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IFR

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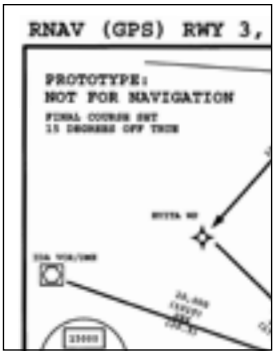

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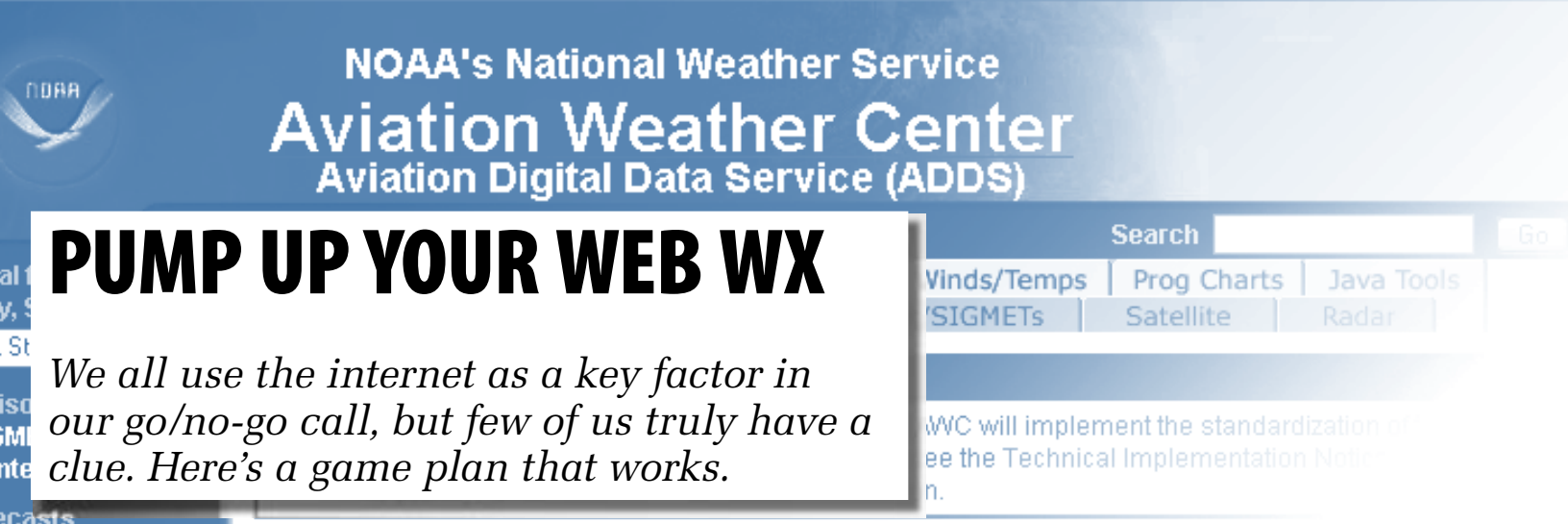


PUMP UP YOUR WEB WX

We all use the internet as a key factor in our go/no-go call, but few of us truly have a clue. Here's a game plan that works.

by Scott C. Dennstaedt

After several years of teaching aviation weather to pilots all over the country, I've concluded that there's something missing in how preflight weather-related decisions are taught. Much of what I see is based on estimations, generalizations, and even old pilot folklore. In the real world, the details make the difference and quick approximations just cause grief when Mother Nature is at her worst.

We instrument pilots have to get beyond these simple generalizations and put together an objective analysis of the weather using a method that works every time. I'm not suggesting this is easy. It's hard, but it involves using exciting products that were not available just a few years ago.

Over the last 10 years the internet has blossomed with weather products freely available to pilots. Only a few of these products have trickled into the FAA's required repertoire for the private, commercial, or instrument tickets. The 1975-revised Advisory Circular 00-6A (Aviation Weather) and its 1999-revised sidekick, Advisory Circular 00-45E (Aviation Weather Services), don't provide insight into how to use many of the online products available today. Many of the charts found on the Instrument Knowledge Test have either been discontinued or are incredibly difficult to find. There are dozens of other, more practical charts readily available.

The Aviation Weather Center's (AWC) Aviation Digital Data Service (ADDS) found at http://adds.aviationweather.noaa.gov/ is one of the best web sites dedicated to aviation weather. Is there a need to go anyplace else?

For many low-impact flights with little or no adverse weather en route, a quick peek at ADDS may be all you need to feel confident in your decision to launch. Add a few weather challenges, however, and ADDS becomes a bit underwhelming.

At this point many pilots make a leap of faith once they've received their standard briefing. For some, it is a giant leap. The good news is there are plenty of tools available today that will easily bridge the gap. The bad news is there are few outlets available to discover and learn how to apply these new tools. Let's start at the top.

The biggest challenge most pilots face is piecing it all together to form an objective analysis and have confidence in our decision to depart. In the end, to minimize our exposure to adverse weather, weather planning is more about making safe compromises between time, altitude, and route. Here are just a few of the steps I take when preparing for a significant cross country flight.

Surface Analysis

I start out every self-briefing with an objective examination of the current synoptic weather picture including what has happened over the last one, two, or three days. This is true even if my departure date is two or more days away. A surface analysis loop (http://www.hpc.ncep.noaa.gov/html/sfcloop/namusloop_wbg_3day.html) from the Hydrometeorological

WATCH THE VALID DATES AND TIMES

Whether looking at a forecast or observation, you must decipher the valid time of the data. Be careful: There are often charts with multiple fields on the same chart each containing a different valid time. If a chart does not contain a date-time stamp or you don't know how to decipher it, get help or don't use it.

Many products are valid at exactly the time on the chart. Other charts have fields that are valid over a range of time. Precipitation forecasts, for example, come in either instantaneous or accumulated precipitation. Accumulated precipitation products are typically valid over a three-, six-, or 12-hour period. Avoid web sites that don't have a specific date-time stamp on their products. The Weather Channel is notorious for providing a vague date-time stamp such as "tonight" or "tomorrow." —*S.D.*

Prediction Center (HPC) depicts the genesis, movement, and dissipation of low- and high-pressure systems as well as fronts, troughs, dry lines, outflow boundaries and squall lines over the last three days (shorter loops are also available).

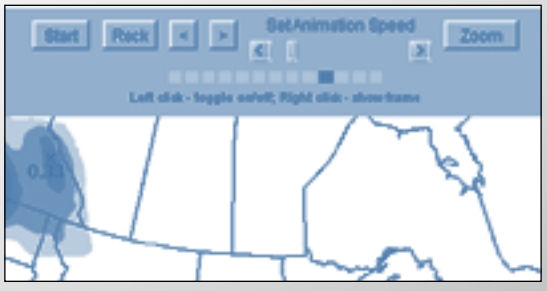
A surface analysis loop provides a great deal of information about the movement, or lack of movement, of major weather systems. Within 12 hours of your departure, you can almost extrapolate what the surface analysis might look like in the near future simply by applying these trends. In other words, the weather that is 12 hours upwind will likely be the weather you will face at the time of your departure or arrival.

USE THOSE LOOPING IMAGES

If I show you a still image of a ball as it bounced on a table, could you tell me much about what happened to the ball shortly after the picture was taken? On the other hand, if I provide you with a five-second movie of the same ball bouncing around on the table, you can probably give me a pretty good estimate where the ball will be and an even better estimate where it won't be shortly after the last frame of the movie.

Whenever possible, try to use web sites that feature a looping image (normally this requires Java to be installed on your computer). We know the atmosphere is three-dimensional, but image loops provide that fourth dimension in terms of time. Trends, patterns, direction and speed of movement, intensifying or dissipating features are easier to spot using a loop of images.

— S.D.



Precipitation Forecasts

Even before I peek at the current NEXRAD image, I locate areas of precipitation that are forecast along my planned route of flight. Precipitation areas represent "hot spots" for adverse weather. Often all of the significant adverse weather exists in regions in and around precipitation. For example, about two-thirds of all icing accidents or incidents were found to have precipitation falling at the surface at the time of the accident or incident.

The Quantitative Precipitation Forecast (QPF) from the HPC (http://www.hpc.ncep.noaa.gov/qpf/qpfloop.html) is an accumulated precipitation forecast product and is the best way to examine the potential for precipitation along your route especially one, two, or three days prior to your departure. QPF does not distinguish between the type of precipitation or between convective versus non-convective precipitation.

The challenge with precipitation forecasts is determining if the weather creating the precipitation will be benign or have some teeth. This normally requires a look at complementary products to determine the potential for convective activity, icing, fog, or turbulence.

The short range forecasts from the HPC (http://www.hpc.ncep.noaa.gov/cgi-bin/get_basicwx.cgi) contain instantaneous precipitation (precipitation coverage) including precipitation type (snow, ice pellets, freezing rain) and precipitation intensity. It will also highlight precipitation areas that may contain thunderstorms.

The newest product to hit the wire is called simulated reflectivity (http://www.emc.ncep.noaa.gov/mmb/mmbpll/cent4km/v2/ or see "Tomorrow's NEXRAD," July 2006 *IFR*). This hour-by-hour forecast creates an image of what the NEXRAD picture might look like in the near future.

The challenge is determining if the weather creating the precipitation will be benign or have teeth.

While it won't pinpoint each and every rain shower or thunderstorm, it will do an adequate job identifying the extent of coverage, location, onset, dissipation, and movement of precipitation areas as well as the storm-scale structure of these events.

Thunderstorm Forecasts

In addition to the short-range forecasts above, to assess the convective potential of the forecast areas of precipitation the lifted index forecast (http://www.emc.ncep.noaa.gov/mmb/namsvrfcst/lift.animate.html) provides a good overview.

While there are some limitations with this product, any regions that are shown to have a negative lifted index are worthy of your attention. Large positive numbers, on the other hand, indicate stable conditions that tend to suppress convective development and provide you with confidence that convective turbulence will not be present in and around forecast regions of precipitation.

Available from ADDS, terminal forecasts and area forecasts are the traditional products used by pilots and FSS specialists to determine the potential for thunderstorms in the future. To enhance these textual products, a convective outlook (http://adds.aviationweather.noaa.gov/data/airmets/airmets_CB.gif) issued by the AWC is a forecast that shows areas that are likely to see an issuance of one or more convective

SIGMETs within a six-hour forecast window.

The Storm Prediction Center (SPC) provides several products useful to pilots that identify the location of convective turbulence. The enhanced thunderstorm outlook from the SPC (http://www.spc.noaa.gov/products/exper/enhtstm/) provides a calibrated probability of 10, 40 and 70 percent that precipitation in the depicted region will contain lightning. Flying outside of the 10 percent area won't guarantee a smooth ride, but it's highly unlikely you'd see any significant convective turbulence.

Turbulence Forecasts

Outside of convective turbulence due to thunderstorms, the most difficult forecast to make is one for severe turbulence. Most forecasts for severe turbulence occur after pilots begin reporting it. It is rare that the AWC issues a SIGMET for severe turbulence hours before the first pilot report of severe turbulence gets filed. Often pilot reports of severe turbulence will trigger the AWC to issue the advisory. This is especially true for turbulence in the flight levels.

While rarely severe, thermal turbulence in the boundary layer (near the surface) can wear you down on a long, low-altitude trip. Thermal turbulence is caused by parcels of heated, unsaturated air rising into relatively strong winds aloft producing eddies of turbulent air. AIRMETs for moderate thermal turbulence rarely exist and are best viewed by looking for unstable layers. Conversely, stable layers often indicate a smooth ride regardless of the magnitude of the winds aloft. The Skew-T Log P diagram (http://rucsoundings.noaa.gov/) is the absolute best tool for finding those stable layers. Small environmental lapse rates or temperature inversions are the key to finding an altitude with little or no thermal turbulence.

For clear air turbulence at FL180 and higher, AIRMETs and SIGMETs represent the official forecast. The Ellrod Index (http://aviationweather.gov/exp/ellrod/ruc/) is another source worth checking. This is an objective index from the Rapid Update Cycle (RUC) weather model providing a forecast out to 12 hours for the continental U.S. (CONUS). Any index of 16 and higher warns of the potential for severe turbulence and is worthy of your attention. The Ellrod Index is segregated into four altitude blocks from FL180 through FL390, making it easy to see which altitude blocks will produce the most significant bumps.

Icing Forecasts

Like turbulence, icing is either incredibly difficult or fundamentally impossible to forecast. Icing, however, does not always occur in regions that are marked by precipitation. AIRMET Zulu has been the traditional advisory to pilots that structural icing is possible. This time-smeared forecast is a shotgun approach and may even forecast icing in cloud-free air.

With respect to icing, the first item to ascertain is the lowest freezing level. Multiple freezing levels should also get your attention in regions where precipitation is forecast. If you fly high enough, structural icing can occur anytime during the year. Even during July and August, departing IFR without knowing the freezing level leaves you guessing if faced with climbing through a cumulus build up at 14,000 feet.

The RUC model (http://adds.aviationweather.gov/icing/) forecast is updated hourly and provides a 0, 1, 2, 3, 6, 9 and 12 hour forecast for freezing level across the CONUS. Finding an altitude and route that keeps you below the freezing level is certainly the best way to avoid an icing encounter, but may not always keep you above the MEA.

The Current Icing Product (CIP) and the Forecast Icing Potential (FIP) provide a better spatial and temporal resolution for pilots than AIRMETs. Every hour CIP provides a recent glimpse of the past and combines a RUC model forecast with cloud data, pilot reports, lightning data, surface observations, and radar. The new CIP severity product combines both icing probability and icing intensity (http://weather.aero/icing/).

Left: *Getting the right picture before the flight stacks the deck for successfully avoiding the nasties in flight and finding your way to a landable destination.*

USE A COMBINATION OF FORECASTS TO SEE THE BIG PICTURE

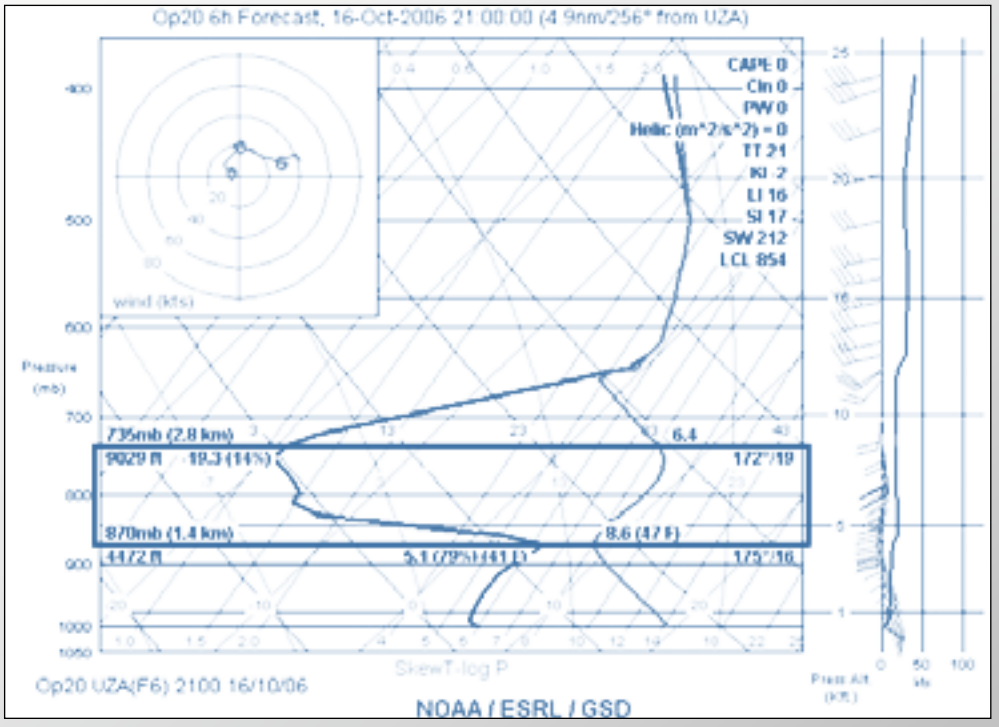
Don't cast aside the official NWS forecast products. Terminal forecasts (TAFs) have limitations as do area forecasts (FAs), AIRMETs, SIGMETs, and Convective SIGMETs. If used within the design limits of the product, though, they give useful information to the pilot. If these limits are not understood, bad decisions can result.

The purpose of using forecasts is to identify the future, three-dimensional location of adverse weather. Adverse weather includes: severe turbulence not associated with convection; visibilities or ceilings approaching minimums; high wind or wind shear near the surface; and icing and thunderstorms (convective turbulence). In most cases, one chart doesn't tell the entire story.

Pilots tend to fixate on planning around adverse weather, but don't recognize perfect flight conditions. Even when the winds are not a huge factor and there are no clouds or precipitation, turbulence can make for an uncomfortable flight. Using the Skew-T Log P diagram, you might find an altitude that has a small lapse rate (least change of temperature with altitude) or stable conditions.

On this Skew-T diagram, stable conditions exist between 4500 feet and 9000 feet pressure altitude. The lapse rate above and below these altitudes suggest the potential for turbulence due to a nearly dry adiabatic lapse rate (3 degrees per 1,000 feet). 8000 feet should provide smooth and cloud-free conditions.

Freezing level, the location of cloud layers and tops, and icing type and intensity can usually be deciphered using this diagram, too, by pilots who have been trained in reading it. — *S.D.*



FIP is also available as a forecast of the potential for icing up to 12 hours in the future.

Fog

Fog is the stealthier adverse weather element and can often be overlooked. Certainly terminal forecasts are your best friend when it comes to a forecast for reduced visibilities and fog, but are not available for most airports. The area forecast along with AIRMET Sierra may also provide some general guidance when fog conditions are widespread.

For a longer view into the future, Model Output Statistics (MOS) (http://www.nws.noaa.gov/mdl/synop/avnmosmap.html) provides a categorical forecast two to three days in advance that is updated four times a day. Additionally, you will have the opportunity to see "TAF-like" forecasts specific to many more general aviation airports than served by the official TAFs.

MOS forecasts are displayed in a tabular format and include a forecast for visibility, obstruction to visibility, ceiling, wind direction, and speed as well as the probability of thunderstorms. (See "Pump Up Your TAF," March 2005 *IFR*.) A categorical ceiling and visibility forecast of a "1" or "2" warns that low IFR conditions may exist, keeping you from being surprised on the morning of your flight.

The Next Steps

Whatever you use for your internet briefing, the key to success is being complete and comprehensive in your analysis. Try not to be biased after looking at the first few charts. It's natural to see a bunch of green lights in the distance and miss the stop sign in the middle.

Just like the trusty checklist you use in the aircraft, review all the important weather elements before you pour on the coals and depart.

Scott Dennstaedt specializes in weather training and TAAs. See more at his web site: www.chesavtraining.com.