Three spreadsheets are presented: The Cross Country Flight Planner, Optimum Speeds to Fly Between Thermals and a Final Glide Planner. Each program is in “straight” Excel 97, using no macros or other fancy devices.

The speed to fly program was originally started, about 12 years ago, for the purpose of finding out just exactly how much faster to fly 077 in a headwind. Surprise! Surprise! After spending several frustrating weeks bootlegging the program into “my” computer at work and then after finally getting it operational, I discovered that you don’t fly faster in a headwind. (We’re talking about flight between thermals here, not final glide.) Airspeeds are shown in 5 mph increments in each of the three programs.

Sink rates used are those published in the June 1970 issue of Soaring, for S/N 100. The polar curve was plotted on an HP-10 CADAM thus the conversion from knots to mph is very accurate but the numbers are only good for that one ship. No problem; you can enter your own sink rates.

- For the speed to fly program, enter your sink rates in Row 14.
- For the flight planner and final glide program, enter your sink rates in the “Polar.”
- For all programs:
  - Cell D1 is used to input different air mass movements.
  - Cell E1 is used to modify sink rates due to different gross weights.
  - Cell F1 is used to modify climb rates when comparing different sailplanes.
- For the speed to fly program, Cell F1 is used to modify climb rates when comparing different sailplanes, or the same sailplane at a different weight.

In the speed-to-fly program, Row 11 is “hidden.” In the cross country and final glide programs, Column “C” and Column “F” are “hidden.” These rows or columns were for intermediate steps deemed necessary at the time but which could probably be eliminated now, by making the basic formulas more complicated. (But that’s the way it evolved and, “if it works don’t fix it.”)

All three spreadsheets are also available in Excel 95. Spreadsheets are available in knots, for the 1-36 and the AC-4 Russia. If you can’t download, send a SSAE with a blank floppy and I’ll send them via snail mail.
The “Cross Country Flight Planner” is exactly that. It is a planner, intended for planning flights or choosing the best routes for a POST task. It is used to plan a flight the same way power pilots plan their flight using the old E-6B computer. It calculates headings, time on course and speeds. You enter:

- Distance to fly, in miles
- True course, in degrees
- Forecast wind speed, in knots
- Forecast wind direction, in degrees
- Estimated average rate of climb, in fpm

The program will automatically compute and instantly display:

- Course correction for wind, which includes correction for distance drifted while thermalling. (GPS computes a new course after each climb and, after each thermal, you are a little farther downwind of the course line. this program keeps you as close as possible to the original course line.)
- True heading to fly while gliding
- Optimum speed to fly between thermals
- Best expected time over course
- Best expected average ground speed

A detailed analysis of the flight is displayed below the primary figures. This is for academic and instructional purposes. It shows, for each airspeed, time spent climbing versus time spent gliding. Results are predicated on the average of all air masses between thermals being “neutral”, (which is probably a pretty good average to start with). All thermals are assumed to be exactly on course. Naturally, they won’t be, so when you actually get in the air, you will have to make some mental adjustments for the added distance and change in direction.

If, after allowing for off-course excursions to thermals, you consistently achieve ground speeds faster than calculated, add a “Mockler” factor into Cell D1 to adjust the average air mass movement. These guys seem, not only to be able to “see” thermals, but more importantly, to avoid sink. I’m guessing that the average air mass movement for them is about a –100, i.e. of all the air they fly through, the average is rising at 100 fpm! (That doesn’t include thermals, just the air between thermals.)

On the other hand, if, you are always slower than the calculated ground speed, the problem may be in estimating average rate of climb. You just climbed 3000 feet in five minutes so your average rate was 600 fpm; Right? Well, - - - not quite. What about that last cloud, where you spent 2 minutes looking for lift and gave up after a total gain of only 100 feet? And what about the minute you just took to center the last 600 fpm boomer? No, your overall average rate of climb so far is less than 400 fpm!
Optimum Speeds to Fly Between Thermals

Print out this program for air mass movements in increments of 100 fpm. Change air mass movement in Cell D1, (it doesn’t show in D1 but all the numbers change accordingly.) Since speeds are in 5 mph increments, optimum speeds to fly will always be within 2 mph of the MacCready readings, (assuming the same polar is used.) Don’t be intimidated by all the numbers, what you really need to know is on the bottom lines after your expected rate of climb.

Average speed through the air (“cruise” speed) is calculated by the formula:

\[
\text{Cruise Speed} = \text{Airspeed times Rate-of-Climb divided by ( Rate-of-Climb plus Sink Rate )}
\]

Example: A 1-26 flying 50 mph, sinking at 201 fpm with estimated avg climb of 400 fpm:

\[
\text{Cruise Speed} = 50 \times \frac{400}{(400+201)} = 33.28 \text{ mph}
\]

This same calculation is repeated for each combination of airspeed and rate of climb, in 5 mph increments of airspeed and 100 fpm increments of climb. The program then chooses and displays maximum cruise speed for each rate of climb along with the corresponding airspeed.

There is an article in the July 99 issue of “Technical Soaring,” titled “MacCready Theory with Uncertain Lift and Limited Altitude.” The gist of this is, when you are low, set the MacCready ring at a lower rate setting, i.e. if you’ve been averaging 500 fpm but you’re below 2000 ft AGL, use the numbers for a 300 fpm climb. This also applies when thermals are widely spaced. Basically, what the author is saying is that you better slow down or you might not get there.
Final Glide Planner

Enter the following:

- Distance to fly or available altitude (or both).
- True course, in degrees
- Forecast wind speed, in knots
- Forecast wind direction, in degrees
- Estimated average rate of climb, in fpm

The program will automatically compute and instantly display:

- Airspeed to fly to go the greatest distance
- Altitudes required to go the selected distance, for each airspeed, or
- Distances expected with the selected altitude, for each airspeed
- Course correction and true heading for each airspeed
- Time spent on final glide for each case

Optimum speed to fly on final glide is the same as shown on the speed to fly sheet. However, you will probably never be at exactly the right altitude to apply this. So you take your choice. Fly slower or climb higher unless you’re too high. Then you can make a “redline” finish if it’s not turbulent.

Unfortunately, this program has not yet evolved enough for use in flight. It is basically the cross-country program with the rate of climb eliminated. However, it does give one a good idea of how much wind correction is required and how much to increase airspeed in a headwind. It also shows what happens when you fly at airspeeds above or below optimum.