IGC Agenda 2006 Item 6.1.7a

TO: IGC Delegates 23Dec05
FROM: Bernald S. Smith, ANDS Chairman
SUBJ: Annex II to MacIntyre COTS GPS proposal for badge flight recording purposes

0.0 This admittedly lengthy paper is submitted as background for delegates in their consideration of the MacIntyre COTS proposal, in case you want to know about many of the ramifications of going to COTS. That's why options and arguments are presented, to show that this is a serious business, that high value is placed on the achievements by pilots attaining silver and gold badges, and that this action is taken with considerable thought and desire to preserve the honor and truth of those achievements. If delegates don't want to read this, of course there is no requirement to do so, but for those who want to see inside the processes, which should be an open book, it's here to see.

1.0 INTRODUCTION
1.1 The MacIntyre proposal is for approval of the use of certain COTS GPS units to be acceptable for recording flight achievements in the IGC/FAI Badge series. It is suggested that only GPS COTS is up for consideration; other satellite positioning systems are not yet approved by IGC for GNSS-based flight recording purposes. There are no other current satellite systems deemed acceptable for worldwide use, altho it is foreseen that others may come to be suitable in the near future. A question can be posed, however: Should GLONASS be approvable for COTS use in certain areas? Can it be shown that there are areas wherein its coverage is satisfactory? It is not suitable for worldwide use, because there are not yet enough satellites in the constellation to meet availability/continuity requirements, nor is it planned to be fully operational until the 2010/2011 time period.

1.2 Proposal options to be considered are either for immediate acceptance for minor SC changes, or for major SC changes, year 1 and year 2 proposals. The MacIntyre proposal is deemed a major change, thus a year 1 proposal. It is understood that a year 1 proposal offered at this meeting would be considered for an implementation date of Oct07. The final determination of what it will say would then be further developed between this IGC meeting and the 2007 IGC meeting, at which a final vote would determine whether 2007 implementation is approved.

1.3 Whatever is proposed, the final rules should be as simple, straight-forward and understandable as possible. Belying that is this lengthy discussion, offered however, to fully explain the background and reasonable options to be considered in the development of a recommendation. To add a personal touch, this writer takes very seriously the flight verification of silver and gold badges.

2.0 OPTIONS
2.1 Thus, for a year 1 proposal, the following possibilities can considered for use of COTS GPS for recording flight achievement:

A - any COTS GPS, or
B - 'approved' COTS GPS

2.2 For approval, there are several matters to consider:

2.2.1. require a suitable output and message format, TBD by IGC, or
2.2.2. no output/format requirement.
2.2.3. require hardware case security of some TBD level, or
2.2.4. no hardware case security requirement
2.2.5. require electronic security of some TBD level, or
2.2.6. no electronic security requirement

2.3 Approval methods to consider:

A' no GFAC approval requirement.
B' require a normal GFAC process with fee, less than at present, or
C' require a modified GFAC process with a modest fee e.g. ??100, or
D' no approval fee required for a GFAC process.
E' require the COTS manufacturer to request GFAC approval, or
F' permit GFAC approval request from any entity, e.g. individual, club, consortium, manufacturer, or
G' permit individual NACs to approve a specific make/model COTS GPS and procedure for use in their country and require a minimum of 3 NAC approvals of the same make/model COTS GPS and procedure for IGC approval for worldwide use of such specific device/procedure, with IGC to keep a listing of country-approved and IGC-approved COTS GPS units. (This is basically the 'old' IGC electronic baro approval concept.)

2.4 Re baro requirements, consider COTS GPS units for use:

a) without baro altitude for any badge leg, or
b) with baro altitude for altitude legs only, in which the baro altitude is internal to the COTS unit, or separate therefrom, e.g. an accompanying separate barograph, or
c) with baro altitude for all legs.

2.5 If without baro altitude:
a' require no additional analysis software be utilized, or
a" require new analysis software, developed by GFAC which will address GPS altitude anomaly problems, to permit utilizing non-baro GPS altitude data, or
a"' require buffer altitude achievement (excess altitude) to account for anomalies.

2.6 COTS units could be considered for the following achievements:

i) any silver badge leg except altitude, or
ii) any silver badge leg, or
iii) any silver or gold badge leg except altitude, or
iv) any silver or gold badge leg, or
v) badge/diplome legs of silver, gold and higher order than gold

3.0 DISCUSSION
3.1 In the GNSS 'world', there are 4 basic requirements for a global positioning system's signal and receivers: availability, continuity, accuracy and integrity. IGC determined there must be one more requirement for GNSS FRs: security. For flight recording, IGC has specified the need for: position, altitude, time, accuracy, and security, with some deeming integrity too costly and unnecessary, so it has never been required. With many of the approved FRs, all of the IGC-specified requirements are at a level suitable for the highest level achievement, world records. With COTS, we consider possibly changing the security requirement and possibly changing the altitude accuracy requirement for some level of badge flight recording purposes.

3.2 Up to now, altitude accuracy has been achieved by requiring baro backup; dropping that requirement could result in occasional altitude inaccuracy, according to data accumulated by GFAC. Altitude accuracy has gotten better with improved GPS engines and improved satellite broadcasts and the increased number of satellites. However, possibly inherent in flying style with large bank angles, possibly inherent in the lower quality, lower cost GPS engine being used by approved FR manufacturers, there are altitude anomalies which the backup baro supplants with good altitude data.

3.2.1 What that means re the use of COTS without baro backup is the possibility of losing a flight record because it would be rejected due to anomalies in the altitude. But, loss of claims happened often enough with the old system of baros and cameras. COTS claim loss is foreseen as a lesser problem than previously with cameras and baros, even if COTS is approved without baro backup for a level of achievement up to gold badge.

3.2.2 Altho not tested, technical experts expect that a yet undeveloped software analysis program can examine GPS altitude anomalies sufficiently that they will be even a lesser problem in evaluating GPS altitude data, possibly even to the point of being acceptable for badge altitude gain.

3.2.2.1 One possibility would be to require an altitude 'buffer'. It is possible that by adding some number of meters as a buffer to the minimum (1000/3000 gain) required for silver/gold badge altitude legs, e.g. 10% or some percentage of the maximum anomaly, whichever is the most, could provide

assurance that any altitude gain recorded exceeded the minimum requirement.

3.2.3 There is concern expressed by some that not utilizing baro data will compromise airspace violation detection. (There is no question, except with electronic baros, that the old camera/baro method is difficult for such detection, except maybe at the turnpoint.)

3.2.4 It is noted that, if the carrying of a separate baro is required, depending upon the type baro, there may be a problem coordinating baro time with GPS receiver time, such that coordinating baro altitude to GPS receiver position may be difficult. That should not be a problem in determining height gained, however.

3.2.5 Altitude data for non-altitude gain legs is useful for assuring continuity of flight. GPS altitude data does that acceptably. Ergo, baro data is unnecessary to assure continuity of flight, with GPS altitude being adequate for continuity, even if the timing interval of GPS position data is deemed unacceptable for continuity. The GPS altitude scale is most often not at question for such legs for flight continuity. Granted there have been cases where intermittent loss of GPS altitude, which would have resulted in the claim being disallowed, have been saved because there was baro data.

3.2.6 Thus, it is deemed redundant and contrary to proposing a simple system, except possibly for an altitude leg, to consider a requirement for including use of a separate baro for use of COTS if the COTS has no embedded baro. This would apply especially if useful baro-anomaly analysis software is developed, in which case that may also preclude needing baro for altitude gain.

3.3 It has been suggested that the old IGC electronic baro (ebaro) approval approach be utilized. That would leave it up to each country to decide which COTS GPS to approve, and how it must be used, permitting use of such unit, and automatically making it IGC-approved for use worldwide when three countries approve the same COTS make/model.

3.3.1 But, there is also concern about going down that route. For one thing, significant guidelines would need to be provided as to necessary features for any COTS to be acceptable. And, would a proliferation of country-only approved COTS provide worldwide equality, e.g. security and accuracy, with all the different makes/models that then might end up in use? Would it result in a situation beyond understanding and control? Can guideline requirements be set to preclude that? The soaring group is a mobile society; with some countries requiring more stringent requirements than others, it could lead to confusion. E.g. with COTs make XYZ, model abc, country A requires a baro whereas country B doesn't approve that make/model under any circumstances, and country C requires baro with that make/model, but only when flying for the altitude leg.

3.3.2 This writer has great concern about NAC approval processes for COTS, like we did for ebaros. There were only a few: XYLON and EW come to mind. Today, we have hundreds of likely candidate COTS. We need to not only feel, but also know, that country A silver badges are the same as country Q, and all the rest of the countries.

3.3.3 If stringent guidelines for COTS are set such that no country could possibly come up with one that fell outside the guidelines, then that might do it. But, how would it be known that was the case if there is no oversight? It might be said that any COTS must be the equivalent of a Garmin XYZ, for instance, which was assessed as adequate, but if it were in individual NAC hands to then decide, there'd be no assurance that worldwide there was consistency of NAC decision-making on which COTS met such determination. It isn't a matter of pushing for control for control's sake, but for consistency; without that the sport is nowhere!

3.4 What special role, if any, need be set out for OOs? For instance, does the unit have to be installed in a sealed box, or made unavailable to the pilot in flight? Much will depend on the COTS' hardware/software characteristics. E.g., datum change, forward positioning

3.4.1 It is deemed important that in determining which COTS units are acceptable, the matter of datum change falls into the category of what should be required re both hardware and software: can the datum be changed manually (or automatically) at any time? What about forward positioning? Some units used to do that; do some still do so, projecting a position after a turn is started based upon immediate past flight course until a new course is set?

3.4.2 It is believed that at least some existing COTS will satisfy the expected TBDs for the options listed in 2.2.1, 2.2.3 and 2.2.5.

3.5 Should IGC approval for use of COTS permit single-country requirements, e.g. baro accompaniment for those countries that want such? E.g., IGC requires no baro, but permits country A to require such. Or, leave it up to each country as to whether they will even accept any use of COTS! E.g. IGC approves COTS, but country
B has the option to not permit COTS. Yeah! That's right; this flies in the face of what is stated re simplicity. Many have said it would not be easy to go to COTS!

3.6 It is also deemed redundant and contrary to proposing a simple system, to consider a requirement for including use of a camera for use of COTS. That would say the move to COTS is one in which the position data of COTS is not fully trusted, in which case the worldwide soaring population is being made into guinea pigs. GPS altitude anomalies are a known factor, and are discussed as to how to deal with such. It is known that position anomalies are rare

enough to be acceptable and easily detectable.

4.0 SUGGESTION
4.0.1 (references recopied below are the items listed in the OPTIONS section [2.0].)

4.1 This is not a proposal, but merely a suggestion for consideration for a path down the COTS road.
Year 1
B - 'approved' COTS GPS
2.2.1. require a suitable output and message format, TBD by IGC.
2.2.3. require hardware case security of some TBD level.
2.2.5. require electronic security of some TBD level.
C' require a modified GFAC process with a modest fee e.g. ??100.
F' permit GFAC approval request from any entity, e.g. individual, club, consortium, manufacturer.
a) without baro altitude for non-altitude legs.
b) with baro altitude for altitude legs, in which the baro altitude is internal to the COTS unit, or separate therefrom, e.g. an accompanying separate barograph, or
a" require new analysis software, developed by GFAC which will address GPS altitude anomaly problems, to permit utilizing non-baro GPS altitude data, or
a'" require buffer altitude achievement (excess altitude) to account for anomalies.
iv) any silver or gold badge leg

5.0 ACRONYMS/DEFINITIONS
ANDS Air traffic, Navigation and Display Systems
baro pressure sensing device depicting altitude
COTS Commercial Off-the-Shelf
ebaro electronic baro
e.g. for example
EW an electronic baro manufactured in the UK
FAI Federation Aeronautique Internationale
FR Flight Recorder
GFAC GNSS Flight Recorder Approval Committee
GLONASS Global Navigation Satellite System (Russia)
GNSS Global Navigation Satellite System (generic)
GPS Global Positioning System (USA GNSS)
IGC International Gliding Commission
NAC National Airsport Control
SC Sporting Code
TBD To be determined, or, to be defined
XYLON an electronic baro manufactured in the USA
....end....

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