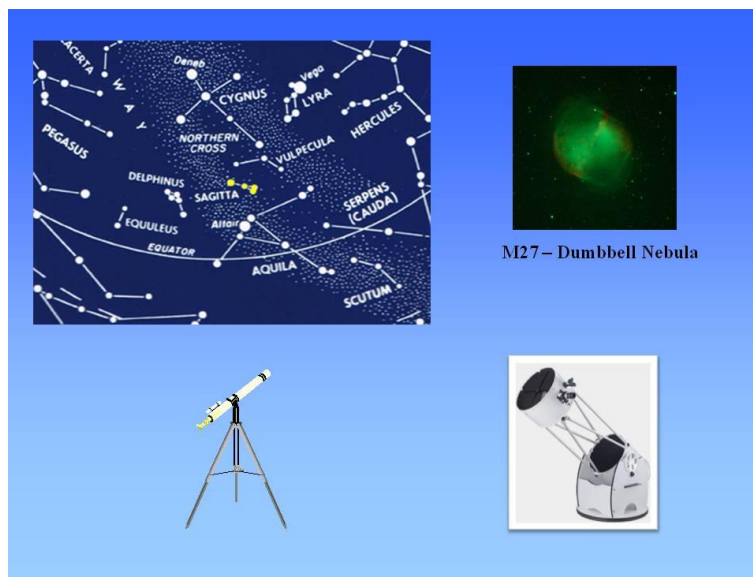# Star-Hopping

One of the toughest issues for the beginning amateur astronomer is finding the deep-sky object that you want to observe. If you are using a GOTO telescope or one equipped with digital setting circles, the telescope will help with that. But, if you are using a low-tech Dobsonian style reflector or a small alt-az mounted refractor, or even just binoculars, then you will need to learn how to Star Hop. Star Hopping is simple, inexpensive, and can be a fun way to learn the night sky!   You don't need to be an advanced astronomer to find deep-sky objects.
All you need to Star Hop is a few equipment related items, star charts, and a little practice.

M27 – Dumbbell Nebula

Before we get into the details of star hopping, let's start off by giving you a little background about what is a 'Constellation'. Constellations are the invention of the human imagination, and are not natural.
Basically, a constellation is like a 'connect-the-dots' picture, with the stars being the dots.
They are a human attempt to organize the wilderness of the Night Sky.

Ancient peoples had plenty of reasons for doing so:
Seafarers and caravan travelers needed a way to find their destinations. Farmers and Herders needed a way to keep track of the seasons to help them figure out when to plant & harvest their crops, or move their animals from summer to winter pastures.

Therefore people devised 'sky pictures' or 'constellations' to help them remember these things and as an attempt to explain the natural phenomena of the night sky. Constellations also tell us the stories and myths of the ancient peoples who invented them. Every Night, a parade of Greek and Roman mythology circles overhead. Many of the ancient heroes and their stories can be found in the night sky.

Modern astronomy currently recognizes 88 constellations that divide up the night sky.
'A' for Andromeda.   thru   'V' for Vulpecula. Now that you know what Constellations are made of and what they represent, how do we go about locating them up in the night sky?   By using Starcharts!

If I wanted to find out where a particular city or state was located, how would I go about doing that?
By using a road map or atlas. From the map, I would find the state, and then the city I was interested in.

Now, if I wanted to find a bright star named 'Vega', what would I do, how would I find it?
The same way that I would find a city here on the Earth. Only now, I would use a star map.
I would find that the star 'Vega' is in the constellation of 'Lyra', in the northern celestial hemisphere.

Star Charts
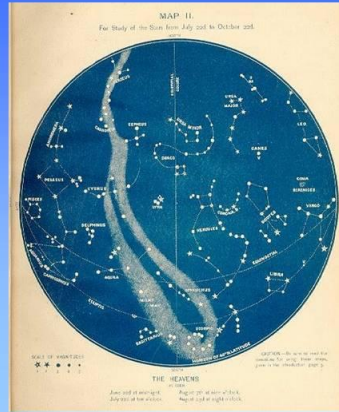
Reading and using star charts is no different than reading a road map. The symbols are a little different, but the basic concepts are the same. You figure out where you are in relation to the map. You find the object you are looking for on the map. Then you find the best way to get to that object using the map.

Like road maps, star charts can come in various sizes and the amount of detail that they can show.
They run anywhere from a few pages showing only the brightest stars to charts having hundreds of pages showing stars, galaxies, and clusters visible only with a telescope. There's also a type of starchart called a 'Planetsphere' or 'Star Wheel' that shows the brighter stars visible above the horizon at any time of the day or year.
So remember, one of the best tools to have in stargazing and learning the constellations is a good beginner's starchart!

Listed below are three steps or considerations to help you in learning the techniques of Star Hopping.
These steps are general, use them as a guide and follow them as you like. Go with whatever works for you.....

#1   Necessary Equipment:
Obtain a star-finder/wheel (or use a monthly astronomy magazine sky chart).

Purchase a star atlas that has individual charts detailed enough to show stars of at least 8th magnitude.
If you are using an unbound Star Atlas, consider getting the sheets/pages laminated.
You can also use a planetarium program for your laptop or smart-phone.
Purchase an observing guide-book for deep-sky objects.

Get a red-dot finder, Telrad, or other zero-power type finder. Mount on your telescope.
To go with your telescope, you will need a good short-focal length wide-field Finder-Scope. At least a 50mm refractor, but preferably an 80mm that uses standard 1.25" eyepieces.   Find one that has a correct- image diagonal, also called an

Amici Prism.   This will allow for a comfortable observing position with a right-side up view that will match the actual sky and your star charts.

Use a small folding table beside your telescope to hold your charts, books and notes. Also get a portable chair so that you can sit in comfort. Nothing hinders star-hopping like back pain!
A red-light (handheld or head-lamp), that you can stand or clip on the table to illuminate your charts and books.

A low-power, wide-field eyepiece, (30 - 40mm) in the main telescope.   Good alignment between the Finder-Scope and main telescope so that an object will be centered in both

#2   Advanced Preparation:
Make a list of the objects that you want to observe and the constellations that they are located in.
It can be a simple paper list or a fancy spreadsheet that you can use to record telescope info.
You could even use your planetarium software to generate a list & charts.
The key is to have a plan for what you want to observe so that you don't waste precious dark-sky time.

Use your star-finder/wheel to determine when the constellation will be above the horizon while dark.
With your star atlas, (or planetarium program), lookup the constellation and find the object on the star chart.
Find a bright naked-eye star near the object. This will be your starting 'Jump-Star'.
(if your charts don't already have this done, draw in the constellation 'lines')
With a pencil and ruler, use the stars on the chart (or printed page from your planetarium program) that form a pattern: triangle, square, line, etc, that leads toward the object from the jump-star and 'connect' the stars using the pencil.
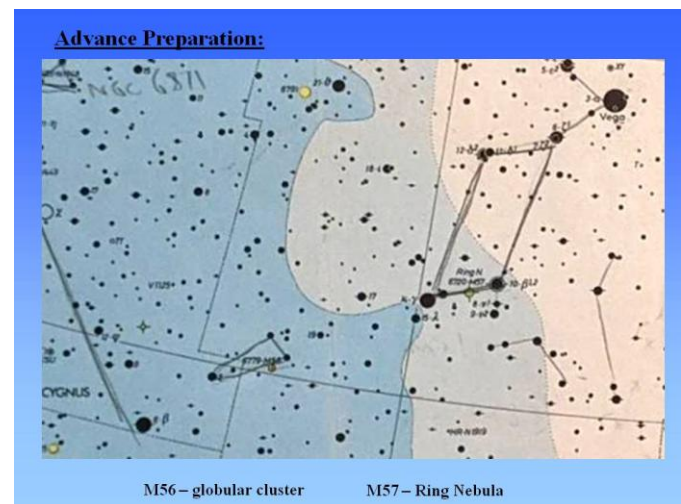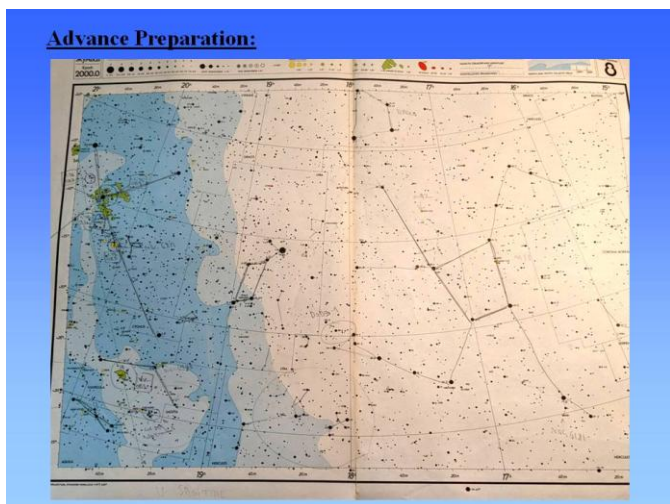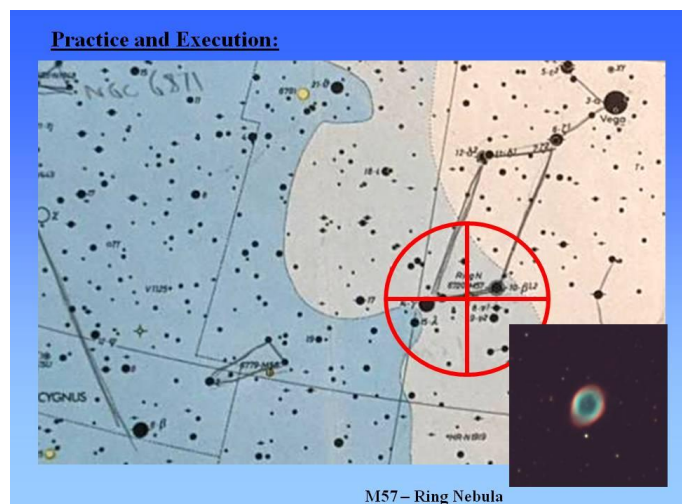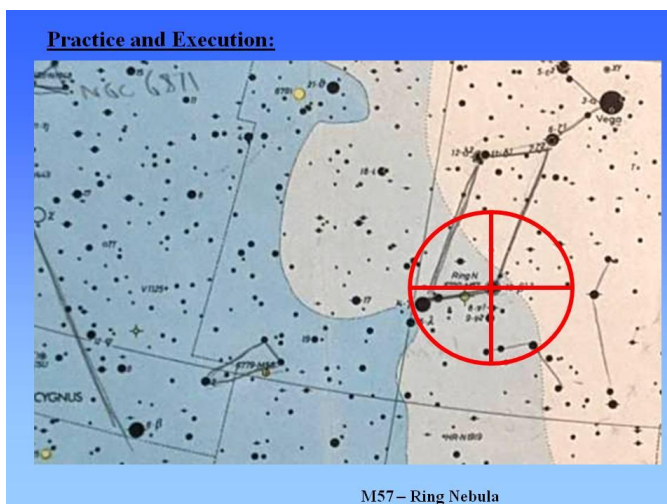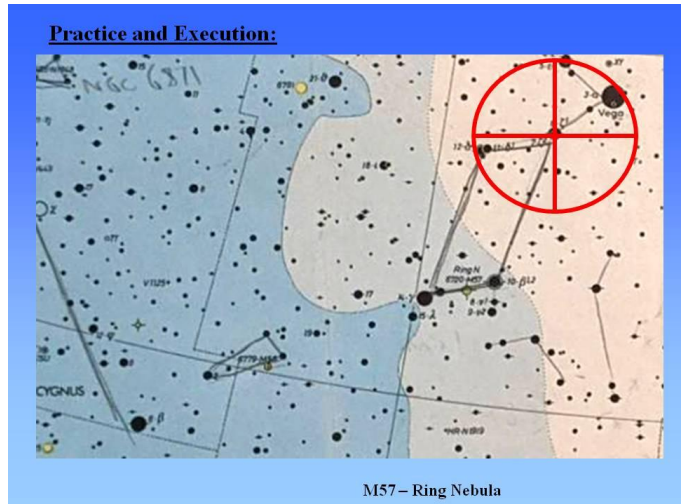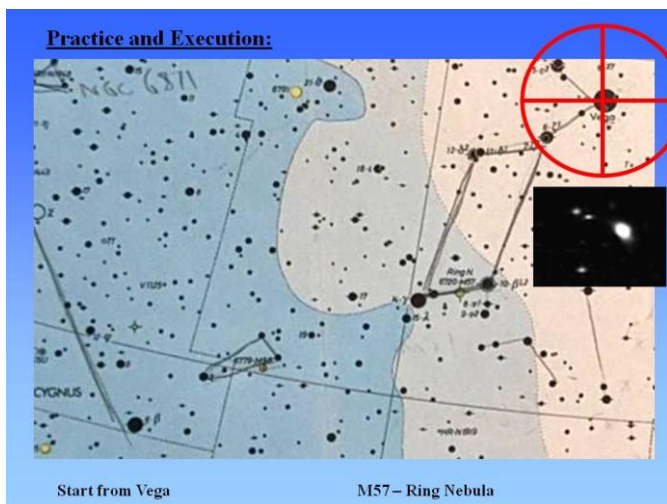
Depending on the star atlas, some come with templates that can help you with plotting.
You can also find different types of chart protractors that you can use with your atlas.
If you laminated your charts, you can use a crayon or grease pencil to mark the chart and wipe it off with a damp towel.

Utilize your observing guidebook or planetarium program to find a description, photo, or sketch of the object.
Get a feel of how difficult the object will be to see in your telescope. Small and faint? Large and bright?   Is it beyond your telescope aperture size or level of darkness of your observing site?   (you may need to save this object for a trip to a dark-sky location or viewing thru a friend's larger telescope).   You might even want to get specific observing guides for the type of objects that you are planning on observing. Barnard Dark Nebula, Abell Planetary Nebula, Arp Peculiar Galaxies.

#3   Practice and Execution:

Start with easy to find objects on your observing list. Find the constellation in the sky using the star-finder/wheel.
Is it in good position for observing?   Open the star-charts to the constellation and find the object on the chart.
Review the star-patterns that you previously penciled in. We're going to start by trying to find M57 – Ring Neb in Lyra.
From the chart, find your naked-eye jump-star (Vega) in the sky and center using the red-dot and Finder-Scope.
Verify that the star is visible in the main telescope's wide-field, low-power eyepiece.
Using the star-patterns that you traced on your chart, begin using your Finder-Scope to 'Hop', or move the telescope to the first star-pattern. After verifying the telescope view to the chart, continue hopping.
If you get lost, return to the naked-eye jump-star and start over.
Depending on your Finder-Scope and if the object is bright and visible in the finder, you may be able to hop right to the object and have it centered in the main telescope using only the finder.

Practice and Execution:

Start from Vega   M57 – Ring Nebula

Practice and Execution:

M57 – Ring Nebula

Practice and Execution:

M57 – Ring Nebula

Practice and Execution:

M57 – Ring Nebula

If not, then using the star-patterns, center the finder in the general location of the object and then begin sweeping using your main telescope's low power eyepiece. Start by moving the telescope one field diameter in each direction.

M57 – Ring Nebula

M57 – Ring Nebula

M57 – Ring Nebula
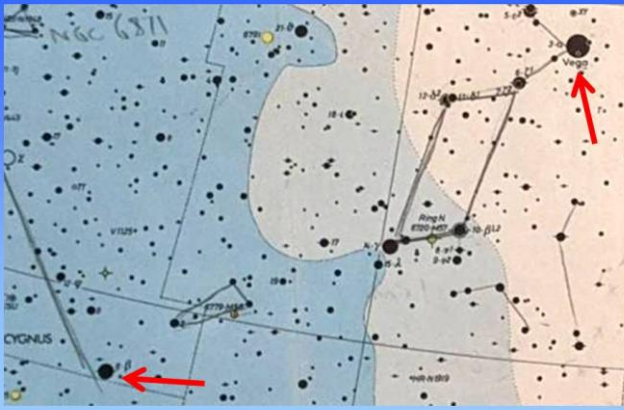
Practice and Execution:

M57 – Ring Nebula
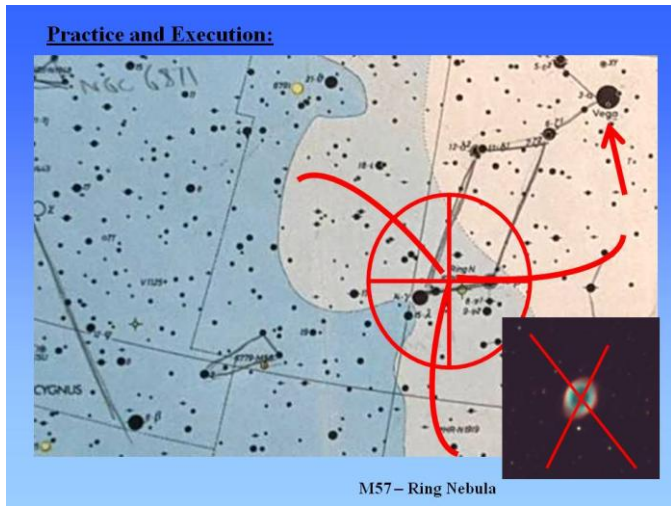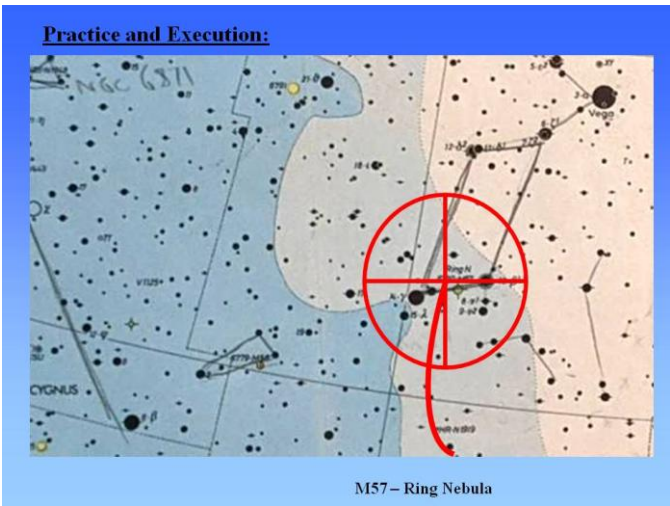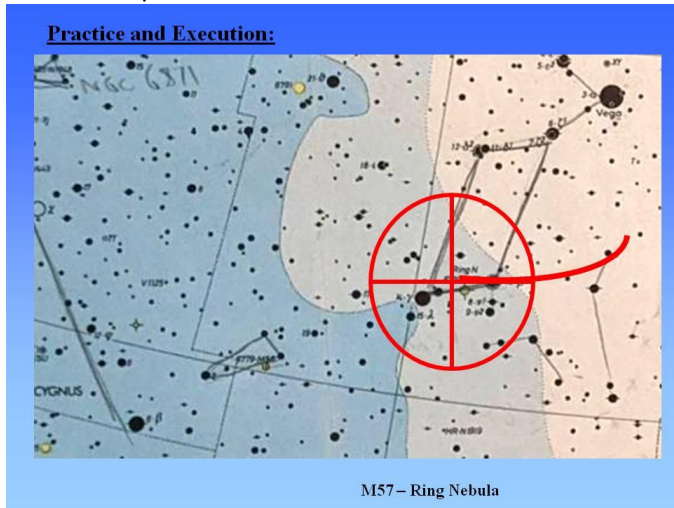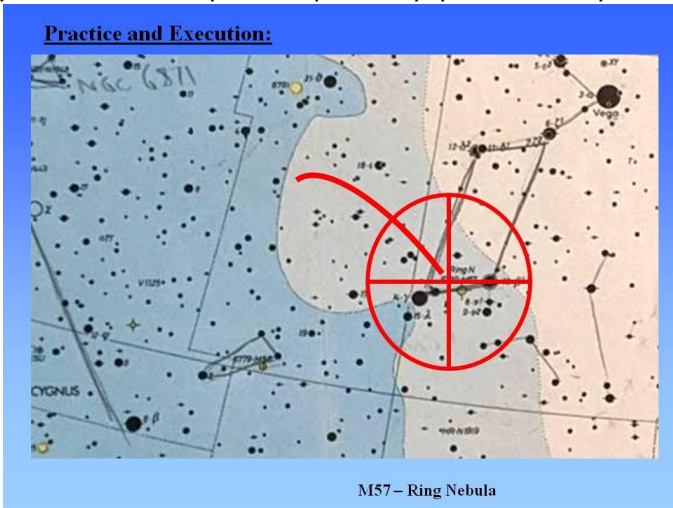
If not successful, use the finder to re-center the general location, and begin sweeping three fields per direction.
If still not successful, return to the jump-star and repeat using the star-patterns to verify that you are in the correct general location of the object. If your advanced preparation from reading the guidebook indicates that the object is small or faint, try switching the main telescope's eyepiece to a higher power and repeat sweeping. If you still can't find the object, set it aside for another night. Maybe the sky conditions just aren't right for you to be able to find it.

Now, let's find M56 – Globular cluster in Lyra.
 I have the option of two different 'jump star's, Vega as before or now I could use Albireo in Cygnus. If starting from Vega, follow the same path that you took to the Ring, and then extend it. Use the two bright constellation stars to either side of the Ring to point towards a triangle of stars that lay half way towards Albireo. M56 is near one end of that triangle. Or I could start with Albireo as the 'jump star' and center in the main telescope using the finders. Then make a short hop to the first star in the triangle. Then make a final hop to globular cluster M56.
If not successful, follow the same sweeping steps as mentioned above until you either find the object or save it for another night.

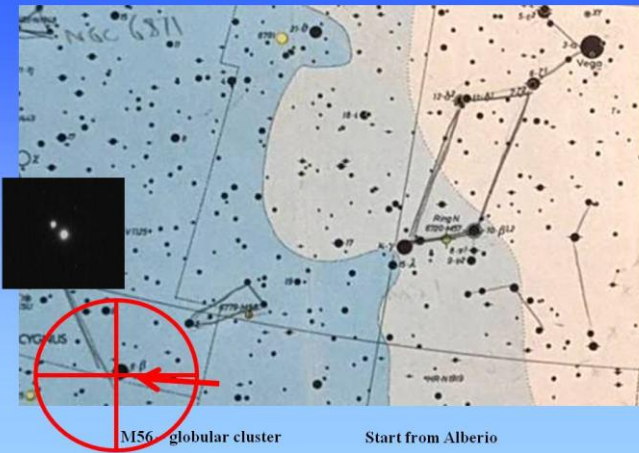**Practice and Execution:** — M56 – globular cluster — Start from Vega or Alberio

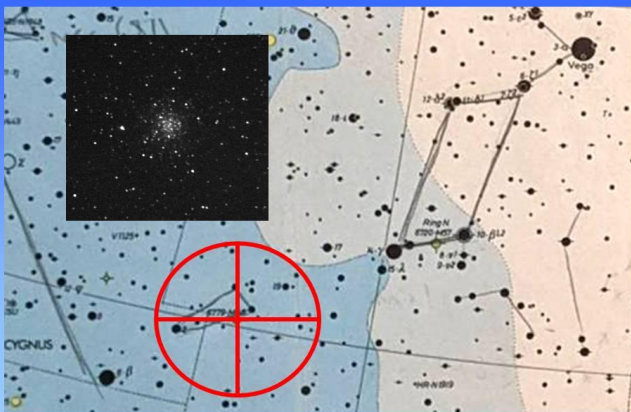**Practice and Execution:** — M56 – globular cluster — Start from Vega

Practice and Execution: — M56 – globular cluster — Start from Alberio

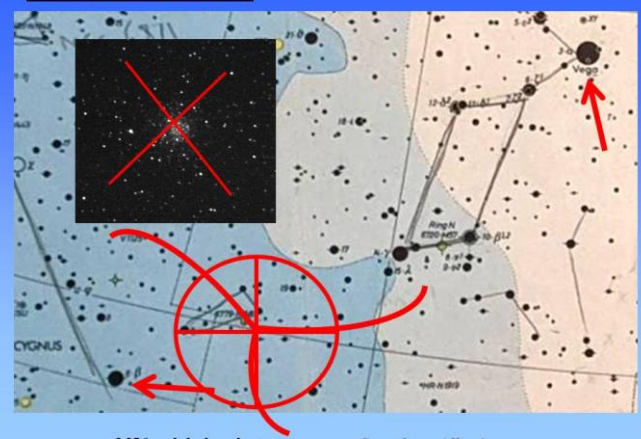**Practice and Execution:** — M56 – globular cluster — Start from Alberio

Practice and Execution: — M56 – globular cluster — Start from Alberio

Practice and Execution: — M56 – globular cluster — Start from Alberio

Once you've successfully found the object, make note of the equipment used, (telescope, eyepiece), sky conditions, observing location, and a brief description of what features you were able to observe of the object.
If unsuccessful, record the same above information, but with a note to make another attempt on a different night.

It's nice to be able to go back years later, (nearly 40 years in this example), and revisit your past record of observation.

In Conclusion -   Patience and Perseverance:

As with any hobby, the more you put into it, the more you will get out of it, and the better you will become at it. It takes time to develop your Star-Hopping abilities. If you stick with it, eventually, you will be able to find objects quicker and easier. - Along the way, you will find that you have become a better observer.

Now that you're able to find the deep-sky object that you are interested in observing, why not take your observing to the next level and try your hand at sketching!

Larry McHenry