

Hazards from asteroid impacts and the Space Situational Awareness programme

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ESLAB 51, ESTEC/NL Dec 2017

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NEO = Near-Earth object – an asteroid with a perihelion < 1.3 au

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What are asteroids?

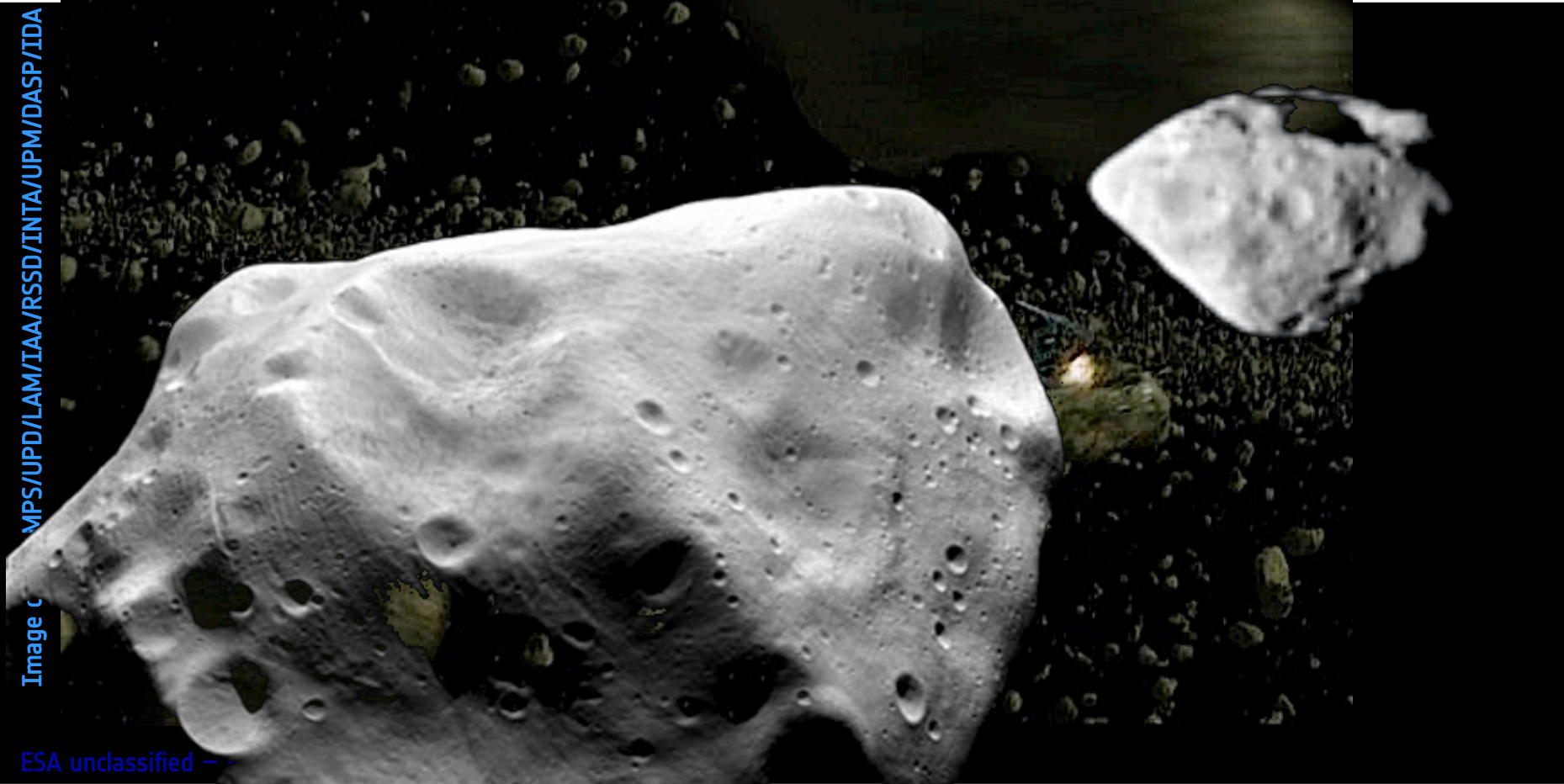
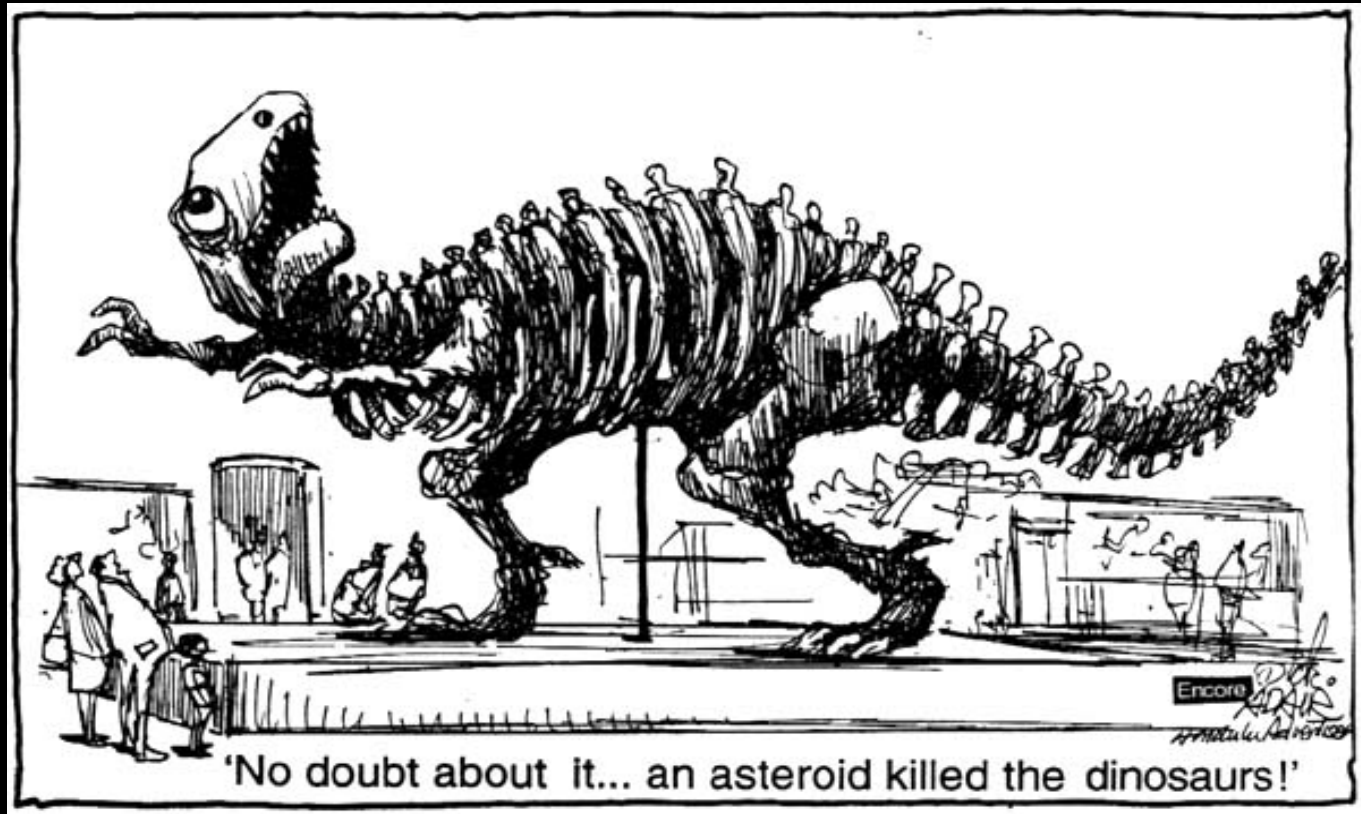


Image credit: MPS/UPD/LAM/IAA/RSSD/TINTA/UPM/DASP/IDA

Image credit

Do they hit? Influence on life?



Cartoon von Dick Adair, Honolulu Advertiser, 10 Okt 2002

Relevance of impacts for
habitability – see Avdellidou’s talk
also refer to : De Sanctis; Delbo
(this session)

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Hypervelocity Impacts & Habitability



- I. Observations
- II. Simulations
- III. Experiments

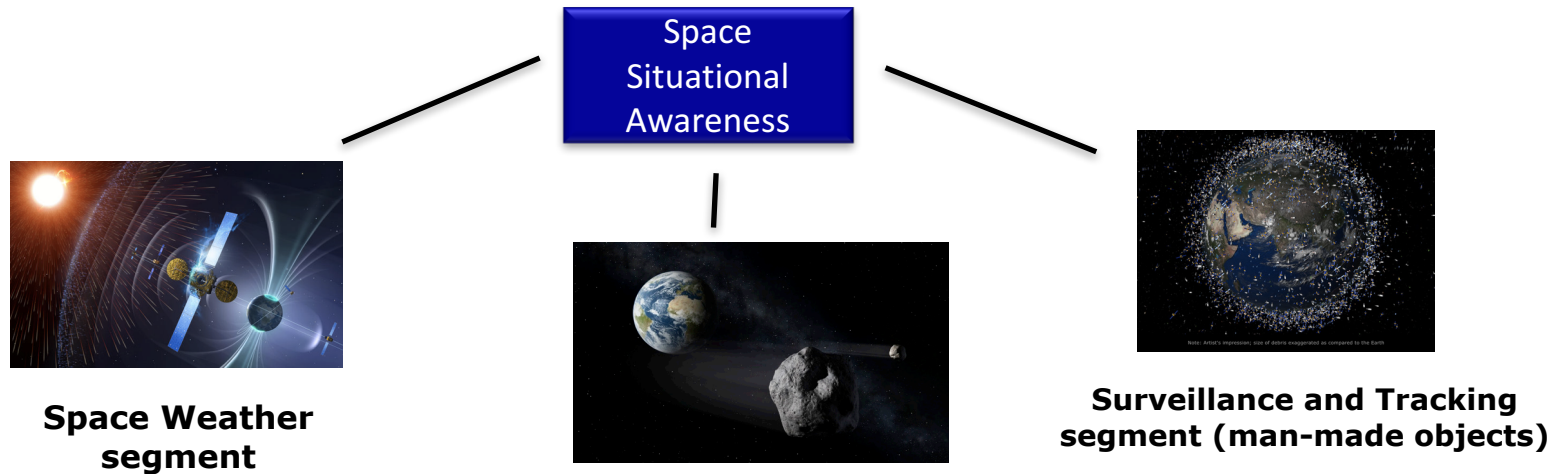
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- 1. Scientific Support Office ESTEC- European Space Agency
- 2. CAPS, University of Kent, UK



ESA's Space Situational Awareness programme

- ❑ Provides a service to customers: governments, disaster management, scientists, information for media (via ESA Communications) about the situation of natural and artificial objects in space; addresses how this affects our assets. This will allow us to better protect our satellites and our planet.
- ❑ Funding 2013-2016 ('Phase 2'): ca. 50 Mio Euro. 2017-2019 ca. 90 Mio Euro.

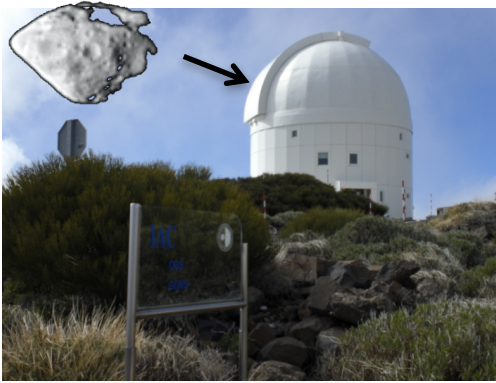


Mission statement



ESA's SSA-NEO segment shall be aware of the situation in space related to natural objects in our solar system. In particular, it shall provide warnings of potentially impacting objects. It shall prepare for mitigation of the resulting risk.

ESA's SSA-NEO segment



IAU Minor Planet Center
The nerve center of asteroid observations in the Solar System



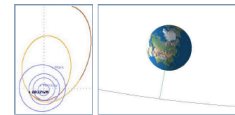
space situational awareness → NEAR-EARTH OBJECTS

Asteroid 2017 GM
A tiny asteroid passes the Earth on 04 April 2017. It is an extremely close approach well below the distance of the Moon and just away from the geostationary ring. It is observable with small telescopes.

Flyby date	2017-04-04
Closest approach time	10:30:00 UTC +00
Minimum distance from Earth surface	86,000 km (distance as a unit)
Flyby speed	18.5 km/s
Size range	μm

Orbit info
The flyby causes a significant increase in the size of the asteroid orbit.

Epoch	Orbit	Aphelion Distance	Perihelion Distance	Eccentricity	Semi-major axis	Orbital period
2017-04-04	11	178.64	1.09	0.196	0.639	1.05
2017-05-04	11	178.64	5.74	0.89	0.753	0.33



Mitigation info
An object of this size leads to the formation of small crater only if metallic composition.

Discovery approach	Time to closest approach	Impact probability	Composition
2017-04-03	Passed	0	Not known

FLYBY FACT SHEET: Asteroid 2017 GM, Release 02/017 April 04, 10:30 UTC
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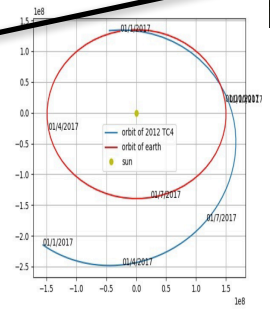
Current number of NEAs in risk list: 647

The Risk List is a catalogue of all objects for which a non-zero impact probability has been detected. Each entry contains details on the highest-probability impact event for the specific object, including its date, time and probability. In most cases, the size presented in the table is estimated indirectly from the absolute magnitude, and flagged with an asterisk to denote its large uncertainty. When a better measurement is available in the literature, it replaces the estimated value.

Object Name	Size [m]	Date/Time	IP	PS	TS	Vel. [km/s]	In list since [days]	IT	PP	OV
2010AF12	9.0*	2095-09-05 23:47	1/16	-3.26	0	12.29	2520	🟢	🟢	🟢
2008Y26	9.0*	2074-05-03 01:00	1/86	-3.91	0	11.57	4085	🟢	🟢	🟢
2012Y4	39.0*	2050-10-12 22:42	1/1245	-3.93	0	12.92	1802	🟢	🟢	🟢
2009SO344	46.0*	2071-09-16 00:26	1/2096	-3.63	0	11.26	9329	🟢	🟢	🟢
2009F1	16.0*	2022-05-08 08:12	1/4464	-3.75	0	26.41	2992	🟢	🟢	🟢
2008QV89	37.0*	2019-09-09 07:03	1/11428	-3.79	0	12.32	3971	🟢	🟢	🟢
2008Q87	71.0*	2060-10-21 18:26	1/76101	-3.83	0	21.57	3396	🟢	🟢	🟢
2012JG28	100.0*	2047-03-28 23:18	1/108979	-3.95	0	21.58	1804	🟢	🟢	🟢
89942 Apophis	375.0	2068-04-12 15:13	1/531914	-3.67	0	12.62	4416	🟢	🟢	🟢
1979XB	860.0*	2113-12-14 18:07	1/1,8466	-3.28	0	26.04	13727	🟢	🟢	🟢

Download as CSV file | Download as Excel file

Last update: 2017-09-14 03:33 UTC



Note: The Minor Planet Center is *not* part of the segment!



Orbits, physical properties, and more....

<http://neo.ssa.esa.int>

Search for Asteroids

Summary

Orbit Properties

Physical Properties

99942 Apophis

Orbital Properties

Orbit type	Aten	
Perihelion (q)	0.746	au
Aphelion (Q)	1.099	au
Eccentricity (e)	0.192	-
Inclination (i)	3.3	deg
Orbit period (P)	323.7	days
Earth MOID	0.00056	au

Next Earth close approach

Date	2021/03/06	
Nominal distance (from Earth center)	0.11265	au
	16852454	km
Maximum Brightness	15.5	-

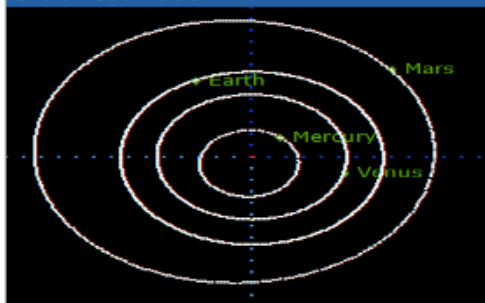
Risk

Object is in risk list
Object is not in priority list

Physical Properties

Absolute Magnitude (H)	18.9	-
Diameter (d)	375.0	m
Taxonomic type	S/Sq	
Rotation period (T)	30.560	h

Orbit Visualization



Discovery Information

Discovery Date	2004-06-19
Observatory	Kitt Peak

Summary and conclusions

- ❑ Since 2009, ESA has been building up a so-called SSA-NEO segment
- ❑ Observations, orbit computations, creation of 'risk list' with possible Earth impactors, set up information flow to e.g. emergency response agencies
- ❑ Provides databases which can be a valuable resource for data mining to understand distribution and composition of asteroids in our own solar system
- ❑ Link to extra-solar objects? The first one was discovered just a few weeks ago!



Credit: ESO/M. Kornmesser



<http://neo.ssa.esa.int>