

Near-Earth Object Observations Program Update

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Planetary Science Advisory Committee
March 1, 2021



Known Asteroid Close Approaches to Earth in 2020

107 known close approaches within 1 Lunar Distance

- **1** estimated to be as large as 200 meters in size
- **30** estimated to be as large as 20 meters in size or larger

7 close approaches within the distance of the
geosynchronous satellites

All close-approach data available at <https://cneos.jpl.nasa.gov/ca>

**2020 SO – Likely Centaur upper stage from 1966 Surveyor 2 launch,
temporarily captured from heliocentric orbit.**

**Orbit identification by Paul Chodas, Davide Farnocchia, and CNEOS
Spectroscopic confirmation of artificial nature by Vishnu Reddy (UA)**





International Asteroid Warning Network (IAWN) (99942) Apophis - 2021 Observing Campaign



- Utilizes this last opportunity for detailed observations of Apophis before its historic close approach in 2029 where it will come to within $\sim 40,000$ km of Earth and will be the first observed approach at such a close distance for such a large (~ 340 meter) asteroid
- Closest this apparition will be occurs on March 6, 2021 (CA dist ~ 0.11 AU).
- Campaign Page: <http://iawn.net/obscamp/Apophis/>

Campaign Coordinator: Vishnu Reddy
NASA HQ Lead: Mike Kelley

NEO Observations Program Status

March 19, 2020 – Peak of COVID-19 Impacts

NEO Data Processing (MPC, CNEOS)

NEO Survey

NEO Astrometric Follow-Up

NEO Radar (Goldstone, Arecibo)

NEO Characterization (IRTF)

NEO Observations Program Status

January 2021

NEO Data Processing (MPC, CNEOS)

NEO Survey

NEO Astrometric Follow-Up

NEO Radar* (Goldstone)

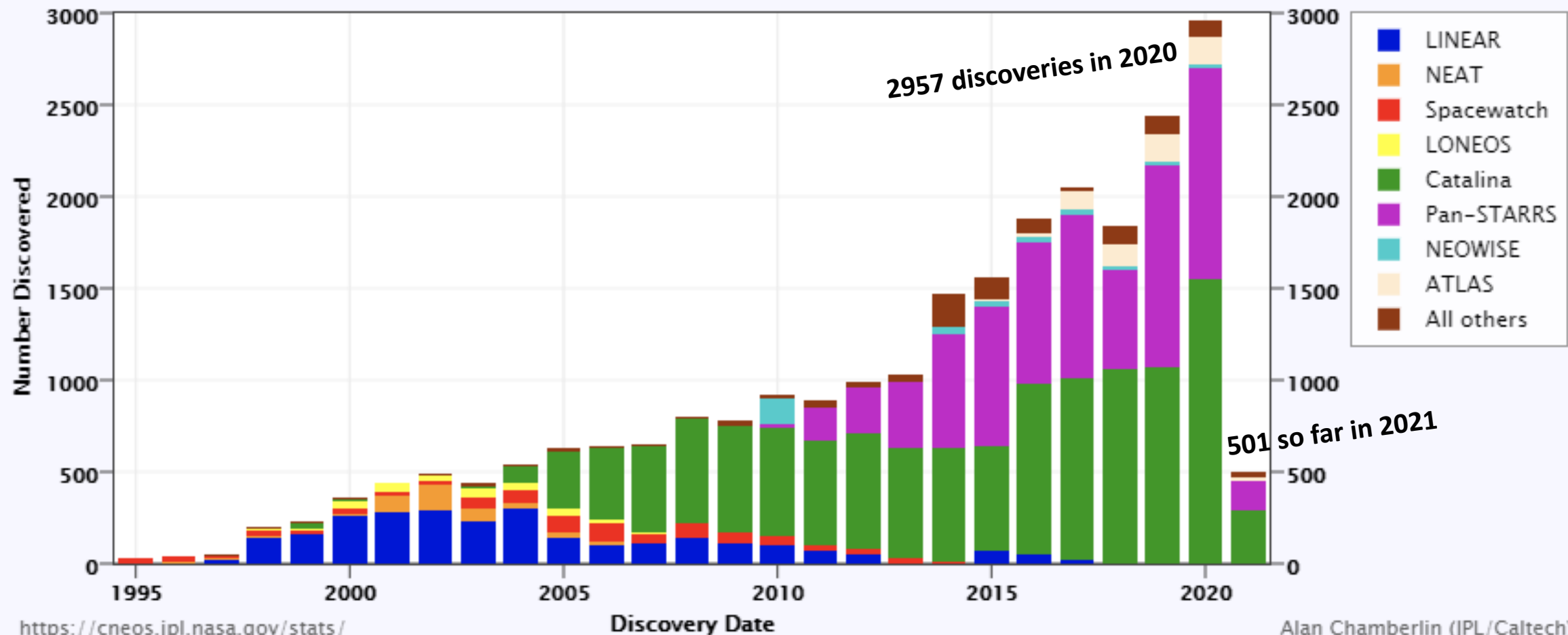
NEO Characterization (IRTF)

* Reduced range with loss of Arecibo Planetary Radar capability

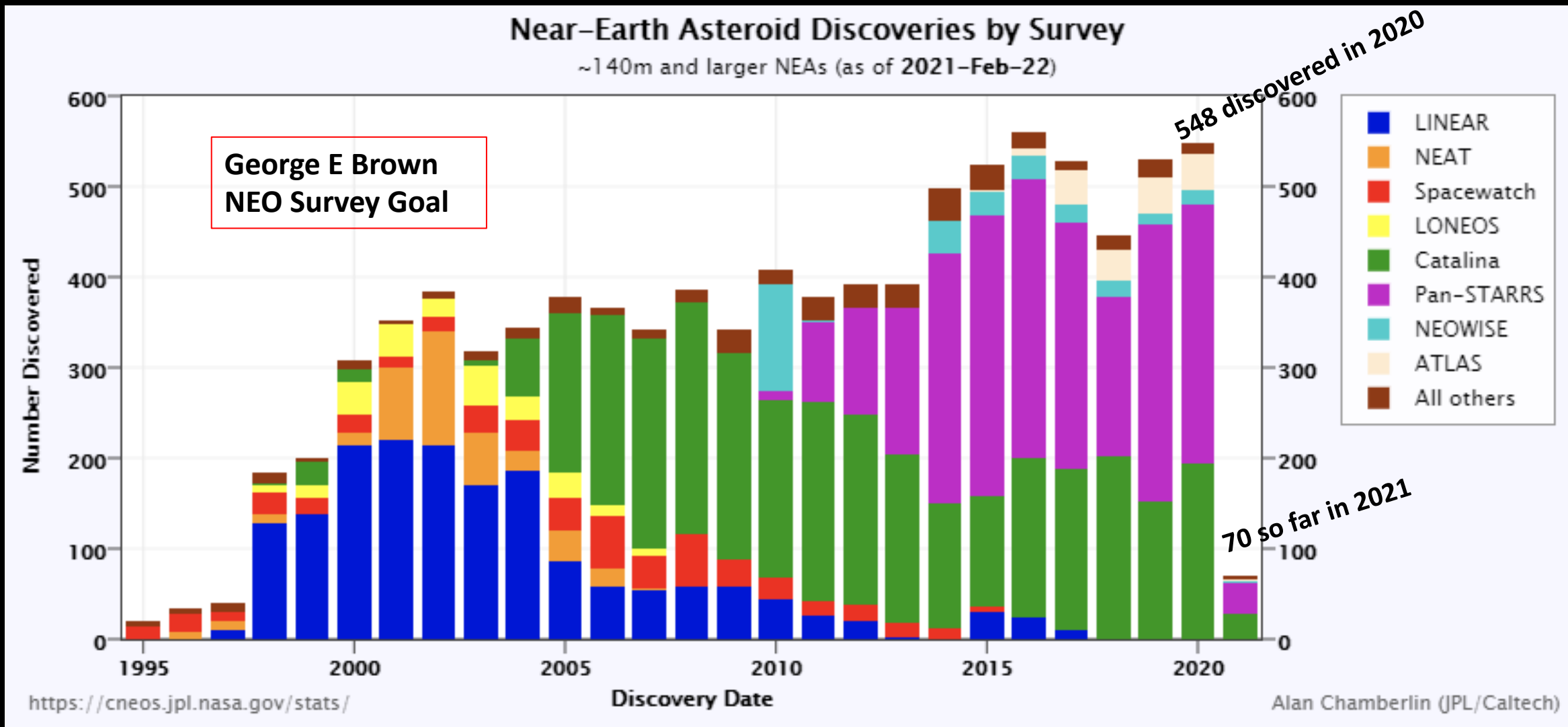
All Near-Earth Asteroids (NEAs)

Near-Earth Asteroid Discoveries by Survey

All NEAs (as of 2021-Feb-22)

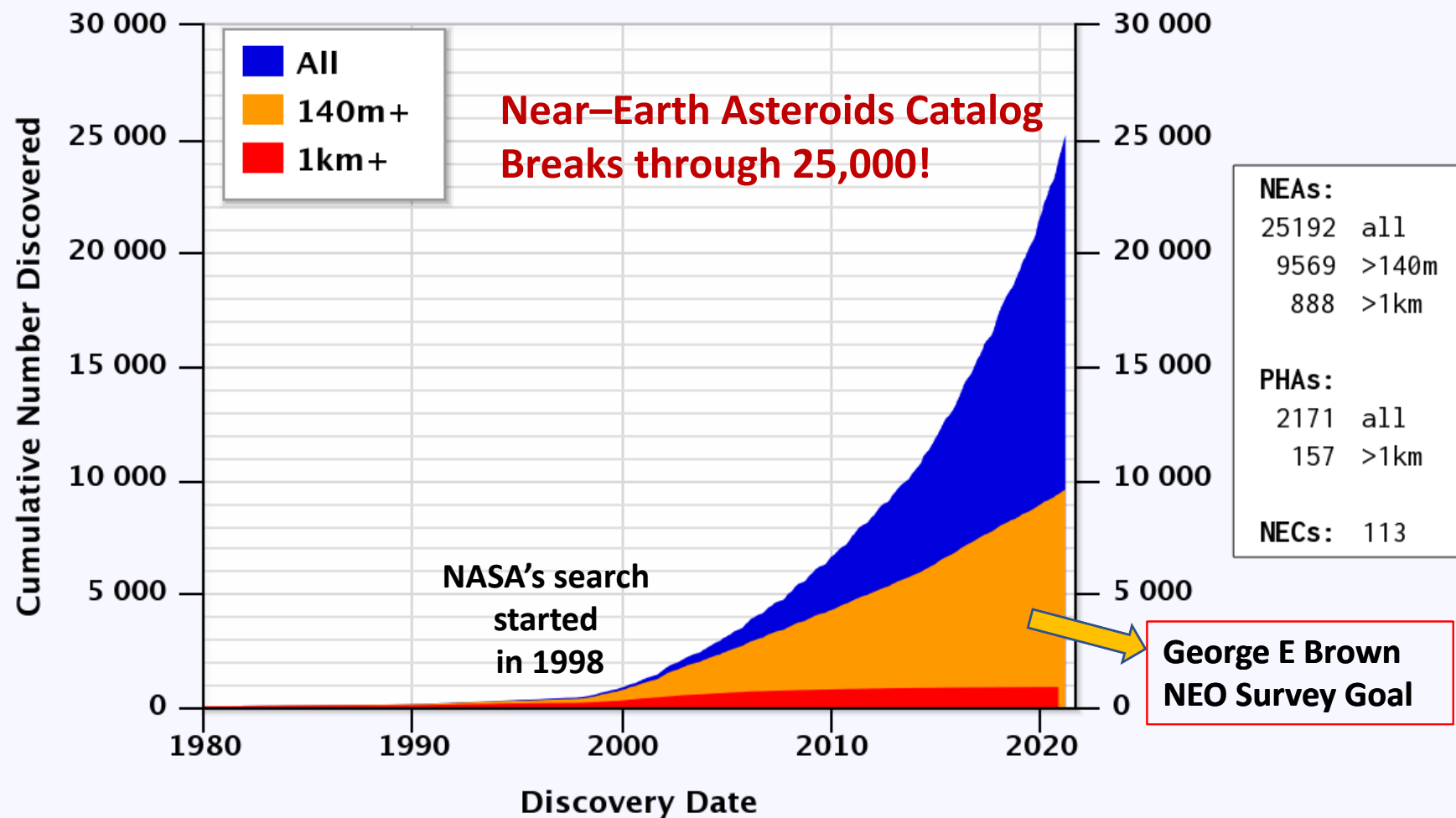


NEAs 140 Meters and Larger



Near-Earth Asteroids Discovered

Most recent discovery: 2021-Feb-22



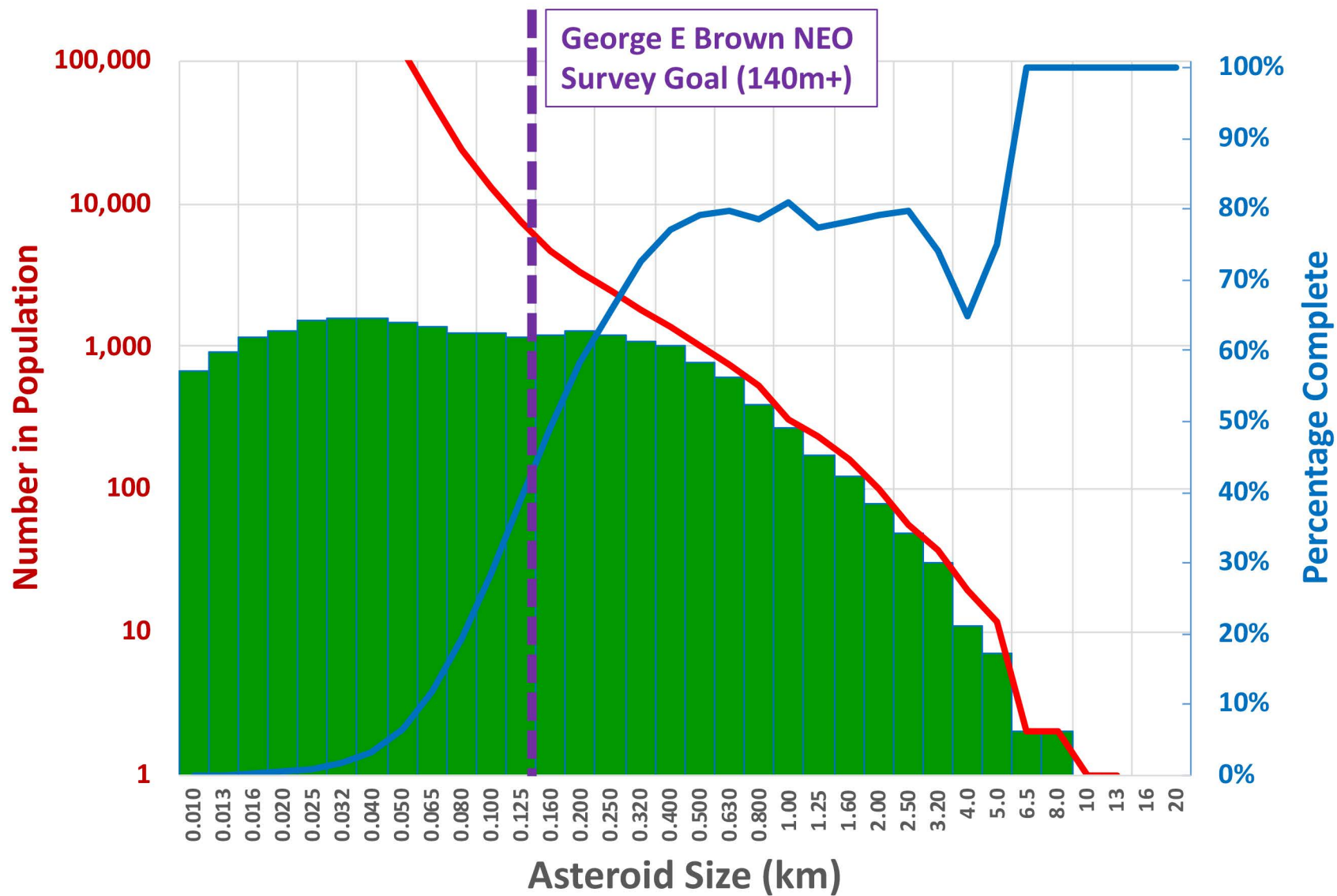
<https://cneos.jpl.nasa.gov/stats/>

Alan Chamberlin (JPL/Caltech)

*Potentially Hazardous Asteroids come within 7.5 million km of Earth orbit

nasa.gov/planetarydefense

Near Earth Asteroid Population and Survey Progress through 2020

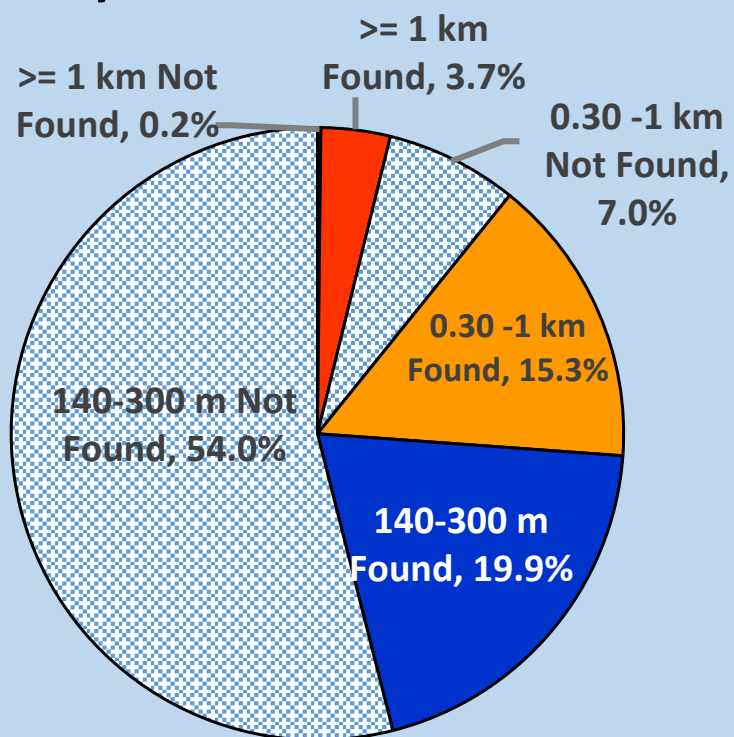


Progress: 140 Meters and Larger

Total Population estimated to be ~25,000

George E Brown
NEO Survey Goal

NEO Survey Status as of 31 Dec 2020



At current discovery rate, it will take more than 30 years to complete the survey.

NASA Planetary Radar Update

Goldstone Planetary Radar

Returned to full-power (450 kW) operations
as of November 2020



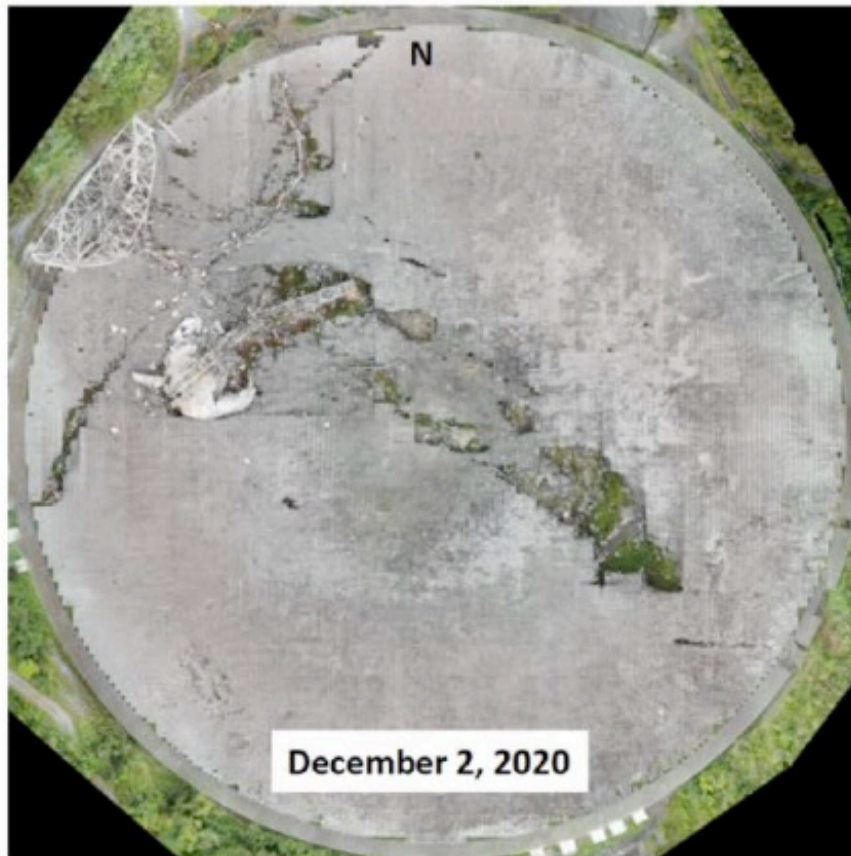
Arecibo Planetary Radar

Several support cables failed and the secondary
bridge collapsed into the dish on December 1, 2020



Stablization and Cleanup at Arecibo by NSF

Selective Demolition (Ongoing)



- The Cis Lunar Environment Array Radar (CLEAR) project is a small scale demonstration and the next step in the development cycle leading to a true deep space radar system capable of cis-lunar space domain awareness (SDA) and tracking/characterization of Near Earth Objects (NEOs) out to 0.5 AU (46 million miles)
- The CLEAR arrayed radar demonstration will have immediate capabilities upon completion to detect, track, and characterize objects in cis-lunar orbit for risk mitigation for NASA missions and extended SDA
- CLEAR would be an adaption of a previous NASA activity called KaBOOM (Ka-Band Objects Observation and Monitoring) and could be executed under a partnership between NASA's Planetary Defense Coordination Office and other NASA directorates with other USG entities.

- KaBOOM built on previous successfully demonstrated concepts, technologies and methods to prove the final steps towards an operational coherent array radar capability.
- KaBOOM validated the ability to achieve coherent power combining from widely separated antennas (*CW/Comm mode capability available today!*)



Launch

July 22, 2021

Delayed to Second launch window
starting November 24, 2021



LICIACube
(Light Italian Cubesat
for Imaging of Asteroids)
ASI contribution

IMPACT: September 30, 2022

DART Spacecraft

650 kg arrival mass
18.8 m × 2.4 m × 2.0 m
6.65 km/s closing speed

Didymos-B

163 meters
11.92-hour orbital period

65803 Didymos (1996 GT)

1,180-meter separation
between centers of A and B

Didymos-A

780 meters, S-type
2.26-hour rotation period

Earth-Based Observations

0.07 AU range at impact
Predicted ~10-minute change
in binary orbit period

- Target the binary asteroid Didymos system
- Impact Didymos-B and change its orbital period
- Measure the period change from Earth

DART I&T Continues to Progress



ROSA Wing 1 Inspection at DSS



Spacecraft being prepared for TVAC

NEO Surveillance Mission

Objectives:

- Find 65% of undiscovered Potentially Hazardous Asteroids (PHAs) >140 m in 5 years (goal: 90% in 10 years)
- Estimate sizes directly from IR signatures
- Compute cumulative chance of impact over next century for PHAs >50 m and comets
- Deliver new tracklet data daily to the Minor Planet Center
- **KDP-B delayed until “late Spring 2021”**

NEO Surveyor
Space-based IR
Observatory

