Draft News Note for JBAA (2016 August)

by John Rogers [2016 June 7]

NASA's Juno spacecraft [went into orbit] around Jupiter on 2016 July 5: the first spacecraft to orbit the giant planet since Galileo was terminated in 2003 [2003 Sep.21]. Indeed, for some years, Jupiter was the only one of the five classical planets that did not have a working orbiter, though that status ended with the demise of Venus Express [2015 Jan.18 – but Japanese orbiter now there] and Messenger [2015 April 30] in 2015. As described below, Juno will start its scientific mission this autumn. This bulletin summarises the state of the planet's atmosphere during the 2015/16 apparition, up to the start of the Juno mission.

Jupiter in 2015/16

The map (**Fig.1**) shows the state of the visible features in [2016 April]. (In this report, and during the Juno mission, we will show images and maps with north up for compatability with the NASA convention.) Thanks to the improved understanding that we have gained from hi-res amateur images and analysis as well as professional studies in recent years, we can now describe the major belts in relation to their multi-year cycles of activity.

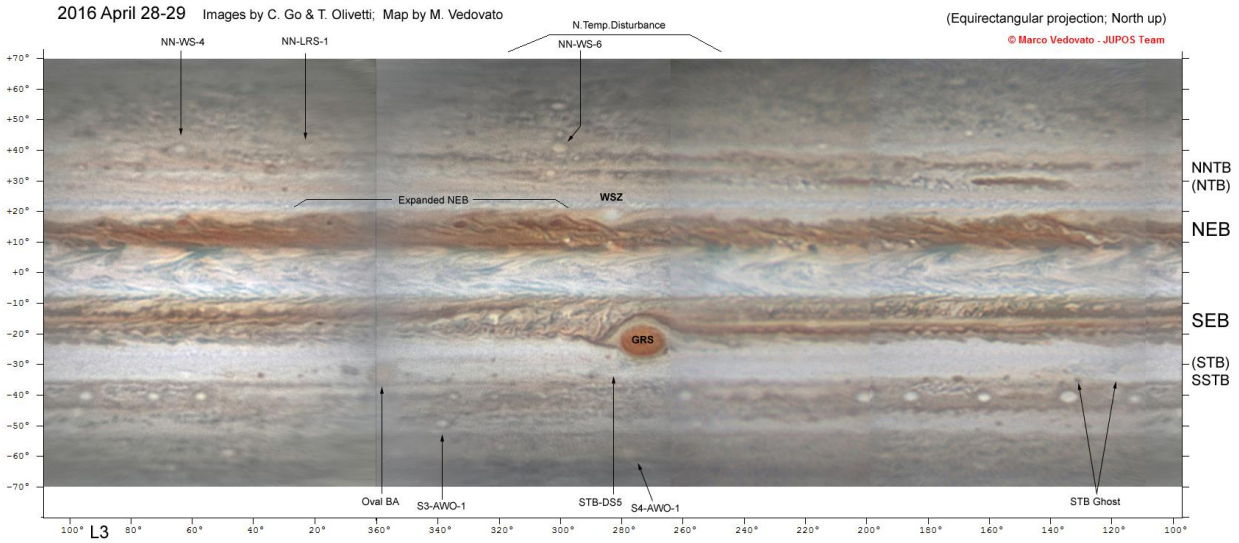

Figure 1. Map of the planet....

The North Equatorial Belt (NEB) has undergone an 'expansion event' every 3-5 years since 1987, in which the north edge of the belt shifts north from 16-17ºN to 20-21ºN. In 2015, both the timing (3 years after the last one), and the appearance within the NEB of rather slow-moving 'rifts' (turbulent bright streaks), suggested that a new NEB expansion event was imminent. Although it was slow to start, it eventually got going during solar conjunction and covered ~95º longitude by 2015 Nov. The expanded sector continued to spread to lower longitudes, as usual, covering 140º by 2016 Feb., and the appearance of several little brown ovals in the North Tropical Zone was another typical feature.

Notably, images in the methane band at 889 nm wavelength showed a wave-like series of diffuse dark patches spaced 18º apart over the expanded sector and flanking regions **[Fig.2A]**. These waves represented thinnings of the haze overlying the NEB. Similar waves had been imaged during the NEB expansion event in 2000, but not subsequently, so their prominence in 2015-16 was an important feature of the event for professional as well as amateur observers.

However, in Feb. the NEB expansion event stalled, and then started to regress, even though it had not quite covered half the circumference. This was unprecedented: all previously studied events spread all around the circumference. Why this one 'ran out of steam' is unknown, but one wonders whether it

marks the end of the recent periodic series of such events. In any case, five cyclonic dark ovals ('barges') have already appeared in and flanking the expanded sector, and some are likely to persist for a year or more.

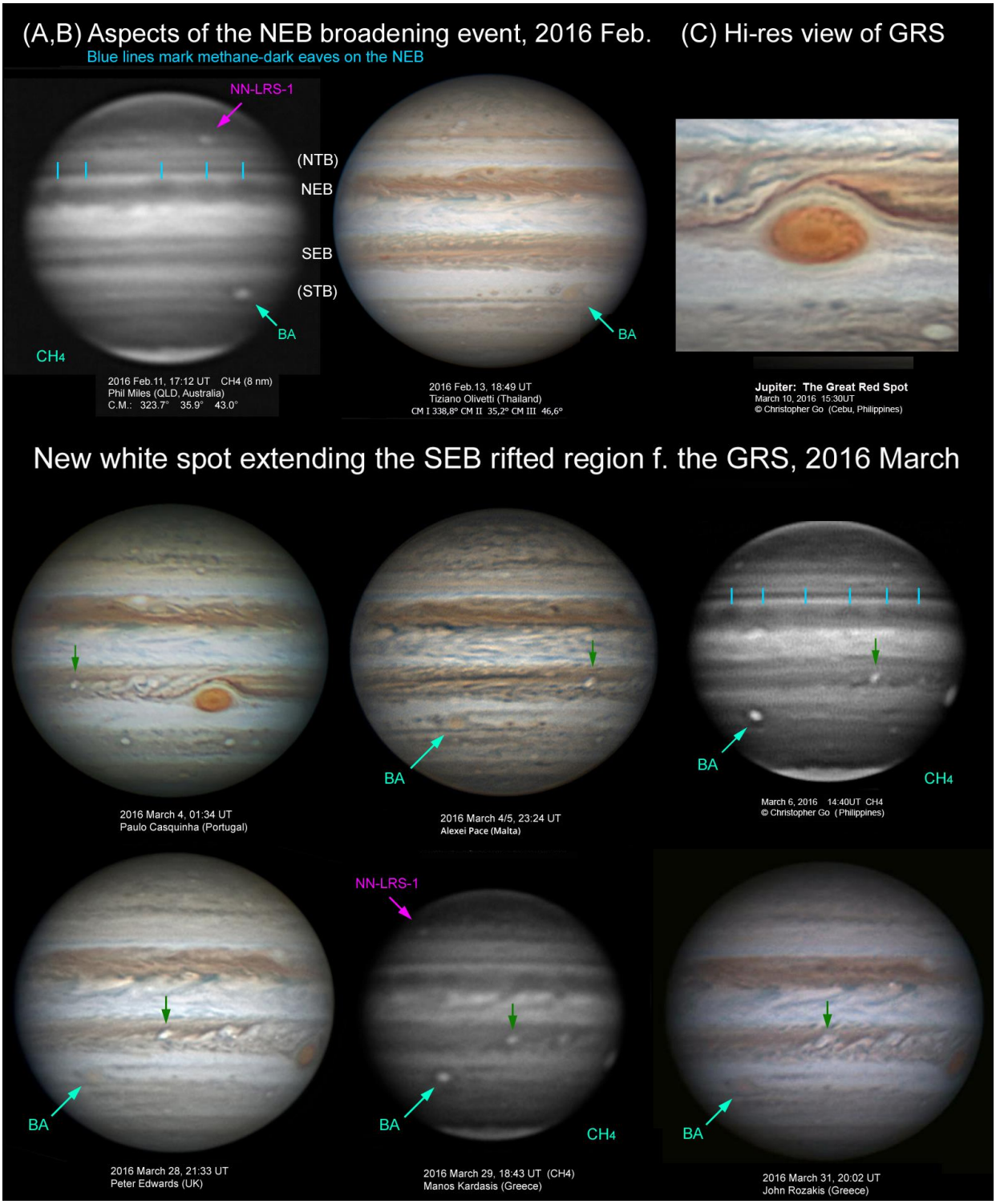

Figure 2: Some images showing features mentioned in the text.....
including methane-band images showing the NEB waves and new plumes in the SEB.

The South Equatorial Belt (SEB) is in a state of normal activity; i.e. the belt is dark and quiet except for a sector of 'rifts' following the Great Red Spot (GRS). Sometimes it undergoes cycles of circum-global fading and revival (most recently in 2010), but then for many years it can be in this normal state, as was observed during the Voyager and Cassini flybys. The rift activity following the GRS had almost stopped in Feb. 2015, but it resumed, and became more extensive in March 2016 as new white spots appeared at higher longitudes than before: one on March 1, and another at even higher longitude on March 26 [**Fig.2**]. These white spots are large thunderstorms, according to spacecraft observations, and when new they are also bright in methane-band images [**Fig.2**], showing that they are convective cloud plumes reaching to a considerable height. The present intensity of the activity suggests that this normal state may continue for some time.

The GRS, though, is unusually small and unusually red, as it has been since 2013. It has been shrinking, with fluctuations, since the early 20th century, and in early 2014 reached the smallest size ever recorded, just 13.5º long – a size which has been approximately maintained since. The strong red colour is normally seen only during fadings of the SEB, but now seems to be the 'new normal' – possibly because the small size means that the GRS interacts less with the adjacent jetstreams, although our observations show that some interaction is continuing. Recent improvements in image resolution have allowed us to track the internal circulation of the GRS on many occasions since early 2014 [Michel Jacquesson & JHR], and the circulation period has consistently been 3.7 (±0.1) days throughout these years – shorter than we have ever recorded before, due mainly to the reduced circumference of the GRS.

The South Temperate Belt (STB) is completely absent! This domain has a unique pattern of long-term activity: it always has between 2 and 4 'structured sectors', outside which the STB is almost featureless. One of these sectors includes the large anticyclonic oval, called BA, which is usually reddish, and moves comparatively slowly. Other structured sectors drift more rapidly, and eventually collide with oval BA, while one or more new ones arise in previously undisturbed longitudes. At present there are three such sectors, but none is dark. One is at oval BA, where the adjacent STB segment has shrunk to a tiny dark spot. Another is a pale bluish loop called the STB Ghost, which is a cyclonic circulation, [which is on course to reach oval BA in early 2018]. The third arose in early 2015 as a very dark cyclonic spot, which has now faded to leave just a pale bluish loop around it; it is developing into a replica of the STB Ghost, which we will call the STB Spectre. These structured sectors are likely to proceed on fairly steady courses; but the complete absence of dark STB is abnormal and perhaps unsustainable, so it is possible that the STB will revive in some unexpected manner, as happened in 1993.

The North Temperate Belt (NTB) undergoes cycles of activity which sometimes recur at 5-year intervals, as in 2007 and 2012. The most distinctive event is an outbreak of brilliant white plume(s) on the super-fast jetstream on the NTB south edge, which typically produces vigorous activity leading to a vividly orange NTB(S). We can now recognise further sequels of the outbreak which typically unfold over several years. One of these, observed from 2009-2011 and again at present, is a darkened sector of North Temperate Zone called a North Temperate Disturbance, induced by a sector of small-scale rifting in the revived NTB.

The NTB(S) has now faded again to a very pale state. Even so, it is sometimes possible to measure wind speeds along it, which indicate that the speed of the jet is intermediate between its normal and super-fast states. Given these conditions, and the 5-year periodicity, we may see a new outbreak in early 2017.

The principal long-lived features on the planet are anticyclonic ovals, which are marked on the map (**Fig.1**). The GRS is the largest, and oval BA the second largest. Other large ones are NN-LRS-1 (the N.N. Temperate Little Red Spot at ~41ºN) and S4-AWO-1 (anticyclonic oval at ~60ºS). These four ovals are all reddish for most or all of the time, and this seems to be a feature of large, long-lived ones, perhaps because their circulation extends deeper than for smaller, white ovals. Anticyclonic white ovals (AWOs) are present in all other domains, notably in the North Tropical domain (White Spot Z, which has existed since 1997), and the S.S. Temperate domain (an array of 9 AWOs). [Many of these are also very long-lived; they typically last for at least several years; NN-LRS-1, S4-AWO-1, and some of those in the S.S. Temperate domain, have existed since 1987-1993 or even earlier.] They are readily identified

on hi-res methane-band images, as all these anticyclonic ovals (except, oddly, WSZ) are methane-bright, as their red or white cloud caps extend to high altitude [**Fig.2**].

More details of these phenomena in 2015/16 have been posted as interim reports on the Jupiter Section's new web pages at: https://www.britastro.org/section_front/15.
Articles explaining the long-term background to these phenomena, along with many previous interim reports, are on our older web site at: http://www.britastro.org/jupiter.

Fireballs on Jupiter [box]

On 2016 March 17 (St. Patrick's day), a bright flash lasting about one second was detected on the limb of Jupiter in videos by Gerrit Kernbauer (in Austria) and John McKeon (in Ireland). This was the fourth ground-based detection of a fireball in Jupiter's atmosphere, following similar events in 2010 June, 2010 August, and 2012 September. They are due to impacts of small asteroids or comets in the 10-metre range, comparable in energy to the smallest fragments of comet Shoemaker-Levy 9, or to the Chelyabinsk impact in Russia [2013 Feb.15]. They explode above Jupiter's cloud-tops and leave no trace.

At the Nice workshop, McKeon described his observation which confirmed the latest event, and the entertaining media circus which followed. Isshi Tabe described how Japanese astronomers conducted intensive, sensitive searches for such fireballs from 2012 to 2015, using a range of apertures from 0.4 m to 2.0 m, in the methane as well as visible wavebands. In over 160 hours of videos, no fireballs were detected. Marc Delcroix described the DeTeCt project, which he developed incorporating work by Ricardo Hueso. The software is available for any observer to use to screen their own videos for fireballs, and all serious imagers are encouraged to use it:
http://www.astrosurf.com/planetessaf/doc/project_detect.shtml. So far over 56 days of video have been analysed, with no new detections – which is disappointing as some theoretical estimates predicted one or more impacts in this time. As each event so far has been recorded by at least two observers – some of them hitherto little known in the wider astronomical community -- it seems that the amateur video coverage of Jupiter is not missing as many events as might have been thought. If the St. Patrick's day event is included in DeTeCt, the nominal rate is ~6.5 per year; but this may be regarded as an upper limit, as that event was only included subsequent to its independent discovery. The lower limit for observable impacts is the actual observed frequency: 4 in 6 years, which should be multiplied at least two-fold to cover the periods when Jupiter is not being observed much (when it is low in the sky from Europe, America, and the Far East, and during solar conjunction): thus, ~1.3 per year. (Both upper and lower limits are, of course, also subject to the statistical uncertainty inherent in small numbers.)

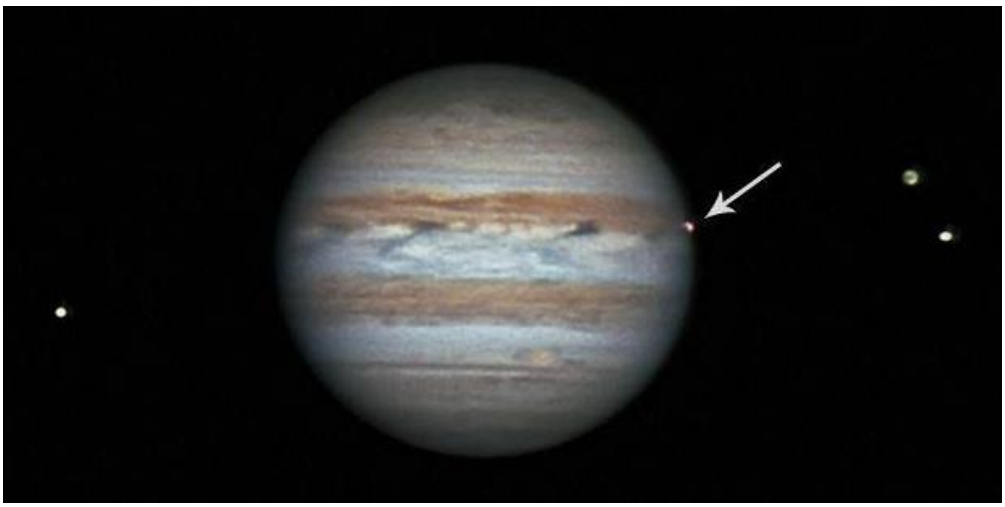

Fig. = composite image from the raw images of both observers

Pro-Am Workshop in Nice

In preparation for the professional-amateur (pro-am) collaboration which is expected during the Juno mission, a workshop on 'Juno Ground-based Support from Amateurs' was held in Nice, France, on 2016 May 12-13. It was organised by Dr Ricardo Hueso and Dr Paolo Tanga, and funded by the European Union through the EuroPlanet network. It took place at the Observatoire de la Côte d'Azur, high on a hill with a spectacular view over the city and the sea.
Tha aims were to inform amateur observers about the Juno mission and the plans for obtaining both professional and amateur observations of Jupiter during this mission; and to enable amateurs to improve their own imaging by sharing of best-practice techniques.
This was a valuable opportunity for some of the best-known amateurs from Europe (and several from the Far East) to meet each other, and to meet professional planetary scientists. The participants were united in enthusiasm that we are all part of a shared enterprise, producing new results, valued by professional scientists as well as ourselves.

Figure: The participants in the Nice workshop, at the Nice Observatory.

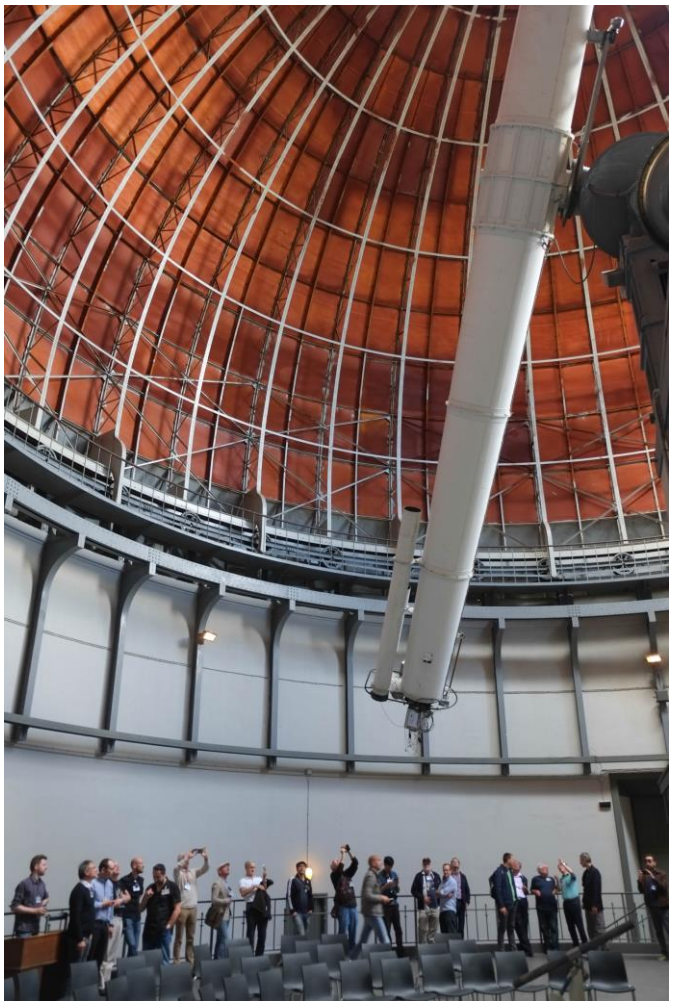

Figure: Workshop particpants viewing the 77-cm refractor of the Nice Observatory, which dates from 1886. The dome was designed by Gustave Eiffel, architect of the famous tower.
(Picture by Matic Smrekar.)

Figure (below): John Rogers, Damian Peach, Christopher Go, Glenn Orton.

[I have some other informal group photos too, one of which could be used.]

There were 30 talks, of which only some can be mentioned here.
Dr Glenn Orton (NASA Jet Propulsion Lab), who represents the JunoCam team and has been travelling the world to liaise with amateurs, explained the Juno mission and the JunoCam project [see below], urging all amateurs to participate. Dr Tristan Guillot (Observatoire de la Côte d'Azur) explained one of the main scientific purposes of the Juno mission, the gravitational probing of the planet's interior. Dr Leigh Fletcher (University of Leicester) showed how large ground-based telescopes can now produce spectacular images and spectra of Jupiter's mid-infrared thermal emissions (and will do so during the Juno mission), which complement spacecraft data and amateur imaging to produce a three-dimensional understanding of the atmosphere. John Rogers described the current state of Jupiter's atmosphere [see above], pointing out phenomena of possible interest for JunoCam, with hi-res maps provided by amateur imagers and the JUPOS team.

Several leading amateur observers presented aspects of state-of-the-art planetary imaging, including Christopher Go (visiting from the Philippines) and Damian Peach (UK) who described how they produce their top-quality images. Go uses at least six programs sequentially: Firecapture for image capture, Autostakkert!2 for stacking, Registax for wavelets, GoogleNik for sharpening, Photoshop for noise reduction, and finally, WinJUPOS for combining several images by derotation. All this takes four times as long as the imaging session itself! Contributions from Australian observers were presented *in absentia* by Ricardo Hueso, and Kuniaki Horikawa described the work of Japanese observers. Christophe Pellier (France) gave a masterly review on the use of filters for Jupiter.

Currently, amateurs use small(ish) telescopes frequently, mostly in the visible waveband, whereas professionals use large telescopes for short periods, mostly in the infrared. But this gap is being bridged. On the professional side, Dr Agustin Sanchez-Lavega (University of the Basque Country) described how his group is now obtaining time for planets on medium and large telescopes, including the 2.2 metre telescope at Calar Alto, using 'PlanetCam' which takes hi-res images from the 0.38 to 1.7 microns - a great step forward in capability. He has also set up a Meade 14" at Calar Alto for remote operation. Whereas remote imaging is now well established for deep-sky objects, it has not been practical for top-quality imaging of planets up to now, because careful manual control is needed for best results. However, several organisations are now installing suitable systems with telescopes in the one-metre range, which will be available for amateur use. J-P. Rivet and J-P. Prost (France) described one such set-up using a pair of 1-metre telescopes owned by the University of Nice. Damian Peach mentioned another being installed near La Silla, Chile; and the Sierra Stars Observatory in California is also installing one. Also, the 1-metre telescope at the Pic du Midi is available for experienced amateurs to use on site, as described by Jean-Luc Dauvergne and Dr Francois Colas.

For top-quality imaging and image analysis by amateurs, software suites generated by individual amateur enthusiasts – Registax, AutoStakkert!, and WinJUPOS -- are now crucial. Emil Kraaikamp (Netherlands) described aspects of his AutoStakkert! software. For the JUPOS team, Michel Jacquesson described how images are measured, and Marco Vedovato described the construction of maps and zonal wind profiles. Dr Ricardo Hueso (University of the Basque Country) showed how his professional team are likewise using amateur images to extract zonal wind profiles. He also outlined new developments of the PVOL database of amateur images, which will make it more convenient and capable, and the development of a companion Virtual European Solar and Planetary Archive, which will give access to all spacecraft images. Johan Warell (Sweden) presented the 'Voyager 3' project of Swedish amateurs to create a continuous animation of Jupiter's winds from amateur images.

The JunoCam data will also require careful processing by amateurs to produce fully aligned and realistic images [see below], but of a completely different nature. Gerald Eichstädt (Germany) showed how he had done this with the images from Juno's Earth flyby; the final versions posted by NASA were mostly his.

Several organisational issues were addressed in a concluding discussion.

1) Submission of images to databases: At present, observers are asked to submit to three worldwide databases (PVOL, ALPO-Japan, and JunoCam), and there are also some national databases. Several observers (especially Jean-Luc Dauvergne) suggested that there should be just one global database with direct uploading from the image processing software. In fact, AutoStakkert!2 already has a direct uploading facility. There was no enthusiasm for discontinuing any of the existing databases, but the operators of all of them are making submission as simple as possible, and will consider how to make uploading and sharing easier.
2) Maintenance of software. Current amateur imaging depends heavily on a few software suites created entirely by individual dedicated amateurs, and Paolo Tanga pointed out that this makes the whole process vulnerable in case these people cease to be able to maintain them. (Registax is already unsupported.) Emil Kraaikamp said that he is personally committed to maintaining and upgrading AutoStakkert!2 (and Grischa Hahn is doing likewise for WinJUPOS). It was generally recognised that the success of these programs depends on the personal flair and enthusiasm of these individuals, and on their own experience as amateur observers, so professional or group support would not be practical even if it were desirable; vulnerability comes with the package.
3) There is still debate about whether image analysis should be done with north up (the convention used by professionals) or with south up (the historic convention used by amateurs). This was not resolved, but during the Juno mission, the BAA Jupiter Section will be showing north up, for compatability with NASA output.

Space here does not allow for a review of all the 30 talks, but all are posted at:
http://www.ajax.ehu.es/Juno_amateur_workshop/talks/index.html

The Juno mission and JunoCam

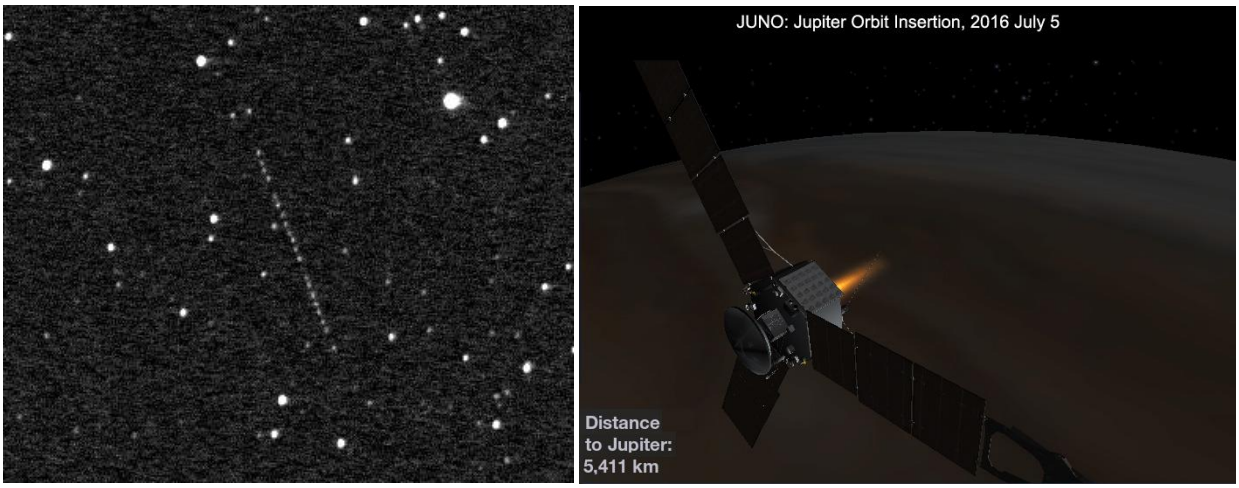

Figure (L). Juno flying past Earth on 2013 Oct.9. Image sequence by Dave Storey on the Isle of Man [if he is a BAA member? – if not, use one by Nick James].
Figure (R). NASA graphic of Juno firing its main engine as it flies low over the dark side to enter into orbit on 2016 July 5.

All about the Juno mission is at: https://www.missionjuno.swri.edu/
and the page for collaboration on JunoCam is at: https://www.missionjuno.swri.edu/junocam.

The mission is intended to study the internal constitution of Jupiter – not the visible atmosphere. There are three main goals, to be achieved by a series of very close flybys covering every part of the planet. First, to map the gravitational field in great detail; this will give information on the internal density layering, possibly including detection of a rocky core and of deep-penetrating jet-streams. Second, to map the magnetic field and magnetosphere in detail, along with intensive study of the polar aurorae by

UV and IR imaging spectrographs. Third, to probe the temperature and pressure of the atmosphere below the visible clouds by means of a microwave radiometer; the results should reveal the abundance of water vapour in the deep atmosphere, and possibly clues to the atmospheric dynamics.
None of these goals requires a camera; but at some point it was realised that politicians and public would expect pictures from such an expensive mission, so 'JunoCam' was included, with the official goal of 'public outreach'. It has a comparatively small data allocation, so only around 10-15 full-colour images will be returned on each perijove. Some of these will be used to support the main scientific goals, by imaging the polar regions and the microwave radiometer targets; but others will be taken at various points below the spacecraft track as determined by public input. This is done through a web site which NASA's Juno team (Dr Candy Hansen and Dr Glenn Orton and Tom Momary) have set up. Amateur imagers are uploading their images of Jupiter to this site; Tom Momary makes a map from these images every two weeks; members of the public (including us) flag up features of interest; and on each orbit, the public will vote on which features should be imaged. The targeting will be determined by the JunoCam team based on these votes and discussion as well as scientific criteria. Meanwhile, amateur images will also provide valuable context for the narrow fields targeted by JunoCam and the microwave radiometer.

The Juno spacecraft is spinning (unlike spacecraft such as Voyager or Galileo), so the JunoCam 'images' will by assembled from scans taken as the spaceraft spins twice a minute – a technique not seen since the Pioneer 10 and 11 flybys of Jupiter in 1973 and 1974. Thus, the raw images to be released by NASA will consist of 3-colour strips, and amateurs will be invited to process them further, de-rotating and combining them to make more realistic images.

[On July 5 (July 4 in the USA), Juno came in over Jupiter's north pole and performed a long main engine burn at closest approach, passing only 4547 km above the cloud-tops.]

All orbits will be highly elliptical and polar (with no satellite flybys), so the key events will be the perijoves. Now the spacecraft is performing several 'engineering orbits', during which the orbital period will be shortened and the instruments checked out; these perijoves are on 2016 Aug.27 (just 4147 km above the cloud-tops), Oct.19, and Nov.2.
The first normally operational perijove will be on 2016 Nov.16; this will also be the first one for which the public will get to vote on targets for JunoCam. From then onwards, perijoves will occur every two weeks, at altitudes around 4300 km until 2017 March, after which the altitude gradually increases.

The timing is not ideal for ground-based observers, as Jupiter is in solar conjunction on 2016 Sep.26, so we will have no hi-res images until November. By the New Year, hopefully the amateur input will be up to standard. However, JunoCam will probably become degraded by Jupiter's intense radiation belts over several months, so the quality of the images may not be sustained beyond spring, 2017. Nevertheless, the main mission continues until 2018 Feb.20 (or possibly later), when the spacecraft will be sent on a final plunge into Jupiter's atmosphere.

Double transits of Europa and Io:

[Two additional panels of images, not included in this file:]

1) Transit of Europa and Io in front of their shadows on the night of opposition, 2016 March 7/8: Excerpts from 4 images by Richard Bosman, Martin Lewis, Ian Sharp, and Rafael Segura.

2) Full-disk images showing transit of Europa and Io and their shadows:
(top) 2016 March 11, 14:32 UT: Christopher Go (Philippines);
(bottom) 2016 March 22, 05:00 UT: Damian Peach (Barbados).
[This pair would be suitable for the cover.]

Jupiter Section Report to Council, 2016

Observations of Jupiter continued at a high level in the 2015/16 apparition, leading up to the Juno orbiter mission, [which began on 2016 July 5 with the insertion of the NASA spacecraft into jovian orbit.]

As is now the norm, thousands of images of the planet were available from observers all around the world, including many images of high resolution. The image quality is still improving as enhanced cameras are brought to market. The ZWO ASI120 series, which most observers adopted only 2-3 years ago, was superceded by the ASI174, and now a few observers are 'test-driving' the ASI290 with even better results. Special mention goes to Christopher Go in the Philippines and Tiziano Olivetti in Thailand, who have both produced remarkably consistent series of v-hi-res images throughout the apparition, and to Phil Miles in Australia, who has been getting remarkable results with a new 20-inch telescope, in collaboration with experienced observer Anthony Wesley. Miles acquired a particularly narrow methane-band filter, and thus achieved uniquely good methane-band images.

In the 2014/15 apparition, we received images from 73 observers: 14 in the UK, 19 in the USA, and 40 spread across 19 other countries. Of these observers, 44 contributed substantial numbers of images directly to the Section; 17 were only occasional contributors, and 12 were among the observers who posted via the ALPO or ALPO-Japan. Additional observers in Italy and France sent images directly to the JUPOS team for analysis. Image analysis was done as usual by the JUPOS team; in 2014/15 they made 64059 measurements of atmospheric features. Visual observations were received from three members in the UK, one in Italy, and one in Japan.

As the planet will be south of the equator for the next 6 years, images from the southern hemisphere will be increasingly important. In addition to the existing contributors in Australia, we now have an observer in South Africa – Clyde Foster, who visited the BAA in London in January – and several excellent observers in Brazil have become known through Facebook.

Opposition was on 2016 March 8. Activity on the planet developed more-or-less in line with predictions we made a year earlier, although more slowly than expected. Thus a sector of the NEB expanded northwards (although this event is subsequently regressing); normal activity continued in the SEB; oval BA decelerated; and a North Temperate Disturbance continued to dominate that domain. Both the NTB and STB are now largely absent, so attention should be maintained on those domains. [A synopsis of activity on the planet was published in the Journal for 2016 August.]

A fireball was detected in Jupiter's atmosphere on 2016 March 17, by an observer in Austria and another in Ireland. This was the first observed since 2012, but the fourth since the start of 2010, suggesting that the actual frequency is at least one per year. Observers are urged to run their raw videos through Marc Delcroix's DeTeCt program to search for such impacts.

We continue to post interim reports on the Section's web pages, on average about once a month; they are notified to Section members by e-mail. (Among those in 2015/16 were reports on the methane-dark waves on the NEB, and animations of the rotation of the Great Red Spot.) A final report on the 2014/15 apparition was also posted on our web site; as usual, this was a collaboration with Gianluigi Adamoli and the rest of the JUPOS team, and thoroughly covered the measured aspects of the planet's activity, although some descriptive aspects have not yet been included. A final report on the 2015/16 apparition is in preparation, for reference during the Juno mission.

Having taken early retirement, the Director is now largely 'employed' in Jupiter studies and has thus made progress on more definitive reports. Two long-term reports have been posted: 'Relationship of NEB rifts to NEB expansion events', and 'Jupiter's South Temperate domain: Evolution 1991-1999 and dynamics of cyclonic structured sectors as seen in Hubble maps'. Our discovery of previously unknown and exceptionally regular wave-trains on the SEBs jet-stream led to collaboration with Dr Leigh Fletcher and a professional publication in Icarus: 'A dispersive wave pattern on Jupiter's fastest retrograde jet at

20ºS'. Our detailed accounts of the SEB Fade and Revival in 2010, previously presented in a series of reports on-line, have now been concentrated into two papers [accepted for] the Journal of the BAA. Similar papers on the NEB Fade and Revival in 2012 are in progress.

The section now has two web sites. The older one, at: http://www.britastro.org/jupiter
still contains all our material including 'Observing guides' and 'Reference articles' and 'Reports' up to 2015. It will remain active, but is now supplemented by a newer site (set up by Dominic Ford) at:
https://www.britastro.org/section_front/15
which contains newer items, especially our reports on the 2015/16 apparition, and recent publications. We also have a 'BAA Jupiter Section' page on Facebook.

Section officers participated in various BAA and 'pro-am' meetings during the session. Presentations on observing the planets were given at two BAA 'Back to Basics' meetings; by Mike Foulkes at St. Asaph (north Wales) on 2015 Oct.10, and by the Director at Shurdington (Gloucs.) on 2016 March 5. The Director gave talks at four conferences.
(1) European Planetary Science Congress (Nantes, France) in 2015 Sep. (plus a poster in the professional 'Giant planets' session). [The talks in the session 'Amateur contribution to planetary science' have been posted online and can be accessed through our new web site.]
(2) Joint meeting of the Royal Astronomical Society and Royal Meteorolgical Society, 'Weather on other planets' at Burlington House, 2015 Oct.9.
(3) EuroPlanet Workshop on 'Juno Ground-based Support from Amateurs' held in Nice, France, on 2016 May 12-13 [report in previous issue of the Journal];
(4) JUPOS team meeting in the Black Forest, Germany, in 2016 July.

The 2016/17 apparition will coincide with the main part of the Juno orbital mission, and we will endeavour to keep up to date with events on the planet, providing information to inform the scientists and public in selecting targets for JunoCam imaging and in understanding what is seen.

John Rogers, Jupiter Section Director, [2016 July].