



EVALUATION OF THE 2010 PROPOSED SPORTSMAN AND INTERMEDIATE KNOWNS

Submitted To The IAC Board of Directors
By The
Known Sequence Review Subcommittee

SUMMARY AND CONCLUSIONS

In July of this year, all 27 proposed Knowns (10 power Sportsman; 12 power Intermediate; 2 glider Sportsman; and 3 glider Intermediate) received from the IAC membership were provided to the IAC's *Known Sequence Review Subcommittee*. This Subcommittee of the IAC Rules Committee was formed in 2008 to provide unbiased, expert evaluations of the proposals to assist the IAC Board of Directors with the process of choosing Sportsman and Intermediate Knowns for the upcoming contest year. The Subcommittee consists of five seasoned competitors with expertise and personal experience in the full spectrum of aircraft performance and competition categories. The *Known Sequence Review Subcommittee* provides a means for the Board to receive unbiased analysis from experts who are imminently familiar with competition and the real-world performance characteristics of airplanes from clipped-Cubs to Edge 540's to gliders.

As is evident in the summary evaluations which follow, not even the highly experienced pilots on the Subcommittee could identify a clearly superior sequence among this year's proposed power airplane Knowns. In fact, the overwhelming conclusion, which could be reached by reading a bit between the lines of each reviewer's notes, is that "None of The Above" was the only clear winner!

Part of the evaluation process was easy, however. The elimination of several sequences from consideration based on nonconformance with IAC policy and procedures for Known sequence design.

IAC policy (Section 221) requires the Sportsman Known to be flyable by aircraft without inverted fuel and oil systems in the class of the 115 hp Citabria. In light of that policy, Sportsman power proposals B and C must be dropped from any consideration by the Board because of sustained inverted flight between figures.

In the Intermediate category, IAC policy requires that the Known sequences be flyable by an aircraft in the class of a Great Lakes. Sequences C, D, E, and H must be dropped from any consideration by the Board because of inclusion of Advanced-level figures (e.g., a 2-point vertical up roll) which could never be safely flown by a Great Lakes, or by a number of other common Intermediate-class airplanes for that matter.



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Within the power categories, there was no consensus on a single “best” sequence. For the **Sportsman Power Known** proposals, sequences E, F, H, and I were acceptable to at least two of the five Subcommittee members. Within those four sequences, **Known “E”** had the most support, while **Known “H”** received second place support IF certain modifications were made.

It must be noted here that the favored proposed **Known “E”** is identical to the 2009 **Sportsman Known**, with the exception that Figure 6 (full horizontal roll) was moved to the Figure 9 position. There is nothing in the IAC rules or *P&P*, however, which prevents the Board from choosing a very similar, or even the same **Known** on two consecutive years.

In the **Intermediate Power Known** category, only proposals I, J, and K were acceptable to two or more reviewers. Among those three, **Known “I”** received the most votes, with the caveat that one reviewer, who did not vote for it, felt that the sequence could present positioning issues in a strong x-axis wind and possible altitude issues.

Happily, it was much easier in the two glider categories. For the **Sportsman Glider Known**, one reviewer was equally happy with either “A” or “B”. The other reviewer actually was able to receive input from the **Sportsman glider pilots** attending the Nordic Glider Championships. Those pilots clearly favored **Glider Known “A”**.

In the **Intermediate Glider Known** category, both reviewers agreed that **Glider Known “C”** was the sequence of choice.

Finally, the Board is reminded that the IAC *Policy and Procedures Manual*, Section 221(C)(7) provides the following guidance:

- 7) *At the Fall Board meeting the Board may take only one of three actions:*
 - a. *Approve a Known sequence without change for use in the upcoming competition year*
 - b. *Reject candidate sequences in their entirety; or*
 - c. *Return a sequence to the Rules Committee with recommendations. Should a sequence be returned to committee, the Rules Chairman will respond within 10 days to the Executive Committee, who will be empowered by the Board of Directors to accept or reject the changes.*



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The balance of this report contains summaries of each reviewer's comments on the 2010 Known proposals. The identity of each reviewer remains anonymous in this report so as to avoid any bias from personality conflicts, etc. Each reviewer only commented on those Known proposals for which they were qualified to comment.

SPORTSMAN POWER KNOWNS

Reviewer #1

Overall Rank Order: F – A – J – G – I – H – E – D

Sequence: "A"

- Interesting and fun sequence; good variety of figures
- Line from F2 to F3 disadvantages lower powered/draggy aircraft, boring
- Dislike F4 Turn into F5 Spin -- uses too much Y-axis
- Like F10 Clover -- but would prefer it not be at bottom of box

Sequence: "B" [UNACCEPTABLE]

- Inverted layout and line (F1 - F2) are not appropriate for Sportsman which must be flyable by aircraft without inverted fuel/oil systems

Sequence: "C" [UNACCEPTABLE]

- 2-point roll on 45 up (F2) and Push Humpty with 1/4 roll down are not appropriate Sportsman figures
- Sustained inverted flight between F2 and F3 violates IAC policy

Sequence: "D"

- F1 and F2 present two downwind 45's
- Lay-down Humpty (F2), Vertical up w/cap (F3), and 4-point Roll (F10) are more typically Intermediate-level figures
- Immelmann (F9) following a Loop (F8) is a tough challenge for lower powered/draggy aircraft

Sequence: "E"

- BORING (especially for Judges and repeat Sportsman)!!! Virtually the same as the 2009 Known.



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Sequence: "F"

- Higher than normal K for Sportsman, but interesting and fun sequence
- Uses "standard" Sportsman figures, plus the Quarter-clover. Good energy flow.

Sequence: "G"

- Line from F4 to F5 is a long cruise
- F6 and F7 present two downwind 45's
- The 90 Turn (F9) and Full Roll (F10) on Y-axis is a challenge -- not typical for Sportsman

Sequence: "H"

- Dislike F6 Turn into F7 Spin -- uses too much Y-axis
- Keeping the Half-Cuban (F8) "in" following the Goldfish/Turn/Spin will be nearly impossible; F5 and F8 essentially present two up-wind 45's with a Turn and Spin between them
- Line from F8 to F9 is a long cruise, boring

Sequence: "I"

- F5 and F6 present two downwind 45's
- Dislike F7 Turn into F8 Spin -- uses too much Y-axis
- Line from F9 to F10 disadvantages lower powered/draggy aircraft, boring

Sequence: "J"

- F1 and F2 present two downwind 45's
- Not excited by relatively low-energy Half-Cuban start, and at end of box
- Relatively low-K, not a lot of diversity (no Wedge's)

Reviewer #2

Preamble

I do not believe we should introduce the 1¼ spin in Sportsman. Rationale: The 1¼ spin will always stop yawed in the direction of the recovery rudder and with the aircraft pitched toward the pilot (positive AOA). In order to make that spin stop 'square' with the nose pointed straight down, some rudder in the direction of spin is needed immediately after autorotation (but not the roll portion of the spin) stops. Over the years that I have been giving spin dual, I have on occasion seen pilots



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apply this trim rudder in the direction of the spin without completely stopping their autorotation. When this happens the spin continues in its original direction, the pilot becomes disoriented, and recovery is delayed. Additionally, if forward stick is improperly added to remove the positive pitch of the nose during the premature addition of 'trim' rudder, the spin will rapidly accelerate and become very disorienting. I have been (unsuccessfully) working with the IAC Safety Committee for years, ever since the Kathy Jaffee fatality, to eliminate the ¼ turn spin variants from Sportsman. I will therefore object to any Sportsman sequence with this choice of spin.

Regarding the Quarter-clover leaf. I do not believe we should use them in competition because, like the barrel roll, they just cannot be judged accurately. And like the barrel roll, they should be withdrawn from competition aerobatics. The judges do not see them enough, there is wide disagreement on how they should be flown and judged, and finally there are similar differences of opinion on how they should be taught. Let's not penalize our competitors for this reality.

So, having said all that, my take on the Sportsman offerings are:

Overall Rank Order: E – I (if modified)

Sequence: "A" [UNACCEPTABLE]

- Spin too late (and therefore too low)
- The clover, 1¼ spin, and wedge are not good figures for grass roots aircraft.

Sequence: "B" [UNACCEPTABLE]

- Sustained inverted flight (F2-F3), ¼ roll on vertical down line

Sequence: "C" [UNACCEPTABLE]

- Sustained inverted flight

Sequence: "D" [UNACCEPTABLE]

- F1 not good for grass roots aircraft
- Uses 1¼ spin
- F9-F10 leaves too little energy for a grass roots aircraft to complete 4-pt roll

Sequence: "E"

- Good, but unimaginative finish line prevents a good sequence presentation at the end of sequence.



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Sequence: “F” [UNACCEPTABLE]

- Uses 1¼ spin
- Downwind Hammerhead
- Quarter-clover

Sequence: “G”

- Okay, but F5-F6 will not fit in box in 20 kt wind and F6 is not good for grass roots aircraft.

Sequence: “H” [UNACCEPTABLE]

- Uses 1¼ spin
- Big dead space between F2 and F3 ruins presentation

Sequence: “I”

- Okay, but only if F7 and F8 are replaced with a one-turn spin (eliminates a 270 turn and 1¼ spin)
- F5-F6 won't fit in box in 20 Kt X-axis wind

Sequence: “J” [UNACCEPTABLE]

- Uses 1¼ spin and Quarter-clover

Reviewer #3

Overall Rank Order: E – H (if modified)

Preamble

I believe the ideal Sportsman Known sequence should be designed to measure airmanship rather than aircraft performance. In my view, fair Sportsman competition can exist between aircraft of widely different performance providing the sequence gives the low performance aircraft access to its potential energy, the opportunity to convert altitude rather than horsepower into requisite energy requirements. Moreover the Sportsman sequence should avoid figures that require prolonged inverted flight, high hp/weight ratio, or excessive g-loading. In my view, the following figures should be avoided in a Sportsman sequence:



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- 1) An uphill goldfish (7.20.1). After completing a roll on the 45 up line, the low performance aircraft has insufficient energy to maintain a constant radius $\frac{3}{4}$ loop.
- 2) The shark's tooth (1.18.1). This figure requires exceeding both redline airspeed and g-loading for a low performance aircraft with light wing loading to establish a reasonable vertical line with sufficient energy to fly radius to a 45 down line.
- 3) Other figures (e.g., 1.6.1) that require anything other than a hammerhead at the apex of a vertical line.
- 4) Point rolls or full rolls on climbing lines. A Citabria is not capable of more than a half roll on a 45 up line.

Sequence: "A" [UNACCEPTABLE]

- F8: See (2) above
- F10: Like the barrel roll, lack of familiarity and global grading criteria makes this an undesirable competition figure.

Sequence: "B" [UNACCEPTABLE]

- F1: See (4) above. Good chance for an inverted stall at the exit of F1.
- F8: See (2) above. Requires much more entry energy than available in a Citabria and excessive entry g-loads.

Sequence: "C" [UNACCEPTABLE]

- F1: Combines problems of (1) and (4) above
- A low performance aircraft is unable to do F2 with the exit energy available from F1
- F4: See (4) above

Sequence: "D" [UNACCEPTABLE]

- F1: See (2) above
- F3: See (3) above

Sequence: "E"

- Acceptable



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Sequence: “F” **[UNACCEPTABLE]**

- F3: After completing a roll, a Citabria has insufficient energy to execute a hammerhead. Moreover a hammerhead is a very poor choice for a downwind turnaround.
- F6: Like the barrel roll, lack of familiarity and global grading criteria makes this an undesirable competition figure.
- F7: See (1) above
- F9: See (2) above

Sequence: “G” **[UNACCEPTABLE]**

- F1: See (4) above
- F6: See (2) above

Sequence: “H”

- Acceptable with modifications
- To avoid unfairly handicapping grass roots aircraft, interchange F4 and F5 and replace the uphill goldfish (7.20.1) with a downhill goldfish (7.21.3)

Sequence: “I” **[UNACCEPTABLE]**

- F6: See (1) above
- F11: Citabrias, clipped Cubs, etc. are incapable of executing a slow roll following an Immelman

Sequence: “J” **[UNACCEPTABLE]**

- F2: See (1) above
- F4: Like the barrel roll, lack of familiarity and global grading criteria makes this an undesirable competition figure.

Reviewer #4

Overall Rank Order: H – I – A – D – J – E – C

UNACCEPTABLE: B – C – F – G

These four sequences were eliminated either for excessive difficulty (e.g., 2x4 on 45-up line) or inverted flight.



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Reviewer #5

Overall Rank Order: A – F

UNACCEPTABLE: B – C

- Inverted flight eliminates sequences “B” and “C”
- There are also opposite rolls in “B”

Remaining sequences acceptable, but with issues:

- All proposals are quite demanding for a grass roots aircraft
- Three slow and box eating figures in a row (Sequences A, E, G, J, and I)
- Y-axis figures for wind compensation are missing or located too late in some sequences (E and G)



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INTERMEDIATE POWER KNOWNs

Reviewer #1

Overall Rank Order: I – J – G – B – F – K – L – A

Sequence: "A"

- Challenging and fun sequence, good balance of inverted work
- Minor G-Loc concern on F2 P-loop if inverted entry line is held too long
- Challenge to drop F5 spin "in" after 1/2 Cuban and 4x8 roll
- F10's inverted push-out (from inv. 45 down to inv. level) happens at the low point in the sequence, and must be at high speed to accomplish F11 -- possible safety concern
- F11 is a very tough figure for grass roots aircraft -- and this just compounds the preceding issue with F10 (a slight improvement would be to change from 2x4 to 1/2 roll at the top of the Immelmann)

Sequence: "B"

- Okay sequence. Mostly "standard" figures. Not much inverted work, no inverted turn. Not that interesting
- F8 will be challenging for lower powered/draggy aircraft
- F12 disadvantages slow rolling aircraft

Sequence: "C" [UNACCEPTABLE]

- F2 half-roll then snap on a 45 down downline will present speed/g issues for some aircraft

Sequence: "D" [UNACCEPTABLE]

- F2 is an Advanced figure. Impossible to fly in lower powered/draggy aircraft, even more so after exiting a loop.

Sequence: "E" [UNACCEPTABLE]

- 2-point vertical up roll (F8) is an Advanced figure. Impossible to fly in lower powered/draggy aircraft.

Sequence: "F"

- Okay sequence -- similar to "B". Mostly "standard" figures. No inverted turn. Not that interesting
- Dislike placement of the F6 snap roll -- after a hammerhead and on the Y-axis
- F13 disadvantages slow rolling aircraft



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Sequence: “G”

- Challenging and fun sequence, good balance of inverted work
- F4 snap and 4x8 roll will be very challenging for lower powered aircraft with a slow snap speed

Sequence: “H” [UNACCEPTABLE]

- F5 loop with a roll on top is not possible in lower powered/draggy aircraft following the F4 270 turn
- F7 snap on a 45 upline is an Advanced figure. Not possible in lower powered/draggy aircraft
- F8 full roll on a vertical downline is an Advanced figure and would be a safety issue for slower rolling aircraft
- F10 Quarter-clover is a Sportsman-only figure

Sequence: “I”

- Challenging and fun sequence, good balance of inverted work, excellent variety of figures

Sequence: “J”

- Challenging and fun sequence, good balance of inverted work, excellent variety of figures
- F3 snap occurs at high altitude, a little harder to judge

Sequence: “K”

- Relatively low K, somewhat basic sequence. No inverted turn.
- F1 Avalanche occurs at high altitude, both loop and snap will be hard to judge
- Line from F5 to F6 will be a long, dull cruise
- Minor G-Loc concerns on F5 down 1/2 Cuban and F10 Split-S if inverted entry lines are held too long

Sequence: “H”

- Somewhat basic sequence with limited inverted work, no inverted turn. Not that interesting.
- F1 Reverse Cuban occurs at high altitude, will be a little harder to judge



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Reviewer #2

Preamble

I would like to say a few things about compulsory sequences in general. I believe they should be a fair, but not energy dependant, test of a competitor's ability to fly 'classic' aerobatics in the category's benchmark aircraft. For IAC Intermediate category, that aircraft is the Great Lakes. Further, the sequence should, theoretically at least, give the pilot a chance to demonstrate good presentation. For this to be possible, each line of the sequence should be able to be flown in the box in the IAC maximum wind of 20 knots down the major axis without seriously compromising any of the figures. Additionally, the sequence should be 'mature' and not have maneuvers that are significantly degraded by wind direction, e.g., downwind hammerheads; downwind spins; snaps immediately following a high speed exit; or spins following a center box roll combination that requires some speed, but makes it very difficult to slow for a proper spin entry. In other words a competitive sequence that has been purged of safety/altitude issues and does not require untraditional maneuvers for that category. For Intermediate, I believe negative pushes to the vertical from level or 45 up lines is not proper, and neither are rollers that have traditionally been reserved for Advanced. The main problem with this year's Known proposals is that they look more, or less in some, like Unknowns rather than Knowns that can be perfected to showcase the pilot's style, preparation, and presentation.

Overall Rank Order: K

Sequence: "A"

- F3-F4-F5 won't fit in the box without rushing F4 and F4 must be delayed until sufficient speed is attained after F2 to begin the maneuver. This puts a proper spin entry in jeopardy on a calm day.
- The F3-F4 combination is marginal for a Great Lakes class airplane.
- There are two cross box combos in the proposal. Why? Pilot needs to demonstrate X-box wind control.

Sequence: "B"

- A downwind spin
- Awkward finish preceded by a 2x8 on vertical down ruins chance for good presentation
- There are two cross box combos in the proposal. Why?



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Sequence: “C” [UNACCEPTABLE]

- Potential for overspeed snap on F2
- F3-F4-F5 line makes for very difficult spin entry without excessively rushing F4
- F10-F11-F12 will not fit in the box in 20 knot wind on the major axis

Sequence: “D” [UNACCEPTABLE]

- A push from inverted 45 to vertical in F2 is an Advanced figure

Sequence: “E” [UNACCEPTABLE]

- Altitude issues
- F8 not compatible with a Great Lakes
- F12 a potential over speed snap

Sequence: “F” [UNACCEPTABLE]

- Downwind spin
- Potential over speed snap in F6
- Awkward finish for good presentation

Sequence: “G”

- F4, the snap/4x8, not well suited for a Great Lakes from low speed
- F9, the 4x2, not well suited for a Great Lakes from low speed

Sequence: “H” [UNACCEPTABLE]

- F1-F2-F3 difficult to fit in box on calm day
- No energy for F5 in Great Lakes after turn in F4
- Big altitude loss in F6, F7, and F8
- Snap on a 45 up line not an Intermediate figure
- F10, Quarter-clover illegal Intermediate figure

Sequence: “I” [UNACCEPTABLE]

- F5-F6-F7-F8 will not fit in box in a 20 kt X-axis wind
- Altitude loss issues

Sequence: “J” [UNACCEPTABLE]

- Altitude issues in Great Lakes (spin too late and too low)
- F8 will lose 400' if properly flown

Sequence: “K”

- Downwind spin, but safe and compatible with Great Lakes



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Sequence: “L” **[UNACCEPTABLE]**

- Altitude issues (spin too late and too low)
- Altitude loss is 400’ in F9, if flown properly

Reviewer #4

Overall Rank Order: F – I – E – A

The following sequences are unacceptable because of excessive difficulty for Great Lakes aircraft, use of Advanced figures, and illegal figures (Quarter-clover). A couple of proposals have spins rather late in the sequence.

UNACCEPTABLE: B – C – D – G – H – J – K – L

Reviewer #5

Overall Rank Order: K – I – J – B – D – L – G

The following sequences are unacceptable because of excessive difficulty for Great Lakes aircraft, use of Advanced figures, and illegal figures (Quarter-clover).

UNACCEPTABLE: A – C – E – F – H



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GLIDER SPORTSMAN KNOWN

Reviewer #4

Overall Rank Order: B – A
Order of preference not strong. Both good.

Reviewer #5

Overall Rank Order: A – B

Sequence: “A”

- Voted as first choice by glider pilots attending the Nordic Glider Championships

Sequence: “B”

- Problems with three figures in line (F1-F2-F3 and also F6-F7-F8)
- Exit speed from F6 quite high for F7 and F8

GLIDER INTERMEDIATE KNOWN

Reviewer #4

Overall Rank Order: C – B – A

Reviewer #5

Overall Rank Order: C – B – A

Brian K. Howard
Chairman, IAC Rules Committee

30 September 2009