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Flight plan

It's reassuring to know that civil aviation is subject to intense scrutiny. Terry Gibson, Carl Thomas and Jonathan Howes explain the complexities of flying safely and chart the industry's ever-evolving regulatory requirements.

The regulation of European aviation is currently undergoing the most significant changes the industry has seen for the past 30 years. Previously subject to each country's internal jurisdiction, the regulatory systems in place were, for the most part, at the discretion of individual NAAs. The launch of Concorde, however, was a major catalyst for a new era of international cooperation to certificate an aircraft. As no certification requirements existed at the time for a supersonic aircraft, the development of the supersonic transport requirements was the first significant attempt to write an Anglo-French joint aviation requirement. This partnership has continued to play a crucial role in the ongoing certification of a range of Airbus products, as well as providing the impetus for a more homogeneous approach to aviation regulation in Europe.

While most national aviation authorities used the FAA requirements, the UK had developed its own set dating back over many years – the British civil airworthiness requirements. Many European countries also had their own interpretations of FAA rules resulting in a complex situation for any manufacturer wishing to sell a product worldwide. Common industry practice was for manufacturers to compile their own internal set of requirements comprising an envelope of the various national requirements and interpretations in an attempt to produce a single design standard that would satisfy all NAAs.

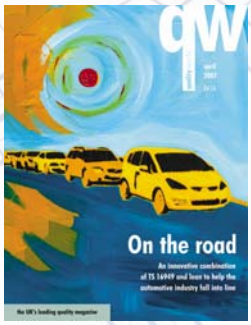
Even this approach did not always achieve the desired outcome as some national requirements were mutually incompatible. Clearly this was an undesirable situation and, as a result of generally increased European cooperation, a solution was sought. This resulted in the formation of the JAA.This body was effectively a 'club' of NAAs and was initially tasked with harmonizing rules throughout the European states and, later, to move as close as possible to harmonizing with the FAA.

Abbreviations

NAA	National Aviation Authority
FAA	Federal Aviation Administration (the US NAA)
JAA	Joint Aviation Authorities
EASA	European Aviation Safety Agency
CAA	Civil Aviation Authority (the UK NAA)

Air pressures

The JAA's initial task was to focus on large aircraft requirements and while it was successful in developing airworthiness codes acceptable to all its members and achieving significant harmonization with the FAA, it undoubtedly had its limitations. Constrained by the terms of the Cyprus



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agreement, which had created it in 1990, the JAA was required to work by consensus, making it difficult to reach agreement on occasions.

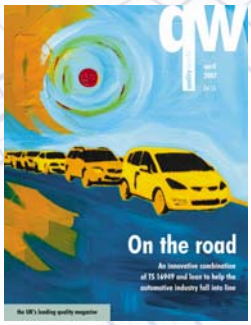
Although not part of its original brief, the JAA also became heavily involved in aircraft type certification. To perform this function, it assembled teams of technical specialists from within the various national authorities who carried out technical investigations against the standards demanded by the increasingly harmonized airworthiness rules. This process replaced the earlier situation where each European member state performed its own investigation and was a worthy attempt to reduce the burden on industry, while simultaneously ensuring that one design standard would be acceptable throughout Europe. Some national differences still existed and these were usually recognized by the team investigation, resulting in a much-reduced investigation by the national authority responsible for the different standard. However, a fundamental problem still remained.

As the JAA was a loose confederation of 40 member countries and not a NAA, it had no legal aviation authority to issue type certificates, which are given in confirmation of compliance with design standards and are a prerequisite for the issue of a certificate of airworthiness for each aircraft produced. The procedure was for each participating NAA to issue its own type certificates against the findings of the JAA team – effectively 40 type certificates. Each participating state still had the option of refusing to accept the outcome of the investigation and although this did not tend to happen, the plethora of individual national type certificates with some national regulatory differences still applied and was clearly still some way from full harmonization.

A further complicating factor was the relationship with the US FAA. Normal practice established over many years had been for the FAA to investigate the technical competence of each national authority from a product's country of origin, which was destined for use within the US. Once satisfied that an adequate level of competence existed, a bilateral agreement was issued which allowed the FAA to accept technical compliance findings on areas of regulatory commonality, with the FAA taking the lead on areas of specific interest to them. This philosophy was mirrored in the approach taken by JAA teams investigating US products with one fundamental difference: as the JAA had no legal authority to make a compliance finding – simply a recommendation – a JAA investigation of US product relied on the FAA to make all formal compliance findings on the JAA's behalf and based on their advice.

The European national authorities then issued their trade certificates on the back of the JAA recommendation. This meant the FAA avoided the need for a bilateral agreement with the JAA by becoming the body within the US, which had formally found compliance with the JAA requirements, in addition to its own requirement differences. This illustration of the lack of legal standing of JAA team findings provides the background to the formation of EASA.

As the JAA was not a national authority, it could not carry a bilateral agreement with the FAA.This became an increasingly important issue and the development of the Airbus A380 was the ultimate driver in the formation of EASA. The FAA acceptance of this very significant aircraft



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required, in the view of the FAA, the existence of a single certifying European body which would be a formal legal entity equivalent to a European NAA and could thus be subject to a bilateral agreement. This would allow the FAA to have confidence in the quality of the investigating team and allow delegation of compliance finding in areas of FAA/EASA regulatory difference. It would also result in one European type certificate valid throughout Europe. The Cologne-based EASA legally came into being in September 2003.

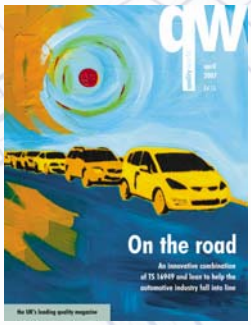
EASA does it

The timescale for the establishment of EASA as a working body has been extremely challenging. The objective was to source experienced staff from within the NAAs and, as these experienced staff members were already well established within their current roles, there was some apathy associated with recruitment. This led to an initial problem of under resourcing with issues associated with the processing of tasks.

Satisfying industry expectations has been challenging in terms of EASA's specific responsibilities for design organization approvals, type certificates, modifications, repairs and European technical standard orders. This has resulted in specialists from NAAs still handling a proportion of the work. Financing EASA has also been the source of much debate with a shortfall at one stage of £1.6m. A further cause for concern in the aviation industry has been its pricing structure, with charges to industry above expectation and, in some cases, being levied for the first time for certain work.

The introduction of EASA has naturally had an impact on the CAA. Despite an initial reluctance to relocate to Cologne, there is now a contingent of former CAA staff employed by EASA. As responsibility for more work within the industry will be transferred to EASA by the end of this year, the involvement of NAAs will be significantly reduced with a consequent reduction in size of the CAA. EASA is still relying on the NAAs to provide experienced technical staff for many projects. As a result, many remaining CAA staff are still involved in certification activity, mostly as a continuation of long-running projects that have transferred from JAA to EASA, with the associated CAA staff simply becoming members of the EASA team for that particular project. This activity is expected to reduce as EASA gains in technical strength and staff numbers.

EASA is responsible for design organization approvals for organizations undertaking design of aircraft, engines, propellers and equipment. While it is responsible for the requirements for maintenance approvals, the task of granting and overseeing these approvals is the responsibility of the NAAs of the member EU states with EASA in a standardizing role. Production organization approvals are handled in a similar manner. Approvals outside the EU are handled directly by EASA although EU member states may also request EASA to perform approval activity on their behalf for their own manufacturers.



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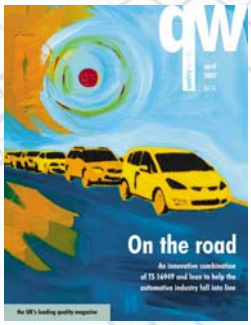
First class?

Another significant trend has been the increasing importance of quality assurance as part of organization approval requirements. Assuring quality within the aviation industry is, of course, safety critical. In the UK, it has long been recognized, however, that it is more efficient for an aviation authority not to be required to check every aspect of the design, production or continued airworthiness of aircraft. This role is delegated to industry, with the air navigation order permitting the CAA to accept reports from a legal entity or organization approved to do so. This principle has been further extended by EASA with much greater emphasis being placed on the privileges of approved design, production and maintenance organizations to satisfy requirements without, or with little reference to, the regulator.

An advantage of this increased reliance on approved organizations in lieu of direct regulatory control is that as more can be delegated to the approved holders, fewer staff are required by the regulator. It is, however, important that adequate product auditing is carried out as part of the approved organization audit and so the audit team needs to be made up of specialists in the different technical disciplines covered by the relevant airworthiness requirements in addition to knowledgeable company approval specialists. This aspect is particularly topical at the moment, as EASA is still evolving and the charging mechanisms it is required to use means that the number of staff it can employ is being closely scrutinized.

The UK requirements for approved persons are still used for simple products, such as microlight aircraft, and focus on personnel capability and procedures. Formal quality systems are only a requirement for airframe design and manufacture organizations. Other organizations of reduced scope have no requirements for this, although the European approvals tend to require quality systems as a matter of course. Now that the EASA requirements are in place a review of the UK requirements for approved organizations is underway. It is likely that the quality system elements of the UK requirements will be updated to align more closely with EASA requirements.

New requirements for maintenance operation approvals were also introduced under the JAA system. Unfortunately, problems were experienced in the UK, resulting in some high profile incidents, including one where a large aircraft could only turn in one direction due to a maintenance error. Investigation into these incidents revealed that while the quality system ensured that procedures were followed, it was not immediately apparent that those procedures were failing to deliver the intended level of safety. The conclusion was that a product audit should be introduced to look at the actual product, together with the procedures and the maintenance standards being delivered. The level of product auditing necessary is still generating debate, with some in Europe taking the view that it is sufficient for the regulator to rely more on procedural audits, while others consider that a higher level of product sampling is necessary.



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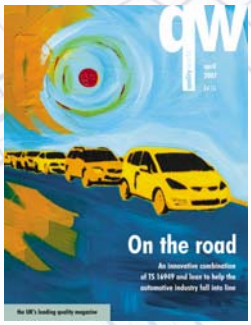
One of the responsibilities of EASA's design organization approval team leader, defined in the EASA internal working procedures, is to 'ensure liaison with EASA staff engaged in product certification activities with the applicant'. In practice, this means that EASA's system provides a good opportunity to integrate both the design organization approval team's audit and the certification team's investigation. This allows the aircraft certification and organization approval team leaders to plan their investigations so that over a period of time the certification and design organization approval requirements can be visited on a rolling audit basis, either by the certification or design organization approval team. This does not necessarily have to be on the same product or modification and both allows the intended benefits of the audit process to be achieved, while also allowing EASA to have confidence that the applicant is applying the certification standards appropriately. This also enables EASA to maintain currency with the application of the certification requirements.

Back to rules

Rulemaking activity has changed significantly as a result of EASA. When JAA controlled this activity the fundamental control of rule development was via various specialist study groups. These groups comprised a core of regulatory staff supplied by the NAAs with a supporting group from industry. The objective was for the NAA members to control the process and for industry to support rulemaking initiatives with detailed technical studies and advice. Initiatives for new rulemaking were frequently generated by the groups, which enjoyed considerable freedom to explore all aspects of their discipline's regulation. Obviously this led to pressure on occasion from industry members who felt that rulemaking should proceed in a certain direction and the NAA members, effectively having the casting vote, were expected to ensure that rulemaking was even-handed and in safety's best interests, while the industry support ensured that the authorities did not demand the impossible. Harmonization effort centred around various specialist harmonization working groups and, since the study groups contained FAA observers, new rulemaking initiatives were generally explored by the harmonization groups as well, often resulting in concurrent equivalent rulemaking by both the JAA and the FAA.

Some areas conspicuously failed to harmonize, one such being the large aircraft bird impact requirements where the FAA required a 4lb bird impact resistance for the cockpit windows and an 8lb bird impact on the tail. The European rule was, and still is, 4lb all over the aircraft. Although a similar standard over the entire aircraft is obviously logical, the FAA was legally tied as adopting this standard would have resulted in a lower level of impact resistance at the tail. This could have been construed legally as a reduction in safety in spite of European arguments that the standard over the rest of the aircraft would offset this, as the FAA requirements do not address general airframe bird impact.

EASA has taken a somewhat different approach. The rulemaking study groups were disbanded due to a perceived abundance of standing committees. It has replaced this structure with a system whereby rulemaking initiatives are started by the rulemaking directorate. Dedicated groups are then formed to address the specific rulemaking activity and disbanded on completion of that activity. Membership of these groups is



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primarily from industry, which is being expected to take a much greater lead in defining the direction than before.

As most of the rulemaking activities that are ongoing existed before EASA came into being, the detailed working of this system with respect to the constant maintenance of relevance of rules to current technology is yet to be fully tested.

Historically, new rulemaking initiatives have arisen from the experiences of certification teams who, when faced with a new situation not covered by existing rules, have generated special conditions to cover the omission. As new situations evolve and become state of the art, these special conditions tend to become generic and rulemaking activity then converts the special condition into a normal airworthiness rule. An example is the extensive development of fly-by-wire controls where the control system behaviour is such as to affect the way the aircraft behaves during design manoeuvres. This can change structural loads and, being system driven, can introduce various dynamic response issues as a result of the system tuning to the aircraft response.

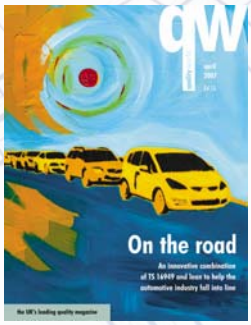
Failure cases can also generate unusual control behaviour and much regulatory effort was expended in developing rules to cover these situations. This 'interaction of systems and structures', while initially a special condition development for the Airbus series of aircraft, has now matured via the study and harmonization groups into a fully-fledged airworthiness requirement.

To infinity and beyond

The JAA and EASA will continue to co-exist until January 2007 with EASA being responsible for certification, production, maintenance, continuing airworthiness and rulemaking in Europe. The JAA will remain responsible for other aspects such as operations and licensing. Ultimately EASA will take full responsibility and will control standardization of activities delegated to other bodies such as NAAs.

Potential future significant developments in aviation are the proposed extension of privately funded space travel into space tourism and the rapid development of sophisticated unmanned air vehicles. Both of these areas introduce significant new challenges. Space tourism is likely to seek to operate initially within less regulated regimes, however, the insurance aspects are still likely to require some form of safety investigation and so the regulatory effort may shift away from NAAs towards private organizations working within the insurance sector.

Future unmanned air vehicles may range from clusters of micro air vehicles up to large autonomous transport systems. These have implications for both human airspace users and third party ground-based risks. Some efforts have already been made to address the unmanned air vehicles issue with a treatment of these aircraft on an 'equivalent manned aircraft' risk basis, in which the aircraft is assessed in terms of size, weight and energy to fit in with an existing airworthiness code and assessed and certified accordingly.



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There is a strong case for more relaxed treatment of unmanned air vehicles involved in operation in remote areas and proposals have been made to treat these on a third party threat assessment only.

Author bios

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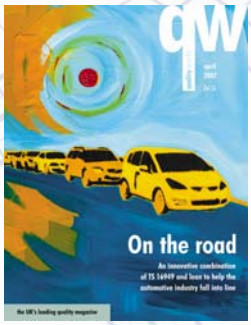

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