

# Instrument Pilot

The journal of PPL/IR Europe

No. 42

March-April 2004

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*Cabair's Twin Squirrel over London promoting Fly! The London Air Show, 16-18 April 2004 See page 15 for details*



## P-RNAV Friend or Foe?

By  
Roger Dunn

P-RNAV is the next technological hurdle for the instrument rated private pilot. It will permit us to use area navigation techniques in TMAs in addition to the en-route use to which B-RNAV is restricted. P-RNAV requires us to navigate with an accuracy of 1nm instead of the 5nm which is permitted for B-RNAV. This should not be a problem for those of us who have equipped our aircraft with a B-RNAV compliant GPS. Almost all such GPS units achieve the required accuracy and reliability, and have the mandatory features for P-RNAV. In practice an instrument rated private pilot who is familiar with his GPS should have no problems in flying the new SIDs and STARs.

Unfortunately P-RNAV arrives with a whole new layer of regulations. Complying with these regulations looks like being a major issue. They may be proportionate when applied to the airlines, but few will consider them proportionate when applied to General Aviation.

### *Non-Precision Approaches*

It is also very disappointing to find that even when we have installed the equipment and complied with the regulations we will not be permitted to use it to fly non-precision approaches or even a holding pattern. For these manoeuvres, we shall still have to rely on our 1940s technology ADFs, which we all know to be vastly inferior to GPSs. It is difficult to understand how this limitation on the use of GPS can be reconciled with an objective of improving safety. Let us hope that we are not the victims of some political move to justify the huge investment in Galileo.

Both JAA and Eurocontrol have made it clear that they regard P-RNAV as optional. This may well be the legal situation. In practice it seems it will prove to be a myth; with effect from November 2004 Nation States will have the right to exclude us from terminal airspace unless our aircraft are certified as meeting the requirements for P-RNAV. The UK, Spain and twelve of the smaller ECAC States have already produced AICs setting out their intentions for P-RNAV. Eleven States have said they will notify TMAs for P-RNAV. By November 2004 Copenhagen, Schipol, Madrid, Barcelona, Canaries, Stockholm, Oslo and five other Norwegian TMAs will require P-RNAV certification. Many others will be added to the list by April 2005. The UK, according to AIC 92-2003 dated 16th October, has said it will notify TMAs for P-RNAV purposes but has not yet named any. Notable absentees from the list of countries publishing their P-RNAV AICs are France, Germany, Italy and Belgium. The list of P-RNAV destinations is expected to grow substantially when the remaining countries publish their AICs. The UK has also stated that operators may not rely on radar in the event of a P-RNAV failure. The implications of this are not yet clear if existing procedures are withdrawn.

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From the information available it seems likely that 2004 will be the last year in which IFR travel will be reasonably practical for us without P-RNAV certification. Obtaining P-RNAV certification for us must now be a high priority.

## **Regulatory Requirements**

The regulatory requirements for P-RNAV are based on a JAA publication, known as Technical Guidance Leaflet Number 10 (TGL 10). The most draconian requirement of this document as currently drafted is contained in paragraph 10.1. It implies that we shall require an Air Operator's Certificate or equivalent and an operations manual in order to obtain certification for P-RNAV operations. Fortunately there are some later publications by Eurocontrol that indicate there have been some second thoughts and that an AOC will not be a requirement for the private pilot but it still seems that some form of operations manual will be needed.

A key requirement for P-RNAV is that our aircraft must be certified by our National Aviation Authority (NAA) for P-RNAV operations. This is a fundamental change of principle for most of us. Hitherto for IFR operations we have been required to equip our aircraft with certified equipment as contained in the relevant Minimum Equipment List. There will also be a requirement in the UK for B-RNAV equipped aircraft to be retrospectively certified for B-RNAV operations.

TGL10 has no legal or regulatory standing in its own right but will be used as guidance by the NAAs when establishing their own regulations and certifying an installation.

The principal requirements are summarised below

1. The installed GPS unit must comply with TSO C129(a) or a close equivalent.
2. The unit must drive a lateral deviation display device such as an HSI, CDI or Map.
3. The display must have TO/FROM and failure indications.
4. The full scale deflection value must be known or displayed (1nm is acceptable for P-RNAV opera-

- tions)
5. There must be provision for the simultaneous display of P-RNAV and ILS data.
6. A current navigation database from an approved source with means of updating in accordance with the AIRAC cycle is needed.
7. It must not be possible to manually update the installed database
8. There must be a means of displaying the validity period of the database.
9. A means of loading a complete procedure from the database is required.
10. The navigation sensor in use must be displayed.
11. The following data must be displayed
  - a. The identification of the TO waypoint
  - b. The distance and bearing of the TO waypoint
  - c. The ground speed or time to the TO waypoint
12. There must be automatic leg sequencing
13. The probability of losing all navigation information must be remote
14. The probability of the non restorable loss of all navigation and communication functions must be extremely remote
15. The display must be located in the pilot's primary field of view
16. The AFM or POH must be amended or an approved statement provided
17. A suitable operations manual must be written and approved
18. The flight crew must be trained in the use of P-RNAV equipment
19. The complete installation must be certified by the relevant NAA
20. Operations approval must be obtained from the NAA.

The first fourteen items are taken care of when you purchase a Garmin 430/530 or its equivalent. The remainder are items that you will have to resolve with your maintenance organisation and your NAA.

In addition to the mandatory requirements there are a number of recommended features. These include

1. The ability to fly offset tracks
2. Autopilot coupling
3. Vertical navigation

4. Ability to fly from a holding pattern to a fix or altitude
5. Ability to fly a constant radius to a fix

The guidance material TGL 10 is open to different interpretations by each NAA. For example there is no definition of the pilot's "primary field of view". One NAA could regard a location in the main radio stack as acceptable for a P-RNAV box whilst another may insist on a repeater closer to the pilot. There could also be different interpretations about the reliability of the aircraft power supply. It is possible that individual NAAs will produce their own layers of guidance or regulatory material for their surveyors. This information may not necessarily be made available to operators. Hopefully the NAAs will not seek to gold plate the wording of TGL 10.

## **Eurocontrol**

Eurocontrol has produced its own guidance material in the form of a document called "P-RNAV – Approval Guidance Information Edition 1, July 2003." This document is intended for operators, industry and flight crew. Eurocontrol have resisted the temptation to add a further layer of regulation but have produced a more readable version of TGL 10 with the addition of an FAQ section.

Once our aircraft is certified, our operational procedures are approved, and we have undergone suitable training we shall be permitted to enter an additional "P" in box 10 of our flight plans and use GPS as the primary navigation source when flying SIDs and STARs. This is a small step from the current practice of most instrument rated pilots who tune the VORs and ADFs but use their GPSs as more accurate and reliable back up devices.

This article is just a summary of my understanding of the current position on P-RNAV and it should not be relied on as definitive. TGL 10 alone runs to twenty-nine pages. If you wish to research the subject in more detail a good source of information is website: <http://www.ecacnav.com/p-rnav/>.



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# Chairman's Update

We have made three recent submissions to the CAA in relation to proposed new legislation and as these have implications for our members I am sure you would wish to have brief details (NB Full copies of the submissions are available via the web site). The content may seem somewhat dull but it is important to our futures as owners/pilots. Dealing with such proposals does take a lot of time and our stance is to be constructive and pro-active rather than merely be against all proposals. We have offered to work further with the CAA on all these matters and I am glad to say that they do take our comments seriously.

**1. Letter of consultation** - Proposal to amend the ANO to adopt ICAO standards for GA (see full text, including 15 appendices (!), at [http://www.caa.co.uk/docs/224/srg\\_gad\\_ICAO\\_LofC&RIA.pdf](http://www.caa.co.uk/docs/224/srg_gad_ICAO_LofC&RIA.pdf))

This is in relation to, inter alia:

## *a) Use of Oxygen*

Crew would need to use Oxygen above FL100 and passengers above FL130. We have responded that the proposed rules appear to be aimed at the larger general commercial fleet and we consider the requirements onerous for small, particularly single engine, GA aircraft. In the USA the requirement for oxygen applies if exceeding 30 minutes above 12,000 feet cabin pressure altitude up to and including 14,000 feet and at all times above 14,000 feet. We do recognise there can be benefits from the use of oxygen at higher flight levels but there have not been a significant number of accidents that can be related to the non-use of oxygen at these lower levels.

Many UK airways have bases in the region of FL90 or FL100. An aircraft that does not carry oxygen would be limited to just ONE cruising level under the proposed regulations. Safety dictates that there should be a choice in case weather makes the filed cruising level unsuitable.

There are now small, light pulse oxymeters available so that a pilot

can monitor his/her blood oxygen saturation level and that of the passengers, which does increase safety margins by providing early warning of impending hypoxia. There is of course nothing to stop a pilot using oxygen at lower levels and indeed it should be a matter of good airmanship as to whether a pilot considers it necessary based upon a number of factors.

It seems that portable oxygen sets will be acceptable for use.

## *b) Required Equipment*

The intention is a Fire Extinguisher (one for each enclosed crew compartment), first aid kit, one torch per crewmember at night & two-way radio must be carried. All of this seems sensible.

## *c) ELTs*

If flying 50 NM offshore an automatic ELT must be carried capable of 121.5 and 406 Hz transmission. There are various definitions of acceptable types according to aircraft type.

We have commented that whilst we support the use of ELT in GA aircraft we do consider the order should provide for use of either automatic or survival ELTs, including Personal Locator Beacons (PLBs – working on 406 frequency). The latter are also more economic.

If a small GA aircraft is unfortunate enough to have to ditch, the pilot and passenger(s), if any, will have sufficient difficulty in removing themselves and their liferaft from the sinking aircraft without having yet other safety equipment to consider. A “survival” ELT (PLB) that could be packed together with the liferaft or affixed to one’s lifejacket would be of far more practical use. There is the real possibility of a fixed ELT being left in the aircraft that then sinks taking the ELT with it. The PLB should be an acceptable alternative considering how infrequently UK aircraft are exposed to this risk.

**2. Letter of consultation** ref Articles 50,51 & 129 of the ANO – This is the proposal to require P-RNAV for mandated en-route and

terminal airspace (see full text at <http://www.caa.co.uk/docs/33/FOD20037web.pdf>)

We have responded that we welcome the move towards P-RNAV because of the opportunity it presents for improved procedures in terminal areas as a result of the improvement in the declared accuracy of the system.

However we are strongly opposed to the proposal that the CAA should have retrospective powers to approve equipment, its installation and operation for the purpose of B-RNAV already installed in General Aviation Aircraft. We are also against proposals that seem to require “operators” to have an “operational approval” for using the equipment in designated areas, or on RNP designated routes and procedures.

Currently there seems to be no mechanism for such “operational approvals” and “competence” to be gained.

**3. Letter of Consultation** (2nd stage) to amend the ANO to introduce new Secondary Surveillance radar Systems in Notified TMAs and En-route airspace – this is the new Mode S requirement and most likely to hurt our pockets quite badly! (Full text at [www.caa.co.uk/dap/document.asp?groupid=367](http://www.caa.co.uk/dap/document.asp?groupid=367) and see under “Consultative Documents” - includes a Mode S fact sheet.)

Following our response to the stage 1 consultation last year a number of proposed amendments have been introduced including a two-year transition period and low access usage exemptions all of which are welcomed. However we have responded to the latest stage by stating we do not consider the consultation process has properly considered the private owner/operator and the regulations covering Basic Mode S should await the introduction of new equipment by other than the current limited number of manufacturers especially as new models are understood to be under development.

Additionally we consider the



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## The Rain in Spain falls mainly where you're trying to fly...

No, this isn't a weather story – ICAO have announced that poor proficiency in English contributed to accidents that caused the deaths of over 1,100 people between the years of 1976 and 2000. They also say that misunderstandings due to language can play a large role in many runway incursions and near misses. To try and help control this problem, all controllers and professional pilots involved in international operations will, from 2008, have to pass a proficiency test in English.

Although native English speakers obviously have nothing to fear from this, ICAO also say that to avoid misunderstandings when operating abroad, pilots must be extremely aware that they may be talking to someone for whom English is a second or third language, and should speak slowly, clearly, and avoid the use of idioms, colloquialisms or jargon. Time to brush up on correct RT procedures?

## The Jeppesen Report...



There seems to be an unusual amount of Jeppesen news this issue, so I've lumped it all together so that they didn't appear to be taking over the entire newsletter!  
<http://www.jeppesen.com>

## New Charts!

Jeppesen have made what they term *significant* enhancements to their European VFR+GPS charts, including improved colour selections; greater contrast on highways and navigational aids; and enhanced terrain representation.

The advancements were driven by customer feedback, and the final iteration of the charts was derived through an extensive focus group review project. The charts receive annual updates, with weekly NOTAMs available on the web or via a complementary email service.

## New Training!

Jeppesen have announced a five-year strategy to produce a fully integrated line of JAA training products targeting the

complete range of ATPL, CPL, IR and PPL licenses and ratings. In addition to a line of traditional textbooks, they will also produce test preparation, study guides, manoeuvres manuals, JAA approved syllabi, lesson plans, instructor's manuals and speciality aviation texts. The ATLP texts will be the first to appear, and are slated for a 3<sup>rd</sup> quarter, 2004 release.

## New Fuel!

Well... pricing, anyway. Jeppesen and World Fuel Services have teamed up to launch a new website allowing users to view fuel prices at 1,500 locations worldwide. The detailed price quote includes any applicable taxes and fees, and also includes volume discount details. As a finishing touch, orders can also be placed through the site, which has helped customers uplift nearly 10 million gallons of jet fuel so far! Unfortunately they appear only to offer Jet fuel at present, so all those of us without a turbo-prop, or who's Diesel conversion has yet to be approved, will have to continue doing it the old way!

## New Deal!

Or rather a stand for continuation of the status quo. Jeppesen announced in February that it was refusing, to sign an agreement with the Australian government to pay a license fee in order to continue to use public data to compile its aeronautical charts and information. Apparently Airservices Australia will be asking Jeppesen and other commercial organisations to pay a so far undecided, but likely to be substantial, fee. The charting companies are extremely worried that if they comply and other countries then follow suit, this could have very far-reaching effects, and put the price of world data out of everyone's reach. Jeppesen also commented that they "believe that any license fee imposed on commercial re-distributors of such data will be perceived by the end user, pilots and aircraft operators, as a de facto instance of multiple taxation and a violation of fundamental ICAO principles and policies."

Airservices Australia: <http://www.airservi.cesaustralia.com/default.asp>.

## GPS now old hat...

The FAA a few weeks ago, finally issued an advisory eliminating the *New Technology* label from GPS navigation systems. What this means in reality, is that these systems can now be installed under much simpler

certification and criteria than was the case previously, somewhat akin to the CAA "minor modification" system. Obviously this also lowers the price of the installation, and also means that more places and people can do it, and less red tape must be broken for each model of GPS fitted to each new aircraft type! Now, since this does precisely nothing for those of us in Europe right now, let's not get too excited, however maybe this will eventually lead to simplification of such installations for us too.

## Logbook Pro gets bundled



Logbook Pro is now available bundled with either the Palm or PocketPC PDA editions together with a few other goodies at a reduced price. The new *Suites* are available from Logbook Pro on the website.

Current owners of Logbook Pro should also keep an eye on the website, as a free maintenance release (v1.9.6) will be available shortly! <http://www.logbookpro.com/>

## SkyView2 gets data update



Euro-Control has posted a new version of SkyView2. In their own words, "SkyView2 is a viewer of spatial aeronautical information and will evolve to prove a concept of open and seamless display of geo-referenced aeronautical information, hence providing progress on principles of multi-source feature based information integration, distribution, mapping and system to system integration." Try saying that fast three times!

In real money, this means that you can view the data (Airports, NavAids, Waypoints, Airways, etc.) that the chart makers like Jeppesen (other guides are also available) use to build their charts, graphically in a self-contained viewer with a basic map backdrop. Current users can simply download an update, and new users can download the entire program, as long as you have a Euro-control username and password.  
<http://www.eurocontrol.int/ais/skyview2/index.htm>

## Mooney goes glass (too)



In line with everyone else, Mooney have also now announced that new Ovations and Bravos will be able to opt for a full glass cockpit. They have chosen the Garmin G1000 system, and the option will add the letters GX and about \$20K to each aircraft, making the Ovation GX around \$409,950 and the Bravo GX \$459,950.

<http://www.mooney.com>

## DCT survey

All members should have had an email from Ole Henriksen asking members to report their experiences with DCT routings both during flight planning and in actual flight, due to some reported difficulties being experienced in filing and flying DCT routings. Euro-Control apparently assures us that there is no effort on their part to restrict DCT, but that individual states may choose to do so.

A forum topic "DCT ROUTINGS IN EUROPE" has been started for your feedback, so if you are flying DCT, please let us know what happens, good or bad!

## IFR Magazine



Unfortunately a US-based publication, but the issue that I saw had several good articles about principle and safety that are just as applicable to Europe. You can get the magazine delivered direct for \$39 for 10 issues. <https://secure.palmcoastd.com/pcd/document?ikey=0107216AW>

## The GAAC (General Aviation Awareness Council)

GAAC issued a press release calling on all those connected with general aviation to seize the initiative and actively promote the current positive advances in GA such as environmentally friendlier and quieter diesel aircraft to their local communities. Charles Henry, the Chairman of the council, is worried that we have been taking for

granted the access to airfields laid down many years ago, and that unless we start taking some positive action to preserve these benefits, they will be denied to our children and following generations. More information and ideas can be found on their friendly green website: <http://www.gaac.co.uk>

## IAOPA World Assembly Fly-In



If you have nothing better to do, plan to fly-in to Toulouse Blagnac for April 24-25. The 2004 IAOPA World Assembly will be held at this, the home of Airbus and Aerospatiale with 2 days of aviation-related conferences, exhibits (including a trip to the Muret AIREXPO Airshow on Sunday 25<sup>th</sup>), and of course, parties! Add to all this that courtesy of the local Chamber of Commerce, all landing and parking fees are waived for the entire weekend, and why would you not want to be there!

You should register in advance which will give you the vital registration number which Toulouse ATC will want to help facilitate your routing, and which will also give you parking near the exhibition and conferences, as well as a chance to win Airbus A320 and A340 simulator time and real flights in SOCATA aircraft, including the TBM700! There are also special AOPA rates in force at two local hotels at around 55Euros per night (although the booking period for these officially expired Feb 15).

For additional information including a complete schedule email: [WA2000@aopa-fr.org](mailto:WA2000@aopa-fr.org)

## Angel Flight Europe completes its First Mission



Two volunteer pilots from Switzerland and the UK teamed up to bring a family who's baby son Todd, was born severely premature in Italy, home to the UK. With no insurance willing to cover the cost of an air ambulance, and the infection risk of scheduled travel unacceptably high, getting Todd back to the UK for specialised eye surgery was proving difficult until Angel Flight Europe stepped in.

The trips was done in two parts from Ancona, Italy to Granchen in Switzerland

in Peter Steven's Cessna Centurion 6-seater single, and then back to Bournemouth in Robin Lough's Piper Aztec twin. Neither pilot received anything other than the grateful thanks of the family for their trouble, but that kind of seems like enough!

For more info (and pictures from the first mission), to join, or donate: <http://www.angelflight-europe.org/index.html>.

## And Finally...

Nothing to do with IR whatsoever, but last month the US Air Force released a truly astounding picture of a pilot ejecting from a Thunderbird Jet at a US airshow last year, after a manoeuvre went wrong. <http://www.avweb.com/newspics/DavisTbirdEject.jpg>



Avweb carried the full story, and have not only further pictures, but also an amazing piece of in-cockpit video from within the doomed plane showing the tragedy evolving from the inside! <http://www.avweb.com/eletter/archives/avflash/192-full.html#186633>

Also, the video entitled "Hard Landing" has been circulating the Internet for a while now, (if you haven't seen it yet, follow the link below). Apparently this was the result of a DC9-80 certification test flight in 1980 designed to test a rate of decent close to 700 fpm coupled with strong back pressure 0.5 seconds after landing, plus full braking.

Apparently the pilot over-cooked it somewhat, and actually touched down at a rate exceeding the structural limits of the aircraft, with the catalogued results. Amazingly out of 7 crew members onboard at the time of the incident, the only injury was one broken ankle! We suggest, that you do not try this one at home, children!

[http://www.simradar.com/Feature/2418/DC\\_9\\_80\\_Hard\\_Landing.html](http://www.simradar.com/Feature/2418/DC_9_80_Hard_Landing.html)



# Towards a Common Transition Altitude

*A Flight Deck perspective*

“ It has been shown that the human brain can only hold about nine items in memory at one time

The final instalment of a five part series from Eurocontrol covering every aspect of transition altitudes and altimeter setting procedures

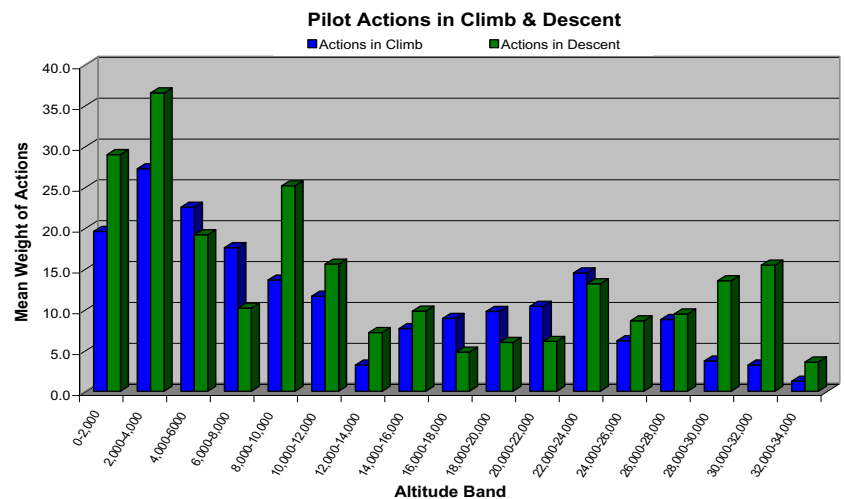
Compiled by  
David Bruford

## Read Back and Hear-Back

Each incident or accident could have more than one primary error type and more than one source. If a pilot makes a read-back error and the controller makes a hear-back error, the altimeter setting will be wrong. Reasons for read-back/hear-back errors are confusing call signs, one pilot not being in the loop because of other duties (taking ATIS, making public address calls), slips of mind and tongue, expectation of something, heavy workload and blocked transmission. Establishing transition altitudes at high workload points should be avoided.

## Altitude Altimeter setting units and unusual values

Uniformity in the use of altimeter reference units is desirable. Guidelines to reduce the risk associated with the use of different altimeter-setting units or with the use of unusual low or high altimeter settings have been established. All digits as well as the unit should be indicated. A transmission such as “altimeter setting six seven” can be interpreted as 28.67, 29.67, 30.67 In.Hg or as 967 hPa. Note that the use of In.Hg. is more prone to errors than the use of hPa.



## Transposing of information

Built in crosschecks can fail. For example the controller could issue a clearance to an altitude coincident with an altimeter setting, followed by a frequency change. The flight crew can perform a correct read-back but transpose the numbers of the frequency with the altimeter setting when inserting the numbers on the altimeter and the frequency selector.

Taking another aircraft's clearance is also an example of error in information processing. This is known as “slips”. Slips are errors of action (as opposed to errors of intention) and occur in relatively familiar environments, during automatic, well-learned behaviours, and are associated with some levels of distraction. Mistakes are likely to occur when the decision requires the simultaneous consideration of more than two or three variables.

## Workload

Transition altitude and altimeter setting are strongly related. A transition altitude where the workload is high can be the cause of an increase in errors.

## Workload survey

Little information was found on the spread of flight deck workload versus altitude, or phase of flight. The workload during cruise is much lower and less critical than during landing and take-off. It is interesting to know where the turning point between low and high workload can be situated. Obviously, the transition altitude should not fall in the middle of a high workload phase or a critical phase of flight.

A survey was carried out on a limited number of flights. The departure and destination altitude was near sea level in all cases. An experienced airline pilot monitored ten flights from the jump seat position. All actions of the captain and co-pilot were registered. Those actions were divided into groups of similar actions, and by altitude band of 2,000 ft. A weight was allocated to each specific group of actions. Afterwards the total weight of actions was calculated for each altitude band. A mean value was calculated for the ten flights during climb and descent. These values are plotted above in relation to the altitude bands.

It is important to note that actions were registered and not workload. Other functions (mental actions) should be added in order to reach a total picture. The altitudes are cockpit readings, related to QNH below the transition altitude and to QNE above. The value of the Y-axis is a mean weight of actions. Therefore, a comparison can be made between climb and descent. In the climb, peak values are observed between 2,000 and 6,000 ft. The first band below 2,000 ft is smaller because the take off and initial departure route is very well prepared before the flight. The overall departure workload is lower than for arrival because of this preparation. A departure contains less “surprises” for the flight crew. The aircraft is flying away from the problems. Below 10,000 ft, most companies apply the “sterile cockpit” concept: only primary tasks are performed; no papers, no cabin interference, no company calls. While the actions below 10,000 ft are considered critical, above 10,000

ft a lot of less critical actions that were previously delayed are now performed. The “associated actions” triggered at 10,000 ft are an important part of the 10,000-12,000 ft band. An increase in workload can be observed between 18,000 and 24,000 ft. This is dominated by ATC calls, frequency changes and associated route changes. It is possible that the change from lower to upper airspace can be partly responsible for this increase.

In descent, a similar picture emerges. The overall workload is 22 % higher. This is because the preparation for the climb could be done in the pre-flight, while the arrival preparation must be done during the last part of the cruise and the descent. Arrivals contain more uncertainties than departures. The same increase in workload is observed around the 22,000-24,000 ft band. The associated actions triggered by the 10,000 ft are now performed between 10,000 and 8,000 ft. This explains why the peak value is now situated just below the 10,000 ft (opposite to the climb - associated actions). Again below this altitude, the sterile cockpit concept is in force. Actions from that moment on should be considered critical.

A transition altitude is the same for both climb and descent. Because of the above mentioned “associated actions” around 10,000 ft, the transition altitude should not be lower than 10,000 ft. The higher workload in the 8,000-12,000 ft band is not an objection, because most of the actions there are grouped associated actions. Every action below must be seen as critical and should be free from interference.

### Between stress, fatigue and boredom

It is generally accepted that people perform less well when fatigued or stressed. Cambridge experiments show that pilots’ flying deteriorates under fatigue: courses and heights are less accurately maintained, fuel checking was liable to be forgotten, there was a strong tendency to become focussed on one particular instrument, and pilots thought they were doing well while in fact they were performing badly.

Much of what goes on in our mind and much of our memory is banished

to the lower part of consciousness. Only the distillation of conscious processing remains. With these neatly packed parts of experience and knowledge, events and problems are tackled as they occur. It has been shown that the human brain can only hold about nine items in memory at one time. The human being is unable to process or even retain all the information and experiences that overload the working environment.

Automation has undoubtedly had a beneficial effect on safety. On the debit side of increased automation has come a loss of proficiency. A marked skill loss has been noticed in pilots who regularly use automatic equipment. Disturbing as well is that there could be “the tendency to breed inactivity or complacency”. This is a natural human reaction to insufficient stimuli. Advanced flight deck automation will be more tolerant of error, but will increase boredom. The flight crew could start making mistakes without even realizing it for hours. Mistakes in a technically complicated environment may stay a long time hidden in the system, and before getting noticed their consequences will have increased significantly. The right trigger at the right time is able to get the pilot back in the loop.

Those triggers are not always foreseen. When flying at flight level and getting the clearance to “Descend to 8,000 ft on QNH 995”, a clear trigger to reset the altimeter is given. This same clearance, but with a condition like “after passing” or “when ready, descend to 8,000 ft on QNH 995” does not contain this trigger. Because the action is delayed, the reset of the altimeter is an item that must be put in our memory (nine items maximum) until execution can take place. But it is known that the information in the brain’s memory is forgotten with the passage of time and with the inflow of additional information. A standard instrument departure that contains an initial level off altitude above the transition altitude is another example of the complete absence of trigger. As the altimeter cannot be set at the moment of receiving the clearance (before departure, the altimeter must be set to QNH) it is up to the pilot’s memory to

recall for the reset of the altimeter.

Altimeter setting for very high transition altitudes might fall in a lower stress environment. This is not always advantageous. At a certain point in climb, altitude awareness for the pilot becomes less important. The mind is focussed on the en-route portion of the flight. The workload graphs (above) show an increase related to the entrance into the higher airspace with its specific requirements. At that point, altitude awareness is not one of the majors concerns any more. In descent, the transition altitude could trigger the altitude awareness on the flight deck. In this respect a transition altitude of 18,000 ft might be too high, especially for lower elevation airports (majority of the cases).

### In conclusion – or not

#### **Benefits - Below 10,000 ft**

Consistent with existing ICAO text.

#### **Disadvantages**

Flight deck workload is too high; multiple exceptions needed (high elevation aerodromes) and there is a conflict with IFR flight procedures.

#### **Benefits - Medium, around 10,000 ft**

Fits in with IFALPA policy and gives an acceptable flight deck workload. It is above noise abatement and other IFR flight procedures. It eliminates the 10,000 / 11,000 ft misinterpretation and complies with existing SOPs at 10,000 ft (only for transition altitude 10,000 ft).

#### **Disadvantages**

few exceptions are needed (high elevation aerodromes).

#### **Benefits - High, above 10,000 ft**

Acceptable flight deck workload and above noise abatement and other IFR flight procedures. No exceptions needed (high elevation aerodromes).

#### **Disadvantages**

There would be an introduction of the 10,000 / 11,000 ft misinterpretation. Frequent altimeter updates are necessary during descent and there is a late trigger for altimeter setting during climb.

*While the jury is still out on a standardised transition altitude this article concludes our series on the subject.*

“

Automation has had a beneficial effect on safety... but with a potential loss of proficiency

”



# Portable Oxygen Systems

By  
Dirk De Jonghe

The medical aspects of oxygen shortage were explained in the last issue of Instrument Pilot. Those of us with pressurized aircraft don't have to worry about using supplemental oxygen unless they exceed a cabin altitude of over 10,000ft. On the other hand, a lot of pilots with turbocharged equipment can benefit from a portable oxygen bottle if they don't have a fixed oxygen system. My current aircraft is not turbocharged but I still find it useful to have oxygen available. It gives me an option of several more flight levels as well as an increased comfort level and higher safety.

Returning from the PPL-IR meeting in Ireland was a very good example. Going eastbound on airway G1 at FL110, crossing the London TMA was a piece of cake, with a nice 30kt tailwind, on top of a solid cloud deck up to FL100. Being on oxygen for the whole flight made it much less tiring.



*Nelson portable oxygen system by Precise Flight*

The basic portable oxygen kit consists of a high pressure bottle, with attached regulator and several masks with rebreathing plastic bags. This is a very crude system, driven more by low cost motives than efficiency.

The flowrate of these simple fixed regulators is 1 litre per minute per 10,000ft of altitude. Most systems will be set up to provide at least 2 liters per minute even if you have no intention of climbing to FL250. In this case a typical portable O<sub>2</sub> bottle of 22 cu ft (623 litres) capacity will provide about 5 manhours of oxygen, just about useless for practical trips. Use the conversion rate of 1 cu ft = 28.317 litres.

Since most of our flights in non-pressurized aircraft will probably be below 18,000ft and we don't want to refill our bottle as often as our fuel tanks, better ways to conserve oxygen must be found. Fitting adjustable flow meters and using Oximizer cannulas instead of face masks will permit a given quantity of oxygen to last 2.5 to 3 times longer depending on altitude. Our hypothetical 22 cu ft bottle with flowmeters and Oximizer cannulas will now last more than 19 manhours at FL150.

## *Oximizer Conserving Cannula*



*Conserving cannula from Mountain High*  
The Oxymizer oxygen conserving cannula has a 'mustache' reservoir where the balance of the constant

flow oxygen is stored while you exhale, permitting lesser flow rates. There is no smell (plastic, breath, garlic) when using a cannula. FAA regulations require you to carry a standby face mask in case someone develops a cold with nasal obstruction. Obviously cannulas only work while breathing through your nose, inadvertent mouth breathing will very quickly negate the oxygen effect on blood saturation.

I find cannulas to be much more comfortable than masks, you can eat, drink, talk and even sleep (for passengers). They are cheap enough that every regular passenger can keep his own cannula.

## *Mountain High EDS*



*2-place Electronic Oxygen Delivery System from Mountain High*

If you are a frequent user of oxygen there is an even a better solution available; electronic puffers like the Mountain High EDS. Adding a pulse system will double this extended duration with no loss in oxygen saturation. The technology behind EDS is very simple, the human breathing cycle is two-stroke, inhaling and exhaling. Exhaling takes two thirds of the time and inhaling one third. So if an electronic device would detect the precise instant that you start to inhale, it could send a puff of oxygen at that time and shut off the flow during

“  
A lot of pilots with turbocharged aircraft can benefit from a portable oxygen bottle  
”



the exhalation since this oxygen is wasted anyway. There is no need to use the 'mustache' type of oxygen conserving cannulas when using an EDS, the standard cannula will work fine since no oxygen is flowing during the exhalation cycle. With EDS and standard cannulas our 22 cu ft bottle will last 48.5 man-hours at FL150.

Taking your empty portable oxygen bottle to a compressed gas shop for a refill will probably be less expensive than having it done at the airport. All oxygen is the same, medical, aviation or welding. Actually welding places the highest demands on purity. Just be sure it is real oxygen you get and not compressed air suitable for scuba divers.

You don't need oxygen on every flight, but it is nice to have the option on long flights. I remember a night flight from Tempelhof to my home base during the Berlinale in February several years ago. Oxygen does wonders to your night vision and clarity of mind. After 3.5 hours at FL130 on oxygen, I was less fatigued than one hour at FL70. Turning on oxygen at night is like turning on the lights on the ground, a very dramatic difference.

### FlightStat Pulse Oximeter



Nonin FlightStat Pulse Oximeter

The previous article about hypoxia in Instrument Pilot 41 mentioned the Nonin Flightstat Pulse Oximeter. This fingertip device measures your blood oxygen saturation level in a very clever way. Oxygen-saturated blood is bright red while oxygen-depleted blood is dark red. An LED provides a red and infrared light source that illuminates your fingertip. On the other side of your fingertip, a sensor will measure the brightness of the red light that makes it through the flesh and calculates the blood oxygen saturation level. Since different people have different lungs, breathing techniques, etc, measuring blood oxygen saturation level makes a lot of sense. It would permit even more finetuning of the oxygen flow rate but most importantly it verifies the correct workings of the human machine in high-altitude situations.

To find more information about the use of pulse oxymetry go to: <http://www.avweb.com/news/aeromed/181896-1.html>

If you want to read up on the medical aspects of how oxygen works go to: <http://www.avweb.com/news/aeromed/181937-1.html>

To find out more about altitude decompression sickness and why you don't want to venture too far above FL180 without pressurization go to: <http://www.avweb.com/news/aeromed/181939-1.html>

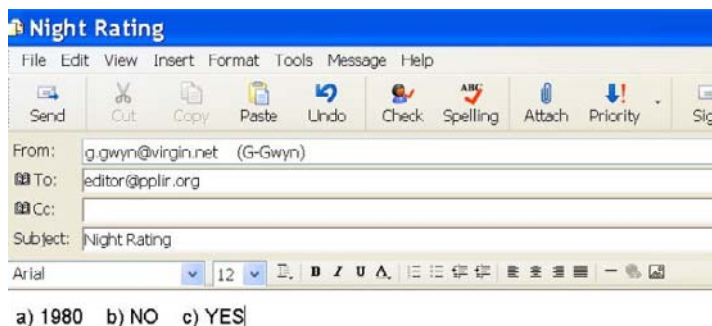
Also read about the flight John Deakin made in his Turbo-Normalized Bonanza, climbing up to FL270, on oxygen with pulse oxymetry monitoring: <http://www.avweb.com/news/columns/182156-1.html>



# Do you hold a Night Rating?

To determine whether we need to commission an in-depth article explaining the Catch 22 licensing situation for night flying with an IR, we need some feedback from members. Please email with guaranteed confidentiality to [editor@pplir.org](mailto:editor@pplir.org):

- What year did you first obtain an IR?
- Have you ever obtained a separate night rating?
- Do you think that the IR entitles you to fly at night?



## INSTRUMENT FLYING and TOURING AIRCRAFT

1-2 May 2004

PPL/IR Europe, in association with Air Nimbus Ltd, is offering a weekend event designed to inform those who are considering either obtaining an instrument rating and or considering ways of gaining access to advanced touring aircraft.

The weekend will be held in Herefordshire between Ross on Wye and Monmouth. E mail [booking@airnimbus.co.uk](mailto:booking@airnimbus.co.uk) to check availability and see the PPL/IR Europe Website for full details: <http://www.pplir.co.uk/sub.cfm/id/169/cat/Forthcoming%20Event/page/Instrument%20Flying%20and%20Touring%20Aircraft>



# On-Board WX Radar vs Stormscope vs NexRad

By  
George J. Yundt III

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Each  
technol-  
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gives the  
pilot only  
a piece of  
the  
puzzle

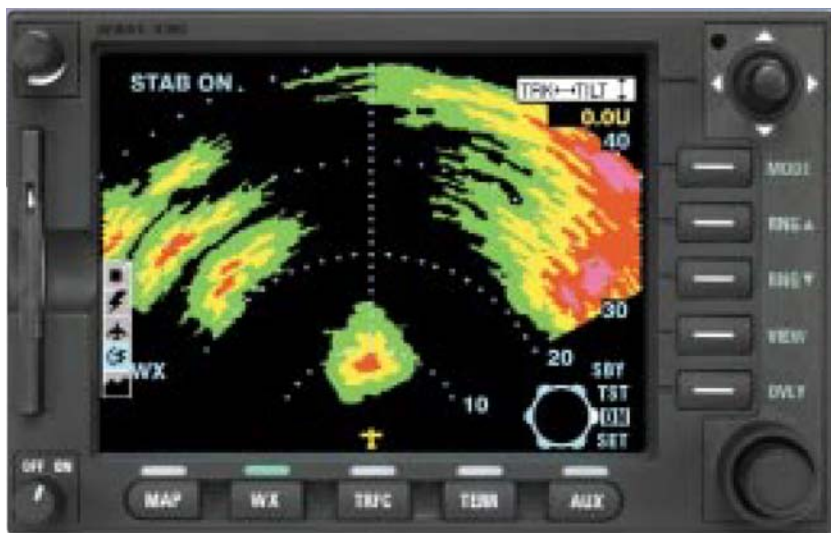
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My Commander 685 aircraft is blessed with a current generation Bendix-King 4-Color Vertical Profile Stabilized Weather Radar, a Stormscope 500A, and Bendix-King VDL Mode-2 Datalink Receiver providing National NexRad images, plus METARs, TAFs, pIREPs\*, etc. To make all the information manageable and provide maximum awareness, all three weather ‘sensor’ sources are displayed (overlying my position and course) on my Bendix-King IHAS 8000 System’s KMD-850 Multi-Function Display. As this technology may be unknown to some pilots, the idea of this article is to provide details of all three resulting from my experiences with weather radar over 30 years, Stormscopes for 25 years and NexRad Datalink over the past two years. I speak from a pilot’s experience, not electrical engineers, as I hold an ATP and have 10,500 hours PIC.

First of all, while the goal of each of the three technologies attempts to give the pilot a pretty good idea of the weather threat confronting the flight, in reality each technology gives the pilot only a piece of the puzzle, but **none** of the technologies give whole picture. I treat them (along with a good pre-flight weather briefing) as complementary sources of information that are best when used in concert. That being said, and recognizing that not everyone will choose, or be financially able, to install all three technologies, here is a brief synopsis:

## **NexRad**

NexRad is the ideal strategic avoidance tool (whether airborne datalinked into



*The Bendix-King IHAS 8000 System's KMD-850 Multi-Function Display*

the cockpit, or looking at the computer at the FBO (fixed base operator) right before departure). It should be used to get the ‘big picture’, and to plan a routing so as to avoid the WX totally, or at least choose the least obstructed routing. Depending on whose device and service you have, you must remember that it is aged information (usually six minutes) and therefore **not real-time!** Also, it aggregates the reflectivity through the entire vertical section (or the largest portion) of the storm, **not** necessarily the altitude you may actually be penetrating at. In a rapidly changing thunderstorm, this information has little value if you are up-close and personal, and are trying to pick your way through a line with more than 30% coverage. Again, it is a great avoidance tool.

## **Onboard Weather Radar**

Onboard Weather Radar is the most widely used tactical tool used by the professionals, and (if operated and interpreted correctly) is the single best thing to have if you choose to pick your way through a scattered or broken line, or if you absolutely must, even penetrate the weather. However, due to inherent design of relatively low RF power, beam- and pulse-width errors, attenuation and X-band’s ability to only ‘see liquid phase’ moisture. It can’t see heavy snow below, ice pellets or hail below -5C, and **certainly it cannot see turbulence.** It definitely does have its limitations. The only thing X-Band does see well is water (rain!). It takes lots of practice, operator experience with tilt and gain, intuition, and good use of your eyeballs (yes, the ORIGINAL weather

*As you may have guessed; George J. Yundt III is an American based pilot so a lot of his comments and the technology he refers to are only available on his side of the pond. However, we make no apology for publishing his very informative article in what is mainly a European read magazine. After all, given time, Europe usually gets what the US pilots have been enjoying for years so we really ought to know what we are missing.*

*\*Pireps are “pilot weather reports” and are an American phenomenon. They are normally given to whoever you are in R/T contact with at the time, and if you are not, then you report to “En Route Flight Advisory Service” (EFAS), call sign “Flight Watch” (equivalent to “London Information”). Pireps are normally volunteered, but in fact ATC has a duty to solicit pireps when certain weather conditions are forecast or known to exist: Ceilings at or below 5,000 feet, viz at or below 5 SM, thunderstorms and related weather, icing greater than trace, light turbulence or greater, windshear and volcanic ash clouds. Pireps are used by ATC in their own traffic planning and passed to other pilots, and by meteorologists in their reporting and forecasting.*

P 20 ►

# A Windscreen Full of Glider



## *A report submitted by one of our members*

**Y**ou know that horrible feeling you get when a small buff envelope drops on the doormat? You just know even before you open it that it's a speeding ticket.

Well you can imagine the trepidation with which I opened a ruddy great buff envelope plastered with rubber stamps: INSPECTION GENERALE DE L'AVIATION, Paris and PRIORITY stickers. Out slides the official report on the airmiss I reported last July!

Yes, I plead guilty to not being switched on that I was flying in class "E" Airspace - that will not happen again but in fairness it's an easy trap for any of us to fall in. Cruising along, accurately flying the clearance, and assuming that the man on the ground is carefully looking after us - after all he would soon be on the radio if we deviated from the clearance. I can tell you that I had the fright of my life - looking up from my chart to a windscreen full of glider!

It was perfect VMC so there really was no excuse for the glider pilot or me!

Now, particularly for France, I check the chart and if I have a passenger I ask them to look out if I have my head down. Just because you are under *positive* control do not assume anything.

### **Official Report**

The covering letter contained within my postal package was obviously a standard enclosure:

Dear Sir,

*As captain of the flight, mentioned in this document, you have filed an AIRPROX report. This incident led to the immediate opening of a local investigation conducted by the air traffic unit in question, which has brought together all the useful data and statements. Further to this, the local quality commission for service/security has met to furnish an explanation and identify possible certain immediate measures to be taken within the unit.*

*On the basis of the established facts and conclusions of this first investigation, the National Committee for Air Traffic safety ("CNSCA") has proceeded with the closure of the incident after extensive analysis. Please find enclosed the closure document which resumes the findings of this commission and which contains:*

- *A reminder of the facts and the interpretation of the circumstances;*
- *the classification of the incident in risk categories; These categories defined in annexe 6 to instruction 20600/DNA/2C of 31<sup>st</sup> January 1996 (enclosed), are intended to establish the risk factor and not that of the malfunctions;*
- *causes and contributory factors;*
- *the lessons learnt and safety recommendations.*

*General information which retains attention being repetitive or serious will be studied during the preparation of the "CNSCA" annual report compiled for the Ministry in charge of civil aviation. It, along with other considerations, could lead to recommendations in the relevant part of this report, thus contributing to measures taken to improve safety.*

*Yours faithfully  
Philippe Jaquard*

The letter was almost longer than the report that ran as follows:  
Airprox, Monday 21st July 2003 at CRNA/SOUTH EAST. G-\*\*\*\* - IFR / Glider – VFR. Nature of the incident: Closing between an aircraft under IFR and a glider. Location: DGN R172/16 NM. Type of airspace: Airway A3. Class of airspace: E.

### **Factual Information**

On Monday 21<sup>st</sup> July at 1311:54 UTC, G-\*\*\*\*, a PA30 under IFR from Cannes and with destination Biggin Hill contacted sector ST of the CRNA/SE "Passing flight level 67 for one hundred to STP". The controller only authorized FL90. G-\*\*\*\* read back.

At 1321:47 the controller authorised G-\*\*\*\* direct MTL and would call them again for a higher level.

At 1322:00 the controller corrected his clearance and authorized G-\*\*\*\* onto AMFOU-PERUS-MTL due to military activity.

At 1323:39, G-\*\*\*\* was authorized to FL100. The pilot read back.

At 1332:19, G-\*\*\*\* was authorized direct PERUS.

At 1336:55, G-\*\*\*\* declared an Airprox for a glider that had passed less than 100ft below them.

At 1348:33, at the controller's request, the pilot of G-\*\*\*\* specified that he did not have the glider's call sign, that the glider was white with an empennage in the form of a T and that it was a high-performance glider that had crossed its path at a 45° angle heading south-west.

The controllers had correctly selected the radar codes displayed on their screen. The glider in conflict did not show any transponder code (*nor paint a primary return – Ed*). The safety

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A controller can only warn of something that appears on his screen  
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# Cranfield, Coventry, Cambridge (IFR)

By  
Leland Vandervort

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I had forgotten that I had planned the track from overhead Coventry rather than a point to the south of it

”

On December 13<sup>th</sup> I experienced my second and most enjoyable IFR flight. I was accompanied by my Instrument Rated friend Nigel who was considerably more critical of my flight performance this time, which I considered to be a good thing! Last time (on my first ever real IFR flight) he pretty much let me get away with suicide, so this time he was much stricter.



## *Cranfield Departure*

We departed Cranfield runway 22 and climbed into the murk and rain. All the better, I guess, because I didn't really care for the weather whilst sitting on the ground anyway. On the climb out I made my first mistake - failing to check for icing every 1,000 feet. This was quickly followed by my second mistake, breaking the departure clearance that involved a right turn on track to Daventry after departure. I was attempting to hold straight ahead until intercepting the 128 radial from Daventry, primarily to avoid over flying the centre of Milton Keynes at a low-ish altitude. However, it was still a 'fault' as I should have requested a departure clearance straight ahead using the so-called 'Stony-Welin Profile' rather than accepting the on-

track right turn. Still one lives and learns – and I had the luxury fall back position of my safety pilot mentor.

Tracking inbound to Daventry was nowhere near perfect. I suppose my ground track must have looked more like a snake's. I was, additionally, not totally familiar with the NDB/DME approach into Coventry. Cleared for a direct NDB/DME approach, I was able to discover first hand just how deceiving the approach really is. It demands several navigation aid changes from the outbound leg through to missed approach. Of course, I missed the most obvious radio navigation aid change: setting up the KNS80 to pick up the actual DME, despite a couple of obvious clues from ATC instructing me to report at 4 miles (oops). This was quickly corrected with a bit of coaching from Nigel.

## *Coventry*

I managed a small balloon on landing at Coventry due to my habit of a consistent high approach speed and I made a conscious effort to correct this for the next two legs of the trip but this highlighted another fault. My target speeds were literally all over the place. Oddly enough, the critical parts of an instrument flight are no different to flying in VMC, so it intrigues me how I can keep the speed nailed while looking out the window in VMC, but when concentrating on the instruments I tend to allow the speed to fluctuate too much... something else to work on! Over a coffee and sandwich Nigel and I debriefed the first leg of the flight. It was also a good time to learn about ADF dip and its practical implications.

## *Cambridge*

Next leg - to Cambridge. Departure from Coventry was fairly uneventful, apart from the speed fluctuations again - something to work on by myself at some point – I must spend an hour or so doing speed 'nailing' various speeds and configurations. Here is where I had a major brain fade when setting up an RNAV waypoint over Grafham Water. The intention was to depart Coventry and fly southeast to intercept the track I had selected. Of course I had forgotten that I had planned the track on the chart from **overhead** Coventry, rather than a point to the south of it. Thankfully, Nigel reminded me that flying southeast with a full left-deflection of the CDI, there was no way on earth I would intercept the desired track... oops again.



Right, got that sorted (more or less, though not really the cleanest RNAV waypoint tracking in the world). After emerging from beneath the Daventry CTA, we climbed to FL55 for the cruise. We called up Cambridge over Grafham Water, and instead of the expected procedural approach to runway 23, they offered us radar vectoring to the ILS. This definitely helped the workload! After being vectored around to finals I presented my usual speed issue again.

I really need to work on that! Anyway, I was weaving on and off the localiser, but fortunately didn't let it slip too far out. On the glideslope however, I was consistently about half a dot below, though for the life of me I really can't think why. Cambridge approach indicated the presence of traffic at two o'clock indicating 2,000 feet with a range of about 3 miles, probably the police helicopter operating in the area. Nigel says "Visual". I repeat, parrot fashion "Golf Mike-Mike, Roger, Visual with the traffic". What am I saying?!? I have my eyes pegged on the instruments, so I can't see anything outside! I carried on in an acceptable way, past the decision height and the landing was much better and speed much more controlled.

### Cranfield Arrival

After a quick turn-around at Cambridge, it was en-route again, back to Cranfield with a mental note of trying to concentrate more on the speed control this time.

I planned to set up a track back in the direction of Grafham Water then intercept a track towards Cranfield keeping to the right of the 060° radial from CFD in order to avoid the danger area at Cardington where they launch tethered weather balloons. We call up Cranfield Approach, reporting inbound. Of course initially (before the call) my estimate for the CIT NDB was completely out the window (another brain fade, perhaps), but fortunately this was

revised before calling them! Inbound to the CIT was pretty smooth, except when passing in and out of scattered cumulus with a broken stratocumulus layer below us. Some relatively light turbulence while in the cumulus made me concentrate more on the instruments. We turned beacon outbound, and for a while I had lost track of the fact that I was using an RBI. "Yes, Leland, if I'm crabbing with drift correction, the relative bearing CAN show directly behind you!"

Two minutes 10 seconds, outbound leg, allowing for a fairly strong wind, turning inbound towards the beacon. I did manage to overshoot the final approach track somewhat, but managed to correct it with a few pointers from Nigel. Beacon inbound... "Pull the tail, not push!" (Silly me!) At last, visual! (What is the runway doing over there?!? -- oops!). Quick correction, visual approach, intercepting the PAPIs having arrived at my minimum descent altitude and down we go. Watch the speed! Home at last!

All in all, a very enjoyable trip. Many thanks to Nigel for his considerably more critical debriefings and pointers. This flight definitely helped me identify several of my weak points that I need to work on. And yet again I am looking forward to the next IFR flight in "real" conditions! There is definitely a big difference between doing simulated IMC (foggles, hoods or screens) and the real thing and it really takes a flight like this to reinforce that fact!



### A Windscreen Full of Glider Continued from Page 11

net was therefore not triggered. No other organisation had made the controllers aware of the presence of the conflicting glider. The glider could not be identified.

According to the report made by the pilot of G-\*\*\*\*, the glider did not seem to be aware of the class of airspace it was circulating in (class E, after verification). The pilot stressed the fact that since he was under radar control he should not have to encounter any kind of conflicting traffic without at least being warned. In addition, the pilot of G-\*\*\*\* deplored the fact that gliders were flying without transponder or radio contact.

### Incident Classification

Taking into account:

- the minimal separation values of 100ft horizontally and 50ft vertically as indicated by the pilot filing the report;
- the "seriousness" of the situation and the risks involved as assessed by the pilot filing the report;
- this incident is hereby classified as: "SAFETY NOT ASSURED"

### Causal factors of the incident

- Ignorance by the pilot under IFR of the class of airspace he was operating in. Hence poor vigilance with regards to following the rule "See and Avoid".

### Lessons learned from the analysis of the incident

- Study the possibility of defining 115 as the minimum flight altitude on the route MTL-PERUS-AMFOU.
- There is a need to remind airline pilots as well as private pilots about the classes of airspace, the services provided and the kinds of flights that coexist in them.
- Conduct some awareness campaigns in gliding schools to stress the problems that occur whenever gliders have to cross airways which traffic under IFR may be using.
- It is advisable for gliders to use maps showing airways.

And there the report ended. The most frightening moment of my aviating life condensed into a few 'lessons learnt'. Personally I have re-learned that the Perspex windows surrounding me are not just there to keep the wind out. They offer the opportunity to see something threatening before it becomes a real danger and I shall treat the implied protection of a radar service with my newly gained knowledge that a controller can only warn me of something that appears on his screen.



## INTERNATIONAL AIR RALLY of MALTA 3rd -7th July 2004



# Stay Cool and Survive

By  
David Bruford

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Diana  
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only one  
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A recent UK General Aviation Safety Information Leaflet quoted details from an AAIB report on an accident to a light twin piston aircraft, which emphasised the need to fly the aircraft in the event of a door/canopy problem. In this case the cabin door had opened just after the aeroplane lifted off the runway, and the pilot (who was alone in the aeroplane) appears to have attempted to secure the door before raising the gear and flap. In so doing he had sacrificed the first rule of flight - **fly the aeroplane**, with fatal consequences.

GASIL stated: “Whilst it is difficult to ignore a distraction such as an open door or canopy, the aircraft **must** be attended to first. With the aircraft under control and trimmed at a safe, slow speed, then **and only then** can some consideration be given to the canopy/door problem. The best course of action is always to land as soon as possible and secure the door on the ground. Passengers/crew can assist if they are present, and once again the best course of action is to ask that the door/canopy be ‘held’ secure rather than attempting a fastening in flight; securing the door is once always best done on the ground. The message in all cases is **fly the aircraft first!**”

## *Diana Barnato-Walker*

This reminded me of the wartime experiences of Diana Barnato-Walker, a true heroine of the Air Transport Auxiliary. On the 30th April 1945 Diana flew a Hawker Typhoon (KE347), in a delivery to

Kemble. Unfortunately this aircraft did not arrive in the immaculate condition it took off in. Diana did not break it; it fell apart in flight. In the cruise, the underside fuselage covering came adrift and after a little buffeting she found herself looking past her feet and rudder pedals at the countryside below. Thanks to a vast experience of many unique situations, her reaction was simply to climb to a safe height where a stall recovery would be practical. There, she experimented with the aircraft in the final approach configuration to discover what the new stall speed would be. That, she concluded, would enable her to guess a safe final approach speed. She then continued to her destination and passed over the threshold at 100 knots, several knots above the new stall speed.



Out of 31 Typhoons that she flew during her career this was the only one that had a problem. Although she flew it with the greatest of care and landed safely, this particular aircraft was never repaired and never used for any kind of flying again because repair contracts were cancelled shortly after V.E day, 8th May 1945. Diana was the only one of 26 pilots who experienced structural failure in flight in a Typhoon to have

survived, and was the only pilot to have completed their journey. It was considered, but never proven, that the probable cause of the structural failure was elevator flutter.

## *Stay Cool*

This story must offer the greatest hope to any modern pilot who has a cabin or baggage door open in flight, fuel filler caps disappear into the slipstream, rubber de-ice strips peel away before their eyes or even ATC calling up to advise that there is a tow bar or tie down weights dangling off the aircraft. I know of one pilot who has experienced all but the last event but this has probably only been avoided because he has never used tie down weights. Staying calm, or allowing your mind to remain in blissful ignorance of the negative consequences while taking constructive measures are the answers to survival. Don't immediately bleat to ATC about your problems, they aren't issued with long enough ladders; stay cool and survive.

*Diana Barnato-Walker's autobiography, Spreading My Wings is well worth reading and will impress even the most seasoned aviator. ISBN: 1904010318*



## Class E airspace – expanded

Your article on Class E airspace included in Eurostuff 41 appears to make light of a very complex and potentially important aspect of future airspace management.

Much is written, even more argued, about the rights of access to all airspace for all users and the need for a more equitable allocation of airspace. What could be more equitable than to allocate each aircraft its own volume of airspace?

Your article only highlighted the possibilities of Class E airspace; what about the other Classifications? Surely there must be a link between the equipage of an aircraft and its pilot's capability and the determination of the appropriate Airspace Classification to be applied. One could imagine that in a number of cases, for example - public transport aircraft, that these aircraft would be permanently allocated a volume of airspace of a higher classification whilst at the lower end of the IFR market, operators would, presumably, only be able to afford Class E airspace.

As for determining the volume of airspace to be allocated, it could be argued that the more expensive, better-equipped, larger aircraft should be rewarded with a larger volume of airspace protection. One could imagine that if this were taken to its ultimate conclusion, there would be no need for a FL Z in the future. Personally, I favour an aerofoil shape in order to reduce drag, allow for a smoother interaction with other "bubbles" and fit under the flyovers at some airports.

**Bill Armit**

## Just found your website - excellent

Hi Guys,  
Just found your website - excellent. I tried to log into the forum but could not find a place to do so? I am also trying to determine two things:

- 1) A ICAO license holder is allowed to hire G reg aircraft and fly anywhere in the UK but what if you want to join in on a trip to France and your license is a full ICAO (happens to be commercial with IR) what happens when you get to the

border of UK and French airspace? How can you get permission to fly anything other than an N reg in France?

- 2) I see a few people looking at giving FAA IR lessons in the UK now. Can this be done as an FAA Instructor in a G reg plane? What if any are the restrictions?

Thank you for your time and help.

**Wyatt**

[wyatt@dsl.pipex.com](mailto:wyatt@dsl.pipex.com)

Hello Wyatt,

The forum is accessible from the main menu on our web site. It requires a user name and password, which members get when they join. You will find the joining form at [www.pplir.org/membershipapp.cfm](http://www.pplir.org/membershipapp.cfm). Flying aircraft registered in countries different from the country of your licence is regulated by one or more of the following:

- 1) The air law of the country of registration,
- 2) the air law of the country issuing the licence and
- 3) the air law of the country in which you fly.

As you say, you can fly a G-registered aircraft on a non-UK ICAO licence in UK airspace, but not "in circumstances requiring compliance with the Instrument Flight Rules" - UK ANO article 21(4)(a). Unfortunately PPL/IR Europe is not at the moment able to advise you on the position in all other European countries.

Our expertise also does not extend to the intricacies of training for one country's licence in an aircraft registered in another country (possibly in a third country's airspace) but the members' forum could well throw some light on the subject, or you could contact one of the training facilities who offer these services, such as American Flight Training Service, [www.flyafsts.co.uk](http://www.flyafsts.co.uk)

Best regards,

**Ole Henriksen**

Membership Secretary,  
PPL/IR Europe

Thanks Ole,

How nice it would be if the various countries could all agree on acceptable standards and then just allow qualified people to fly!!!

Wyatt

[wyatt@dsl.pipex.com](mailto:wyatt@dsl.pipex.com)

Dear Wyatt,

Such standards do exist - the ICAO convention - and countries that are signatories to that do recognize each other's licences as long as the licence matches the aircraft registration. Otherwise international aviation would not be possible. The problems arise when you want to fly one country's aircraft on another country's licence, possibly in a third country's airspace. The ICAO convention does not provide a legal framework for this but leaves it to individual countries to regulate.

The reason that virtually all countries restrict such use is that the implementation of ICAO standards varies between countries, and a local authority would have no way of assuring that local standards were met if pilots from any ICAO nation could fly aircraft from any ICAO country in any ICAO airspace. A couple of simple examples of this are language (not all ICAO countries require their pilots to be proficient in English) and units of measure (some ICAO countries use metric units in both their airspace and their aircraft). International operations, mostly by airlines, are regulated through other means such as route licences.

When implementations of standards come together (as is happening in Europe at the moment), a more flexible use of licences results, but as we know this is a very slow and painful process.

Best regards,

**Ole**



# FLY!

THE LONDON AIR SHOW  
TAKES OFF!

Earls Court is taking to the skies with Fly! The London Air Show between 16 – 18 April 2004.

The first UK indoor air show is set to be a fantastic look into flying and aerospots, encompassing light aircraft, helicopters, microlights, technology, flying clubs, schools and associations, extreme air, and aviation careers and services. In addition the event is packed with adrenaline-charged features to get the pulses of the passionate racing. For information and tickets visit [www.londonairshow.co.uk](http://www.londonairshow.co.uk) or call 08701 60 70 30.



By  
David Bruford

## *ASEAC it here, ASEAC it there*

“*The Anti-Single-Engine Aircraft Campaign has made its first courageous move to restrict the ability of these whinny little inconsequential aircraft to exist.*”

OK. You’ve got your shiny new PPL. Maybe you’ve even added a night rating or, if you’re British, an IMC rating. You own your own aircraft or have located an organisation or friend gullible enough to let you fly their pride and joy without them.

So what’s next? New places to fly? Places that your instructor would never take you to?

You look through your aerodrome flight guide and seek out places that are worth an overnight stay. Places with action, nightlife and good hotels. Not for you grassy slopes in the middle of nowhere with bed & breakfast accommodation offered by an old farmer who only has sons that he wants you to share a bedroom with, contrary to all the farmer’s daughters jokes that you have heard.

After a while the call of big airports and landing on a two-mile long runway bores you. You miss the challenge of landing where success is not a guarantee, where the skills that you learnt as a student can be tested, where your brain could be pushed to the limit by sudden and illogical landing requirements...

Then you need to fly to Exeter, in the glorious county of Devon, England. Make sure that the wind for your visit favours the 08 runway (or for an extra special thrill arrive on 08 and depart on 26) and that you are in a single engine piston aircraft. Ensure that you study the NOTAMs first (as we all do) and follow the logical instructions laid out as follows:

NNNNZCZC RPT153 031237 GG  
EGTEZGZX 031235 EGGNYNYX  
(CO407/04 NOTAMR C0406/04 Q)  
EGTT/QMRXX/IV/NBO/A/000/999/  
5044N00325W005 A) EGTE B)  
0402031235 C) PERM E) OPERATORS  
OF SINGLE ENGINE PISTON  
AIRCRAFT ONLY

1) FOR ARRIVALS TO RWY 08: FOR SINGLE ENGINE PISTON ACFT THE THR OF RWY 08 IS DISPLACED BY 1173M AND IS NOT MARKED. INTERSECTION OF RWY 08/26 AND

DISUSED RWY 13/31 MAY BE USED AS A GUIDE. RWY 08 DEP ARE NOT AFFECTED.

2) FOR DEP ON RWY 26: FOR SINGLE ENGINE PISTON ACFT THE LENGTH OF RWY 26 IS 900M FROM THE EXISTING THR. INTERSECTION OF RWY 08/26 AND DISUSED RWY 13/31 MAY BE USED AS A GUIDE. RWY 26 ARRIVALS MAY USE THE FULL LENGTH.

AD-2-EGTE 1-8, PARA 6 REFERS) [There doesn’t seem to be a ‘(‘ before the) to add to the confusion.]

So for you cocky pilots who boast an instrument rating, and who doesn’t eh? Try the same airfield at minima. Those that do, and succeed with a successful landing, may apply for an official PPL/IR Europe Bolloms Dry Cleaning voucher (due to demand these will only apply in respect of brown corduroy trousers used without bicycle clips).

031246 EGGNYNYX (CO408/04 NOTAMR C0394/04 Q) EGTT/QPOCH/IV/NBO/A/000/999/5044N00325W005 A) EGTE B) 0402031246 C) 0404022359

E) INCREASED MINIMA APPLICABLE TO SINGLE ENGINE PISTON ACFT ONLY

AD 2-EGTE-8-2 LLZ/DME/NDB (L) RWY 08 OCA (H) 700 (602)

AD 2-EGTE-8-3 SRA RTR INM/2NM RWY 08 OCA (H) 700 (602)

AD 2-EGTE-8-4 NDB (L) DME RWY 08 OCA (H) 700 (602)

SINGLE ENGINE PISTON ACFT NOT AUTHORISED TO/PROHIBITED FROM FLYING AD 2-EGTE-8-1

ILS/DME (L) RWY 08 INSTRUMENT PRECISION APPROACH IN TOTAL RESTRICTIONS AND INCREASES

DUE TO PUBLIC SAFETY ZONE REQUIREMENTS. PLEASE NOTE NEW VISUAL APCH AND LAND PROC IN FORCE FOR SINGLE ENGINE PISTON ACFT ONLY)

B) 0402021400 C) PERM E) RWY 08 IS NOT AVAILABLE FOR LANDING OF SINGLE ENGINE PISTON A/C AT NIGHT

P.S. Flying over the displaced threshold at 2.54cm for 1173M is permitted for those who really want to test their skills.

## *Transition Altitude on the up?*

According to the Eurocontrol ATM Procedures Development Sub-Group TAFG (? entries on a postcard please)

Update in January, France is studying the airspace structure of the Paris TMA including possibly raising the TA and the UK is proposing to raise the TA to 6000 ft in all airspace. As ever trying to please all sides, Switzerland is continuing to explore changes with Germany and France in common border areas.

## *Aviation safety: naming and shaming*

According to the Airports Council International E-Communiqué, European Parliament and Council representatives to the Conciliation Committee have reached agreement on safety rules for aircraft from non-EU countries using Community airports. Under the new legislation, standardised EU-wide inspection procedures will prevent non-EU aircraft from diverting to different airports within the Community as a way of evading safety checks. Most relevant following the recent Sharm-el-Sheikh fatal accident, passengers will be able to find out whether their flight is being run by an operator with a dubious safety record. EP rapporteur Nelly MAES (Greens/EFA, B) said: “One cannot help but ask whether those poor people who boarded flight FSH 604 [Flash Airlines] would have been quite as willing to do so had they been fully aware of the airline’s safety record and the aircraft’s history”. In addition, non-EU aircraft can expect to be grounded and their crews may face inspections if there is good reason to suspect that safety rules are being flouted.

A key demand of Parliament, accepted by the Council as part of Tuesday’s agreement, is that air carriers from non-EU countries will be ‘named and shamed’ throughout the EU if they fail to meet international safety standards. Under the new Directive, the Commission must publish an annual report analysing the information gathered through controls conducted by the Member States, and the Council has accepted Parliament’s wish that the report should be made available to the general public and industry stakeholders. It must be simple and easy to understand and indicate clearly whether a non-EU air carrier is regarded as safe or not. The European Commission will now have the power to extend safety measures taken by one Member State to the whole Community (for example if an airline is banned or subjected to special conditions of operation).



*Scaramouche, will you do  
the Fandango Thunderbolt  
and lightning, very, very  
fright'ning me (Galileo)  
Galileo (Galileo) Galileo,  
Galileo*



I don't know if Freddy Mercury was a PPL with an interest in the EGNOS/Galileo project but if not it was somewhat spooky that he wrote a song about the financial atrocity so early into its conception. Those readers old or patient enough to follow my rantings on the subject will know, if they read other aviation publications, that I appear to be the only person against it (that excludes pilots because it is still a theoretical Navaid so doesn't bother real people) and the airlines have expressed positive disinterest. However, my ranks have been swollen following the AEA-EC Meeting on EGNOS/Galileo held in Brussels on the 4th February 2004.

To fill in a bit of background: "The European Union (EU) and European Space Agency (ESA) have jointly decided that Europe develops, funds and operates a multi-modal satellite navigation system, called Galileo, planned to be operational from 2008 and to be independent from the US GPS. Galileo is expected to cost approximately 3.6 billion Euro and its annual operations costs are estimated to 220m Euro/annum. The initial development phase (One billion Euro) will be funded from public EU and ESA budgets but for the next phases of the programme a public-private partnership will be set up. In this context the aviation community has been targeted as a potential source of financing." New financial victims are required because the EU member's countries have set limits on what they will pay towards the project (invoking white elephant budgetary restrictions) and the companies who have been given the contracts to create the folly are only willing (very sensibly) to invest less than they are to get back.

So, the EU and manufacturers agree that the project exceeds financial sensibilities but as they are so far into it, they really have to keep pushing it forward, or lose face.

The meeting in February followed up the AEA/IATA/ERA/IAOPA Position Paper on Galileo (1st July 2003) and Giorgio Solari (Galileo JU) made a presentation on the status of the Galileo and EGNOS programmes. He stated: "EGNOS is a first generation wide area augmentation system to GPS, which is jointly developed by EU, ESA and Eurocontrol. The Commission reported that the ESA plans for the Operational Readiness Review (ORR) of EGNOS for the first semester of 2004. It was reported that EGNOS would provide primary means of navigation down to APV-II. Now that the decision has been taken to develop Galileo, the Council has decided that EGNOS should be integrated into Galileo (once operational). Public funds will be provided to pay for the initial operations costs of EGNOS (until 2008) and the Council has also decided that EGNOS should be certified for civil aviation use.

With regard to EGNOS, the airlines/AEA are reminded that they have disassociated themselves from the EGNOS project as early 1997, due to the lacking benefits. Despite this opposition, a number of ATS Providers, by abusing their monopoly position, have invested approximately 100m Euro in the development of EGNOS and have recovered those investments from the airspace users through the route charges (despite the lack of benefits). [Meow – Ed] The airlines/AEA reminded that they expect appropriate action to be taken at the political level to reimburse the airlines for those 100m Euro invested by ATS Providers in EGNOS."

Andrew Shand, Manager ATC Performance & Projects at British Airways outlined that it would, from a cost/benefit point of view, be foolish to require airlines to equip with EGNOS, whereas similar benefits could already be achieved with existing aircraft equipment (Baro VNAV) at no cost.

Mr G Wilson (DL) reported that despite the fact that the US equivalent to EGNOS (Wide Area Augmentation System (WAAS) – which (unlike EGNOS) is entirely funded by the US taxpayers) is already operational, no US airlines are planning to equip for WAAS due to the lack of benefits.

Mr Solari continued with various pro-Galileo points of little substance or interest but my ears and spirits perked up when Vincent De Vroey (Manager Ops & ATM Association of European Airlines) introduced the airspace

user position stressing that the airspace users are, generally speaking, very positive towards the potential of GNSS, of which Galileo could form a part. However, the airspace users have several concerns, which need to be solved. In particular:

- the fact whether or not GNSS could become the sole means of navigation is not yet proven from a technical/safety, institutional and cost/benefit point of view.
- Airlines are not interested in "technology for the sake of technology" but request the introduction of new beneficial operational applications for which the right (most beneficial) technologies will have to be selected. In this context GNSS is just an enabling technology which could potentially be used for new operational applications.
- the added value of the Galileo Safety of Life Service is questionable for aviation users (*search & rescue*).
- the PwC Galileo Business case study is seriously questioned and should be withdrawn [Here – here. Did they seriously expect a case study commissioned by Galileo to come out against it? – Ed].
- the airspaces users are, in the present charging system of 100% cost recovery, strongly opposed to ATS providers joining the Galileo PPP since ATS providers do not take any commercial risk and can not be seen as 'private investors'. In this context reference was made to the 'EGNOS experience', which should be avoided (ATS providers investing 100m Euro and recovering those investments from the airlines despite lacking benefits). The Commission was requested to take this into account when selecting the consortium.

Andrew Shand continued by outlining that the transition costs (retrofit of in-service aircraft) are also potentially very high, which should be taken into account in any business case. The Commission acknowledged the concerns of the airlines and promised to take them into account. All found the meeting very useful and it was agreed that this type of exchange should be continued in the future.

So in conclusion Galileo proceeds apace despite the existence of a fully functioning and effectively free U.S. sponsored satellite navigation system. I still dream that the project will be quietly dropped and the 3.6 billion Euro used to end poverty in the world, or invested in cancer and AIDS treatment. Naïve? Unfortunately... yes.



two-year transition period whilst welcome in principle should be extended to three years to coincide with the current date for introduction of basic Mode S for all aircraft in VFR airspace. The low usages exemption proposed is for an average of 30 hours per annum in the mandated airspace; we have proposed this should be 50 hours per annum.

However we have also been having an interesting debate on the need for Enhanced Mode S in aircraft of above 5,700 kg or 250 KTAS (note it is True airspeed rather than Indicated airspeed). By such a limit on airspeed a number of aircraft are "caught" by the requirement that would otherwise not be e.g. Twin Aero Commanders, King Airs, MU-2s, Conquests, PC-12s etc. Much regulation uses Indicated airspeeds for control e.g. ICAO holding speeds. True airspeeds are not in POHs whereas Indicated airspeeds are the determining speeds. It is also the case that many such airframes will not be capable of fitting Enhanced and the cost alone will render it an uneconomic proposition. We hope the continuing

discussion will resolve this aspect satisfactorily.

As to Basic Mode S proposals for aircraft of 5,700 kg or less and a maximum true airspeed of 250 kt or less, we are supportive of the proposal subject to the amendment of the low time access limitations and three-year transition period.

The proposals include establishment of a central Mode S Exemption "cell" for granting of exemptions covering most of the UK and mainland Europe. It is clearly essential that owners/operators can apply for and be granted such exemptions well in advance of the current 31st March 2005 deadline for the introduction of the regulation. Bearing in mind the lead times for installations it is essential this aspect is dealt with expeditiously. As the proposed regulations still have some way to go before being adopted this seems another good reason to allow a three year transition period rather than two years.

We shall keep members advised of progress on the above three proposals via the web site and/or future issues of IP.

Paul Draper, Chairman PPL/IR Europe



The PPL/IR Europe AGM will be on 1 May 2004 at Niederrhein (EDLV), Germany.

Arrivals during the morning (airport requires PPR for UK arrivals but I will complete necessary forms from your application form to ease this minor burden).

Both VFR and IFR flights are accepted with a radar service available from Langen Radar. IFR plates are on the EAD site. All landing fees will be at first 'band' (up to 1,000 kgs) regardless of aircraft weight. (This should work out at around Eu25 including handling plus Eu5 overnight parking.) Fuel will be available.

- 12:30 Buffet lunch in airport terminal cafe/restaurant
- 13:30 AGM (in Officers Club 800 yards away but we will be taken in a coach)
- 14:30 Coffee/tea
- 14:50 Guest Speaker - Hr Goernemann - Deputy Chairman and Chairman Elect of the JAA Committee for Communications, Navigation, Surveillance and Air Traffic Management.
- 16:00 Guided tour around airfield (by Coach)
- 17:00 Finish

The coach will drop off those departing at airport and take others direct to their hotel in Kevelaer about 5 miles away (as required).

Kevelaer is a pleasant town with a large pedestrian area. We have provisional reservations at a couple of reasonable hotels thanks to the handling agent at the airport (early booking will be needed to secure these rooms).

Please contact Ian Chandler for more information (Email: [meetings@pplir.org](mailto:meetings@pplir.org) or tel: +44 795 781 2523).

### Application Form

#### AGM - Niederrhein – 1 May 2004

I would like to attend the meeting on 1 May 2004

Name: .....

Email address: .....

Tel number: .....

Arriving by Air/Car?: .....

If arriving by air:

Aircraft registration: .....

Aircraft type: .....

Max TOW (kgs): .....

Arriving from: .....

ETA (date & time): .....

ETD (date & time): .....

Fuel required? Y/N: .....

(if yes, Avgas or Jet A1 and approx how much, in litres): .....

Names of:

Pilot .....

Passengers .....

.....

.....

If arriving at EDLV from UK, passport no. and date of birth of

all on board is also required.

Hotel required? Yes/No: .....

If yes type of room: Double, Twin or Single?: .....

(Further details of the hotels available will be supplied on receipt of this form)

Please email above details to [meetings@pplir.org](mailto:meetings@pplir.org) or fax this form to +44 1702 354488

For further information telephone +44 795 781 2523.



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**PPL/IR EUROPE**

is open to any pilot interested in the operation of light aircraft under IFR in Europe. The annual subscription is GBP30 and more details are available from the Membership Secretary.

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avoidance system God gave each of us) to glean the maximum amount of information available from an airborne radar system. One other word of advice: Very few light twin aircraft have good quality radomes (*a housing for a radar antenna; transparent to radio waves*). Most original equipment manufacturers provide a fibreglass nosecone... it isn't necessarily a good radome! In my experience, Norton / St. Gobaine makes the best radome for a Commander, but you can expect to pay over \$10K for even a good re-conditioned one. Specifically, look for something that has the geometry for a 12" flat plate antenna (approx 40% more gain than a 10"), as well as proper honeycomb construction for good RF transmissivity. The world's best radar isn't worth 10 cents if you don't have a good radome! There are a few large aircraft radars that also have a Doppler feature. Today, they can actually 'predict' turbulence but only out to about 10 miles ahead. Maybe we will have them added to light aircraft radar systems in the next 10 years or so.

### Stormscope

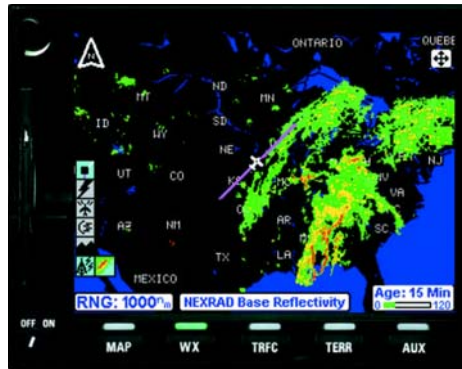
A Stormscope's recommended use depends whether it is stand-alone (then it should be used only as a strategic avoidance tool) or, if it is used in conjunction with either the two above technologies (then it can be used collectively as tactical tool). A Stormscope plots electrical activity on the display only, presenting the pilot with azimuth and pseudo-range (it uses algorithms to calculate and plot range as a function of RF strength of the static discharge (lightning strike)). Since some strikes are much stronger than others (which it will plot the strike closer than it actually is), and some are weaker (plotting them further away than they really are), it can only approximate the true location of the storm cell. The later Stormscope models eliminate a good portion of the radial spread phenomena by providing a 'cell mode'. The good news



is that it has 'conservatism built in', i.e., it shows the strongest storms closer than they actually are, warning the Stormscope only equipped pilot to steer a wider deviation (which is prudent!). In my opinion, there is one thing that Stormscope predicts quite well, perhaps better than anything else, and that is moderate to severe turbulence. The reason is simple; In order to generate enough molecular friction to generate a lightning strike, you must have significant convective activity. Where there is lightning, there is usually significant turbulence! This is why I believe that a Stormscope is the ideal partner to have with weather radar.

So, there is no one single system available to the light twin owner today that gives the full, complete story. However, if you combine two, or better yet, all three of the technologies above, you have superb weather avoidance capability.

So, in conclusion, NexRad gives a comprehensive 'big picture' of the weather, Stormscope does not. If you have a schedule that permits you the luxury of total avoidance (i.e. land when things look unpleasant), then all my previously discussed limitations of the DataLink NexRad melt away.



### NexRad Value Added Services

Depending on what model & service of DataLink you purchase, you can get far more than just the NexRad map image. In fact, on my aircraft I use the METARs, pireps, SIGMETs, TAFs, Special Reports every hour, and in fact use them literally every hour, of every flight! Better yet, one little known fact is that many Automated Surface Observing System (ASOS) and Automated Weather Observing System (AWOS) only airports report into the 'system' more often than once an hour. My little home airport (Joliet - 30° SW of Chicago which has AWOS) reports into the national system several times an hour, so I can see the latest report usually never more than 15-20 minutes old. Chicago O'Hare, Midway and DuPage, my three big neighbouring airports,

only report once an hour (unless they report a Special) into they system!

Again, depending on whose model & system you select, you may soon be able to get certain other useful 'value added' services provided. One includes a national version of Stormscope for lightning detection. I understand that this is still six months away with my vendor (Bendix-Honeywell). Another very useful value added features is graphical METARs that I originally thought were 'fluff', but I now find them to be very useful. I understand that other reports are also coming, including tops reports, icing charts, winds aloft and even graphical TFRs. In conclusion, clearly the purchase of a good DataLink, display, and service provider will provide you far more utility than just a Stormscope alone (even though again I emphasize how useful I find a Stormscope myself in conjunction with a radar).

Be careful to choose only a high bandwidth system. I recommend a broadcast service (as opposed to satellite request-reply schemes), I am not a big fan of the Orbcom, EchoFlight and other slow speed LEO satellite systems... far too slow and therefore will be very limited (if not impossible) for expansion and growth to include the future value added products I mentioned above. As I stated, I have the Bendix-King with the high speed VDL Mode 2 receiver (which is a high speed ground based system). I have no trouble in getting good useable signals anytime above 2-3 thousand feet in the Eastern US and find that not having WX data on the ground before takeoff is not a big factor (that's why they have the computer in the FBO!).

Check out <https://www4.bendixking.com/static/FIS/DataLinkWeather.jsp> for more info. Another vendor that I have used (in a friend's aircraft) is the recently certified WSI through a high speed Geo-Stationary satellite (see: <http://www.wsi.com/solutions/aviation>). It too is excellent, but it only works today with a UPSAT (now Garmin) MX-20 MFD or L3 Cockpit Display or various portable tablet / pocket computers. I understand that more MFDs with WSI connectivity are coming soon, including future Garmin and Avidyne products (both who are going to high bandwidth, in spite of their previous low speed request-reply satellite offerings!) XM WxWorks also has a very attractive up & coming offering, with the widest bandwidth available anywhere (with the side benefit of also being able to provide music & news programming!)

