

ORION - THE HUNTER

by Mark Humphrys

Surrounding the central star of Orion's Belt, ϵ Orionis, is the nebula NGC 1990, extremely faint, with a diameter of around 50 arc minutes (Figure 2). Towards δ Orionis lies the reflection nebula IC 423, roughly 4.5 by 2.5 arc minutes in size. IC 426 lies to the north of ϵ Orionis. It is about 5 arc minutes in diameter, with a 9th magnitude star at its centre.

M78 (NGC 2068) lies about 2.3° northeast from ζ Orionis. It is easily confused with a comet, as one side of it is sharply defined while the other has wispy nebulosity resembling a cometary tail. Two 10th magnitude stars embedded within it resemble the cometary nucleus³. There are three other faint nebulae near to M78: NGC 2064, NGC 2067 and NGC 2071. The first two are extremely faint, and will need a lot of patience to make them out. The latter is slightly brighter and with a 10th magnitude star embedded in it. It is around 4 by 3 arc minutes in size.

Now for a real challenge. About 1° north of M78 lies the Sh2-276, Barnard's Loop, an extremely faint semi-circular nebula that extends for some $7 - 8^\circ$ across the sky. In photographs it is quite magnificent, but can it be seen visually? You may be able to notice it as a slight brightening of the sky, as you move across its boundary. Needless to say, it will require perfect seeing conditions.

Other objects to look out for in Orion are NGC 2169, an open cluster of about 20 or so stars up to 8th magnitude, about a degree or so away from ξ Orionis (Figure 4). Some observers have reported seeing the bright stars forming a "37" pattern⁴, can you see this? Also in the vicinity is the star cluster NGC 2194, with an overall magnitude of 9, containing about 100 stars. It has a diameter of about 8 arc minutes.

There are numerous other deep sky challenges to be found in Orion. Give it a try this winter to see what you can hunt down.

References and further reading

1. *Burnham's Celestial Handbook*, Robert Burnham, Jr.; Dover Publications Inc., 1978
2. *Astronomy Encyclopedia, The*, Ed. Patrick Moore; Mitchell Beazley, 1987
3. *Deep Sky*, Winter 1987; Kalmbach Publishing
4. *Deep Sky*, Winter 1988/1989; Kalmbach Publishing

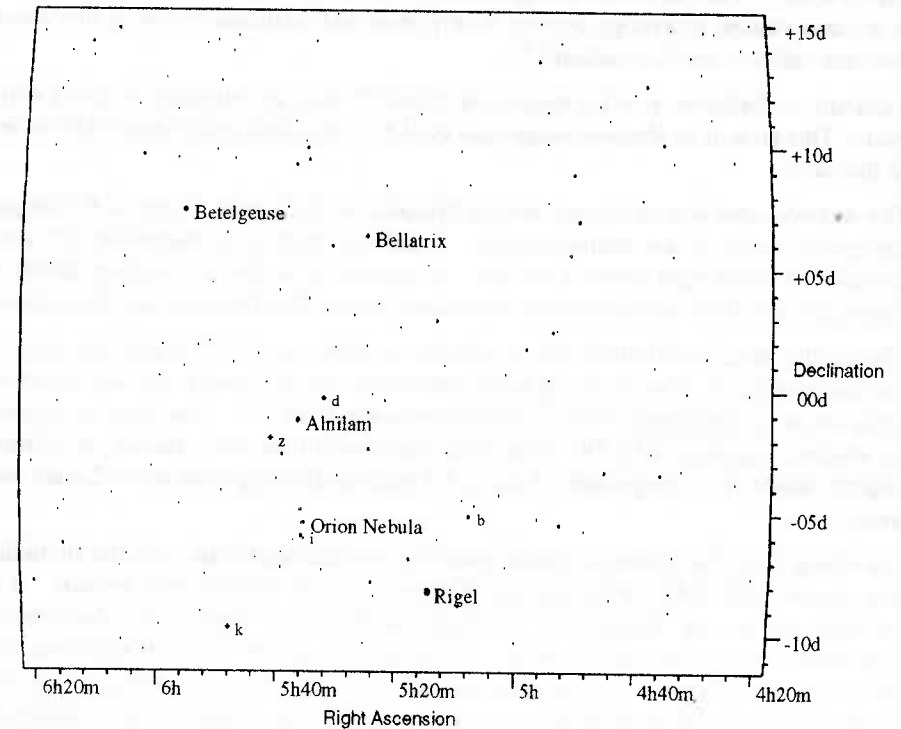
Passion for Astronomy, Patrick Moore; David & Charles plc, 1991

Uranometria 2000, Vols 1 & II, Tirion, Rapport and Lovi; Willmann-Bell, 1987 □

© Mark Humphrys, 1993

Orion is visible in the late evenings in November and December. It is best placed for observing in the evenings in January and February.

Mark describes the constellation Orion - its bright stars and many deep sky objects. The article is illustrated by four star charts (Figures 1 to 4), plus the general chart below which has been produced by an Archimedes computer program called (aptly enough) *Starchart*. All stars to 6th magnitude are shown in this chart, but to find most of the deep sky objects you will have to refer to the more detailed charts included with this article.



Winter is the time when one of the most distinctive of the constellations, Orion, is visible in the sky. It contains a wealth of deep sky objects for observers with nothing but the naked eyes, to observers with huge light buckets. In this article I am going to explore a few of those sights.

The shape of the Hunter can be visualised by starting with the giant red star Betelgeuse forming the right shoulder of the Hunter (Figure 1), Bellatrix representing the other shoulder. The brightest star of the constellation Rigel is the Hunter's left ankle, while Saiph marks the Hunter's right knee. The Hunter's Belt is made up of the three bright stars Mintaka, Alnilam and Alnitak, while the Hunter's Sword is made up by θ Orionis and the Great Nebula, with its tip indicated by ι Orionis. >>>

The brightest stars

Starting at Orion's shoulder, Betelgeuse is a red supergiant, a variable with a range of magnitudes from 0.1 to 0.9, although on occasion it has been recorded dimming to 1.2. It has a period of around 5.7 years, although there appears to be smaller cycles superimposed on the main cycle ¹. Because of Betelgeuse's proximity to us - about 520 light years - and its sheer size, it is possible to measure its diameter directly through observation. It has been found that during this variation in magnitude its volume also varies. At maximum it is estimated that its volume is equivalent to the volume occupied within the orbit of Jupiter, while at minimum the volume is merely that occupied by Mars's orbit ¹. The star is also thought to be about 20 times the mass of our Sun. But due to its large volume its average density is only about one millionth of that of the Sun, and it has been called a "red-hot vacuum" ¹.

γ Orionis, or Bellatrix, is a 1.6 magnitude, class B2 star, at a distance of about 470 light years. This gives it an absolute magnitude of -3.6 ², or a luminosity about 4000 times that of the Sun ¹.

The western-most star of Orion's belt is Mintaka, or δ Orionis. It has a 6.7 magnitude companion some 53 arc seconds north. δ Orionis itself is a magnitude 2.2 star at a distance of 1500 light years from us. Its spectrum is O9 II, another bluish white supergiant, very hot, with an estimated luminosity some 20,000 times that of our Sun ^{1,2}.

The middle star of the Hunter's belt is Alnilam, or ϵ Orionis, a 1.7 magnitude, class B0 Ia, another supergiant. The star is slightly further away than δ Orionis, although it is twice as luminous as its neighbour, with an absolute magnitude of -6.2. (the Sun, in contrast, has an absolute magnitude of 4.79.) The final bright star of the belt, Alnitak, or ζ Orionis is slightly fainter at 1.8 magnitude. It has a 4.2 magnitude companion some 2.4 arc seconds away ¹.

Travelling down the Sword of Orion, there are several bright stars visible, including the star cluster NGC 1981, although it is θ Orionis that is perhaps best known. It is the multiple star system "Trapezium" of which the four main components form the shape from which the system gets its name. The system lies at the centre of the Great Nebula, M42, in a region where star formation is actively taking place. It is thought that the ages of the stars are less than 300,000 years old, making it one of the youngest clusters in the sky ¹. The tip of the Sword is marked by the star ι Orionis, another white supergiant at a magnitude of 2.8. It has a bluish, 6.9 magnitude companion some 11 arc seconds away, and a third, reddish, 11 magnitude companion some 50 arc seconds away ¹.

Further south lie the last two stars to be discussed, Saiph and Rigel. Saiph, or κ Orionis, is yet another white supergiant, shining at magnitude 2.1 at a distance of 2100 light years. At a distance of 10 parsecs its absolute magnitude would be -6.9, giving an estimated luminosity some 50,000 times greater than the Sun. The brightest star of the constellation is Rigel, β Orionis, also the seventh brightest in the sky. It is a bluish white B8 class star with a magnitude of 0.12. Yet another supergiant, it is some 60,000 times more luminous than the Sun, and one of the most luminous objects in the Galaxy. It has a 6.7 magnitude companion some 9 arc seconds away (pa 202°).
»»

Deep Sky Objects

Starting with perhaps the most famous nebula in the night sky, M42, the Great Orion Nebula (Figure 2) - visible with the naked eye, spectacular in binoculars, mind blowing in a telescope. The nebula is a region made up of gas and microscopic dust, although its average density is about a millionth of that of the best laboratory vacuum. In certain areas the gravitational collapse of the gas cloud is causing the formation of new stars. The heat from these stars heats up the surrounding gas causing it to fluoresce. The greenish colour so easily seen in the 14-inch SCT is caused by the Oxygen emission lines at 500.7 and 495.9 nanometres. The reds, blues and other colours that are so prominent in photographs only become visible in the long exposures required to take the photographs; the light is too faint for the human eye to detect colour. The composition of the gases which make up the nebula are dominated by Hydrogen, roughly 90%, and 9% Helium, while the remaining 1% is made up of Carbon, Oxygen, Nitrogen, Sulphur, Neon, Chlorine, Argon and Fluorine. It is estimated that the Nebula lies some 1600 light years from us, and that it is around 30 light years across ¹.

The Orion Nebula is but a small visible part of a massive gas cloud which extends over most of the Orion constellation. Other areas of nebulosity can be seen throughout the region, particularly where stars embedded in the Nebula have heated up the surrounding gas and caused it to glow. M43 is the small nebula that can be seen separated from M42 by a dark lane of matter. Embedded in M43 is an 8th magnitude star which is powering the nebula's illumination. Above the Orion Nebula lie several smaller areas of nebulosity.

NGC 1977, nebulosity surrounding the stars 42 and 45 Orionis, is 40 by 25 arc minutes in size. Slightly north lie two much smaller patches, NGC 1973 and NGC 1975, extremely faint. These nebulae are, in fact, reflection nebulae; they reflect the light from nearby stars, rather than emit their own light as emission nebulae do. It is thought that the light bounces off the microscopic dust particles present in the nebula ². Above these two nebulae lies the open cluster NGC 1981, a group of about 10 stars of magnitudes 8 down to about 10.

North from NGC 1981 lies the Belt of Orion. It is here that one of the great challenges of deep sky observing lies - the Horsehead Nebula, Barnard 33 (Figure 3). Looking first at the bright star ζ Orionis, this is surrounded by the very faint nebula IC 434, sometimes known as "Orion's Dagger" ³. The Horsehead Nebula lies about half way down on its eastern edge. Look out for the 8th magnitude star lying in line with it. To see the dark nebula it is important to get ζ Orionis out of the field of view, as the light from this will swamp that from the faint surrounding nebula. A difficult challenge, but it has been spotted with 10x70 binoculars with a pair of nebula filters taped to the eyepieces ⁴!

In this area are several other objects to try to find. NGC 2023 is quite close to the Horsehead, some 10 arc minutes in diameter with an 8th magnitude star at its centre. NGC 2024, northeast from ζ Orionis, quite large at 20 arc minutes diameter. Further east from NGC 2023 lies IC 435, another area of very faint nebulosity, also quite small at 3 arc minutes. It has a magnitude 9 star embedded in it. Two other nebulae, IC 431 and IC 432, lie just to the north of ζ Orionis, both with stars at their centre. Both are very faint!

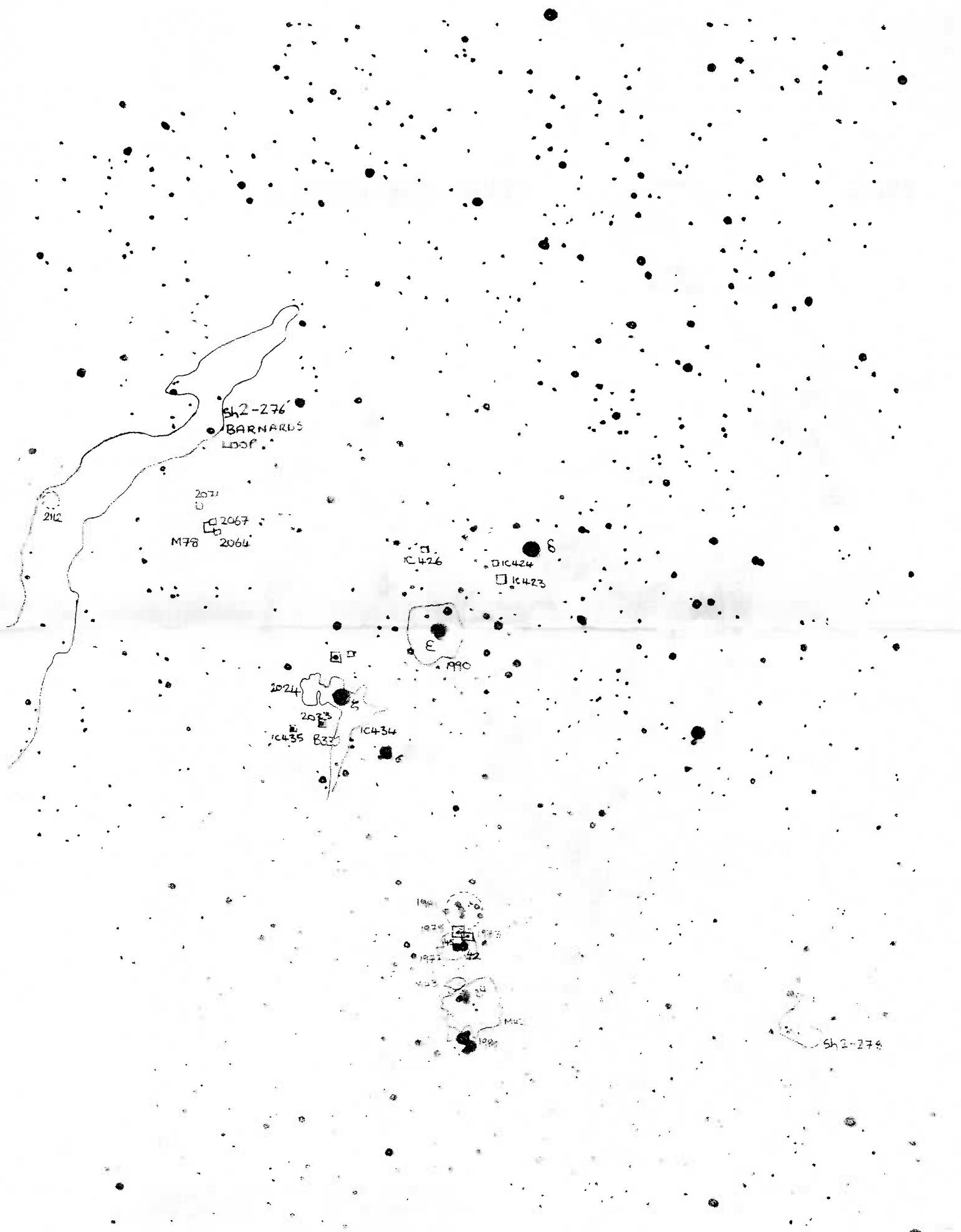
FIG. 1

ORION - THE HUNTER



ADAPTED FROM A PICTURE APPEARING
ON PAGE 15 OF "PASSION FOR ASTRONOMY"
BY PATRICK MOSE

FIG 2 ORIONS BELT AND SWORD



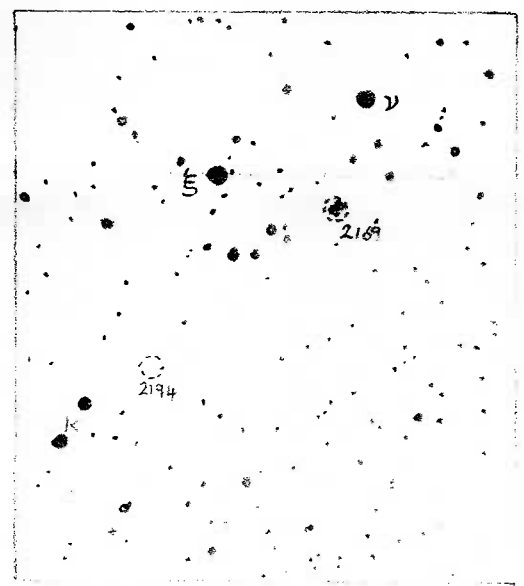
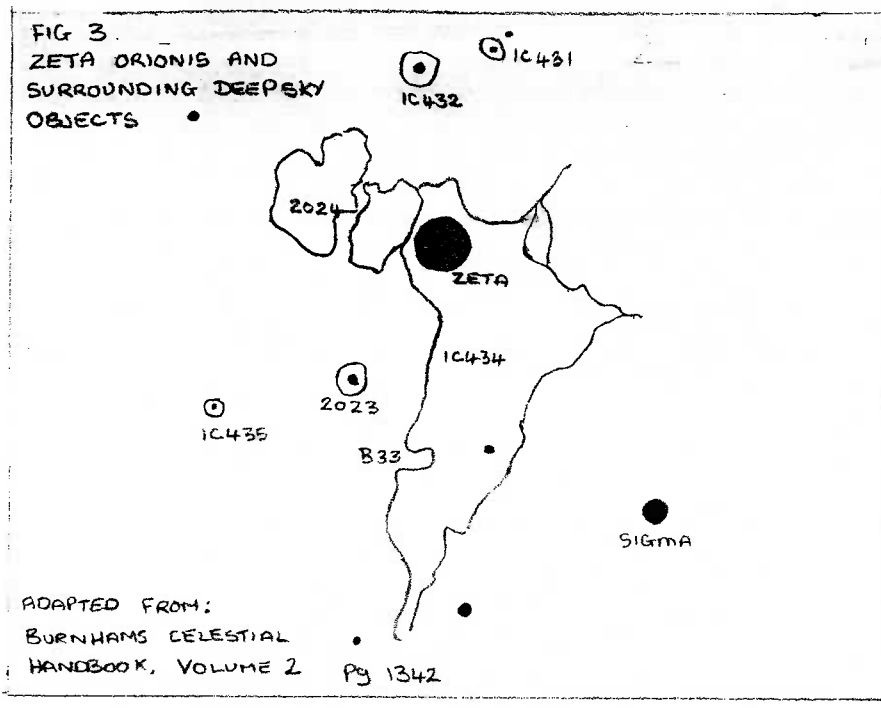


FIG 4 STAR CLUSTERS 2169 AND 2194
FROM URANOMETRIA 2000 VOL I PG 182