Satellite OOS DIE ANOTHER DAY

by Aon Space

Executive Summary

- à Part 1 : What is space insurance ?
- à Part 2 : The space insurance market
- à Part 3 : Space risks underwriting princip
- à Part 4 : Insurance & On-orbit servicing
- à Conclusion

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Part 1
What is Space Insurance?

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Why Insure Satellite Risks?

- Commercial versus Government/Inter-Government
- Role of banks and project financial backers
- Special Characteristics
  - High Technology/Prototypes
  - High risk of failure for satellite/project/business
  - Inaccessibility in orbit (so far...?)
  - Replacement time
- International and National Law/Convention (Liability Risks)

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A drastic change increasing sensitiveness to insurance

FROM	TO
Government Influence	Commercial business
Public orders	Market forces
Multinational Organisations	Private companies
Corporate or Sovereign financing	Non-recourse project finance
200 to 300 MUSD project cost	>1 billion USD projects
An engineers' world	Bankers and lawyers everywhere

What is space insurance?

- Space insurance can be defined as the insurance of any risk related to the construction, launch and exploitation of a satellite
- A stricter definition limits this to the launch and post-launch phases
- Different insurance markets exist for different phases

Who buys Satellite Insurance?

- Satellite manufacturers
- Launch service providers
- Satellite buyers /Operators
- Satellite users
- Banks and Investors

The different insurable phases

Assembly Integration Testing → Transport → Pre-Launch → Launch → In-Orbit Life

- Pre-Launch (construction, storage, transport ...)
- Launch and In-Orbit Insurance
- Loss of Revenue Insurance
- Third Party Liability Insurance
- Contractual Liability Insurance
- Launch Delay Consequential Loss Insurance

Part 2
The space insurance market

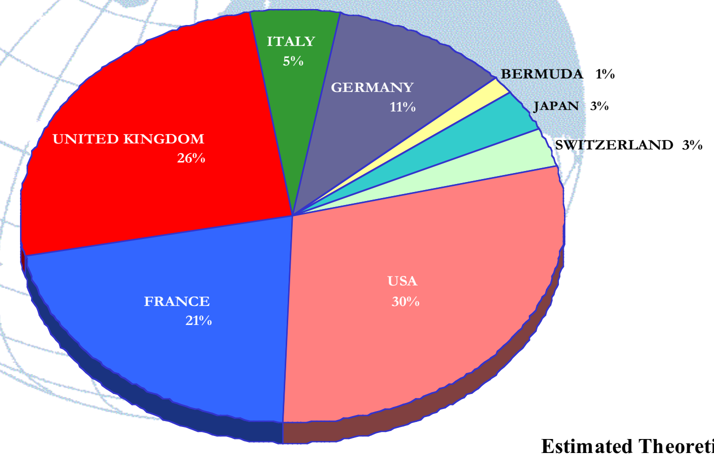
History of the Space Insurance Market

- 1965 - First satellite pre-launch and liability policy fo
  Earlybird (Intelsat 1)
- Mid 1970's - Full launch coverage becomes available (withc
  deductible)
- Early 1980's - Emergence of a specialist satellite underwritin
  market
- Mid 1980's - Market becomes very competitive
  (rates driven down to about 7% for a shuttle
  launch 8% for others)
- - Severe losses (Challenger, Ariane and Delta) l
  to dramatic reduction in capacity and increase
  rates (launch approx. 25%)
- Late 1980's - Gradual reduction in rates
- Early 1990's - Market matures
- Mid 1990's - Relative stability achieved.
  Capacity expanding.
  Ariane V63 loss (US$356 million)

History of the Space Insurance Market (cont.)

- à 1997 - Capacity continues to increase, now exceeds US$ 900 million. Competition between insurers creating downw pressure on rates and extending periods of co
- à 1998 - Capacity reaches US$ 1.2 billion. Decline in rating levels and loss experience att insurers' profitability
- à 1999 - Cumulative losses through 1998 and 1999 provoke market " hardening" with steep increasing rates
- à 2000 - Cumulative losses keep increasing with a high of claims in 2000. Insurance rates suffer a ser rebound.
- à 2001 - Level of premium is decreasing. September 11 events cause a strong market hardening and a capacity shrinking. Concerns about serial losse
- à 2002 - Market is difficult although no losses so far. M threat of pending claims

Estimated World Space Insurance Capacity for 2002 (USD)



Estimated Theoretical Total:
USD 800,000,000

Total likely to be used per launch:
USD350,0000,000 - USD400,000,000

Estimated World Space Insurance Capacity for 2002 (USD)

FRANCE	00 000
AGF	75 000 000
SCOR	60 000 000
La Réunion Spatiale	30 000 000
QBE	10 000 000
	208 750 000
Marham, Lloyd's consortium	30 000 000
Hiscox, Lloyd's consortium	56 500 000
AIG	15 000 000
Generali	25 000 000
GAUM	15 000 000
Watkins, Lloyd's syndicate	22 500 000
Ace Global Markets, Lloyd's synd.	20 000 000
Goshawk, Lloyd's syndicate	7 500 000
Amlin, Lloyd's syndicate	4 000 000
Catlin, Lloyd's syndicate	5 000 000
Other Lloyd's synd. + companies	8 250 000
	0 000
Munich Re	50 000 000
Inter Hannover	25 000 000
GE Frankona Re	12 000 000

ITALY	
SATEC	42 500 000
WITZ RLAND	
Swiss Re	25 000 000
U.S.A.	
XL Aerospace	40 000 000
Axa Space	80 000 000
ACE USA **	50 000 000
USAIG	43 500 000
Berkshire Hathaway***	25 000 000
BERM	
Axis	10 000 000
Tokio	10 000 000
Mitsui Sumitomo	10 000 000
Nissay Dowa	5 000 000
Sompos Japan Insurance	2 500 000

Market Capacity for Launch in 2002

- Total theoretical capacity approximately US$ million
- Insurers balance books by avoiding "peaks", consider potential accumulations such as dua launches.
- Therefore total normally available capacity is somewhat less, perhaps around US$ 350 - 4 million.

Market Capacity for In-Orbit in 2002

- Possibility of multiple losses from one event cause
  - Environment
  - Commonality between Satellites
    - design
    - manufacturing processes
- Most insurers write less than their maximum launch capacity
- Total market capacity around US$ 200 to 25 million

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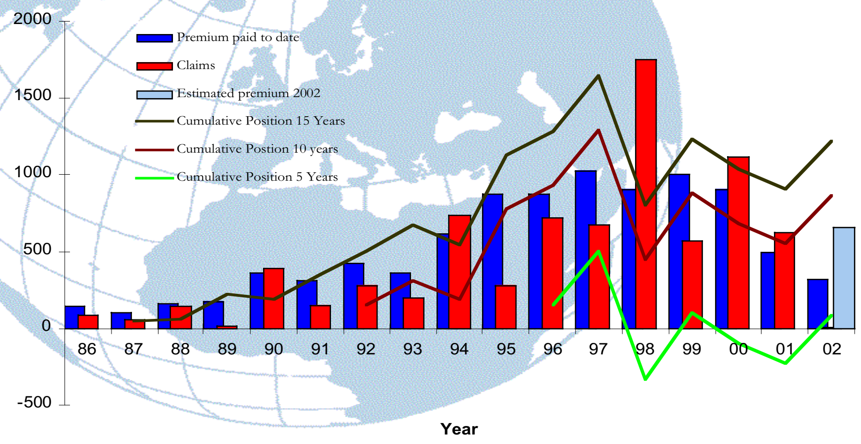
Market Position History



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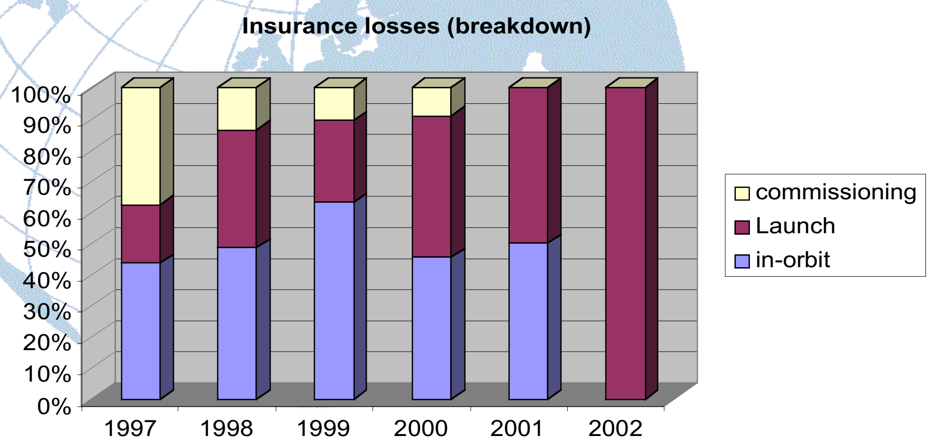
Breakdown of losses (by number of occurrences



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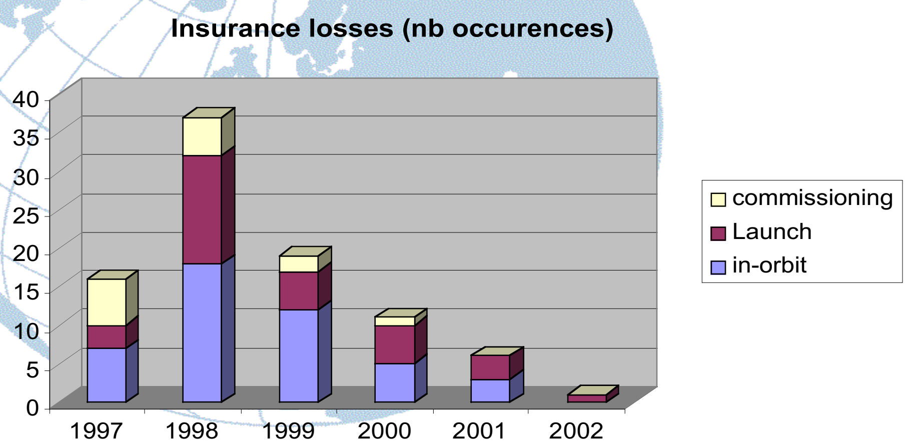

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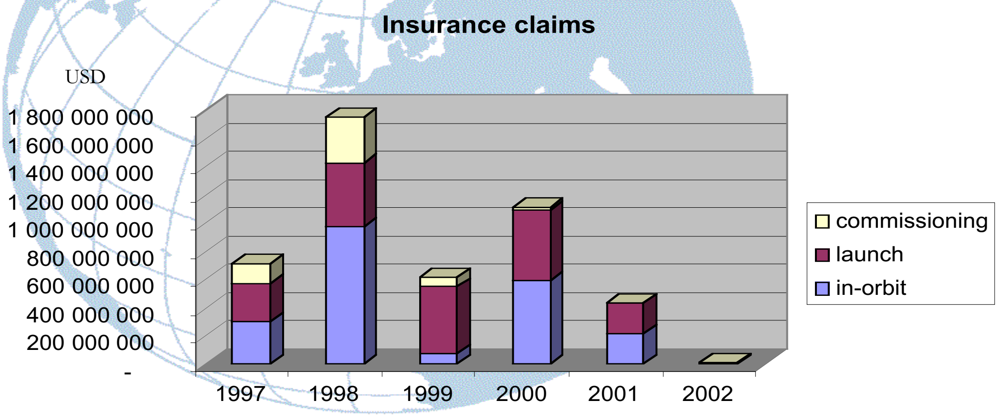
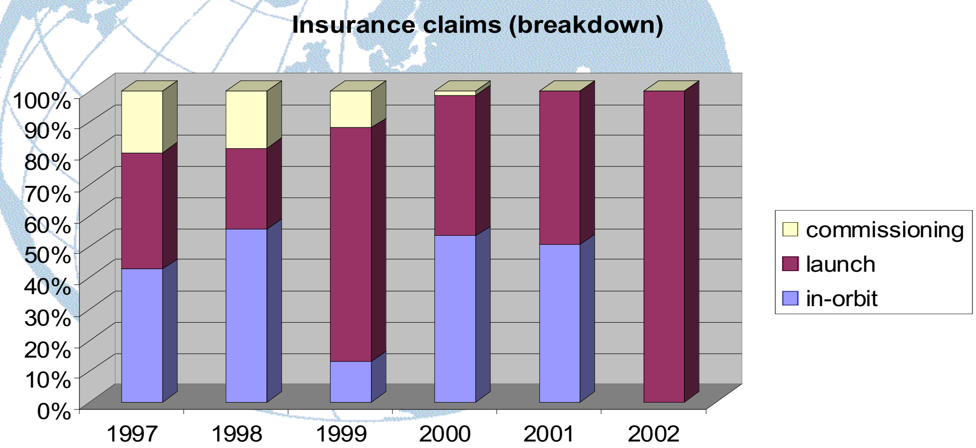
Breakdown of losses (by monetary amounts)



Breakdown of losses (by monetary amounts)



Major Claims in 1999

Date of Loss	Satellite	Loss Phase	Loss Amount (USD)
27th April	Ikonos-1	Launch	157,000,000
5th May	Orion-3	Launch	265,506,000
6th September	Yamal 101	Post-sep	50,500,000

Major Claims in 2000

Date of Loss	Satellite	Loss Phase	Loss Amount (USD)
12th March	ICO-F1	Launch	235,000,000
27th August	Solidaridad-1	In-Orbit	276,000,000
20th November	Quickbird-1	Launch	265,000,000
22nd November	Galaxy 7	In-Orbit	132,000,000
November	TDRS 8	In-Orbit	98,000,000

Major Claims in 2001/2002

Date of Loss	Satellite	Loss Phase	Loss Amount (USD)
12th July	Artemis	Launch	75,000,000
12th July	Bsat-2B	Launch	63,000,000
6 th September	Panamsat 7	In-Orbit	215,000,000
21th September	Orbview 4	Launch	74,000,000
2001	Telstar 5	In-Orbit	4,000,000

Note: No major claims in 2002 (cumulative $10M claims to date)

Pending in-orbit losses

Satellite	Sum Insured
Galaxy 11	$286,000,000
Thuraya D 1	$371,000,000
PanAmSat 1R	$343,000,000
Anik F1	$200,000,000
XM Rock	$200,000,000
XM Roll	$200,000,000
Arabsat 2A	$101,000,000
Arabsat 3A	$170,000,000

Part 3
Space risk underwriting principles

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How the Market Works

- Relatively few events but with high sums ins / Risk spread only among a few insurers
- Long term strategies necessary
- Importance of technical analysis and present (Not strictly an actuarial approach)
- Leading markets - (quotations) and following markets (acceptance of shares)
- Placing slip "Summary"/Policy Wording "Contract"

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What is Insured?

- à **Physical loss, damage or failure of a satellite during following phases**
  - Launch and commissioning
  - In orbit life
- à **All phases**
  - Business interruption/ Loss of revenue
  - Liabilities

Launch and Commissioning

- à **Arranged either by satellite buyer or by manufacturer, depending on the contract**
- à **Provides indemnity for loss, damage failure of the satellite to meet specification which resu**
  - Loss of operational capability; and /or
  - Loss of life
- à **Usual risk period: from intentional ignition or off for up to:**
  - 180 days
  - One year
- à **Specifically tailored to customer's requireme**

In Orbit

- Covers the satellite whilst operational
- Similar coverage to launch and commissionin
- Arranged by the satellite buyer except wher In-orbit warranty exists
- Insurers require regular satellite status repor
- Renewable annually, though longer periods c be considered

Very rough guide to Premium Rates and Quantum of Risk by Phase

- Launch, commissioning and early orbit:
  - 13% to 25% of the Sum Insured
- In-Orbit
  - 2% to 3% per annum of the Sum Insured
- Launch Liability
  - 0.15% of the Indemnity Limit

Policy Wordings

- à Contract defining nature, scope and mechani
cover
- à Individually tailored, not written on a pre-set form but some common aspects (such as exclusions)
- à Key issues
  - Insuring agreement
  - Policy period
  - Total loss definition (often 75% of operational capability)
  - Partial loss definition (usually proportional to los
operational capability)
  - Claims handling procedures
  - Salvage (On-orbit servicing ?)

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Part 4

Insurance & On-Orbit Servicing

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On-orbit servicing and insurance

à In-orbit losses represent around 50% of curr insurance claims

à In-orbit insurance rates have dramatically increased over the last two years.

à Insurance more difficult to procure for this ph

à Large concerns from insurers about serial los due to design or manufacturing anomalies, he technical exclusions are imposed

à Therefore, good news are always welcome !

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On-orbit servicing and insurance

à Historical anomalies are rather bus-related th payload-related

- on-board computers
- solar arrays
- batteries
- thrusters

à OOS may repair more easily bus-related problems...?

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Conclusion

à On-Orbit Servicing can help structuring more cost-efficient insurance policies for satellite operators by either

- allowing to repair a faulty satellite and avoiding a
- maximising salvage value to insurers after a claim

à Trade-off for insurers will be between

- paying a claim upfront and
- funding a rescue mission with no full assurance of success

à Therefore, OOS must demonstrate its feasibil and its reliability before moving forward