THE DAILY SPACE

FRIDAY, 4TH NOVEMBER, 2016

WORLD SPACE RISK FORUM

WELCOME

Welcome to Day 3 of the 2016 World Space Risk Forum. Yesterday we learned about some of the most critical risks we face in space – cyber risks, the ownership of space resources, and the abundance of new launch vehicles. Our Keynote speakers and CEO Panel provided the opportunity for industry leaders to describe their visions of the future and debate their different approaches. Today we will learn about the tools that will allow us to move forward – statistical programs and new launch vehicle technologies that will revolutionize our industry.

CHRISTOPHER KUNSTADTER
CHAIRMAN - WSRF 2016

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Friday, 4th November

MORNING

6.30AM TO 7:30AM Fitness Activity

9:00AM TO 9:15AM **INTRODUCTION (B)**

9:15AM TO 10:00AM **KEY NOTE (B)**

WHAT WE'VE LEARNED ABOUT RISK

CHRIS KUNSTADTER, XL Catlin

10:00AM TO 10:15AM **PANEL SESSION**

#10: SPACE MARKET ROUNDUP AND RELIABILITY TRENDS, SERADATA (B)

TIM FULLER, Seradata

DAVID TODD, Seradata

10:15AM TO 10:30AM **COFFEE BREAK**

hosted by AG

10:30AM TO 11:00AM **KEY NOTE (B)**

THE FUTURE: RE-USING ROCKETS

DR. HANS KOENIGSMANN, SpaceX

11:00AM TO 12:00PM Closing remarks, followed by Lunch

hosted by AG

AWARD!

John Celli, President of SSL, receiving the Outstanding Service to Industry Award from WSRF 2016 Chairman, Chris Kunstadter

KEY NOTE SPEAKER

Key Note Speaker on Day 2 of WSRF 2016, Stéphane Israël, Chairman and CEO of Arianespace

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INTERVIEW

RICHARD PARKER

DIVISIONAL PRESIDENT, ASSURE SPACE

Richard Parker of Assure Space takes a look at the small satellites sector, market consolidations, next generation launchers and going to Mars!

Q What are the key factors you think will or will not define the future of the current interest in the segment of small satellites launchers?

A Satellites are designed for a purpose, not to be large or small. The commercial satellite industry has evolved through a requirements-driven approach to satellite design and functionality. It has historically been more cost effective to build and launch larger satellites. However, in recent years, the trade-off between satellite size and functionality has undergone a period of transformation as smaller spacecraft have become more attractive due to lower development costs and shorter lead times.

Although small satellites have been used for the past 50 years their use has typically been limited to scientific, educational and technology demonstration missions. With advances in both miniaturization and integration technologies small satellites are increasingly being used for commercial imaging and communication missions.

The challenge for small satellite operators is not access to space as most existing launch vehicles offer piggy-back opportunities for small satellites. The key factors will be achieving a launch price point and launch frequency to support smaller satellites, more missions and shorter satellite lifetimes.

Existing rockets are looking to fly more small satellites, but numerous new launch vehicles are in development, all aiming to provide a dedicated service for small satellites. Most of these new vehicles will be able to launch several hundred kilograms into the standard sun-synchronous orbit most commonly desired by small satellite missions. If the price-per-kilo indicated by some of these new launch providers is achieved, we will continue to see significant growth in the small satellite market.

Q Following the announcements of unlikely partners such as SES/O3B and Intelsat/OneWeb, do you think there are any other market consolidations or disruptions that may impact the direction of the industry?

A The traditional satellite business model is under threat from a glut of capacity at GEO and a new wave of constellations at MEO and LEO orbits. High Throughput Satellites (HTS) deliver much higher capacity than conventional satellite services at a fraction of the cost. HTS satellites that are currently deployed or under construction will more than triple the current global bandwidth over the next two years. This significant increase in capacity will continue to put pressure on satellite bandwidth pricing.

As prices fall, the demand for capacity from customers will increase, but large satellite operators who have a high number of customers are more sensitive to falling transponder pricing and will likely see revenues under threat from cannibalization.

With this background, the investments in O3b and OneWeb, do not appear so unlikely. In fact, the low latency offered by satellites in lower orbits is an advantage over GEO satellites for certain markets such as government and mobile. Notwithstanding these investments, the consensus is that it will be a difficult environment for smaller or underfunded satellite operators. In this environment, further consolidations can be expected.

Q What do you think will be the key differentiators of the next generation of launchers, which are all expected to become the primary launchers of the respective agencies in the next 4-5 years?

A Several new launch vehicles are on the horizon – Antares 230, Angara 1.2, Vulcan, Ariane 6, H3, Vega-C, New Glenn. Clearly the launch industry is set to become even more competitive than in recent years. This is a new relatively new challenge for the launch industry. When SpaceX introduced the Falcon 9 in 2010 there was no strong requirement to offer a cost-competitive rocket. Atlas and Ariane were, and still are, examples of highly reliable launch vehicles and the satellite industry accepted that such reliability came with a high cost. This scenario worked well for space insurers; sums insured were high and claims were low.

The challenge for the new batch of vehicles is to achieve better performance at significantly lower cost and greater frequency. For many of the launch providers this will require a new approach to rocket design and manufacturing. New production techniques, such as 3D printing and modular design and manufacturing, will need to be utilized. Investments in state of the art factories with higher manufacturing capability, and potentially reusability, will need to made to achieve pricing goals. It is my belief that these investments in smart manufacturing will differentiate the launch market.

Launch vehicle providers will want to bring these new vehicles to market as soon as possible to offset their investments. This will mean fewer test flights, lower sums insured and greater probability of launch failure. As always insurers will need to proceed with caution.

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RICHARD PARKER

DIVISIONAL PRESIDENT, ASSURE SPACE

Q Out of all of the non-space industry related, macroeconomic events such as presidential elections, Brexit and/or rising/ faltering economies, which do you think has the greatest impact on the space industry and would that impact hinder or aid industry progress?

A I do not believe events such as Brexit or the U.S. Presidential Election will have a near-term measurable effect on the space industry. However, space insurers, and the space industry in general, require a strong global economy to support growth. Most but not all insurers are facing rate reductions coupled with low investment returns. The space insurance market currently favors insurance buyers and has done so for the past several years. Space insurance rates are at historic lows and each year space underwriters announce that the market has bottomed out, but premiums continue to decline. Insurance capacity is currently at an extraordinary level. Most of this capacity has strong security with the ability to absorb losses and pay claims.

The overall stability of the space insurance industry is good for the wider space community. There are many companies working to develop low-cost access to space, new spaceflight technologies and new space-related business models. Insurance will be an essential part of the financing for these commercial space ventures and will increase the demand for insurance.

Q Many government and commercial space organizations have announced missions to Mars and beyond. Do you think that this goal can be achieved by a single organization's capabilities or do you see the necessity for a more collaborative approach across borders?

NASA has had a human Mars vision for some time, as has Russia and China. Since there doesn't appear to be a race amongst nations put a human on Mars, international collaboration is certainly possible, albeit unlikely. In the U.S., Boeing, SpaceX, Lockheed Martin and others have also announced Mars plans – suggesting that a commercial space-race does exist. These organizations have the capability to reach Mars, but the question is should these be NASA-led missions or commercially-led missions.

Mars is long way away; many technical hurdles will need to be overcome and it will cost a lot of money to get humans there. This suggests that collaboration between the commercial players and/or the various governments will eventually occur.

PANEL Day 2, Panel 3, Unbounded and Unknown Risks, in full flow.

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INTERVIEW

JOSE MARIANO

CEO & FOUNDER OF ZERO2INFINITY

Making Dreams a reality. CEO & Founder of Zero2Infinity, Mr Jose Mariano, explains what drives the company, speaks of their Bloostar development and the Zero2Infinity aim of being a supplier of frequent flights to Near Space, LEO and beyond.

Q Tell us about Zero2Infinity, where are you based and how are you financed?

A At Zero2Infinity our mission is to enable others to make their dreams come true above where airplanes fly. We are agnostic regarding the dream, it could be a hyperspectral satellite constellation, or the first board meeting overlooking the blue planet. We want to take your dream up there so that in can be a real success. In 2016 the main business is elevating heavy payloads to near space (above over 99% of the mass of the atmosphere) for a variety of purposes, including scientific, educational, commercial and communications. The next step, leveraging on its existing expertise, for Zero2Infinity is to complete the development of Bloostar, a dedicated small satellite launcher to put satellites in Low Earth Orbit on demand. Moreover, Zero2Infinity has also drawn interest from international investors and corporations to develop a pressurized pod to take human beings to near space for Science and Leisure, called Bloon.

We are based in Barcelona Spain. We are financed by venture capital, business angels and European Union grants.

Q Your focus is on simplifying access to space. What are you doing to enable that?

A We believe that space has a great potential but the bottleneck is access. Space access is hard mainly because the same vehicle has to do many different things, it has to comply with too many requirements and that leaves very little room for innovation. It's literally "rocket science". We like to think that we take a different look at the problem. We break the problem in two parts, first get outside of the dense layers of the atmosphere, second reach orbital speed. The first phase uses a balloon and the second a patented rocket optimized for vacuum operation. We believe this is the first architecture that is conceived from day one to meet the emerging small satellite market, not as an afterthought of ground or aircraft launched missiles.

Q You have worked on some interesting projects. What is the biggest achievement so far?

A We are the first private company to acquire the capability to send heavy payloads to near space. This used to be only done by Government Agencies. In terms of test flights, we are proud of having flown a 400kg toroidal pressure vessel at 32km. This is the building block of both the Bloostar launcher and the Bloon passenger vehicle.

Q How are you managing the risk aspects of your activities?

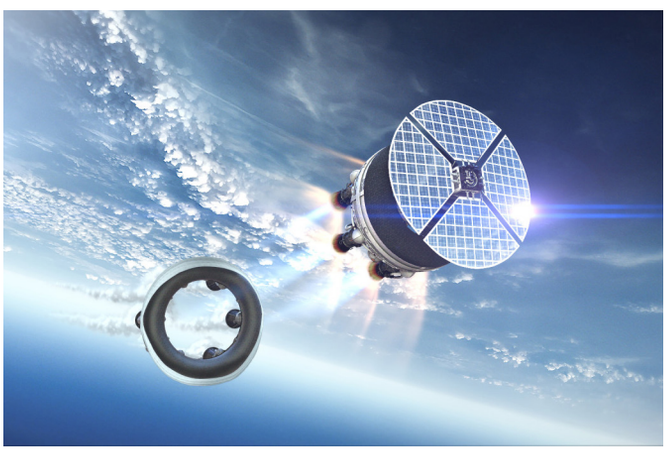
A One benefit of breaking the problem in two is that we can have a totally different risk profile. Bloostar has engine out capability on the first and second stages. Since it ignites at 22km over the ocean, the consequences of a Rapid Unscheduled Disassembly are manageable, in comparison to destroying a carrier aircraft or damaging a launch pad. Also the ride itself is much gentler than for any prior launcher, since there are no vibrations from the ground reflections, maximum dynamic pressure phase or turbopumps. This smoother flight profile reduces the risk of satellites to get damaged on the way up.

Q What is your view on how the space access market will evolve over time?

A We believe that there will be several small payload launchers, possibly 2 in the US, 1 in Asia and 1 in Europe. Responsive launch and frequent launch will be achieved first for micro and nano launchers than for heavy ones. We can clearly see 10s of launches every year in the segment that Bloostar services, we have a harder time to see 10s of launches for heavy vehicles. We've designed Bloostar so that we don't close any doors for reusability, even if it's not required in our business plan. There are several scenarios in which reusability is useful, specially if we manage to refurbish the stages faster than the time that it takes us to produce new ones. It's more a matter of speed and ability to ramp up flight rates than a matter of cost per kg per se.

Q Where will Zero2Infinity be in 20 years' time?

A We see ourselves as providers of elevation. The highest that we've flown so far is 35km. But the company is not called Zero 2 35km. It's not called Zero 2 LEO either. In 20 years we see ourselves as an international and truly commercial supplier of frequent flights to Near Space, LEO and beyond.



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INTERVIEW

BOCAR BA

CEO OF SAMENA TELECOMMUNICATIONS COUNCIL

Bocar BA of SAMENA Telecommunications Council tells The Daily Space about the reason for their set up and achievements to date

Q Why was the SAMENA Telecommunications Council set up?

A SAMENA Council was created to represent the voice of telecom operators in the SAMENA region to policy-makers and regulators. In this role, SAMENA Council has contributed to the industry as a networking platform, an agenda-setter, and as a sector development partner to both public and private sectors. SAMENA Telecommunications Council's originally envisioned role as that of an advocacy body for telecom operators, facilitating constructive communication and collaboration with regulatory bodies, and assisting in both assessing realities of the regional marketplace and aligning stakeholder priorities with grander goals, remains integral to SAMENA Telecommunications Council's existential identity.

Q What achievements have SAMENA Telecommunications Council made to date?

A SAMENA Telecommunications Council drives its sense of achievement by centering its focus on playing an industry-wide accepted role of enabling digitization and digital economic development, encouraging broadband investment, facilitating transparency and good governance, and fostering multi-stakeholder cooperation. SAMENA Telecommunications Council's contributions are evident from our engagement with regulatory bodies and ministries, and through CRO Meetings of the ITU, which SAMENA Council has been globally chairing since the 4th CRO Meeting, held throughout the world during major ITU events. The Council has also brought critical industry issues, such as spectrum planning and taxation, to the forefront of global telecoms agenda for Administration-level dialogue.

Q What do you plan on carrying out in the next 5 years?

A SAMENA Telecommunications Council is working very closely with key stakeholders in the regional government sectors, including with TRAs, and other government bodies across regional markets. With far-reaching ICT visions set forth by the governments of the UAE, Saudi Arabia, Bahrain, Qatar, to name a few, the future of our region's markets is smart hyper-connectedness. We see a digital society developing before our eyes, and are excited that SAMENA Council's involvement is being sought by the government sectors in the early planning stages, especially with regard digital development enablement in the modernized communications industry. The future of the regional markets also appears bright, because policy-makers and regional stakeholders are proactively seeking means and ways to achieve collaboration, with the purpose of utilizing ICT resources as development generators for sustainable development. It is in these areas that SAMENA Council looks forward to making its contributions over the next few years. In view of the recently held 20th Session of the Council of Arab Ministers of Communication & Information, which reiterated the importance of bringing telecom operators on board in order to successfully fulfill national digital development and connectivity goals, SAMENA Council anticipates working closely with regional governments to better represent operators and to collaborate with governments bodies on various digital development areas.

PANEL The CEO Panel look to the future on Day 2 of the Forum

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INTERVIEW

LUCA ROSSETTINI

CEO AND FOUNDER OF D-ORBIT SRL

Ali Asghar, Moderator of the Panel "What's Driving Commercial Space Startups", caught up with D-ORBIT SRL CEO and founder Luca Rossittini to talk more about D-Orbit and their future plans.

Q Tell us about D-Orbit where are you based and how are you financed?

A D-Orbit is based in Italy (production facilities), with subsidiaries in Portugal (software for critical applications) and U.S. (commercial hub).

D-Orbit is privately held and financed in equity via European Venture Capital money

Q What is the focus of your business in the near term and long term? What are you doing to achieve it and your business model?

A D-Orbit started addressing the niche market of satellite and launcher's stages decommissioning as an important strategic step towards the goal of becoming the first in-space transportation company. Moving satellites at the beginning or end-of-mission through our smart systems provides clear benefits to our customers while letting our company grow the expertise and network to move forward.

Currently, D-Orbit products and services portfolio includes decommissioning systems for any type of satellite in any orbit and launchers' stages; fast orbit raising systems; life extension propulsion systems for nanosatellites; and the last product we launched is a small, self-decommissioning, satellite platform able to offer a precise deployment of several nanosatellites in orbit, reducing their time to operations: the overall idea is to offer to nanosatellites the same service offered to the primary payloads of launchers via a dedicated in-orbit "bus".

The initial business model is based on hardware direct sale. However, the company is transitioning towards a service-based model, starting from Hardware As A Service model, towards more sophisticated models (coming in the next months) to cover not only the "new space" market but also the "institutional" market with an innovative approach. Insurers are the ones we want to talk with right now

Q You have worked on some interesting projects. What is the biggest achievement so far? What have been the biggest challenges?

A When we started the company, few years ago, space debris mitigation was mainly a subject for research entities, space agencies and universities. We gathered feedback and needs from a large network of operators and integrators worldwide and eventually we became the first company to offer commercially a system able to remove a spacecraft in hours from space, much more effective than any other system if compared in terms of performance and cost.

However, it has not been easy: we basically helped creating a new market and if you pair the low reputation typical of a young company with the resistance of the space players to include innovation – especially if it comes with a solid propellant motor – into their expensive satellites, well, to start signing contracts was hard at the beginning. Now, after 8 months from our first contract, we are pleased to observe that several manufacturers are considering our products to respond to their customers' requirements. Without generalizing too much, few years ago operators were asking their selves if removing or not a satellite, while now they are asking how to remove it in the most effective way. Awareness on benefits coming from removing a satellite, and the improvement of the regulations are changing the general approach to the problem. And we are part of that.

Eventually, we plan to increase our market penetration investing in a full demonstration mission: our decommissioning technology is meant to work after many years in space, so we decided to design, build, launch, operate and decommission a satellite. All done in house. D-SAT mission, launch on March 2017. The first satellite ever removed from space in a fast, safe and direct way by means of an independent decommissioning system.

Q How are you managing the risk aspects of your activities?

A Apart from the standard risk definition typical of the space sector and standard procedures, I see, in our activities, two main risks: time and money. That is why we decide to go for equity investments: being funded in short time to be able to accelerate according to the market growth. Currently we are one the most funded space "scale-up" in Europe and we are going to close another round of financing next year to give another boost to the company and we already got interest by new VC funds.

Time is of essence for us. Internal milestones but especially being able to respond quickly and effectively to our customers. We believe that a vertical integration approach helps us reducing the timing risk, improving our performance with

"MOVING SATELLITES AT THE BEGINNING OR END-OF-MISSION THROUGH OUR SMART SYSTEMS PROVIDES CLEAR BENEFITS TO OUR CUSTOMERS WHILE LETTING OUR COMPANY GROW THE EXPERTISE AND NETWORK TO MOVE FORWARD"

INTERVIEW

LUCA ROSSETTINI

CEO AND FOUNDER OF D-ORBIT SRL

respect production and also keeping under a good control and management the relationships with our suppliers.

Q What is your view on how the space market will evolve over time?

A No doubt the space market is evolving. Like it happened for other industrial sectors on Earth several decades ago. Satellites are going to benefit from the extremely rapid improvement of the technology in the commercial market on Earth, smaller, cheaper and more performing. Although today it looks like the new space companies are not paying enough attention to the reliability, this word will become once again important. So smaller satellites, lower lifetime (both to take into account the reliability and the pace of technology innovation), less expensive. Cubesats as defined today set a standard; however, I'm expecting more sophisticated architectures, single-point-of-failure-free taking advantage of the modularity concepts. Eventually, transportation: today if I have to take a flight, I'm not going to bring my bike with me... I simply use a taxi to move from A to B. In space satellites still bring their own "bike" to move in orbit. I'm expecting that in the future spacecraft will have the option of taking a taxi, saving mass and costs. The new access to private capital will be the key enabling factor making all of this possible.

And this is the short term. Should I continue on the long term?

Q Where will D-Orbit be in 20 years' time?

A Transportation, both of goods or people, waste management, eventually helping traffic control. We will need all of these soon in space. D-Orbit will be among the first providers of these services. More details? Come and meet our people at D-Orbit!

LUNCH

WSRF 2016 Yahsat lunch, top table hosted by Balakrishnan Doraisamy

When your financial risk is up here you need the best information you can get

Updated every working day, the Seradata SpaceTrak online launch and satellite database will provide you with the up-to-date information you need at the touch of a button. SpaceTrak will give you comprehensive data on:

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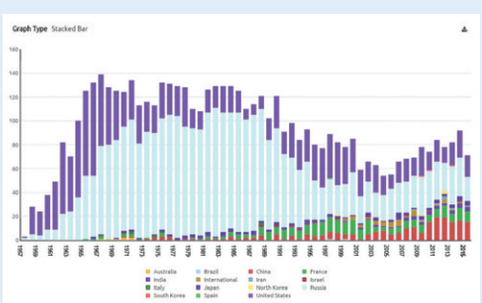

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WORLD SPACE RISK FORUM

INTERVIEW

DR. MICHAEL MENHART

CHIEF ECONOMIST, MUNICH RE

Following his thought provoking Key Note on Day 1 of the Forum, Chief Economist of Munich Re, Dr. Michael Menhart, gives us his views on global economy risks, insurance price pressures and increased market capacity.

Q We realize that the global economy is facing multiple risks. In your view, what are the main risks the world economy is currently facing?

A Global economy is dominated by high uncertainty - which has its root cause in a variety of political and economic risks. The risks of unintended consequences from the ultra-expansionary monetary policy of major central banks are a major risk, so is the speed of increase of debt levels in many emerging markets. On the political side, we have the risk of further escalation of geopolitical conflicts such as the one in the Middle East, and we have major elections right in front of us, which have the potential to further increase uncertainty.

Q Since the financial crisis of 2007/2008 how has the global debt markets evolved?

A Overall, global debt has substantially increased since the financial crisis, but with different trends across countries and sectors. Households and corporations in advanced economies have deleveraged, government debt in these e countries overall has increased, also due to cleaning up the financial crisis fallout. Debt levels in emerging markets, and especially corporate debt levels, have increased substantially and have increased very fast, both can be a threat to stable growth in these countries.

Q What has been the impact of quantitative easing and in your view, has it been effective? What are the long-term effects of QE?

A Many central banks have tried to help increase economic growth and financial stability. What they did increase is the volume of their balance sheet. Central banks have taken over a new role. Whatever happens in the world, they are the ones to react and "calm the market", this has become a vicious circle - the more often they do it, the higher market expectations are. The higher market expectations are, the more pressure central banks feel to increase monetary stimulus. QE is not going to increase growth; the world is not suffering from a lack of cheap money.

Q Since 2007/2008 how has the world insurance aggregate capacity evolved? In your view, what is the impact of the additional vehicles to take on third party capital e.g. ILS, side cars, reinsurance on aggregate capacity?

A The capacity has increased substantially; some observers believe by roughly 25 percent since end of 2007. Increases in so called alternative capital have clearly outpaced increases in traditional capacity, so their impact was meaningful. However, this dynamic has somewhat levelled off in 2016.

Q Is the increase in aggregate capacity a direct consequence of increased global debt and QE? What is the impact on pricing/rating as a result?

A The increase in alternative capital is closely linked to the "search for yield" among investors at a time when expansionary monetary policy by leading central banks and esp. QE have substantially lowered investment yields. This is especially true since investors putting money in (re)insurance also benefit from largely uncorrelated yields, esp. in nat-cat business. However, at least parts of the new investor base seem to be long-term oriented and have built up expertise in this new alternative asset class. Thus, it is unlikely that all of this investment money will disappear should QE end and interest rates rise again. Therefore, in sum this new capital has put additional pressure on (re)insurance rates, although an important part of market softening in recent years was driven by traditional capacity providers themselves.

Q Do you see this pricing/rating change/pressure across all lines of insurance?

A On the one hand, it is concentrated more in reinsurance business, and here in the important property cat segment, given its short-term nature (as opposed to long-term, and more difficult to model, casualty business). On the other hand, with property cat reinsurance rates declining in recent years, this has also put pressure on primary insurance prices and helped to lower rates in other (re)insurance classes as well, since market participants have shifted their capacity out of property cat and in to other lines of business.

Q How much capital needs to be lost to change this market? USD10bn loss? USD100bn loss? USD1 trillion?

A The exact amount of over-capacity (or excess capacity) in the (re) insurance market is hard to gauge, but many observers put it at clearly more than 100 billion USD. Thus, any capital depletion (either from a large loss event or as a fallout of financial market turmoil) would need to be above this level. However, given the very low levels that rates have reached, we are seeing some signs of stabilisation in the market, but not enough to fundamentally change it.

Q What is the best way for an insurance company to protected its future? Diversified securities? Multi-currency protections? Stop underwriting? Any other ideas?

A From an economist perspective, diversification and prudent risk management will stay as important as a they were in the last years. The world economy will not give a lot of tailwind for growth, it must come from innovation - this will be key for success.

QUICK POWWOW!

JAN SCHMIDT

HEAD OF SPACE AT SWISS RE CORPORATE SOLUTIONS

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Jan Schmidt, Head of Space at Swiss Re Corporate Solutions, who hosted the Space Powwow! Sessions, lets us in on the thinking behind this years exciting new addition.

Q Global Swiss Re Corporate Solutions is hosting the Space Powwow! series of talks at this year's WSRF, tell us why you are behind these?

A I'm a great fan of TED talks and when Lucy mentioned in our first sponsorship meeting the idea of introducing 'dynamic short talks' to the Forum we got excited about it and signed up for it.

Dynamic short talks are interesting and inspiring and they are a great platform to convey a message and knowledge to the audience. They are also used to raise awareness on certain issues in only a few minutes. In our opinion a wonderful medium for the World Space Risk Forum.

Q Where did the name come from?

A For trade mark reasons, we weren't allowed to use the name TED Talk and 'dynamic short talk' seemed neither to be a dynamic name nor a short one. Marcel finally came up with the idea Powwow, following the social gathering held by many Native American communities.

We would have preferred to sit around in a circle with the Powwow speaker in the middle, but for logistical reasons this was not possible.

We hope this year's Powwow will be great success and will become a fixed part of the Forum in the future.

Q What do you hope the delegates will take away from attending the Space Powwow talks?

A Inspiration for more!

Q Which Space Powwow! are you most excited to hear?

A In particular, I'm interested in Daren and Chris' Powwows. However, all speakers have been carefully selected and I believe they will all do a fantastic and engaging job.

SPACE POWWOW!

Dr. Darren McKnight, Technical Director at Integrity Applications Incorporated, engages the crowd during his Space Powwow! The Mean is Meaningless!

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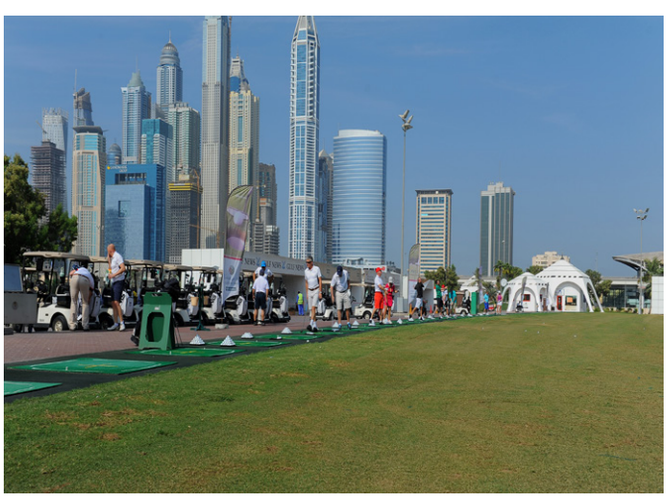
GOLF DAY

FORE! Some shots from the World Space Risk Forum 2016 Dubai Golf Championship.



Robert Schenone, XL Catlin, accepts his prize following a victorious day on the course

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