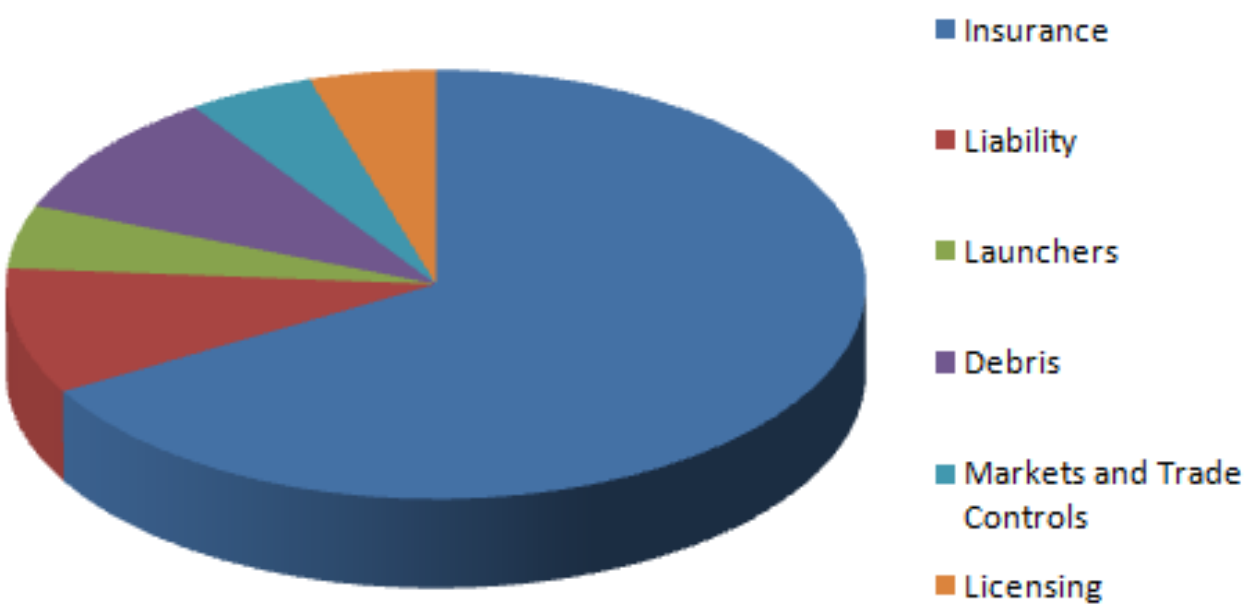
Space Insurance

Overview

What we will cover today



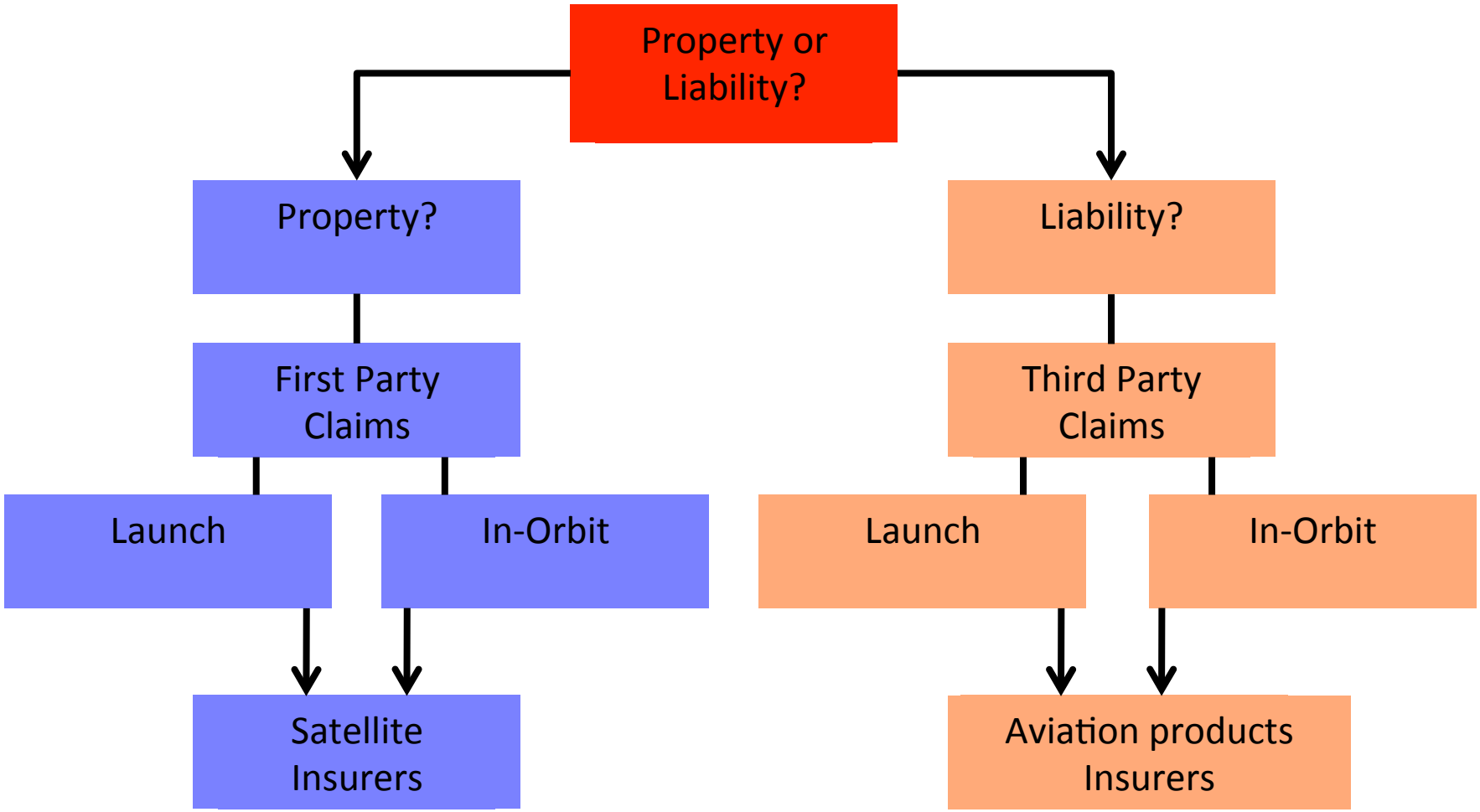
Insurance capacity explained

- Insurer's capacity is the amount or limit that an insurer is able to offer for any one risk
- Market capacity is the accumulation of all insurer's capacity
- Distinguish between
  - Theoretical capacity which is what an insurer claims to have available
  - Actual capacity what an insurer will offer for a very good risk

Relationship between capacity, rating and losses

- Capacity drives premium rating
- Losses drive capacity
- Losses drive premium rating
- Space insurance market does distinguish types of loss
  - Generic manufacturing issues
    - HS601 spacecraft SCPs and XIPS
    - BSS702 spacecraft
    - Loral LS1300 solar arrays
    - Spacebus BAPTA
- Space insurance market reacts after losses

Space insurance explained



Asset protection - characteristics

- Protection for risk of loss to the satellite
  - All risk of physical loss or damage
  - on an occurrence basis
  - Physical breakdown or failure
  - Impact from any type of foreign objects
  - A product warranty / life cover type insurance
- Indirect losses are not covered
  - Loss of revenue
  - Loss of use

Asset protection - characteristics/ continued

- Launch insurance
  - Asset all risks and costs around 8% depending on satellite launch vehicle combination
- In-Orbit insurance
  - Asset all risks on station and costs around 0.7% depending on satellite and satellite health
- Third Party Liability insurance
  - Protects from claims by TPs for damage to persons or property and costs about 0.15% for LEO and 0.1% GEO

Minimising exposures

- Involves two processes
  - Pre-contract
    - Set terms in the RFP
    - Negotiate terms
    - Broker can help with both of these
  - Post-contract
    - Be a model client
      - Responsive
      - Ready
    - Market the risk effectively
      - Good procedures
      - Good technical presentation
      - Good relationships with underwriters

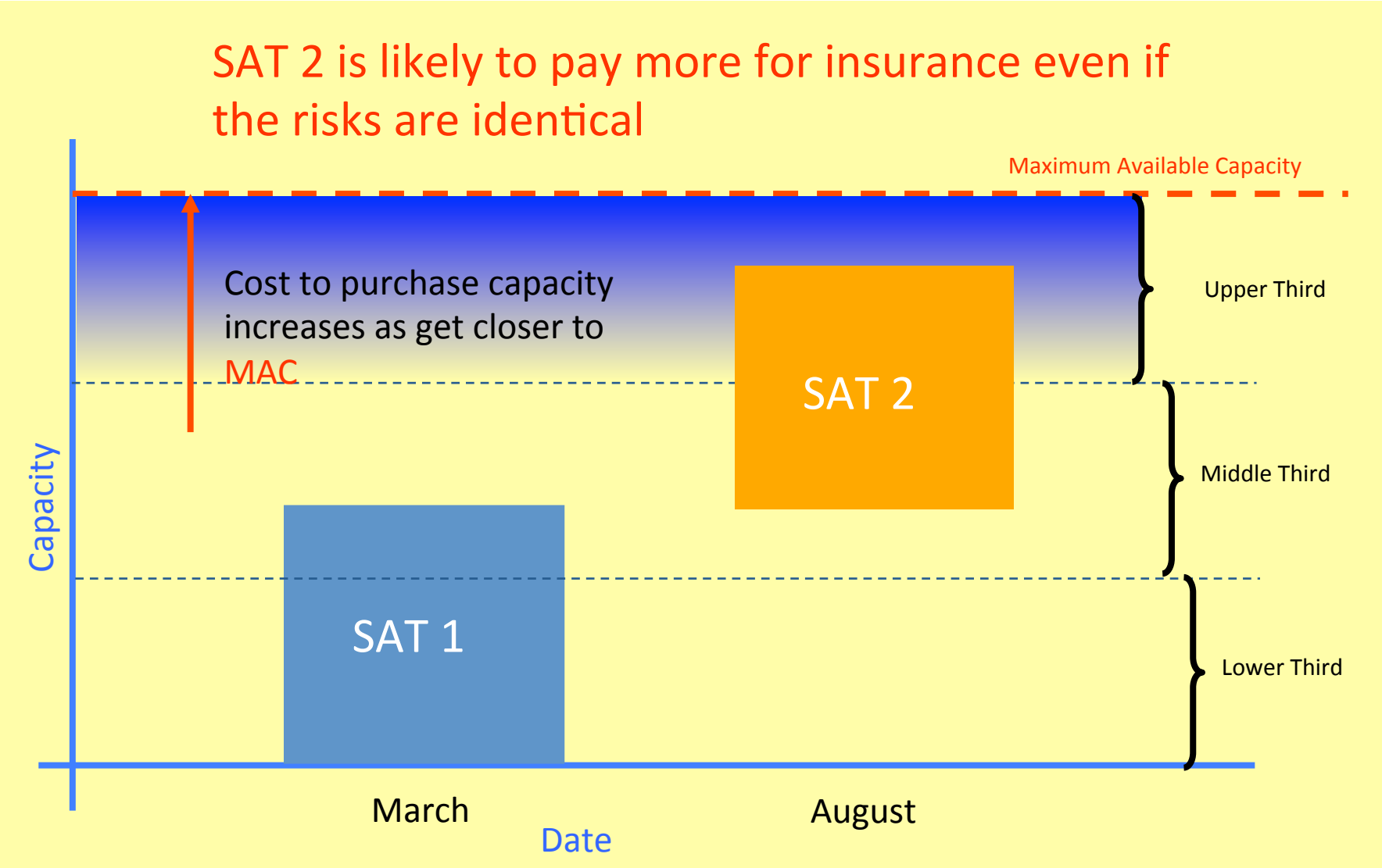
The technical presentation

- Importance of technical presentation cannot be over stated
- Introducing the risk to insurers
  - First impressions count
  - Underwriters looking for
    - Competency of operator
    - Good procedures
    - Good heritage and few single point failures on satellite
    - Reliable launcher
- Poor, sloppy or ill prepared presentation
  - Puts underwriters off
  - Means risk is not attractive – reduces competition
  - Likely to be charged a higher premium
  - Increase of USD1-2m would not be unreasonable

Marketing potential

- Good technical presentation to tell a good story
- Operators should ensure that their manufacturer is able to respond to technical questions in a timely fashion
- Agree marketing strategy with broker as early as possible
- Get everything in place approximately 12 months in advance
  - Last minute / late deals usually more expensive because underwriters know that the product is required
    - Especially if financing is involved
    - Especially if the satellite is a dual launch
- Dual launch
  - Two operators competing to have their risk placed in an insurance market where capacity is limited
  - Nightmare for the last to finish placing

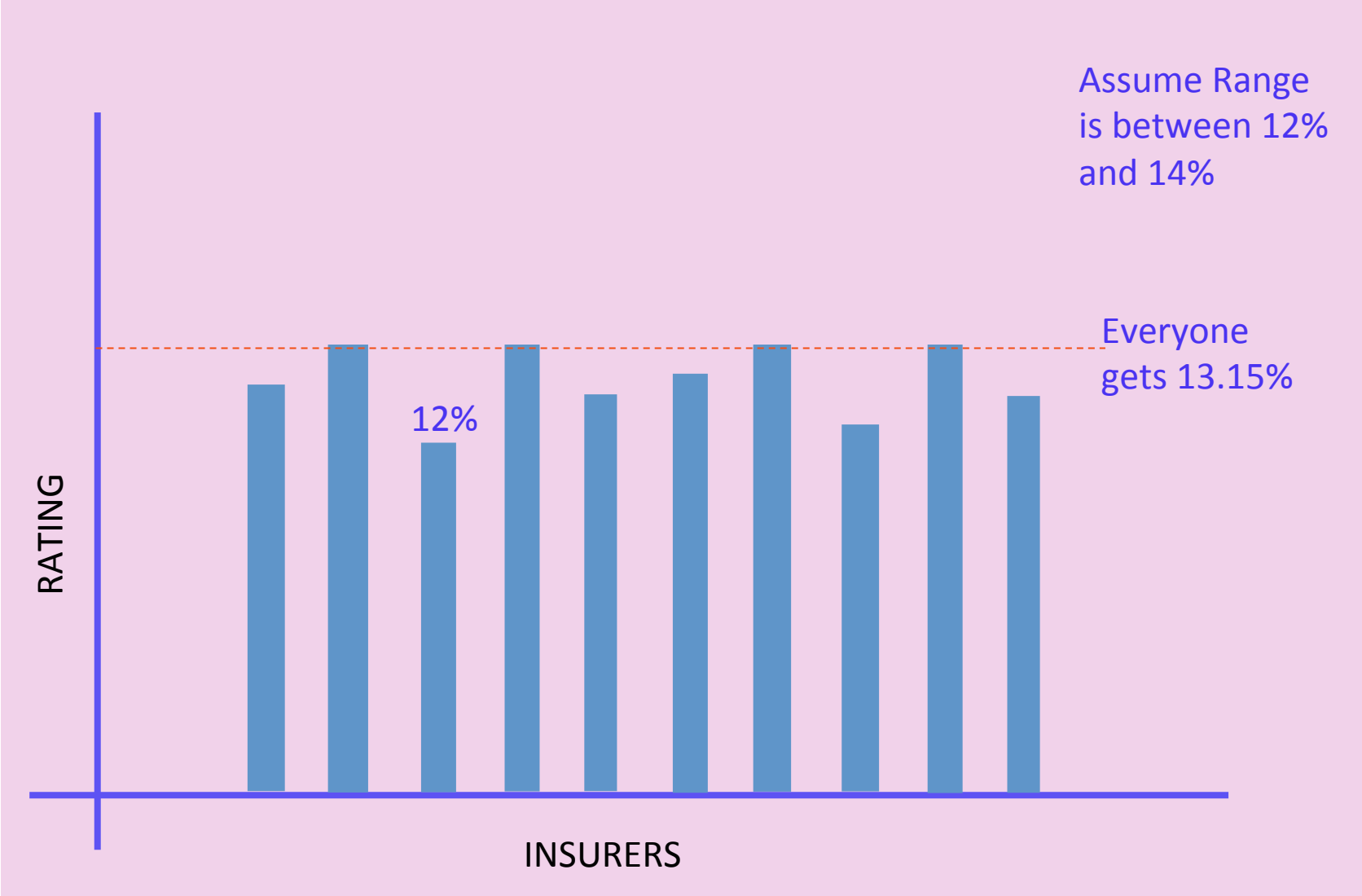
Dual Launch - Problem



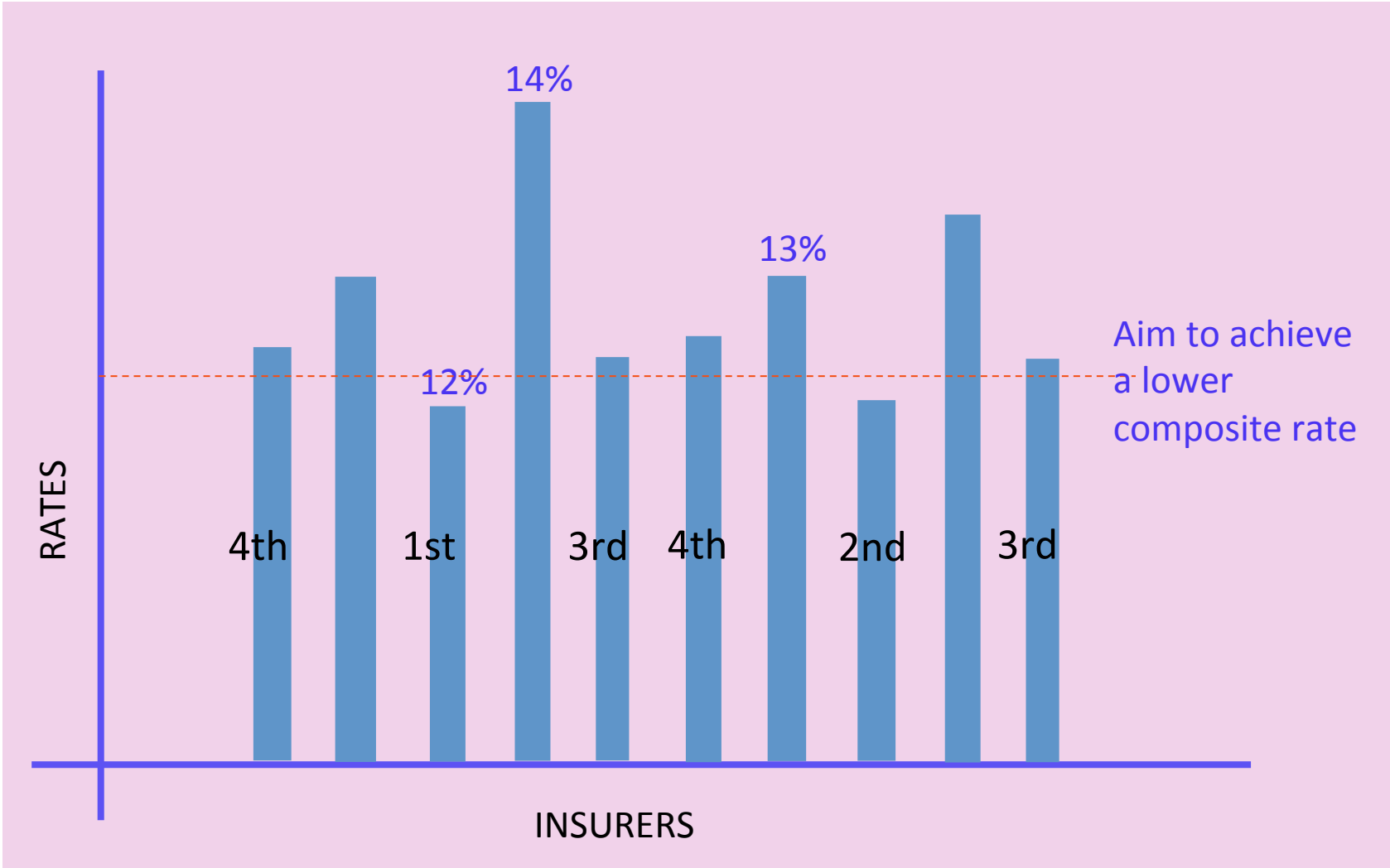
Market placing

- Echoes the problem with dual launch regarding timing
- When risk is placed requires careful reading of the market and activity surrounding the market
  - Proton placements are a good example
- Placing a risk at the start of the year can be good or bad
  - Good because underwriters may need income and few risks may have been placed
  - Bad because the market cycle may indicate that rates are still dropping
- If your placement is 'ready to go' the broker can move quickly and respond to matters that are likely to influence pricing

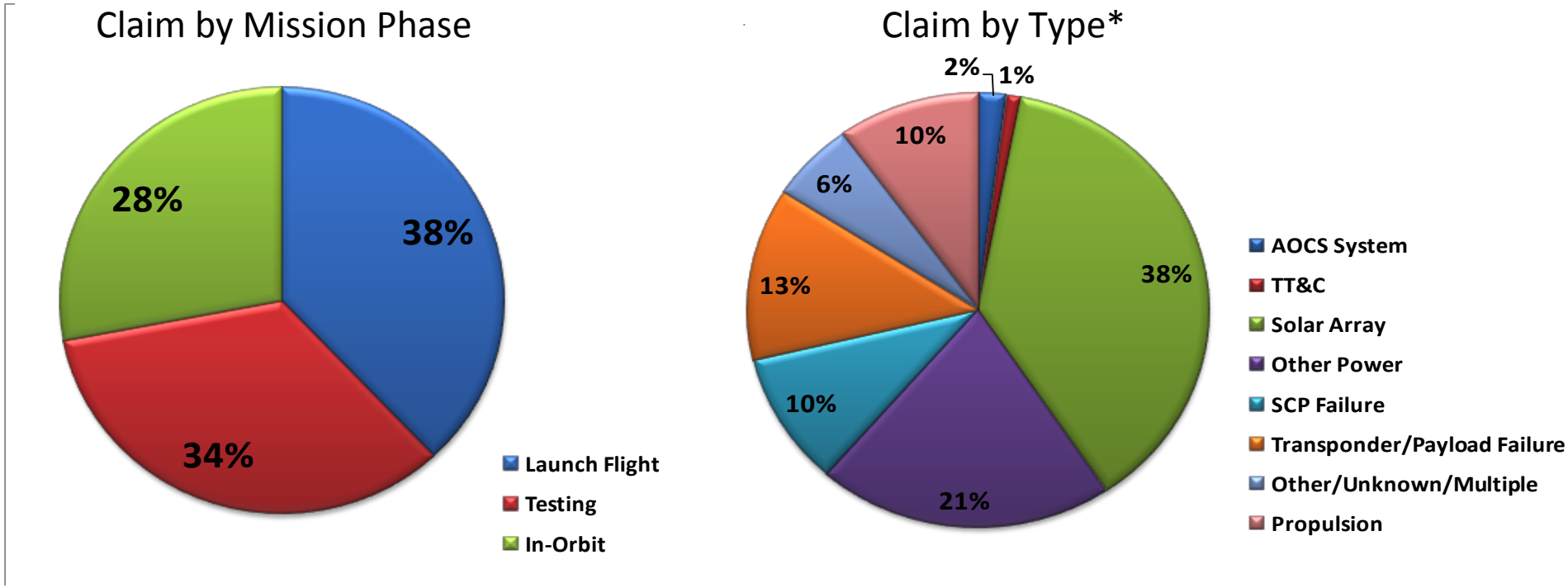
Marketing Strategy - Horizontal



Marketing the Risk - Vertical Marketing

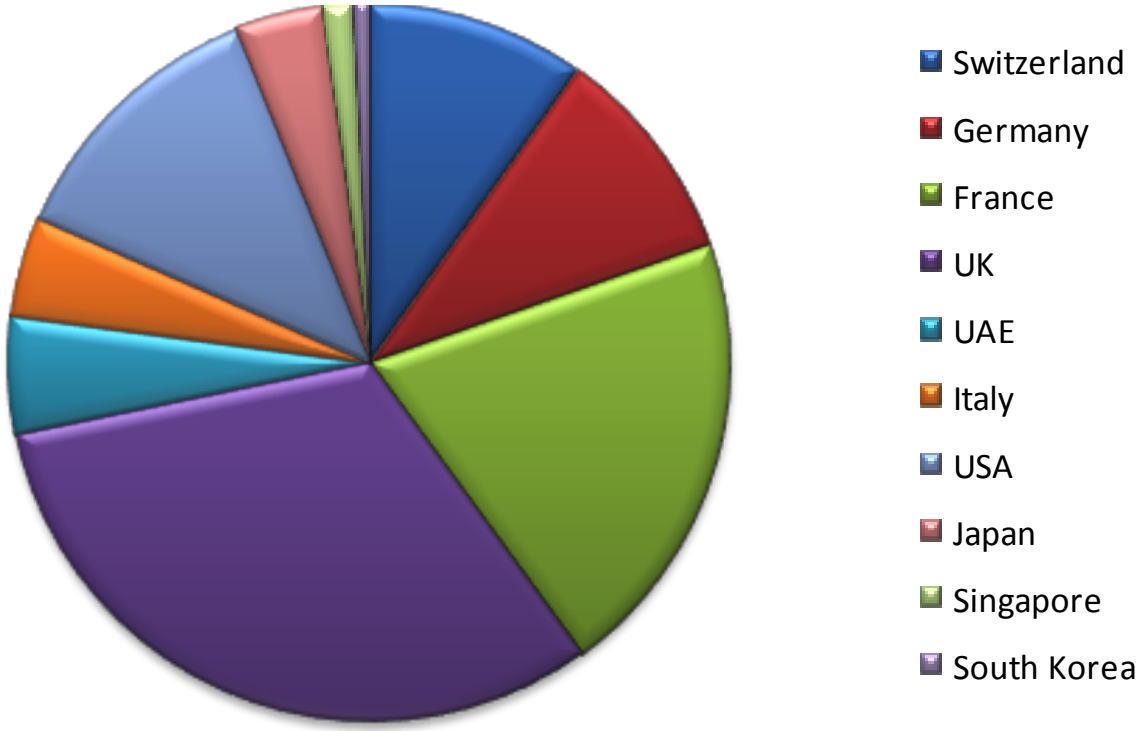


Claims 1996 - 2012



Disputes arise over engineering capability and measurement methodology

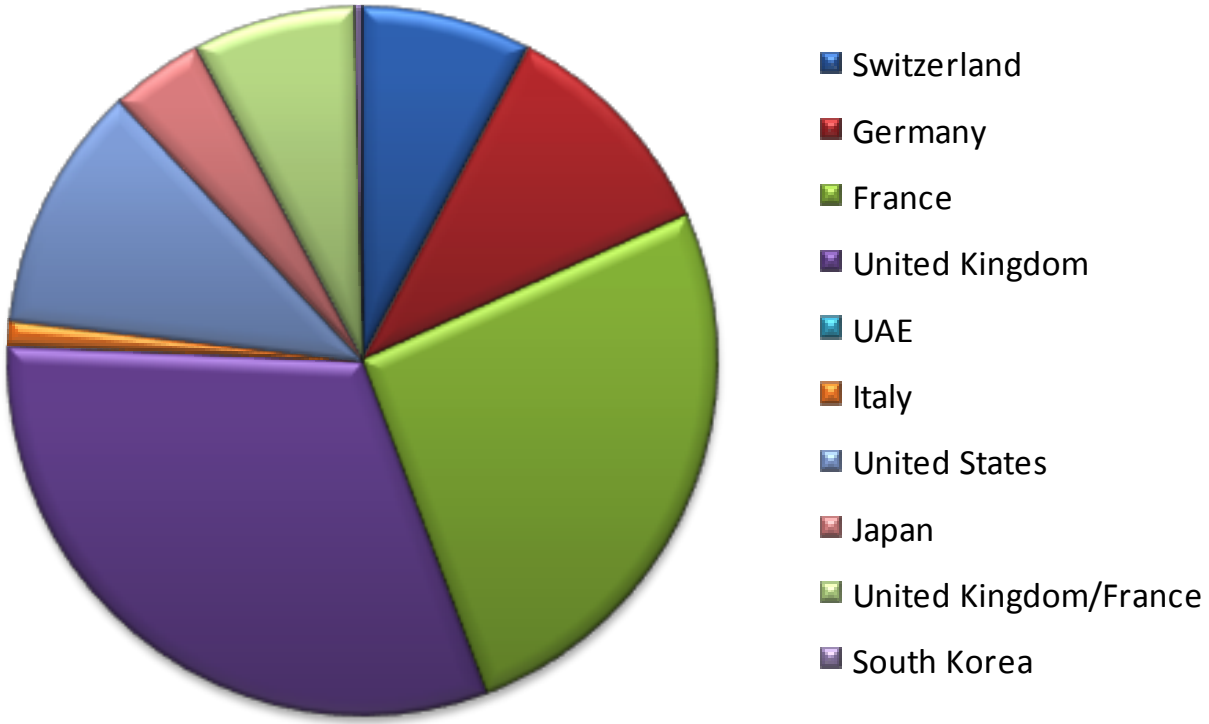
Market capacity - Launch



Theoretical – USD 763m Actual – USD 629m

One launch loss on Ariane 5 could tip the market

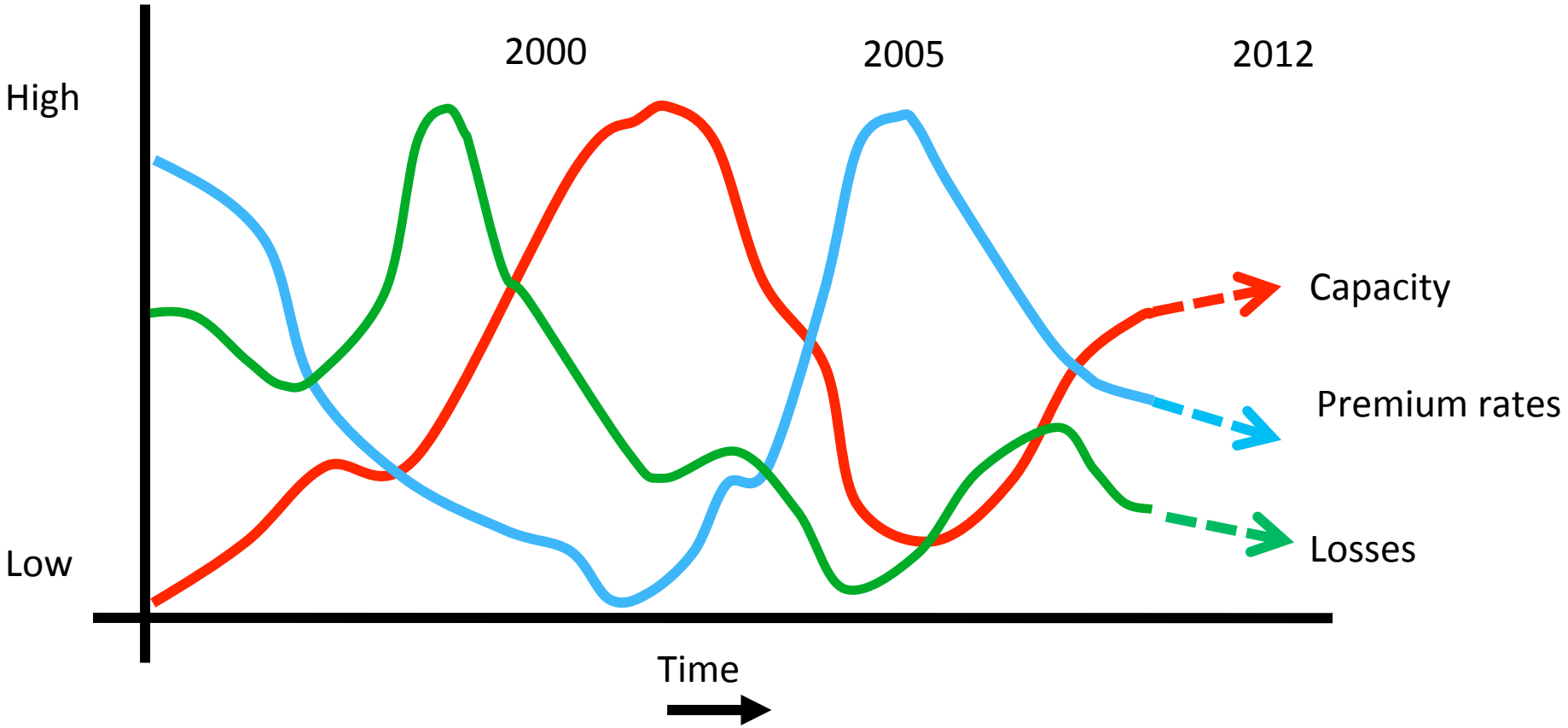
Market capacity – In-Orbit



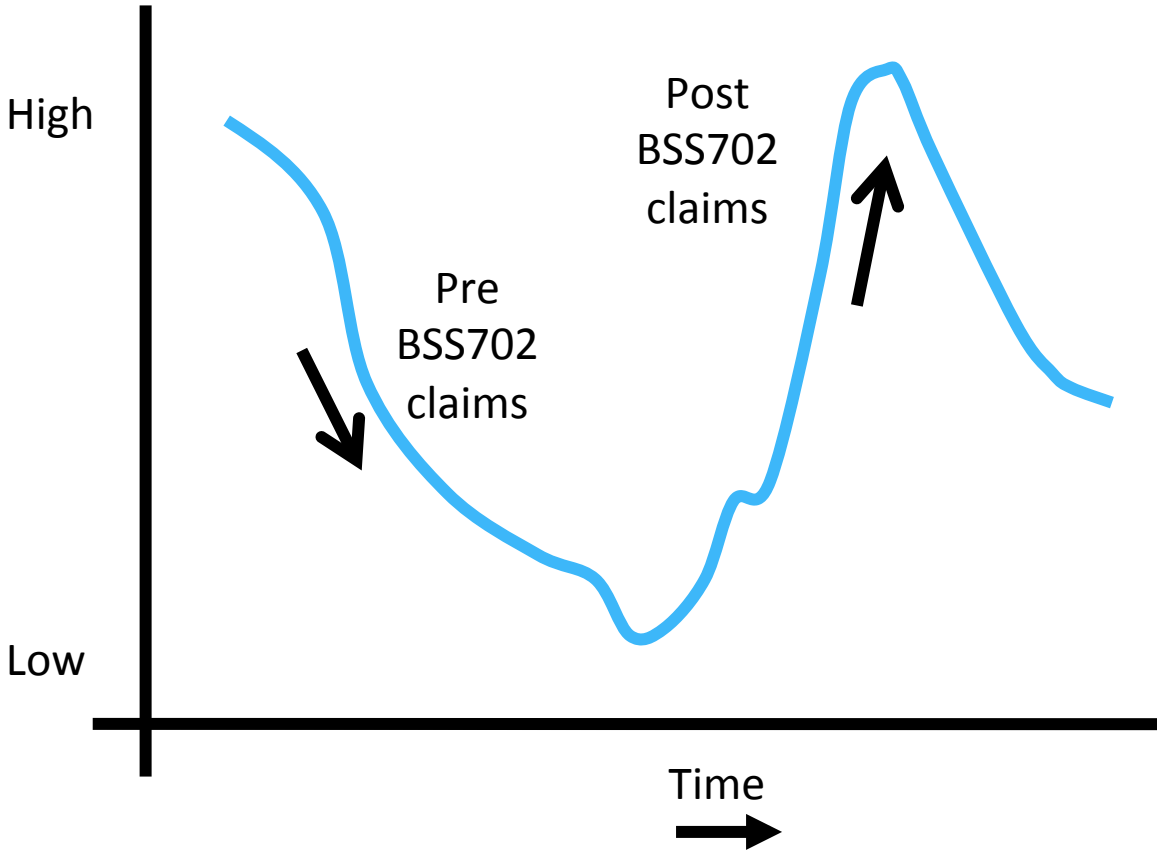
Theoretical – USD 711m Actual – USD 539m

2 Total Losses in GEO to tip the market / difficult to quantify

Drivers for changes in premium rating



Volatility in space insurance market



- Premium rates doubled over 24 month period
- Insurance premium is third largest cost in mission
- Doubling costs significant impact on budgets and financing

Launch Vehicles

Launch Vehicles

- Launch vehicle selection
  - Type of mission
  - Orbit
    - LEO
    - GEO
  - Satellite mass
- Main commercial launchers
  - Arianespace
  - International Launch Services
  - CGWIC

DELTA-II

- Built in USA
- Launched from Cape Canaveral and Vandenberg
- Height 40 m (126 ft)
- Weight 200 t (450,000lbs)
- Payload to GTO ~2100kg

The Boeing Company

ARIANE 5

ESA

- Built in Europe
- Launched from French Guyana
- Height 60 m
- Weight 780 t
- Payload to GTO ~10t kg (single payload)

LONG MARCH 3B

China Daily

- Built in China
- Launched from Xi Chang
- Height 55 m (180 ft)
- Weight 426 t (940,000lbs)
- Payload to GTO 5100kg

PROTON-M

- Built in Russia
- Launched from Baikonur
- Height 53 m
- Weight 700 t
- Payload to GTO 5500 kg

ILS Thor-5

SEA LAUNCH (Zenit 3SL)

Sea Launch Company

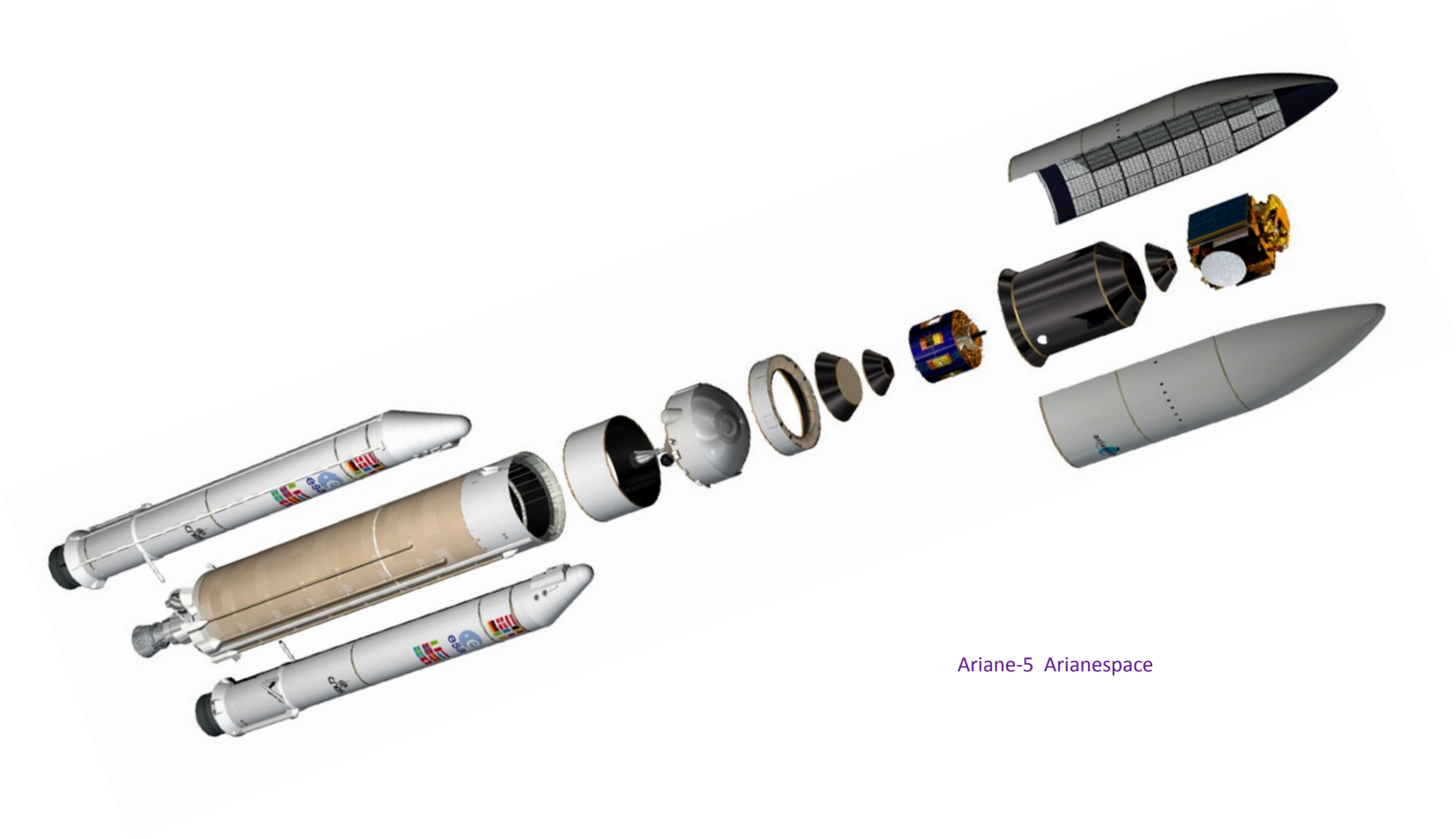
- Multinational
- Launched from equatorial platform
- Height 43 m
- Weight 456 t
- Payload to GTO 6100 kg

DNEPR

Kosmotras

- Built in Ukraine
- Launched from Baikonur, Yasniy
- Height 34 m
- Weight 263 t
- Payload to LEO 3700 kg

Parts of a Launch Vehicle



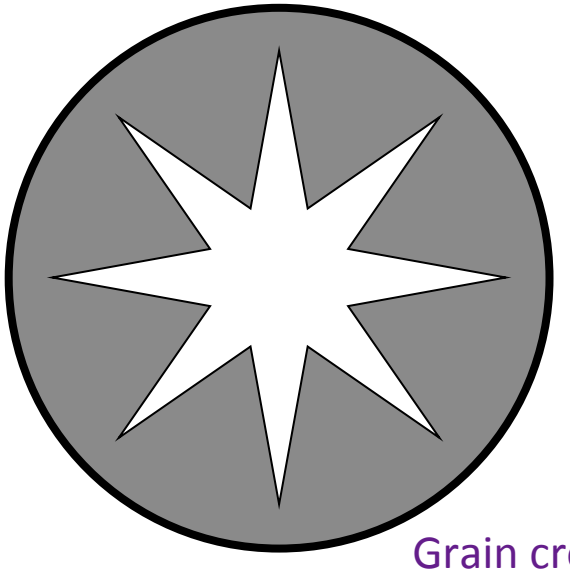
Ariane-5 Arianespace

Parts of a Launch Vehicle

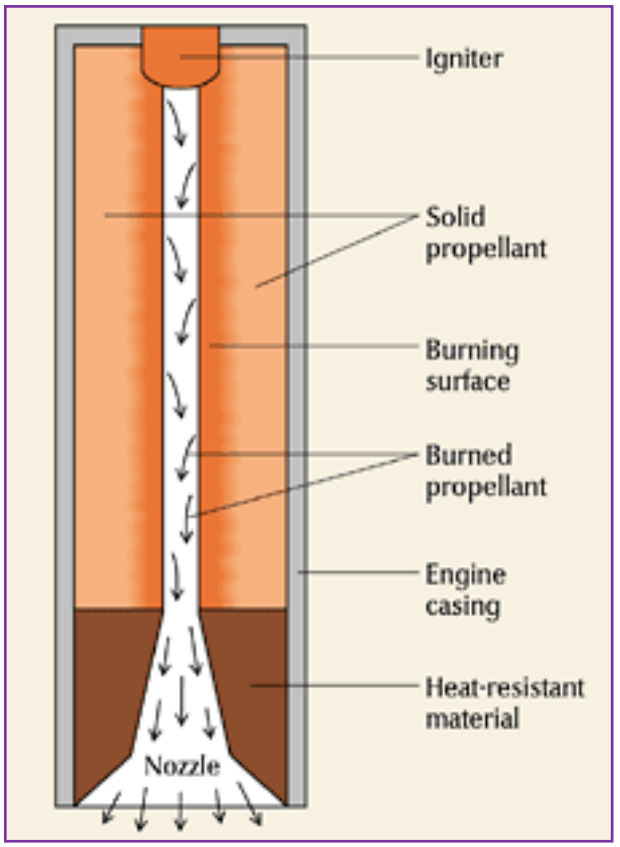
- Each stage typically includes the following key components:
  - Engine/propulsion
  - Guidance and Flight Control system (sometimes the 3rd stage system controls all three stages)
  - Tanks/structure

Solid Propellant Rocket Engines

- Also called a solid rocket motor, SRM, or booster, SRB



Grain cross-section



The Importance of Location

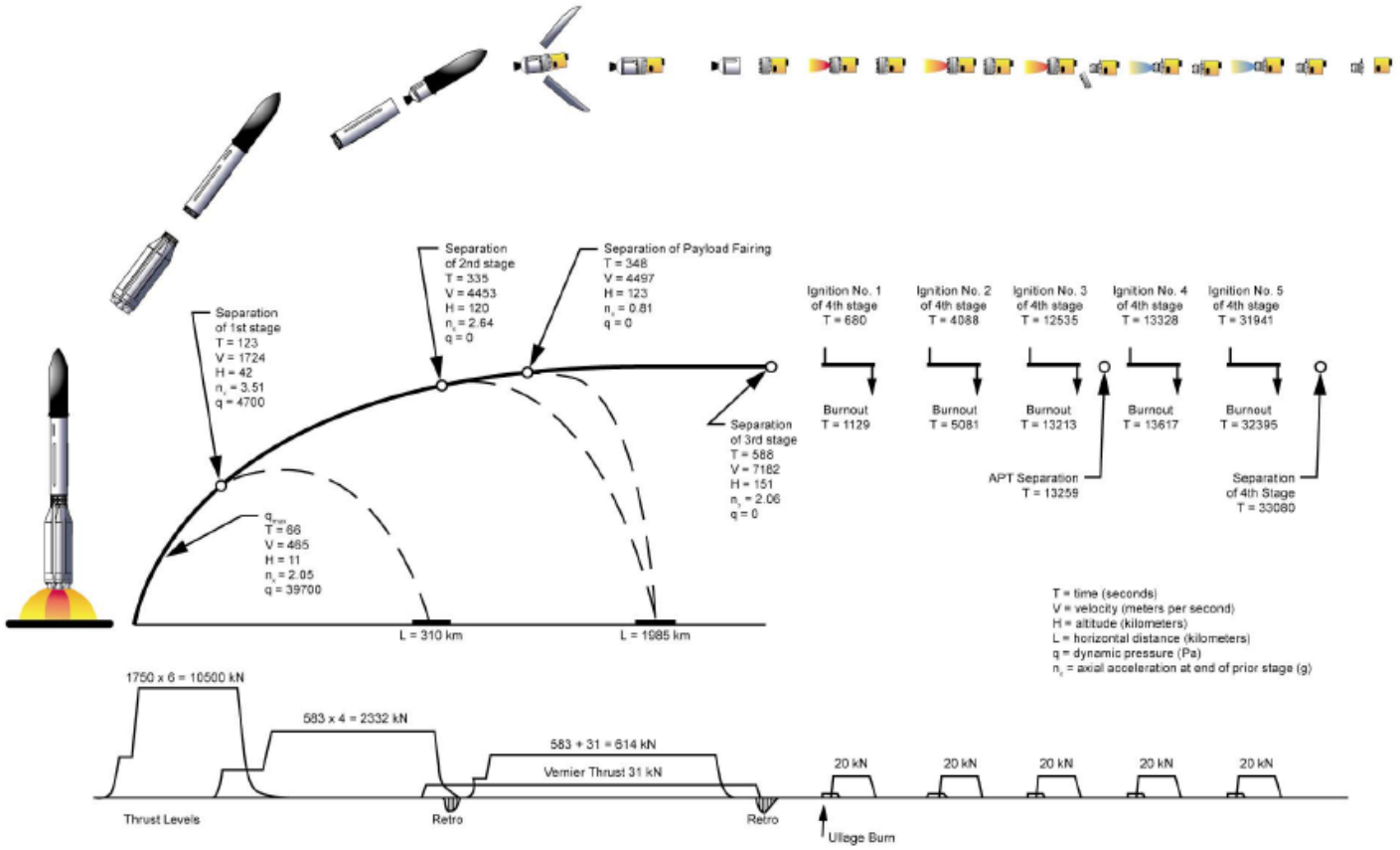
- Geosynchronous missions are better launched from the Equator
- Earth's rotation gives a head start on the orbital velocity and no need to remove inclination
- GTO inserted mass drops off as move further away from the equator
- Sea Launch does it on the equator
- Ariane is almost as good at 6 degrees
- Baikonur loses 25% of capability

Launch Site	*Latitude, degrees*	*GTO Weight*
Equator	0	1000kg
Cape Canaveral	28	883kg
Baikonur	45	731kg

Launch Sequence

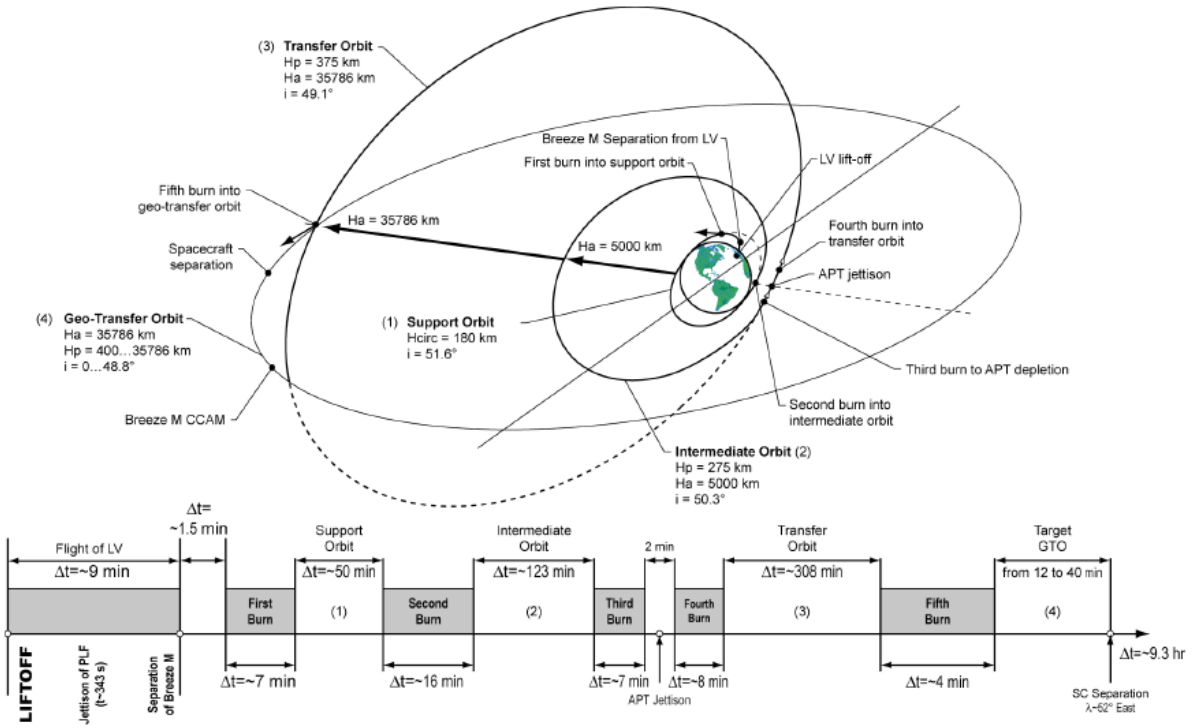
Proton Launch System Mission Planner's Guide, LKEB-9812-1990
Revision 6, December 2004

Figure 2.3.1-1: Typical Proton LV Ascent Plus Breeze M Main Engine Burns



Launch Sequence

Figure 2.3.2-1: Breeze M Typical Injection Into GTO



Launch Insurance

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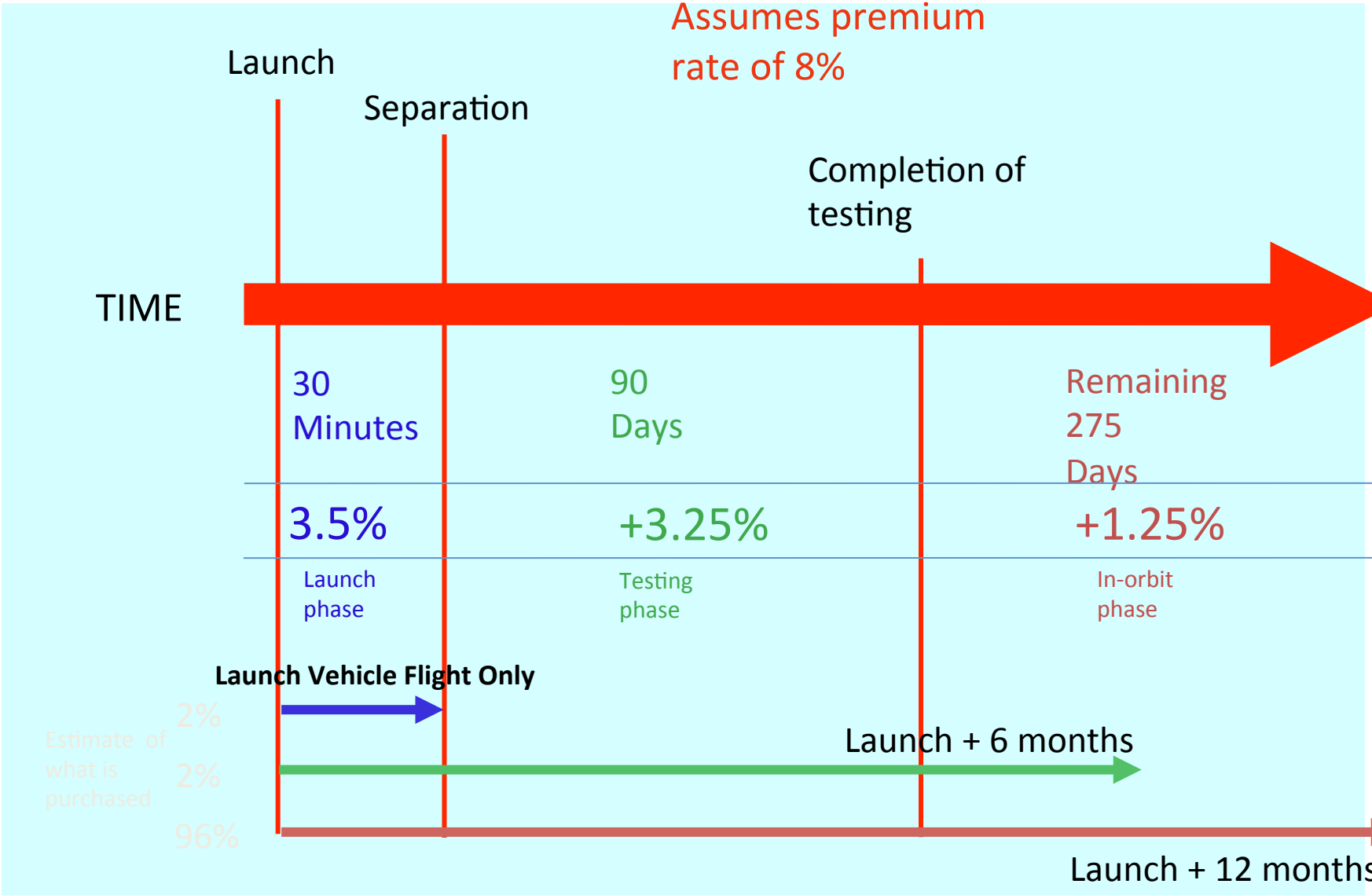
Launch Insurance



Primary Drafting Considerations

- What type of cover is required
  - Launch Vehicle Flight Only (LVFO)
  - Launch and In-Orbit
- Launch Vehicle Flight Only
  - Key consideration will be definition of “Separation”
  - If not a defined term in the contract ask the launch agency
- Key considerations for Launch and In-Orbit insurance
  - Amount of Insurance (Launch Risk Guarantee)
  - Definitions of key terms
  - When does risk of loss transfer?
    - Launch is best
    - Any exposure to terminated ignition costs?

Drafting Considerations

- Always refer to the contracts
  - Satellite Contract takes precedence over Launch Services Agreement
  - Satellite Contract contains the basis for risk transfer from manufacturer to operator
  - Use the same defined terms
    - What is good for the operator in the satellite contract, should be good for the insurance policy too
    - Insurance is there to cover the commercial risks - so match them by using the same terms
    - Also helps in the event of a claim because everyone is working to the same basis
- Launch Service Agreement is useful for filling gaps for launch related activities

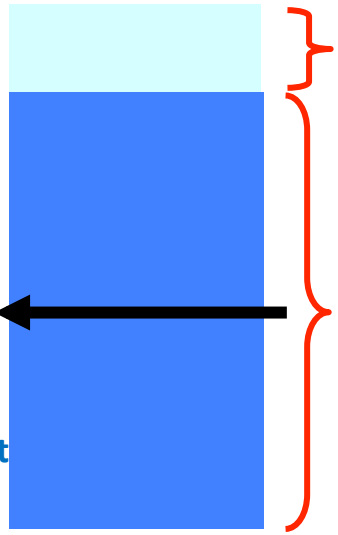
Primary Drafting Considerations

- When does risk of loss need to attach?
  - Examine the contracts
    - LSA
    - Procurement Contract
- Determine where the risks are
  - LSA - is there an LRG?
  - Procurement Contract - look for express provision e.g. “Transfer of Title and Risk of Loss”
- Consider the implications
  - LRG means lower sum insured during launch (see following chart)
  - Procurement Contract - Transfer of title need not coincide with assumption of risk

Launch Risk Guarantee Explained

Launch risk guarantee depends on a long term insurance facility to provide insurance for the → pays premium for insuring the → If there is a loss the insurance of the

Customer needs to protect interest in launch service cost



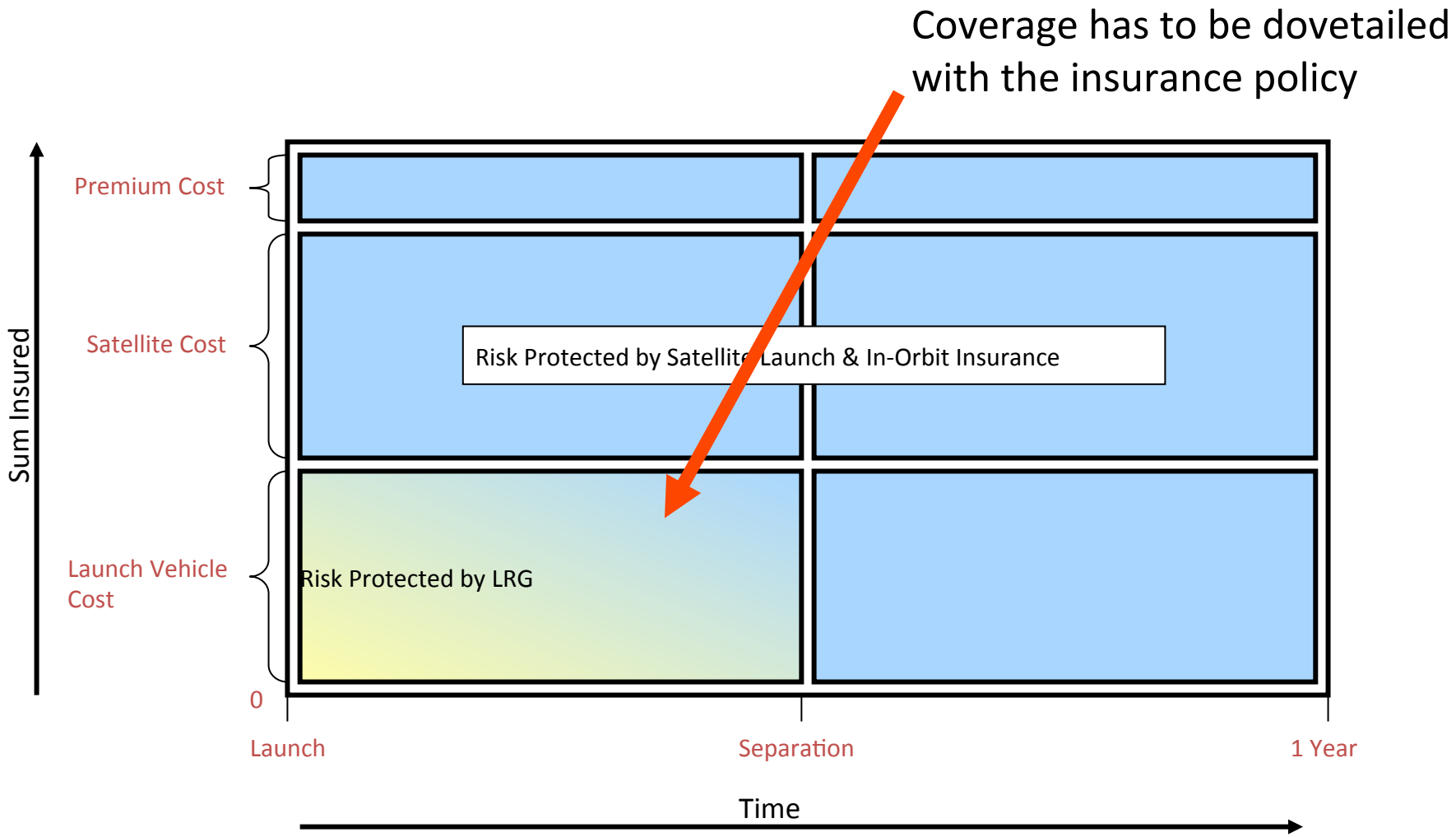
Launch Risk Guarantee offered under launch service agreement to insure launch services costs known as Launch Risk Guarantee Amount

Reimburses the Customer

Or it is used as a credit against a reflight

Customer's interest is protected through the Launch Risk Guarantee

Combining LRG's with Launch & In-Orbit Insurance



In-Orbit Insurance

In-Orbit Cover

- Wording negotiations tend to be concise compared to protracted launch insurance negotiations
- Insurers of the launch programme tend to be approached first
- Rates are presently in the region of 0.65 - 1.5% for 12 months cover depending on satellite type
- Theoretical burn rate is believed to be closer to 3% but changing substantially to about 0.25%
- Insurance capacity is high which is causing rates to fall because the market is so competitive
- Recent losses have halted falling rates

In-Orbit Cover – Drafting Considerations

- Follow the same wording as used for the launch insurance but remove the "launch" references removed
- Basis of cover is the same

$$1 - \left(\frac{\text{Available Communications Capacity}}{\text{Stated Communications Capacity}} \right) \times \text{Amount of Insurance}$$

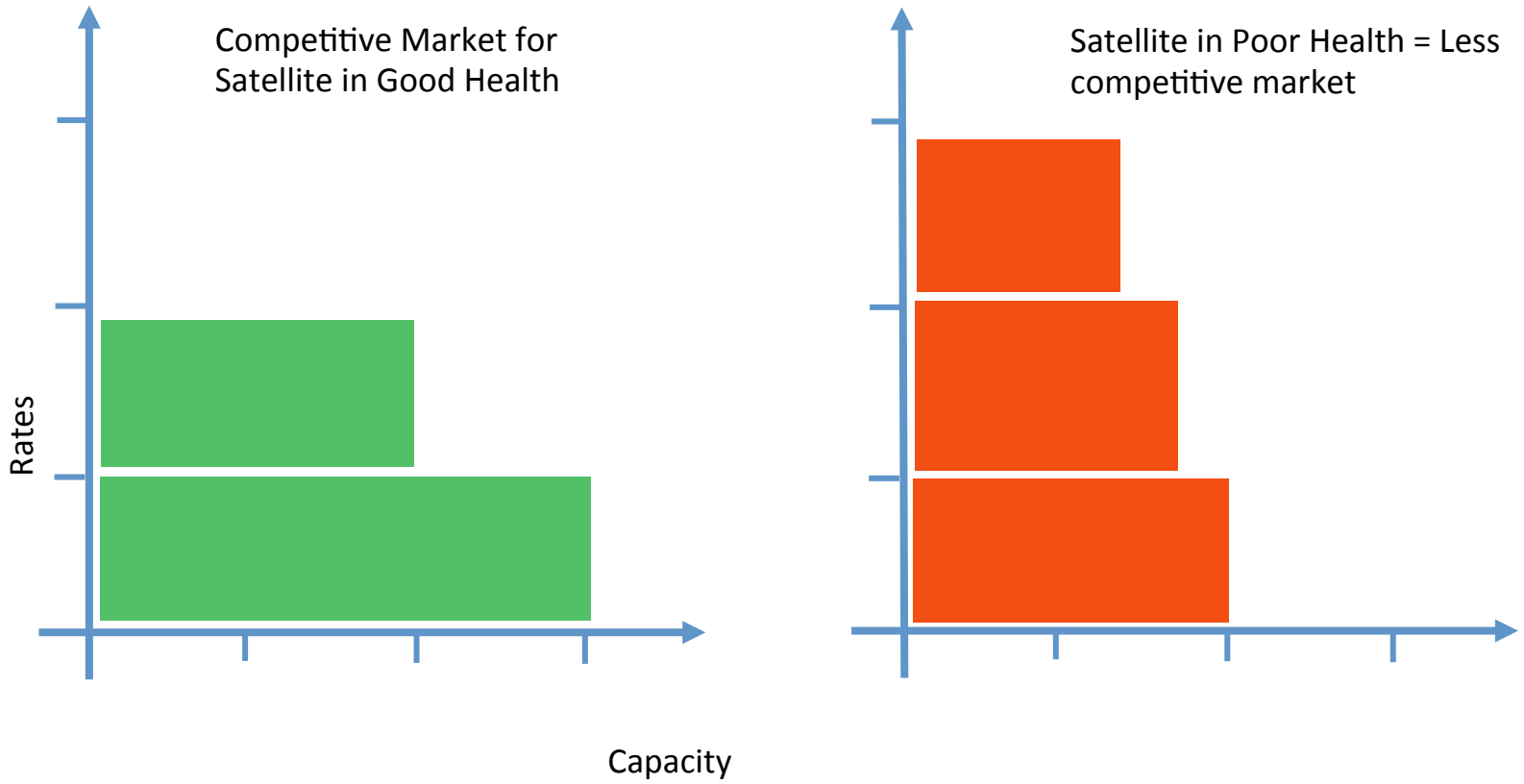
- Calculation based on available transponder years
- Transponder years based on original life and remaining satellite life

In-Orbit Cover

- Negotiations to place in-orbit insurance start about 3 months before the date of renewal of the policy
- Operator provides a health report for the satellite to identify
  - Any changes in health
  - Any anomalies that have occurred in the preceding 12 months
- Deviations in health generally result in either
  - Increase in premium rating from the normal range
  - Application of an exclusion for certain types of loss
- Poor health generally results in
  - lower appetite for the risk
  - Less competition to be on the placement
  - Higher rates

In-Orbit Capacity

- Supply and demand principles apply



Third Party Liability Insurance

Third Party Liability

- Insurance for TPL is placed in the aviation liability markets
- Aviation markets operate on a standard text, which means wordings are fairly rigid in terms of content and structure
- Who needs to be covered?
  - Launch agency
  - Operator
  - Other contractors and sub-contractors (including satellite manufacturer)
  - “Any government that would be considered a Launching State, as that term is defined under the Liability Convention 1972”

Licensing and TPL insurance

- Launching state licenses activity
- Launching state sets insurance limit
  - France EUR60m
  - USA excess basis
  - UK EUR60m
  - Netherlands USD200m

Licensing and TPL insurance

- Launch agencies provide cover
  - Arianespace EUR60m
  - ILS USD100m
  - Sea Launch USD100m
  - CGWIC USD100m
- FAA requirements have reduced over the years (MPL recalculation?)
- About to change?

Space surveillance

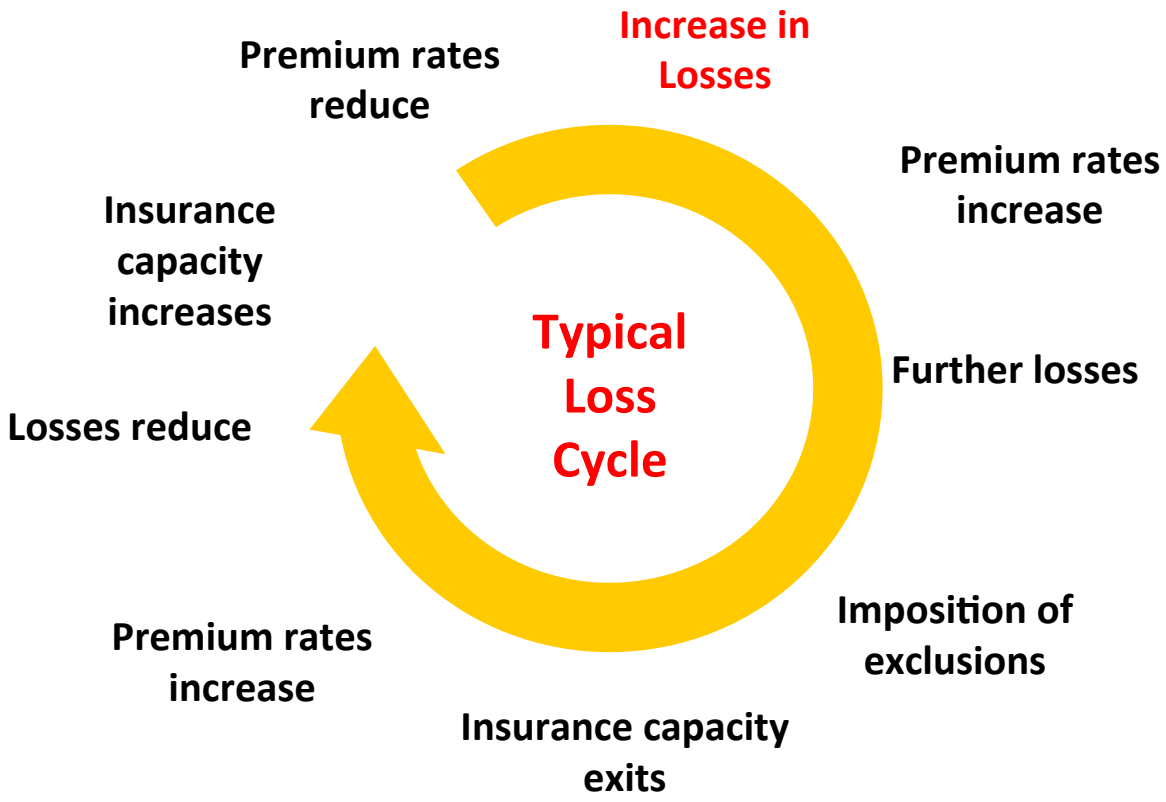
- Insurers are concerned about
  - Collisions
    - Iridium 33 and Cosmos 2251
    - Factor for TPL insurers not so much for property insurers
  - Solar activity
    - Link between solar activity and satellite incidents
    - Galaxy 15 and Telstar 401
    - Reporting is an issue of commercial confidence
  - Space debris
    - Known increase to risk of loss
    - Collisions and solar activity less so

Space insurance and space debris

- Are insurers worried about it?
  - Yes
- Does the orbital location matter?
  - LEO is more congested than GEO and orbital trajectories are different
- Is it a factor in rating?
  - Not for asset insurance
  - Slight differentiation on liability insurance
- When will it become an issue?
  - When there is an accumulation of significant losses
- Why isn't the market being more pro-active?

When debris becomes a problem

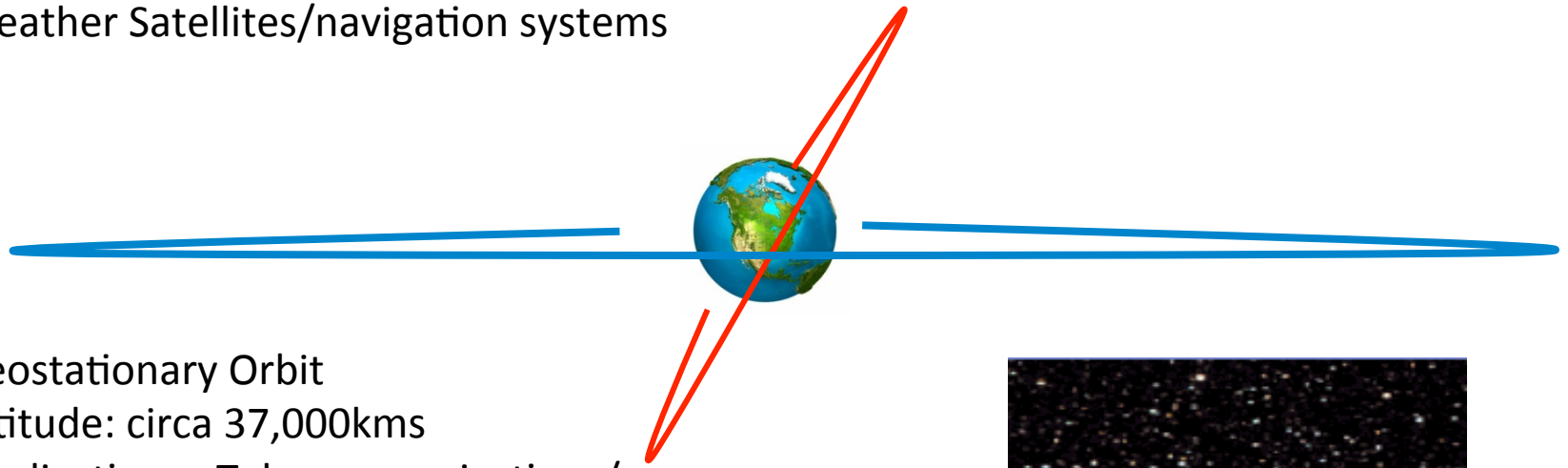
- Space insurance market will react when losses accumulate



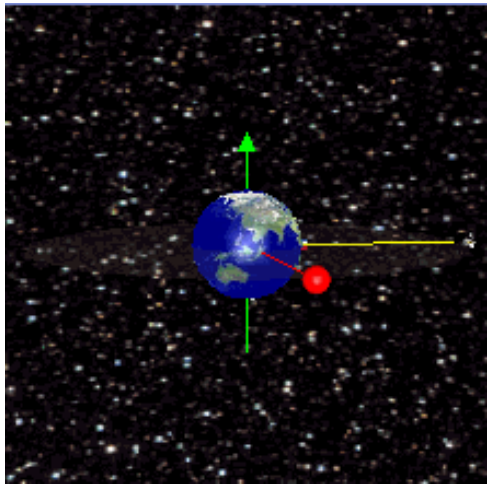
Future Demand and Trade Control

Markets

Low Earth Orbit
Altitude: circa 700kms
Applications: Earth Observation/Radar/Mobile telephony and internet/
Weather Satellites/navigation systems



Geostationary Orbit
Altitude: circa 37,000kms
Applications: Telecommunications/
Television/Internet



Future Demand

- Space is a growth area
- A sector worth £40Bn by 2030
- UK has 5% global share / wants 10% global share by 2030
- UK Government recognised this
  - The industry-led Space IGS was a joint government, industry and academia initiative that defines a 20-year vision and strategy for the future growth of the space industry
  - 16 specific recommendations in the strategy
  - Implementation by joint industry and Agency teams
  - Progress on this activity is reported quarterly to the Space Leadership Council

Projected Launches and Payloads

Table 1. Commercial Space Transportation Payload and Launch Forecasts

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Total	Average
Payloads												
GSO Forecast (COMSTAC)	23	21	20	23	21	20	20	20	22	22	212	21.2
NGSO Forecast (FAA)	37	44	28	35	42	49	16	15	16	15	297	29.7
Total Satellites	60	65	48	58	63	69	36	35	38	37	509	50.9
Launches												
GSO Medium-to-Heavy	19	16	15	18	16	15	15	15	17	17	163	16.3
NGSO Medium-to-Heavy	10	12	13	15	12	16	11	10	11	10	120	12.0
NGSO Small	1	1	0	0	1	1	1	1	1	1	8	0.8
Total Launches	30	29	28	33	29	32	27	26	29	28	291	29.1

IGS Recommendations

Recommendation 1 *- Implement a National Space Policy*

Recommendation 2 - UK Executive Space Agency (UKESA), resourced and empowered to maximise growth opportunities for the UK Space sector.

Recommendation 3 - Establish a National Space Technology Strategy with a separate budget

Recommendation 4 - Access to finance

Recommendation 5 - Procure an innovative indigenous Earth Observation (EO) data service

Recommendation 6 - Map out a strategy for the UK to secure world leadership in the technologies and services related to climate-change validation, adaption and mitigation

Recommendation 7 - Develop Space-enabled services to become the complementary Information and Communication Technologies (ICT) infrastructure to both the fixed fibre optic and wireless networks

Recommendation 8 - The UK should use the low-carbon characteristics of delivering broadcast and broadband services from Space to help meet our national emissions reduction targets.

IGS Recommendations

Recommendation 9 - Set up a senior-level panel to ensure that Government can take a strategic view of emerging Space capabilities

Recommendation 10 - Lead in promoting the use of mobile satellite-based services (MSS) as a core element of the UK's and Europe's future emergency, safety and security communications infrastructure

Recommendation 11 - Regulatory reform relating to radio frequency spectrum allocation, the operation of the Outer Space Act, allocating orbital slots for new satellites and treaty negotiation with other Space nations.

Recommendation 12 - Show exemplary and proactive support in championing initiatives aimed at addressing STEM (Science, Technology, Engineering and Mathematics) issues in our schools, colleges, universities and businesses

Recommendation 13 - The UK should initiate and lead at least three Space exploration or science missions by 2030.

Recommendation 14 - Establish a hub and spoke network to link UK centres of excellence in all Space disciplines

Recommendation 15 - The UK should invest earlier, more consistently, and at higher scale in ESA Space programmes

Recommendation 16 – Establish a Space Leadership Council chaired by the Secretary of State for Business, Innovation and Skills

Trade Controls

- International Traffic in Arms Regulations
  - Regulate technology transfer of certain items
  - Satellites and launch vehicle export control regulated by US DoD following loss of Intelsat 708 (15 Feb 1996)
  - Cox Commission Report 1999
  - Investigation found that China had benefitted from US technology advice given at Failure Review Board

Trade Controls

- ITAR has been in force since late 1999
- 3 January 2013 President Obama signed into law the National Defense Authorisation Act
- It gives the President the authority to remove satellites from the United States Munitions List (USML) which means they are no longer subject to International Traffic in Arms Regulations
- Change in law gives the President the authority to place satellites under the authority of the Commerce Control List (CCL) thereby allowing satellites to be exported to certain nations without a special licence –China, Pakistan and Iran amongst others continue to be prohibited from receiving satellites and related technology