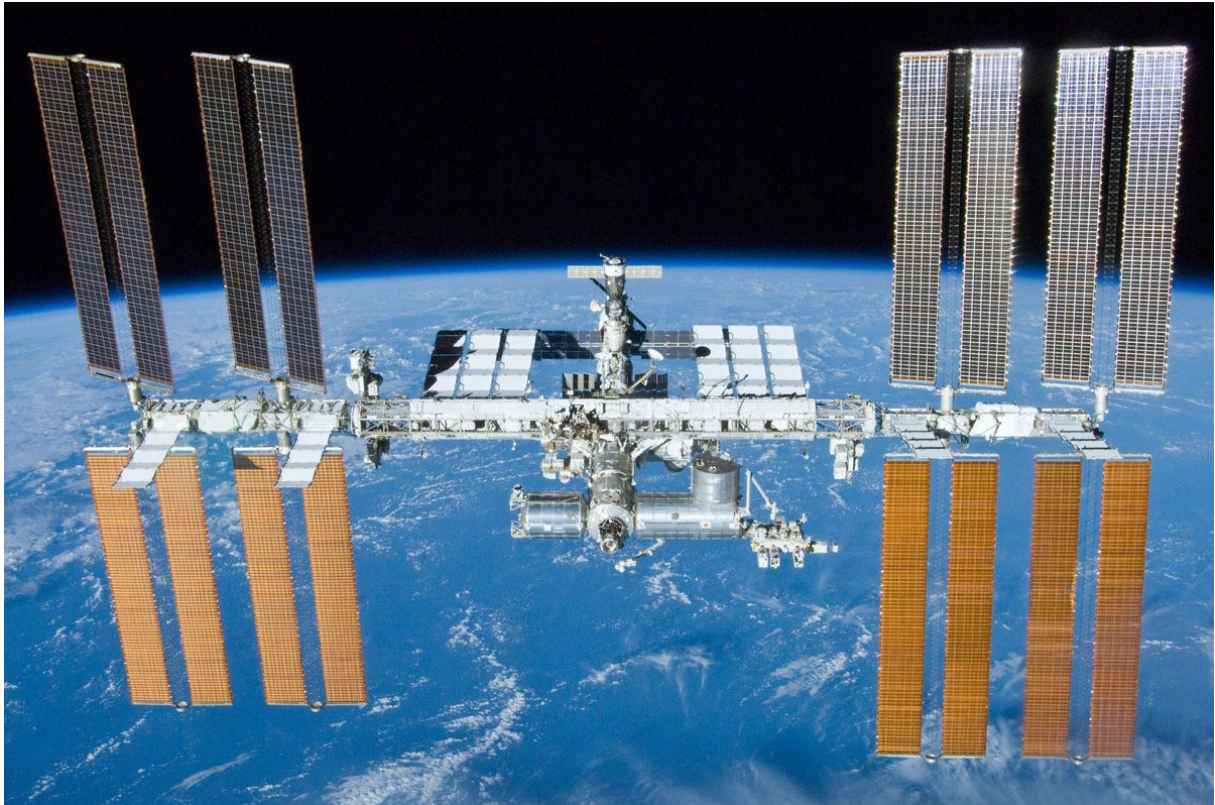


Risk management in the space industry

Interviewer: [Gareth Byatt](#) – Director, Satarla Australia

Interviewee: [Mike Lutomski](#) – Satarla Associate, Consultant

ex NASA ISS Risk Manager, and ex Director of Safety Systems and Risk at Space Exploration Technologies



The International Space Station (courtesy of NASA)

Mike,

Thank you for making the time to provide your thoughts and insights into risk management in the space industry. I have been very fortunate to visit NASA's Risk team in the US a few times, and to talk with them by phone quite often, which has always been tremendously interesting and a terrific learning experience for me.

I'd like to start this interview by asking for your thoughts on how "risk and reward" in space exploration has changed since the 1960's – in particular for safety risk in manned spaceflight. I have seen some very good explanations by NASA on posters at public exhibitions about space exploration that really make the risks very clear.

Putting people into space is inherently dangerous, with so many unknowns. It is difficult to imagine how it may ever be otherwise.

Is it possible to compare the safety risks in human space flight with high-risk industries such as oil & gas, mining and construction?

Mike: *I think it's worth looking at how the risk and reward in the space industry has changed over time, from several angles. Back in the early 1960's the "space race" between the US and the Soviets was at full throttle. At that time this space race was very much part of the Cold War, and it was a high strategic priority of both nations. It was being battled out in a public. Each side battling for "firsts" in space and trying to grab the headlines.*

The Soviets achieved a lot of "firsts" (such as the first living creature in space, the first human in space, first woman in space, the first spacewalk). NASA was formed in 1957, in direct response to the Sputnik program. The space race was a very high priority in the US at the time, not just in NASA but everywhere in the US government. Everyone was cooperating, there was a real drive to get things done as a national priority. In the 1960's the US was willing to take a large risk to catch up to the Soviets and put man on the moon, which included acknowledging the risk to human life.

That's the backdrop to things as we fast-forward through the decades since the 60's. The highest risk missions of NASA (in the context of them all being high risk) were, I think it is fair to say, in going to the moon. There really was a high chance of the astronauts not coming home, and the astronauts accepted the risk. For example, the way that [the Apollo 13 team made it back to Earth](#) was a miracle in so many ways. To survive an explosion of oxygen tanks on the way to the moon was nothing short of incredible.

When we look at how the space industry has developed since this time, we see how the view of risk and reward has changed markedly based on political drive, public sentiment, funding availability, the changing nature of what the space industry has become and many other factors.

Although the risks have been and still are publicly acknowledged, catastrophic events always give us a very hard "jolt". It was harder when we didn't really know the real risks of the programs that were developed. In due course we got better at quantifying risk, but before that, our lack of true understanding made it hard.

Take the shuttle program as an example. After the Challenger space shuttle tragedy in 1986, people started asking about the risks to human spaceflight and why we should risk human life to go to space. At the time, it was hard for NASA to truly know what the original real risk of a catastrophic failure of the Shuttle program was. Most engineers and manager thought the risk was much lower than it has been proven to be. Some engineers at NASA calculated a risk of around 1 in 10, or 1 in 20 for the first several missions. Imagine comparing that to automobile or a plane travel.



A huge amount of effort went into quantifying catastrophic risk after Columbia. Our understanding of safety continued to improve (and continues to improve to this day). I think towards the end of the shuttle program engineers estimated a probability of 1 in 90 for a catastrophic failure.

For [NASA's commercial crew program](#) today, the "stretch goal" for a catastrophic failure is 1 in 270. That is clearly still very risky.

Gareth: NASA don't hide from the high risks, do they. I have a copy of the book by Diane Vaughan, about the Challenger disaster, and NASA openly admit to the failures of the management system that occurred on that fateful day.

Mike: That's right. We need to remember that we use cutting edge technology in the space industry, but we still rely on a pretty crude way to get into space – rockets with highly combustible fuel and oxygen which explode into incredibly forceful action. It's a brute force and dangerous way to accelerate a spacecraft.

Gareth: I'd like to continue on the "risk and reward theme", and culture. The culture of any organisation sets the tone for how risk is perceived, taken and managed, and the awareness and common understanding of risk. Given the risks of space exploration, for manned space flight and unmanned exploration, I wondered if you could describe what in your view are some key elements to having a positive culture to taking and managing risk. I appreciate this is a big topic and it is not easy to distil into a sentence or two!

Mike: Awareness of risk and a common interpretation of risk and risk severity is critically important. This relates to my summary of risk and reward just now. You have to start there. In our industry, particularly for human spaceflight, I think the common understanding of risk has to be connected to doing something that is seen as genuinely important to humanity – it has to be visionary.

For example, using a manned shuttle or another vehicle to deploy satellites into orbit around the world is not visionary nowadays. Human spaceflight should be for doing something more meaningful. This includes conducting significant scientific experiments in space that can and will provide major benefit to people on Earth or working out how to live in space (which is partly what the ISS is for). To take the risk of putting people into space, it has to be worth that risk. The spin-offs from space research include work on treatments for cancer, research into bacteria. There is a lot of materials research.

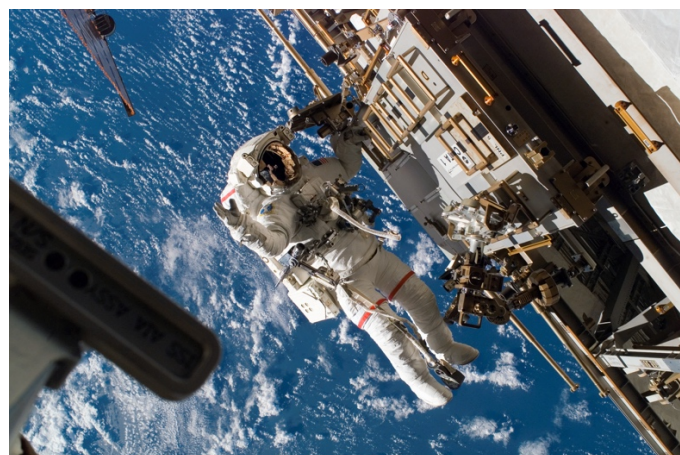
Some things that we do in space can only be done “up there” – such as how the body reacts when it is in space for long periods.

It's also important to evaluate the reasoning and the risk initially and re-evaluate it regularly. Just like in the business world, things change – and arguably faster than they used to do. People change, the views of impacted stakeholders change. There are many, many stakeholders involved in the space industry, many of whom don't realize they are involved like the US taxpayers, and of course many that do who work in both the government space industry and the commercial sector.

Gareth: In how you just described the space industry and its large network of stakeholders, it makes me think of an industry that I am involved in – infrastructure work. Infrastructure projects often have very large numbers of diverse stakeholders and trying to get a common view on risk amongst them all is very hard.

Mike: Yes, that analogy sounds fair. Stakeholder management is critical, and challenging, in many industries.

Gareth: Talking of stakeholder management, you were the NASA Risk Manager for [the International Space Station](#) a few years ago. That must have been a fascinating role, working with a multi-cultural team and many stakeholders involved with the ISS in space and on the ground. What were (and perhaps still are) the most important things to ensure the team shared a common view of their risks on the ISS and how they dealt with them? I'm sure challenges and risks arise every day on an endeavour of this magnitude and complexity.



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Mike: *It certainly was a privilege to hold that role. I found that building a good relationship and building trust with people I worked with came first. This creates an important foundation. It also means appreciating different views, different experiences and being open to constructive criticism. It takes time and you have to want to do it.*

Gareth: This point about being open and establishing trust makes me think of a blog article called [Keeping Score](#) that you kindly provided for my website and my [Newsletter](#) which focused on project risk a few months ago. In this article you stress that risk management is an important communication channel – that getting air time to openly discuss risks as a team is a higher priority to “keeping score” of the number of identified risks. Would you agree that a key factor in good teams is how risks are freely raised and discussed (which I think relates to the point we discussed on culture just now)?

Mike: *Absolutely, it's important that we don't lose the forest for the trees. You have to be prepared to start with the basic fundamentals. When someone is new to concepts of risk management, start with Risk 101. Focus on good communications and decision-making. You can move on to databases and different techniques at the right time once a good base is established. Even when you do that, you should always nurture and maintain the importance of open communication and the freedom to raise potential and actual risks.*

Gareth: Are our ways of managing risk similar across different industries? I'm wondering whether there are things you have seen work well in the space industry that you think other industries could benefit from. To take a leaf out of the “space book”.

Mike: *I think all the Risk techniques and tools are transferable. We use similar tools and ways of doing things in the space industry to other industries. The key is how we all go about implementing them. The most important step is to get good participation by the team and to really use these tools and techniques effectively to make good decisions.*

Some tools of the trade lend themselves to certain disciplines. Many qualitative risk techniques are easily shared. The space industry makes good use of quantitative risk, as do other industries (finance and engineering come to mind). The judicious use of quantitative risk can be a very powerful aide when appropriate, and if you have the resources and the investment in skills to use it properly. RM qualitative tools are good and have low overhead. Quantification requires effort, and often more overhead; used well, it can provide great insights, but don't assume it is easy. It takes effort. Small organisations could struggle with this.

Gareth: You need time to review and analyse data used in quantitative risk.

Mike: *Absolutely. The environment you are in is key. Perhaps there is an urgency to use quantitative risk techniques to help inform decision-making, being fully aware of the effort that is required, to use it for decision-making.*

You need to do the right things to ensure your quantitative analysis works but at the same time don't turn it into rocket science (pun intended).

Gareth: I certainly see a greater interest in using quantitative risk in many industries. I agree that it has to be set up and done properly in order to succeed.

Gareth: It's fair to say that the space industry is at the cutting edge of innovation in many ways – much of which finds its way into industries and activities that benefit society, as you mentioned earlier. I look at risk management as “joined to the hip” with innovation and the “speed of change”. Thinking through risk can spur innovation, not serve as “tick the box” compliance. Are there behaviours and traits that Risk professionals in any industry can adopt to help to foster this mindset?

Mike: *I agree. We have to be open to new information and ideas. Even if or when you do something for decades, you may not understand it as well as you think. Be humble, look at new points of view and seek dissenting opinions.*

Gareth: Perhaps a key part of our make-up is to have a natural curiosity?

Mike: *Yes, I think so, and to not be over-confident as well. There are always signs that things are happening and changing, and we need to be listening and “tuned in” to spot them early enough. Often someone is pointing it out; we need to listen. Our modern environment requires us to take risk; where we may need to apply the brakes sometimes to things which can be hard to do under schedule and political pressure.*

Gareth: I think to do this we need to be aware of our own biases and avoid being “native” in a program or project team, as well, which is a fine balance to maintain.

Mike: *Absolutely.*

Gareth: The space industry, both manned and unmanned, faces a lot of down-to-earth risks too, right? For example, there must be the usual types of project risks to take and manage – for budget, scope, quality, schedule and so on. Your premises and buildings and IT must have typical risks. Treat them the same?

Mike: *Absolutely. We do indeed face all the same risks that other businesses face. We face external constraints, schedule and cost risk, supply chain risk, business operations risk.*

For organisations such as NASA, the US political environment has a big impact. For example, when Congress passes bills, particularly those that affect international relations with other countries, they can affect NASA's abilities to work with its international network of partners.

Gareth: Cyber risk makes the news constantly. I imagine that it is a big risk for organisations working in the space industry, given its high profile.

Mike: *Cyber risk is certainly a risk for those in the space industry, but in some respects the Cyber threat to us may be a bit less than you may think. For civilian agencies like NASA, so much of their information is made open to the public. Also, a lot of the technology we use in space is not easily transferable to make a quick profit or copy a product. A lot of private sector organisations hold sensitive data of their customers that could be a target of Cyber criminals.*

Banks and financial institutions, for example, may face bigger costs of Cyber risks because of the way their data can be commercialised and the commercial threat to their businesses.

Gareth: Countries such as India and China are growing in their space industry capabilities, professional journals document best practices, there seems to be a lot of industry sharing.

Mike: *Yes. It's a much more open world of information and technology now, with exciting possibilities.*

Thank you very much for your time, Mike.