

# Association of Space Explorers

**National Defense University  
Toward a Theory of Spacepower  
26 April 2007**

## **Space and the Commonwealth of Mankind The NEO Challenge**

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Association of Space Explorers;  
Chairman, B612 Foundation**

# Report Documentation Page

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## The Bottom Lines

**1) Decisions re a NEO threat will likely have to be made within a decade**

- Rapidly changing (knowledge) environment.

**2) NEO challenge is intrinsically international**

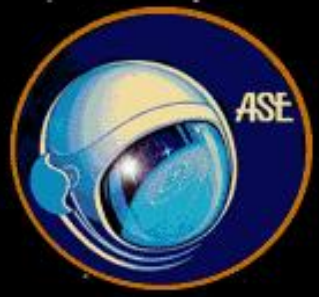
- Specific impact point unknown at decision time
- Deflection = shift of risk between nations

**3) Deflection options; non-nuclear and nuclear**

- The issue of precision (NASA missed it)
- Nuclear option needed only for near term, low probability event

**4) World community must make key decisions**

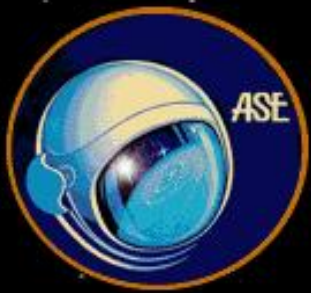
- ASE-NEO Workshops; draft UN/COPUOS instrument



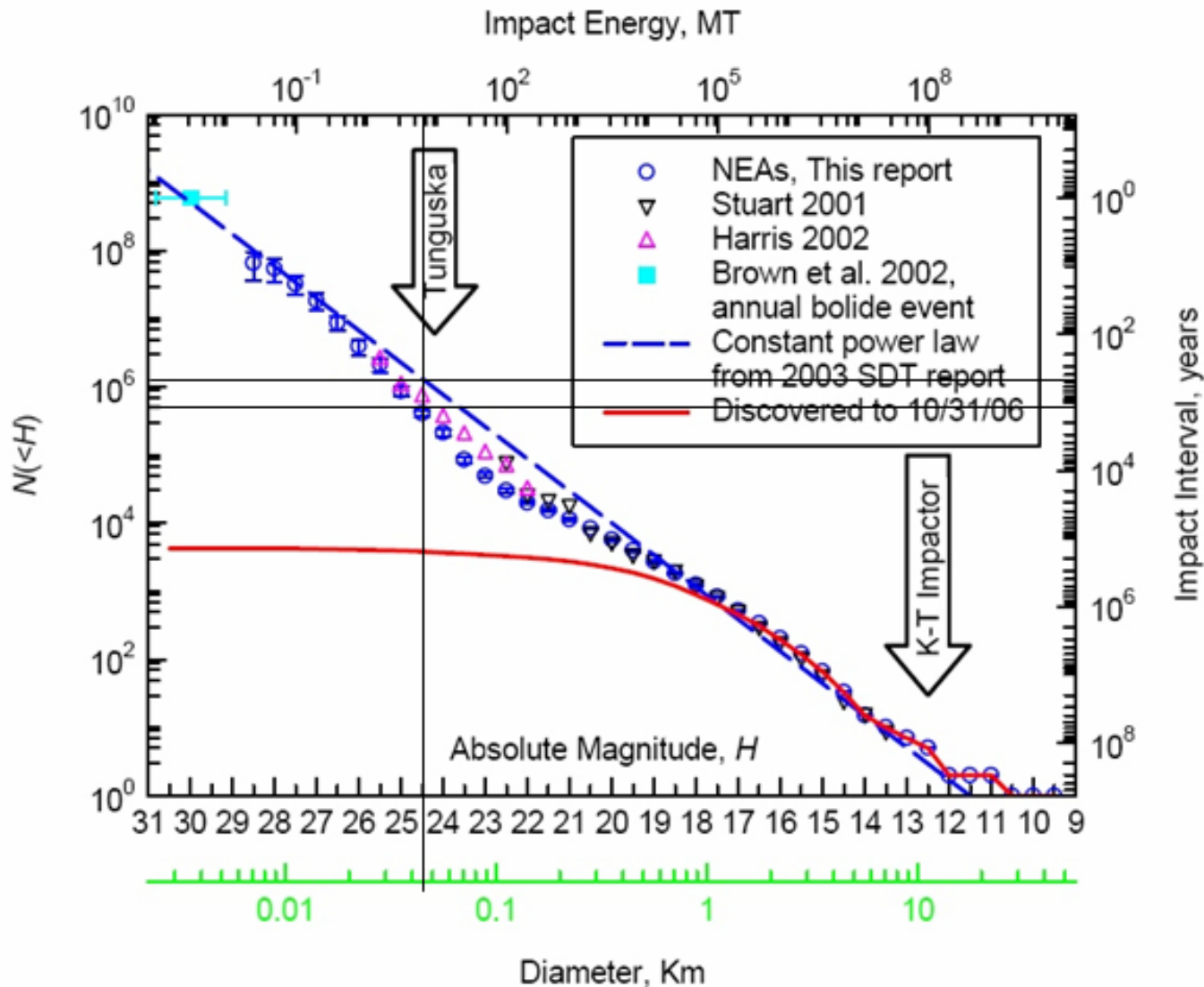
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## The Three Components of Protection of the Earth from NEO Impacts

- ✓ Early Warning
- ✓ Proven Deflection Capability
- ✓ International Decision-making Protocol



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## Early Warning

### Spaceguard 1 & 2

(Comparable Numbers)

2007 2019

Target Population

1,000 25,000

71% completed

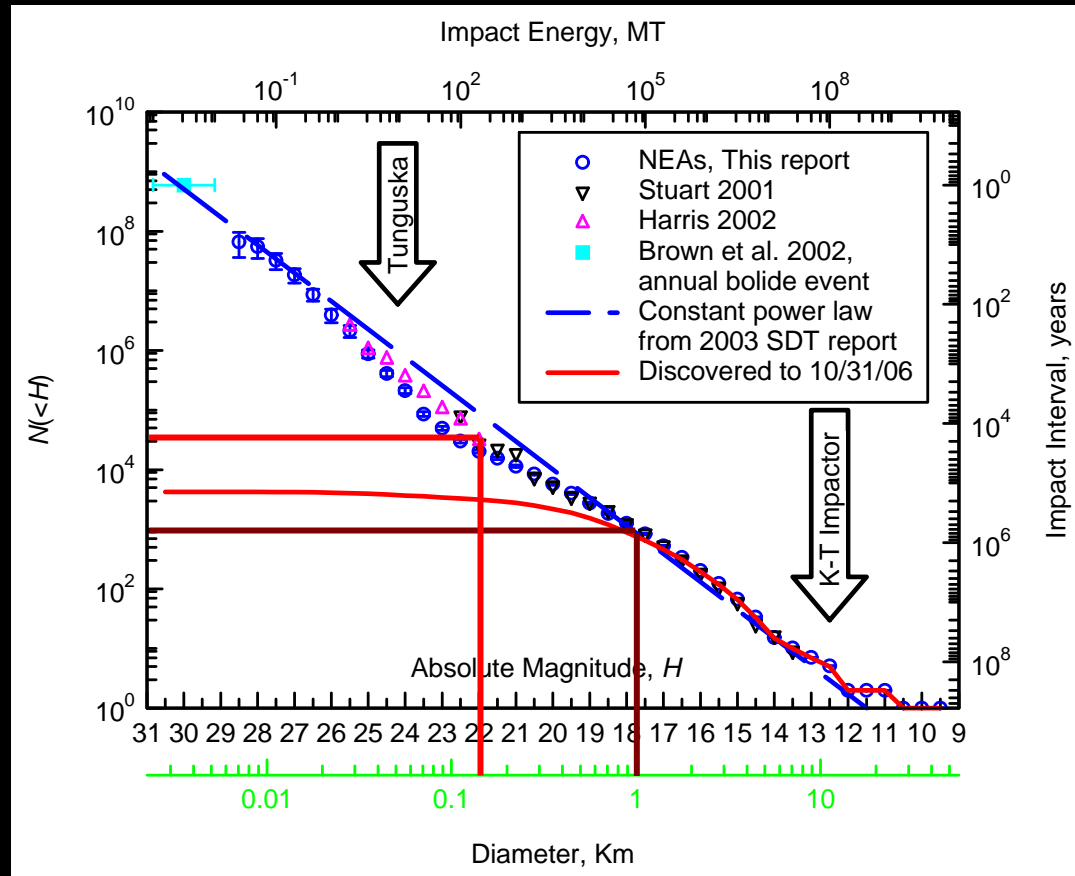
708 18,000

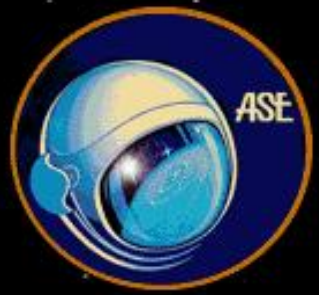
Total Discovered

4,640 116,000

Potential Impactors

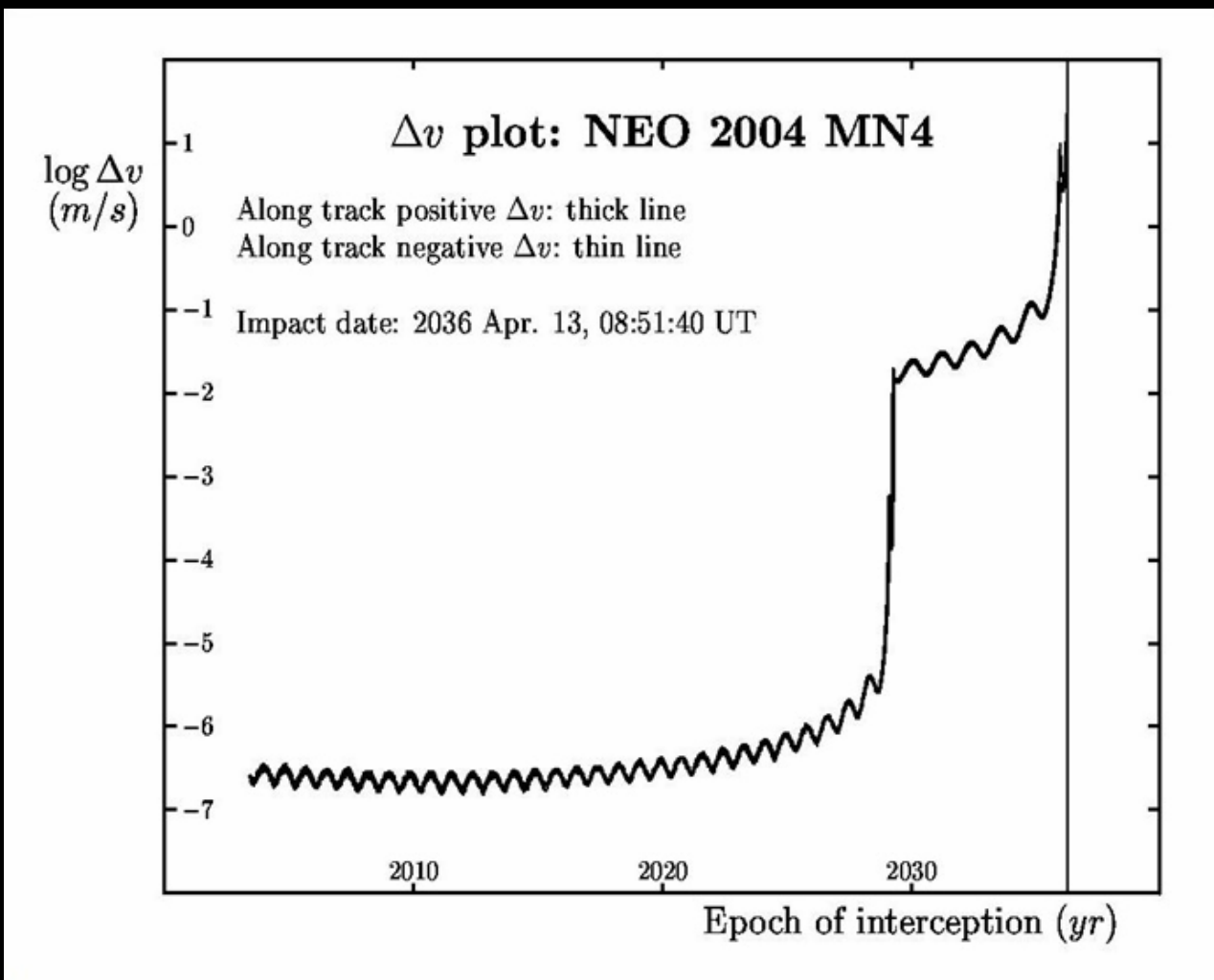
137 3,400





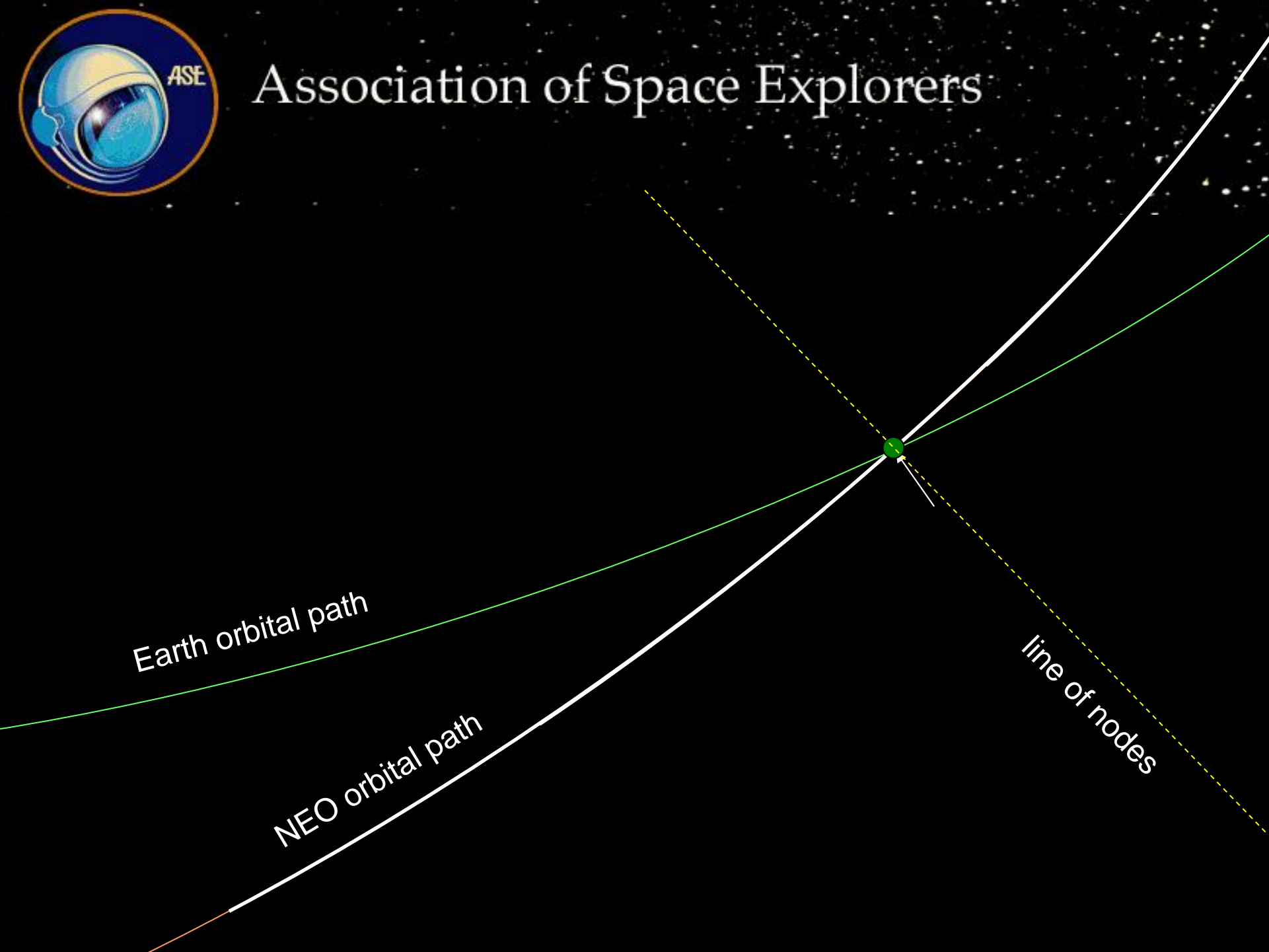
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## Decision Time





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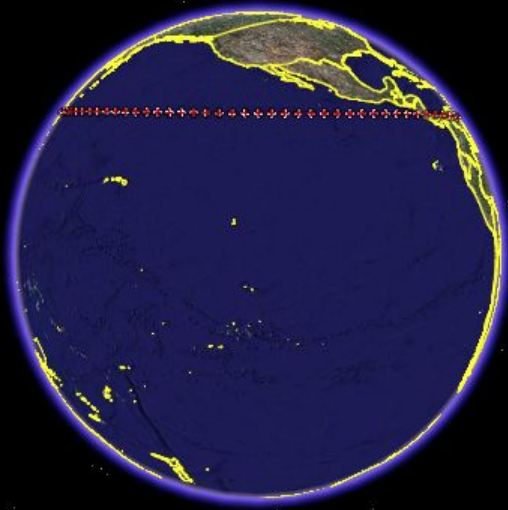
Earth orbital path

NEO orbital path

line of nodes



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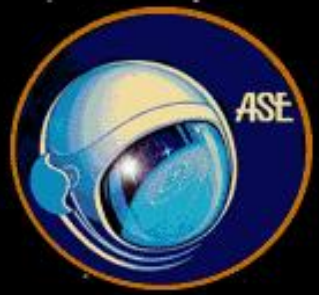
**2007 - Path of Risk for Apophis**



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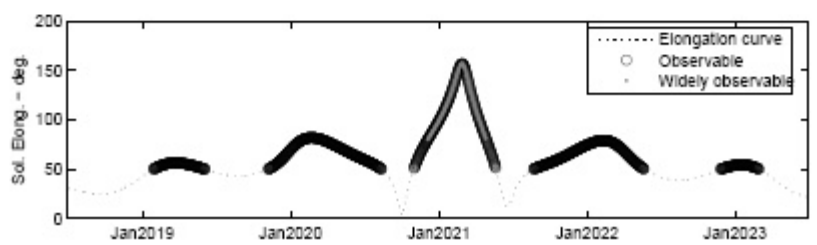
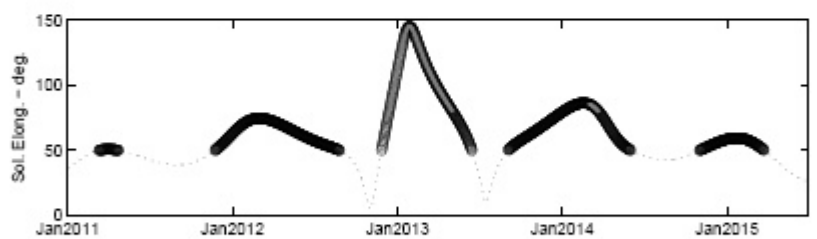
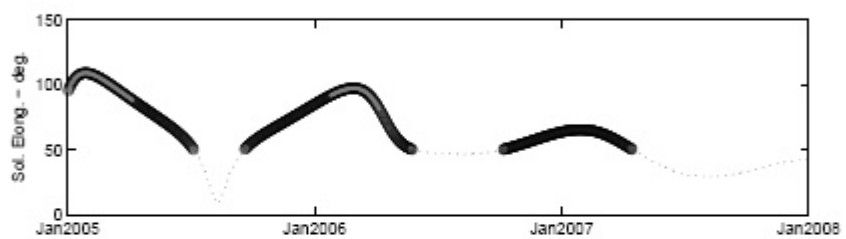
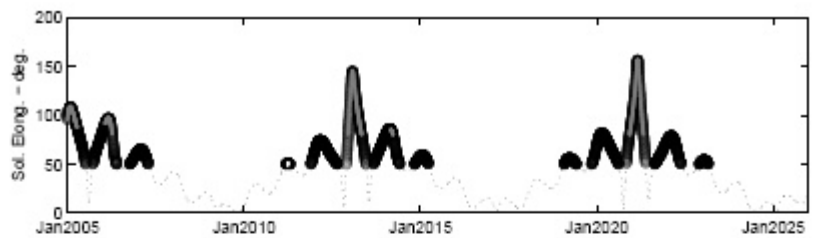
**2020 - Paths of Risk for NEOs of  
Concern**

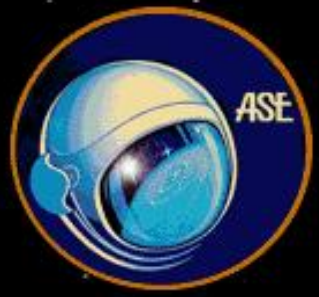


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## Episodic Tracking

Potential Impact Detection





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## Current Deflection Capability

### Kinetic Impact

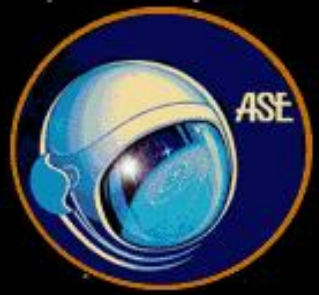
Pushes the asteroid via direct impact



### Gravity Tractor

Pulls the asteroid using mutual gravity as a tow-rope



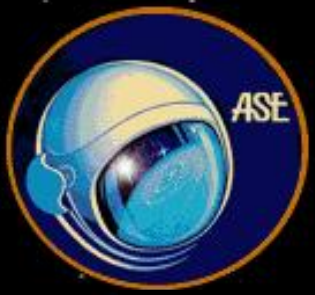


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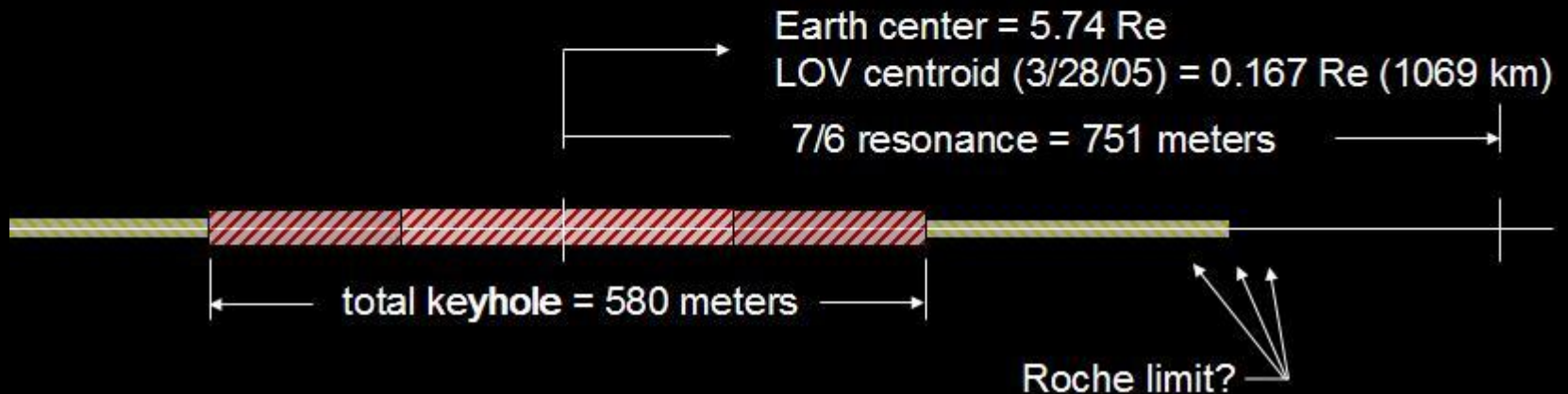
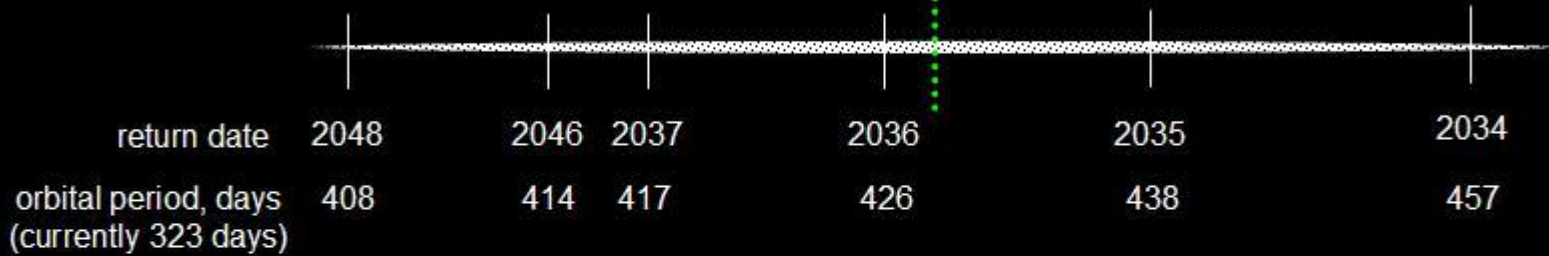


## Nuclear Explosion

Explodes surface off NEO  
to create impulsive push



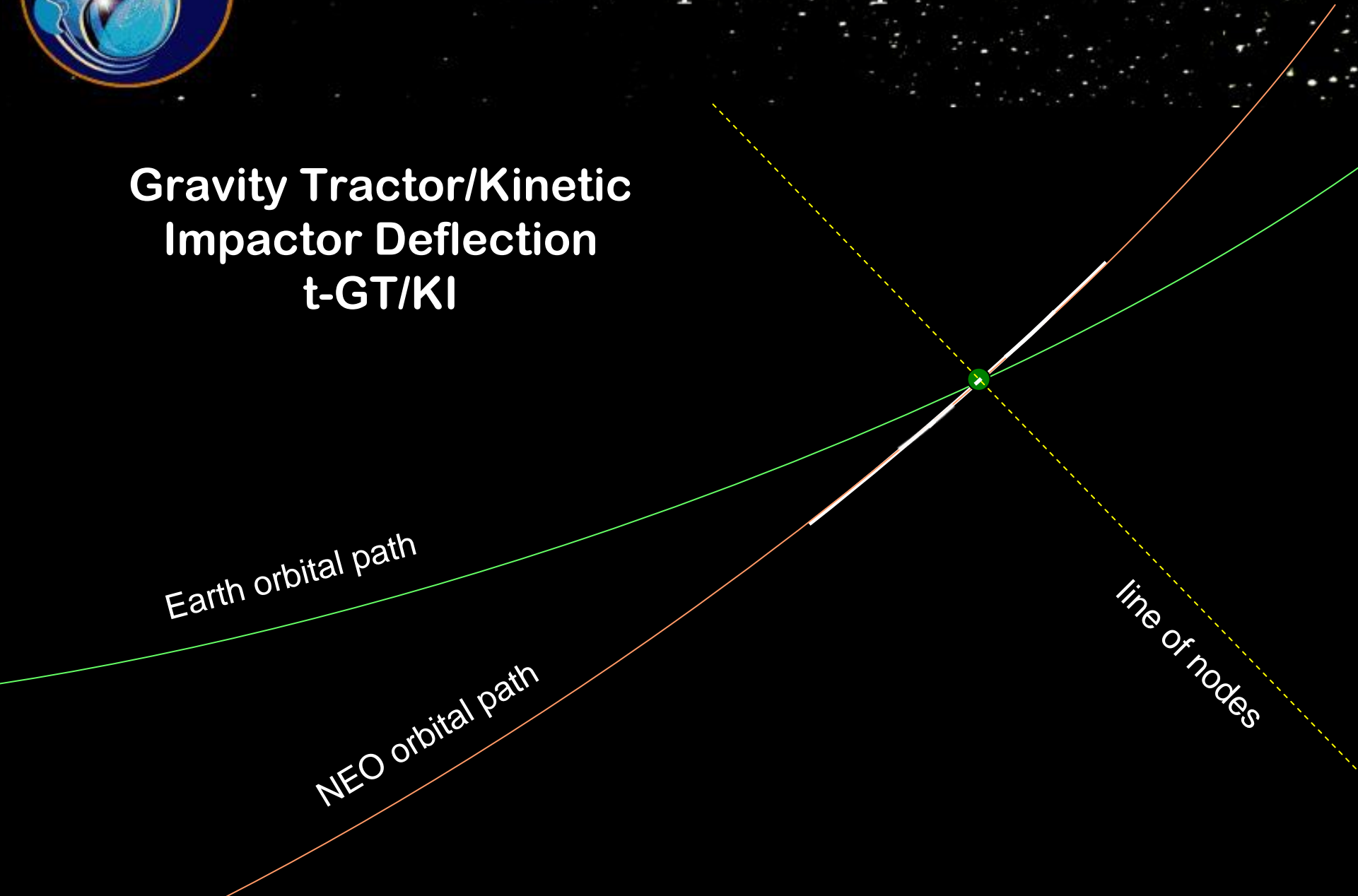
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## Gravity Tractor/Kinetic Impactor Deflection t-GT/KI



Earth orbital path

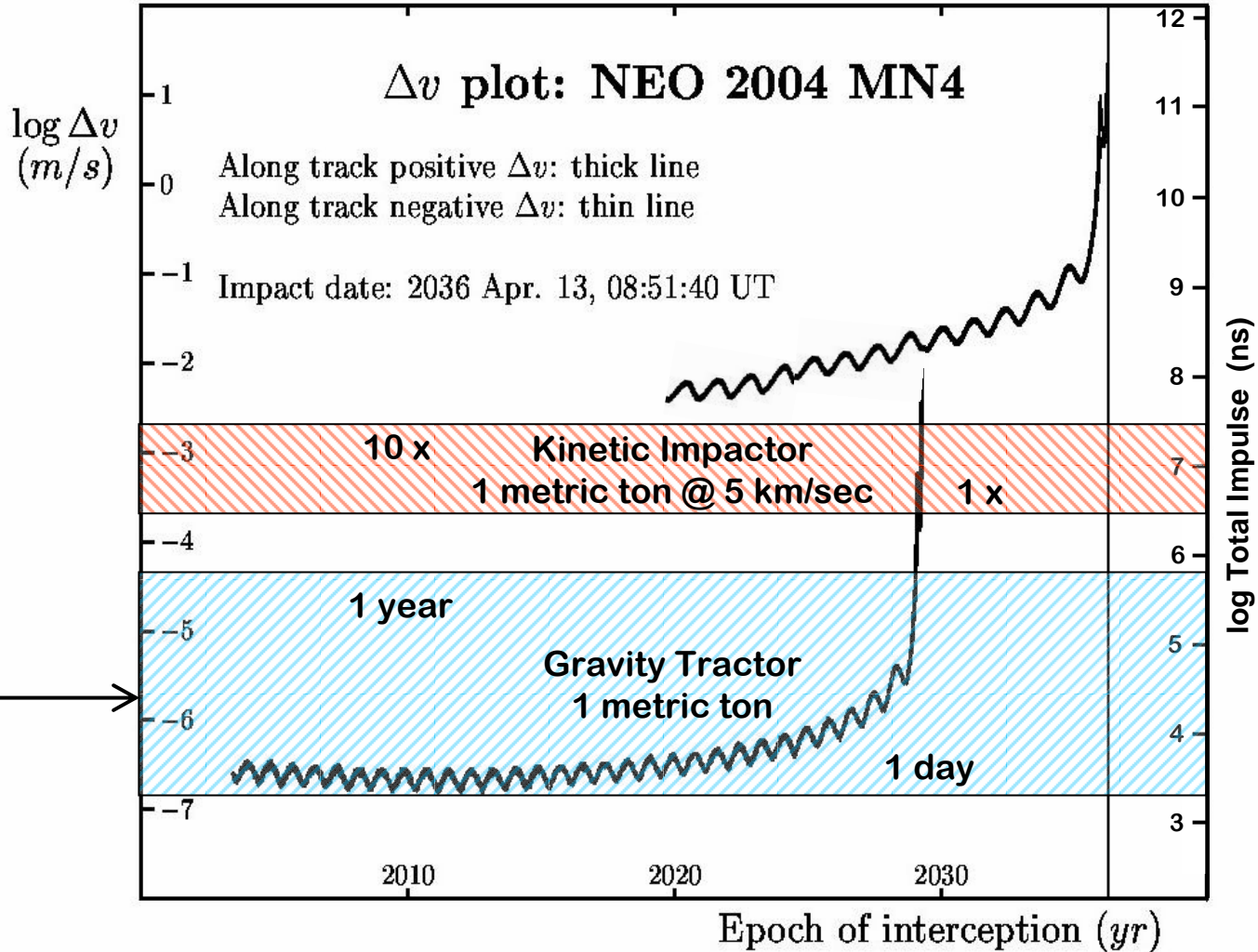
NEO orbital path

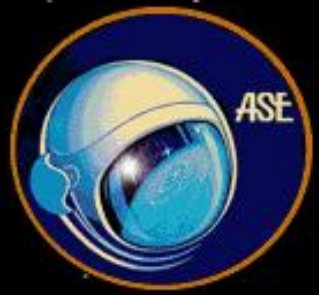
line of nodes



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## Deflection Time



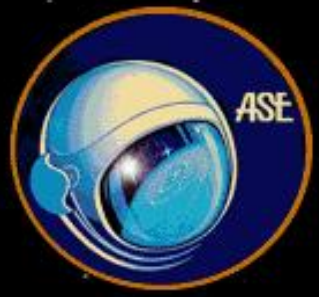


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**The ASE-NEO  
Committee  
addressing the UN  
Committee on  
Peaceful Uses of  
Outer Space on the  
NEO impact threat**

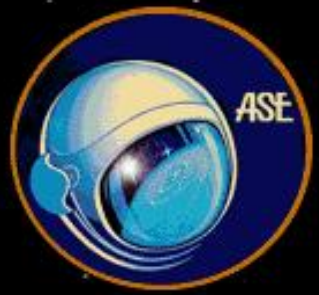
**February, 2006**



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## **The ASE takes the position that...**

- 1. The United Nations is the appropriate forum for decision making**
- 2. An adopted treaty or protocol specifying the decision process should be in place as soon as possible**
- 3. The information on NEOs provided by member states must support this negotiated decision process**



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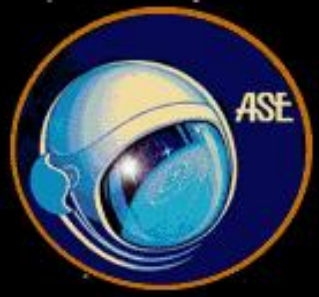
## International Decision-Making ASE Next Steps..

**Bring together a group of world diplomatic and legal experts in a series of 4 workshops to identify, develop, and ponder the many issues associated with a pending NEO impact. (First workshop scheduled for 9-12 May, 2007, Strasbourg, France)**

**Generate, as a workshop product, a draft United Nations Treaty (Protocol, Convention, ...) on NEO Deflection.**

**Deliver this draft treaty to the United Nations Committee on Peaceful Uses of Outer Space in their spring session in 2009, for further deliberation, debate, and (hopefully) adoption.**

**Organizing and conducting these international workshops will cost the ASE \$250K which we are in the process of raising. Of this we have ~\$180K, enough to cover the first year's cost.**



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**The End**

**Q&A**