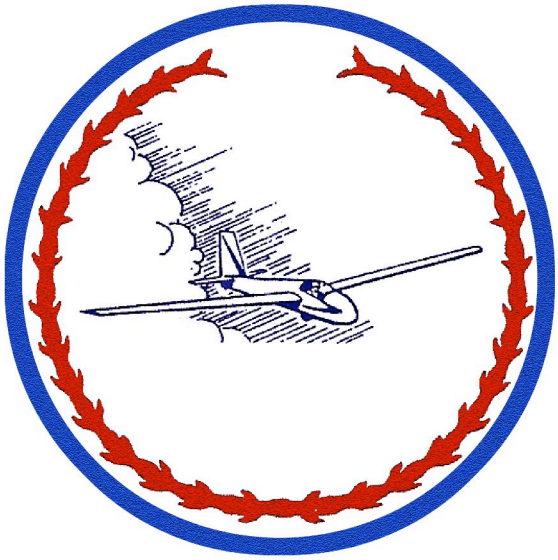
PILOT's OPERATING INSTRUCTIONS

1-26 ASSOCIATION



CROSS-COUNTRY SOARING

Glide Calculator

SGS 1-26

(e-Version 1.0 26 Jan 2007)

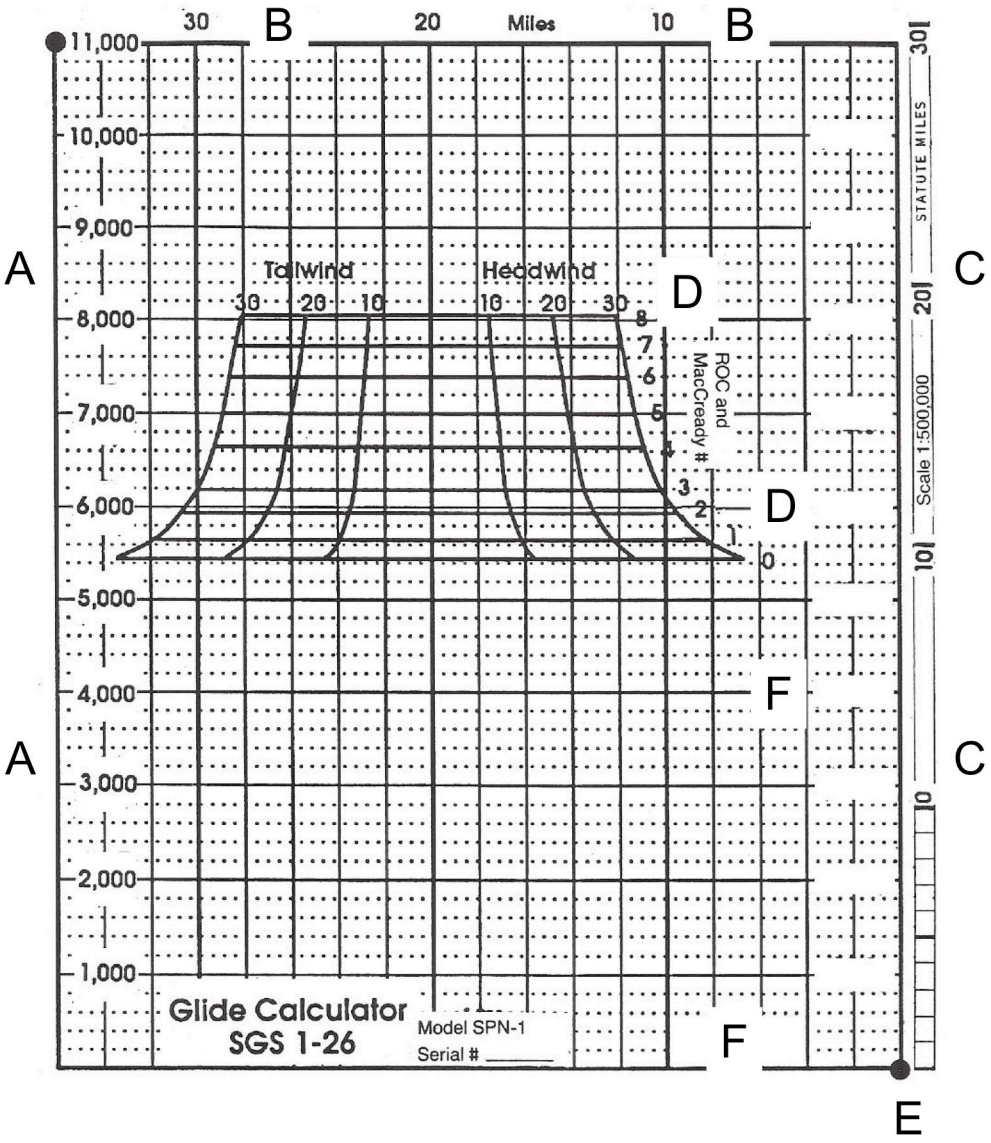


Figure 1

A. AMOUNT of altitude you need to accomplish your plan.

B. Statute miles-to-go to your "destination".

C. Mileage scale to use with US Sectional Charts.

D. Rate-of-climb in hundreds of feet per minute (McCready numbers).

E. Your "DESTINATION" (turn point, etc) with zero miles-to-go and zero altitude needed.

F. If you know your destination and your desired arrival ALTITUDE ASL, enter it here and appropriate enroute altitudes in the blanks along the right side. I use a RED Sanford Sharpie Permanent Marker--easily removed with alcohol pad. BLACK is difficult.

SGS 1-26 GLIDE CALCULATOR SPN-1

The SPN-1 is the result of work by numerous 1-26'ers over a period of many years to make the solution of the 'FINAL GLIDE" calculation feasible in the real world of the cockpit. In this calculator I have combined the flight test data and calculations by CHARLES SHAW, data plotting by LARRY PARDUE, plus ideas from a number of other innovative pilots, particularly STEVE DUPONT and PAUL McCREADY in the earliest days. I obtained and studied all the previous devices I could find—some very innovative, some quite arcane, but I found none that could be used with one hand in the cockpit. This SPN-1 fills that need; it is certainly a "one-handed" machine!

To be truly effective this sort of calculator must be used in conjunction with some sort of "SPEED-TO-FLY" device, the most common of which is the simple McCready ring mounted on your vario. (See pages 9 and 10 for "How to make a speed ring" details. Electronic speed to fly indicators are good too but not particularly better. (I have one in 443 but find that I use the McCready ring on my mechanical Winter Vario most of the time). The point is that the SPN-1 integrates the actual 1-26 polar as measured by SHAW and later confirmed by JOHNSON with the McCREADY solution to show you such useful things as **"how far can you glide from here, the fastest speed home, and other really nice to know stuff!"**

So-- although these sorts of calculations are essential when flying in competition, there are plenty of other situations where they are really useful. For example, "how far can I safely go from the home field today", or "can I get across this un-landable area or must I go around"? "Can I get to that next airport after the last thermal of the day or should I land here?"

In summary, the SPN-1 GLIDE CALCULATOR provides a graphical means to determine the inter-action of the SGS 1-26 polar with the 5 main variables affecting your cross country flight. They are:

a. Distance to go. (NOTE measure mileage on a US Sectional Chart using the scale on the right edge of the SPN_1)
b. Altitude required (or available)
c. Head or Tail wind component
d. Rate of climb (ROC) forecast or actual
e. Speed Ring (McCready) setting

The CURSOR (elastic string) like the cursor on a slide rule, allows you to tie these variables together in useful ways to solve your particular glide problem.

Here are some of the types of problems you can solve with this device----I'm sure you will think of others.

a. How HIGH TO CLIMB before starting your final glide for FASTEST SPEED HOME or to glide across this un-landable area.

b. HOW FAR OUT can you start your final glide if you have a max height restriction, (top of thermals, cloud base, Class A Airspace, etc).

c. HOW FAR can I glide from here (last thermal of the day situation).

HOW HIGH TO CLIMB

Example: For FASTEST SPEED HOME (See Figure 2)

The problem of how high to climb in the last thermal before starting your final glide (assuming you are looking for fastest speed) is strongly related to both your current Rate of Climb (ROC) and conditions you expect between here and the finish line. Assuming conditions appear to be relatively uniform, here are some sample problems:

You are 12 miles from home experiencing an actual ROC of 300fpm, (3 kts), and you believe you will have a 10 mph tail wind component on final glide

Holding the calculator at the upper left corner with you left hand, move the CURSOR with your left thumb so that it crosses the intersection of 300 fpm climb and the 10 mph tail wind component (Figure 2, point A). Find the intersection of the 12 miles-to-go vertical line and the CURSOR (Point B). From that point read from the horizontal height lines the altitude it will cost you to fly home at fastest speed using the McCready setting of "3" on your vario and flying the speed it commands.

ANSWER: About 3200ft, Point C.

Don't forget to add to the altitude you need for your landing pattern.

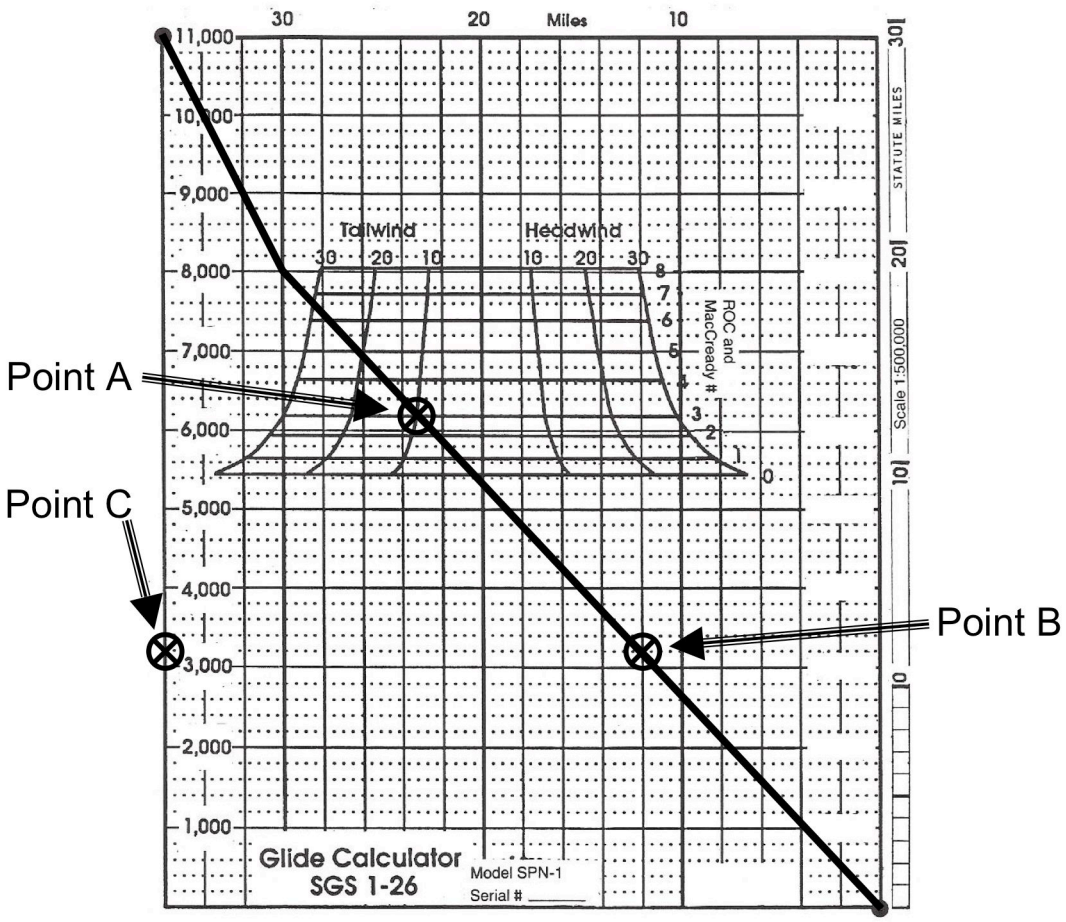


Figure 2

There are several good references you can read on how to use your Speed Ring, but to refresh your memory, by setting your Speed Ring index mark at the ROC you used to calculate your final glide (on the SPN-1) , AND then flying the speed commanded by the vario, you should make the fastest speed home, assuming of course you encounter the conditions you forecast.

TO CROSS THIS BLUE HOLE OR UN-LANDABLE AREA

You are facing a 15 mile wide blue hole with nice looking CU on the other side. You have been experiencing about a zero wind component. HOW HIGH do you need to climb to get across assuming neither lift nor sink enroute. Using the procedures described in the example above, place the cursor to cross the ZERO ROC and ZERO WIND then at the intersection of the cursor and 15 miles-to-go read an altitude "cost" of about 4000ft. Add that to the ASL altitude you want to have when you reach the other side and that is the ASL altitude you need to climb to before you start out across this area.

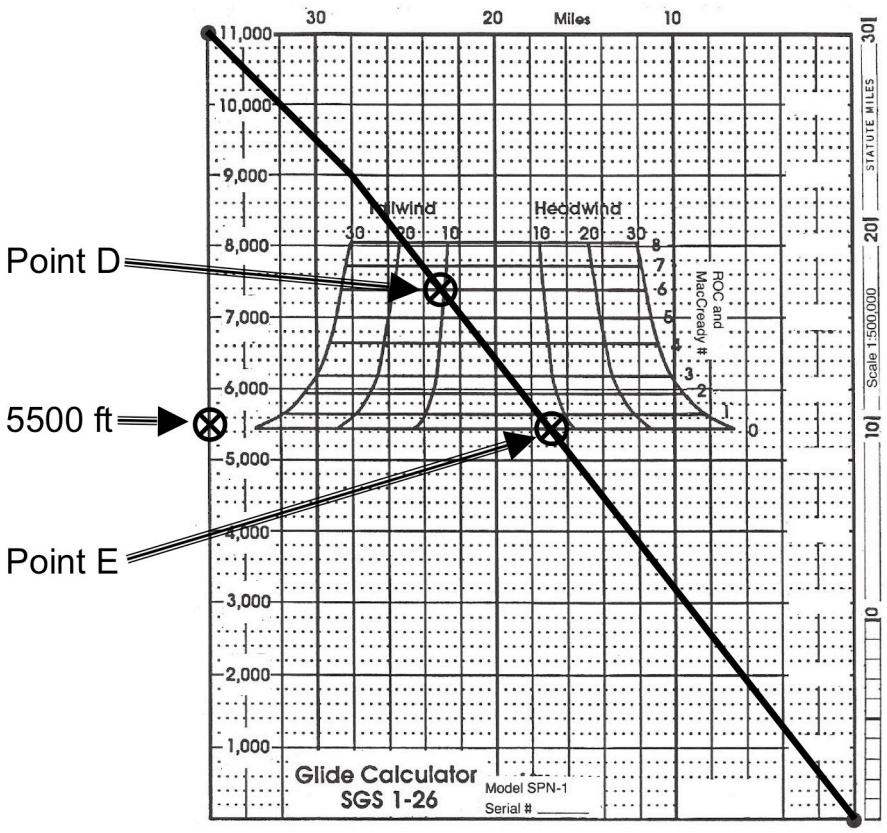


Figure 3

HOW FAR OUT TO START FINAL GLIDE?

We are almost always limited in the max height we can efficiently (or legally) reach enroute so this is probably the most often used function of this calculator.

EXAMPLE: Your max useable height above your desired arrival altitude is 5500ft. The day is strong with 600fpm thermals and you are expecting a 10 mph tail wind (YOU WOULD BE SO LUCKY!!). How far from home should you start your final glide?

Here's how to figure it: With your left thumb, push the CURSOR so it crosses the intersection of 600fpm ROC and the 10 mph TAIL WIND component line. (POINT D). Go down the CURSOR to its intersection with the 5500 ft height line and from that point read the distance using the vertical miles-to-go lines (POINT E). You should get about 17 miles- see Figure 3).

ANOTHER EXAMPLE:

You are flying in Colorado from my home field, Meadow Lake Airport (00V), elevation 6880 ft ASL. It's a typical summer day, the blue sky is full of fair weather CU with bases somewhere above 18,000 MSL and the winds aloft are nearly calm

Your task is to beat JIM WALKER'S 200km Region 9 speed record and you're now averaging near 800 fpm at the top of every climb. HOW FAR OUT should you start your final glide and what Speed Ring setting should you use?

First, the "experts" agree that you should use your current (20 second average probably) ROC for most final glide calculations, Second, you are limited to 17,999 ft ASL by the FAR's, and if you want to cross the finish line at a conservative 8000ft ASL, that gives you 10,000ft to work with. So, set the CURSOR at the intersection of "0" wind and 800 fpm ROC. Go up the CURSOR to 10,000ft and from that point read the distance using the vertical distance lines. You should read a little over 24 miles.

Set your speed ring at "8", and go like a "bat out of hell!" In fact you may find that it commands too high a speed for comfort (or even safety). In real life you might choose to fly at a lower Speed Ring setting, say "5", in which case you could have started your final glide from 28 miles out. Do you see how to get that answer?

HOW FAR CAN I GLIDE FROM HERE

Suppose that for any number of reasons you don't want to get out of gliding distance from the field. Maybe there's no crew available or you're at a new location and you're not comfortable with the possible land-out sites, or whatever. Put the CURSOR at the intersection of the ROC you have recently been experiencing, and the wind component you expect from your proposed location back to the field. As long as you REMAIN ABOVE THE CURSOR (STRING), you will be able to glide back to the field at that Speed Ring setting or any lower one. Remember, your "location" at any given moment is at the intersection of your height above your destination and your miles-to-go.

EXAMPLE:

I am 6 miles up-wind (15mph) from the field at 3500ft above pattern altitude and have been getting about 400 fpm ROC in thermals. Can I safely go further? How far?

ANSWER: Yes, 7 more miles, (See Figure 4).

Suppose I get a little nervous out there over that un-landable terrain. If I set a more conservative "0" on my speed ring to come home will I have a bigger altitude cushion

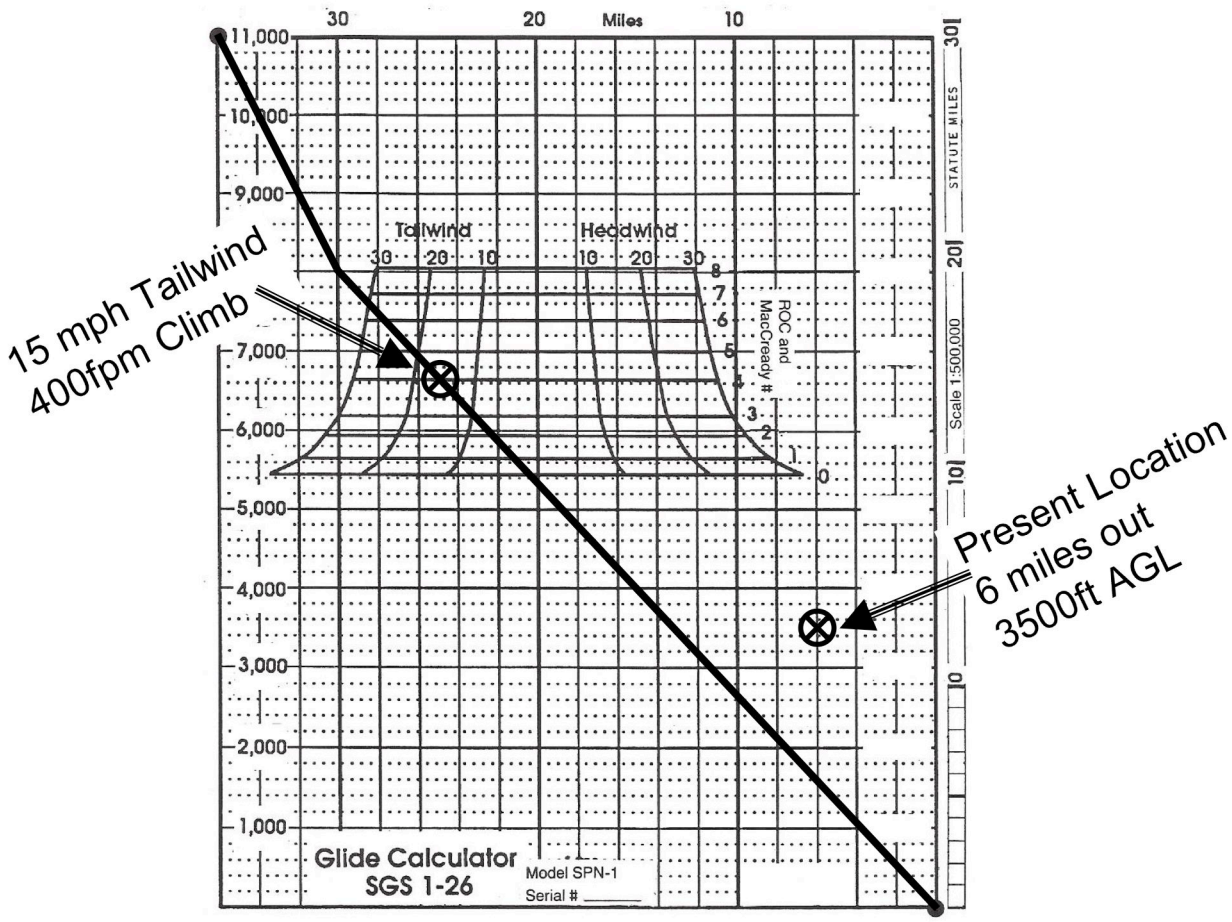


Figure 4

when I get there? YES—it will take me only about 2700ft to get home instead of the 3500ft required at a Speed Ring setting of "4," but of course it will take a little longer. How do I get that answer? Well, set the CURSOR at the intersection of "0" McCready and 15mph tail wind component. Slide down to the intersection of the CURSOR and 13 miles (7 +6) and read the altitude required to get home using the horizontal height lines.

The above procedure fits many real-life situations, i.e. on a cross country when you are leaving what you fear is the last thermal of the day, you want to know **"can I make it to my destination, should I divert, or should I land at this nice airport just ahead?"**

WHAT GLIDE RATIO (G/R) CAN OR DID I MAKE

G/R can be stated as the ratio of horizontal distance flown per unit of altitude lost. Using the units of statute miles, the "miles-to-go" found at the intersection of the CURSOR and 1 mile of altitude (5280ft) is the G/R. For example, assume you expect a 10 mph tailwind and an average climb in thermals of 400fpm. Set the CURSOR on

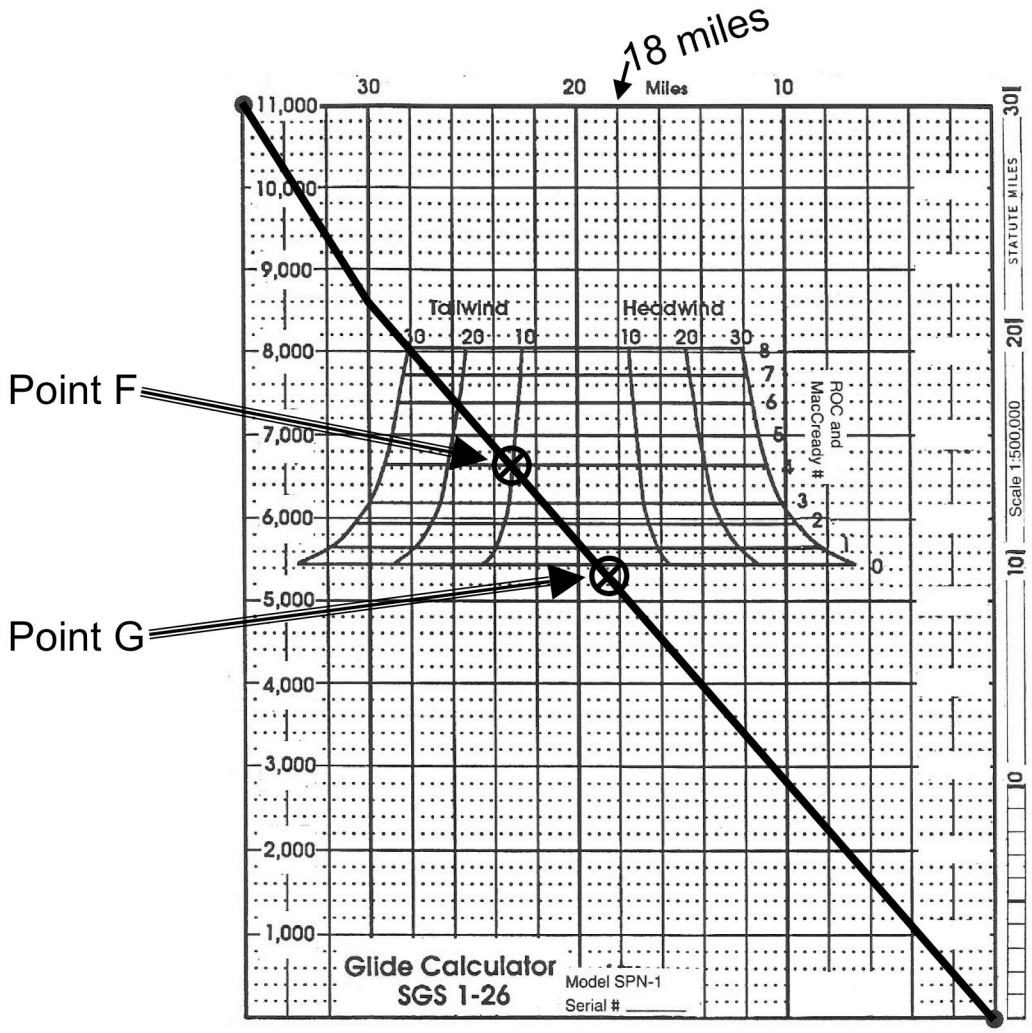


Figure 5

those values (Point F), then go down the CURSOR to 5280 ft (1 mile) altitude and using the vertical miles lines, read a bit over 18 miles, i.e., with your Speed Ring set at "4" you should make good a G/R of a bit over 18/1. (See Figure 5).

As you know, speed has a big effect on L/D, hence on G/R. For example, in the case above, assume you decide to re-set your Speed Ring to "0". Put the CURSOR at "0" McCready and 10 mph tailwind and read a G/R of about 23/1.

To see how markedly wind affects G/R, assume a 10 mph HEADWIND. With the CURSOR at 400fpm up (ROC scale) and a 10 mph headwind, read a G/R of only 13/1.

To calculate the G/R you have actually made, set the CURSOR at the intersection of the miles you went and the altitude you lost. Follow the CURSOR to 1 mile of altitude. The miles-to-go at that point is the G/R you made.

MAKE A SPEED-TO-FLY RING

A McCready SPEED-TO-FLY ring is simply a moveable speed scale attached to the perimeter of your vario so that the needle simultaneously points to an "UP" or "DOWN" value and a corresponding "speed" value. The speed scale includes an index mark (normally your minimum sink speed), which in flight you set to the "McCready Number" you have decided to use for the time being.

Just as a reminder, that "magic" McCready number is simply the ROC you expect (or had) in hundreds of feet per minute (or knots, close enough). If you expect a ROC of 400 fpm (or 4 knots), your McCready number would be "4".

FOR EXAMPLE, if your average ROC in thermals has recently been 300 fpm, (or 3 knots) and you expect the same in the next thermal, set the McCready Speed Ring index mark opposite the +300fpm (or 3 knot) mark on your vario, then fly whatever speed the vario needle points to on the McCreedy scale. Armed with this "how-to-use-it" info, calibrate your new Speed Ring as follows:

First, place an INDEX MARK on the ring and at the same location, mark the MINIMUM SINK speed of your glider. For CHARLES SHAW's light 1-26 he found that to be 36mph but for my max gross "D" model or a heavy "E" I find it needs to be about 5 mph higher. (See Schweizer flight manual for D and E L/D curves).

Next, set this INDEX mark opposite "0" ROC on your vario. Then mark the ring with the speed values opposite the ROC values listed in the appropriate one of the two tables on the next page. NOTE: THIS WHOLE CONCEPT OF AN ADJUSTABLE SPEED RING WILL ONLY WORK IF YOUR VARIO SCALE IS LINEAR. You can use a fixed ring on a non-linear scale vario however.

Factory made (blank) speed rings can be bought for most mechanical varios from one of the advertisers in SOARING or you can make one as basic as a piece of cardboard taped to the panel. Even one taped on with the INDEX mark opposite "0" on the vario will give you a lot of really good speed-to-fly information and is well worth the minimal effort to make it.

SPEED RING CALIBRATION DATA

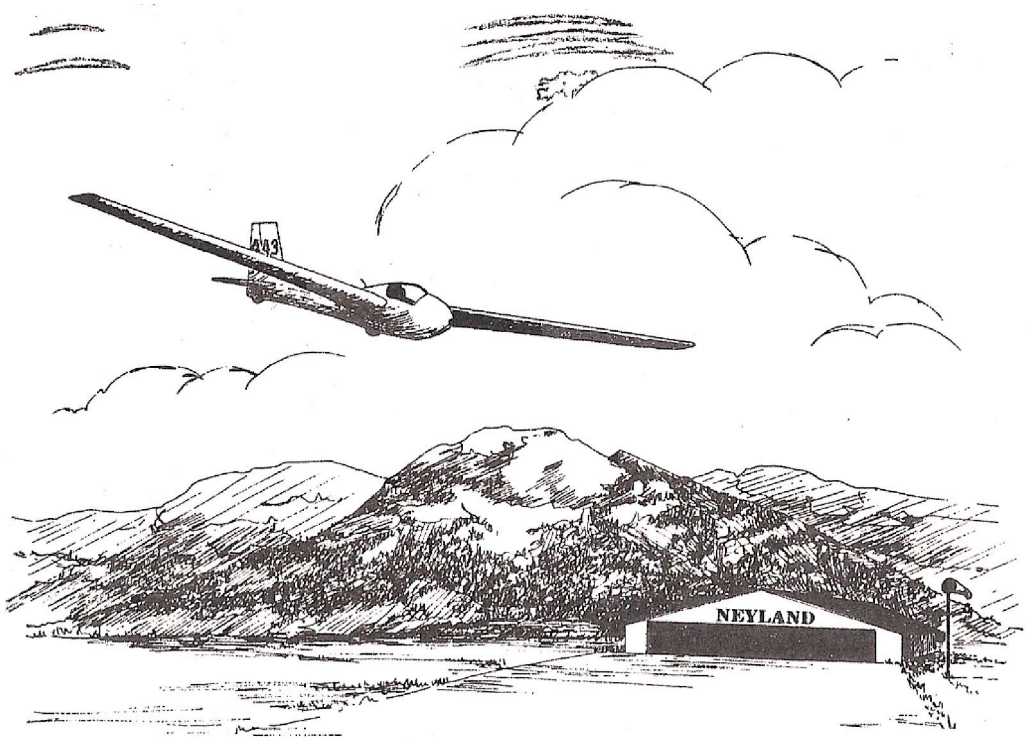
RING AIRSPEED	VARIO ROC	RING AIRSPEED	VARIO ROC
LIGHT 1-26		**HEAVY 1-26**	
36 mph	0 fpm	41 mph	0 fpm
40	-100	45	-90
45	-200	50	-200
50	-310	55	-310
55	-420	60	-420
60	-570	65	-550
65	-760	70	-730
70	-1000	75	-950
75	-1300	80	-1250

ACKNOWLEDGMENT

This PILOT OPERATING INSTRUCTIONS (POI) publication and the SPN-1 calculator are the result of the combined efforts of Charles Shaw, Larry Pardue, and myself plus the help of my son (glider pilot) Dave in getting this document formatted for publication on-line.

We join in hoping they will increase you pleasure in flying our favorite “bird” and help you reach all your soaring goals. However, I take all “credit” for any errors or mis-directions that may have crept in . If you find any please let me know.

Lew Neyland 443
Lneyland@aol.com



Greetings my 1-26 friend!

I hope you have chosen the most challenging, hence the most satisfying soaring task in the world, i.e., to work toward earning all three of your Diamonds in the 1-26.

Many of us have set that goal but as of 2006 only 37 have gotten there! The really good news though is that four of those were earned recently (2000, 2005 and 2006). The 1-26 mystique is alive and well!

This GLIDE CALCULATOR is designed to help each of us fly faster and farther, safely. Remember that faster is farther in the 1-26. Our relatively slow speeds mean that, especially for your Diamond Goal and Diamond Distance flights you are racing against time—the time the lift ends for the day.

I wish you a long and happy sojourn in the WONDEFUL WORLD OF 1-26'ing!

Lew Neyland (443) 26 January 2007
e-mail: Lneyland@aol.com

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