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Space Insurance Market Review and Future Outlook

VII International Conference Aviation and Space Insurance in Russia

MARSH & McLENNAN COMPANIES

Topics

Where do we stand?

Recent events

Perspectives

2016 at a Glance

- 2016 was a good year for space insurers with USD 400m profit estimated
  - Four potential limited claims
  - 33 launches insured on the international markets
- Overcapacity
- Historical low rates

BUT

- Several near-miss events for the international space insurers
  - Amos 6, Intelsat 31, LM failures
- Lots of delays on Falcon and Proton manifests
- Volatility!

2016 Claims

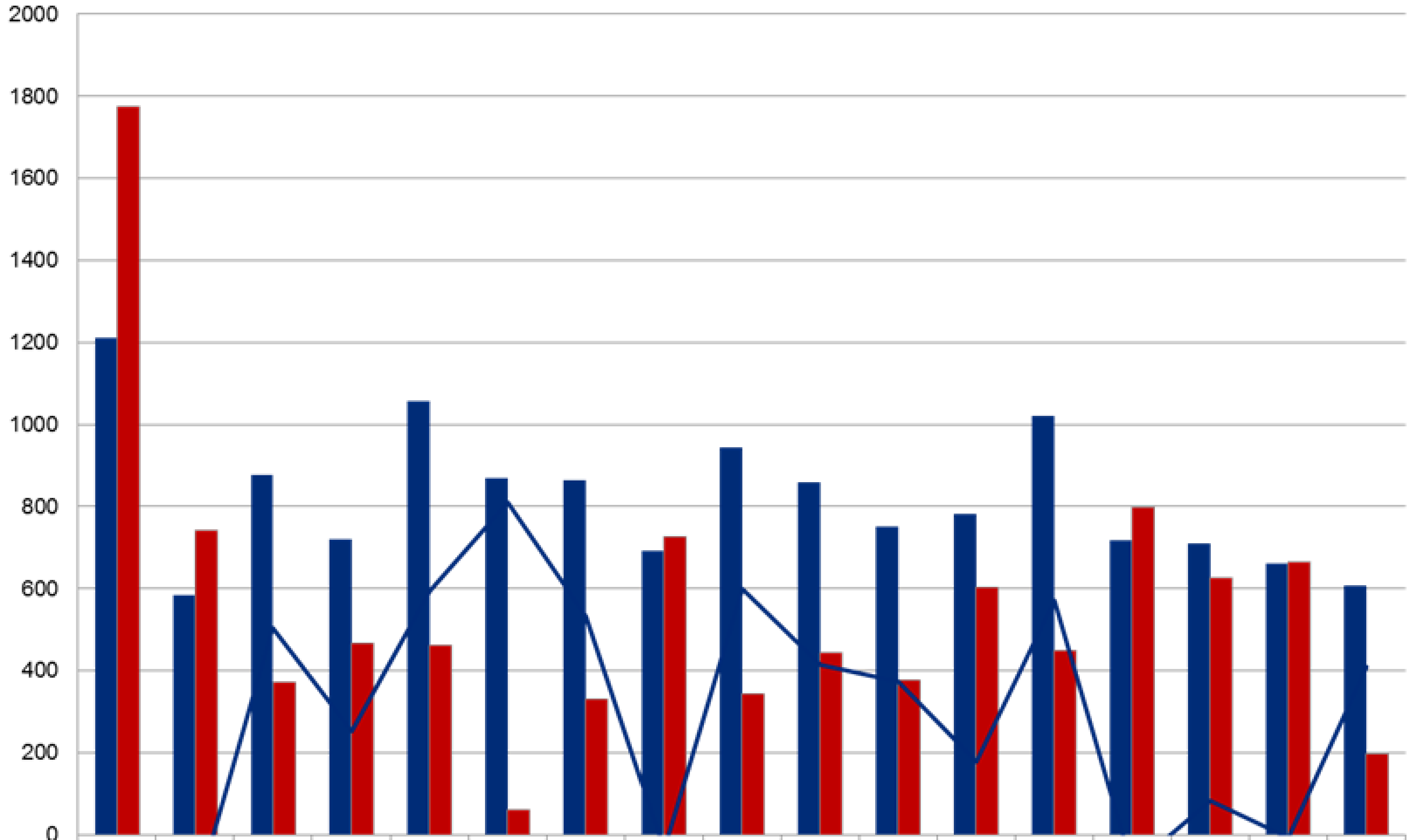
Satellite	Launch Vehicle	Satellite Type	Loss Phase	Type of Loss	Date of Loss	Maximum Claim Amount	Claim Description
Intelsat-33e	Ariane 5 ECA	BSS 702MP	Post-Sep	Partial Loss	24-Aug-16	USD 46m	Apogee kick motor (AKM) failure resulted in longer than expected orbit raising and small reduction in overall lifetime. Loss quantum will only be known once satellite reaches its desired orbit.
DMC 3A & 3C	NA	SSTL-300	In-Orbit	Total Loss	Nov 2016	USD 78m	Failure of primary downlink unit on 2 out 3 satellites in fleet. Investigation ongoing as to whether redundant downlink units are subject to failure in the future. Investigation is ongoing.
Progress MS-04	Soyuz U	Progress MS	Launch	Total Loss	01-Dec-16	USD 21m	Early separation of Progress Module from 3rd stage of Soyuz resulting in total destruction of the module. Insured domestically for 35M EUR, but reinsured international for 20M EUR (approx. 21.4M USD).
Gao Jing-1	Long March 2D	CAST3000B	Launch	TBA	28-Dec-16	USD 52m	Launch vehicle anomaly resulted in satellites separating into incorrect orbit. Satellite used on-board fuel to correct its orbit. Loss quantum will only be known once remaining fuel has been calculated.

Preliminary figures and worst case scenario as still under investigation and some of these failures could be offset by the margins on-board satellites

Falcon 9 Ground Loss

- 01/09/16 catastrophic explosion during the ground static fire testing preparations
  - Amos 6 and the launch vehicle destroyed
  - Significant damage to the launch pad
  - Root cause identified as a failure of one of the composite overwrapped pressure vessels inside the second stage Liquid Oxygen tank
  - Corrective measures implemented by SpaceX
  - Successful return to flight on 14/01/17
- Launch campaign phase (“pre-launch”) insured in the marine cargo market
  - Huge blow on the cargo market
  - Event affected the annual premium income for space insurers in 2016

Premium and Claims

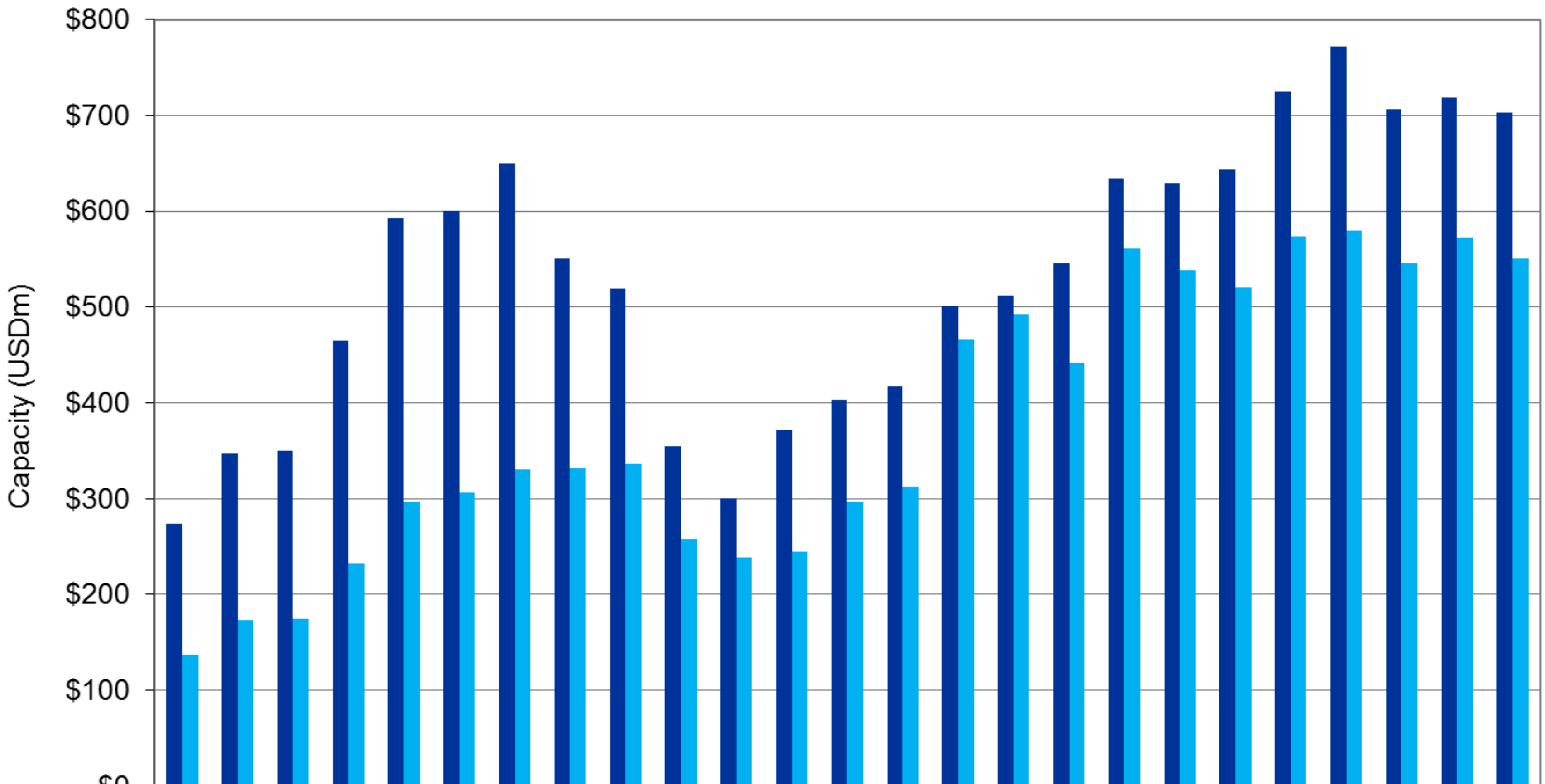


	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Premium	1212	585	877	721	1057	870	864	691	943	860	750	781	1021	718	711	660	606
Claims	1774	743	372	468	463	60	331	726	343	445	376	604	450	798	627	666	196.8
Annual Profit	-562	-158	505	253	594	810	533	-35	600	415	374	177	571	-80	84	-6	409.2

Capacity

- In 2016, capacity for both launch and in-orbit increased slightly in theory
  - But only available for what insurers deemed a perfect risk profile
  - For in-orbit placements available capacity was reduced due to
    - Low level of profitability for insurers to justify deploying their full capacity
    - Some insurers believe premium rating levels were below the burning cost
  - Available capacity significantly lower for both launch and in-orbit risks which are deemed ‘non-standard’, e.g. imaging satellites, Russian hardware and impaired risks
- 2017 market capacity
  - “Operating” capacity stable at USD 700m for launch and USD 550m for in orbit

Historical International Market Capacity



	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2016
Launch	$274	$347	$350	$465	$593	$600	$650	$551	$519	$355	$300	$372	$403	$417	$501	$512	$546	$634	$629	$644	$725	$772	$706	$718	$703
In-Orbit	$137	$174	$175	$232	$297	$307	$331	$332	$336	$258	$239	$245	$297	$312	$466	$492	$442	$561	$539	$520	$573	$580	$546	$572	$551

Recent Premium Rate Review
Launch + 1 Year Rates

- Long period of profitability in space insurance prior to 2013 and high levels of underwriting capacity put pressure on insurers to provide premium rate reductions
- Premium rates for Launch + 1 decreasing since 2005, especially for desirable risk profiles
- BUT Rate differentiation for Russian hardware (Proton, Soyuz …) following string of bad news over the past years
- For 2017 we anticipate the same trend
  - Launch rate reductions for good risk profiles
  - Higher differentiation for some ‘non-standard’ risks, however good news and track record will bring them back on track

Recent Premium Rate Review
In-Orbit Rates

- In orbit insurance premium declining since 2005
  - “Year on year” reductions were achieved for good risk profiles, but levels of reductions steadily reducing
  - Significant rate increases for any undesirable risk profiles (i.e. satellites with anomalies …)
- In general reduced appetite for in-orbit risks
  - Capacity being deployed more conservatively for all risks
  - Some markets only writing fleet in-orbit placements or for operators with an imminent launch placement
- Modest premium rate reductions for “healthy” is expected to continue in 2017

2017 Market Developments
New Trends

- A number of first flights of new hardware expected in 2017
  - SpaceX Falcon Heavy maiden flight
  - SpaceX Falcon 9 first reuse of a reconditioned first stage (SES-10)
  - Orbital ATK’s Star 3 satellite
  - CGWIC first DFH-4 with electrical propulsion
  - Zenit to resume launch operations
  - Deployment of the Iridium NEXT constellation
- Challenges for insurance industry
  - Performance to greatly affect perception of this new hardware
  - How to assess SpaceX reconditioned launch vehicles
  - Potential generic issues on constellation hardware and how to factor this in the pricing
  - Review of insurers’ approach on constellation to risk evaluation?

2017 Space Insurance Market Outlook

- More than 30 insured launches expected in 2017
  - 2017 premium income is expected to exceed that of 2016
- The market is in a competitive but delicate position
  - 2016 was a good year for insurers, although previous 3 years results are not good for insurers
  - Increased volatility due to new hardware and evolution of the satellite constellation sectors combined with the perceived eroding premium
- This is likely to further polarise the insurers' on risk profiles
  - Premium rating for good, heritage risk profiles likely to reduce, with more capacity being offered
  - Premium rating for less favoured risk profiles likely to stabilise or increase, offered capacity likely to reduce, insurers to more often seek exclusions for health issues

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