



Near Earth Objects

The NEO Observation Program and Planetary Defense

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15 January 2013



NEO Observation Program



US component to International Spaceguard Survey effort
Has provided 99% of new detections of NEOs since 1998

Began with NASA commitment to House Committee on Science
in May, 1998

- Averaged ~\$4M/year Research funding 2002-2010
- Starting with FY2012, now has \$20.5 M/year

Program Objective: Discover $\geq 90\%$ of NEOs larger than 140 meters in size as soon as possible

NASA Authorization Act of 2005 provided additional direction)

“ . . . plan, develop, and implement a Near-Earth Object Survey program to detect, track, catalogue, and characterize the physical characteristics of near-Earth objects equal to or greater than **140 meters** in diameter in order to assess the threat of such near-Earth objects to the Earth. It shall be the goal of the Survey program to achieve **90 percent completion** of its near-Earth object catalogue **within 15 years** [by 2020].



NASA's NEO Search Program

(Current Systems)



Minor Planet Center (MPC)

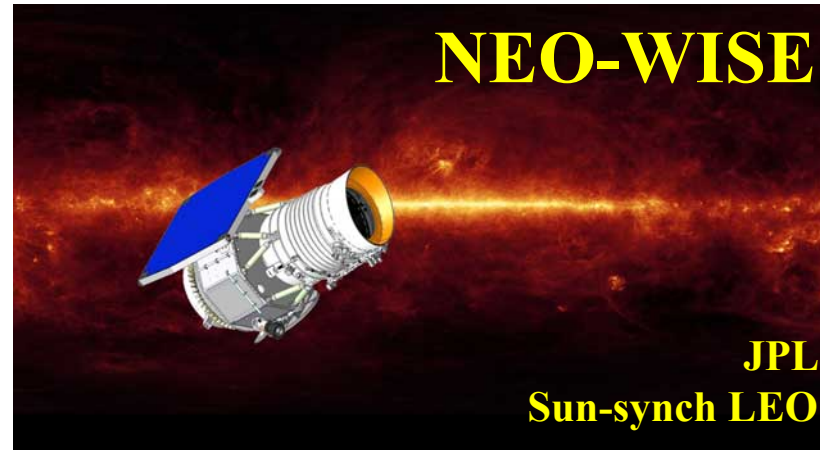
- IAU sanctioned
- Int'l observation database
- Initial orbit determination

www.cfa.harvard.edu/iau/mpc.html

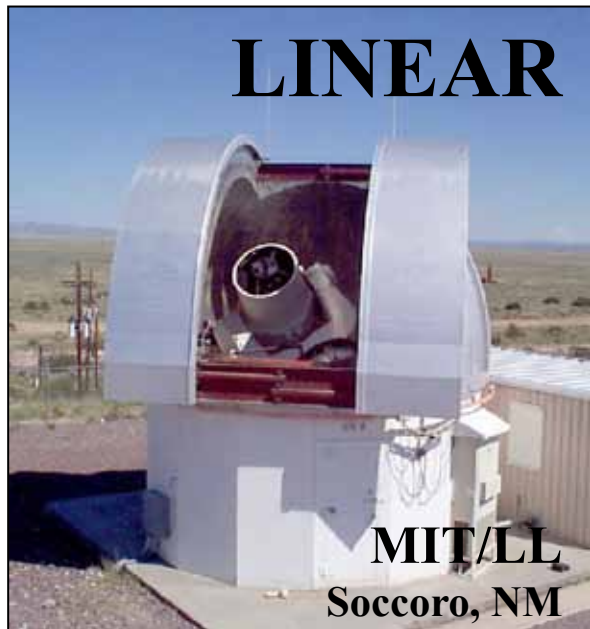
NEO Program Office @ JPL

- Program coordination
- Precision orbit determination
- Automated SENTRY

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

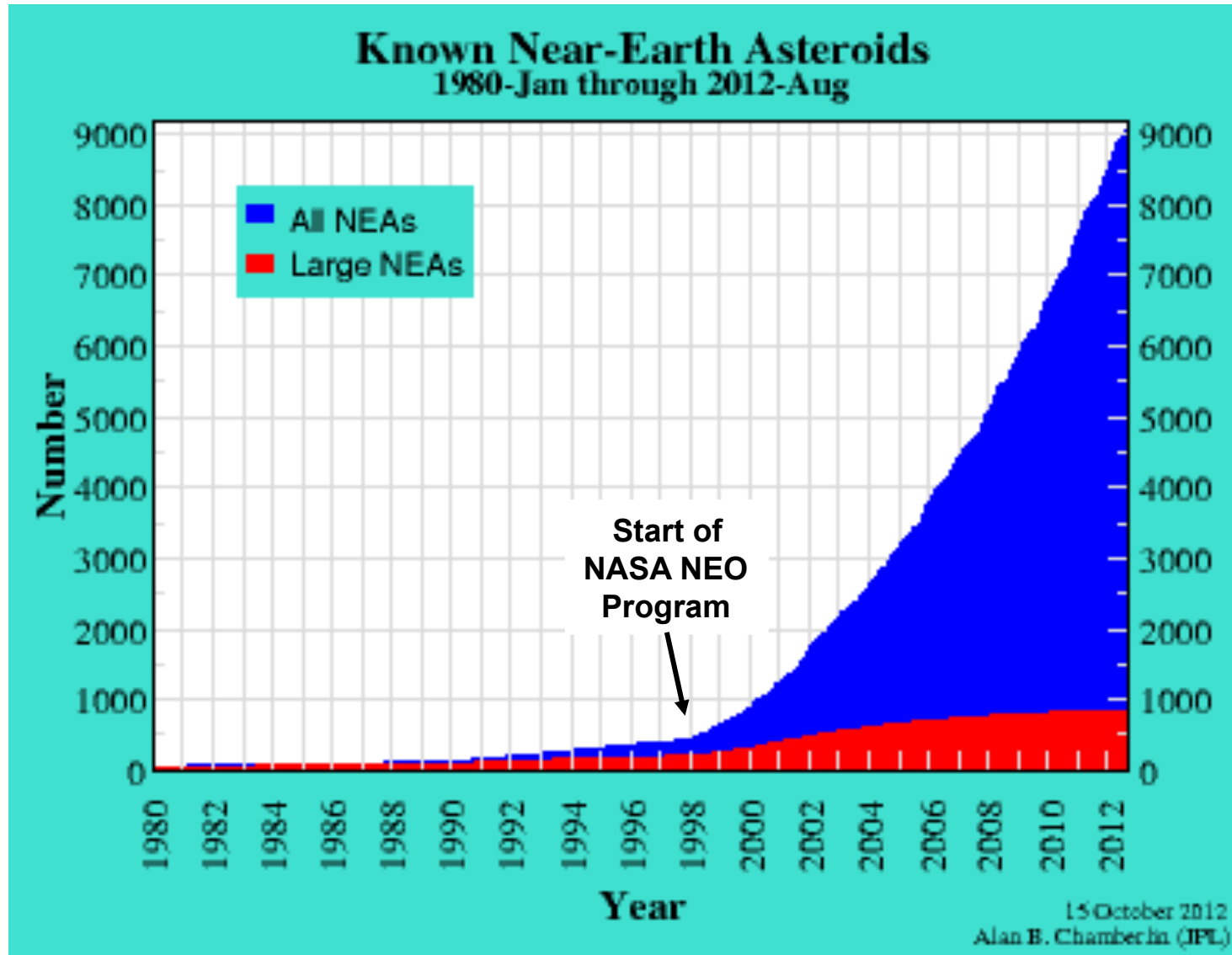


End of
Operations
Feb 2011,
Analysis
Of Data
Continues





Known Near Earth Asteroid Population

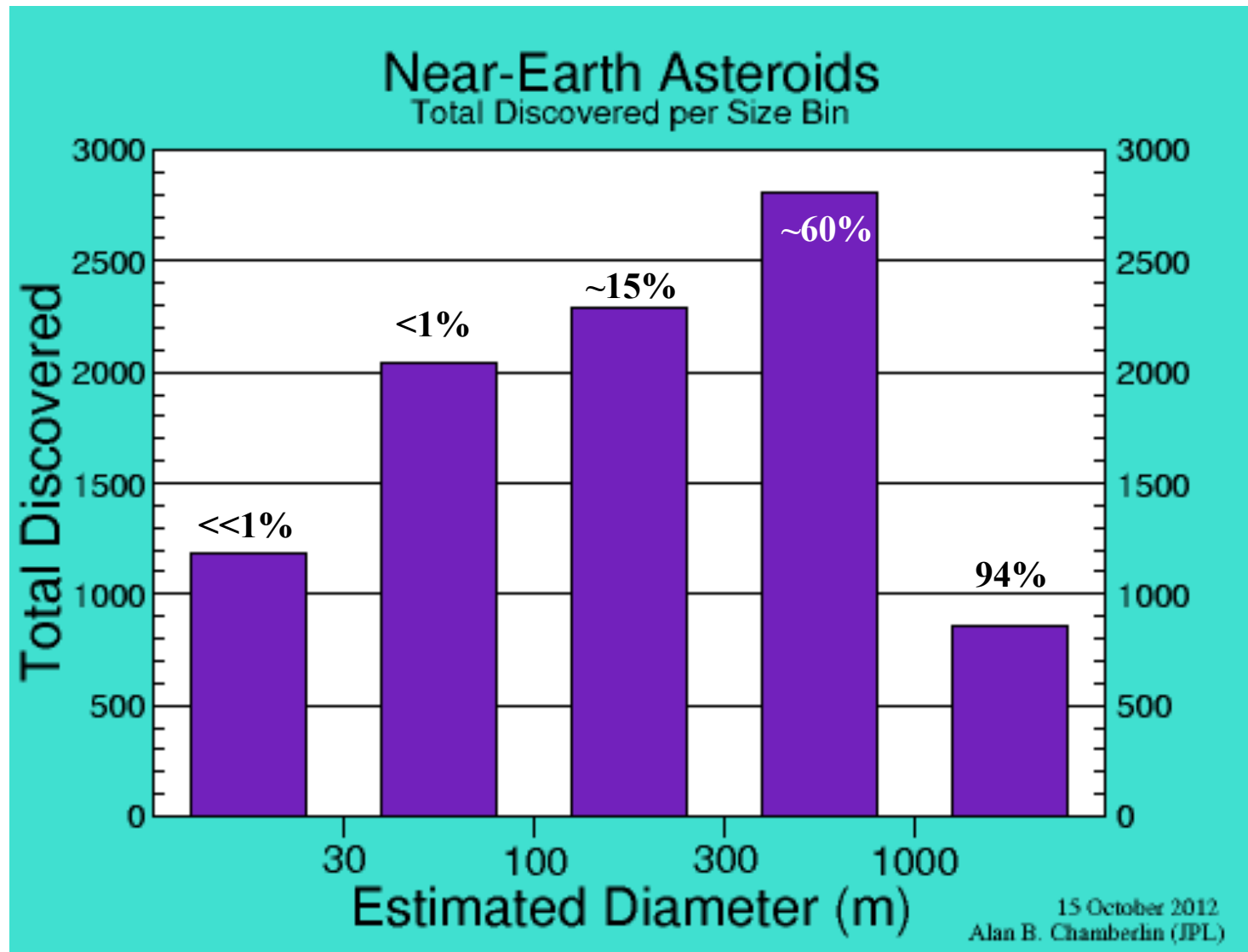


9504
1/13/13

>859
1/13/13



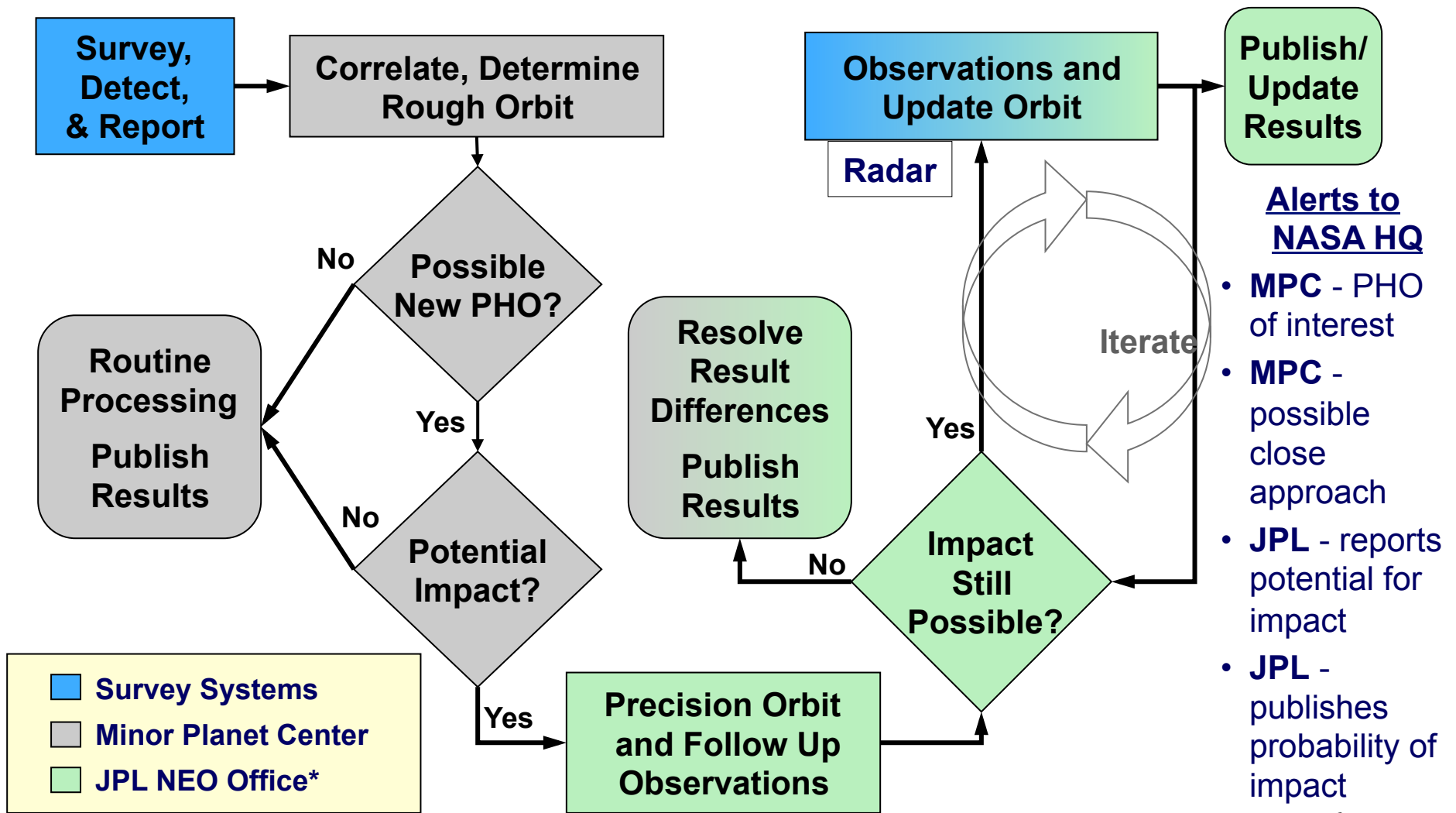
Known Near Earth Asteroid Population





Spaceguard Survey Catalog Program

Current Spaceguard Survey Infrastructure and Process



* In parallel with NEODYs



NASA's NEO Search Program

(Current Systems)



Minor Planet Center (MPC)

- IAU sanctioned
- Int'l observation database
- Initial orbit determination

www.cfa.harvard.edu

NEO Program

- Program coordination
- Precision orbit determination
- Automated data processing

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

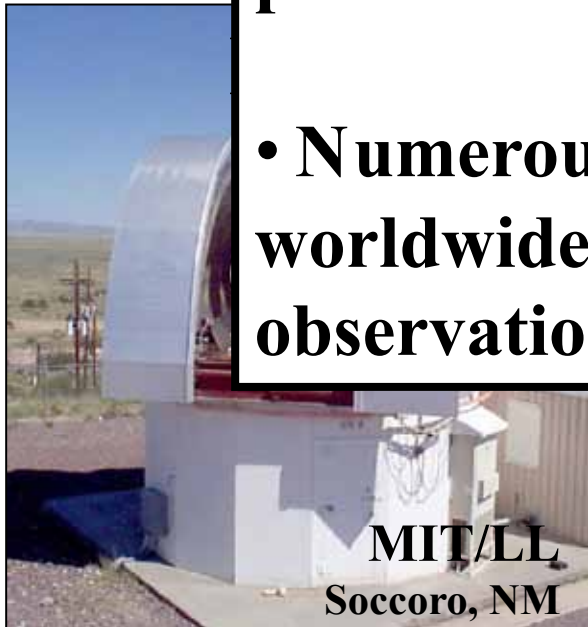


NEO-WISE

End of Operations
Feb 2011,
Analysis
Of Data
Continues

Not Shown – “Follow-up” Projects:

- Several Professional Observatories provide critical data to secure orbits
- Numerous Amateur Astronomers worldwide provide high-precision observations to fill critical gaps



MIT/LL
Socorro, NM



UofAZ
Arizona & Australia



UoH HI
Haleakula, Maui

PL
O

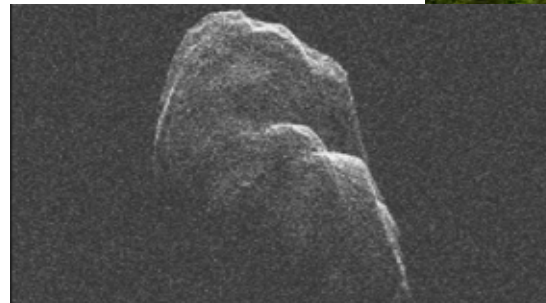
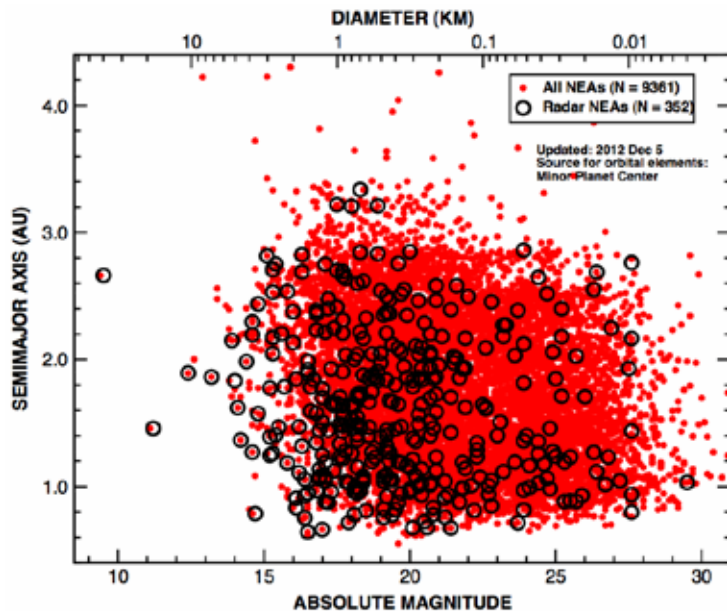
STARRS



Increased Radar Studies



- Observations on the limited number of accessible objects, but next best thing to a flyby
- Detections/year from Goldstone and Arecibo doubled
 - Required for timely precision orbit determination
 - Characterization with sufficient signal strength
 - Shape, spin-state, surface structure
 - Satellites (an then derived mass)



Shape, Size of
4179 Toutatis

Study of Shape, Size, Motion and
Mass of 66391 (1999 KW4)

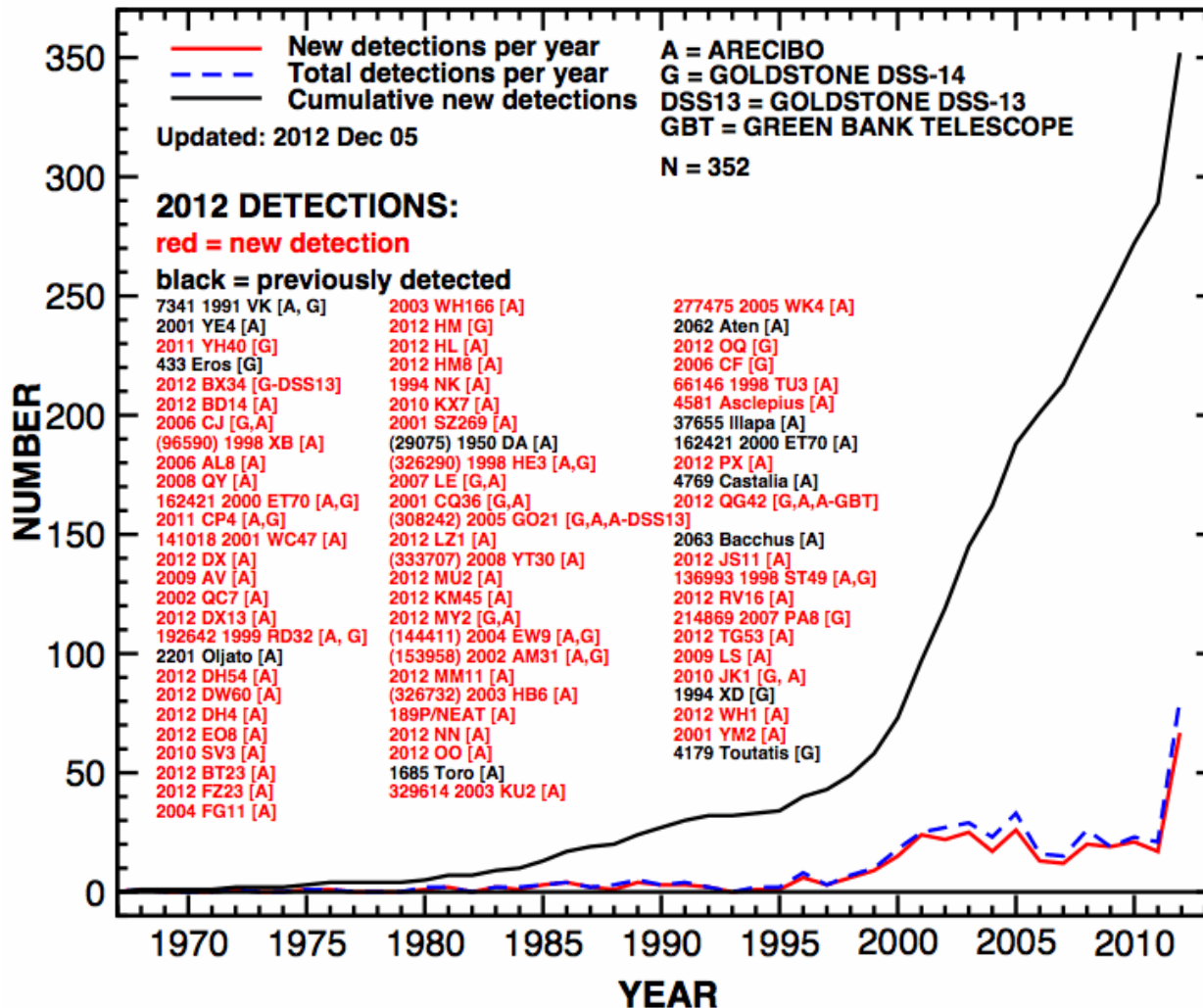




Increase in Radar Program



RADAR DETECTIONS OF NEAR-EARTH ASTEROIDS



2012 Results
76 Detections
64 New

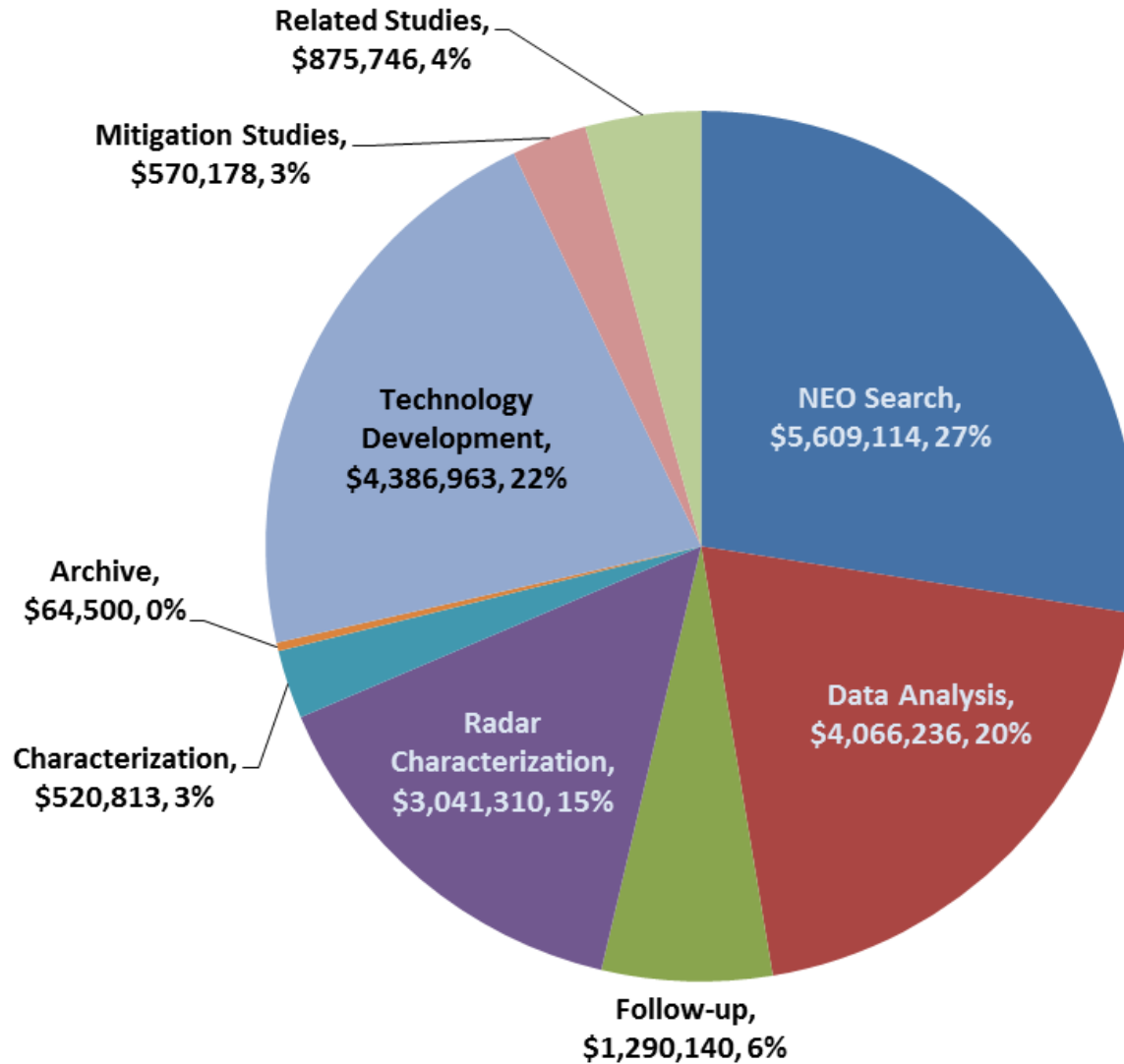
<http://echo.jpl.nasa.gov/>



FY2012 Budget Allocation



NEOO Program FY12



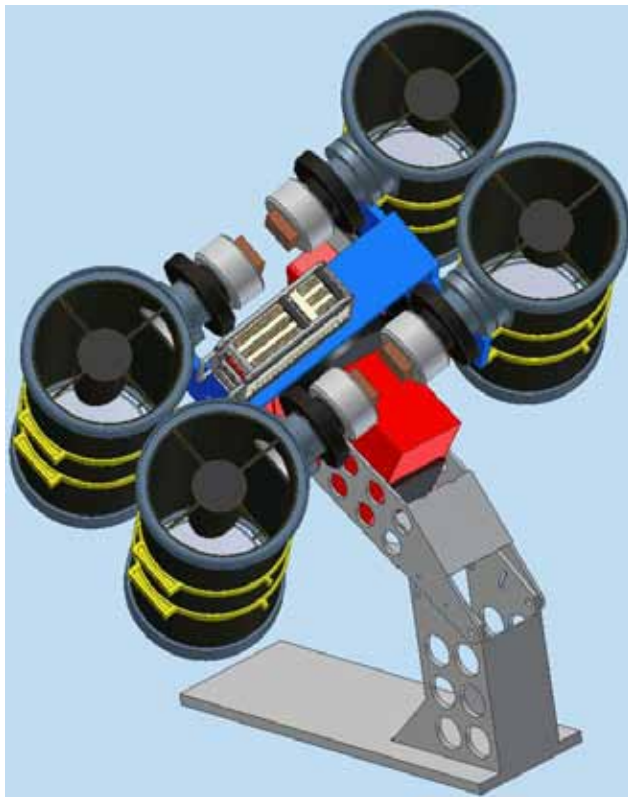


Near Term Impact Warning



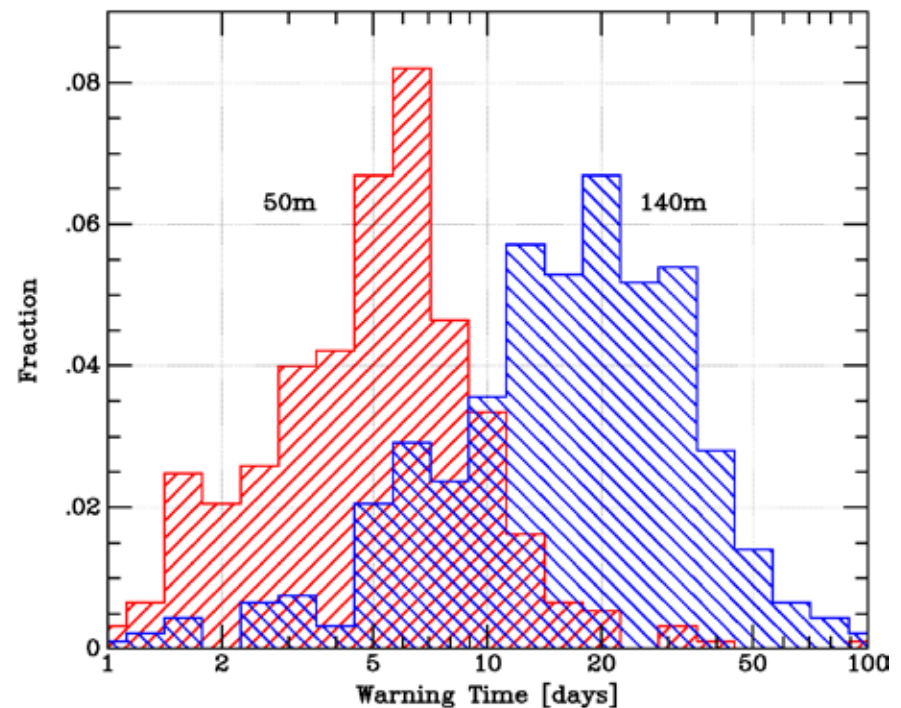
Asteroid Terrestrial-impact Last Alert System –ATLAS*:

A project to patrol the entire night sky every night in search of incoming asteroids



Proposed ATLAS telescope design

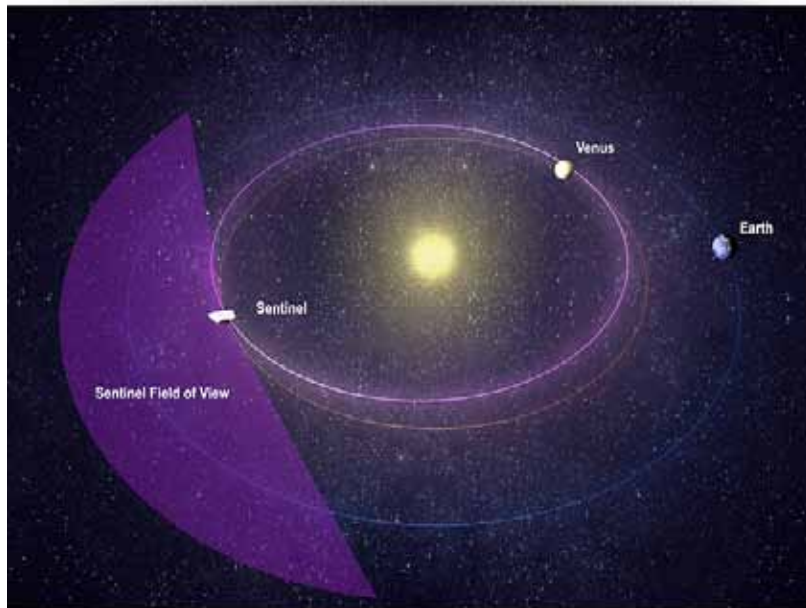
A geographically dispersed network (> 6 sites) of small coupled telescopes observing “shallow but wide” to provide more complete sky coverage for warning of near-term impact threats



*Courtesy University of Hawaii Institute for Astronomy



B612 “*Sentinel*” Project



NASA has signed a Space Act Agreement (SAA) to support B612 Project Sentinel

- Established NASA Technical Consulting Team (NTCT)
- Supported B612 Project Concept and Integration Review (PCIR)
- NTCT members will also support Sentinel Operations and Data Analysis (SODA) Working Group
- SAA Schedule/Milestones:

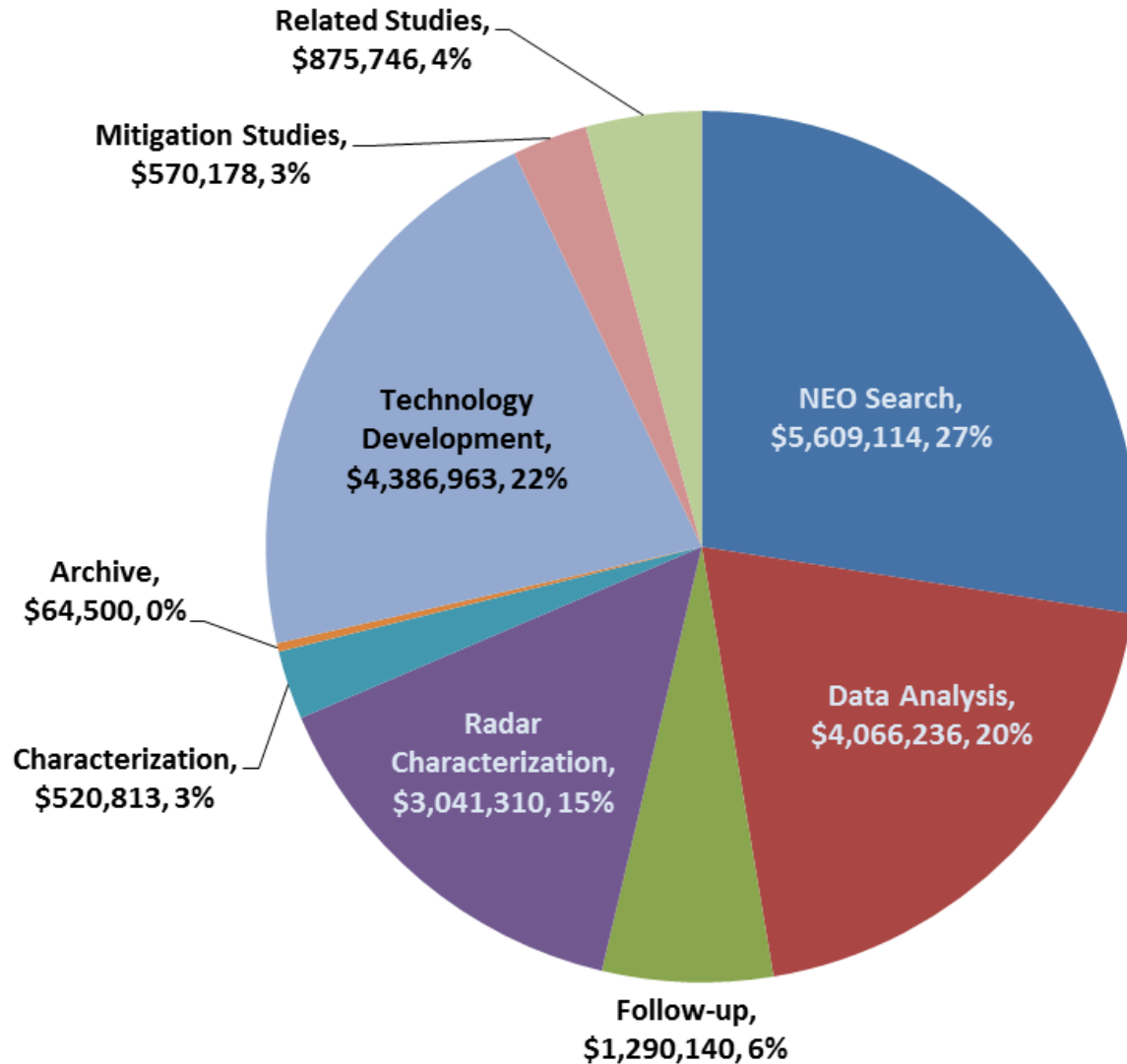
Sentinel contract start date	Sept. 2012
Preliminary Design Review	Sept. 2013
Critical Design Review	June 2014
Launch	June 2016
Initial on-orbit data delivery	NLT launch +6 mos



FY2012 Budget Allocation



NEOO Program FY12



Total Budget
\$20.425M

Fully Competed
\$17.045M
83.5%



ROSES 2013 Solicitation



Near Earth Objects (NEOs) are defined as asteroids or comet nuclei whose perihelia are less than 1.3 AU. NASA is **striving to discover all potentially hazardous NEOs with sizes down to ~100 meters** and to characterize that population through determination of their orbital elements, with the **goal of detecting more than 90 percent of this population as soon as possible**. In support of NASA's commitment and goal, this program supports NEO investigations whose primary objective is to **complete the inventory of the population of NEOs with sizes greater than 100 meters**. In addition to this goal, the Human Exploration and Operations Mission Directorate has expressed an interest for the NEOO Program to search for a Human Spaceflight accessible Near-Earth Asteroid (NEA) target destination, regardless of its size. Therefore, investigations that provide capability to detect the smaller NEAs that are in low delta velocity orbits relative to Earth will receive additional consideration.



UN COPUOS Activities



- NEO Working Group of the Scientific & Technical Subcommittee (STSC), In work since 2007 – One 3 year extension
- Final Report and Recommendations scheduled to be presented at February 2013 session in Vienna, Austria
- Draft Recommendations:
 - Establish International Asteroid Warning Network (IAWN)
 - Composed of existing assets (Search, MPC, Sentry, NEODyS, etc)
 - Work for recommended improvements and additional capabilities
 - Establish a Space Missions Planning and Advisory Group (SMPAG)
 - Comprised of representatives from Member State space agencies
 - Calls for Impact Disaster Planning Advisory Group (IDPAG)
 - To work with existing UN Space-based Information for Disaster Management and Emergency Response (UN-SPIDER)
 - Provides for COPUOS Mitigation Mission Advisory Group (MMAG)
 - Encourage international response activities and advise on threat response



Planetary Defense Conference 2013



- 15-19 April, 2013, in Flagstaff, AZ
 - Local Host – Northern Arizona University
 - David Trilling Chair of LOC
 - Abstract Deadline 18 January
- Program:
 - Day 1: Introduction, Background, NEO Search
 - Keynote Speaker Deputy Administrator Lori Garver
 - Day 2: Characterization, Mitigation Techniques
 - Day 3: Tour of Barringer Crater
 - Day 4: Impact Effects, Consequence Management
 - Day 5: Impact Emergency Exercise, Wrapup
- <http://www.iaaconfereces.org/pdc2013/>