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"HOUSTON, WE'VE HAD A PROBLEM..."

On April 14, 1970, Apollo 13 astronauts James A. Lovell and John L. Swigert both said these words to NASA Mission Control. Usually misquoted in the present tense, the sentence marks the start of an extraordinary story of creativity both on and off the face of the planet... This Info Sheet looks at some of the general creativity lessons from the story of the successful failure: Apollo 13's doomed flight…

The Ship

Launching on a mission that some mistakenly describe as 'routine', Apollo 13's launch took place at 13:13 deliberately, it's noted, to spite the idea of any superstitious nonsense associated with the number 13! Aside from the rockets that carried it out of Earth's atmosphere, the actual ship comprised three main sections: the cylinder-shaped Service Module, which housed the engines and 'workings' of the ship; the conical Command Module, from which the crew controlled the mission; and finally the small two-man ship that travelled down to the Moon's surface– the Lunar Module. Once there, the Lunar Module was designed to split in two! Having separated, half of it would remain on the Moon to serve as a launch pad; the other half would fly back to, and dock with, the Command Module before being jettisoned and allowed to crash into the Moon's surface.

The Hidden Problem

Weeks before Apollo 13 was rocketed out of Earth's atmosphere, the number two oxygen tank, filled with liquid oxygen and carried in the Service Module, underwent transfer from Apollo 10, and subsequent modification. But unbeknownst to engineers, a series of maintenance procedures on the tank caused some of its internal wiring to become exposed.

So, in practical terms, the ship's mission was destined to fail not by superstition, but by this invisible error – it was like flying with a time bomb! Despite an engine gremlin on launch, though, things continued smoothly for some time. Indeed, it wasn't until Houston asked the crew to stir the oxygen in tank two for the fifth time, that trouble began... But sure enough, 55 hours, 53 minutes and 18 seconds into the flight, John Swigert flipped the appropriate switch. In an instant, the faulty wires sparked, their insulation caught fire, the liquid oxygen exploded – and the catastrophic blast that resulted, took out Apollo 13's main supplies of air, water, and power. As Houston's instruments went crazy, the astronauts – now 321,860 km from Earth – calmly reported that they'd "…had a problem". In truth, they still had one and would have to overcome several more – and each was life-threateningly serious…

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Problem One: Immediate Survival

The Command Module, in which the astronauts were flying, immediately and quickly began to run out of oxygen and power. It also had very little battery power: if the crew stayed put, they'd be dead within minutes.

Solution

Transfer – by hand – the essential data from the Command Module into the Lunar Module, and use that as a lifeboat since it had its own supply of air, water and oxygen. However necessary, this solution in itself created issues, not least of which was that only the Command Module could re-enter the atmosphere of Earth.

Lesson

To understand that your problem may actually be several problems is an important step. Contrary to our instincts, we don't always need to understand every element of every issue when problem solving. Some issues require immediate action; others require a great deal more careful thought and research. Be aware of which kind of problem you're trying to solve as you solve it, and understand, too, that it's sometimes desirable to simply swap one problem for another… The crew's evacuation to the Lunar Module was clearly an imperfect solution, but it kept the astronauts alive and bought them time to begin problem-solving in earnest.

Problem 2: Turning The Ship Without Using The Engine

So, as the crew transferred to the Lunar Module, they shut down the still-needed Command Module to conserve what little power it had for atmosphere re-entry back home… Assuming they made it that far. But for now, there was a more pressing problem: in order to turn Apollo 13 around quickly, the crew would have to use the engine on the Service Module. This was situated very near to the source of the explosion and – if damaged – could easily fail or make things considerably worse: even a small error in the turn could result in the ship crashing into the Moon or forever being lost in space…

Solution

In what sounds like the plot of a sci-fi movie, Apollo 13 was ordered to do the complete opposite of what immediately seemed best… Instead of turning quickly, they continued flying towards the Moon, using the burn of the less powerful engine of the Lunar Module to maintain trajectory. The idea was that the stricken ship could use the Moon's orbit to make the turn by performing a slingshot manoeuvre around it. While adding four days to the length of the return flight, it avoided using the suspect engine.

Lesson

Even in a crisis, not all problems should be solved by doing the obvious thing. After the first couple of ideas on any creative project, try using 'The Opposite Technique' to discover the black, white and shades of gray in your creative options. It's astonishing how often 'the opposite' proves to be a better course of action than the obvious answer. See our Info Sheet on it here: **http://www.dmiproductions.co.uk/infosheet/pdfs/oppositethinking.pdf**

Problem 3: Inadequate Supplies

Remember, in normal use, two men would travel down to the Moon's surface in the Lunar Module, which was designed to split in two. Half the ship would then return to the Command Module before being jettisoned. Consequently, the Lunar Module was equipped to support two men for about a day and a half. But the plan to slingshot around the Moon would take the three men four days to complete, meaning that the crew's consumables – including water, which was critical to the ship's power systems – would run out before they got home.

Solution

They drank less, switched off as many systems as possible and they wore all their underwear at once to help battle the cold… In other words: they prioritized the ship's needs and made do!

Lesson

Sometimes, even the best solutions will do no more than get you by. Don't be disappointed, disheartened or disillusioned if, on occasion, your practical creativity results in a make do and mend answer. In creative terms, that might mean you have to go with imperfect concepts and continue to look for answers as you go along. And in life and death situations, of course, it might mean being incredibly uncomfortable – but still alive!

Problem 3: Round Pegs in Square Holes

An unforeseen consequence of having the entire crew in the Lunar Module for so long was that their breathing meant an excess of life-threatening carbon dioxide began to build up in the ship. Unless the men could change the ship's filter, they would soon poison themselves just by breathing! And whilst the command module did have more filters available, they were round in shape: the Lunar Module had square filters: the round 'peg' did not fit in the square hole…

Solution

The NASA team took a duplicate of every single piece of equipment that was aboard Apollo 13 but that wasn't absolutely essential for the landing… And created a way to adapt the round filters to fit the square holes.

Lesson

Think inside the box! Sometimes it is just better to be realistic than to indulge the outlandish. To us, a lot of brainstorming seems to be ego-driven drivel in which pretentious chancers make the most outrageous suggestions they can, and mark their territory by dismissing other people's ideas. This defies the very purpose of practical creativity. In many cases, it can be better to accept that certain limits exist, and work within those parameters. Don't fall for the brainstorming myths! Check out our 'Better Brainstorming' Info Sheet here: http://www.dmiproductions.co.uk/infosheet/pdfs/betterbrainstorming.pdf

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Problem 4: Lost in Space

As they approached Earth, Apollo 13 was off course – the ship would undoubtedly hit the planet's atmosphere and bounce off it, before drifting into the depths of space. But for the ship to correct its course without navigation equipment, the team needed a fixed point in space to reference.

Solution

The engineers calculated the amount of thrust needed from the engines of the Lunar Module – not designed for this job, you'll recall – while the astronauts used the only two things they could as references in space: the Earth and the Moon! They kept view of these by having one crew member eyeing each heavenly body through the frame created by the ship's windows, while the third man used his wristwatch to time the firing of the engine because the on-board clocks had no power!

Lesson

Look at the problem from different perspectives. From the point of view of the team at Ground Control, there was no way to help Apollo 13 navigate its way home. But that's because they were on the ground… Up in space, the problem looked completely different! Make time to explore how things look from different perspectives and – similarly – consider what happens to things if you change elements of them and look again: read our Info Sheet here **http://www.dmiproductions.co.uk/infosheet/pdfs/factornudging.pdf** for more.

Problem 5: Cold Start

Ever tried starting a car on a really cold morning? Not always easy! But it pales next to the idea of powering up a NASA Command Module – from near frozen – to run off a rapidly-draining battery, whilst in flight! And though it was theoretically possible, even one small mistake during the complicated start-up procedure could cost the crew their lives.

Solution

In advance of the critical moment, Ground Control ran test after test after test in its simulators to find ways to safely power up the Command Module and ensure the requisite power would be available. When the time came, NASA radioed its plan up to the astronauts to put into effect. It had over 500 steps!

Lesson

"All things are created twice." The notion that great creativity comes in flashes of inspired spontaneity is romantic and mostly nonsensical. But even on those rare occasions when a flash of inspiration happens, it's still true to say that things are created at least twice. Once in the mind as a concept, then once again as it is made real. Often, there are more than two stages. There are drawings for architecture, then blueprints... There are sketches for paintings, then outlines... There are scripts for films, then shooting scripts, storyboards and rough cuts... There are ideas for problem solving, then plans…

In other words, don't put up with any of the twits – and there are plenty about – that think they have all the answers and don't need to plan ahead: they don't, and they do! The steps between having a thought and reifying it can be the difference between its success or failure – be prepared to work hard, even on easy ideas.

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Problem 6: Shields! Shields!

When time came to jettison the Service Module so that the ship could re-enter the earth's atmosphere, the crew could see – for the very first time – the full extent of damage the explosion caused four days earlier. It was extreme, causing serious doubt as to whether the heat shield on the bottom of the Control Module would survive the severe conditions of re-entry...

Solution

None. They just had to take a chance.

Lesson

At some point, when you've done everything you can think of and tried all the techniques you know, you just have to stop being creative. There are countless problems all over the world that remain simultaneously solved and unsolved… Solved, because the appropriate solutions would work if they were implemented; unsolved because the people responsible for them fail to stop creating and take action.

Final Thought…

Here's something we find quite fascinating in relation to seeing things differently: you'll recall the problem we mentioned earlier in regard to the explosion in the oxygen tanks being caused by the need to stir them? Well, it turns out that a sensor fault meant that the oxygen was deliberately being stirred on Apollo 13 unusually often during the flight. When the tank exploded, it wasn't the first time they were stirred during the mission. It was the fifth...

What difference does that make? Well, it gives us an interesting perspective. If the oxygen tanks had been stirred according to the mission schedule, the fifth occasion would have coincided with the Lunar Module being on the surface of the Moon! The astronauts simply could not have recovered from that. So some people argue that the Apollo 13 incident wasn't really anything like the disaster it could have been. Rather, some of it was very, very fortunate! And that leads us to one final thought about problem-solving: sometimes, what seems like a problem in one context turns out not to be a problem at all!