6 February 2025

English only

Committee on the Peaceful Uses of Outer Space
Scientific and Technical Subcommittee
Sixty-second session
Vienna, 3–14 February 2025
Item 9 of the provisional agenda*
Near-Earth Objects

Status report by the International Asteroid Warning Network (IAWN) and the Space Mission Planning Advisory Group (SMPAG)

1. The intention of this conference room paper is to outline main activities by the International Asteroid Warning Network (IAWN) and the Space Mission Planning Advisory Group (SMPAG) since the 61st session of the Scientific and Technical Subcommittee.

Notification by IAWN on asteroid "2024 YR4"

2. On 27 December 2024, asteroid designated "2024 YR4" was first reported by the Asteroid Terrestrial Last Alert System (ATLAS) station of the University of Hawaii, located in Chile during their Near-Earth Asteroid (NEA) search operations for NASA. The worldwide network of observatories of IAWN continued to perform follow-up observations. Detections were also found in archival images taken on 25 and 26 December 2024.

3. The three orbit computation centres of the IAWN, namely the NASA JPL Center for NEO Studies (CNEOS), the ESA Near-Earth Objects Coordination Centre (NEOCC) and the NEO Dynamic Site (NEODyS), independently computed the impact probability for "2024 YR4" on 27 January 2025 and jointly arrived at the conclusion that the impact probability for this asteroid exceeded the 1 per cent threshold for potential impact on 22 December 2032.

4. The IAWN provided information to SMPAG and the United Nations Office for Outer Space Affairs in a notification on 29 January 2025, which was disseminated by UNOOSA, in its capacity as the permanent secretariat of SMPAG[1], on 30 January to States members of the United Nations with the IAWN information notification concerning a potential impact of asteroid "2024 YR4" that exceeds 1% probability threshold for 22 December 2032 (see annex I for the actual IAWN notification for asteroid 2024 YR4 sent on 29 January 2025).

* A/AC.105/C.1/L.418.
[1] General Assembly resolution 71/90, para. 9.

5. The IAWN and SMPAG recalled criteria and thresholds, as agreed in 2017[2] for impact response actions, as follows: thresholds for issuing warnings of possible impact effects of asteroids by IAWN is (i) a probability of impact greater than 1% and (ii) a rough size estimated to be greater than 10 meters (33 feet). For SMPAG to start mission option(s) planning when warned of a possible impact: (i) Predicted to be within 50 years; ii) probability is assessed to be greater than 1 per cent, and iii) object is characterized to be greater than 50 meters in size (please refer to Criteria and thresholds in annex II).

6. According to calculations from available observations, the size of asteroid "2024 YR4" is most likely between 40-90 meters and the probability of the object missing the Earth is almost 99%. The object is still being considered by the IAWN and SMPAG, which will provide further information to inform Member States.

7. SMPAG, on 31 January, at its ad hoc meeting of the Heads of delegations, agreed on the following statement, given the currently available information about asteroid "2024 YR4":

In a dedicated (virtual) meeting on 31 January 2025, the Space Mission Planning Advisory Group (SMPAG) has considered the very small probability of an impact of asteroid 2024 YR4 in December 2032. The object currently has a 1.3 % impact probability, the estimated size is between 40 and 90 m. The threshold for SMPAG to become active is >1 % and >50 m in size, therefore SMPAG has considered the known facts about the object. It was concluded that it is too early to take immediate action. However, SMPAG will monitor the evolution of impact threat and possible knowledge about the size closely. Another meeting to take decisions on future activities will be held latest towards the end of this visibility period (roughly end of April/early May this year), or earlier, if the evolution of the threat merits.

8. SMPAG at its 24th meeting on the 5 February 2025, agreed on an updated statement, as follows:

In an in-person meeting on 05 February 2025, the Space Mission Planning Advisory Group (SMPAG) discussed the most recent information provided by the International Asteroid Warning Network (IAWN) on the asteroid 2024 YR4 encounter with Earth in Dec 2032. The object currently has a 1.6 % impact probability, and the estimated size remains between 40 and 90 m. At this meeting, it was concluded that SMPAG will continue to actively monitor the evolution of the impact probability and possible knowledge about the object size. The Group has started to discuss activities but considers it is premature to develop specific recommendations for space missions. Recommendations for space mission profiles are discussed as part of the on-going exercise and can be adapted to 2024 YR4 if deemed necessary. This will be reassessed at a future meeting, which will be held towards the end of this visibility period (roughly the end of April/early May 2025) or earlier, if the evolution of the threat merits.

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Other activities (unrelated to asteroid 2024 YR4): Hypothetical asteroid impact exercise

9. The IAWN and SMPAG have also been working since August 2024 on a hypothetical asteroid impact scenario to test their capabilities, in preparation for the 2025 IAA Planetary Defense Conference. The preliminary recommendations of the hypothetical asteroid impact exercise can be found here. Recommendations for space mission profiles are discussed as part of the on-going exercise could be used as examples for addressing the 2024 YR4 situation.

[2] A/AC.105/2017/C.1/CRP.25

Annex I: Actual IAWN Notification on 29 January 2025 on a potential impact of asteroid 2024 YR4

INTERNATIONAL ASTEROID WARNING NETWORK (IAWN)

POTENTIAL ASTEROID IMPACT NOTIFICATION

Date: 29 January 2025
From: International Asteroid Warning Network (IAWN)
IAWN Coordinating Officer (NASA) for the IAWN Steering Committee
To: Chair (ESA), Space Mission Planning Advisory Group (SMPAG);
Planetary Defence Programme Officer, United Nations Office of Outer Space Affairs (UNOOSA)
Title: Potential for Impact of Near-Earth Asteroid 2024 YR4 on 22 December 2032

Impact Probability	1.3% as calculated by NASA JPL Center for NEO Studies and ESA Near-Earth Objects Coordination Centre (NEOCC) with the NEO Dynamic Site (NEODyS)
Date of Potential Impact	22 December 2032
Impact Risk Corridor	Across the eastern Pacific Ocean, northern South America, the Atlantic Ocean, Africa, the Arabian Sea, and South Asia
Asteroid Size	Most likely in the range 40–90 meters (130–300 feet) in size
Expected Damage Level if Impact Occurs	Severe blast damage in the unlikely event of an impact
When will there be new information?	The asteroid will be observable, and information will be updated, through early April 2025 and then again starting in June 2028 when the asteroid will return to the vicinity of Earth

ADDITIONAL DETAILS:

- **Notification Threshold:** 1% is the notification threshold for IAWN[1]
- **Impact Probability:** There is a 1.3% probability that near-Earth asteroid (NEA) 2025 YR4 could impact Earth on 22 December 2032. While there is large uncertainty in whether the asteroid will impact Earth, if an impact occurs it will be on this date. There is almost a 99% probability that 2024 YR4 will safely pass by Earth on this date.
- **Impact Probability Confirmation:** The impact probability was calculated by the NASA JPL Center for Near-Earth Object Studies (CNEOS) and ESA Near-Earth Objects Coordination Centre (NEOCC) with the NEO Dynamic Site (NEODyS), in coordination with the worldwide network of observatories in the International Asteroid Warning Network (IAWN) submitting observations to the Minor Planet Center (MPC).
- **Future Observability and Update to Impact Probability:** Future observations will reduce the uncertainty in the 2024 YR4's trajectory and impact probability. The NEA will be observable through early 2025 April, after which point it will become too faint to be observable from Earth until 2028 June when the asteroid's approximately 4 year orbit returns it to the vicinity of Earth. The NEA will be quite faint and will likely require large (2-meter and larger) telescopes. By the end of the 2025 observability window, the impact probability could increase to a couple tens of percent or it could more likely drop back below the notification threshold (1% impact probability). Detections of 2024 YR4 in archival images have not been found but searches will continue as the orbit is better constrained.

- **Impact Risk Corridor:** The impact risk corridor for 2025 YR4, which is the region of Earth along which a potential impact could occur, extends across the eastern Pacific Ocean, northern South America, the Atlantic Ocean, Africa, the Arabian Sea, and South Asia
- **Asteroid size:** 2024 YR4 is likely in the range 40–90 meters (130–300 feet). The size cannot be further constrained without deep space radar observations, thermal infrared observations, or imagery from a spacecraft that could closely approach the asteroid. Additionally, the asteroid is now too distant for radar observations and will not come within radar range until 2032.
- **Expected Damage Level if Impact Occurs:** Blast damage could occur as far as 50 km from the impact site, based on the larger end of the size range.
- **Discovery:** 2024 YR4 was first reported on 27 December 2024 by the Asteroid Terrestrial Last Alert System (ATLAS) station of the University of Hawai'i in Chile during NEA search operations for NASA. NASA-funded astronomers and the worldwide network of observatories of the IAWN continued to perform follow-up observations. Detections were also found in archival images taken on 25 and 26 December 2024.

[1]*This notification is issued by the International Asteroid Warning Network (IAWN)* in accordance with criteria and thresholds for impact response actions in report A/AC.105/C.1/2017/CRP.25 to the Scientific and Technical Subcommittee of the United Nations Committee on the Peaceful Uses of Outer Space. The threshold for issuing warnings of possible impact effects is a probability of impact greater than 1% and a rough size estimated to be greater than 10 meters (33 feet). IAWN is a worldwide collaboration of asteroid observers and modelers that was recommended by the United Nations. https://iawn.net*

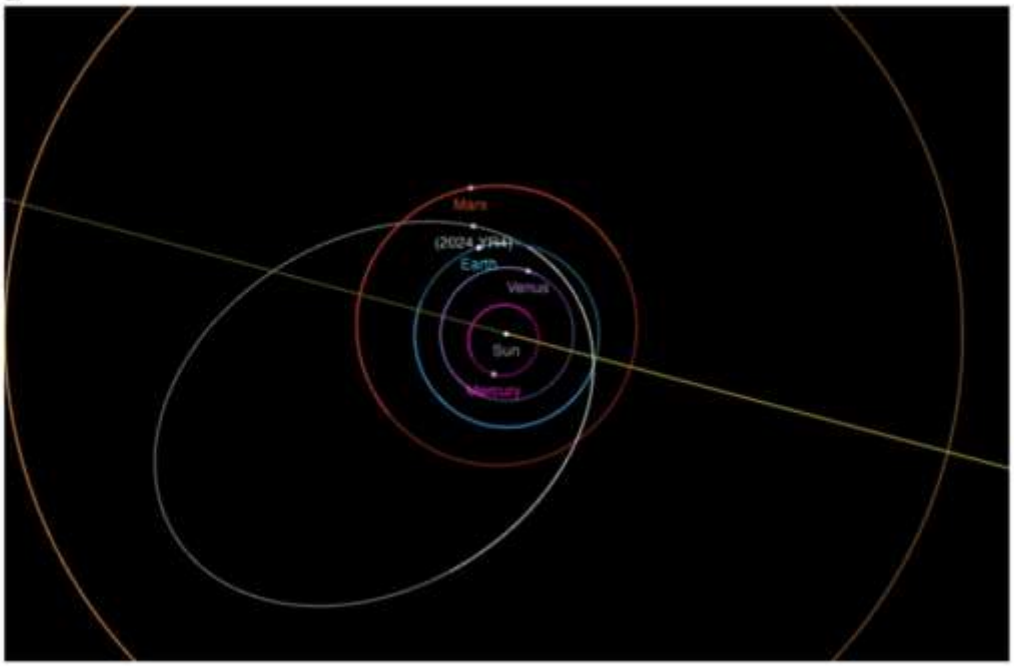
The Committee in its annual reports (e.g. A/78/20, para. 119) notes that should a credible threat of impact be discovered by the IAWN, available information would be provided by IAWN and disseminated to all Member States through the Office for Outer Space Affairs. The Office for Outer Space Affairs disseminates information pursuant to General Assembly resolution 78/72, paragraph 14, concerning the work carried out by the International Asteroid Warning Network (IAWN) and the Space Mission Planning Advisory Group (SMPAG) and in its capacity as the permanent secretariat of SMPAG. IAWN also provides information to SMPAG.

**The United Nations General Assembly in its resolution 70/82 of 9 December 2015 noted with satifaction the establishment of the International Asteroid Warning Network (IAWN) and the Space Mission Planning Advisory Group (SMPAG) to implement recommendations for an international response to the near-Earth object impact that were endorsed by the Committee on the Peaceful Uses of Outer Space in 2013 (A/68/20, para. 144).*

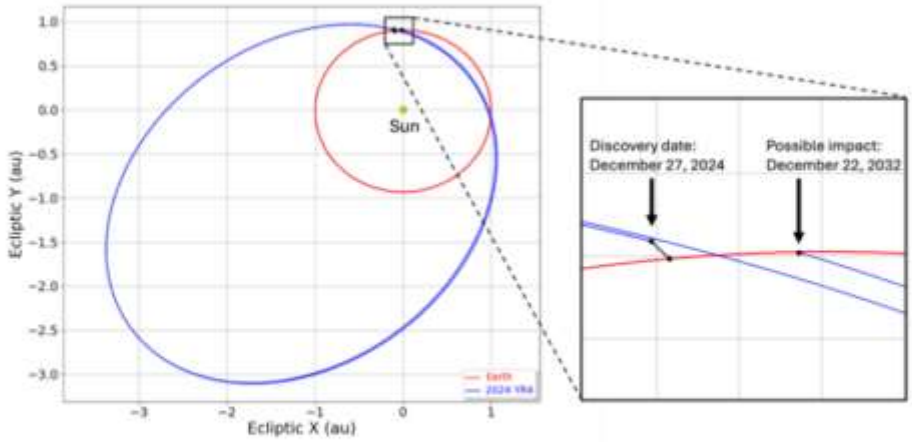
Graphics and Websites

1. Helio-centric orbit diagram of 2024 YR4 relative to Earth orbit
2. Position relative to Earth orbit of 2024 YR4 at discovery in December 2024 and after two orbits of the asteroid around the Sun on 22 December 2032
3. Possible locations of 2024 YR4 relative to Earth on 22 December 2032 from Monte Carlo modeling

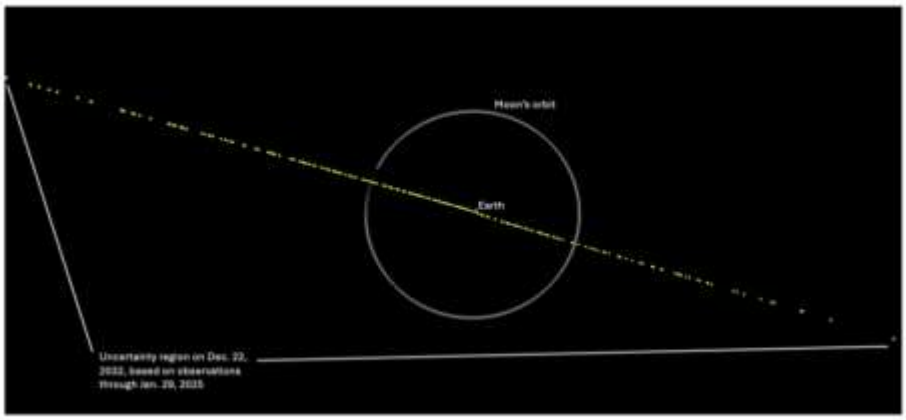
1.


Mars
(2024 YR4)
Earth
Venus
Sun
Mercury

2.


Sun
Ecliptic Y (au)
Ecliptic X (au)
Discovery date:
December 27, 2024
Possible impact:
December 22, 2032

3.



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Annex II

Criteria and thresholds for impact response actions by IAWN and SMPAG, as initially agreed by the IAWN and SMPAG in 2017[3]

The IAWN and SMPAG in 2017 agreed on initial criteria and thresholds for impact response actions, as follows:

(1) IAWN shall warn of predicted impacts exceeding a probability of 1 per cent for all objects characterized to be greater than 10 meters in size, or roughly equivalent to absolute magnitude of 28 if only brightness data can be collected.

Rationale: Impact probabilities greater than 1 per cent are rare. Most objects greater than 10 meters in size will have effects (air blast and pieces) that could reach the Earth's surface. IAWN is compelled to warn populations if bodies will have effects that reach the ground. Setting threshold at 1 per cent is a compromise between not being overly alarmist and not warning too late for necessary action to be initiated. It is a probability figure that individuals and governments can comprehend. An alert such as this demonstrates that the IAWN is functioning. Further, it ensures the flow of communications from IAWN to the public and the United Nations.

(2) Terrestrial preparedness planning is recommended to begin when warned of a possible impact:

- Predicted to be within 20 years,
- Probability of impact is assessed to be greater than 10 per cent, and
- Object is characterized to be greater than 20 meters in size, or roughly equivalent to absolute magnitude of 27 if only brightness data can be collected.

Rationale: Terrestrial preparedness and the increased potential for impact will also involve determination of a "risk corridor" from objects with 10 per cent impact probabilities and impacts in less than 20 years. This provides populations and population centres on the Earth information to begin preparations for emergency preparedness if needed. The surprising effects of the Chelyabinsk event in 2013 from an object ~18 meters in size in turn, led to the establishment of a lower limit (20 meters) in these threshold criteria.

[3] A/AC.105/2017/C.1/CRP.25

(3) SMPAG should start mission option(s) planning when warned of a possible impact:

- Predicted to be within 50 years,
- Probability is assessed to be greater than 1 per cent, and
- Object is characterized to be greater than 50 meters in size, or roughly equivalent to absolute magnitude of 26 if only brightness data can be collected.

Rationale: Several decades warning, if available, enables sufficient lead time to mount characterization missions. If a 1 per cent probability on a 100-meter object is assessed, SMPAG will be informed immediately following verification of the precise orbit. Part of such a characterization mission would likely deploy a transponder with the object.