Title: Understanding the universal language of aviation meteorology

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By the 1930’s it was clear that commercial air travel was set to expand dramatically. This prompted the international community to take steps to formalise co-operation between states and to develop a framework to regulate commercial air transport.

In December 1944, fifty two States signed the ‘Convention on International Civil Aviation’ which ultimately led to the establishment of the International Civil Aviation Organisation (ICAO – today the organisation has 191 members). The signatory governments had agreed ‘certain principles and arrangements in order that international civil aviation may be developed in a safe and orderly manner’.

To ensure that the signatories met this ambition a set of regulations known as the ‘Annexes to the Convention’ were devised with each Annex addressing a specific aviation related activity – including meteorological services. The annexes are comprised of a set of ‘Standards and Recommended Practices’ with which ICAO member states must comply. Specifically, Annex 3 defines the scope of meteorological services required, as a minimum, by the aviation industry.

What this means in practical terms is that aviation weather forecasts and observations have a standard content, format and coding structure and the criteria for amending forecasts is also specified. The range of forecasts governed by these regulations include TAFs (Terminal Aerodrome Forecasts), significant weather charts, upper air wind charts SIGMETs, local warnings and AIRMETs. Since the adoption of the Single European Skies legislation meteorological service providers are audited to ensure that they comply fully with the regulations. Prior to this there was very little regulatory oversight. The potential impact of audit failure is great as it would lead to the withdrawal of designation as a meteorological service provider to the aviation sector and the consequent loss of a valuable revenue stream.

The situation illustrated above shows how highly empowered aviation users are in relation to the meteorological services they receive. It is they who dictate, through ICAO’s consultation processes, the exact nature of these services. In effect, through the application of ICAO regulations a universal meteorological language now exists that allows a pilot to interpret forecasts, warnings and observations wherever in the world he travels. The historic events of seventy years ago in Chicago set in train a process that is ongoing. The Annexes are updated and amended every three years ensuring that safety, economy and international co-operation are continually enhanced.

The preceding paragraphs illuminate the service providers’ responsibility under the Chicago Convention. However, it is equally important to emphasise the responsibility of the pilot in becoming fluent in this universal meteorological language. They must study the meteorology modules of their pilot training courses carefully and become expert in decoding weather messages. This will help form a clear understanding of what the weather forecasts mean and what its’ limits are. Such a diligent approach will allow the pilot to prepare well for his flight, reduce risk and help to make it a safe and enjoyable experience.

I emphasise the above point as I once had an unnerving experience when providing a novice VFR pilot with an enroute briefing for a flight he intended to take between Kilkenny and Cork airport. I began by reading him the Cork TAF which described a situation whereby good VFR weather conditions were set to gradually give way to very strong winds, low ceilings and poor visibility. Immediately after hearing the TAF the pilot interrupted and said ‘grand so things are improving’ and he hung up the telephone! I had no way of re-establishing contact with this person and had great concerns for his safety as he clearly misinterpreted the TAF and placed himself at risk of flying into inclement weather conditions.

With that experience in mind, let us consider the Terminal Aerodrome Forecast (TAF) – one of the most highly structured of all the aviation forecasts that is read every day by pilots the world over. TAFs are written chronologically beginning with current ‘base’ conditions which describe what the weather is doing at the very outset of the forecast period. Then change groups (i.e. BECMG, TEMPO, FM groups) are used to describe how the different variables within a TAF are expected to evolve over time – in some cases with a probability attached (e.g. PROB40). Those change groups are used according
to a criteria based on operationally significant thresholds which are specified in the ICAO regulations.

The table below shows the thresholds for cloud ceiling and visibility. When visibility or cloud height is expected to pass through those values then the forecaster will include a change group in his TAF to reflect this.

### TAF change group criteria for Wind and Visibility

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Visibility</th>
<th>Cloud Ceiling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change group thresholds</td>
<td>150m, 350m, 800m, 1500m, 3000m, 5000m, 10+km</td>
<td>100ft, 200ft, 500ft, 1000ft, 1500ft</td>
</tr>
</tbody>
</table>

Using the above criteria enables the forecaster to meet the dual objectives of 1) keeping the TAF as succinct as possible while 2) focussing on key operational thresholds. After all, the longer the TAF the more difficult it is for users to extract the required information.

Let us look at a simple example of a TAF to gain an understanding of the impact of these change group thresholds on, for example, cloud ceiling and how a pilot should interpret the forecast:

- **EINN 111200/121200**
- **BECMG 111500/111700**
- **28012KT 9999 SCT022 BKN030**
- **22017G30KT 4000 RA BKN009=**

(Base conditions in **green**; change group in **orange**)

Initially the cloud ceiling is at 3000ft. This is expected to fall to 900ft between 1500 and 1700UTC. This value of 900ft is the forecasters’ *best estimate* of what the cloud ceiling will drop to during this time period. However, if you look at the change group criteria in the table above the forecast is still correct if the actual ceiling measures, say, 600ft *(as 900ft lies within the same range as does 600ft, i.e. between 500ft and 1000ft)*. It’s important for pilots to realise that the values they read in a TAF are the forecasters’ best estimate of likely conditions— but that they also represent an *interval* of possible values.

Not all pilots have the same ratings and not all aircraft have the same capability to land in low cloud or poor visibility. A pilot should remember that the values in the TAF are the forecasters’ best estimate – but that the regulations act as a constraint and limit the number of change groups that can be included.

It is the knowledgeable and critical use of these forecasts that really increase their value to the pilot. He needs to understand the criteria on which these forecasts are issued and to be able to critically assess the forecast information – before he leaves the ground.

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