Introduction
Welcome to the Spring edition of the BMAA Training Newsletter. This quarterly publication is aimed at Microlight Instructors and will provide useful information and insights to the ups and downs of microlight training. Remember that this is a two way channel and we welcome and encourage you to air your comments, ideas and thoughts via email, post or via the online instructor forum.

News

Airfield Public Liability Insurance
Crispin Speers & Partners Ltd are now offering public liability insurance with a limit of £1,000,000 any one accident for an annual premium of £530.00 which is approximately 40% less than their normal price. This will only be available if there is enough interest and a bulk buy has been arranged. Contact David Bacon for more details. (David.Bacon@cspinsurance.com)

Rating Validity Extensions
All Pilot Licence rating issues, renewals and revalidations are being extended to the end of the calendar month in which they are issued. This is to align ALL ratings with European Law (now UK law) that states that the validity period of ratings shall extend to the end of the relevant month. This is a ‘once off’ to align the rating validity periods, after which all ratings should be valid to the end of a month.

The Rating Validity Extension is only to be applied at the next Revalidation, C of E, Renewal or C of T by an Examiner, it cannot be applied retrospectively to an existing rating.

We are still awaiting the CAA for final confirmation upon which an Instructor Bulletin and Guide amendments will be issued.

New Examination Papers
Some examiners have been receiving new rewritten NPPL Navigation examination papers (M13ABC) directly from the CAA. These are not the new papers that the training committee are rewriting, but the CAA’s own. Any people in possession of these papers are urged to contact the BMAA office for resolution.

Increasing incidents
There is an increasing number of pilots having incidents on start up. These involved starting accidentally with full power and no helmet or seatbelt attached. Lucky enough no body was hurt, but it does make you think to put on your gear even if you are just taxiing around the corner for fuel. If you have any incidents that are not normally reportable, then we encourage you to share them with us (don't worry no names will be published).
NPPL Syllabus Review

For those of you who weren’t present at the Instructor Seminar, the ‘straw man’ approach to the syllabus review was presented. Whilst the review was still in its very early stages in February, the opportunity to present initial thoughts to the instructor base was too good to miss! The presentation is now available for you to view on the instructor e-group – so you can refresh your memories if you did see it at the Seminar, or read in its entirety if you weren’t there.

The proposal – and it is still a proposal at this stage - is to split the syllabus into phases as detailed below.

<table>
<thead>
<tr>
<th>Phase 1:</th>
<th>Understanding the aircraft components, operation and control responses</th>
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<td>Phase 2:</td>
<td>Use of the controls to achieve basic flight attitudes</td>
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<td>Phase 3:</td>
<td>Low speed handling</td>
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<td>Phase 4:</td>
<td>Part 1 - Circuit to solo</td>
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<td>Part 2 - Performance take offs and landings</td>
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<td>Phase 5:</td>
<td>Advanced handling</td>
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<td>Phase 6:</td>
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<td>Phase 7:</td>
<td>Solo consolidation</td>
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<td>Phase 8:</td>
<td>GST preparation</td>
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<td>Phase 9:</td>
<td>Navigation</td>
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Phases, not specific exercises would be signed off by instructors (ultimately for licence application verification), although the phases and elements can still be split out by instructors to monitor progress through the phases with students – and of course, all elements within a phase must be covered.

There is a logical flow of phases, although we suggest that phases 1-3 must be followed sequentially. The later phases are appropriate for instructors to use their discretion (depending on student aptitude and operational requirements) to decide the actual order of tuition.

Since the Seminar, we have continued to work on the detail of the review. This is not a quick job, and it is important that we do it right, rather than do it fast (whilst still doing our day jobs!). We have also been gathering feedback and comments from all sources for which we thank those who been involved. A summary of feedback to date, and responses, is also provided below. Please continue to provide comments and raise points, as they are all valuable input to our process – send your e-mails to trainingcommittee@bmaa.org, or contact any of us directly.

We intend to provide you with updates of progress in the next Instructor Newsletter, however please be aware that specific detail will need to be reviewed within the Training Committee and approved by the Panel of Examiners (before finally being adopted by the CAA). So changes are not imminent, but will be properly thought through and implemented sensibly.
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<tr>
<th>Question/Comment</th>
<th>Response</th>
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<tr>
<td>Can we include an avoiding turn in the syllabus as this an absolute lifesaver?</td>
<td>Students should know how to execute a steep turn in response to a collision threat. Avoidance of a collision should be given as one of the reasons that a steep turn might be required.</td>
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<td>Should RT be included in the syllabus?</td>
<td>Since it is not a requirement that radio be used in microlight aircraft, it should not form part of the syllabus. Students learning at a school where radio is required will be instructed in its use. However, many schools are based at airfields where there is no provision for radio and some pilots have no desire to fly in areas where radio is required.</td>
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<td>Wouldn’t it be nice to align the microlight syllabus with the GA syllabus and have common exercise numbers?</td>
<td>The microlight syllabus is a stand-alone document which has been developed specifically for microlight flying. The emphasis placed on a given exercise will not necessarily be the same for microlight and SEP students.</td>
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<tr>
<td>What exercise will be covered during an FI revalidation if the syllabus relates to phases?</td>
<td>The elements within the phases (e.g. 1c) will be equivalent to exercises, which will either stay as they are now or be redefined.</td>
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<td>It would be impossible to include use of GPS in the syllabus because it would soon become out of date. How would different systems be covered?</td>
<td>Only general guidance could be included in the syllabus. This would include basic principles, advantages, disadvantages and common errors. The content should be included in the ground syllabus. The use of specific types fitted to training aircraft would be covered as part of familiarisation within Phase 1. This would be on a ‘where applicable’ basis in the same way as radio and transponders are to be covered.</td>
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<td>At airfields where powered approaches are the norm and glide approaches can only be done when traffic and conditions permit, we may have to teach powered base/final approaches as a first task and include glide approaches as conditions permit.</td>
<td>Clearly the circuit and approach procedures should be appropriate to the airfield and should take into account other traffic. However, the importance of practising glide approaches should be emphasised. A glide approach during which adjustment is made on the base leg improves judgement and accuracy, thereby equipping students with a greater skill in the event of an engine failure. The advantages and disadvantages of different types of approach should be fully explored.</td>
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<tr>
<td>Students should be taught how to orbit.</td>
<td>At airfields where orbiting is likely to be a requirement, it should be taught as part of the airfield procedures. Orbits are only used as a contingency under ATC instruction for traffic separation. Students should be made aware of the procedure, however it is not to be practiced where there is no instruction to do so from an ATC unit.</td>
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<td>Why are engine failures not being introduced earlier in the syllabus as they are generally taught earlier?</td>
<td>Only phases 1, 2 and 3 will be required to be taught in order. Phases 4-8 do not need to be sequential and it is at the instructor’s discretion as to when engine failures should be introduced.</td>
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<tr>
<td>Could changing the syllabus affect the current microlight license recognition in other countries?</td>
<td>No, The NPPL (A) M is a national license and there is no change to this.</td>
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<tr>
<td>One exam (Aircraft Gen) is fine</td>
<td>Noted, thank you</td>
</tr>
<tr>
<td>Happy with splitting Aircraft General syllabus subjects as suggested, immaterial whether exams are split as will continue to do in one sitting, therefore in the ‘one exam’ camp</td>
<td>Noted, thank you</td>
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<tr>
<td>Suggested type specific Aircraft General exams</td>
<td>Responses on the e-group to this suggestion suggested that this would reduce the inclusiveness of all microlighting types, and also that implementation in this area would require a legislative change. No plans to progress.</td>
</tr>
<tr>
<td>One exam - Nav is most complex, extra exam cost and complexity, already have two technical exams (written and oral), no need for three in this area</td>
<td>Noted, thank you</td>
</tr>
<tr>
<td>General comment to keep theory focussed on need to know for students (although good for instructors/examiners to have more knowledge to raise their game) - less is more!</td>
<td>Noted (and working on this principle), thank you</td>
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Instructor Seminar 2014

First of all for those who came, thank you for attending the instructor seminar. It seemed to be successful and all feedback was well received. The next seminar will be held on Tuesday 10th February 2015. (Venue to be confirmed.)

For those who didn't manage to attend or even for those who did but have forgotten already, here is a brief outline of what was discussed.

**Current Affairs - Geoff Weighell**

Geoff introduced the idea of selling a 'BMAA Membership package' to schools who could then encourage new students to join the BMAA during their training immediately by issuing a card and receiving a membership number via the BMAA office.

Handouts were given out with common errors on both the NPPL Application and Medical forms. An option for electronic student records was touched upon and Geoff demonstrated a Microsoft Excel spreadsheet which had been constructed to help future applications. He asked for volunteers to try using it within their school on a trial basis.

The NPPL application fee has been split into two parts. One part of £100 to the BMAA and the other £51 direct to the CAA.

**Instructional Matters**

An AAIB Recommendation was touch upon prompting an suggestion that all instructors should completed a test on each type flown (Fixed/Flexwing) within a certain period. The idea would be to
carry out the test on alternate types. For example if you did a Flexwing test last time then carry out a fixedwing test this time. Obviously there will have to be some leeway for weather etc.

Fiona highlighted the issue of doing something 'special' or 'different' for the instructor test. This negates the whole point of the test, which is to look at how the instructor teaches his students.

**The Training Committee - Rob Grimwood, Sandra Reid and Mike Edwards**

The training committee members were introduced giving a brief outline of everyone's role. The remit and ongoing work was also highlighted which included Syllabus, Exams, aids to communication (Forum, Newsletter) and Mike Edwards discussed instructor liability insurance and was gauging interest in an option to bulk buy.

**New Syllabus**

Sandra Reid, Sandie Reader and Fiona Luckhurst are currently working on proposed changes to the NPPL Microlight Syllabus.

**Threat and Error Management - Mark Young**

Mark Young (CAA) gave an interesting and informative presentation on TEM (Threat & Error Management). The presentation itself has been uploaded to the Instructor Group for viewing.
Rob gave 2 briefings on Ex14. The first was to highlight common errors in preflight briefings followed by suggestions for improvement from the crowd. The second briefing was given correcting the flaws from before and to give people an idea of what FIE's are expecting in a test. We must thank Rob for his efforts as he told us that it was 100 times worse than an instructor test. Not surprising as he had over 100 instructors watching his every move!

Seminar Feedback

"I enjoyed the seminar very much and have learnt some valuable points. There was some discussion about further training post qualification. As a school operator I always feel that it is difficult for a school to tell a newly qualified pilot that it would be a good idea to part with more money. It would be very helpful if somebody else was putting these ideas forwards. One possible way could be a ‘where to go from here’ leaflet published by the BMAA that gets returned with the log book on license application. It appears our safety man, Pete Watson, is doing lots of good work in the archives and observing the most common causes of accidents. However I feel this his work is not being communicated effectively to its intended audience. Perhaps the BMAA could publish a leaflet which is also sent out with the log book highlighting common causes of accidents, based on Pete’s findings, associated with low hours pilots. A few stats, bent aeroplane pictures and extracts from accident reports could help to get the message across. Pete also talked about the large number of accidents related to a late/no go-around decision. Again perhaps we should be producing more material related to this particular area which can be passed on by instructors to students/pilots. A few years ago there was a leaflet produced to tackle winch cable accidents and it is this sort of thing I am thinking of for our go-around scenario. I always remind my students that nobody talks about go-arounds but everybody talks about accidents! Geoff talked about a package for selling BMAA memberships. As a potential retailer of membership packages it would be very helpful if we could focus on the benefits of being a BMAA member. Aaron is an example of one
such benefit, answering queries quickly and effectively. - Angus Lacy-Hulbert"

"There was mention of the BGA 'barometer' at the seminar. You can find a copy of my version of what I think was being referred to that I did a few years back (I think it even found its way into MF IIROC). [http://www.bumble-bee.demon.co.uk/Misc_info/How_safe_am_I.jpg] - Joan Walsh"

"If instructors have to sign off phases in the log book or training notes, it could create a problem in that students may have to repeat a lot of one phase if there is a long gap in training or if they fly with a different instructor (because it will not be known which parts of the phase have been covered). - Dominico". Training committee comment "These elements within phases (e.g. 2a) are equivalent to the exercises the current syllabus. These will still be recorded as part of the training."

"BMAA Membership Point Of Sale Package: Excellent idea and very easy to implement. Changes to microlight syllabus may have unintended side effects such as non acceptance of this syllabus in other countries. One flying instructor pointed out that the anomaly that the NPPL (SSEA) took quite a while to be accepted by the French, whilst the NPPL (M) pilot has not ever had a problem about flying abroad. GPS / Glass Cockpit: What is required to be done formally on the ground is familiarization of the cockpit and instrument panel with all its buttons and switches and fuses. This should be done at leisure, on the ground, with the operating handbook for the particular instrument panel, GPS or Ipad app. It can be done with peers and friends helping. - Deepak Mahajan"

Safety First

Accidents

During the last Training Committee meeting Pete Watson (BMAA Safety Office) gave some insights into recurring accidents and incidents. Areas touched upon were out of currency issues where pilots had not flown for some time and also where pilots were flying a different type than that normally flown. Some of the accidents were seen to be in the landing phase so in the next newsletter we hope to write a technical (best practice) article on possible instruction techniques to hopefully help reduce these occurrences.

Pete also commented that a summary of accident reports for microlights was available on the [BMAA accident summary webpage]

Spring is Sprung

Here follows another fictitious article to provoke discussion on the forum between instructors. We invite people to openly discuss ideas/responses on the Yahoo eGroup or email them directly to the editor which can be included in the next edition....

The approach was going well, Fred thought. Speed right on the button at 65, a trickle of power maintaining a steady glide slope, his aiming point one-third into the field with one stage of drag flap left in reserve to bring it back a bit nearer the hedge once he got closer. He was surprising himself, considering the conditions and his own lack of practice, for Fred had had a long lay-up over this past winter.

A permanently soggy home airstrip since the previous November had conspired to keep him and his beloved Eurostar (actually, his one-quarter-beloved Eurostar, for Fred was part-owner of the highly polished aluminium wonderplane so cherished by his syndicate) grounded for the last four months.

Last night had been the first time he had managed to get airborne, albeit briefly, since he was late from work and sunset threatened, but he’d made two decent enough circuits into the open 600 metre strip with the wind blowing a leisurely 5 knots right on the nose. Though solo, he’d noted a fairly heavy arrival on both roundouts, but he’d put this down to his innate rustiness, though he could have sworn he started the roundout with a respectable 65-70 mph indicated each time.
He'd tried to get his local instructor to fly with him, but Joe was otherwise engaged, so Fred had decided he would shake the rust off on his own. In any case, the Soggy Bottom Microlight Flyers were holding their first fly-in of the season on the following day, and Fred was determined to fly to the well-manicured little strip at Sprote. He'd even promised his flying buddy Max that he could fly in with him, making his mouth water at the thought of the famous Sproteburgers on offer at this popular event.

Saturday dawned clear and bright, following a cold night, and the dew was obvious on the grass at Fred's home strip. Though chilly, two cups of vacuum-brewed tea had warmed our adventurers' cockles as they pulled the Eurostar out from its semi-open hangar and Fred performed a perfunctory pre-flight check – heck, he'd only just flown it last night and he was the last to put it away, so it didn't need much checking really. No obvious dents, tyres looked OK, a quick check on the oil level, no damage to the props... yes, she'll fly Fred thought.

Max had flown with Fred before, so Fred didn't need to brief him – in any case, Max was also an NPPL (he regularly flew a Eurofox) so the two set about making themselves comfortable in the cockpit before firing up and getting the engine warmed up. At this time of the morning no-one else was active at the strip, so they did their pre-takeoff checks on the threshold, and within a couple of minutes the aircraft accelerated down the runway. As Fred lifted off, he thought the ASI was reading a little low, but the handling felt right and by the time he'd settled into the climb (which he usually made at 80 for good visibility over the nose) the aircraft felt OK and the airspeed was indicating 80.

The flight to Sprote was about 40 minutes and was relatively uneventful, though there seemed to be a pretty strong headwind against them. Arriving over their destination, Fred felt that familiar butterfly in his stomach – though always a welcoming strip and well-kept, Sprote boasted a miserly 300 metres, with more than one tree to get in the way on the approach, and a wooded hill to one side that could produce interesting conditions in a crosswind. Still, the Sproteburgers beckoned and Fred buckled down to the job in hand...

It was about a quarter of a mile out from the strip on final approach that Fred's confidence in his approach started to waver a little. Whilst his airspeed was still a steady 70, somehow the aircraft didn't quite feel as responsive as he'd expect, and as he dropped the last stage of flap and prepared to make a small dog-leg around that wretched tree that had quailed many a faint heart, Fred felt the turbulence from the hill grab a wing. Instinctively, he applied opposite aileron but the down going wing dipped even further, refusing to obey his command.

Fred recognised his mistake almost as soon as he made it. Trying to hold the nose up to maintain the approach in this critical situation was making things worse. Applying more power, and now, correctly, pitching forward, Fred regained control, lurching awkwardly past the tree and doggedly regaining a chaotic, low and rushed approach to Sprote's threshold hedge. Desperate to get over the hedge and to reach solid ground, Fred pushed the throttle almost to the firewall, then as the hedge was cleared and the runway beckoned, he rapidly closed the throttle as he found himself sailing up the strip at a more than comfortable speed. In 10 seconds it was all over... 3 nosewheel/tailskid bounces, one collapsed nosewheel, one shattered prop and two shocked aviators looking down at the base of a hedge, whilst 20 concerned groundlings ran to assist in extricating them.

Fortunately, neither Fred nor Max had suffered injury, but it was apparent that neither a chunky Sproteburger nor a warming cuppa would be able to console them over their now-mangled Eurostar.

As this pilot's biennial instructor, what would you have done with Fred on his 1-hour instructional flight?
Feedback from last month

We’ve had some interesting responses to the questions posed in the previous two editions regarding the “difficult student” profiles. Many thanks to those of you who’ve shared your ideas – keep them coming!

Firstly, the conscientious student who flew very well but was extremely nervous on nearing the ground:

One instructor reported success with a technique called EFT (Emotional Freedom Technique) – yes, I did have to google it! After listing the usual techniques that she’d tried in order to help the student overcome his pronounced fear of landing, she told us:

“One day I offered him an alternative strategy. We agreed that the next visit we'd spend half an hour to an hour away from everything else and have a confidential talk. During the talk, I introduced him to a technique called EFT (Google it). Basically we talked through each stage of a circuit and he owned up to his thoughts and feelings at each stage and I got him to ‘tap’ (Google it!) on the negative aspects. Things got a bit more intense (technical term) as we turned final and talked our way through the approach and down to the hold-off and flare. We worked on those phases and then went for a flight in the circuit. Half an hour later he was solo and never had a problem again with his landings”.

Another instructor reported success with a different approach for a student with very similar difficulties:

“….We ended up with him flying the circuits perfectly to the last couple of hundred feet and then me taking control completely but with him telling me what I needed to do and me overtly doing what he said was required. We carried on until he was telling me how and when to do things that resulted in a landing. I admit this took some time but once he was able to separate the actions required and develop an ability to sequence decisions, when I started handing control back to him he was able to do decide and act on his own. Leaving a trickle of power on to give us more time in the flare/landing phase helped as did a liberal interpretation of the whereabouts of the runway centre line until he had mastered the sequences. It did take several sessions and I would not put the technique into the manual but it did work eventually.”

One instructor commented on the need to over-emphasise control inputs in order to build new motor skills to override the student’s natural resistance to the required input. He suggested using a powered approach because:

“It gives a longer, gentler approach – with time to practice the following inputs:

1) For fixed wing training, pedal the rudder pedals. It is a helpful proactive input that works! It’s amusing and diverts tension; and they could make brilliant tail wheel converts!!
2) With flex wing training, use the bar - initially in pitch, to provide the sense of control and feedback – and reduce the fear.

A continuous control input on the approach to land means the student is doing ‘something.’ This may help to prevent the mental block and also develop a feedback loop of action and reaction. The flex wing instructor sets up a powered approach to land, with the instructor using the hand throttle and offering ‘invisible assistance,’ to achieve a landing that is a ‘none event.’ Repeat from now on with a continuous student pitch input of, bar forward and check back; then bar back and check forward – controlled by the instructor. Even if the input is inappropriate, it will occupy the nervous student.”

He also comments on the use of lowering go-arounds (suggested in the previous newsletter):

“Although a good initial technique, does not address the landing problem; after all what is being practised is just flight at a reduced height. A landing has unique problems and requirements. Too
many go-arounds may be habit forming and reinforce the student’s incapacity - leading to frustration.”

Another instructor comments:

“I try to ensure that nervous students frightened of landing only initially practise in very calm conditions. The use of glide approaches means that the student has one less thing to worry about. I try to show them that under these circumstances the aircraft basically lands itself and that all they have to do to ensure a gentle landing to try and stop it landing for as long as possible!”

Secondly, the elderly student who, after many hours, simply wasn’t progressing:

One instructor’s solution:
“Whether self employed, or semi retired, these ‘older’ guys are rarely in a rush, or counting the pennies …….. I treat our time together as leisure and pleasure time. They come to relax and enjoy the club environment… and go flying. It’s away from work and home and usually at the end of a nice drive out into the countryside. These students usually say that the above ‘package’ is why they come flying.

*Our* need for them to succeed and progress towards *our* idea of their goal is often counter productive. Instructors like to give value for money and expect student progress. This will be apparent to the student and puts them under pressure. In my view, if these gentlemen want to fly and enjoy having an instructor as their passenger, or ‘flying buddy’ – then that’s the job I am being paid for.

After I have explained and demonstrated what a circuit is for and of course several hours that are the intricacies of exercises 12 and 13, I introduce the idea of mutual cooperation by getting the student to ‘teach me,’ by telling *me* what he’s doing and why. By flying more as a ‘colleague,’ I invite them to **plan ahead** and so help to develop an aviation mindset. This seams to share the load and reduce the pressure he perceives he is under. I find they make good progress………This linguistic, proactive process builds awareness very quickly”.

And from another instructor:

“With such students, it’s important not to prolong a lesson beyond the time that it will be useful. I’ve found some elderly students can only concentrate for a short time before they start making mistakes that they weren’t making before. When this happens I stop their lesson, they have a rest and a cup of tea and if the workload and diary permits, they continue a while later when they are refreshed”.

Comment: Getting ongoing feedback from the student in one way or another seems to be a common theme. I’ve certainly found that getting the student to tell you what they’re doing is very helpful and can sometimes uncover some odd misconceptions! Regarding student goals, I once met an instructor who had an elderly student who wasn’t really concerned about getting a licence, but liked coming to the airfield for all the reasons stated above. After discussion with the student, the instructor decided that rather than persist in trying to “teach” the student, he would simply fly for fun – letting him relax and fly to other strips. At the other end of the spectrum, some students, despite being elderly and slow to learn, are very keen to stop writing cheques and to get their licence as soon as possible – sometimes with specific flying goals in mind. So perhaps the important thing is to make sure that the goals of instructor and student are aligned.

The Training Committee was asked for the official answer to these questions. The answer is that there isn’t one! It's easy to dismiss other people’s suggestions when they differ from our own ideas, so perhaps the key is to try to be both imaginative and open-minded.
"Twas the night before Christmas" feedback on last article

One instructor commented:

"I suspect Pete accidentally knocked the throttle off and thought he had an engine failure because he was rushed and not thinking. In the process of going through his emergency drills he did not attempt an engine restart which would have revealed what was going on. Tipping over was exasperated because he had allowed his wheel spats to fill with mud and reduce their ability to run smoothly. 

Accident investigation – pilot error."

Some answers from Mike Edwards (article creator)

"What were the contributing factors to the unfortunate Pete’s Xmas Eve bimble?

Well, the most obvious starting point was that of having a drink. It might only be a small part of beer and a large part of lemonade, but did you know that the 20 mg allowance on blood alcohol level is based upon the trace elements of alcohol that occur naturally in the bloodstream? A long time ago, a few young pilots at an airfield did a little informal experiment, using a sober safety pilot. They found that even half a pint (of beer that is, not whiskey!) affected their judgement and ability. In this case, it may have caused Pete to be a little less careful about his preparations and flight – and of course the early darkening evening may have rushed him through his preflight preparations.

Pete might have frowned at the muddy exterior of his aircraft, but did he check inside the spats? A build up of mud inside would cause possible acceleration problems on take off, but later in the flight, that same build up could freeze, clamping the tyres nicely when Pete touched down. Who needs sticky brakes?

Pete’s descent down from 3500 feet should have been accompanied by regular engine warming and at the first sign of roughness he should have thought “carb icing” and opened up the power. It’s easy to get complacent about our reliable 912 engines, but believe me, they can and will ice up given the right conditions, even if they have a water jacket for permanent heating. I have experienced carb icing at least 3 times in our Eurostars when I or my pupil have missed the warm-ups on a descent. Most recently, one of our aircraft got an airlock in the water system which resulted in one carburettor freezing whilst the other functioned perfectly. The engine ran and got the pilot back, but he was a little shaken by the experience.

Lastly, although Pete carried out a seemingly well judged forced landing, he failed to do his TIF checks in the last phase. With a windmilling prop and a throttle left open, that carb ice could disappear at any time, upon which the engine could fire up again at just the wrong moment, Murphy’s Law being what it is. Coupled with the accumulation of frozen mud in the wheel spats, this ruined what should have been an idyllic seasonal flight.

The occurrences in this particular report have actually happened even though they’ve been brought together in this fictionalised account. In the case of the frozen mud in the spats, I was one of the people who rushed over to the Taylor Mono aircraft to get it the right way up so we could get the pilot out. He, thankfully, was unhurt, but it taught all of us there that day a valuable lesson!"
Pushing the Envelope

by Guy Gratton

We all know the term “Flight Envelope”, but what is it? Gung-Ho pilots in films talk about “pushing the envelope”, qualified test pilots carefully “explore the envelope” and the rest of us, if we wish to live long and uneventful lives stay well “within the envelope”.

The flight envelope is the range of speeds and g-levels at which your airplane has been shown safe to operate and within which you can guarantee the continued safety of the airplane. This article is intended to show you how the flight envelope is worked out, what it means to a pilot, and finally, how it will be affected if you try to increase the weight of the airplane.

The first things that an airplane designer needs to know when calculating the flight envelope are the g-limits and something called the torsional divergence speed.

The g-limits vary according to the type of airplane being designed. If they were designing a jet fighter or an aerobatic display aeroplane he or she might pick around +9g and -4g. For a glider the maximum g is usually at least +5.3g. For an ultralight, typical g limits are +4g and -2g, which (since nobody in their right mind would want to pull more than 4g in an ultralight) are almost universal. Before flight, the airplane wings (and other bits) are tested to these g-limits plus a 50% safety factor by loading them up on the ground. That means that for a 4g ultralight, the structure should have been been tested to at least 6g without breaking (or at least only bending a bit) at the maximum take-off weight.

The torsional divergence speed ($V_{div}$) is something calculated at the design stage and is the speed at which the wings will fall off when you fly much too fast. The designer then wisely applies a safety factor to this to provide him with the design diving speed ($V_d$ or sometimes $V_{df}$) which is the fastest he’s prepared to let anybody fly at.

Armed with these pieces of information, the designer can then give the test pilot a diagram like this, which is his initial flight envelope.

Now this is a useful starting point for the test pilot and it gives him enough information to, very carefully, explore the airplane’s handling up to a (hopefully) safe maximum speed. Occasionally the airplane’s handling turns out to become too poor at some high speed below $V_{div}$, in which case the test pilot and designer will between them agree a lower value of $V_{div}$. However, the envelope is still far from complete because it’s obviously absurd for the airplane to pull 4g (or even stay flying) at, say, 10 mph. So another thing the test pilot will be doing is testing the stall speed. Once the stall speed at the maximum weight is known, this can be added into the flight envelope. The way the designer does this (because they’re clever people and can do maths) is to say:-

![Diagram of Flight Envelope](image-url)
1. The stalling speed at 1g at the maximum take-off weight is $V_s$.
2. But lift, $L = \frac{1}{2} \rho V^2 S C_L$. ($\rho$ = air density)
3. Since at stall and 1g, lift = weight and $C_L$, the lift coefficient = $C_{L\text{max}}$, the maximum lift coefficient; we then get $W = \frac{1}{2} \rho V_s^2 S C_{L\text{max}}$.
4. If we re-arrange all of this, I can say that the stalling speed at any g loading is proportional to the square root of the speed with $V_s$ being at 1g.

The designer then re-draws the diagram with a stalling speed curve on it. At the same time, because only test pilots are supposed to fly right up to $V_{df}$, a safety factor gets put into the top speed and a slightly lower speed, $V_{ne}$, gets put onto the diagram. So, we get (nearly) the final flight envelope.

![Stalling Speed Diagram](image)

This is nearly the full flight envelope, and the airplane can be flown anywhere within the dark box on the g-Airspeed (often called V-N) diagram quite safely. However because the designer’s a clever chap and can not only do maths, but understands aerodynamics as well, there are a couple of extra tricks to get through before finishing.

Firstly the designer looks at the lift equation and spots the term $\frac{1}{2} \rho V^2$, sometimes called dynamic pressure. Conveniently this is the quantity that is really measured by an air speed indicator (ASI). So, the diagram can be changed to read “Indicated Airspeed” and only one diagram is needed and not one for every height (since the air density, $\rho$, changes with altitude).

Finally the designer thinks about the top right hand corner of the graph, where if the pilot tried hard enough they could pull more than 4g and possibly bend the wings - an action which both pilots and engineers are agreed is a bad thing. On the left hand side of the graph, this wouldn’t be possible because the wings would stall before enough g could be pulled to break them. So the designer calls the airspeed at which the airplane would stall at 4g (the top left corner of the graph) the manoeuvring speed, or $V_a$. He or she then inserts a note in the airplane handbook telling pilots that they should not use full control deflection above $V_a$ since that could damage the airplane. And finally, we have the final flight envelope, which gives the stall speed(s), never exceed speed, g-limits and $V_a$ - the manoeuvring speed. And it looks like this:-

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Having done all of that, and to keep things simple for the pilot who’s far too busy to remember different limiting speeds for everything, the designer will also ensure that any other primary controls (such as ailerons or a rudder on a 3-axis ultralight) are stressed to take full deflection up to the same manoeuvring speed - which is why most airplane manuals refer to $V_a$ as the “Maximum Speed for full deflection of flight controls”. Flaps, if fitted, are classed as a secondary control and may have a separate maximum speed, usually called $V_F$.

What about the weight?

The normal flight envelope given in an airplane manual is based upon the maximum take-off weight - let’s say in this case it’s 250 kg. As the weight reduces it becomes more and more safe because loads upon the wing at any given g-level are reduced. In ultralights, although it’s possible to define several envelopes for different weights - it’s normal to use only the one, safest envelope. BUT - if you increase the weight then this envelope becomes less safe. A 250 kg airplane flying at 290 kg would have its 4g limit reduced to less than 3½ g. In the same airplane $V_a$ would reduce by about 15% and the stall speed would increase by 8%. All of this would usually reduce the safety factors below a level should be properly considered safe.

This does mean that unless you wish to re-do all of the load tests yourself on your 250 kg ultralight to show that it is good for 290 kg at 6g (and risk breaking it in the process) you should really stick with the current maximum weight until you buy a new airplane which is rated for a higher weight.

"Coriolis Effect“ feedback from John Bradbury

The Coriolis YouTube videos are excellent, and I have no problem with the essence of the content and explanation. The concept of rotational velocity is what we need to get across to the students, particularly as Cosgrove’s explanation is only good for movement (object or parcel of air) south from the north pole and north from the south pole. In Cosgrove’s “Pilots Weather”, he incorrectly states (page 29) that any movement towards the north (regardless of hemisphere) will always be anti-clockwise. The anti-clockwise deflection will of course only apply to the southern hemisphere and apply for movement both north and south.

Now to my issue. The concept of rotational velocity holds good for a parcel of air starting its journey either northwards or southwards; but what if the parcel of air starts its journey directly east or west? In this scenario, the ground over which the parcel travels, will have the same rotational velocity and consequently no angular deflection. In all explanations/examples I have seen or read, the high and low pressure systems are displaced at different latitudes; but what if the systems are displaced on the same latitude?

Reply from Geoff Weighell: "John is of course correct that where an area of lower pressure exists any flow from the same latitude will initially have no rotational force. However as the area of low pressure will also have higher pressure directly to the north and south of it the airflow towards the low pressure will come from all sides, not just along the same latitude. As soon as the other flows begin they will create the turning force which will then be applied to the parallel flow too."
Final Matters

Next Issue

The next issue of 'Microlight Training' will be published in July 2014. If you have any questions, ideas or an article you would like publishing then please do not hesitate to contact me directly at editor@microlighttraining.co.uk

Your Training Committee

We have been asked for details of who contributes to this newsletter and what roles other members have. Here is a summary list below...

<table>
<thead>
<tr>
<th>Name</th>
<th>Duties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simon Jeffrey</td>
<td>Editor of Newsletter and working on new Air Law Examinations. Also looking at ways to keep the BMAA instructors informed and up to date on current issues.</td>
</tr>
<tr>
<td>Sandie Reader</td>
<td>New Syllabus sub committee and also working on Air Law Examinations. Producing various articles such as &quot;Are we being imaginative enough&quot; in the last newsletter.</td>
</tr>
<tr>
<td>Angus Lacy-Hulbert</td>
<td>Working on Meteorology Examinations.</td>
</tr>
<tr>
<td>Deepak Mahajan</td>
<td>Helped organise last instructor seminar and and mini seminars for instructors to practise briefings. Working on remaining new examination paper questions.</td>
</tr>
<tr>
<td>Sandra Reid</td>
<td>New Syllabus sub committee.</td>
</tr>
<tr>
<td>Mike Edwards</td>
<td>Promoting safety articles within the newsletter such as 'Spring has Sprung'. Also working on Human Performance and Limitations Examinations</td>
</tr>
<tr>
<td>Rob Grimwood</td>
<td>Chairman. Working on Aircraft Technical Examinations.</td>
</tr>
<tr>
<td>Fiona Luckhurst</td>
<td>Vice Chair. Working on New Syllabus and liaison with panel / CAA.</td>
</tr>
<tr>
<td>Paul Dewhurst</td>
<td>Working on Aircraft Technical Examinations and safety articles.</td>
</tr>
<tr>
<td>Dave Lord</td>
<td>Working on Meteorology Examinations.</td>
</tr>
</tbody>
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Links:

- BMAA Knowledge Base: [http://faq.microlighttraining.co.uk](http://faq.microlighttraining.co.uk)