

# Status of Planetary Defense

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Washington, DC

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## ASSESS

[CENTER FOR NEAR EARTH  
OBJECT STUDIES]



## SEARCH, DETECT & TRACK

[SPACE-BASED & GROUND-BASED  
OBSERVATIONS, IAWN]



# PLANETARY DEFENSE

## MITIGATE

[DART, FEMA EXERCISES]



## CHARACTERIZE

[NEOWISE, GOLDSTONE, IRTF]



## PLAN & COORDINATE

[SMPAG, PIERWG, NITEP IWG]






# Signatories to the International Asteroid Warning Network (IAWN)



<https://iawn.net/about/members.shtml>

  <p><b>National Institute of Astrophysics, Optics &amp; Electronics (México)</b></p>	<p><b>European Southern Observatory</b></p> 	<p><b>China National Space Administration</b></p> 	<p><b>Northolt Branch Observatories (UK)</b></p> 	<p><b>Zwicky Transient Facility (US)</b></p> 	 <p><b>Višnjan Observatory (Croatia)</b></p>  <p><b>Instituto de Astrofísica de Canarias (Spain)</b></p>
 <p><b>Korean Astronomy Space Science Institute (KASI)</b></p>  <p><b>외계행성 탐색시스템 KMTNet Korea Microlensing Telescope Network</b></p>	 <p><b>University of Nariño Colombia</b></p>	 <p><b>European Space Agency</b></p>	<p><b>Inst. of Solar-Terrestrial Physics (Siberian Branch, Russian Academy of Sciences)</b></p> 	 <p><b>Sormano Astronomical Observatory (Italy)</b></p>	
 <p><b>Institute of Astronomy, Russian Academy of Sciences (ИНАСАН)</b></p>	 <p><b>Crimean Astrophysical Observatory (Russian Academy of Sciences)</b></p>	 <p><b>National Aeronautics and Space Administration</b></p>	 <p><b>Kourovka Astronomical Observatory (UrFU)</b></p>	 <p><b>SONEAR Observatory (Brazil)</b></p>	
 <p><b>Israel Space Agency</b></p> <p><b>Peter Birtwhistle (UK)</b> <b>David Balam (Canada)</b> <b>Patrick Wiggins (USA)</b> <b>Gennady Borisov (MARGO Observatory)</b> <b>Jordi Camarasa (Observatori Paus B49)</b></p>	 <p><b>Special Astrophysical Observatory (Russian Academy of Sciences)</b></p>	 <p><b>Fondazione GAL Hassin (Italy)</b></p>	<p><b>Keldysh Institute of Applied Mathematics, Russian Academy of Sciences (KIAM RAS)</b> <b>Agenzia Spaziale Italiana (ASI)</b> <b>Baldone Astrophysical Observatory, Latvia</b> <b>G.V. SCHIAPARELLI, Italy</b> <b>Observatoire de la Côte d'Azur</b></p>		

**Currently 32 signatories**

# 7<sup>th</sup> International Planetary Defense Conference

## Impact Emergency Response Exercise

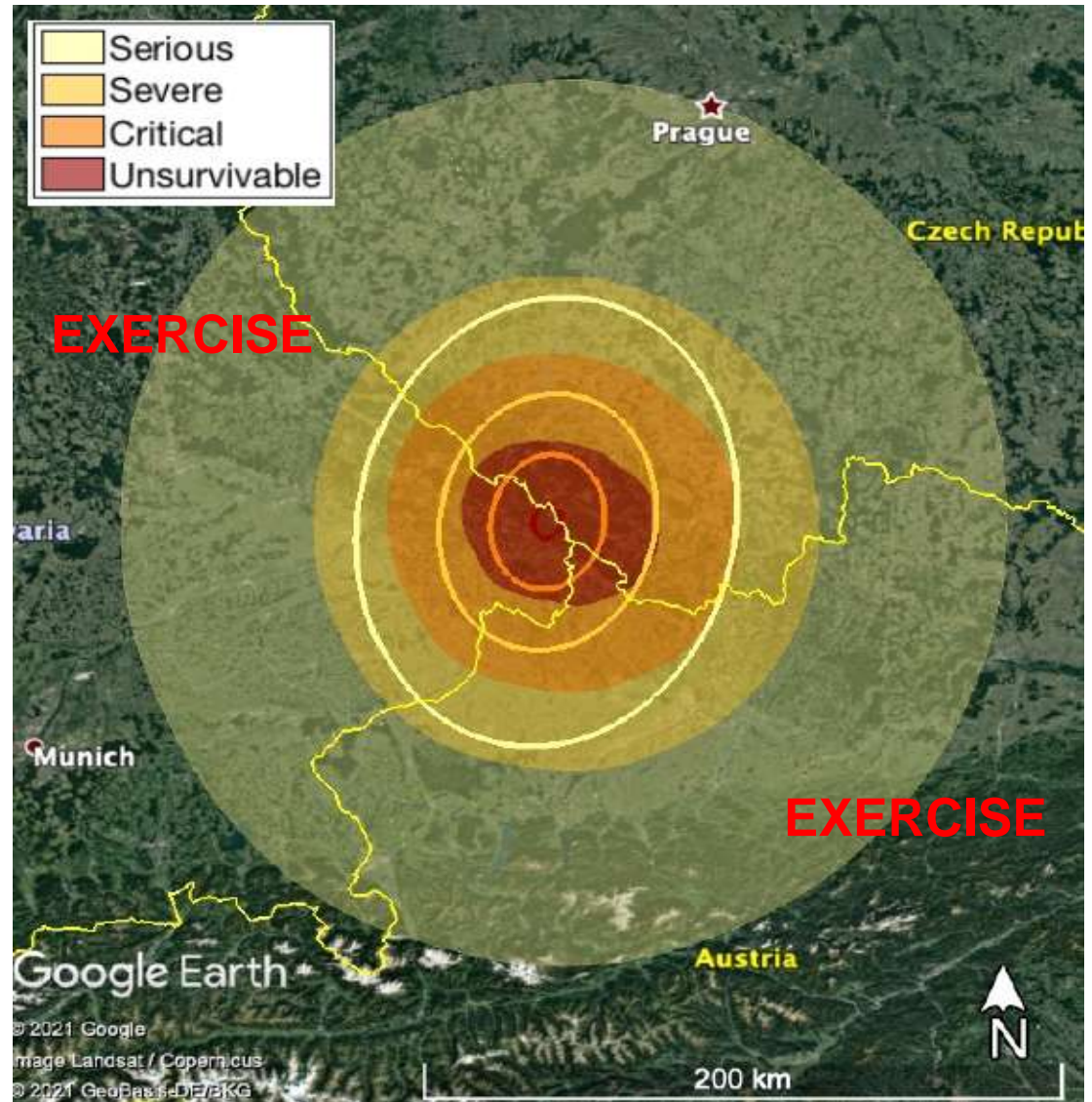
### EXERCISE

6 Days prior to Impact  
Optical and Radar tracking

100 to 110 meter object  
Impact Probability 100%

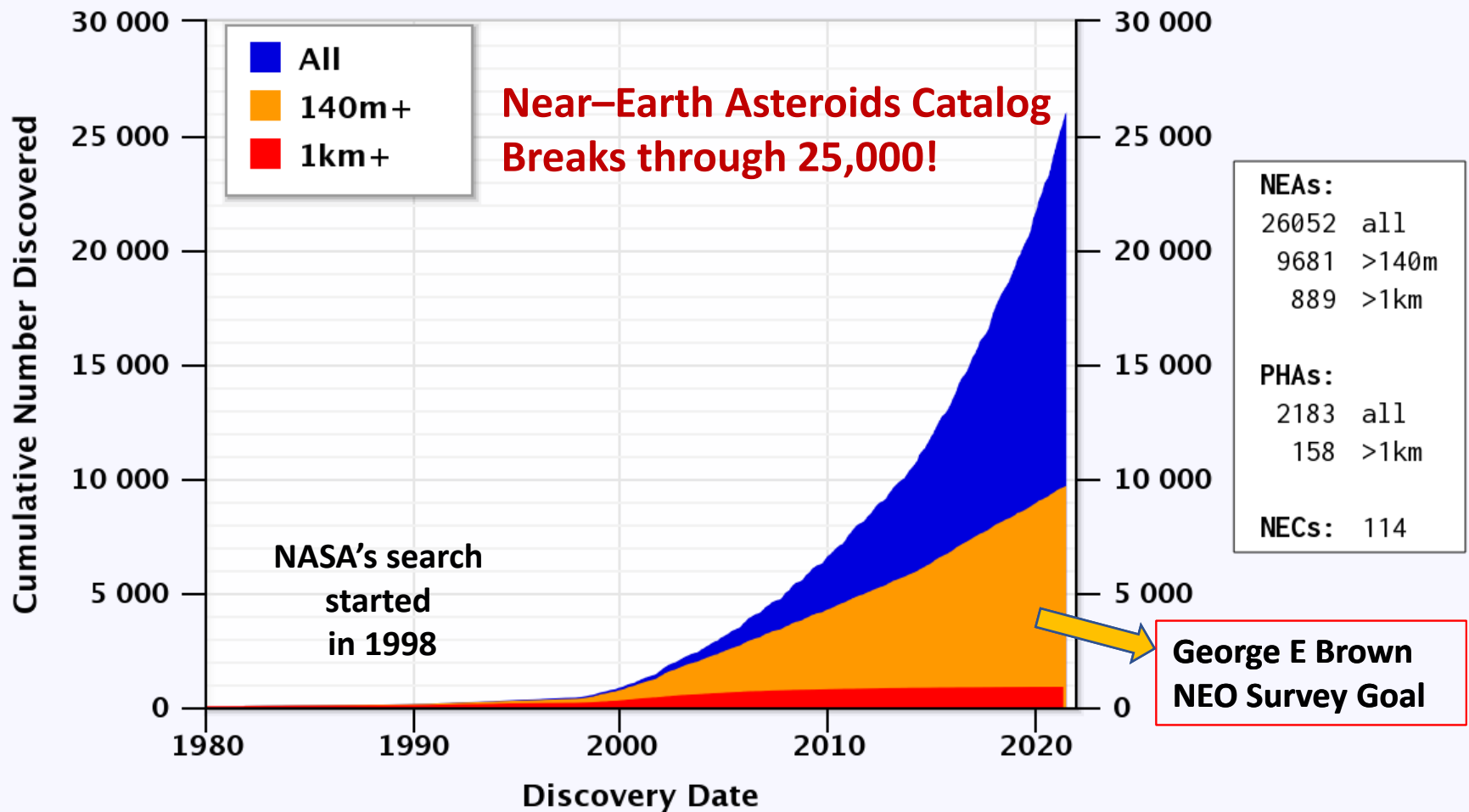
Entry Velocity 15.2 km/sec  
Energy Release ~ 40Mton TNT

Impact Effects:  
Area of Complete Devastation  
~25 km radius  
Area of Sustained Damage  
~100 km radius  
Total Area Affected  
~140,000 square kilometers



## Near-Earth Asteroids Discovered

Most recent discovery: 2021-Jun-11



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

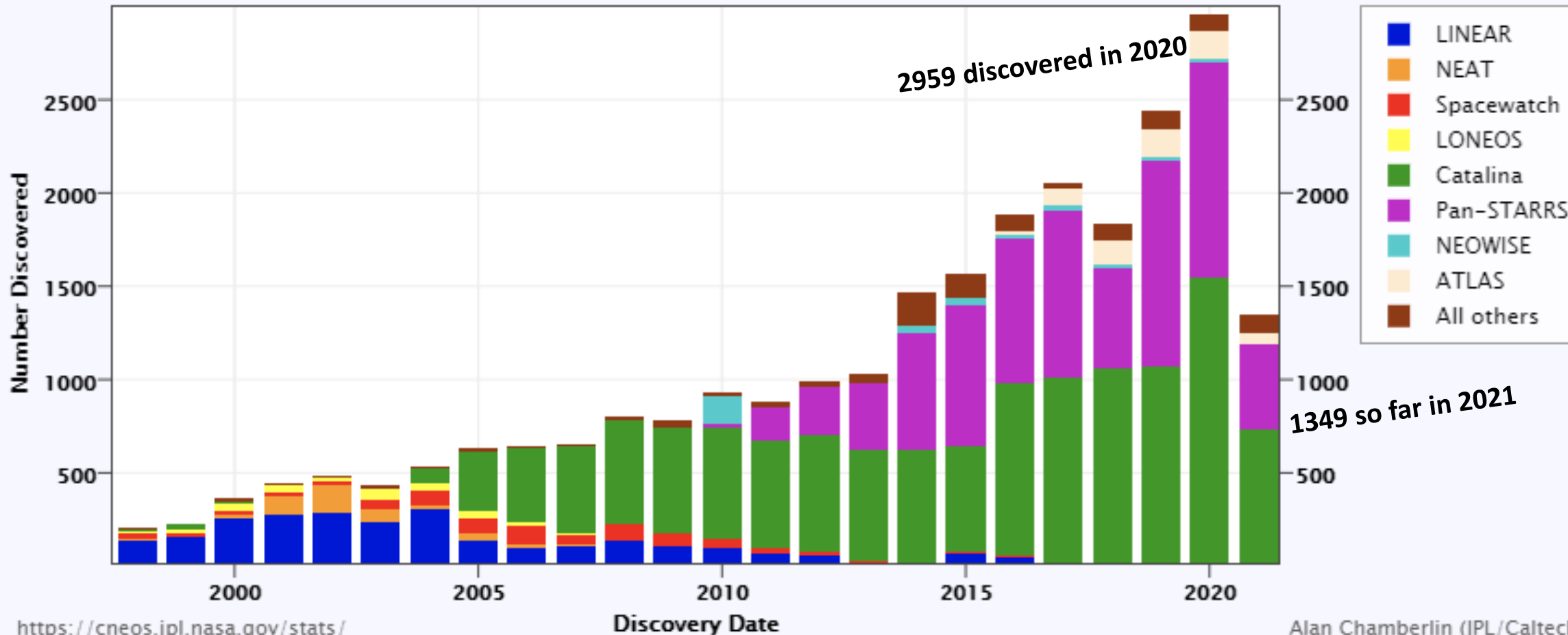
Alan Chamberlin (JPL/Caltech)

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

# All Near-Earth Asteroids (NEAs)

Near-Earth Asteroid Discoveries by Survey

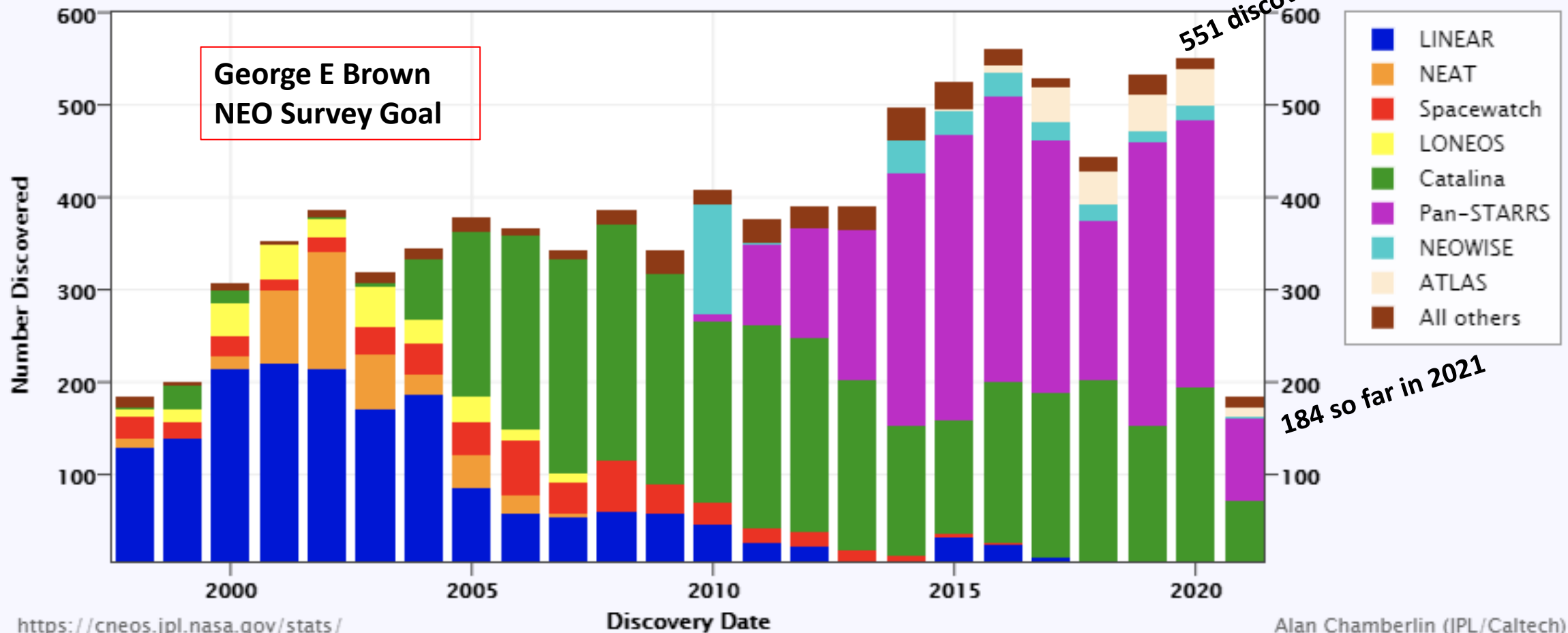
All NEAs (as of 2021-Jun-13)



# NEAs 140 Meters and Larger

## Near-Earth Asteroid Discoveries by Survey

~140m and larger NEAs (as of 2021-Jun-13)

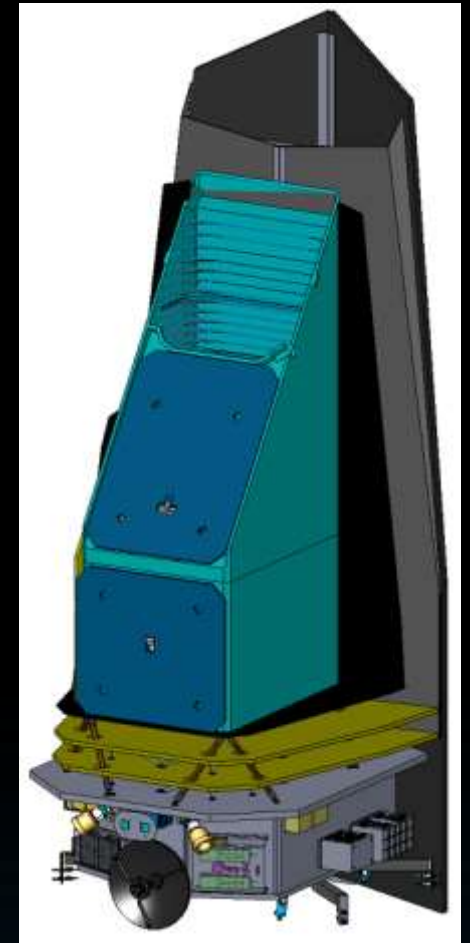


# NEO Surveillance Mission

## 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

NEO Surveyor  
Space-based IR  
Observatory



**KDP-B approved 11 June for entry into Preliminary Design phase**

**President's Budget Request for FY22 would fully fund NEO Surveyor for launch in 2026 if enacted**



# Planetary Radar Planning Activities

## Arecibo Planetary Radar

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



## Future of Planetary Radar

- **Keck Institute Space Studies Workshop on Next Generation Planetary Radar 10-14 May, 2021**
  - Goal of draft report by mid- Summer
- **National Science Foundation Arecibo Observatory Options Workshop running through month of June 2021**

# Launch

On Track for Second launch window  
starting November 24, 2021



**IMPACT: September 30, 2022**

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

## 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

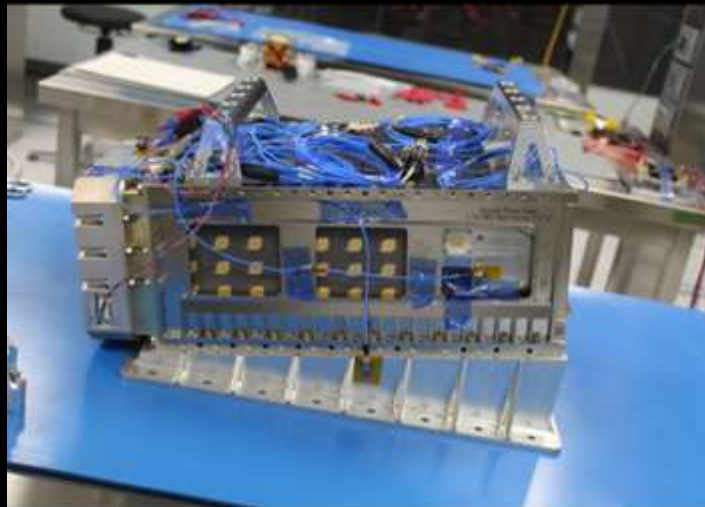
0.07 AU range at impact  
Predicted ~10-minute change  
in binary orbit period

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

# DART Final I&T Activities Proceeding Well

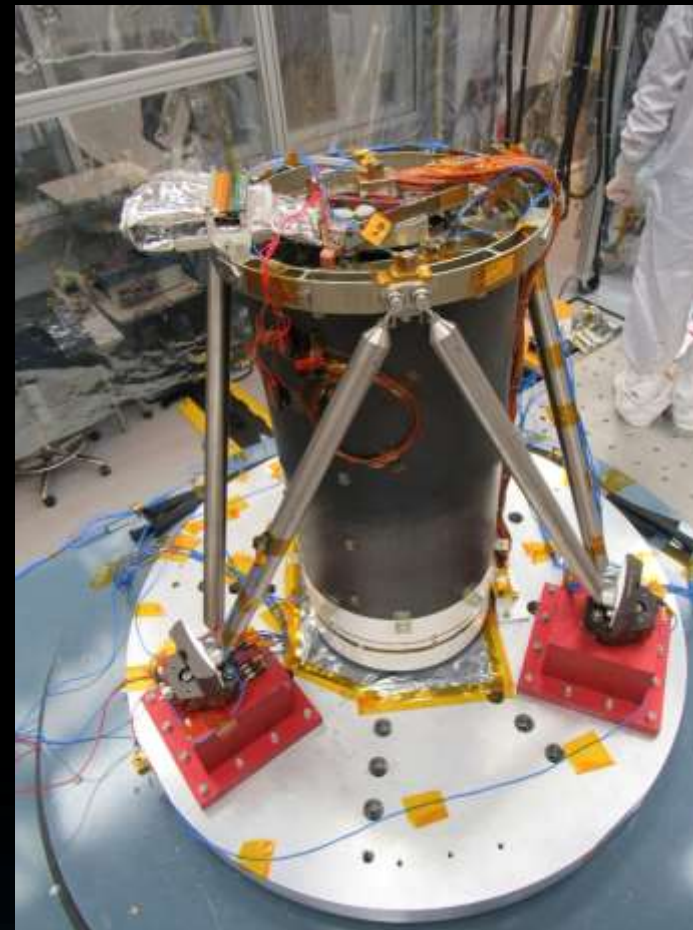


ROSA Wing 1 Installed  
on Spacecraft



*Fully Integrated LICIA Cube System*

On Track for  
Final Vibe Test in July  
Pack and Ship Review  
in September



Rebuilt DRACO completed Vibe  
(shown) and TVAC Testing

