General Aviation Unit

E Conditions Final Consultation Comment Response Document

CAP1353

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Background

This is a comment response document following the final consultation on the proposal to allow the operation of experimental aircraft under E Conditions, CAP 1220.

The final consultation took place between Thursday 23rd July and Wednesday 19th August 2015.

Consultation Responses

Commentor:	Respondent No. 1
Comment:	You may like to consider the addition of a 'purpose to fly' of 'Sales and Market Evaluation'. This would make it possible for a magazine aviation journalist to fly the aircraft either as the pilot, if suitably qualified/competent or as a passenger/co-pilot for the purpose of 'market evaluation'. Flying a 'journalist' as part of the 'test team' is not really a comfortable thing to do and if shove came to push would be difficult to justify/prove….at the subsequent enquiry!! This would give valuable commercial feedback to a company as to how the market would/could receive their aircraft/modification etc. A simple flight time limit could be placed on the aircraft, say 40 hours prior to being allowed to carry members of the 'press'! If my memory serves me right I believe that the FAA have a similar classification in their 'experimental' category and we used this whilst operating the Europa US company demonstrators.
Authors' Response:	Chapter 4 – 'Demonstration of the Aircraft' addresses this issue. To include flights for sales and marketing purposes would require additional airworthiness assurance which goes beyond the intent of E Conditions.

Commentor:	Respondent No. 2
Comment:	I attended the RAeS conference last November and commented on the proposal at the time. As the owner of a consulting firm which has specialised in aircraft development and certification (previously CAA DOA DAI/1828/01) I have first-hand experience of the limitations within the current system. Now the CAA has seen sense to initiate UK Experimental E-conditions we should lose far fewer innovative and technologically important projects to the US and mainland EU. One concern I had regarding the A8-26 organisation, our experiences in getting modification through the LAA (PFA) in the past were universally slow and requiring more information

	than the equivalent Mod submitted via the DOA route. However, I am a participant in the first professional Experimental E-Conditions project (Mr Mark Hales is the Competent Person) which is being granted to him after a consultation and interview with Francis Donaldson of the LAA. So it appears this hurdle at least is now negotiable without delay. The acid proof of this will be a potential requirement to examine the project dossier, which I suspect the LAA will insist on doing. I have noted that Method 1 – RAeS route requires full membership and CEng status, which I will now pursue as a mid-term objective in order to initiate and become a Competent Person for other projects.
Authors' Response:	Comments noted.

Commentor:	British Gliding Association
Comment:	The British Gliding Association fully welcomes and supports the concept of a UK national Experimental Category for use in experimentation and proof of concept evaluations for all light aircraft in UK. In the case of pure sailplanes, within our delegated airworthiness system, the BGA has historically operated such a system concept, applied to nationally registered sailplanes under our management. The BGA views the proposed system as proportionate and sensibly risk based. Our Technical Committee has been involved in the development of these proposals and the BGA would expect to take up the practices of this well formalised approach, for application to UK registered sailplanes. In future, for wider applications to SLMG's and tugs, we expect to be users of this new approach. We would further note the lack of such a system within EASA regulations, which we find regrettable. Our only view of principle is that is regrettable that this remit for limited experimentation cannot be used to deliver concepts to market without the full application of the full airworthiness and design qualification system. Sport aviation has thrived on developments by individuals and small groups of inventors,

	and it is disappointing that this kind of enthusiasm cannot be promoted further. An extended option for continuing certification of such embodiments on a one-off, or even Permit to Fly basis, for sporting/non-commercial applications would be welcome.
Authors' Response:	Comments noted. EASA are aware of the CAA's E Conditions proposals and are considering their position.

Commentor:	Respondent No. 4
Comment:	As requested by your letter dated 23 July 2015, the aim of this letter is to comment on CAP 1220, Operation of experimental aircraft under 'E' Conditions. The process to be followed to operate an aircraft under E Conditions has been detailed in Chapter 7 for new aircraft and for aircraft with existing P to F and C of V. It is considered likely, however, that there will be a high number of instances of people/organisations wishing to fit e.g. different engines to aircraft as part a major rebuild of an aircraft to an otherwise approved design. Such an aircraft may have a P to F but will not have a C of V. They should, however, follow the process chart for aircraft that do. The aim of all flying conducted under E conditions should be to get the aircraft to the point where the formal approval process should find nothing new or untoward. This suggests that the flight test programme developed by the competent person should cover all the test points that e.g. the LAA would conduct during their subsequent testing. An understanding of the testing process that the LAA would conduct for an aircraft modified by e.g. the fitment of a new engine would therefore be useful. When considering the modification, as noted at Chapter 6 para 2, the competent person should not work in isolation (unless they wish to do so) but should sensibly consult with those who could usefully contribute, especially those who have undertaken a similar process before. As the LAA have hitherto been on the critical path for all such modifications, it is considered that all but the most experienced competent

	person might want to take their advice. From both of the above points, it would appear logical to involve the LAA in informal discussions before completing the dossier; the question then remains as to how that can be achieved in a timely and effective manner. That discussion would essentially be centred round a review of relevant historical information of what has been done before and from which pertinent information could be gleaned. In other words and following the previous example, what test flying would the LAA call for when looking at a new aircraft/engine combination? The meaning of Chapter 6, para 5, 2nd sentence is unclear, especially with regard to the differences that need to be reconciled. Chapter 1. No comment except the CAA will have to show some flexibility to fine tune these conditions as they develop over the following few years. We hope that everything will not be 'cast in stone', as we don't know how things will develop. Chapter 2. Limiting the 'E' conditions to **UK Registered Experimental Aircraft** only is a big mistake. For example: **Orphaned aircraft**. Limiting the modifications to permit aircraft will reduce a large part of the market to work under this system. IE, it needs to extend to those EASA aircraft that are orphaned, such as Jodels, Robins, Stinsons and Seabees etc. There are a vast number of excellent older aircraft in the market that would be ideal candidates to modernise. If you wish to limit the E Conditions to permit aircraft only, a mechanism needs to be in place for these orphaned aircraft to be incorporated into the LAA, quickly with the minimum of fuss. **EASA Aircraft**. To take this point further, why can 'E' Conditions not be extended to mods on EASA aircraft? IE, over the previous five decades, STCs have been issued on Cessnas, Pipers etc. If an organisation has the expertise, why would they not be permitted to develop more STCs under the

	‘E’ conditions, allowing updates / modernisations to aircraft? This would open up another large market to the UK and develop our skills and reputation internationally. **Imported LSA / Experimental aircraft** from the US etc. Again, a huge market of proven aircraft from the US but not permitted within the UK, for no apparent reason. We assume these will be allowed under ‘E’ Conditions, given they will have a track record and be less hazardous than a new design that has no proven record. Chapter 3. Where is the ‘declaration’ form and what are the fees? They are not easy to locate on the CAA website and for an SME will not be such an issue, but for a retired person, funds may be limited. For the dossier, can the CAA / LAA issue guide lines and / or copies of previous flight tests? This will give a clear indication what, as regulatory bodies you will be looking for, when the mods go in for full certification. The risk assessment example is not sufficient in our opinion. We will provide a more comprehensive numerical sample we would prefer. This will be based on those we have been using for the past 30 years within the construction industry, which has a worse safety record than GA! Chapter 4. The exclusion of ferry flying is not acceptable to SMEs. If, after extensive testing and a range of comprehensive flight tests, a one-off ferry flight, for example to an airshow should be acceptable, assuming a detailed risk assessment is carried out correctly and agreed with the competent person. Could this not be determined on each individual case, as few will be needed per annum but it is critical for sales and marketing? For example, to fly an aircraft to Sywell for Aero Expo or the LAA Rally the day BEFORE a show opens to avoid risk to the general public. Chapter 5. Why only ‘G’ Reg if the C of A or Permit is suspended? (see Chapter 1). As the aircraft in question will be only flying within

	a restricted area determined under the risk assessment and without any standard certification, flying for example an 'N' reg aircraft will incur no more risk than a 'G' reg. This condition may also rule out any and all aircraft from outside the UK as we will have to go through the process of reregistering to the 'G' reg, which may not be possible if the LAA decided to block this route. This ruling is illogical and will stymie development of GA in the UK, unless we can register ANY aircraft onto the 'G' reg, regardless whether the CAA or LAA ultimately accept this into the UK. Chapter 6. 'The Competent Person' appointment system is fine, but it will be hard to find persons of sufficient calibre to fulfil the need. We are fortunate to have our own already, but this will not be the case for most organisations. 'Encouraging' the Competent Person to refer back to the outside sources for information is acceptable, as long as this is not interpreted as an 'instruction' to refer back to the LAA / CAA. This will grid-lock the process again, as it does at present. While we are happy to seek advice from anyone, the tardiness shown by the LAA in previous years would naturally exclude having to rely on the LAA for advice and information. Chapter 7. In reference to chapter 5 comments, if **Form CA1** is used, will the CAA register any and all aircraft to the 'G' reg, even if new to the UK? This will allay our fears as outlined previously. Please confirm the 'calendar duration' of 12 months applies to the test flying, but not from the start of the project. We assume for the design, calcs, construction etc. is outside the 12 month period stated. Chapter 8. On page 22, reference is made to 'wing, rotor'. Can we assume that 'E' conditions are available for development of helicopters and autogyros in addition to fixed wing? Regarding risk, it is understood that risk to 3rd parties need to

	be minimised, but we feel this should also apply to the test pilot. This has been agreed with our 'Competent Person'. The rest of the dossier is understood. We feel the ICAO 'Safety Risk Table' can be improved by apportioning numbers, not letters to the 'Severity' table. This gives a numerical value when set against the 'Probability' table. A numerical limit can then be apportioned before and after the implementation of control measures. It is a simpler means of determining any particular action. Chapter 9. Can the CAA specify the maximum time taken in issuing a response or letter of acknowledgement? The problems with GA to date has been to excessive delays in any response from the regulatory bodies. Waiting weeks (or months) is not acceptable for a response. Chapter 10. This is understood but a minimum height requirement, i.e. 3000 AGL may encourage a more responsible approach during the flight testing. Chapter 11. This is understood and agreed. Chapter 12 Please issue previous examples of a Flight Test Programme to indicate the flight envelope the CAA, LAA and BMAA consider appropriate. These must exist and will assist in meeting any future requirements for certification. Chapter 13. This is understood and agreed. Chapter 14. This is understood and agreed. Chapter 15. This is understood and agreed.
Authors' Response:	Chapter 1. Comment noted.

	Chapter 2. E conditions is for experimental flying for a limited period rather than for modifications which should be made through the existing certification route. EASA aircraft are not precluded from E Conditions; however, EASA should be consulted for advice as there could be problems reverting such an aircraft back to an acceptable EASA standard. For the orphaned EASA types, these aircraft may be able to transfer to a National Permit to Fly (given the agreement of EASA and CAA) and would become eligible for E Conditions. It is already possible to import a US Experimental aircraft into the UK but it would need to be UK-registered and obtain a Permit to Fly for normal operations. Such an aircraft could, once on the UK register, be flown under E conditions for a limited duration if it was being flown for experimental purposes. Some may even come under the SSDR rules and therefore be completely deregulated. Chapter 3 / Chapter 12 The flight tests will be specific for each E Conditions project and will need to be carefully developed by the Competent Person and his team. It is not possible for the CAA to provide copies of previous flight tests. Chapter 4 Ferry flying is excluded under E Conditions. Should it be necessary to ferry the aircraft from A to B then an application for this purpose must be made to the CAA for an Exemption in the normal way. Chapter 5 Subject to the normal CAA registration process, any aircraft can be entered onto the UK register and subsequently operated under E Conditions. Chapter 6 It is agreed that the text in para 5, 2nd sentence should be improved. The following is proposed: “It is for the Competent Person to keep the owner and Test

	Pilot appropriately briefed on all aspects of the test programme." Other comments noted. Chapter 7 Form CA1 is used to apply for the registration of any aircraft onto the UK register. It is confirmed that the 12-month period applies to the test flying only. Chapters 8 It is confirmed that E Conditions can be used for the development of helicopters and autogyros as well as fixed-wing aircraft. Though the test pilot is not considered to be a third party, the risks to the test pilot should also be minimised. The Safety Risk Table is taken from the ICAO Safety Management Manual and is one example of how risk can be determined. Other recognised safety management techniques may be used. Chapter 9 The Letter of Acknowledgement will be produced by the Aircraft Registrations Section. The Service Level Agreement for this activity is within 3 working days. Chapter 10 It is agreed that the inclusion of a minimum height requirement for the designated test area in the CAP would be beneficial. The following proposed text has been added to Chapter 10, Flight Test Areas: E Conditions aircraft should only be operated in a specified flight test area. The area, including maximum and minimum safe height, should be agreed by the Competent Person and clearly identified in the Dossier

Commentor:	Respondent No. 5
Comment:	Until reading through E Conditions yesterday, we had always discounted flight testing our CRPS under UK legislation and Rules. The electric contra electric propulsion system (CRPS) that we are shortly to commence prototype manufacture has a number of issues that complicate working within the present guidelines. 1) The equipment is a 225kW self-contained electric coaxial twin propeller propulsion system designed to bolt onto existing aircraft at the firewall in place of a piston engine. The system is also intended for fitment to aircraft specifically designed for electric propulsion. 2) Of concern to us is the fact that it confers “twin engine” status on a receiving aircraft. The CRPS has completely duplicated electric and mechanical components and can operate as a single “engine” system during an “engine” failure or to extend range, a feature used in the Fairey Gannet, Avro Shackleton etc . There are no single point failure modes. 3) As a coaxial system it does not produce significant asymmetric flight conditions during a failure. Is it necessary for a pilot to hold a twin rating to fly an aircraft thus equipped? Will an aircraft actually be classed as a twin? 4) There are a multitude of issues that will arise with an electric propulsion system in aircraft (and whilst these cause no real issues in the marine propulsion world where they are extremely common) I do wonder how the present E Conditions will cope, especially with contra rotation. 5) Aircraft fitted with batteries and not hydrocarbon fuel require substantial differences in design, safety and operation. For instance there is no change in weight between take-off and landing which of course affects many operational characteristics, not least of all trimming and weight and balance considerations. Bonuses of course are no warming or cooling requirements, no exhaust and little heat production and being extremely quiet there may be issues (like electric cars) where warning noise needs to be a feature. 6) The whole issue of electric control and power management is completely unaddressed in electric aircraft and for instance where two differ “fuels” are operating how is this to be addressed.? Presently the CRPS unit has its own

	integrated battery packs, motor controllers, inverters, software and hardware but the battery chemistry (high discharge rate) is different from the ancillary battery packs (low discharge rate, but high energy density) situated elsewhere (aft of the firewall) in the aircraft. This component operates the aircraft during the cruise (low power) phase of flight and can also partly recharge the CRPS packs to allow high power flight. It is also possible that other hybrid systems could be fitted such range extenders or fuel cells in place of the secondary low discharge element. These systems may introduce complex issues. There are many other issues that will arise particularly if electric contra rotating twin systems and the benefits this arrangement brings to light and sport aircraft should (as we expect) become very common. It is worth perhaps saying that apart from shaft bearings there are only two rotating components in the system making it extremely simple, unlike a piston and turbine driven systems that have immensely complex power trains.
Authors' Response:	Comments noted. It should be noted that there is a 2,000 kg weight limit for aircraft operating under E Conditions. The issue of whether a pilot flying an aircraft with an electric coaxial twin propeller propulsion system should be qualified with a twin rating would be subject to an assessment of the aircraft by CAA/EASA.

Commentor:	Respondent No.6
Comment:	1. It is most important that the CAA does not use E-conditions as an excuse to abdicate responsibility for the regulation of prototype aircraft and the flight testing of such aircraft. Many designers welcome working with the regulator (either CAA or LAA/BMAA under devolved authority) to achieve a safe and compliant product, and benefit from the additional safety level that the regulatory process ensures. 2. I do not agree that qualification as a chartered engineer is a suitable indication of the competence of an individual to run a design and flight test programme. This status does not necessarily guarantee the skills or experience necessary. Further, the RAeS does not specialise in light aircraft design

	(albeit the Light Aircraft Group does exist), nor do they go out of their way to promote light aircraft design in any practical sense (apart from to offer this new experimental route as a benefit of being a member with chartered engineer status, and their activities with manpowered aircraft). The content of their in-house magazine does not reflect particular interest or specialisation in light aircraft design (other than to report accidents). 3. It does not seem reasonable for the CAA to refuse to approve a competent person. Many competent people hold AD458 positions, yet do not hold a chartered engineer qualification, as such a qualification (chartered status) is unnecessary. I see this as the CAA abdicating responsibility. 4. Further, a corporate entity holding an A8-21 design approval should be able to act as a competent entity, thus benefitting from the liability insurance held by the company, and not singling out an individual who would require individual insurance cover. 5. Chapter 1 does not mention the Permit to Test route, possible through the LAA. This organisation exists to encourage amateur design of aircraft, by LAA members not having access to their own company approval and B-conditions. The document fails to recognise an important facility which has been in place since 1948 (I believe), with many new designs flying successfully, and with competent designers achieving approval of new designs without significant regulatory cost. 6. The risk matrix seems unsatisfactory in that it allocates 'multiple deaths' as a catastrophic risk, but does not allocate a severity to a 'single death'. As only one person (the pilot) is likely to be affected (if third party risks are properly mitigated), what is the severity of risk inherent in a single death (of the pilot)? 7. The probability matrix seems unsatisfactory because each aircraft and project is different and hence the likely frequency of an occurrence is largely unknown. 8. The Annex B dossier, although an example, would benefit from the following changes: The name and address lines need to be longer. The 'Specific Purpose of this E-conditions operation' is unclear in layout. Is a written response required, or just deletion of a or

	b as appropriate? I do not understand the lines 'Original Design' and 'Under E conditions'.
Authors' Response:	Comment 1. Comment noted. The scope of experimental flight under E Conditions has been deliberately limited (see CAP 1220) to minimise risk. The CAA does not see itself abdicating responsibility in this area and still has the means to intervene in any application where there may be concerns. Comment 2. The CAA considers that a Member or Fellow of the RAeS who has achieved Chartered Engineer status via the RAeS will have the knowledge, integrity and responsibility to manage an E Conditions flight test programme and seek appropriate advice when needed. Comment 3. The CAA will have no direct involvement in the authorisation of the Competent Person. For personnel that hold suitable AD458 positions but are not Chartered Engineers, then in order to achieve Competent Person status, they should follow the LAA/BMAA route. Comment 4. Comment noted – it is understood that some A8-21 approved organisations may become involved in E Conditions activities; however, it will still be necessary for an individual Competent Person to take overall responsibility for the project. Comment 5. The LAA Permit to Test route is still available for amateur-designed aircraft and is separate to E Conditions. It is not felt that this particular route needs to be included in this chapter. Comment 6. The severity table is taken from the ICAO Safety management manual and is one example of how risks may be categorised. It is noted that the guidance in FAA AC23.1309-1 classifies the serious or fatal injury to an occupant as Hazardous. Comment 7. It is recognised that each project will have different risks and probabilities of occurrence. It is up to the Competent Person and his or her team, using recognised guidance material, to identify these risks and to estimate their

	probability of occurrence as part of the safety assessment and to mitigate them accordingly. Comment 8. Part A of Appendix B is the Declaration which must be completed as described. Other parts of Appendix B may be considered as an example of the minimum additional information that should be provided. Consideration will be given to improving the layout of the dossier where necessary.

Commentor:	Respondent No. 7
Comment:	I was involved in discussions on "experimental category" whilst serving on executive committee/board of directors of "LAA". I have read John Edgley's paper on this subject, and while not in disagreement with his proposals, I feel that his interests lie with commercial interests, mine are solely "home builder" based. In recent years, home building has shown a strong tendency towards kit assembly and more demanding " approval" requirements. Nothing wrong with this but it can be very daunting to the individual who wishes to design, build and fly his own aircraft, without any commercial considerations. I would therefore ask you to consider the following points:- Home built experimental permit to fly (EPtF) EPtF aircraft to be constructed under supervision of appointed inspector; ideally with design experience. Detailed drawings and design calcs. To be lodged with CAA/ LAA prior to issue of permit to test fly. Details of subsequent modifications to similarly submitted. Specified flight test programme to be successfully completed for issue of "experimental" Permit to Fly. No overflight of urban areas until completion of say 50 hours Limits on number of seats/engine size. Limited number of aircraft (say four) to be constructed without obtaining full design approval (with LAA) . This list is by no means exhaustive. This proposed "experimental" category could perhaps be considered as a half way house between SSDR and the

	established Permit to Fly regime.
Authors' Response:	Comments noted. The proposed 'half way house' does not fit with the spirit of E Conditions and is more akin to the existing LAA Permit to Test process. As stated in the CAP, E Conditions is intended for one-off experimental aircraft undertaking short flight test programmes.

Commentor:	Respondent No.8
Comment:	I have read the draft CAP 1220 and consider it excellent. I know from experience at Kingston University that a really good set of rules covers all but the most improbable situations and I have neither the wisdom nor the experience to presume to be critical. Page 10, General Guidelines. The bottom line reads as though preventing a relocating flight. Should there be a reference to page 13 and the need to declare a new test area? Page 11, General Guidelines. The third paragraph might allow for an extension beyond 12 months if there has been no unreasonable delay. An extension might be justified if the E Conditions flying had exposed cause(s) for prolonged investigation. Having experienced rule writing problems in course module definitions and degree regulations, I think that CAP 1220 has been extremely well written and I look forward to some really innovative flying leading to new commercial opportunities for makers and users of small aircraft.
Authors' Response:	Comments noted. Chapter 3, General Guidelines, has been updated.

Commentor:	Engineering the Future
Comment:	Summary: Endorsement of approach of working with the relevant professional body, and an offer of help in future endeavours.
Authors' Response:	Comment noted

Commentor:	Respondent No. 10
Comment:	Overall, I believe these proposals are an excellent step in the right direction and will help the UK aviation industry to operate competitively in the world market. The E conditions address one aspect of experimental flight and it is hoped that in time, the CAA will be able to consider the long term operation of aircraft that incorporate unusual and non-certified features. Competent person - you describe acceptance of a chartered engineer and member of RAeS in most documentation but in the actual BCAR text you introduce extra wording stating "...a Chartered Engineer registered VIA THE RAeS...". Why does the Chartered Engineer have to be registered VIA the RAeS, a chartered mechanical engineer will be registered via the IMechE for example? Proposed ANO changes - you list 16(2)(g) as the old SSDR definition (115kg, 10kg/m2) that is now rather wider (single seat microlight).
Authors' Response:	Requiring the prospective Competent Person to be a Chartered Engineer, the registration of which has been via the RAeS process, helps to ensure that the individual has an appropriate aeronautical background and provides an understanding that he/she will abide by the professional standards of the Society. Whilst other individuals who hold a Chartered Engineer status, achieved through another professional institution such as the IMechE or IEE, may well be suitable for a Competent Person role, they will be unable to apply through the RAeS unless their Chartered Engineer status is registered with the Engineering Council via the RAeS. The alternative route is through a BCAR A8-26 approved organisation such as the LAA or BMAA. The ANO text in 16(2)g is quoted from the 2009 ANO and will be revised to reflect the increased weights for SSDR microlights at the next amendment.