FIGHTING FIT

HOW TO PREVENT CONFLICT ON THE WAY TO MARS

Missions to the red planet will need a new breed of astronaut

THE EARLY days of the American space programme—days of white-knuckle test flights and solo orbital missions—called for pilots with qualities such as supreme self-confidence, unflinching bravado and ice in their veins. Or, to put it less kindly, "narcissism, arrogance and interpersonal insensitivity". That was the assessment of one of NASA's first staff psychiatrists, Patricia Santy, in her book "Choosing the Right Stuff".

Listen to this story

0:00 / 0:00

Yet as the space programme has grown up, so have the astronauts. And they are continuing to evolve with

their missions. The next giant leap—travelling to Mars—will require people made of very different stuff from their predecessors. They must survive not only deep space but one another's company. It took Apollo 11 about three days to get to the Moon and two days to make it back. A voyage to Mars will probably be an 18-month round trip in a spacecraft no larger than a small house, as well as perhaps a year spent on the planet.

Rotations on the International Space Station last about six months, so many astronauts have become used to long stretches in space. But a mission to Mars will add new complications. Crews on the space station have real-time contact with experts on Earth to help them manage whatever comes up. As the Mars crew ventures deeper into space, gaps in their communications with mission control will grow to 20 minutes or more; crews will need to be able to co-operate without support to solve unforeseen problems.

"There's going to be some conflict, there's no doubt about it," says Noshir Contractor, a behavioural scientist at Northwestern University, in Illinois, who works with NASA to help crews in space co-operate. The trick, he says, is not to avoid conflict but to manage it.

When engineers design a spacecraft, they do so first on a computer so they can consider every variable and understand how the machine might behave in different scenarios. NASA is trying something similar in building crews. Its researchers are creating computer models of how different people interact when confined together, and using those models to predict conflict and optimise performance over a long mission.

Humans are more complicated than spacecraft. But Dr Contractor likens his work to weather-forecasting. Weather is a complex, non-linear interaction of factors including air temperature, pressure and wind speed. Yet models can reliably predict next week's temperatures and chances of rain. Meteorologists turned to computers in the 1950s; social scientists began computerising "human factors" a decade ago.

Effective computer models demand a lot of data, so NASA has created a supply. Inside Building 220 at the Johnson Space Centre in Houston, Texas, is a structure three storeys high and 14 metres long, composed of two standing cylinders connected by a third lying on its side. Called the Human Exploration Research Analogue (HERA), it is a laboratory in which crews perform mock space missions of a few days to a few months. They are confined to the laboratory, eat only space food and follow a minute-by-minute itinerary of tasks and exercise. Monitored by cameras and microphones night and day, they are routinely prodded, physiologically and psychologically. Vibrations, sound effects and communication delays with a mock mission control add to the realism, and the stress. Dr Contractor calls HERA the "ultimate human Petri dish".

With no one to complain to about their colleagues, teams in HERA work, live, eat and solve problems together. In one experiment, four-member crews participated in mock 30-day missions to an asteroid called Geographos, where they collected rock samples and simulated spacewalks. They faced communications delays with Earth of up to five minutes each way, and at one point underwent 24 hours of sleep deprivation.

So what have these models and experiments revealed? Conflict within a team is not always a bad thing. Happy teams are not necessarily the most productive. “If we're going to draw an arrow of causality, it's stronger to reword the statement as ‘a productive team is a happy team’,” says Leslie DeChurch, a psychologist at Northwestern University. “Nothing builds cohesion in a team like excellence.”

Avoiding conflict can discourage the creative friction that can generate new or better ideas. Conflict associated with tasks is different from that associated with personalities. Conflict over ideas can be helpful. But when conflicts get personal, things can get ugly.

> **“ The idea of being stuck in small spaces with the same people for a long time has a chilling ring of familiarity**

In both the leader and the crew, psychologists look for people who are able to read what others are thinking of them—or “self-monitor”. Those who are good at self-monitoring can often tell, for example, whether they are intimidating others into silence, and then find ways to put them at ease. It turns out that they are also people others enjoy working with.

Psychologists also measure conscientiousness. That may sound like a crucial quality for a trip to Mars. But, on average, crew members selected these days for missions in HERA score moderately in this respect.

Research in HERA has shown that people who score very highly on conscientiousness are more likely to be seen by others as a hindrance. To others, the conscientious person can feel like a nag. A good combination of personality traits mixes a degree of conscientiousness with high self-monitoring capability. That person can

personality traits mixes a degree of conscientiousness with high self-monitoring capability. That person can critique others' work without crossing lines—lines which each crew member may define differently.

Successful teams for space missions will require constant tweaking. You cannot dispatch perfect crew members and expect them to remain that way for years. In repeatedly testing participants in HERA, researchers found that certain skills within a team, such as creative thinking and problem-solving, tend to decline about halfway through a mission. The reason? Probably living in a low-stimulation environment, eating the same foods and looking at the same people and the same dark sky every day. Knowing that a team's performance can be dynamic—however good it might be at the start—crews on Mars missions will have to find ways to keep firing up each other's imaginations.

Based on its HERA experiments, NASA believes it can now feed prospective crew members' physical, intellectual and personality traits into its model and, with 75% accuracy, predict who will clash with whom during a mission.

Equipped with such information, Dr Contractor's team is trying to come up with ways to mitigate problems, including by tweaking the "playbook" given to crew members. This is the hour-by-hour schedule that lays out details of tasks, including who will work when with whom. If the model shows, say, that team members A and B will come to blows by day ten, researchers can tweak the playbook for that day to pair A with C instead. Or the task itself could be switched to one in which both A and B are highly skilled; success breeds camaraderie. A third option is to put A and B together with D, a crew member they both like who can broker and mend their relationship. Re-pairing crew members can repair teams, as Dr Contractor puts it.

EVERYONE CAN HEAR YOU SCREAM

The idea of being stuck in small spaces with the same people for a long time has a chilling ring of familiarity. And there are lessons from the space programme that might apply to terrestrial life during a pandemic.

First is the need for routines, not just for work but for cooking or downtime, too. Planned routines provide structure and are central to space missions. HERA's playbook tells crews exactly what they will be doing hour by hour, including work, meals and fun.

At the same time, good communication and an ability to adjust are critical. On December 28th 1973, the three crew members of Skylab, the first American space station, declared a "work slowdown" and cut off contact with ground control, refusing to do their assigned tasks. They had become frustrated by their workload and complained bitterly to each other but kept those complaints from their colleagues on Earth.

Perhaps the most important insight NASA has gleaned from studying team dynamics—in space and on Earth—is the preciousness of one trait in particular: a sense of humour. Studies of crews overwintering at the South Pole show that a confined group needs people to fulfil various roles, including leader, storyteller and social secretary. But the most important task by far is that of the clown, a person who is funny and also wise enough to understand each member of the group and defuse tensions. Laughter, as much as courage, will sustain astronauts on their long quest to Mars. ■

ILLUSTRATION: PATRICK LEGER

This article appeared in the Christmas Specials section of the print edition under the headline "Fighting fit"

More from Christmas Specials

Interactive archaeology

A Zimbabwean archaeologist retells the story of a civilisation

Teach your children well

Does good parenting in Hong Kong mean submitting to the Party?

The pleasures of the table

An economic history of restaurants