

Customer's View on Flight Calibration

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ABSTRACT

The Flight calibration (FC) is common work for the FC-team and for the Maintenance staff (MS) responsible for the NAVAIDS in every country. Both of them is doing his job in the same time and the synchronization between them is main key for the success. Meaning of the word "success" is: fulfil the job, as it is required in DOC 8071 and ANNEX 10 in the shortest portion of time! Of course, if there is chance to make it cheaper, than we are happy!

Working as Head of NAVAIDS group in Technical Department (Directorate General of Civil Aviation, Macedonia) during 1995-1999, I have a chance to work with different FC-teams (from Germany, Hungary, Bulgaria and Yugoslavia). Of course, it was possibility to gather different experience. The good coordination and synchronization with FC-teams lead to make the time for FC for every particular NAVAID's piece of equipment, very short. Advantages are big, especially for ILS, when runway is "out of service" during FC. I had a lot of conversation with the flight engineers how to improve the measurements and make FC-time shorter.

Intention of this presentation is to provide information how the MS is accepting the FC. I hope that this information will give better understanding of the FC companies how to make better cooperation with the MS. The ATC is not considered by this presentation. I did not find any problems with them, keeping in mind that airports in Macedonia are with low traffic. I do not pretend that this presentation will include almost everything, but I would pretend that my presentation will become base for further discussions. Also, here are mentioned only my attitude and my experience. I hope that these discussions will result with improving the FC service.

NAVAIDS GROUP AND FC IN MACEDONIA

Technical Department (TD) of CAA of Macedonia is responsible for control and maintenance of all equipment

serving for ATC, AIS and MET Departments. It is divided into five groups: for Radars, Power Supply, COM/MET equipment, Automatic Data Processing Systems (ADPS) and NAVAID's. NAVAID's group, as part of TD is consisting from one engineer and 5 technicians by organizational chart of CAA. But, at the moment only 4 technicians are in charge. They are working 12 hours every day and control and maintenance of NAVAID's equipment are their main responsibilities. I was Head of group 3 years and in 1996 I was transferred in Planning and Development Department, but I was involved in FC for two more years.

NAVAID's group is taking care of 2 ILS's (CAT I and CAT II), 2 VOR's, 1 DVOR, 4 DME's and 3 NDB's. FC is on the schedule twice per year for all NAVAIDS equipment. We are making tenders for FC services (usually for three years contract) and the FC companies are offering one price for the overall periodical (routine) calibration of the above-mentioned equipment.

SOME CONSIDERATIONS ARRISED FROM MY EXPERIENCE

1. Best time for FC

In the DOC 8071 is not mentioned the best period for FC. My experience told me that the best solution for our equipment is the period from 15th of March until 15th of April (for the first FC) and from 15th of September to the 15th of October (for the second one) each year. In period March-April we are doing complete periodical FC and in period September-October we are doing partially FC (usually the ALARMS are not checked).

The reason to have above-mentioned periods for FC is: OUTSIDE TEMPERATURE. All equipment is situated in shelters with air-conditioners. So, the outside temperature does not have big impact to the equipment. But, the antenna system is outside, there is no heating and there is no cooling. Impact of the temperature to the antenna system is big, especially to the radiating diagram and bandwidth of the antennae. Also, there is impact of the temperature on the antenna cables where phase of the signal is changed. Winter temperature in Macedonia is usually -10°C and summer temperature is sometimes 35°C. The average temperature in periods when FC is conducted, are between 5°C and 10°C, which gives good tolerances for the antenna system. Our experiences with FC in above-mentioned periods of the year are:

- a) very small shifting of the parameters of the radiating signal; and
- b) adjusting of the NAVAIDS equipment takes considerable small portion of time!

Of course, impact of the temperature on the VOR, DME and NDB is negligible, but for ILS and DVOR is considerable due to numbers of antennae and length of the cables.

Recommendation: For the equipment installed on sites with big differences in temperature during the winter and summer, I am recommending this approach for conducting FC!

Benefits: Conducting the FC in these periods brings the following benefits to the FC-team: the flight-time of the FC aircraft (for adjusting every parameter of NAVAIDS equipment) is very short and savings in fuel are considerable! For the customer benefits are "outage" of the runway is shorter (ILS) and losses (in landing and take-off capacity) are small. Also, environmental conditions (bad weather!) for conducting the FC are acceptable.

2. Attitude of the MS to the FC

Most of the FC-teams are not satisfied with the cooperation with MS during FC (especially, when they are doing ILS). By my opinion, they have right! This is the biggest problem during FC! My technicians, usually overestimating the responsibility of the ILS during landing, were afraid to conduct the FC without my supervision. Even during the training when the equipment is purchased they are concentrated only for basic maintenance. For all more complex jobs on the equipment, the engineers are taking care, so technicians are free to enjoy the life. The problem is increasing where the engineers are absent or when the knowledge of the engineers is on very low level (which is common in some States). Few years ago, when I leave the group, the technicians started to do FC by them selves. But, as I am informed, they did not doing all tests, especially, ALARMS. When FC-team is doing ALARMS then there is need for change of the central line of the LLZ and possible mistake can produce tragic events!

The reason for the fear is that they are not sure that the knowledge (which they have) is enough for the FC adjustments. Lack of the deeper understanding how the ILS is working makes them very unreliable. Duplication of the equipment results with very high MTBO and it means there is no constant need for repairing (read: be in touch with) the equipment. The knowledge is usually forgotten and fear is born! Also, the FC engineer is doing his job constantly, at least ten times every month. They are so familiar with FC that they can do job automatically! But, the MS is doing FC only twice per year, so do not expect that they can manifest same familiarization with FC as FC team!

This is the reason that technicians or engineers can not respond in timely manner to the requirements of the FC team. This makes FC team nervous, cost the FC company money and can spoil the results.

Recommendation: Try to negotiate with MS to have the reliable and experienced people with equipment. If there is no such a person, you can hire the expert familiar with that kind of equipment. But, try to evaluate do the savings in fuel, time and duration of the FC are feasible!

Benefits: Experience tells us that sometimes is cheaper to hire and pay expert and finish FC for three days, than pay hotel and daily allowance for the FC-team for six days!

3. Initial meeting (IM) with MS

Before starting with FC, meeting for familiarization with the conducting the FC is very important. Normally, all FC-teams are doing this meeting. FC-team knows his equipment and methods of FC measurement and MS knows NAVAIDS equipment. Try to make relation of trust and confidence between FC team and MS. MS will be very happy if they gather some additional knowledge about the methods of measurement conducted by particular FC-team and companies Standard Operating Procedures. Those meetings (usually called Briefings) must produce trust between two sides. Usually, on these meetings detailed agenda of the measurements is agreed and possible misunderstandings are evaluated. Try to solve issues as much as it is possible. Good preparation work is key to success!

Recommendation: Make those meetings obligatory! Prepare your own template (table called SCFC!) which will be fulfilled during those meetings. The example is given as Appendix A!

Benefits: Common meeting for clarifying the issues is resulting with better understanding how the things will go on, it will improve team work and trust between FC-team and MS and will make FC shorter.

4. Conducting the FC

IM is producing agenda and it is important to stay to the agenda. If there are some changes try to inform the MS on site in advance.

Communication between FC-aircraft and MS must be reliable. I would like to mention one think here. There is agenda for FC and it is available to FC-team and MS. But, FC-team is doing his job constantly (at the aircraft) and MS just set the required parameters of the NAVAID's. During measurement, the MS is doing nothing. Usually, they are out of the shelter and making conversation between them. During some tests as it is VOR orbit check, it needs time to finish it (20 or 30 minutes). "The working temperature" of the MS is going low and when FC-team call from the aircraft for changing transmitters, usually, it is shock for the MS. They know the agenda, but, they are out of the shelter and they are trying to do his job as soon as it is possible.

My experience told me that their efforts to change the required parameters are finishing with mistake in 40 % of the cases. During this “inactive” period of time (waiting for call from FC-aircraft) the MS forgot which transmitter is on air or what is the test performing or what is the situation with radiated signal, etc... Fixing the mistake takes time and FC-aircraft is flying ineffective. MS and FC-team are being nervous!

Recommendation: Think in advance! Try to inform the MS on site about next step at least 2 minutes before finishing the current test. It will give them time to “tune” from “inactive” to “active” position and they will be ready for your next request!

Benefits: There is no need to be nervous that “those bloody technicians downstairs” are doing something wrong. Why to fly “ineffective”, when you can fly “effective” – it is question of just two minutes in advance!

5. Conducting the FC measurements

All FC-teams would like to do more than one test in the same time, where it is possible. For example: LLZ and Markers, VOR and DME or GP and DME/P in the same time! The time for FC is shorter and savings in fuel are considerable. The costs are going down and the profit is going up. But, can MS respond to your request? Can they change few parameters in the short portion of time? Answer is: YES, if everything is coordinated on IM! If FC-team is experienced with particular MS, than he can predict numbers and types of the measurements, which can be done during FC. If the FC engineer is able to monitor few measurements in same time (VOR and DME during orbit check!), than he can inform the MS about the irregularities in signal (of VOR or DME!). He can negotiate with MS for possible changes of the parameters of the equipment conducting the same flight (orbit check!).

But, keep in mind that the MS are not so happy when, they have to change more than one parameter. It increases the possibility for their mistake and it increases difficulties to set back the changed parameters. So, try to coordinate this during IM.

Recommendation: During IM, investigate the possibility to merge some of the tests during FC. If MS is ready to accept this, than clarify it in SCFC! During the testing of VOR (Orbit check!) it is normal to test also the DME collocated with VOR. The same is situation with ILS and DME/P, etc. On Ohrid aerodrome, we worked together on GP and LLZ in the same time! Clarify this issue in SCFC!

Benefit: More tests in the same time means shorter time for FC!

6. Distribution of FC results

The FC is finished. There is short meeting after FC and list of paper with preliminary results is submitted to the customer. The data of overall FC are stored in the memory of the FC-equipment computer and have to be post-evaluated from FC-team. Usually, 10 to 15 days are necessary the evaluated data in forms of diagrams or tables to reach the customer. But, are you sure that those diagrams and tables are understandable for the customer? Few comments regarding this question will give you better understanding of the issue:

- a) You do not have any problem with that, but this is very big problem for the MS!
- b) The common understanding about navigational terms is not the issue, but the abbreviations of the measurement values on the diagrams and tables are not familiar to the MS!
- c) The FC equipment in the aircraft is measuring the signal and you can see it as current on your instrument. It is also mentioned in your diagrams: current versus position! But, MS is dealing with DDM %. It is problem!
- d) Probably, it sounds funny to you, but misunderstanding of the diagrams and tables are increasing the MS aversion to the FC! The MS usually puts the results somewhere and forget them!

Those few comments are reality in the life of the MS. I have chance to work with different FC-teams and every team has different equipment, different method of measurement connected with used equipment and different presentations of the results. It made me crazy to understand the diagrams! When I tried to contact somebody from the FC-team by phone, usually they are absent or there was no time for explanation.

First example: There is VOR/DME Sinko in Macedonia and there are some problems with the coverage below FL 140 in the sector 280°-350°. I liked to find what is reason for that and I spent two hours to understand that the problem is in the low level of the receiving signal in that sector due to obstacle!

Second example: The DDM for LLZ and GP in some FC equipment is measured in mA (current which is produced in FC NAVAID's receiver by the LLZ or GP signal!) and it is also as μA puts into diagrams. For the MS it is unknown! They are dealing with DDM% and they understand only DDM%! Even the instruments used by MS for ground checks of NAVAID's are giving results in DDM %! For LLZ $1 \mu\text{A} = 0.103 \text{ DDM}$ and for GP $1 \mu\text{A} = 0.117 \text{ DDM}$, but are you sure that MS is familiar with that? Clear explanation about connection of DDM and μA is very good for better understanding of what is wrong with “signal-in-space” of the checked equipment.

Recommendation: Prepare leaflet with diagrams and clear explanation of the terms and abbreviations used in your reports! There is no problem to make this explanation in MS Word and distribute it together with FC reports. And, put the correlation between μA and DDM for LLZ and GP.

Benefits: Better understanding of your reports will improve the self-confidence of the MS and will help you to avoid possible future problems (telephone calls and explanations!). It will also increase professionalism of your company and open the way for new contracts.

CONCLUSION

FC companies offer the PRODUCT on the market (FC services!) and ATS administrations are buying this PRODUCT! The relation between Supplier and Customer is established in advance. So, try to think to your PRODUCT as product for the market where advertising is very important. I hope that this overview of the FC from the customer's point of view will help for better selling of your PRODUCT. I do believe that it will improve FC, which is very important thing regarding safety!

SCHEDULE FOR CONDUCTING FLIGHT CALIBRATION (SCFC)

Date _____

Equipment _____

Task No.	Measurement or activity	Tx 1	Tx 2	Notice