

THE SKY IS THE LIMIT

Commercial Spaceflight and the Law

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EUROPE

0 km 210 420 630 km

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- National Capital
- other main city

- KOSOVO, under transitional administration
- FYROM, the Former Yugoslav Republic of Macedonia
- The Israel Parliament (KNESSET) decided JERUSALEM to be the capital. As negotiations regarding the status of this city haven't come to something yet, most of the embassies are based at TEL-AVIV-JAFFA



2



World Map
Miller Projection
1000 2000 3000 miles
Scale at Equator
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LAND ELEVATION		SEA DEPTH	
16,200 ft	10,000 ft	1000 ft	1000 ft
13,200 ft	8,000 ft	3,300 ft	3,300 ft
9,500 ft	6,000 ft	6,600 ft	6,600 ft
6,600 ft	4,000 ft	10,000 ft	10,000 ft
3,300 ft	2,000 ft	13,300 ft	13,300 ft
0 ft	0 ft	16,600 ft	16,600 ft
0 ft	0 ft	19,900 ft	19,900 ft
0 ft	0 ft	Depression	Depression

XCOR Lynx

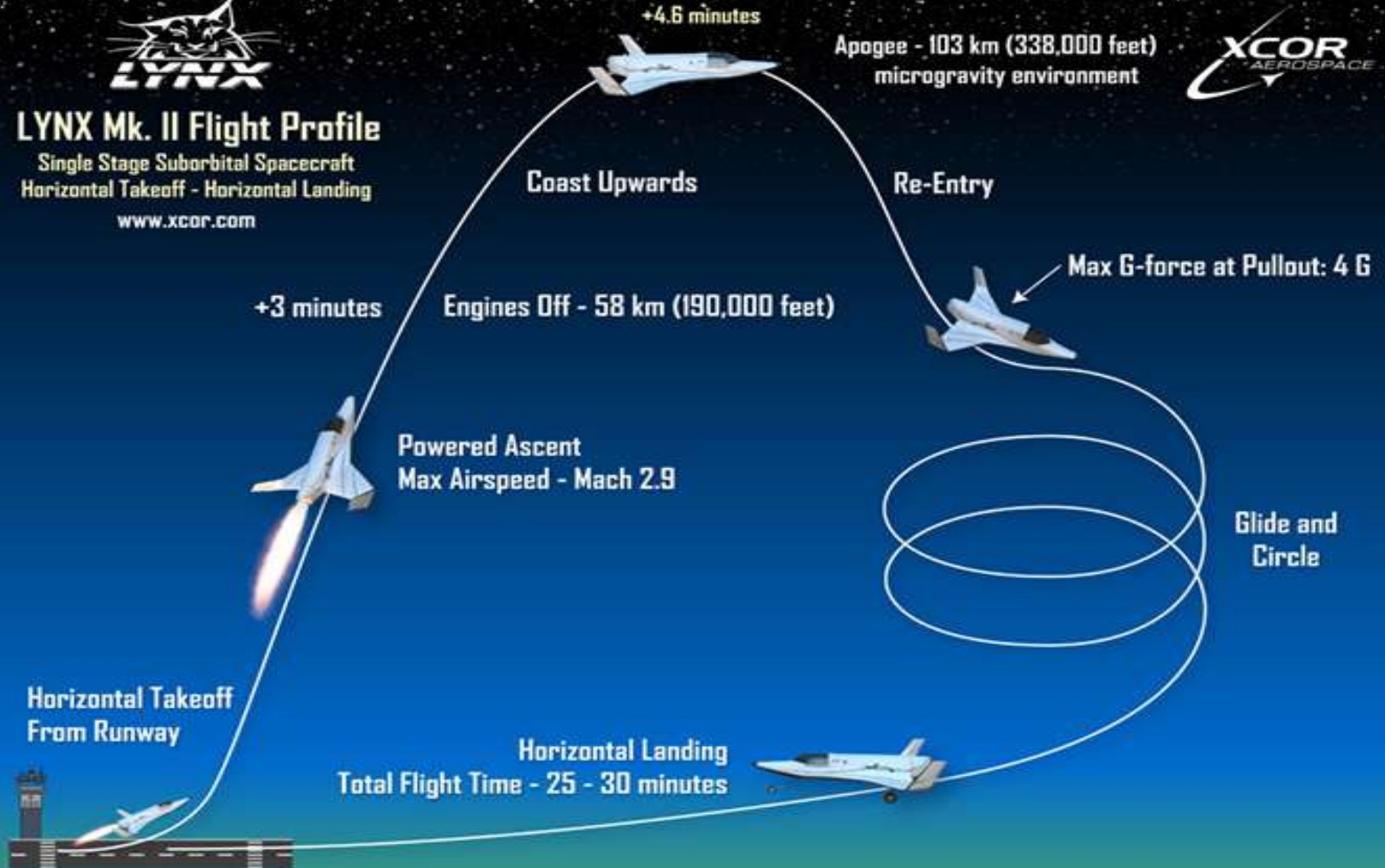


LYNX FLIGHT PROFILE



LYNX Mk. II Flight Profile

Single Stage Suborbital Spacecraft
Horizontal Takeoff - Horizontal Landing
www.xcor.com



Boeing CST-100 – docking with ISS



TICKETS TO RIDE

◆ Rome–Amsterdam: some 1,300 km

Return ticket price: upwards from some 300 €

◆ Rome–New York: some 6,900 km

Return ticket price: upwards from some 700 €

◆ Rome–outer space: 100 km (...)

*Return ticket price: 250,000 US\$ (Virgin Galactic) /
€ 95,000 (XCOR SXC)*

◆ Rome–ISS: \pm 400 km (...)

Return ticket, incl. week's stay: > 20,000,000 US\$

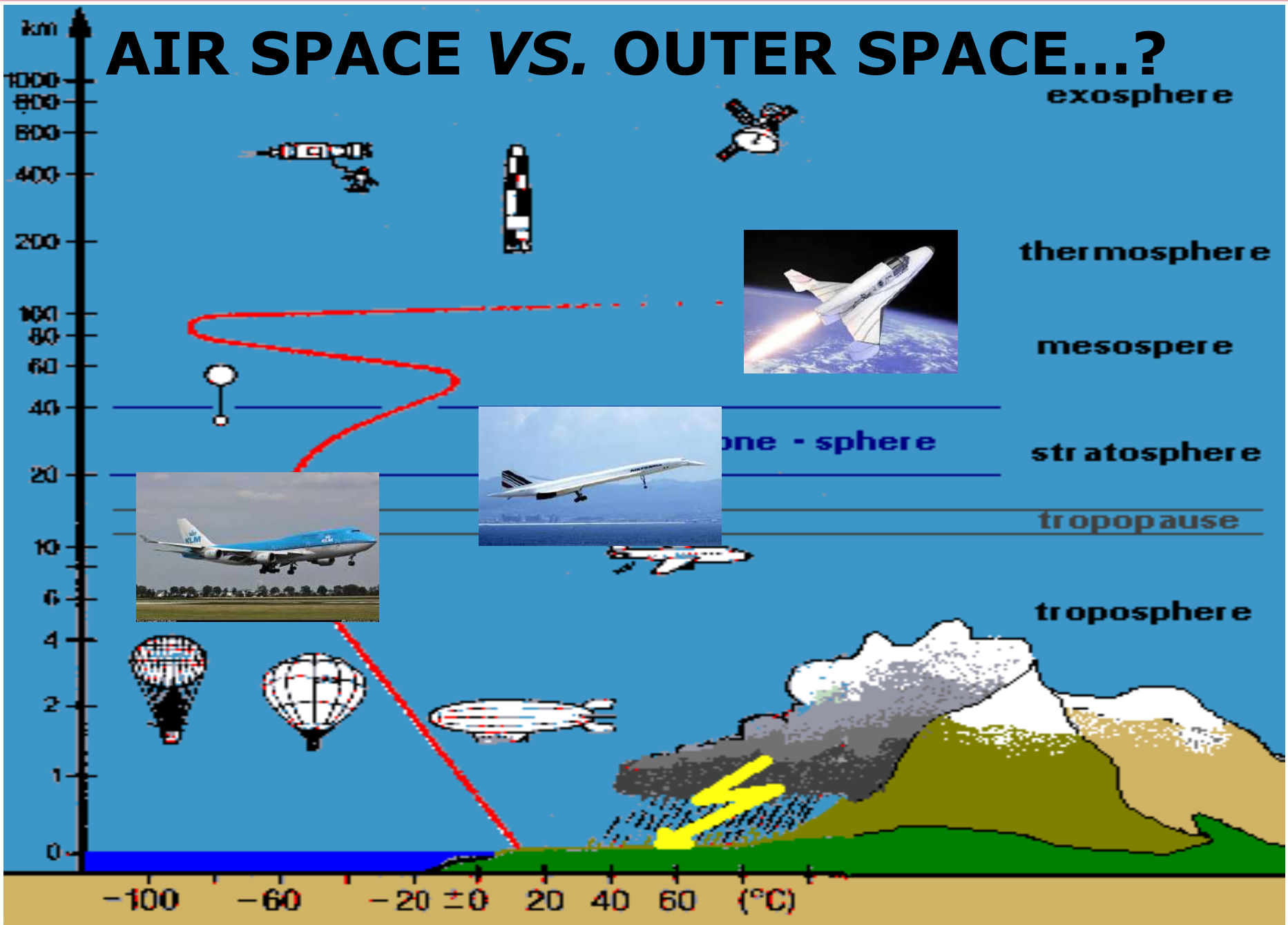


- ◆ Who should license?
- ◆ Which requirements for a license?
- ◆ Which requirements for crew, 'spaceflight participants', vehicle?

- ◆ Who is responsible?
- ◆ Who is liable?
- ◆ What liability regime applies?



AIR SPACE VS. OUTER SPACE...?



AIR LAW CONVENTIONS

- ◆ 1944 Chicago Convention
 - Regulating international safety of aviation
- ◆ Regime of thousands of bilateral treaties
 - Regulating mutual access to aviation markets
- ◆ From 1929 Warsaw to 1999 Montreal
 - Harmonizing domestic contractual liability regimes
- ◆ 1952 Rome, 1978 Montreal ... & national law
 - On third-party liability
- ◆ 1963 Tokyo *et al.*
 - On criminal activities on board aircraft / at airports

KEY DEFINITIONS AIR LAW (1)

◆ Airspace

- Area above national territory & territorial waters subject to territorial sovereignty (Art. 1, Chicago)
 - ... but no vertical limit provided ...
- All activities in airspace subject to consent, subsidiary (any) conditions imposed by underlying state

KEY DEFINITIONS AIR LAW (2)

◆ Aircraft

- “Any machine that *can* derive support in the atmosphere *from the reactions of the air* other than the reactions of the air against the earth’s surface” (various Annexes to the Chicago Convention)
- Nationality by registration → quasi-territorial jurisdiction (Art. 17, Chicago)

SAFETY: INTERNATIONAL REGIME

◆ States have to implement relevant international responsibilities for safe operation aviation in national airspaces and national aircraft

→ Licensing & certification system

- Requiring compliance with detailed, technical & internationally-agreed rules Chicago & Annexes

◆ Private liability for private aviation

- National liability regimes have to comply with international regimes under respectively ratified conventions

OUTER SPACE TREATY (1)

Article I

“Outer space (...) shall be free for exploration and use by all States (...) in accordance with international law, and there shall be free access to all areas of celestial bodies.”

Article II

No territorial sovereignty in outer space! ... →



BOUNDARY ISSUE

- ◆ Tendency to convergence – on 100 km
 - Various international proposals
 - Russia, China, Germany, Pakistan
 - Several national laws
 - Australia, Kazakhstan, Isle of Man, EU Regulation
 - Even in the US: non-federal / non-official documents
 - Virginia draft statute, FAA astronaut wings
 - Private initiatives
 - Fédération Aéronautique Internationale (FAI), International Academy of Astronautics (IAA)
 - *Private operators!*

OUTER SPACE TREATY (2)

Article VI (part 1)

“States shall bear *international responsibility* for *national activities in outer space*, whether such activities are carried on by governmental agencies or *by non-governmental entities*, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty.”



OUTER SPACE TREATY (3)

Article VI (part 2)

“The *activities of non-governmental entities in outer space*, including the Moon and other celestial bodies, shall *require authorization and continuing supervision by the appropriate State Party to the Treaty.*”

Article VII → Liability Convention

Article VIII → Registration Convention



LIABILITY CONVENTION

Articles I(c)&(d), II-V

States bear *international liability* for *damage caused by space objects launched by them, procured by them, launched from their territory and/or launched from their facility.*

Article XII

Damage in principle without limitation ('restitutio in integrum').



REGISTRATION CONVENTION

Article II(1)

State shall register space object it launches, of which it procures the launch & for the launch of which it uses its territory & facility.

Article II(2)

In case there is more than one launching State, only one (of them) shall register.

→ Article VIII, Outer Space Treaty
Registration allows for jurisdiction.

NEED FOR NATIONAL SPACE LAW

- ◆ States have to deal with the consequences of their international responsibility and liability for private space activities
 - Licensing system
 - Requiring compliance with sets of obligations licensee to operate safely, securely & fully respecting international (space) law obligations licensing state
 - Requiring international third-party liability reimbursement obligations, including insurance
 - Requiring other (domestic) liability arrangements

NORWAY

- ◆ 1969 Act on launching objects from Norwegian territory into outer space
 - Permission required for launch from Norwegian territory, vessels & aircraft; outside if by Norwegian citizen / company (Sec. 1)
 - “Certain terms can be set for such permission” (Sec. 1)
 - Minister can issue relevant regulations (Sec. 2)
 - *Note: Act established before Liability Convention!*

SWEDEN

◆ 1982 Act on Space Activities

- License required for space activities from Sweden / elsewhere by Swedish citizen / company (Sec. 2)
 - Incl. launching & operation of space objects
 - Excl. launching of sounding rockets
- Licensee required to provide full reimbursement for international liability claims paid by Swedish government (Sec. 6)
- ... “unless special reasons tell against this” (Sec. 6)

UNITED STATES (1)

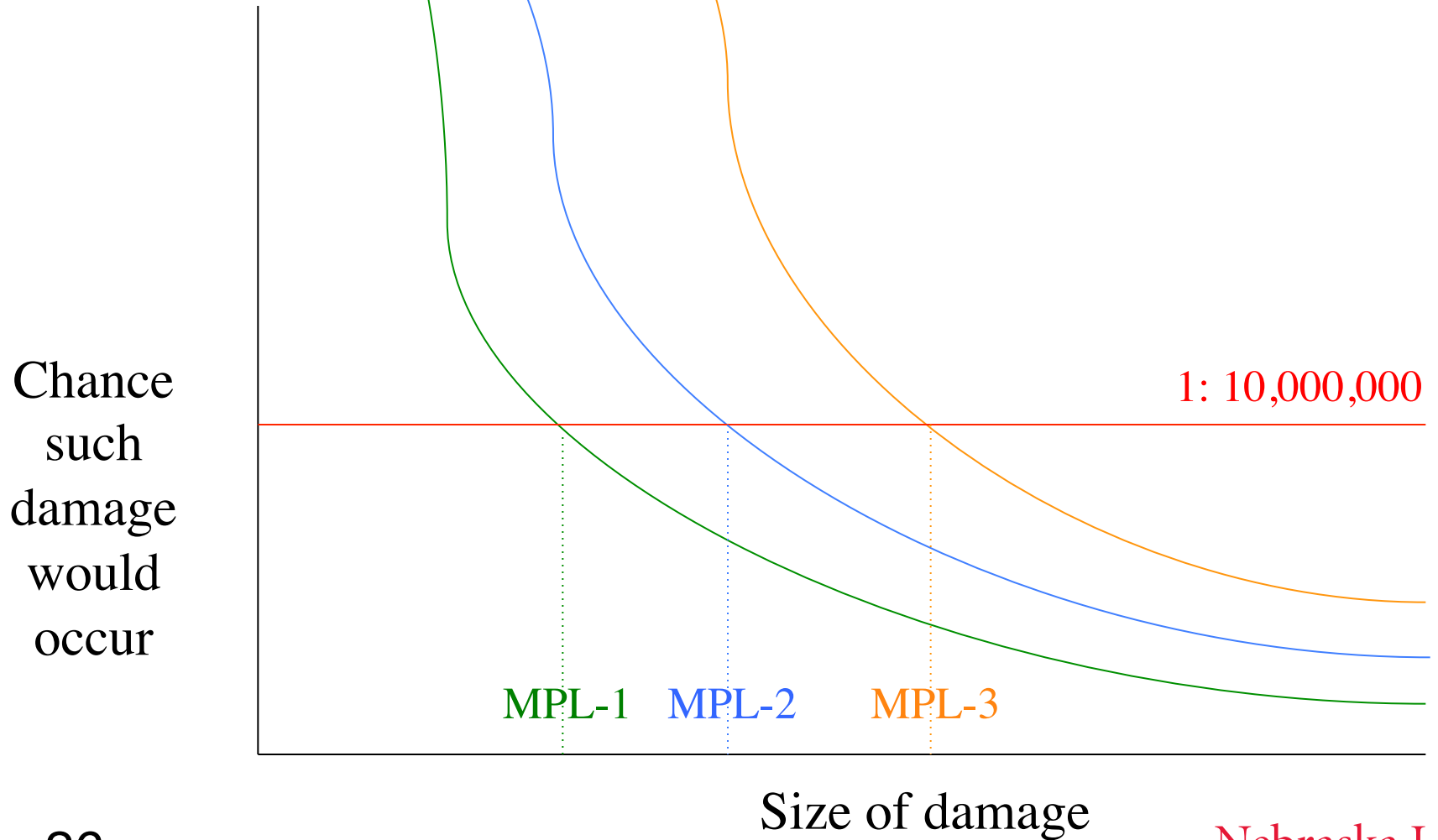
◆ 1984 Commercial Space Launch Act

- License required for launches from US territory & facilities / by US citizens (Sec. 50904(a))
- License required for operation of launch site on US territory / by US citizens (Sec. 50904(a))
- Included: launch (site) operations by non-US operator if controlled by US citizens:
 - From the high seas *unless* agreement exists with other state exercising jurisdiction (Sea Launch)
 - From other countries *only if* agreement exists with other state providing for US jurisdiction

UNITED STATES (2)

- ◆ 1988 Amendments – mainly on liability
 - Obligations to compensate damage to federal launch site if used & obtain proper insurance (Sec. 50914(a))
 - The lesser of: Maximum Probable Loss / US\$ 100 million / reasonably insurable contractual liability coverage
 - General waiver of inter-party liability *vis-à-vis* other partners (Sec. 50914(b))
 - Obligations to compensate damage to third-party victims & obtain proper insurance (Sec. 50914(a))
 - The lesser of: Maximum Probable Loss / US\$ 500 million / reasonably insurable contractual liability coverage

MAXIMUM PROBABLE LOSS



UNITED STATES (3)

- ◆ The practice on MPL:
 - Contractual liability for use federal launch sites
 - Maximum of US\$ 100 million has occasionally been quoted (for Atlas-V launches)
 - SpaceShipOne flights of 2004: MPL of US\$ 0 ...
 - Launch from private launch site – no issue for any MPL
 - Meanwhile handful such sites being developed & licensed
 - Third-party liability
 - Maximum MPL imposed so far: US\$ 261 million (for Atlas-V & Delta-IV launches)
 - SpaceShipOne flights of 2004: MPL of US\$ 3.1 million

UNITED STATES (4)

◆ Further as to third-party liability:

- National: indemnification three-tier-structure
 - 1st tier: licensee (/his insurer) pays
 - 2nd tier: US government promises to ask Congress to pay up to US 1.5 billion in 1988 value
 - 3rd tier: no compensation for victims
- International: \approx other way around!
 - US government pays claim under Liability Convention
 - 1st tier: licensee (/his insurer) repays government
 - 2nd tier: for US government regardless of Congress...
 - 3rd tier: ... *also* for US government...!

RUSSIAN FEDERATION

◆ 1993 Law on Space Activities

- License required for all space activities (Art. 9)
- License required by Russian citizens & companies, & by foreign citizens & companies under jurisdiction Russia (Art. 9)
- Compulsory insurance imposed on licensee including for third-party damage in amounts to be established (Art. 25)
- Russia provides full indemnification, as applicable to be reimbursed by licensee up to insured sum (Art. 30)

SOME INSURANCE PRACTICE

◆ Maximum insurance requirements imposed

- Proton US\$ 300 million
- Soyuz US\$ 100–300 million
- Molniya US\$ 150 million
- Zenith US\$ 150–500 million
- Dnepr US\$ 100–150 million
- Tsyklon US\$ 100 million
- Rockot US\$ 100 million
- Cosmos US\$ 100–150 million
- Strela US\$ 100 million
- Start US\$ 80 million

AUSTRALIA

- ◆ 1998 Act about space activities
 - Licenses / permits / authorizations / certificates required for launches & re-entries (only) by Australian nationals / from Australia (Secs. 11-15)
 - Insurance / financial requirements (Secs. 47, 48)
 - Incl. liability Australia under the Liability Convention
 - 1st tier: Maximum Probable Loss / A\$ 750 million (± US\$ 575 million)
 - No requirement to reimburse beyond 1st tier (Sec. 69)
 - 2nd tier: for Australia up to A\$ 3 billion (± US\$ 2.3 billion)
 - *Note: 3rd tier under Liability Convention also for Australia...*

BRAZIL

◆ 2001 Edict & enclosed Regulation

- License required for launching from Brazil by nationals & foreigners (Arts. 1, 2)
- License only granted if sufficient technical, economic & financial qualifications can be documented (Art. 6)
- License requires proof of “[p]urchase of insurance to cover possible damages to third parties, according to the degree of risk of the activities to be carried out by applicant, where appropriate, in the value previously established by [the Brazilian space agency]” (Art. 9)

FRANCE

◆ 2008 Law on Space Operations

- All space activities require authorization (Arts. 2, 3)
 - National: indemnification 2nd tier (Arts. 13, 15)
 - International: again other way around (Arts. 14-17)
 - 1st tier: France pays international claim & requires reimbursement by authorized entity up to amount determined by Finance Act – currently € 50–70 million (± US\$ 53–74 million)
 - 2nd tier: France pays international claim & ... will not be reimbursed by authorized entity
- France effectively acts as insurer above reimbursement limit

KAZAKHSTAN

◆ 2012 Law on Space Activities

- License required for space activities conducted by individuals and legal entities – “in accordance with the legislation of the Republic of Kazakhstan on licensing” (Art. 13) – legislation = *to be developed*
 - Will *inter alia* have to determine scope of licensing obligation & extent of (international)(third-party) liability, including insurance & reimbursement / indemnification
- *Note: bilateral treaty Russia–Kazakhstan on use Baikonur cosmodrome (= Russian facility on Kazakh territory) allows Kazakhstan to derogate to Russia*

VARIATIONS LICENSING ... (1)

◆ Scope *ratione materiae*

- Launches only vs. all space activities (with variations)
- Unclear impact of other domestic regimes – e.g. national high-key sensitive technology export controls on – launch operations

◆ Scope *ratione personae*

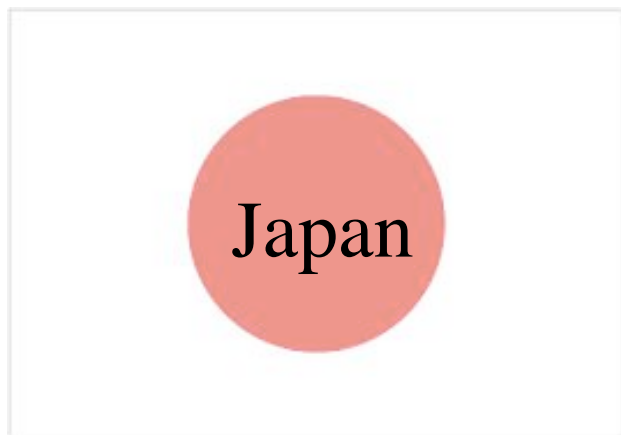
- Only nationals; only from territory; or both – in various combinations
- Variety in governmental discretion

VARIATIONS LICENSING ... (2)

◆ Liability regime

- Separation *vs.* integration third-party liability & liability for use governmental launch sites
- Separation *vs.* integration international & domestic liability
- Provision of caps to liability / government indemnification
- Insurance: mandatory *vs.* optional / per license; limited to liability cap *vs.* unlimited

MISSING SO FAR...



BUT ANYWAY...

- ◆ Those domestic space laws all intend to address ‘classical launches’ (by private operators):
 - Expendable launch vehicles → one-off licenses
 - Payloads, not humans → different safety requirements
- *Would they apply to commercial manned spaceflight? Should they? Should they be adapted? Should air law be used instead?*
- ◆ Two serious ‘efforts’ so far – fundamentally different

EUROPEAN UNION & EFTA

◆ European Aviation Safety Agency

- Tasked to address safety of aviation in Europe, in particular through certification, standardization & crew licensing
- Started to work on adapting aircraft certification regulations to sub-orbital vehicles
 - Based on definition aircraft under Chicago as discussed
 - Problems however with several sub-orbital vehicles being developed which do not fit in that definition
- Efforts currently stalled...

TFEU AS PER LISBON TREATY

- ◆ EASA harmonization national legislation *on aviation* allowed
- ↔ No harmonization national laws under ‘parallel’ *space* competence (Art. 189(3))
 - Six EU member states already have national space legislation addressing private space activities...
 - ...just not specifically *manned* private space activities
 - Transport Title TFEU generally does not apply outside European territories: Curacao ↔ Sweden
 - ICAO also hesitant to address sub-orbital vehicles

UNITED STATES REVISITED

- ◆ 2004 Amendments – to adapt Commercial Space Launch Act to manned launch & re-entry
 - ‘Space law approach’ instead of ‘air law approach’
 - Possibility for experimental permit next to license
 - Third-party liability regime continues to apply
 - Inter-party liability regime continues to apply – except for ‘space flight participants’
- Instead of contractual liability towards ‘space flight participants’: ‘informed consent’ regime
 - No waiver of liability as such – just strong defence in court

INDIVIDUAL STATE STATUTES!

- ◆ All: ‘informed consent’ (as ‘dictated’ by respective Statute) *does* mean waiver of liability
- ◆ Beyond that, number of differences/problem:
 - Some states add exception to waiver in case of ‘knowledge of existence of dangerous conditions’ ...!
 - Application waiver beyond spaceflight operator differs – often including manufacturers
 - Different extent of application to victim’s entourage
 - Different interaction with existing common law
 - Also: what if suit brought in other state...?
 - And what about the other 44 states anyway? [Nebraska Law](#)

THE U.S. PERSPECTIVE

FEDERAL PREEMPTION!?

**Federal
jurisdiction**

State Nebraska Law
jurisdiction
University of Nebraska

THE INTERNATIONAL PERSPECTIVE

**BEAUTY CONTEST!
FORUM SHOPPING!!
FLAGS OF CONVENIENCE!!!**

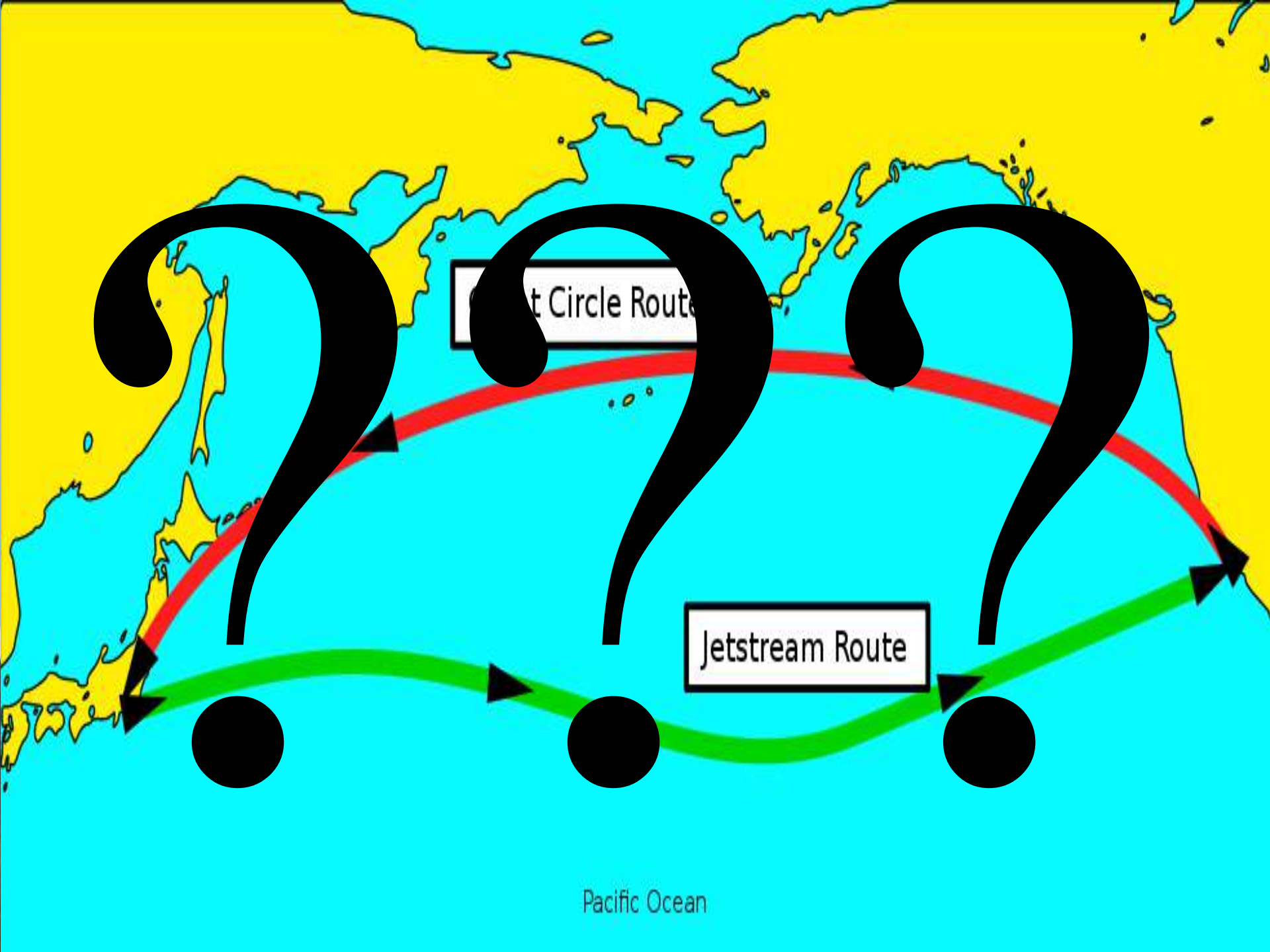
Nebraska Law

University of Nebraska

↔ BEAUTY OF SPACE LAW

... as compared to law of the sea

- Cheap flags, cutting corners on crew training, certification & other safety-related requirements
- ◆ *States* responsible for national space activities & liable for damage they may cause
 - Absolute liability for damage on earth
 - No principled limits to liability
- ◆ Launch is most dangerous phase – enlightened self-interest calls for prudent licensing



Great Circle Route

Jetstream Route

Pacific Ocean

SPACE HOTEL





*“Daddy...
please!!!???”*

*“Soon, my son,
soon – once we
know all the
right laws are in
place!”*