

Toward a Global Governance Framework for Planetary Defense: Legal, Institutional, and Funding Challenges

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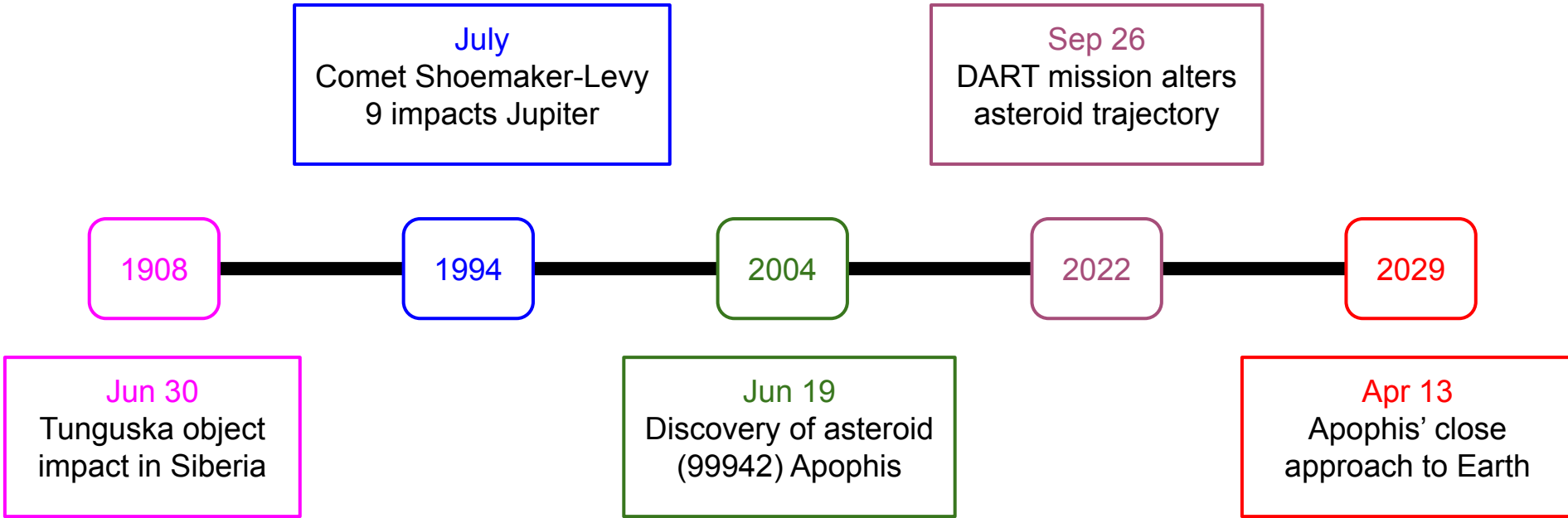
Outline

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Key Events (Past & Future)



Why Planetary Defense Governance Matters?

- Existing space treaties ensure “peaceful use” but ignore asteroid threats
- NEOs like Tunguska, Chicxulub and Apophis highlight existential risk
- No legal guidance on deflection missions, liability sharing, or dual-use tech
- NASA, ESA and others track NEOs—yet lack a unified global response framework

Threat & Collective-Action Challenges

Three NEO threat scenarios

1. Direct Earth impact → catastrophic regional/global damage
 2. Collision with active satellites → debris cascade, Kessler Syndrome
 3. Triggering wide-area debris fields → long-term LEO unusability
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Collective-action hurdles

- Free-rider problem
- Tragedy of the commons
- Prisoner's dilemma

Legal and Institutional Gaps

Outer Space Treaty (OST)

- Art IV: prohibits “weapons” but unclear on kinetic or nuclear deflection
- Art VII: launching State liable for damage → “liability chill”

No mechanism for:

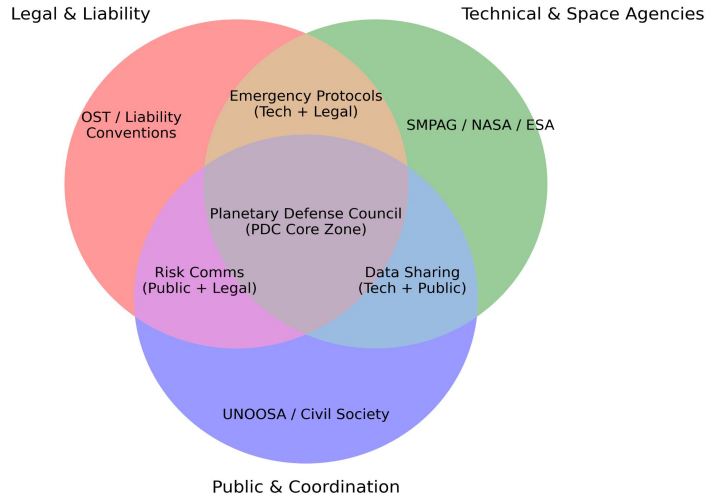
- Authorizing deflection missions
- Sharing costs & risks
- Managing dual-use technologies

Liability Convention & Rescue Agreement

- No “good-faith mitigation immunity”
- Astronaut rescue vs. asteroid deflection: mismatch

Formation of a Planetary Defense Council

Planetary Defense Governance Venn Diagram



Governance Domains:

- Legal & Liability Frameworks
- Technical & Space Agency Capabilities
- Public and International Coordination

Key Functions:

- Authorize Deflection Mission
- Facilitate Technology Transfer
- Coordinate NEO Monitoring
- Define Risk Thresholds
- Provide Dispute Resolution

Implementation Ideas:

- Universal Voting Rights
- Stable Leadership
- Override National Decisions
- Balanced Coordination and Sovereignty

Liability & Funding Protocols

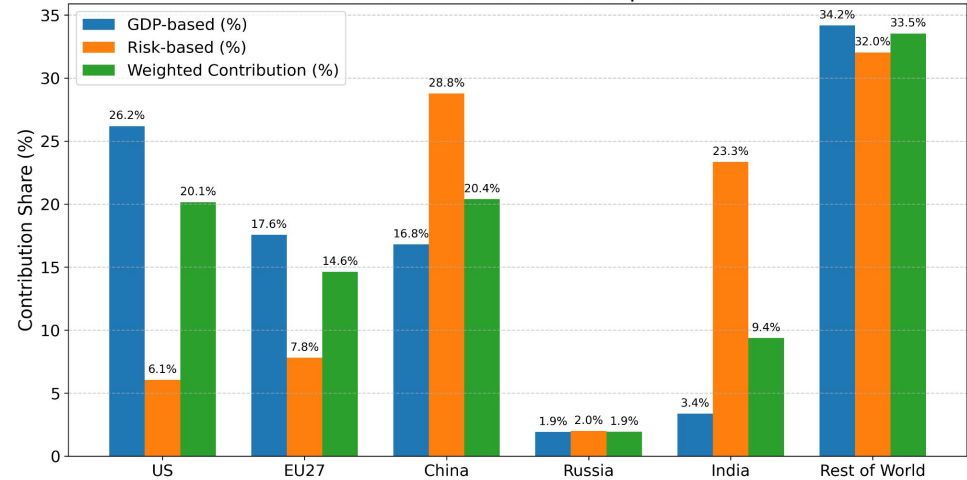
Good-Faith Mitigation Immunity

- Annex to Liability Convention
- Proportional liability based on contribution (investment, risk exposure)

Global Planetary Defense Fund

- Hybrid contributions: 70 % GDP, 30 % risk (population \times urban density)
- Transparent administration by PDC

Planetary Defense Fund Contribution Model
Based on GDP and Risk Exposure



Technology Exchange & Neutrality

Secure Tech-Transfer Protocol

- Classify: civilian, dual-use, restricted
- Intranet under PDC oversight
- Inspections & red-flag mechanisms

Space Neutrality Agreement

- Allow only defensive nuclear use under strict verification
- Voluntary supplemental OST treaty

Dual-use precedent: NPT Article V (“peaceful nuclear explosions”)

Maritime Law Analogies & Path Forward

Adapt “Salvage” & “Port of Refuge” → incentivize early intervention

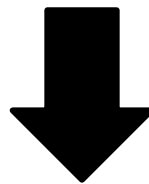
Model IMO-style body → Planetary Defense Coordination Agreement (PDCA)

Future Work:

- Operationalizing PDC: bylaws & budget
- Simulation of cost-sharing schemes
- Public engagement & private-sector integration

Take-home: Defending Earth is a technical challenge **and** test of global cooperation

Global Planetary Defense Framework



**Planetary
Safety**

**International
Cooperation**

**Legal
Framework**

**Institutional
Structures**

**Technological
Advances**

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Thank you!