NASA'S NOSE The man who sniffed his way round the space station

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OPINION INTERVIEW

Of all the hazards of space flight, smell would seem the least significant. **George Aldrich** disagrees. As NASA's "master sniffer", he leads a team of 25 people whose job is to test everything that goes up on the shuttle for smelliness. For as he tells **Angela Swafford**, things behave differently in space, and once you're up there you're stuck with them. At his lab in the New Mexico desert, he has smelt everything from tennis shoes to teddy bears. And there is no substitute, he says, for a human nose

Nose job

Has a space mission ever been aborted because of a smell?

The United States space programme has never cancelled a flight because of a smell, but the Russians did in 1976. It was because of an acrid odour, and the report said that the cosmonauts tolerated it for a while but that it eventually became unbearable. They actually had to make an emergency landing. That's all we know about it. The Russians weren't very talkative to the Americans back then, and I'm sure if they knew what happened they wouldn't tell us.

Have bad smells ever caused problems on American flights?

A few months ago we tested some straps with Velcro tabs on them. They were in a big hurry to get them up there so we only did a toxicity test. They didn't want an odour test. It passed, and they loaded it on the shuttle and took it up to the space station. But when they opened the bag the straps smelt pretty bad and the astronaut zipped it back up and said: "That ain't staying up here."

What did it smell like?

It was like when you cut an onion and then smell your fingers 15 minutes afterwards when the onion juice has mixed with the oils of your skin. I guess that's what they get for being in a hurry.

Do things smell differently in space?

Yes, it's because of the confined space and the heat. Think of a new car. If you parked it in normal weather with the window open, that new car smell would be there in the background. But if you parked it in the sun on a sweltering day with the windows up, then the smell would be pretty overpowering. You'd be speeding up the evaporation of the chemicals.

When did you realise you had an exceptional nose and how did you become a NASA sniffer?

I never really thought much about whether I had a good sense of smell. I started with NASA in the fire department when I was 18. I was young and healthy and they asked me to be on their Odor Panel. I've now done 744 "smell missions", over 100 more than anyone else.

What's the selection procedure for becoming a sniffer?

You have to pass a special physical. You can't have any allergies or respiratory problems, and they frown on high blood pressure. NASA wants healthy test subjects, and if you have a lot of allergies your nasal passages are already irritated and cannot be used. And then you have to be able to smell. We have what we call the "10-bottle test": seven of them have odours and three of them are blanks. We have to certify our noses every three months like this.

Do you always pass the test?

I've passed it every time I've taken it in 27 years.

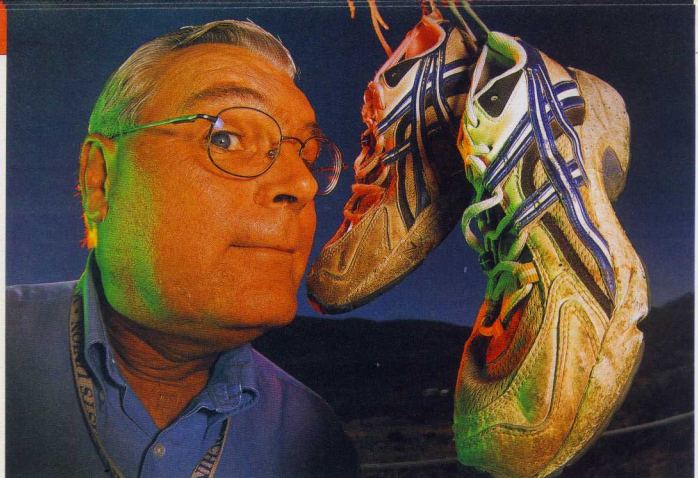
Do you do any special training to keep your nose in shape?

I don't have any nose exercises or anything like that. It's all raw talent. I try to stay away from some of the stinky odours. I've got four grandchildren and when my wife's changing their diapers I try to stay far enough away from her to avoid the smell, because I try not to shock my nose.

What kind of things do you smell?

Anything that goes inside the capsule. We do things like paints, magic markers, ink, fabrics, epoxies. We've done circuit boards, wires, socks, tennis shoes, shaving cream. We used to do a lot

Chip Simons



of female products. We did deodorised and non-deodorised tampons. We also did adult diapers. The astronauts wear diapers when they are out doing their space walks and that type of thing. We did a guitar and a case. We did toy animals like Chuckie Bear and Barney.

Somebody took those toys into space?
Yes. It was a female astronaut. I think she had a child that wanted Barney to go into space, so it had to go through the testing to make sure it was okay.

What kind of things have you rejected?
We rejected some mascaras from Sally Ride. She was the first American female astronaut and we tested a lot of things for her.

How do you go about testing an object?
We load the material into a sealed container and heat it to 120 °F (49 °C) for 72 hours. Then we inject the gas through a gas chromatograph, which gives us the quantity of the compounds, and a gas chromatograph mass spectrometer, which identifies them. That tells us whether there's anything toxic or carcinogenic in it. If it passes the toxicity test then it goes before the five people on the Odor Panel, who smell it and grade it on a scale from 0 to 4. Undetectable smells score 0, while 1 is barely detectable, 2 is easily detectable, 3 is objectionable, and 4 is very irritating or revolting. We take an average of the scores. Anything over 2.4 gets rejected.

Can you detect the composition of things just by smelling them?
No. Take the Velcro straps. What was the chemical that smelt like an onion? I have no idea. I'm sure it was the combination of the components that were in it. If something had a very strong ether or alcohol smell, or was a sulphur compound, I could detect those.

Do you get to see the object that you are smelling, or do you smell them blind?
We prefer for the sniffers not to see it until after they have tested it. There is a chance it might influence them. They might see that the object is, say, sticky tape and simply make up their minds it smells like sticky tape. But I have worked in the area for nearly 30 years and a lot of times I know what it is. People are more than welcome after the smell test to go ahead and look at the report, find out what compounds are in it, find out exactly what they've sniffed and look at the article.

Has anyone ever suffered side effects from sniffing?
I can remember two occasions. There was the one with the Velcro straps, where we had an aftertaste at the back of our throats. And a few years before I got onto the Odor Panel, back in the Apollo days, the sniffers smelt some ink that blistered their noses. After Apollo 13 was brought back to Earth, they had to reprint a lot of the instructions for experiments the astronauts hadn't done so they could do them on future missions. They sent us a sample of the ink they used on the reprints. It was a near-miss, because if those flight plans had gone up there and started blistering the astronauts' noses it could have aborted another mission. The funny thing about it was that the sniffers said the ink had an acrid, eye-watering effect on them and that's almost the same thing that forced down the Soviet mission in 1974. We'll never know exactly what the problem was with the Russians, but it could have been something just as simple as the ink on their flight plans.

What happens when you get a cold? Can you work?
If I have a cold and the nurse sees an irritation or redness, I cannot participate in the three-bottle odour test that we have to do before testing every material. I've only failed the nurse's examination two or three times in my 27 years.

Why doesn't NASA employ dogs or electronic devices to do your job?
For a start, dogs don't talk. You can throw odours at dogs but they can't tell you what it smells like. There are some electronic noses that are supposed to be pretty good, but in my opinion they don't come anywhere close to the range of the human nose. There's nothing better than the human nose. Take the

case of the ink that blistered noses, or the straps with the aftertaste. An electronic nose is not going to be able to read those.

Do you use your smelling skills anywhere else?

For the past three or four years I've helped judge the local Odor-Eaters Rotten Sneaker Contest. For the past two years, Odor-Eaters has asked me to be the International Judge of Odor. All these 5 to 15-year-old children show up at the contest with their dirtiest, rottenest sneakers and we pick a winner. This contest is a huge shock to my sense of smell. I'm usually still smelling them several hours after it's over.

Can you switch off your nose when you are not working?

Are you asking if I stop and smell the roses? I love the smell of fresh mountain air, of course. I probably think a little bit more about odour than most people do. I guess I do like to stop and smell the roses.

Do you consider your work crucial to the future of space flight?

I think it's very important. For all the money it takes to get the shuttle off the ground, it's pointless if they have to abort the mission because of an odour inside the capsule. It is even more important because of the space station. The shuttle will be regularly supplying the astronauts up there with fresh supplies and taking away all their waste. I wouldn't be doing it if I didn't think it important.

Do any other space programmes have smelling missions like yours?

The only other one that I know of is in Japan. Someone from our lab went there and we were able to compare notes. I am sure we were the first at it and they learned from us. We were just making sure that we were doing the odour test in the same way. The Japanese are the only ones with whom we can compare odour notes.

What does it say on your business card?

I call myself a nasal-naut. I've got a picture of the shuttle with the solid rocket boosters, and my daughter has drawn a little skunk. Right in the middle it says: "If something smells in the space programme I'll be there to get wind of it."

What would you be doing with your smelling skills if you weren't working for NASA?

I am beginning to think that I should write a book, or endorse a perfume, or even have a perfume of my own.

FIRST PERSON NICOLA JONES

Four is not enough

WITH all the fuss about the genome, one basic fact continues to surprise. Every genetic part of us, all the codes for the colour of our skin and eyes, our propensity for having a double chin or a flat tummy, our risk of getting certain diseases, comes from the combinations of just four bits. Four bases, nicknamed A, T, C and G.

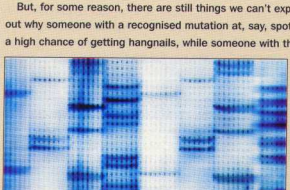
Just four. Doesn't that seem odd to you?

For me, it all sounds suspiciously like the Middle Ages when people believed passionately that all matter was made from another four bits: earth, air, water and fire. Well, that turned out to be a little short of the truth, didn't it?

Fast-forward a few centuries and the "bit" of choice was the atom, fervently believed to be the unbreakable building block of matter. On again and it was protons, electrons and neutrons. Getting better, but still not quite right. Then we found tinier bits like quarks, muons, leptons and. . . it just goes on. To this day, all those indivisible bits keep on being divided.

Which leads me to believe that our four, holy, magical bases are very probably not the end of the story. Imagine a day some hundred years hence. We think we finally have the genome pegged. All the bits and genes have been sequenced, identified and pinned down.

But, for some reason, there are still things we can't explain. We still can't quite figure out why someone with a recognised mutation at, say, spot 134 on chromosome 12 has a high chance of getting hangnails, while someone with the same mutation, living in the same house and even using the same washing up liquid, sails through life with perfect cuticles. Or why one identical twin is addicted to chocolate while the other spits it out. Or why I keep killing all my houseplants despite there being so many green thumbs in my family tree.



Then, one day, the penny drops and the jaws of all geneticists around the world collectively fall to the floor. Some subtle change, maybe somewhere deep down in the quarks inside the atoms of the bases, means that each of those four bits comes in three different varieties. Tweak the quarks and what looks like an A could be slightly, but critically, different.

Perhaps the physibiochemist who discovers this has a sense of humour. Since we've used up "colours" for quarks, "flavours" for neutrinos and "spin" for electrons, she calls this new quality "pitch". And, for good measure, she names the 12 new bases after musical notes. A, A flat, A sharp, C, C flat, C sharp, and so on. She runs into a bit of trouble with T, so she renames it E (ethymine), which makes for a surprisingly even spread across the octave.

Geneticists run for their lab equipment, with the old human genome sequence now looking hopelessly antiquated, and start all over again. The great-grandson of Craig Venter, who is, by chance, a pianist, promises to hold a concert and play the genetic score when it's completed.

It may be a tad fanciful and, to be honest, I'm not sure the physics holds up. But it could happen. We've been wrong so many times before, why stop now?