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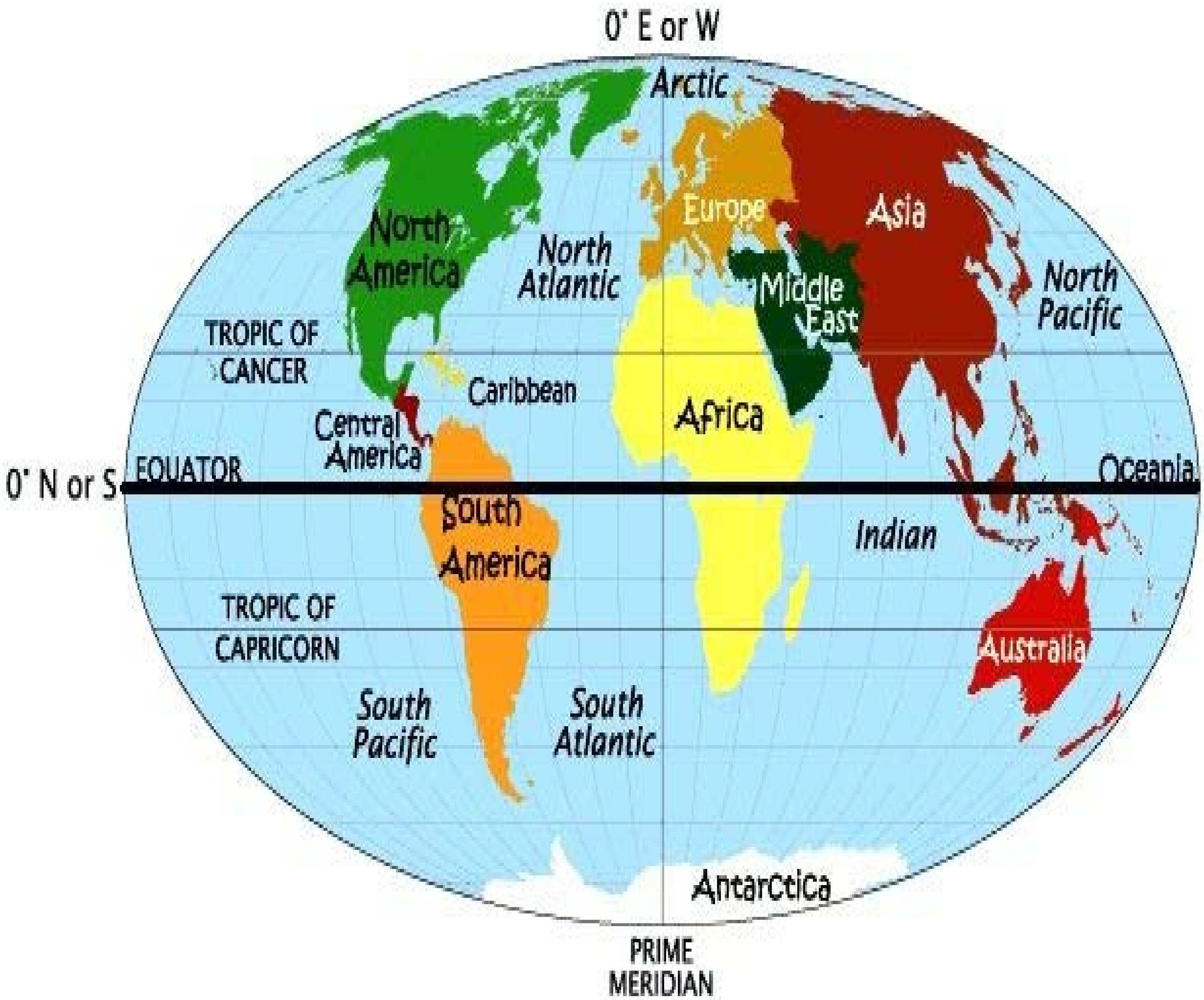
SOLAR PRIMER

As pilots concerned with all aspects of our environment, we have noticed that the sun does not shine on our faces the same all year round. As a matter of fact, you can only get sun vertically on your face between two lines of latitude (and even then only two days a year). These are the Tropic of Cancer (23.5° north of the equator) and the Tropic of Capricorn (23.5° south of the equator).

And please at this point of time, let me make a general statement. My answers will NOT be accurate to half a degree. One degree accuracy is what you can expect from me. I will calculate these values above (for example) as 24° in all the rest of my equations

In North America, this means that if we want maximum solar radiation (power) we will have to point our faces (and our solar generating array) south all year long. And not just ANY south, but TRUE south. The sun couldn't care less where that huge magnet in Greenland is; instead it cares where the earth is actually rotating on its axis. The true north-south pole line. (And please note that I use the word "solar array" equivalent to "solar cell")



I would like to pause right here and acknowledge that I will be disinheriting roughly half of the world with my analyses and equations. I am going to do equations that are valid for north of the equator. For my colleagues in Australia, South America, half of Africa, and the South Indian Ocean countries, the equations will be incorrect, but inversely incorrect. Anybody in this part of the world that wants to correct my equations for south of the equator, please be my guest and be assured that I do NOT have these equations copyrighted. Feel free to correct them for your part of the world and share.

Having said that, I think it is obvious that any solar power project is going to be impacted by (a) their latitude and (b) the time of year that they are trying to pry power from the sun. For example, I'm sitting here in Northern California, about 500 miles north of Los Angeles and San Diego. My brother in San Diego is going to have to pitch his solar cells up much more that I to get maximum energy, and my colleagues in Oshkosh WI are going to have to pitch their solar array much further down than I am for optimum results. Not only that, but my brother Don in San Diego is going to get more energy over the year than I am, but Dick Knapinski (Director of Communications for EAA-OSH) is going to get less energy that I will. Fact of life and nothing any of us can do except move.

Let's do the first equation (all these equations will be on a series of spreadsheets, so you don't really have to copy them down).

The question is, "Where do I point my solar array for best efficiency?"

The first answer we must have is, "What is your magnetic declination/variation?" which is a fancy way of asking "How much east or west is your hangar is the line from the Greenland earth magnet to the actual True North pole. Most of us don't have a "True North" compass (with the exception of a few of our colleagues with this built into our cell phones) so the equation is:

True North = Compass Reading minus Declination (for easterly declination)
True North = Compass Reading plus Declination (for westerly declination)

So, here I sit at Grass Valley Airport 13° easterly declination trying to figure out where I point my solar array. True North is to the LEFT of Greenland (facing north), so it is correct that if I point my compass 13° CCW ("minus Declination") to 347° then the compass should be pointed to True North. And so it is. **I point my solar array DUE TRUE SOUTH, which is 180° from true north, or 167° on the compass**

So where do we get this "declination (variation)" information? http://www.gcmap.com/airport/KGOO has this information for any airport in the United States:

Type:	Airport (Airfield)
Use:	Public/Civil
Latitude:	39°13'27"N (39.224056)
Longitude:	121°00'09"W (-121.002555)
Datum:	WGS 1984
Elevation:	3157 ft (962 m)
Variation:	**13.44°E (WMM2020 magnetic declination)**

This is enough information for you to point your solar array in the right direction. Now we have to figure out what the correct 'pitch" angle is for you and your time of year. On to the next subject "Pitch Angle".

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