



On Jan. 22, 2018, the Stimson Center and the Secure World Foundation (SWF) partnered to host a roundtable discussion on the relationship between space insurance and incentivizing responsible behavior in space operations. The goal of this event was to bring together space insurance companies, underwriters, satellite operators, and experts from non-space fields to determine if the insurance industry can help incentivize responsible behavior and best practices among satellite operators. The discussion looked at trends in both the satellite industry and space insurance industry, and also the role of insurance in other domains such as nuclear power, maritime, and cyber.

The main takeaway from the day-long discussion was that while the insurance industry currently does not play a big role in incentivizing behavior, it could in the future as the commercial space sector evolves. The suppliers of space insurance face steep competition and limited demand, so they currently compete to gain customers. Most satellite operators purchase property insurance to protect against launch failures, but not on-orbit liability insurance. The space insurance community would like to encourage responsible behavior but, designing and marketing products to do so in the highly price-sensitive market would require a level of collaboration among insurers, underwriters, and brokers, which is difficult given current antitrust regulations. Factors that could change the status quo include broadening of the commercial space sector, a major space catastrophe that greatly increases on-orbit risks, a non-space catastrophe that changes the global insurance market, rising interest rates that upset the balance of capital in the space insurance market, and partially exempting space insurers from antitrust laws. An additional factor that could change the current balance of power in the outer space insurance arena is government regulations that require U.S. outer space operators to have insurance for on orbit activities. The British government has required such insurance and the power of the UK insurance industry to dictate behavior has been increased.

Trends in the Commercial Space Sector

The workshop began with a presentation about the satellite industry value chain as a way to look at broader trends in the commercial space sector. Manufacturing of satellites and of launchers

couple with launch services to create the “upstream” portion of the value chain. Satellite operators gather the data that feeds through satellite ground segments into the rest of the “downstream” value chain comprised of militaries, public civil organizations, businesses, and consumers. Both the upstream and downstream portions of the value chain generate revenue, but of the \$250 billion in revenue from 2017, the downstream portion of the market comprised 97%. Outside of the value chain, space agencies, investors, insurers, and regulators act upon the value chain as a source of demand, to promote research and development, monetize risk, or to modulate behavior. Space insurers, in this context, are outside of the value chain because they do not generate demand for satellites or use the data that come from them.

Participants agreed that advances in smaller satellite technologies and other proposals (such as on orbit servicing) would have an impact on the space insurance market as well. Much of the revenue from satellite operations and insurance comes from large satellites, mostly at geosynchronous orbit (GEO) - a market which is currently experiencing a downturn. Large GEO satellites cost hundreds of millions of dollars and are expected to perform for upwards of 10-15 years, recouping their costs over time. Part of the draw of smaller satellites are that they cost less and can be replaced more easily, refreshing technology rapidly. Another presenter made the connection that constellations of smaller satellites could be their own form of insurance, expecting loss and replacing with other on-orbit assets in reserve. This change to expectations of satellite longevity could upset the space insurance market in significant ways.

Beyond insurers, there is a balance of obligations among investors and lenders that can influence operator behavior. Investors and lenders are interested in reducing risk and have a theoretical interest in protecting their investment through responsible operations.

Trends in the Space Insurance Industry

The second session was led by representatives from companies that offer space insurance, and it provided an overview of current trends in the space insurance sector.

The global insurance market is roughly \$5 trillion dollars per year, and space insurance represents about \$500 million to \$1 billion per year, or roughly \$750 million. It is a small but very competitive market. There is a lot of interest in space and also a lot of capital interested in space insurance. Currently, there are around 30 insurers for traditional western risk. They can compete on coverage terms and capacity, but due to the fierce competition, most are only competing on price.

One presenter explained the distinction between property (first party) and liability insurance (third party). These are typically packaged together in most insurance products, but they are separate in space. Property insurance of a satellite insures against the failure of that satellite during launch or operation and will typically recoup the cost of the satellite, not any lost future revenue. Liability insurance of a satellite would insure against damage caused to a third-party by the operator’s satellite. A small number of countries require on-orbit liability insurance as part of

their regulatory oversight, but still only a handful of satellites carry liability insurance. The vast majority of all satellite ventures carry property insurance, which is typically the third-largest expenditure behind launch and manufacture. Lacking a robust market for liability insurance, insurers have less leverage over the on-orbit activities of satellite operators thus they have yet to promote best practices and safer behavior. Historically, the thinking has been that insurers needed to look at the launch and the first three months on orbit, and after that, owner/operators wouldn't have to worry so much about risk.

It was pointed out that risk management for space is more than just insurance, in that one of the major principles for insurance is that the losses are unforeseen. Good behavior is intended to mitigate the foreseen risks.

One presenter explained how pricing for insurance is not driven by operational experience. Even after the 2009 Iridium-Cosmos collision, prices quickly fell back down, and are now even below pre-collision prices because traditionally-calculated collision risk is extremely low - it is an insignificant element in pricing on-orbit insurance. Orbital space is very large and the relative size of satellites are very small, so the possibility of a collision is one that has a very high severity of consequences with a very low frequency of occurrence. In any case, a true third-party liability claim could be catastrophic for the satellite operator at fault and potentially the space insurance market. In the 60-plus years of satellites orbiting Earth, a true third-party liability lawsuit has not taken place, so there is no direct precedent for such an event.

While precedent for on-orbit liability claims are lacking, liability for damage during launch is required for some parties and regulated through indemnification cross-waivers in the United States. The 1988 Commercial Space Launch Act (CSLA) sought to encourage private space industry by recognizing the hazards of launch and standardizing indemnification across all the parties involved in a launch. Participants noted that the CSLA enabled a lot of successful development and that it might be a good model to hold as a benchmark for future legislation on this issue.

One speaker noted that in 2017, of the roughly 60 launches that occurred around the world putting 260 satellites in orbit, there were roughly 6 or 7 claims. It raises the question of how many of these losses were due to bad behavior versus incompetence (which technically isn't illegal).

Space insurers would like to reduce premiums for better actors, but the pricing competition prohibits any meaningful action. Those selling insurance have very little pricing power and very little direct interaction with their customers - most of it goes through brokers, who depend heavily on models to determine pricing. There is very little flexibility for space insurance pricing for the insurers. Some of the participants suggested collaboration between the insurers to develop best practices such as maintaining reserve propellant for end-of-life disposal. However, concern was expressed from the insurers present about antitrust regulation. In the United States

and Europe, colluding to influence pricing decisions among competitors quickly runs afoul of government regulators.

Lessons from Nuclear Power, Cyber, and Maritime Domains

The third discussion session featured experts from different, non-space domains - specifically the nuclear power, maritime, and cyber industries. They shared their experiences with insurance and regulation concerning risk.

The nuclear power industry is subject to strict regulation after notable public disasters over their history of operation. Unlike satellite operators, nuclear operators are held hostage to each other in terms of reputation. If any nuclear operator has a catastrophe anywhere in the world, public and governmental opinion shifts very quickly to reevaluate all nuclear operators. In light of the danger posed by nuclear catastrophes, governments established antitrust waivers to encourage nuclear operators to collaborate in order to improve industry-wide safety. Lastly, governments have also become the backstop and guarantor of nuclear industry. One presenter characterized this as removing the nuclear operators from tort liability. Without this liability and established precedent, fear of lawsuits has not developed as a driver for better safety performance in the nuclear industry.

Maritime regulation, law, and conceptions of risk are often compared to space and the satellite industry because they share similar questions of jurisdiction ambiguity. Yet, the maritime domain has centuries of precedent among states, international bodies, and commercial interests, which guides performance. Such precedence does not exist in the space domain. For example, maritime vessels have to be verified to ISO standards, while there is no equivalent requirement for space vehicles. With requirements for both property and liability insurance, the maritime arena has a robust insurance market with high demand and the ability to differentiate premium pricing. Insurers assist in improving safety and best practices because it minimizes their exposure to risk. Also, maritime insurers have standardized liabilities in their contracts, which has been very important to the industry.

The cyber security domain is distinct from space, nuclear, and maritime because it is not a stand-alone domain, and it is integrated into every aspect of society. The current economic incentives make attacking cyber networks much more feasible and profitable than defending. Regulation has run the gamut from laissez-faire to full government control with mixed results. Some of the best efforts may be in influencing the boards of companies to have a culture of cyber security that permeates the organization. Without top-down support, efforts to defend could continue to be futile. Cyber insurance does exist, but it is developing very slowly and only covers identifiable and foreseen risks. Monolithic insurance pricing may never be a driver of best practices, but maybe different insurance types, similar to health insurance, could adapt to the cyber environment. Finally, best practices, such as public reporting of vulnerabilities, are becoming more common, but are not fully adopted or enforceable.

Conclusions

This event sought to elucidate the relationship between space insurance and incentivizing good behavior. Based on the information presented, it seems that the structure of the space insurance market currently precludes any incentivizing from the insurers onto the operators. While the insurance industry is not currently in a place to drive responsible behavior, it can be a supporting force.

Due to the current market complications, ensuring these best practices may fall to governments. While many governments are loathe to impose mandates upon private companies, without action and due to the nature of liability in space, governments could be holding much more risk than is currently assumed.

Government activity might be as simple as incentives such as fast-tracked licensing for spectrum allocation and earth-observation and antitrust waivers for space insurance companies to collaborate on safety practices. A more complex approach would involve regulated standards, provision of robust public SSA data, and mandated liability insurance.

In addition, it was suggested that those who can affect the financial well-being of satellite operators would be better-placed to incentivize good behavior - namely, the investors. Examining their role in establishing norms for good behavior on orbit was posited as a possible follow-on discussion.