A different approach to data exchange and communication in the Flight inspection and the ATC environment

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ABSTRACT

Sharing important information with the involved actors has become the foundation of every organization, including ANSP and aircraft operators. A simple method is devised, based on shared information and tutorial tools for ATC personnel, to save precious time of frequency use and to organize in a better way Air Traffic Management, safeguarding at the same time the commercial air traffic needs and the Flight Inspection Service Provider efficiency. This is an improvement over previous coordination procedures, and it is aimed to the optimization of the human and time resources required for the preparation and execution of a flight inspection mission.

INTRODUCTION

Even if we are *de-facto* in the era of the information technology most of the coordination and information distribution between the flight inspection service provider and the ATC and technical support staff is still done through voice communication (phone and staff meetings, and during the flight by radio) and in some cases through e-mails and faxes. This process is indeed productive but also time consuming and overall not so efficient. The idea behind this study is to provide a background for the implementation of a "transparent and semi-transparent" web-based network of operational data distribution to the benefit of all the involved actors: the flight inspection service provider, the ATC units, airport operators (handling agencies and airport management), airlines, aircraft operators, and the authorities (civilian, military).

This paper is conceptual and no physical experiments have been made.

The entire concept is based also on quality procedures and quality control and has been developed as a network-centric system.

ACRONYMS, TERMS AND ABBREVIATIONS

ANSP	Air Navigation Service Provider
ATC	Air Traffic control
CAA	Civil Aviation Authority
CAT III	Relevant to ILS categories
FISP	Flight Inspection Service Provider
ILS	Instrument Landing System
NAVAID	Aid to navigation (either ground or space-based, including light-based)
Ticket	A message to the involved actors which starts a coordination procedure

THE CONCEPT OF "TRANSPARENCY"

This is simply an image of how the information is filtered out. Those allowed full access to the data will enjoy "transparency", the other with limited access to the data

will have a "semi-transparent" view of data and processes.

Basically the inclusion in either family is decided by the level of knowledge required by a given organization to efficiently handle the flight inspection mission. The entire process is managed by the FISP. The maximum level of transparency will be endorsed to the CAA, ANSP and the FISP itself. A limited full-transparency will also be granted to the technical ground staff, but only for the area of competence (given airport or given NAVAID). Semi-transparency will be granted to Airport Authorities, handlers, airlines and other registered operators.

The system is totally transparent for every NAVAID and every location for the CAA and the ANSP and, of course, for the FISP (Intranet). For technical ground staff the system is transparent by NAVAID and location of competence. For other operators the system is semi-transparent by location, meaning that only certain data are available. A detailed list of available data has not been developed yet, because of the conceptual nature of this study.

DATA FEED

To start a coordination process the FISP will need to input certain data to the system, either new or retrieved from an existing database and will subsequently create a *mission ticket* for a given NAVAID at a given date. Warnings will be automatically generated and sent to the registered users which will have a certain numbers of days to answer, providing feedback for the intended operation. Feedback priority is established and users request will be accommodated in hierarchical order. In case of contrast the hierarchically prevailing will take precedence over the other.

Not all the requests can be accommodated, but the FISP will know well in advance if there are CAA constrains (mandatory), Military or ATC constrains (mandatory or negotiable), other users requests (always negotiable).

When this process is over (it might require some iterations) the FISP will post the *agreed mission ticket* and the mission is formally programmed.

In case of last minute issues emerging from any actor (except the FISP itself) a warning must be sent to the FISP which will react properly, modifying or canceling the mission. If this happens when the flight inspection aircraft is already in flight the FISP will advise the crew if feasible, issuing alternate instructions.

Data feed between all the actors and the FISP may be exchanged even if the mission is ongoing.

For time-critical issues a direct contact with the crew can be established through ATC or through ground technicians.
After the mission is completed and the flight inspection data evaluated the FISP will issue a *mission completed ticket*. This will allow endorsed users (CAA, ANSP and technical staff) to obtain the final report with relevant technical data about the specific NAVAID. This ticket may be used also for administrative purposes.

Anytime a ticket is posted an automatic warning is generated to the interested actors. It should be noted that these warnings are not intended for everybody, but are tailored to fulfill specific needs. A *mission ticket* warning is send to all the actors involved and the same happens when an *agreed mission ticket* is issued. On the other side, when a *mission completed ticket* is posted the warning is sent only to relevant actors, basically the CAA, the technical ground staff and the ANSP (which is usually the customer).

Note that this system can cope also with the uncertainty that can be related to weather forecast, in fact if the weather is supposed to be marginal for the intended day of operation a *stand-by mission ticket* can be issued for another NAVAID (even more than one). All the actors will know that an alternate plan has been foreseen and will be activated or cancelled depending on conditions. If an *agreed mission ticked* is posted for the original or for one of the stand-by mission, all the relevant *mission tickets* will be cancelled automatically, unless the FISP decide otherwise (i.e. for the needs of a follow-on mission, etc.), and the actors notified. A flow chart is provided in Appendix 1.

NET-CENTRIC SYSTEM

According to a definition, *net-centric* means "Participating as a part of a continuously-evolving, complex community of people, devices, information and services interconnected by a communications network to achieve optimal benefit of resources and better synchronization of events and their consequences", which is exactly what we want to obtain and is exactly what we are talking about when it cames to information distrubution, communications and feedback management.

It is clear that aviation is a complex system and that flight inspection is part of the whole; as any other gear in a giant gearbox it must work properly, well oiled, smoothly running and in syncronization with all the other parts. A small grain of sand and the consequences will be unpredictable in their full extent, but for sure disruptive for the entire system, locally or globally.
The concept that we are proposing is definitely net-centric.

ESTABLISHING HIERARCHIES

To properly assess the feedback and the requests from registered users a hierarchical system must be defined. This will require a prioritization of the registered users importance.

Requests in response to a *mission ticket* might be mandatory if coming from the CAA or ATC (and in certain cases from the Military), or might be negotiable (CAA, ATC, all others). Only certain requests from the CAA, ATC units and the Military are considered mandatory by definition. Other requests are always negotiable and will be treated accordingly. It should be stressed out that this is a strategic planning and any occurrence which is tactical (i.e. occurs after the mission has commenced) will be handled on a "case by case" basis.

When deciding when and where a mission should be organized (according to customer needs) the FISP will act as a network leader, opening a *mission ticket* for the intended date and place, then will react to mandatory requests from the CAA and ATC and eventually to requests coming from other sources. This will start the iteration that will be completed when all the mandatory request have been fulfilled and the other requests negotiated: at the end an *agreed mission ticket* will be issued.

TIMEFRAME

A *mission ticket* should be issued at least two weeks in advance. The process should be concluded with the posting of the *agreed mission ticket* not later than 10 AM the day before the mission. This will give all the actors enough time to assess their needs and will also allow relatively accurate weather planning for the intended day of the mission, thus mitigating weather related cancellations. After the mission is over a *mission completed ticket* should be posted within a reasonable amount of time, possibly not exceeding 5 working days.

WHAT CAN I SEE?

What can a registered user see? What is the level of transparency he can enjoy? What are the information that he needs to provide his services? And finally: what are the date he expects after the mission is completed?
The answer for all the above questions is: data and information. Depending on the level of access (transparency) that has been granted to a specific user the level of information made available may vary from a simple timetable (expected arrival and departure time, aircraft type and call-sign, crew names and contact information) to a more sophisticated database of previous records for a given NAVAID, type and geometry of maneuvers to be performed by the flight inspection aircraft, special requirements, (i.e. "departing aircraft must hold CAT III" or "minimum separation from preceding aircraft 7 nautical miles", etc.). Again, since this study is conceptual in nature, no provision to establish a complete list of available items has been made.

SECURITY AND QUALITY

NAVAIDs records will be available through a secure server only and access will be granted to specific users. Other information may be subject to restrictions and not made available to the general public.
The process is conceive from the beginning as a quality system procedure, where communications exchange is recorded and traceable. Communications, response to tickets and endorsements from users (when needed) must be formal, meaning that they must be issued by postholders or authorized persons.

HOW IT SHOULD WORK?

Let's consider now an example: a mission is planned to calibrate ILS RWY36 at LIMF (Turin Caselle – Italy) and the FISP issue a *mission ticket* generating automatically an e-mail message to the interested actors. After few days the first round of feedback messages has been collected with the following results: no constrains from the Italian CAA, a mandatory request from ATC to change the scheduled time due to an expected peak in the number of movements, a notification from the handling agent that parking is not available overnight. This will trigger a switch from Turin to Cuneo (LIMZ) as operating base. The handling agent in Cuneo has received an e-mail notice at the beginning of the process since this airport was designed originally as the alternate and now confirms availability for the overnight parking. Furthermore the mandatory request from ATC will account for a rescheduling of the mission flight schedule. No reports have been received from the airlines operating out of Turin airport since the traffic density is low thanks to the coordination made with ATC.

Three days before the mission a request come from an aerospace company based at Turin: they have to demonstrate a fighter and a transport plane to foreign dignitaries and protocol does not allow for a change in the schedule which incidentally is overlapping with the flight inspection mission. Since the demonstration flights will last only 7 minutes each a decision is made to allow both activities at the same time, coordinated by ATC. During the demo the flight inspection aircraft will perform off-airport runs (i.e. coverage checks). ATC will advise tactically the flight inspection crew few minutes before the demo flights (this may not sound unusual, but the real advantage is that this has been briefed and agreed upon days in advance, and not in the heat of the moment, making it an efficient, coordinated and safe effort).

Ground technical staff is happy with the schedule and can retrieve previous NAVAID records at any time in preparation for the calibration flight (managers will have time to organize new shifts if more personnel is needed).

When the calibration of the NAVAID has been completed the crew will post immediately a provisional report, stating just the basics (reporting the usability status: usable, usable with limitations, not usable). This post should be mandatory and conservative in nature if doubts about the correct functioning of the NAVAID had arisen during the flight(s).

After review of the collected data (post-flight analysis) a final report is issued and the status of the NAVAID is formally reported. This will become a *mission completed ticket* to which no response is expected except an "acknowledge" from the CAA and the customer (normally the ANSP). This final ticket may be used to trigger administrative processes (i.e. generation of invoices to the customers, etc.).

INTEGRATION

Since this is just a concept we have the freedom to do a brainstorming of sort, and imagine this system integrated in a future (not so far in time anyway) ATM system, where information distribution will be essential. In general, and referring to the example of the gearbox above, we have the opportunity to create an extremely integrated network of resources that can provide solutions just by making information available. Again it is necessary to use the concept of "transparency" to avoid overloading with unnecessary data the distribution system. Not even the smallest grain of sand should be left unaccounted for, because when your gearbox is running at maximum speed a problem can be catastrophic. Flight Inspection is or may be the small grain of sand and must be considered properly. In the past we have proposed other ways to mitigate the impact of our activity, like night flight inspection, but unfortunately this solution is becoming less popular due to noise abatement consideration, even if for many airports and for remote NAVAIDs can still be considered the perfect solution. Been an integral part of the whole system is the way to proceed. Future developments may dictate a change in Flight Inspection strategies, but when you are part of a system you move and change with the system and for the benefit of it.

CONCLUSIONS

Once established this web-based system will became the enabler for a more sophisticated coordination and data distribution effort. This effort will in turn provide to the users more efficiency in general terms. If we breakdown the possible benefits by category of users we can expect improvement in the following fields:

- FISP: predictable mission management, NAVAIDs data always available (this can be an advantage also for the crew when there is a change of schedule during an ongoing mission), mitigation of weather and non-weather related cancellations, full traceability of the ongoing processes (and quality control)
- CAA: NAVAIDs status perfectly known at any moment
- ANSP: NAVAIDs status perfectly known at any moment, ATC always aware of what the flight inspection aircraft will do next when in flight (operational benefit)
- Ground technical staff: NAVAIDs records always available for the NAVAIDs under their technical responsibility, better planning of resources to accommodate flight inspection needs
- Airlines: knowledge of flight inspection activity means delay management, optimizing the schedule (some flight with premium passengers might be kept on time, while other slightly delayed according to tactical needs)
- Airport managers and handling service providers: better apron management, in case of programmed delays due to flight inspection activity better support to the airlines

This is a quest for a general improvement in efficiency and cost-effectiveness. In a world where everybody is struggling to obtain an economic, technological and industrial edge over competitors nothing can be left untried.

ACKNOWLEDGMENTS

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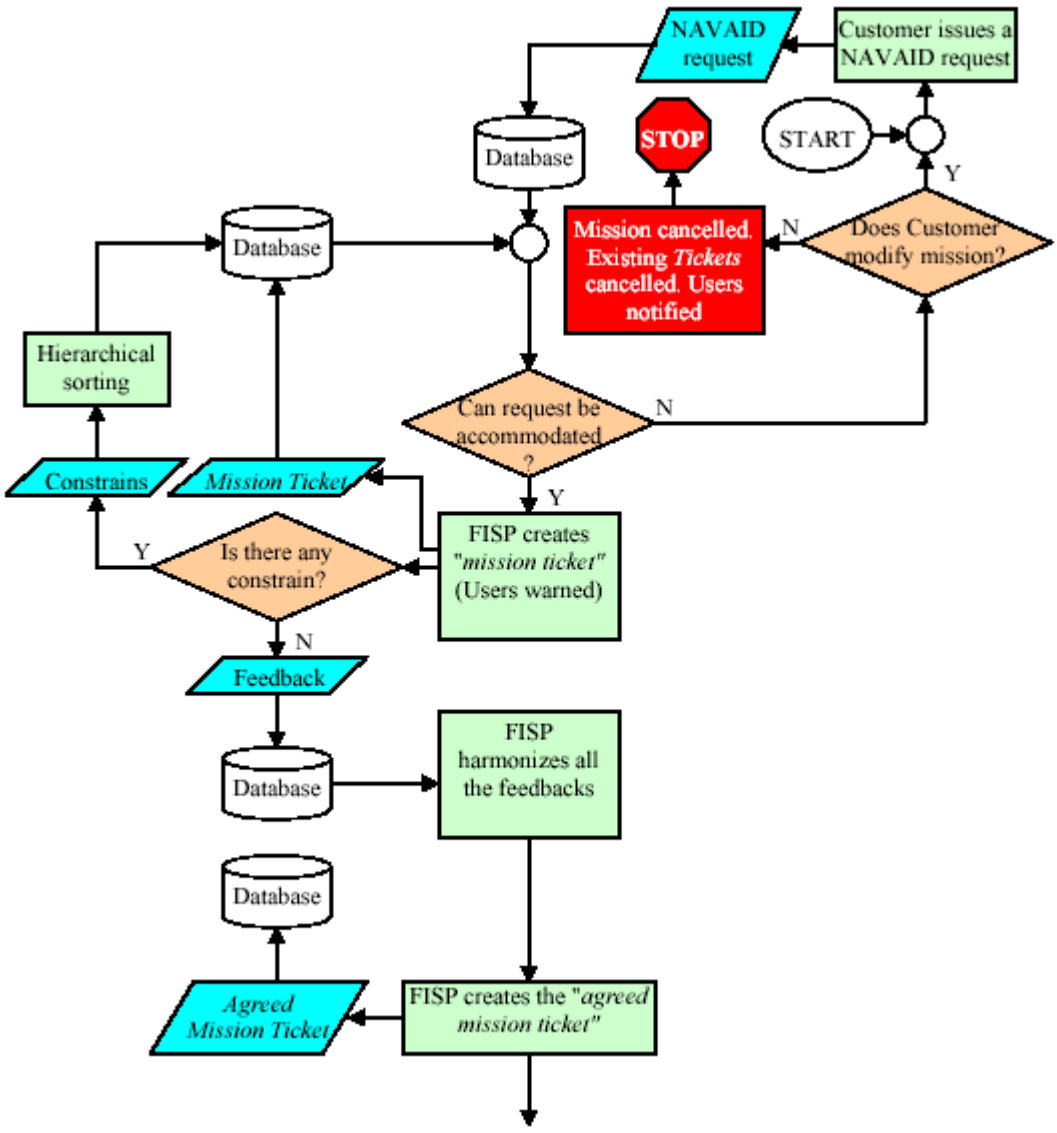
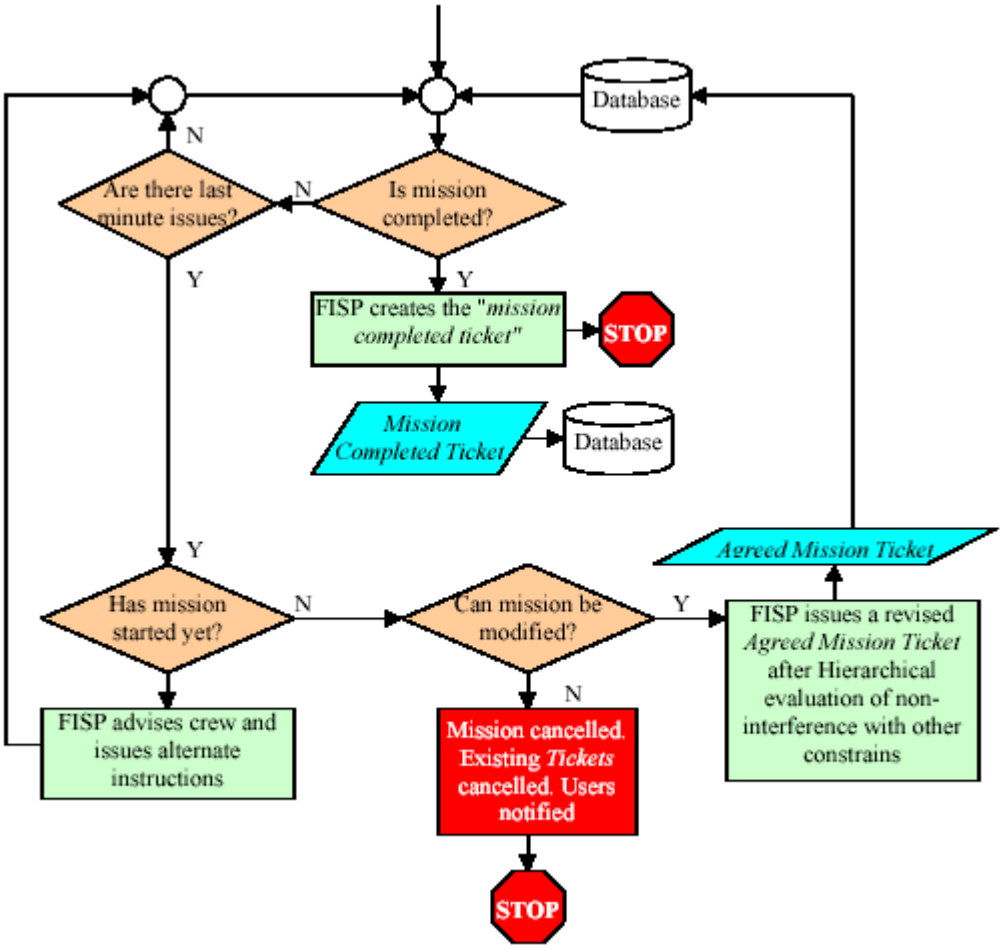
APPENDIX 1

A flow chart has been provided to visualize the process. Even if this is just a concept and therefore not extremely detailed, the information distribution path is clearly visible. This is, of course, is the general overview of the process, which will be expanded to encompass all the details and FISP internal iterations during a follow-on development phase.




Database
N
Are there last minute issues?
N
Is mission completed?
Y
Y
FISP creates the "mission completed ticket"
STOP
Mission Completed Ticket
Database
Y
Agreed Mission Ticket
Has mission started yet?
N
Can mission be modified?
Y
FISP issues a revised Agreed Mission Ticket after Hierarchical evaluation of non-interference with other constrains
N
FISP advises crew and issues alternate instructions
Mission cancelled. Existing Tickets cancelled. Users notified
STOP

Fabrizio Maracich: short biography

- Born in Turin (Torino), Italy oct. 11, 1967
- Academic background in Aeronautical engineering.
- Pilot - ENAV S.p.A. – Radiomisure (Flight inspection dept.).
- Special project staff member with responsibilities over flight testing and simulations of new technologies and procedures.
- Flight Instructor.
- Instructor at the ENAV S.p.A. Training Academy, involved in training *ab initio* Air Traffic Controllers about flight related subjects, mainly *air navigation* and *aircraft performance*.