



Juno's Extended Mission and the Contributing Role of Amateur Observers

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Introduction

NASA has approved an extension of the Juno mission, originally in 53-day elliptical polar orbits around Jupiter. The extended mission began 1 August 2021 and will continue through September 2025. The extended mission expands Juno's science goals beyond those of the prime mission.

Expected Science in the Extended Juno Mission

- Atmosphere studies: Investigate Jupiter's northern latitudes, polar cyclones, ionospheric profile (electron and neutral temperature) using a series of occultations of high-gain radio signal, and variability of lightning on Jupiter's night side
- Interior structure: Investigate shearing at depth of a region of intensive inward magnetic field lines ("the Great Blue Spot"), characterize Jupiter's shallow dynamo and unexpectedly dilute core, and the interior/atmosphere coupling
- Magnetosphere studies: Explore the polar magnetopause and probe the polar cap auroral acceleration
- Ring studies: Characterize the ring dust and its source bodies and the ring plasma environment
- Ganymede: Investigate the 3-D structure and dynamics of its magnetosphere and ionosphere
- Europa: Investigate the ice shell and characterize surface sputtering
- Io: Constrain the global magma ocean and magnetospheric interaction

Physical Details of the Mission

The sequence of orbits and key investigations of the primary and extended missions are shown in Figure 1. We note that on PJ34, the orbital period is reduced from 53 days to 43-44 days. It will further be reduced on PJ45 to 38 days and again on PJ57 to ~33 days.

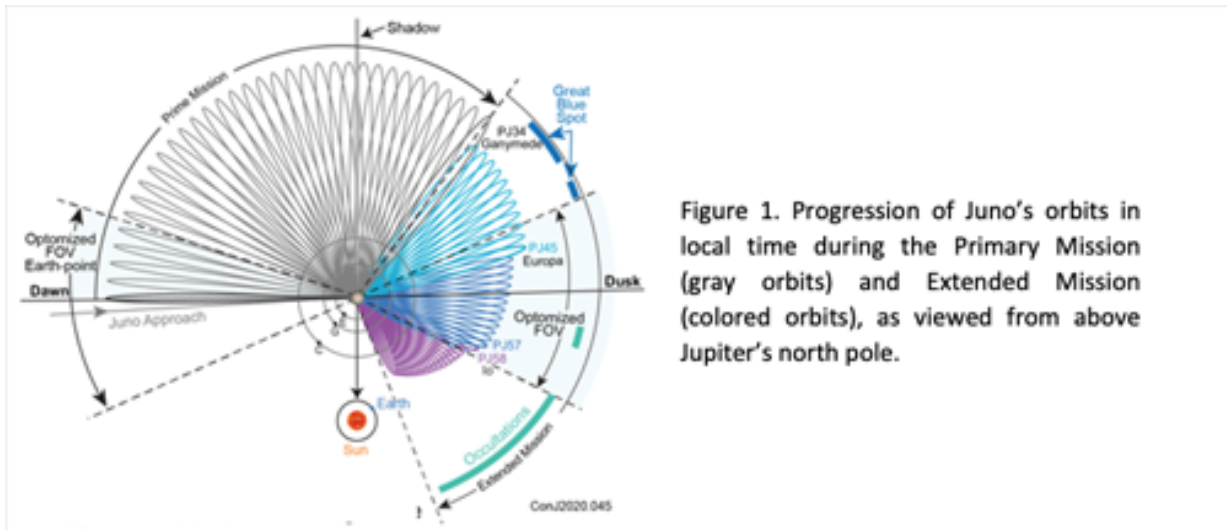


Figure 1. Progression of Juno's orbits in local time during the Primary Mission (gray orbits) and Extended Mission (colored orbits), as viewed from above Jupiter's north pole.

Some characteristics of perijoves (close approaches) PJ35-PJ53 of the extended mission are shown in Table 1. We caution that while the day of year for the perijoves is reasonably fixed, the exact times may change by hours in either direction and the longitudes will change accordingly. Timing for later orbits up to PJ76, may be affected by currently unmodeled anomalies in satellite masses that could change dates and times.

Role of Amateur Astronomers

We've noted in the past at previous EPSC meetings how amateurs can contribute to the Juno mission via the world-wide 24/7 coverage of Jupiter. Observations during the extended mission will provide both the Juno science team of changes in Jupiter's atmosphere, such as the interaction between the Great Red Spot and smaller anticyclones, and the occurrence and evolution of outbursts such as "Clyde's Spot". Atmospheric maps will also provide context for Juno's lightning searches. For these and for the continuity of atmospheric scrutiny, from which the mission has benefitted so far, we wish the community clear skies and fervently hope for your continued success.

Table 1. Current estimated parameters for Juno extended mission perijoves PJ34-PJ53.

PJ	Date	Approx. Spacecraft Event Time	PJ lat. (centric)	Approx. PJ long. (Sys. III)	Solar Elongation
34	2021 Jun 8	07:30	28°	290°	105°
35	2021 Jul 21	08:00	29°	300°	147°
36	2021 Sep 2	23:00	30°	100°	165°
37	2021 Oct 16	17:00	31°	40°	119°
38	2021 Nov 29	14:00	32°	80°	78°
39	2022 Jan 12	10:30	32°	90°	41°
40	2022 Feb 25	02:00	33°	280°	7°
41	2022 Apr 9	16:00	34°	60°	26°
42	2022 May 23	02:00	35°	70°	60°
43	2022 Jul 5	09:00	36°	310°	95°
44	2022 Aug 17	15:00	37°	150°	135°
45	2022 Sep 29	17:00	37°	230°	177°
46	2022 Nov 6	21:00	38°	350°	136°
47	2022 Dec 15	03:00	39°	160°	97°
48	2023 Jan 22	06:00	40°	200°	63°

49	2023 Mar 1	05:30	41°	170°	15°
50	2023 Apr 8	10:00	42°	270°	0°
51	2023 May 16	07:30	43°	150°	11°
52	2023 Jun 23	07:00	44°	80°	21°
53	2023 Jul 31	09:00	45°	120°	26°