Report of the RC Pylon Subcommittee 2009.

The RC pylon subcommittee consisted in 2009 of 13 members. After some preparation by e-mail a very well attended subcommittee meeting was held during the World Championship in Ballenstedt Germany. The minutes of this meeting is appended to this report. (*Annex 1*)
A similar meeting is planned for the next WC in Bundaberg, Australia.

The World Championship 2009 was held in Germany in the city of Ballenstedt and was a very successful event from many viewpoints. The organisation was excellent, the number and quality of the competitors were better than ever; all safety standards from the sporting code were met and in some important aspects exceeded. Only the weather conditions were not the best, although the championship could be flown completely, despite some short interruptions due to rain. For further details is referred to the FAI jury report.
The more technical observations from the sub committee points of view are appended to this report (*Annex 2*) These will be used to improve the rule book and the guides for organizers.

Contacts were made with the organizing team of the 2011 WC and a very good cooperation with the pylon subcommittee is expected from these contacts. Organizational experiences were shared.

New rules on noise reduction will be effective from 1-1-2010. Since this is more or less a new field for many competitors, the Sub Committee organized a very well attended workshop during the World Championship in a hotel conference room (Thanks to Gerd for organizing this nice place!) on this subject. The SC has good hopes that all competitors are sufficiently informed to implement the new rules without major problems.
A document has been produced to give further explanation. This document is appended to this report (*Annex 3*) and will be published on the CIAM/Pylon web site pages.
The procedure for homologation of muffling systems as it will be carried out by the Pylon Sub Committee is described here too. Information on homologated systems will also be published on this site. For a number of countries test stations manned by noise experts will be appointed to bring the testing and homologation procedure closer to manufacturers and competitors.

A successful Euro cup competition was held in 2009. It had 3 events: in Italy, Czech republic and France and a total of 88 competitors. The results can be found on the web site pages.
The organization of a world cup competition will be prepared in 2010.

November 14th 2009-11-13

Rob Metkemeijer
chairman RC pylon Sub Committee.

Minutes of a meeting of the CIAM pylon subcommittee.

Thursday 23d July 2009, time 21.00 – 23.30 hours.
Airport Ballenstedt, Registration building.

Attendants:

Rob Metkemeijer (chair)	Netherlands	present
Jim Allen	USA	present
David Axon	Australia	present
Trevor Henderson	New Zealand	represented by David Axon
Hans Joachim Schaller	Germany	present
Ed.Smith	Canada	represented by Richard Moldenhauer
Zdenek Malina	Czech Republik	present with interpreter Klein
Emidio.Tosi	Italy	present, part of time represented by Antonio Tosi
Russel van de.Westhuizen	South Africa	present
Francisco Lopez Manas	Spain	not present
Johan Bjerkander	Sweden	present
Geb Jones	United Kingdom	present
Laurence Perret	France	represented by Bernard Brun

Agenda:

1. Opening
2. Scope of the subcommittee work, mission.
3. Procedures for rule changes inside and outside the subcommittee.
4. Speed control rule, implementation in the near and further future
5. Evaluation of current safety rules.
6. Implementation of 2010 noise rules, homologation and measurement.
7. World cup?
8. Q500 provisional FAI class
9. Future development to make international pylon racing stronger. Relationship to Q40
10. Other matters.

1. Opening.
Rob welcomes all attendants and hopes that at least once every two years at the WC there will be a similar meeting. The usual place to communicate for CIAM technical subcommittees is the day before the plenary CIAM meeting in Lausanne every year of a WC in their class, but for pylon the number of SC members present is usually very low, so we have to use the opportunity to combine a bi-annual meeting with a WC.

2. Scope of work, mission.
The main tasks of the subcommittee are

- Propose and prepare new rules and guidelines in our sporting code, modify existing rules that are not satisfactory.
- Being the eyes and ears of CIAM, our world wide organization, with respect to developments in pylon racing.
- Report on safety and noise matters.

3. The rule making process.
Recapitulation of the formal process:
The subcommittee, but also every NAC, can put in proposals for new rules or rule changes. In the yearly annual plenary meeting of CIAM, usually in the end of march in Lausanne, these are voted for . Each country present has one vote. A new rule or a rule change is decided by simple majority.
The subcommittee gives an advice to the plenary meeting, based on voting prior to the plenary meeting. To get to such an advice the subcommittee will have a SC meeting the day prior to the plenary meeting . The chairman

will organize that SC members that are unable to attend this meeting (or in the case no meeting is held) give their opinion, preferably by e-mail.

Proposals can only be put in every other year ultimately 15 November of the year preceding a WC. The agenda with all the proposals is usually published in the month January or February preceding the plenary CIAM meeting in March. In the case of F3D this is 15 November of every even year, the next opportunity being November 2010. Implementation of new or modified rules will be in the next year (the non WC year)
For urgent proposals for rule changes for necessary rule clarifications, safety and noise this two years cycle may not be applied.

It is the chairman's opinion that the subcommittee has to take initiative for the necessary developments in rules. In cases were the subcommittee cannot come to a common proposal, everyone (including subcommittee members) can put in own proposals and send it to CIAM through their NAC in the appropriate time. The SC will give advice for the plenary, the decision is taken by voting in the plenary meeting..

4.Speed control rule, implementation in the near and further future.

In the observation report of the WC 2009 in Ballenstedt an overview is given of the development of the average course speed (beat 5 competitors of a WC) over the last 9 championships. The calculated value for the WC2009 is 241.9 km/h (average time of best 5 was 59.5 seconds). The rule states 234 km/h (average time of the first five to be 61.5 seconds or more) so measures have to be taken.

Inside the subcommittee there is no full agreement (UK) on the speed limiting rule The question is whether it can be changed after the heavy period pylon had in CIAM in 2005-2006. To continue F3D inside CIAM Bob Brown had to promise "a quiet slow down" which was eventually translated into the current rule.
Tosi states however that Italy, where the critical situation started, has "calmed down", maybe due to the new safety rules that were introduced in 2007.
Schaller (GER) suggests to take more competitions, like Euro or World cups into account to have a more representative value for normal competitions.
Axxon (AUS) suggests not to take the first 5, but e.g. the first 10. In he case of the WC 2009 this would give an average course speed of 237.3 km/h.

There is a general opinion (Allen, Moldenhauer a.o.) that for the moment the type of measures should be such that current models and motors can be used for at least some more years. So it is generally agreed that the speed limitation will be done by reduction of air intake size for the first 6 – 10 years. Metkemeijer (NED) states that a positive side effect of the power reduction will be less engine (piston) failure, engines will on the average become more reliable and hopefully more engine factories will be able to come back into competition.
At the moment we have an intake limit of 114 mm2 (venturi diameter 12mm) ; a reduction to 8 (50 mm2) or 9 mm (64mm2) eventually will not be problematic for engine behaviour. RPM's will come down a bit, propeller development will go to slightly bigger props. The intake size reduction can take place gradually, if necessary after each WC.
Note: The average course speed as defined in the rules at the 2009 WC was 241.93 km/h, see the observations report. A proposal for a 87 mm2 (10.5 mm diameter) venturi will be made separately by the chairman, based on a necessary appr. 10% power reduction

Good possibilities for a further future may be a new definition of the exhaust system (still fitting current models) and/or propellers. Both will affect noise emission at the same time.
Hans Schaller will try to give a formulation for the future exhaust system and Rob Metkemeijer will try to give propeller definitions for further speed and noise control.

Changes of the airframe like thicker wings or more fuselage cross sectional area in relation to speed control have little support at the moment.

5. Evaluation of current safety rules.
In 2007 a number of safety rules, proposed by the sub committee and prepared by a small commission led by Jim Allen, were made effective in the rules. They were the following:

1. No gear boxes (speed control)
2. size of air intake (speed control)
3. fail safe

4. wing span
5. rigid pylons of 70mm diameter
6. max 7 people on the course during practice
7. safety inspections of models
8. helmets during practice
9. 3 models per race
10. low flying
11. safety circle.
12. safety during landing procedure.

The impact of any safety rules can be enormous . Besides effects on the real safety for the competitors, they may be related to insurance issues. If someone is hurt or worse, insurance companies may try to find reasons not to pay. If we do not act according our own safety rules this can be such a reason.
The reason to discuss them now and in the future is that the safety rules should all be workable, so they can and will be maintained. If there is any doubt about these safety rules (e.g. they are impossible to effectuate or written wrongly) they should be made right or better be not in the rulebook for the reason give above.

The following remarks were made on the 2007 safety rules (numbers refer to list above):

1. OK for everyone.
2. OK for everyone for the next couple of years.
3. OK for everyone.
4. OK for everyone.
5. OK for the moment. There is a proposal from NED to change to soft pylons, weak enough to keep a model flying without disturbance, but proof will have to be provided that this will prevent crashes.
6. OK for everyone.
7. OK for everyone.
8. OK for everyone.
9. OK for everyone.
10. The low flying rules 5.2.17 (o) and (q) need revision because it's written inconsistently and the therefore the interpretation is unclear. In the first team managers meeting at this WC it was agreed (on a proposal of the contest director and the FAI jury) that " persistent flying below the pylons" was to be interpreted as follows: 3 consecutive passings of the centre line of the model below pylon height judged by the timekeepers and pylon #1 judges. Only in the case that both agree an infringement will be given. The general opinion is that the rule does not have the safety effect it supposes to give and penalises potentially the best pilots. High flying is considered far more dangerous, since an uncontrolled high flying model may reach the pits or spectators. A low flying model even after hitting a pylon will not travel far, a high flying model losing control will. A proposal to make a rule clarification according to the way low flying was judged at this championship will be prepared. A way to limit to high flying was discussed but it's implementation is very difficult. It may be added to the task of the side line judge as an element of dangerous flying. Needs further study however.
11. The pilot's safety circle is almost generally in use now. Although there is still discussion about it, the principle of an area where pilots, callers and starters stay in is generally agreed. There is a proposal from NED to change the shape of the pilot's area so that the callers will be inside the area during release of their models and giving an improved shape to make it possible for pilots to take more positions at a fixed distance to pylon#2. It is agreed that all SC members will try to do statistics on places where ground impact occurs between now and October 2010. This should give more argumentation for a more convenient shape and position of the pilot's area without scarifying safety. The ground impact statistics as reported by the starters at the WC will be attached to the 2009 subcommittee report.
12. OK for everyone. It is common practice now that in the pilots briefing prior to a competition the landing area is defined by the starter(s) or contest director.

<u>6. Implementation of 2010 noise rules, homologation and measurement.</u>
A well attended workshop was given on july 24th by the SC chairman to clarify the approach and the rule to competitors and others. The sheets are appended to the e-mail with these minutes.
Evidence of working on noise reduction (as well as on safety matters) is necessary to keep our position in CIAM. The situation is stable now. However, a number of SC members feel quite unhappy with a rule they think is not really necessary.
The net effect of the obligatory secondary silencers will be quite limited (in the order of 5 dB(A)). Further noise reduction (if ever necessary) will only be possible when propeller noise will be reduced by smaller propeller

load (more diameter) and lower tip speed (lower rpm). Only then better exhaust silencers can become effective. Speed and noise control will therefore follow the same path more or less.
Two pipe suppliers (de Chastel and van den Bosch) will have pipes with secondary silencer tested and these will be commercially available soon. Also retrofitted silencers on the current pipes may be made available.
A document to describe the homologation process and the method of technical processing on competitions is in preparation as a working document for the SC.

The following agenda items:
7. World cup. Not deeply discussed.
8. Q500 as a provisional FAI class . There was a warning from Jim Allen about making an international set of rules in Q500 which may be not accepted because they may create just another different type of Q500, not commonly accepted. This aspect will be taken care of. However, given the developments of Q500 all over the world this is the time to try to make it as international as possible. In the meantime the German Aeroclub has made a proposal for the new provisional Q500 class, based on the F3D rules, only changing the definition of airframe/engine/propeller. It is likely to announce the new provisional Q500 class this year and fully agree on the rules next year, so they can be sent to CIAM before November 15th 2010.
9. Further developments to make F3D stronger, relationship to Q40. Not deeply discussed.

The last 3 items were hardly discussed because of the limited time and since no real preparation work was done. The Subcommittee members are invited to do work on these issues in the next period.

RC pylon subcommittee

Observations during the F3D WC 2009 in Ballenstedt, Germany.

1. No transmitter impound.
It was agreed between the contest director, the FAI jury and all team managers that there would be no transmitter impound. The argumentation was that the great majority of the competitors used 2.4 GHz systems no two competitors on the "normal" frequency bands had the same frequency. Therefore it was possible without scarifying safety aspects to have no transmitter impound as a local rule. **Maybe this or a similar procedure could be proposed for other classes too.**

2. Failure of electronic timing system.
The competition, which ran very fluently from an organisational viewpoint because of very good logistics and good discipline of all competitors, was (too) regularly disturbed by failures of the electronic start- and timing system, which resulted in a high number of reflights. This situation lead to almost unacceptable delays.
The system was installed too late also, so it could not be used during a part of the day for official training. The system used was basically the well proven system of the Melnik club (CZ), successfully used at the WC of 2003 and in every Euro cup competition in Melnik and also at a competition earlier this year in Germany. But for some unclear reason (was it only a bad mechanical switch?) it was regrettably the weakest part of the competition.

3. Information of results and standings.
The electronic system was supposed (and promised) to show the results and current standings continuously and almost real time. This was not the case. Probably because the man (Michael) operating it, was too busy to keep the competition going (which has highest priority without ant doubt). Only the last days some display was present, although it hardly functioned. Due to this situation it was almost impossible for team managers to do any kind of strategy since there was hardly information available.
My conclusion is that in Annex 5V of the F3D rules giving guidance to organizers a paragraph in the minimum requirements for the communication of contest results will have to be added explicitely.

4. Interruptions of the competition due to rain and/ or wind
The weather was very unstable during the competition, with sometimes windy conditions and rain showers. In a few cases of heavy rain fall the competition was stopped for a short time by the starters / contest director, in other cases flying continued in (light) rain. Wind was never a reason to delay the competition.
In general (while I was watching the competition from the position of the pylon #1 judges) the decisions to stop or continue were taken in reasonable and fair manner, although some competitors definitely had some disadvantage. A protest was put in on this, but it was rejected.
Creating a perfect world, where flying conditions for every competitor will be exactly the same all the time, is not possible of course. It is a part of all outdoor sports that weather conditions will influence performance. In our case this is partly solved by flying many races in a championship, so statistics will help to give everyone about the same average conditions.
However we may be able to add guidelines for contest directors to enable them to make efficient decisions when the racing should be stopped.

5. Interpretation of the low flying rule.
In the first team managers meeting it was agreed (on a proposal of the contest director and the FAI jury) that " persistent flying below the pylons" was to be interpreted as follows:

- 3 consecutive passings of the centre line of the model below pylon height
- judged by the timekeepers and pylon #1 judges. Only in the case that both agree an infringement will be given.

No infringements were given using this criterion.
Rules 5.2.17 (o) and (q) need revision. In the F3D sub committee meeting during the championship the general opinion was that the rule does not have the safety effect it supposes to give. High flying is considered far more dangerous, but for the moment there is, apart from the general rule about capability of pilot (5.2.12.h, to be judged by the contest director) no effective way to do something against it. This needs further study.

6. Use of pilot's circle
The pilot's circle as a safety measure was used for the first time on a WC. According to the starter's report there only very few problems in maintaining the rule, the starters were instructed to "help" the pilots not to step out of

the circle, which was only a few times necessary and the pilots acted accordingly. There turned out to be no problems, and there was almost no interference between pilots in taking the position closest to pylon 2 position on the circle. No infringements were given.
A theoretical point was brought up by Australia (during the first TM meeting), that right after take off the callers are positioned outside the circle. It will be cleared in the rules that callers are supposed to walk into the circle straight away after releasing their models.
In the SC meeting it was agreed to collect more data (also from similar pylon race classes like Q40 and Q500) to revise the shape to a more optimal one from the viewpoints of safety and practicability.
Data from the 2009 world Championship are in the figure below.

6. Pylon 1 judging.

During the competition a number of people (including myself) have been sitting behind the pylon #1 judges. They were kept at sufficient distance (> 15 meter) not to interfere with the judges work. The usual reason to go there is to give feedback to the pilots and callers after the race about the distance flown.
My personal reason to be there (appr. 30% of all races) was to judge how the pylon #1 signalling worked out for the competition.
The following comments can be made:

- the general opinion was that the judges did a very good job, they were quick in their reaction, well concentrated over the competition days and there was no sign of bias.
- Their approach to the signalling was to give the best information to the pilots (push the button exactly at the moment the model passed the pylon) at the price of some anticipation. The same thing when catching a ball, you extrapolate it's path and you know with great accuracy when and where it lands in your hand.
- This approach led to quite a number of cuts not given, because the signalling system does not allow to give a cut once the signal for passing the pylon has been given. (when you have a light, you cannot have a cut). The number of cuts gave regular dissatisfaction by the "watchers" about cuts not being given. Most probably this had no great effect on the final results, because it looks like it spread unbiased and equally over the competitors. My conclusion is that to prevent this type of errors (which may one day have great effect on the results) the way the pylon #1 judges act and the way some electronic systems work should be changed.

In my opinion there is a basic mistake in the system by the fact that the pylon #1 judges (think they have to) "help" the pilots distance flown by the optimal timing of the turn signal. Rule 5.2.18 states however: *At the instant the model aircraft draws level with the No. 1 pylon the pylon judge will switch his signal on. When the model aircraft draws level with the No.1 pylon on the way back the signal is switched off.*
Trying good timing of the signal with a model that flies at our speeds and a human reaction time of 0.2 seconds, means that the signal cannot be earlier than the moment it has passed the pylon 15 - 20 meters. This is well beyond the accuracy at which pilots at a WC turn around #1, so if the pylon judges act with normal reaction time, the information is of no use to the competitor, only an anticipating judge can give info *at the instant.* But such a judge will be "fooled" now and then, as it happened at this WC.
As a principle a judge cannot be at the same time a kind of assistant to the competitor by giving him the best possible information and give on the other hand the competitor penalties.
This differs from the pylon #2 and #3 judges, who only judge cuts, which is a well defined situation.

My first proposal is to **separate the timing of the signal (to inform the pilot when he passes the pylon, but which is to making errors) from the judging of the cuts.** Cuts will be given by the pylon judge as his first job, independent from the turn light, so his primary job is identical to the #2 and #3 judges. The turn light can be operated by a third person (a helper of the team), by the pylon judge as a service to the competitor or not at all. In the latter case the judging of cuts will be identical for all three pylons. Discussions about pilots getting cuts after they got a light for passing the pylons will be history.
The cut lights can easily be connected to a electronic timing system, the turn lights do not have to be connected to the system other than for a logging/backup information reason.

A second way to solve the problem is to go back to the rules and adapt all electronic timing/cut systems to this. Rules 5.2.18 c states : *When a pylon cut has been made the signal will flash on and off 5 times or another signal will be activated to inform the competitor about the pylon cut.* This implies that the electronic system should be able to do such. In Ballenstedt the pilots either got a light for passing the pylon or a cut signal. The flash option in rule 5.2.18 implies a combined function of the turn lights, where the pylon judge can correct his (anticipation) error by flashing the turn light. It is clear that it is quite complex to make software in the electronic

timing system that is able to interpret this flashing. A way to do it is to activate flashing from the (separate) cut button.

7. Average speed.

The average course speed of the top 5 competitors, as defined in the rulebook, was 241.9 km/h in Ballenstedt
The development of this speed over the last years was:

Austria 1993	194.8 km/h
USA 1995	202.4 km/h
Czech Rep. 1997	205.9 km/h
Sweden 1999	226.3 km/h
Australia 2001	227.5 km/h
Czech Republic 2003	230.7 km/h
France 2005	236.4 km/h
USA 2007	234.3 km/h
Germany 2009	241.9 km/h

According to the rules a proposal for speed limiting measures will have to be made to bring back the average course speed to 234 km/h

8. Report om model processing

Processing team:
Hans Visser,
Bert Metkemeijer
Rob Metkemeijer (technical director)
Carolien Metkemeijer (administration)

On the processing day 153 models were processed.
During the competition random checks were carried out on 20 models from 19 different countries. One model was processed completely after it had broken the world record. After the last round of the competition the top three (plus two reserves) were taken in quarantine and completely processed after the competition had finished.

In Bulletin 3 the processing was announced as follows:

Model Processing

Model processing will take place on Wednesday 22nd July at the world championship site, in parallel with official practice. A designated area in the hangar will be separated in order to execute the technical measurements.
A time table will be established and distributed at the first team managers meeting on 21st July with equal slots for each race team, race teams of the same country will be processed together. Attending national teams will be divided into two groups: one group for the morning hours, the other one for the afternoon hours. If a team has processing in the morning, official practice will be in the afternoon and vice versa.
Procedure will be as follows:
A maximum of 3 models per pilot will be processed; each model must be accompanied by its specification certificate, signed and stamped by the owners National Airsport Control. This certificate will be kept by the organizer for the duration of the competition.
Check of wing and tail surface areas: We ask all competitors to bring documentation on the surface area calculation. Model manufacturer's documentation and calculations will be accepted.
We will further check weight of model, wing root thickness, wingspan, fuselage height & width, wheel diameter, spinner nose radius, dimensions of exhaust system.
Check of fuselage cross-section: We ask all competitors to bring templates and documentation of the cross sectional area calculation. Model manufacturer's documentation and calculations will be accepted.
Check of venturis (engine's air intake) cross section: They will be checked with a 12 mm diameter, 1 mm wide gauge. For non circular venturis the competitor must provide proof (template, calculation), that the venturi cross section complies with the rules.

On the processing day engine's swept volume will be checked only on request of the competitor, but it will be measured at the random model checks taking place during the competition.
All engines and exhaust will be marked with the competitor's number. Additional engines and exhaust systems may be processed during the competition. Motors and exhaust systems which have been checked and recorded in this way may not be exchanged with other competitors.
Further checks:
Check of properly functioning of fuel shut-off
Checks of model's safety according to Sporting Code par. 5.2.11.f
Check of the 3 letter Olympic identification mark.
Check of the FAI sticker and the model identification code.
For 2.4 GHz transmitters: proof of max. 100 mW output.
Distribution of model identification stickers: At the end of the processing the stickers are to be fixed by the competitors.
All teams should have completed the processing by 16:00 h latest.

The following observations were made:
Many models did not comply with the technical specifications in the rules initially. This caused major delays during processing day :

- Minimum weight . Since there occurred problems with the accuracy of the scale during the checks in the first rounds of the competition (due to the absence of a recently certified scale and/or standard 2250 grams calibration weight as well as a sufficiently stable table for the scale) the scale was calibrated (to calibrated scales of food shops in Ballenstedt) all competitors were given the opportunity to weight their models until the end of round 2 after consultation of the FAI jury. It will be proposed to add **a calibrated weight of 2250 grams** (or a recently certified scale with 1 gram accuracy) to the processing equipment as well as the identification of **accuracy standards** for a number of measurements and measurement equipment to Annex A.5S, article A.5S.4
- Spinner nose radius. many models had a too sharp spinner nose (R< 5mm).(ABR . B.18.3 and B.18.4) Because this was the first time that this was processed in a WC F3D (to my knowledge) the processing team provided a simple horizontal turning tool and a set of files, to give everyone the opportunity to make his spinner legal on the processing day. **The interpretation of the safety rule concerning the spinner nose radius needs clarification however, a proposal for clarification will be made by the pylon SC.**
- On the basis of the same rule pitot tubes on wings, which are frequently used to monitor the speed of models, were not allowed. This was done after consultation of the FAI jury who interpreted the safety rules in ABR this way**. A proposal for clarification will be made.**
- Air intake cross section. Many competitors who failed the simple diameter test (for circular venturi's) did not initially provide proof to justify the correctness of their air intake size. A number of competitors had initially too large air intakes and had to replace them by correct ones.
- A few fuselages (Dago's old type) had initially too small width and had to be modified accordingly.
- One type of wing, used by German and Czech competitors(Frago, manufactured by Hovorka, CZ) was not according to rule 5.2.6.3 stating that "the wing thickness may decrease in a straight taper line from root to tip". Since in this specific case the wing thickness was always more than a straight taper from 22 mm at the root to 0 mm at the tip as Hovorka's documentation showed, and because the rule states "may", the FAI jury allowed this wing type. **A proposal for a new formulation of this rule maintaining the original safety aspect but allowing for more complex wing shapes as currently common in F3D, needs to be made**.
- All safety checks were carried out. A considerable number of models had initially no functioning fail safe and a small number needed improvements for safety in the connections between the servo's and the controls.
- No problems with wing area, fuselage cross sectional area. All manufacturers and/or builders of models provided sufficient data.

Implementation of the noise rules per 1-1-2010.

1. Introduction.

From January 1st 2010 Annex 5P Noise rules of the F3D pylon racing sporting code will be effective. Since this is a new rule in pylon racing the following document is written to give assistance to pilots, manufacturers and officials with the implementation of these new rules.
The text of the new noise rules can be found in the 2009 sporting code as an addendum.
In 2010 Annex 5P will be included in the body of the F3d rules.

2. Principles.

All current pylon racing engines are used in competition with a tuned exhaust pipe. The new rules state that a secondary muffler with certain effectiveness has to be added to this pipe.
The effectiveness of the muffler can be checked by the contest director in three ways (A.5P.2):

1. By homologation of the exhaust system. (A.5P.3) for further explanation see paragraph 4.1. (This is the route to be used by manufacturers of exhaust systems)
2. By testing the exhaust system with an electro acoustic actuator. (A.5P.2.2) for further explanation see paragraph 4.2. (This is the route to be used by individual constructors of exhaust systems or modified commercial units.)
3. By measurement on a running engine at a reduced piston speed (A.5P.2.1)

For practical reasons the third method is not preferred. The time to process the exhaust systems will be simply too long. However, since this method is similar to noise tests in other model flying classes, its explanation in the annex 5P is sufficient and no further reference will be made to it in this document. A competitor may insist on a measurement using (A.5P.2.1).
The other two measurement techniques are new in aero modelling so they need explication in this document.

The type of the secondary muffler as requested in the rules can be of any design as long as it fulfils the noise reduction requirements of (A.5P.2). To give development of the mufflers a start, paragraph 3 of this document describes a type of muffler that does not affect the performance of the current tuned pipes. This is done to make the transition from the current pipe to a muffled pipe possible without complications in engine behaviour.

The extra weight that the muffler will add to the model is already taken care of in the sporting code of 2007.

3. Example of muffler design.

In Annex 5.P examples of muffler types are given. At the time those designs were made, only a little experience and data were available. This implies that those designs are slightly over dimensioned. In the figure below the dimensioning of the muffler is based on the latest testing.
The muffler as drawn in figure 1 can be used as a working example.

It is based on the principle that the muffler is added to the tuned pipe without having an effect on gas flow and tuning effects of the pipe.
The tail pipe length is reduced to approx. 10 mm to make space for the perforated pipe. Tests show that compared to identical pipes with longer tail pipes, there is no change in effectiveness of the pipe, but the average pipe pressure drops from less tail pipe flow resistance, which may have some effect on needle settings.
The perforated pipe should preferably be made of steel. Because of the exhaust gas temperatures aluminium may weaken of even melt under certain circumstances, since there is no cooling air around it.
The outer pipe can be aluminium. A minimum wall thickness of 1 mm is recommended.

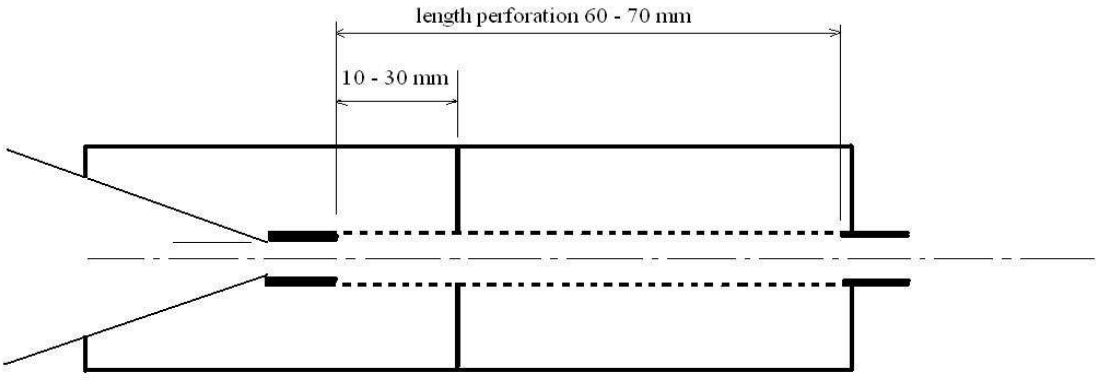

Fig 1. Example of secondary silencer connected to tuned pipe.

Measured with the electro acoustic actuator this type of integrated muffler gives approximately 16 dB reduction compared to the pipe without the muffler.
The baffle in the middle improves the reduction by about 4 dB. The same muffler without the baffle meets the rule's criterion of 12 dB reduction compared to the un-muffled pipe without any real margin for error.
With the addition of the internal baffle there was no relationship between the improved acoustic effect and the engines behaviour and performance, in other words, no deterioration in engine performance.

Be aware that this is just an example design; it will be possible to develop very different resonator types of mufflers, but these may affect the gas flow behind the tail pipe and the tuning effect of the pipe in a more complex way.

4. Testing and processing of exhaust systems.

4.1 Homologation

4.1.1. Principles.

Homologation is the simplest way to deal with the noise rules. It is based on the principle that suppliers of exhaust systems will have their exhaust systems tested by the CIAM pylon sub committee to get a homologation identification number for that exhaust system. That ID number will be valid for pipe lengths within a range defined by the manufacturer/supplier.
An exhaust system will be marked by the supplier with that ID number and can be processed at competitions without further testing.
Competitors that use homologated exhaust systems are not allowed to modify the exhaust systems concerning internal dimensions, tail pipe length and diameter. When a homologated system is used with modifications, the test procedure has to be followed for non homologated systems (4.2).

4.1.2. Procedure of homologation.

Anyone who wishes to have a muffler or a pipe/muffler unit tested and homologated must submit 2 samples and a drawing before January 1st of the year it will be used to one of the muffler homologation officers appointed by the CIAM pylon sub committee. These can be sub committee members or experts outside the sub committee. For

the first two years 2010 and 2011 this period will be extended to 31st of December to give everyone the opportunity to develop pipes in these first years and to have them homologated immediately.
One example will be kept by the sub committee for future reference.
The drawings will be available through the CIAM web site for organizers of competitions and their technical directors.

These mufflers and pipe/muffler units will be tested before March 1st and published on the CIAM F3D web site before March 15th of that year. For 2010 and 2011 pipe/muffler units will be tested 6 weeks after they are submitted, publication will follow within 4 weeks. All homologated mufflers will stay on the web site until further notice of the supplier.

The test method will be as described in paragraph 4.2.
Each manufacturer/supplier will receive a homologation number and test form filled in and signed by the homologation officer.
The homologation number will be of the format: F3D- (AAA) – (NUMBER)
AAA is a 3 letter code for the manufacturer/supplier, to be proposed by them.
NUMBER is the homologation number as given by the pylon sub committee.

The test forms will be published on the CIAM F3D web site.
The format of the test form for homologation can be found in annex 1 of this document.

4.2 Testing with an electro acoustic actuator.

4.2.1. Introduction.

There are several reasons to use an electro acoustic actuator as the preferred way of testing the exhaust systems.

- There is no need to run engines to test the effectiveness of an exhaust system. Running engines for each exhaust system is too time consuming and practically impossible, certainly at a competition with many competitors such as a World Championship. Also it makes random checks viable where the engine may not be in a condition to run, such as after a competition flight.
- The method is very quick
- The method gives good reproduction of results. Measurements on running engines don't give good reproduction because of many other variables, like the propeller and the engine's needle setting, playing a major role.

The most important disadvantage of the electro acoustic actuator is that there may be a discrepancy of attenuation result between an exhaust system tested on the electro acoustic system and on the real engine. For one parameter, which is the effect of exhaust gas temperature, the rules take this into account. There may be other effects related to engine rpm and all kinds of resonance effects in exhaust systems that make the comparison less accurate. The order of magnitude of the effectiveness can be established however with sufficient accuracy.
The method was successfully tested in model car racing to find unpermitted modifications by competitors using homologated mufflers. These modifications could then be proved by physically opening the mufflers afterwards.

4.2.2. Equipment.

The acoustic noise is generated by an electronic white noise generator with a frequency range of 500 – 4000 Hz (-3 dB points, low and high pass filter minimum 1st order, 6 dB/octave).
The loudspeaker is a 1" horn driver type with a resonance frequency of 300 Hz or lower.
To avoid discrepancies in measurements by differences in equipment it is proposed to standardise the equipment, especially the loudspeaker, as much as possible.

The Paso UT 35, a professional 1" horn driver, is proposed. http://www.paso.it
If you have a problem finding it, it can be supplied by the sub committee for a price of approx. € 45 excl. VAT (Through a Dutch Paso dealer).
The noise generator electronics can also be supplied by the sub committee for € 25 excl VAT. This is without casing or power supply, only the electronics. It will be built and adjusted to standard specs in limited numbers.

The loudspeaker needs an adapter to fit it to the pipe. It has a 15 mm internal diameter opening and an O-ring seal similar to O-rings used on current engines. (O-ring OD 21 – 21.3 mm), so it will fit all current pipes. The adapter is designed for minimum volume.
Adapters to fit the Paso UT35 can be supplied by the subcommittee for € 8 excl. VAT.

See fig 2. for the equipment.

Fig 2. The system for electro-acoustic testing.

The measurements can be carried out with any simple sound level meter. A meter according to IEC 61672-1:2002 class 1 can be used. It will be used with frequency weighting "A" in mode "slow".

4.2.3. Measurements.

All measurements take place at a distance of 1.00 m ±2 cm to the centre of the relevant opening perpendicular (within ± 5 degrees) to the axis of the pipe.

To avoid inaccuracies due to sound reflections, the following guidelines should be followed.
The sound source is placed on a stand at a height above the ground of 1.5 m.
There should be no sound reflecting objects (like walls) within a distance of 3 meters from source and microphone.

Note: For quick measurements a different distance (but not less than 10 cm due to effects of wavelength) can be taken as long as the measurements of the source, the standard pipe and the muffled pipe are made at the same distance within 5%. The result for the effectiveness of a muffler is basically independent of measurement distance. It is likely that the measurement distance in Annex 5P will be reduced to 10 cm in a next version of the sporting code. When doing measurements at a small distance like 10 cm reflecting objects at 1 metre or more will have no effect on the readings, which makes it possible to do the measurement in a room (minimum room volume appr. 30 m^3) on a table. During development of exhaust systems this is an easy way to do indicative measurements in the workshop.

The 1 meter distance can be easily controlled by a (max) 3 mm diameter distance piece of appropriate length fixed to the microphone as shown in fig.3 - 6. Such a distance piece will not affect the readings.

The measurement procedure is simple:

A. In the case that the original (non-muffled) pipe is <u>not</u> available, use this procedure.
1. Measurement of the source @ 1 m: see fig. 4, gives result X0 dB (A)
2. Measurement of the pipe plus muffler @ 1 m, see fig 5 and 6, gives result Y dB (A)
The insertion loss IL0 of the pipe+muffler is defined as X0 – Y.

From measurement it was found that the insertion loss X0 – X1 of the currently most commonly used un-muffled pipes (De Chastel and van den Bosch) is 8 dB(A) so the minimum requirement for above as derived from the rules is **IL0 ≥ 20 dB(A).**

B. In the case that the original (non-muffled) pipe is available, use this procedure.
1. Measurement of the un-muffled pipe @ 1 m: see fig. 4, gives result X1 dB (A)
2. Measurement of the pipe plus muffler @ 1 m, see fig 5 or 6, gives result Y dB (A)
The insertion loss IL1 of the added muffler is defined as X1 – Y.
The minimum requirement for according to the rules is **IL1 ≥ 12 dB (A).**

Since it may be expected that after some years the original, non-muffled pipes will not be available anymore, it is likely that the current requirement of 12 dB (A) for IL1 will be replaced by a requirement of 20 dB (A) for IL0.

With the equipment as described above X0 is 88±1 dB (A) and X1 is 79±1 dB (A).
It is recommended if an other type of source is used, that X0 is between 80 and 95 dB (A).

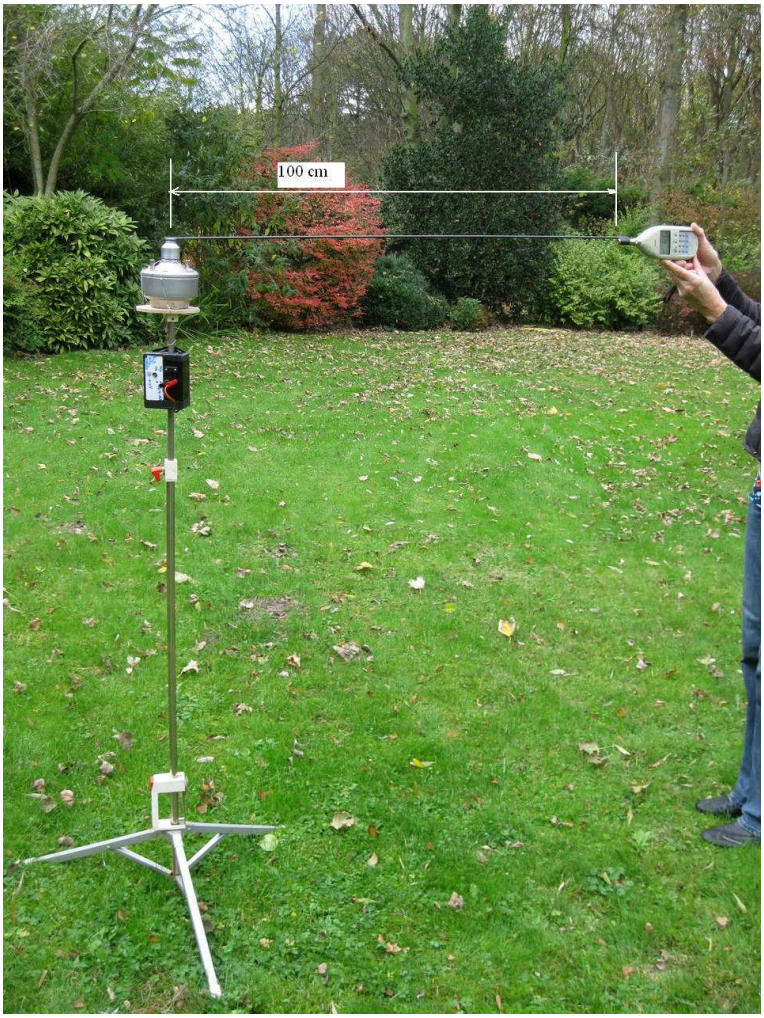

Fig 3 Reference measurement at a distance of 1.00 m (±5 cm) from the adapter opening. This is the X0 reading. Source and measuring microphone 1.5 metres above ground. No other objects within 5 meters.

Fig.4 Reference measurement @ 1 m of the standard pipe without muffler. This is the X1 reading.

Fig. 5 measurement @ 1 m of the pipe plus muffler (integrated type). This is the Y reading

Fig. 6 measurement @ 1 m of the pipe plus added muffler. This is also a Y reading.

CIAM pylon subcommittee

Test form for F3D mufflers.

Manufacturer or Supplier	…….
Three letter code manufacture/supplier	…….
Type	…….
Date	…….
Drawings	as attached
Sound level of source @ 1.00 m (X0)	……dB(A)
Sound level exhaust w/o muffler @ 1.00 m(X1)	……dB(A)
Sound level exhaust with muffler @ 1.00 m (Y)	……dB(A)
Insertion loss IL0 = X0 – Y	…… dB(A), requirement 20 dB(A)
Insertion loss IL1 = X1 – Y	…… dB(A), requirement 12 dB(A)

This exhaust system is homologated with homologation Identification number:
(Format F3D-AAA- CIAM homologation number), AAA is the three letter code of the manufacturer/supplier

F3D - ……. - …….

The CIAM pylon subcommittee
For this committee
The homologation officer

…… (Signature)

……. (Name)