



Minor Planet Center Updates & new Developments

*Federica Spoto, Matthew Payne & the MPC team
Center for Astrophysics | Harvard & Smithsonian*

CENTER FOR
ASTROPHYSICS
HARVARD & SMITHSONIAN



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The MPC



The Minor Planet Center (MPC) serves as the single worldwide location for tracking and cataloging asteroids, natural irregular satellites of the major planets, and comets, making it central to planetary defense efforts

The MPC is located in Cambridge (MA) at the Center for Astrophysics.

It operates as part of the Smithsonian Astrophysical Observatory under the auspices of the Division F of the IAU

The MPC is responsible for:

- Announcing the discovery of new objects
- Maintaining a consistent catalog of observations and orbits of minor planets, comets and natural satellites
- Announce identifications
- Numbering (assign numbers to objects that have good enough orbits)



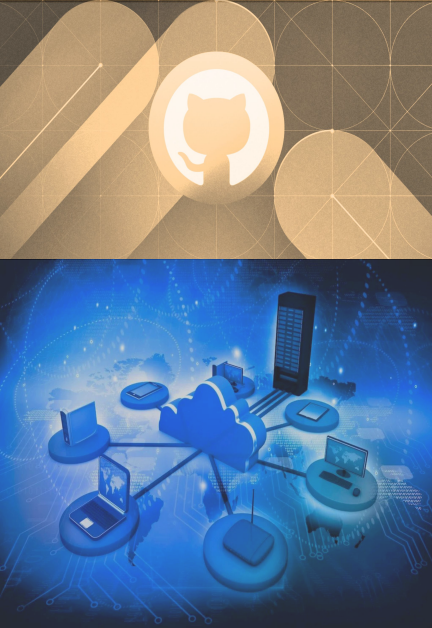
The MPC

| <i>Name</i> | <i>FTE</i> | <i>Role</i> |
|--------------------------|------------|--|
| <i>Matthew Payne</i> | 1.00 | Director |
| <i>Federica Spoto</i> | 1.00 | Project Scientist |
| <i>Mike Alexandersen</i> | 0.90 | Astronomer |
| <i>Dave Bell</i> | 1.00 | Software developer |
| <i>Nora Casale</i> | ~0.80 | Software Developer |
| <i>Margaret Pan</i> | ~0.80 | Astronomer |
| <i>Rosemary Pike</i> | ~0.25 | Astronomer |
| <i>Peter Veres</i> | 1.00 | Astronomer |
| <i>Radiy Matveev</i> | 1.00 | Software Developer |
| <i>Mike Rudenko</i> | 1.00 | Software Developer & Sys-Admin |
| <i>Brian Burt</i> | 1.00 | Software Developer |
| <i>Michael Lackner</i> | 1.00 | Contractor: Database Development & AWS Migration |
| <i>Peter Williams</i> | 1.00 | Technical Lead |



The MPC staff has expanded to **16** team members (5 astronomers & 7 software developers). New additions to the team are: **Paul Di Re** (project manager ~25%); **Yatrik Solanki** (software developer) - started in March 2025; **Jorge Hernandez** (astronomer) - starting in June 2025

What have we been up to?



- The MPC has spent the last years improving its current systems and working towards getting ready for the incoming surveys.

1. **Improving the reliability and access to our data** : website, replication of database tables, APIs, documentation

| OBSERVERS | DATA | NEW | STATUS | DOCUMENTATION | EXTERNAL |
|-----------|------|-------------------|--------|---------------|----------|
| | | Developments | | | |
| | | Existing Upgrades | | | |
| | | Newsletters | | | |

MPC Documentation

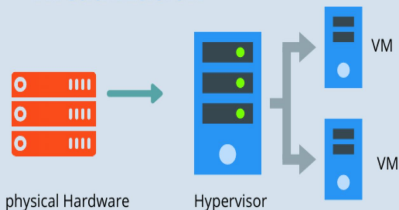
Frequently Asked Questions (FAQ)

- [List of FAQs](#)

2. **Virtualization** : creating a new hardware infrastructure for easier disaster recovery and faster processing times (use of multiple virtual machines)

3. **Moving towards a database-centric system** : ensuring consistency between flat files and database tables for a smooth transition

Virtualization

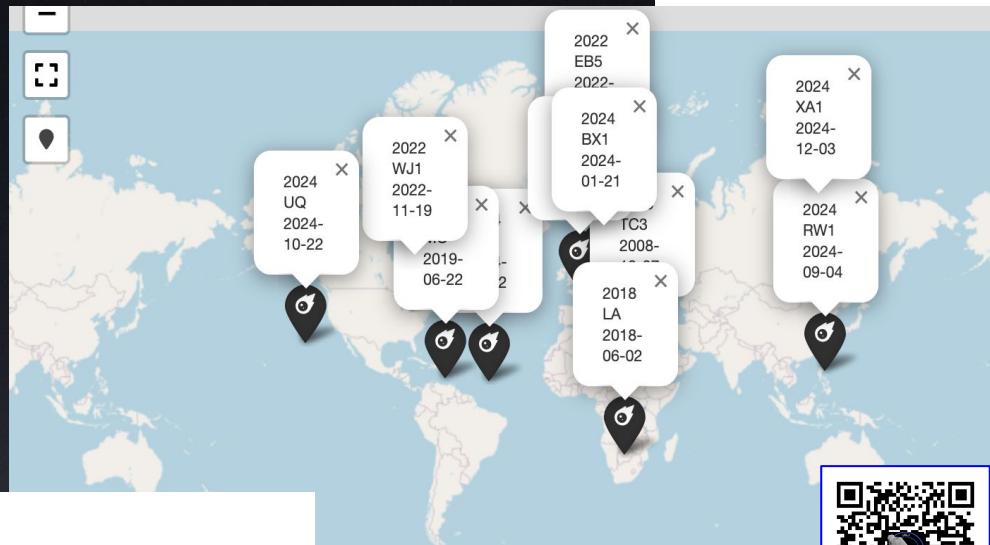


Parts of the new system are already operational and others currently run as part of testing phases with the Vera Rubin/LSST and NEO Surveyor Teams

Past impactors

List of past impactors and their impact locations
(object that have been discovered before entering
Earth's atmosphere):

2008 TC3: Sudan
2014 AA : Atlantic Ocean
2018 LA : Botswana
2019 MO : Caribbean
2022 EB5: North of Iceland
2022 WJ1: Ontario
2023 CX1: North of France
2024 BX1: Berlin
2024 RW1: Island of Luzon (Philippines)
2024 UQ: Pacific Ocean
2024 XA1: Eastern Siberia



MPC Explorer

2025-03-13: This service relies on [Streamlit](#). If you encounter errors related to CSS or JavaScript modules, they are caused by a kn

[Designated Objects](#) [NEOCP](#) [Lists](#) [Documentation](#) [Known issues](#)

Search for a designation, e.g. Benuu, A1234, 1, 401P, Jupiter X, K23A00B, 2024 AA, 2019JD24, C/2019 Y4, CK18Y010, S/2020 S1, SK03J020

2024 YR4

Selected Object: [2024 YR4](#)

[Designation](#) [Observations](#) [Orbit](#)

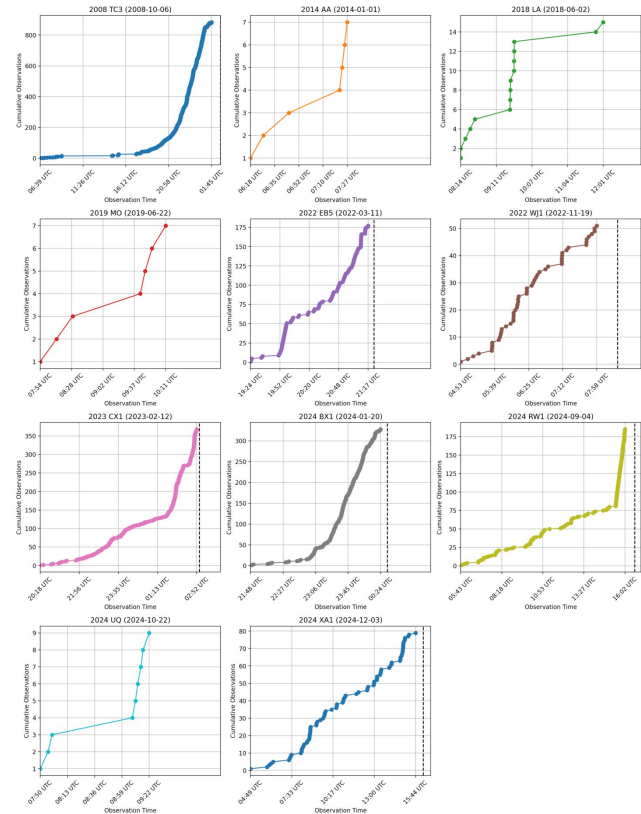
| Id | Type | Values |
|----|------|--------|
|----|------|--------|

[MPC Explorer - Past Impactors list](#)



When to designate an impactor?

Cumulative Observations per Object, Until Impact



Plot from the list of past impactors page from the [MPC Explorer](#): Cumulative distribution of the number of observations per past impactors.

Open question: when is the right time to designate an impactor?

- The MPC has tried two different approaches:
 - *Keeping the object on the NEOCP* until the impact
 - *Removing the object from the NEOCP* before the impact (once the orbit and the impact location were already well determined)

PROs of keeping the object on the NEOCP

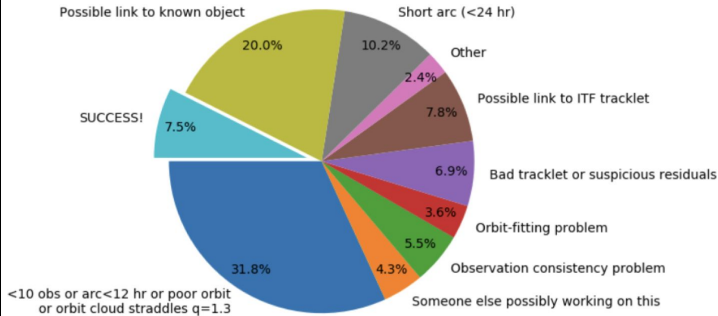
- Recent monitoring systems, like JPL Scout or ESA Meerkat relies on the objects being on the NEOCP
 - Continuous update of observations and ephemerides
 - Easier follow-up from part of the community

CONS of keeping the object on the NEOCP

- The object doesn't have an official designation from the MPC
- More difficult follow-up for the part of the community that has tools set up to work with Horizons and not Scout (or the ephemeris service and not the NEOCP)

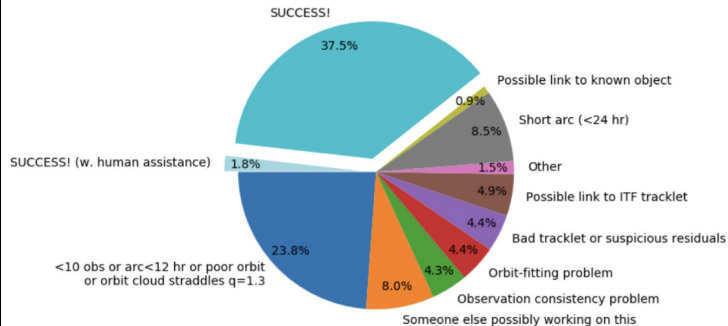
We are working towards finding the best combination.

NEOCP Automated Processing last message
for 1112 objects from 2023-01-01 to 2023-05-01



https://minorplanetcenter.net/media/newsletters/MPC_Newsletter_Jan2024.pdf

NEOCP Automated Processing last message
for 776 objects from 2023-11-06 to 2023-12-31



NEOCP Automatic Processing (NAP)

- NEOs or very distant objects ($q > 5.6$ au) are usually MPEC'ed when we have sufficient astrometry to determine a well constrained orbit
 - Check out our April newsletter for new criteria on MPECs for distant objects
- NAP is an automated script that is able to automatically process and designate NEOCP objects
- Before being automatically designated, the objects go through a very thorough verification process
- **Work in progress:** automating the designation of very-short arc (*less than 24 hours?*)
- **Fun fact:** 2024 YR4 was automatically designated by NAP on Dec 27, 2024

Orbital elements:

2024 YR4 Earth MOID = 0.0027 AU

Epoch 2024 Oct. 17.0 TT = JDT 2460600.5 MPC

M 351.06547 (2000.0) P Q

n 0.24389582 Peri. 134.64369 +0.69266147 -0.71874695

a 2.5370741 Node 271.41255 +0.64353755 +0.65354657

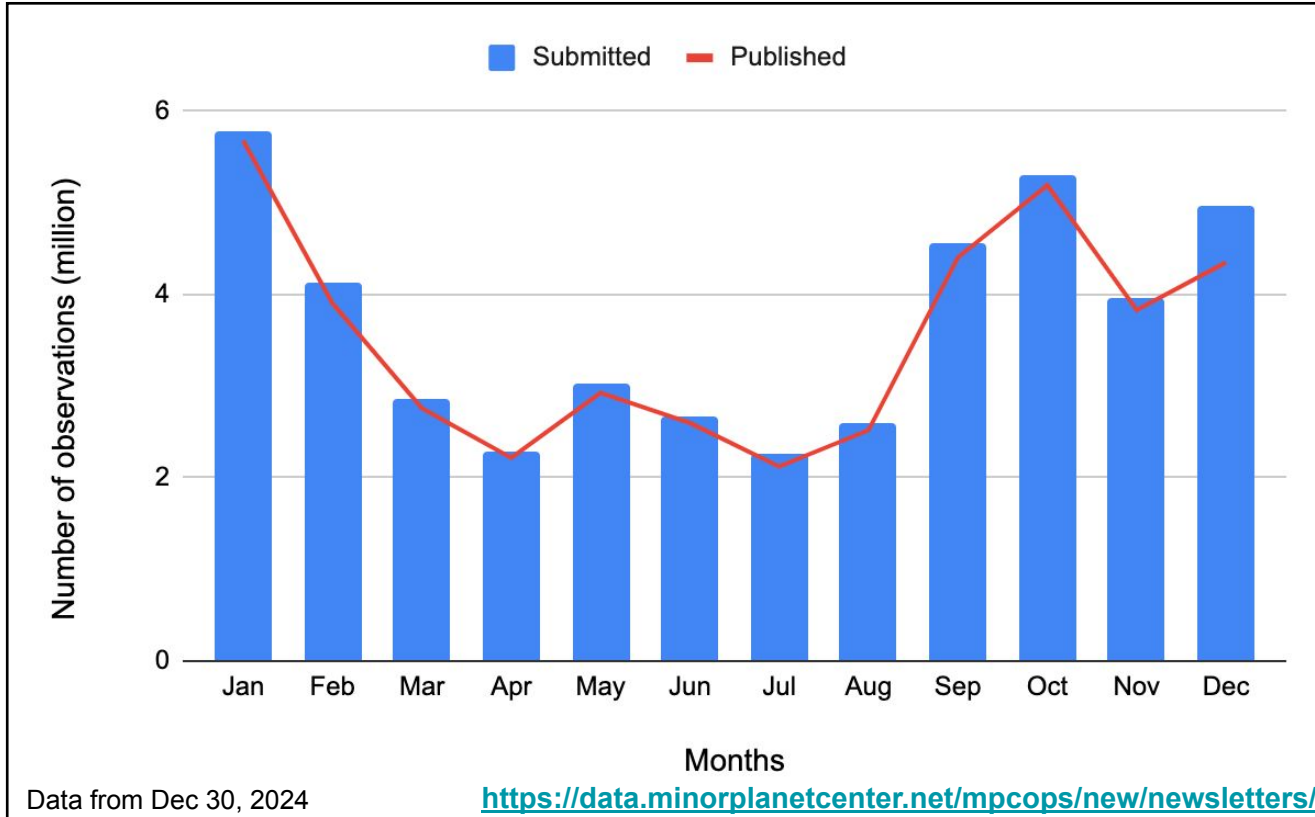
e 0.6638562 Incl. 3.45180 +0.32569849 +0.23723343

P 4.04 H 23.72 G 0.15 U 7

Thank you.



More than 44 million observations have been submitted to the MPC in 2024



For any questions, suggestions, requests, please don't hesitate to contact us using [Jira](#)

