

**EXERCISE**

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**NOT A REAL WORLD EVENT** *This is part of an asteroid threat exercise conducted during the 2015 IAA Planetary Defense Conference.*

## **Nations of the World to Send Six Kinetic Impactors to Deflect Oncoming Asteroid**

Paul W. Chodas (International Asteroid Warning Network/JPL)

Press Conference, August 1, 2019

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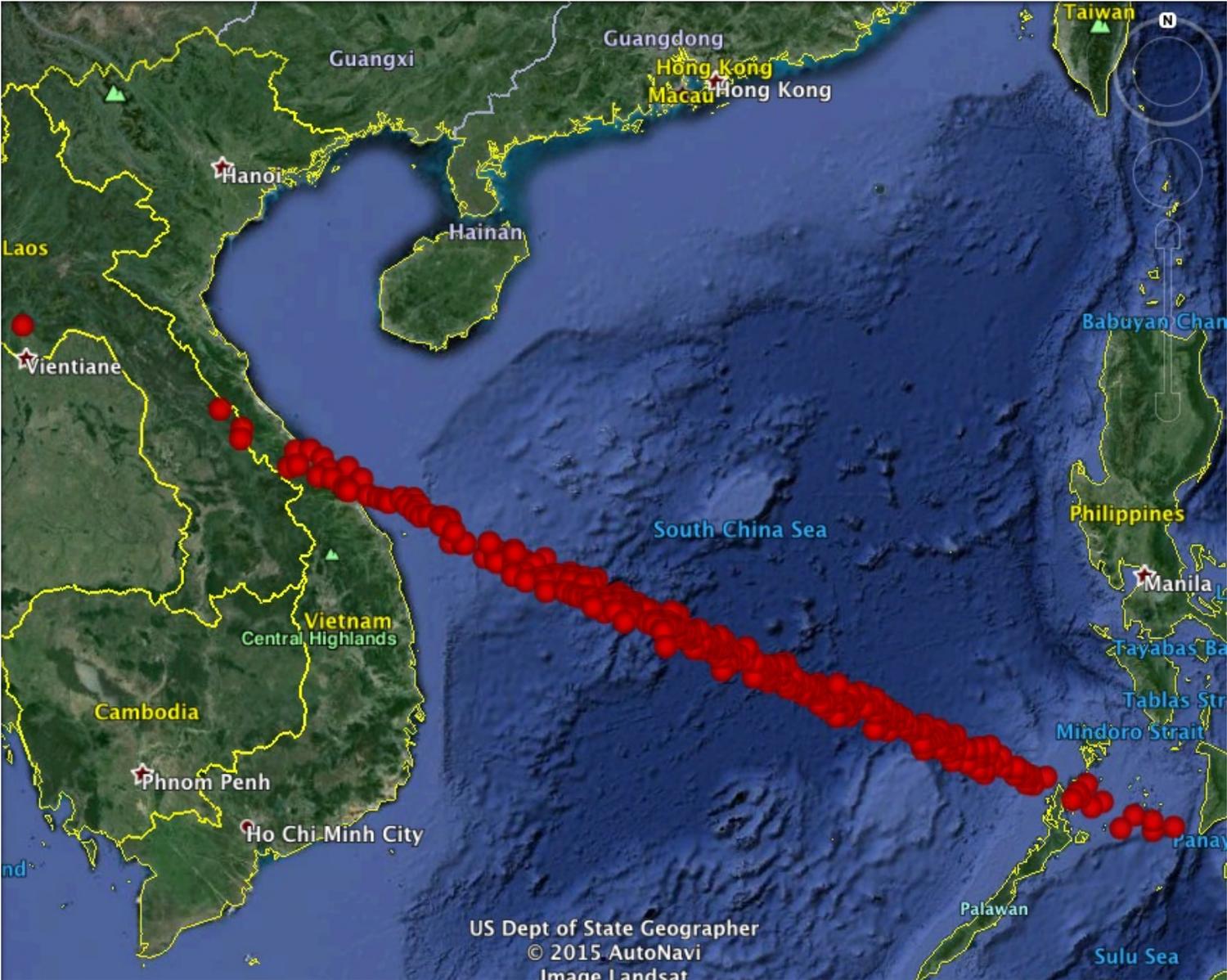
# Six Kinetic Impactors to Deflect Asteroid

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- ▶ Several space-faring nations will launch a total of six kinetic impactors later this month to deflect asteroid 2015 PDC
  - ▶ The U.S. will launch 3 missions, using a Delta IV-H, a Falcon Heavy, and an Atlas V 551. A larger spacecraft to be launched on NASA's first SLS had to be scrapped because the launch vehicle could not be completed in time
  - ▶ Europe, Russia and China are ready to launch one kinetic impactor each, on Ariane 5, Proton, and Long March
  - ▶ The deflections will occur over a 7-day period in early March, 2020
- ▶ Based on tracking observations over the last 2 years, IAWN has refined the trajectory for 2015 PDC, and determined that it will most likely impact in the South China Sea
- ▶ For more info: <http://neo.jpl.nasa.gov/pdc15/day4.html>

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# Updated Impact Footprint for 2015 PDC



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# Kinetic Impactor Mission Design

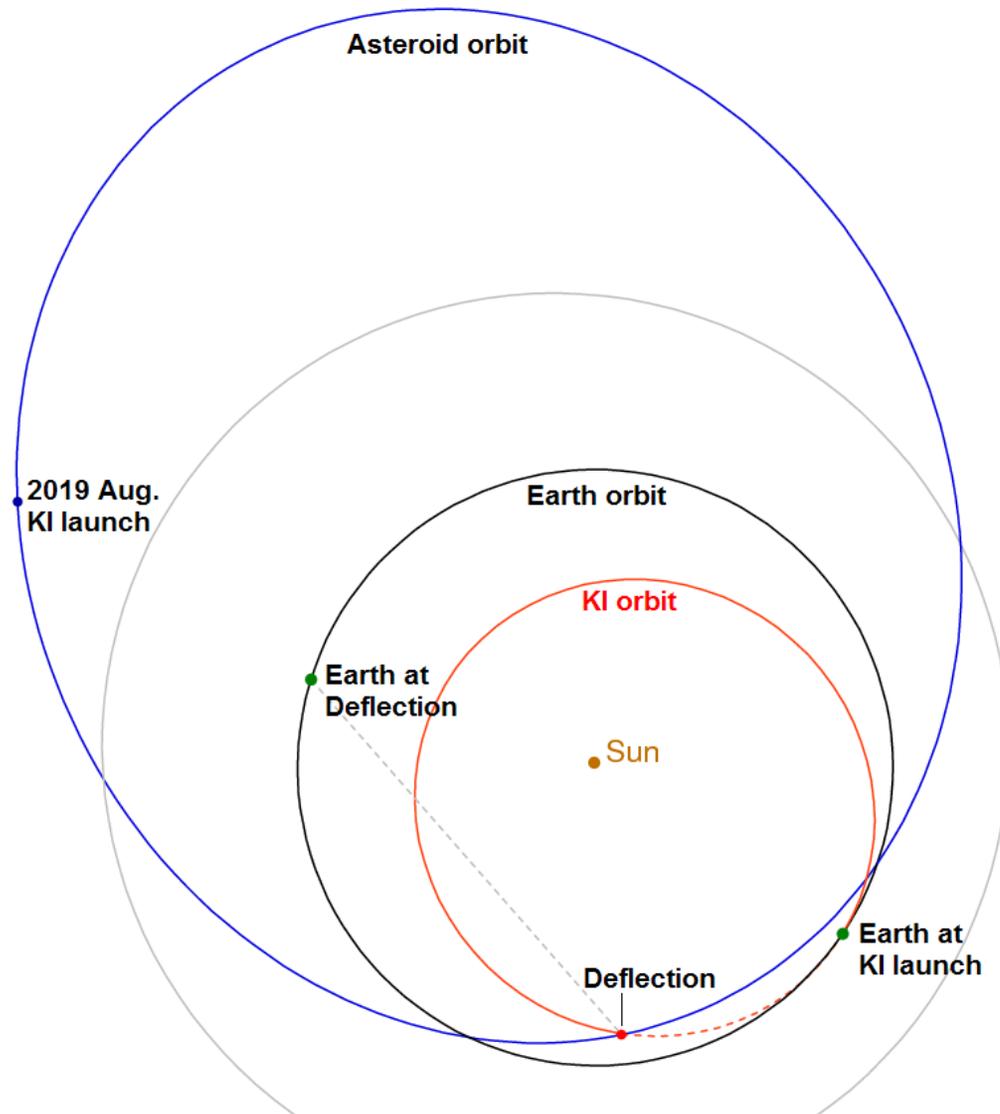
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- ▶ Asteroid physical properties have become more certain:
  - ▶ New color measurements support the categorization of this asteroid as S-class; scientists consider it “highly unlikely” that the asteroid could be as large as 400 meters
  - ▶ The best estimate of the asteroid size is now **150 to 250 meters**
  - ▶ Light curve measurements in 2015-17 with amplitude of 0.83 magnitudes indicate a rotation period of 3.2 hours
- ▶ Officials remain confident that 6 KI missions in combination will succeed in deflecting the asteroid away from impact
- ▶ India has joined the effort and will launch a flyby observer to assess the effectiveness of the deflection
- ▶ Development of nuclear deflection missions was put on hold due to strong opposition from some UN Security Council members

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# Kinetic Impactor Trajectory to 2015 PDC

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Launch period:  
Aug. 12-22, 2019

The KI deflections  
occur over a 7 day  
period, Feb. 28  
through Mar. 6,  
2020

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# Design Your Own Deflection Mission



<http://neo.jpl.nasa.gov/nda>

**Delta-V Mode** | **Intercept Mode**

Time of Deflection (D): 1096 days

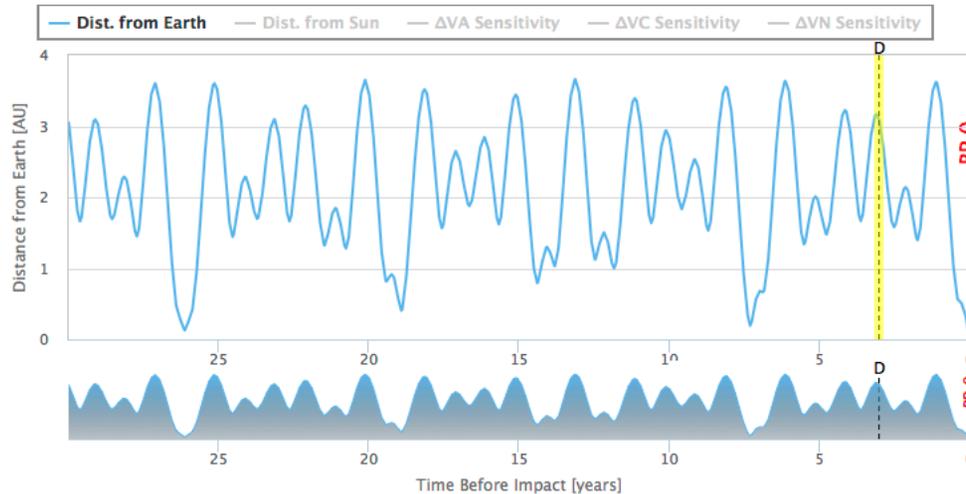
$\Delta VA$ : 0.000 mm/s  
 $\Delta VC$ : 0.000 mm/s  
 $\Delta VN$ : 0.000 mm/s

**Simulated Near Earth Object (NEO)**  
 PDC15 a=1.78 i=5 e=0.49

Object parameters are only applicable in Intercept Mode

Diameter: 0.14 km  
 Density: 1.5 (porous rock) g/cm<sup>3</sup>  
 Beta: 0.0001  
 Mass: kg

Reset | Slider  $\Delta$ 's | Advanced Mode | Tips

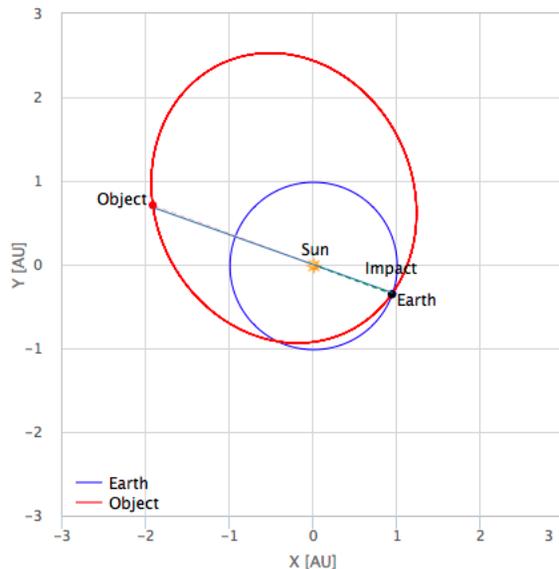


Read overview

Start the app

Take a tour of the app using the 2015 PDC scenario

Orbit and Positions at Deflection



**Orbit Changes**

$\Delta VA$ : 0.000 mm/s  
 $\Delta VC$ : 0.000 mm/s  
 $\Delta VN$ : 0.000 mm/s  
 Total  $\Delta V$ : 0.000 mm/s  
 Period at D: 864.071 d  
 $\Delta$  Period: 0.0000 s

**B-Plane Values**

$\zeta$  (zeta): 0.621 R<sub>e</sub>  
 $\xi$  (xi): -0.436 R<sub>e</sub>  
 B magnitude: 0.759 R<sub>e</sub>  
 Capture Rad.: 1.420 R<sub>e</sub>  
 Perigee Dist.: 0.405 R<sub>e</sub>

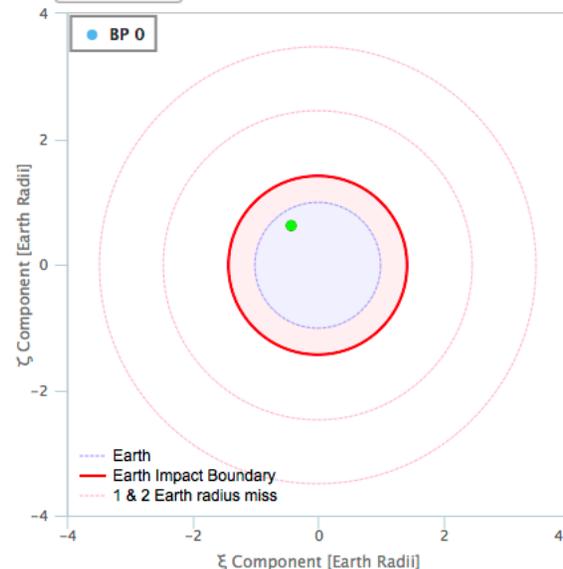
**IMPACT**

$V_{\infty}$ : 11.087 km/s

\* R<sub>e</sub> = Earth Radii

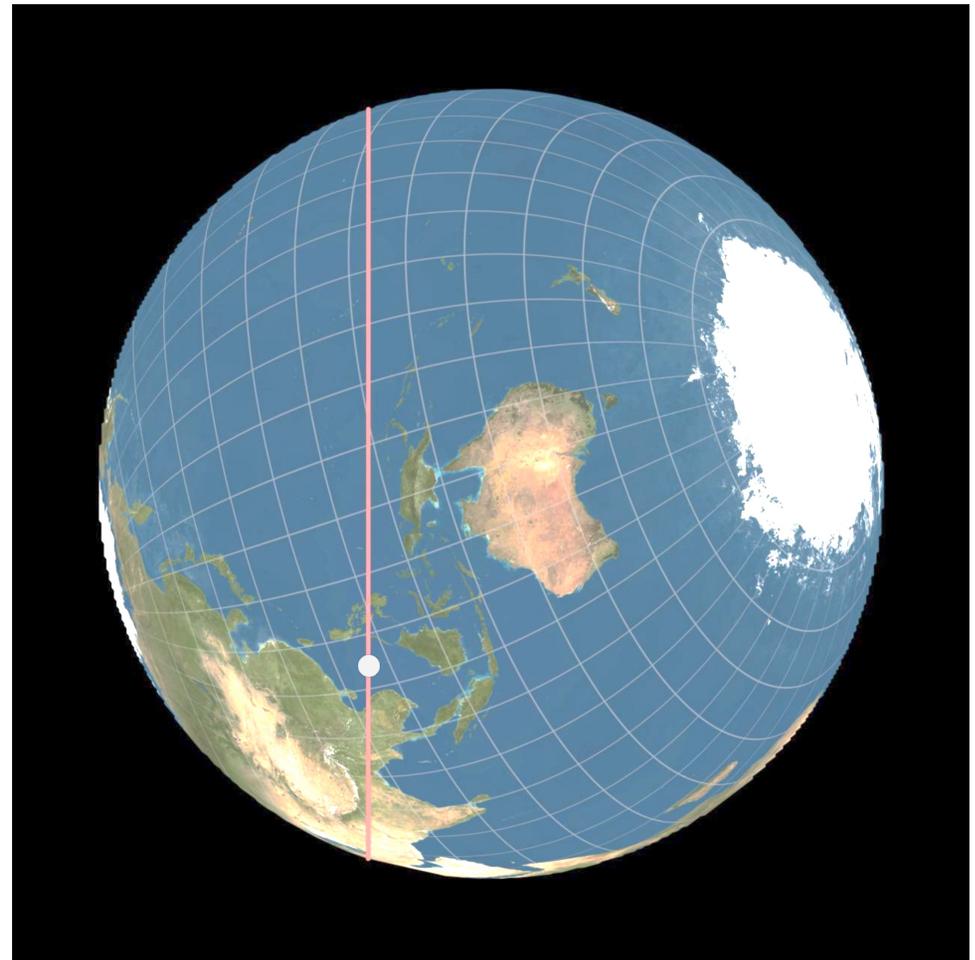
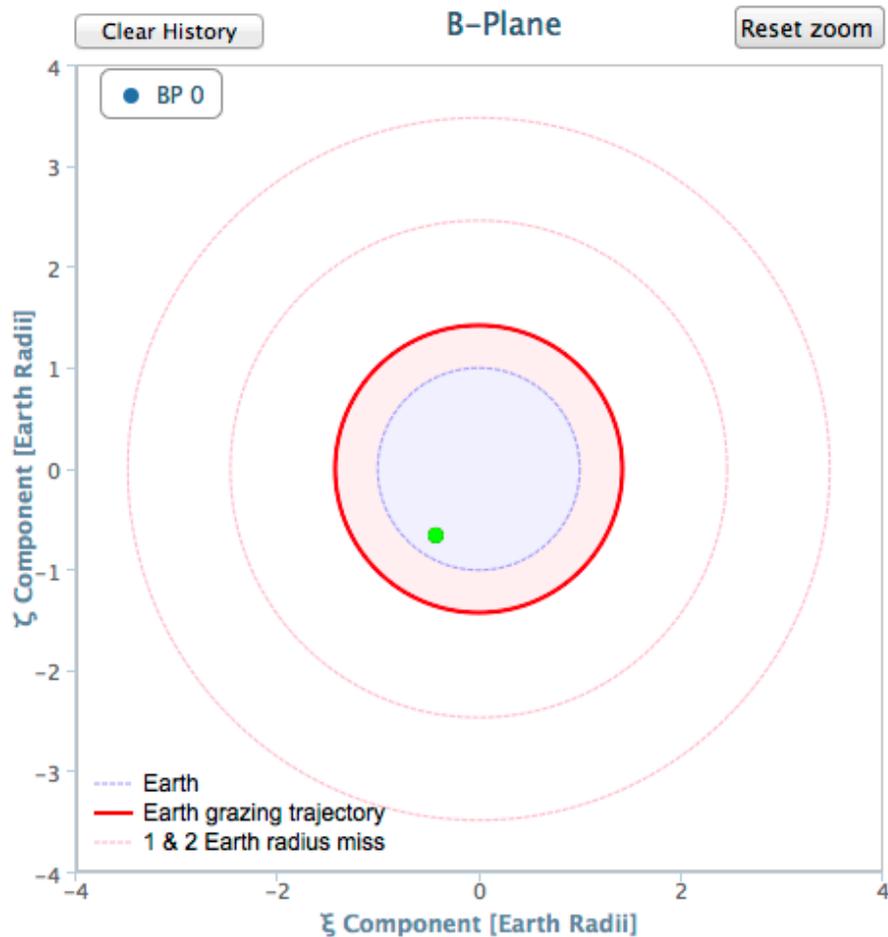
- Save Current Session
- Restore Session
- Deflection Map

B-Plane



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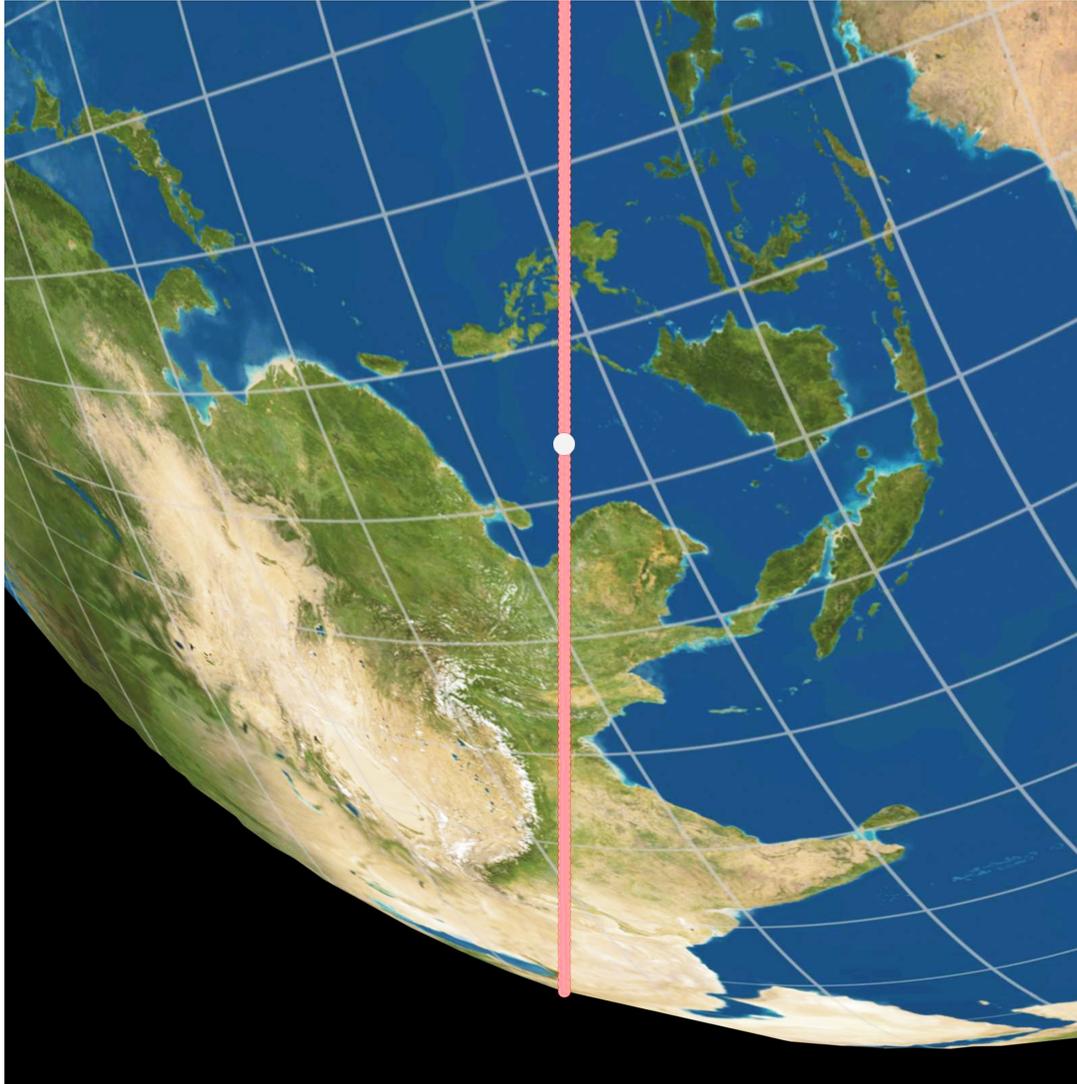
# Updated Nominal Impact Trajectory



For object diam: 0.25 km, density: 1.5 g/cc, Beta: 1, deflect 913 days before impact, flight time 198 days, launch vehicle: Delta IV-H, **3 or 4 launches required**  
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# Close-up of Risk Corridor in B-Plane

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