



Near Earth Object Observations Program

Update on NASA NEO Program

Presentation to
UN COPUOS
Scientific & Technical Subcommittee

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NASA HQ
3 February 2015



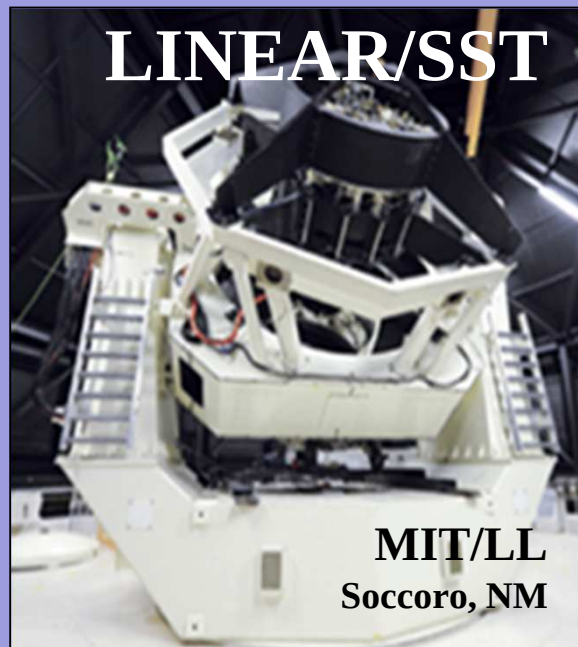
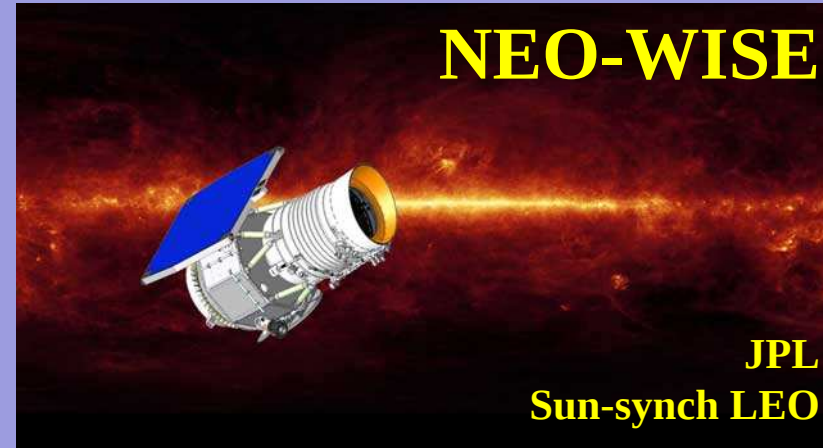
NASA's NEO Search Program

(Current Systems)



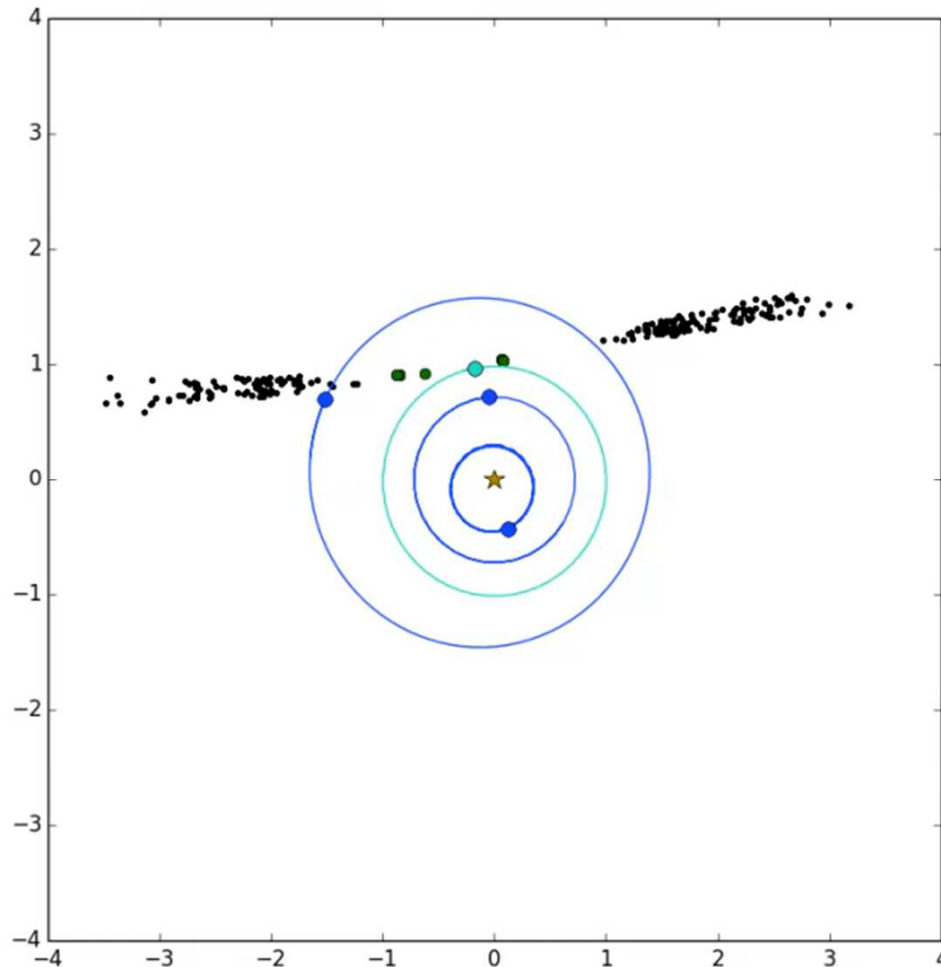
Minor Planet Center (MPC)

- IAU sanctioned
 - Int'l observation database
 - Initial orbit determination
- <http://minorplanetcenter.net/>
NEO Program Office @ JPL
- Program coordination
 - Precision orbit determination
 - Automated SENTRY
- <http://neo.jpl.nasa.gov/>





Observations from NEOWISE - 2014



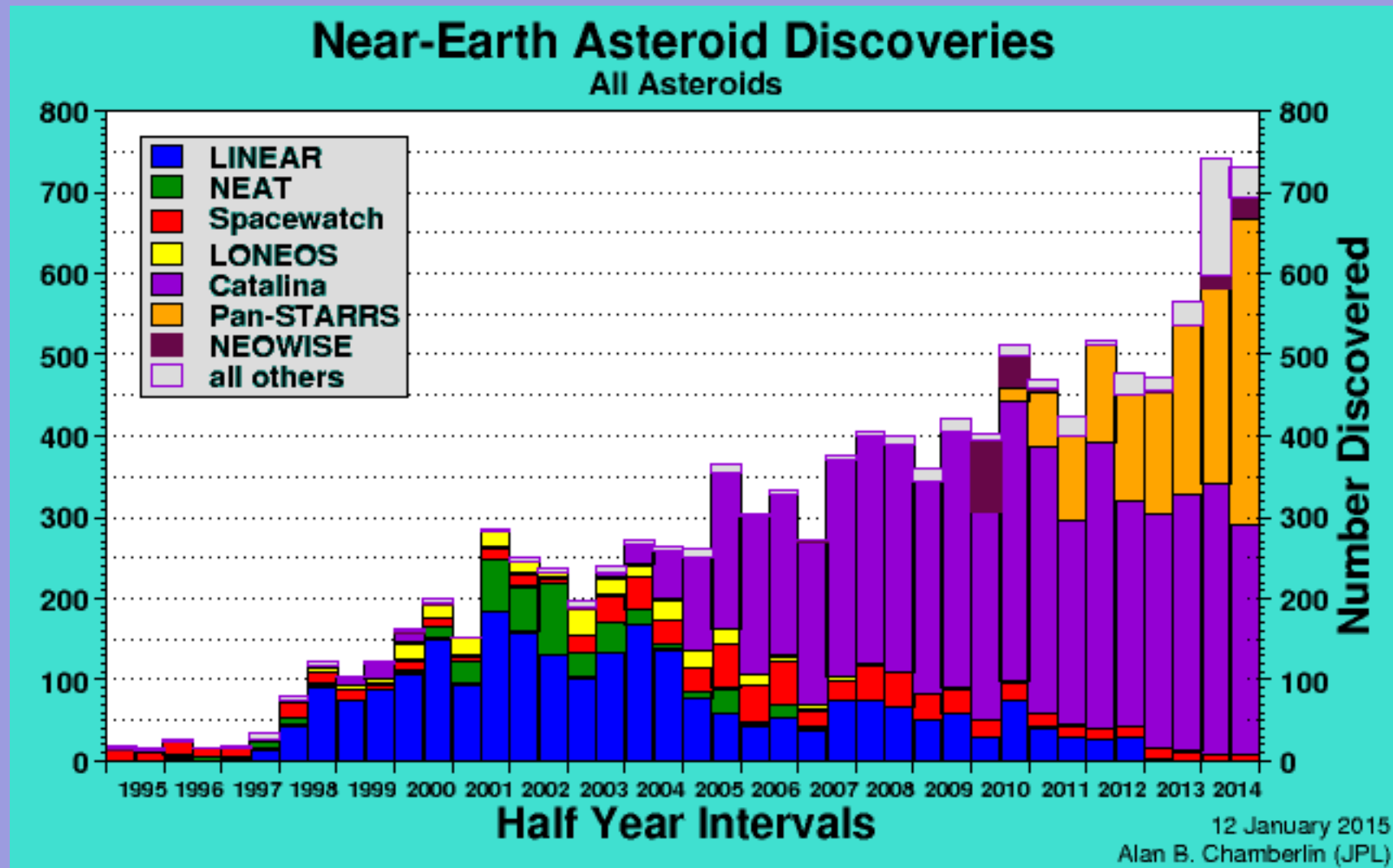
WISE Operations
Jan 2010
Feb 2011,
135 NEAs found

Reactivated
Sep 2013

NEOWISE began Ops
Dec 2013
Has found to date
40 NEAs
3 comets

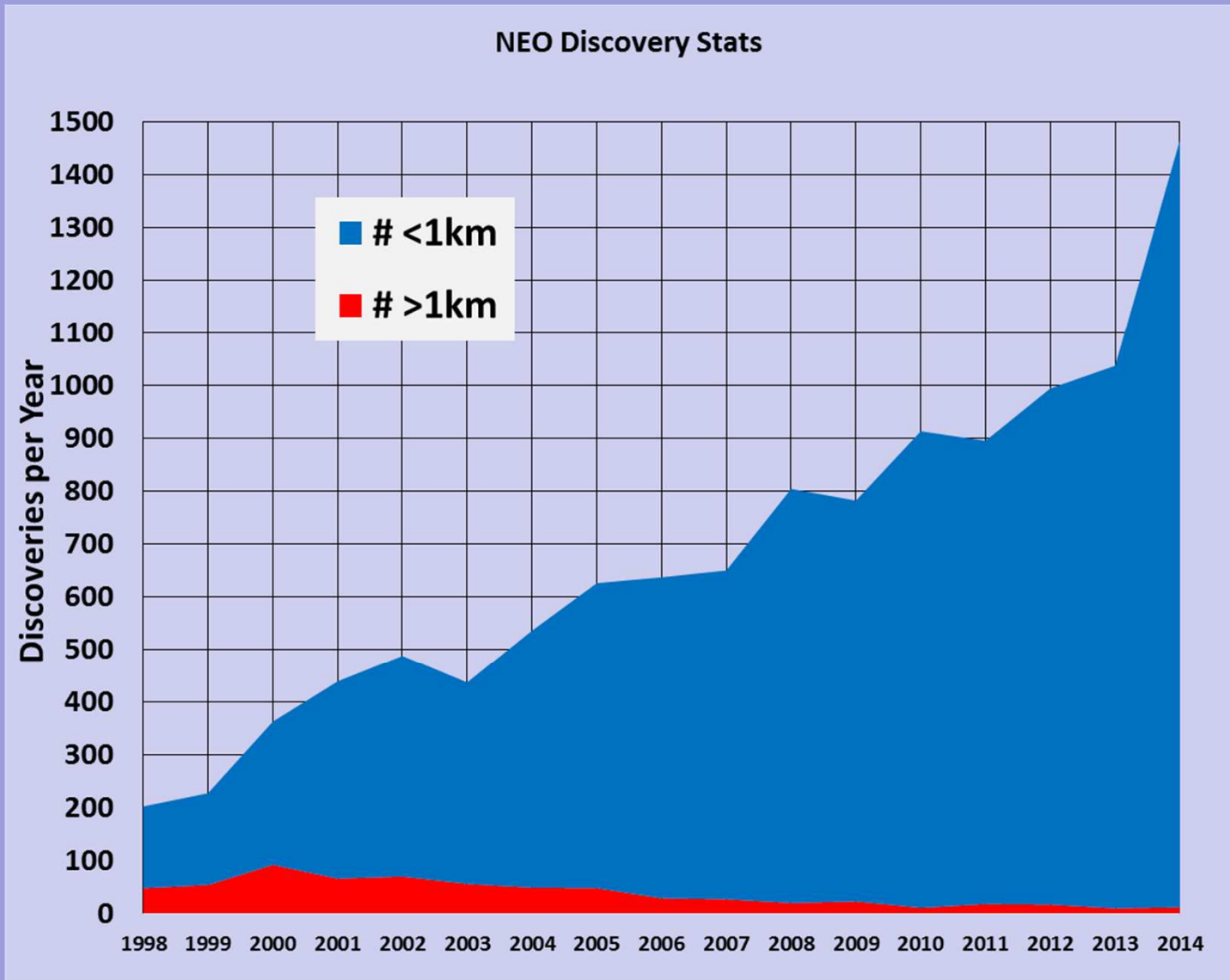


Project Contributions to NEO Discovery





Annual Near Earth Asteroid Discoveries

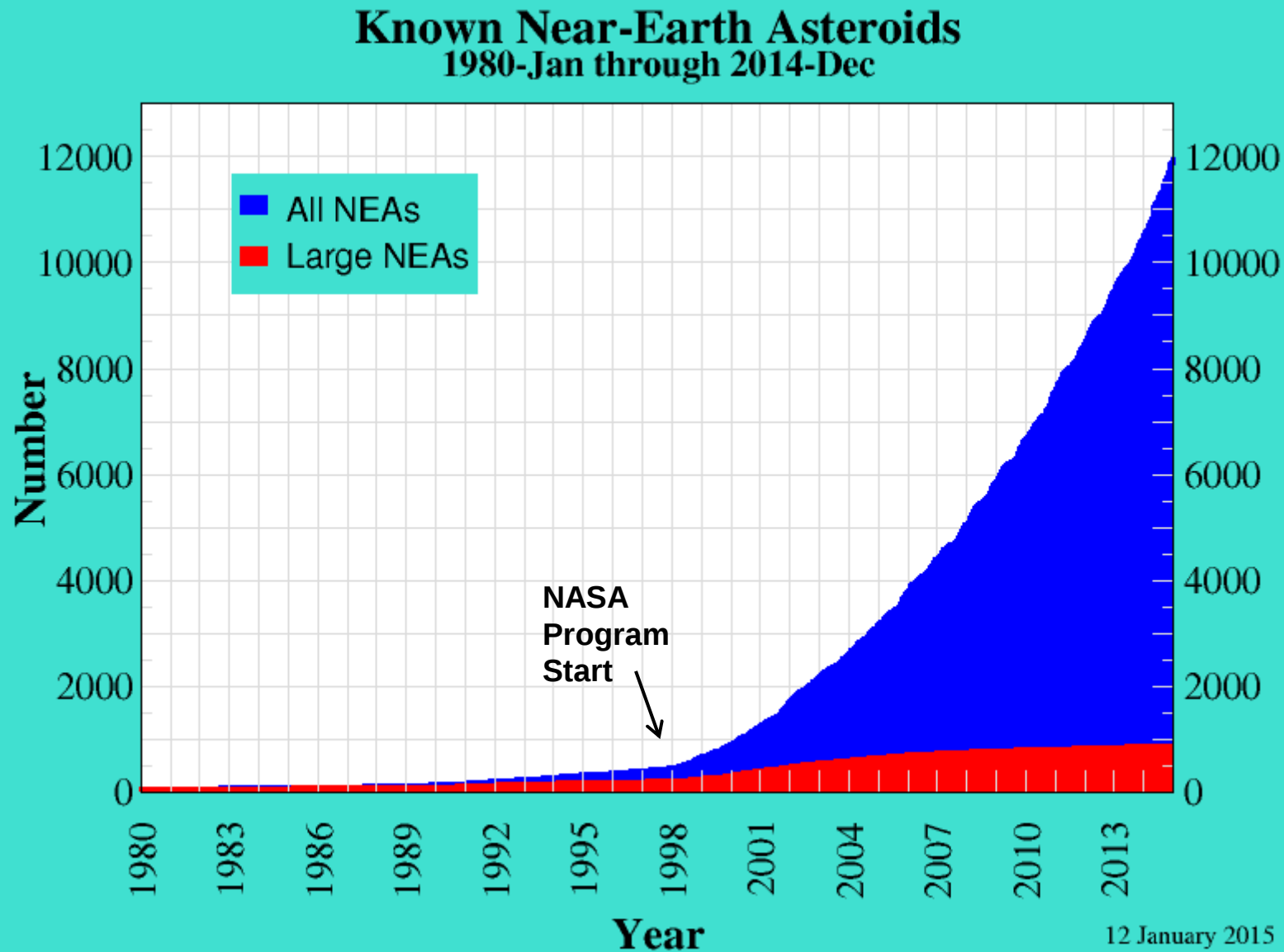


**1479
Discoveries
in 2014, up
43% in 2014**

**Only 13 large
(>1km) NEAs
discovered in
2014: most
have now
been found**



Continued Survey Success



As of
Today:
12,090

870 larger
than 1 km

12 January 2015
Alan B. Chamberlin (JPL)



Chelyabinsk Bolide, Feb. 15, 2013

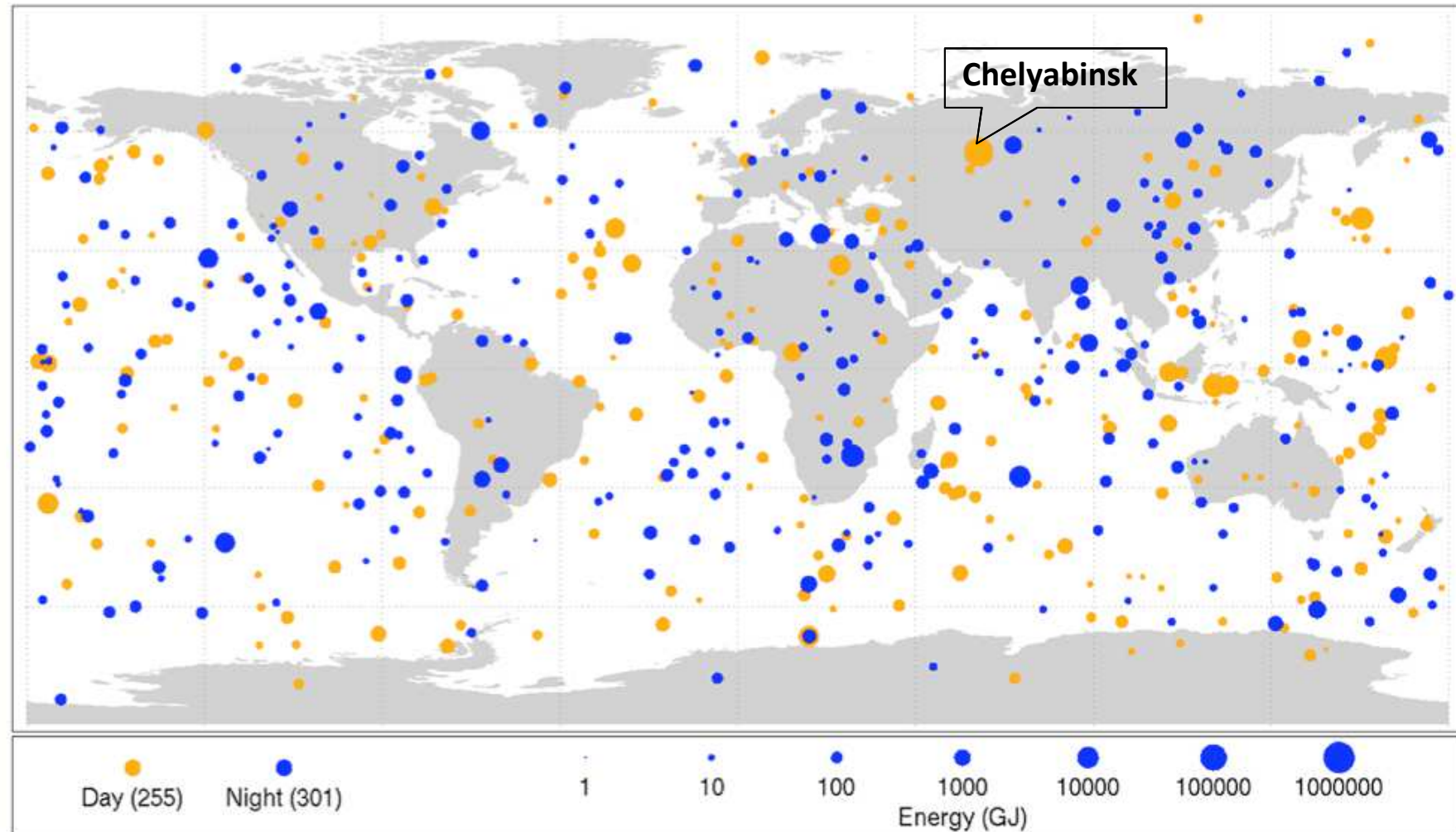


- A 20-meter (60-foot) asteroid entered the atmosphere at about 19 km/sec (12 mi/sec)
- The event released about 500 kt of energy, producing a large shock wave



Bolide Events 1994 – 2013

Small Asteroids that Disintegrated in Earth's Atmosphere



This diagram maps the data gathered from 1994-2013 on small asteroids impacting Earth's atmosphere and disintegrating to create very bright meteors, technically called "bolides" and commonly referred to as "fireballs". Sizes of orange dots (daytime impacts) and blue dots (nighttime impacts) are proportional to the optical radiated energy of impacts measured in billions of Joules (GJ) of energy, and show the location of impacts from objects about 1 meter (3 feet) to almost 20 meters (60 feet) in size.

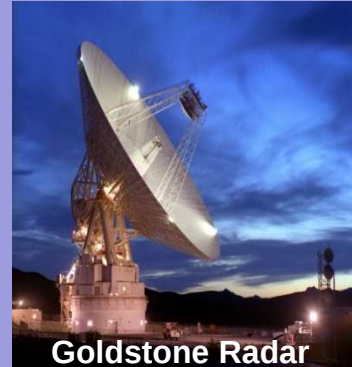


Primary NEO Characterization Assets and Enhancements



Radar (Goldstone and Arecibo)

- Increased time for NEO observations
- Streamlining Rapid Response capabilities
- Increased resolution (~4 meters)
- Improve maintainability



Goldstone Radar



Arecibo Observatory



NASA Infra-Red Telescope Facility (IRTF)

- Increased call-up for Rapid Response
- Improving operability/maintainability
- Improve Instrumentation for Spectroscopy and Thermal Signatures

Spitzer Infrared Space Telescope

- Orbit about Sun, ~176 million km trailing Earth
- In extended Warm-phase mission
- Characterization of Comets and Asteroids
- Thermal Signatures, Albedo/Sizes of NEOs
- Longer time needed for scheduling

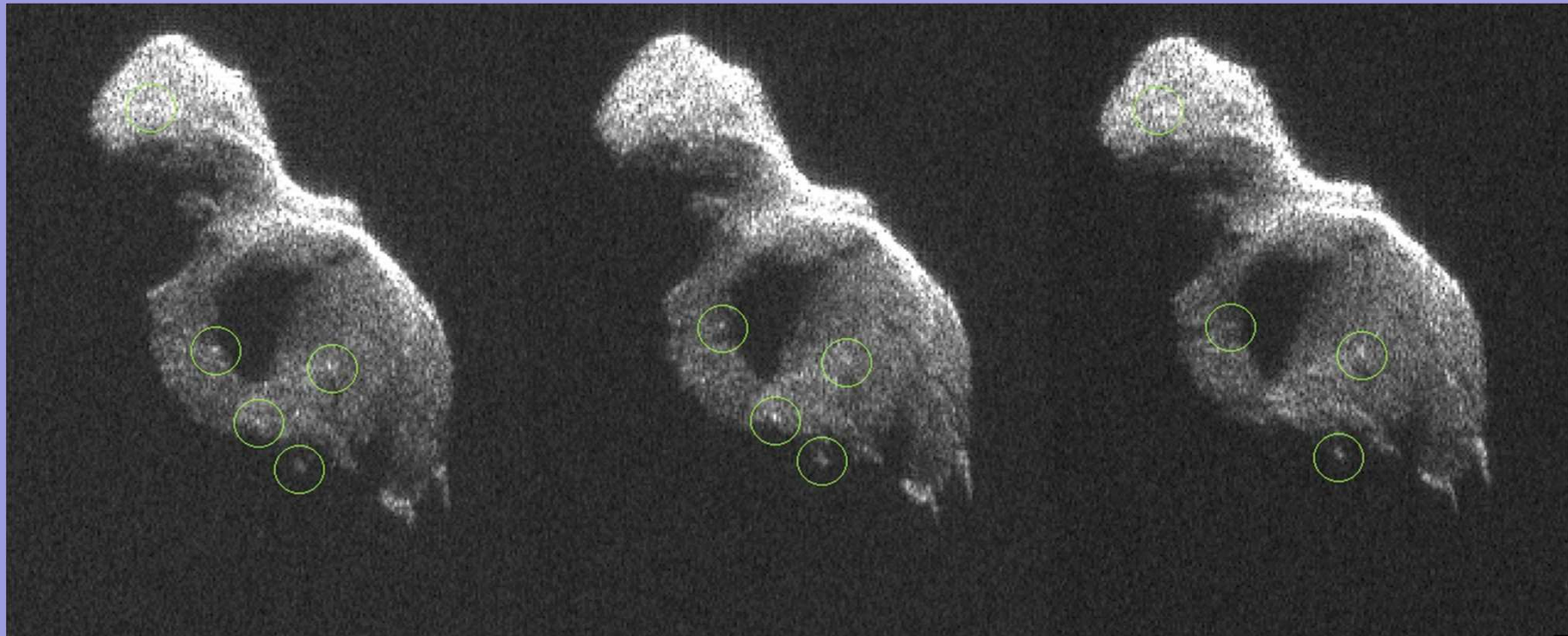




Radar Imaging of 100 meter class NEAs



For observing this asteroid found by NEOWISE, radar scientists had the 70-meter (230-foot) Goldstone deep space radio antenna transmit signals to the asteroid, then the 305-meter (1000-foot) Arecibo Observatory collected the reflected radio waves. Images were produced with resolutions as fine as 3.75 meters that reveal an elongated asteroid at least 370 meters (1200 feet) in size with irregular surface features and a rotation period of about 20 hours.





Radar Images of Asteroid 2004 BL86, Jan. 26, 2015



- Earth close approach of about 3.1 lunar distances last week
- The asteroid has a moon!
- Main Asteroid is about 330 meters across; satellite is about 70 meters across (it's small and blurry size in the image is an artifact of the processing)
- Radar pulses were transmitted from Goldstone, received at Green Bank
- Resolution is ~4 meters



Impact Emergency Response Exercise #2



EXERCISE

30 Days prior to Impact
Optical only tracking

40 to 60 meter object
Impact Probability 100%

Date/Time (UTC)
2021 Sep 5 17:02

Center Point

Latitude

29.7

Longitude

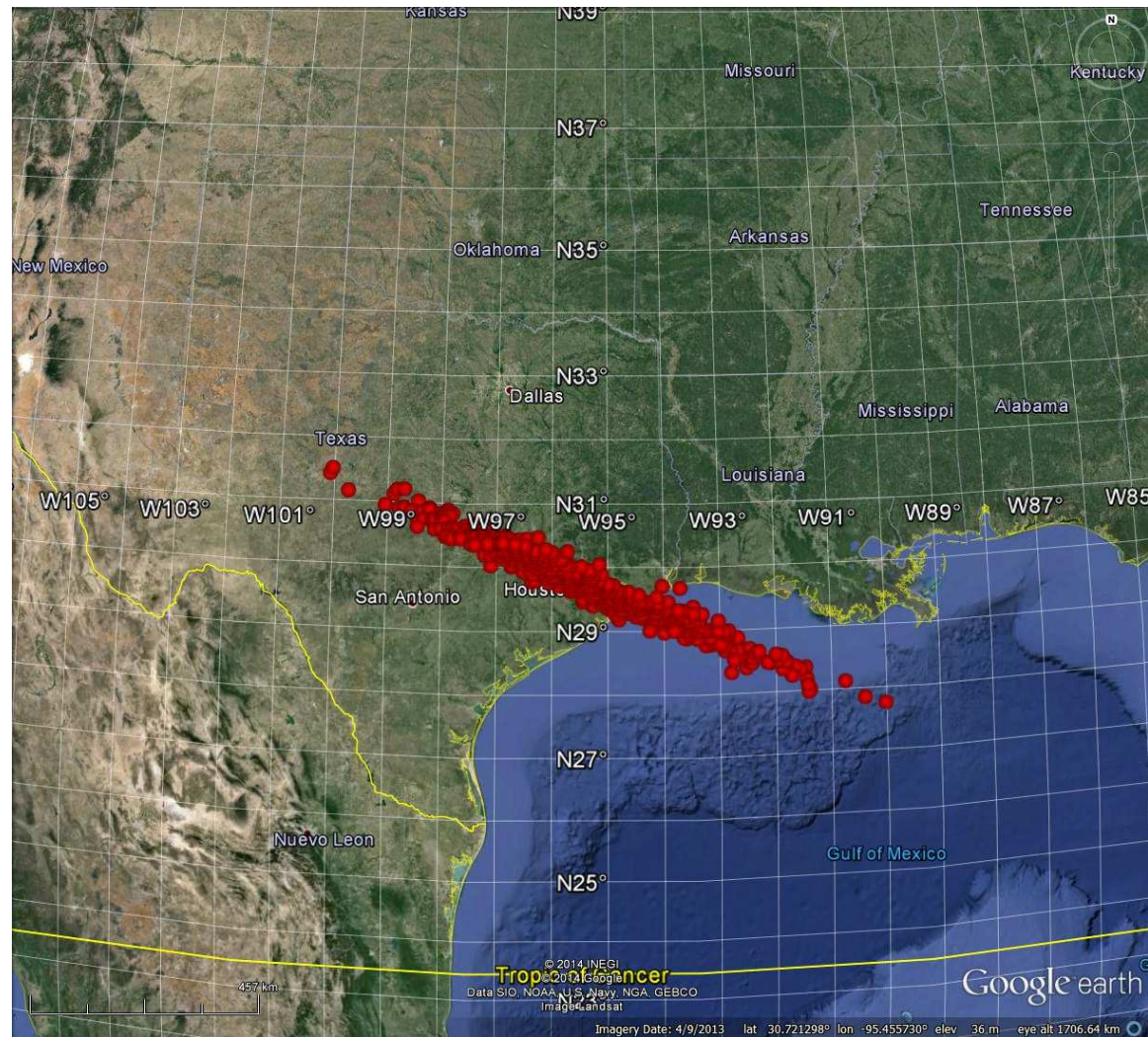
-95.3

Footprint size

1000 x 50 km

Major axis Azimuth (deg)

130



EXERCISE



AIDA

Asteroid Impact & Deflection Assessment (AIDA)

- The AIDA is a mission concept to demonstrate asteroid impact hazard mitigation with a kinetic impact spacecraft to deflect an asteroid
- AIDA would be a joint US and European mission:
 - European rendezvous spacecraft, the Asteroid Impact Monitor (AIM) mission
 - US kinetic impactor, the Double Asteroid Redirection Test (DART) mission
- NASA has agreed with ESA to enter parallel pre-formulation concept studies in 2015
- The AIDA mission would intercept the secondary member of the binary Near-Earth Asteroid Didymos in October, 2022



AIDA = AIM+DART



Summary of 2014 NEO Activities



- USA continues to expand and enhance NASA's NEO Program
- This is reflected in the increased NEO discovery rate
- New and innovative techniques used for characterization
- Engaged in several partnerships for threat mitigation concepts
- USA looks forward to involvement with IAWN and SMPAG