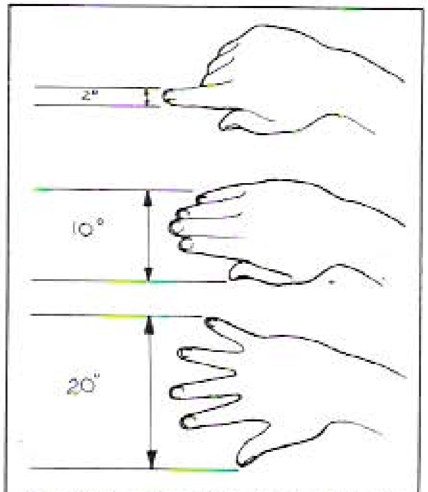
HOW TO TELL THE STARS

A new, simple method for identifying stars, telling time by them and finding directions at night.

ARTICLE BY W. S. KALS

A KNOWLEDGE OF THE STARS and planets will enrich your backpacking experiences, just as will knowing about plants and birds. An understanding of the orderly motion of the sky can even be useful for telling time and determining direction.

For thousands of years star lore concentrated on constellations, the patterns of stars. There are a lot of them—88 by official count. Many are hard to remember. Few resemble the beasts, things or people for which they are named. They often are difficult to find, especially when they lie on their sides as they rise or set in the sky. Result: Few people can identify more than three constellations.

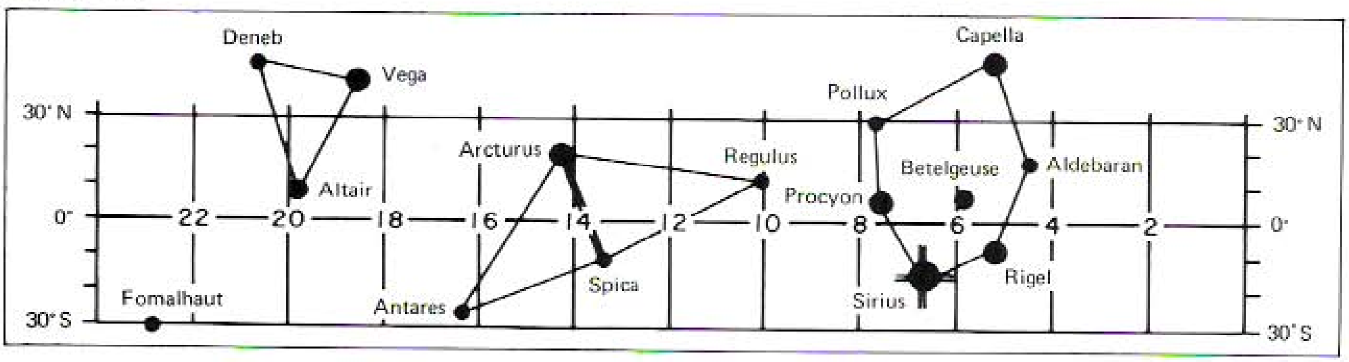


THE SIMPLE METHOD FOR MEASURING DEGREES OF LATITUDE.

I have a different approach for learning to identify the stars. Instead of concentrating on *patterns* of stars—sometimes quite dim stars—the system is based on the *brightest* stars. There aren't many of them. Only 15 first-magnitude stars can be seen everywhere in the northern hemisphere between the tropics and the arctic circle. Six more become visible at times in the southernmost part of the area.

These are all "fixed" stars. That is, they do not move in relation to their neighbors. Additionally, you may see up to five planets that look like bright stars. The planets change position among the fixed stars.

These are the 15 brightest stars visible in the northern temperate zone. Fourteen of them have been arranged in three superconstellations. The degree scales on the left and right margins of the chart will enable you to measure the angle between any two stars. The degrees can be measured off in the sky with your hand. The horizontal line in the chart's center is the celestial equator; the numbers along it label the vertical hour lines. Both are used to align the chart with the sky.



The Planets

The five planets you can see with the naked eye look like bright stars. Star charts don't show them. If they did, the charts would soon be out of date because the planets keep moving among the fixed stars.

Mercury is seldom seen. It is visible only for a few days or weeks, always low on the horizon, either in the east just before sunrise or in the west shortly after sunset. Sailors who know Mercury's periods of visibility sometimes wait years before spotting it. Clouds near the horizon regularly interfere.

Venus is easy to see and to identify. It is by far the brightest starlike object in the sky. As a morning star, it appears in an easterly direction up to three hours before sunrise; as an evening star, it can be seen in a westerly direction up to three hours after sunset. Venus must get tired of being the last star to disappear in the morning and the first to appear in the evening, for it takes regular vacations that sometimes last for several months. Here is Venus's schedule for the next few years:

1976 P.M. after beginning of August

1977 P.M. to end of March
A.M. mid-April to end of November

1978 P.M. April to October
A.M. after mid-November

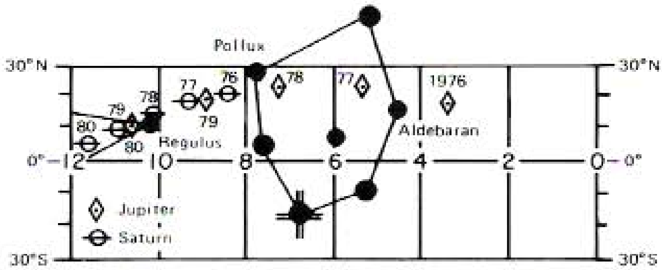
1979 A.M. to mid-July
P.M. after mid-October

1980 P.M. to beginning of June
A.M. after end of June

Saturn moves so slowly among the stars that it's easy to find even when you haven't seen the sky for months. Between 1976 and 1979 it will move only from the vicinity of Pollux to that of Regulus.

Jupiter seems to try to catch up with Saturn but never quite makes it. Until 1980 it always will be west (right) of Saturn. Jupiter is the brighter of the two planets, at least as bright as the brightest fixed star.

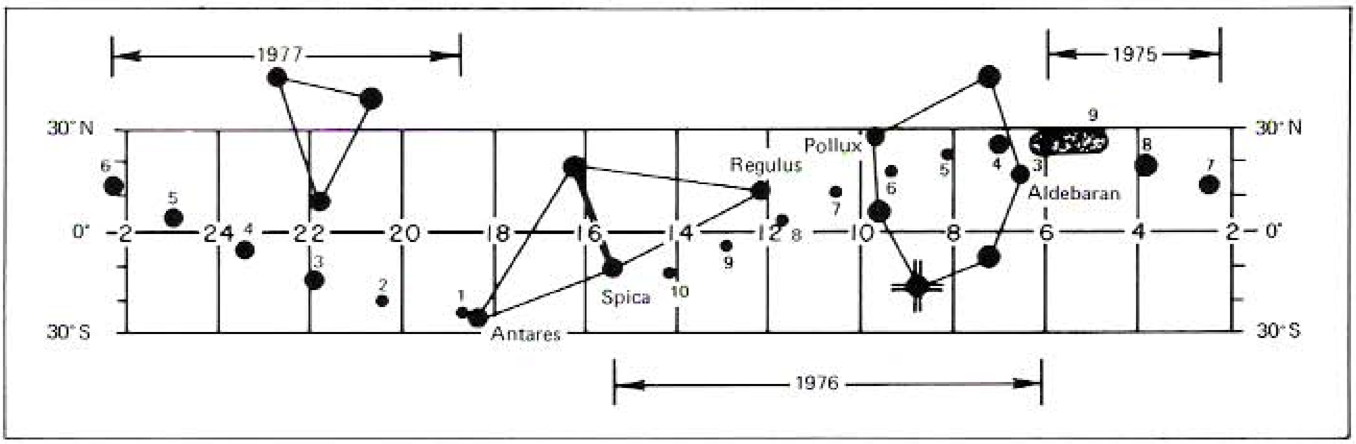
Some people claim they can always recognize Mars from its reddish color. But Antares is almost as red, and every two years or so it and Mars appear together. Additionally, Mars sometimes is brighter than Jupiter; at other times it's no brighter than Polaris. At any rate, it always will be near the curve on the star chart.



The planets Jupiter and Saturn look like bright stars. Unlike stars, however, they change their position. The chart shows their position at midyear for the next four years. In the first half of each year they will be a little west (right) of the marked location; in the second half, east (left).

The figure *(below)* shows the position of Mars and its brightness compared with fixed stars. From near the edge of the drawing in July 1975, the planet moves eastward (left) as Jupiter and Saturn do most of the time. But in November, Mars seems to stop, then to reverse and loop before resuming its easterly course. During the time it dawdles, it reaches its greatest brightness—about that of Sirius—in December. Near the end of 1976 Mars will be so close to the sun that it will set before dark and rise after daylight, and you won't see it at all.

Like all planets, Mars wanders among the stars. Being nearer the sun, it moves faster than Jupiter and Saturn. The chart shows its mid-month position in relation to the superconstellations through June of next year. The numerals next to the planet indicate its position for each month, and the dot size its brightness at the time. In the middle of January 1977, for instance, Mars will appear in the sky alongside Antares and will be no brighter than a second-magnitude star.



The 15 first-magnitude stars are identified—the brightest the most prominently—on the star chart on page 45. The horizontal line at zero is the celestial equator. Scales, in degrees, appear at the right and left sides. (What would be north or south latitude on a map is called declination by astronomers.)

You can measure degrees in the sky to locate the stars without any special equipment.

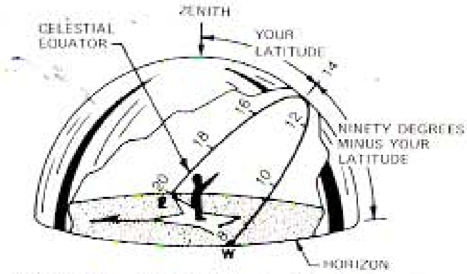
Here is the way you do it: At arm's length the width of your hand, with the fingers and thumb together, covers 10 degrees in the sky. At the same distance, each of your fingers covers two degrees. And the span of your spread hand—between the tip of the thumb and the little finger—covers 20 degrees. Using this system, you can take the measurements from the left or right margin of the star chart and transfer them to the sky by using your hands.

For example, Deneb is about 30 degrees from Vega. In the sky you will find these stars three hands apart. Or you first can measure the stars in the sky with your hands and then check the measurements on the star chart.

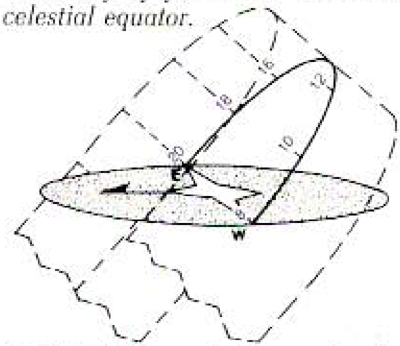
The labels along the equator of the star chart, which on a map would be in degrees of longitude, are in hours. These correspond to the meridians in the sky which astronomers call "hour circles."

To make the brightest stars easier to remember—the ones visible everywhere in the area—I have arranged 14 of them into three superconstellations.

On the right near the six o'clock



To fit the star chart to the sky, you must first locate the celestial equator in the sky. To do this, face due south. Then, using your hand, measure down from the zenith the number of degrees in your latitude (or subtract your latitude from 90 degrees and measure up from the southern horizon). Point to the spot just found in the sky and swing your arm from right to left to the horizon. The arc traced in the sky by your hand will be the celestial equator.



Imagine the star chart curved so that its celestial equator lies over the line you have traced in the sky. Only half of the chart will be above your horizon showing the stars visible now. What astronomers call "local star time" determines which hour line on the chart should be due south of you. In the diagram, the chart is aligned for a local star time of 14^h^.

line is Betelgeuse, pronounced BED-uhl-jooz. (Its reddish tint may be the reason that sailors dubbed it "beetle juice.") Around Betelgeuse is a rough hexagon of stars measuring two or three hands on a side.

To help remember them, I think of a fastidious ship's captain. The first mate reports to him, "Captain, all de rigging seems properly polished." That gives me, clockwise from the right: Capella (kuh-PELL-uh), Aldebaran (AL-de-buh-ruhn), Rigel (RYE-jel), Sirius (SEE-ree-uhs), Procyon (PHRO-see-uhn) and Pollux (POL-luhks).

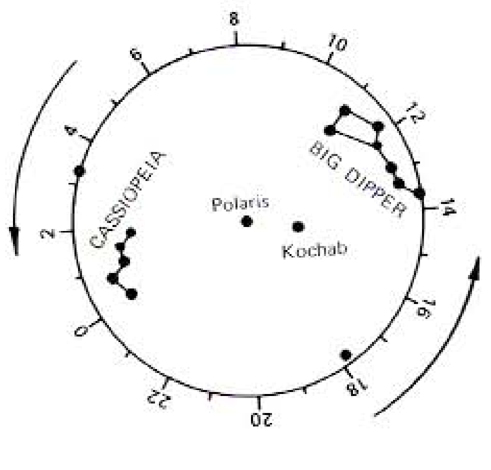
Between 10^h and 16^h I have drawn a double triangle (each half measuring three hands by five hands) formed by four stars. To remember their names, I think of broccoli being served to the impossible captain. Its ingredients: Regular spices and arsenic. That reminds me of Regulus (REG-gyou-luhs), Spica (SPY-kuh), Antares (an-TARE-eez) and Arcturus (ark-TOO-ruhs).

Near 20^h I have drawn a nearly equilateral triangle measuring three hands on a side. I remember the stars in the triangle by the newspaper headline following the arrest of the cook: "Vegetable Alteration Denied." That gives me Vega (VEE-gah), Altair (al-TARE) and Deneb (DEN-eb).

Only one of the 15 stars, Fomalhaut (FOH-muhl-hot), is left out of the three superconstellations.

Fitting the Star Chart to the Sky

Once you become familiar with the



How To Tell Time From the Stars

Here's a simple method of telling time from the stars: Imagine Polaris as the center of an ordinary clock. Kochab (KOH-kab), the star 1½ hands from Polaris and of approximately the same brightness, makes the tip of the hour hand. Like other stars, it turns counterclockwise around Polaris once every 24 hours. That's half the speed of an ordinary clock hand. To get elapsed time, you merely double the hours Kochab seems to have moved backward around the clock face. For instance, suppose you turn in at 9 P.M. and see Kochab to the right of Polaris in the three o'clock position. During the night you see Kochab directly above Polaris in the twelve o'clock spot. The difference is three hours; doubling that provides the elapsed time—six hours. And six hours past 9 P.M. means that the time is three o'clock in the morning.

How To Find Local Star Time: Alternative Method

To fit the star chart to the sky, you need to know your local star time, i.e. how much time has elapsed since the vernal equinox has passed due south of you. (It passes due south of you every 23 hours and 56 minutes.)

There are two methods for telling local star time. The simplest uses the North Star and the constellations that appear nearby (see the text on page 49). But it works only when you can see the northern sky.

The second method will work anywhere. Here's how: Use the table *(right)* to determine the approximate local star time for midnight. On March 20, for example, the local star time at midnight is about 12^h. (The table applies to any standard time zone.)

If you want local star time for any time other than midnight, simply add hours after midnight or subtract hours before midnight. On the same date at 5 A.M., five hours after midnight, star time is $12 + 5 = 17^h$; at 7 P.M., five hours before midnight, the star time is $12 - 5 = 7^h$. Sometimes a morning calculation may provide a nonsense figure. For instance, at 5 A.M. on September 6 the addition $23 + 5 = 28^h$, and there's no such star time. But remembering that 24^h and 0^h are the same thing, you deduct 24^h. Therefore, the correct answer is that local star time is $28 - 24 = 4^h$. At other times subtraction will seem impossible. At 7 P.M. on November 20, five hours before midnight, you'd get $4 - 5^h$. To avoid that, borrow 24^h and add it to the star time before you subtract: $4 + 24 = 28^h$. Then the local star time will be $28 - 5 = 23^h$.

When daylight time is in effect, you must subtract one hour to get standard time. You can subtract it from the time your watch shows or from the star time. For example, at midnight on June 21 local star time will be 17^h, not 18^h. Or, on the same date, 4 A.M. daylight saving time is only 3 A.M. standard time, so star time then is about 21^h. These calculations become quite automatic after you've done them a few times.

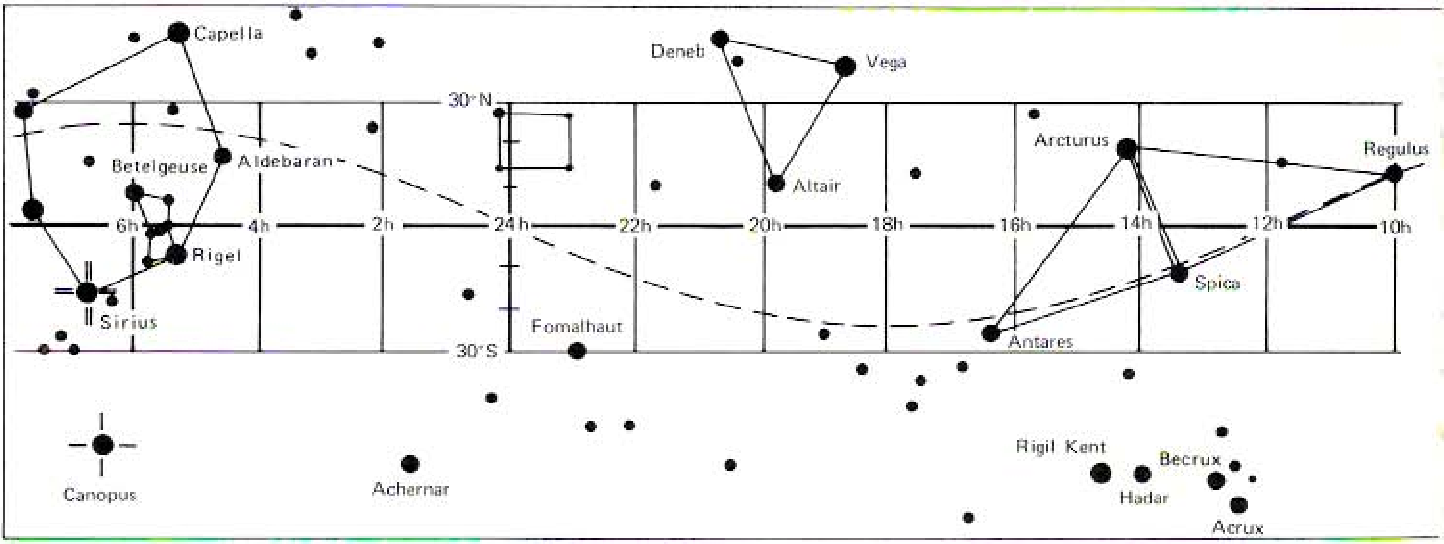
The times in all these calculations are approximate, for the same midnight star time is used for about a week. Also, for a precise calculation, *local* time should be used instead of standard time. To keep an entire state, province or country on the same standard time, that half-hour limit is exceeded in some areas. But even in such areas the star time calculated from the table will be accurate enough for aligning the star chart to spot the superconstellations and identify the brightest stars.

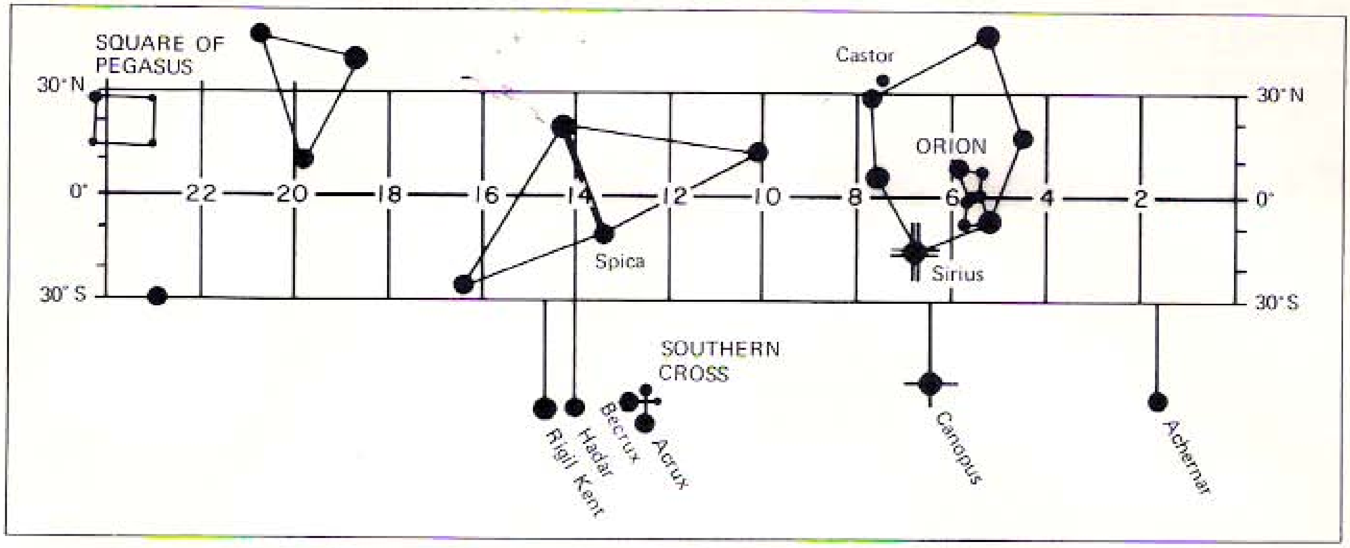
Day of month	1-7	8-15	16-23	24-end
Jan.	7	7½	8	8½
Feb.	9	9½	10	10½
Mar.	11	11½	12	12½
Apr.	13	13½	14	14½
May	15	15½	16	16½
June	17	17½	18	18½
July	19	19½	20	20½
Aug.	21	21½	22	22½
Sep.	23	23½	0	½
Oct.	1	1½	2	2½
Nov.	3	3½	4	4½
Dec.	5	5½	6	6½

Local star time for approximately midnight (standard time) for any date

You can get approximate local star time at midnight on any date of the year from this table. (It is based on standard time and can be used in any time zone. For daylight saving time, subtract one hour.) For any other time of night, add hours after midnight to the star time; subtract hours before midnight. For example: On November 20 at midnight local star time is about 4^h. At 2 A.M., two hours later, it is 6^h; at 10 P.M., two hours earlier, local star time is 2^h.

This star chart shows all the stars you are likely to see on a full-moon night except those on the Polaris and local star time chart. The larger the dot, the brighter the star. The dotted curve is the path Mars, Jupiter and Saturn follow





In addition to the stars that make up the superconstellations in the northern temperate zone, this star chart shows the six first-magnitude (brightest) stars that become visible south of latitude 35 degrees north. Also shown are several second-magnitude stars: Castor, the twin of Pollux, and the stars that make up the Square of Pegasus and the constellation Orion. The three central stars of Orion are directly on the chart's celestial equator. Whenever Orion is visible, the line you trace in the sky with your arm should go right through them.

superconstellations, they are simple to remember and find. In the meantime, the star chart will allow you to find them anywhere in the area and for any date and time of night.

To do this, you need to know south, your latitude and what astronomers call "local star time." (Local star time indicates how much time has elapsed since a reference point in the sky—the vernal equinox—has passed due south of you.) A simple way to find all three uses Polaris (PO-lah-ruhs) and stars that appear nearby.

You probably know how to find Polaris—the Pole Star or North Star. You look for the best-known of all star patterns, the Big Dipper. A line through the two stars farthest from the handle of the dipper leads to Polaris. Its distance from the nearer pointer is three hands. Polaris, a second-magnitude star, is about as bright as the pointers and is the only such star in the vicinity. Because Polaris is always due north, the opposite direction is, of course, south.

You can find your latitude by measuring the distance between Polaris and your horizon. For example: At latitude 40 degrees north, Polaris will be two hand spans above the north horizon. Since there are 90 degrees between the zenith—the point directly above you—and the horizon, you also can measure from the zenith down to Polaris and subtract that from 90 degrees to find your latitude when the north horizon is obstructed.

Polaris appears to stand still, but the stars near it seem to turn around it because of the Earth's rotation. That allows you to get local star time from

Continued on page 73

as they wander among the stars. All stars and hour lines appear twice on the chart. To align the chart with the sky, use the hour line nearest the fold.