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Photo courtesy of the European Space Agency

The risk takers

The area of space risk assessment and insurance is a niche market but an extremely important part of any space programme. Helen Jameson finds out more about the business and how it all works.

The space industry is today valued at approximately US\$251 billion. The changes that the industry has gone through since the first satellite was launched over 50 years ago have been enormous. Satellites have become a great deal more complex and more expensive as a result. The skies are getting fuller every year with satellites operating with smaller and smaller separation distances. Satellite operators and manufacturers are becoming more ambitious with their satellite programmes. Take O3b Networks that has already embarked on a satellite project that will ultimately bring high speed, low-cost connectivity to the Asian, African, Latin American and Middle Eastern markets via a constellation of 16 satellites. The satellites will be launched by Sea Launch who is currently developing a special dispenser to enable them to place eight spacecraft into orbit per launch. This highly ambitious programme is just an example of the way in which the industry is moving. It wants to be bigger, better and faster, producing more impressive capabilities and increasing capacity and flexibility to fulfil the demands of their customers.

In the early days of the satellite story, satellites were often destroyed as man learned how to build and launch them but nowadays, with satellites playing a significant part in our everyday lives and underpinning crucial communications services and networks, the need to insure them has become vital. You would not leave your house, your biggest asset, uninsured against fire or flooding. For the same reasons, each satellite that is launched, and the process it goes through to get into orbit, must be covered against loss. They are expensive and take time to replace and, as we all know, in this day and age, time is money and cannot be wasted.

The advent of space tourism is also bound to be significant in terms of risk assessment and insurance, where manned space vehicles will be taking paying customers into space. It will be down to individuals to take on that risk, as they do when taking part in adventure sports. Most people do consider space travel to be a high-risk activity. It will be important for risk assessors to bear this in mind for future public space travel. The Apollo and Gemini missions did not



have a fixation on risk assessment when they were pushing forward the frontiers, but in the context of taking the general public into space, risk is something that must be calculated and mitigated.

Assessing the risk of all these ventures is key. These spacecraft must be insured. The loss of a spacecraft would otherwise be devastating. By its very nature, the satellite business is risk-filled. The launch, the placing into orbit, the deployment of the satellite components such as solar arrays, the testing and remainder of the life of the satellite - all must all be taken into account by the underwriters. It is a highly complex and lengthy job to do. Every programme is different. As Philippe Montpert, Managing Director of Willis Inspace told Satellite Evolution, 'there is no one size fits all solution'. Elements of risk vary greatly and each case must be taken on its own characteristics.

Recent problems

Over the past two years the satellite industry has suffered some problems including launch failures, satellite loss and damage to satellite assets. These included the loss of SES AMERICOM's AMC-14 satellite in April 2008 when an anomaly occurred during the second burn of the fourth stage of the rocket resulted in the satellite being placed short of the planned geostationary transfer orbit. The satellite was declared a total loss as it could not be re-positioned. The satellite was fully insured for a total of \$150 million. In early 2007, New Skies experienced a launch failure and lost their NSS-9 satellite. This was followed by another failure in September 2007 when the JCSAT-11 satellite failed to be placed into orbit. These are just a couple of illustrations that highlight the fact that the satellite industry is fraught with risk.

Risk analysis can be broken down into three areas: Contractual, Financial and Technical.

Contractual: This involves the review of contracts that are associated with a certain project. These contracts would be, for example, the launch service agreement, procurement contracts, the contract with the satellite manufacturer, any transponder lease agreements and sales or user contracts. After analysing each contract involved, decisions may then be made on risks that may be transferred to other parties, ones that may be retained and that must be insured.

Financial: The financial aspect of risk assessment focuses on the identification and quantifying of the potential exposure to risk. This phase would involve a review of the business plan and any related financial documents. A statistical analysis will also be carried out, plus a review of financial exposure to risk. In addition, several 'impact studies' will take into account any potential interruptions, damage to assets, loss of revenue or extra expenses. This phase will also cover contractual liability.

Technical: The vital technical phase comprises the review of all space and ground segment and related technology. This is used to brief the insurance underwriters. The satellite design description will be reviewed and the satellite's reliability, redundancy, budget and margins focused upon. In addition, the entire programme, and technical team are scrutinised, plus quality control elements, test plans, industrial organisation, hardware heritage, launch vehicle operations and the entire mission profile.

Once these reviews have been completed, a tailored plan can be developed to meet the specific needs of the mission. Normally, the rocket and space equipment, components of the spacecraft, launch vehicle and upper stages will be insured. In addition, the land infrastructure involved will also be taken into account. For example, a facility may be in more danger of experiencing earthquakes for example. Expenses will also be considered should a re-launch of the rocket have to take place.

Crucial stages

The satellite is at risk throughout its entire lifetime, however, there are certain phases of the lifecycle where the spacecraft is at more risk than others. A satellite can cost up to \$120 million and the launch

itself \$100 million. Insurance comes in as the third most expensive part of a space programme.

Pre-Launch: The period before launch sees the satellite being encapsulated into the launch vehicle fairing. Then, the fairing, with the payload inside, is transported from the spacecraft integration facility to the launch complex site. Here, it is integrated onto the booster and awaits its eventual transfer to the launch pad. Obviously, at this stage damage can occur to the payload whilst being transferred from facility to facility.

As recently seen with the MEASAT-3a satellite, damage can also occur on the launch pad and can cause a lengthy delay whilst the spacecraft is repaired, losing crucial revenue for the operator. Pre-launch insurance covers the satellite or its parts when in transit and any work that is undertaken on the launch site.

Launch: Launch is the most critical part of the mission. It is where most can go wrong. Launch coverage starts at ignition and ends at the point of satellite separation. The satellite is at risk of a launch failure where the launch vehicle does not even make it in to the sky, or it can fail at any stage of the launch cycle that involves its successful complete deployment into orbit. As mentioned earlier, a satellite can be placed into an incorrect orbital position. This may be corrected in some cases but can result in the spacecraft's loss. Arianespace offer a Launch Risk Guarantee that enables customers to receive a re-flight within ten months of a failure or a cash payment or an offer of credit towards a future launch in the event of a partial failure.

In Orbit: There is no way of sending technical help to a satellite that is experiencing difficulties. No shuttle can be sent to fix any problems. Once in orbit, the satellite must deploy its various components and operate as intended. Once the satellite is placed into its correct orbital position, the satellite must go through a period of testing. Insurance covers this period and the remainder of the satellite's lifespan. Other risks that threaten a satellite whilst in-orbit could be physical damage such as strikes by space debris, loss of capacity, loss of on-board fuel or loss of electrical power or even magnetic storms.

Space Risk Assessment Tool (SpaceRAT)

The Space Risk Assessment Tool was developed by QinetiQ and satellite insurer Sciemus. It enables insurers to quantitatively assess the risk involved with satellites. Users can obtain statistical analyses of particular spacecraft to predict likely future claims. The analysis is based upon an extensive historical database of spacecraft over 20 years and up to a year in the future. The SpaceRAT enables operators to make substantial savings on the cost of protecting their spacecraft against in-orbit failure.

The underlying mathematical model is based on QinetiQ's extensive experience in space systems reliability. A satellite is broken down into a number of 'critical components' with an associated level of redundancy. Failures on similar spacecraft in these critical systems will influence the reliability of the spacecraft.

Safeguarding Space assets

The satellite insurance industry is an integral part of any satellite mission. Often criticised for asking for high premiums, it must be recognised as well that a satellite is an extremely costly asset and the whole process involved in its manufacture, transportation, launch and in-orbit operation must be covered. It is of course, not just black and white. A satellite can fail on all sorts of different levels, there are many components that can go wrong. The investment poured into satellites by operators is enormous and it is down to both the insurer and the operator to ensure that they get what they want out of their relationship.

As stated before, there is no one size fits all solution to the insurance of any mission and that is why careful risk assessment must be carried out at every stage to ensure that if the mission should fail, then appropriate and timely compensation can be sought for the operator. ■