International Asteroid Warning Network (IAWN)
Status Report to STSC 2017

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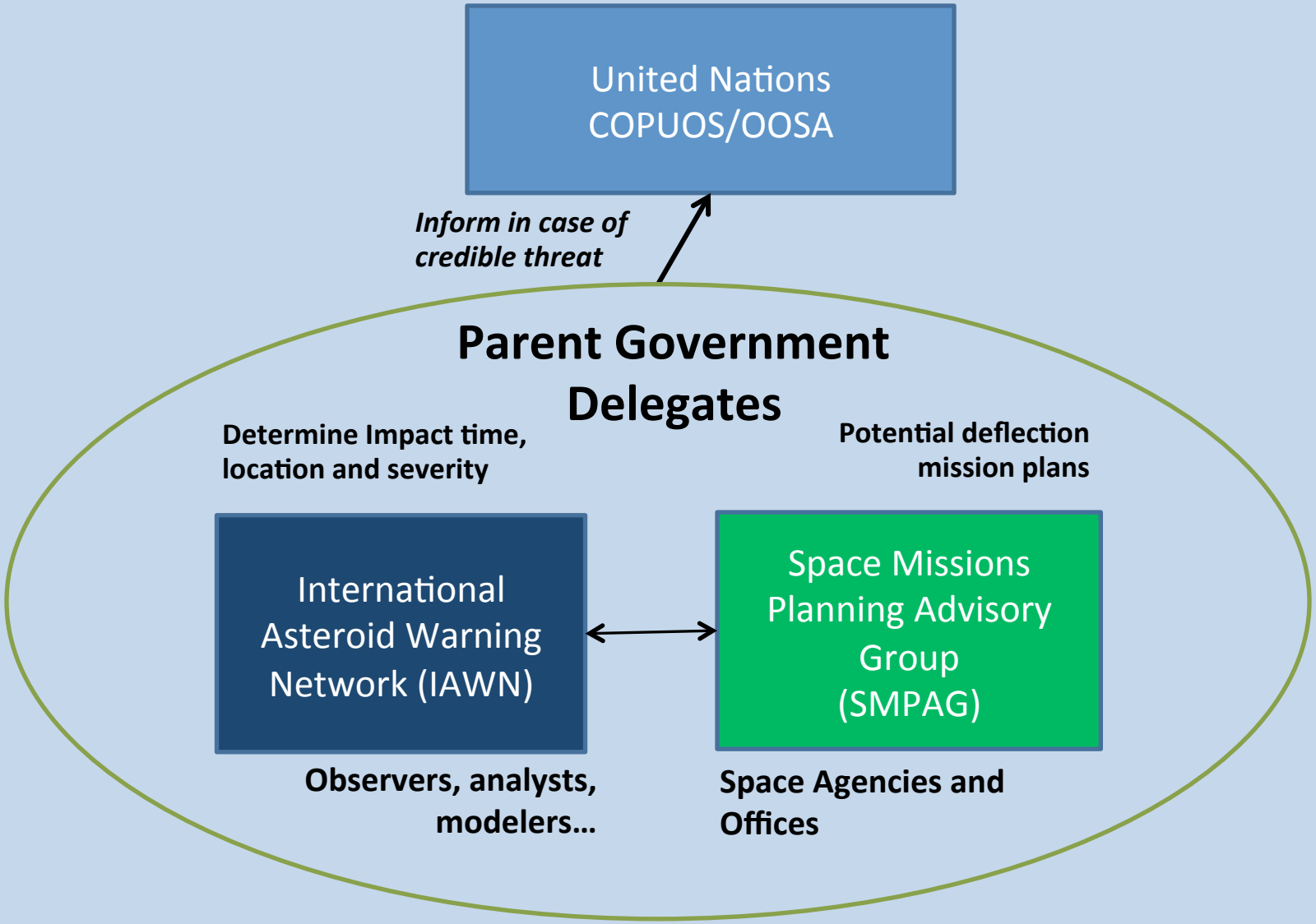
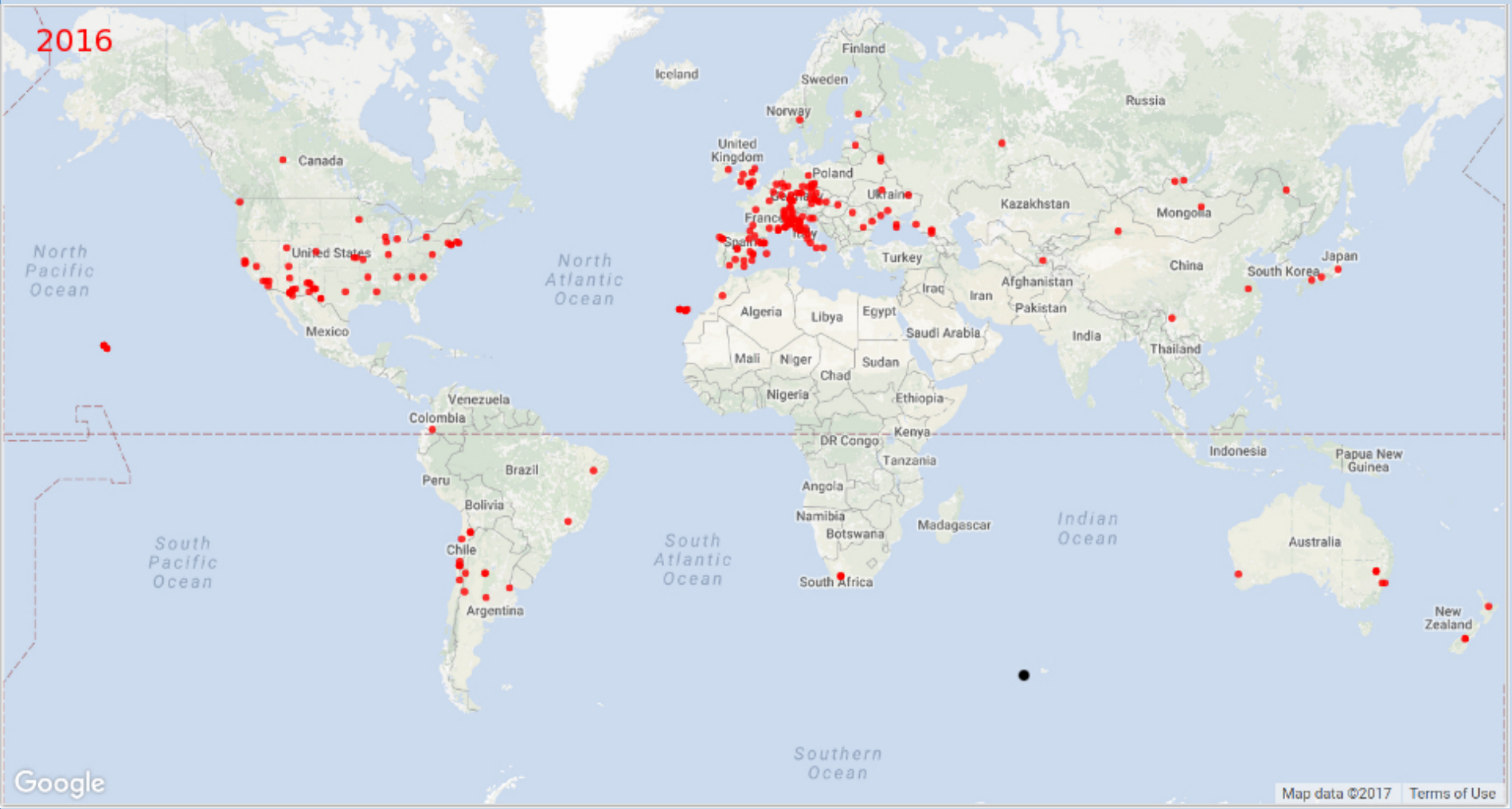
UN Office of Outer Space Affairs
Committee on Peaceful Uses of Outer Space

Overview for NEO Threat Response

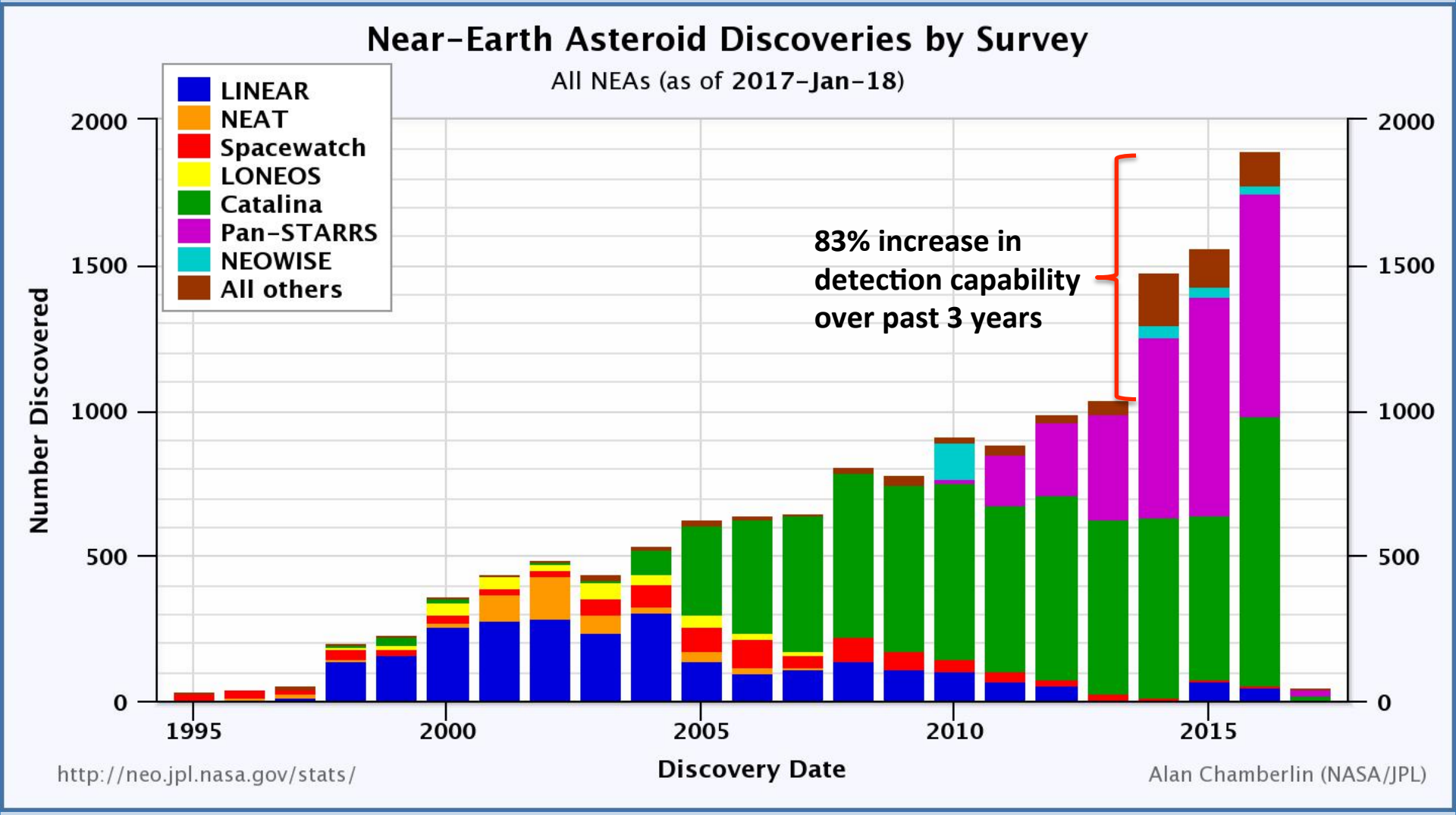


Worldwide Observing Network

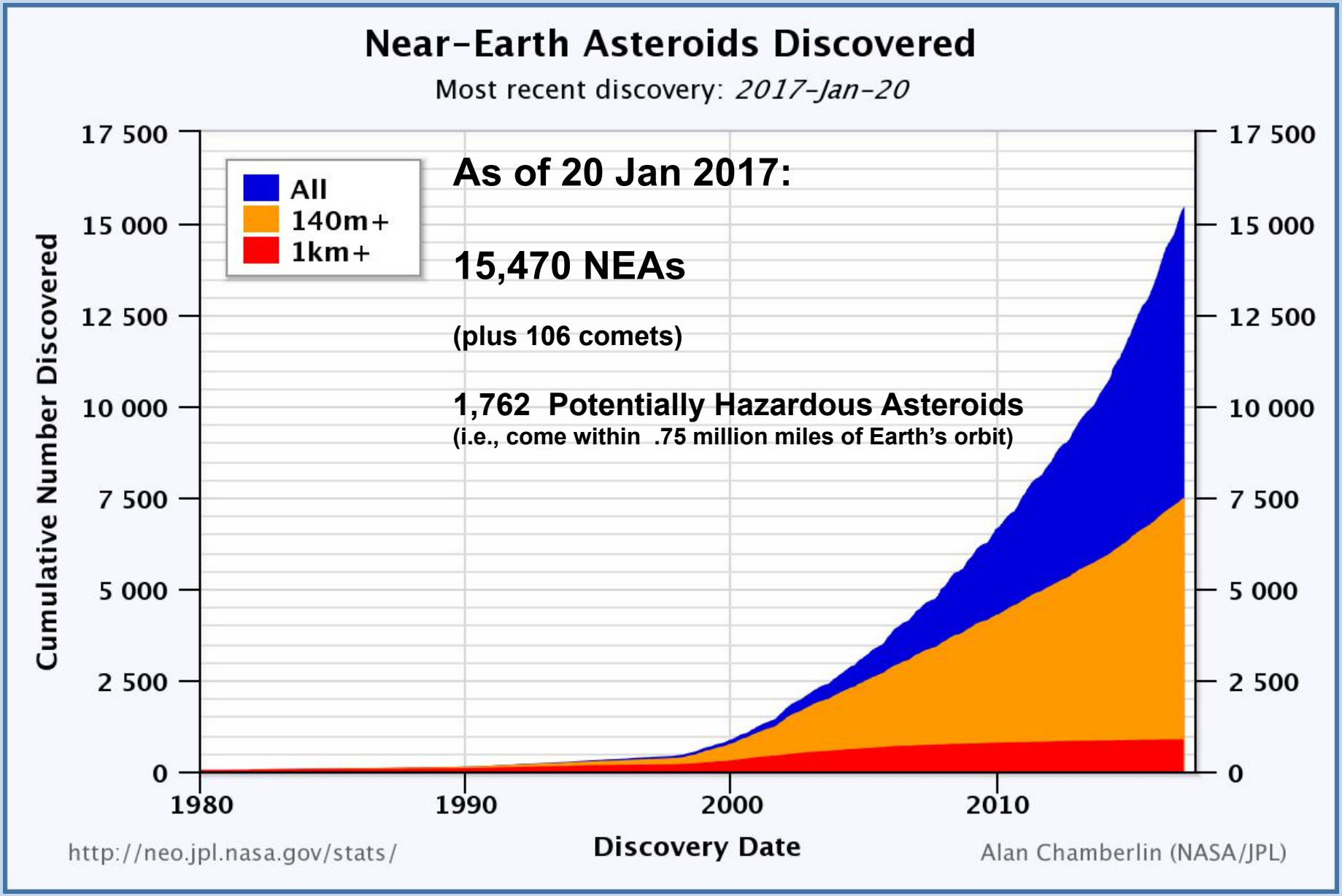


Received ~18.6 million (1.7 million NEO) observations from 76 (36 NEO) countries in 2016 (and one in space!)

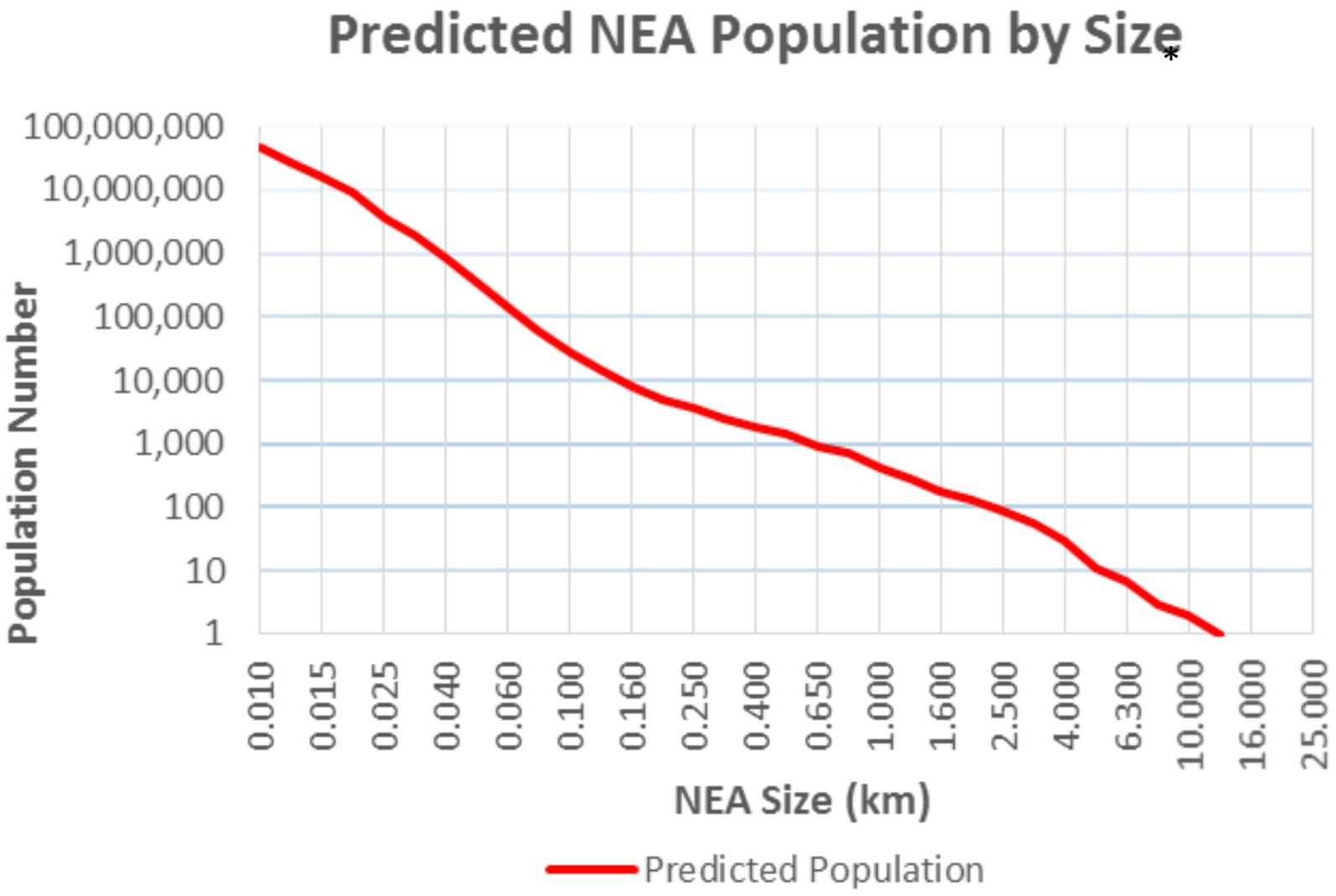
Growth in Capability



Known Near-Earth Asteroid Population

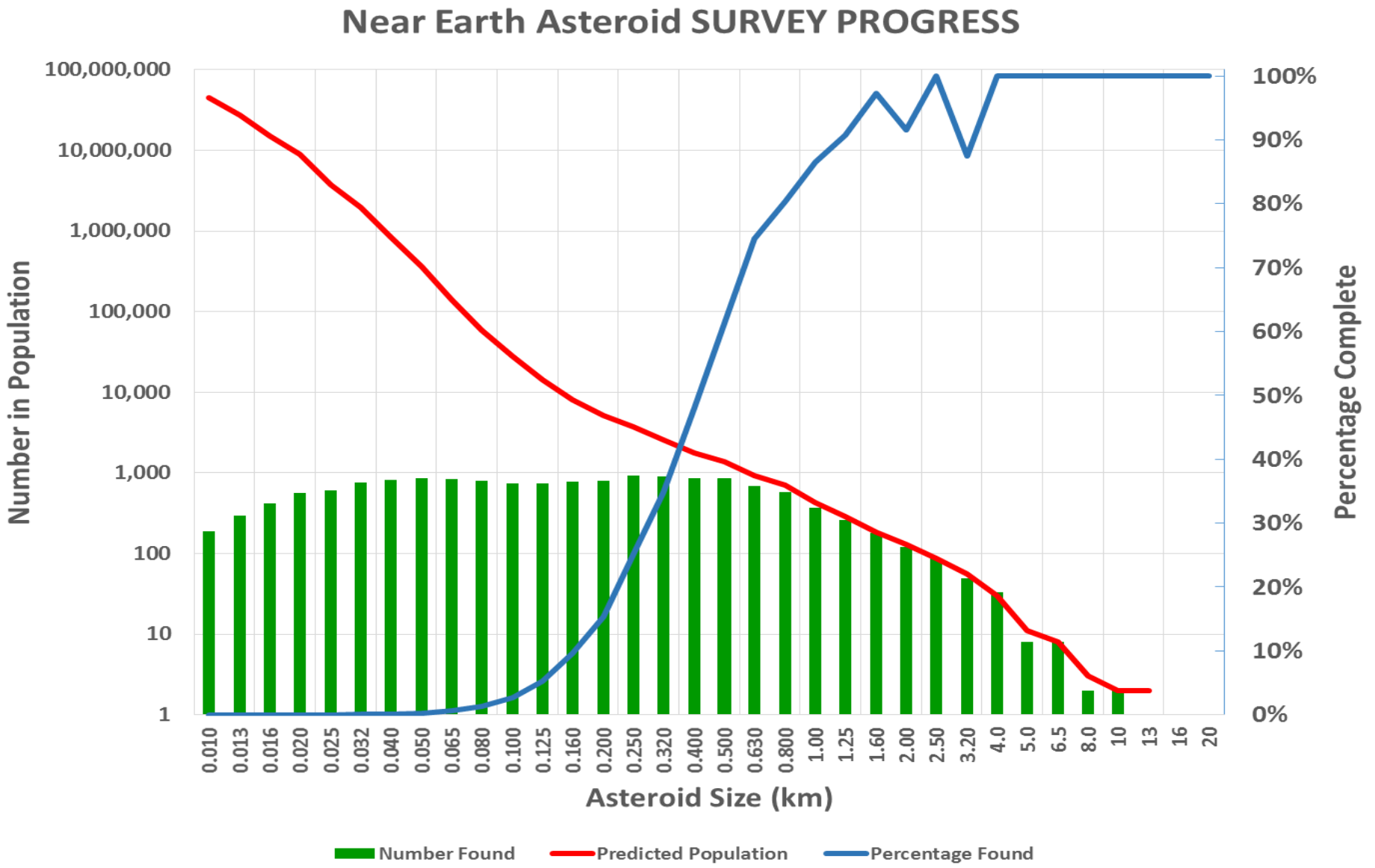


Near-Earth Asteroid Survey Status

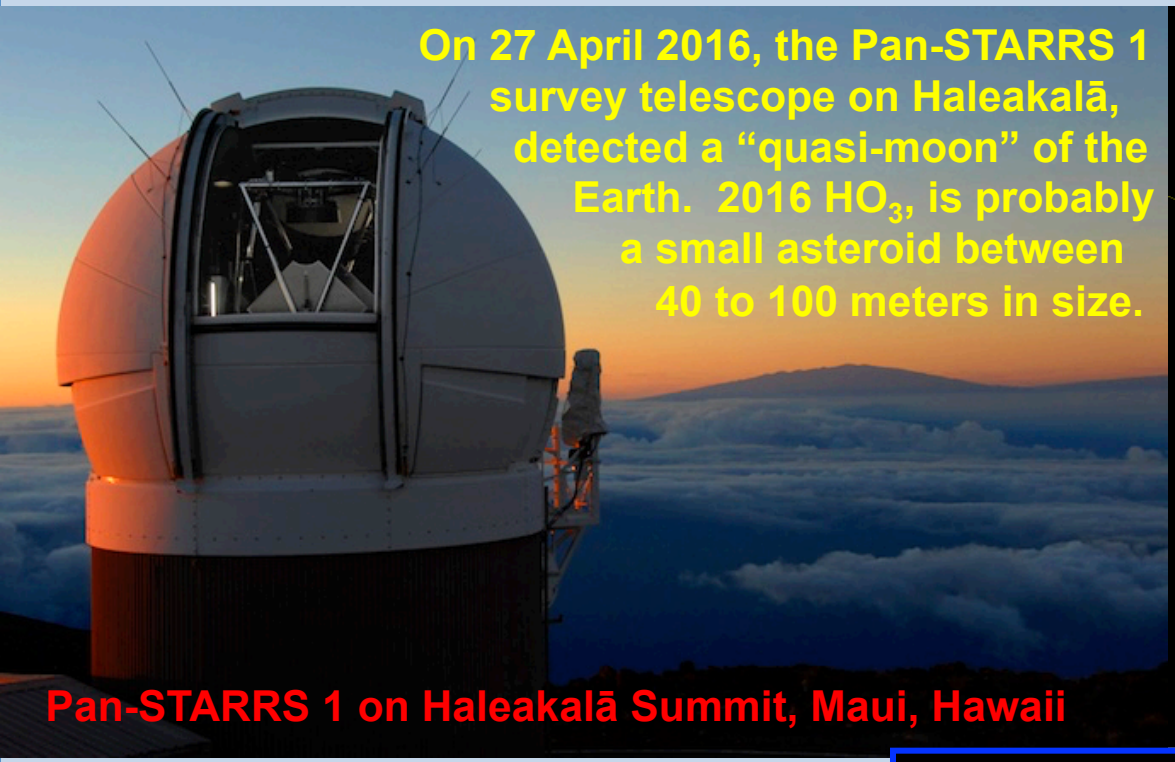


*Harris & D'Abramo, "The population of near-Earth asteroids", *Icarus* **257** (2015) 302–312, http://dx.doi.org/10.1016/j.icarus.2015.05.004

Near-Earth Asteroid Survey Status

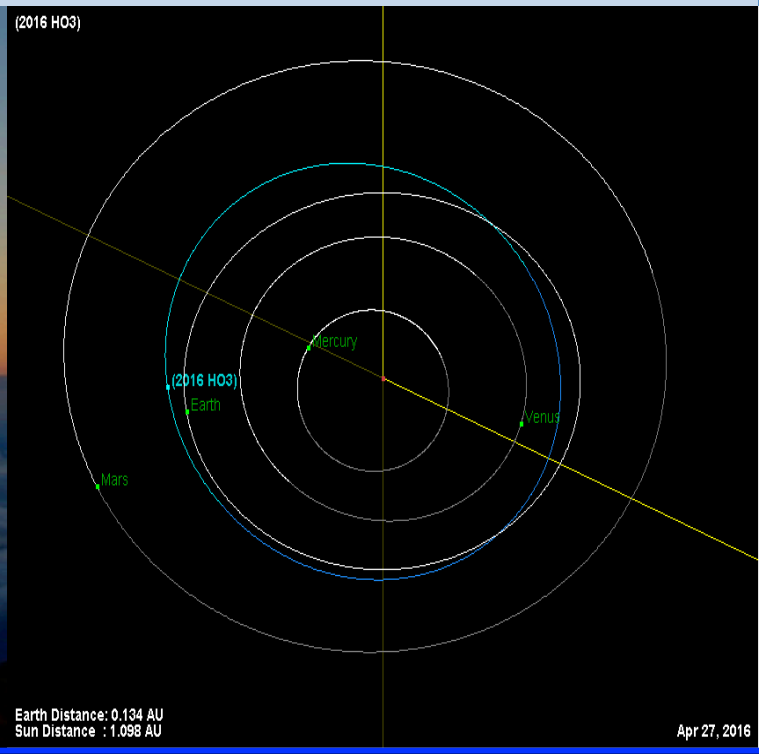


Discovery of 2016 HO_3: Earth's Quasi-Moon

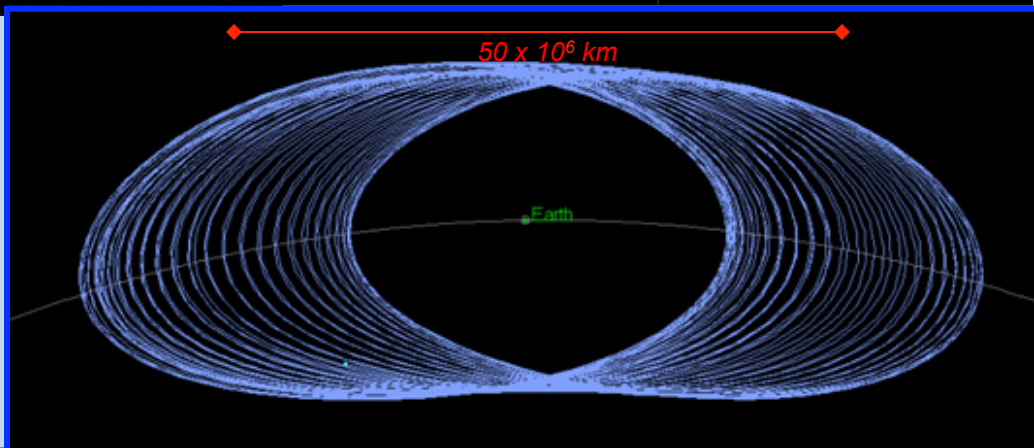


On 27 April 2016, the Pan-STARRS 1 survey telescope on Haleakalā, detected a "quasi-moon" of the Earth. 2016 HO_3, is probably a small asteroid between 40 to 100 meters in size.

Pan-STARRS 1 on Haleakalā Summit, Maui, Hawaii



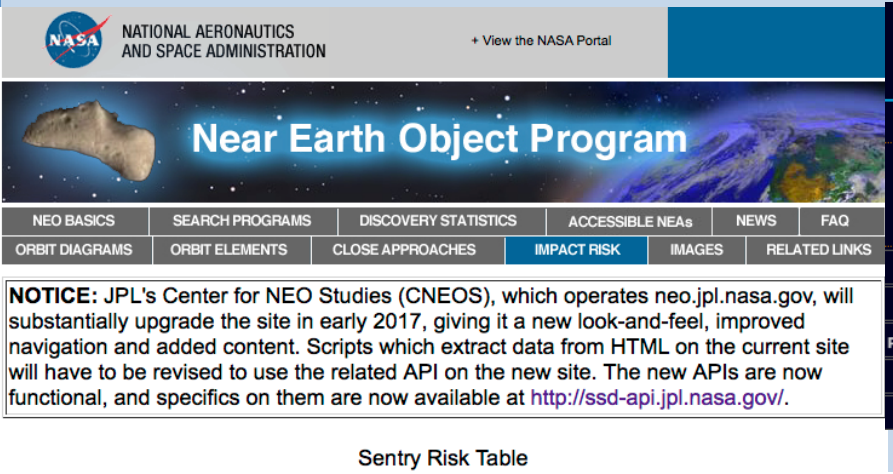
A distant but, constant companion of the Earth, this plot of the 2016 HO_3 over 60 years (1960-2020) shows its librating orbit relative to the Earth. (Shown here in a rotating frame centered on the Earth and projected onto the ecliptic plane.) 2016 HO_3 never approaches closer than 14 million km nor ventures further than 40 million km away.



IAWN Functions

- ✓ (a) To discover, monitor, and physically characterize the potentially hazardous NEO population using optical and radar facilities and other assets based in both the northern and southern hemispheres and in space;
- ✓ (b) To provide and maintain an internationally recognized clearing house function for the receipt, acknowledgement and processing of all NEO observations;
- ✓ (c) To act as a global portal, serving as the international focal point for accurate and validated information on the NEO population;
- ✓ (d) To coordinate campaigns for the observation of potentially hazardous objects;
- ✓ (e) To recommend policies regarding criteria and thresholds for notification of an emerging impact threat;
- ❑ (f) To develop a database of potential impact consequences, depending on geography, geology, population distribution and other related factors;
- ❑ (g) To assess hazard analysis results and communicate them to entities that should be identified by Member States as being responsible for the receipt of notification of an impact threat in accordance with established policies;
- ❑ (h) To assist Governments in the analysis of impact consequences and in the planning of mitigation responses.

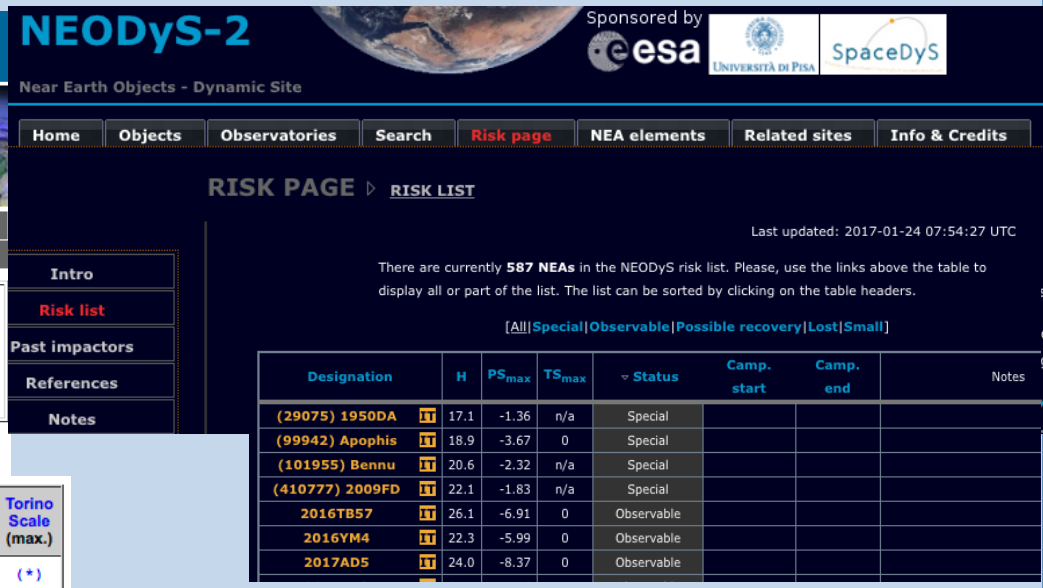
Orbit Prediction & Assessment of Impact Risk



Sentry Risk Table

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.)
29075 (1950 DA)	2880-2880	1	1.2e-04	14.10	17.6	1.300	-1.42	-1.42	(*)
101955 Bennu (1999 RQ36)	2175-2199	78	3.7e-04	5.99	20.2	0.490	-1.71	-2.32	(*)
410777 (2009 FD)	2185-2198	7	1.6e-03	15.87	22.1	0.160	-1.78	-1.83	(*)
1979 XB	2056-2113	5	9.9e-07	23.63	18.6	0.657	-2.75	-3.07	0
99942 Apophis (2004 MN4)	2060-2105	12	8.9e-06	5.85	19.1	0.370	-2.83	-2.93	0
2000 SG344	2069-2113	104	2.2e-03	1.36	24.8	0.037	-2.93	-3.26	0
2016 NL56	2019-2116	225	1.3e-06	13.07	21.4	0.188	-3.04	-3.37	0
2007 FT3	2019-2114	138	1.1e-06	17.05	20.0	0.340	-3.08	-3.67	0
2010 RF12	2095-2115	52	6.5e-02	5.10	28.4	0.007	-3.20	-3.20	0
2006 QV89	2019-2041	12	7.6e-05	5.16	25.3	0.030	-3.35	-3.35	0
2009 JF1	2022-2022	1	2.4e-04	23.92	27.1	0.013	-3.43	-3.43	0
2008 UV99	2019-2111	32	1.6e-07	15.60	19.6	0.399	-3.44	-3.55	0
2008 UB7	2049-2100	33	6.6e-05	18.47	23.9	0.057	-3.45	-3.76	0

http://neo.jpl.nasa.gov/



http://newton.dm.unipi.it/neodys/

Parallel Websites at ESA and NASA contain all known information on discovered NEOs

Signatories to IAWN

- KASI — Korean Astronomy Space Science Institute, Daejeon, South Korea
- INAOE - the National Institute of Astrophysics, Optics, and Electronics in Cholua, Mexico
- INASAN - the Institute of Astronomy, Russian Academy of Sciences, Moscow, Russia
- ESO - European Southern Observatory
- ESA – European Space Agency
- NASA – Includes Minor Planet Center, Center for NEO Studies, 4 major NEO search projects and x object characterization projects
- University of Nariño, Pasto, Colombia
- Peter Birtwhistle, amateur astronomer, West Berkshire, England

Planetary Defense Coordination Office

This office was established January 2016 at NASA HQ to coordinate planetary defense related activities across NASA, and coordinate both US interagency and international efforts and projects to address and plan response to the asteroid impact hazard.

Mission Statement:

To lead national and international efforts to:

- **Detect any potential for significant impact of planet Earth by natural objects**
- **Appraise the range of potential effects by any possible impact**
- **Develop strategies to mitigate impact effects on human welfare**

IAWN/SMPAG: Criteria/Thresholds for Impact Response Actions

- IAWN shall warn of predicted **impacts exceeding a probability of 1%** for all objects characterized to be **greater than 10 meters in size**, or roughly equivalent to **absolute magnitude of 28** if only brightness data can be collected.

- Terrestrial preparedness planning should begin when warned of a possible impact:
  - Predicted to be **within 20 years**,
  - Probability of impact is assessed to be **greater than 10%,** and
  - Object is characterized to be **greater than 20 meters in size**, or roughly equivalent to **absolute magnitude of 27** if only brightness data can be collected

- SMPAG should start mission option(s) planning when warned of a possible impact:
  - Predicted to be **within 50 years**,
  - Probability is assessed to be **greater than 1%,** and
  - Object is characterized to be **greater than 50 meters in size**, or roughly equivalent to **absolute magnitude of 26** if only brightness data can be collected.