

IAWN Media Workshop

14 November 2011

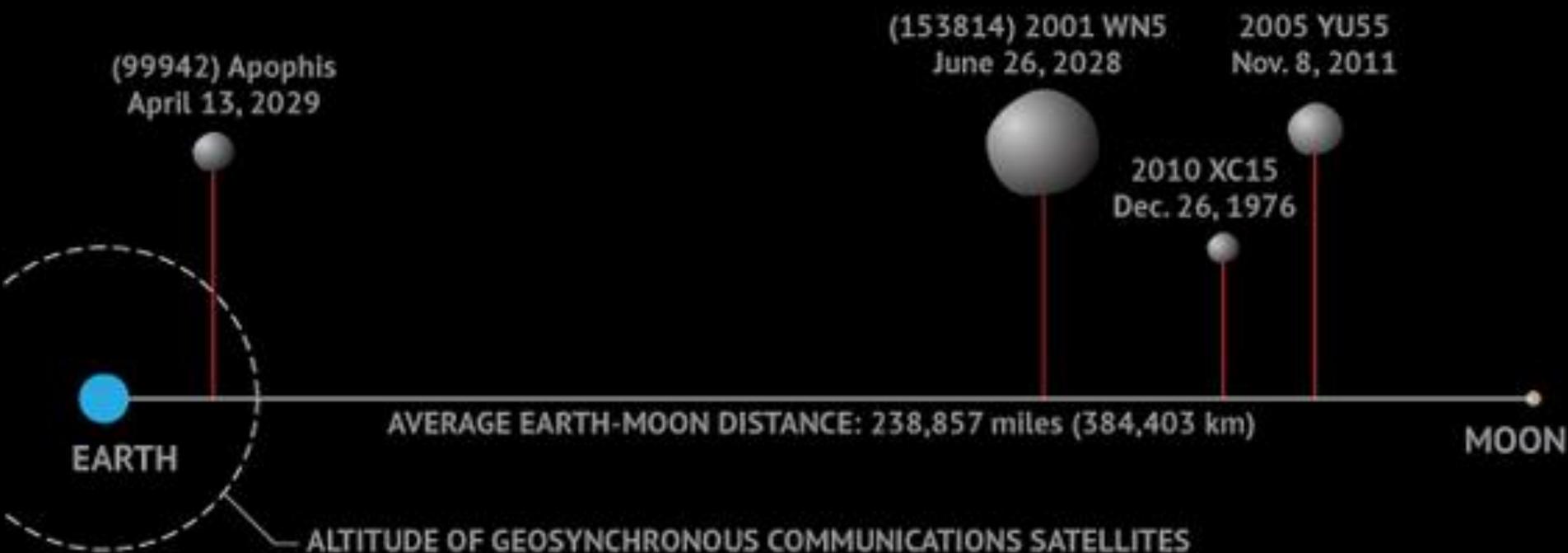
NEO Threat Update & Scenarios for Discussion

**Rusty Schweickart
B612 Foundation
Association of Space Explorers**

Asteroid discoveries, 1980-2011

Famous Flybys of Near-Earth Objects

The designations of various asteroids and their date of closest approach to the Earth. Asteroids are shown to scale with each other but are greatly magnified compared to the Earth and Moon.



SOURCES: NASA, JET PROPULSION LABORATORY

KARL TATE / © SPACE.com

Earth motion

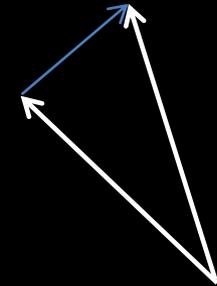
Asteroid motion

Sun

Moon

Earth

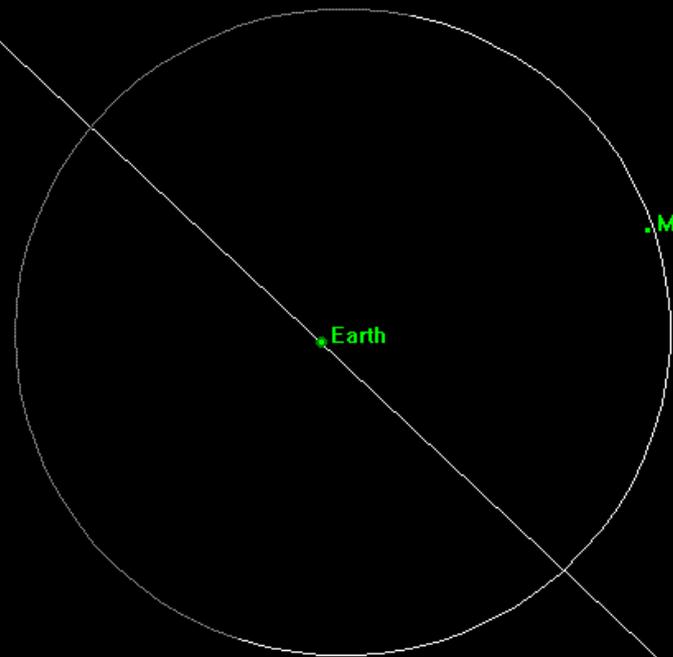
2005 YU55



2011 Nov 8.438



. 2005 YU55



2005 YU55 (JPL s60)

Primary source: neo.jpl.nasa.gov/risks

374 NEAs: Last Updated Nov 10, 2011
 Sort by Palermo Scale (cum.) or by Object Designation

Recently Observed Objects
 (within past 60 days)

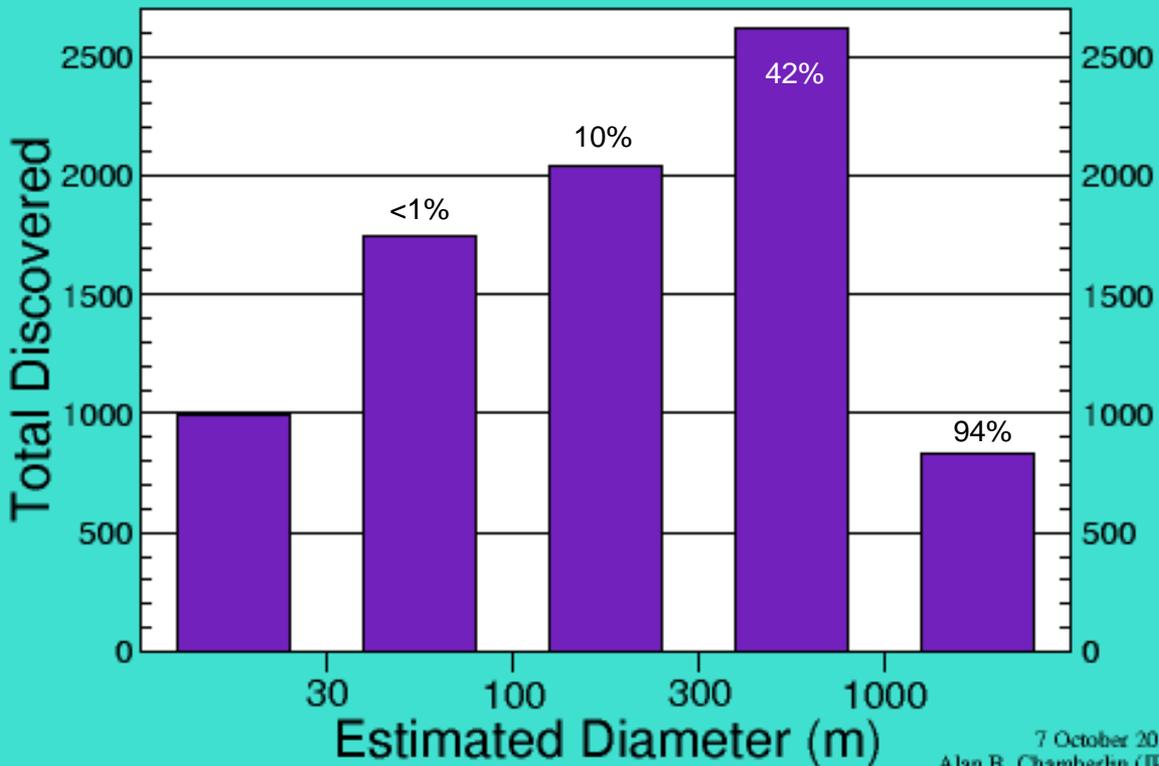
Object Designation	Year Range	Potential Impacts	Impact Prob. (cum.)	V _{infinity} (km/s)	H (mag)	Est. Diam. (km)	Palermo Scale (cum.)	Palermo Scale (max.)	Torino Scale (max.)
2011 AG5	2040-2047	5	1.6e-03	9.55	21.9	0.140	-1.12	-1.12	1
2011 UW158	2108-2110	3	1.2e-05	6.10	19.5	0.430	-2.72	-2.73	0
2011 UZ255	2069-2072	2	1.6e-05	13.31	23.3	0.075	-4.01	-4.01	0
2011 PU1	2063-2106	17	1.9e-04	5.44	25.1	0.032	-4.09	-4.51	0
2011 UM169	2100-2107	19	5.4e-05	13.97	25.0	0.033	-4.49	-4.71	0
2011 UE305	2042-2109	6	3.7e-07	15.67	21.4	0.179	-4.58	-4.83	0

Objects Not Recently Observed

Object Designation	Year Range	Potential Impacts	Impact Prob. (cum.)	V _{infinity} (km/s)	H (mag)	Est. Diam. (km)	Palermo Scale (cum.)	Palermo Scale (max.)	Torino Scale (max.)
101955 1999 RQ36	2169-2199	8	7.1e-04	6.36	20.7	0.560	-1.12	-1.52	n/a
2007 VK184	2048-2057	4	5.7e-04	15.63	22.0	0.130	-1.56	-1.57	1
2009 FD	2185-2190	2	1.9e-03	15.87	22.1	0.130	-1.76	-1.80	n/a
1994 WR12	2054-2109	129	9.4e-05	9.83	22.1	0.130	-2.83	-3.72	0
2011 BT15	2074-2109	45	7.9e-05	6.90	21.7	0.150	-2.88	-3.58	0
1979 XB	2056-2102	3	3.8e-07	24.35	18.5	0.681	-2.94	-3.01	0
99942 Apophis (2004 MN4)	2036-2103	6	7.4e-06	5.87	19.7	0.270	-2.97	-3.08	0
2008 CK70	2030-2030	1	3.7e-04	15.29	25.2	0.031	-2.99	-2.99	0

Near-Earth Asteroids

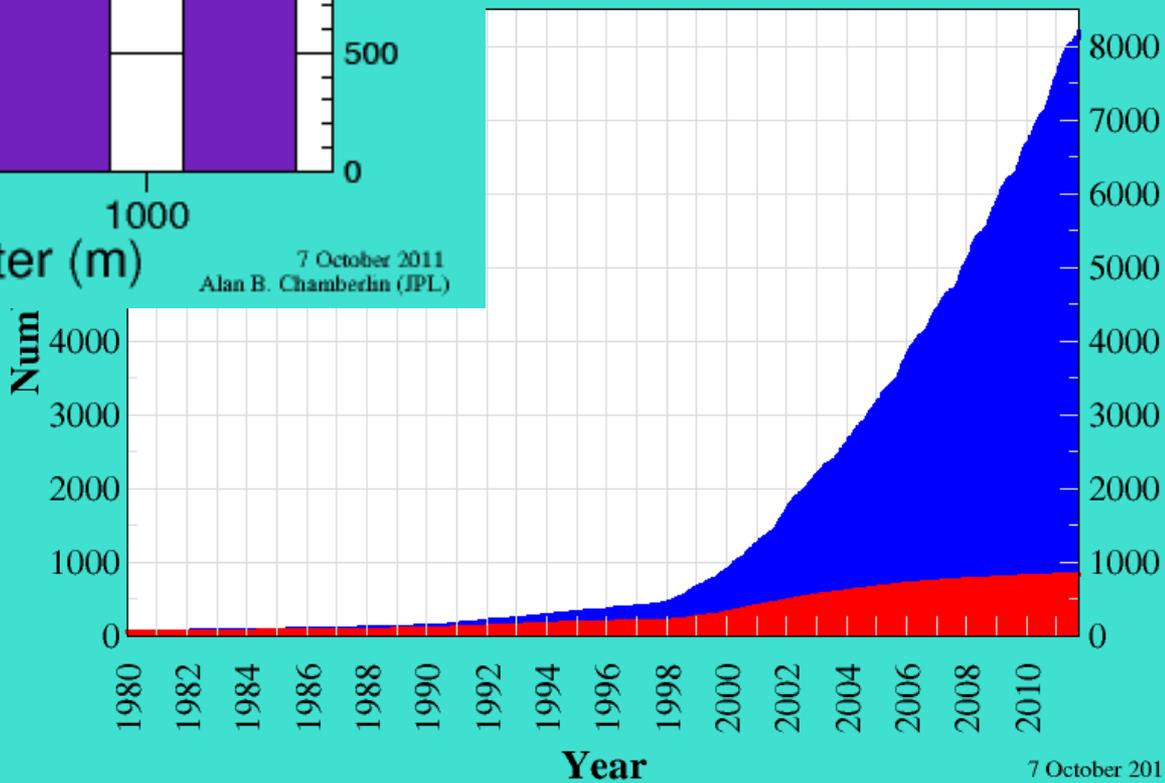
Total Discovered per Size Bin



7 October 2011
Alan B. Chamberlin (JPL)

Near-Earth Asteroids

Jan through 2011-Aug



7 October 2011
Alan B. Chamberlin (JPL)

Impact Energy, MT

10^{-1}

10^2

10^5

10^8

Impact Energy, MT

10^{-1}

10^2

10^5

10^8

$N(<H)$

$N(<H)$

10^{10}

10^8

10^6

10^4

10^2

10^0

10^0

10^2

10^4

10^6

10^8

Tunguska

K-T Impactor

Impact Interval, years

Diameter, Km

Diameter, Km

0.01

0.1

1

10

Scenarios for Discussion

Asteroid impact warnings will come in two categories

- last minute warnings (evacuate)
- long term predictions (deflect)

Let's talk last minute warning

Impact trajectory of 2008 TC3

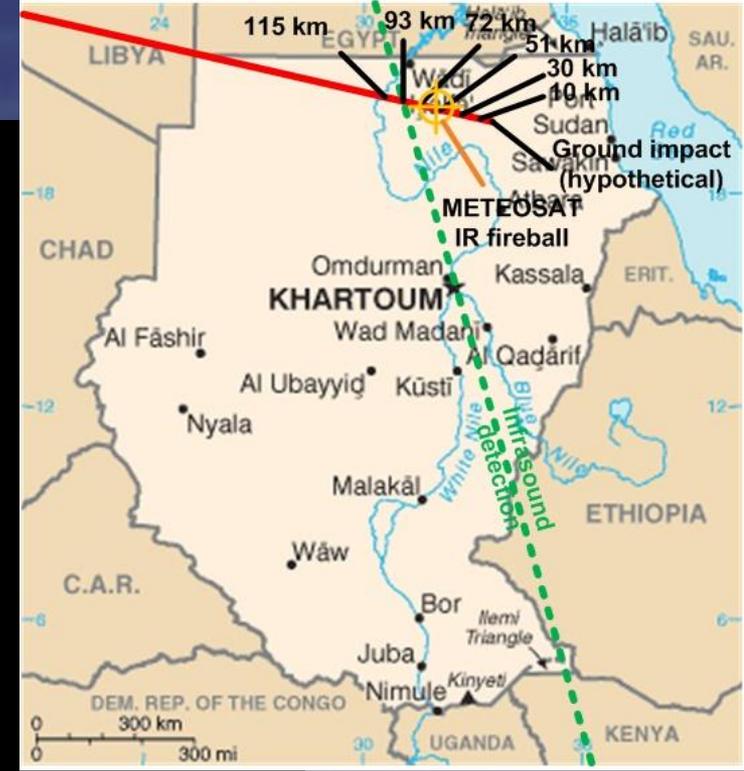


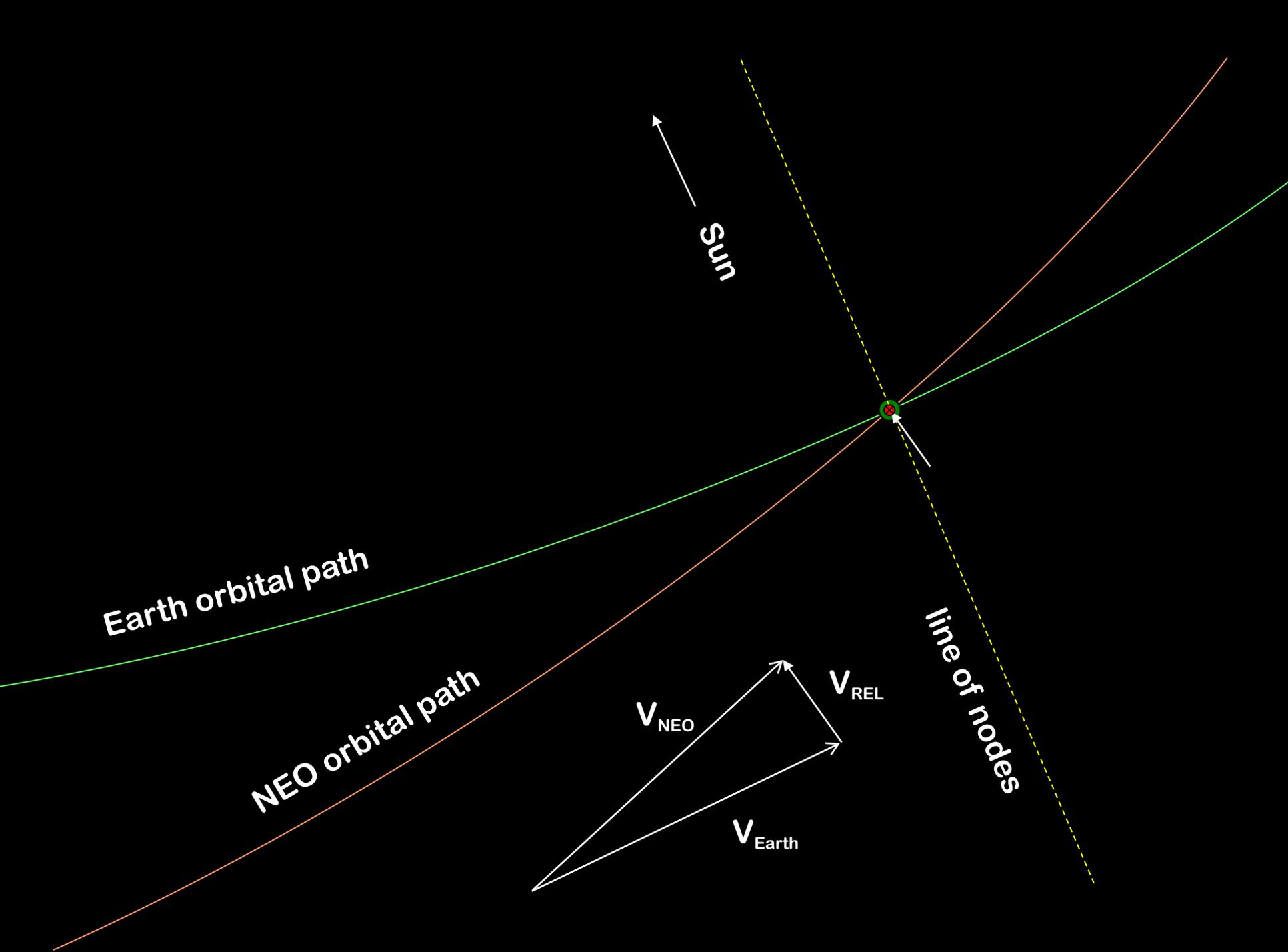
1:00 UT

2:00 UT



to Sun





ATLAS

Last Minute Warning

John Tonry, PI

100 km



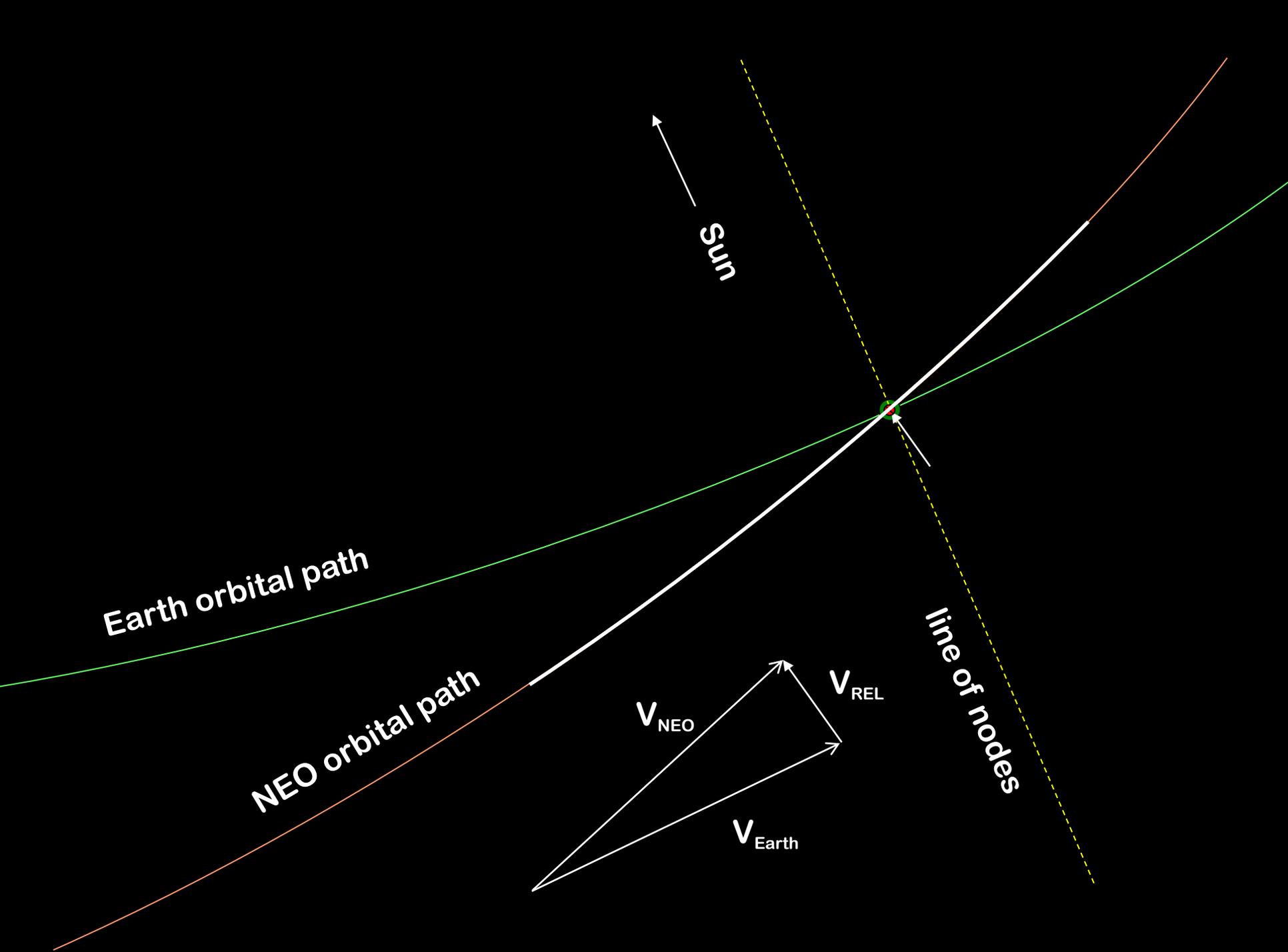
Scenarios for Discussion

Asteroid impact warnings will come in two categories

- last minute warnings (evacuate)
- long term predictions (deflect)

Let's talk long term predictions

- direct impacts
- keyhole "impacts"

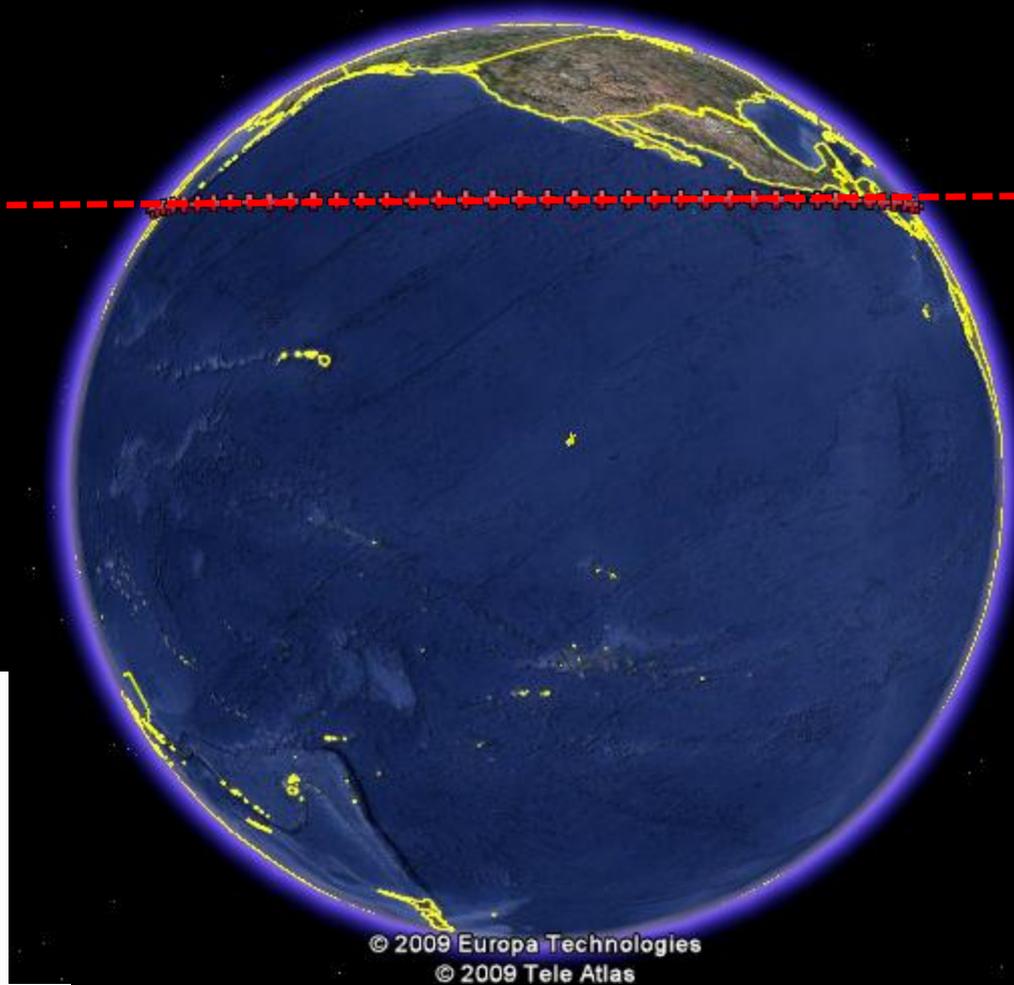


Apophis

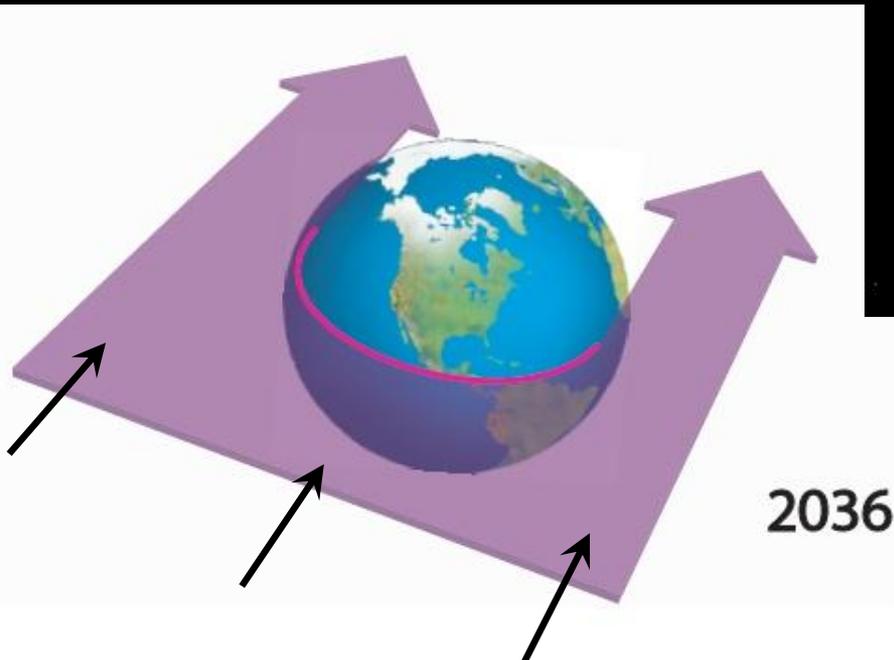
potential impact

Sunday, 13 April 2036

~21:00 UT



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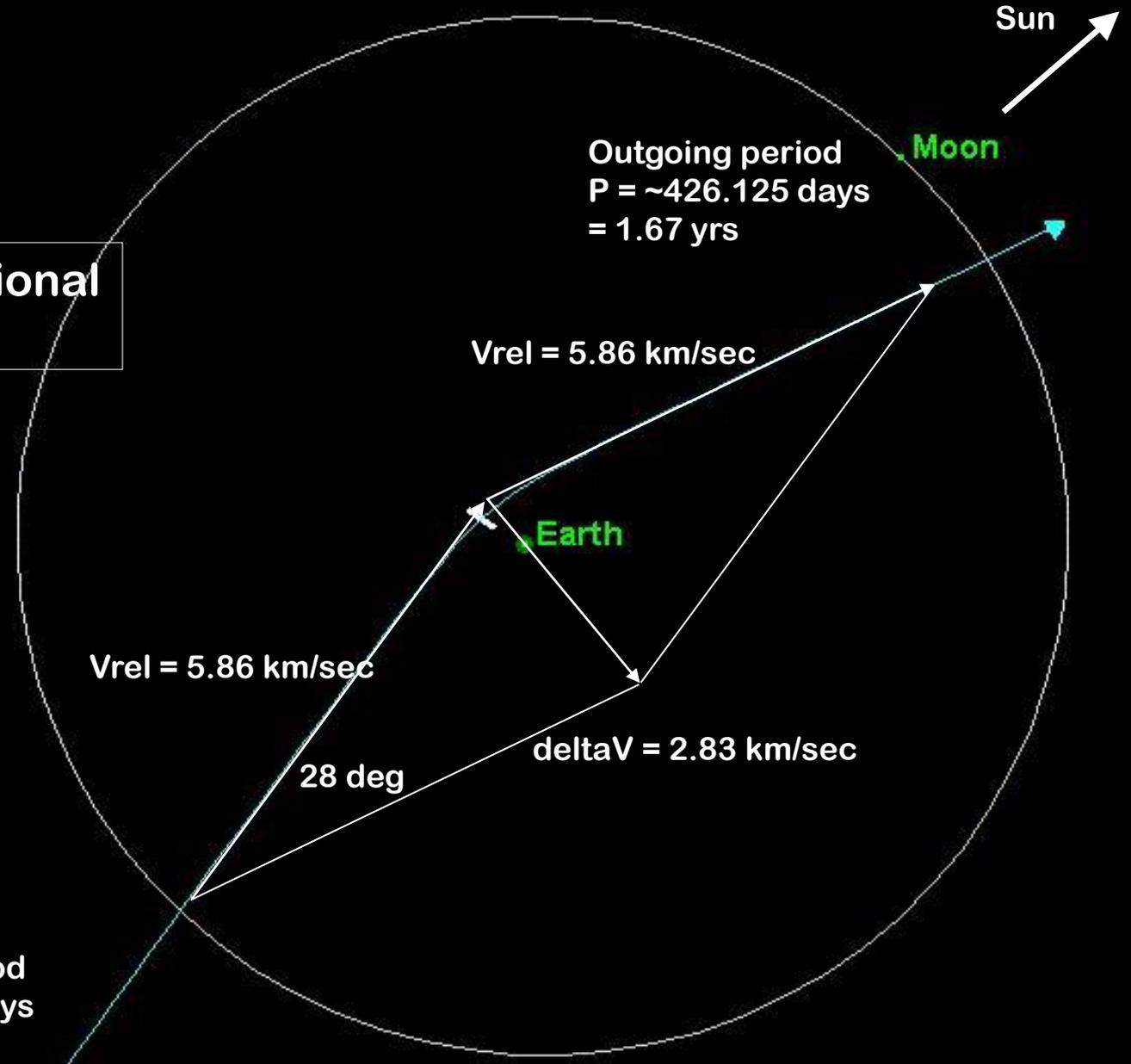


2036

cge – close gravitational encounter

Apophis
close encounter
geometry
Friday, 13 April 2029
~21:00 UT

Incoming period
 $P = 323.588$ days
 $= 0.886$ yrs

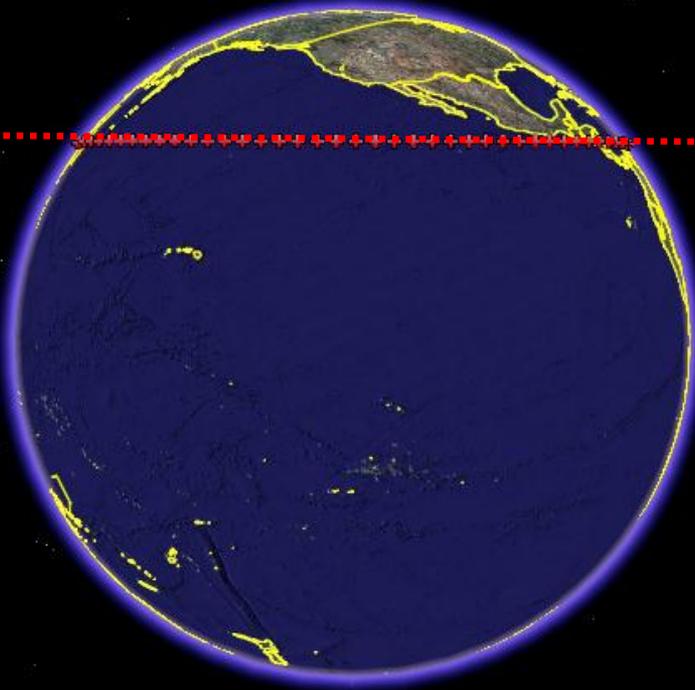


Both strength AND precision are needed for a successful deflection campaign

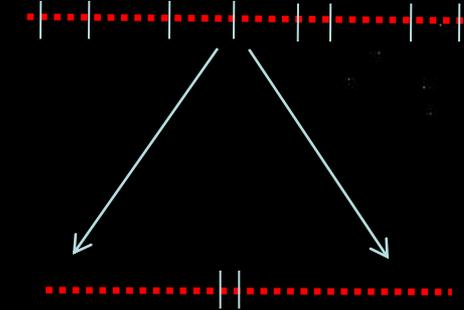
Total impulse required
7.5e7 newton seconds
5136 kilometers



Primary Deflection =
Miss the Earth



Shepherding =
Guide between keyholes



Total impulse required
1e4 newton seconds
0.6 kilometers



12,840 kilometers





ASTEROID THREATS

A call for global response

A proposal for an international decision-making program to protect our planet from Near Earth Object impacts.

Dealing with the Impact Hazard

Toward a Decision-Making Program for Asteroid Threats

Recommendations on a Decision-Making Program for a Global Response to Asteroid Threats

September 25, 2008



Association of Space Explorers

What?

Developed and published by the ASE and its Panel on Asteroid Threat Mitigation

Submitted to UNCOPILOG via Action Team-14 (NEO) for introduction at COPUOS 06

The report calls for the formulation of a standing international decision-process for timely detection/assessment actions in impact threatening NEOs

Humanity sees "the Earth now as it truly is, bright and blue and beautiful in that eternal silence where it floats," ...



... "men as riders on the Earth together, on that bright loveliness in the eternal cold, brothers who know now they are truly brothers."

The End

Discussion/Q&A