together.



Emphasis on *almost*.

KICK KICK KICK

Remember this: It's what astronauts call "negative training."

KICK KICK



We also got used to zero g in the good ol' Vomit Comet.

KICK KICK KICK

KICK KICK



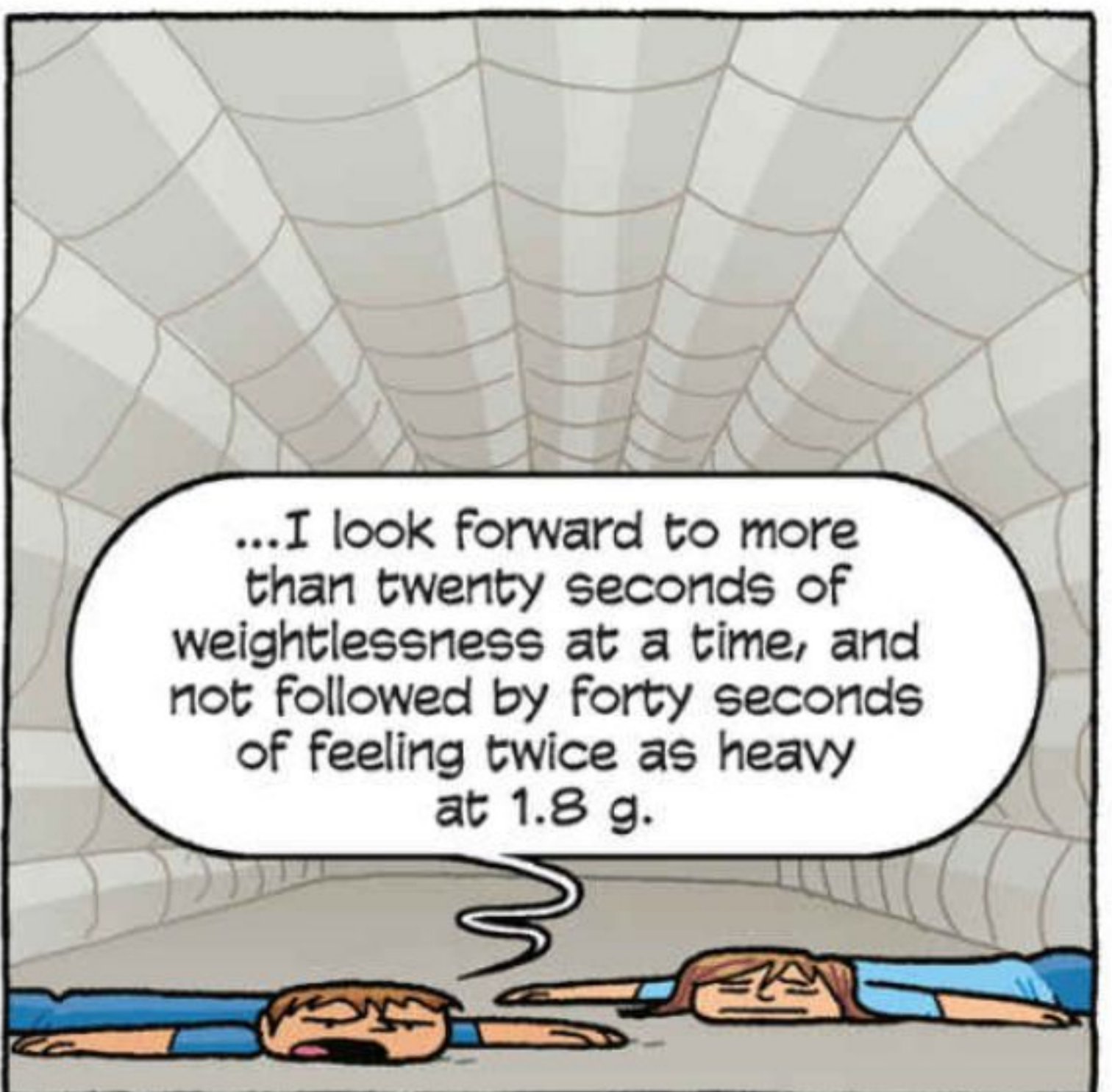
No water resistance up here!

Yup. A lot easier to move, and use tools.

Of course...



...I look forward to more than twenty seconds of weightlessness at a time, and not followed by forty seconds of feeling twice as heavy at 1.8 g.



Zero g and lotsa g's are both part of spaceflight, and to get even more?



That's what the T-38s were for.



We didn't wear pressure suits—it wasn't just about getting flight training...

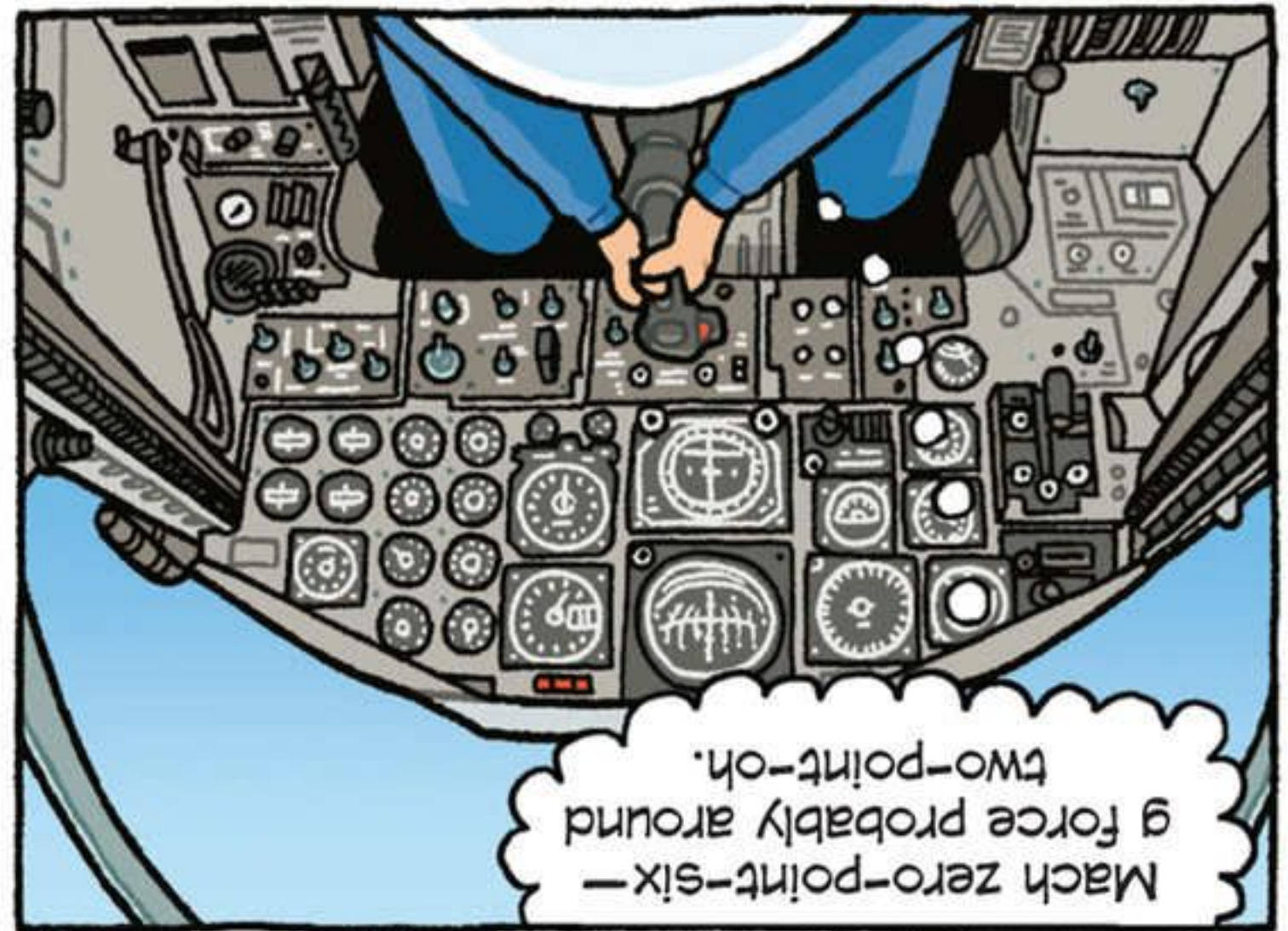
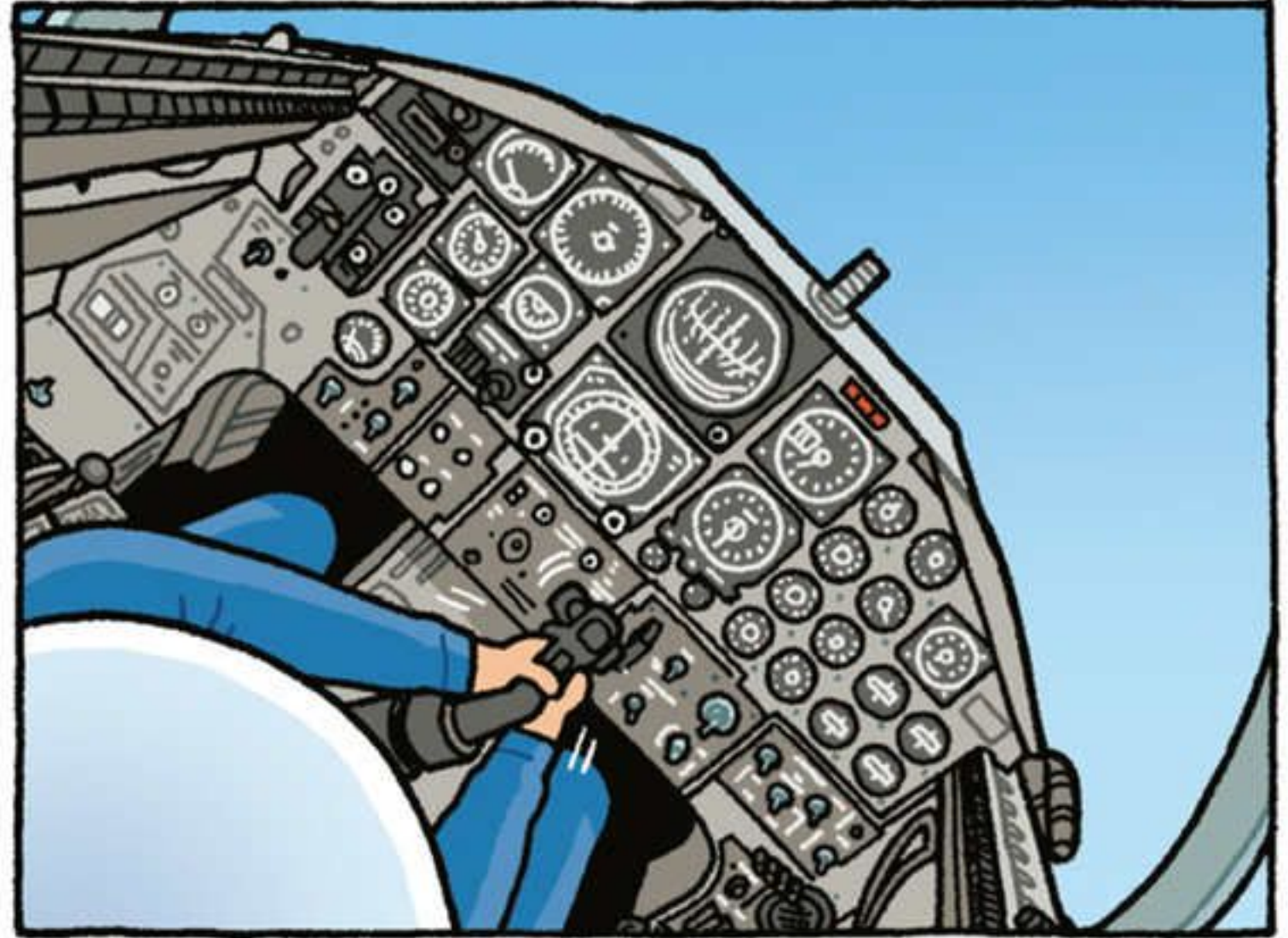
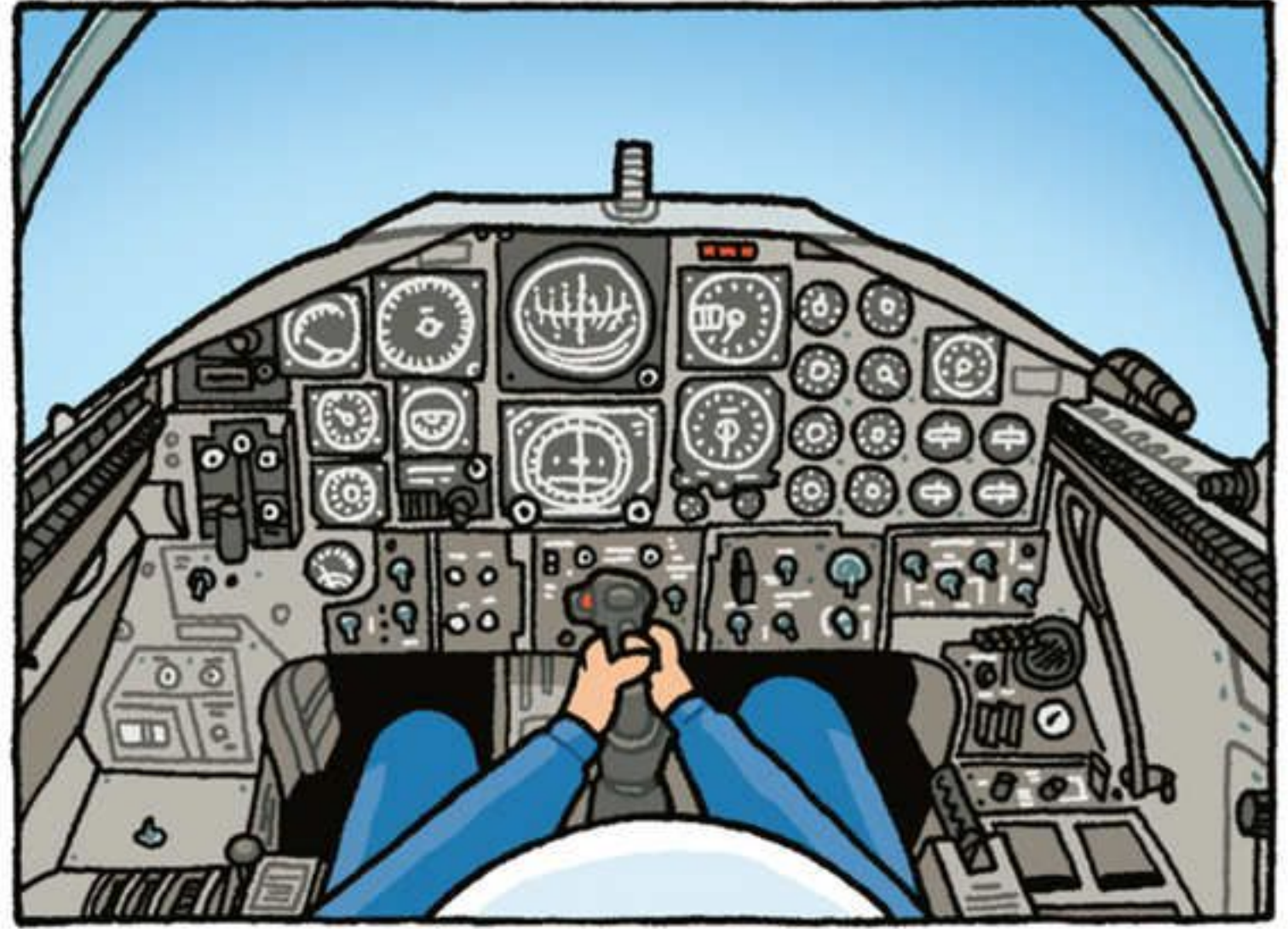
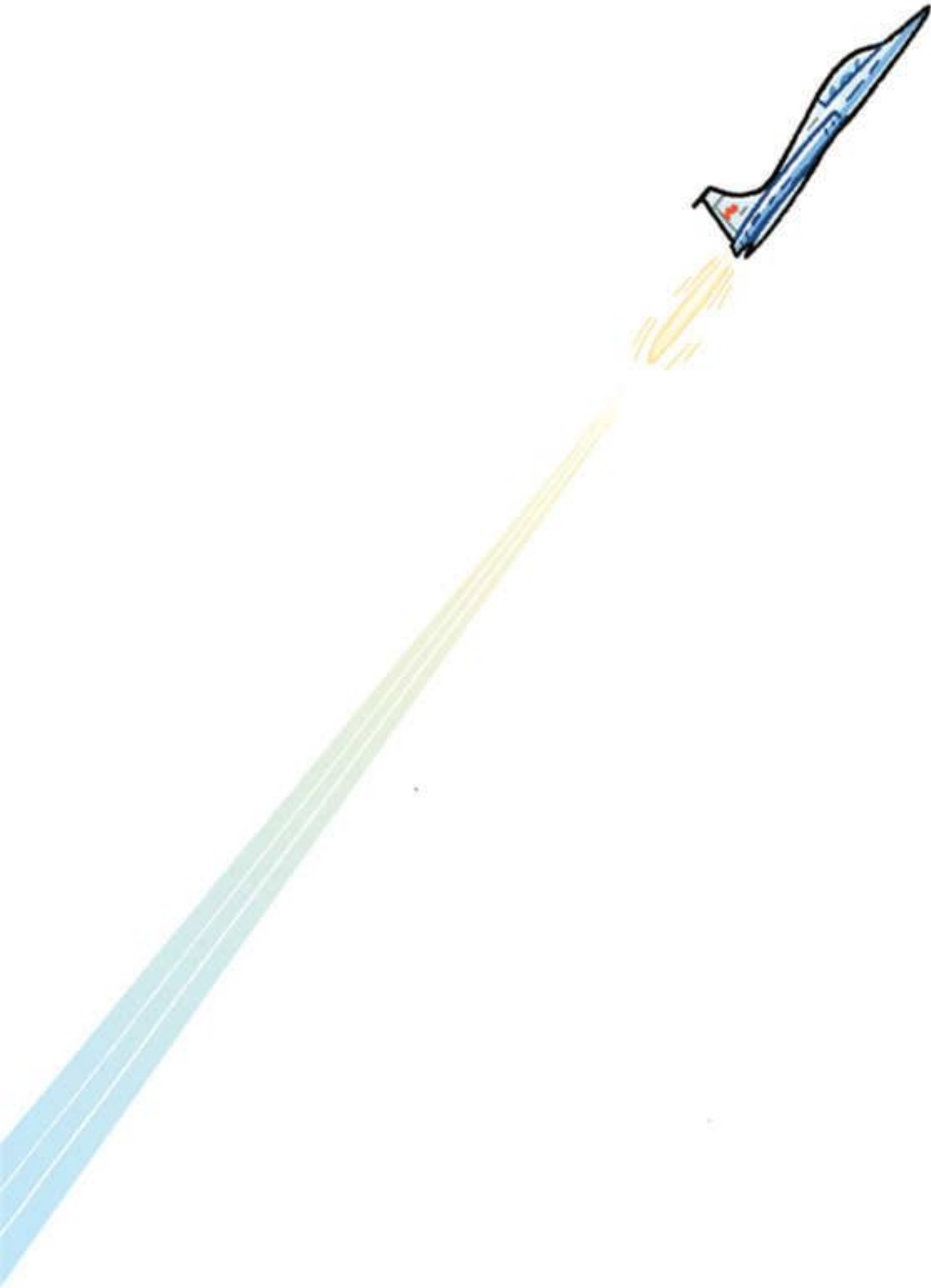


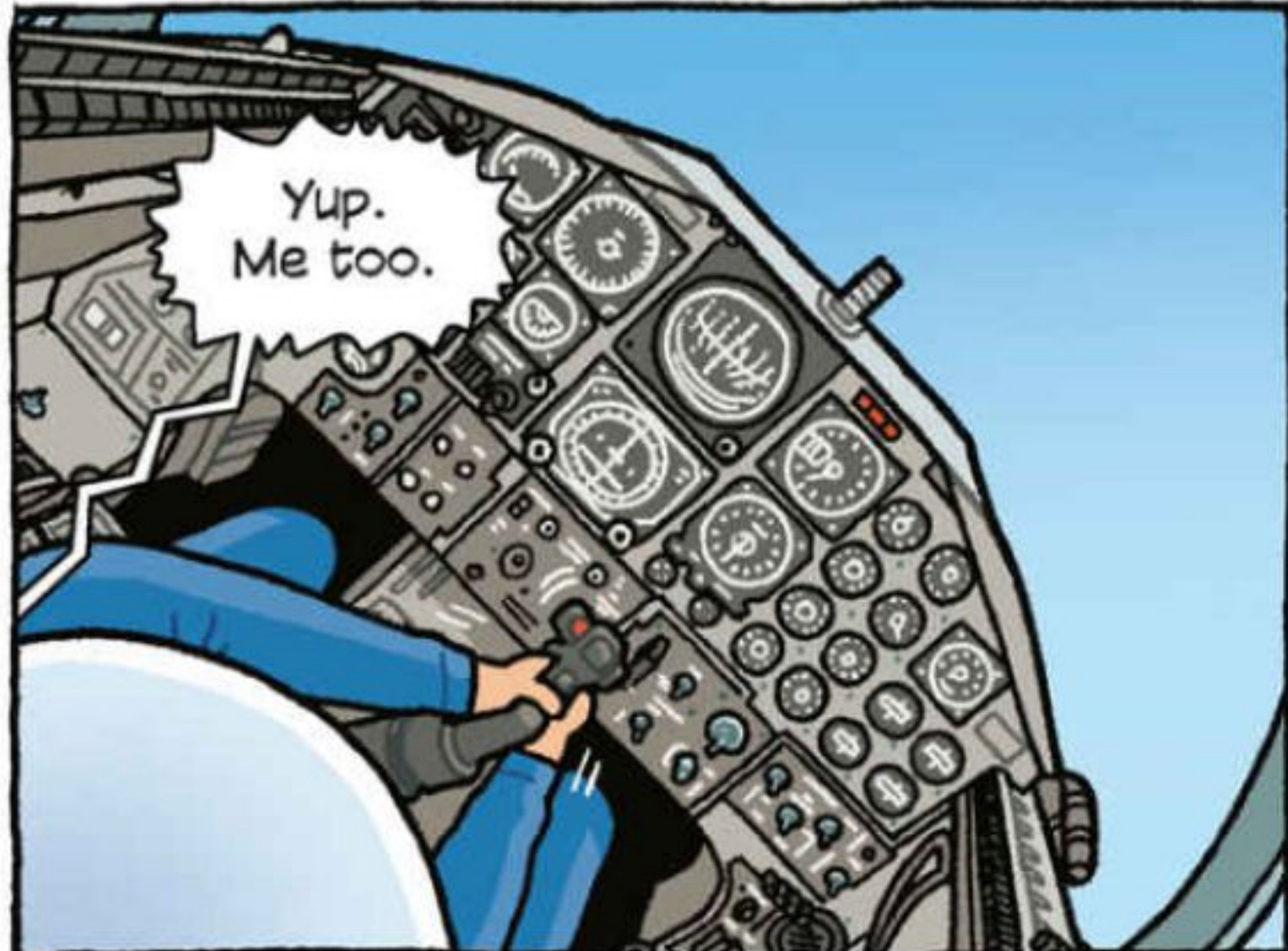
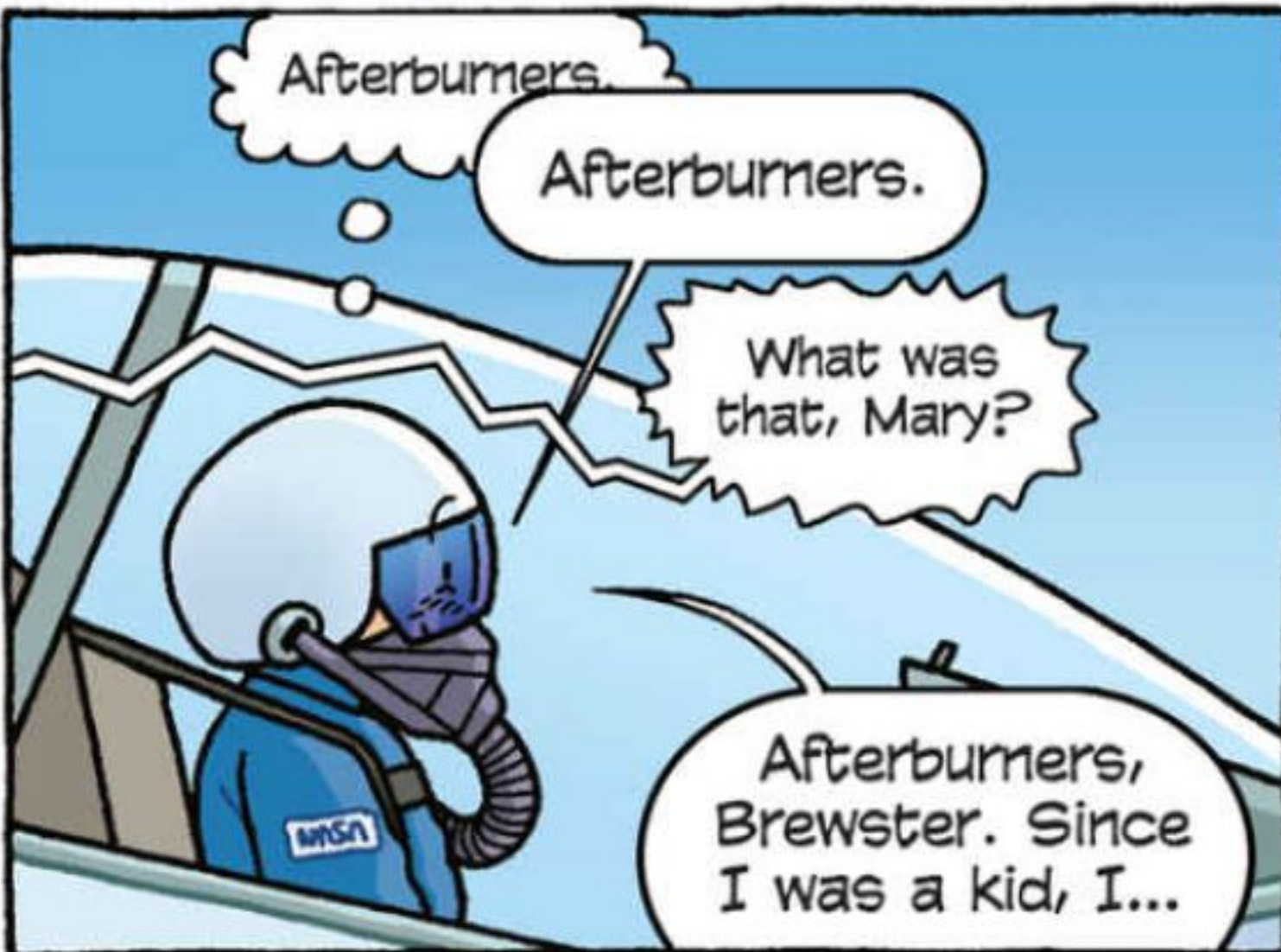
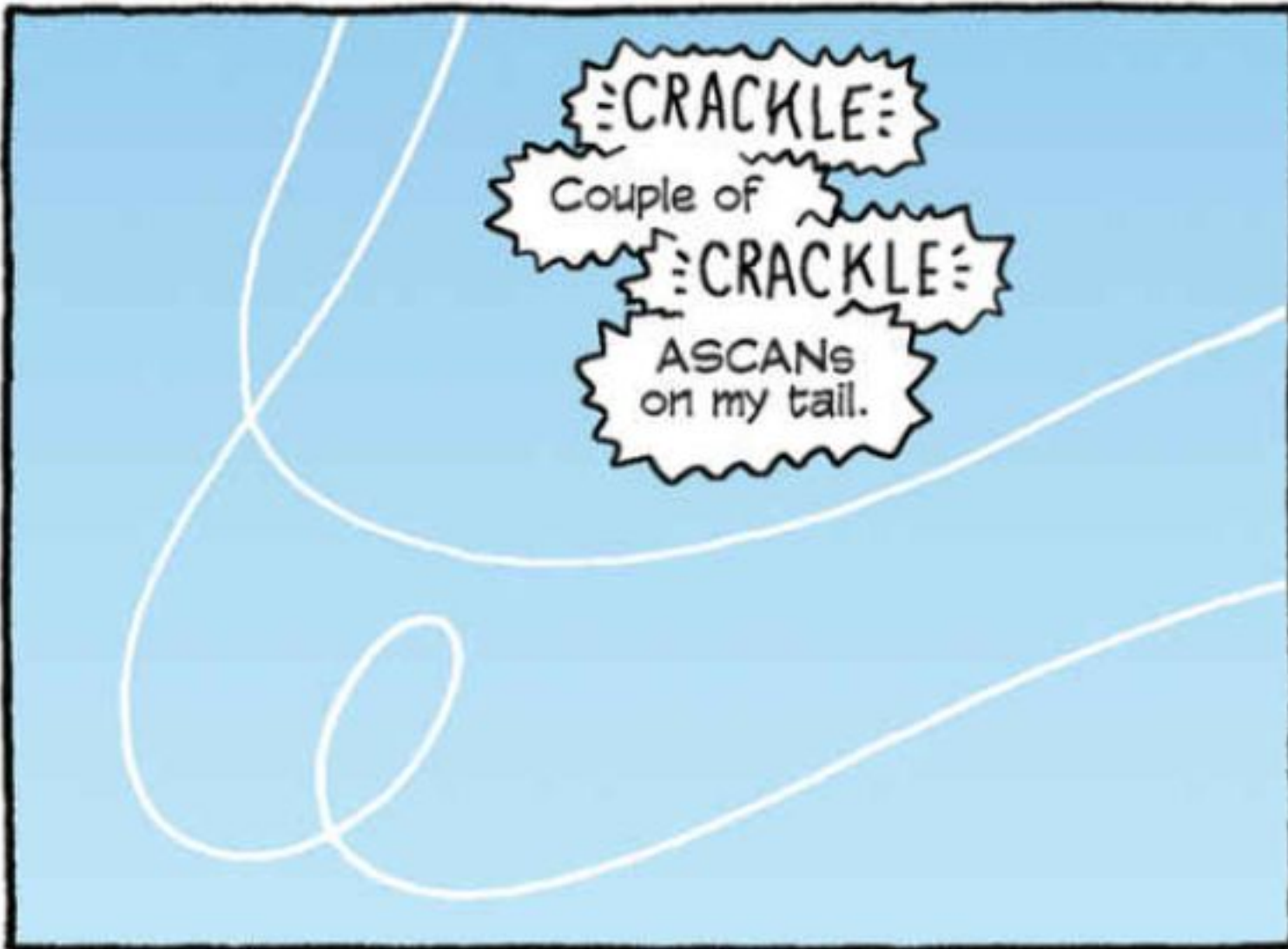
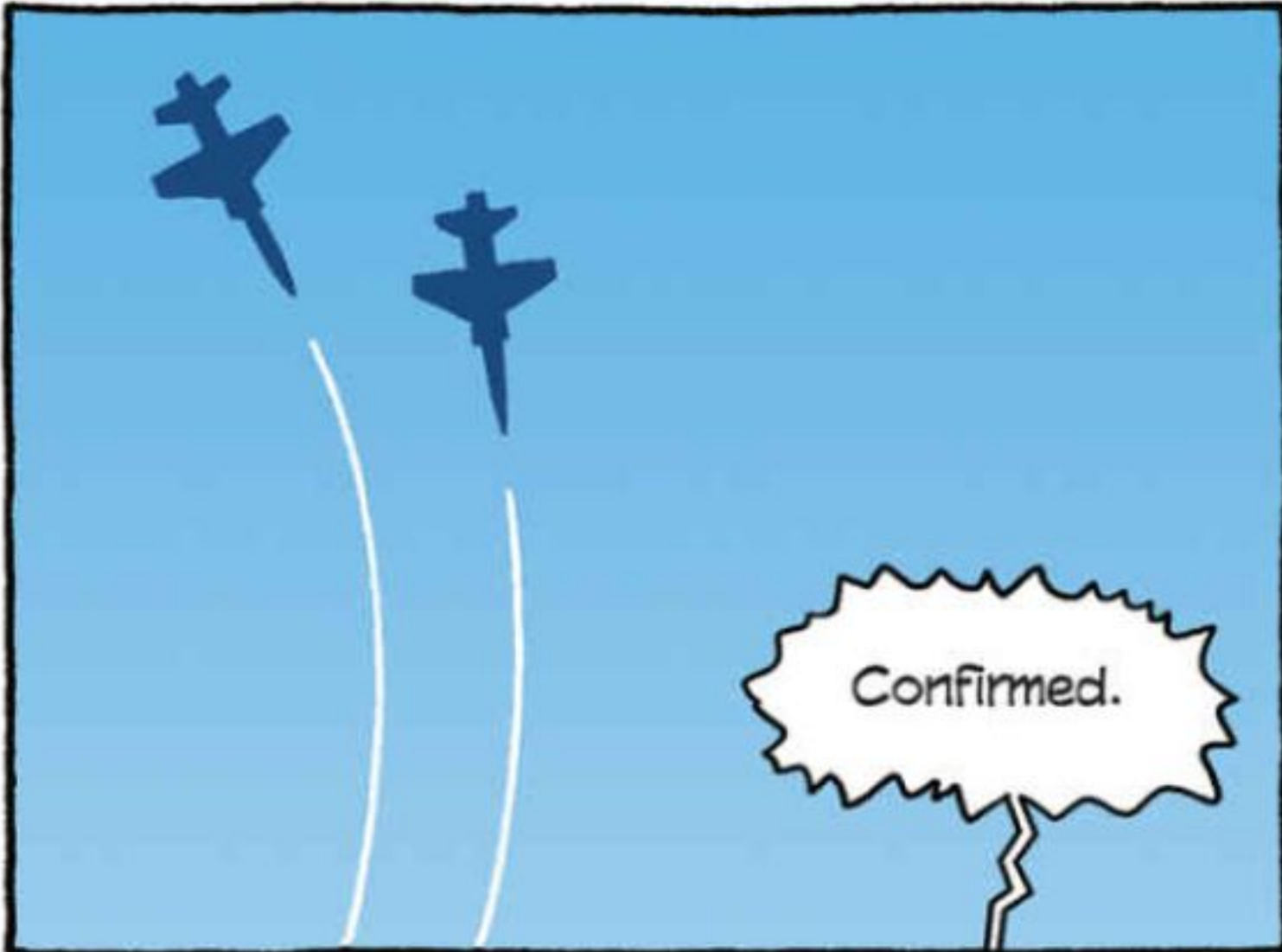
Part of the point was for us to get used to working under high-g, since the shuttle would bring us to 3 g during launch.



So we flew.







As an ASCAN—astronaut candidate—I got to go up and out with guys who are great pilots.



The T-38s are trainers, so, you know...I got to fly them under all kinds of conditions.

Though you're not supposed to land...



...you're not even supposed to fly under 250 feet.

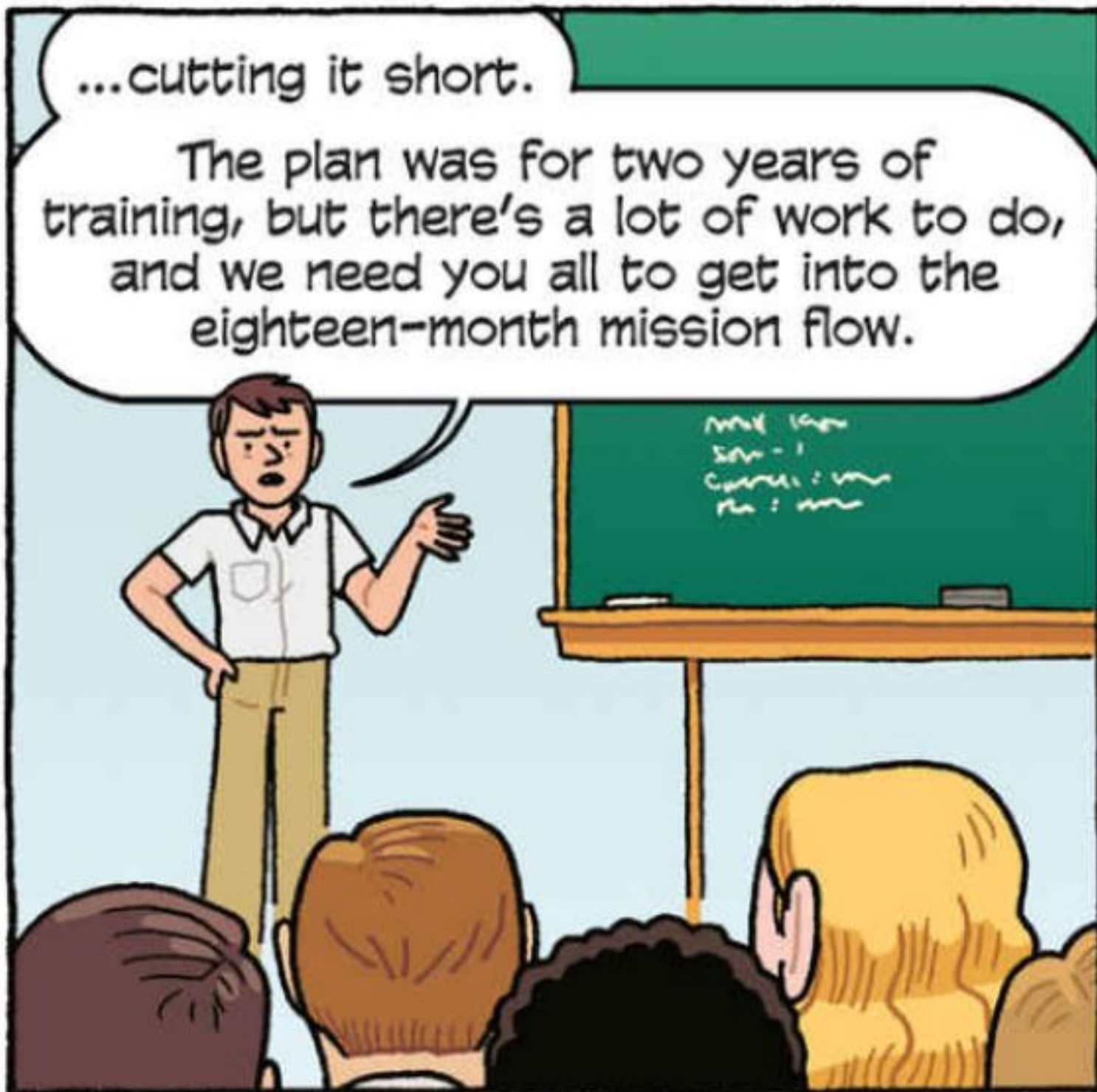
Those are the rules.



I'll leave it at that.



So, our training was pretty extensive. It was much more than Valentina ever got, even though they cut it short for the first shuttle astronauts.



...cutting it short.

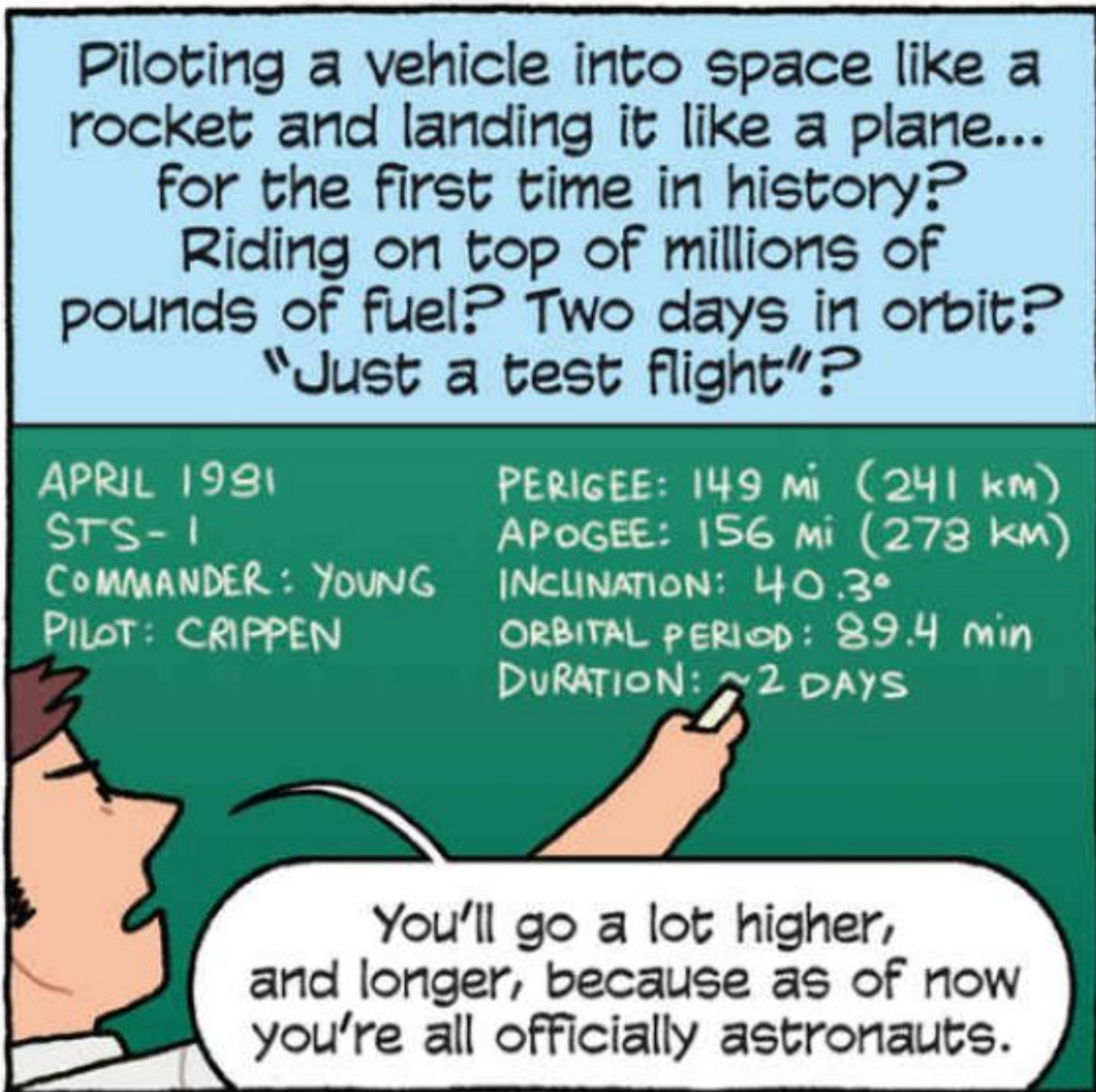
The plan was for two years of training, but there's a lot of work to do, and we need you all to get into the eighteen-month mission flow.



I'm flying the first shuttle, and launch is coming up fast. But mine is just a test flight.

APRIL 1981
STS-1
COMMANDER: YOUNG
PILOT: CRIPPEN

It's time for you all to start getting ready to go on the missions that follow.



Piloting a vehicle into space like a rocket and landing it like a plane... for the first time in history? Riding on top of millions of pounds of fuel? Two days in orbit? "Just a test flight"?

APRIL 1981
STS-1
COMMANDER: YOUNG
PILOT: CRIPPEN

PERIGEE: 149 mi (241 km)
APOGEE: 156 mi (278 km)
INCLINATION: 40.3°
ORBITAL PERIOD: 89.4 min
DURATION: ~2 DAYS

You'll go a lot higher, and longer, because as of now you're all officially astronauts.



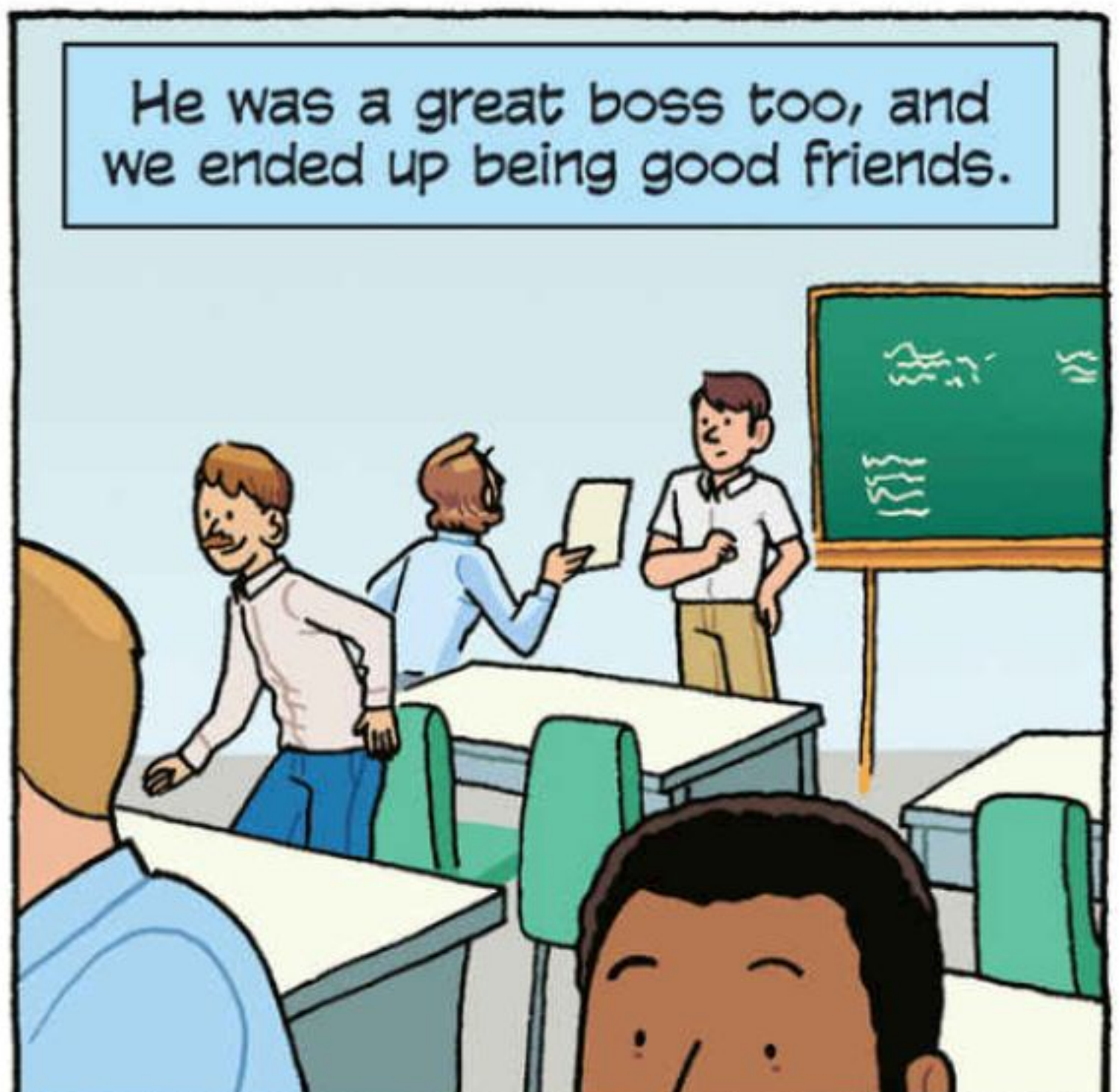
Congratulations.

John was a cool customer, that's for sure.

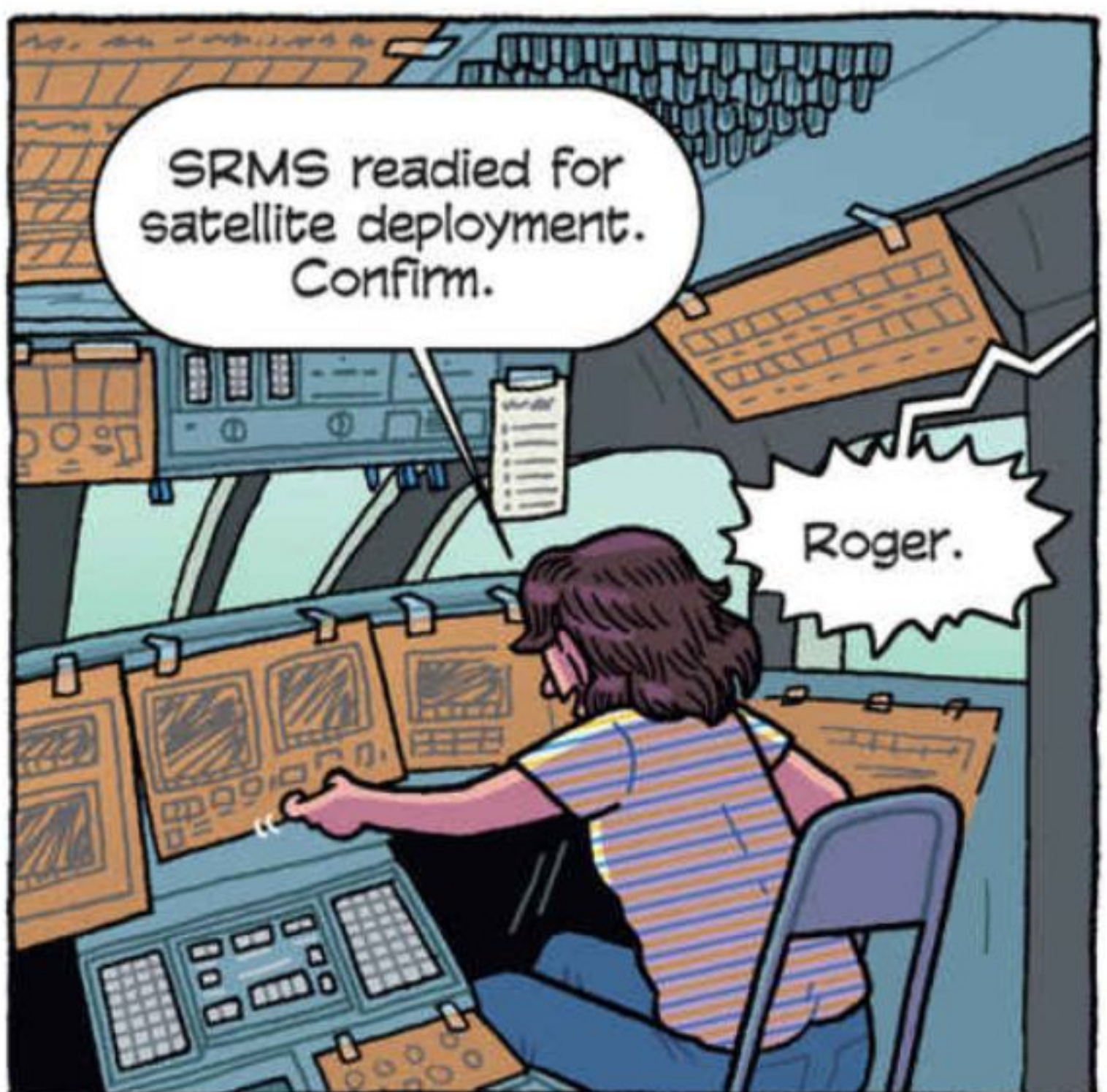
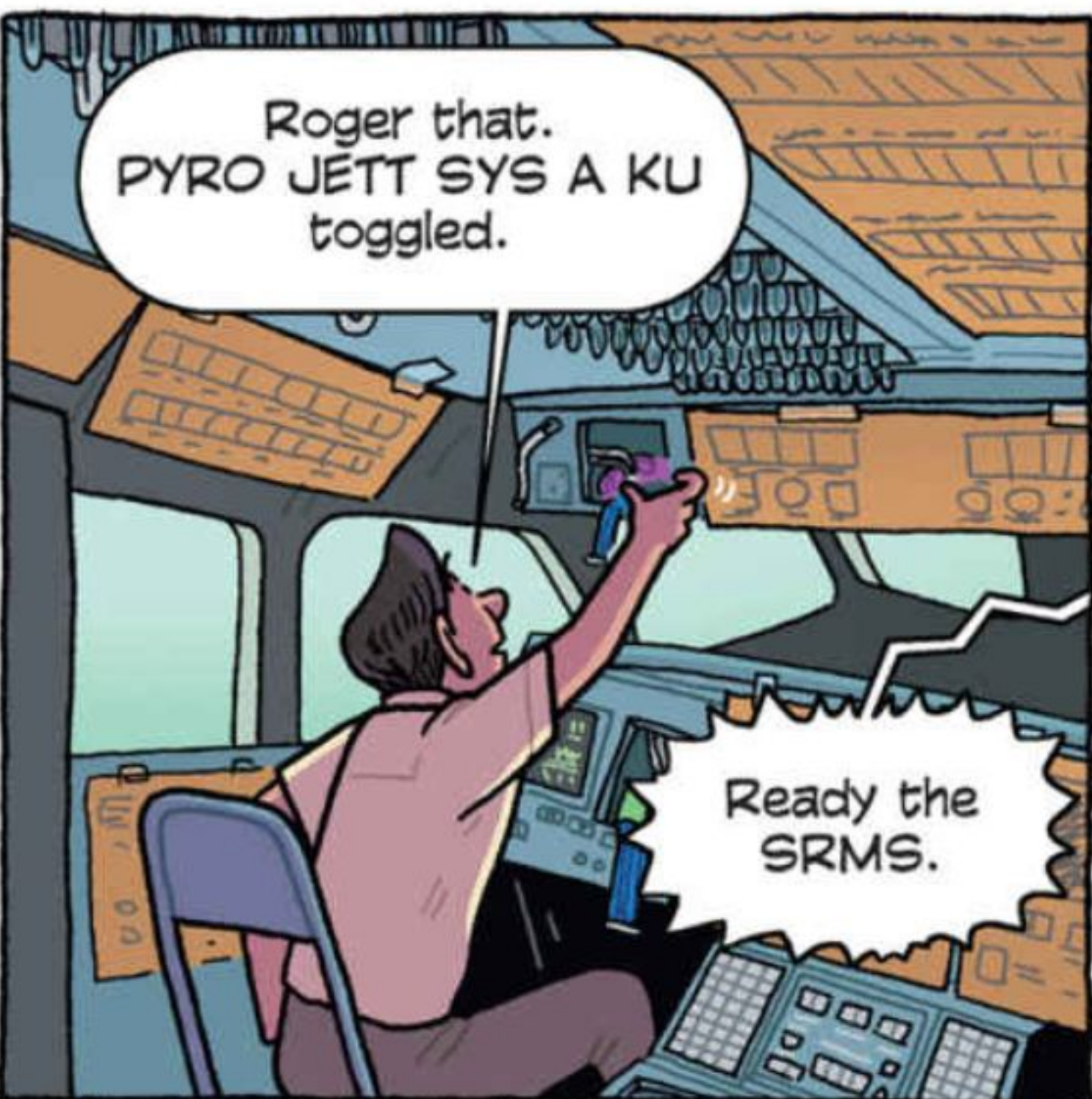
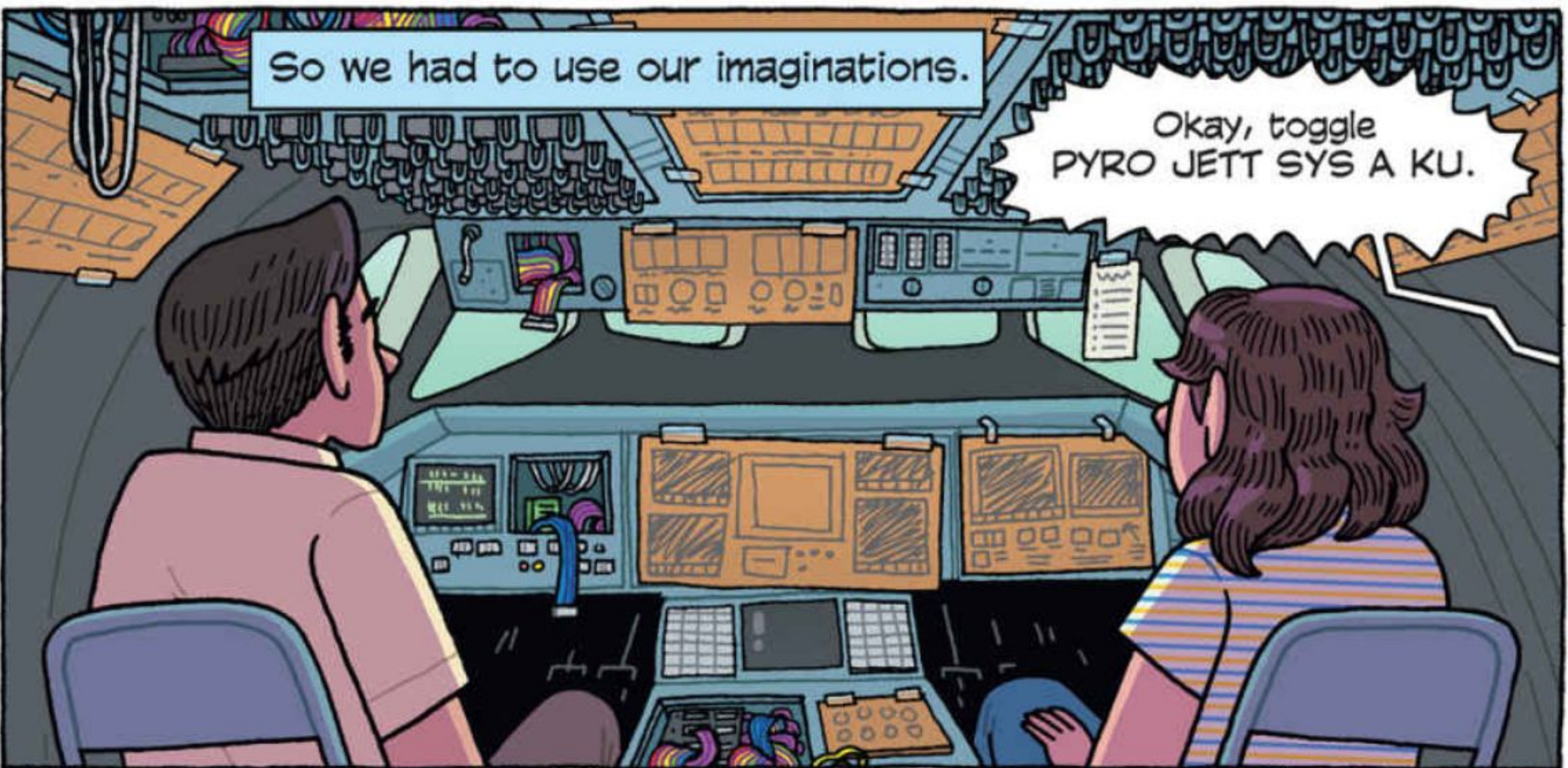
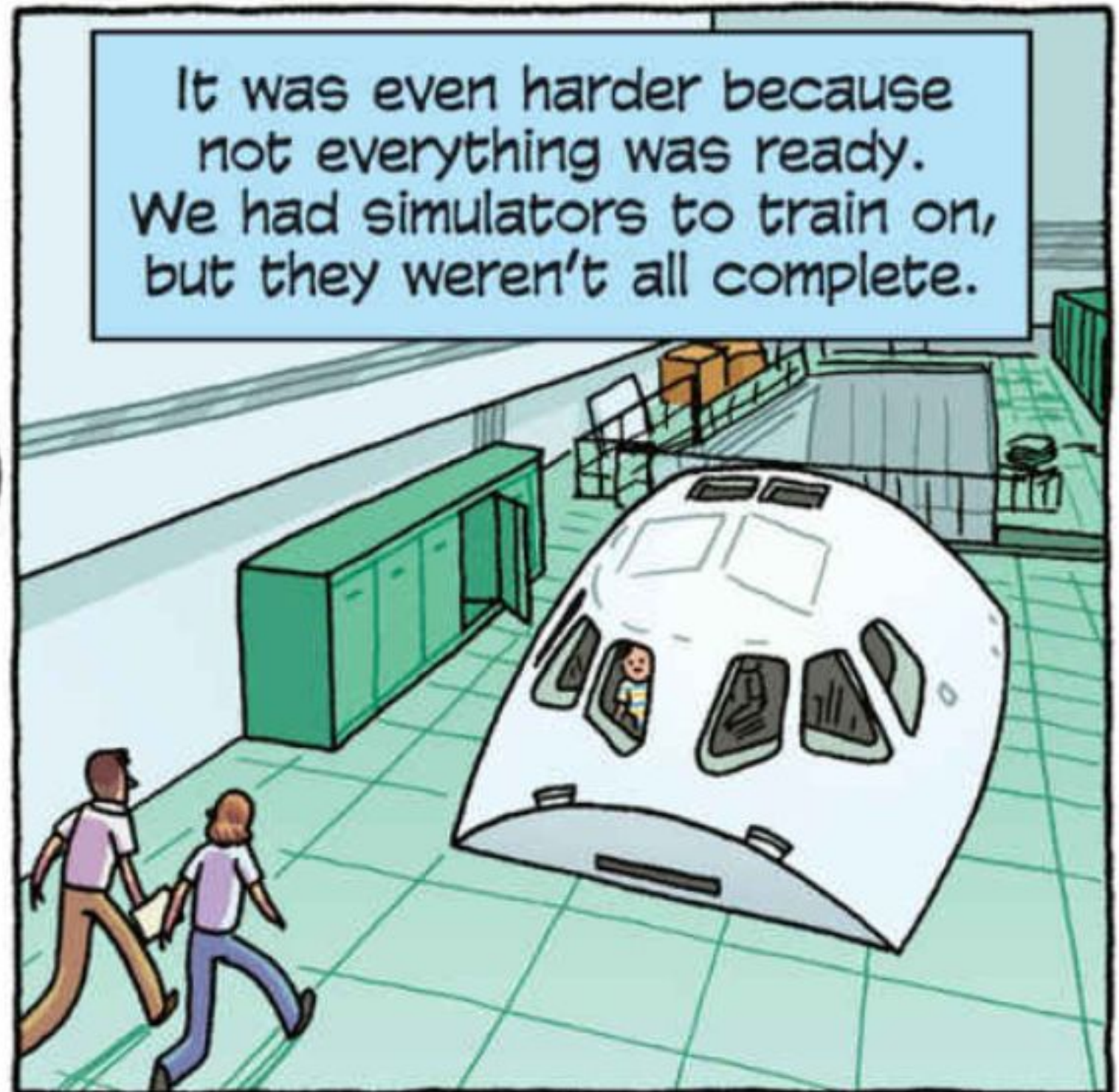


Your silver pins will be delivered to your offices.

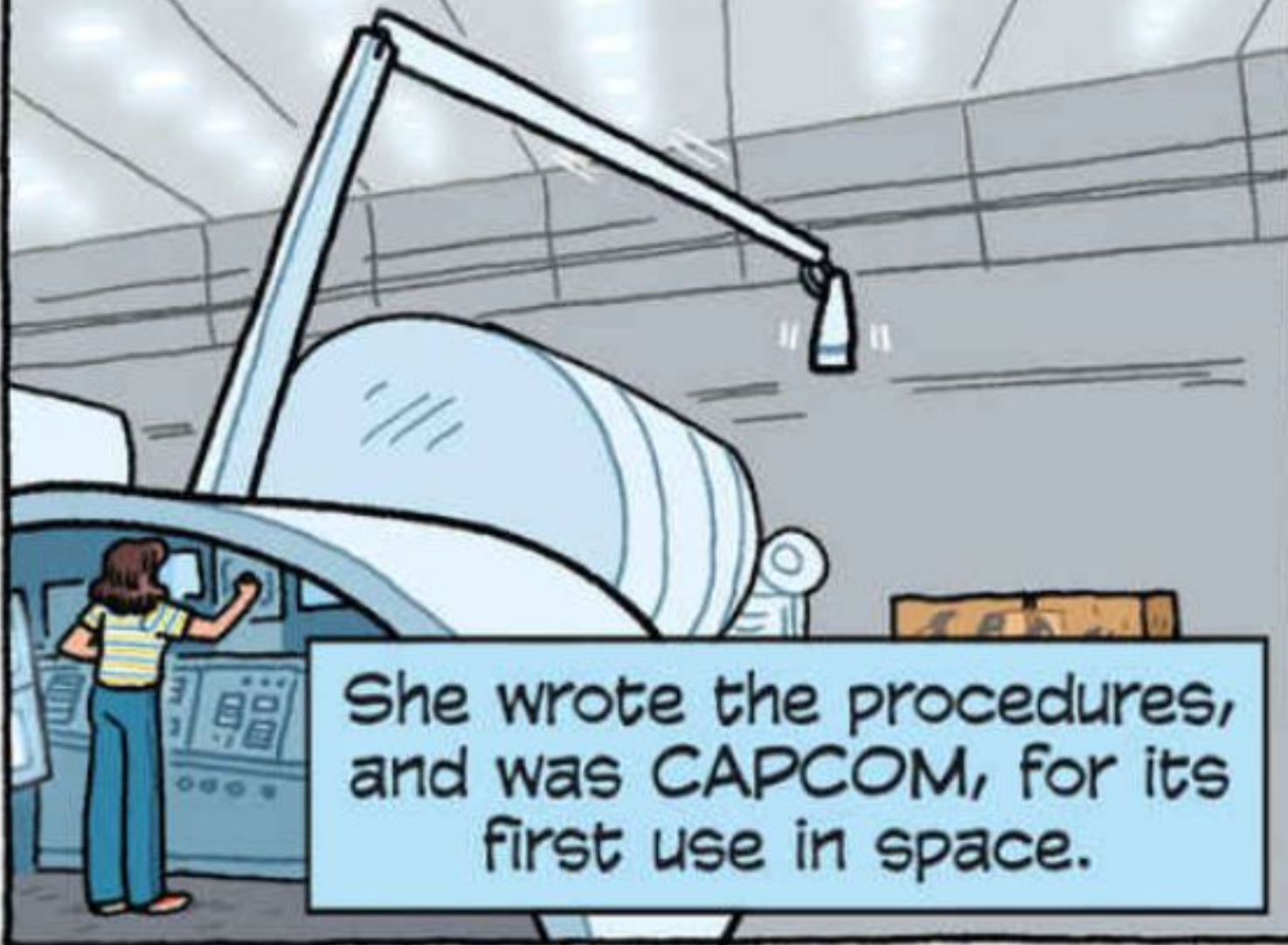
Now get back to work!



He was a great boss too, and we ended up being good friends.



Sally helped develop better and better simulations for the SRMS, also known as the Canadarm.



She wrote the procedures, and was CAPCOM, for its first use in space.

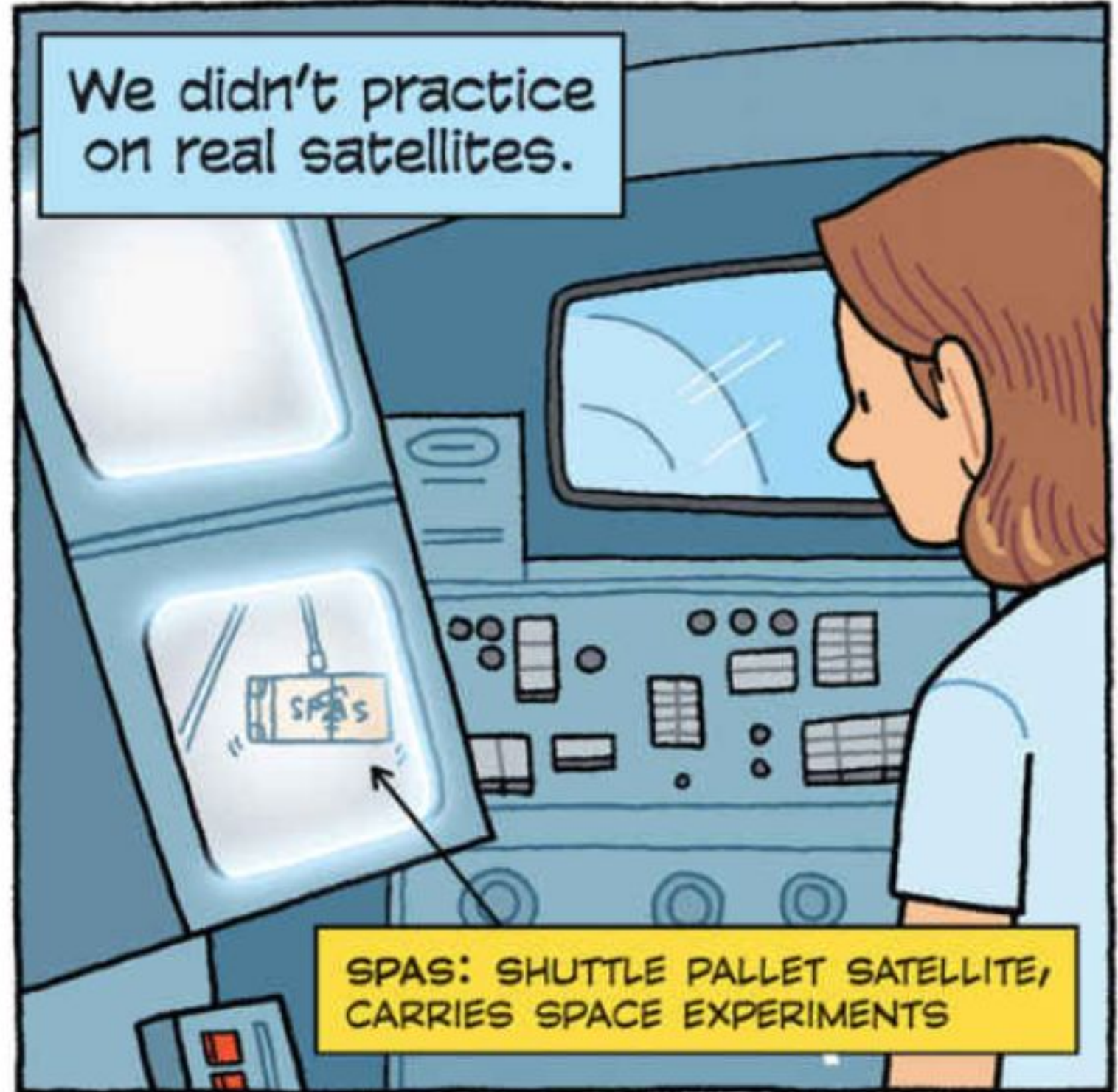
Once I finished fixing the Shuttle Waste Management System—the toilet—I started working on SRMS myself.



Sally was going to use it to release and retrieve satellites. When my turn came, I was going to do that too.

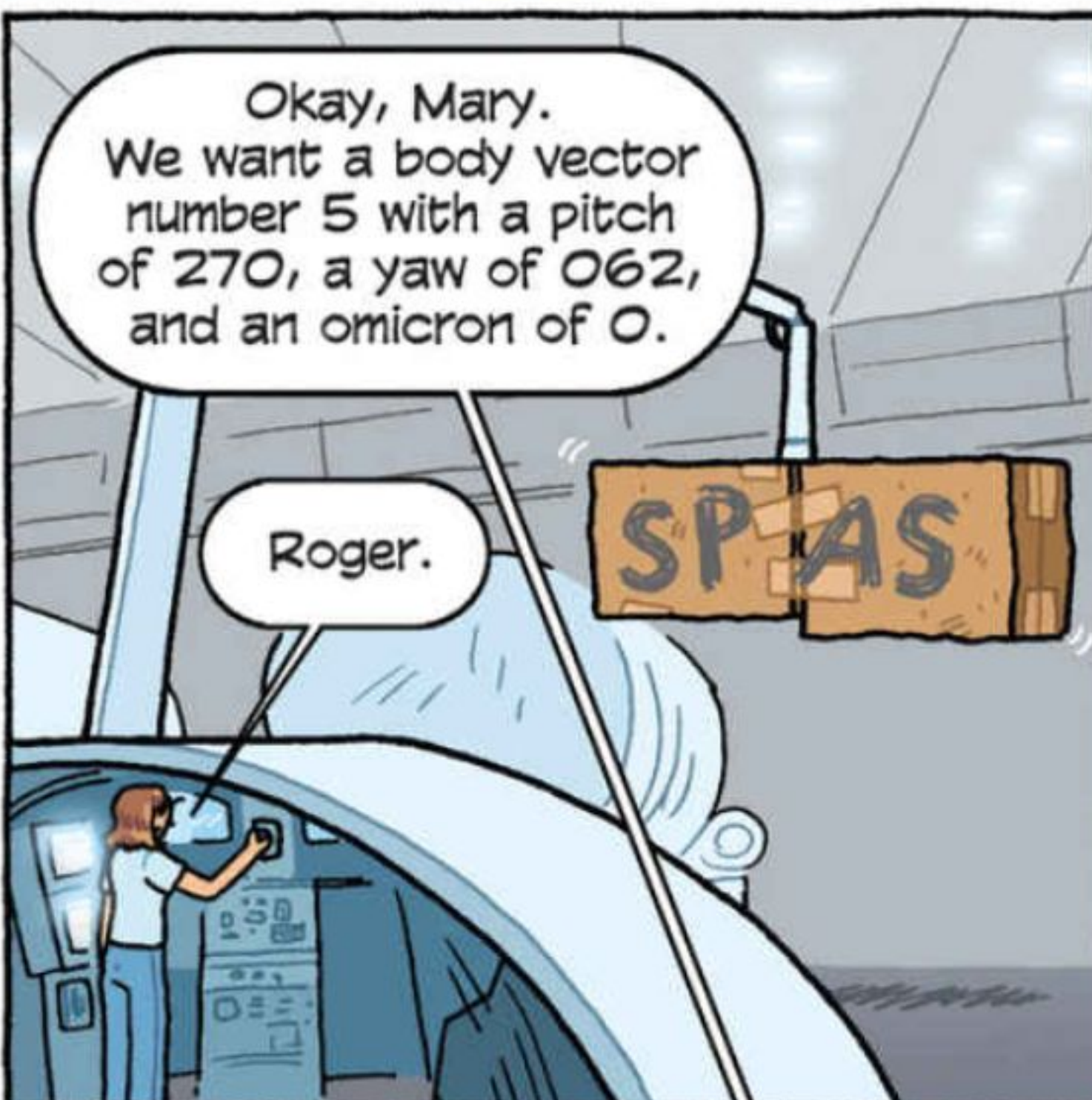


Okay, up and to the left.



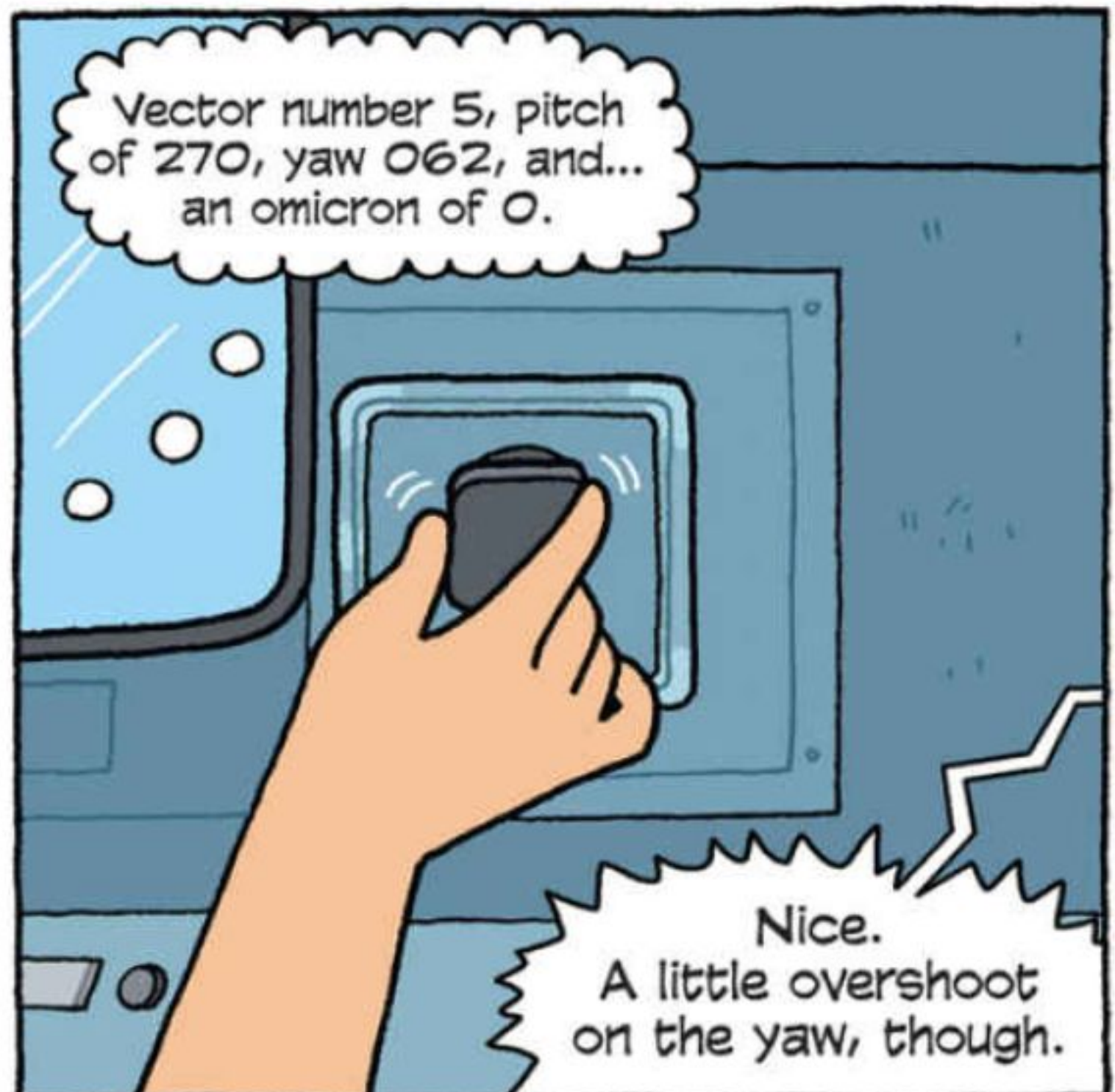
We didn't practice on real satellites.

SPAS: SHUTTLE PALLET SATELLITE, CARRIES SPACE EXPERIMENTS



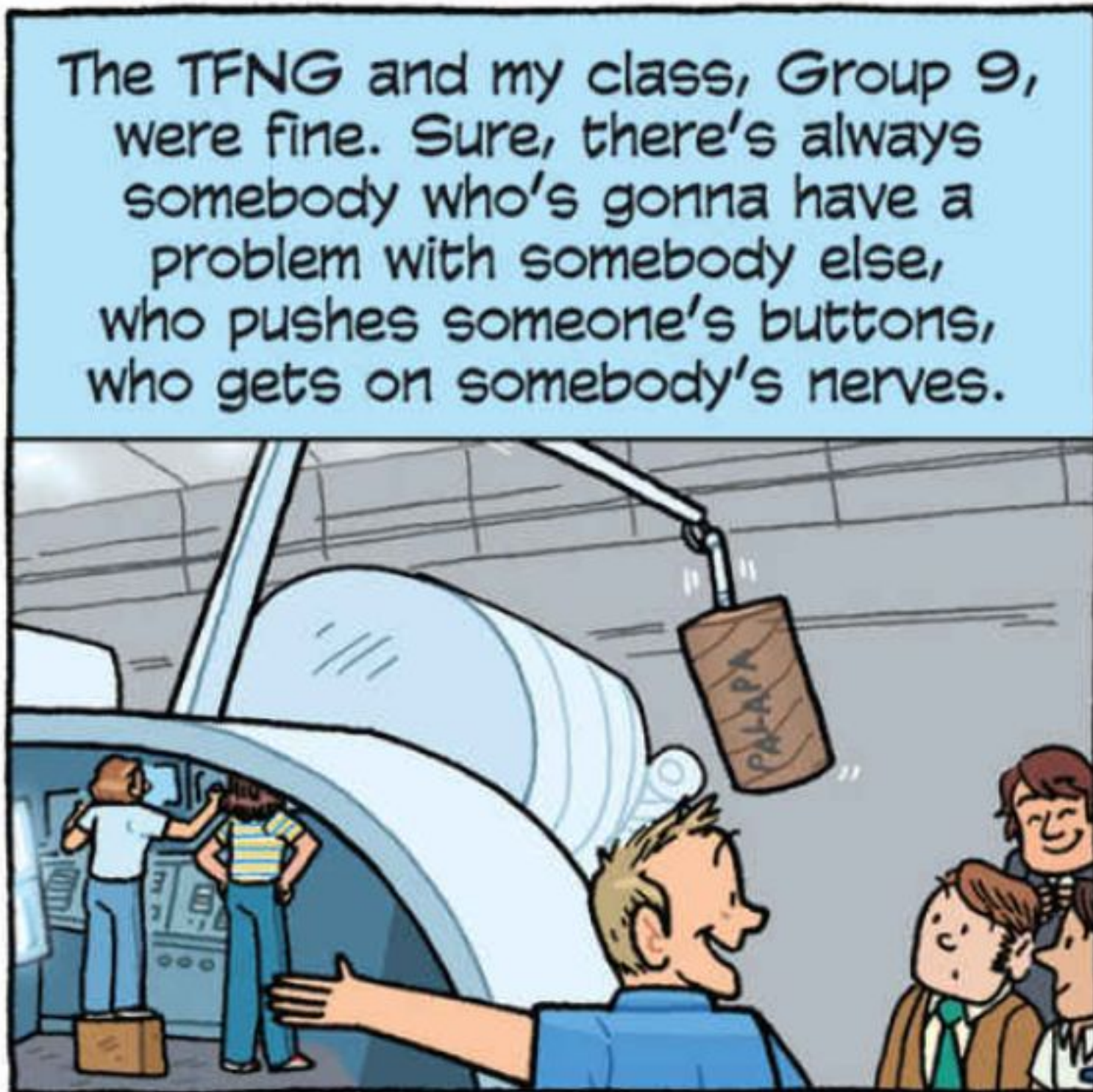
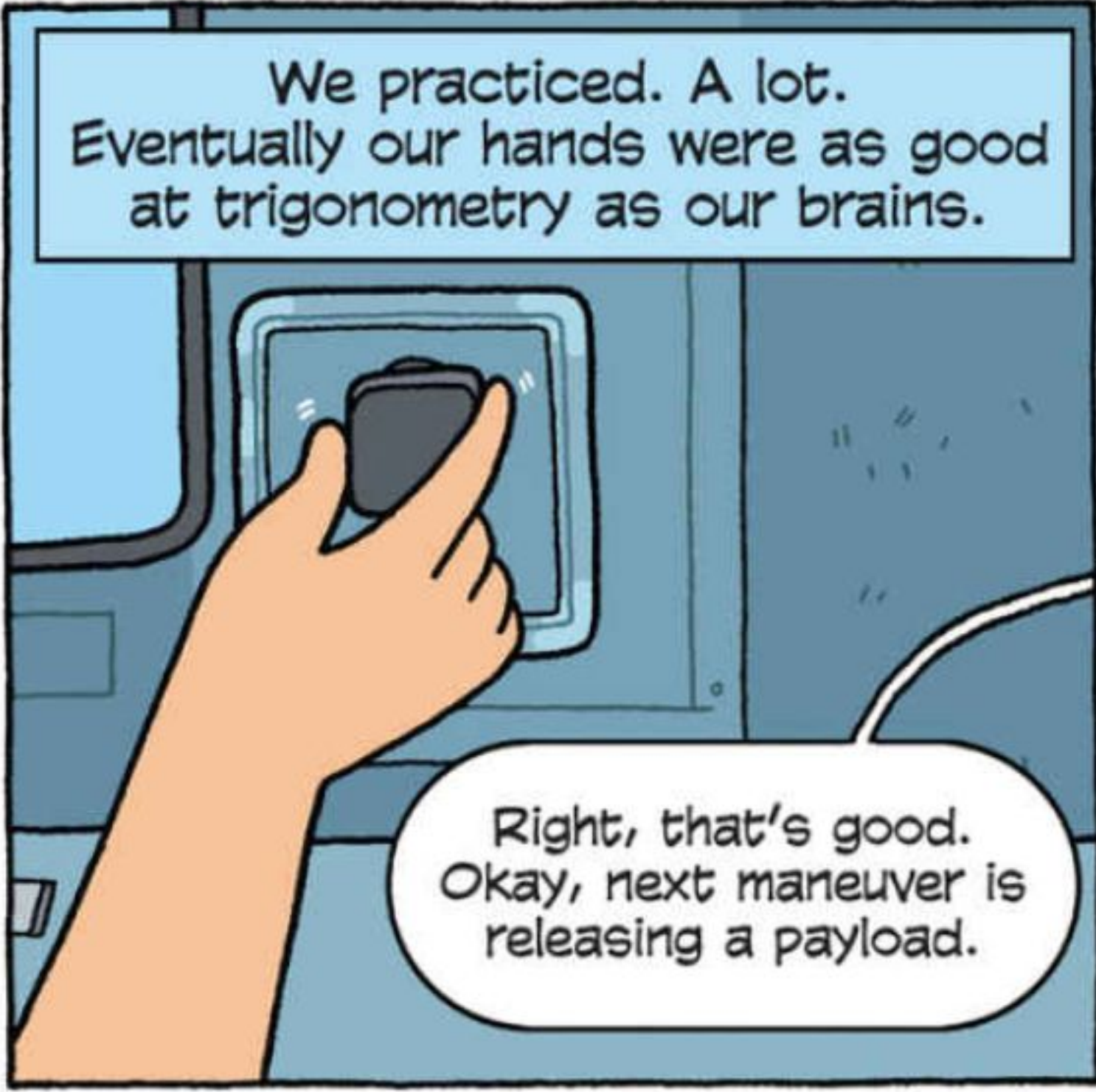
Okay, Mary. We want a body vector number 5 with a pitch of 270, a yaw of 062, and an omicron of 0.

Roger.

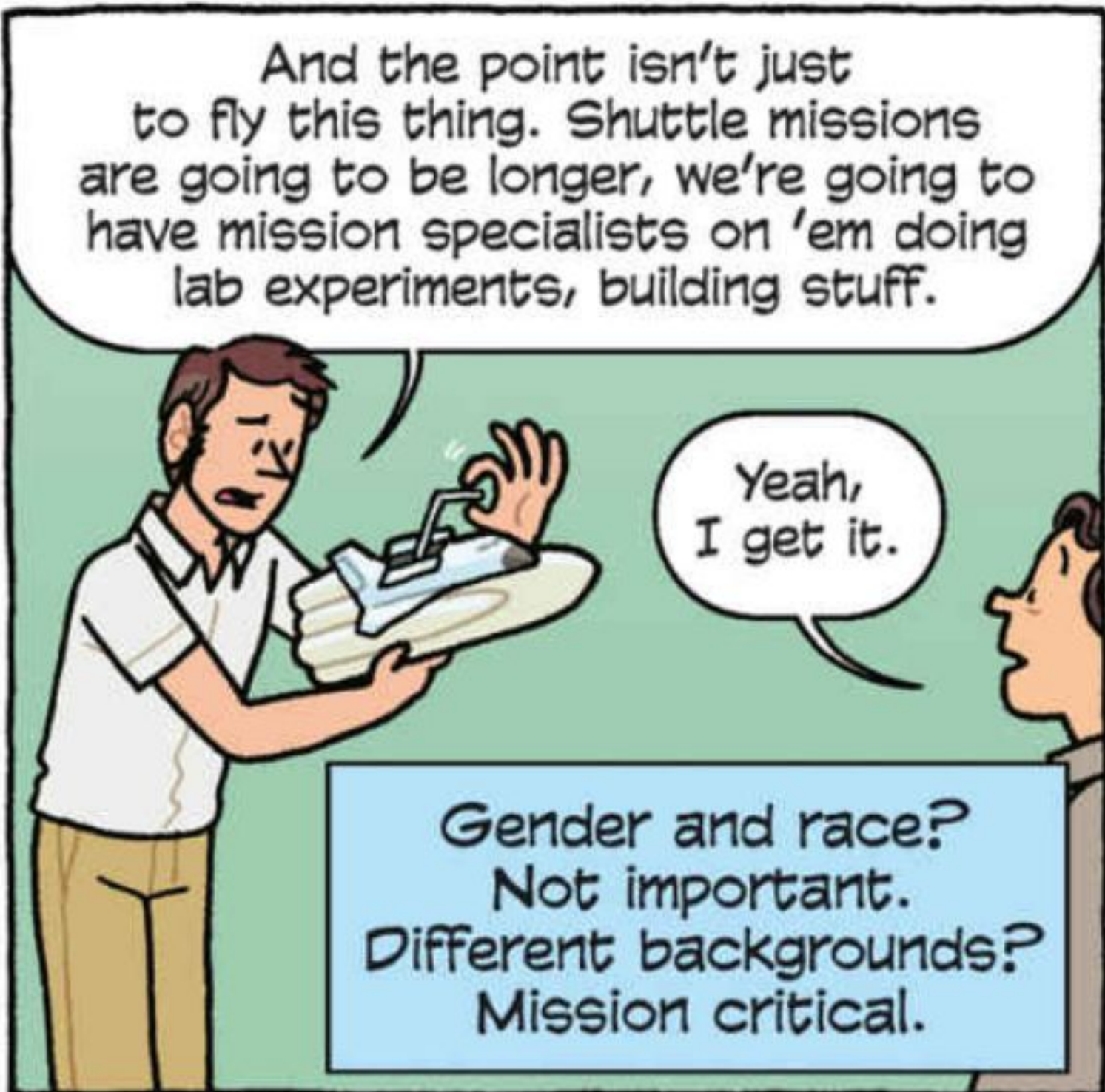
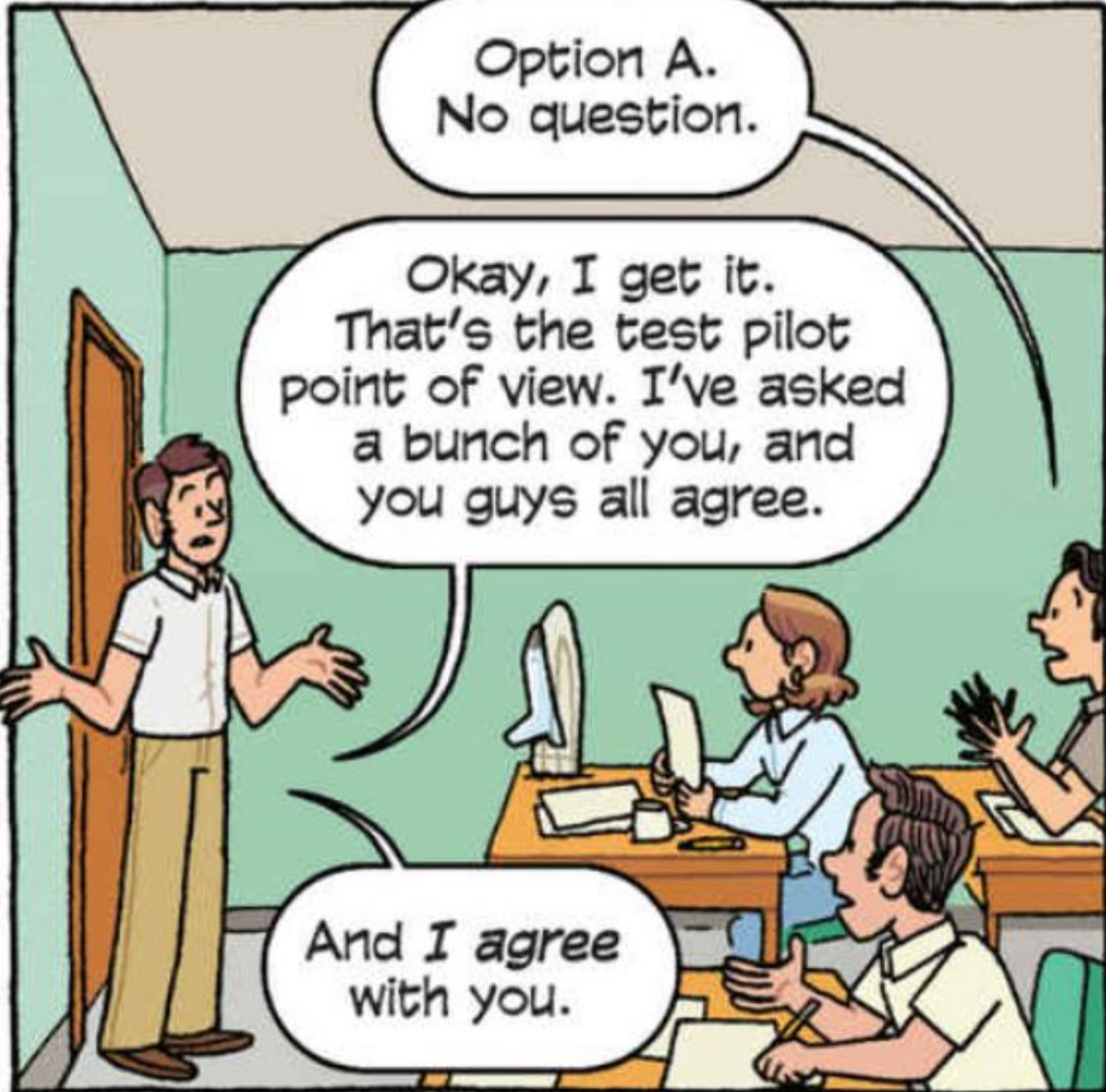
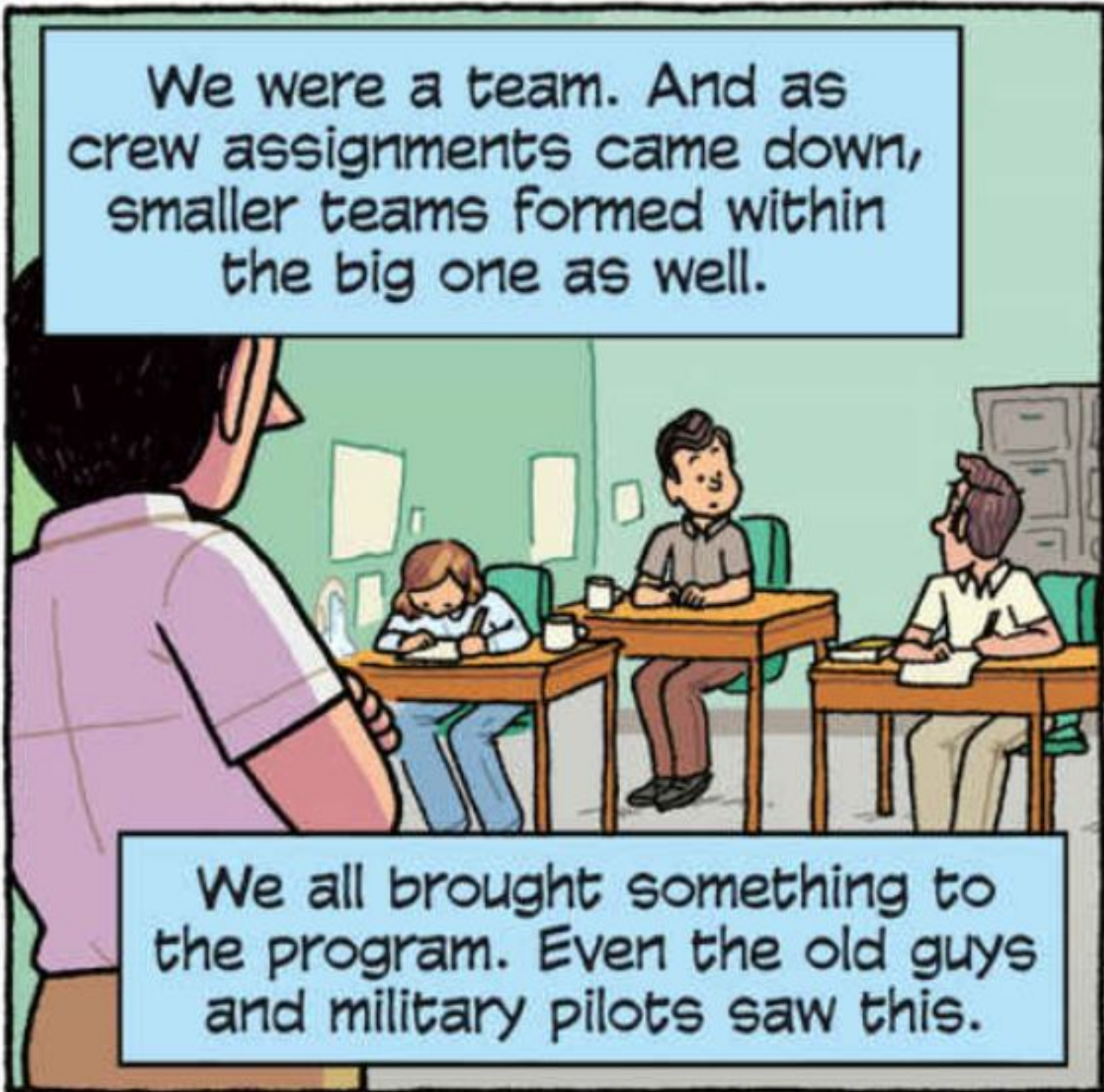


Vector number 5, pitch of 270, yaw 062, and... an omicron of 0.

Nice. A little overshoot on the yaw, though.







...yeah, we can make it work. We just gotta approach it from a different angle.



Humans do great things in part because we're so good at generalizing and working together. But as John said, "group think" is a problem.

All right, they've asked me a question about space suit cooling. Either of you able to break away for a sec?



Sally knew that as well as anybody, so after being picked as the first to fly, she was careful not to speak for anyone but herself.

I don't want those engineers to get the idea that "Ride wants X, so all women want X."



And between her and Carolyn Huntoon, we all had a voice on large engineering decisions...

Small decisions, like dealing with the press...

Okay, Sally's getting the brunt of this, so we need to figure out how we—as NASA—are going to respond to questions about people of different sizes on the shuttle.



By "different size," they mean "women," right? And I already answered about EVA!



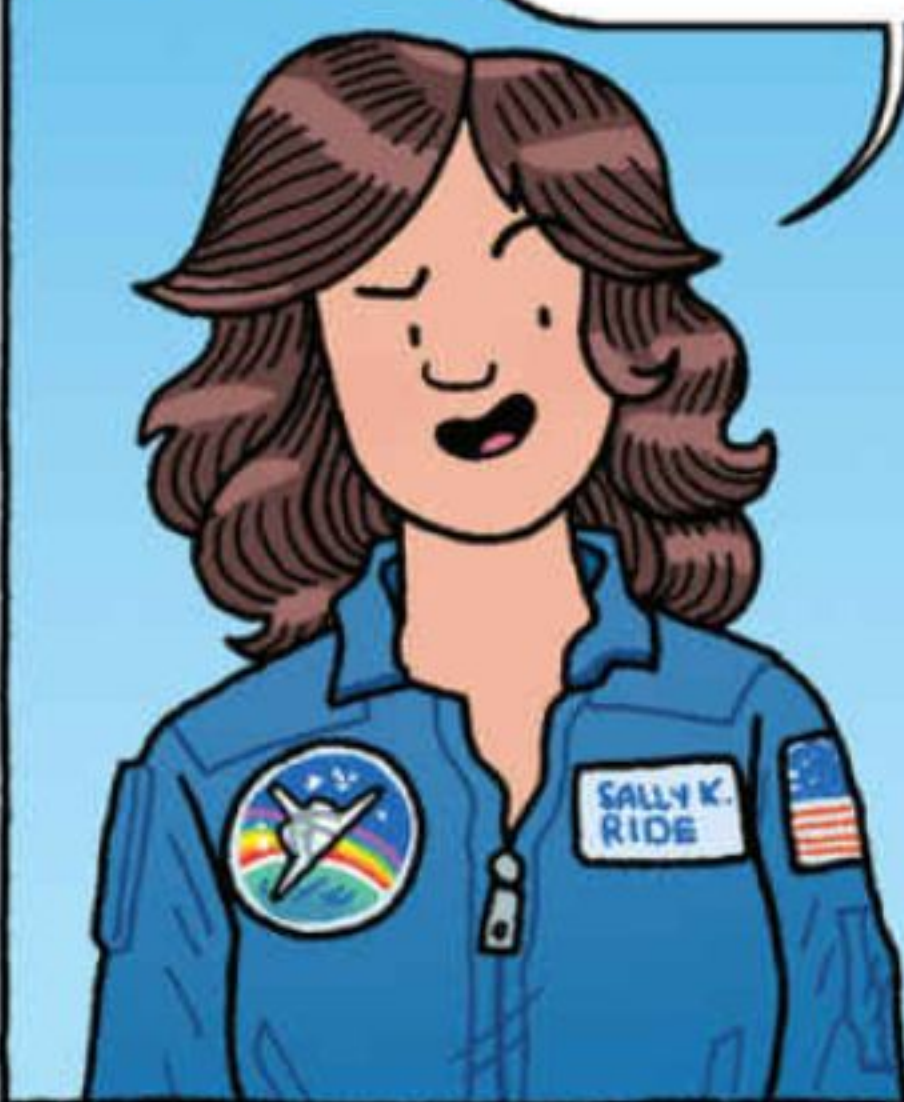
Yeah, the windows thing. It was a good line. But the fact is, EVA suits cost millions, and they're not going to fit everybody. So...

That's the reality. So provided a change fits in with all the other specifications and regulations and requirements, NASA does it.

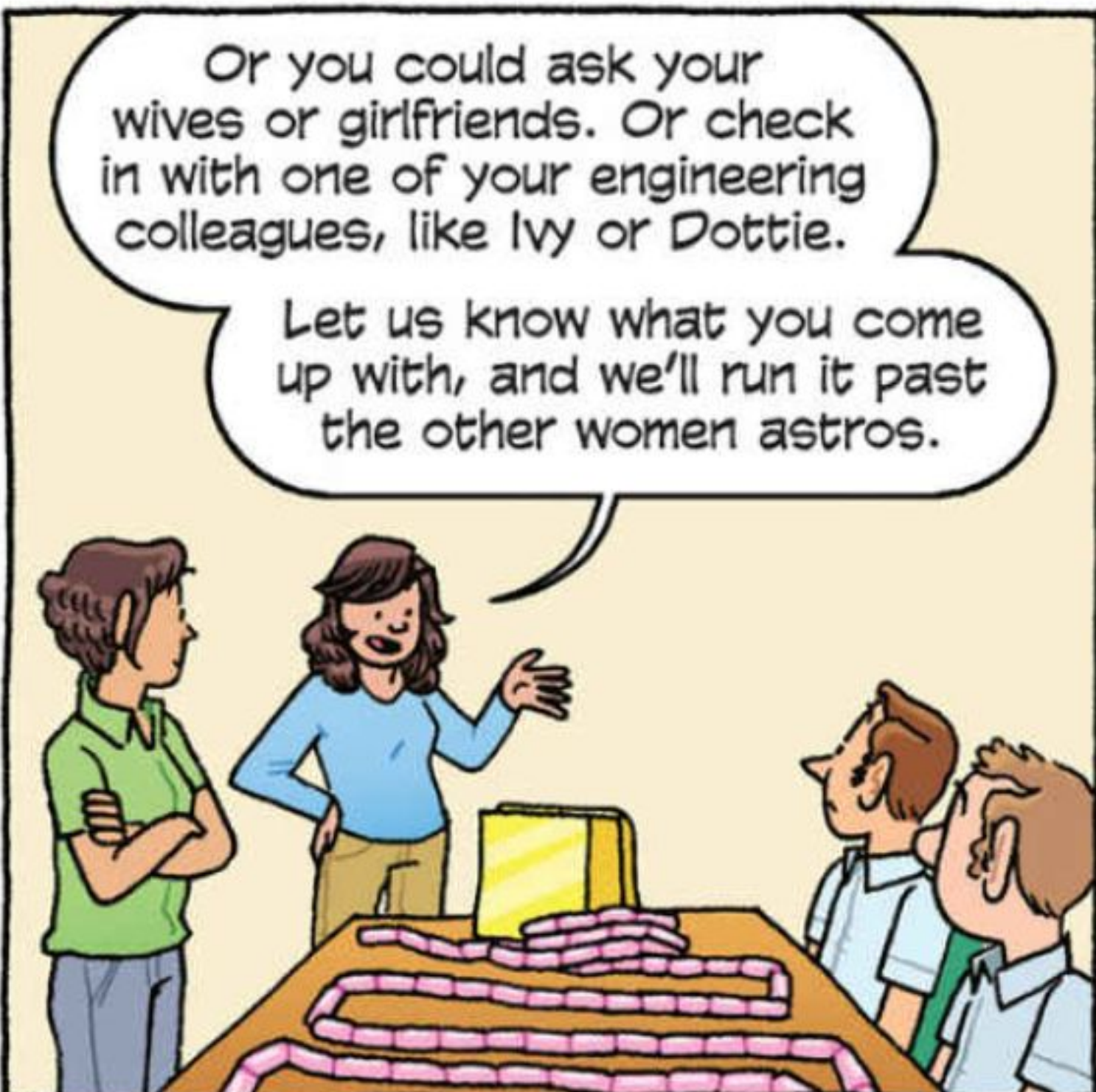
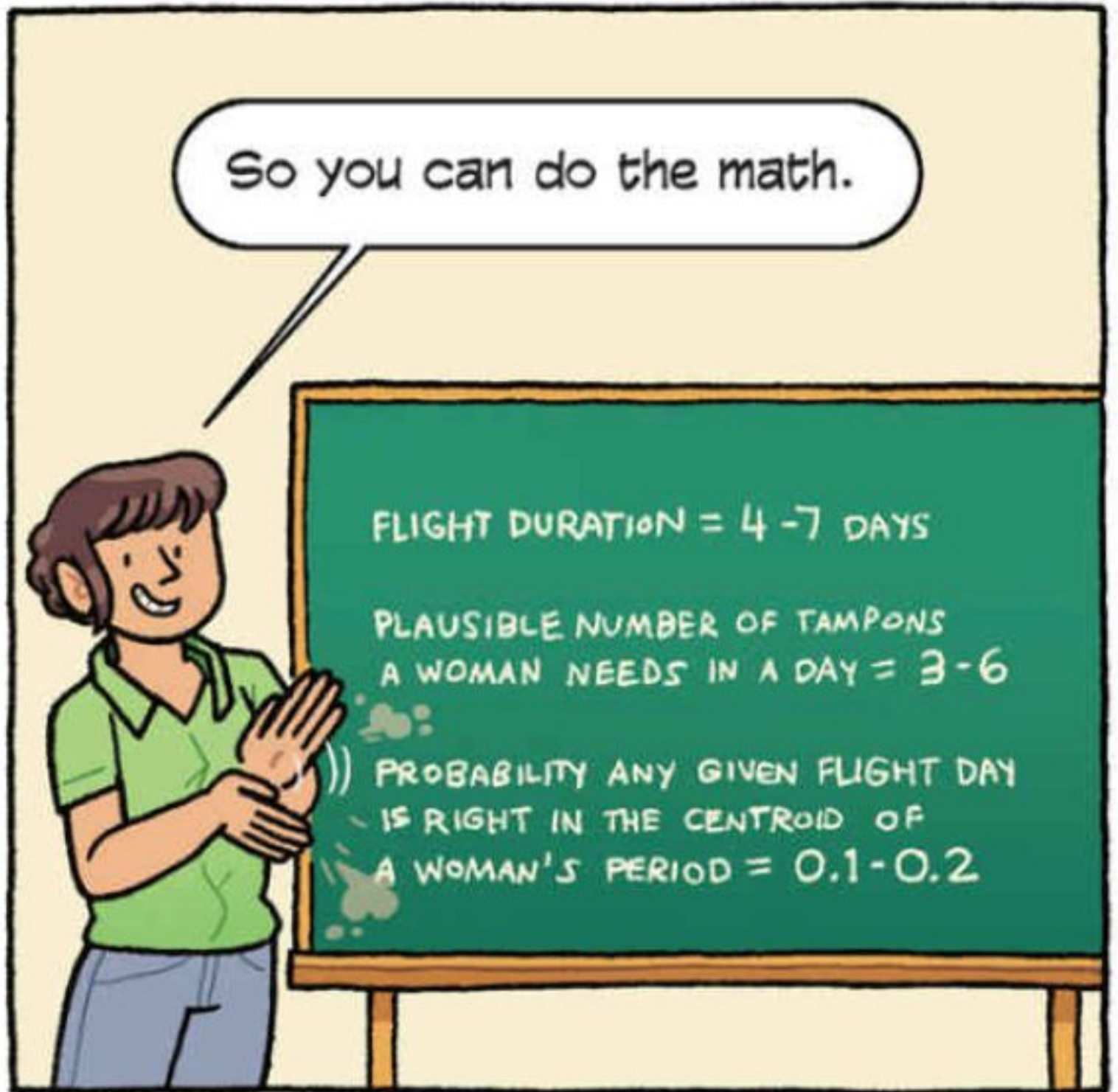
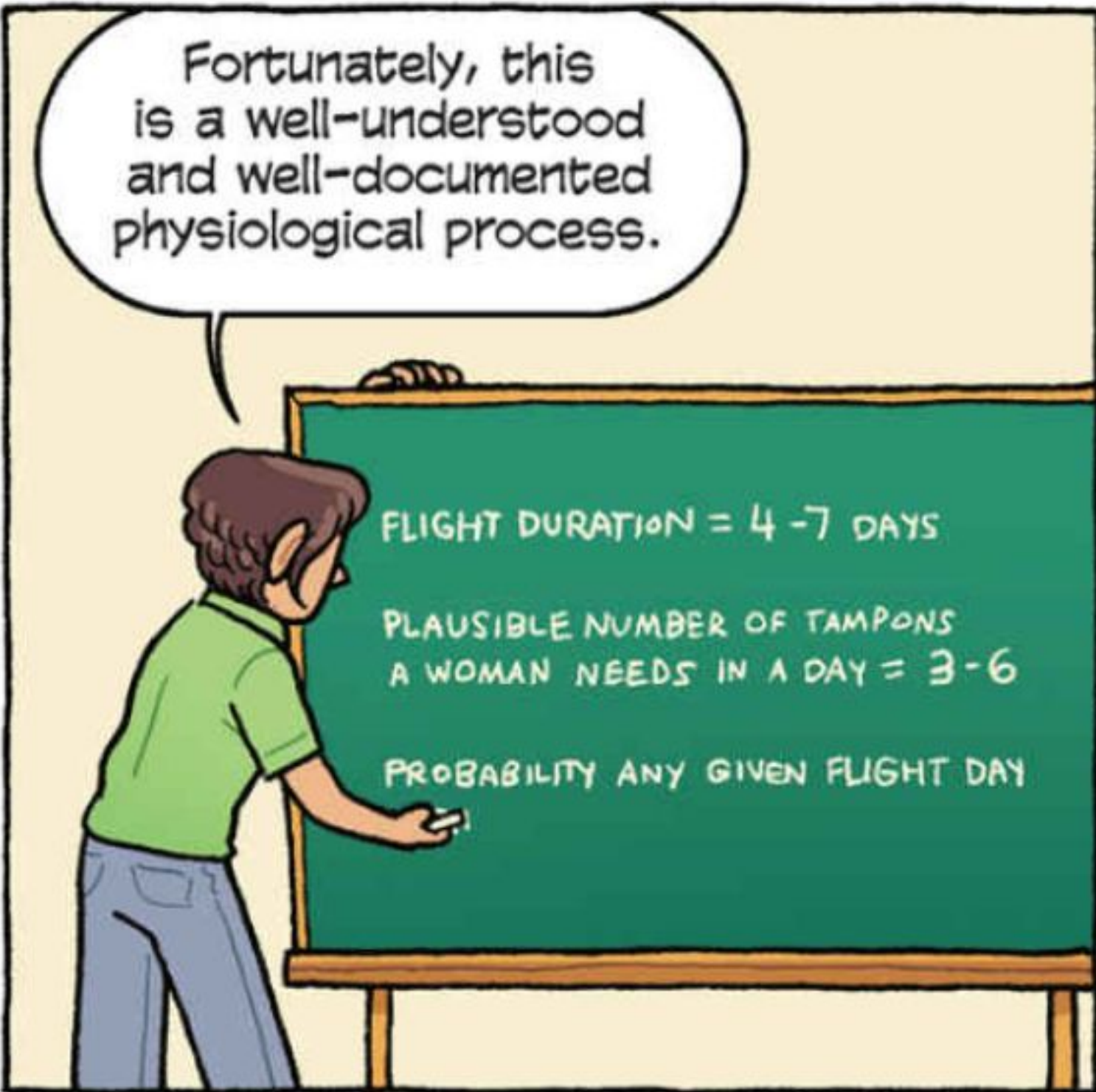


But suppose an astronaut said, for example, that her suit was cutting into her knees?

Then they'd find someone with their knees in a different place.







I mean, brains and ability?
Yeah, even guys who walked on the moon figured out we were the same in that respect. But there are some *actual* differences between men and women.



I guess talking about this stuff is one of those differences.



In the end, we probably put twice as many pads and tampons in the hygiene kit as someone would use, and then 50% more...just in case.



Some have cut their hair, some will tie it back.
Everybody—women and men—will have moisturizer in their kit.
Space is dry.



So we'll have different kits for each astronaut. But they all agree about the women's locker room. And so do I.
What's the issue, Dr. Huntoon?
The issue is there is no women's locker room. Still.



I understand that with the six female TFNG here, we've doubled the women scientists and engineers here at Johnson.
So, you know, it's time.
Well, I'm not sure if those numbers...

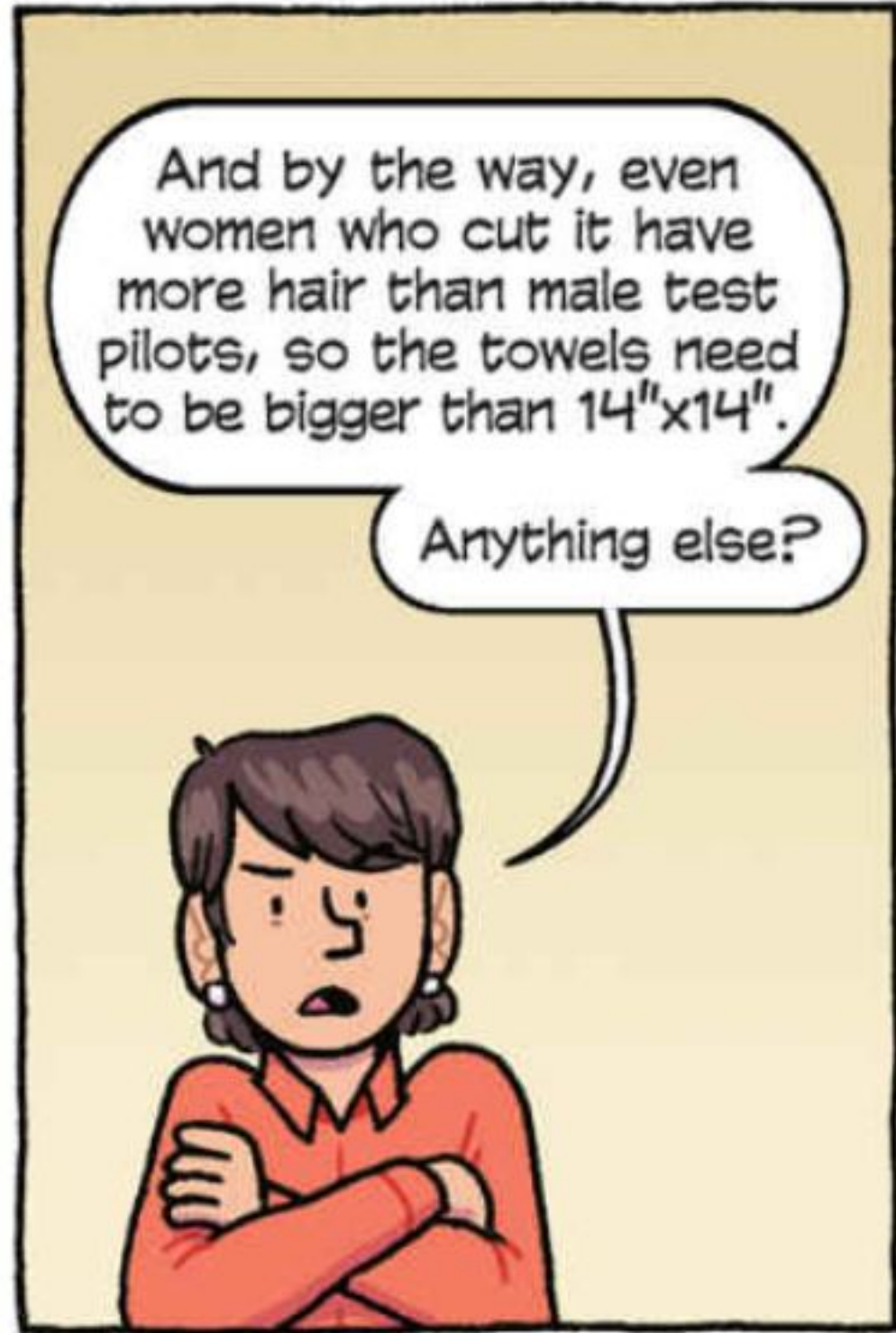


Me either. Let's see. Here at Johnson Space Center, we have me and Ivy and Dottie and...hey! It might be more than double with Dunbar and Cleave here too.

...



I'm pulling your leg. My point is, they're here, and there're going to be more, so let's get going.



And by the way, even women who cut it have more hair than male test pilots, so the towels need to be bigger than 14"x14".

Anything else?



Um, well, yeah. I've noticed that there's no real dress code for the, um...

Dress code?

Well, what if one of the, um, women dresses inappropriately?



Really. Like if their belt doesn't match their shoes? Because most of the military guys don't know how to do that either.

No, I mean...



Okay, I guess there's no dress code?

Good decision. I endorse it. Anything else?



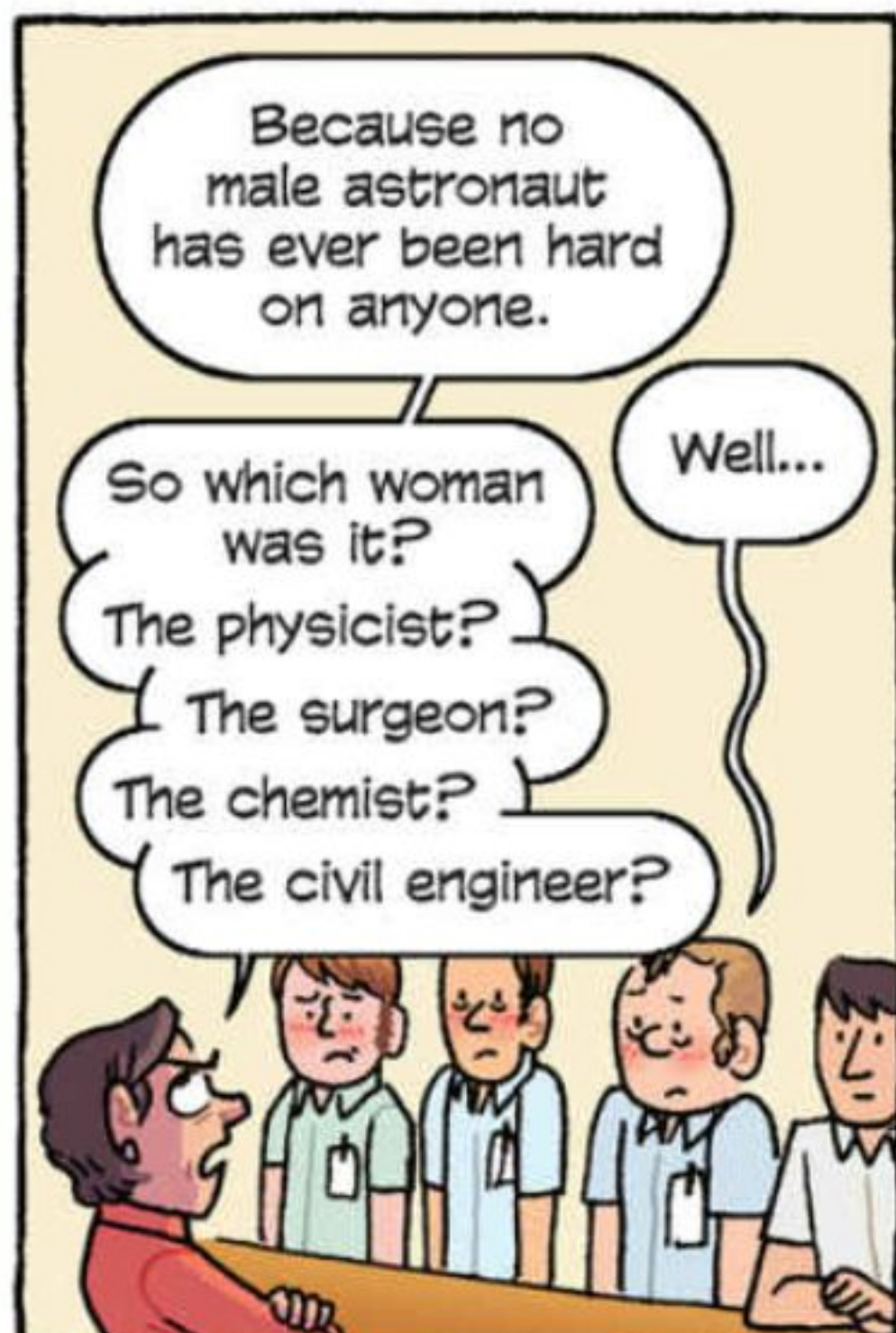
Yeah. I've heard that one of the female astronauts was kind of hard on somebody in a meeting last week.

Yeah, I was there. In fact, one of 'em told me that something wasn't right just the other day.



Oh my goodness gracious! And that's not what you expected, is it?

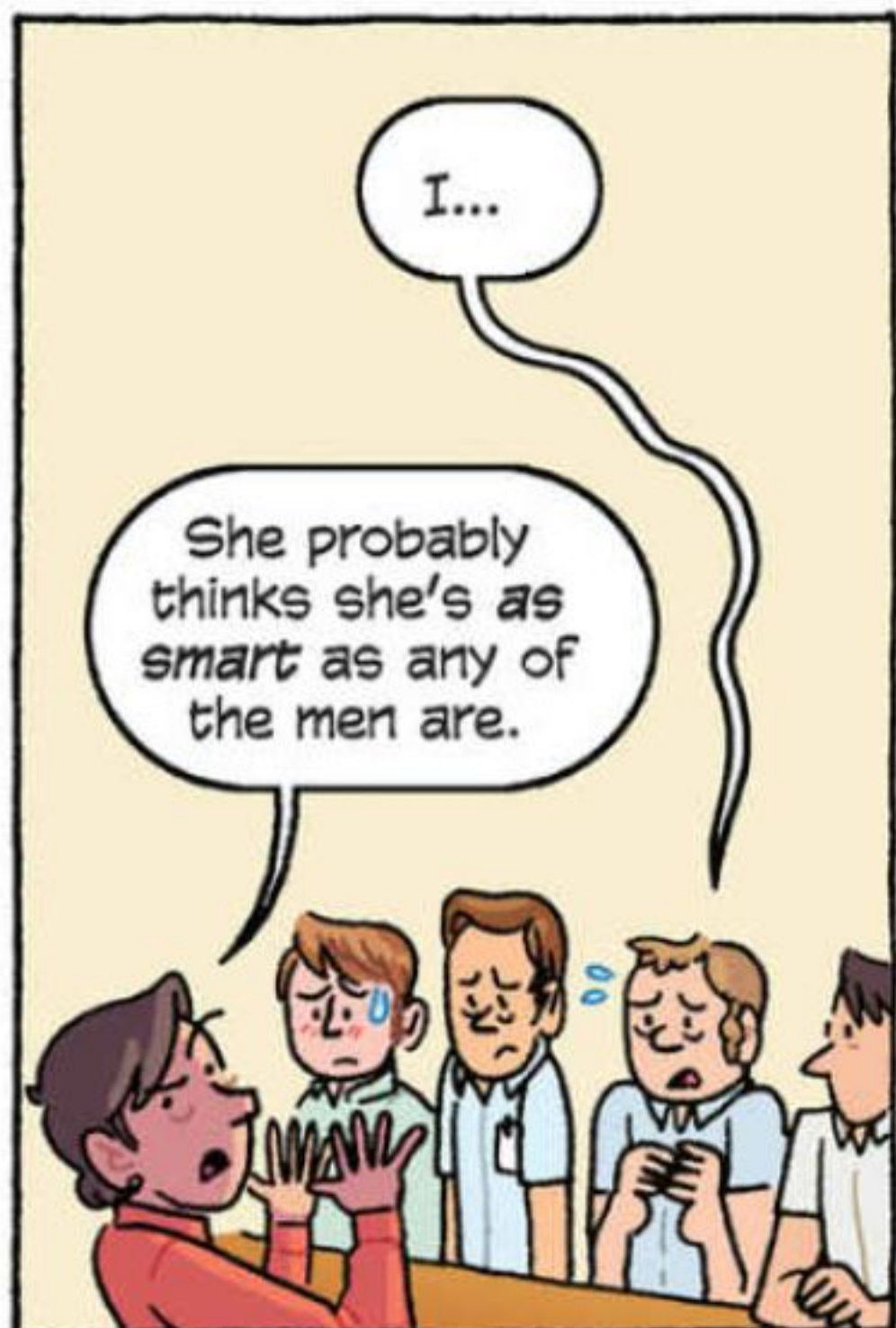
No!



Because no male astronaut has ever been hard on anyone.

- So which woman was it?
- The physicist?
- The surgeon?
- The chemist?
- The civil engineer?

Well...



I...

She probably thinks she's as smart as any of the men are.



Yeah. No. Wait.

Um...



You take my point.

Let's get to work on that locker room.

Don't forget—bigger towels.



Yes, ma'am, Dr. Huntoon.

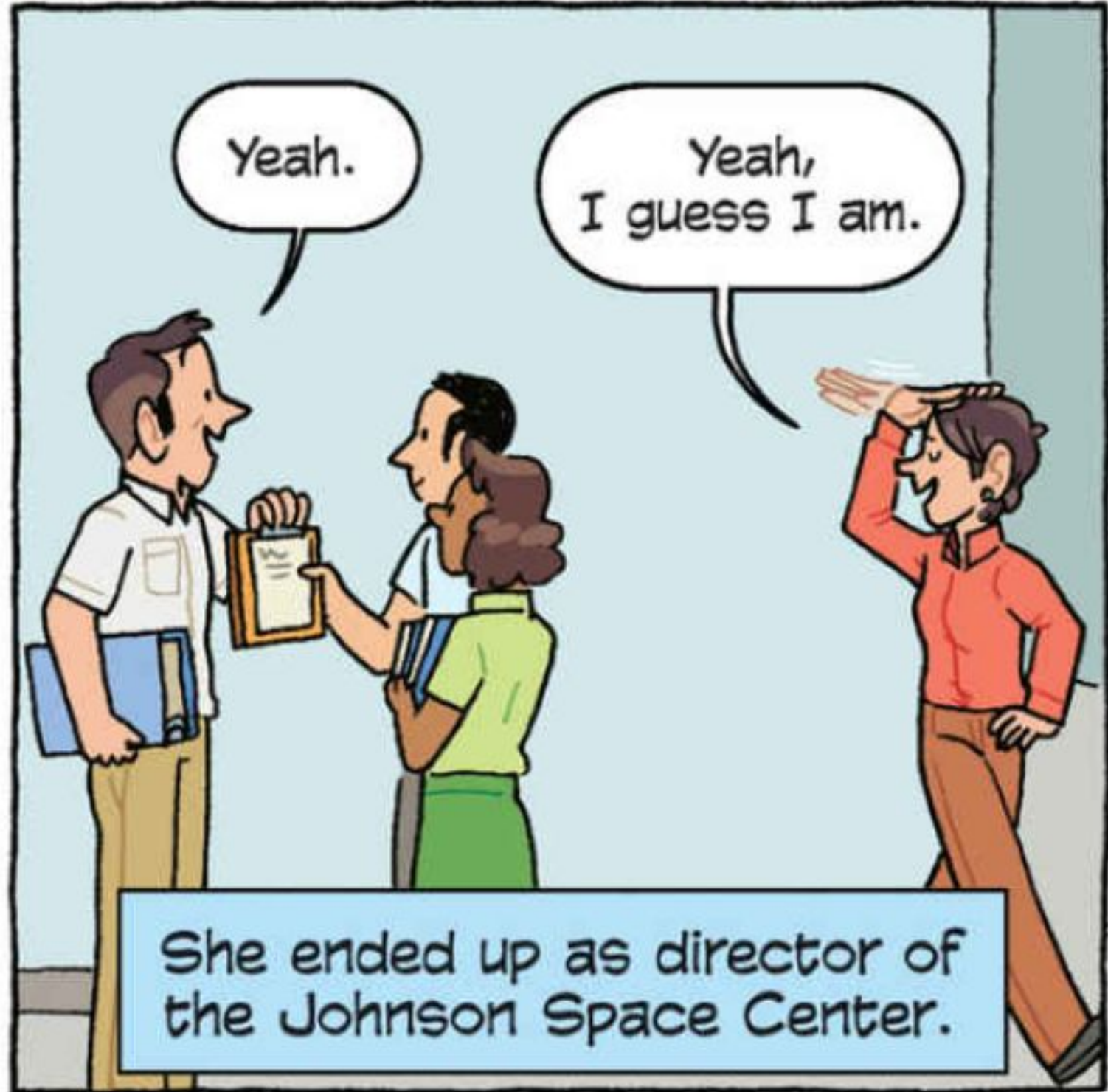
Carolyn ran a lot of interference for us and didn't make any excuses for it.



Good work.

Do I sound like a fiery feminist?

...



Yeah.

Yeah, I guess I am.

She ended up as director of the Johnson Space Center.



To no one's surprise.

They're smart fellas. Just give 'em good data to work with.

Data on your good judgment and performance. They'll get it.

So some things moved slow, while other things moved fast.

STS-1, 12 APRIL 1981
JOHN YOUNG, COMMANDER
BOB "CRIP" CRIPPEN, PILOT



Really fast.

STS-2, 12 NOVEMBER 1981
JOE ENGLE, COMMANDER
RICHARD TRULY, PILOT



So while I was gearing up as an ASCAN, Sally was gearing up too.

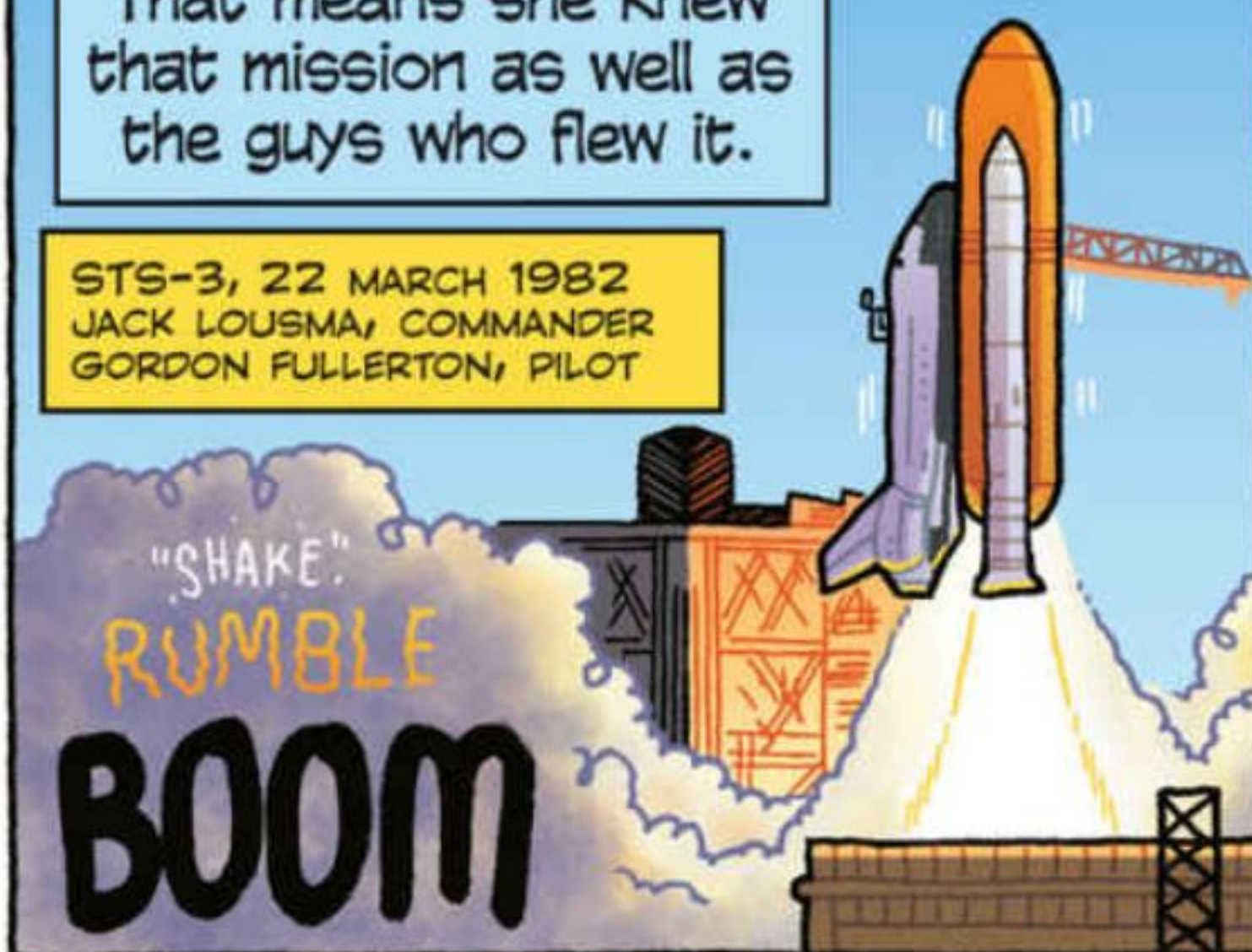
Gearing up to go up. STS-2 tested the Canadarm.



She was support crew on STS-3, the second-to-last shuttle test flight.

That means she knew that mission as well as the guys who flew it.

STS-3, 22 MARCH 1982
JACK LOUSMA, COMMANDER
GORDON FULLERTON, PILOT



By the time I did support for STS-5, the shuttle was fully operational. Mission Specialists and everything.

STS-5, 11 NOVEMBER 1982
VANCE BRAND, COMMANDER
BOB OVERMYER, PILOT
JOE ALLEN, MISSION SPECIALIST
BILL LENOIR, MISSION SPECIALIST



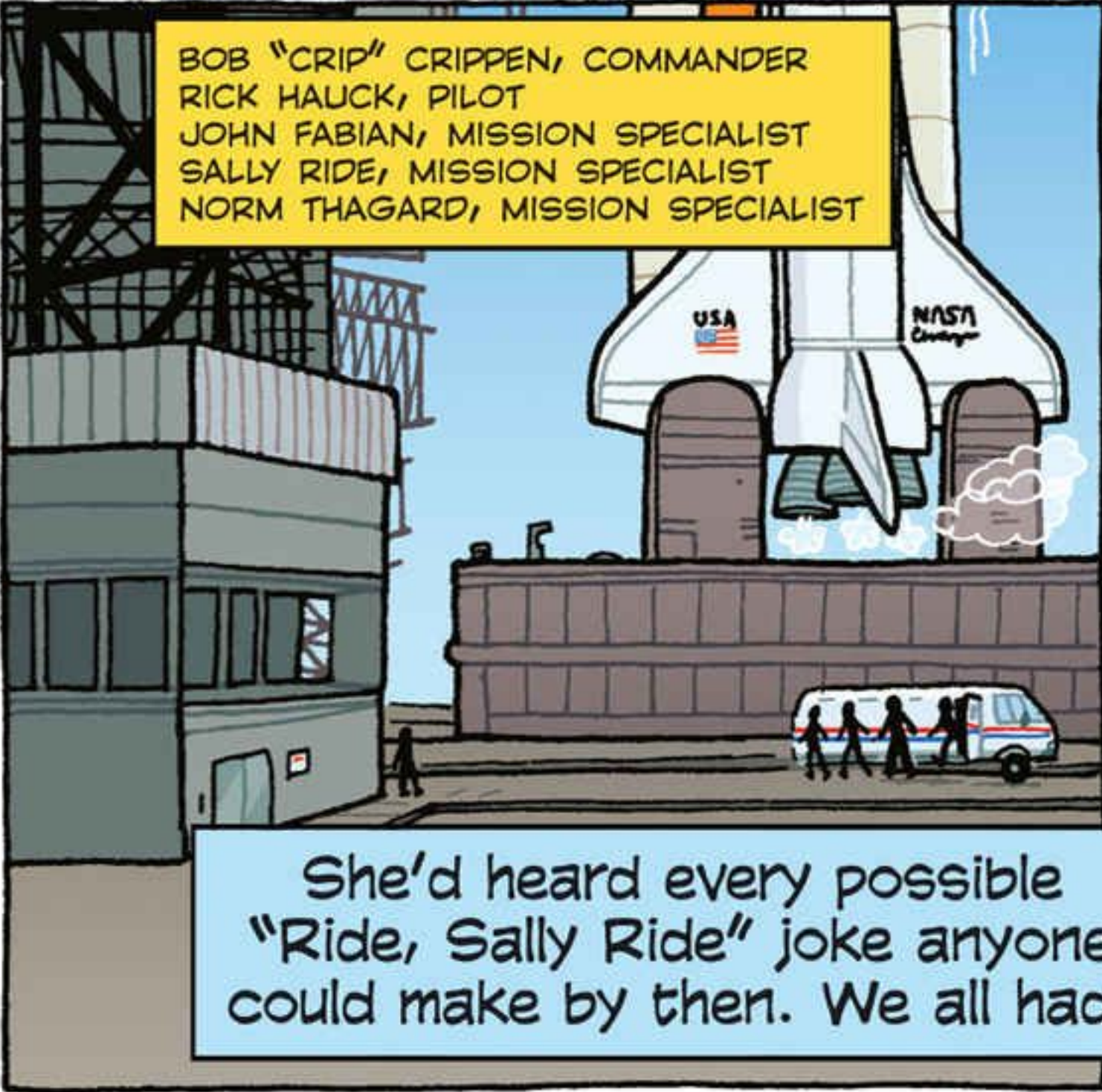
And less than a year later came STS-7. That was Sally's ride.



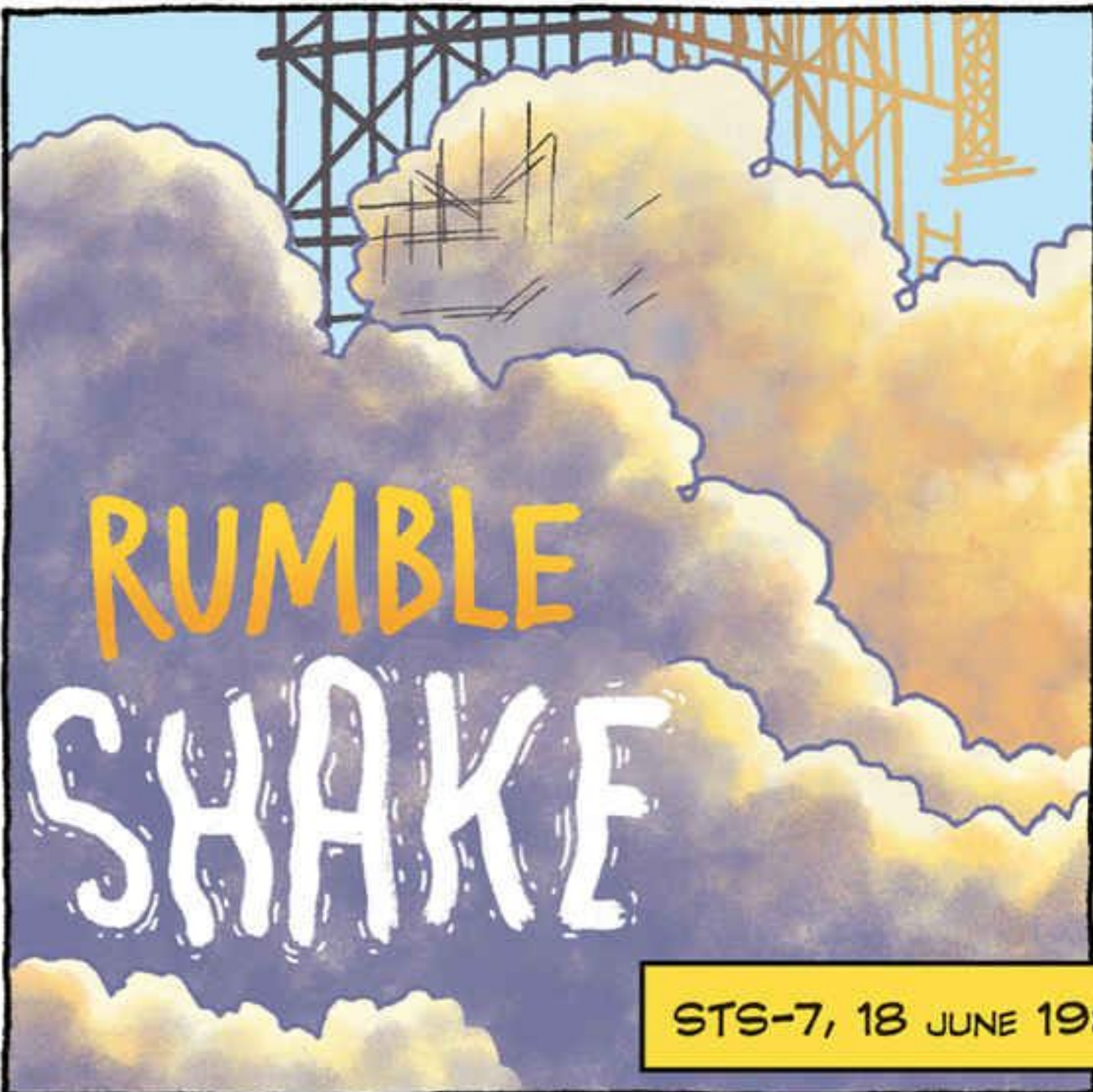
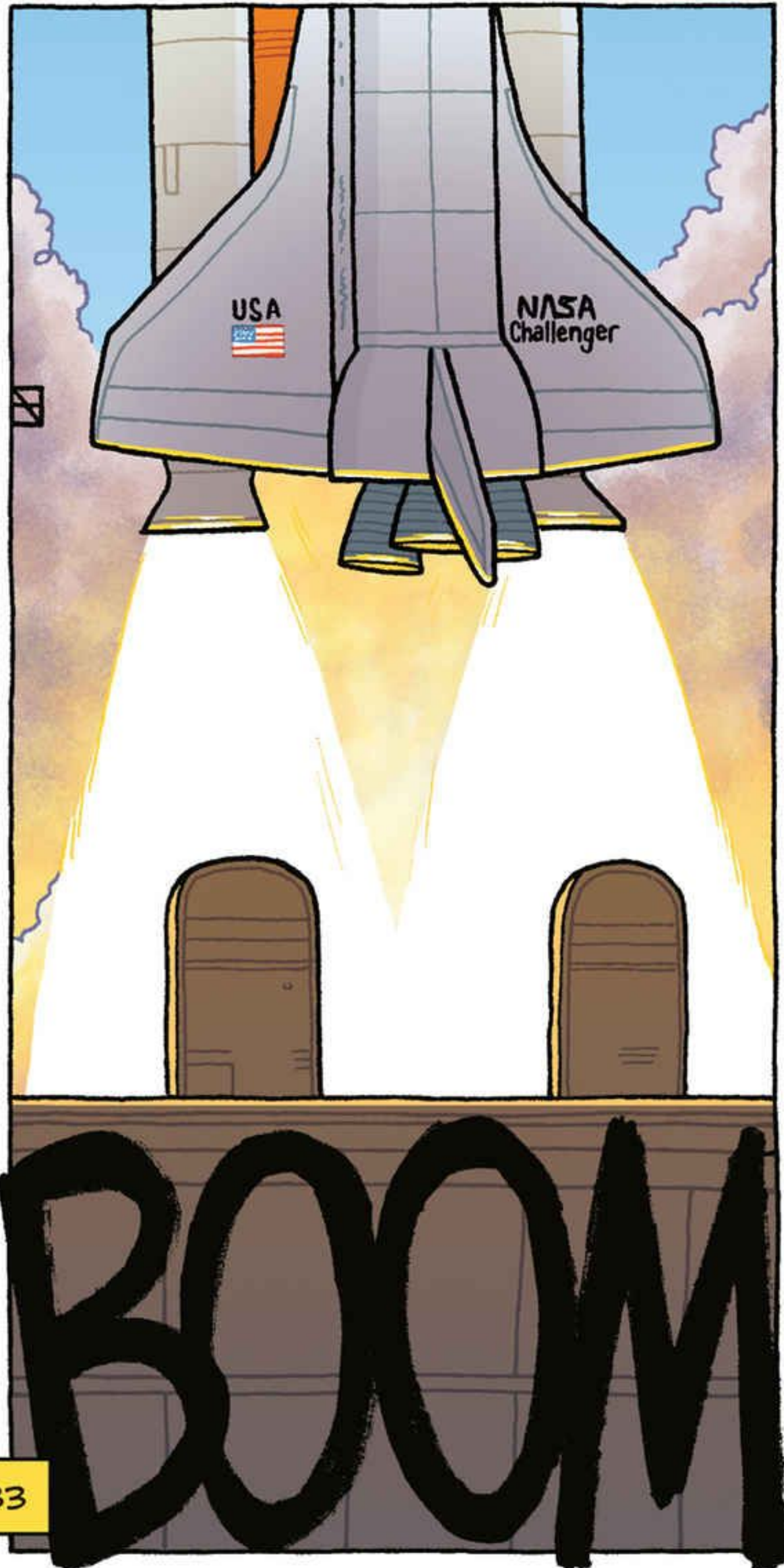
Sorry, couldn't resist.



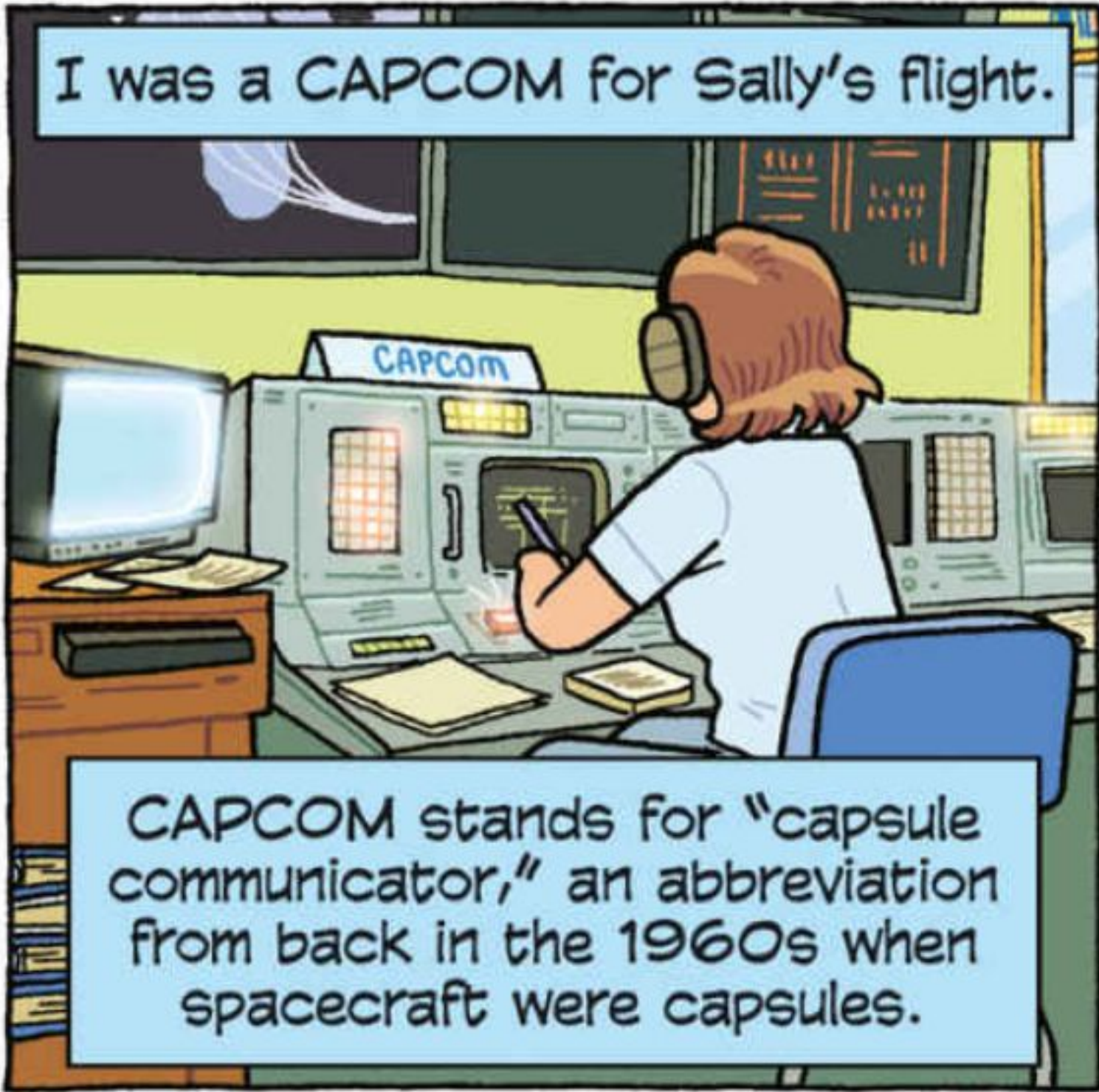
BOB "CRIP" CRIPPEN, COMMANDER
RICK HAUCK, PILOT
JOHN FABIAN, MISSION SPECIALIST
SALLY RIDE, MISSION SPECIALIST
NORM THAGARD, MISSION SPECIALIST



She'd heard every possible
"Ride, Sally Ride" joke anyone
could make by then. We all had.

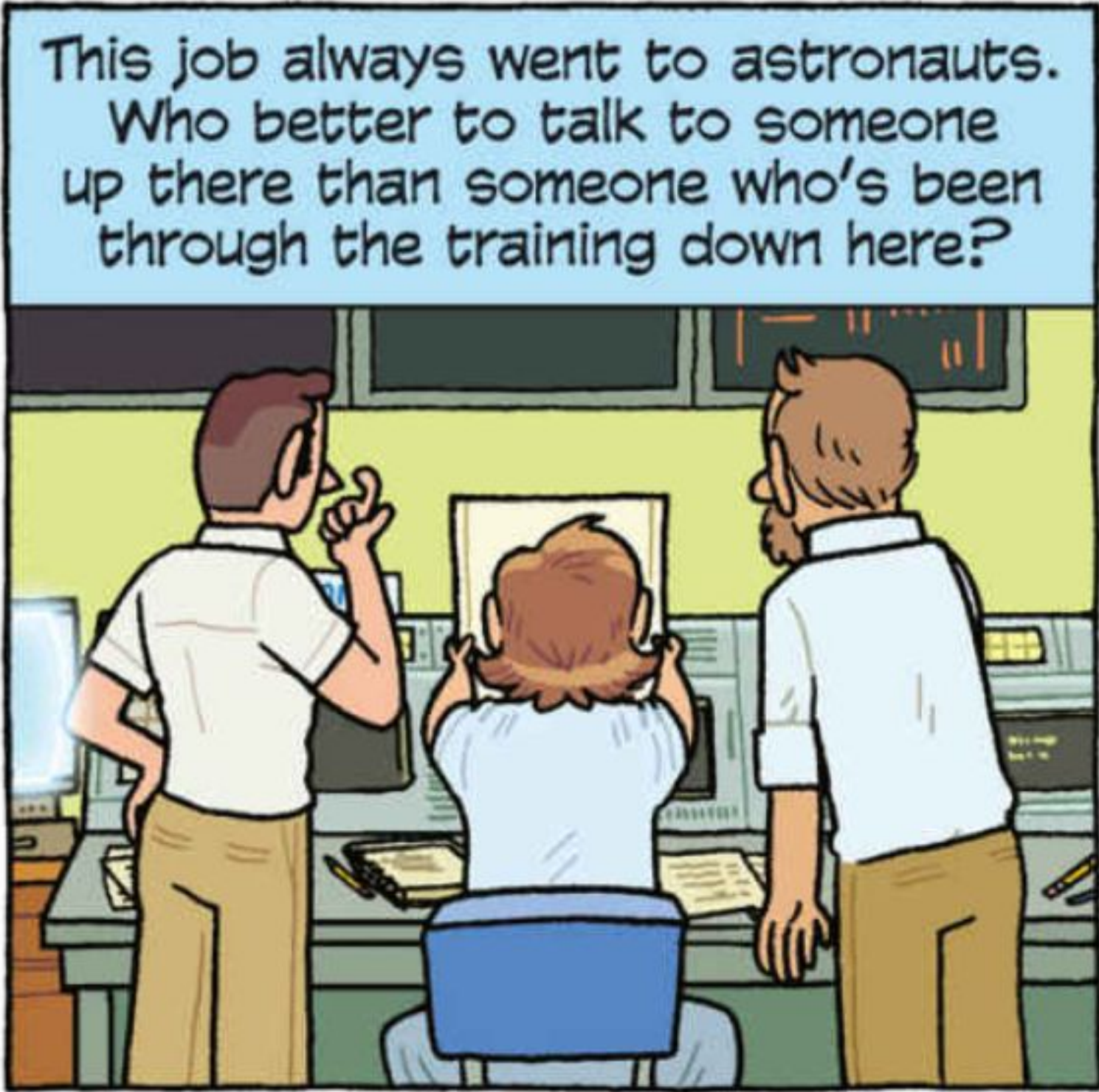


STS-7, 18 JUNE 1983

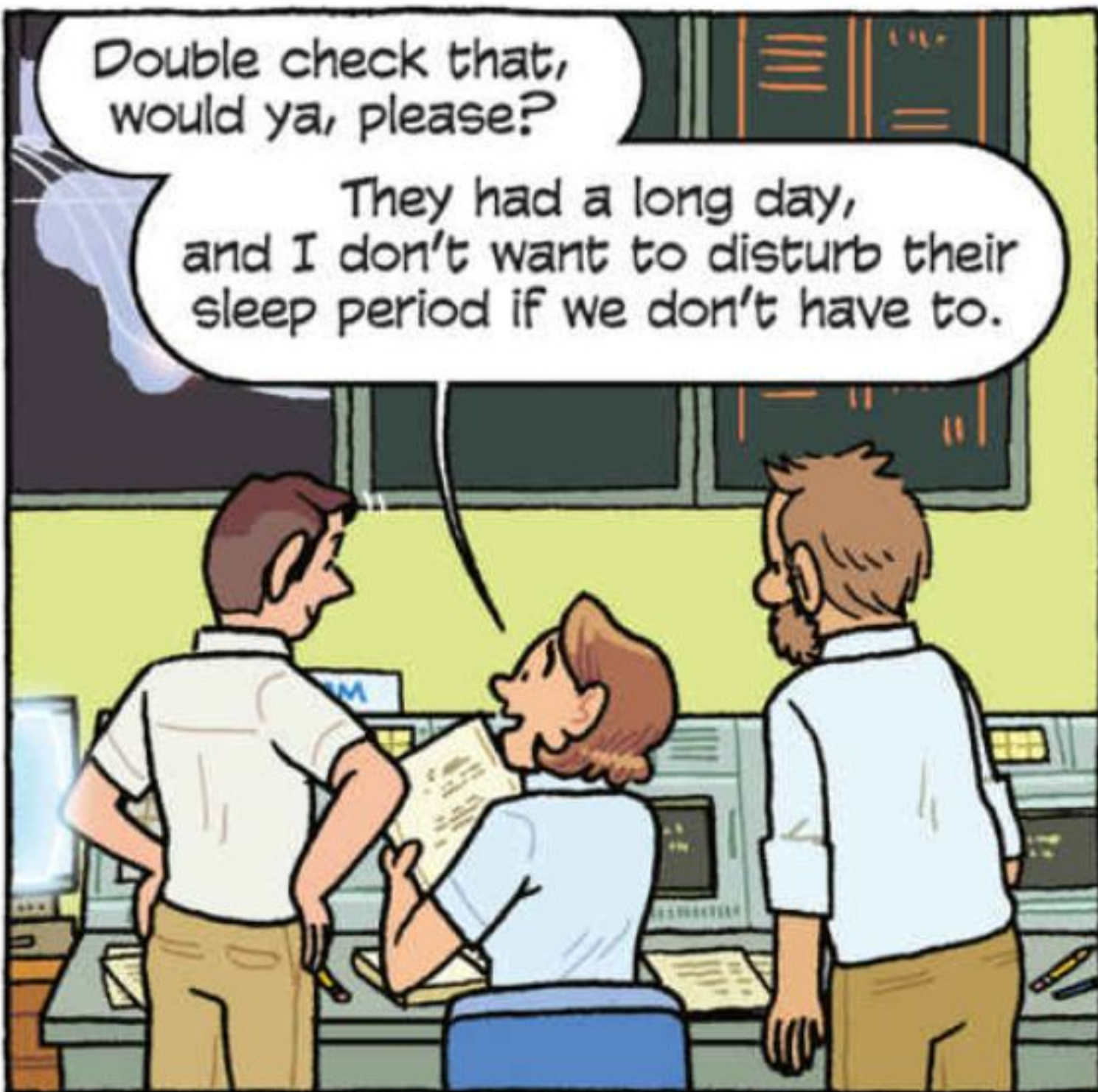


I was a CAPCOM for Sally's flight.

CAPCOM stands for "capsule communicator," an abbreviation from back in the 1960s when spacecraft were capsules.

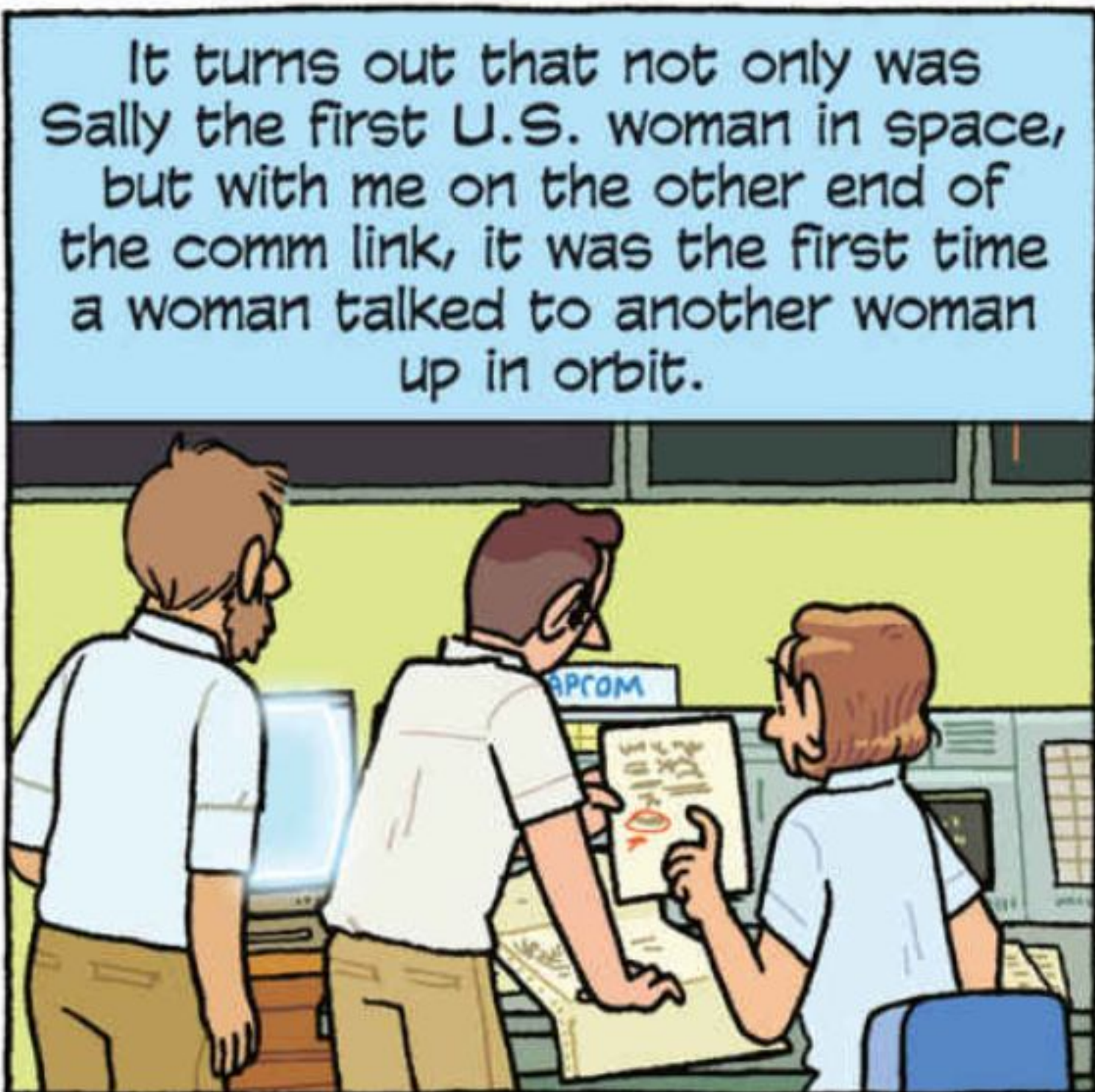
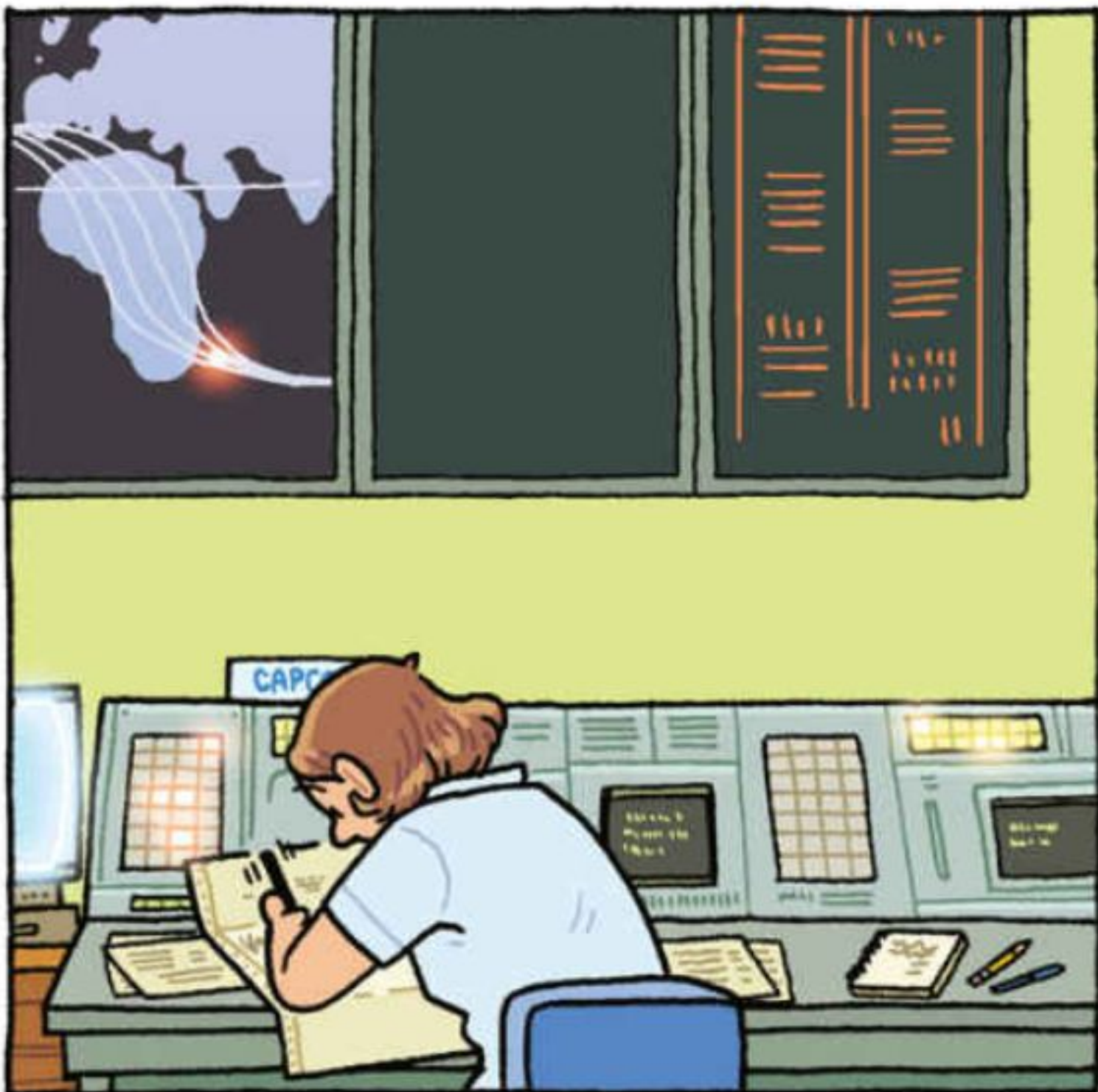


This job always went to astronauts. Who better to talk to someone up there than someone who's been through the training down here?



Double check that, would ya, please?

They had a long day, and I don't want to disturb their sleep period if we don't have to.



It turns out that not only was Sally the first U.S. woman in space, but with me on the other end of the comm link, it was the first time a woman talked to another woman up in orbit.



Okay.

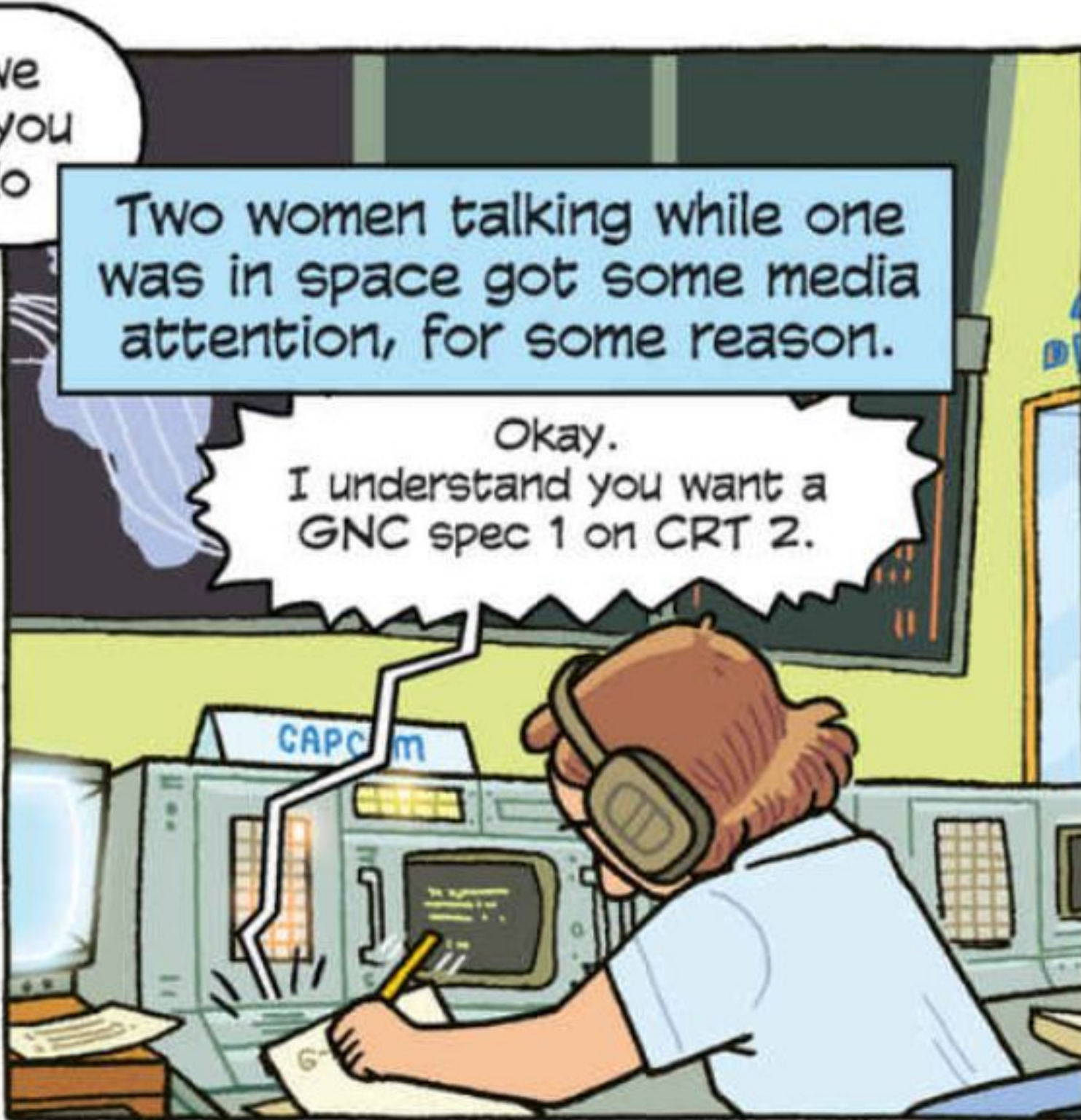
Good evening, Sally. Sorry to wake you up.



We need you to do an action for us.

So we want you to do

We're afraid that 1X resolver that gives you the IMU BITE is going to ride through the region, and it will give you a message about once an orbit.



Two women talking while one was in space got some media attention, for some reason.

Okay. I understand you want a GNC spec 1 on CRT 2.



That's affirmative.

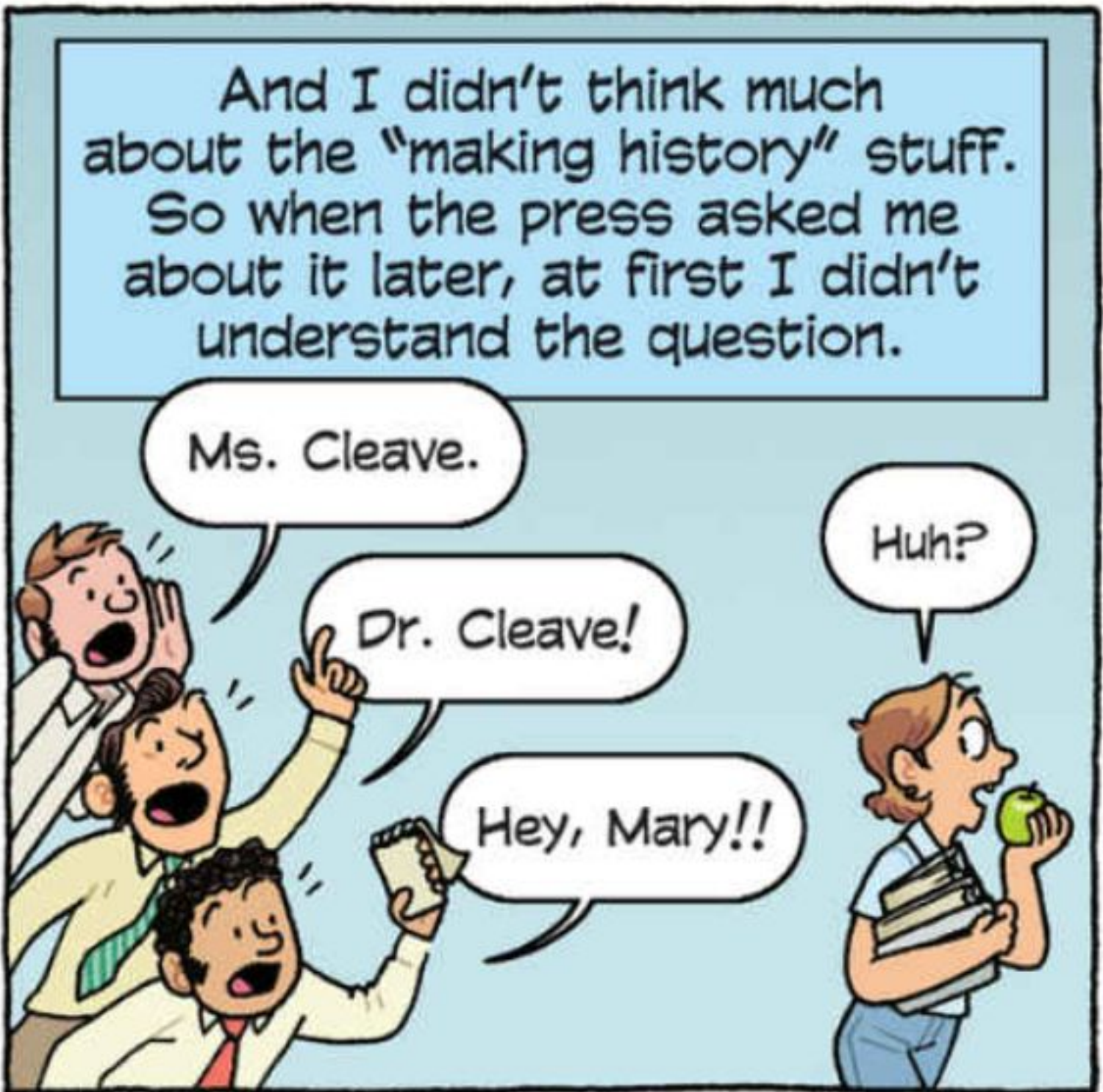
Okay. We'll do that. Thanks.



Thanks a lot. Next we're going to do

But not right away. I was at Mission Control overnight, so there weren't many reporters around.

Okay. We understand and appreciate it. Good night.



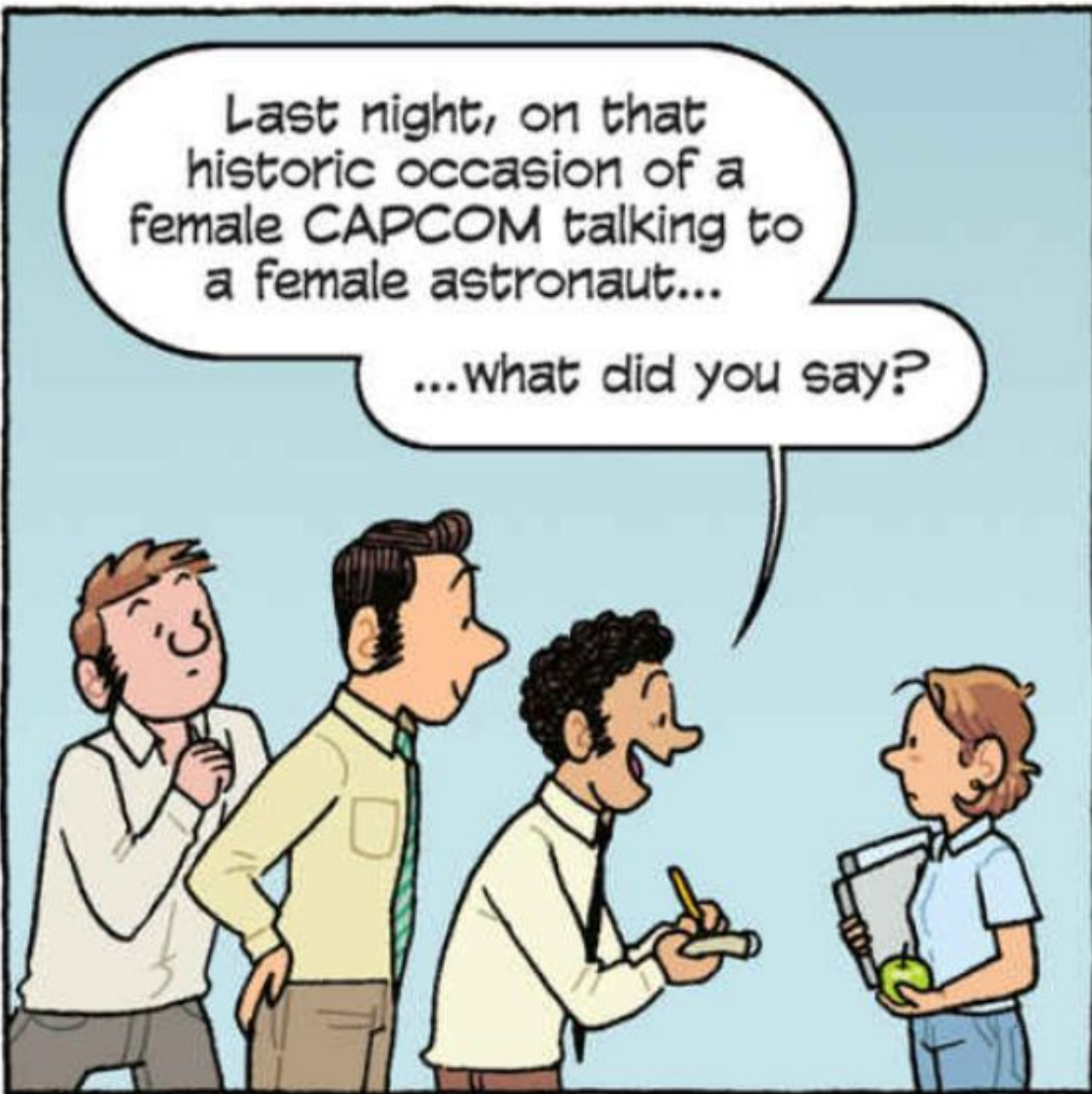
And I didn't think much about the "making history" stuff. So when the press asked me about it later, at first I didn't understand the question.

Ms. Cleave.

Dr. Cleave!

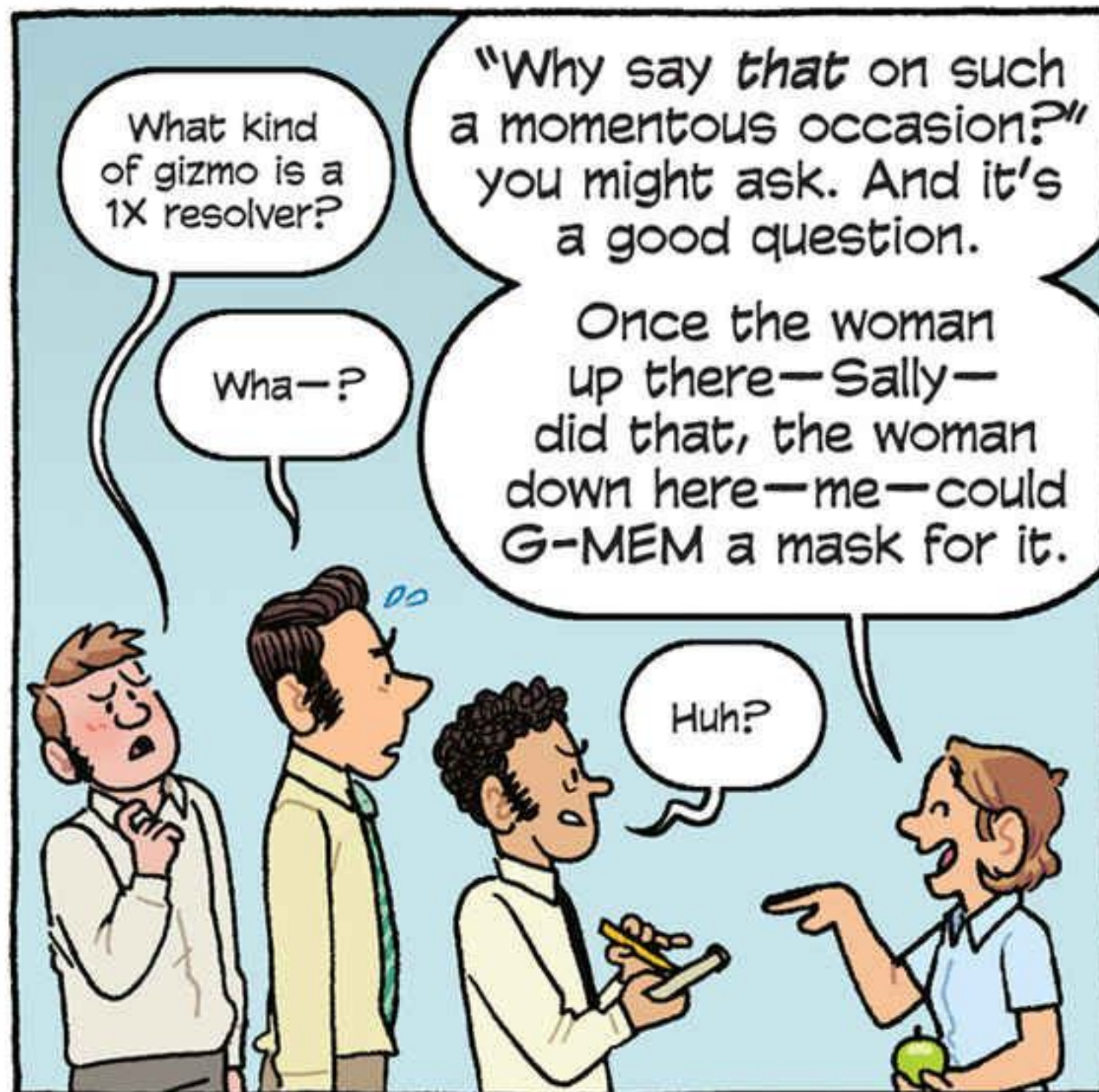
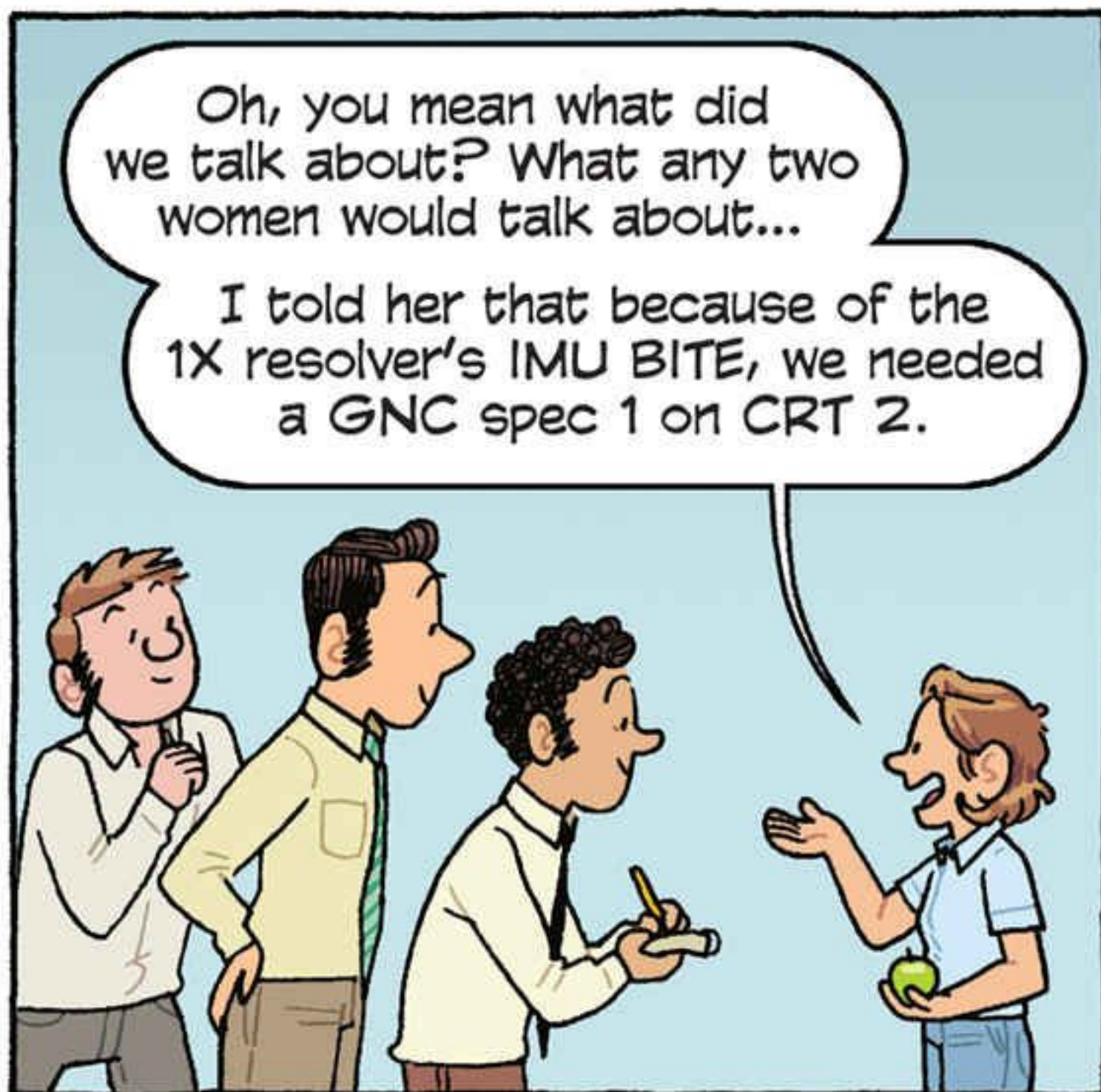
Hey, Mary!!

Huh?



Last night, on that historic occasion of a female CAPCOM talking to a female astronaut...

...what did you say?



They did a lot of experiments, so we learned all kinds of science and lab techniques.



We noticed that the MOMS experiment is powered off this morning, and the temp is continuing to increase, and we're seeing 113.5 now.

We wonder if we're still on a 115 limit for shutdown.



That's affirmative on the 115. We also got some good news. They had a good burn, and the Palapa satellite is now all set on orbit.

Hey, that's great.



It wasn't all business. Every shuttle crew gets special wake-up music each day, and we used "Tequila Sunrise" one morning.

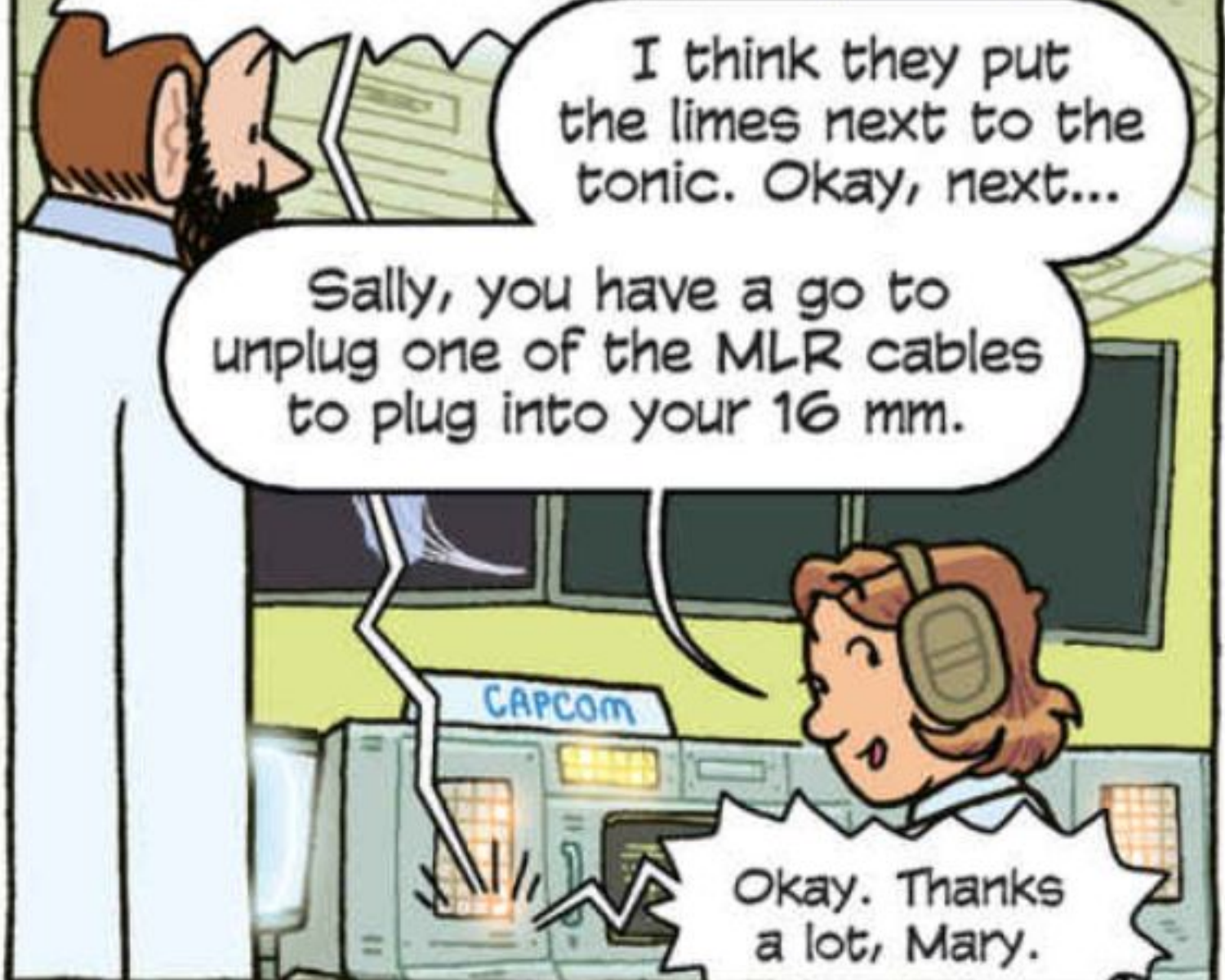
Yup. Hey, did you like that wake-up call?



Now you know why we're such a happy crew. We'd like to thank you for that wonderful PPK.

PPK = Personal Preference Kit. (Nobody's—male or female—included alcohol!)

Looking forward to dinner; we're wondering where they put the limes.



I think they put the limes next to the tonic. Okay, next...

Sally, you have a go to unplug one of the MLR cables to plug into your 16 mm.

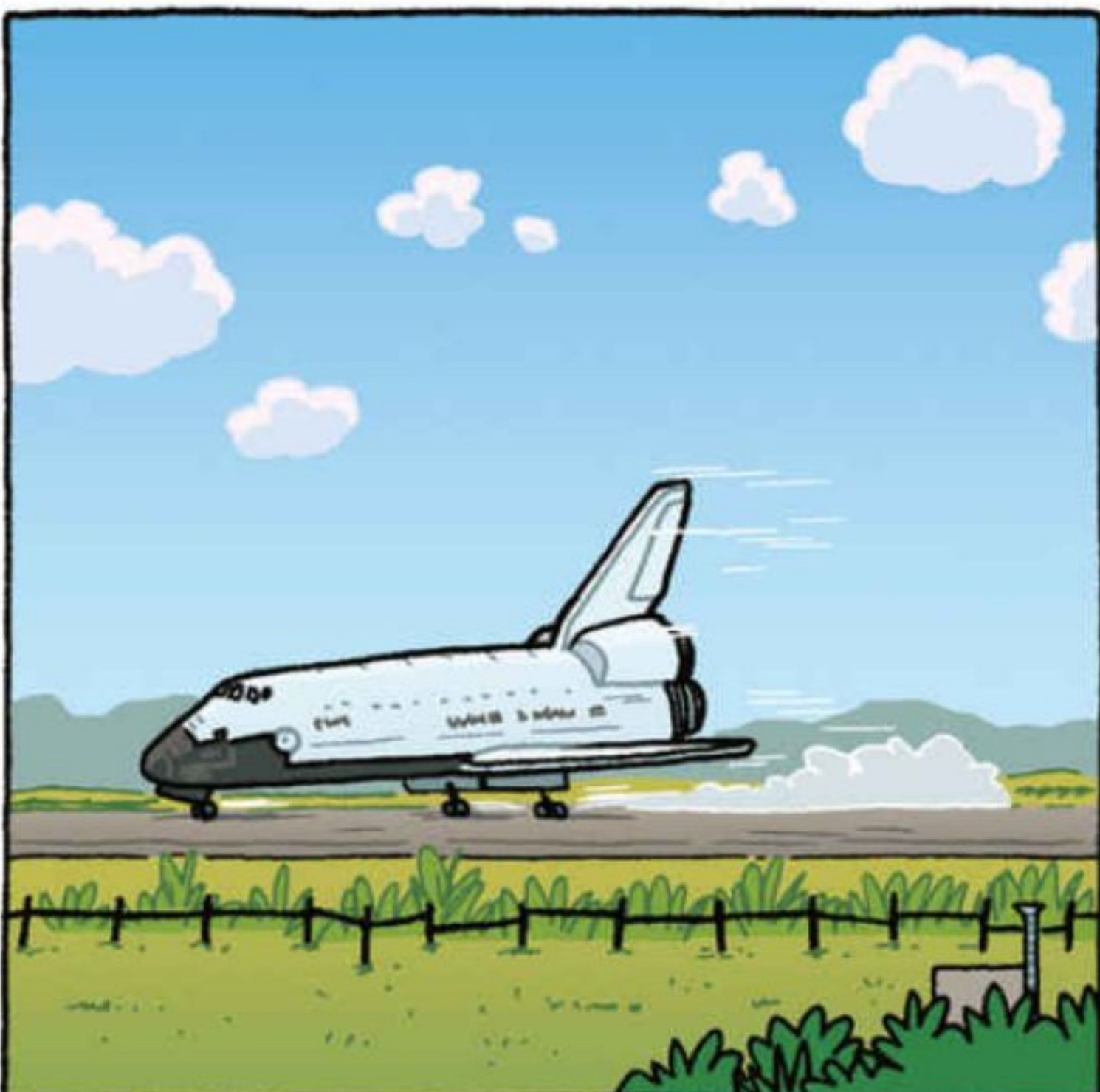
Okay. Thanks a lot, Mary.

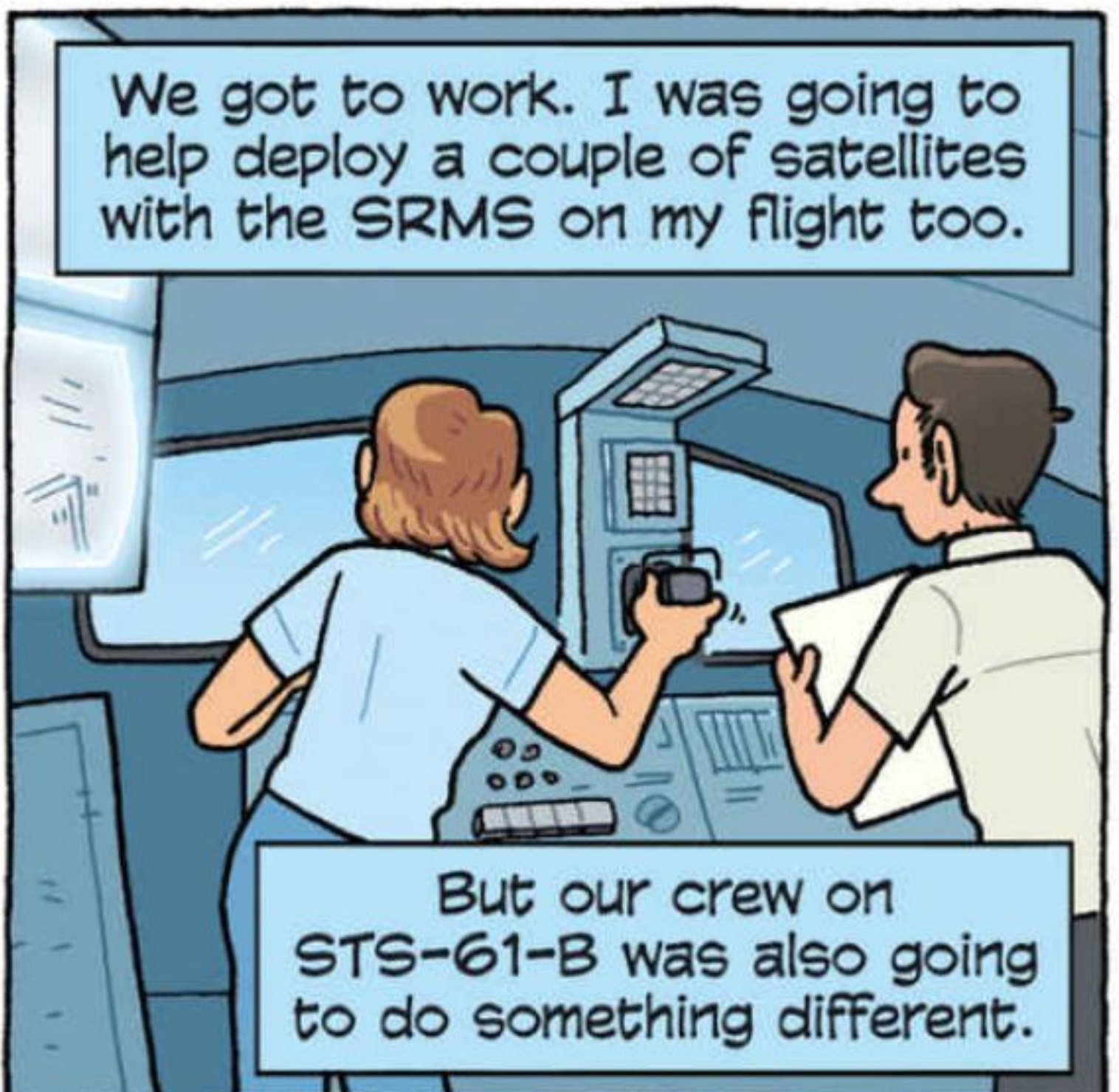
Also, we got a 35-mm shot to back up the MOMS data take of the ground track over Africa looking straight down.

We also cranked up the SRMS elbow camera and were able to VTR the MOMS's shutters closing.

Ah, very good. You're ingenious so early in the morning here.







We were going to start practicing to build the International Space Station.

Cleared the payload bay. Looking good.

That meant *astronauts* on the other end of that 50-foot arm you're moving.

Compared to a satellite they're relatively light, even when you add in over 250 pounds of spacesuit.

But when you add in the cost of the EVA suit and training, astronauts aren't cheap.

A little to the right, and...

Not to mention that they—we—are, ya know, *people!*

CLANG CLANG

Nope, you just banged him into the side of the shuttle. High chance of suit puncture—that's gonna make this a *baaad* day.

CLANG CLANG

I didn't practice on *real* people.

Rats. I should have seen that one coming. Sorry.

Okay, great, Mary. Captain Cardboard is positioned correctly, but now he tells you "I need to get more leverage on this bolt." What do you do?

TORQUE = FORCE X DISTANCE FROM FULCRUM

Can't make him stronger, so I increase the distance like...this, so we create a longer lever arm.

Roger that. Nice.

It's precision work at the end of a 15.2-meter, 410-kg robotic arm complete with wrist, elbow, and shoulder joints.

Fun!

Yeah, it is.

And it's a good thing you're having fun, because we're going to do it again.

And again.

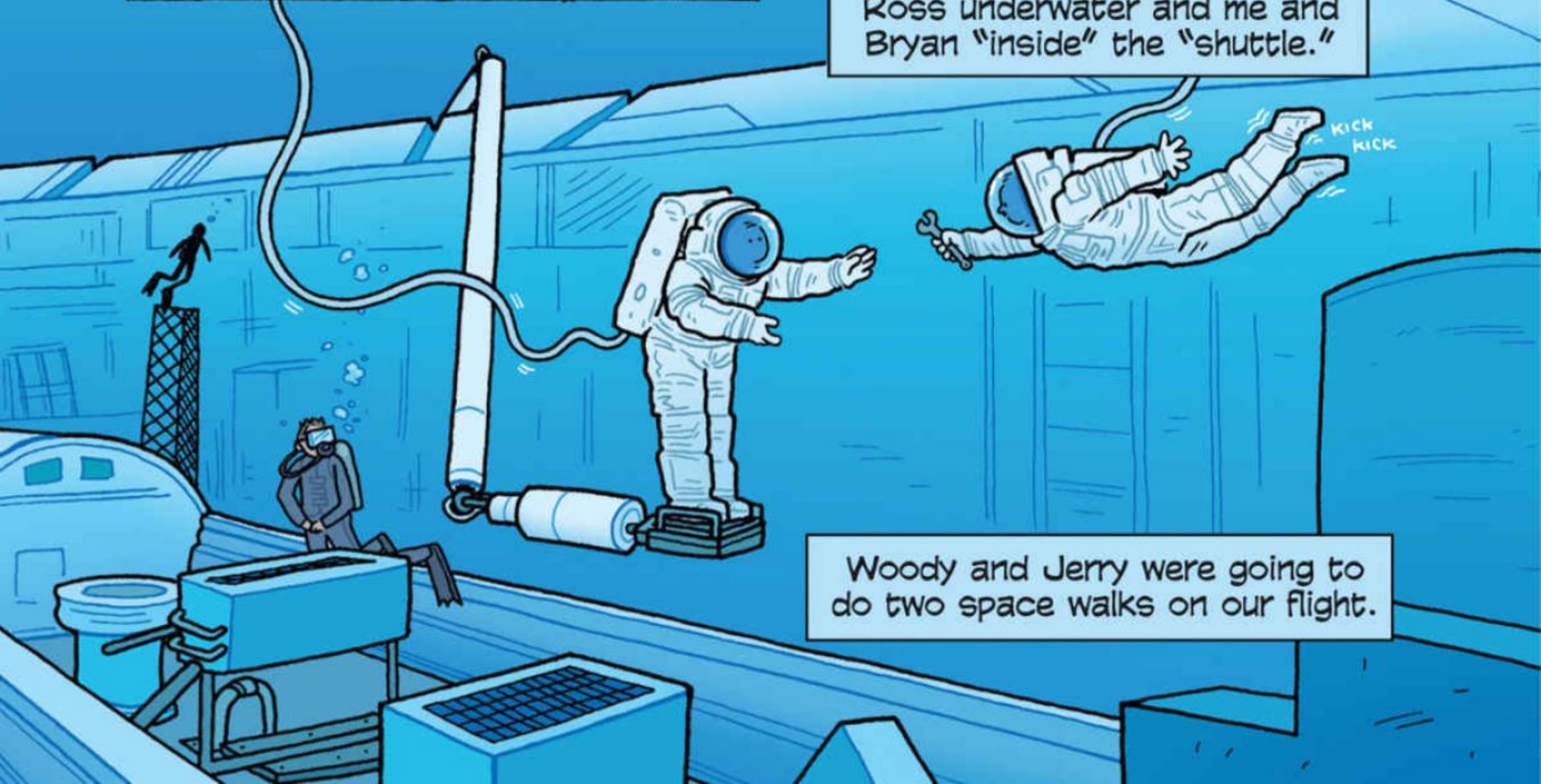
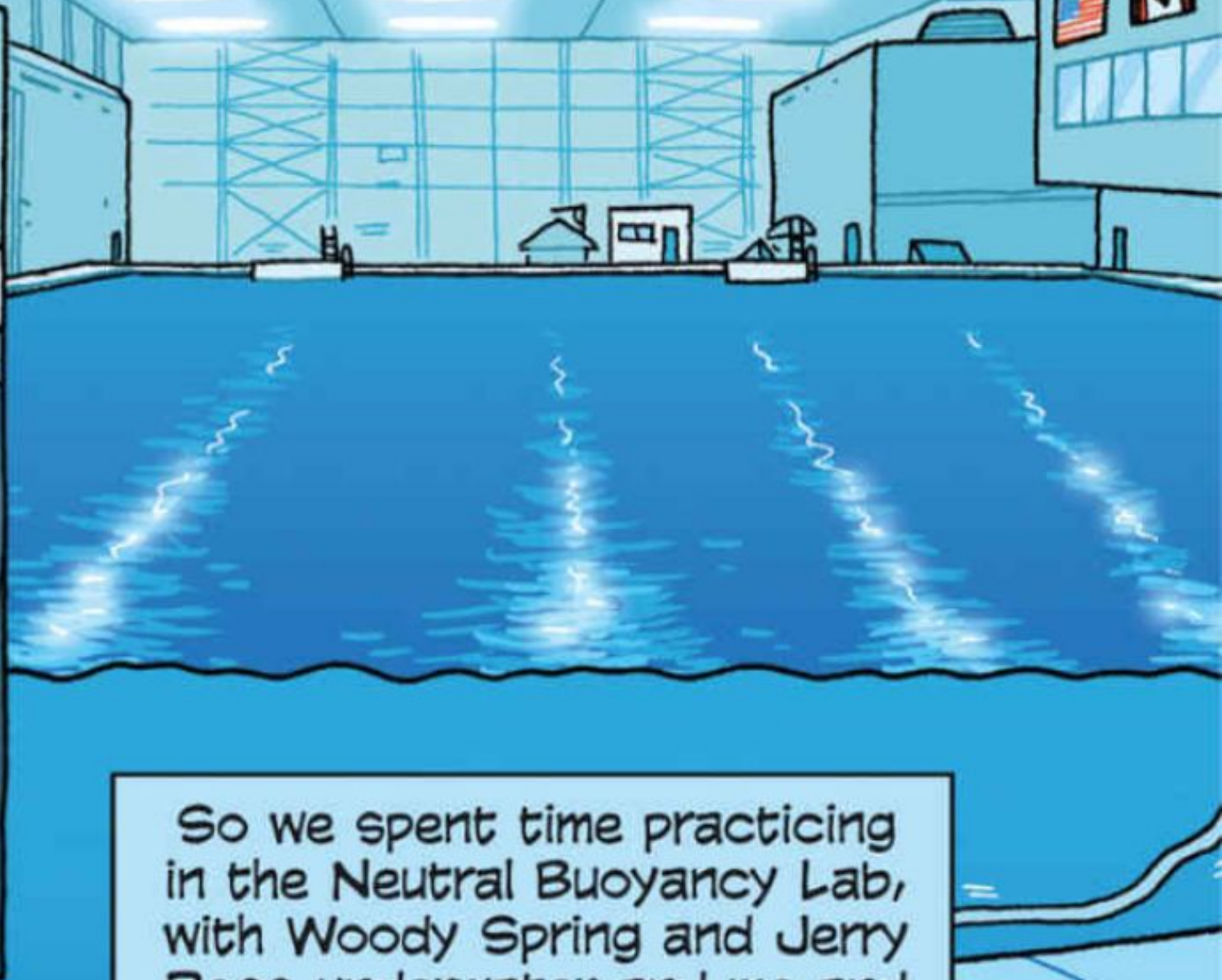
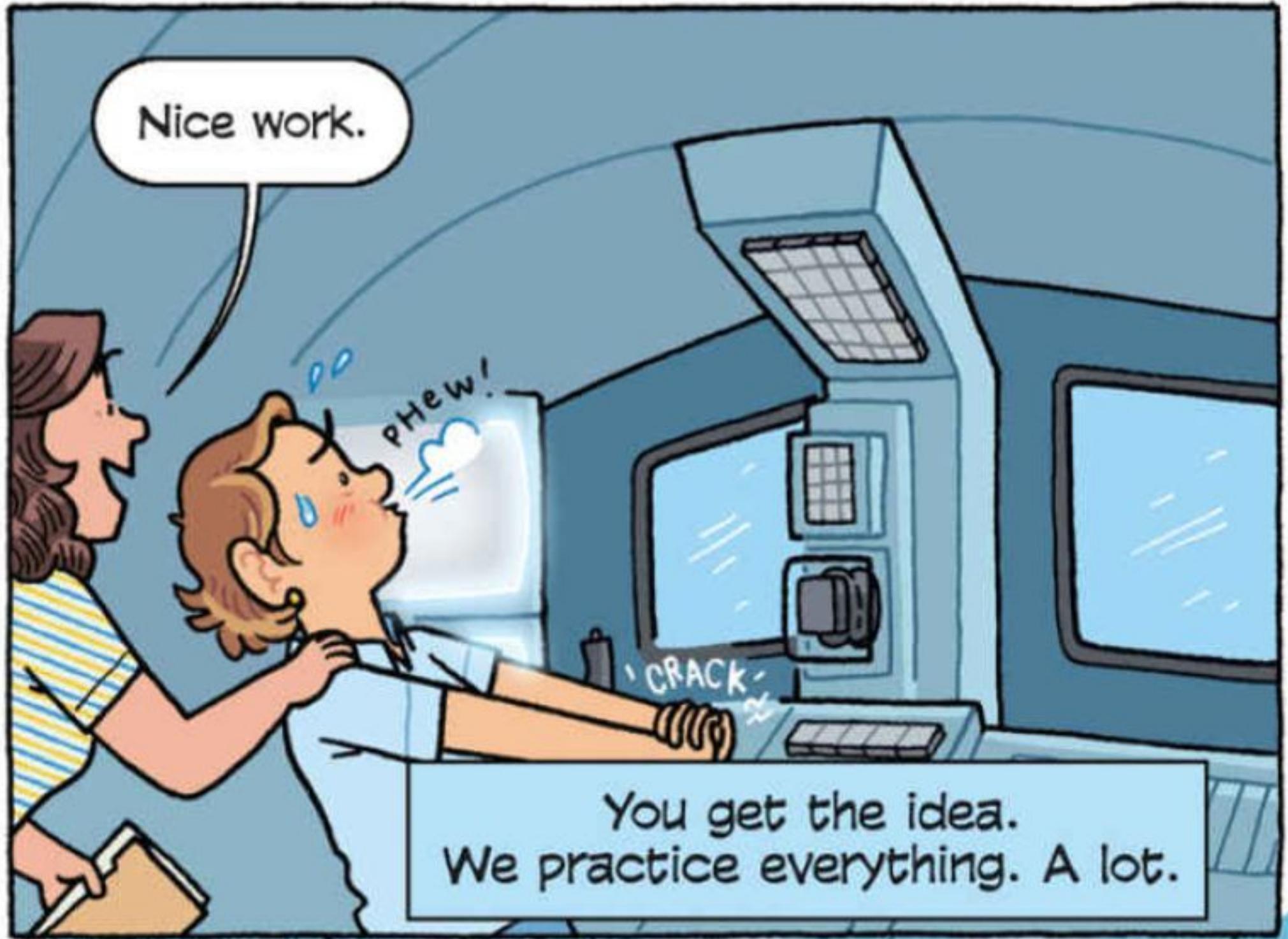
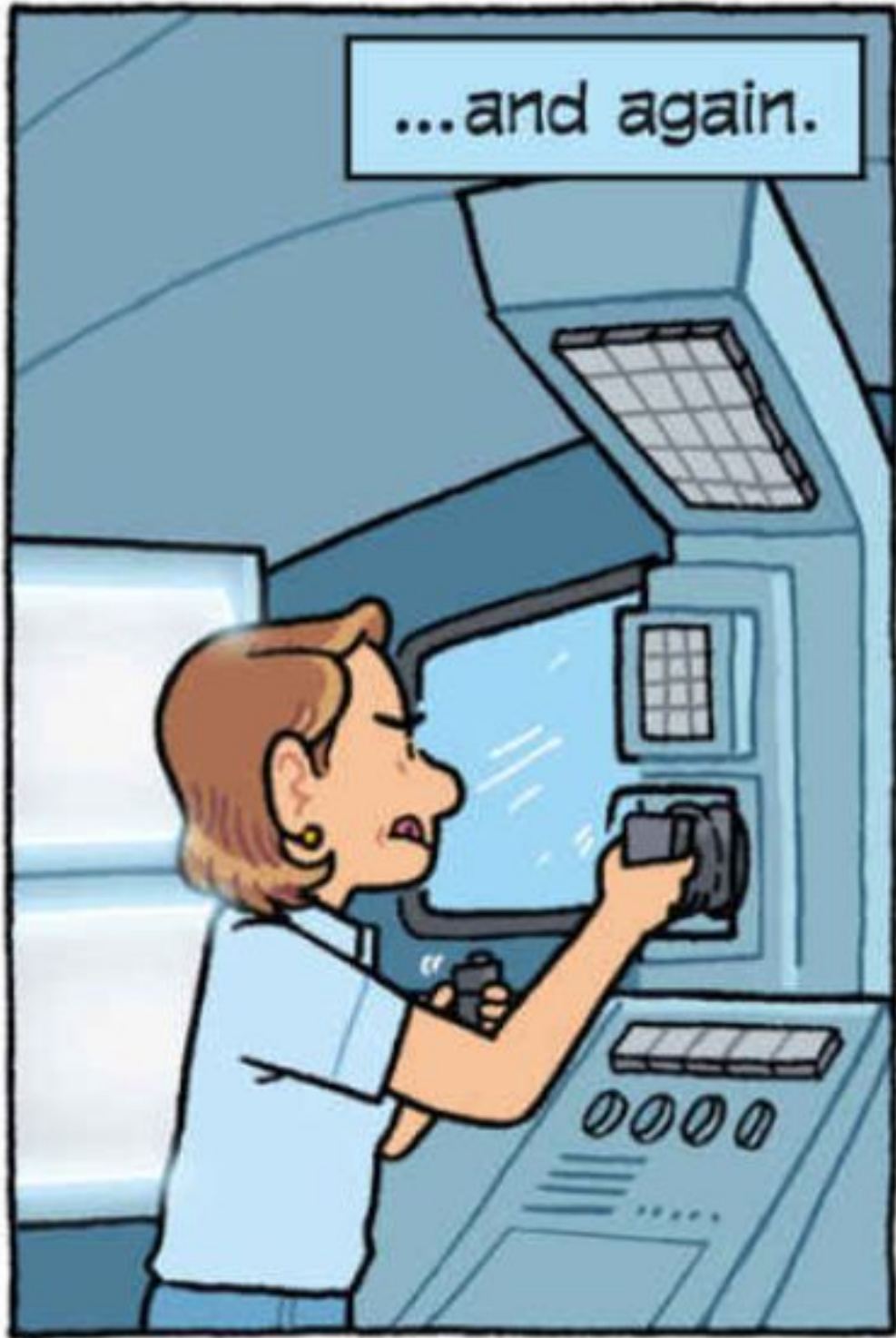
And again.

And again, blindfolded, simulating a loss of visual contact.

NEEEEE
NEEEEE
NEEEEE

And again, simulating a Canadarm failure.

And again.



We learned a lot, but knew that once we were in space, things would behave differently.

I'm a little worried about hand fatigue on a six-hour space walk.

Yeah, toward the end it's rough controlling the tools.



I mean, sure, they won't weigh anything up there. But they still have mass.

And you gotta hold 'em tight while your hand's inside this really stiff glove turned balloon.



And as always, we had a lot of lab experiments to run in the shuttle too, and scientists weren't always realistic with their plans.

Okay, the next step is to pour this into here.

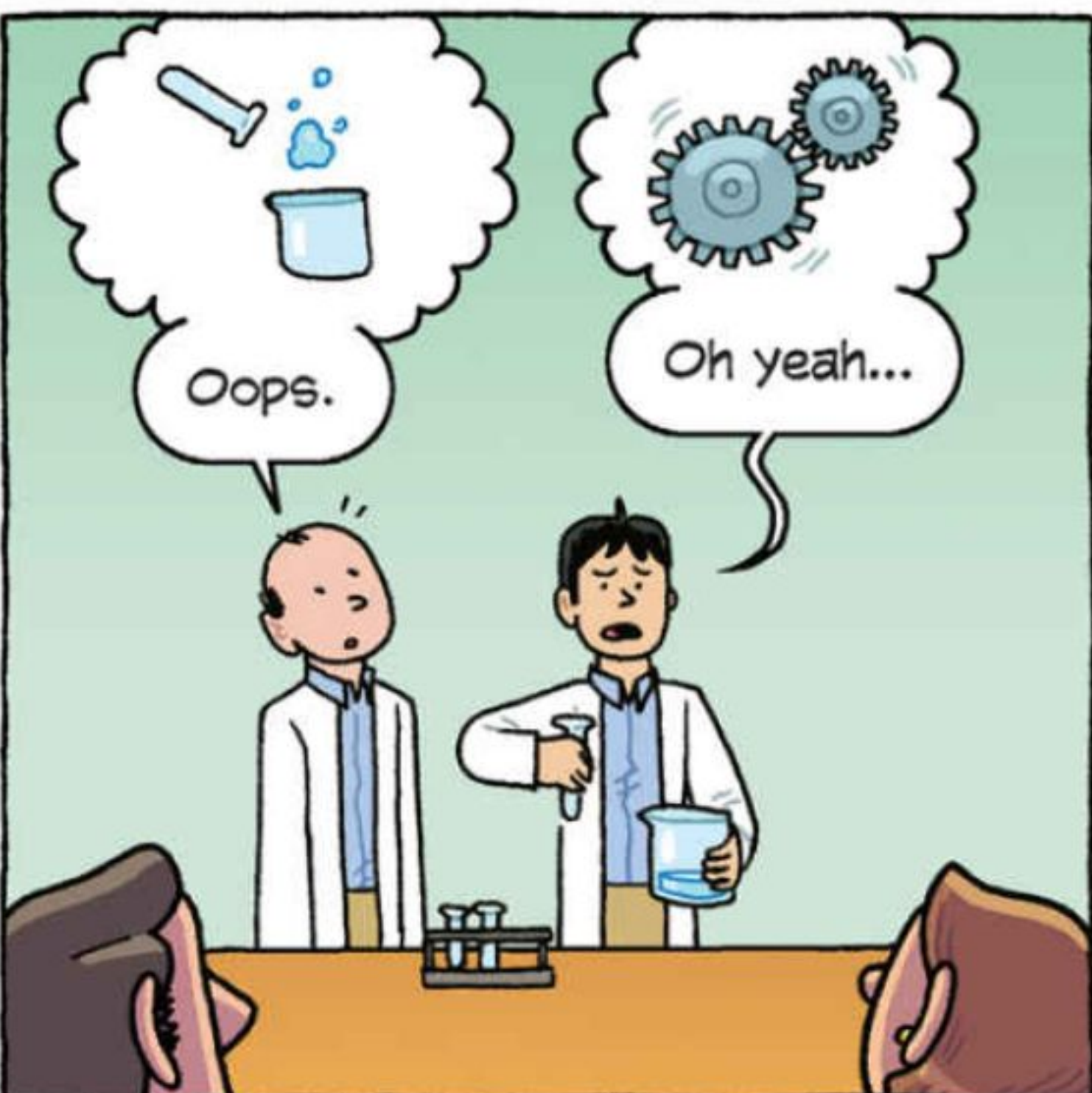


Okay, but remember, you can't actually pour anything in space.



Oops.

Oh yeah...

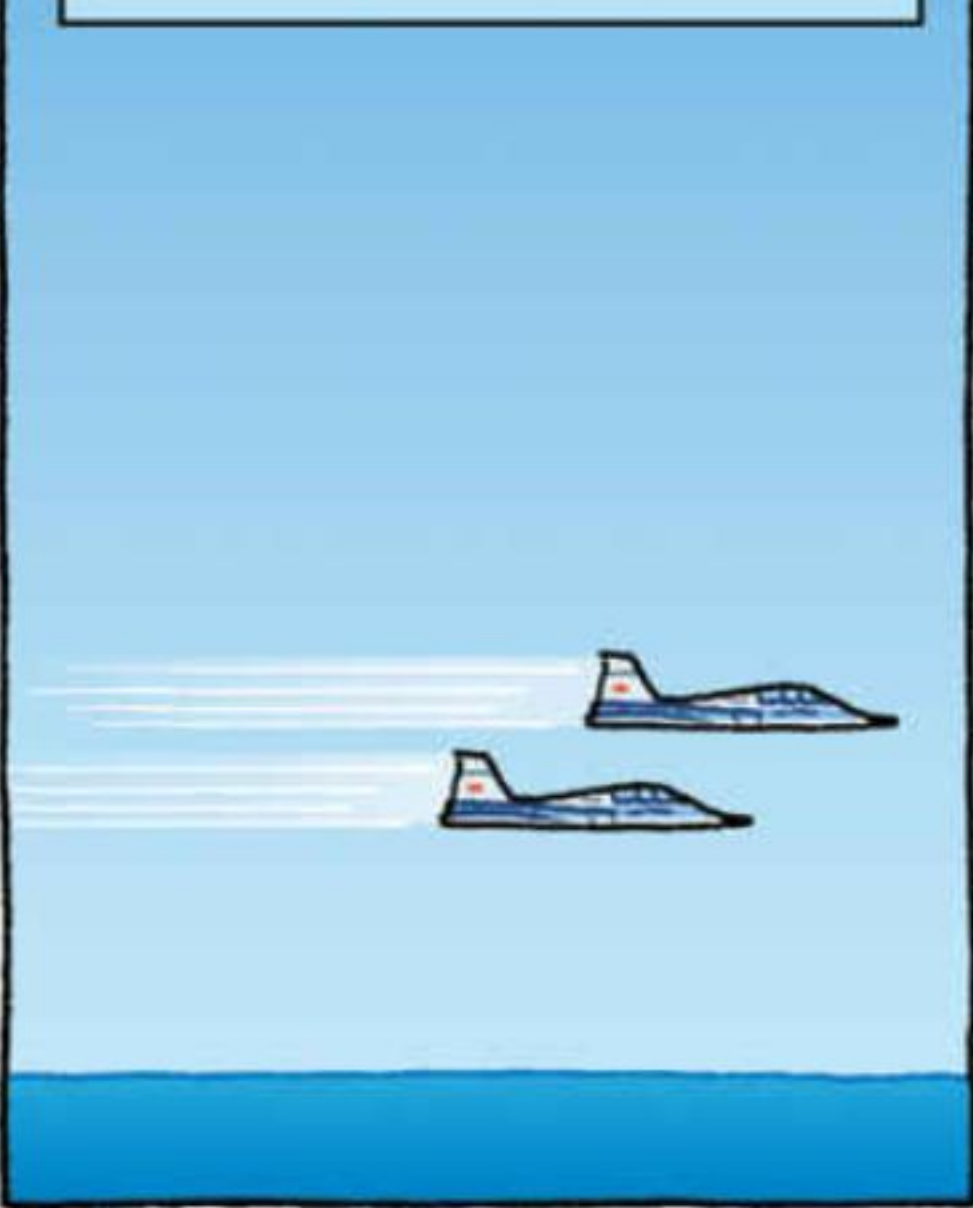


Um...we'll get back to you.

So we made things work. It was about two years of intense preparation.



It went by really fast. We were busy.



We solved a lot of problems in advance.



We were focused.



We were tight.



STS-61-B
27 NOVEMBER 1985
BREWSTER SHAW, COMMANDER
BRYAN O'CONNOR, PILOT
JERRY ROSS, MISSION SPECIALIST 1
MARY CLEAVE, MISSION SPECIALIST 2
SHERWOOD SPRING, MISSION SPECIALIST 3
CHARLES WALKER, PAYLOAD SPECIALIST 1
RODOLFO NERI VELA, PAYLOAD SPECIALIST 2

We got along really well.



So when November 1985 came around, we were ready.



Sure, it's natural to be nervous. And we were. But mostly, we were excited.



We were ready.

Just days before launch, you go into quarantine. You don't want to catch a cold before going into space.

Remember the thing about not being able to pour liquids up there?



Imagine having a stuffed-up nose in an environment where nothing drains.

Yuck.



So we said good-bye to our families. They were sad because we wouldn't be home for Thanksgiving.

But we were with friends, so it was okay.

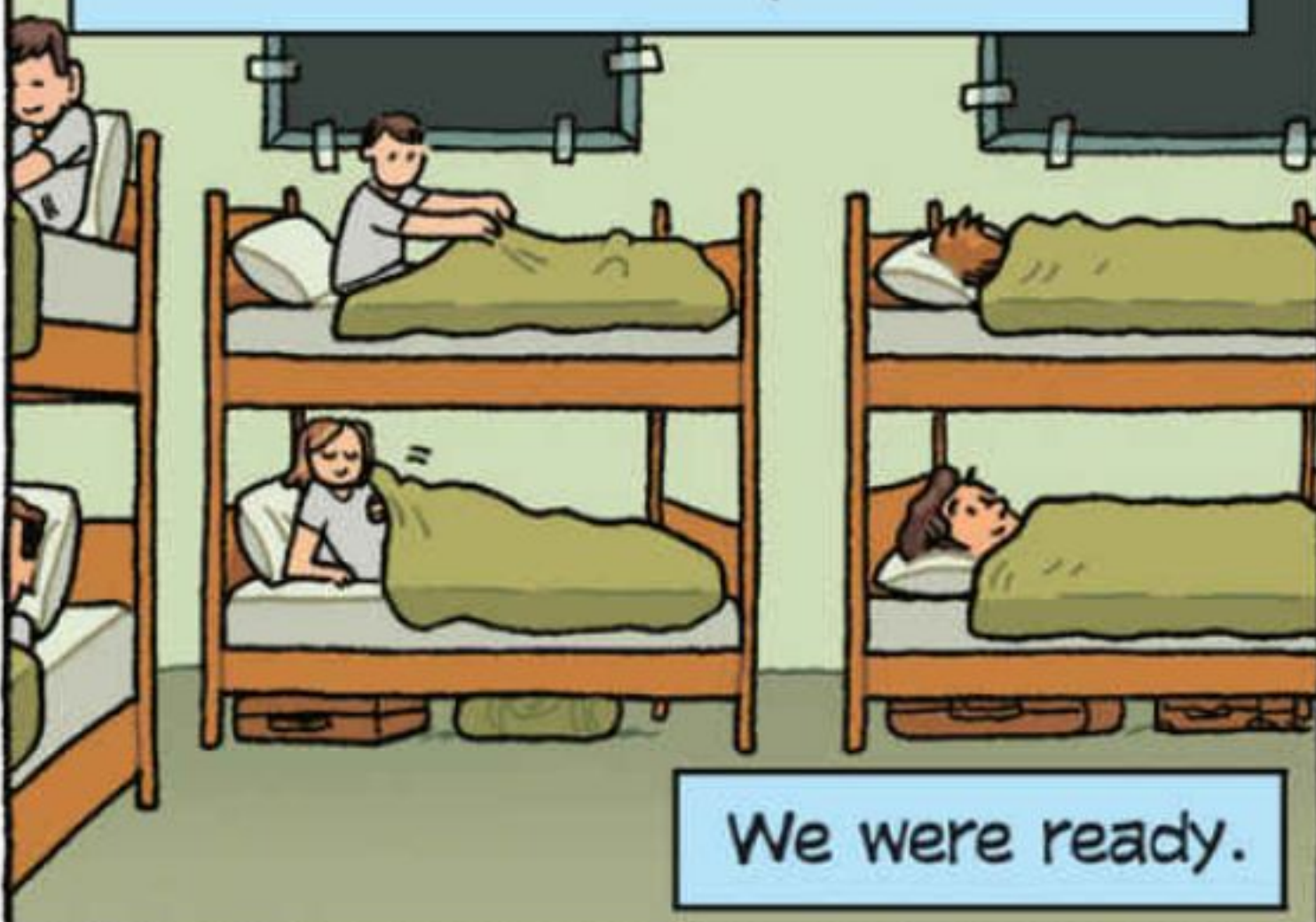


Okay, folks, it's 8 a.m. — time for bed.



We also had to shift our sleep schedule, since we were going to launch at night.

We'd been working hard for two years, so it wasn't too hard to fall asleep. (The blacked-out windows helped.)



We were ready.

I'm ready.

Let's go, let's go, let's...

Okay, first we'll...

Tomorrow!

ZZZZZZZZ

Estoy listo.

Can't wait.

Launch day meant breakfast in the afternoon. (Not that we could tell!) Rita Rapp, NASA's dietitian since the Mercury days, would make us anything we wanted.



I'll have one piece of toast, unbuttered, and a half a cup of coffee.



Most of us didn't take advantage of that. Too excited. Also, we were about to go through high-g followed by weightlessness.

And in between, a couple hours on the launch pad while we checked out the shuttle systems. So a full stomach didn't seem like a good idea.

We ate quickly, dressed in our flight suits, and headed out to the launch pad.



We'd practiced this over and over again too, and it sounds simple, right? Just get in a van.

Okay, guys, we've done this before.



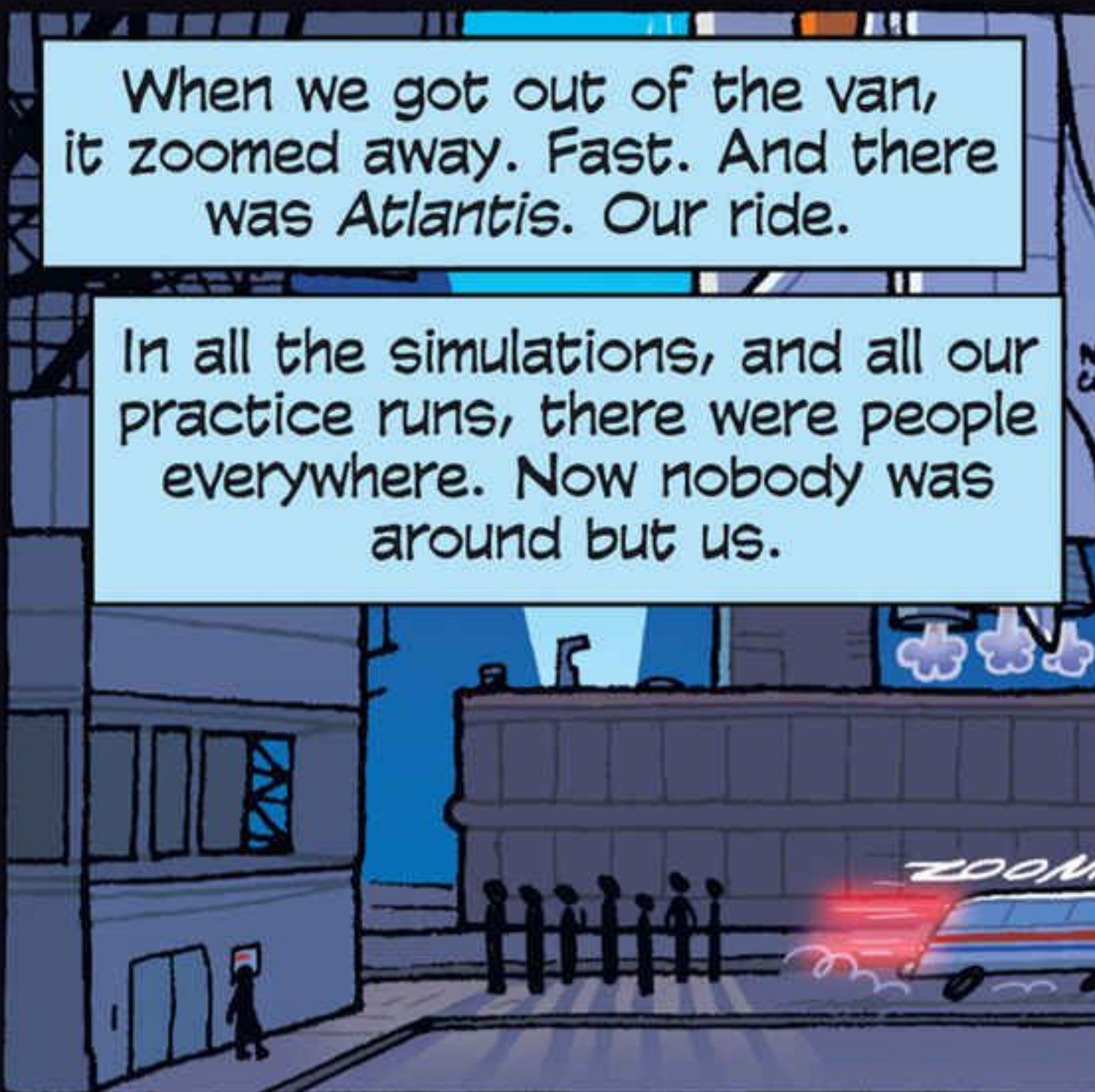
But this time we're not coming back in a few hours.

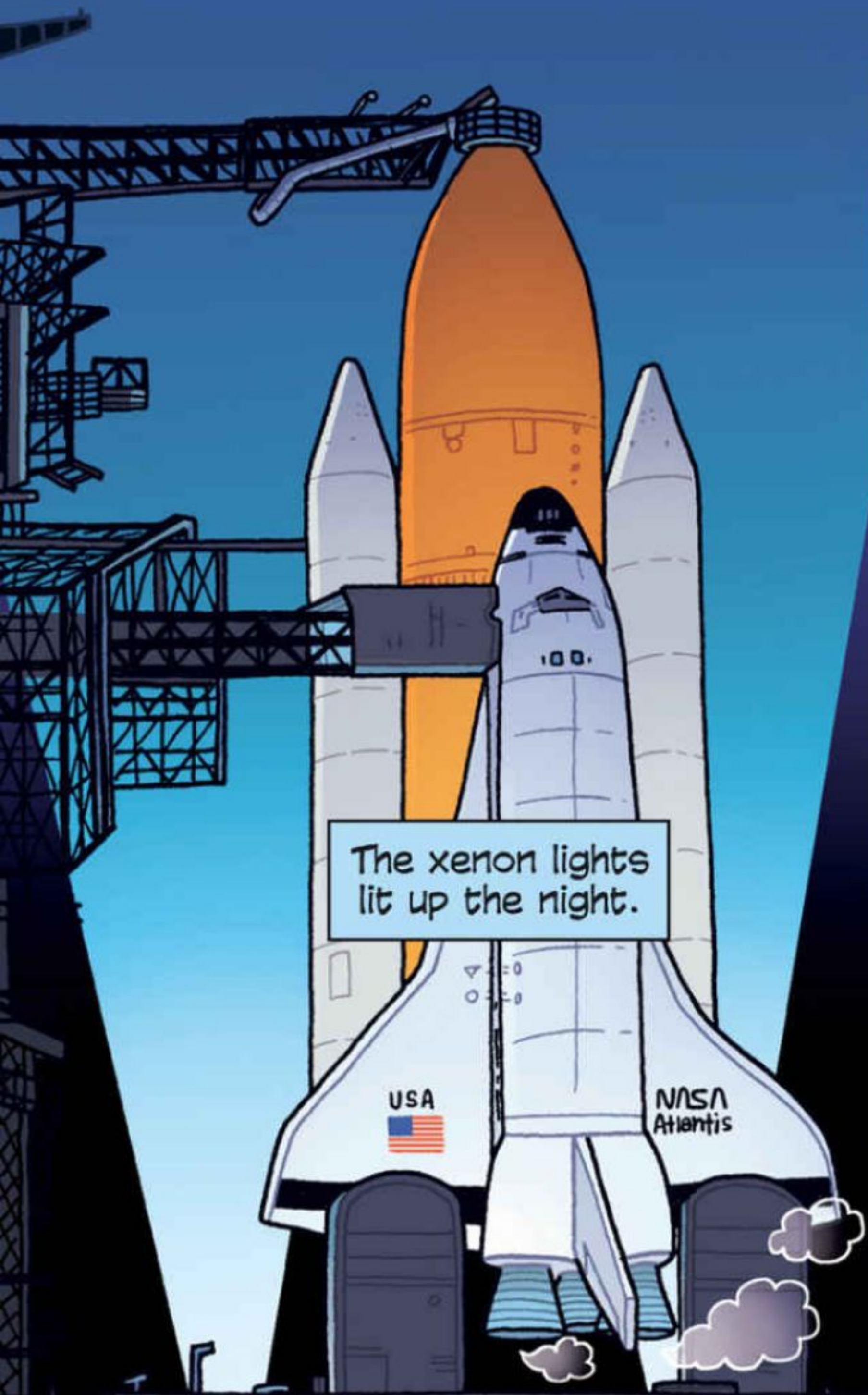


Okay, get together for a prayer.

?!







The xenon lights lit up the night.

They walked us across the orbiter access arm one by one.

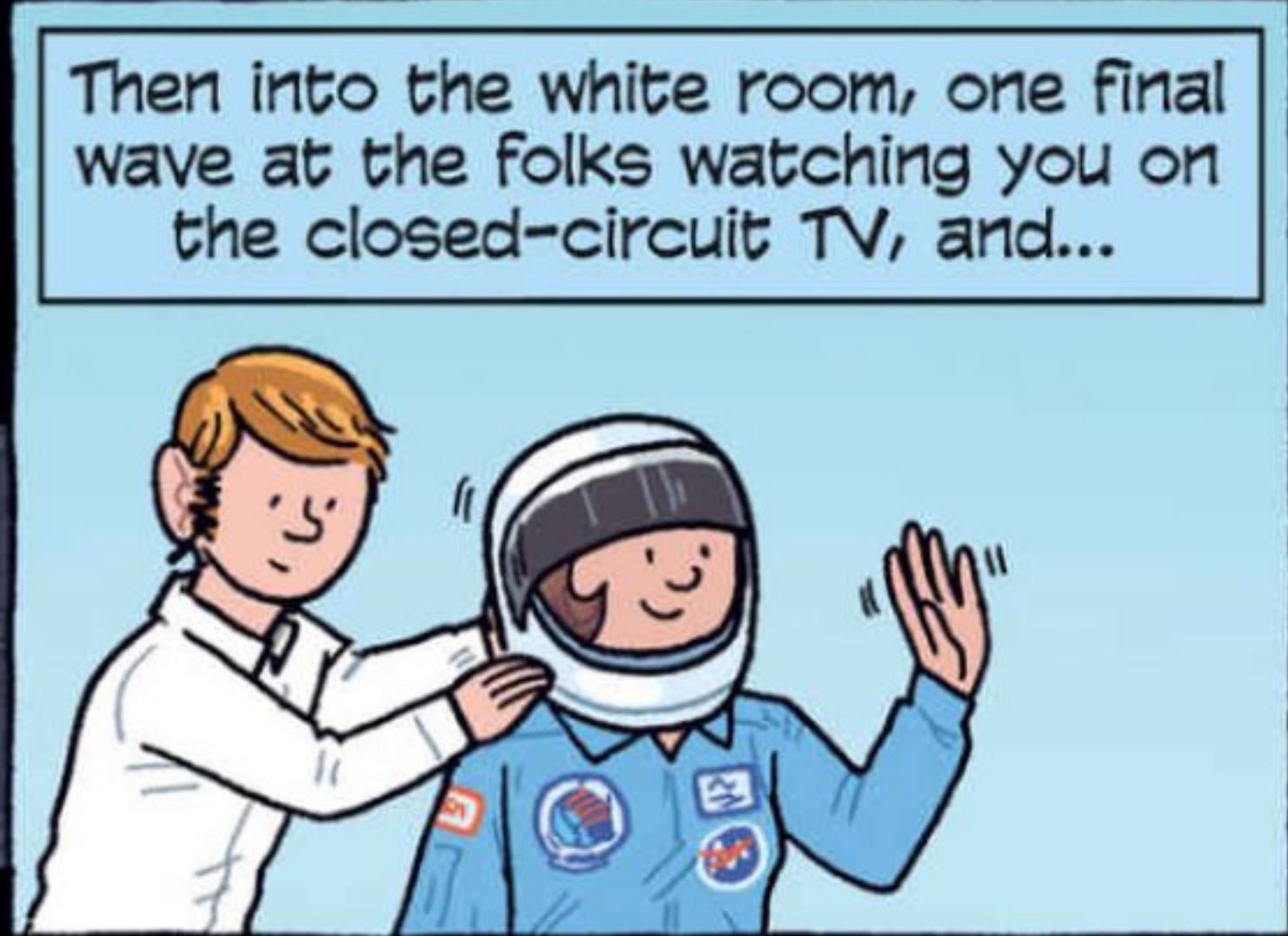


It took a while.

Anybody need to go? "Last Toilet on Earth" is right over there.



Then into the white room, one final wave at the folks watching you on the closed-circuit TV, and...



Really bright! We hadn't seen daylight for a while, but we were going to see a lot of sunrises from Atlantis.

One every ninety minutes or so, in fact.



...into our home for the next week.

Pretty small at 2,300 cubic feet—about the size of a couple of school buses.



Of course, soon we weren't going to be limited to standing on the floor. But still, not a lot of space for seven people to live.

Until then, and for the last hour and a half or so on Earth, we had a lot to do to make sure our home was ready to travel.



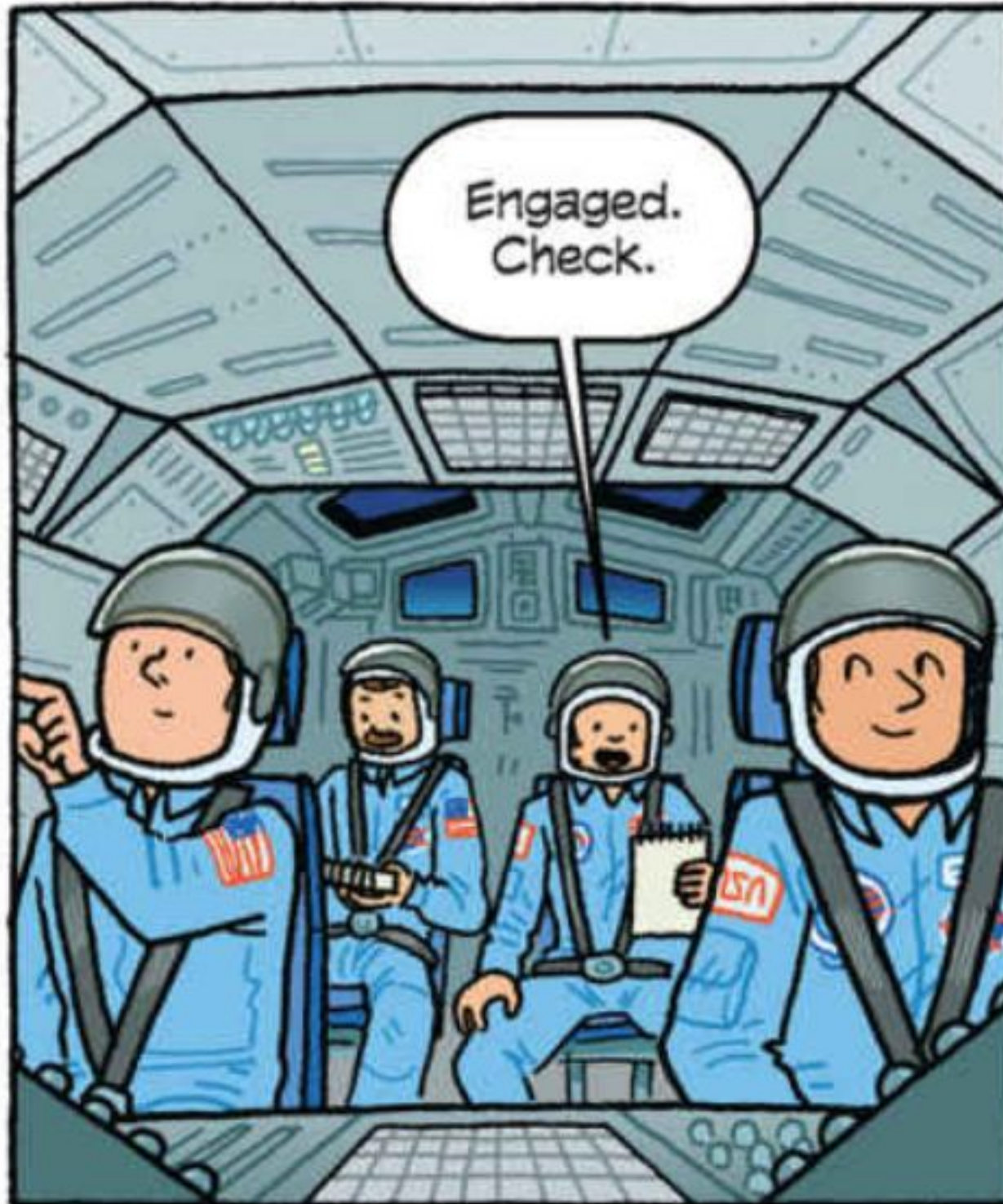
Okay, preflight check.



CLICK
CLICK



CLICK
CLICK
CLICK



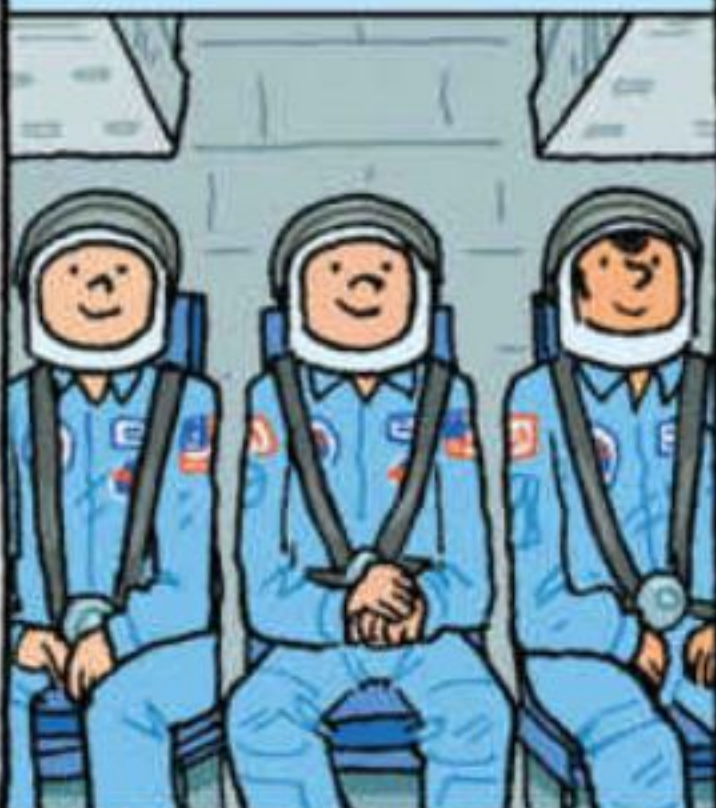
Engaged.
Check.



Affirmative
on that, Mary.

Our visors were up, so we had good conversation.

For this launch, I was on the flight deck, and was going to have a great view. Woody, Charlie, and Rodolfo were below.



When the time came to go...

Close visors.

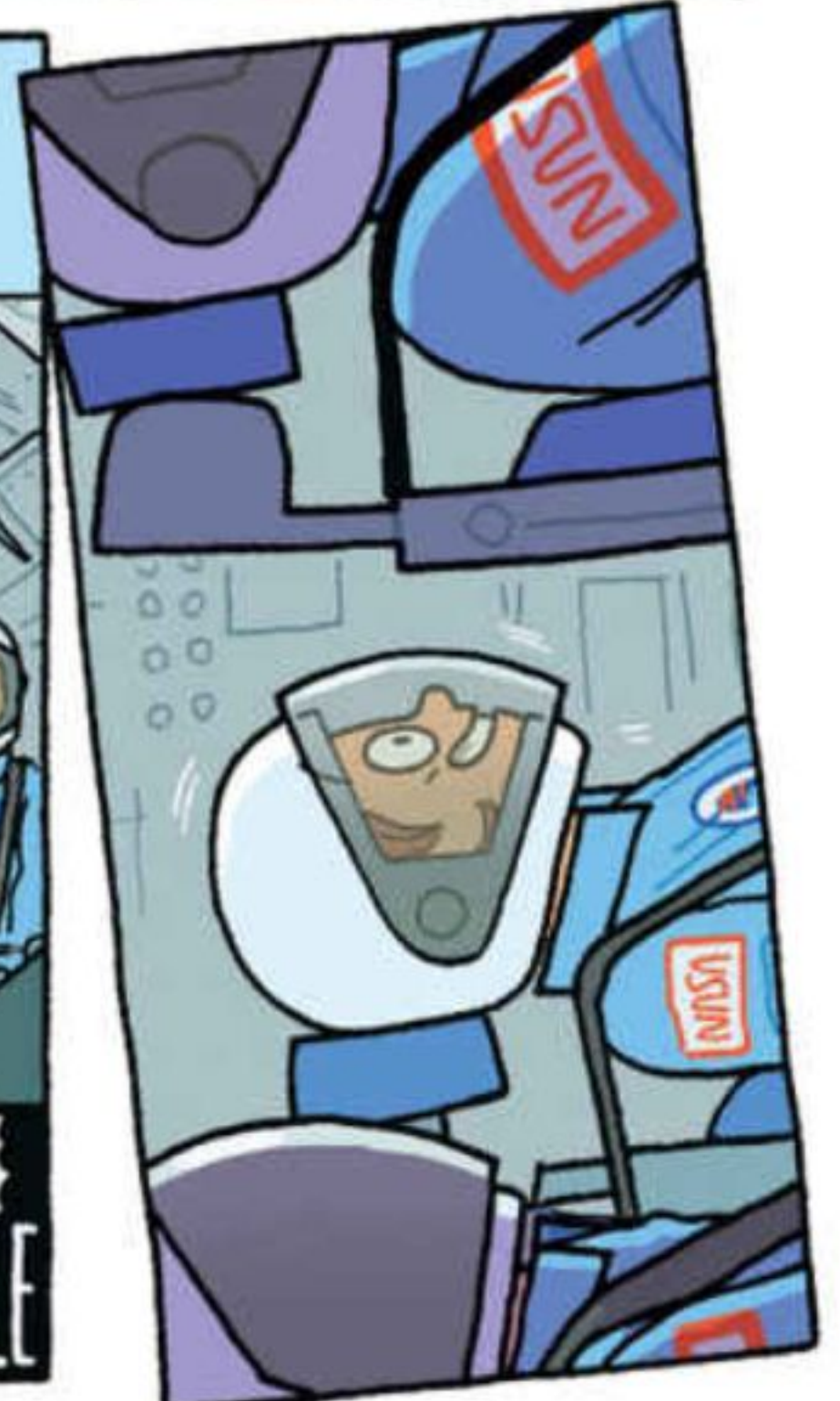


We all heard the same rumble and felt the same...



Ten...nine...eight...

RRRUUMMBBLLLE







There's a bit of sway as the liquid fuel rockets fire. Then the solid ones fire and you



...straighten up again. And it looks like the tower is moving, but it's not

And it feels like a giant

...in the back of your seat, and solid rocket boosters burn and you shake and they burn for two minutes

WHOOOF
WHOOOF

RUMBLE
SHAKE



ROAR

RUMBLE
RUMBLE RUMBLE
RUMBLE RUMBLE
RUMBLE RUMBLE
RUMBLE RUMBLE

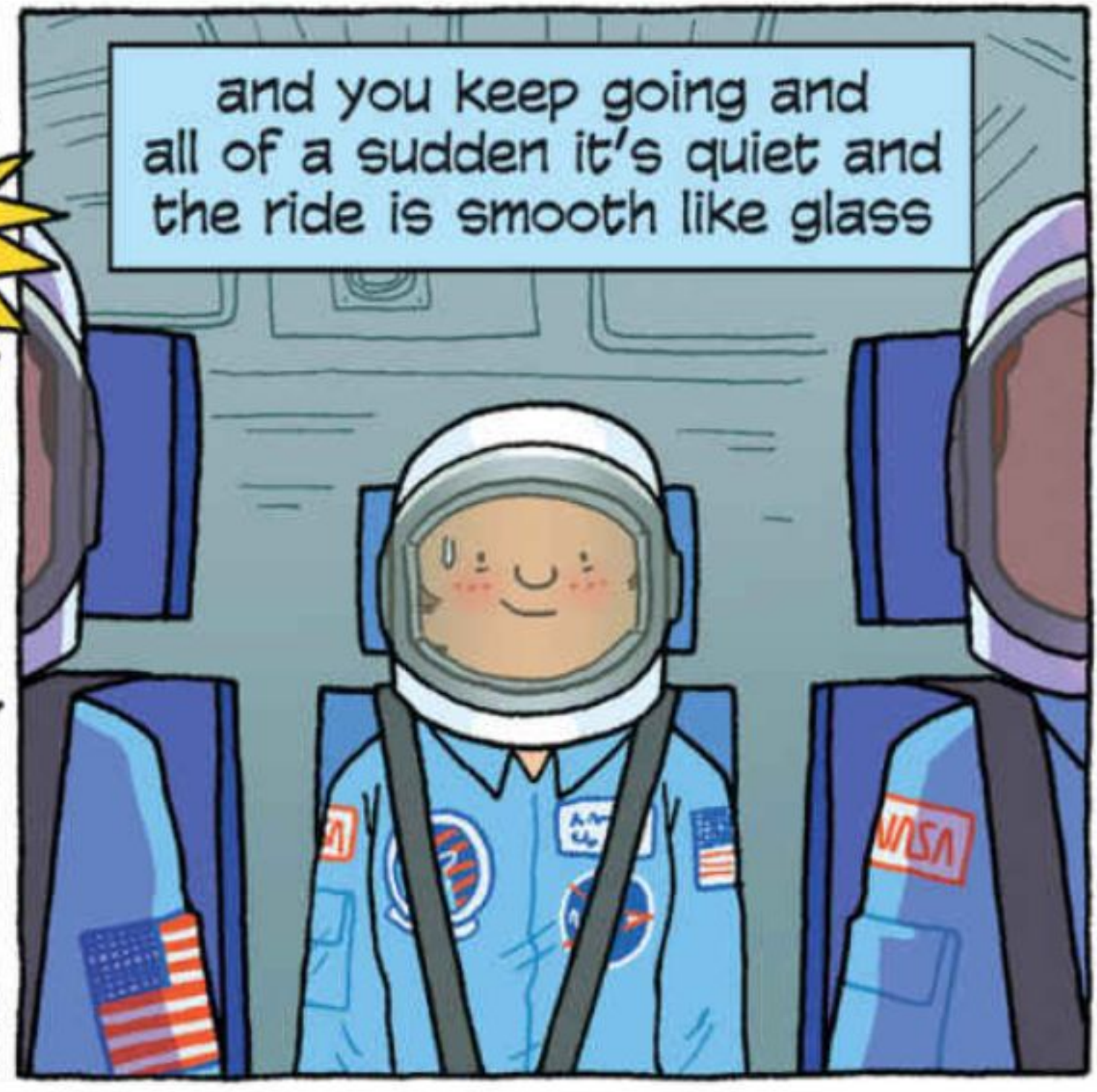


and the world falls away and it's

SHAKE SHAKE SHAKE

and the solid rockets burn out and separate from the shuttle and you're in the middle of

BB
OOA
ON
MG



and you keep going and all of a sudden it's quiet and the ride is smooth like glass

and we're not done yet because we're not in orbit, so the engines pick back up again and acceleration builds and pressure



and it's like a big monkey sitting on your chest and the monkey gets heavier



and heavier



and heavier



and heavier

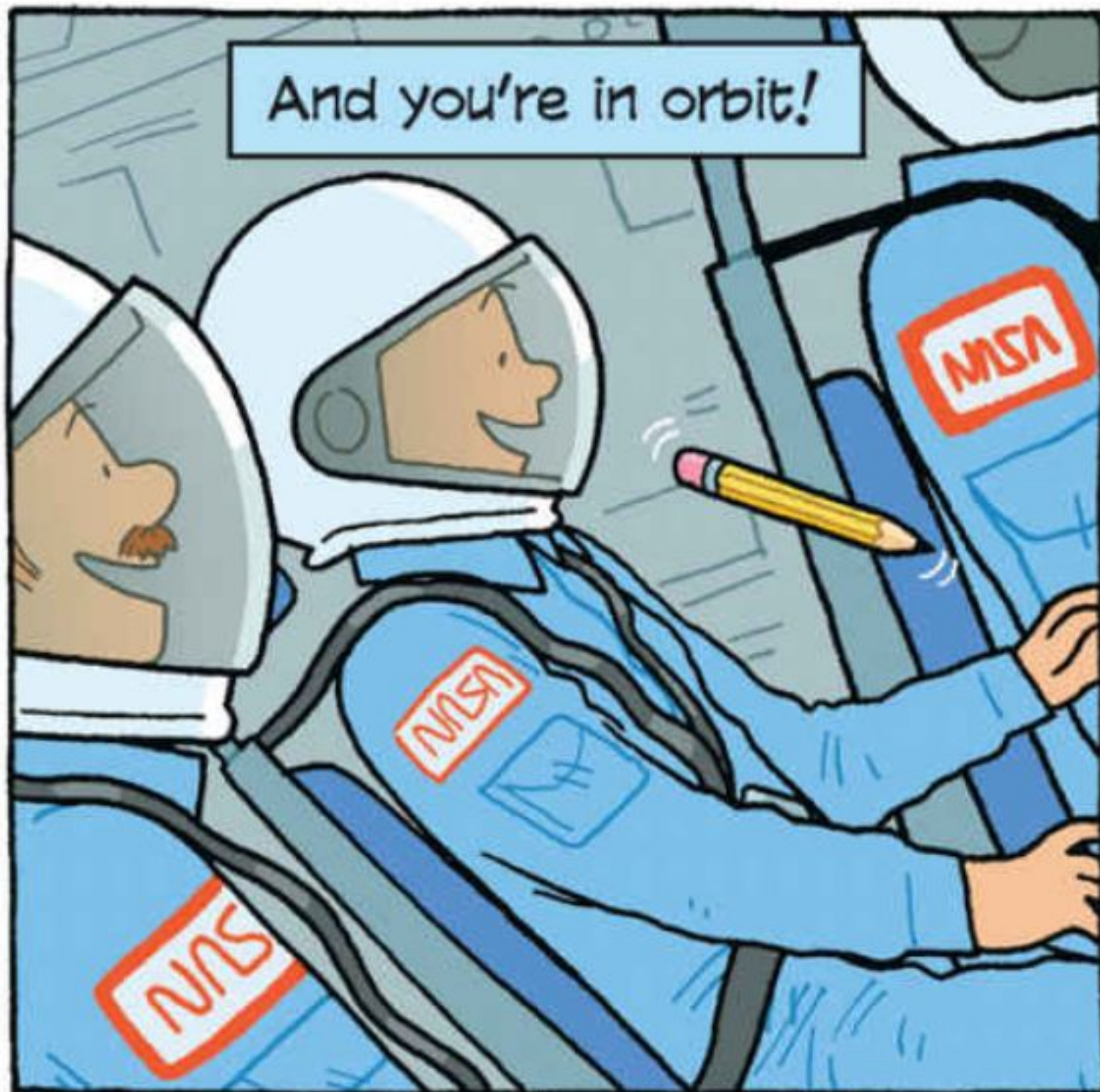


and heavier and your arm weighs three times too much and you have trouble breathing



and then. And then it disappears.

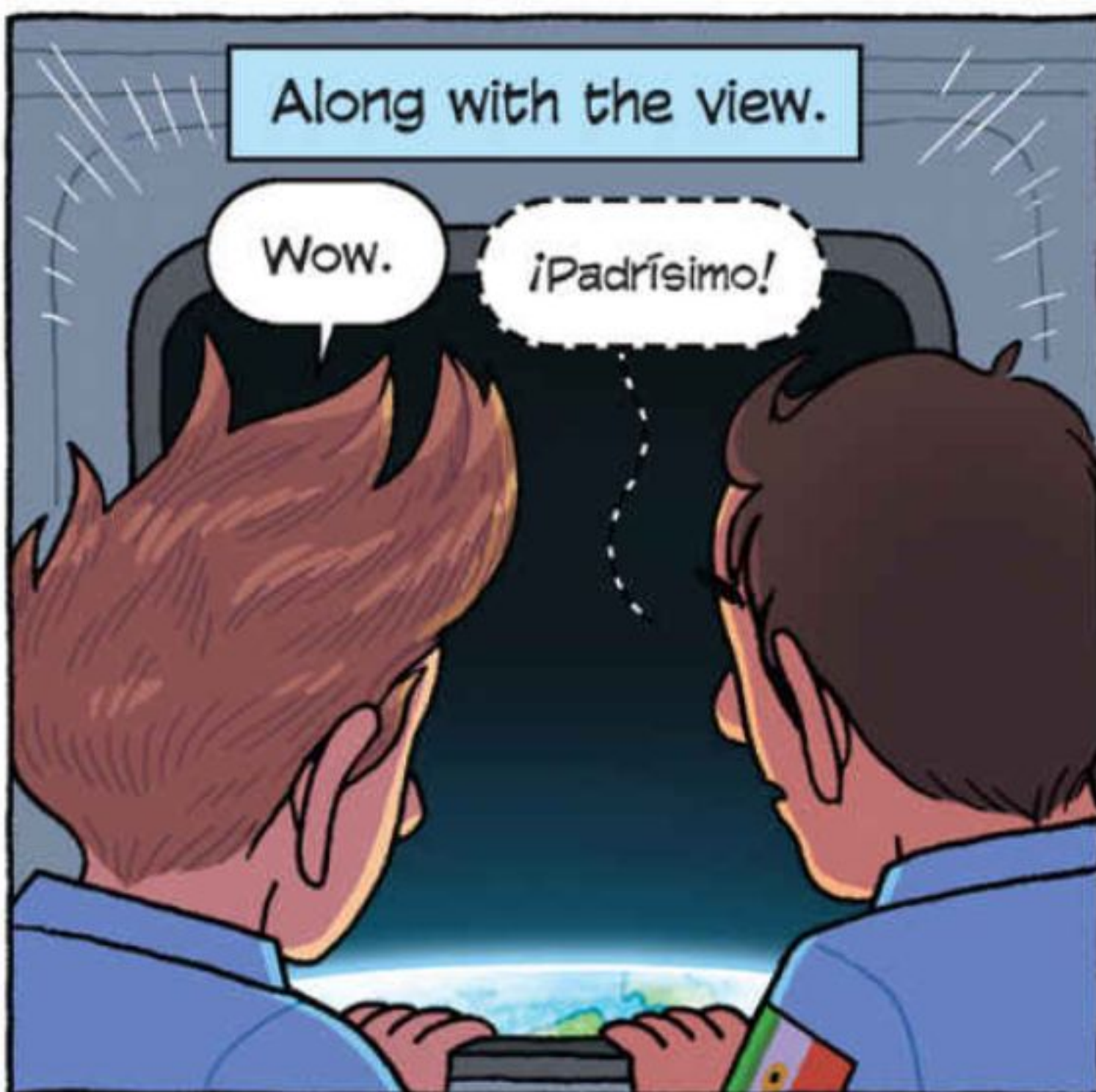




And you're in orbit!



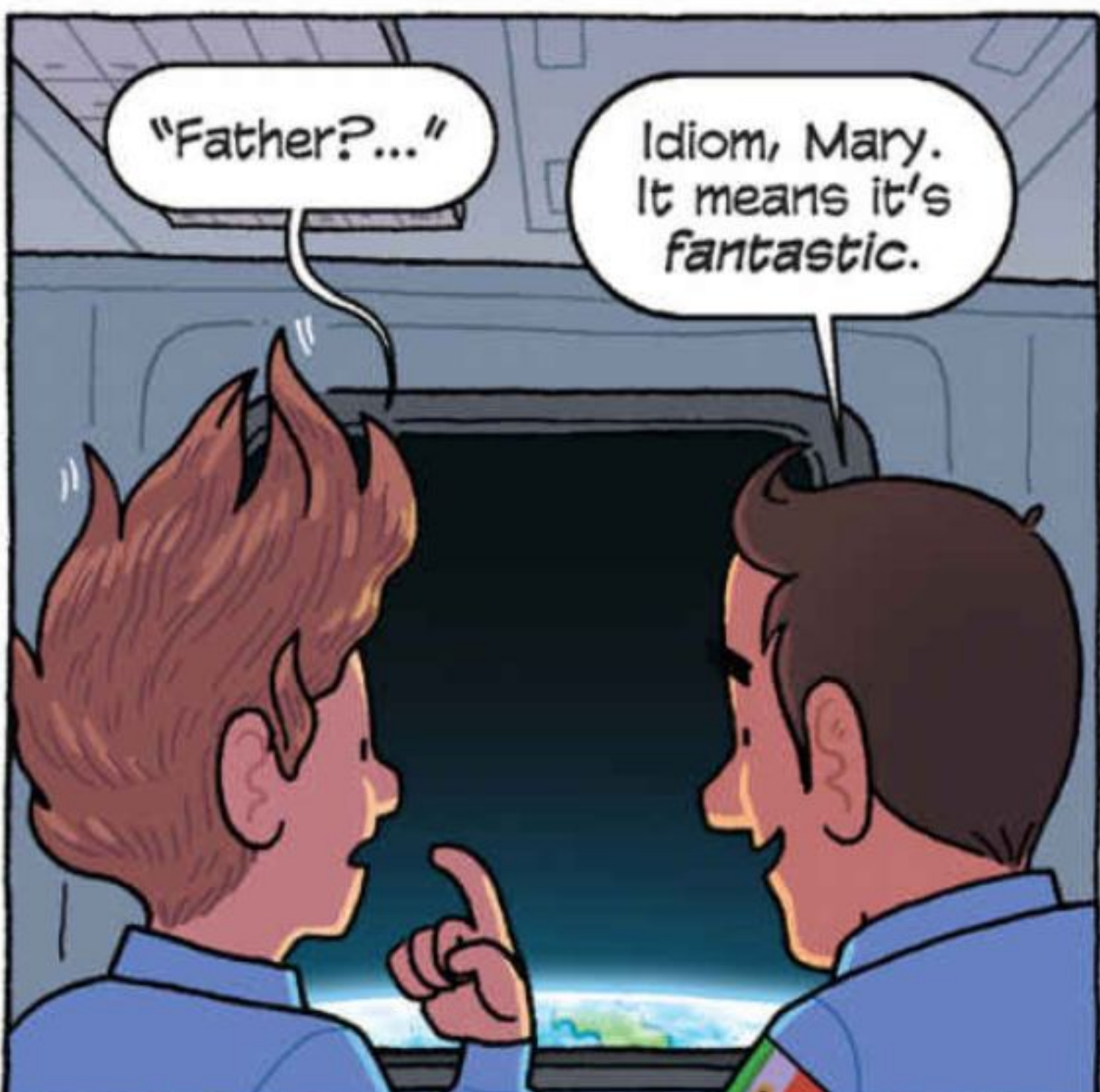
We enjoyed weightlessness for a few minutes.



Along with the view.

Wow.

¡Padrísimo!



"Father?..."

Idiom, Mary. It means it's *fantástico*.



Yeah. You can say that again.

It really was fantastic. It was also time to get to work.

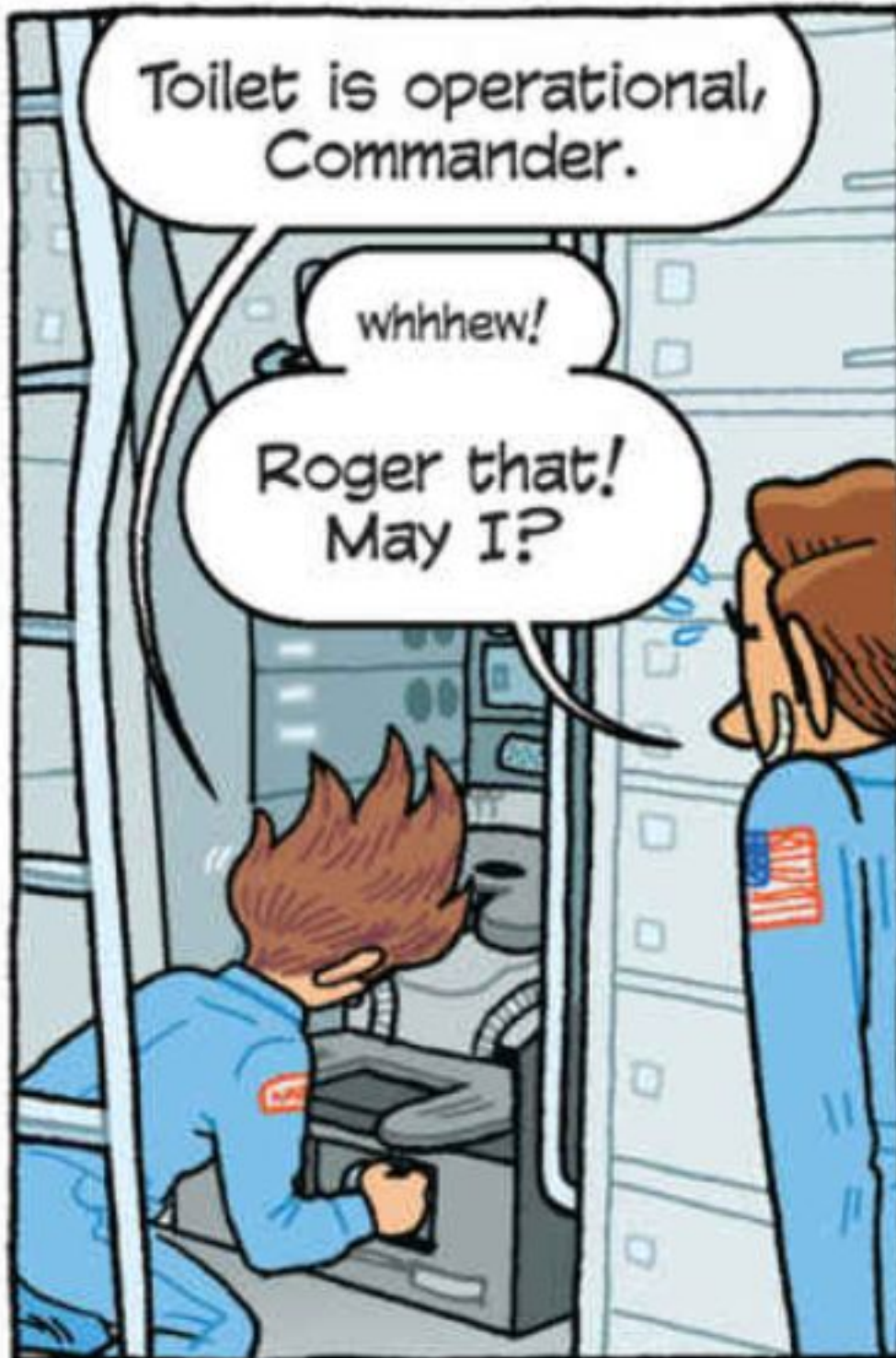


Whoa.
Whoops!
Excuse me.

The shuttle felt a lot roomier now that we weren't stuck to the floor. But navigating in 3-D and zero g takes some getting used to. You don't need much strength to get moving fast.



It had been hours since our last chance at a toilet, so one of the first jobs was to get the head up and running.



Toilet is operational, Commander.
Whhhew!
Roger that! May I?



Be my guest.

We had a lot to do, and us first timers in zero g didn't want to "zing the gyros" by moving too fast, too soon. So we got right to it. Some had a little to eat first.



Urgh. No thanks, maybe later.

Not all of us felt like doing that right away, though.

I was the flight engineer on STS-61-B, so I had to be able to find our navigation stars in case we needed backup for the star tracker device.

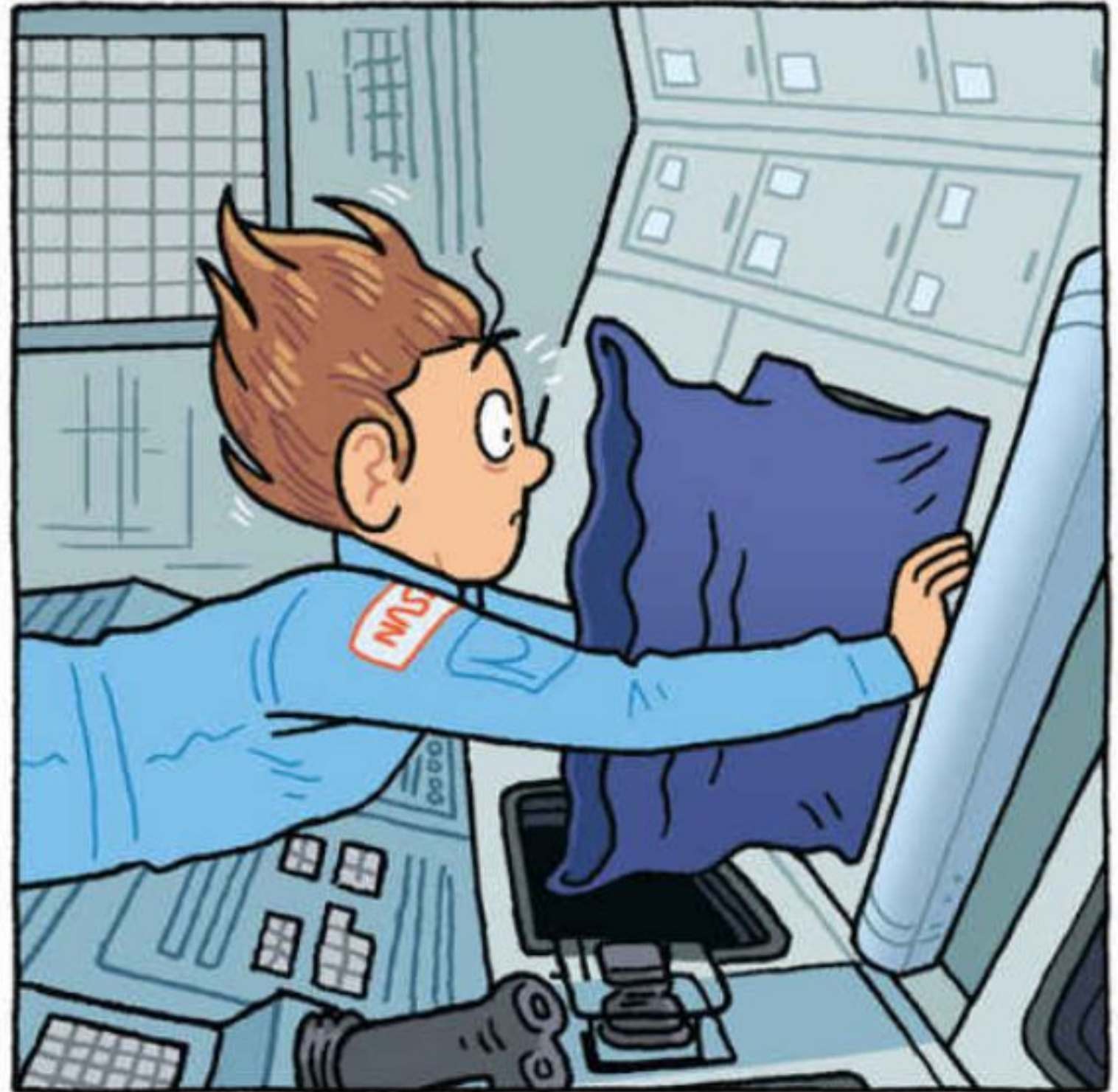


So you gotta adapt your eyes to the dark. You have a bag that you put around the window, then you look out and you find your nav stars.



You know, before you really need 'em!

So my first day up on orbit I go into the little bag, hang out. And I look out...



And I mean... you have never *seen* the stars.



Even if you've been out in a dark sky, you've never *seen* the stars without an atmosphere in the way, and messing with your view!



I mean, air is *not* overrated, but...



It's...
it's breathtaking.

And then I think...



@#\$%!
I'm never going to
find the nav stars.

I'm used to seeing
just a constellation or
two, and now...

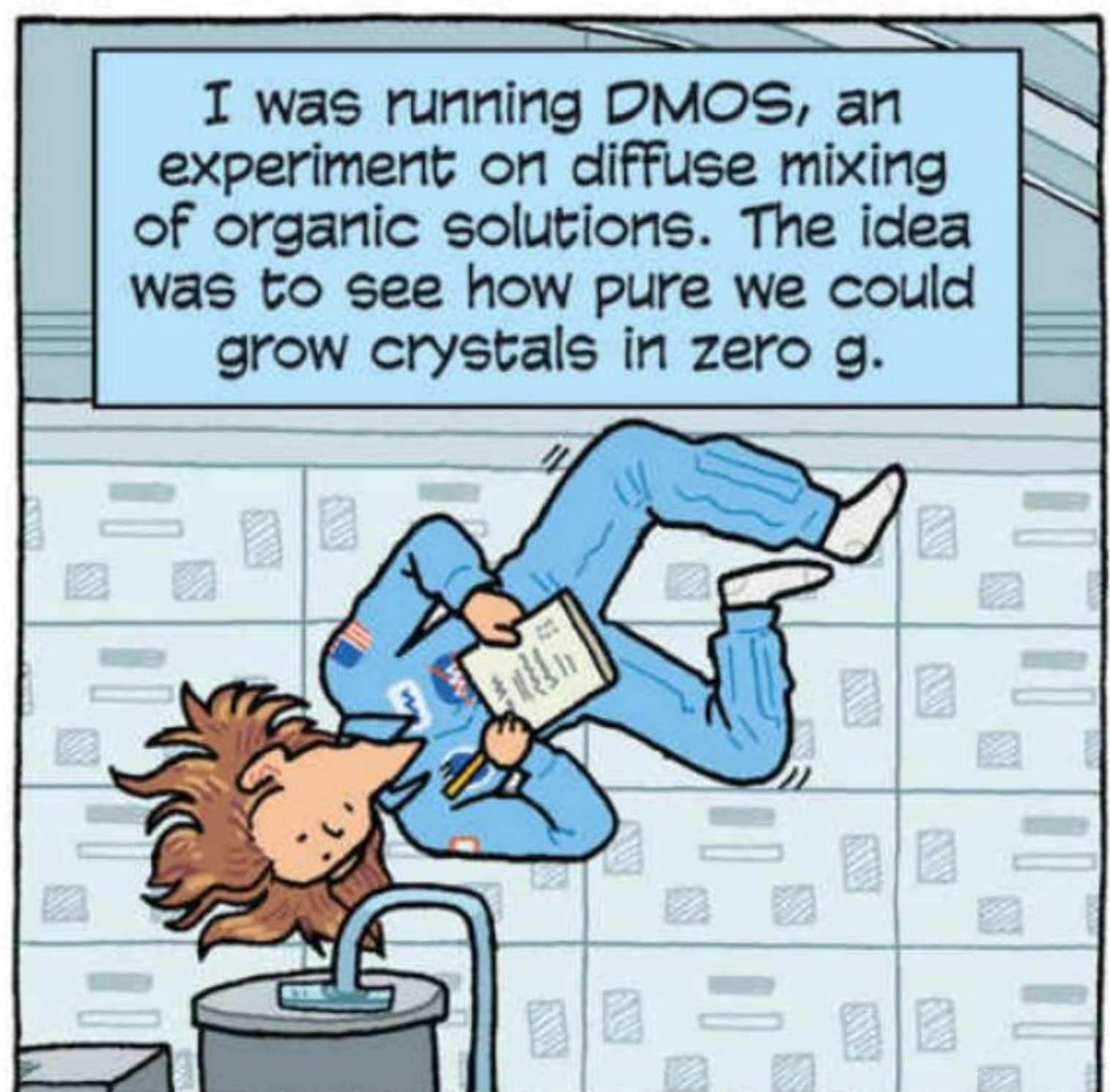
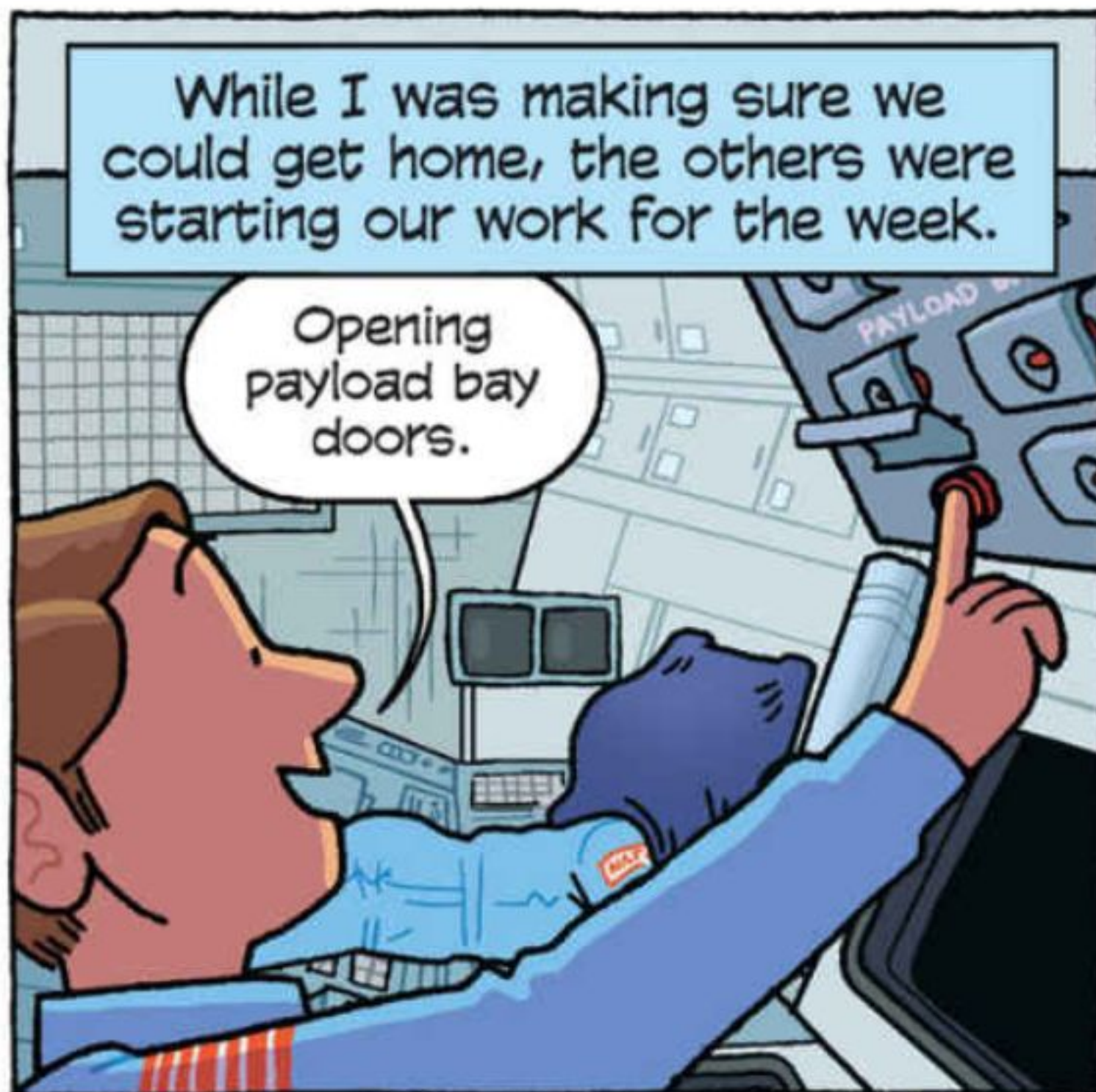


Okay, this is why
we do this before a
nav computer failure.
Deep breath.



<Inhale.>
The colors.
They're...





Rodolfo did botany experiments with beans and wheat. And he and Charlie were going to do experiments on themselves.



They were testing the rate of drug absorption—acetaminophen (a pain reliever) and ScopeDex—in their blood while in space.

Are you sure you don't want anything?

The oven's warmed up.

Not yet. It's interesting—it's been twenty hours since breakfast, and I've been working my butt off. Still not hungry, though.

Maybe tomorrow.



Yes, tomorrow. So when you're done checking out the equipment, we'll be ready for our sleep period. That'll help with the adaptation.



ScopeDex is an anti-nausea drug, helpful in zero g, where about half of all astronauts suffer from space adaptation sickness.

And sleep is helpful no matter where you are... on or above Earth.



Not that it was easy to relax. We were tired, but excited.



And with a beautiful sunrise every hour and a half, and a beautiful night sky to look at when it was dark?

But NASA schedules mandatory rest time. So we tucked ourselves in, literally—I stuck my hands in my pockets so they wouldn't float up and smack me in the face.



zzzzzzzzzz

Can't wait.

zzzzzzzzzz

zzzzzzzzzz

Okay, first we'll...

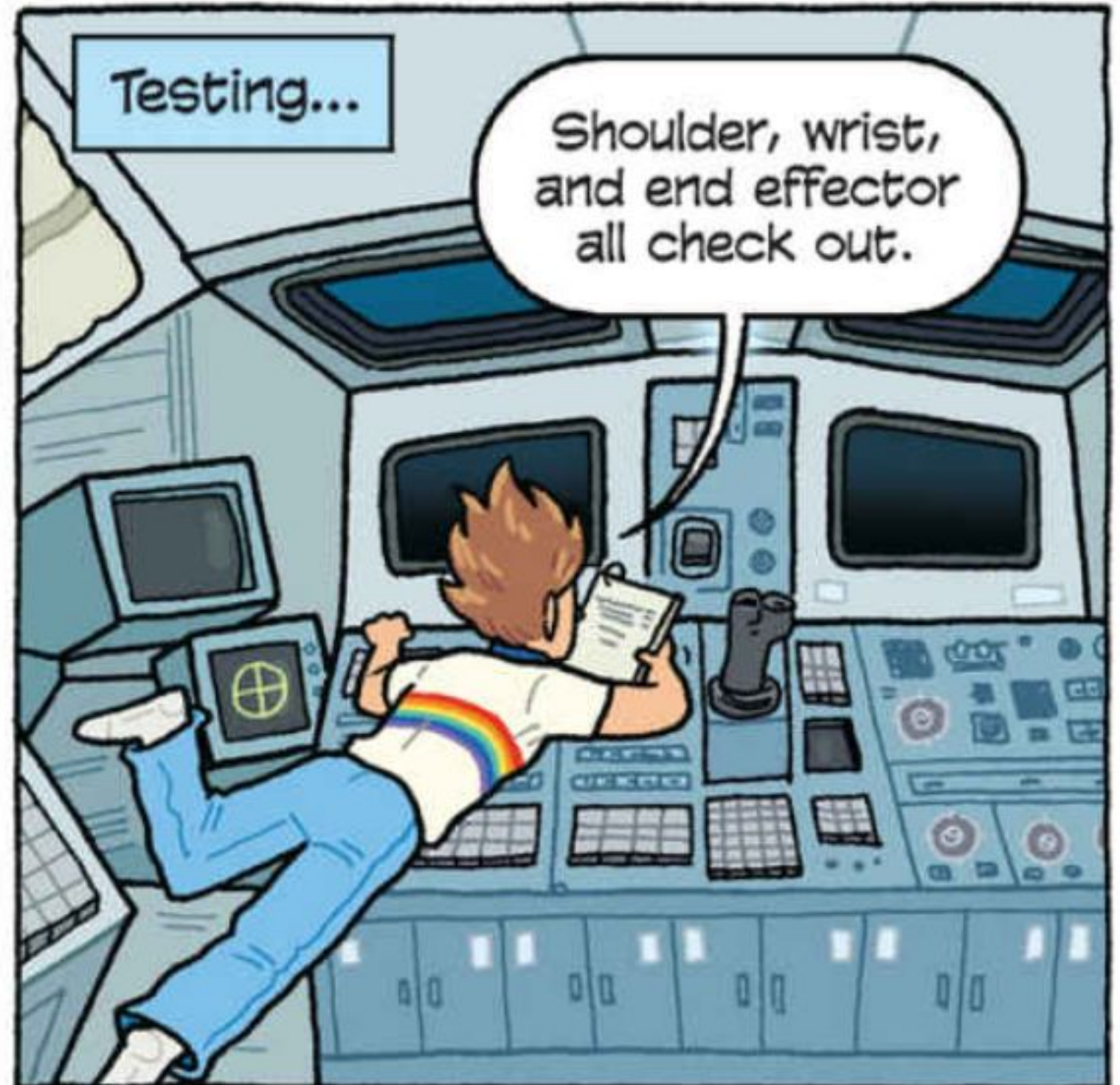
Tomorrow!

Tan
cansadooooohhhzzzzzzzz.

Five (or so) sunrises later, my stomach growled so loudly it woke me up and said, "Okay, I get it, we're in space. I'll cooperate now!"



We had breakfast, and...





At least they'd have been clean. Once Woody and I start EVAs tomorrow, we're going to be wishing for a washing machine and showers.



Maybe this is a good time to talk about the flip side of eating and drinking.



You'd be surprised at how much practice it takes to use the toilet in outer space.

Without gravity, well...



It takes a lot of practice during training back on Earth to find the exact position where everything's going to go where it needs to go.



You check yourself with a closed-circuit camera mounted in the toilet, and memorize the position of your thighs on the restraints when everything is...lined up...just right.



So yeah. Not everything about space flight is glamorous.



Hey, good timing there, Mary. That's catching the sun just right.

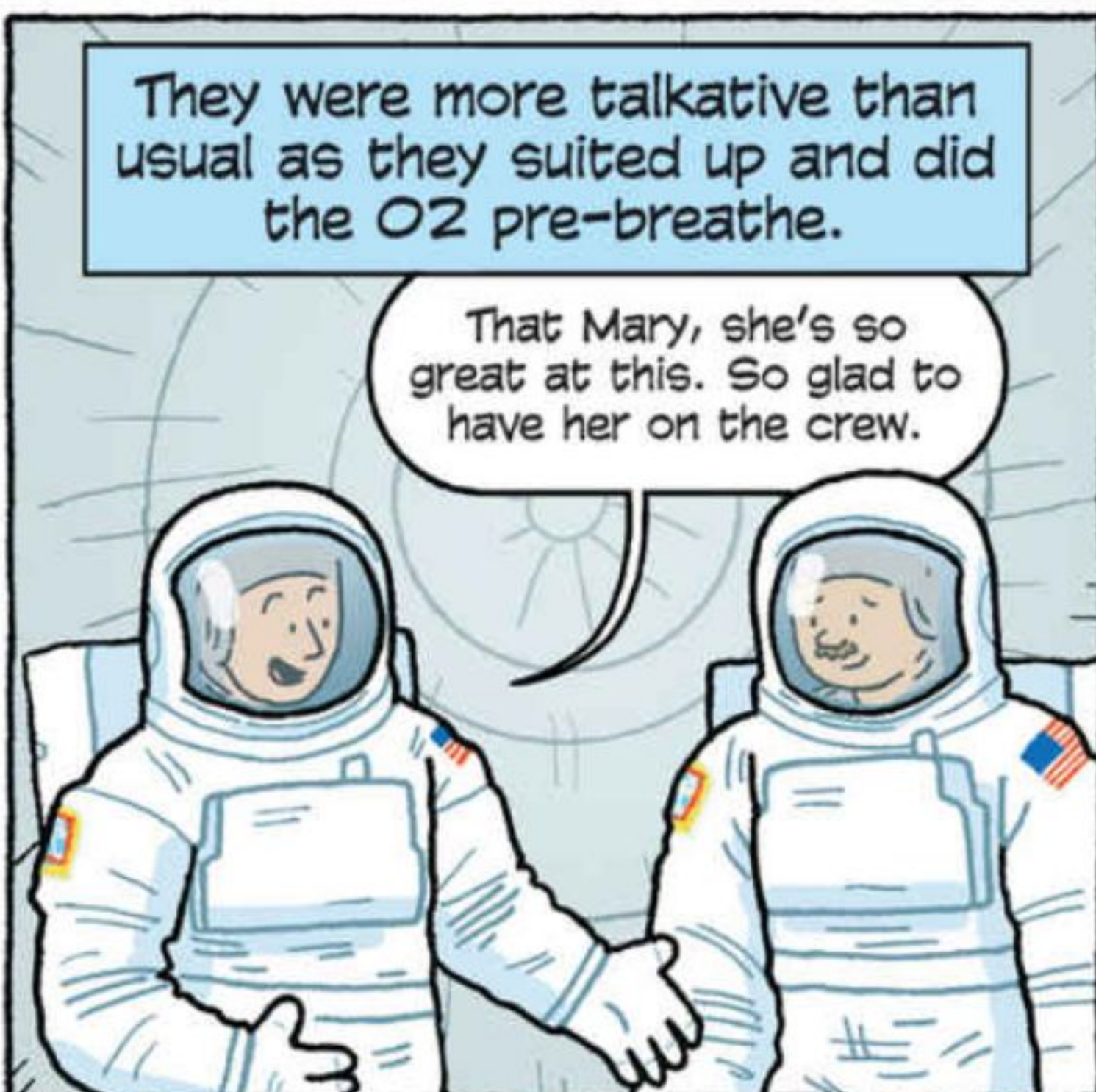
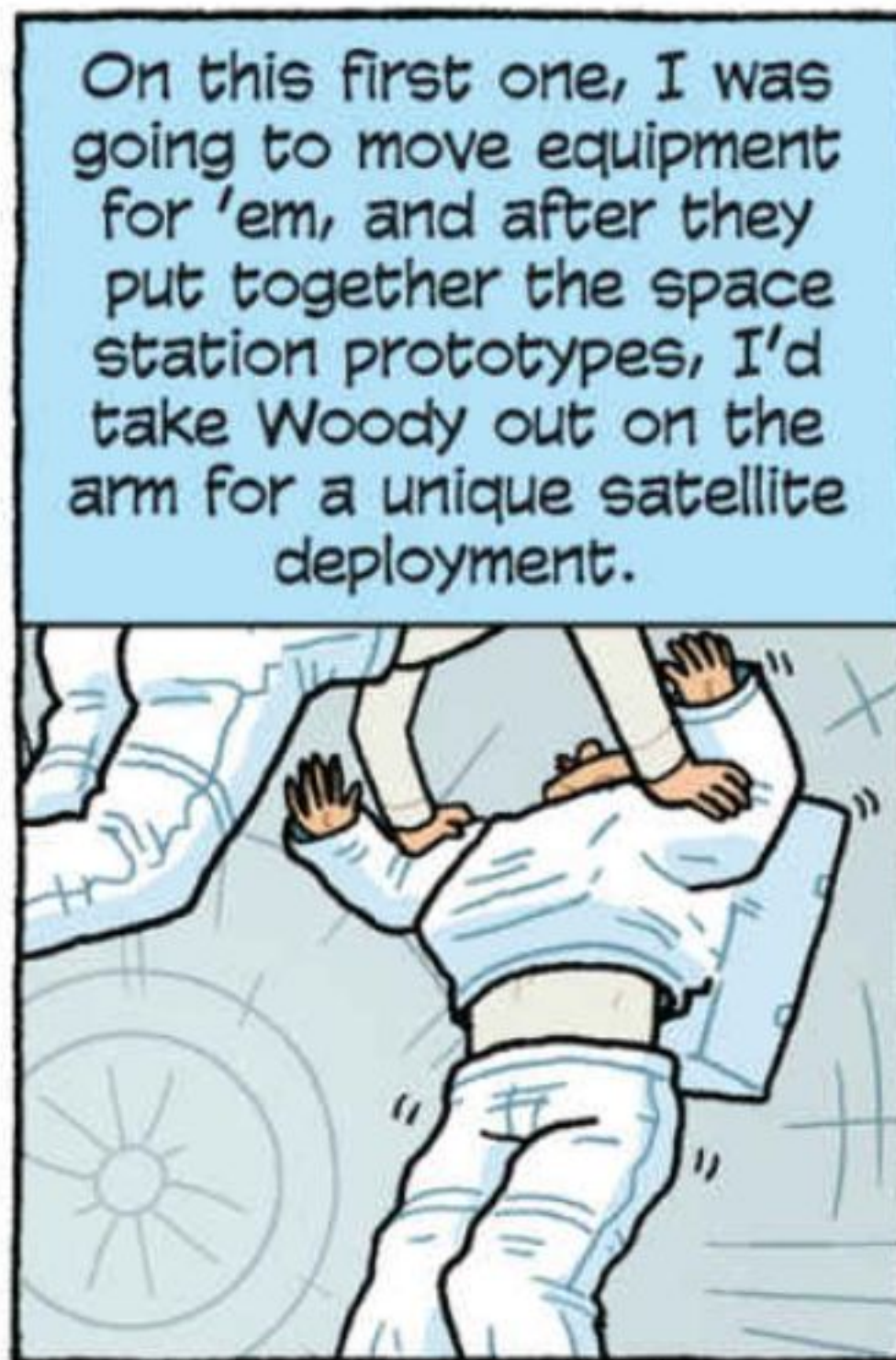


You just left a trail of ice about 15 miles long.

Mission Control is calling it "Cleave's Comet."



HA HA HA HA HA HA HA HA HA HA HEH HEH HEE HOO HOO HA





You can say that again.

They're buttering me up.

These two tough-guy military veteran fighter pilot astronauts are... nervous!



I'm a little nervous too, I guess.

Hey, guys, everything looks good in here.

And don't forget while you're out there, "the best man for the job may be a woman."



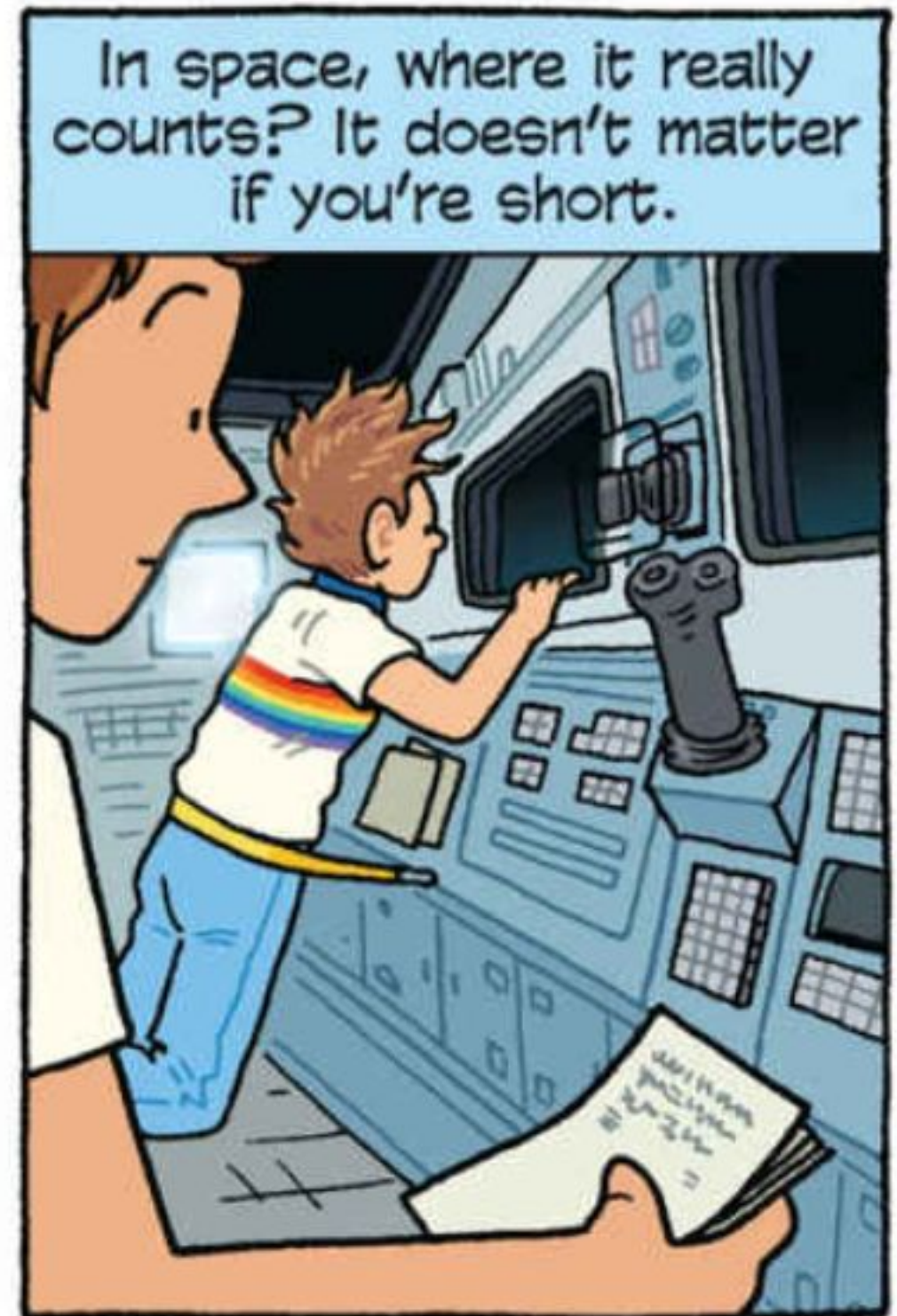
HA HA HA HEH HEH

I think they said that because you're the one who finally figured out how to make the shuttle toilet work.

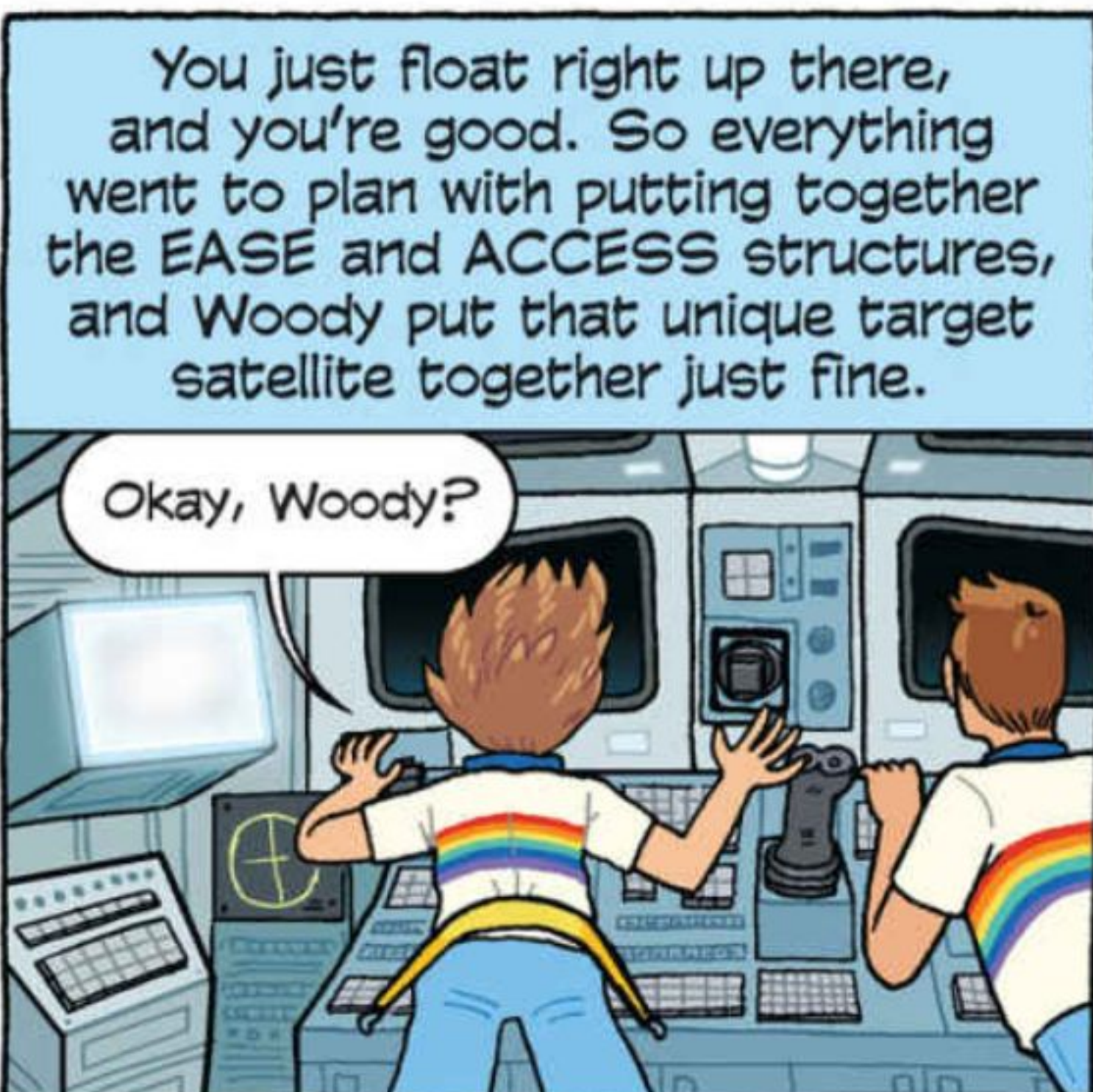


Maybe. But rumor was that NASA really did think women were better at working the Canadarm.

The only problem smaller people like me sometimes had was seeing through the simulator windows. But that was on Earth...



In space, where it really counts? It doesn't matter if you're short.



You just float right up there, and you're good. So everything went to plan with putting together the EASE and ACCESS structures, and Woody put that unique target satellite together just fine.

Okay, Woody?



Okay, Mary, take me up.

Okay!

TWEAK PULL

JUDGE

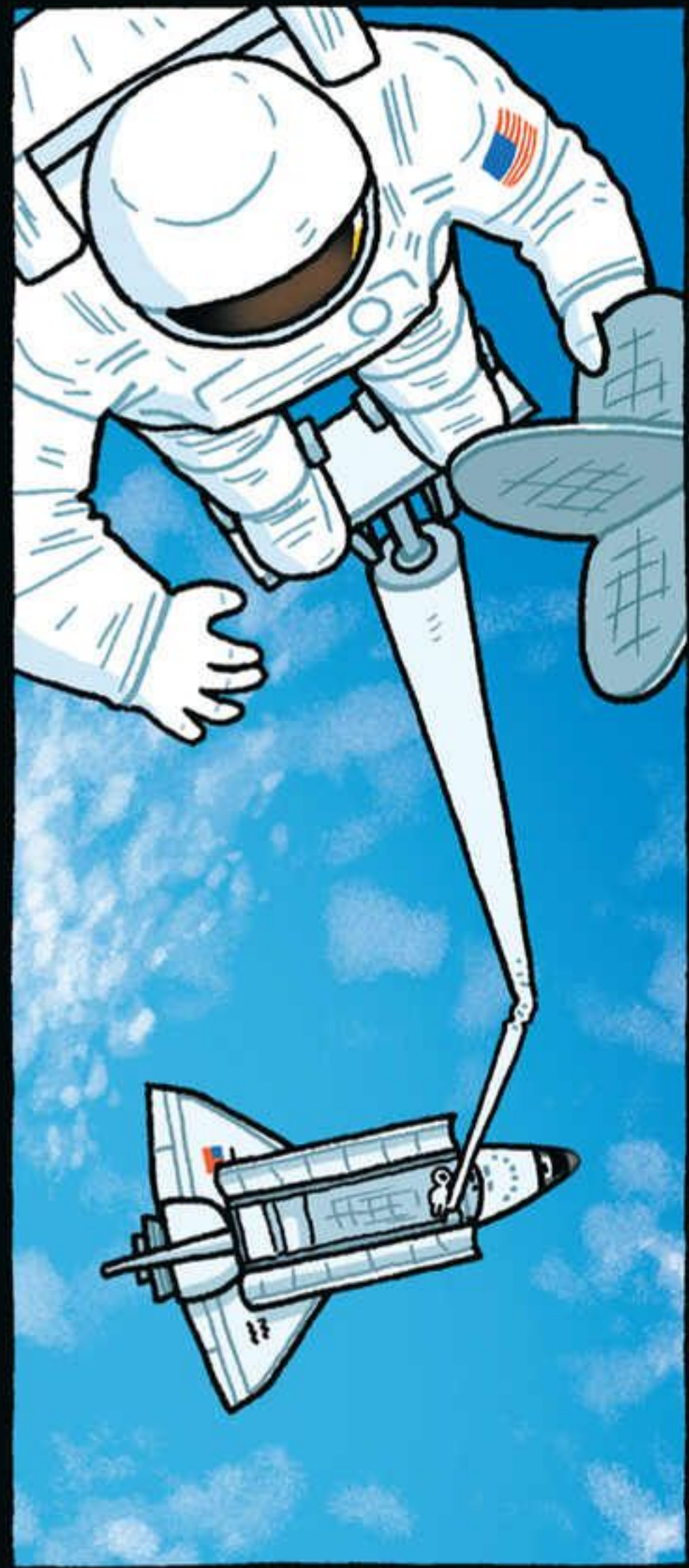
FOOF!

Whoa.

All right.
This is cool.
That's right,
you're cool.
You're cool.

All right.
This is cool.
That's right,
you're cool.
You're cool.

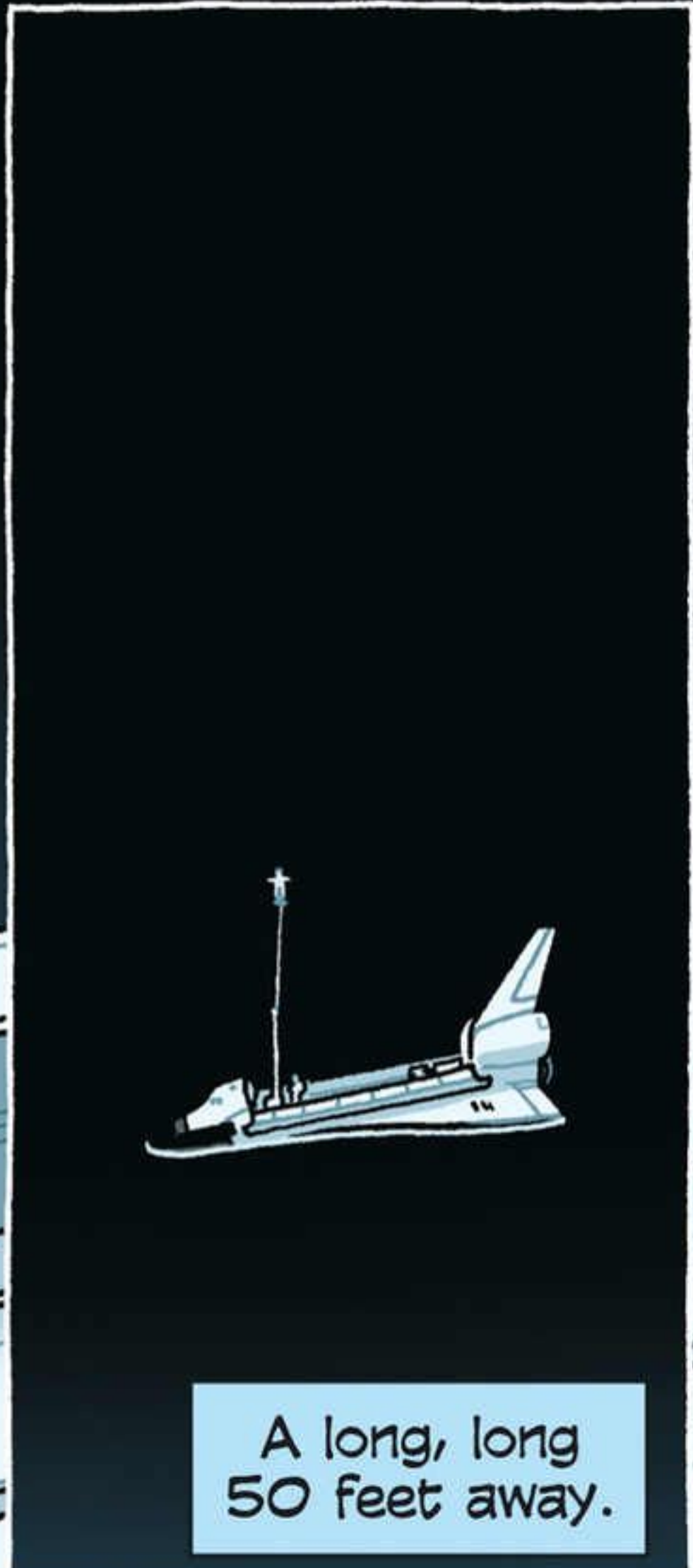
What
was that,
Woody?



Um.
We're cool.
But this is...
high.



He said later that
it wasn't that he was
230 miles above Earth,
or going 17,500 miles
per hour. His reference
point was his current
home. Space shuttle
Atlantis.



A long, long
50 feet away.

I had Woody up there to launch that target satellite.

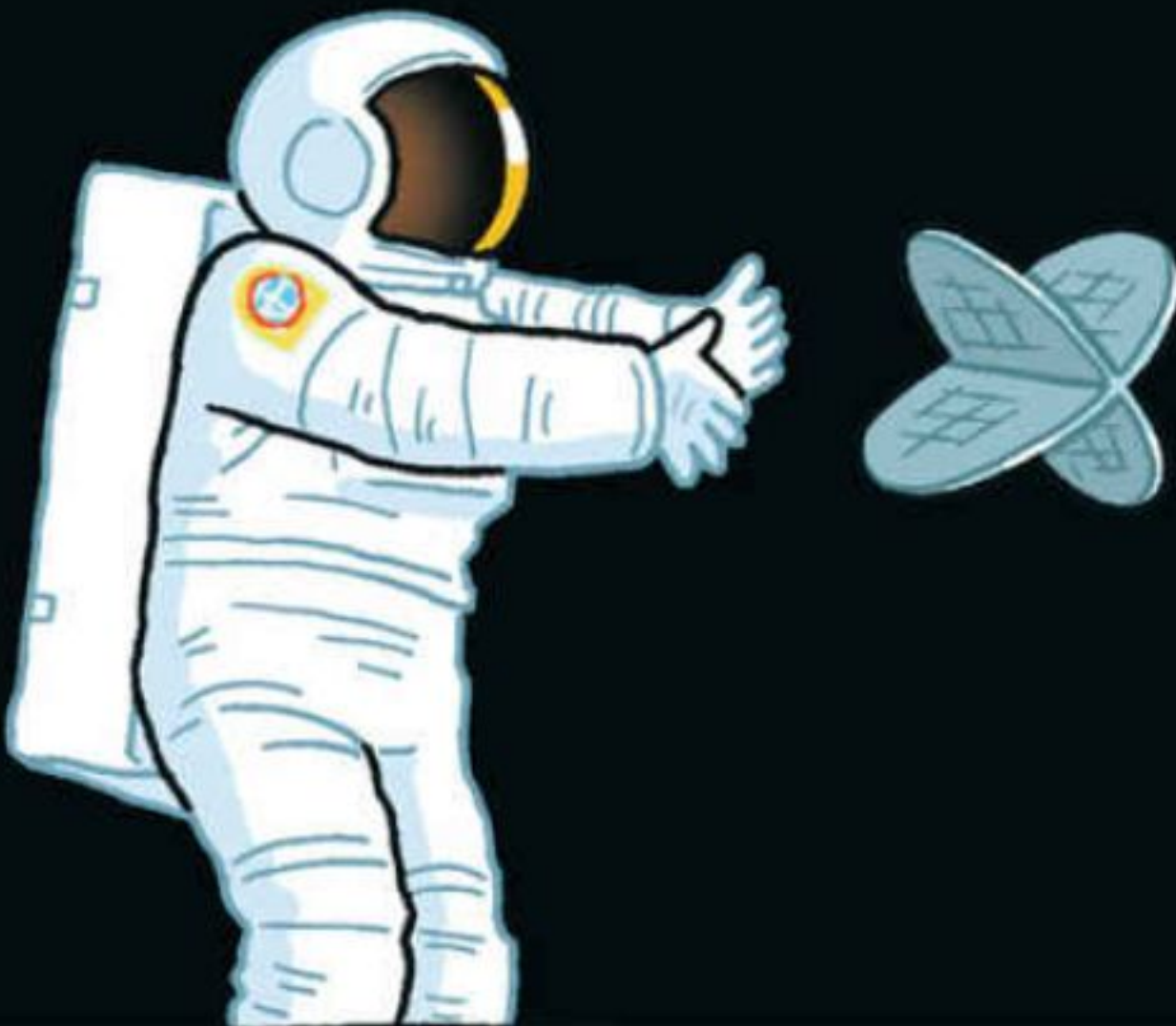


Okay, Mary, a little more to my left and...



So Woody put it together, got it in position, gave it a little push, and...

The first ever hand-launched satellite was in orbit.



The next day, Bryan and Brewster were going to use it to test rendezvous software for future space station docking, among other things.



Jerry and Woody were going to rest, report on their work, and help out with experiments.

In addition to figuring out how to start building a space station, our flight contributed to space exploration in a couple more ways. One was about working outside the ship...



Well, first of all, the arm is a lot more responsive than the hydraulic simulator. A lot.

You can say that again. You'll see, Jerry.



Can't wait.

I think.



And because of the flight deck's window configuration, the operator needs an extra set of eyes. Maybe two extra sets.

Also, the Earth in the background is distracting. Way too bright, way too complex.

Way too beautiful.



Better to work with deep space as a backdrop.

Finally, put a couple of lights on the end effector and you'd be all set.

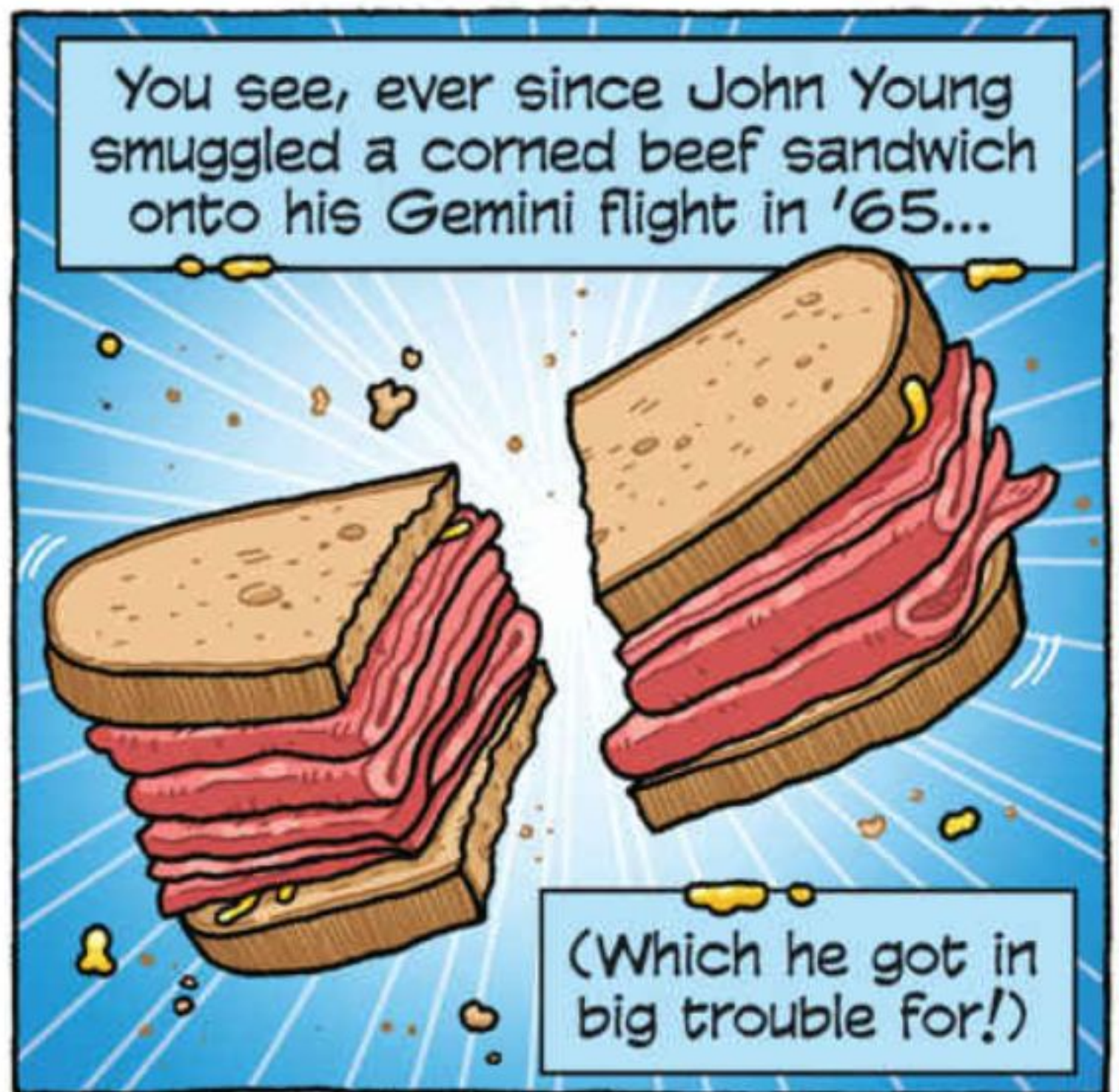
Can you get that for me, Woody?



Our other big discovery applied to inside the ship, and affected every flight after ours.

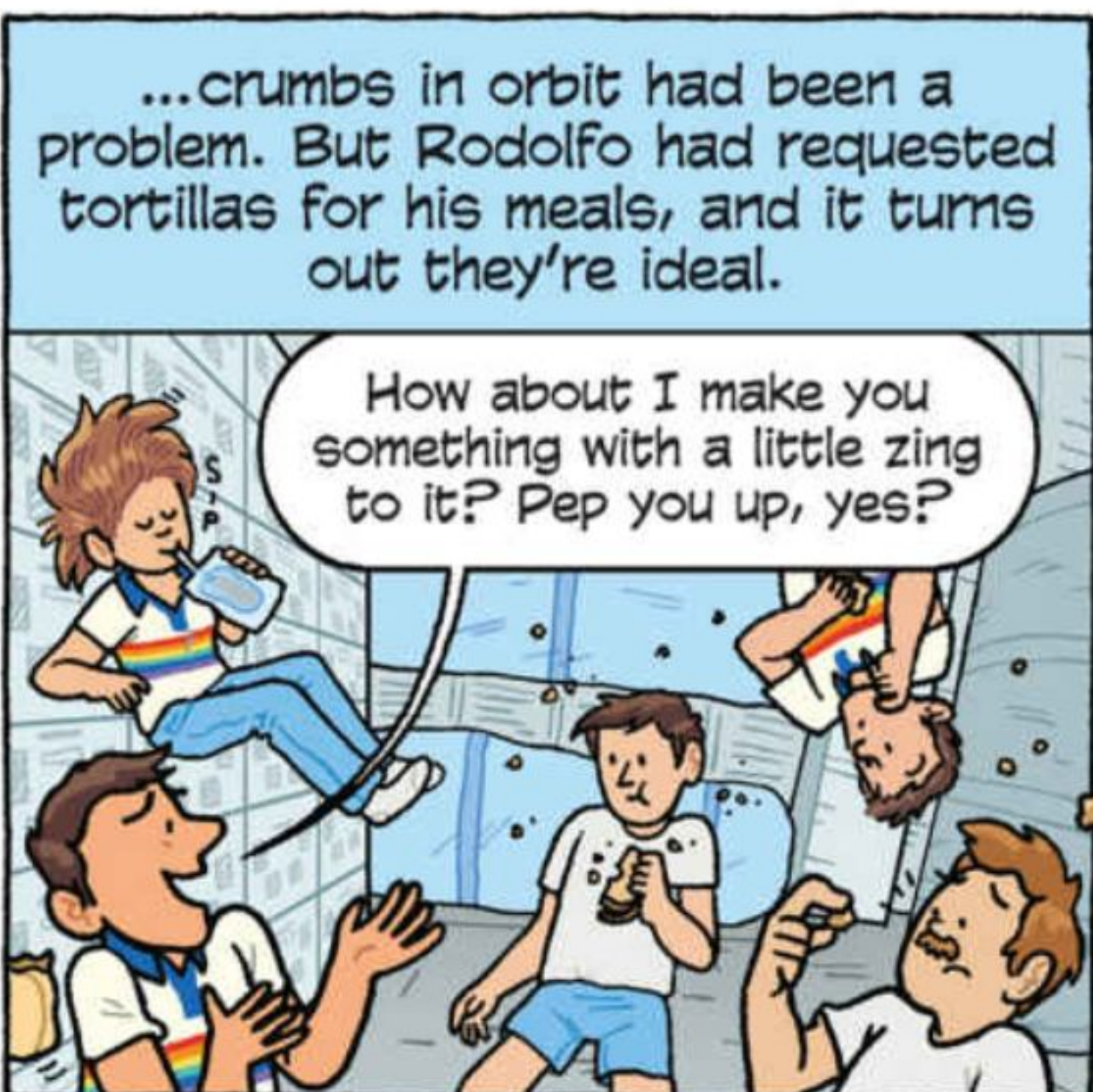
I...don't have the energy to chase that down.

Me either. I. Am. Beat.



You see, ever since John Young smuggled a corned beef sandwich onto his Gemini flight in '65...

(Which he got in big trouble for!)



...crumbs in orbit had been a problem. But Rodolfo had requested tortillas for his meals, and it turns out they're ideal.

How about I make you something with a little zing to it? Pep you up, yes?



I recommend it, guys. Tastes great, no crumbs. What's not to like?

It was a "duh!" moment for NASA.

From then on, flour tortillas were pretty much standard for every flight.



Try one, Charlie.

And they make great cabin frisbees, too.

Anyway, after a day of rest for Jerry and Woody, science for Charlie, Rodolfo, and me, and rendezvous software testing for Brewster and Bryan...



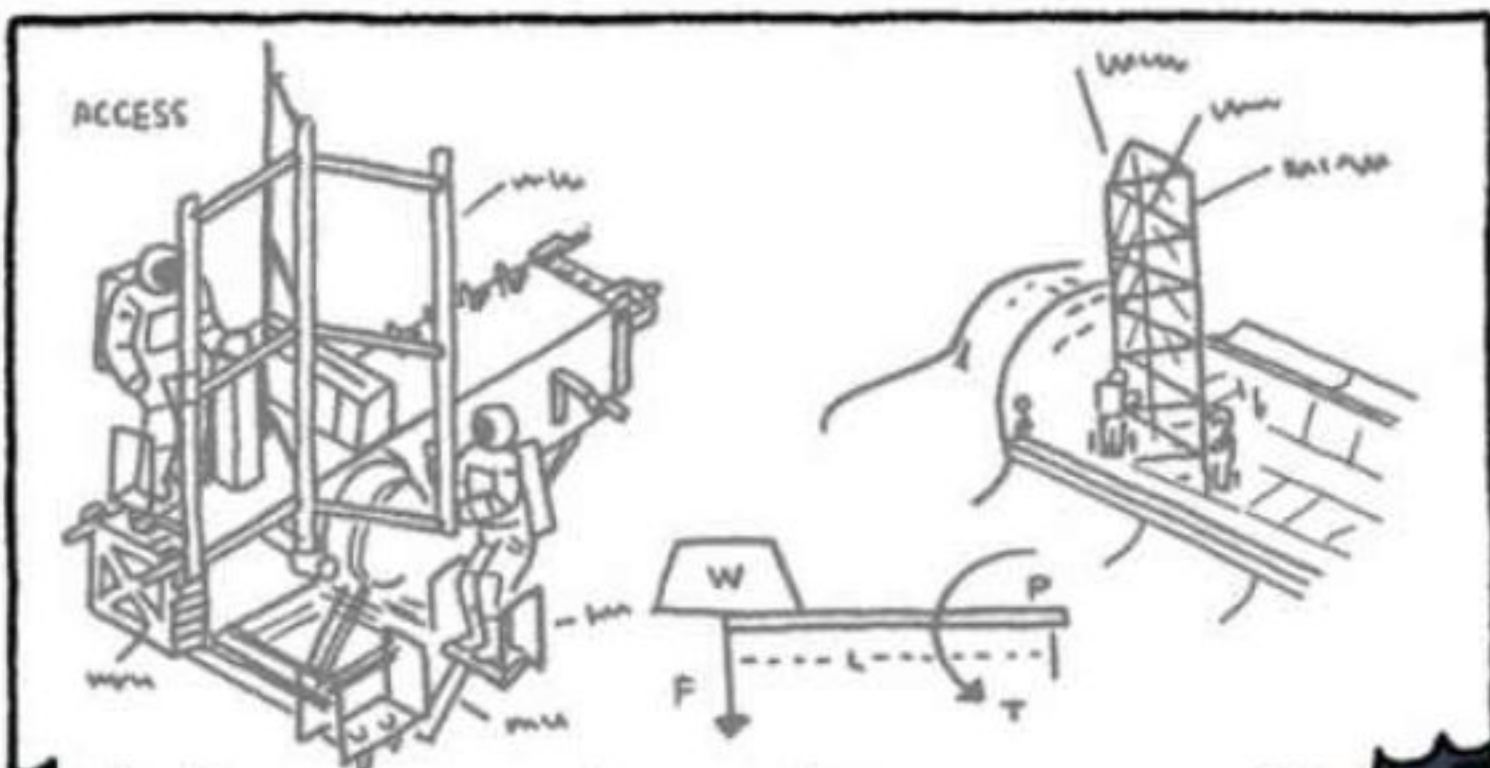
Woody and Jerry were back in the airlock, getting ready for EVA 2.

It takes a long time to get outside in space. You can't just push open the door and go.

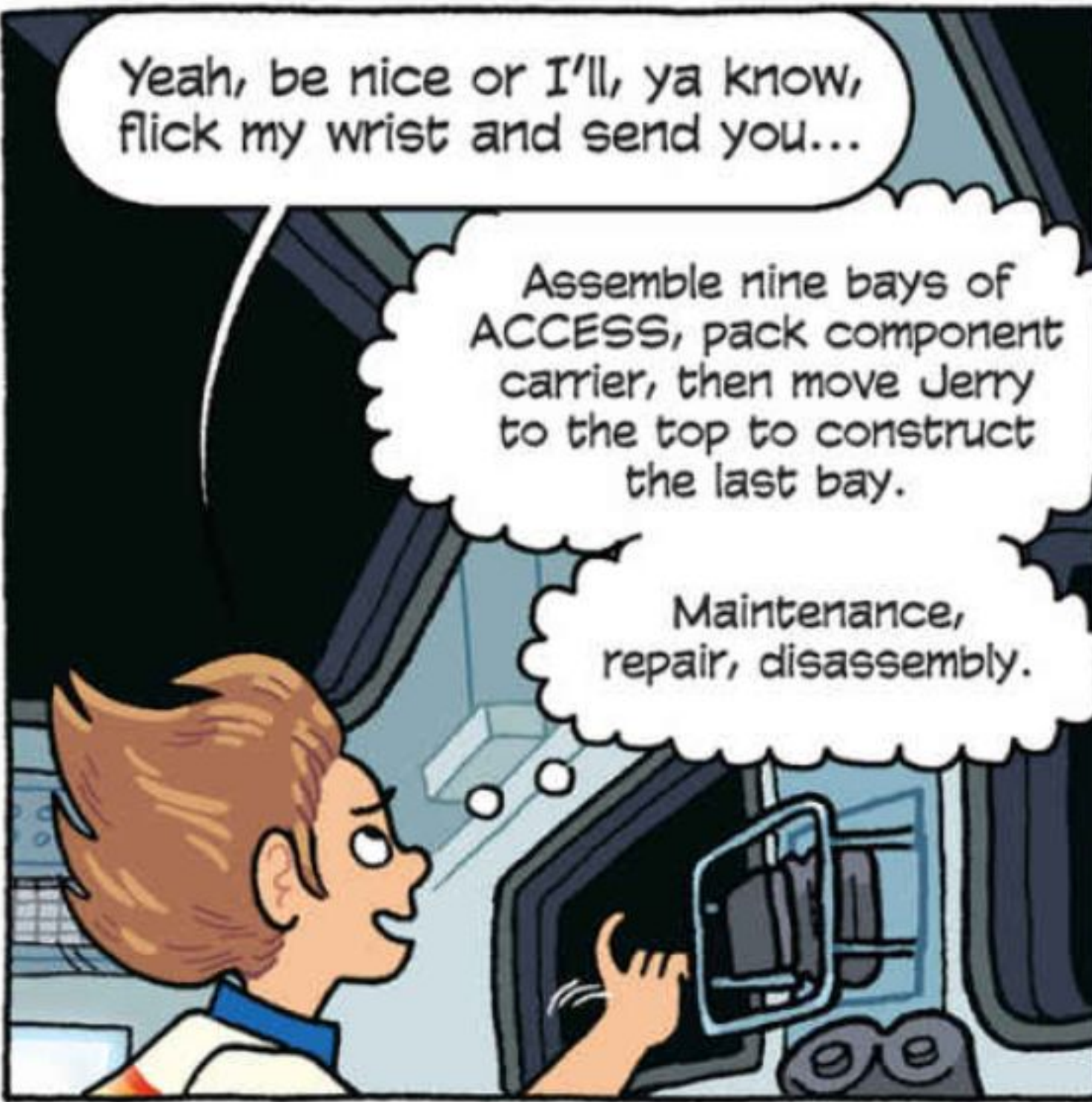


Mary sure is good at this. She's really a great guy.

So while they suited up and did their O2 pre-breathing—and buttering me up—I went over the plan again.



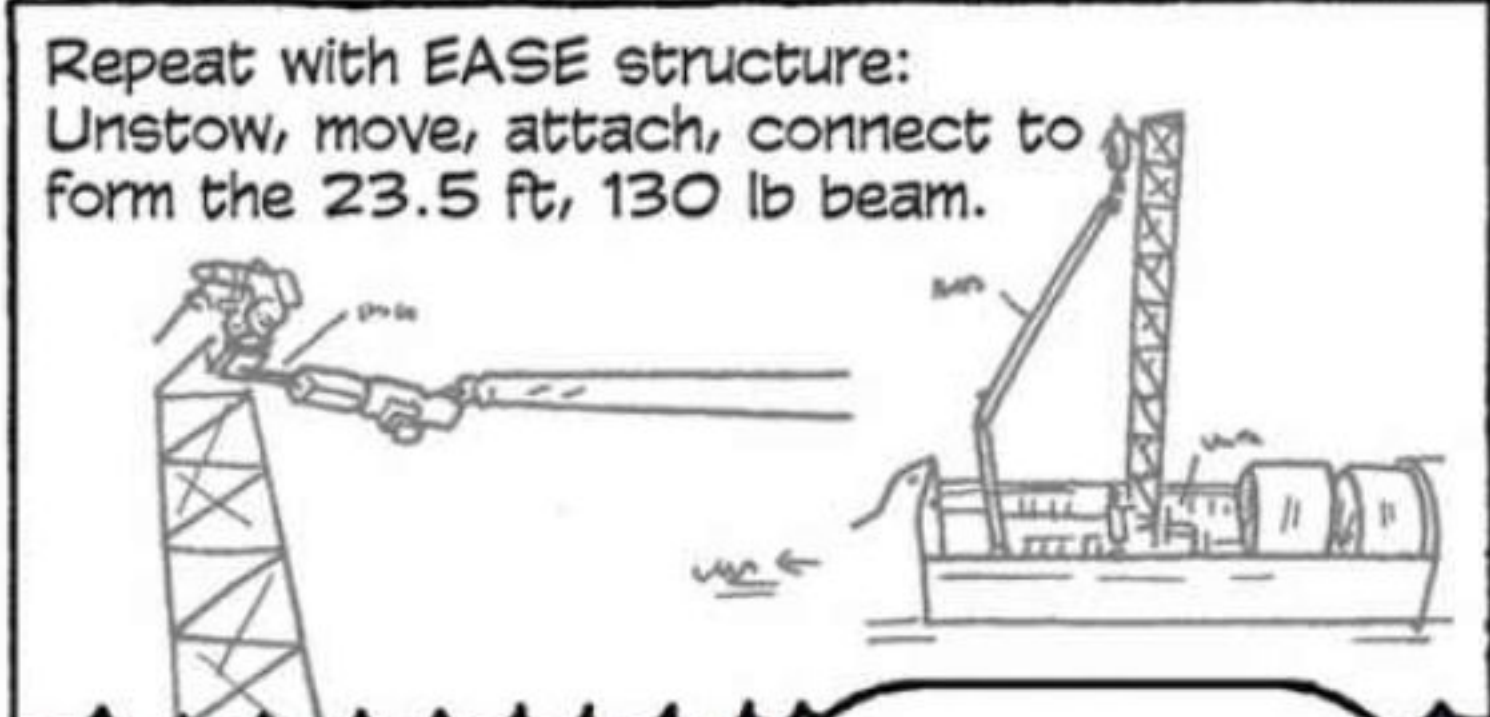
"Great guy"?



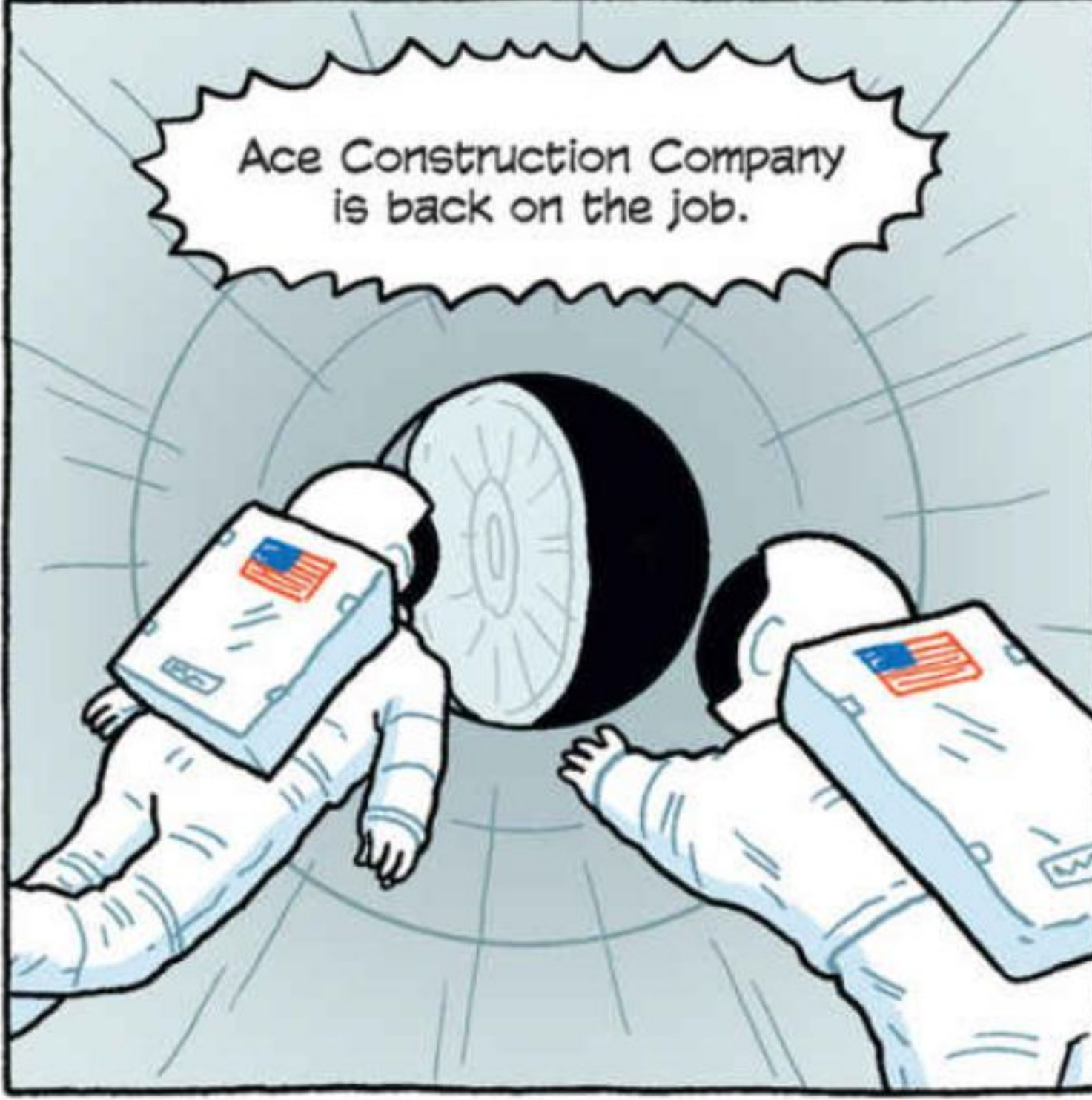
Yeah, be nice or I'll, ya know, flick my wrist and send you...

Assemble nine bays of ACCESS, pack component carrier, then move Jerry to the top to construct the last bay.

Maintenance, repair, disassembly.

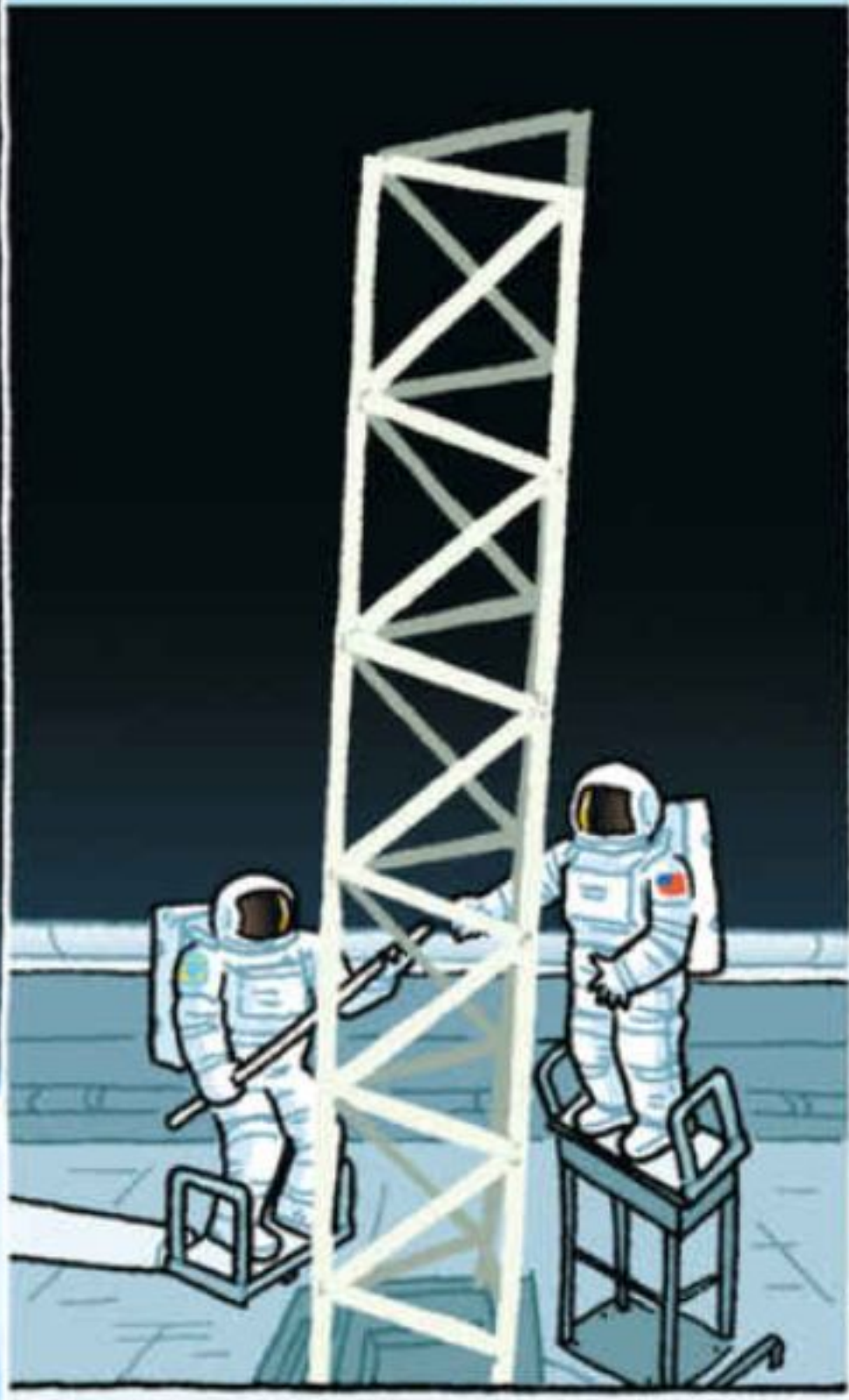


Okay, boys, that's enough goldbricking.



Ace Construction Company is back on the job.

On their first EVA, we experimented with assembling space station components, figuring out what works...



...and what's hard, in space.



@#%\$!

I don't know how I did this yesterday! I hope we're getting good footage of how much fun this is.

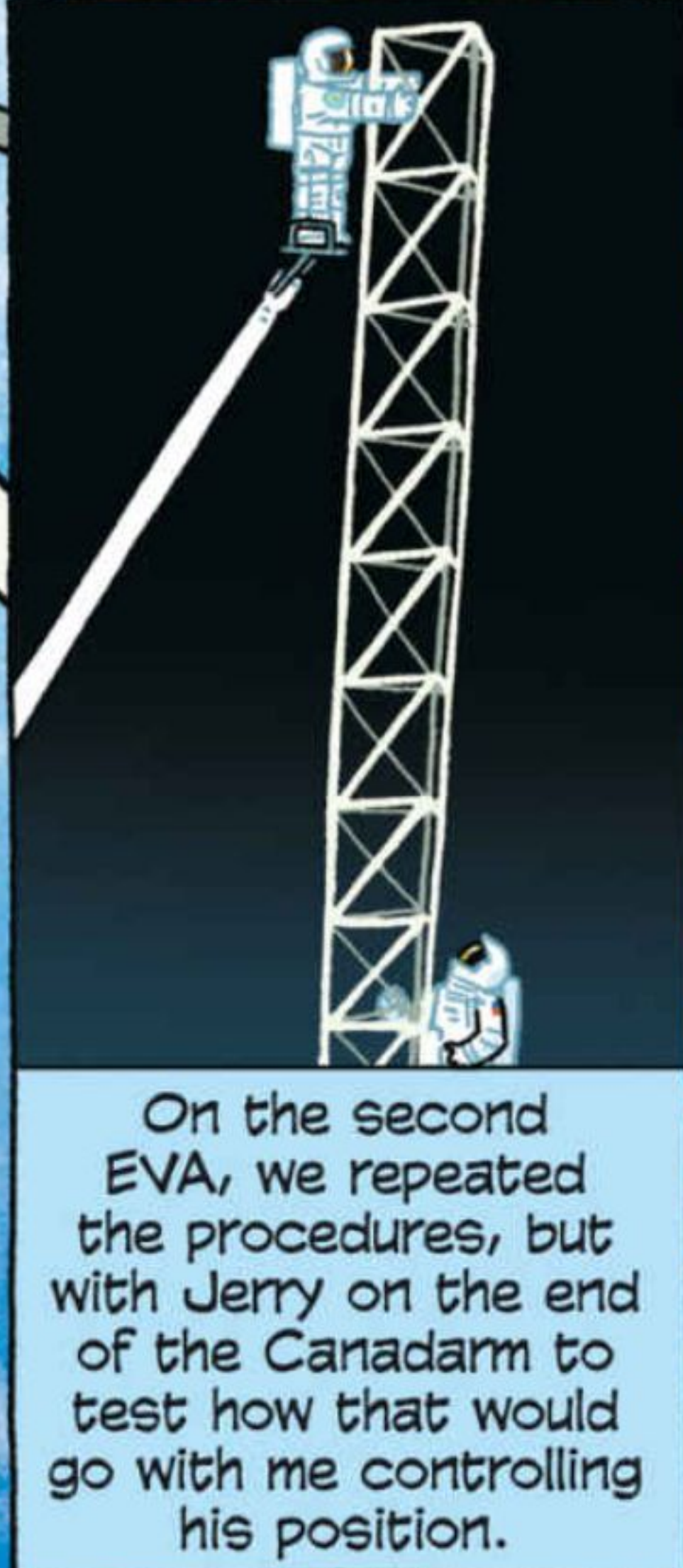
I remember, Jerry. You need three hands.



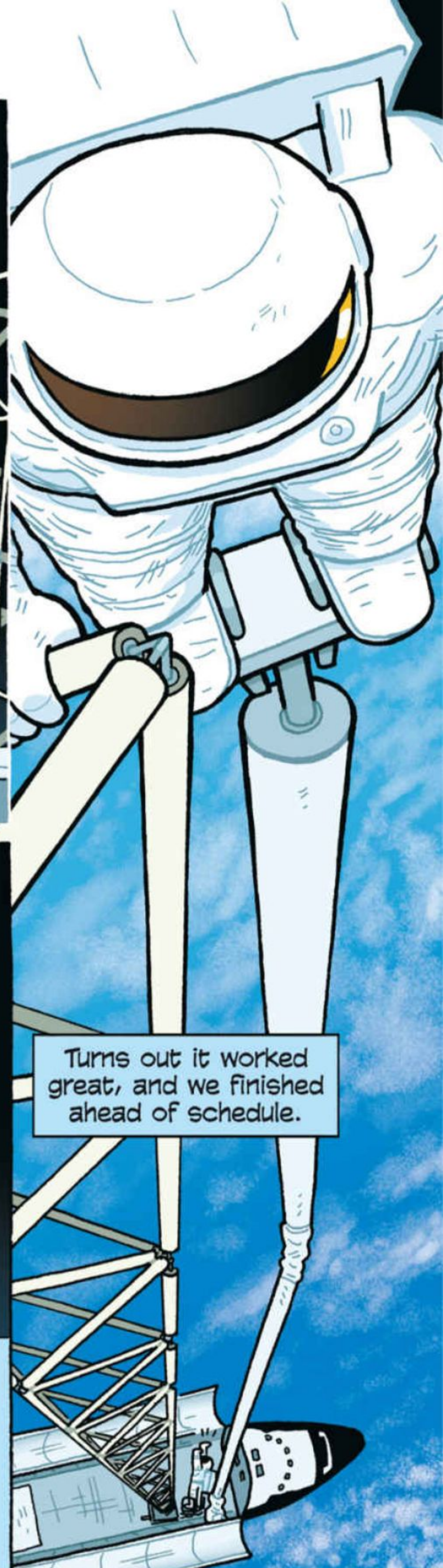
At least.

I keep wanting to bite things to hold on to 'em.

On the second EVA, we repeated the procedures, but with Jerry on the end of the Canadarm to test how that would go with me controlling his position.



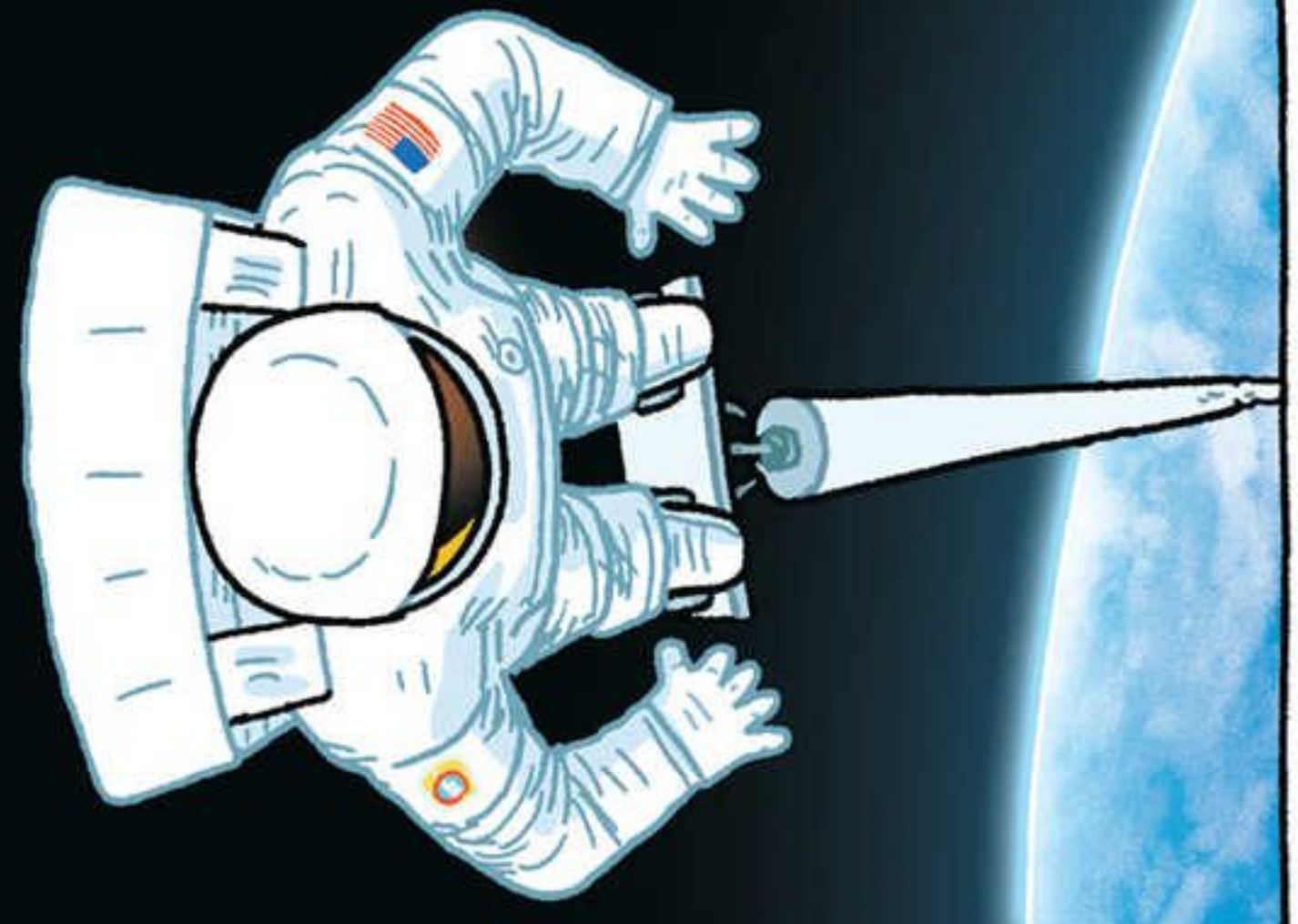
Turns out it worked great, and we finished ahead of schedule.



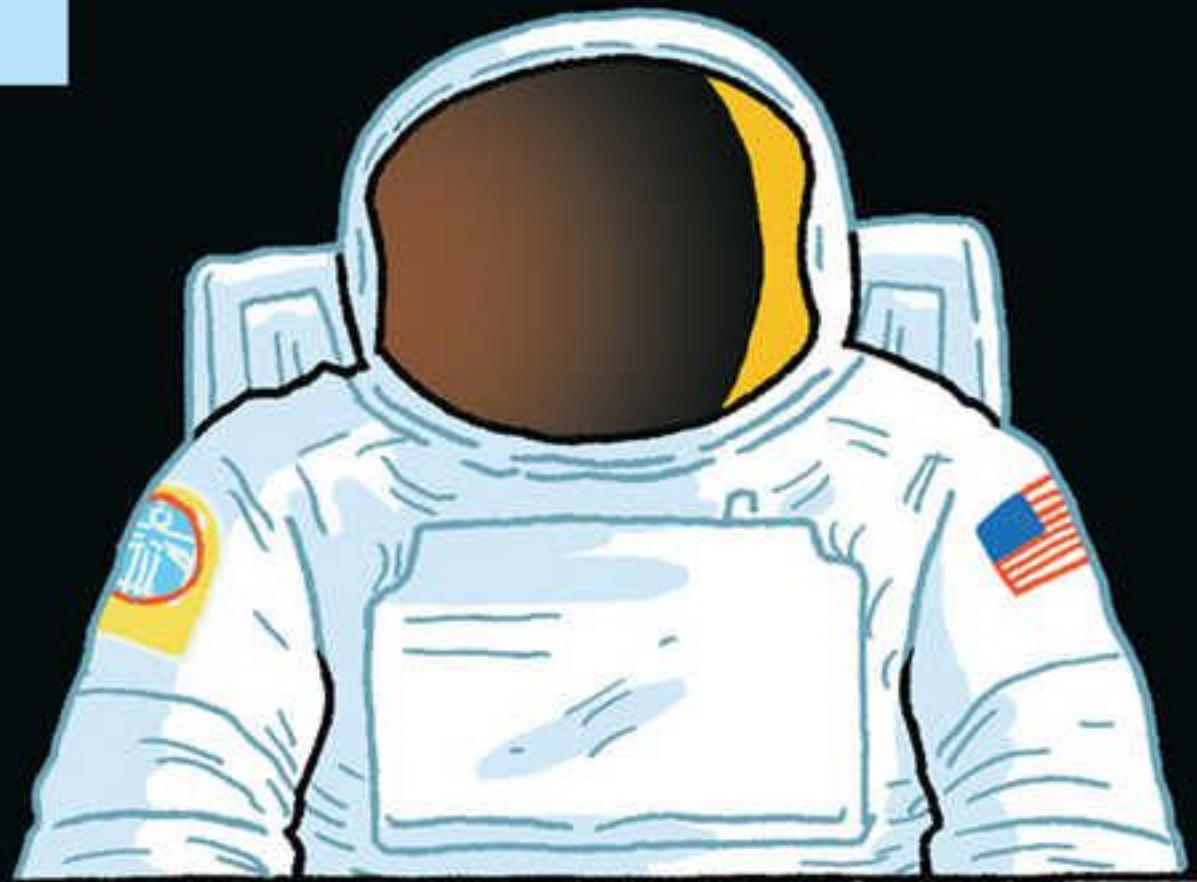
So we had time at the end for me to pull him all the way back. So far back that he couldn't see the shuttle.



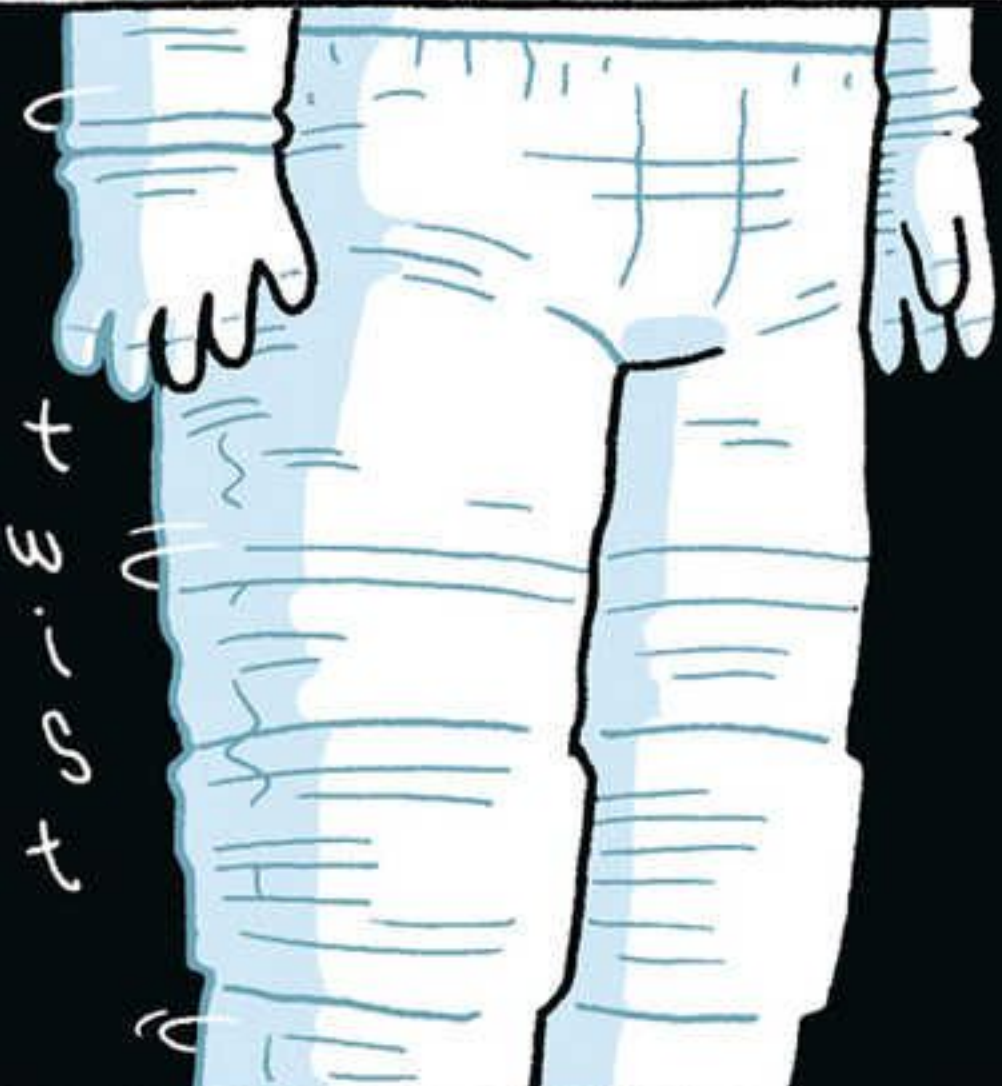
I did it slowly in case anybody got upset—which these guys would never admit to.

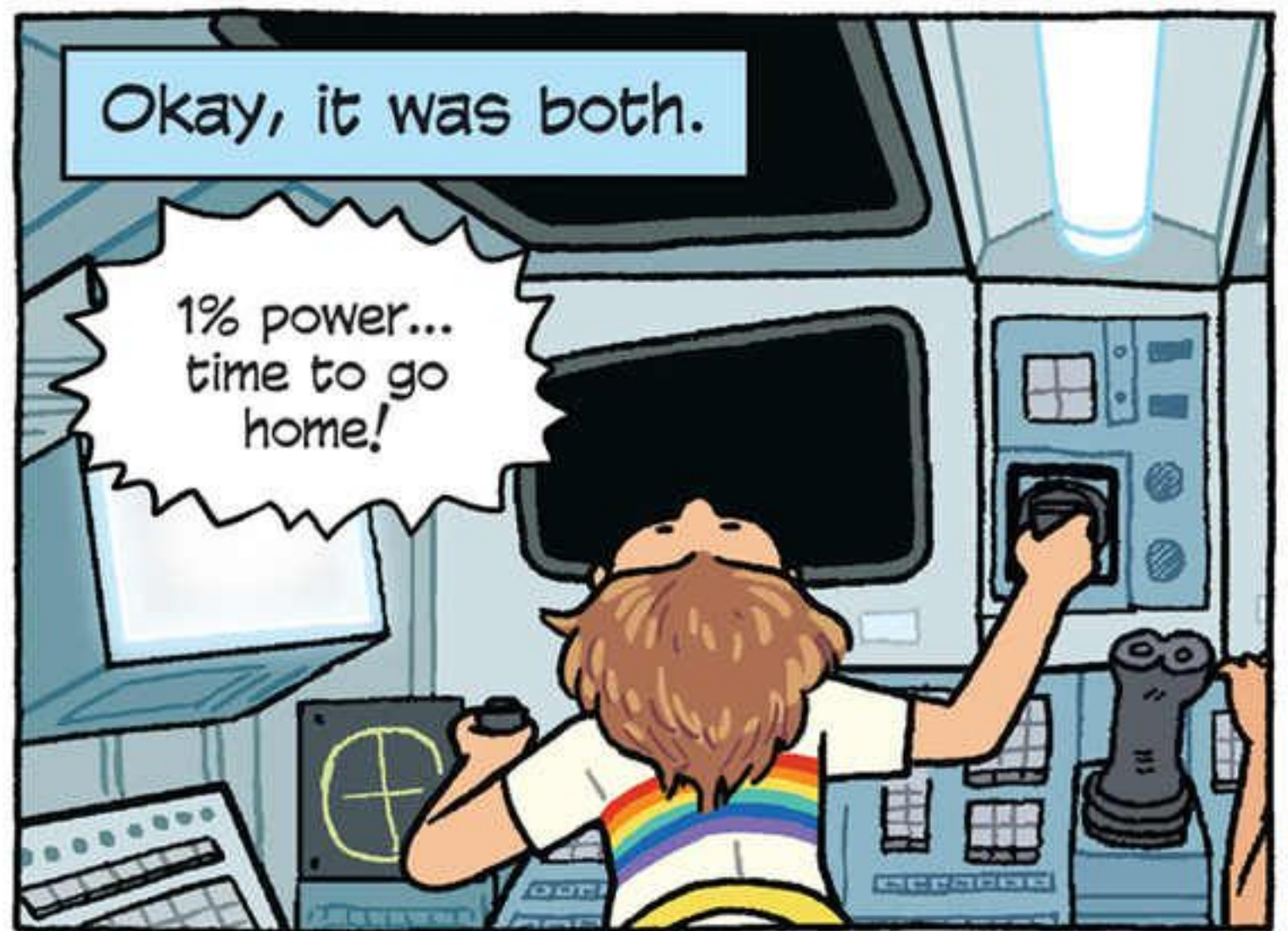
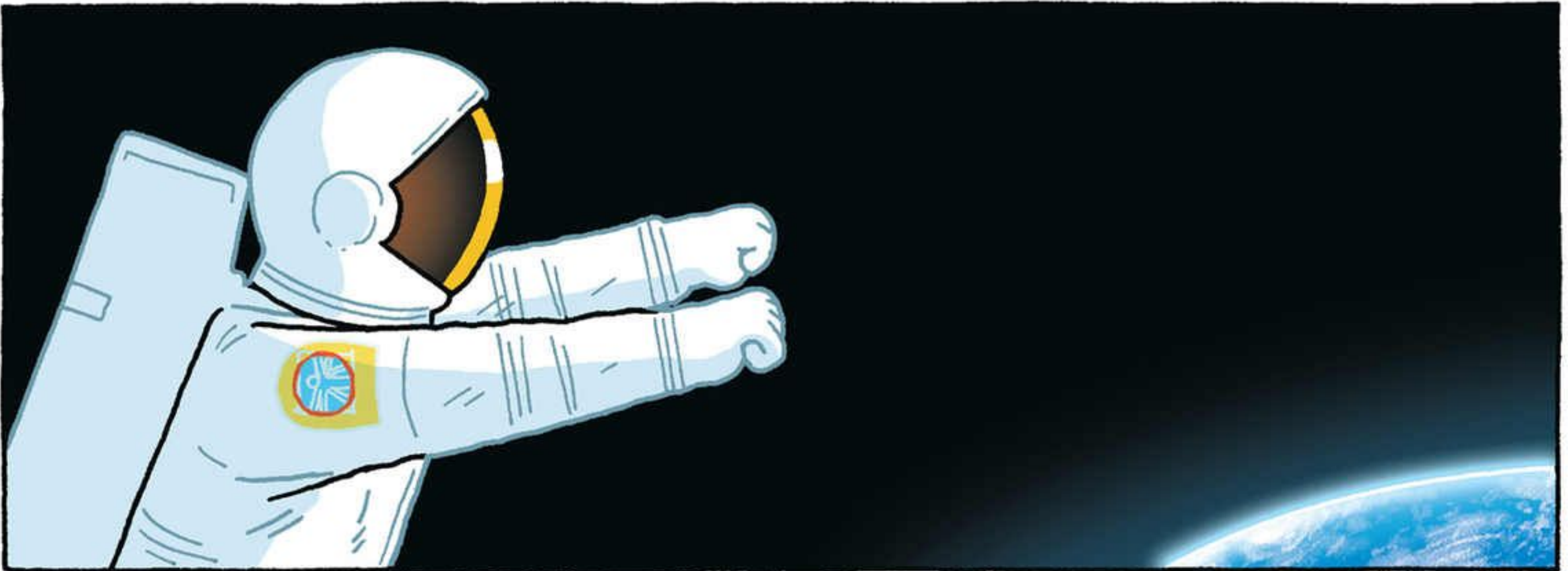
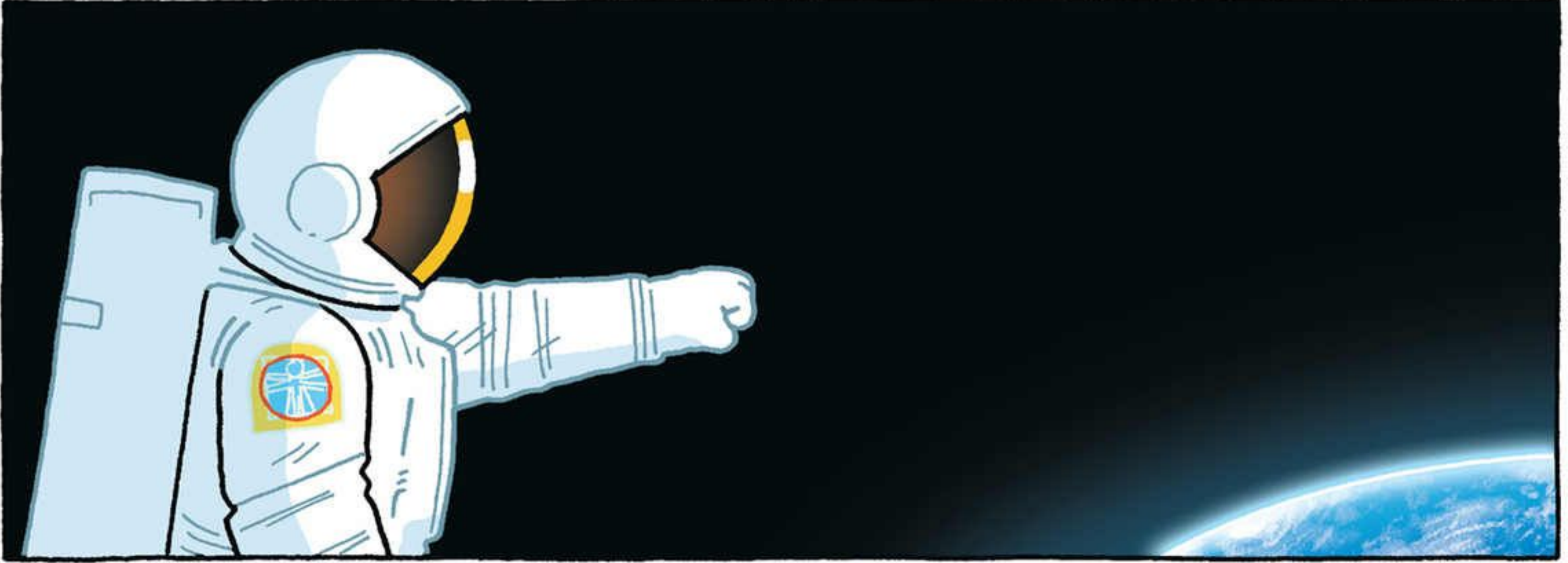


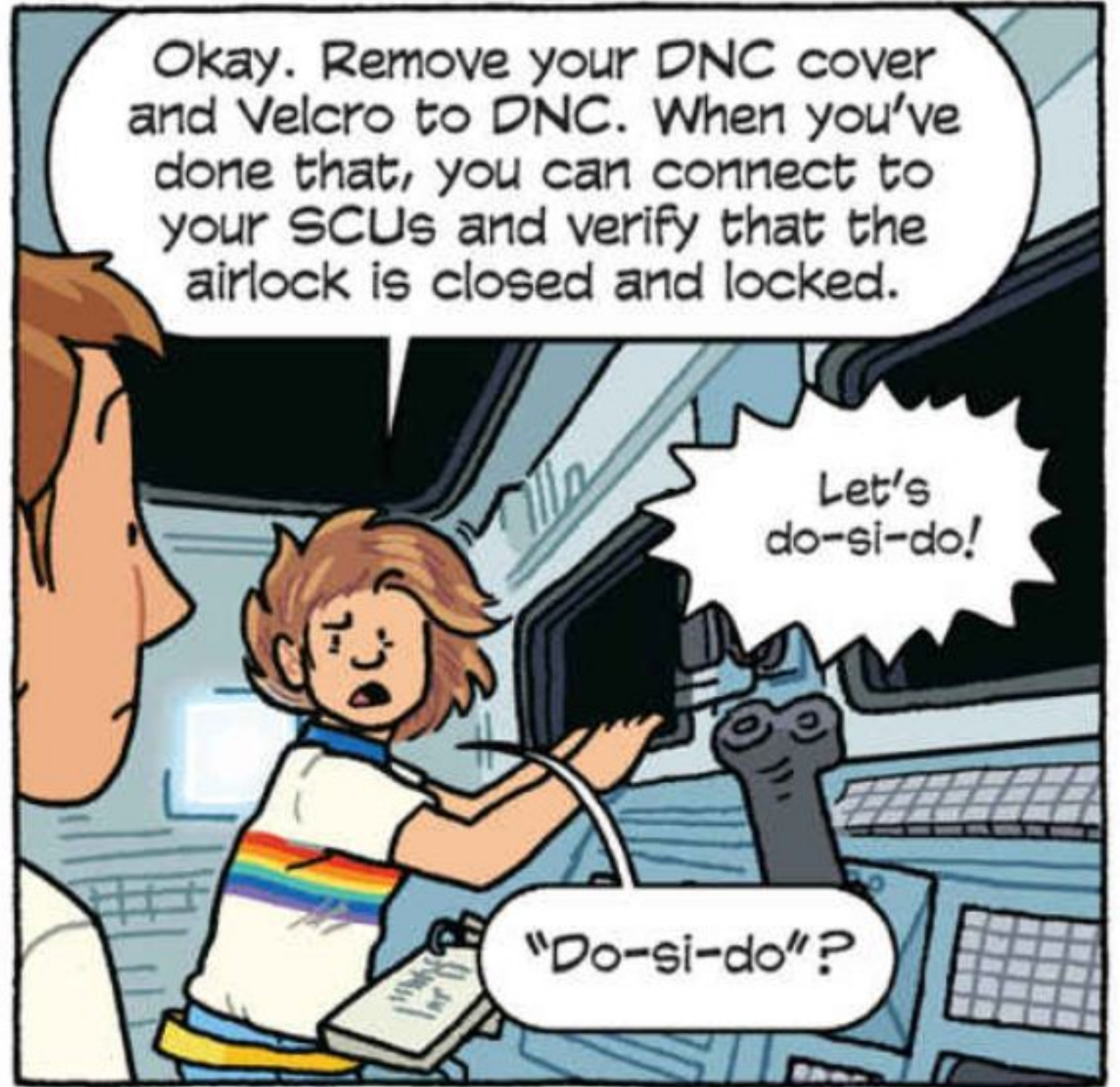
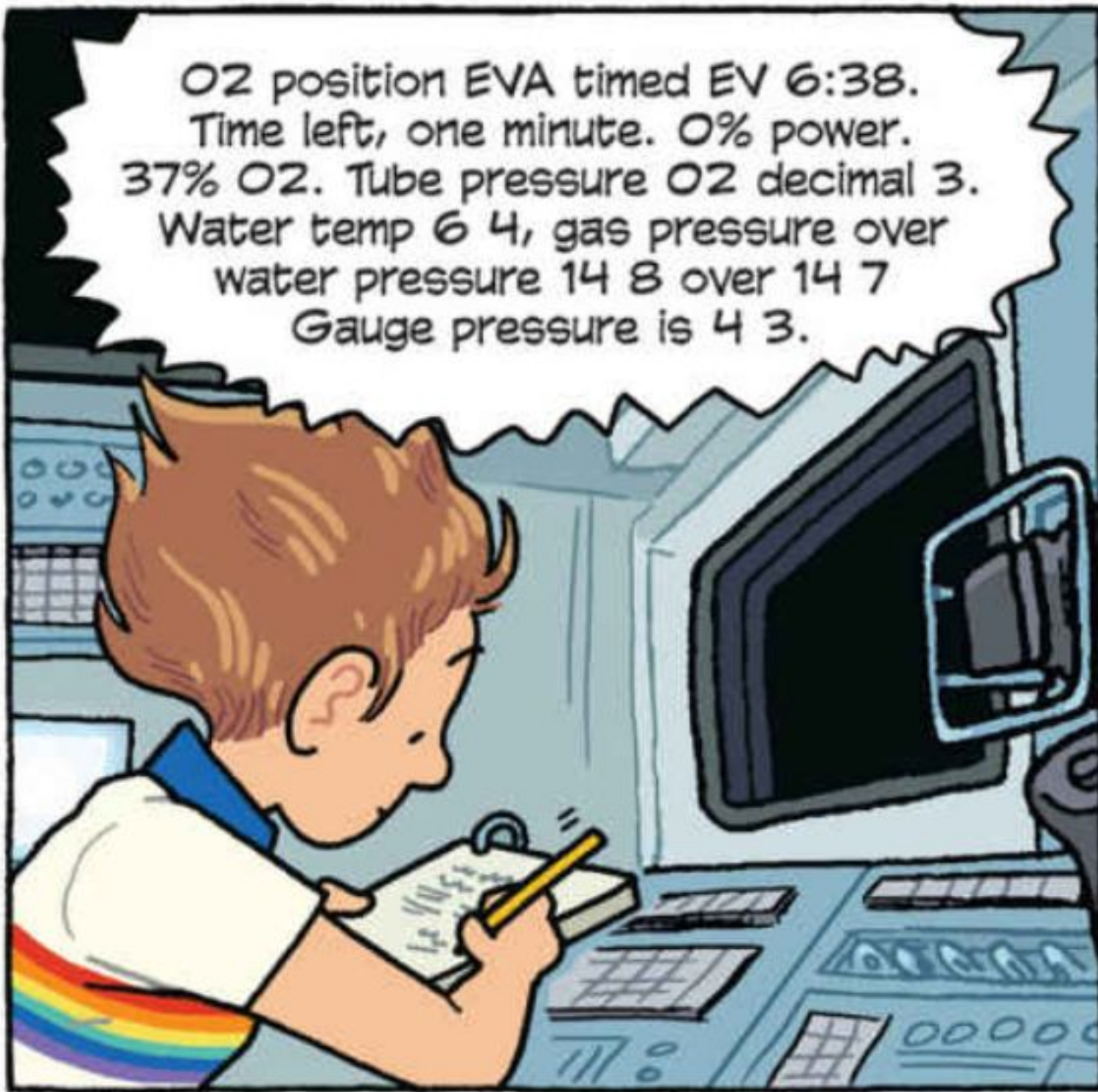
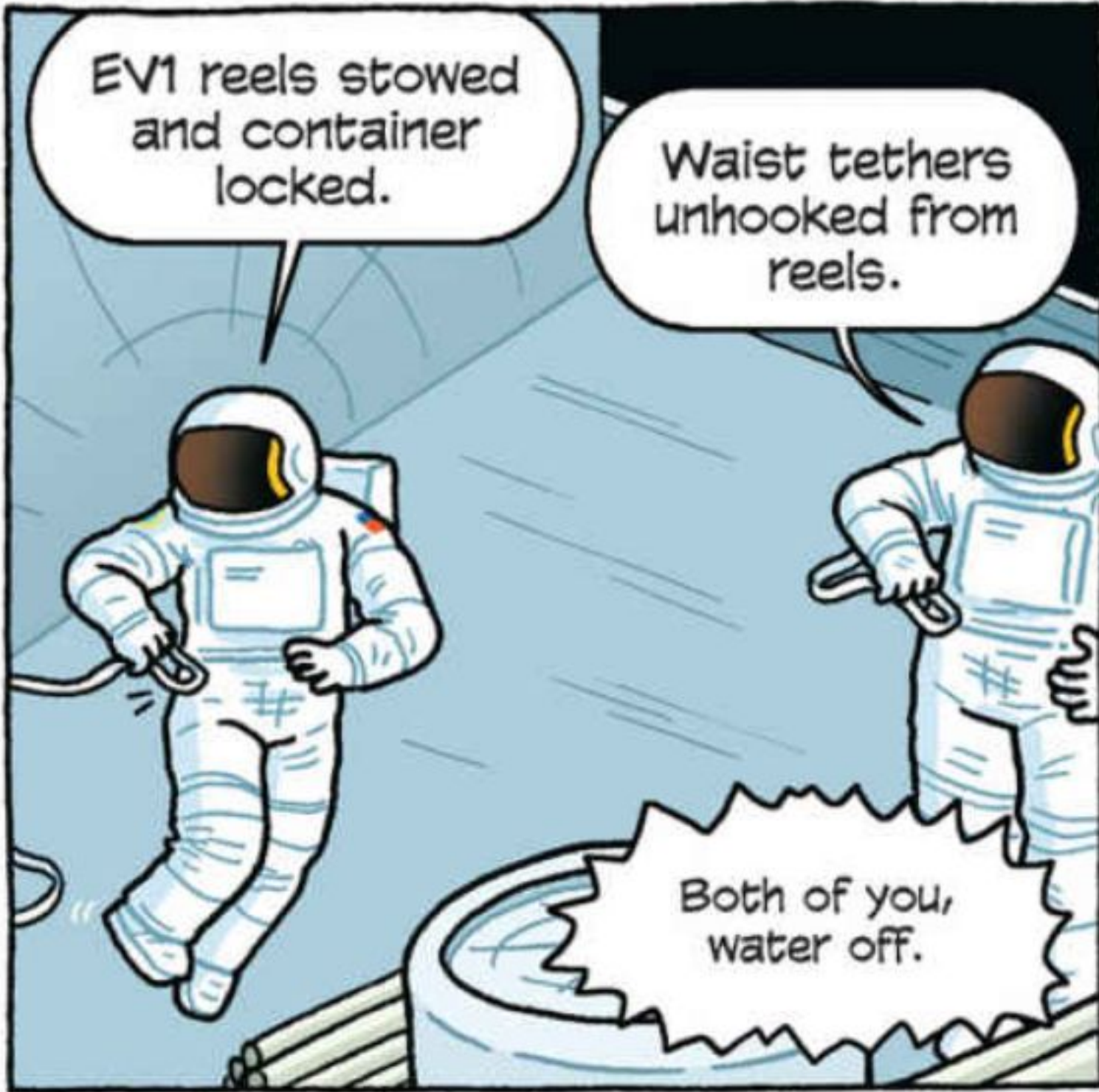
He was up there all by himself and couldn't take reference on the spaceship at all.



And then I rolled the wrist of the Canadarm and he was all by himself. And...







On our last day on orbit, we deactivated the experiments, did another wastewater dump, and had a press conference in Spanish and English...



We packed everything back up—including the dirty laundry, real secure, to keep it out of Charlie's face when we hit gravity again!



And then we had a little time to see the sights. It was a Halley's Comet year, the last one until 2061, but...



I'm not sure. I'll take some pictures, but, um, it's really not that distinctive just yet.

Not as clear as Cleave's Comet?

Haven't I heard that joke before, Sally?



Sure, but it never gets old, right?

Well...

But some things *truly* never get old. Looking out at the stars against that black velvet background. Charlie described them as diamond hard. Solid lasers.



That's pretty good.





Looking the other way?
Even better.

And you know, it surprised me.



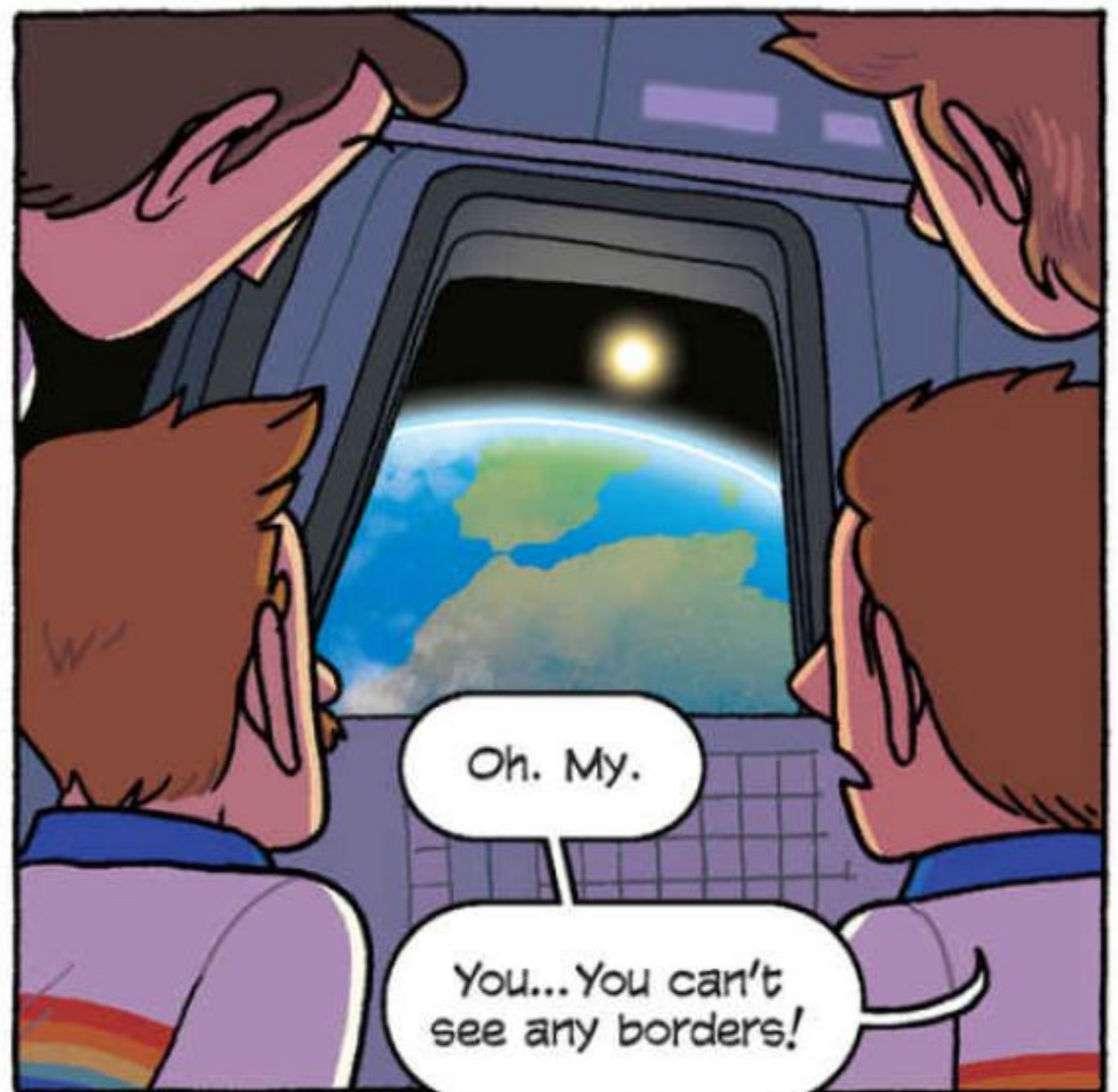
I'd been training with these
guys for years. Heard stories
of flying jets and helicopters
during the Vietnam War.

You don't expect them to
be environmentally sensitive.



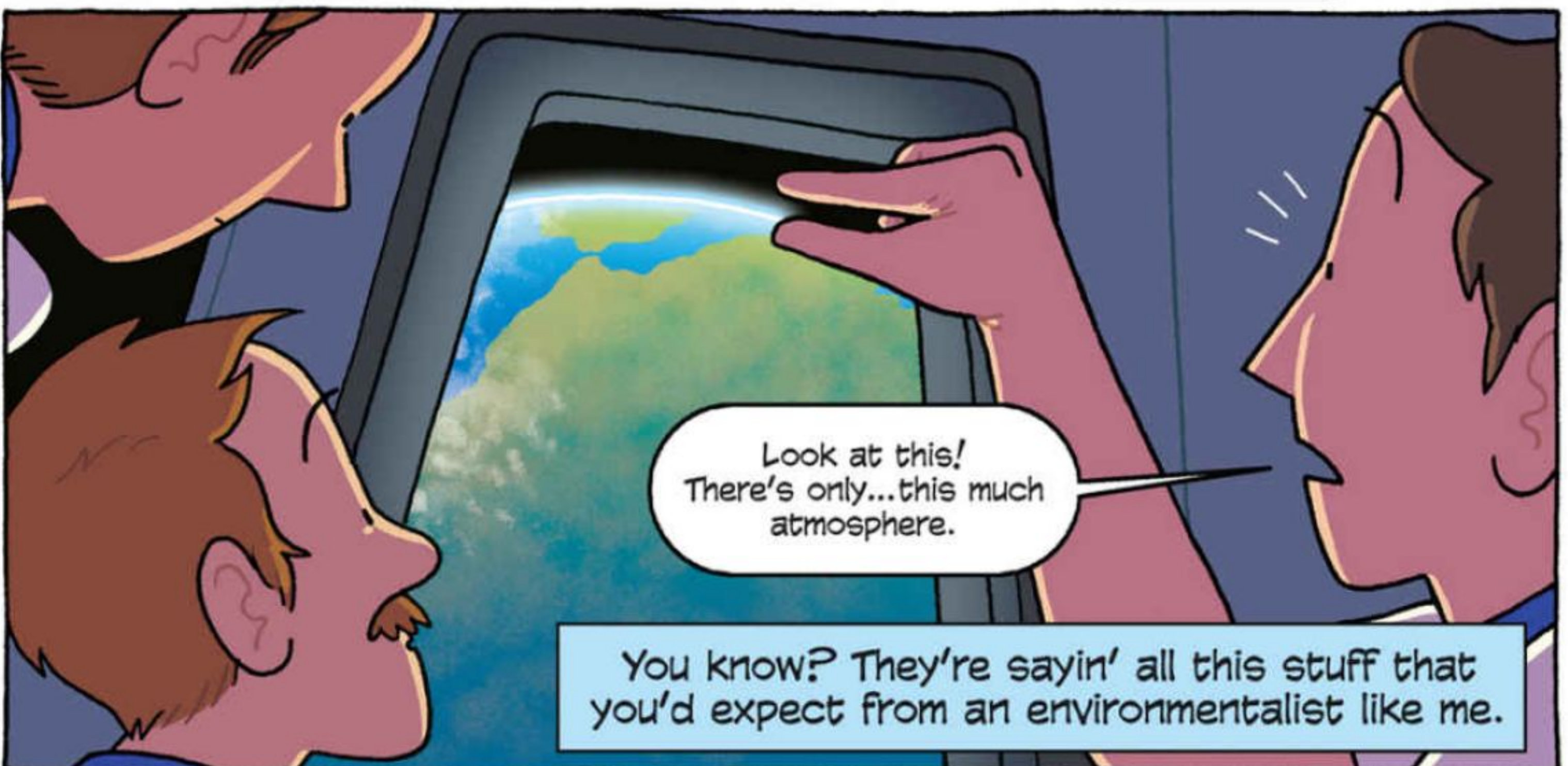
But these tough-guy military
veteran fighter pilot astronauts?

They get up in a spaceship,
and they look out the window,
and they're all...



Oh. My.

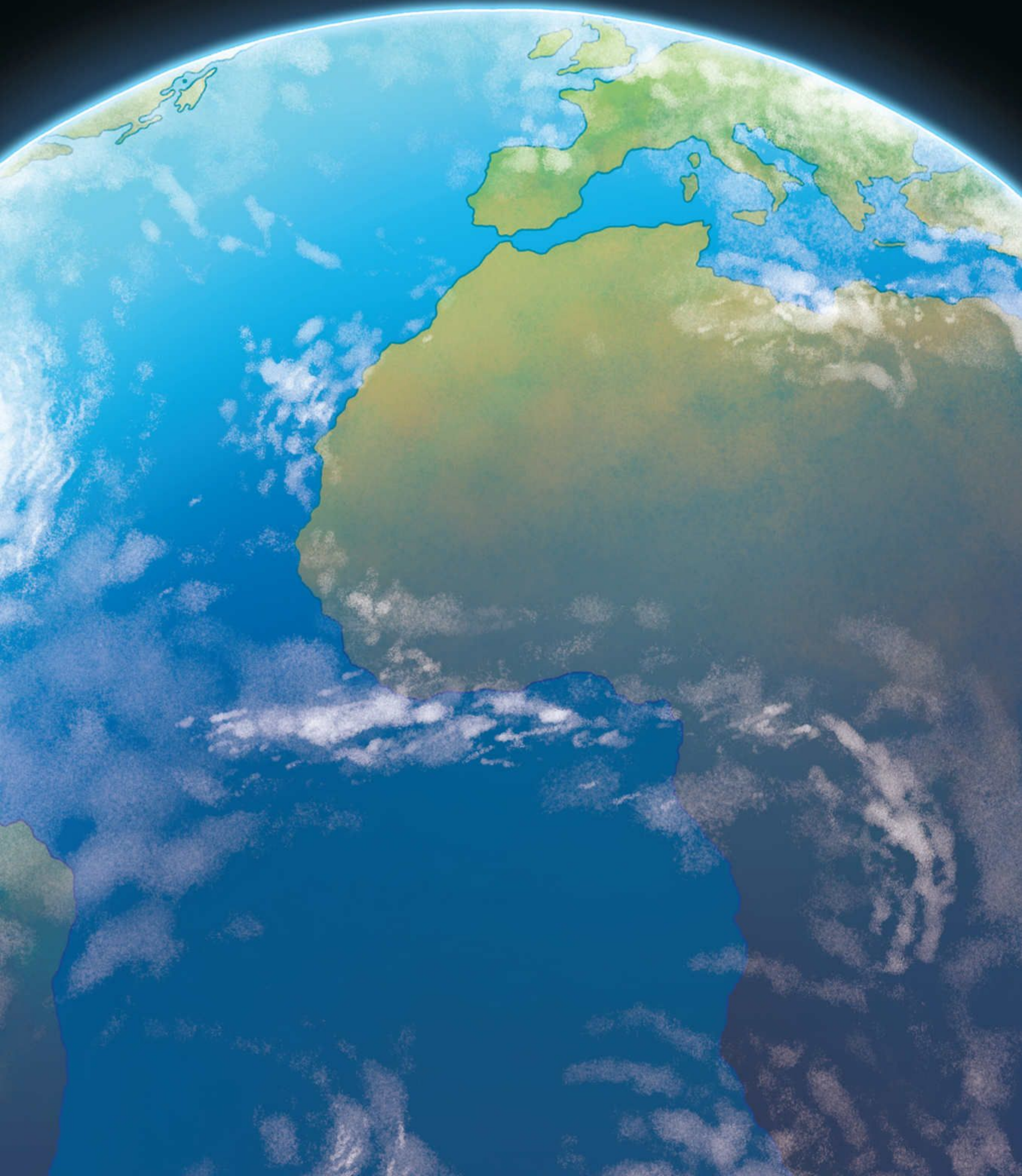
You... You can't
see any borders!



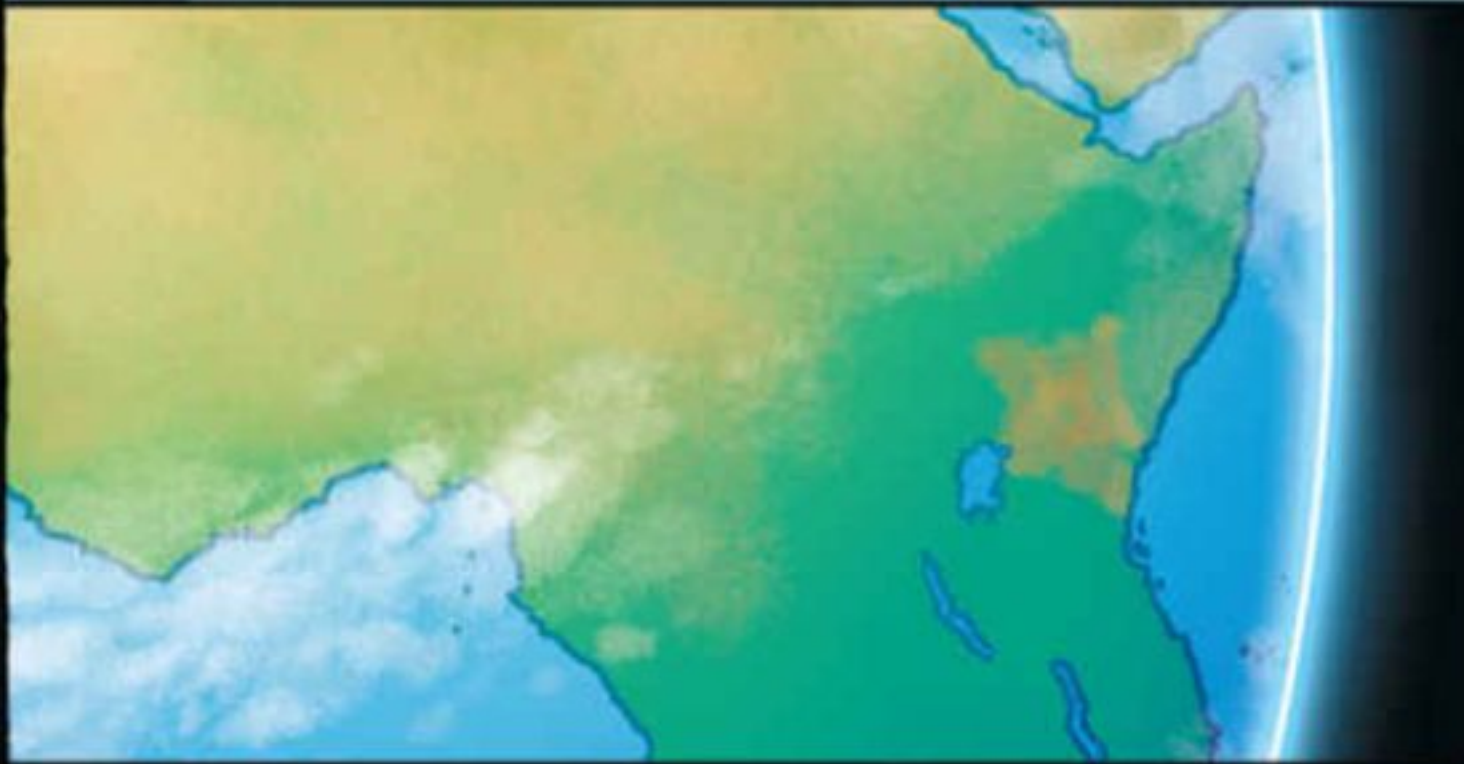
Look at this!
There's only... this much
atmosphere.

You know? They're sayin' all this stuff that
you'd expect from an environmentalist like me.

It's called the Overview Effect.



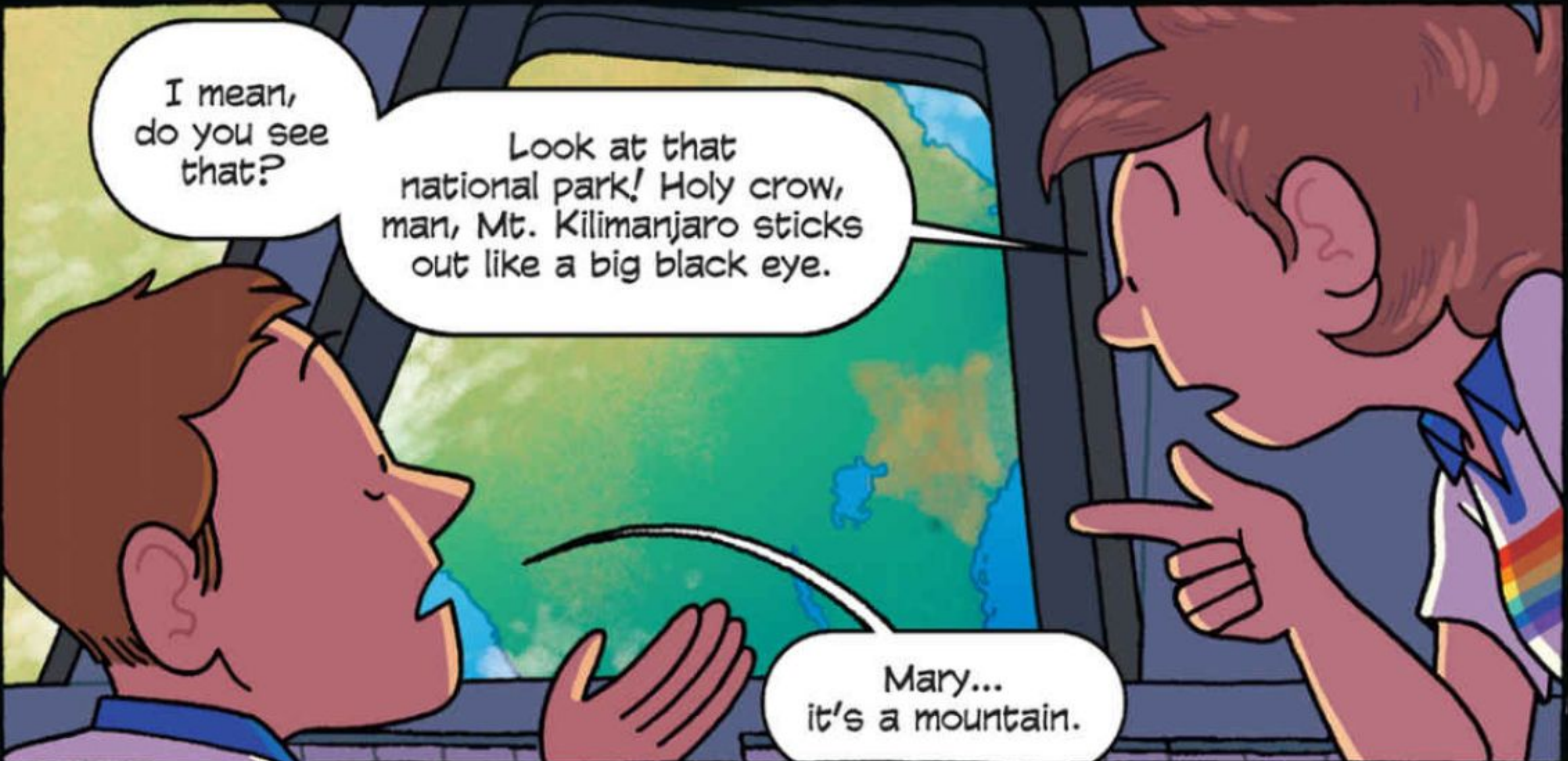
It's real common. You hear it from just about every astronaut, ever. They look at our planet and go, "Wow. Gotta take better care of *that*."



Did I experience it? Sure. But I saw things differently too.



My god. You can see land use policy differences! There's the border—that country has good ones and that one doesn't.



I mean, do you see that?

Look at that national park! Holy crow, man, Mt. Kilimanjaro sticks out like a big black eye.

Mary... it's a mountain.



Right, I know. And it's also not overgrazed.



So I had the Overview Effect, too. I got it looking both ways—out into deep space, and down at home.

And then the last experiments were done and stowed and the last checklists were complete and the last wastewater got dumped and we slept and ate one last time.



And we returned to Earth.



Your mind can take it in as kinda soothing, that palette. But intellectually?

It's 3,000 degrees Fahrenheit just a fraction of an inch beyond the outside of this window.

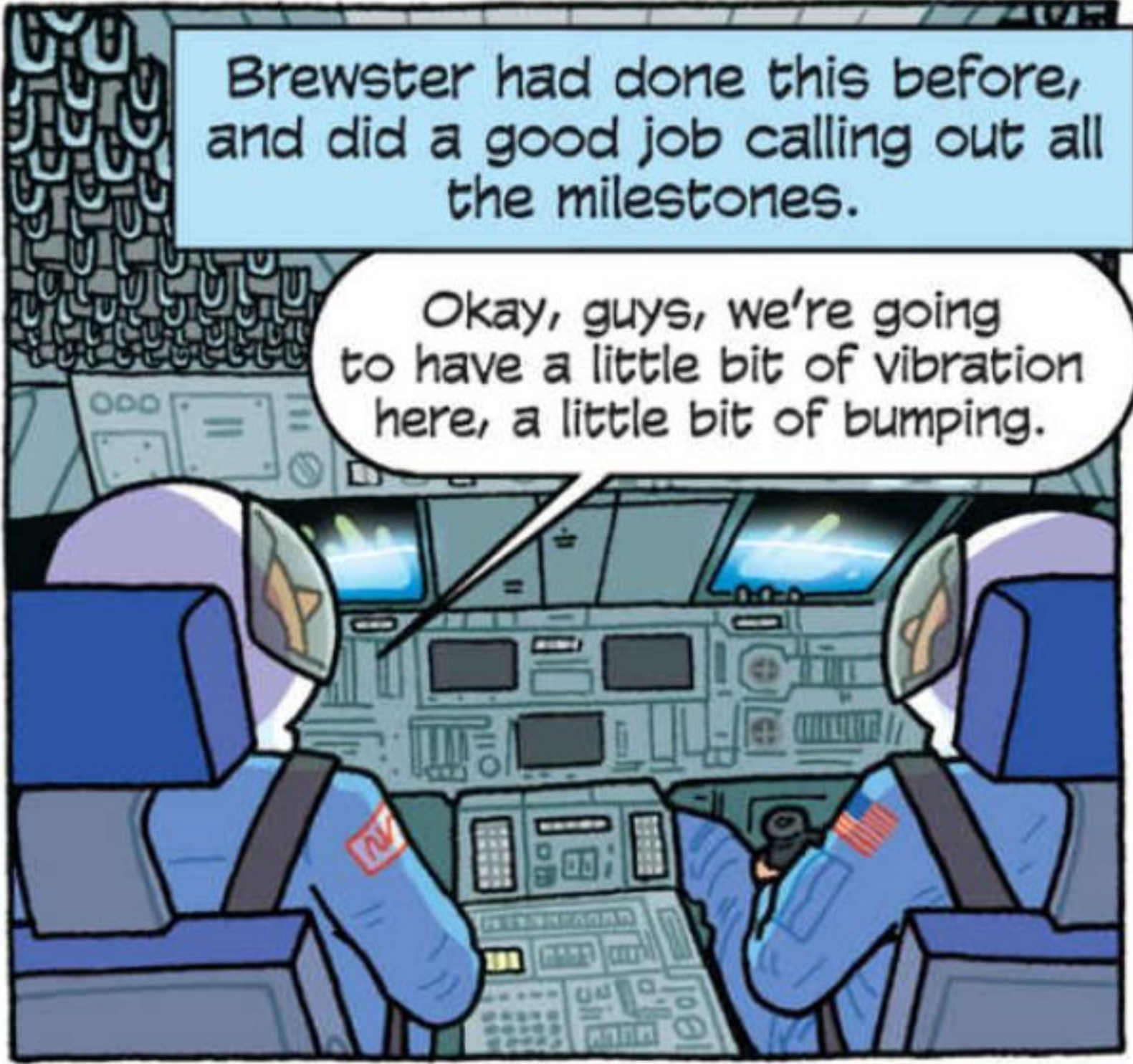
We're going 18,000 miles an hour.

We got quite a bit of vibration and a little bucking for the first time in well over a week.

Now, as soon as we pass transonic, it's going to go away again.

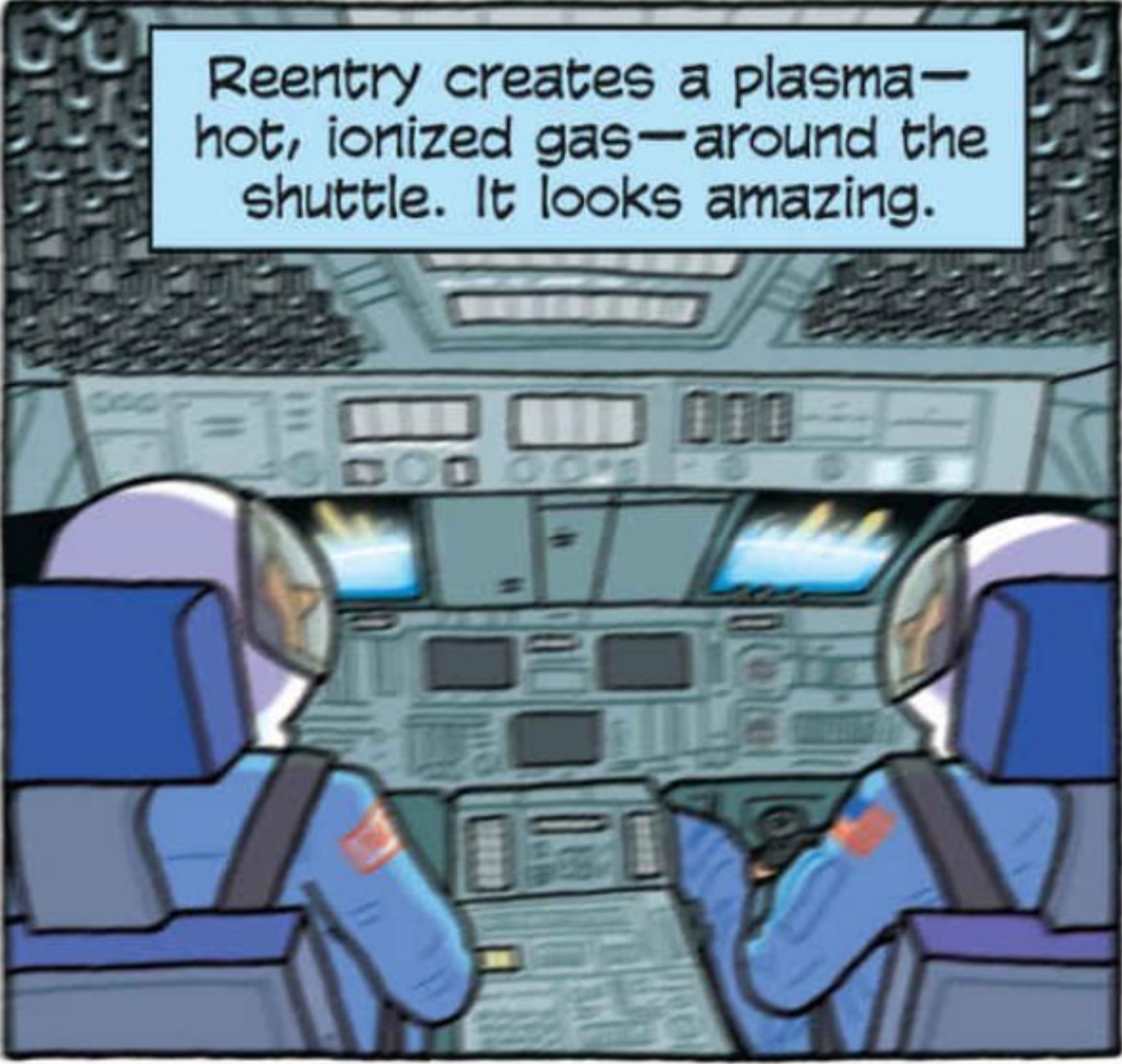
And it did.





Brewster had done this before, and did a good job calling out all the milestones.

Okay, guys, we're going to have a little bit of vibration here, a little bit of bumping.

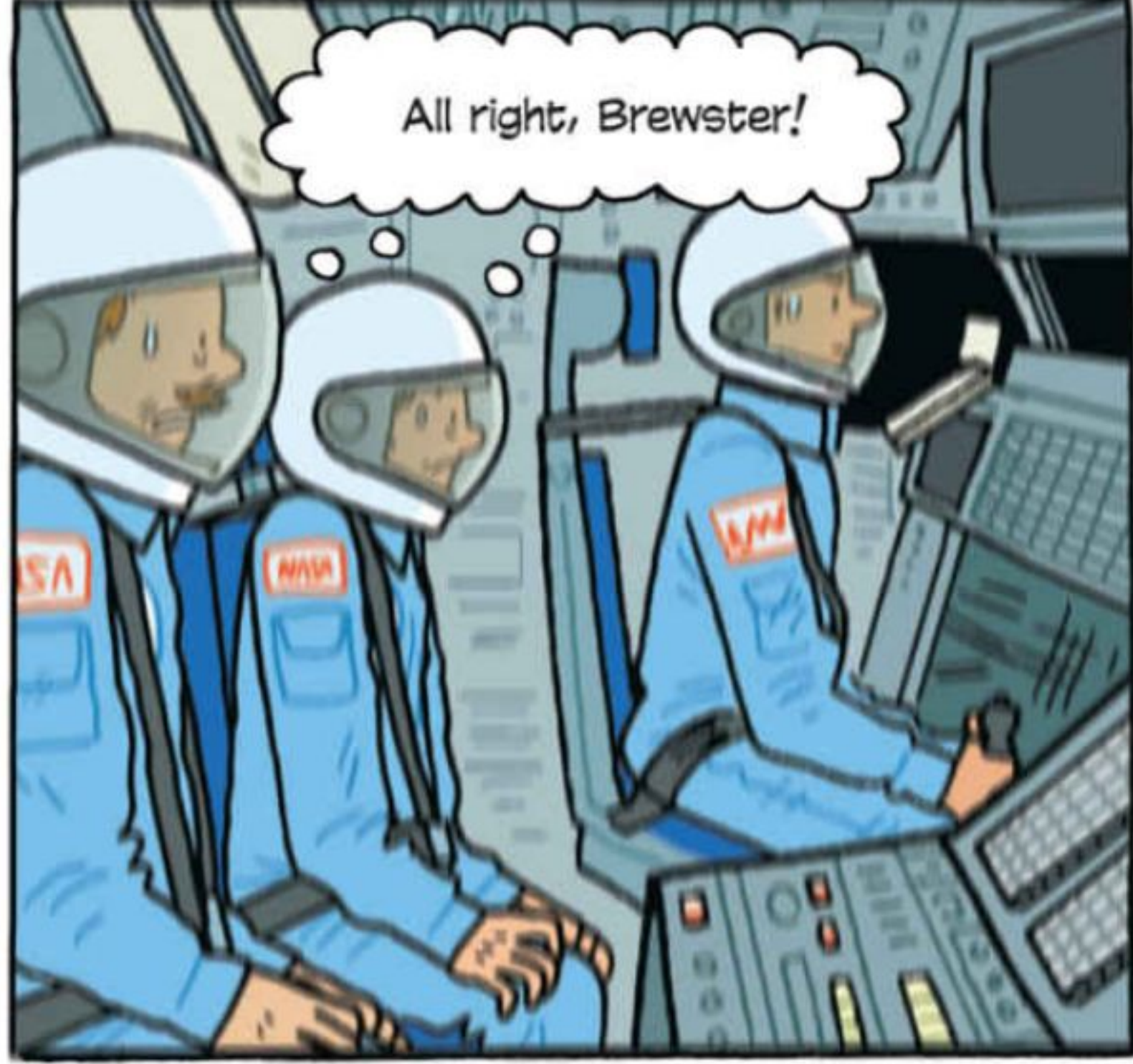


Reentry creates a plasma—hot, ionized gas—around the shuttle. It looks amazing.



It's definitely thick enough to start beating you around.

And when we hit that thin shell of air that makes life possible? Well...

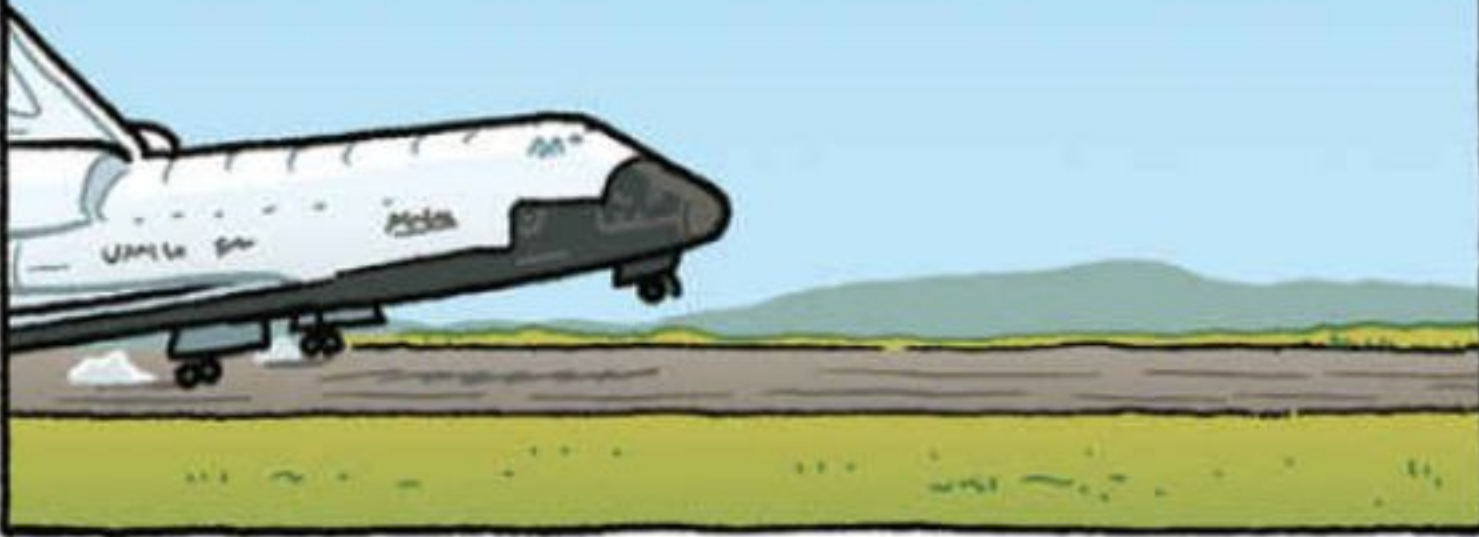


All right, Brewster!



And we came over the Pacific one last time, and then Brewster did a perfect landing.

I mean, we had to check the computers just to see that we got WOW—weight on wheels. We could hear them rolling before we felt anything on our rear ends.



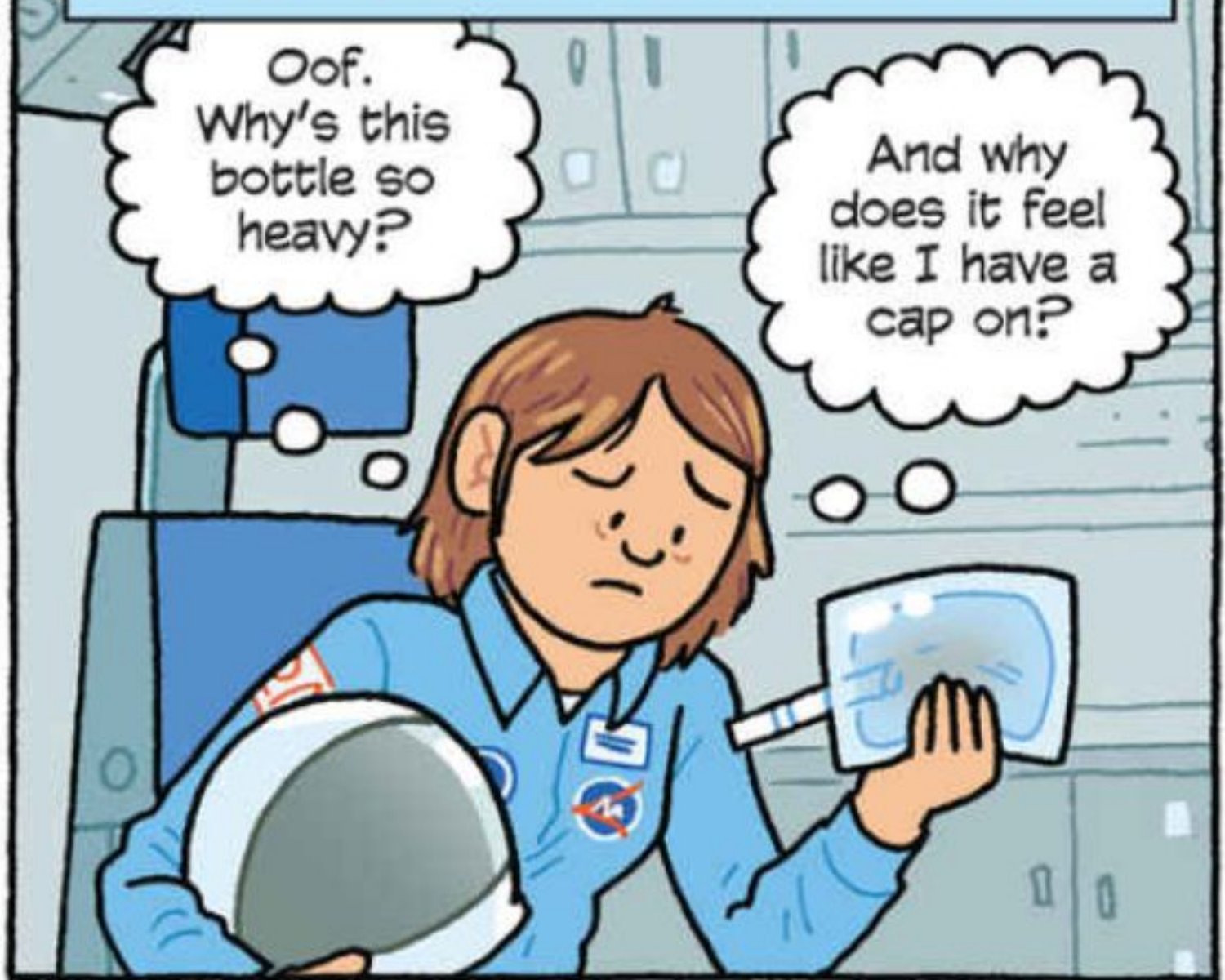
And then again with weight on nose gear. It was so smooth. Brewster's WOW and WONG were better than any commercial flight landing.



We coasted to a stop, completed our landing checklists, and were back on Earth for real.



The only thing left to do was to figure out how to stand up again.



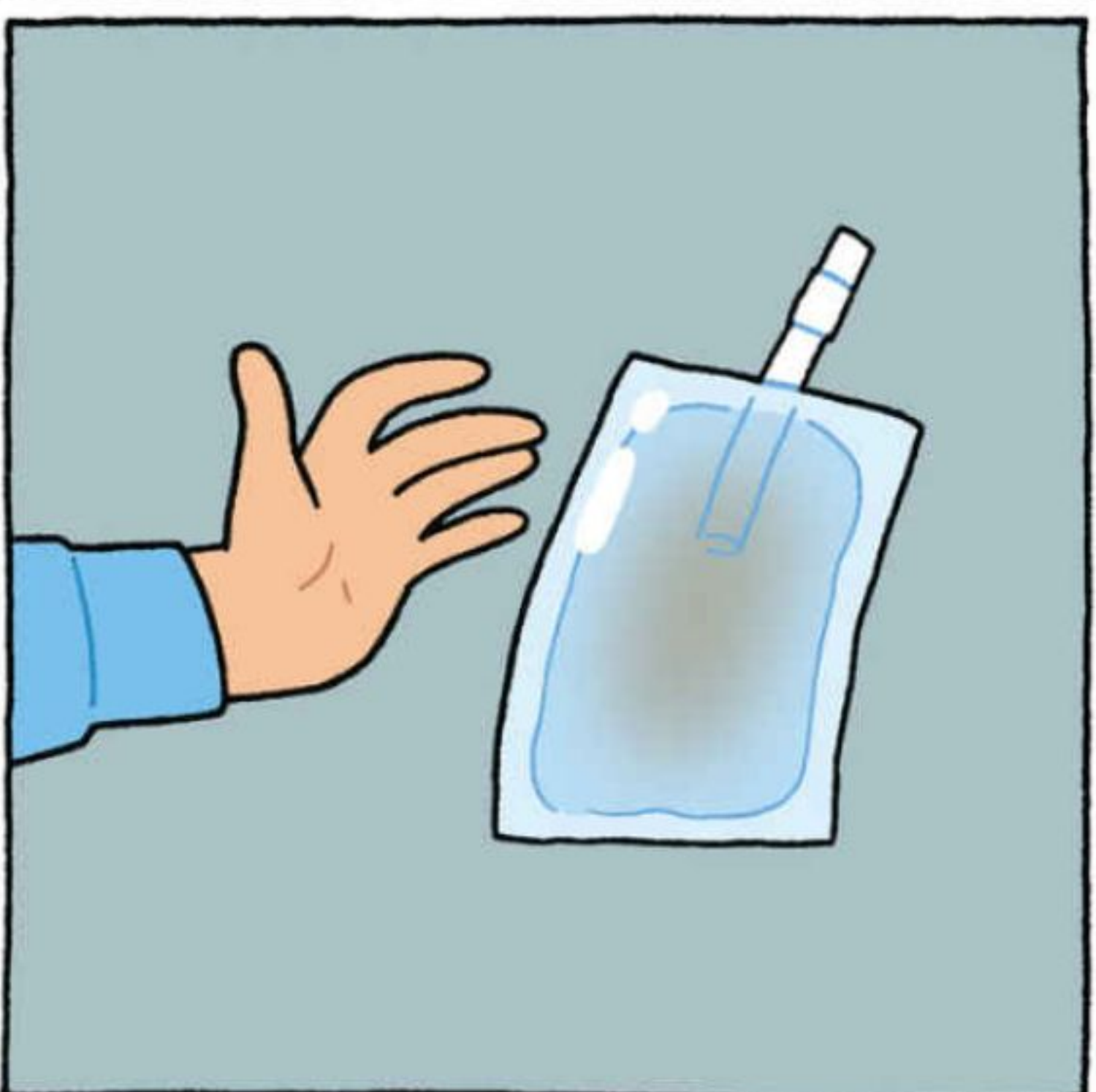
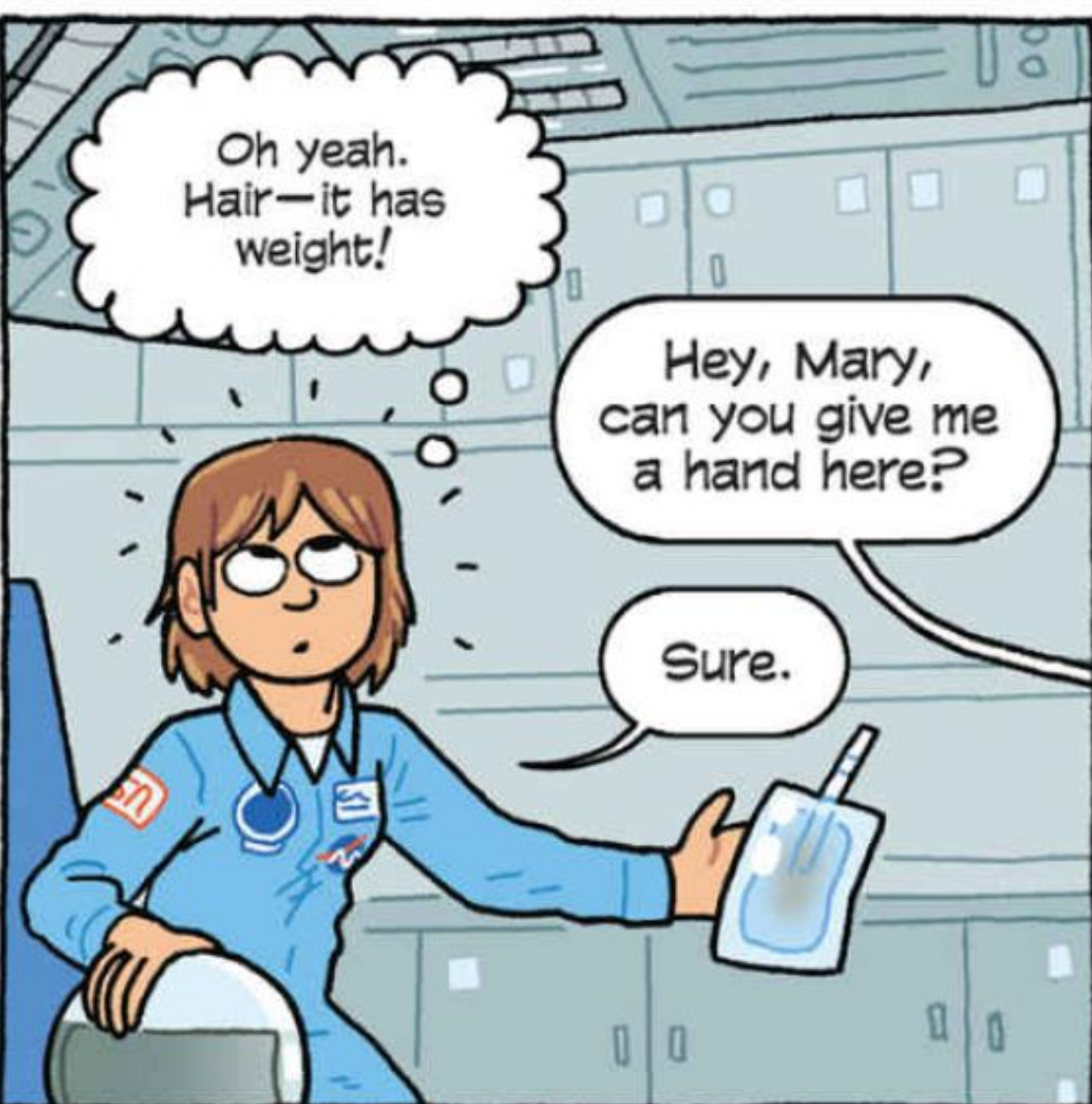
Oof. Why's this bottle so heavy?

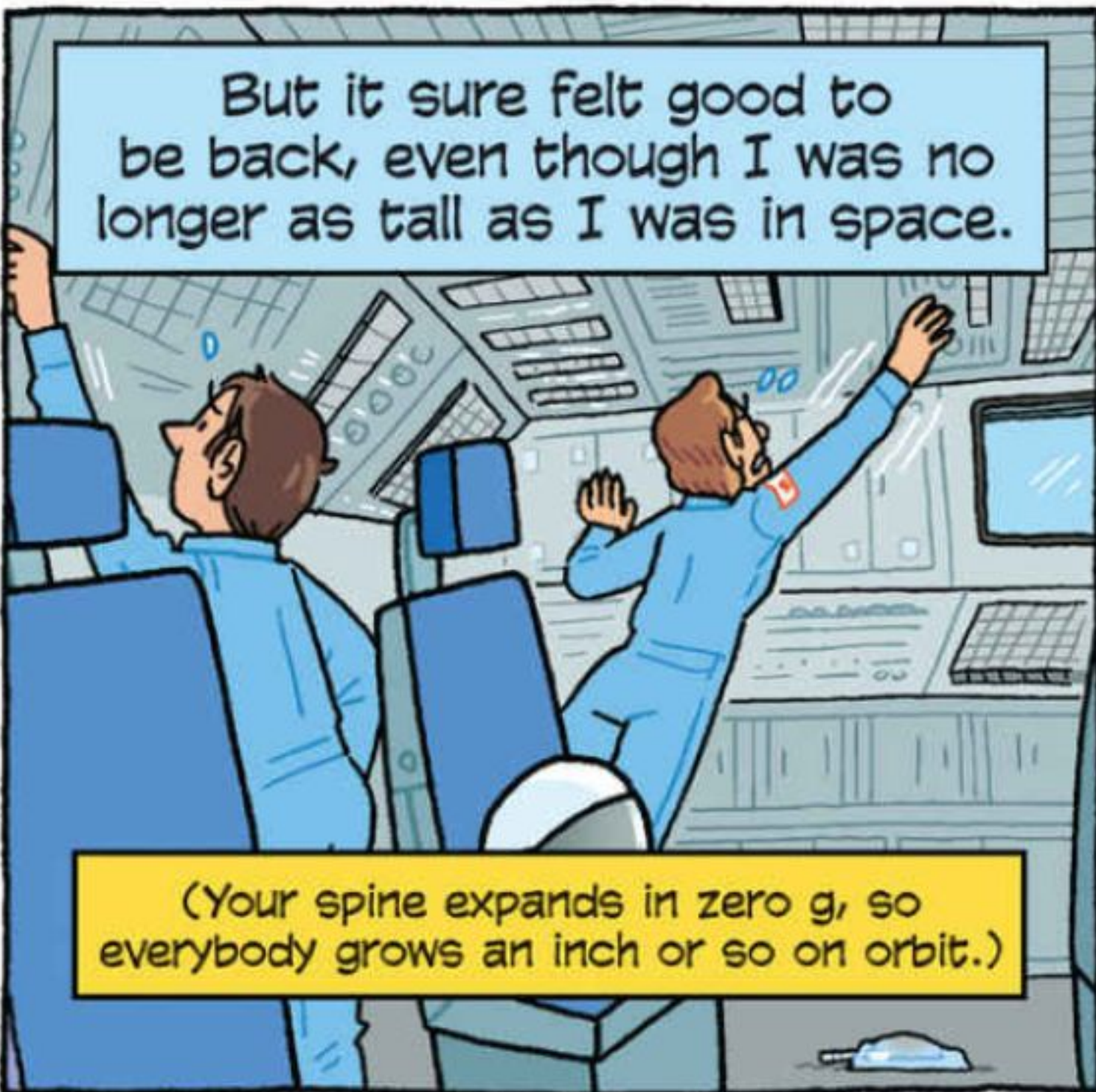
And why does it feel like I have a cap on?

Oh yeah. Hair—it has weight!

Hey, Mary, can you give me a hand here?

Sure.







Our flight was just about perfect, but there were things to improve. The water, for one thing. We used a lot of iodine to purify it, so it looked, and tasted, bad.



And when a lot of your food is dehydrated, if your water tastes lousy your food tastes lousy.

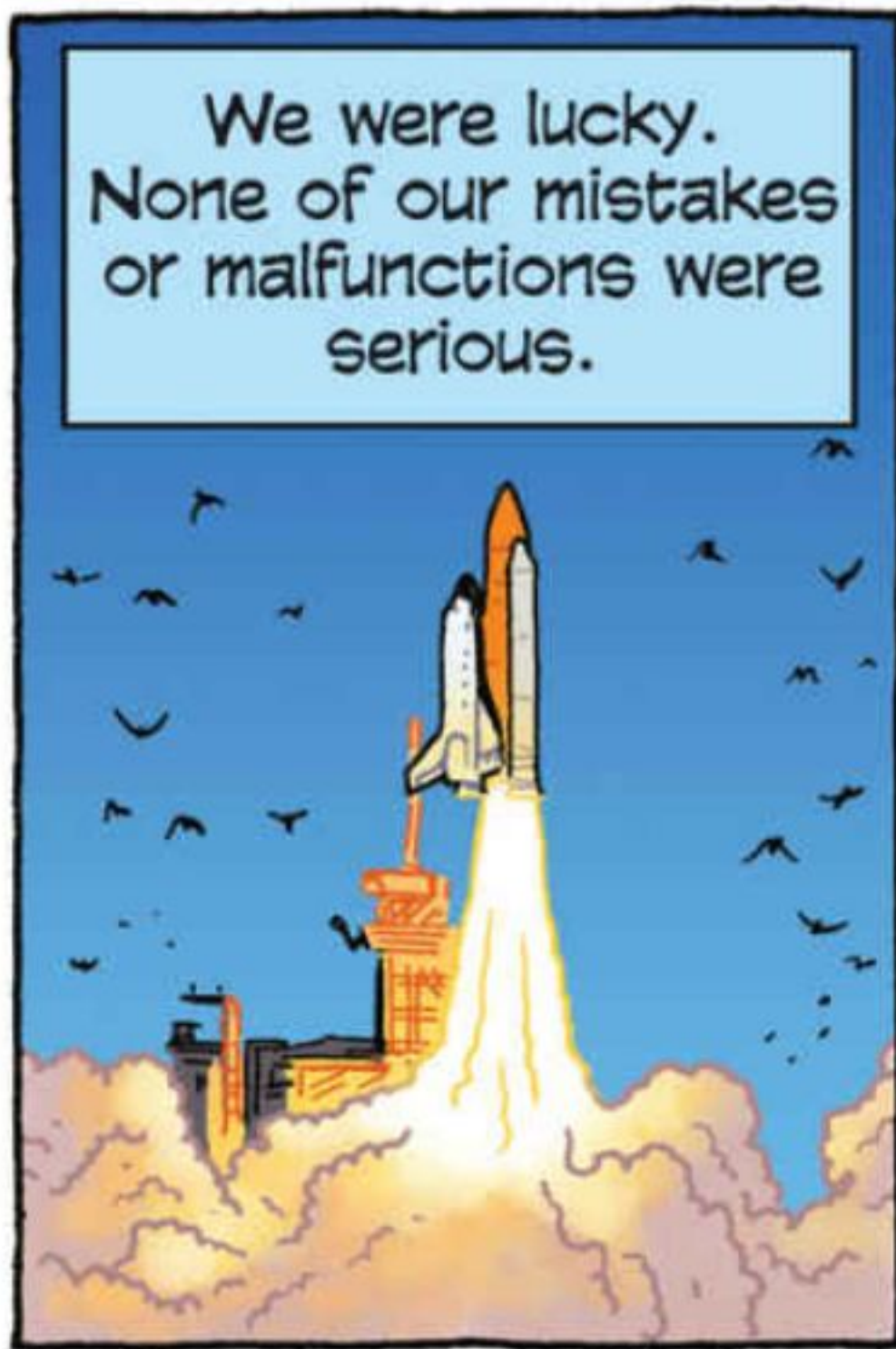
NoD NoD

Nobody goes to space for fine dining, but we can do better. I have some ideas for water treatment...

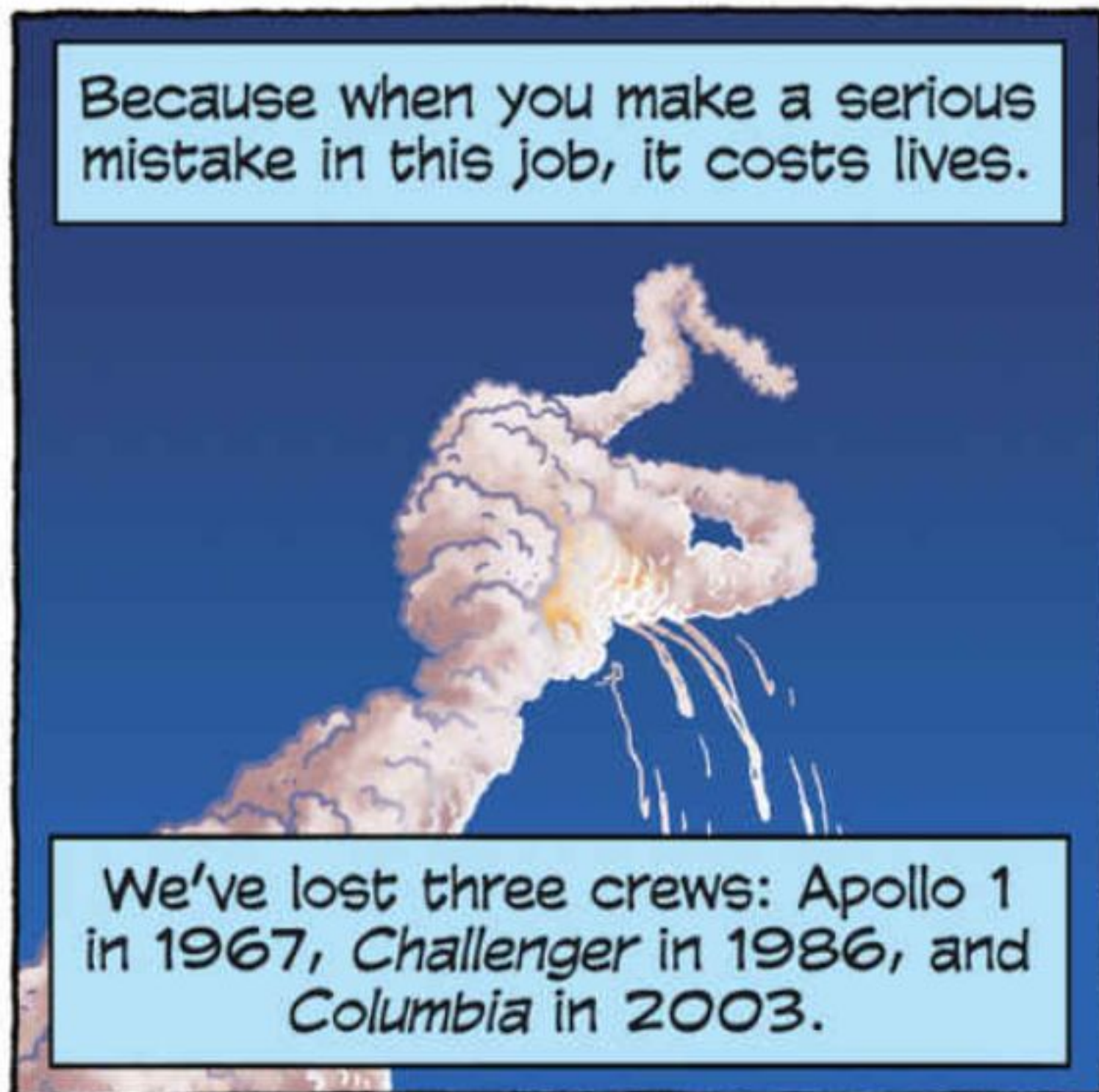


We talked about construction techniques for the space station, experiments, IMAX cameras.

Everything. Because there's always stuff to improve.

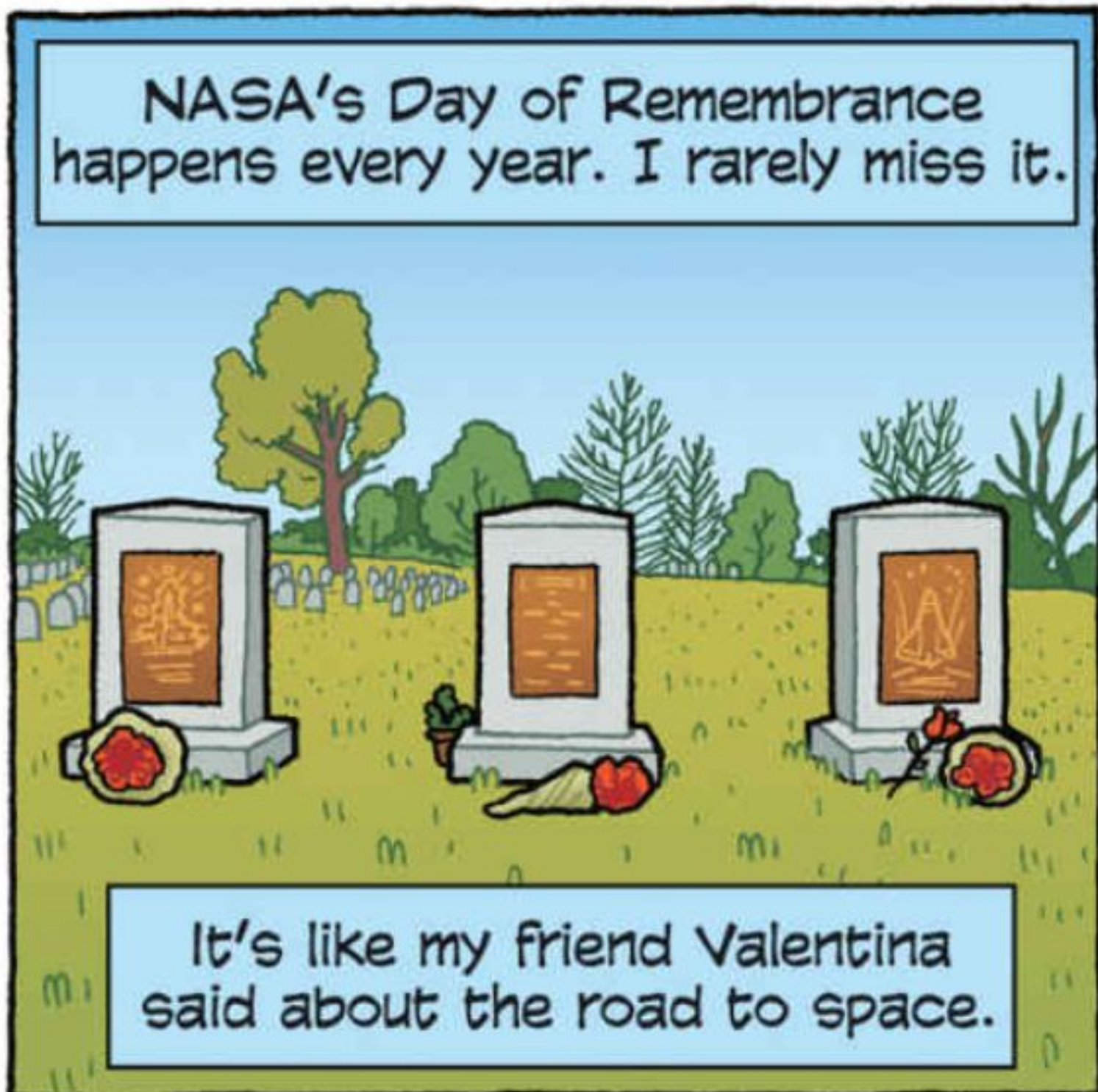


We were lucky. None of our mistakes or malfunctions were serious.



Because when you make a serious mistake in this job, it costs lives.

We've lost three crews: Apollo 1 in 1967, Challenger in 1986, and Columbia in 2003.



NASA's Day of Remembrance happens every year. I rarely miss it.

It's like my friend Valentina said about the road to space.

But we don't give up. We figure out what went wrong, what mistakes we made, then we fix them and we move on.

Because when in doubt, refer to Rule 1.

THE RULES

1. ALL FLIGHTS ARE GOOD FLIGHTS.
2. SOONER IS BETTER THAN LATER.
3. LONGER IS BETTER THAN SHORTER.
4. HIGH INCLINATION IS BETTER THAN LOW INCLINATION.

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I stayed in the flight rotation after *Challenger*, and I think everybody else did too. We all follow the rules of flight.

So in 1989, I went back up on STS-30. This time we had only five crew members, and Mark Lee was a rookie, so I gave him his choice of seats.



Flight deck on ascent or entry?

Heck, I don't know. What did you do on your first flight?

I was flight engineer, so I was up there for both...

Okay, I'll go with ascent.



That meant I was seated alone, below. I thought it was a really lousy deal.

I'm going to be all by myself down here and I can't see a thing.



It was **ROAR**

WHOOOF WHOOOF **RUMBLE**

RUMBLE **RUMBLE**





It was great.

ROAR

**WHOOMF
WHOOMF**

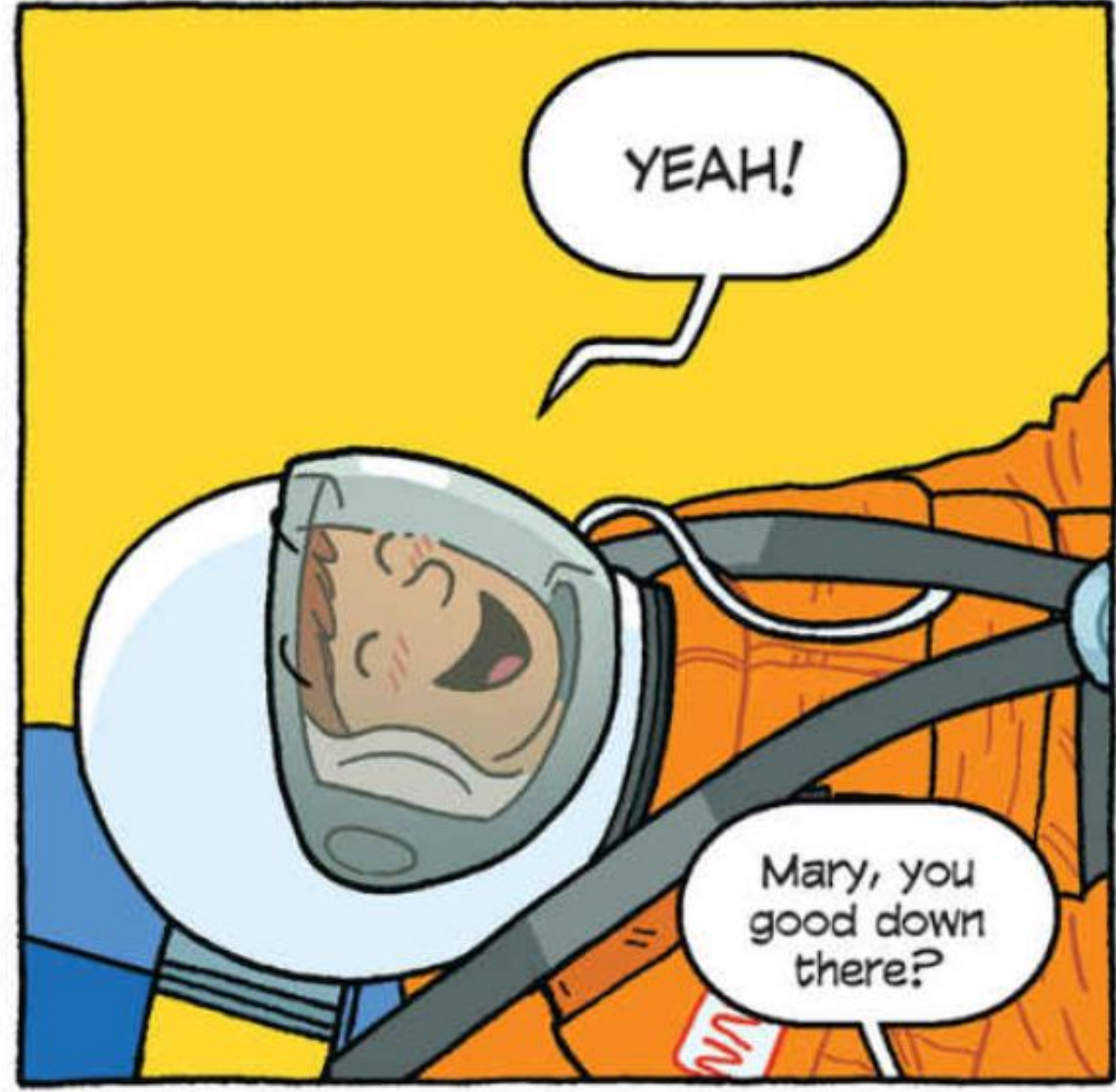
RUMBLE

**RUMBLE
RUMBLE**



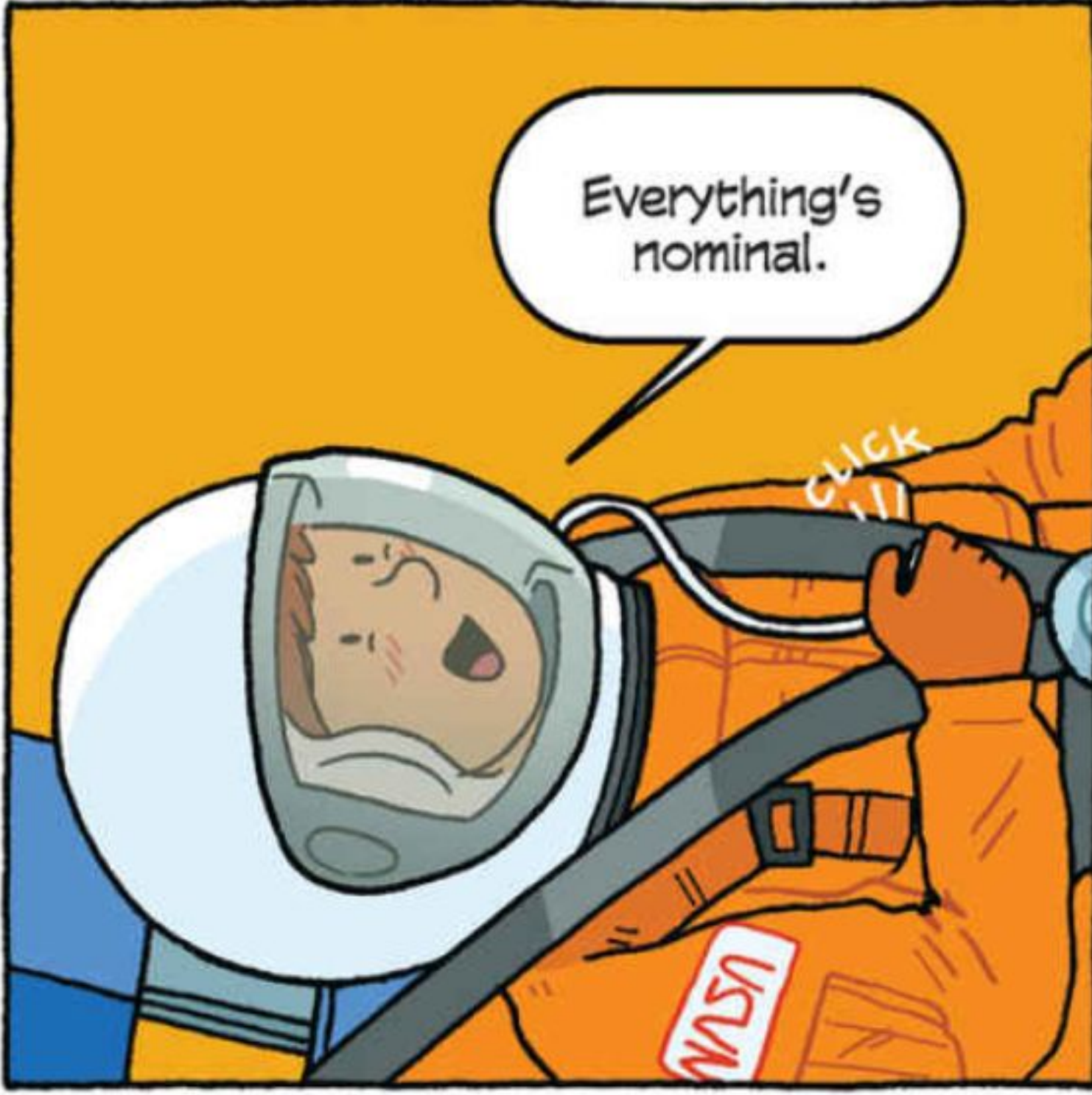
After *Challenger*, we wore pressure suits to launch. It was push to talk, so unless I had my hand on the mic button, nobody could hear me.

Whooooooooo!



YEAH!

Mary, you good down there?



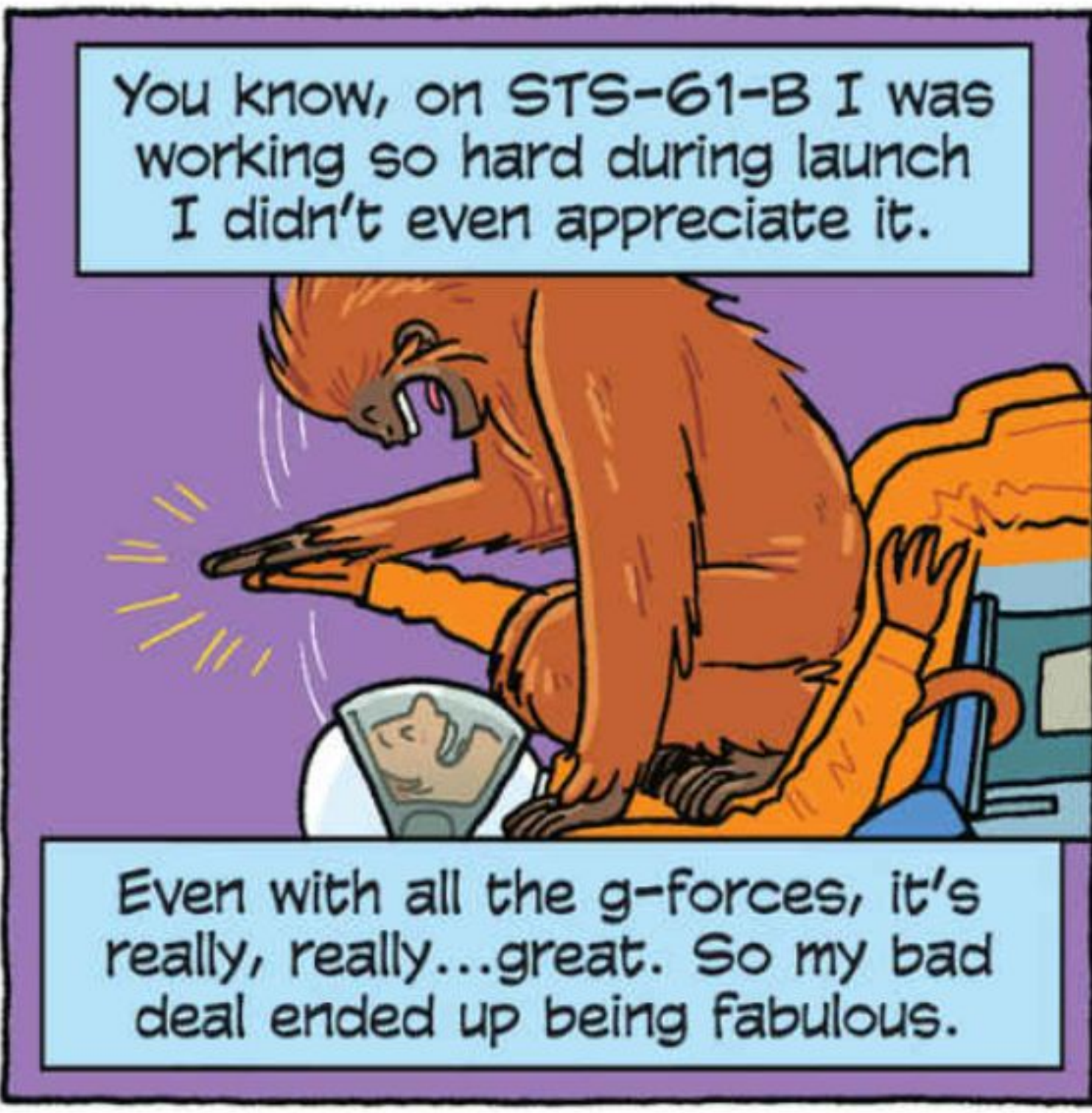
Everything's nominal.

CLICK



Heck yes it's nominal. This! Is!! A!!! RIDE!!!!

Wooooo!



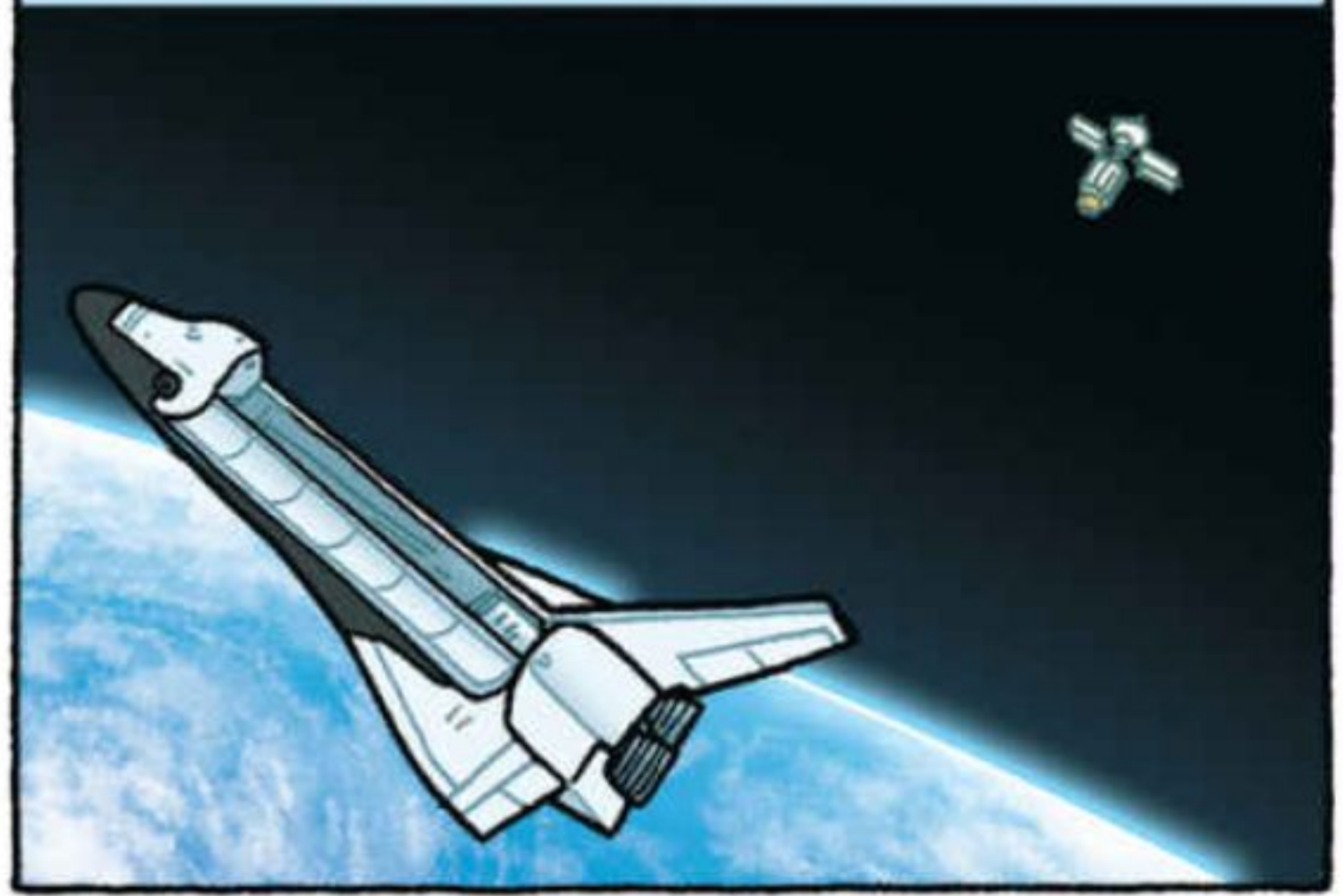
You know, on STS-61-B I was working so hard during launch I didn't even appreciate it.

Even with all the g-forces, it's really, really...great. So my bad deal ended up being fabulous.

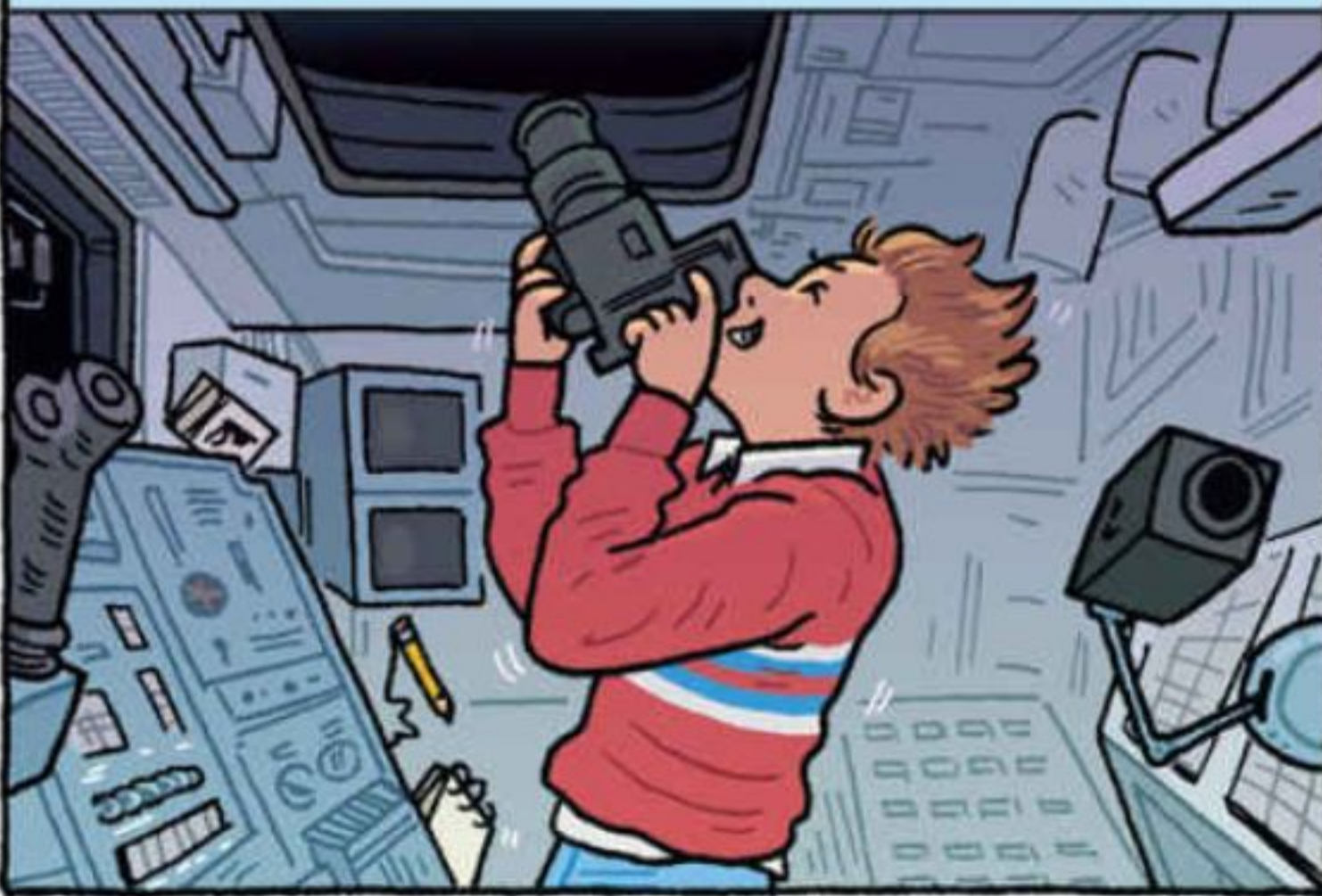
Our primary mission was to launch *Magellan*, which was going to do radar imaging of Venus's surface.



Understanding a planet where greenhouse gases took over is important, and *Magellan* did great work. That kinda got me interested in robotic spacecraft.



Mike Lee and I worked real hard until we deployed *Magellan*. First day, it's out of the payload bay. After that it belonged to the Jet Propulsion Lab engineers and scientists.



So we got rid of this thing, and then I got to do a lot more picture taking. I wasn't part of the flight crew, so I didn't have to worry about crew rest periods.



As my officemate Mike Mullane says, "I can sleep back on Earth—how often can I look out the window from space?"

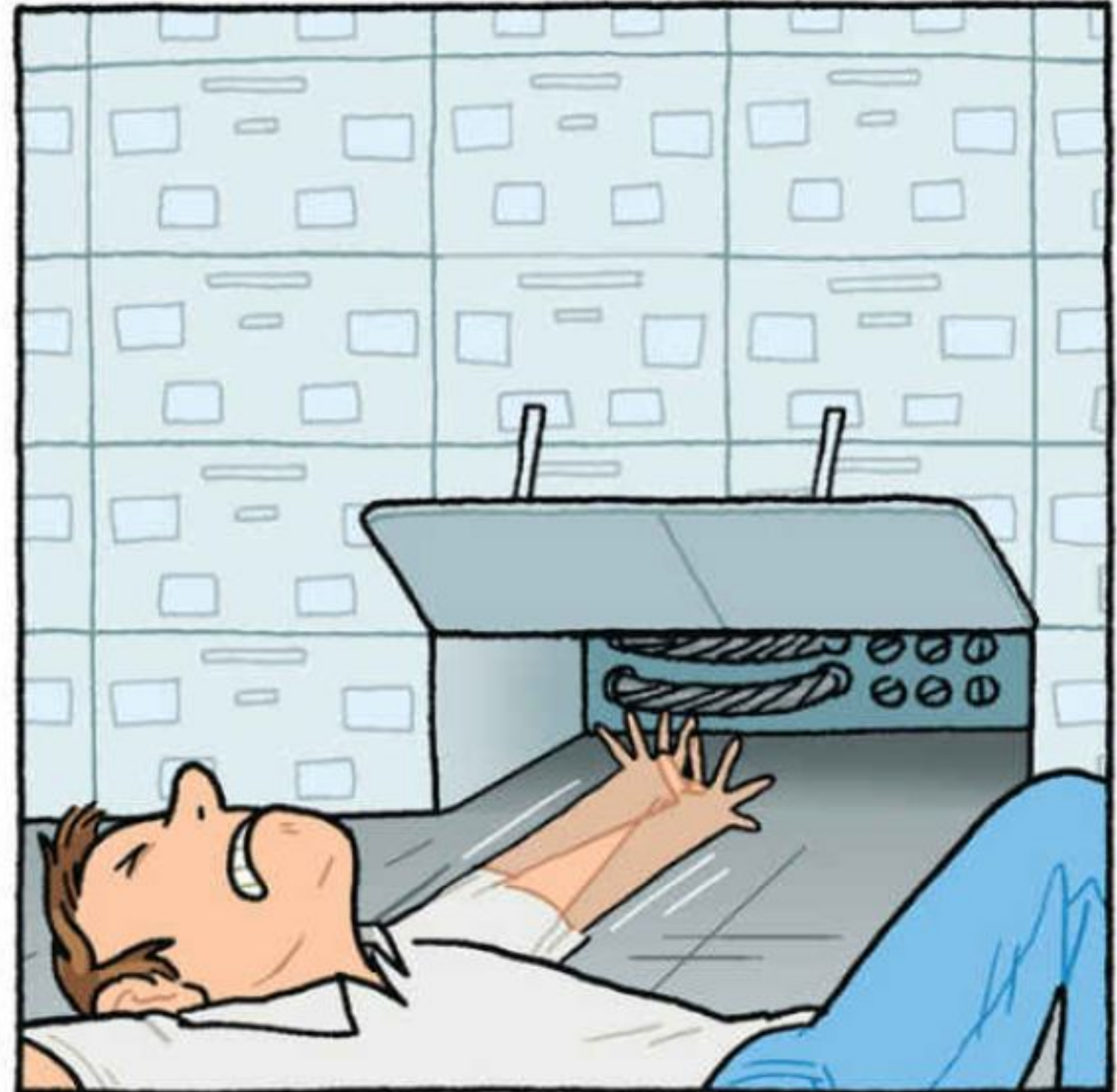


So basically for the rest of the mission, I didn't sleep too much. I was up taking pictures and just having a good time.

Sure, I did other stuff too. We had microgravity experiments with fluids and more.



Also, one of the GPCs—general purpose computers—failed and had to be replaced.



This was the first time anybody had to do that in orbit.



Sometimes it pays to be small, Commander!

Heck yeah.



It was a shorter flight than my first. The water tasted a lot better, even though the dispenser for it malfunctioned—which made preparing food a pain. More wraps.



And returning to Earth was just as sweet.



Back home I started thinking about what to do next.



Being an astronaut is great, but Rule of Flight #2—"Sooner is better than later"—maybe wasn't in my favor anymore.

Astronauts keep coming into the program, and I was helping with the interviews and selection now...

Okay, so we agree on Colonel Eileen Collins for a mission specialist? Air Force, two master's degrees...



There's no end to qualified people, it turns out.

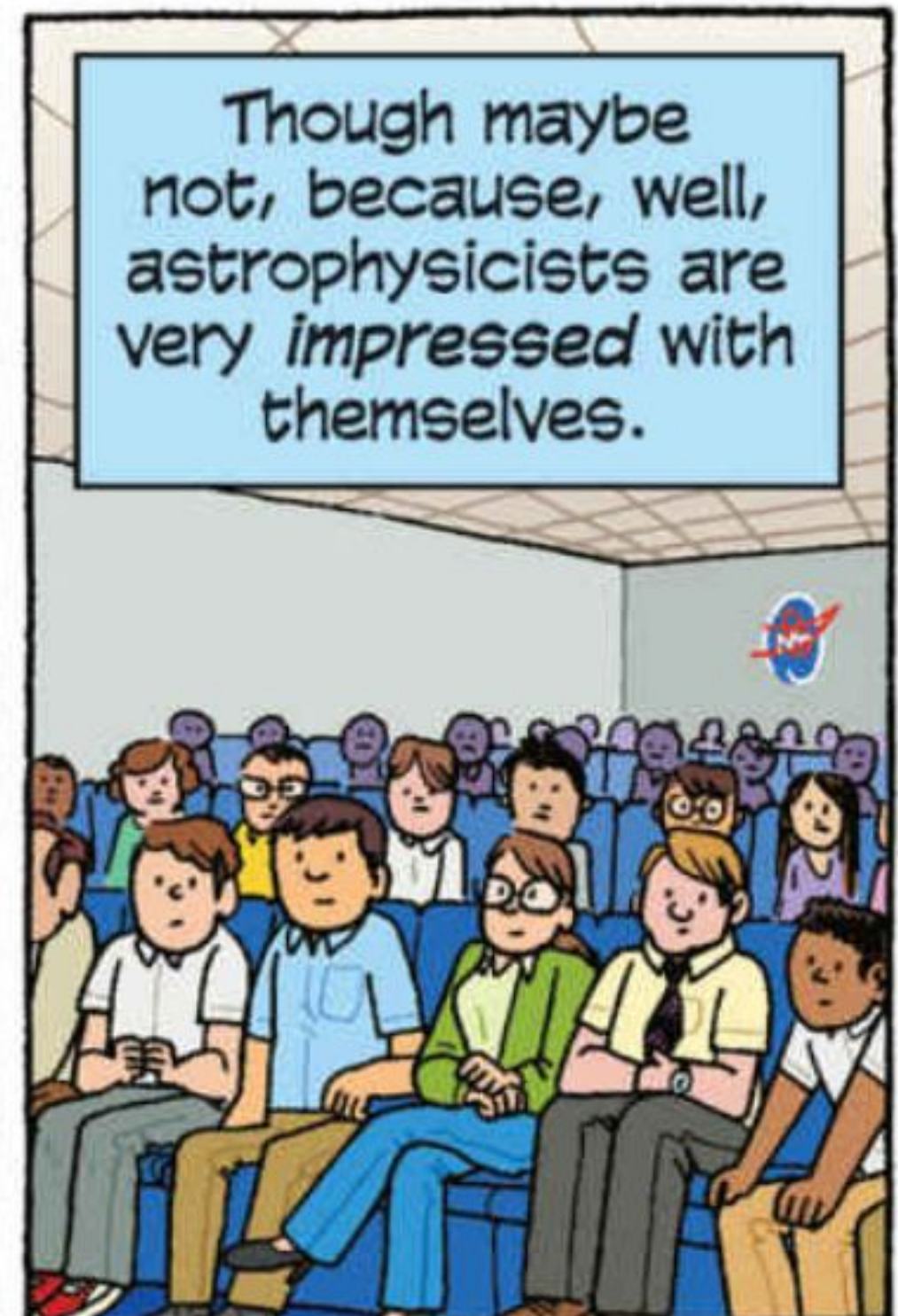
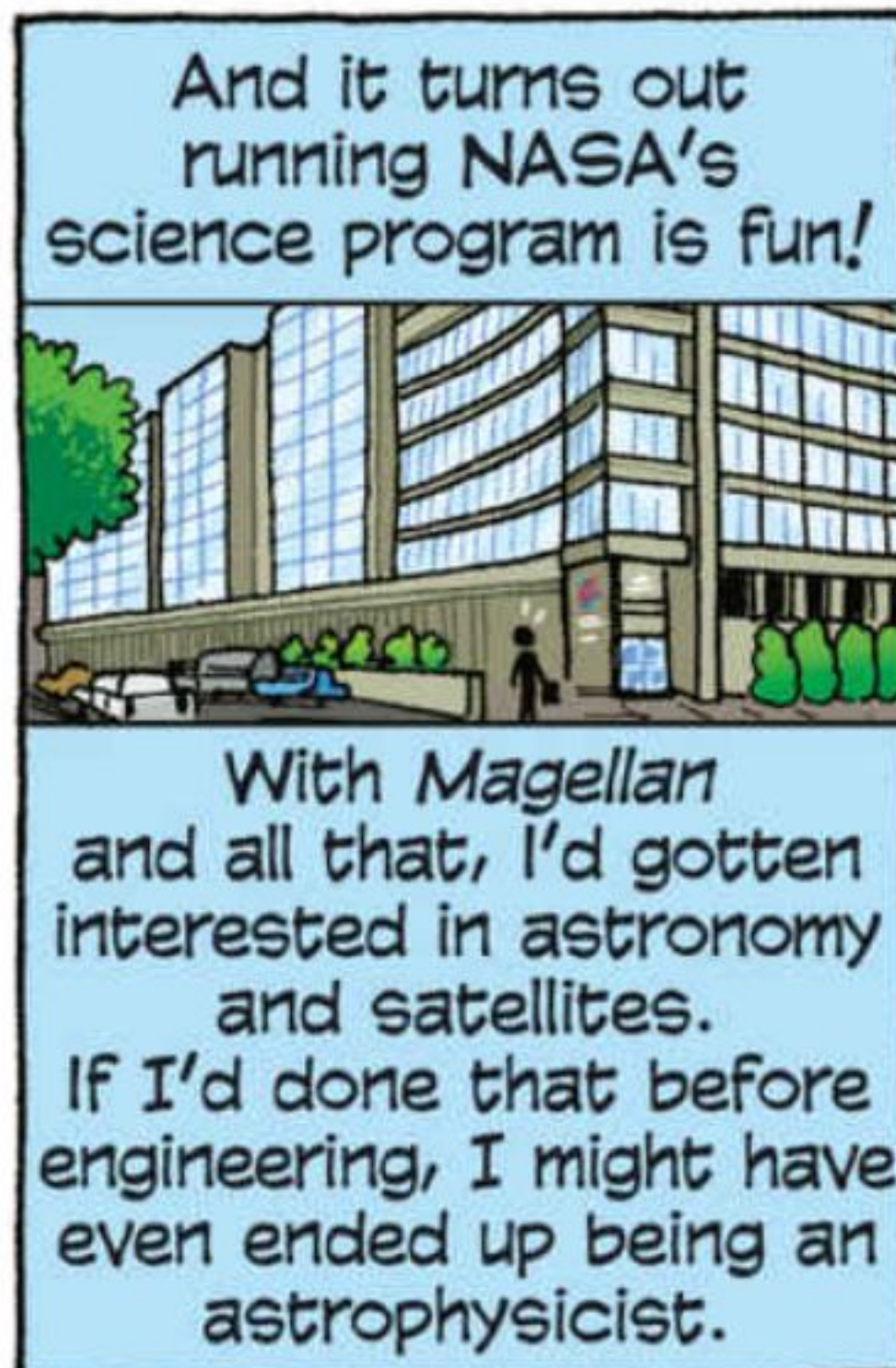
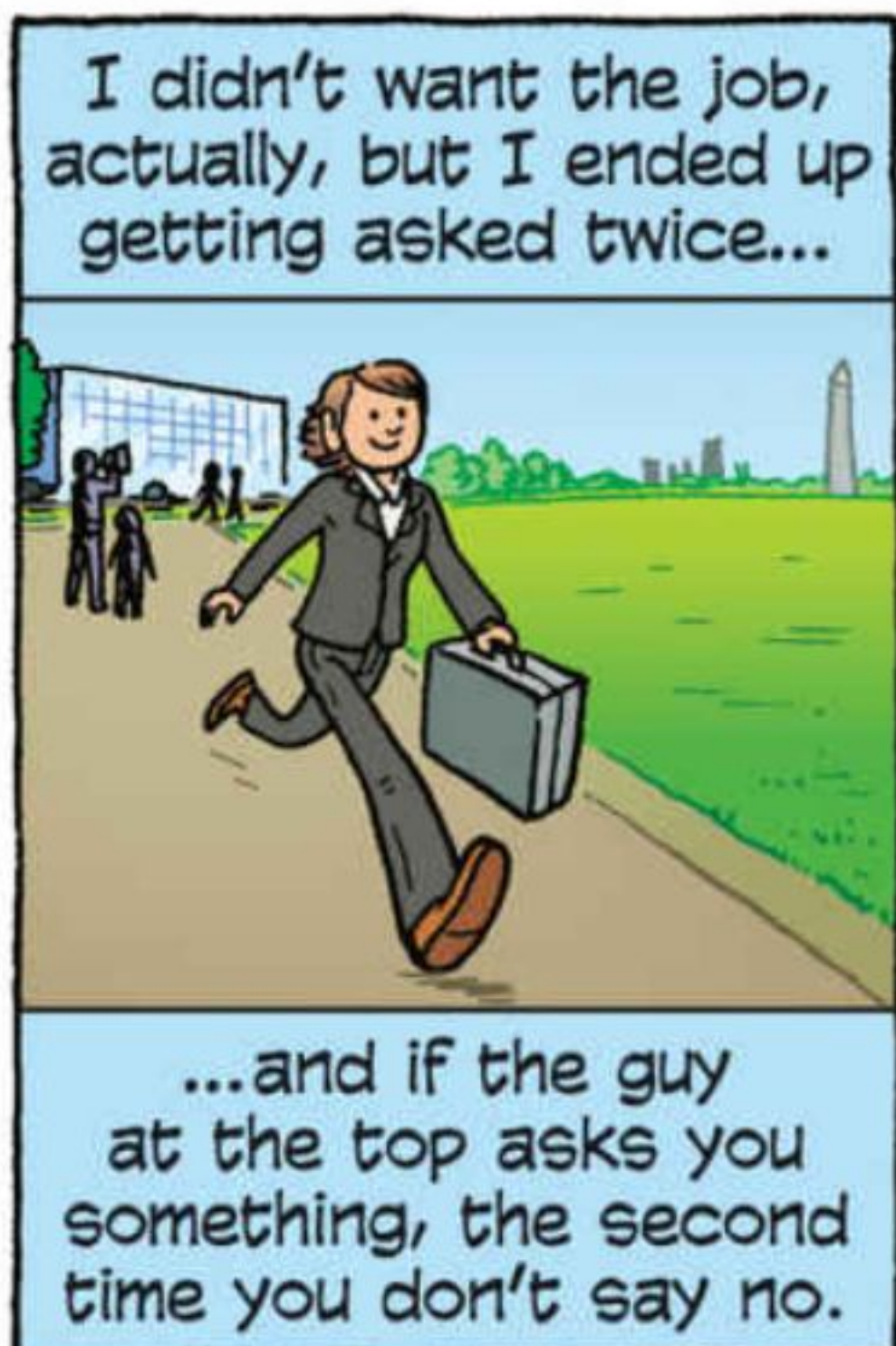
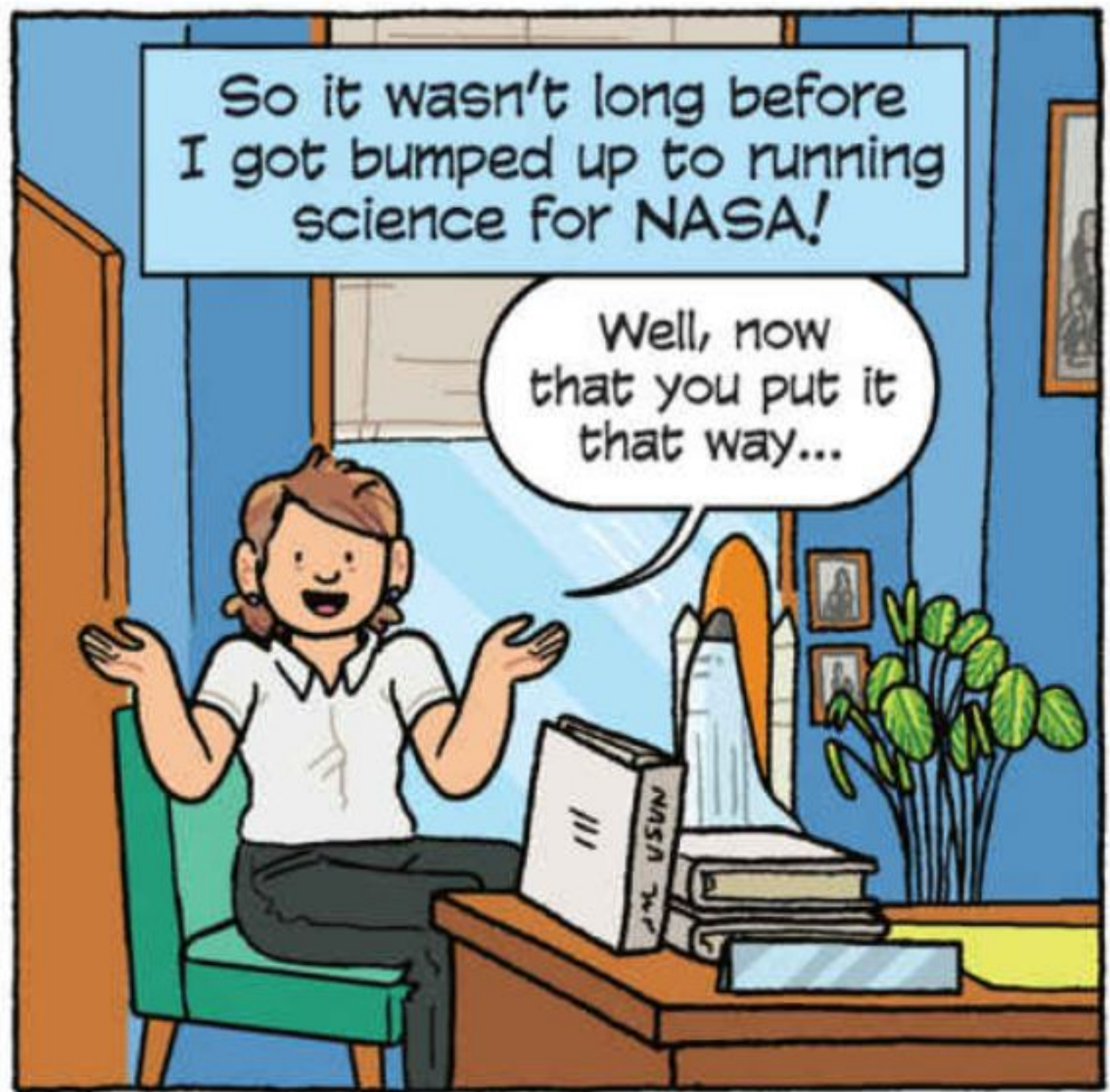
Uh... Sure? But she's not really a hard science person.

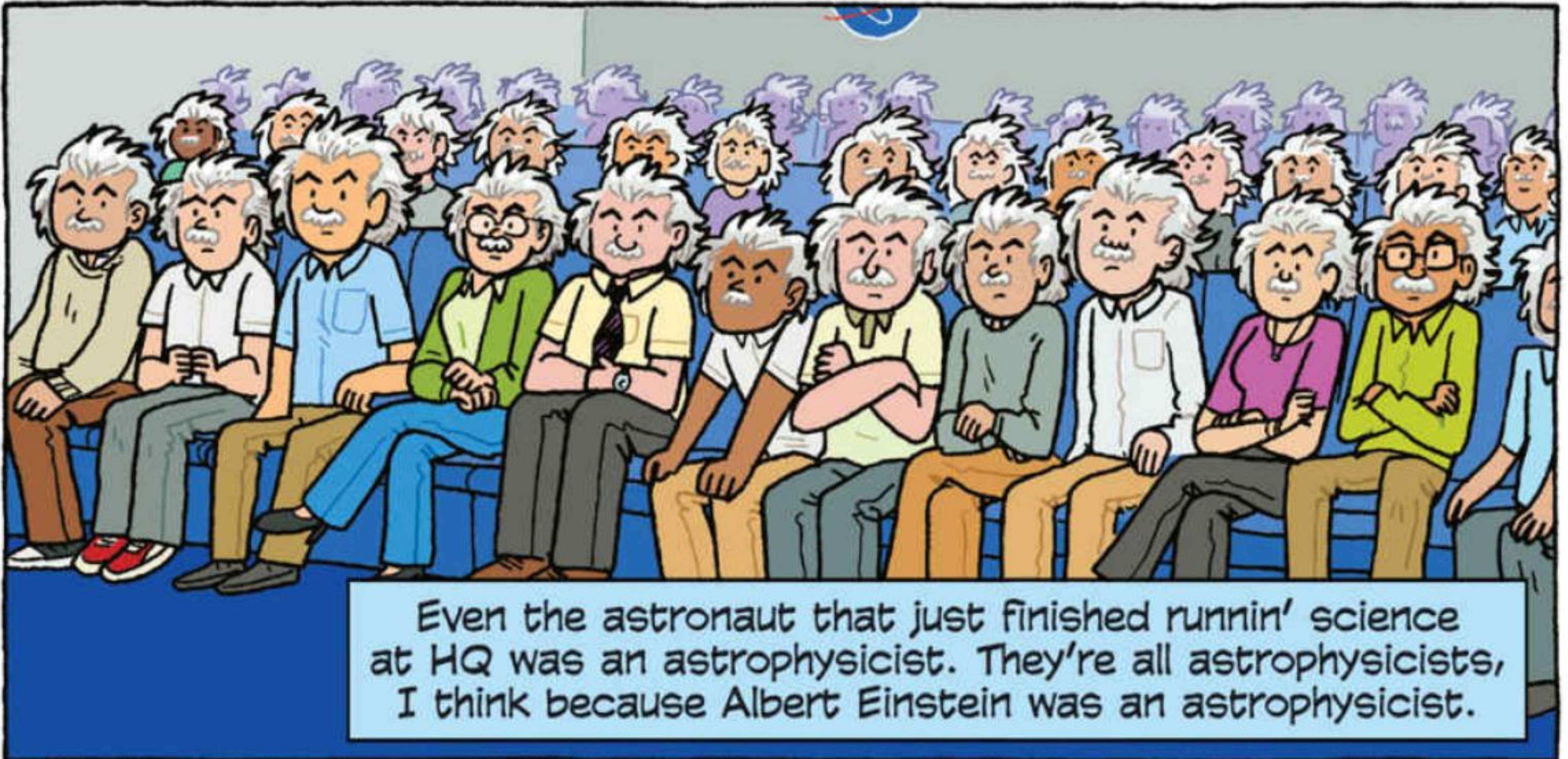
Right, I guess.



But maybe...







Even the astronaut that just finished runnin' science at HQ was an astrophysicist. They're all astrophysicists, I think because Albert Einstein was an astrophysicist.



It turns out I'm also the first woman who's ever done this. So I stand up and I'm like...

I'm Mary Cleave.



Ooooookay.
Hi, I'm really happy to be here.



I'm Mary Cleave and I'm a sanitary engineer.



I got my first job at NASA because I could fix the toilet.

Oh god...the looks on their faces!

It was worth a million dollars.

You know what? I had a really good time. I mean, we were starting to discover so much about Earth.

Not to mention the rest of the universe.

And I—we—are so insignificant... really nothing.

NASA HQ: SCIENCE HAPPENS HERE—SPACE TRAVEL TOO.

We can't even comprehend how much we don't know and can't even identify.

ATMOSPHERE: STILL FRAGILE, STILL NOT OVERRATED

Dark matter, dark energy. I remember when we thought that stuff was like 70% of the universe.

INTERNATIONAL SPACE STATION: PEOPLE LIVE IN SPACE YEAR ROUND NOW—I WORKED ON THE LIFE SUPPORT SYSTEMS FOR IT.

And then 75%...

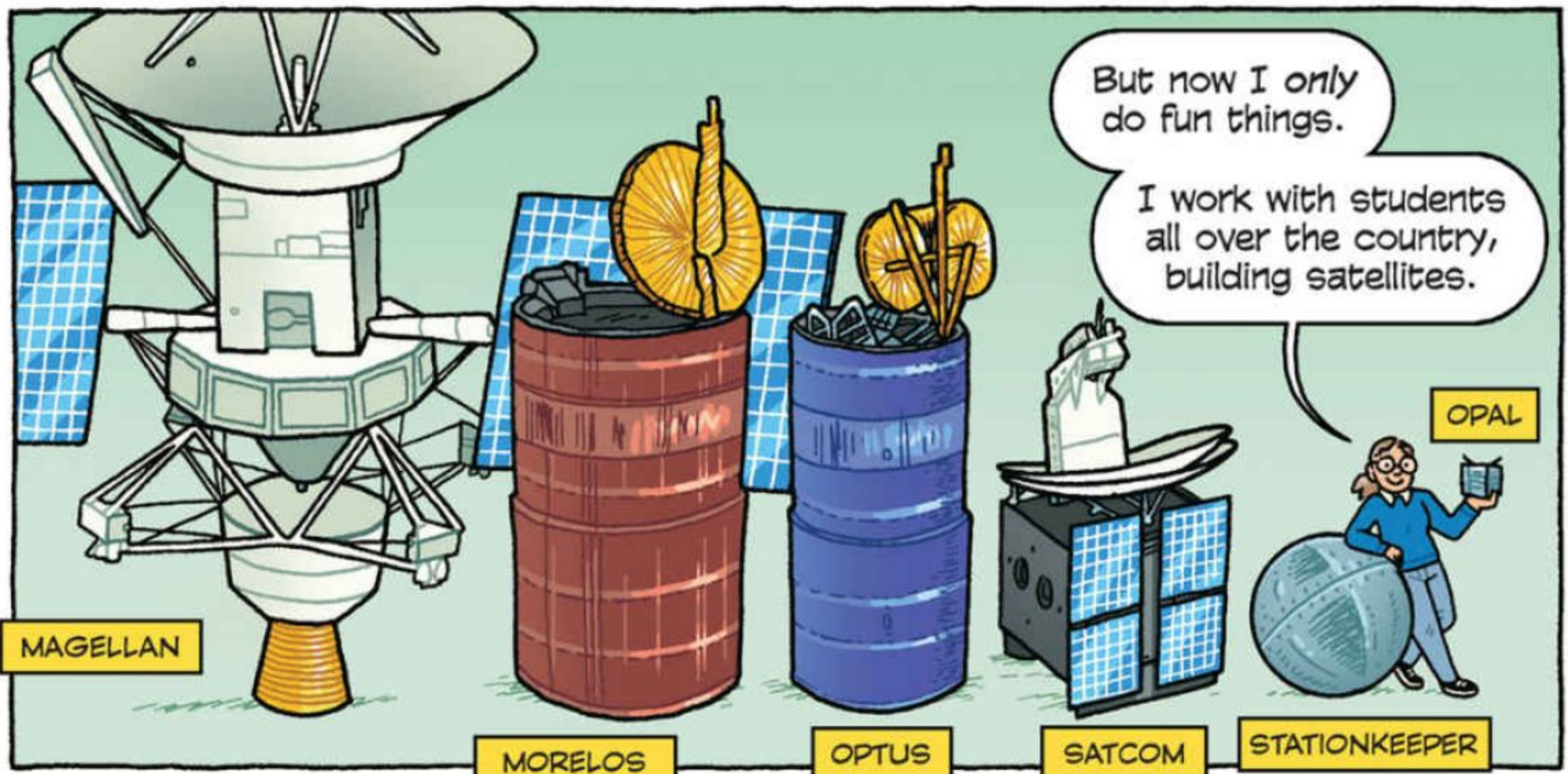
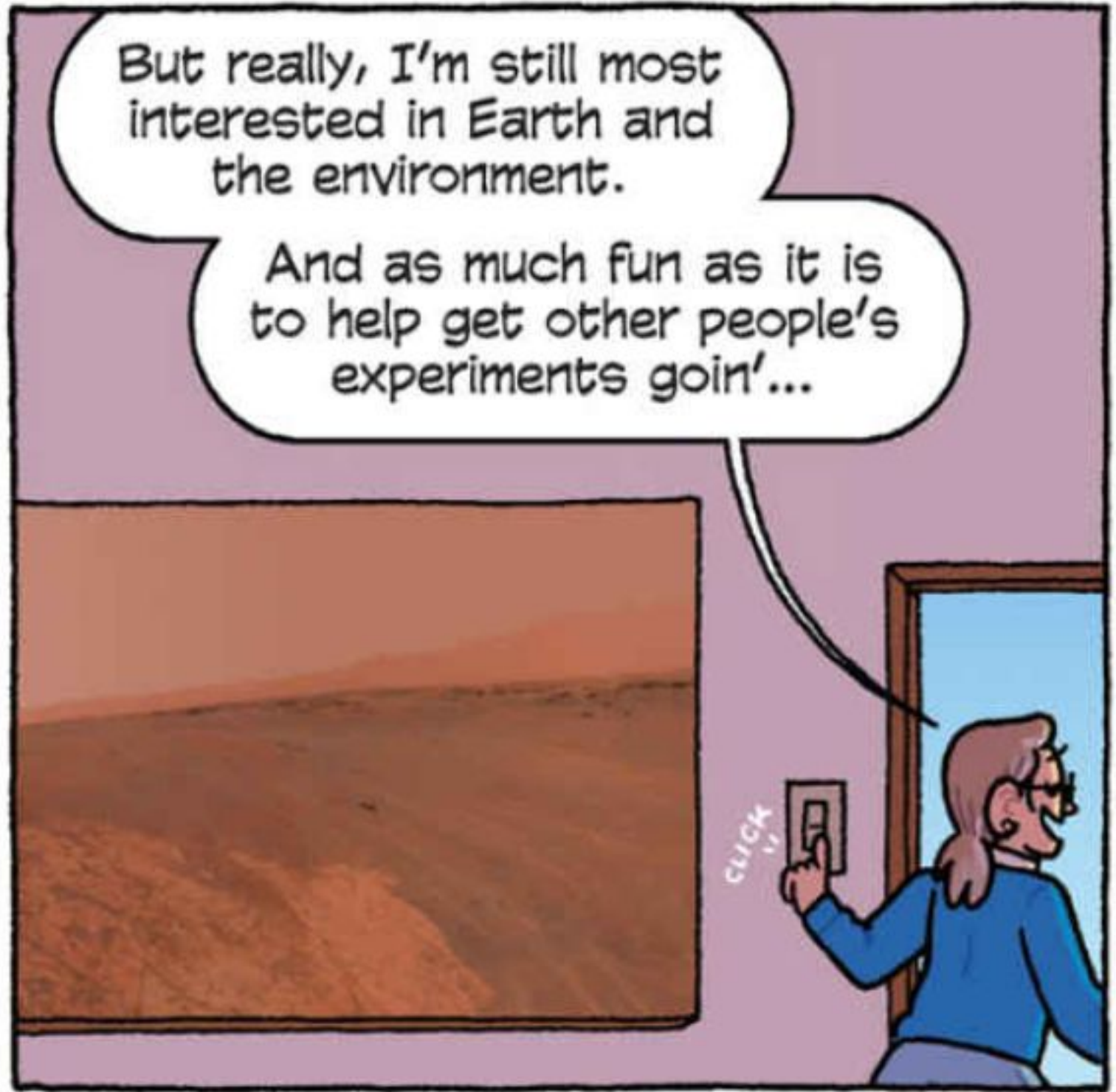
MAGNETOSPHERE: IT KEEPS US SAFE FROM SOLAR RADIATION... THERE SHOULD BE A MAGNETOSPHERE APPRECIATION DAY!

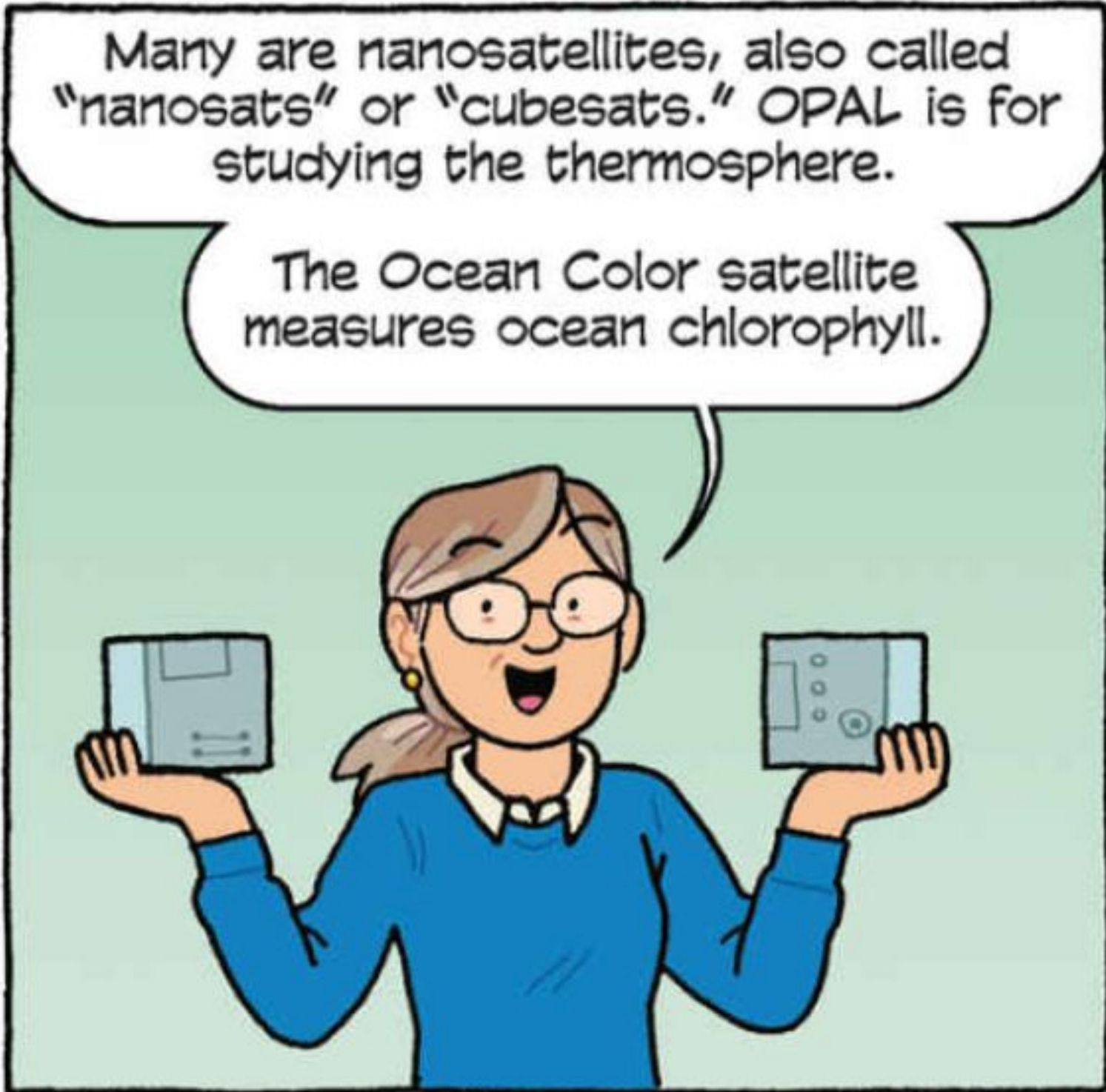
And now we think it's like 95% dark matter and dark energy...

MARS: I STILL WANT TO CROSS-COUNTRY SKI ON ITS ICE CAPS

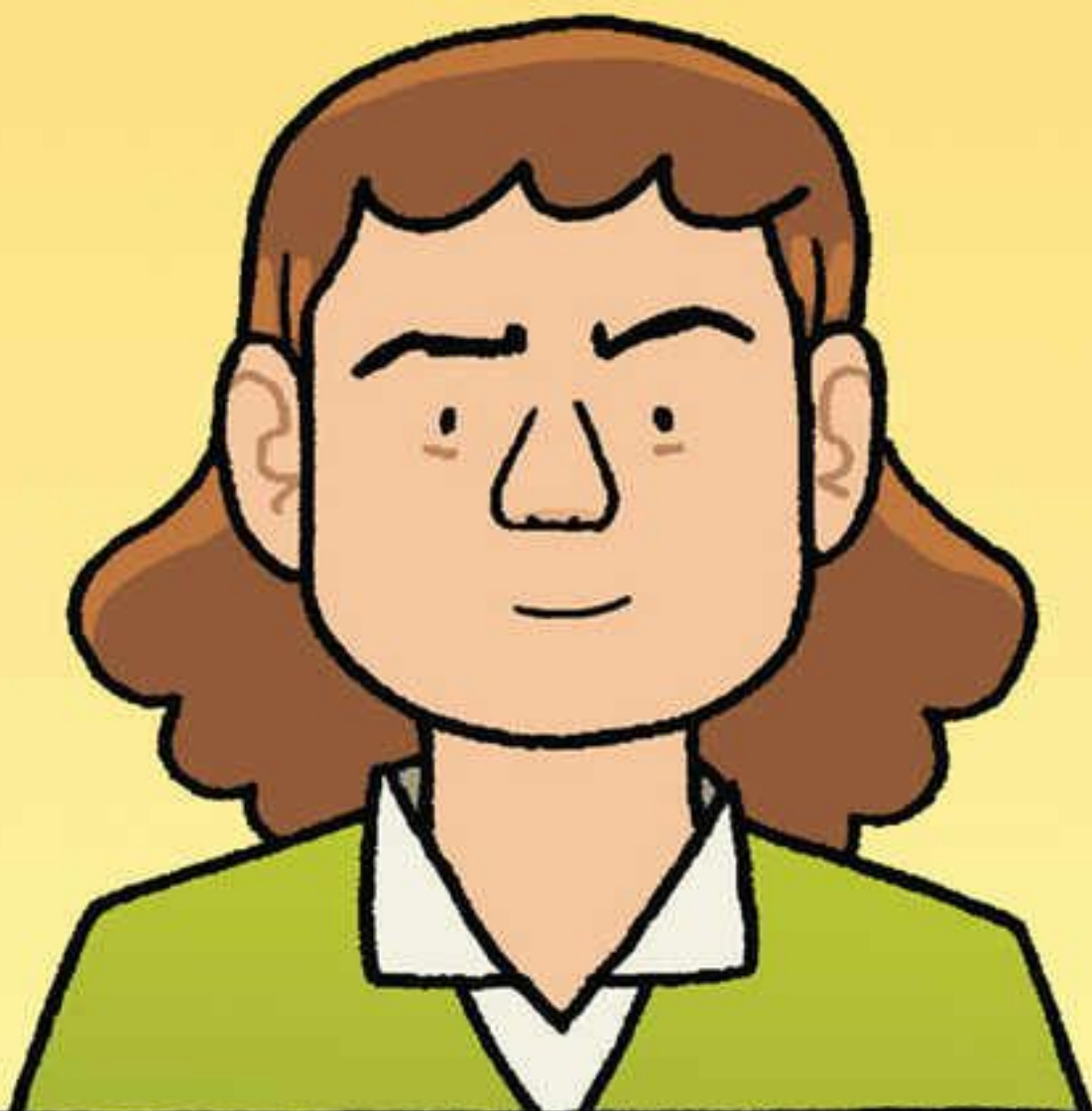
We can't...we don't even know what they are. I mean, that's insane!

HALLEY'S COMET: VISITS EARTH EVERY 75 YEARS





And these people.



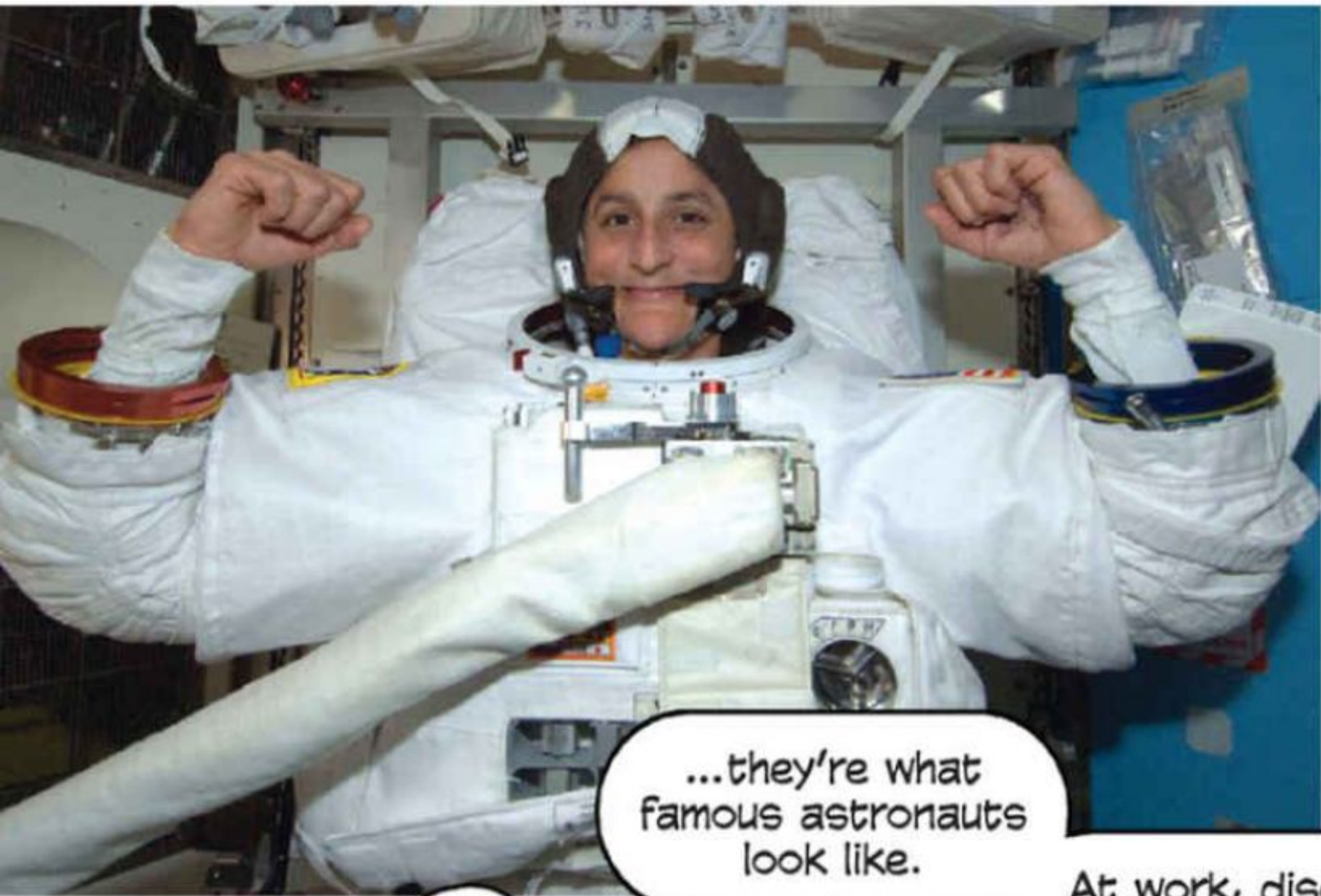
Heck yes it's nominal.
This! Is!! A!!! RIDE!!!!



Wooooo!







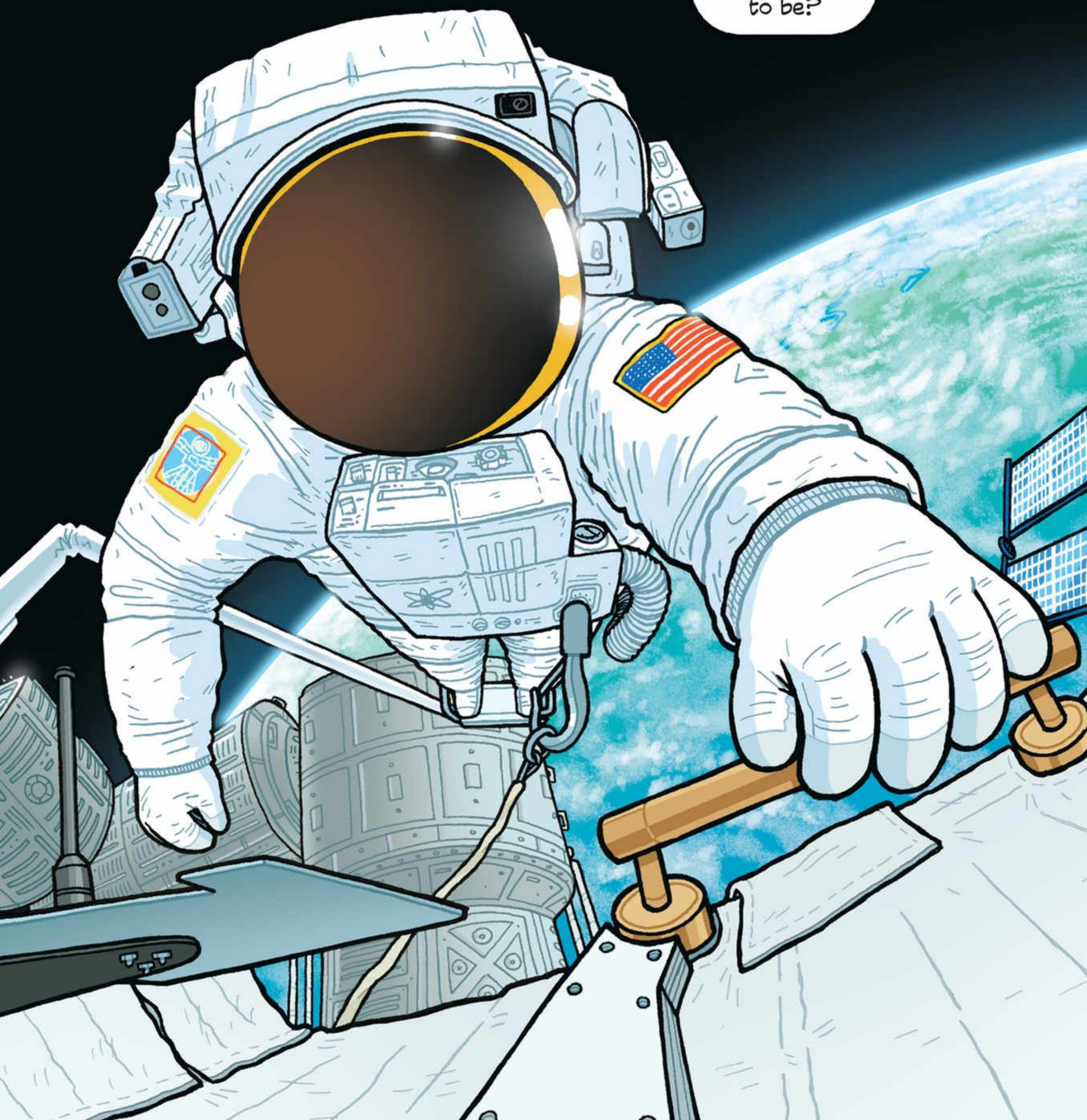
...they're what famous astronauts look like.

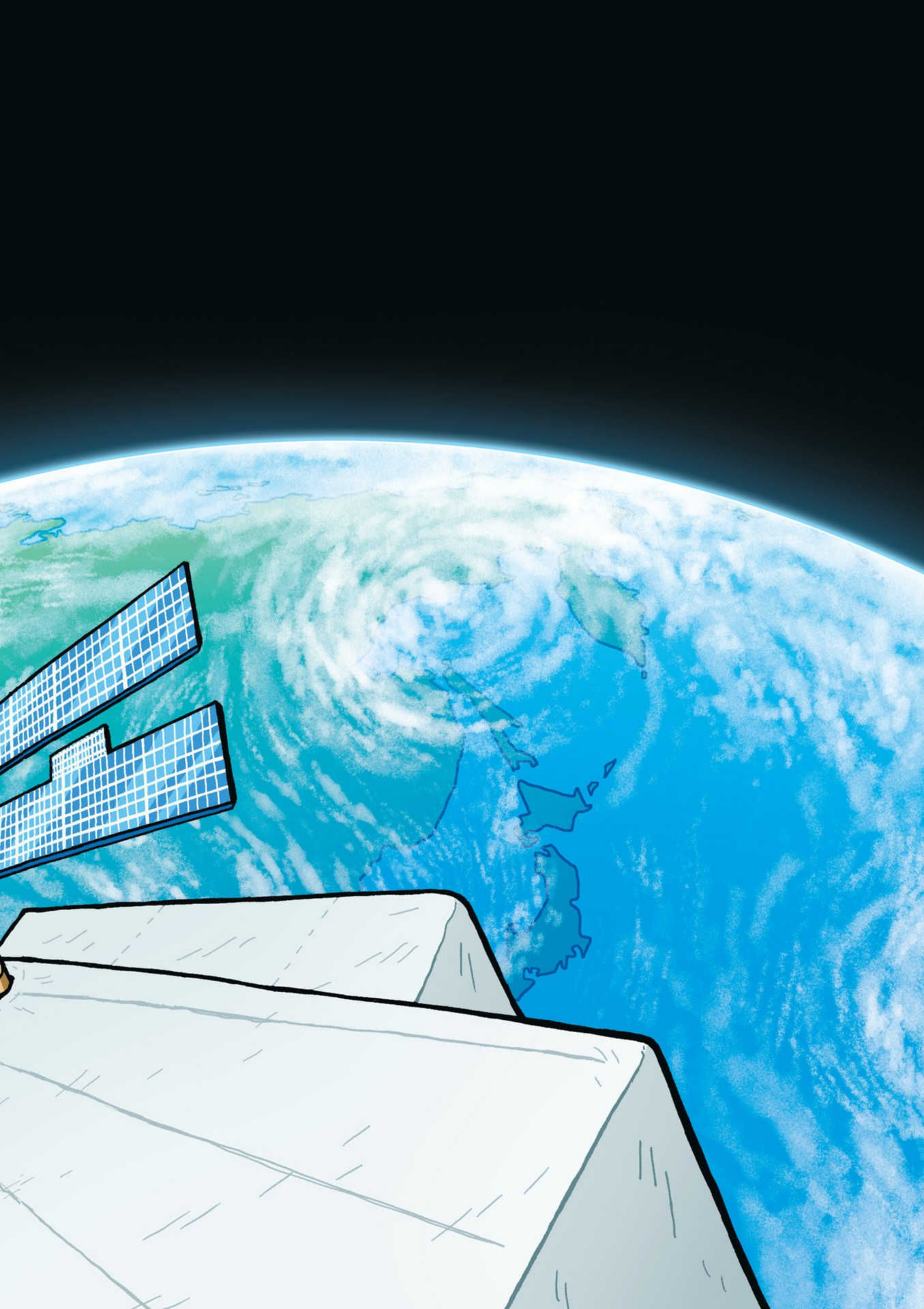
At work, discovering new things about Earth and space.



So look again.
Who do you see
in there?

And what
do you want
to be?

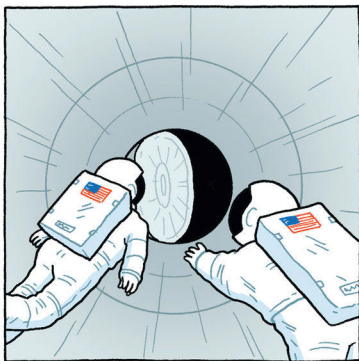




ACKNOWLEDGMENTS

First and foremost, thanks to Mary, who spent time talking, answering questions, and even showing us around her hometown—including a stop for some ale at a pub where George Washington, Thomas Jefferson, and Benjamin Franklin used to hang out.

In the book, you noticed that the Soviet scientists and cosmonauts speak...well, they almost seem to speak Russian! That's thanks to Kevin Cannon, who created the excellent faux-Cyrillic font for an earlier book about the space race he and Jim did together. And our friends Casey and Calista, etc., etc. are tops when it comes to turning scripts into stories and stories into comics.



AUTHOR'S NOTE

Space travel is wonderful in many ways, and one of them (at least for comic book creators) is that it's so well documented. You can listen in on trips to the Moon with Neil Armstrong and Buzz Aldrin and Michael Collins! You can hear Sally Ride make bad jokes as CAPCOM. You can read about missions and hear stories in the words of real astronauts and rocket scientists.

We did all those things for this book, and below you'll find a list of the most important resources we used to put this story together. So much got left out that we could do a bunch more graphic novels, though, and maybe we will; space is hard to get to and live in, but it's great for comics!

(Because people always ask about scenes we had to cut out because of space, here's maybe our biggest regret: We weren't able to fit in what happened the evening Cleave's Comet appeared over Houston. It turns out that the 911 switchboards lit up as emergency responders got overwhelmed with UFO reports. The police called NASA, and you can just imagine the conversation from their perspective:

"UFO sighting? When?"

"Uh-huh. Uh-huh."

"Okay, look. We know what that was, but... do you really want us to identify it?")

Even with all those references, there are a few things you won't be able to check out yourself. Specifically, the conversations we had with Mary Cleave and Carolyn Huntoon aren't published, so you'll have to take our word for what they said to us. Sorry about that, and thanks to Mary and Carolyn for their help, their support, and the great stories they told.

REFERENCES / BIBLIOGRAPHY

PEOPLE

Our best, and favorite, sources of information were people. We spent hours talking with Mary, and she answered every question we asked with patience, candor, and humor. She also put us in touch with Carolyn Huntoon, who was generous with her time and thoughts and stories.

NASA

The great thing about doing a book about space is that NASA has resources about almost everything, including-especially!-the people who did the science and exploration. The following are from the NASA Johnson Space Center (JSC) Oral History Project. As you can see, even though when Jim first read Mary's interview he knew he wanted to meet her and write a book about her, we read many more than just hers. And there are even more for you to discover at historycollection.jsc.nasa.gov/JSCHistoryPortal/history/oral_histories/oral_histories.htm.

Mary L. Cleave, interviewed by Rebecca Wright, Washington, D.C.-5 March 2002

Anna L. Fisher, interviewed by Jennifer Ross-Nazzal, Houston, TX-17 February 2009 and 3 March 2011

Ivy F. Hooks, interviewed by: Jennifer Ross-Nazzal, Houston, TX-5 March 2009; Rebecca Wright, Boerne, TX-24 March 2009

Dorothy B. Lee, interviewed by Rebecca Wright, Houston, TX-10 November 1999

Jon A. McBride, interviewed by Jennifer Ross-Nazzal, Kennedy Space Center, FL-17 April 2012

Bryan D. O'Connor, interviewed by Sandra Johnson, Washington, D.C.-17 March 2004

Sally K. Ride, interviewed by Rebecca Wright, San Antonio, TX-6 December 2002

Jerry L. Ross, interviewed by Jennifer Ross-Nazzal, Houston, TX-4 December 2003

Margaret Rhea Seddon, interviewed by Jennifer Ross-Nazzal, Murfreesboro, TN-21 May 2010



Brewster H. Shaw, Jr., interviewed by Kevin M. Rusnak, Houston, TX-19 April 2002

Sherwood C. "Woody" Spring, interviewed by Jennifer Ross-Nazzal, Arlington, VA-18 November 2003



Kathryn D. Sullivan, interviewed by Jennifer Ross-Nazzal, Columbus, OH-10 May 2007 and 28 May 2009

Charles D. Walker, interviewed by: Sandra Johnson, Houston, TX-14 April 2005; Jennifer Ross-Nazzal, Washington, D.C.-17 Mar 2005; Sandra Johnson, Springfield, VA-7 November 2006

We didn't stop there, of course, and consulted the following as well.

NASA Audio Collection at archive.org, STS-61-B EVA 2 audio digitized, cataloged and archived by the Houston Audio Control Room, at the NASA Johnson Space Center, archive.org/details/STS-61B

Space Shuttle Flight 23 (STS-61-B) Post Flight Presentation by The National Space Society, space.nss.org/space-shuttle-flight-23-sts-61b-post-flight-press-conference-video/

Space Shuttle Mission STS-30 Press Kit, November 1985, Release No. 85, science.ksc.nasa.gov/shuttle/missions/sts-30/sts-30-press-kit.txt

Space Shuttle Mission STS-61-B Press Kit, April 1989, www.jsc.nasa.gov/history/shuttle_pk/pk/Flight_023_STS-61B_Press_Kit.pdf

STS-7 Air Ground Transcript, Vol. 1: Launch through MET 02:05:00 (Public Information Office, NASA Johnson Space Center, Houston TX 77058, 1983)

ARTICLES

Here are a few of the many articles on spaceflight, and women in space, that were the most helpful.

"An extraterrestrial sandwich: the perils of food in space" by Jane Levi, *Endeavour*, vol. 34 no. 1, 2010, 6-11, doi.org/10.1016/j.endeavour.2010.01.004

"The first woman in Earth orbit: Part 1" by Asif A. Siddiqi, *Spaceflight*, vol. 51, January 2009, 18-27

"The first woman in Earth orbit: Part 2" by Asif A. Siddiqi, *Spaceflight*, vol. 51, February 2009, 64-71

Jane Briggs Hart papers: circa 1925-1996, Bentley Historical Library, University of Michigan, Ann Arbor

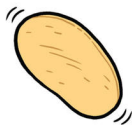
"Q & A: Nichelle Nichols, AKA Lt. Uhura, and NASA" by Arcynta Ali Childs, *Smithsonian*, June 23, 2011, smithsonianmag.com/smithsonian-institution/q-a-nichelle-nichols-aka-lt-uhura-and-nasa-180943982

"Sally Ride, Astronaut: The World is Watching" by Sara Sanborn, Ms., *January 1983*, 45-52; 87-88



BOOKS

Finally, you can't make a book like this without reading other books. Here are our favorites from the stacks (and stacks of stacks) of books near our writing desk and drawing table.



Almost Heaven: The Story of Women in Space, by Bettyann Holtzmann Kevles (Cambridge, MA: MIT Press, 2006)

The Astronaut's Cookbook, by Charles T. Bourland and Gregory L. Vogt (NY: Springer, 2009)

Beyond Uhura: Star Trek® and Other Memories, by Nichelle Nichols (NY: G.P. Putnam's Sons, 1994)

Challenge to Apollo: The Soviet Union and the Space Race, 1945-1974, by Asif A. Siddiqi (NASA SP-2000-4408, 2000; history.nasa.gov/SP-4408pt1.pdf)

Lovelace's Woman in Space Program, by Margaret Weitekamp, history.nasa.gov/printFriendly/flats.html

The Mercury 13: The Untold Story of Thirteen American Women and the Dream of Space Flight, by Martha Ackmann (NY: Random House, 2003)

Promised the Moon: The Untold Story of the First Women in the Space Race, by Stephanie Nolen (NY: Four Walls Eight Windows, 2002)

Qualifications for Astronauts: Hearings Before the Special Subcommittee on the Selection of Astronauts of the Committee on Science and Astronautics, U.S. House Of Representatives, Eighty-Seventh Congress, Second Session, July 17-18, 1962

Right Stuff, Wrong Sex: America's First Women in Space Program, by Margaret A. Weitekamp (Baltimore, MD: The Johns Hopkins University Press, 2004)

Tethered Mercury: A Pilot's Memoir: The Right Stuff...But the Wrong Sex, by Bernice Trimble Steadman, with Jody M. Clark (Traverse City, MI: Aviation Press, 2001)

Valentina: First Woman in Space, by A. Lothian (Edinburgh, UK: The Pentland Press, 1993)

Women in Space: Following Valentina, by David J. Shayler and Ian Moule (Chichester, UK: Springer/Praxis, 2005)



SCRIPT

Page 60

Panel 1
Hiking out into the cold, high desert, where we see how arid it is, and sparse. It's a lot like the ocean in its flatness, and a lot like space in its lack of obvious life.
In the distance we see some of the black crust she's talking about.

CAPTION:
That's the black stuff you see out there.

Panel 2
She's consulting a compass and a map, with little treasure "x"s all over it, marking the locations of her instruments.

CAPTION:
We were trying to figure out where all the carbon dioxide emitted by nearby cities was going. It was getting sucked up by plants, but we didn't know which ones, or where.

CAPTION:
Turns out it was in fact the cryptogrammic crust.

Panel 3
Hiking along, whistling, having a ball, map tucked into her back pocket.

CAPTION:
This stuff is mostly dormant but if it rains its up and chugging full speed in 20 minutes. I mean it's really amazing stuff.

Panel 4
Cleave is kneeling over a piece of plywood, just about to lift it up.

CAPTION:
We set up these little research instruments all over, and protected them with a piece of plywood.

Panel 5
Boing! She jumps back as a bunch of rattlesnakes slide out. (Cleave-2016a)

SFX (all over):
raaaattttllllle
hissssssssss
rrraattttllllllle

CLEAVE (thinking):
Every time!

Panel 6
She's grabbing her gun in the holster, but the snakes are zipping away so she doesn't have to draw or fire.

CAPTION:
I actually carried a six-gun, filled with snake shot, on my hip when I was doing that work.

CAPTION:
So that was really fun.

All books start the same way: as an idea! Here's how this book became...well, a book.



THUMBNAILS

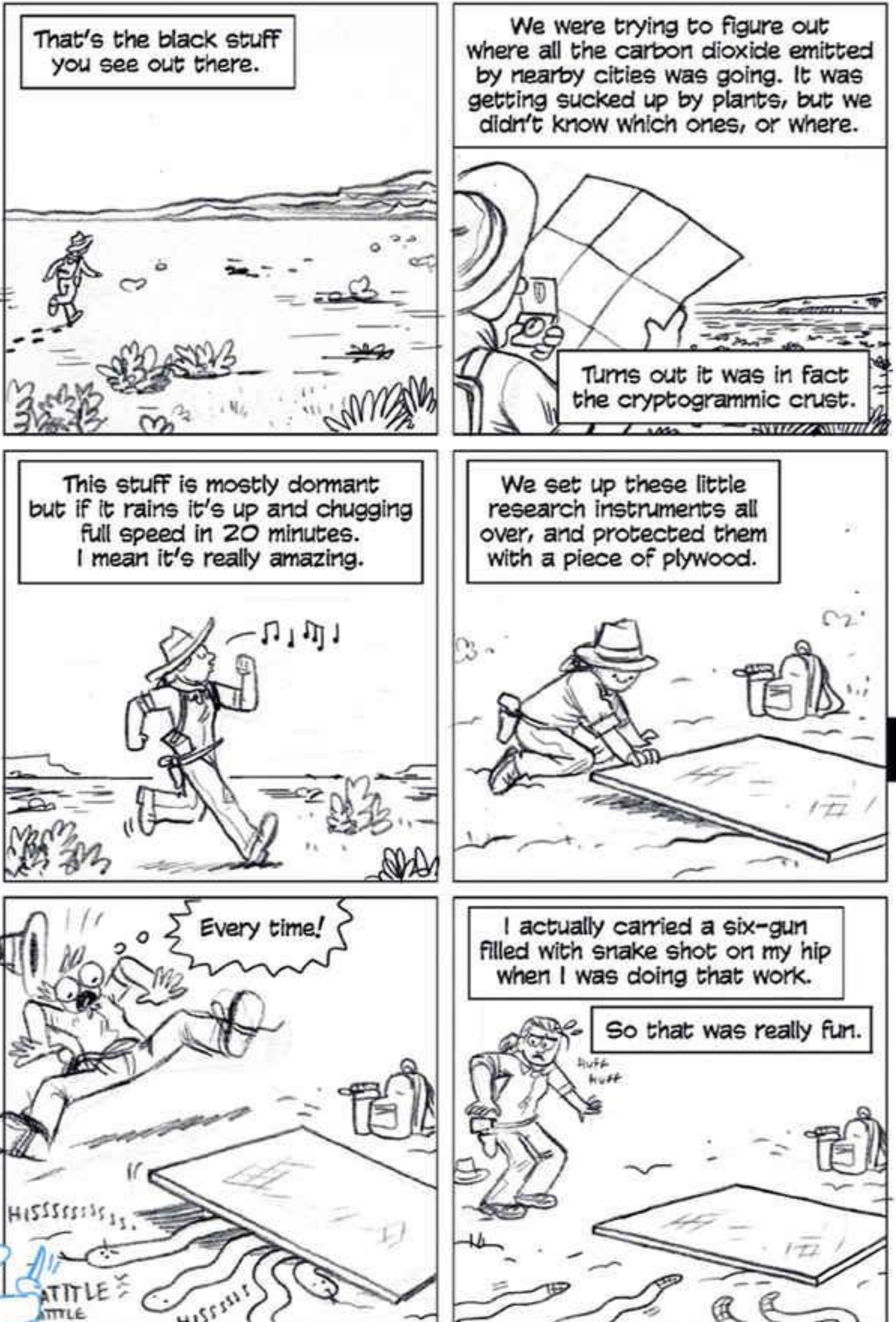


The script contains lots of source notes for panels/scenes. Here, "Cleave-2016a" refers to my first phone interview with Mary in 2016, where she told the story about the snakes.

I get the script, read it a whole bunch of times, and then draw it!

I keep my drawings loose and sketchy; right now, we just want to see how the story flows.

PENCILS



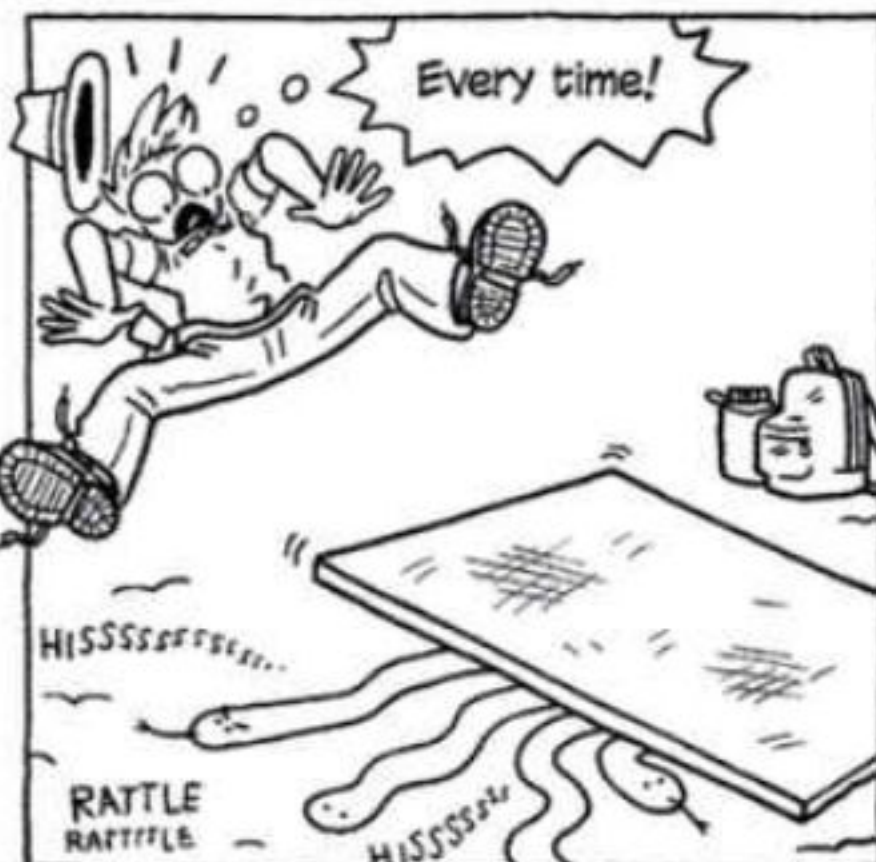
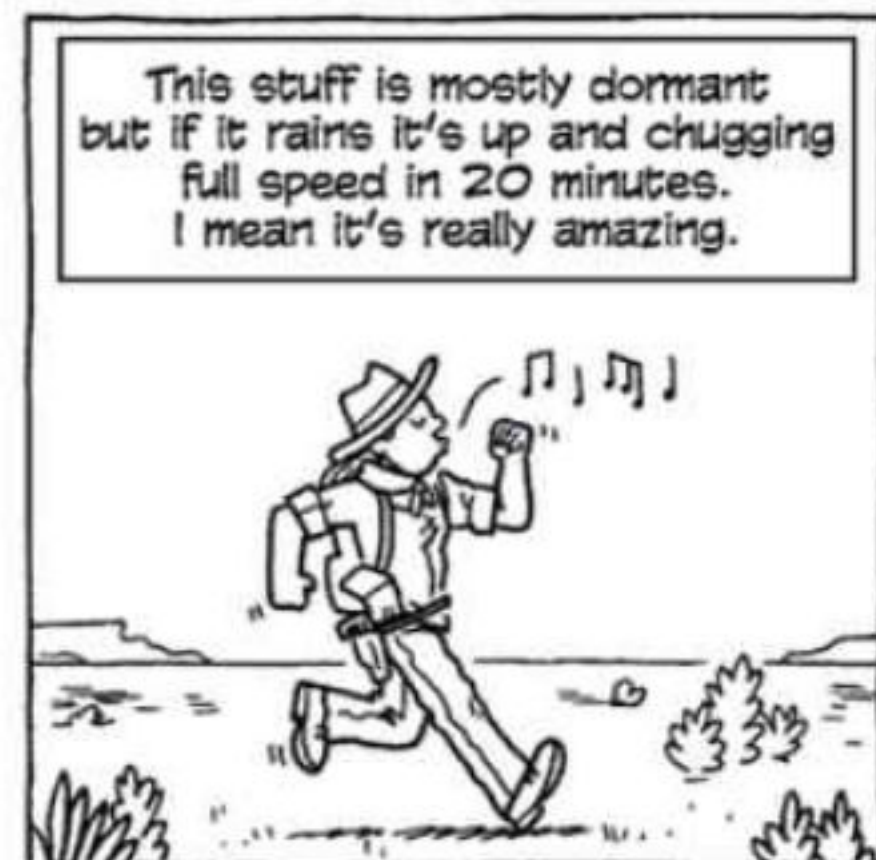
Our intrepid editor Casey reviews it and shares feedback, and then we're on to the pencil stage, where sometimes we tweak the words...

I might suggest removing, adding, or changing them so they work better with the images.

Not this time, though—looks good to me!

Yay! Now it's time to tighten up the drawings—but they're still pencils.

INKS



If everything looks good to Casey and Jim, I can ink the pencils...



60
...and then color them!

There's still lots more work to do, like design and production and promotion, but eventually the book is released into the world.



And that's where you come in... Books don't mean much without someone to read them, so thanks for reading!



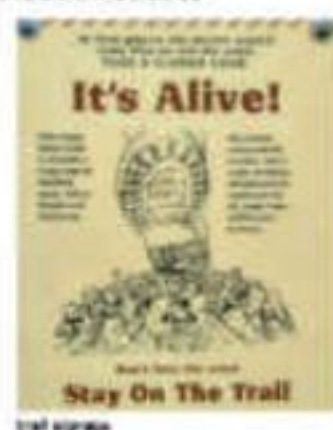
REFERENCES



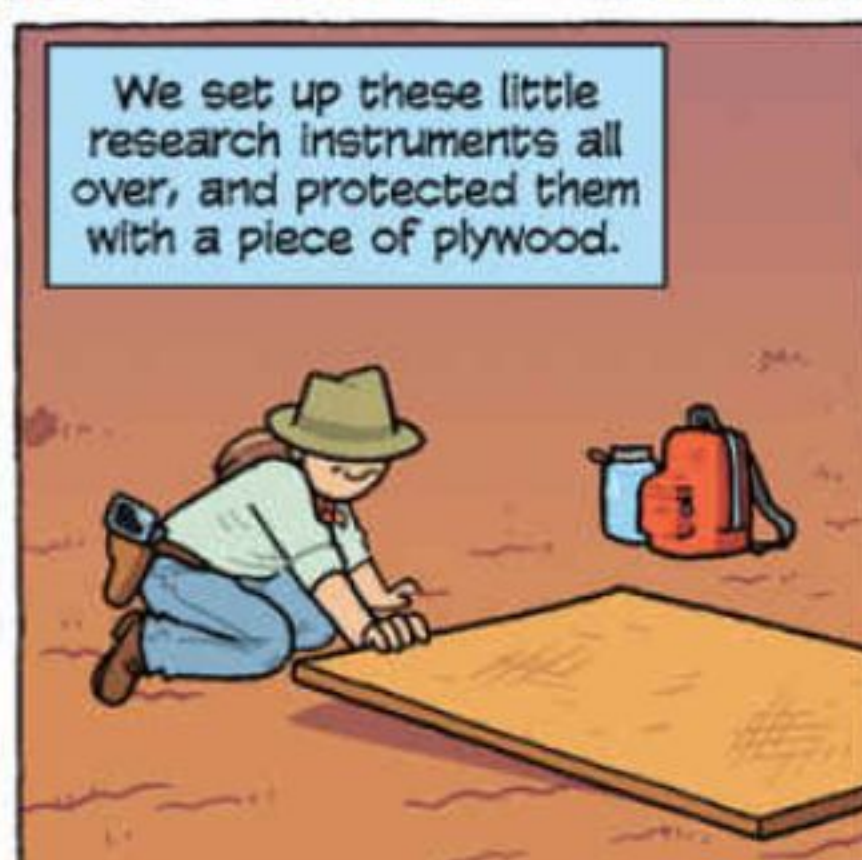
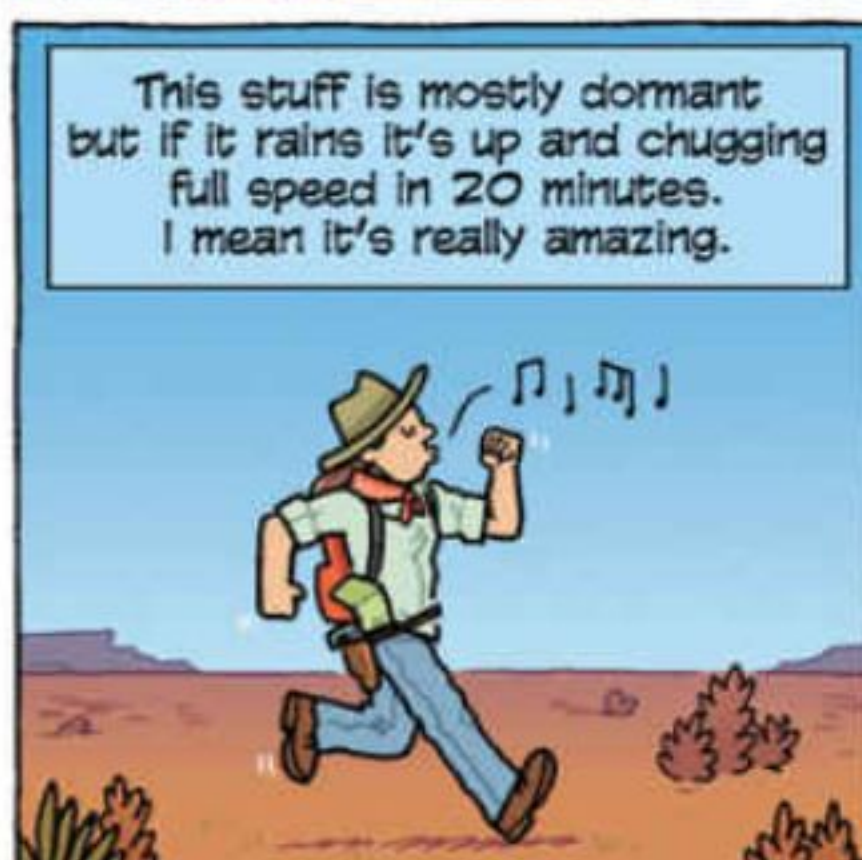
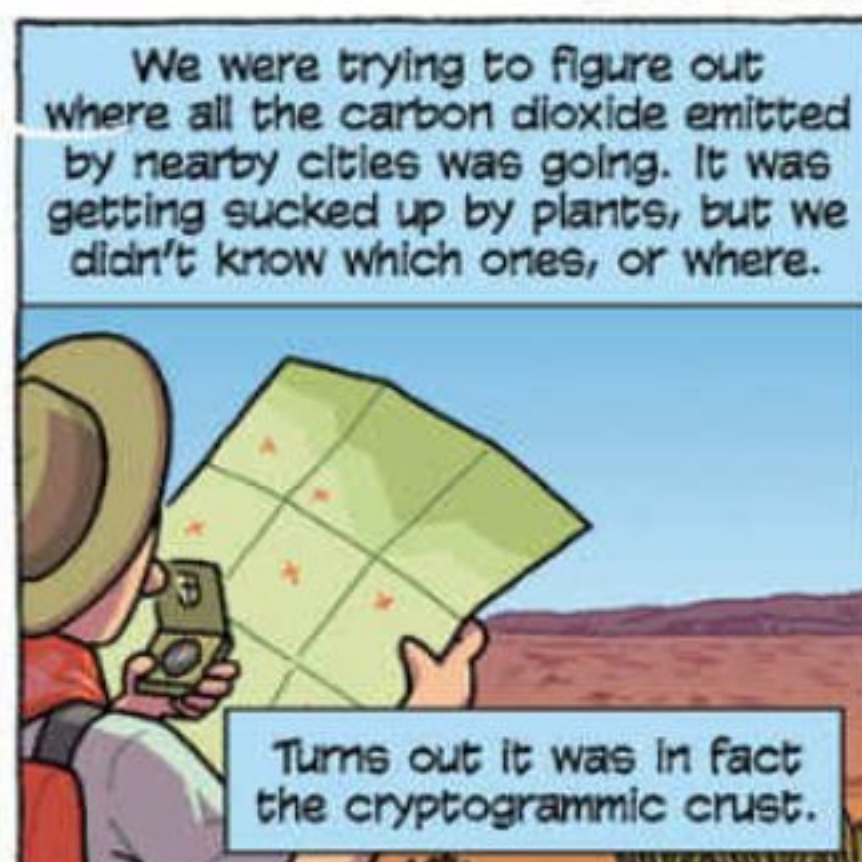
<http://panamapratte.blogspot.com/2011/08/high-desert-memory.html>



Coyote in Utah with trail running through it
by Jason Hildner/Flickr/Creative Commons license



COLORS





VALENTINA
TERESHKOVA



CHARLIE
WALKER

STS-61-B
CREW



ROSS



SPRING?



BRENTFORD
SHAW
COMMANDER



BYRAN
O'CONNOR
PILOT



RODOLFO
NERI



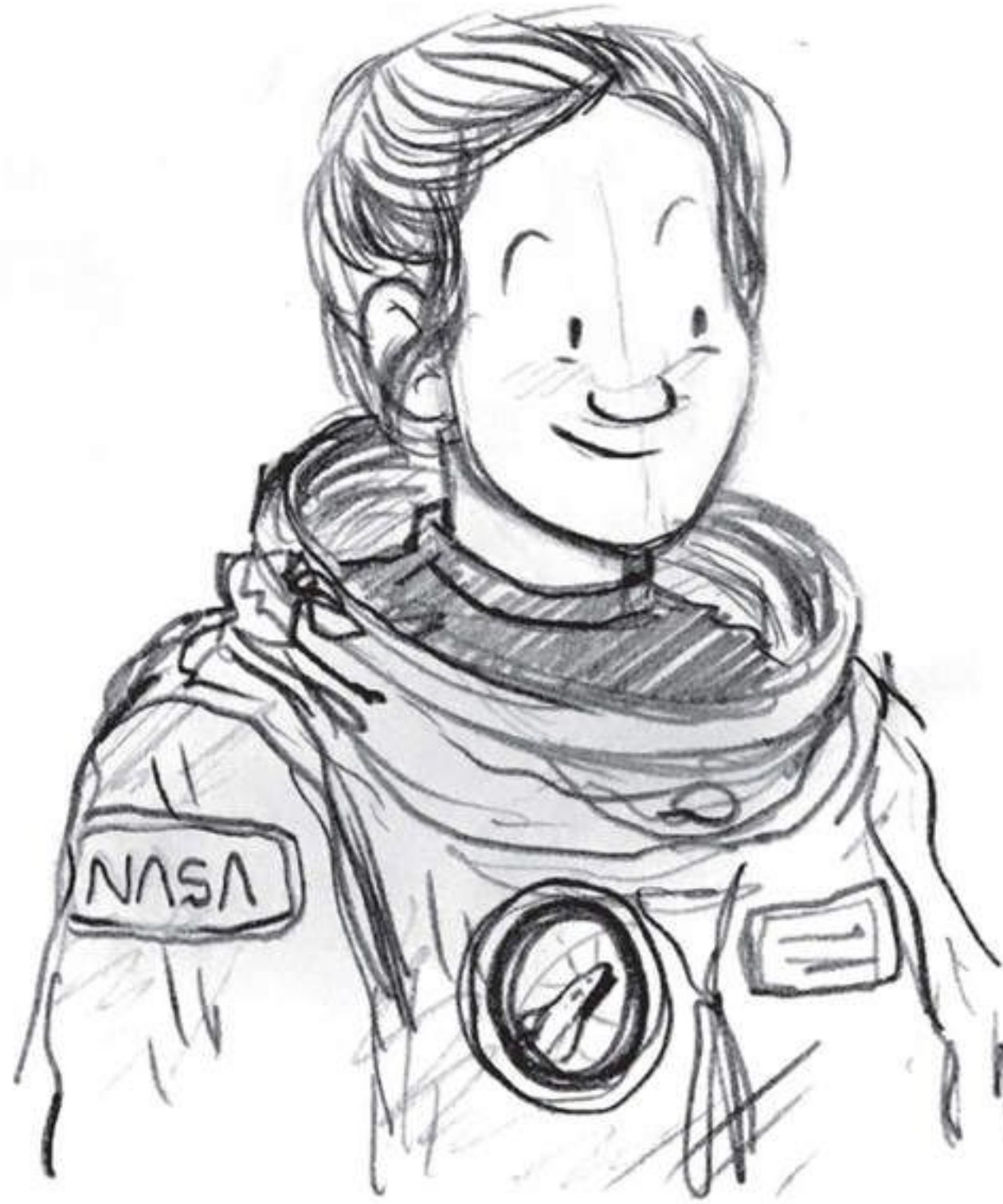
MARY
CULAVE



ZERO G /
Vomit
COMET



MARY CULAVE





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Photo of Valentina Tereshkova on page 155 by Keystone-France, © Getty Images
All other photos credited to NASA

Astronauts was penciled digitally in Photoshop. Inked with .7 mm and .5 mm
Uni-ball Vision Rollerball pens on Strathmore 300 Series Smooth Bristol Board.
Scanned and then colored digitally in Photoshop.

