

## **JunoCam at PJ57: Part II: Jupiter**

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Juno's 57<sup>th</sup> perijove was on 2023 Dec.30, about 4 hours after the close flyby of Io. JunoCam obtained a series of inbound and north polar images, and a lo-res outbound series, all free of the problems seen at PJ56. [Figure 1](#) shows a selection of images almost from beginning to end of the Jupiter flyby. Perijove was on the dark side at 47.4°N, and equator crossing was at L3=108. *For comparison with ground-based images, please see our 2023/24 Report no.4, posted elsewhere on this web site.*

This report, like all in this series, is due to the work of the NASA JunoCam team: Drs Candy Hansen (Principal Investigator), Glenn Orton, Tom Momary, and Mike Caplinger (of Malin Space Science Systems); and Gerald Eichstädt, who produces complete sets of high-quality processed images and map projections. Details were given in our PJ6 report. Gerald produces both cylindrical and polar map projections of all the images, and also assembles them into composite maps using automated (though not automatic) procedures.

Abbreviations and conventions are as in previous reports, including: AWO = anticyclonic white oval, FFR = (cyclonic) folded filamentary region, CPC = circumpolar cyclone. Latitudes are planetocentric. Longitudes are in System 3 (L3).

**Impact flash site:** Just 12 hours before Juno's late inbound images, a typical impact fireball was recorded by an amateur observer in Colombia, Andres Arboleda: on Dec.29 at 23:57 UT, at L3=221, latitude 27°N (planetocentric; 30°N planetographic; in the whitened NTB(N)). The impact site was visible in Juno's approach images only 12 hours later, such as [Figure 2](#) (*see labelled version in Report no.4*). The images showed nothing unusual there, although this is the shortest time interval yet between a fireball and a spacecraft image of the site -- even less than JunoCam's last such observation, at PJ37.

### **Global maps and inbound images**

The late approach images showed a section of the NEB, with excellent views of large interesting features ([Figure 2](#)). These are labelled on [Figure 3](#): White Spot Z, the long-lived AWO; ADS, an anticyclonic dark spot that has now reddened and faded; and a typical dark brown barge, with another rift wrapping cyclonically around it. Between these spots is the longest faded barge, overlaid by mesoscale waves with a wavelength of 1.15° (1390 km), similar to those recorded in this same sector at PJ52. They are aligned with the expected retrograde flow along the N edge of the faded barge, and this is not the first time that we have recorded mesoscale waves along the edge of a barge; they may form where the retrograde jet is accelerated by the barge circulation.

Because the previous two flybys passed over similar longitudes, this sector was also well seen at PJ55 (see [Figure 6](#) of our PJ55 report) and PJ56 (though the images have not yet been fully restored).

[Figure 3](#) is the global map made from the PJ57 images. An unlabelled version is in the ZIP file, and our ground-based map for comparison is in *Report no.4*.

## North polar region

North polar projection maps of the JunoCam and ground-based images are in [Figure 4](#). The best match between them is with Chris Go's images (L3 207-328) taken at the same time as Juno's approach. Many features are well matched, including the large N5-AWO (also shown in [Figures 1 & 3](#)), and several FFRs and an AWO in the NPR at  $\sim 66\text{-}73^\circ\text{N}$ , and even a cyclonic white spot at  $77^\circ\text{N}$  (also shown at the top of [Figure 5](#)).

[Figure 5](#) is a map of the *circumpolar cyclones (CPCs)*. It shows 5 of the 8 CPCs and most of the central North Polar Cyclone (NPC). CPC-8 is very disturbed and we wonder whether it will survive. Three AWOs are indicated (red arrows). The one outside the octagon is now quite large and stationary. Inside the octagon, very unusually, there are two AWOs close together. All these features will be fully discussed in our report on PJ58. [Figure 6](#) is part of the map at full resolution, showing CPC-1 and one AWO; this is JunoCam's highest-resolution image so far of both features. On the edges of CPC-1, the very bright clouds flanked by relatively greenish haze are very likely thunderstorms.

After north pole crossing, images 62-64 were taken as Juno passed low over the NPR and crossed the terminator. As usual, they did not show any distinct shadows and the few pop-up clouds appeared subdued, presumably due to the diffuse overlying North Polar Hood. Prominent linear bands were seen over the Bland Zone towards the southern horizon. Only one image was taken during the close passage over the dark side.

## South polar region

The south pole is now in darkness, and distant from Juno's trajectory, so I have not commented on this region at many recent perijoves. But some of the features can still be profitably followed in maps from JunoCam's outbound images, so we can find out whether there are any changes between summer (6 years ago) and winter (now). Here are four figures from Gerald Eichstädt's south polar maps at PJ57, which show aspects apparently similar to the state early in the mission, although closer study and measurements will be needed to establish whether there are any changes.

[Figure 7](#): South polar projection map. Several of the CPCs can be half-seen protruding from the darkness, although no structure can be resolved in them.

[Figure 8](#): Composites of south polar projection maps emphasising the terminator regions, to show elevated haze structures. These show two features that we also noted in the PJ52 report: (i) a dense pattern of circumferential streaks, which may represent ripples in the S. Polar Hood; (ii) the Long Band, which has been present intermittently throughout Juno's mission.

[Figure 9](#): Three south polar projection maps showing different aspects of the Long Band under different lighting. The central panel is from [Figure 8](#). Arrows indicate its left portion (previously tangential to 1 or 2 CPCs although we cannot distinguish them here) and its right portion where it curves north (at somewhat higher longitude than previously). At PJ43 and PJ46, we had noted that there was a remnant of it but shorter and weaker than before. Since then we have not followed it systematically, but the images at PJ52 clearly showed a feature like the Long Band, and now we see it again.

[Anim-1](#): Animated blink of south polar projection maps from images 70 & 79, 2h 00m apart, showing the rapid, wavy winds of the N6 jet, and the circulations in the FFRs. It looks very similar to the blinks that we used several years ago to characterise these features; measurements would show whether the wind speeds are the same.

## Figure legends:

**Figure 1.** A selection of images from beginning to end of the Jupiter flyby. All processed by Gerald Eichstädt, contrast enhanced by JHR. *Image 21:* GRS.

*Image 57* (detail): the large long-lived AWO on the N edge of the N5 domain (north is up).

*Image 70:* first image after perijove, looking down on the south pole; note the dense pattern of haze bands visible on the terminator. The blue-green area is due to saturation as this is one of the outbound images given longer exposure in order to improve terminator detail.

*Image 101:* Final image, including shadows of Europa and Ganymede.

**Figure 2.** Image 50, processed by Björn Jónsson (with sharpening), showing important features in the NEB. (For a similar image that is unsharpened and labelled, see our *2023/24 Report no.4.*)

**Figure 3.** Global map from the PJ57 images, made by Gerald Eichstädt. This is mainly from inbound images, except the high southern latitudes from outbound images (including the shadow of Ganymede). Long-lived features are labelled; an unlabelled version is provided in the ZIP file. Orange arrows indicate barges, in the NEB and SEB, or faded barges.

**Figure 4.** North polar projection maps of the JunoCam and ground-based images. The best match between them is with Chris Go's images (L3 207-328) taken at the same time as Juno's approach.

**Figure 5.** North polar projection map down to 75°N showing the circumpolar cyclones (CPCs) and three AWOs (red arrows). This copy is at reduced resolution.

**Figure 6.** Excerpt from the north polar map at full resolution, showing CPC-1 and one AWO, from images 60 & 62.

**Figure 7.** South polar projection map (Gerald Eichstädt's automated assembly.)

**Figure 8.** Composites of south polar projection maps emphasising the terminator regions, to show elevated haze structures.

**Figure 9.** Three south polar projection maps showing different aspects of the Long Band under different lighting. The central panel is from [Figure 8](#). Arrows indicate its left and right portions.