THE OSTIV SAILPLANE DEVELOPMENT PANEL

by W.G. Scull, Chairman of the Training and Safety Panel

Background

To appreciate the importance of this Panel it is necessary to have some understanding of how OSTIV came into being.

The pre-World War II organization which preceded OSTIV was the Internationale Studienkommission für Segelflug, or ISTUS. OSTIV was actually formed at the World Gliding Championships in Samedan, Switzerland, in 1948. In 1977, OSTIV became an International Associate Member of the FAI, the Fédération Aéronautique Internationale, with links to what was CIW, the Commission Internationale de Vol á Voile, now the International Gliding Committee (IGC). The latter is purely concerned with competitions and records; OSTIV is a source of technical expertise on which the sporting organization may draw.

Another important historical fact is the condition that the hosts of a World Championships must also hold an OSTIV Congress at the same time.

The broad OSTIV objective is to complement soaring achievement with technical support, in meteorology, scientific and technical, safety and training. The Sailplane Development Panel (SDP) concerns itself mainly with airworthiness.

The history and development of airworthiness requirements is interesting. The two principle codes available in published form in Western Europe in the 50's were the German Bauvorschriften für Segelflugzeuge (BVS) and the UK requirements, BCAR Section E. The former, and a newly-updated version of the latter formed the main base documents from which the first OSTIV Airworthiness Requirements for Standard Class Sailplanes (OSTIVAR) were prepared. Subsequently the German requirements were developed through the Lufttüchtigkeitsforderungen fur Segelflugzeuge (und Motorsegler) LFS and LFSM, and in parallel the OSTIV rules have been extended to all classes including powered sailplanes, and are now termed airworthiness standards OSTIVAS.

Surprisingly, some of the people involved at the beginning still play a part. Cedric Vernon, for example, started his working life as an apprentice with Handley Page and progressed to become assistant chief designer (aerodynamics). He has been involved with the SDP for 33 years, particularly concerned with draffing the OSTIVAS and for much of that time was also editor of all the published OSTIV papers.

Vernon

He played a major part in preparing the UK BCAR, Section E requirements, and later was secretary to the JAR-22 study group from its inception in 1976 until 1980 while he was working for the Civil Aviation Authority. His 1000 hours of gliding includes some test flying.

Notably, he is the only non-American ever to receive the Soaring Society of America's Exceptional Service Award for his services to gliding.

The Work of the SDP

The first OSTIVAS (then called OSTIVAR) were published in 1962. The latest meeting of the Panel was in Helsinki on the 6 and 7th September 1996. The first item on the agenda was finalizing a new edition of OSTIVAS. (This publication is available from the OSTIV secretariat – see frontispiece of TS).

So what purpose does this publication serve? First,

and foremost, it gives guidance and advice to designers. More importantly, it was the basis for the original JAR-22 requirements. Realize that the SDP has had 35 meetings, usually held annually; the JAR-22 study group meets twice a year and has met 39 times.

The extent to which the OSTIVAS is a basis for the JAR-22 requirements is best appreciated by a comparison of the two documents, a task for the cognoscenti! More important perhaps is the experience that comes to both through the expertise within the SDP. For instance, the Chairman, Piero Morelli, is a Professor of Aeronautical Engineering at the Politecnico in Turin. He has been a pilot since 1953 and a glider pilot since 1955. Importantly, he has co-designed seven gliders (with his brother, Alberto, also a Professor of Automotive Engineering in Turin); two of these, the M100 and M200 went into series production.


Morelli

Professor Morelli was largely responsible for the initiative of World Class glider, including the competition to select a winner. He has been chairman of the Panel since 1978.

Such expertise is priceless and, remember, it has come together on the basis of volunteer effort. Such is the spirit of gliding!

The various subjects call on the expertise of individuals who are specialists and experts in their field. Topics cover the whole spectrum of design and development. One interesting development to which particular attention has been given in the last few years is the concept of a crashworthy cockpit, A good example of such a cockpit is that of the ASW24 which won an OSTIV prize. The design improvement for this cockpit was based only on calculations.

One designer, Gerhard Waibel, trained as a mechanical engineer but took part in glider design and construction at the Akaflieg Darmstadt, working on the D34 and D36. Since then has designed 10 gliders (+ variants) for Schleichers. He has been a pilot since 1954, has 3500 hours, virtually all cross-country and test flying, and has flown in a World Championships (6th place in the Standard Class).

Gerd enlivens meeting with his enthusiasm and spirited presentations.


Waibel

One aspect of the debate on the crashworthy cockpit that has not hitherto had much attention was a very practical one concerning stowable items. A pilot carries quite a lot of personal equipment which, if not properly stowed, can be a hazard, from cracking canopies to jamming controls. The simple advice is that there should be adequate stowage, recommendation rather than a design requirement – an important demarcation.

An apposite quotation, when considering amendment of airworthiness standards, is:

> *"When it is not necessary to change it is necessary not to change."*(1641, Lucius Cary, 2nd Viscount Falkland)

A more important consideration was the strength of attachments for removable equipment, from batteries to oxygen bottles. The present requirement is 20 'g' longitudinal acceleration and the debate was whether to increase it to 25. Accidents may occur, even fatal, because of improper or weak stowage of such items; but one accident probably does not warrant a design change, a point for regulators to bear in mind. Improper installation is an operational matter. After discussion, the Panel agreed to retain 20 'g'. Even though this criterion applies to motor glider engines, the consensus of opinion was against an increase since no data are available on the additional weight and cost that would be involved.

There were other concepts in crashworthiness. Gerd Waibel talked about a load-absorbing undercarriage where progressive collapse reduced the extent of injury to the pilot. There has been a lot of research on this subject. Much of the work, which is still continuing, is carried out at the Fachhochschule Aachen (FHA) by Professor Wolf Röger and his team. Unfortunately, he could not be present and Petr Kousal of the Czech Republic reported on some further investigations of the FHA results. Crash tests are carried out using an anthropomorphic dummy, suitably instrumented. For a given crash profile (45° nose down/descent at 8 meters/second) the comparative loading resulted in full disintegration of the conventional "open" cockpit while the structure of the crashworthy cockpit remained integral. The loads on the 'dummy' spine did not exceed the half of the critical spinal loads because of good kinetic energy absorbtion and this could make the difference between being able to walk again, or not!

Another panel member, Petr Kousal, is an engineer who works as an airworthiness inspector for the Czech Civil Aviation Authorities. He has over 2000 hours as pilot and flight test engineer in aeroplanes, gliders and helicopters. He has worked in the aviation industry as designer and test engineer. was co-designer of a motorglider, the L13SW (Vivat) and a member of the "World Class" glider judging panel.


Kousal

A recent development in crashworthiness is the concept of a sailplane parachute rescue system (SPRS). This is not a new idea and at least one glider comes so equipped. These devices are commonplace in hanggliders and microlights. Since about 50% of mid-air collisions re

sult in fatalities, the prospect is attractive in terms of saving life – there is increasing evidence to show that such parachutes do so.

For the last three years there has been a working group dedicated to producing appropriate design standards, chaired by Oran Nicks. This was an offshoot of the crashworthiness sub-group of the panel. The latest meeting of the full Panel saw the culmination of this work with the final version of the requirements, another drafting job for Cedric Vernon. They will be published as an attachment to the OSTIVAS.

Oran Nicks, with 3000 hours of gliding, is an aeronautical engineer, previously at NASA, responsible for outer space exploration, and latterly at the Texas A & M University where his work included the wind tunnel testing of the SM 701 glider aerofoil section. Although recently retired, he still instructs and flies in regional competitions, as well as building a world-class glider, a PW5. He is also the author of a book, *Far Traveler*.


Nicks

A continuing debate concerns fatigue testing. The Panel has members with considerable experience; one, Alan Patching from Australia (now retired from the Panel) has carried out a test on a Janus with one new and one repaired wing. So far this has run for the equivalent of 35,000 flight hours; the only failures have been to metal fittings, including the test rig!

Another expert in this held is Christoph Kensche, who has done much work on load spectra, advising which is the most appropriate for gliders; he has also advised the JAR-22 study group, a reflection of the expertise in the Panel.

Christoph Kensche is a Diploma Engineer (Dipl. Ing.) working at the DLR (German Aerospace Establishment) at Stuttgart; his special field is fatigue of composite structures for certification purposes. A glider pilot for 30 years with 2000 hours, he is also an instructor.


Kensche

Apart from the decision on the most appropriate test spectrum for those cases when tests are necessary the main point at issue is the fatigue life of materials in current use. Carbon fibre in particular has been in use since 1972 and is known to have a good fatigue life. Regarding the use of new materials, it is considered that, if they are used at 80% of their static strength, in conjunction with the safety factor of 1.5 in design, then no fatigue tests are necessary.

Frank Irving referred to his paper on winch launching which he had given in Borlänge. The point at issue was the choice of recommended speed. A graph showing boundaries of stall and weak link failure intersected at a point termed V_{scrit} The recommended speed should be higher than this figure. From an operational point of view, it is desirable that limiting speed was as high as possible. There must be some margin above the recommended speed. The inter-relationship between weak link strength and limit speed was recognized; for example, the ASK-13 with 1000 kg link and limiting speed of 56 kt (?) would be better with a weaker link and higher limit speed. This is because the speed is often exceeded in ignorance of the loading; this also undermines compliance with other limits of cockpit loads and speeds - an important operational matter.

Frank Irving, mentioned earlier, was a senior lecturer in aerodynamics at Imperial College of Science and Technology, London. He was chairrnan of the British Gliding Association's Technical committee for 25 years and has been a glider pilot since 1946. He, too, played a major part in drafting BCAR Section E and is the author, or co-author, of several books, including *New Soaring Pilot* and an excellent monograph on longitudinal stability.


Irving

There was discussion of control forces, specifically for closing airbrakes and actuating Sailplane Parachute Rescue Systems (SRPS). The allowable force for airbrakes is 20 daN (deca Newtons, about 44 lb); based on ergonomic data the evidence was that smaller pilots, notably the 5 percentile female could not apply this force, the relevant tests had been measured in conditions not really appropriate to glider cockpits Test measurements under more representative conditions would be made and the matter re-examined.

Water ballast standards were also considered, particularly the case of failure to jettison some of the water. The worst cases are with full tanks in one wing, and none in the other, or being unable to jettison tail ballast. The extent of the problems is not known and details of accidents and incidents are to be collected.

The connections between the OSTIVAS and JAR-22 requirements come in for a great deal of discussion. At present they exist only at a personal level; some people are members of both the JAR-22 study group (SG) and the Sailplane Development Panel (SDP). Filippo De Florio (of the Italian civil authorities RAI) has been a member of both for many years although he has recently left the JAR-22 group.

Jan-Eric Olsson now provides a link as a member of the SG and SDP: he is also the representative for the European Gliding Union. His background is eminently suitable. He was trained as a pilot in the Swedish Air Force. He is also an engineer, glider pilot and instructor (including aerobatlcs) with a total experience of 5000 hours. He works for Scandinavian Airline Systems (SAS) as the senior quality control engineer.


Olsson

Steps are being taken to establish a more formal link between the two bodies. A particular concern is the effect of one JAR (Joint Airworthiness Requirements) on another, specifically the requirements of JAR-21 Certification Procedures for Aircraft and Related Products and Parts. It seems likely that the effect of this on JAR-22 will require all flight instruments to be approved. Such a requirement would be a disaster for the cost of glider instruments. Clarification and assurances are being sought on this important point, bearing in mind that gliders are purely sporting aircraft.

Other important topics are too numerous to mention in detail; they include:

• Research into towplane upsets at the Politecnico di Torino by Professor De Matteis using radio-controlled models. This program is soon to be implemented and seems to be the nearest to reality so far.

• A report of the fatigue test of a PIK 20 sailplane showing a safe 'life' of 34000 hours depending on the scatter factor used (3 or 4): this allows for the fact that only one specimen was tested.

• A report on the design and construction of a new single seat towplane, the PIK 27. This will be powered by a 115 hp Rotax water-cooled engine and would tow gliders up to a weight of 750 kg. The cost would be 300,000 Finnish Marks (£43,000 or $65,000) in kit form and require about 1000 man-hours of work to complete.

• A report and video on 'Human Flight with Light' was given by Dipl.-Ing. Michael Rehmet who had been an important part of the development team. The aircraft, called "icaré 2 XXL" had won the Berblinger-Competition for a solar-powered motorglider. It required battery assisted takeoff but sustained flight used solar energy alone. The project will be the thesis subject for Michael's doctorate.

With young engineers involved in such projects and as a member of the SDP the future of OSTIV is assured. Remaining full members of Sailplane Development Panel are: John ASHFORD (AUS), Bogumil BERES (PL), Eric DE BOER (NL), Filippo DE FLORIO (I), Andreas DEUTSCH (CH), Jozsef GEDEON (H), Rüdiger KUNZ (A), Erkki LEHTONEN (SF), David MARSDEN (CDN), Lubomir OLSAN (CZ), Willem OYENS (NL) Michael REHMET (D), Wolf RÖGER (D), Justin SANDAUER (PL), Tony SEGAL (UK) Peter SELINGER (D),Jerzy SMIELKIEWICZ (PL), Ladislav SMRCEK (UK), Eric SOUBRIER (F), Jan SPIEKHOUT (NL), Tadeusz ZBOS (PL), and Guido DE MATTEIS (I).

This report would be incomplete without thanks to our hosts of the meeting in Helsinki. A big "kiitos" (thanks) and "kippis" (cheers).

About the Author:

Bill Scull attended this meeting as chairman of the OSTIV Training and Safety Panel (TSP); he also attends the JAR-22 study group as an operations adviser. His background is as an apprentice and research technician with AVRO; from 1966 his 'business' has been gliding, as an instructor, as CFI at Lasham, senior national coach for the British Gliding Association (BGA) and, subsequently, as BGA director of operations.

He has written extensively for the UK magazine, *Sailplane and Gliding*, and has authored three books. He is also a Fellow of the Royal Aeronautical Society.