14ème th SIIV IFIS
Toulouse-France 12-16 Juin/June 2006

Flight Inspection in Busy Terminal Area: How to make it more cost effective ?

Mr. Enzo Maria Feliziani
Pilot

ENAV S.p.A Flight Inspection Dept.
Hangar 127 Ciampino Airport
00040 Roma - ITALY
E-mail: EMFeliziani@enav.it

Mr. Fabrizio Boris Maracich
Pilot

ENAV S.p.A Flight Inspection Dept.
Hangar 127 Ciampino Airport
00040 Roma - ITALY
E-mail: FMaracich@enav.it

ABSTRACT

The flight inspection activity conducted in congested areas produce, as a collateral effect, delays and therefore a cost for the whole system. From an analysis conducted on the procedures today in use all over the world to solve this problem, we are able to point out two different approaches:
1. on the ATC side:
   i. the use of a coordinator, located next to the ATCO;
   ii. the use of special trained team of ATCOs;
2. on the airborne side: night operations;

Each of these techniques has its own advantages and disadvantages. Each provider can choose the technique, that best fits its organization, or a combination of the two.
In this Paper we present an overview of these techniques highlighting their most important advantages and disadvantages.
Furthermore, we present a study, led in Italy, on the costs caused by the delays imposed to the flight inspection activity in the most congested areas.

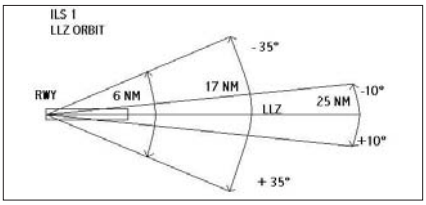
PURPOSE

To make Flight Inspection activity in congested traffic environment more efficient.

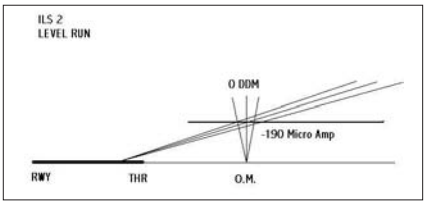
BACKGROUND

There are many difficulties in performing FI flights in a very busy environment. These are the four main problems encountered during everyday operations:
1. Delays imposed to commercial traffic;
2. Delays imposed to FI activity;
3. Air Traffic Controllers providing unnecessary separations between FI aircraft and rest of traffic since FI flight profile are not well known;
4. Tendency of Air Traffic Controllers to consider the FI activity as "low priority", thus putting the FI aircraft in a sort of "last of the line" condition.

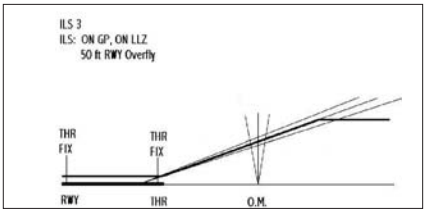
The type of check where the most of delays lies, both for commercial and FI activity, is the flight inspection of an ILS. Here the main issues, as seen from the ATC point of view, are:
1. The ILS 1 (LLZ cut) is the most complex flight profile to manage as it requires many crossings of the approach path. Obviously changes of speed or trajectory cannot be asked to commercial flights during the approach to land final phase and careful evaluation of separations is mandatory. Furthermore, long communications between Controllers and FI Pilots are sometimes needed to exactly explain the nature of this flight profile. *(the intentions of the flight crew)*



2. The ILS 2 (level run) is less demanding to the ATCO. Nevertheless, it is difficult to explain on the frequency. Sometimes departure are delayed during ILS 2 checks, even if the flight inspection aircraft do not over fly the runway and so do not create any kind of conflict with the departing traffic.



3. ILS 3 (on course and on path approach) is, of course, the simplest profile to manage of the entire check. Anyway, it is often not so easy to obtain the right timing and distance between the preceding aircraft and the FI aircraft. Correct timings and distances would avoid wasted runs caused by interfering aircraft (preceding or departing aircraft too close to the F.I. aircraft, especially during LLZ check).



COST STUDY CASE

ENAV has undertaken a study to exactly quantify the annual increase in flight inspection costs induced by ATC delays. The study analyzed the flight inspection time spent on selected main Italian facilities. The most important results are shown in the following tables.
For this study it was necessary to determine a "reference" ILS flight inspection time, i.e. without ATC delays, and compare this figure to the flight inspection time spent for the check of ILSs located in congested areas.
The Parma ILS was chosen as the "reference navaid" for this study because the Parma airport is located faraway from the most congested TMAs and it is used only by a few commercial flights. An average time of 3h and 41m (Fig. 1) is necessary to flight check this ILS and this time was held as the reference time for the flight inspection of an ILS in Italy without the influence of ATC delay.
A set of ILS located in complex environments (navaids located near or inside the most congested TMA, namely Rome and Milan TMAs), was selected as the subject for the study case. For each of these ILS the average flight inspection time was calculated and compared to the "reference" ILS flight inspection time to obtain the average deviation of the "complex environment" ILS set from reference and its "ATC Cost Index". The latter measures the ATC delays overhead imposed to flight inspection time.

NAV AIDS	FLIGHT INSPECTION TIME hh/mm/ss			AVERAGE N/A hh/mm/ss	DEVIATION hh/mm/ss
Fiume 34L	5.40.00	6.15.00	7.00.00	6.18.20	2.36.40
Fiume 34R	9.00.00	7.20.00	8.00.00	8.06.40	4.25.00
Fiume 16R	5.30.00	11.00.00	8.00.00	8.10.00	4.28.20
Fiume 16L	5.30.00	7.00.00	11.30.00	8.00.00	4.18.20
Fiume 25	8.40.00	5.00.00	6.30.00	6.43.20	3.01.40
Malpensa 35L	6.20.00	8.00.00	8.30.00	7.36.40	3.55.00
Malpensa 35R	4.20.00	6.30.00	6.10.00	5.40.00	1.58.20
Malpensa 17L	4.30.00	6.10.00	6.40.00	5.46.40	2.05.00
Linate 36R	6.30.00	7.05.00	7.25.00	7.00.00	3.18.20
Torino	8.45.00	8.00.00	4.15.00	7.00.00	3.18.20
AVERAGE FLIGHT INSPECTION TIME				7.02.10	
AVERAGE DEVIATION FROM THE REFERENCE DATUM					3.20.30
ILS ATC COST INDEX (TMA)					0,47
PARMA (REFERENCE)	3.30.00	3.30.00	4.05.00	3.41.40	
GENERAL ILS COST INDEX					0,3

Fig. 1. Impact of ATC Delay on the Flight Inspection Activity

NAV AIDS COST INDEX	
GENERAL ILS COST INDEX	0,3
VOR COST INDEX	0,2
PAPI COST INDEX	0,3
RADAR COST INDEX	0,2

Fig. 2. NAV AIDS Cost Index

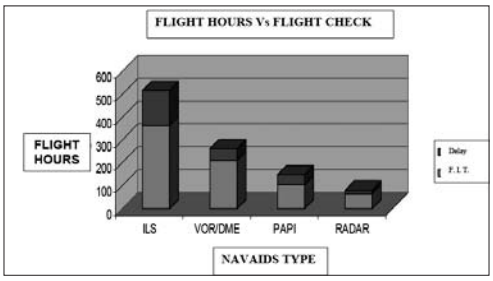


Fig. 3. Incidence of ATC delay on the Flight Inspection Time

The ATC Cost Index found for the "complex environment" ILS set was 0,47. The same index decrease down to 0,3 if we consider the whole Italian ILS set (Fig. 1). The same methodology was applied to all other navaid types, like VOR, NDB, PAPI and RADAR (Fig. 2), to obtain the related ATC Cost Index. These cost indexes permitted an estimate of the total amount of flight hours lost each year due to ATC delay.

The result of the Cost Study Case confirmed that this is a significant figure, amounting to, approximately, 14% of the total ENAV' flight inspection activity (Fig. 4). From the evidence of the ENAV' AFTM office, it shows that the delay caused by the scheduled restriction to the air traffic flow by the F.I. activity has been 8% of the total delay related to the ATC (Fig. 5).

Once again, the necessity for a solution to this critical problem becomes evident.

DELAY EVALUATION ON THE CONSIDERED FACILITIES					
NAVAID TYPE	FACILITIES	AVERAGE UNIT FLIGHT TIME	TOT H	F. I. T.	DELAY
ILS	37	7 X 2	518	362,6	155,4
VOR/DME	44	6	264	211,2	52,8
PAPI	75	2	150	105	45
RADAR	8	10	80	64	16
Total Flight Hours Loss					269,2

Fig. 4. Economical impact

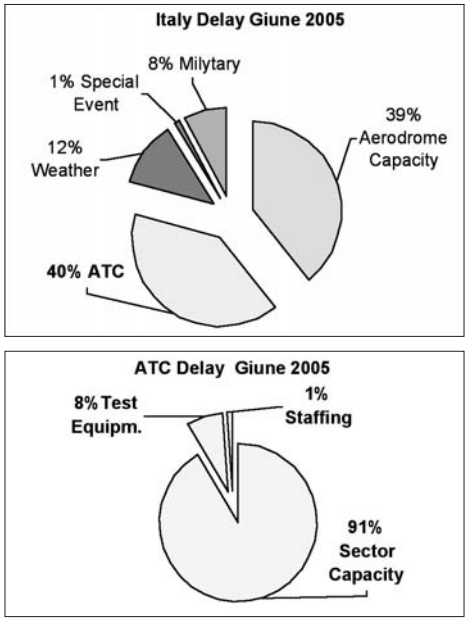


Fig. 5. F.I. Inspection Delay Vs ATC Delay

POSSIBLE SOLUTIONS

We analyzed the most common procedures in use all over the world to reduce the number of flight inspection hours lost due to ATC delays and we pointed out al least two different approaches to this issue.

A first possible approach is to intervene on the ATC side using either an operational coordinator located next to the ATCO, or a special trained team of ATCOs.

The second approach is to perform FI operations at night.

Each of these techniques has its own advantages and disadvantages.

The operational coordinator seems to produce very good results[1], but at the same time it is necessary to use a certain amount of well trained human resources.

The use of a special trained ATCOs team is also a good choice and it is a very common technique, but there are difficulties in setting an efficient coordination between the FI activity and the ATCOs working shift. Sometimes it is difficult to respect the flight inspection scheduled time, e.g. due to aircraft failures or weather problems, therefore this technique requires a flexible use of the special trained ATCOs team.

Night operation needs some special considerations since it is not allowed all over the world and it may require appropriate technology and procedure implementations. Where used it provides great advantages but it is very demanding for the crew, it presents serious limitations in presence of obstacles in the operation area and also limitations connected with noise abatement procedures.

The use of one of these techniques or a combination of these could be useful to obtain a reduction in FI flight time and improved relationship between FI crew and ATCO, for the following reasons.

ATC side:

1. Providing the Controller every news on the current flight, in order to provide safe operations and expedite commercial traffic. This is obtained mainly with:

1.1. Precise information on FI aircraft performances and particularly on speeds that the aircraft needs to maintain to perform the intended task;

1.2. Precise information about flight profiles (horizontally and vertically) so the controller can forecast exactly the position of the FI aircraft at the end of the intended maneuver;

1.3. Precise information about flight profiles (horizontally and vertically) that the aircraft is able to perform if a need to make an emergency maneuver arise.

2. Reducing drastically the use of the frequency, since all explanations can be obtained from the OC or from the special training that they have received.

3. Reducing coordination time between sectors of the same ACC

4. "Reassuring" the controller, thus permitting a more relaxed environment (lower stress level).

Night Operations:

In the case of night operations the advantages come from the lower level of traffic in the operation area, while the same area is usually very congested during the day time. In the night scenario FI crews can perform their flight checks in a most efficient way because the delay usually imposed by surrounding traffic is reduced to a minimum. However, night operations require an important up grade in terms of rules, technology and procedures[2]. Among the possible technologies to support night operations we can find IR sensor, MMWR (Millimeter Radar), EVS (Enhanced Vision System) and SVS (Synthetic Vision Systems).

EFFECTIVENESS OF THE PROPOSED SOLUTIONS

ENAV has conducted different studies to evaluate the effectiveness of the three solutions proposed in this paper. The data related to savings in time using the operational coordinator were collected during the experimentation conducted by ENAV in 20023. The data related to savings in time obtained using a special trained team of controller derive from the experience of our colleagues in Europe. The data related to savings in time using night operations were collected during a study conducted by ENAV in 2005. This study was based on a set of computer based simulations reproducing the flight inspection activity in the night environment of three major Italian airports (Milan, Turin and Bergamo) located in a congested TMA.

The results of these studies are synthesized in the following paragraphs, addressing four topics: savings in ILS FI flight time; reduction of delays imposed to commercial traffic; workload; FI culture spread among ATCOs.

Savings in ILS FI flight time

An average saving in ILS FI flight time of approximately 30% can be achieved intervening on the ATC side while a 40% can be achieved using night operations. More in detail:

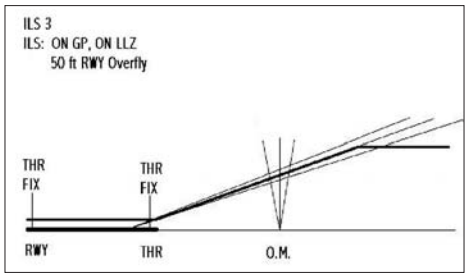
I. ILS 1

The use of one of the ATC techniques, or a combination of those, produce an important reduction in flight inspection time. Here the OC can

visually show the anticipated trajectory of the FI aircraft on the radar display to the ATCO on-duty, avoiding frequency congestion, misunderstandings and saving precious time on the communications side. A well training team would be able to reach the same goal.
Night operations will permit to the FI crew to perfectly optimise the timing of the control's procedures.
During ILS 1 operations a 40% saving in flight inspection time can be achieved intervening on the ATC side while a 50% can be achieved using night operations.

II. ILS 2
In this case the OC can explain the flight profile pointing out, for instance, that departures need not to be restricted by this profile during the inbound track, or that some delays to commercial traffic can be avoided during the run due to the horizontal profile of this pattern which allows an easier separation achievement. The specific trained ATCOs would be aware of these issues as well.
In this case too the night operations would completely avoid any misunderstandings and unnecessary delay.
During ILS 2 operations a 30% saving in flight inspection time can be achieved intervening on the ATC side while a 30% can be achieved using night operations.

III. ILS 3
For this kind of approach is very important how the "missed approach segment" is managed. Usually the controllers work with approaching and departing aircrafts, and their instructors taught them to maintain well separated such different kind of traffic. The FI aircraft very often is at the same time an approaching traffic and a departing traffic, thus generating a lot of confusion in the controller activity. During this flight inspection profile, too, it will be possible to exactly coordinate the right timing and distance between the preceding aircraft for the approach and the FI aircraft with the use of the appropriate techniques on the ATC side, thus avoiding delays and wasted runs due to interfering aircraft (preceding or departing aircrafts too close to ILS antennas, especially during LLZ check).
In this case too the night operations would completely avoid any misunderstandings and unnecessary delay.
During ILS 3 operations a 30% saving in flight inspection time can be achieved intervening on the ATC side while a 20% can be achieved using night operations.



Reduction of delays imposed to commercial traffic
A reduction of the delays imposed to commercial traffic of up to 25% can be achieved using one of the above procedure;

Workload
A significant reduction of the stress levels and workload can be achieved both for the flight inspection crews and the controllers on duty. They can both enjoy better working conditions.

FI culture spread among ATCOs
The continuous relationship between either OC / special trained controllers and normal ATCOs can facilitate the spread of the FI culture in the ATC units, thus facilitating the understanding of each others needs and providing an even greater level of safety.

CONCLUSIONS

Today, with commercial traffic increasing its volume every year and with a high competition level between companies, significant commercial traffic delays are no more tolerable. We have to make FI activity more efficient, less expensive and less demanding for the whole system. It is therefore imperative to devise a viable solution to reduce the impact of flight inspection activity on the system.
Our analysis highlighted two possible approaches to the problem. The first one is to intervene on the ATC side using an operational coordinator or a special trained ATCOs team. The second one is represented by night operations and the experimental results showed that this practice does produce very good results, even if it requires an important effort in terms of rules and procedures implementation, as well as technology upgrade, to maintain a high level of safety.
The use of one of the above procedures, or a combination of more than one, despite looking expensive and time consuming will produce a great amount of savings and it will be well worth the initial effort, providing a dramatic reduction for F.I. flight time and a considerable reduction in commercial flights delays too.
The use of special techniques during the F.I. activities, especially in the highly congested operational environment that we are facing today, has become a necessity to achieve a better quality of work for both F.I. Crews and Air Traffic Controllers.

REFERENCES

1. E. M.Feliziani, F. Maracich, "Advantages in Employing an Operation Coordinator during Flight Inspection Activities", Proceedings of the 12th International Flight Inspection Symposium, Rome, June 2002

2. F. Maracich, E. M. Feliziani, "Evolution of the Night Flight Inspection Concept: Technology and Operational Procedures", Proceedings of the 14th International Flight Inspection Symposium,Toulouse, June 2006.

3. E. M.Feliziani, F. Maracich, "Advantages in Employing an Operation Coordinator during Flight Inspection Activities", Proceedings of the 12th International Flight Inspection Symposium, Rome, June 2002