

Reference for VFR Flight Planning Excel Spreadsheet

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Rev 1.20

Introduction

This Excel VFR flight planning spreadsheet runs on Excel 5.0 to 2000. This is the 12th (released) revision of the flight planner and since the last version some minor bugs have been fixed and a new "Airports" sheet has been added by popular request. Sunrise and sunset calculations have been completely redone and their accuracy is now much better (within a few minutes of official reported values).

The flight planner format is not exactly the same as the VFR planning forms one normally sees, but I believe this approach conveys more information and eliminates some of the mindless tasks associated with flight planning. This latest version is even easier to use because the airport information can be prepared in advance and one has to only know the airport identifier. I have verified the flight-planning results with an E6B and other flight planning software and the agreement is good for the level of accuracy required for flight planning purposes.

To see a list of changes, go to the revision history at the end of this document.

If you find any errors I would appreciate your immediate feedback.

Summary of Features

- Time/Speed/Fuel calculations
- Weight and Balance calculations with graphical display
- NEW ... Airport database on a new Airports sheet (user entered information)
- Aircraft details database
- Flight plan(s) generation
- Reverse flight plan generation
- Great circle distance and initial course
- Sunrise/sunset calculations
- Multiple time zones (built-in table), Zulu time calculations, Daylight savings time
- Temperature and Density altitude
- Warnings for fuel, currency, passenger count, night flight
- Cost computations
- Weather summary page
- Comm/Nav & Runway Info page
- Basic Howto sheet for first time users and new pilots.

Note: This spreadsheet does not contain a database of waypoints or airports, however, the user can enter information (on a local basis) into an Airports sheet which contains some examples. The reason a database

is not provided because of the enormous task of maintain a current list and file size would grow enormously which may not be relevant to many users in other parts of the world.

Layout

The spreadsheet consists of 9 worksheets.

- The first sheet gives a quick but basic step by step approach to using this spreadsheet for first time users of this spreadsheet or to new/inexperienced pilots.
- The second is an Airports sheet where users can enter airport identifiers, airport names, runway, frequency and timezone information for airports in a given geographic area.
- The third is the “Flt Plan” sheet which comprises the wind based time/speed/fuel calculations for user-defined VFR checkpoints. It also contains various miscellaneous information and calculations that enhance the flight planning application. This is the sheet that you will most often look at and take with you on a flight.
- The fourth sheet contains a reverse flight plan in case you plan to come back to the original airport using the same checkpoints. The only significant information user needs to enter is the altitude and departure time. User can override wind and other settings as needed.
- The fifth sheet is the “Gen Info” section which has navigation information, communication/navigation frequencies, airport information and “sketches” the user may wish to have in hand when approaching the destination. Some info from the Airports sheet is used here.
- The sixth sheet is an “Aircraft” sheet which contains data on various aircraft including Cessnas, Pipers etc. User can put new aircraft data here.
- The seventh “W&B” sheet is for weight and balance calculations, that allow the user to determine with the help of a graph whether the plane meets the CG and moment requirements
- The eighth sheet is the “Weather” sheet. This contains information transcribed from DUATs or other weather sources.
- The ninth timezone sheet has timezone and daylight savings (summer time) information for most countries of the world and internal timezones for large countries.
- Print macros to print out a select group of sheets has been added to the bottom of various sheets.

Each of these sheets is further explained in the following sections.

Howto Sheet

Brief step-by-step instructions are provided here to get this application to work for the first time without getting into too much detail and to get a basic flight plan completed quickly. Meant for first time users and new or inexperienced pilots doing their first few flight plans.

Airports Sheet

Added this version (1.20) to help speed up and reduce chances of mistakes when entering airport information. Following fields are currently supported: Airport identifier (e.g. KSFO), airport name, latitude (deg, min, seconds), longitude (deg, min, seconds), elevation, variation, airport frequencies – from CTAF to approach/departure, four airport runway configurations with identifier, length and widths for each, time zone information (must be compatible to names in the Timezone sheet) and other comments.

With this information entered, user need not spend much time entering this laborious information that is prone to error. Information for airports can be obtained from various sources, <http://www.airnav.com> is a

good source of information on US airports.

Flt-Plan Sheet

- User defined fields on the worksheet are shown in **red** in the example spreadsheet. The user will have to input data into these fields.
- Areas with a grey background and **blue** text represent calculated fields that are protected when the sheet is protected.
- **Black** text is usually headings and informative text.
- Fields with **green** text are non-printed fields, calculation fields or unit description.
- **Magenta** text fields are option descriptors that describe a specific option for other worksheet fields (being phased out). Comment boxes and check boxes have been added in this version.
- ~~Striken~~ through text (printed version only). Normally hidden text on screen unless there is an error, in which case, the text will appear as **red in light-yellow background**.

This sheet has two sections - the checkpoints section and the miscellaneous calculations section. These are detailed below.

Checkpoints section

The **Location** column is where the user specifies VFR checkpoints. The first one (B24) should always be the origin airport and should be entered as the 3 or 4 letter identifier. The "Top of Climb" which is the next row is automatically calculated. The destination airport id is in field B25. The first VFR checkpoint should be entered in field A6. The distance to the first checkpoint should be entered at the bottom of all the checkpoints in field F21. The reason for this is that the program determines the *top of climb* (TOC) distance and times based on final altitude and airspeeds. It then assigns the remaining distance and time to the first checkpoint from the TOC position which can vary depending on a lot of factors as you know. The caveat in all this is that if the first checkpoint occurs before TOC is reached, there may be some negative numbers in some of the fields! The other intermediate checkpoints are then entered in the column till the final destination airport. This again must be entered as the 3 or 4 letter airport identifier. Once the airport ID is entered, all the airport info is automatically pulled from the Airports sheet. As opposed to previous versions, this version shows the information to that checkpoint on its own line (and not the following line) making the flight planner easier to read.

The other columns in this section that are user specified are wind direction, **WndD**, wind velocity (**WndV**) given as *true* direction and true airspeed (**TAS**). In the spreadsheet, the values for the various V speeds come from the "Aircraft" sheet page. To alter information to suit a specific aircraft, you will have to change the values in that sheet. The aircraft data selected is based on the aircraft identifier specified in the field R31, as detailed in the "Aircraft" sheet section below.

The true course (**TC**) is entered in column E and distance between checkpoints in column F. All the user inputs now are more logically placed towards the left of the sheet. The magnetic variation (negative values for easterly variation) is entered in field B28 and this is used to calculate the true heading (**TH**). The spreadsheet calculates the wind correction angle (**WCA**), magnetic course (**MC**), magnetic heading (**MH**), and the fuel consumption for each leg (**Fuel**). A new field indicating cumulative fuel consumption has also been added. The **MC** should be used to determine VFR flying altitudes as per the hemispherical rule.

There is also a ground speed (**GS**) calculation and two time columns, estimated time enroute (**ETE**) and estimated time of arrival (**ETA**). Blank spaces are provided for actual times - these may be entered during the flight. There is also an extra VOR/Notes field that is provided for the pilot to put in VOR information, contact frequencies or other notes associated with each checkpoint.

IMPORTANT: In the fuel consumption portion, I have taken the liberty of putting a 40% higher fuel consumption during climb-out and a 35% reduction in fuel consumption during descent. These two fields are underlined in the spreadsheet. The user may wish to adjust these percentages if he/she is not comfortable with this. Also please be aware that the fuel consumption rate I have used for the various aircraft are default values in the Aircraft sheet. Specific aircraft may deviate from this value, and users are cautioned to use the right numbers from the POH or estimate values if unavailable.

You can also enter the climb rate (field M21) in feet per minute which will give you a more accurate estimate of time to reach your "Top of climb" altitude. You can enter the descent rate (field M22) and the spreadsheet will calculate for you when you can start your descent into the destination airports' traffic pattern altitude (specified in the Gen Info sheet field B24).

Miscellaneous Calculations section

This is the bottom half of the flight plan that includes various sub-sections such as Airport Information, Magnetic variation and Time Zones, Fuel/Distance/Time summary, Fuel consumption, costs and other time related and aircraft selection functions.

Airport information is automatically displayed such as latitude and longitude of the origin and destination airports. The program will calculate the great circle distance in field D26. Hopefully this distance will be less than the total distance arrived at in field M25 (sum of your piece-wise route segments)! The initial true course is calculated in field D27. It should roughly correspond to the average true course for the trip (for relatively short trips).

Also here you can enter actual airport temperature in degrees Celsius. Density altitude is displayed for both departure and destination airports.

You will also have to enter the amount of fuel you started the flight with in field N29. The program will then check if you will have sufficient fuel left when you complete the flight. Please check this value carefully, especially when you change the aircraft type, as this there is no default value for this field and will result in outrageous W&B numbers if not properly entered. This version will warn you if the entered value is greater than the capacity for the aircraft and will result in some ERR fields. The method of determining how much fuel is acceptable at the end of the flight can be altered by the user depending on level of comfort and FAA requirements. Currently, the program will warn you if you fall below a quarter tank. This may be overly conservative but it is what I feel comfortable with.

Date and time information can be entered which is used for other calculations such as whether night flight will be encountered. If you take passengers, based on the last time you flew, the sheet will check for your currency. The program will calculate sunrise and sunset times at departure and destination airports using the latitude and longitude of the departure and destination airport along with the date and time zone information. This information will then be used to warn you if you are likely to encounter "night" conditions. "Night" for logging purposes is from civil twilight-dusk to civil twilight-dawn. This version now warns of night conditions from a logging point of view. Note, for night currency, you should use 1 hr *after* sunset to 1 hr *before* sunrise to determine this condition (United States of America).

Fuel reserve check has been changed from previous versions. Here, if fuel reserves fall less than 1 hr of fuel left at the end of the flight (based on GPH of the particular aircraft), it will flag a warning. Feel free to change the criterion!

This spreadsheet has world timezone information. The timezone fields are B31 and B32 (departure area timezone and the destination time zone respectively). These are automatically filled when you enter the airport identifier and you have completed this info in the Airports sheet. Please make sure the timezone in the Airports sheet is exactly as specified in the Timezone sheet. For example, the Pacific timezone for the

US is called "USA Pacific". The spreadsheet will print the arrival time based on the time zone of the destination. Note, Zulu time calculation will not be affected by this and the spreadsheet will take into account summer/standard time information. For example, USA Arizona is 1 hr ahead of USA Pacific during standard time, but will be 0 hrs ahead in summer time. If you span multiple time zones, only the destination arrival time will be adjusted, not intermediate checkpoints. Didn't want to make the time zone feature into a real project!

The spreadsheet at this time does not know when Daylight Savings takes place, so you will have to check or uncheck the Daylight Savings box for both departure and destination airports. It would be possible to automate this, but this is too complex based on country/region and not worth the effort, unless localised to a specific part of the world.

You can also predict the cost of the trip based on \$/hr for the various planes. This will enable you to do a what-if comparison to see which aircraft turns out to be more economical. For example, the C152 has lower speeds resulting in longer flight time as opposed to the faster but more expensive C182. I have also added a reservation charge that is not normally seen when renting from FBOs. Our club has a reservation charge that varies and this is a highly customised calculation. You can turn this feature off by unchecking the Reserve Charge box. The operating cost per hour information is now part of the "Aircraft" sheet. To predict your cost, you must change the charges specified in the "Aircraft" sheet for the planes you fly, based on the charges you encounter.

To add or delete checkpoints, merely add checkpoints or clear the relevant entries to remove checkpoints. If the altitude field is left blank other fields in the row are hidden (at least on the screen). Also, the final destination airport should be kept on Row 19 and you can delete/add checkpoints between row 6 and 18. This will keep the summary fields from messing up if you inadvertently add rows beyond the final row (19). Up to a maximum of 15 checkpoints can be added in one trip. This should be sufficient for most GA type flying.

Reverse Flt-Plan Sheet

This is a new sheet added this version thanks to Matthew Price. It is almost identical to the flight plan section described above, except that the destination airport now is the departure airport and vice-versa. All the intermediate checkpoints are also reversed. You have to enter only a few fields although you can over write whatever you feel like. You have the option of adding fuel in this section and this will be reflected by conditional formatting based on whether you check the Refuel box or not. Most of the other fields can be left untouched, except that you may decide to change the winds especially if the return trip takes place much later or weather is changing quite rapidly. Total trip cost (for both flight plans) is calculated in this sheet.

Gen Info Sheet

This is a more free form sheet that contains airport information, navaid information, approach and departure frequencies, airport comm frequencies, telephone numbers etc. The user has considerable latitude in modifying this sheet to suit his/her requirements. I have also put in a stick-diagram for the runways at the destination airport as well as some pattern and runway length information. There is room to put notes and other information as well. This version has been formatted to look better than previous versions. Also, graphics for the airport "stick" diagram have been improved. At the bottom of the sheet a fairly complete flight plan for the onward and return journey is generated. Some user/contact information may need to be entered separately, but most of the other fields are automatically generated from information obtained from other sheets.

Aircraft Sheet

Included are V-speeds, costs, and W&B information for the Cessna 152, 172, 172RG, 182, Piper Warrior and Archer and Beech C23. Please note, the data entered is for certain year of aircraft and will vary within the model depending on installed equipment and other factors. Some data is incomplete as I didn't have access to all of the data. Please adjust values as appropriate for the particular aircraft you fly.

New aircraft can be added as additional columns. Row 2 (callsign/aircraft-ID) is used as the keyword search for determining which column is currently in use. If "N1234X" is entered in the Flt Plan field R31, then the "N1234X" column is selected in the Aircraft sheet for all the calculations on the worksheet. For the calculations to work correctly, the aircraft ID entered in field R31 of the Flt-Plan sheet must correspond exactly to the value on Row 2 for the column containing the aircraft data that you wish to use.

If you fly multiple aircraft (typical for a renter, club member), this feature allows easy switching between aircraft and helps you customise some of the performance numbers for each plane, even if they are of the same make and model.

W&B Sheet

This gives a graphical view of the weight and balance situation for the aircraft that has been specified. It uses fuel information from the flight planning section, but the user will have to enter the pilot and passenger weights, luggage etc. *This revision also shows the W&B situation at the end of the flight.* The W&B will work for the aircraft type specified in the Normal category only. Utility category is not covered.

The numbers have been taken from the POH of the various aircraft and the user may need to verify the Basic Empty weight for the *particular* aircraft selected, plus make sure other numbers are appropriate. The number of passengers from the Flt Plan sheet is used to prompt for individual weights of passengers and this in turn is entered appropriately into the B column. The sheet checks if the aircraft is a 2 seater or whether too many passengers have been entered and appropriately formats the fields.

The spreadsheet shows curves for BOTH takeoff and landing regimes using the lower of the take-off and landing weights in cases where they are different. For example, for the C182 you can have a take off weight up to 3100 lbs but for landing, 2950 lbs is the limit. Since the landing weight must be under 2950 lbs., this number is used for both the landing and takeoff curves for sake of simplicity.

All the moments and slope calculations now come off the Aircraft sheet making it easy to add other aircraft. The Piper Warrior, Archer and Beech are new additions, although some of the information may not be complete.

Weather Sheet

This sheet has fields for the pilot to enter the weather data from DUATs or a live briefing. There is also some space to write down NOTAMs and ATIS information. As a reference, I have added some of the common METAR/TAF weather phenomena abbreviations.

Timezone Sheet

This sheet has timezone information for most countries of the world in tabular form. For large countries spanning multiple timezones these are identified separately. All times are with respect to UTC. Information on whether a particular timezone switches to daylight savings or summer time is also indicated. If the user selects daylight savings time (B31), then that information will be taken into account in all the time related

calculations. Many countries do not have summer time. In such a case, selecting daylight savings will have no effect on time calculations.

Printing

The printout of the sheets by default will result in no shading in text boxes and all cells including hidden ones will be printed (if printed in B/W settings). However, the hidden text on screen will be striken through when printed (as done here) so these fields are meaningless unless there is a real error. A black & white printout will not look like the screen version where conditional formatting in colour has been employed. This will still result in cells and text being visible when they are actually hidden on the screen. I have not tried this on a colour printer, where it may look OK, but few users are likely to print in colour, hence I have resorted to striking out the text. You will need to ignore the striken through text when you print the spreadsheet and rely on the screen for a more aesthetic looking version.

Future plans and Acknowledgements

If you have any other suggestions on improving this spreadsheet please contact me via e-mail, and I will try to incorporate them. If you send me information on other aircraft which are not included in this version, I will include it in future revisions. You can mail me the whole spreadsheet or just the aircraft sheet with the new data entered.

For version 1.01, many thanks to Matthew Price for adding various useful features and ideas to improve the layout and presentation. Thanks to Tyler Kirby as well who has taken this spreadsheet to another level by adding an airport database search and navaid search for the route of flight. This has not been updated in quite a while.

Thanks to Raj Upadhaya for the ideas and implementation of the "Aircraft" sheet, Sandy Mustard, Michael Pendleton, Sven Pavlik, Shabtai Lerner, Kevin Mills, Birke Brookbank, Greg Kettmann, Gilbert Bibeau, Jeremy Shearer, Louis Milord, Dave Coleman and others for various suggestions to improve the spreadsheet as well as their valuable bug reports. Also, thanks to all those who reported bugs and reviewers of this application. I would like to acknowledge the contributions of my wife in cleaning up the documentation in the early versions.

Disclaimers

USE AT YOUR OWN RISK!!! I cannot guarantee the accuracy of the spreadsheet and strongly recommend that the data provided in this spreadsheet be supplemented with your own calculations and good judgment as PIC, especially in the areas of fuel estimates, Weight and Balance etc.

Use of this program is governed by the following licence agreement.

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Main URL: <http://members.home.net/snarayan/aviation/ftpln10.zip>
<http://members.home.net/snarayan/aviation/ftple10.zip> (self extracting version)
(to be renamed to a .exe file for self-extraction)
Latest bugs info http://members.home.net/snarayan/aviation/ftpl_bugs.html
Tyler Kirby's version http://members.tripod.com/s_narayan/aviation/tk_ftpln.zip

The files listed below and the zip archive may also be retrieved from
WWW sources such as <http://www.download.com> (C|Net) and <http://www.hotfiles.com> (Ziff Davis net)

The files contained in the zip archive (ftpln10.zip) are:

ftpln120.xls Excel 5.0/97/2000 spreadsheet
ftpln120.doc Word 7.0/97/2000 reference
ftpln120.txt Plain text reference
ftpln120.pdf Adobe PDF format reference

pdf / html versions available at my website

Revision History:

Ver 0.3 First Released version (to the internet) *Date: 17.11.1996*
Ver 0.4 Added magnetic course and Notes fields in Flt-plan section and added the Weather sheet.
Date: 3.2.1997.
Ver 0.5 Cessna 182 added to the aircraft types along with cosmetic improvements to the Flight Plan
section. *Date: 30.6.1997*
Ver 0.6 Added Aircraft sheet to include multiple aircraft types and sunrise/sunset calculations. Added
timezone and daylight savings time information. Cleaned up Flt Plan sheet layout. Switched
magnetic variation to "East is Least (negative)" philosophy. Minor updates to W&B sections and
other layout improvements. *Date: 21.1.1998*
Ver 0.6c Fixed bugs related to loading this spreadsheet with Excel 97 and a minor graphical anomaly in
the W&B graph display. Thanks to Shabtai Lerner and Kevin Mills for reporting these bugs. Also
corrected some minor errors in the sunrise/sunset and zulu time fields and their usage. *Date:*
30.3.98
Ver 0.6d Corrected a gross error on one of the fields using the magnetic variation number after having
switched to the new format. Contact information changed. *Date: 1.5.98*
Ver 0.70 Added departure and destination time zone calculation fields. Improved the user interface for
entering course and distance info. Added cumulative fuel consumption field. Removed the zulu
time switching field (all changes in the Flight Plan sheet). Climb/descent rate fields added. Fixed
minor bugs reported since 0.6d. *Date: 7.7.98*
Ver 0.80 Modified flight planner row presentation for checkpoints making it more intuitive to read.
Improved the look of the General Info spreadsheet. *Date: 10.7.98*
Ver 1.00 Added reverse flight plan sheet. Other improvements include adding of check boxes and print
macros, initial true course for great circle calculation, better differentiation of 2 and 4 seater
aircraft in the W&B sheet and passenger headcount, fuel reserve warning calculation, as well

as some improvements to the presentation and layout. Many thanks to Matthew Price for adding the reverse plan sheet and the macro/print functions and various suggestions and ideas.

- Ver 1.01 Minor update. Added an eighth Howto sheet. Updated the WCA field to produce "decent" numbers when your headings are close to 000 deg. Added daylight savings field for destination airport and updated the night calculations (meant for logging, not currency checking).
- Ver 1.10 Fixed a bug in the reverse flight plan where the magnetic heading column inadvertently used a wrong cell address for the variation (B28 instead of B30). Added and fixed calculations related to independent daylight saving time settings used at departure and destination airports. Added 65% and 75% cruise power settings. Cessna 172-RG aircraft added to the aircraft selection.
Date: 27.2.2000
- Ver 1.20 Fixed some minor errors in time calculations, completely re-did the sunrise and sunset calculations, added an airports sheet which affected the flight plan, reverse flight plan and general info sheets. *Date: 5.11.2000*

Wish you safe landings...