BRISBANE VALLEY FLYER

JUNE- 2020

BRISBANE VALLEY SPORT AVIATION CLUB INC

www.wattsbridge.com.au
www.bvsac.org.au

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Newcomer - an ION 100 aircraft running up before flight at Kabe Airfield in Minnesota, USA.
See page 11

Peter Ratcliffe (Pres.)	0418 159 429	Ian Ratcliffe(Treasurer)	0418 728 328
Vern Grayson (Vice Pres.)	0431 465 874	Jackie Daley (Secretary)	0438 783 740

From the Club

Hi Everyone

Unfortunately, once again, due to the ongoing COVID-19 restrictions put in place by the Government, we are unable to hold the 6th June 2020 general meeting of BVSAC.

We have high expectations that, by early July 2020, reducing social distancing and the removal/reductions of other limitations, will allow us to call a 2020 General Meeting for the BVSAC in that month. We will provide a further update closer to the 4th July 2020 meeting to confirm this.

Best regards,

Jackie Daley
BVSAC Secretary

email: secretary.bvsac@gmail.com
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Framework of a Forecast

By Rob Knight

I have a non-flying relative in the UK who sent me an interesting question relating to a UK PPL who crashed in poor weather in southern Scotland. He was reputedly a fastidious pilot who was meticulous in his planning but made the mistake of entering weather beyond his capability – the same issues that I have been highlighting in recent issues of this magazine. However, his situation highlights an additional factor that I never mentioned in relation to avoiding such bad-weather accidents. He got his forecast, and planned in accordance with its every prediction EXCEPT he got the time period wrong. Such an apparently small matter cost him and a passenger their lives. The question I was asked was how a pilot could misread a simple time when they could read a complex code to ascertain the weather predicted in the document. I thought it quite a good question.

Let's look at the structure and contents of BOM issued forecasts and reports in Australia. These are standard and comply with an international format code to minimize the chances of an itinerant pilot reading an Aussie forecast or report incorrectly. Of particular note is the time structure depicted. Without exception, all times in aviation weather forecasting and reporting are given in UTC, the only universal time structure available.

Converting local times to UTC has its own hazards but it's really quite simple. We measure time from the start of a new day, each new day starting at exactly midnight. To have a common basis for time we use UTC (or GMT as it used to be called), and it is midnight in UTC when the sun crosses that position's antemeridian[1]. The time is then 00.00Z (Z = Zulu meaning the listed time is in UTC).

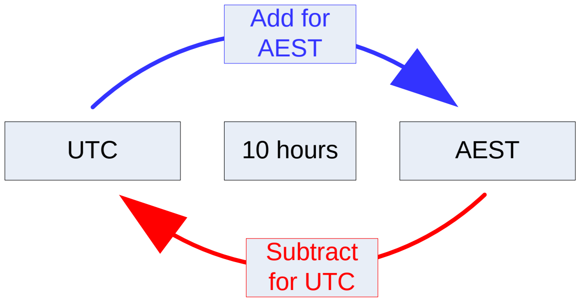
The sun travels around the earth (360°) every 24 hours. This means the rate of travel must be 360/24=15° per hour. As the Australian Eastern Standard Time zone is tied to the 150° meridian, time in the AEST zone is 150/15=10 hours ahead of UTC. Thus UTC is merely a common universal time zone from which we can quickly and accurately ascertain the actual relevant time in our specific time zone. AEST time is defined as UTC + 10 hours so, if a time provided in a forecast is 1200Z (midday in UTC), this correlates to 1200 + 10 = 2200 hours AEST.

Forecast and report times are provided in blocks of six digits, the first block, of two digits, being the day in the month and the second block, of four digits, being the time statement. For example, listed in a forecast for today is a time given as 071100. To read this, these digits must be separated into these two blocks – the first is the day of the month (the 7th day), and the second block is the time in Zulu (1100Z). This equates to 1100 + 10 = 2100 hours AEST or 9 pm AEST.

This sometimes leads to confusion because all Zulu times after 1400 hours must inevitably fall onto the following day/date in AEST. Thus a forecast or Report time of 071600Z will 1600 + 10 = 2600 hours which doesn't exist in a 24 hour day so the actual AEST will be 2600 – 24 = 0200 hours AEST on the 8th, <u>on the following day</u>.

For me, I arrived at a simple table I memorized years ago when this time regime was imposed on us.

[1] When the sun is exactly overhead the 180° meridian around the earth, on the exact opposite side of the world.



Using the image on the right –to convert UTC to AEST (the blue arrow)-

A time statement of 120900 would convert to 0900 + 10 = 1900 AEST, or 7 pm on the 12th.

A time statement of 211900 would convert to 1900 + 10 = 2900 AEST, or 29-24 = 0500 hours AEST on the 22nd day or 5 am on the 22nd.

With practice I have simplified this concept even further. A time of 0900Z (9 am) will be 10 hours later or 1900 AEST or 7 pm.

To convert AEST to UTC using the image above, use the red arrow. If the current time on a clock set to AEST is 1300 hours (11 am), then subtract 10 to get 0300Z. Naturally, if the AEST time is a value less than 100- hours, the day will be the previous date. For example, today is the 7th and my wrist watch says its 0955 AEST. Take 10 hours from this value and the UTC time is 062355.

For those interested, a free electronic UTC – AEST - UTC converter is available at
https://www.worldtimebuddy.com/aest-to-utc-converter
This should function on any smart phone or tablet.

Using the details above, the time/s we need our forecast to cover can be ascertained. If we wish to depart at 0700 AEST we need a forecast that covers the period from at least 1900Z and so on. Without this time understanding, most forecast are useless as the pilot cannot clearly place time and relevant weather locations with any accuracy.

So, moving on to the forecasts and reports themselves, the commonly used documents include:

Forecasts (predictions of future weather conditions)

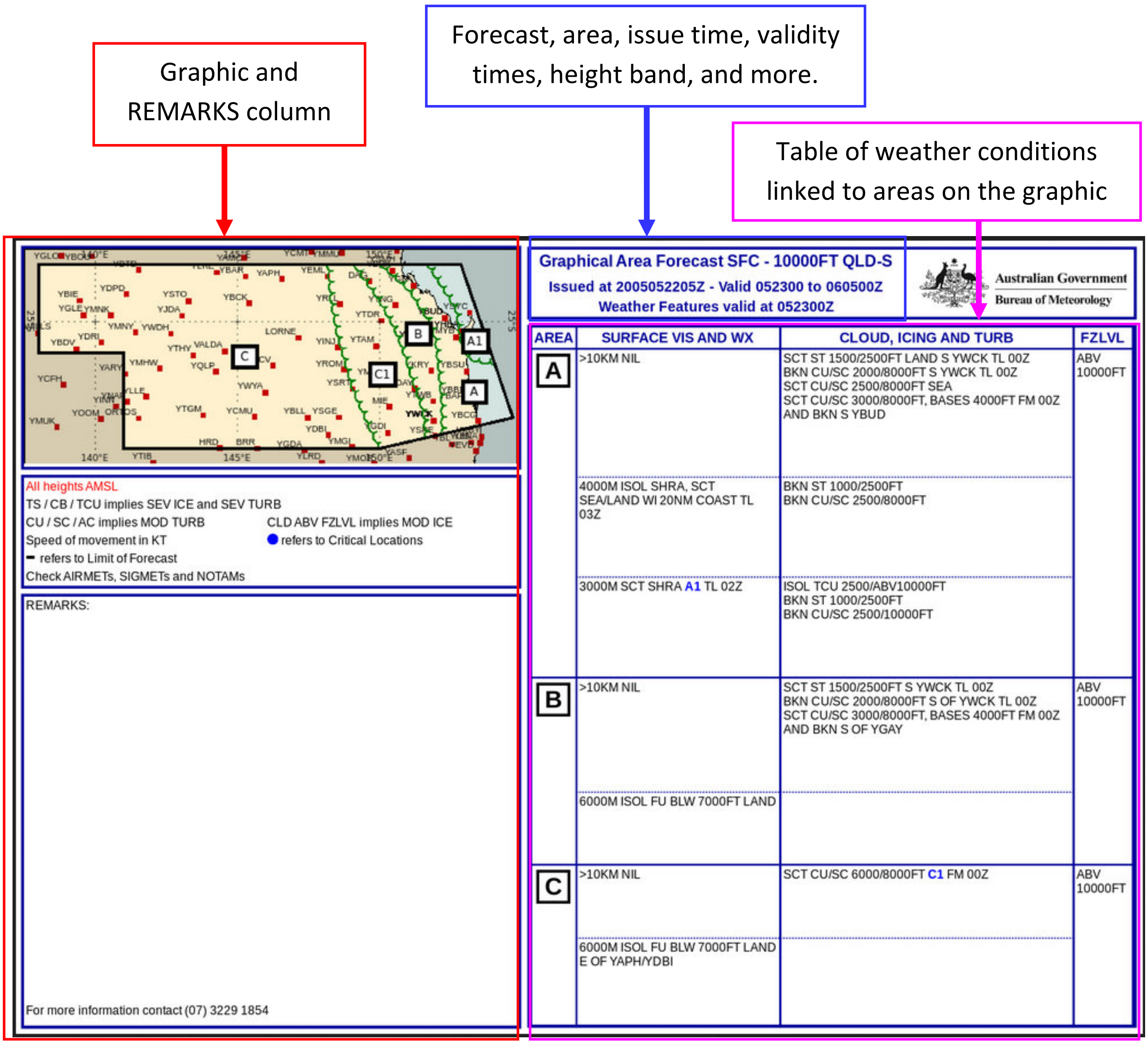
- Graphical Area Forecasts (GAFs),
- Terminal Area Forecasts (TAFs),
- Grid Point Wind & Temperature (GPWTs) *(see page 8)*
- Trend Type Forecasts (TFF), and
- SPECI (Special forecast, with designated specific weather expected)

Reports (statements of conditions a specified times, present or past)

- METAR (Meteorological Aerodrome Report)
- SPECI (Special report, with designated specific weather occurring or having occurred).

GAF

A Graphical Area Forecast (GAF) a combination of graphical and textual information relating to a geographical area. The graphic is divided into areas that share common weather characteristics which are detailed in an associated table. Below the Graphics Table, is a REMARKS area for specific items of note.



Presentation of an actual GAF. Note the use of Zulu time throughout.

The image above displays a GAF. On the computer screen a light-blue tab CLICK-ON link, with darker blue text, appears immediately above the right side of the table of weather conditions. Clicking on this will download a HI-RES PDF for easier reading or even saving. See image below for **Click-on** link.

Explanations for GAFs and any other BOM produced Forecasts or Reports are available, the link being directly from the menu, or the individual forecast page. See image below.

To read a GAF, note that areas within which it is intended to operate and, using their designated letters, check the conditions listed against them. For example, if a plan was to proceed along the coast, it is important the pilot notes that the weather and the area designated as A1 has visibility below the VFR minimum (3000 metres listed, when the requirement is 5000 metres), BKN (broken – 5 to 7 oktas) stratus cloud as low as 1000 feet AMSL, and showers/rain, until 0200Z (1200 AEST or midday). In other words, it would be prudent to postpone the flight until the conditions improve or choose an alternative route where the conditions are more clement. In considering the areas inland, this is especially noteworthy because the **areas A, B, C,** and **C1** all list improved visibility outside of precipitation and smoke although cloud basses are still depicted as being down to 1000 feet AMSL in places. Considering the terrain elevations inland, the conditions depicted are not ideal for VFR operations and straight-line tracks through these areas is not likely to be possible. This is supported by the statement in **area A** that isolated showers with visibility down to 4000 metres is predicted to exist within 20 nautical miles inland of the coast until 0300Z (1300 AEST) Such a flight would require a greater time allowance to fly around areas of inadequate weather conditions and thus an appropriate fuel at departure for such time contingencies in circumventing these predicted showers and low cloud.

To a professional VFR charter pilot with an Instrument rating, these conditions might be good enough to go, because VFR operations are not completely excluded by the predicted weather. But now, as a pilot flying for fun, the risk of the undesired excitement I might get if the weather goes pear-shaped completely outweighs the potential for enjoyment. Now THAT is risk management and the risks are such that I would not even contemplate planning such a flight in these forecast conditions. Ascertaining this very point is the PRIMARY PURPOSE of a FORECAST.

TAF

A Terminal Aerodrome Forecast (TAF) is a coded statement of meteorological conditions expected at an aerodrome and within a radius of five nautical miles of the aerodrome reference point. It contains a time of issue and period of validity for the conditions it predicts.

Below is a downloaded TAF for Bundaberg. Unlike the GAF where the presentation is graphic and thus visual, the TAF must be decoded.

BUNDABERG YBUD

TAF YBUD 072312Z 0800/0812

09010KT 9999 SCT040

FM080900 12005KT 9999 SCT025

RMK

T 24 25 24 20 Q 1022 1020 1019 1020

METAR YBUD 080030Z AUTO 10007KT 9999 // NCD 25/13 Q1021 RMK

RF00.0/001.20

Let's look at this line by line to see the simplicity of it.

Airport name — Airport name abbreviation

BUNDABERG YBUD

Confirming **forecast type** and Airport name

The issue time of the TAF, expressed in a six-figure group followed by the code letter Z, e.g. 072312Z gives an issue time of 2312 on the 7th day of the month in UTC (or 0912 AEST on the 8th day of the month)

The **period of validity** is given in the format ddhh/ddhh, where dd is day of the month and hh is hour UTC, e.g. 0800/0812, which gives a 12 hour validity period from 0000 on the 08th to 1200 on the 08th UTC. This equates to being valid from 1000 hours AEST (10 am) on the 08th to 2200 hours AEST on the 8th.

TAF YBUD | 072312Z | 0800/0812

Surface wind velocity in degrees True, to the nearest 10 degrees, in knots. A variable wind direction is given as VRB.

Flight visibility in metres. 9999 indicates the predicted visibility is greater than 10000 metres.

Predicted weather. In this case scattered (3 to 4 oktas) of cloud, base 4000 feet AMSL

09010KT | 9999 | SCT040

From (time change) Time of change 8th day at 0900 UTC (= same day 2100 AEST).

Wind velocity change The surface wind veers to 120°T at 05 knots

Visibility Remains the same

Weather The cloud base reduces to 2500 feet AMSL.

FM080900 | 12005KT | 9999 | SCT025

Surface Temperature At time of issue (HH) (or 0912 AEST) same day.

Temperature at HH+3, HH+6, HH+9

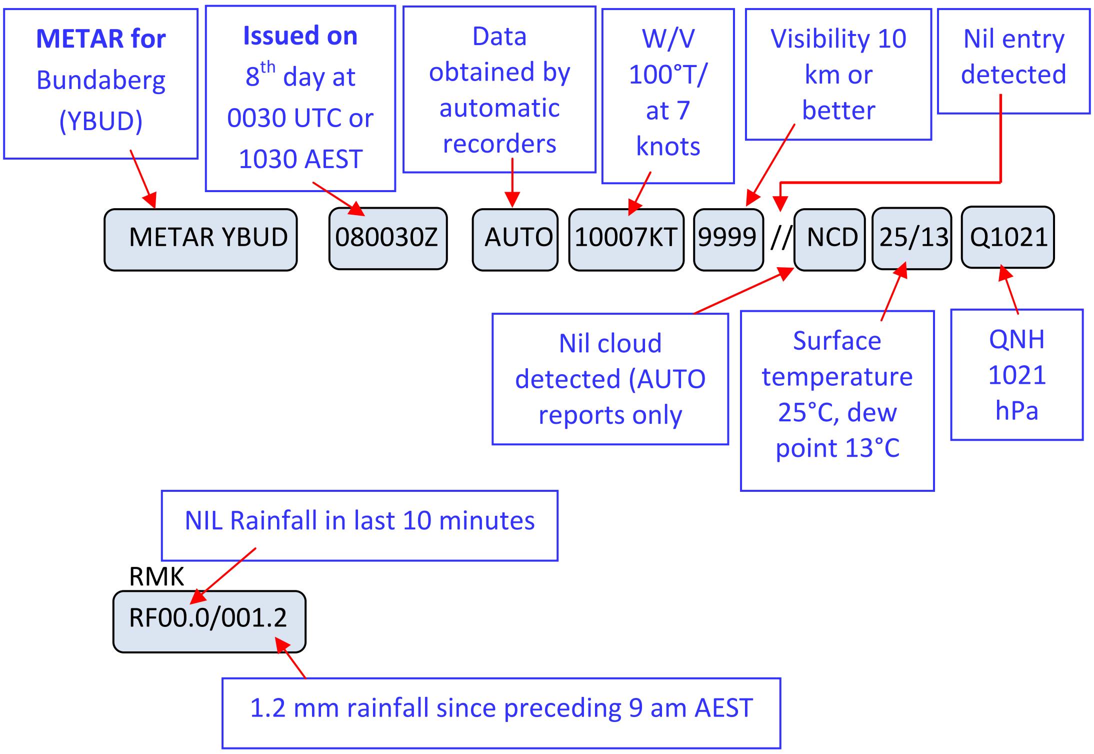
QNH Forecast At HH (Time of issue, and HH+3, HH+6, HH+9.

RMK
T 24 25 24 20

Q 1022 1020 1019 1020

The next series of code refers to the METAR for the airfield

Note that a METAR is an aerodraome REPORT and NOT a forecast so it's telling you what is occurring at the time the METAR was issued.



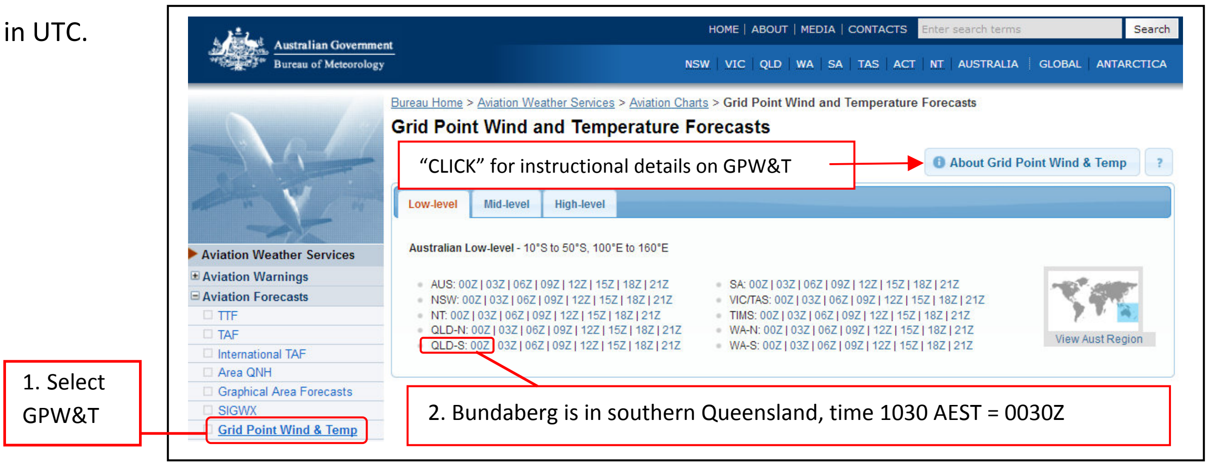
Grid Point Wind & Temperature

This is the forecast from where a pilot gets their forecasts for operational wind and temperatures from.

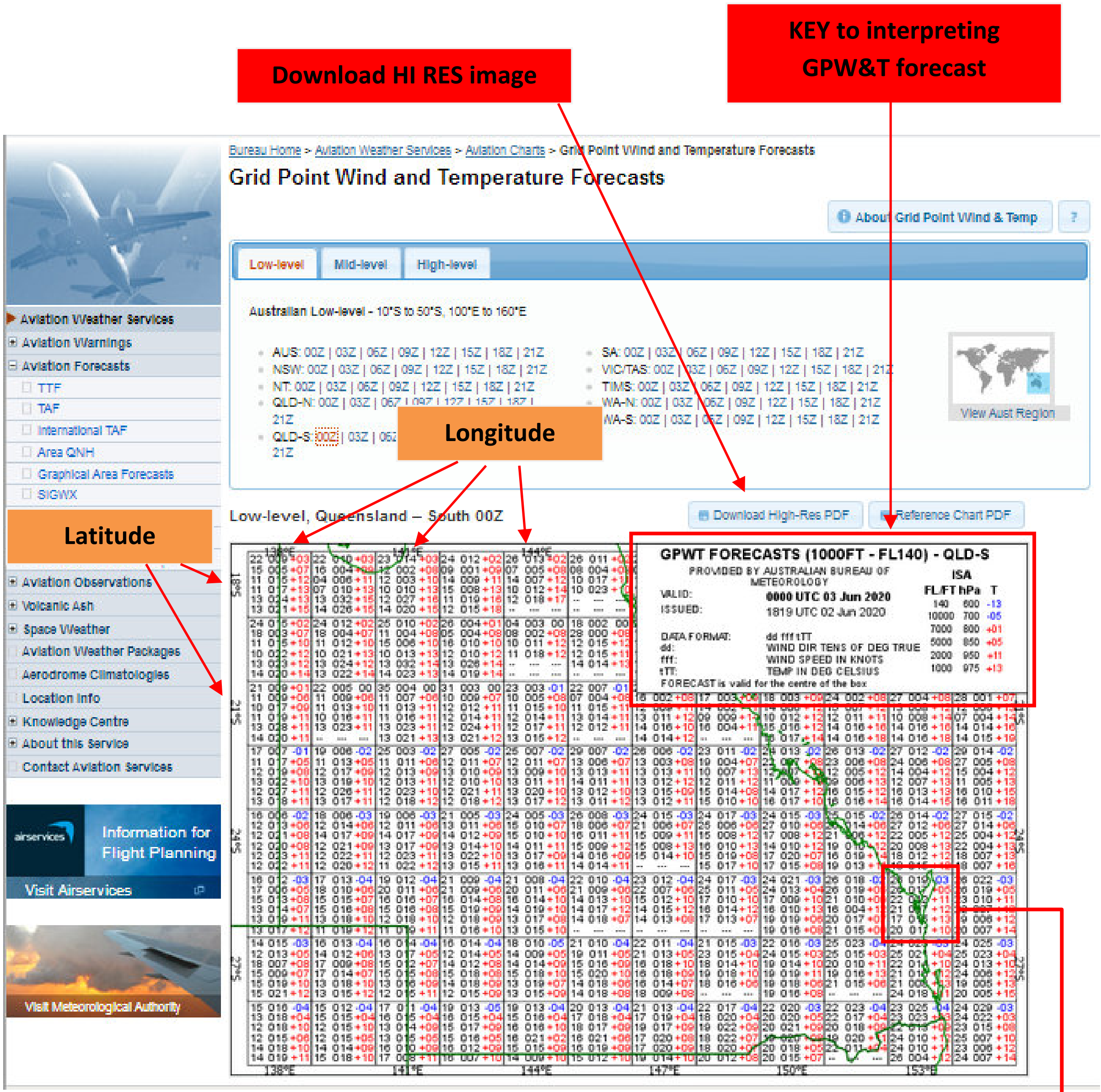
It differs from the previous forecasts which give a time and then provide the conditions in that stated period, for a GPW&T, the pilot selects the time for which they want the forecast to cover.

Selecting the required GPW&T.

Note your intended departure time and area(s) for which the forecast is required. Note that all times MUST be in UTC.



GPW&T Presentation



Wind velocity in Deg True   Temperature °C

Flight level	FL 140	260/19	-03
Altitude	10000 FT	260/17	+05
	7000 FT	220/012	+11
	5000 FT	210/007	+12
	2000 FT	170/015	+13
	1000 FT	200/11	+10

Just like rocket science and brain surgery, it's not hard if you know how to do it AND you get practice. Pilots that fly for a living read these things every day and to them it's just like reading a magazine or a book. For us that fly for fun, dying isn't much fun and to minimize the chances of that because of weather issues, we need to ensure that our lack of practice doesn't morph into a lack of life.

I use the downloadable information data sheets and frequently re-read them. I have used them to compile this piece and will probably consult them again before the week is out. You can only know what you are doing if you have a full understanding of what you are doing and what you are getting yourself into. Because I no longer read forecasts and reports every day, and plan flight every day, the only way that I can feel I make the right weather interpretations is to check out the details so I know that I am right.

Look at the long list of unfortunate pilots that are now just statistics because of bad weather. – every one of them said that they were a good pilot. Were they really? Are YOU?

Happy Flying

------ ooOOoo ------

New single seat prototype out of India.

Details are still sketchy about this new class of light Indian designed and manufactured aeroplane. Designed to operate off any road or motorway, it is said to be so simple to operate that training is not required, nor is there any medical requirement to operate it except for, perhaps, an eyesight check. Although its acceleration is limited, it gets off from a standstill in an instant, and immediately takes off so it easily complies with the definition of being a STOL machine.

Its fuel economy is still unconfirmed but it appears that it's petrol consumption is nil. No flight performance figures are yet available, but observers say that its stall speed is "off the clock".

Control is by yoke rather that the more common control column.

Further reports will follow further press releases.

Prototype awaiting take-off clearance

Ion Aircraft - The 100 and the 105

By Stephan Wilkinson

ION 100 in flight

Ion Aircraft is developing a line of light, two-seat (tandem) airplanes suitable for training, sightseeing, and cross-country cruising.

Two models are currently being designed they are:

> The Ion 100 is a kit aircraft being designed from the ground up to be Light Sport Aircraft (LSA) compliant, and
>
> The Ion 105 is a non-LSA variant of the 100, with better cruise performance. The 105 version is intended to comply with the US Experimental category requirements.

Rear seat occupant

Following the kit models Ion will begin sales of the Ion 120, a fully finished factory-built version of the Ion 100 sold under the LSA rule. The Ion 120 will be a turn-key complete aircraft--just climb in and fly away.

More info on the webpage. http://www.ionaircraft.com

------ ooOOoo ------

Harry's Joke:

During my last physical examination for my pilot's ticket, my doctor expressed concern about my level of exercise or rather the lack it. He asked me what, for example, I had done for exercise the previous day. So I told him.

"Yesterday afternoon, I took a five hour walk, about 10 kilometres, through some pretty rough terrain. I waded along the edge of a lake where I had to push my way through some "wait-a-bit". I got sand in my shoes and my eyes and almost stood on a snake, jumping aside at the last minute. The route took me over several steep rocky hills before it ended. The mental stress of it all left me shattered but at the end of it I relaxed and had a couple of beers."

Inspired by my story, the doctor responded, "You must be one hell of an outdoors man."

Surprised, I said "No. I'm just a shit golfer."

Harry

HAS YOUR AEROPLANE HAD A RAD-47/CAO-100.5 CHECK
AND HAS IT BEEN RECORDED IN THE AIRCRAFT'S MAINTENANCE LOGBOOK?

By Rob Knight

Under Australian aviation law all aircraft are required to have the accuracy of their transponder, their airspeed, and their altimeter systems, checked within every 24 month period, and the results entered into the logbook(s) pertaining to that aircraft. The legislation under which this check is required is CAO 100.5 or the RA-Aus Technical Manual for recreational aircraft maintenance.

Below is an extract from the **RAAus TECHNICAL MANUAL – Section 12.4 Issue 4 – 2016** relating to this specific requirement. Note that this is extracted from the latest version of the Technical Manual available for download on the RA-Aus website.

The requirement is split into two regimes – commencing **1**, relating to aircraft intending to be operated in controlled airspace, and **2**, aircraft operating exclusively in Class G, uncontrolled airspace. Most Recreational Aircraft will fit the second regime – the Class G requirement legislation

SECTION 12.4

INSTRUMENT & TRANSPONDER CHECKS

1 AIRCRAFT OPERATING IN CONTROLLED AIRSPACE (CTA) – CLASS C, D, E,

- Aircraft that are currently legally permitted to fly in Controlled Airspace (CTA) as detailed in provisions of CAO 95.10, 95.32 or 95.55, **must** have their instruments maintained in accordance with the provisions of CAO 100.5. The checks are only available through a LAME with specialised calibrated equipment and appropriate licence ratings.
- Compass "swinging" is not mandatory, however, CASA AWB 34-008 provides good advice. A compass deviation card should be fitted following any compass checking.
- Compliance with the required checks must be noted in the aircraft log book.

2 AIRCRAFT ONLY OPERATING OUTSIDE CONTROLLED AIRSPACE (OCTA) – CLASS G

- Altimeters must be checked every 2 years against a currently certified altimeter (a LAMEs test equipment) or other appropriate test equipment (e.g. a water manometer and scale, or GPS) and must not deviate by more than +/- 100 feet, up to the maximum normally expected operating altitude of the aircraft.
- Airspeed indicators must be checked every 2 years against a manometer or against a GPS using test runs in opposite directions; and airspeed indications shall not vary by +/- 5kts; and
- Aircraft with more than one ASI must not have variations between the instruments of more than +/- 5kts.
- Pitot and static systems must be checked for leaks every 2 years using a device capable of holding pressure for a minimum of 2 minutes without loss of pressure.

Speaking from the recreational Aircraft standpoint, it seems, from eavesdropping on conversations, that many RA owners are blissfully unaware of the requirements in Section 12.4, and most of those that are aware of it seem aggressively against this simple ensurance of aircraft instrument accuracy.

This both disappoints and disquiets me: disappointed because these owners are not prepared to maintain their aeroplanes in accordance with the legislation which could result in others' jeopardy, and disquieted when I wonder what other requirements they might be ignoring that could subsequently endanger my safety and others as well as their own.

Their primary argument against carrying out this check is stated as cost. Yet what is the cost in real terms – the cost of getting a LAME to carry out the required checks. Or, if Class G airspace is your thing, either the aforesaid LAME or several lower cost alternatives including an in-flight comparison between the instruments and a GPS. Cost cannot be an issue – it is a legal requirement and one that other airspace users are entitled to see you have done

Personally, I have used the GPS option and found it quite simple. The GPS I use has a built in altimeter reading in metres but that is no problem as the GPS reading in metres quickly converts to feet using the formula *"feet = metres X 0.304"* as provided in the VFRG under *"Conversions"*. Averaging the groundspeeds by flying four tracks, perhaps the cardinal compass points 360°, 090°, 180°, and 270°. By averaging the four groundspeeds, an acceptable comparative value to check the IAS is available.

The physical dangers in not ensuring the aircraft is within limits lie in at least two areas, one pertaining to each of the instruments. A flawed reading on an ASI is hazardous to any approach, regardless of whether the error is over-read or under-read and a faulty altimeter could see an aircraft climb unwittingly into prohibited airspace above or to be unable to provide accurate heights in position reports and in the circuit pattern. This last flaw increases the chances of a mid-air collision dramatically. Incidentally - a mid-air collision can ruin your whole day!

If a GPS is not for you, for ASI at least, Ian Ratcliffe has developed a device to do the required checking. Contact Ian via the BVSAC.

Related to this topic, I keep hearing that not all recreational aircraft owners/ maintainers possess a copy of the RA-Aus Technical Manual. This document is the bible for recreational aircraft maintenance and, without it, adequate aircraft maintenance is not possible.

If you are an RA owner/maintainer, I cannot state highly enough, the need for you to get a current copy of this legally required document, and ensure that you have an understanding of it to maintain your aircraft adequately. As it is downloadable on the net, cost cannot be an issue.

------ ooOOoo ------

Mountain Wave Monsters And What They Can Do

Patrick Veillette, Ph.D. May 22, 2020

Standing Waves Credit: Comet Program/NOAA

With a wingspan of nearly 200 ft. and max takeoff weight in excess of 700,000 lb., a Boeing 747-100 is not easily disturbed by turbulence. Imagine then being at the controls of a heavily loaded one during departure from Anchorage International Airport (PANC) on March 31, 1993, when extreme turbulence abruptly rolled the aircraft 50 deg. to the left, followed by a significant yaw. Several pitch-and-roll oscillations followed as the pilots struggled to maintain control of the lumbering giant.

The severe turbulence induced dynamic lateral load that so exceeded the load-carrying capability of the No. 2 engine pylon that it ripped completely from the jumbo. The flight crew declared an emergency, dumped a lot of fuel and returned to PANC for an emergency landing.

The NTSB's investigation determined that the strong rolling motions induced by the atmospheric turbulence produced "multi-axial" loading that caused structural failure of the pylon.

That wasn't the first time that a rugged commercial airliner experienced severe structural failure due to atmospheric turbulence. On March 5, 1966, British Overseas Airways Corp. Flight 911, a Boeing 707, departed Tokyo's International Airport destined for Hong Kong. The flight crew requested a visual meteorological conditions (VMC) climb westbound via the Fuji-Rebel-Kushimoto waypoints, which would take the Boeing nearer to Mount Fuji, possibly to give the passengers a better view of the landmark. The request was granted.

After takeoff, the aircraft made a continuous climbing right turn over Tokyo Bay, and rolled out on a southwest heading, passing north of Odawara. It then turned right again toward the mountain, flying over Gotenba, at an indicated airspeed of 320 to 370 kt., and an altitude of approximately 4,900 meters (16,000 ft.), well above the 3,776-meter (12,388 ft.) mountain peak.

Winds at the summit of Mount Fuji were measured at 60-70 kt. from the northwest. While flying into the wind, approaching Mount Fuji from the downwind side, the aircraft encountered severe clear air turbulence (CAT) associated with lee waves. Subsequent investigation determined that the vertical stabilizer failed first, which then broke the left-side horizontal stabilizer as it departed in a left and down motion. Shortly thereafter the right wing failed upward and completely separated from the aircraft. The four engine pylons, ventral fin and forward fuselage also failed from a leftward over-stress, and each eventually departed the aircraft during the in-flight breakup.

Clouds associated with mountain waves.
Credit: Comet Program/NOAA

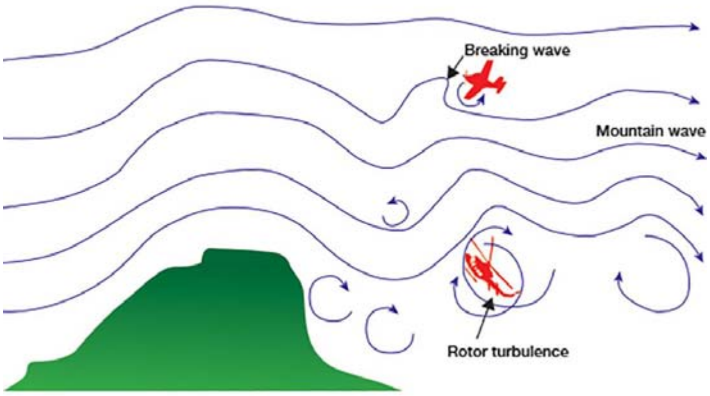
All 113 passengers and 11 crewmembers were killed in the disaster. The official investigation determined the probable cause as, “The aircraft suddenly encountered abnormally severe turbulence which imposed a gust load considerably in excess of the design limit.”

A U.S. Navy A-4 Skyhawk was sent up shortly after the accident to search for the wreckage and encountered extreme turbulence in the accident area. The cockpit accelerometer display registered peak values of +9 and -4g, causing temporary loss of control, and leading the Navy pilot to believe his fighter would also break up in the turbulence. He regained control and landed safely, but the aircraft was grounded for post-flight inspection. Many other aircraft that passed near Mount Fuji that day also reported moderate to severe turbulence.

Atmospheric rotors pose a great hazard to aviation. The World Meteorological Organization’s “Aviation Aspects of Mountain Waves” states the turbulence contained within mountain wave rotors is worse than that experienced by atmospheric research pilots in thunderstorms!

NTSB records from 1990 to 2017 contain 42 accidents in which mountain wave turbulence was a primary contributing factor. Rotor turbulence was so severe in numerous accidents that it caused the in-flight break-up of the aircraft. Additionally, the extreme rotor turbulence can make aircraft control impossible. A search of the NTSB database found 16 fatal “Loss of Control” accidents attributed to the turbulence during mountain wave encounters.

The FAA’s Airplane Upset Recovery Training Aid states, “Turbulence, when extreme, can lead to airplane upsets, and/or structural damage. These incidents of turbulence can cause large airspeed, altitude or attitude deviations. The aircraft may be momentarily out of control. Severe or extreme turbulence can be associated with clear air turbulence and mountain waves.” It also states, “Moderate turbulence will be experienced 150-300 mi. downwind on the leeward side when the wind component of 25-50 kt. at ridge level. Severe turbulence can be expected in mountainous areas where wind components exceeding 50 kt. are perpendicular to and near ridge level.”



Hypothetical air flow pattern associated with a mountain wave. Source: Flight Safety Australia

Extreme turbulence is defined as the “aircraft is violently tossed about and is practically impossible to control. Structural damage may occur. Rapid fluctuations of 25 kt. or greater will be experienced. Vertical gusts equal to 50 fps or greater will be encountered. The most frequent locations of extreme turbulence are found in mountain wave rotors and severe thunderstorms.”

And according to the “Aviation Aspects of Mountain Waves,” “rotor turbulence is much more intense in waves generated by larger mountains. Violent sharp-edged gusts exceeding 12 m/s (approximately 2,362 fpm) have been measured in some Sierra waves, and experienced pilots have reported complete loss of control of their aircraft for short periods of time while flying in the rotor areas.”

Some of the earliest scientific data on rotor turbulence came from the Jet Stream Project, overseen by Joachim P. Kuettner, an avid soaring enthusiast who was a scientist at the U.S. Air Force Cambridge Research Center in 1955. The project used B-29 and B-47 aircraft as well as specially designed Pratt-Read gliders built to tolerate 8-10g to study the atmospheric motions within mountain waves. One flight assignment had project pilot Larry Edgar tasked with descending through a "roll cloud" in a spectacular mountain wave near Bishop, California.

As Edgar's glider descended through 14,000 ft., it encountered a very severe and turbulent gust, extreme yawing and rolling forces. Positive Gs were so extreme as to cause failure of the left wing at the mid-aileron point, producing a high rate of roll to the left. The high negative Gs built up to the point that they caused damage to Edgar's eyes. Then the left wing failed completely, causing even more rapid rolling. The load factors created were so adverse that the glider's nose section broke free from the rest of the structure. It is estimated the glider encountered approximately 16g! Despite all that, Edgar managed to bail out of his disintegrating craft and float safely to the ground, having suffered only bruises.

This and other early research projects helped with understanding "classic" mountain waves in which the rotor is present underneath each wave crest. Most of our modern aviation training texts contain pictures of this configuration. These "classic" waves contain what some researchers categorize as Type 1 rotors. Such rotors are frequently recognizable by rough appearing fracto-cumulus cloud lines that form parallel to a mountain range when sufficient moisture exists in the atmosphere. Rotor clouds are constantly forming on the upwind side and dissipating on the leeward side. The transition from the smooth air in the updrafts and downdrafts to the extreme turbulence of the rotor section is often very rapid.

More recent research aided with advanced instrumentation has helped us understand rotors that rise to much higher altitudes. Research pilots with the National Center for Atmospheric Research (NCAR) in Boulder, Colorado, have studied mountainous airflows for several decades with specially instrumented aircraft to measure the turbulence. In a 1992 experiment, the NCAR Sabreliner experienced severe turbulence at 20,000, 30,000 and 39,000 ft. The unit's Queen Air along with the Sabreliner encountered severe turbulence at all levels below 15,000 ft. They encountered frequent 2-4g gusts, both horizontal and vertical, in rotors. On one occasion a gust produced a 7g load factor on the aircraft. Surface winds in Boulder exceeded 100 kt. in some locations and the NCAR hangar at nearby Rocky Mountain Metropolitan Airport (KBJC) was severely damaged in an infamous Front Range windstorm. The conditions airborne were even more extreme. Two DC-8s flying over the Front Range experienced temporary losses of control due to the turbulence, and one of them suffered structural damage.

A collaborative group of scientists and organizations has sought to better forecast conditions that create this extreme turbulence. The Sierra Rotors Project was the first phase of a coordinated multi-year effort to study atmospheric rotors and related phenomena in complex terrain. It was a joint National Science Foundation funded project involving the Desert Research Institute, Naval Research Laboratory, Universities of Washington, Utah, Wyoming and Arizona State, the British Met Office, the Army Research Laboratory, the Air Force Research Laboratory, along with the NCAR. The second phase of the project was the recently completed Terrain-Induced Rotor Experiment — nicknamed "T-Rex," which seems fitting given the ferocity of the subject matter being studied.

The team of 60 scientists hoped to improve the understanding and predictability of CAT caused by complex terrain. The knowledge gained should help forecasters predict when and where rotors are most likely to occur and their intensity, as well as the nature of the mountain waves that crest high above the rotors and cause strong turbulence.

The field activities focused on the Owens Valley to the east of the southern Sierra Nevada, which is the tallest and steepest topographic barrier in the contiguous U.S. The ridgeline of the Sierra Nevada reaches an average elevation of 11,500 ft. MSL, and the tallest peaks exceed 13,100 ft. MSL, including the tallest mountain in the contiguous U.S., 14,505-ft. MSL Mount Whitney. In contrast to the tallest peaks, the valley floor lies at an average elevation of approximately 3,770 ft. MSL. This elevation change occurs in less than 5.5 nm, resulting in 30% eastern facing slopes. Soaring enthusiasts and atmospheric researchers have long known that the mountain waves and attendant rotors can reach particularly striking amplitude and strength there.

The researchers took advantage of the newest advances in remote sensing and numerical modeling. On the ground, they probed the atmosphere with radars, lidars (laser-based radars), automated weather stations, wind profilers and balloons. Those aboard special aircraft including a modified Gulfstream V observed the rotors from above and released dropsondes (instruments that contain temperature, wind and other sensors) into the most turbulent areas. Two other aircraft, the University of Wyoming's Beech King Air 200T and the UK Environmental Research Council's BAe146, flew at lower elevations, gathering data by aiming special radars into the rotors.

The $81.5 million Gulfstream, owned by the National Science Foundation and operated by the NCAR, is nicknamed Hiaper, for High-performance Instrumented Airborne Platform for Environmental Research. During the T-Rex project it departed from its base at KBJC to California's Owens Valley for 10-hr. flights during the project's observation periods.

What follows are some of the project's more notable findings: The strongest wave events were found to be associated with (1) an upper-level pressure trough along the Pacific Coast with strong westerly flow across the Sierras and (2) a cold or occluded front approaching California from the northwest, in particular in the pre-frontal stage over the Owens Valley. In addition, the jet stream was typically found to cross Oregon or Northern California during strong wave events. The strongest waves were also correlated with strong winds at the mountain crest level, a pronounced inversion layer and large vertical shear in the lower troposphere.

James Doyle, of the Naval Research Laboratory, and Dale Durran, of the University of Washington, in a paper titled "Rotor and Sub-Rotor Dynamics in the Lee of Three-Dimensional Terrain" (*Journal of Atmospheric Sciences,* December 2007), found that irregularities along the ridgeline of a mountain chain create "sub-rotors" within the airflow that are intensified well in excess of those in the parent rotor. Because of their intensity, Doyle and Durran opine, such sub-rotors likely pose the greatest hazard to aviation.

The Desert Research Institute's analysis of the data found considerable variation in the behavior of the waves, for reasons that are not yet completely understood. The teams observed a pronounced diurnal variation of the wave and rotor activity, with the maximum wave and rotor strength occurring in the early evening hours. They also noticed lee wave and rotor response is strongly controlled by changes in the upstream ambient wind and stability profiles.

Two types of rotors were observed during the projects. The first was found to be located under the crest of a lee wave, paralleling the topography and its curvature — the classic Type 1.

The second type was signified by a roll cloud that looked like an almost vertical wall. Researchers currently refer to these as Type 2 rotors. These sometimes have a massive roll cloud with a nearly vertical leading edge and tend to form a straight barrier extending the full length of the mountain range. Type 2 rotors may reach heights of 25,000-30,000 ft.

In the words of Kuettner and Rolf F. Hertenstein, associated with the NCAR and Colorado Research Associates, respectively, in their research report titled "Observations of Mountain-Induced Rotors and Related Hypotheses: A Review," "It is unlikely that aircraft can be designed strong enough to withstand the excessive loads of a fully developed Type 2 rotor."

At the International Civil Aviation Organization's Second High-Level Safety Conference in Montreal in February 2015, information from accident and incident investigations revealed that present day encounters with this atmospheric phenomenon may infringe on current aircraft certification envelopes. The subcommittee overlooking certification issues recommended the follow-up include the need for improved ICAO airworthiness, operations and detection equipment provisions in order to further mitigate changing meteorological risks.

The FAA's Airplane Upset Recovery Training Aid states, "Avoidance of environmentally induced upsets is the best course of action. Pilots should monitor the environmental conditions and avoid high risk situations." This is mirrored by *Flight Safety Australia,* a publication of the Australian Transport Safety Bureau, which cautioned, "It is absolutely essential that aviators are aware of the wind and its potential effects on aircraft." As pointed out in the fatal accident of an Agusta 47G on Aug. 19, 2001, near Mount Archer, Queensland, Australia, such warnings pertain to rotorcraft as well.

What are the early warning indications that pilots should look for in weather reports so they can anticipate and try to avoid rotor encounters? Any NOTAM containing "ACSL" (altocumulus standing lenticular) should be taken seriously as an indication of mountain wave activity, as well as PIREPs observations. Reports of pressure falling rapidly at stations on the lee side of a mountain are also indicative of mountain wave activity. Reports of strong surface gusts, blowing dust and windsocks at opposite ends of the runway showing greatly varying winds are classic signs of mountain wave turbulence that extends to the surface.

Furthermore, avoid flight in or near rotor clouds as you would a mature thunderstorm. And avoid flight in the vicinity of ragged or frayed lenticular clouds, as these are prime indicators of severe turbulence. Whenever near a rotor, observe the turbulence penetration speeds published in your aircraft's AFM.

When those of us who enjoy wave soaring see those "lennies" in the air, we dream of the silky smooth updrafts that can lift us to high altitudes, but we also know that extreme turbulence in the rotor and the downdrafts are very severe hazards to all aircraft. Like any significant weather threat, this one demands respect and a knowledge of how to safely operate around it. This is a threat that can't be shrugged off with a "we fly jets so the weather doesn't affect us" attitude. There is only one method for dealing with this atmospheric threat, and that is "avoid . . . avoid . . . avoid."

Turbulence Tragedies: Three Incidents Recounted

Dec. 10, 2015, Hurricane, Utah

Aircraft: RV-7

Injuries: 2 Fatal

The ATP was conducting a local personal flight. Witnesses observed airplane debris floating in the air. Post-accident examination revealed extensive damage to the horizontal stabilizers, elevators and wings consistent with overloading. A review of the weather information indicates that there were likely low-level winds gusting from 26 to 46 kt. at the time of the accident and that moderate to severe turbulence likely existed at the accident site. The NTSB determined the pilot's abrupt flight control inputs in severe winds and turbulence resulted in an inflight breakup.

May 11, 2005, Ouray, Colorado

Aircraft: Cessna T210

Injuries: 4 Fatal

The airplane was reported missing and the Civil Air Patrol located the wreckage near Mount Whitehouse. National track analysis program radar data depicted the accident flight's altitude varied from 17,500 ft. MSL to 19,200 ft. MSL. The aircraft ground speed during this time was measured to vary between 124 kt. and 314 kt. An airman's meteorological information (AIRMET) for occasional moderate turbulence below FL 180 was valid. In addition, an AIRMET for occasional moderate turbulence between FL 180 and FL 410 and possible mountain wave action had been issued. The

NTSB determined the probable causes of this accident were the pilot's inadvertent flight into adverse weather conditions, loss of control and resulting exceedence of the design stress limits of the aircraft, which led to an inflight structural failure. Factors in the accident included the severe turbulence and the mountain wave.

Aug. 19, 2001, near Mount Archer, Queensland, Australia

Aircraft: Agusta 47G

Injuries: 1 Fatal

According to the Australian Transport Safety Bureau, the pilot of an Agusta 47G was fatally injured when he lost control of the helicopter after encountering severe mountain turbulence on the northeast slope of Mount Archer. "The extensive damage to the helicopter, severed tailboom and the location of parts on the ground led transport safety investigators to conclude that the main rotor blade may have contacted the tailboom in flight. This type of damage was consistent with flying into mountain wave turbulence, and may have occurred from one of two events: blade flapping (divergence of the main rotor blade from its normal plane of rotation encountered during severe turbulence) or the pilot's instinctive reaction to pull up after a sudden nose-down pitch . . . . Weather conditions at the time were conducive to mountain waves."

All credits to Patrick Veillette, Ph.D.

Book Review

Title: As The Pro Flies

Author: John R. Hoyt, Background: Ex US Navy pilot and FAA Flight Examiner.

Published by: McGraw-Hill Book Company, New York, Toronto, London

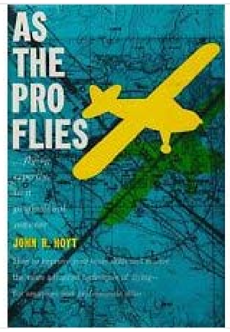
Topic areas: Hoyt discuses, chapter by chapter, basic flying skills required in light aeroplanes. He has a light style of writing but his terminology is succinct, precise, easily digested, and remembered. The illustrations are instructive and his use of humour to express a point makes recall simple.

Availability: EBay has numerous copies available, many for under AUD$30.00

Other books by this author: Manual for Aviation Cadets, and Safety after Solo.

Reviewer: Rob Knight

This book is a gem amongst gems. Apart from the section on night flying, every other part has a high relevance to RA Aircraft operations. As an instructor I highly recommended this publication to all my students as they graduated as PPLs and most took advantage of this advice. Many that went on to complete CPLs, used the texts in this book as a basis for their advanced exercises.



FLY-INS Looming

All awaiting current social distancing rules to be rescinded.

What the Hell is THAT - – Westland P12 Delanne

Westland P.12 Delanne, bob-tailed with a gun turret and an extra wing! — San Diego Air & Space Museum archive photo

The Westland P.12 Delanne was unusual given the tandem wing design (successful in a flying model of the Langley Aerodrome, John Montgomery's gliders and Henri Mignet's *Flying Flea*) as well as being named after an aircraft designer — Maurice Henri Delanne — which was not in keeping with the British naming convention of the time.

The redesign of the Lysander airframe was the result of a lack of success of the type in the early days of WW2 and the concept of a rear gunner in light attack aircraft (*e.g.*, Douglas SBD Dauntless, Fairey Firefly, Aichi D3A "Val", Junkers Ju 87 and Imam Ro.43 *Grillo* "Cricket") as well as fighter designs (*e.g.*, Boulton Paul Defiant) was still in favour. Half the Lysanders in the Battle of France were shot down and quite easily when encountering the modern *Luftwaffe* fighter designs.

Westlands's chief designer, Arthur Davenport, decided that, to better protect the Lysander, the addition of a rear gun turret on the aircraft to protect it from stern attack. To counter the substantial aft shift of weight, he compensated by shortening the fuselage and adding a rear wing — á lá the designs he knew of by France's Maurice Henri Delanne. Refreshingly, the results of the July 1941 maiden flight by Harald Penrose were more than acceptable, so successful that, in fact, the flight test concluded with an aerobatic loop! Harald reported the aircraft was stable and did not fly appreciably differently than the Lysander though the rudders required more airspeed before becoming effective.

June 1944 was the end of the Delanne's service — though successful in its own right, aviation aircraft design had evolved away from rear turret defences in all but the largest of aircraft.

Keeping up with the Play (Test yourself – how good are you, really?)

1. The image of the GAF on page 5 provides the validity period. What is the end of the forecast period in AEST?
   A. 0500 AEST.
   B. 1500 AEST.
   C. 1605 AEST.
   D. 1700 AEST

2. Which of the following options is the most correct?
   A. Rain comes from stratus cloud, showers come from cumulus cloud.
   B. Cumulus cloud cannot form in a stable atmosphere.
   C. Cumulonimbus clouds can form in areas of stratus cloud.
   D. A, B, and C are correct.

3. In a GPW&T forecast what does the abbreviation FL refer?
   A. Frequently limited to.
   B. Flight level
   C. Freezing Level
   D. Fahrenheit lag

4. In general, METARS are produced every:
   A. 30 minutes
   B. 60 minutes
   C. With each issue of a TAF
   D. With each issue of a GAF forecast

5. Why does carburettor ice form in the carburetor even though it may not form anywhere else on the aircraft?
   A. Because of water in the atmosphere in a gaseous state
   B. Because of the localized effects of cowled engine cooling.
   C. The combination of the reduction in air pressure and the evaporation of a liquid inside the carburettor.
   D. The air flowing around the aircraft creates friction and prevents the air cooling to cause ice.

See answers overleaf

Answers: 1, A, 2, D, 3, B, 4, A, 5, C

If you have any problems with these questions, See Notes BELOW or call me (in the evening) and let's discuss them. Rob Knight: 0400 89 3632.

1. 1500 hours.

2. A, B, and C are all correct.

3. Flight level - which is the height above the 1013.2 ISA datum. This ensures that all high-level aircraft operations are based on the same altimeter subscale setting to minimise the chance of a collision. (Type the link below into your browser and hit ENTER.)
   http://www.bom.gov.au/aviation/knowledge-centre/products-hazards\

4. A is correct – every 30 minutes. (Type the link below into your browser and hit ENTER.)
   http://www.bom.gov.au/aviation/knowledge-centre/products-hazards\

5. C is correct – The carburettor throat is a venturi designed to lower the pressure of the air flowing through it and so drawing fuel from the main jet. The act of lowering the pressure of any gaseous fluid resulting in a lowering of its temperature (Boyle's law).
   In addition to the cooling effect of the lowering of the air pressure, we also have the fuel evaporating after it exits the main jet. As it evaporates the effect of the latent heat of vaporisation will further cool the air.
   If the combination of these two cooling effects lowers the temperature inside the throat, ice will form through deposition and attach itself to the walls of the throat and other metal surfaces damaging the mixture ratio and the volumetric efficiency. If the ice accumulation is sufficient, the engine will cease to function. (Type the link below into your browser and hit ENTER.)
   https://en.wikipedia.org/wiki/Carburetor_icing

------ ooOOoo ------

Aircraft Parts and Tools

Item	Condition	Price
VDO Volt Readout instrument	Brand New	**$70.00**
Skystrobe Strobe light for Ultralight	NEW – IN BOX	**$75.00**
Altimeter – non-sensitive with subscale in "Hg.	Brand new	**$50.00**
Pipe bender (for 6, 8, & 10 mm tube)	Used but as new	**$40,00**

Headsets

AvCom headset. Functions perfectly	Excellent	**$160.00**

Contact Rob Knight at either kni.rob@bigpond.com, or call **0400 89 3632**.

Vehicles for Sale

Ute-back Trailer

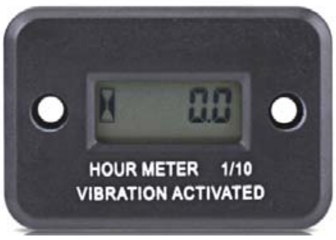
The rear end of a Ford Courier ute, covered with a Courier fibreglass canopy. Very robust, good tyres, complete with spare - on Land Rover wheel rims.

Tows very well: Excellent condition.

For quick sale - $2100.00 ono

Contact Rob Knight - **0400 89 3632**

Closing Down Sale (All Ex Forest Hill Airfield)

Item		Sale Price
Rover Rancher ride-on mower Superb - runs great and is complete with new battery and manual.		**$650.00 ono**
Caravan for sale - Franklin. 12 foot, 1978 model. Currently registered. Good condition for age. Contact Rob Knight for more images – **<u>0400 89 3632</u>**		**$2500.00 ono sold registered, or** **$1500 unregistered as is.**
Push mower, single stoke, very limited use. Not ideal for a septuagenarian hence sale. Complete with catcher. Contact Rob Knight **<u>0400 89 3632</u>**		**$40.00**
Makita four stroke. Starts easily, runs well. Comes with catcher and mulching frame. Needs blades sharpened. Contact Rob Knight **<u>0400 89 3632</u>**		**$120.00 ono**
Digital timer/hour meter. Acts and accumulates on operating vibration Contact Rob Knight 0400 89 3632		**$12.00**
Chain saw, 25cc Ozito. Short blade, automatic blade oiling. Very good condition. Once very useful, now very surplus to requirements. Complete with fuel bottle fuel can, and oil. Contact Rob Knight **<u>0400 89 3632</u>**		**$70.00**

Petrol Ryobi Weed Wacker. Runs well Contact Rob Knight **0400 89 3632**		**$100.00 ono**
Generator Power King 5 KVA Contact Ray Jones **0431 569 477**		**$450.00 ono**

General Sale

Item		Sale Price
Suzuki s G16 motor, modified to lay over at 55 degrees to fit inside aircraft cowling. Includes overhauled, balanced, painted motor, new injector carby, starter, alternator, fuel pump, distributor, coil, stainless steel exhaust, and SPG-3 gearbox. Contact Colin Thorpe **0419 758125**		**$5700.00**
Microtech Engine Management System Manage all engine parameters Data log in 3d Control timing, fuel, air-fuel ratios Set idle & wide open throttle rpm Monitor system voltages Paid $1300. Contact Colin Thorpe **0419 758125**		**$750.00**
Pioneer Ballistic parachute. Includes explosive charge. For details and more illustrations - contact Colin Thorpe **0419 758125**		**850.00**

Bullit ballistic parachute - Spring loaded. For details and more illustrations Contact Colin Thorpe **0419 758125**		**$280.00**
3 Blade black Ivo prop. Ground adjustable, Dia. 1500mm Contact Colin Thorpe **0419 758 125**		**$450.00**
3 Blade blue Ivo prop. Ground adjustable, Dia. 1540mm Contact Colin Thorpe **0419 758 125**		**$300.00**
NEW - Cummins finished aluminium spinner, polished with shaped cut-outs Suit 3 blade prop, Dia. 243mm x 300mm high 101.4mm pcd mounting holes Contact Colin Thorpe **0419 758 125**		**$480.00**
USED - Fibreglass spinner to suit 3 blade prop Dia. 215mm x 290mm high, 101.4mm pcd mounting hole. Contact Colin Thorpe **0419 758 125**		**$80.00**
Koger folding canopy sunshade Contact Colin Thorpe **0419 758 125**		**$170.00**

K&N cone air filters, washable Brand new. 42 mm (1.65”) mouth. Two of. Contact Rob Knight **0400 89 3632**		**$15.00 each or** **$20.00 for both**

Aircraft for sale

¾ scale replica Spitfire

$60,000

Powered by a 6 cylinder engine, this delightful aircraft has good performance and low hours. Available for immediate delivery.

It comes with a low flight time, excellent handling qualities, superb charisma, a brand new mechanical fuel pump and two jack stands.

For details contact Bill Watson. Tel., **<u>0447 186 336</u>**