

Performance Measurement in ATM?

A necessity or a hindrance to efficient ATCO work?

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Performance Indicators as published and used by Air Navigation Service Providers must not be linked in any way to the pay and/or working conditions of individual controllers IFATCA policy on Performance indicators

Its Friday afternoon in an air traffic control en route center anywhere within continental European airspace in August. The afternoon shift has started and the controllers know that they will face Thunderstorm activities (Charlie Bravo's {CB} in their jargon) as on their way to work they have seen the cauliflower-like clouds building up.

Recent decades of modernization of government controlled activities like public service function has led to new expectations on public service management. Economical, socio-political and organizational objectives to this new trend have been defined to offer the same service, cheaper, faster and more efficiently. Limitation of public spending of GDP (through privatization and de regulation) , reform of the "machinery" of budgeting, leading to a more transparent, flexible and more citizen involved system, with managerial discretion and new tools, like performance management, contracts for service delivery and "Agencification" have been identified, explained and implemented.

Prof. M.Finger, OECD

The afternoon shift works with a reduced number of air traffic controllers as some unforeseen sick leave has been announced by two of the afternoon-shift controllers. The supervisor was unable to replace them and has taken the decision to announce a special configuration of 12 instead of 13 sectors (2 sectors collapsed into one) to the Central Flow Management unit. Capacity values have been indicated as 40 (normal value 50 for this configuration, reduced by CB activities to 20%) for the specific collapsed sector. The hourly rate for the ATC center has been set at 120 movements per hour and has been reduced by 20% to 96 movements.

ICAO at the 11th Air Navigation Conference in 2003 has endorsed the Global ATM Concept Plan (ATMCP). A set of high level expectations by the ATM community are listed in Doc 9854. These eleven Key performance Areas are used in performance management: Access and Equity, Capacity, Cost Effectiveness, Efficiency, Environment, Flexibility, Global Interoperability, Participation by the ATM community, Predictability, Safety, and Security. The ATM community expectation embodied by each Key Performance area will be met by pursuing more specific performance objectives. These are defined to assist the ATM community in producing relevant and timely enhancements (operational improvements) to a given region's ATM system in order to satisfy the ATM community expectations. Performance objectives are expressed in qualitative terms, and may include a desired or required trend for a performance indicator (e.g. reduce the cost per kilometer flown) while not yet expressing the performance objective

in numeric terms (this is done as part of performance target settings). Care has to be taken to ensure that the agreed performance objectives are "SMART" (specific, measurable, achievable, relevant and timely). ICAO, ATMRPP, Performance based transition guidelines

The two controllers sitting at the collapsed sector start their work. In the middle of their sector an active CB forces aircraft to circumnavigate by more or less 40 nautical miles (NM) from the center of the activity. The executive controller approves and identifies a new pattern of aircraft crossing points. They co-ordinate with adjacent centers as the aircraft (on their new path) will come very close to the sector boundaries and potentially conflict with (so far) unknown traffic flows. Both controllers at the sector are busy with their respective tasks.

The Performance Review Commission (PRC) was established in 1998 by the Commission of EUROCONTROL, in accordance with the ECAC Institutional Strategy (1997). One objective in this Strategy is "to introduce strong, transparent and independent performance review and target setting to facilitate more effective management of the European ATM system, encourage mutual accountability for system performance and provide a better basis for investment analyses and, with reference to existing practice, provide guidelines to States on economic regulation to assist them in carrying out their responsibilities."

Eurocontrol's PRC has published to date 8 yearly reports. They analyse the performance of the ATM system in the following Key Performance Indicators (for 2005): Safety, Traffic, Delay, cost-efficiency, Flight efficiency

After 45 minutes of concentrated work the controller pair experiences a blockage of one of the two frequencies (coupled due to the collapse sector) making it difficult to effectively communicate with aircraft. Luckily the blockage lasts only for 90 seconds.

En-route delays (1.3 min/fl) increased but met the agreed target (1.4.min/fl). This is a significant achievement in view of traffic growth. The airport ATM delays are getting close to en-route delays, and exceed them at certain times. This warrants special attention. 2005 ATFM delays Minutes 17.6 Million estimated costs Euro 1'000 Million

Eurocontrol, Performance Review Report 2005 (PRR 2005)

Although flight-efficiency improved slightly, cost of flight inefficiencies increased significantly due to higher fuel prices 2005 , direct route inefficiency 4 % or 300M km, estimated costs Euro 1'400 Million Eurocontrol PRR2005. The costs of en-route and terminal ANS incurred by airspace users in Europe were some Euro 7 Billion in 2004

Eurocontrol PRR 2005 / Cost of an B777ER up to \$ 264 million.

After 90 minutes the short term conflict alert (STCA) triggers a warning 120 seconds ahead of a potential conflict. Both the executive and the coordinator are not surprised by this warning and have discussed the appropriate separation standard, which would be minimal (less than 7 NM but still within the 6 NM tolerance they are allowed to apply). They decide to provide vertical separation, but maintain it on the horizontal level also as they were blocked both above and below by other aircraft which were not following the initially foreseen tracks. The pilots of affected aircraft have been informed of the crossing(s).

In summary, there are significant performance shortfalls in European ANS at present: Transparency on ANS safety is generally low. It is not possible to affirm that there are no significant safety issues

Eurocontrol PRR 2005

For the future it will be a major challenge to drive ANS performance to satisfactory levels in all Key Performance Areas within an acceptable timescale: e.g. Maintaining safety, which implies reducing risk at least four-fold, when traffic doubles, and ten-fold if it triples

Eurocontrol PRR2005

The STCA indicates that they will have 6.0 NM at the closest point of crossing and both controllers continue to work their air traffic normally. This STCA alert triggers an alert flag at the supervisor's desk where he has the ability and duty to make a quick review of the situation on a replay monitor at his desk.

The performance of the air navigation services system as a whole at European level should be assessed on a regular basis, with due regard to the maintenance of a high level of safety, to check the effectiveness of the measures adopted and to propose further measures.

European Commission Regulation 549/2004 Single European Sky/ The framework regulation

The supervisor decides to leave the ATCO pair working as there was no real infringement of any separation standard. According to regulations he completes an STCA report and prepares the form for the ATCOs acceptance and signature. He also goes to the sector to inquire how the traffic is evolving. The controller pair is unable to speak with him (as they are concentrated on the traffic) but show the thumbs up sign and continue to work. After 110 minutes they both are replaced and take their coffee break. They pass the supervisors desk, before leaving for coffee to sign the STCA report and get another form that must be filled out when there is an operational incident (blocked frequency).

Safety - the conformance of air transport to specified safety targets;
Delay - The time taken in excess of the optimum time that it takes a user to complete an operation;
Cost effectiveness - The value for money that users receive from the supply of air traffic" services;

Predictability - The ability of a user to predict variation and to build and maintain optimum flight schedules;

Access - The accessibility of airspace, ATM services and airport facilities under controllable conditions;

Flexibility - The ability of ATM to accommodate changing user needs ;

Flight Efficiency - The ability of the ATM system to allow a user to adopt the preferred flight profile in terms of flight level and route;

Availability - the availability of critical ATM resources and of the ATM services provided to users;

Environment - The conformance of air transport to environmental regulations;

Equality – Equality

Eurocontrol PRC Key Performance Areas

On the following Monday, as a result of the operational incident report the incident investigation department analyzes this Friday afternoon session with CB activity "somewhere in European airspace." The results of the analysis are interesting, as one of the frequencies was blocked for 89 seconds and no direct impact on safety resulted. The STCA alert was simultaneously analyzed and the conclusion was that it was a non event and had to do with the parameters of the technical system. The actual traffic load in the first 60 minutes was 53 movements (instead of the 40). The increase was the result of the CBs causing traffic to climb higher than originally planned. In the second 60 minutes the traffic count was 54 (instead of 40) again due to the fact that the aircraft flew higher than planned to avoid the CB activity.

The system should not be used as a performance monitor for individual controllers

IFATCA policy on ATC Separation Monitoring tool (ASMT)

The CFMU established a report on this Friday afternoon session and showed in their daily debriefing sheets that this ATC center (somewhere in Europe) actually caused more than 10'000 minutes delays that day because it had collapsed two sectors and reduced the offered capacity by 20% in the afternoon. This cost the airlines in direct costs 71 E/minute¹. Indirect costs (like re-route, planning of the daily legs etc.) are difficult to articulate. Safety indicators have received another two indications (radio blockage, and STCA alert) – however it does not say anything on the safety performance of this afternoon. Further, the apparent over-delivery (additional traffic than the sector capacity) of traffic to the sector is analyzed by the flow management unit and is noted on the negative side of the statistics. The operational manager of this unit automatically receives a report of the number of delay minutes that have been created. After analyzing the report of the flow management unit s/he becomes worried as in his/her performance based bonus s/he is allowed only to 250'000 minutes delay a year and the additional 10'000 minutes of this Friday brings him/her close to 200'000 minutes delay and this only in August. The delay factor makes 20% of his/her performance-based bonus and therefore s/he is wondering if



s/he will achieve the maximum year end bonus which is in the order of 10% of annual salary. After a co-ordination meeting with all operational managers of the European flow the head of operations of this service provider has a discussion with the operational head of the ATC centre, about this Friday afternoon session, as it had been earmarked as a negative example during the meeting. The user representative of the airlines has complained that the ANSP was unable to offer more capacity on this particular Friday afternoon as it was one of the busiest during the August month.

Performance measurement is not an end in itself. So why should public managers measure performance? Because they may find such measures helpful in achieving eight specific managerial purposes. As part of their overall management strategy, public managers can use performance measures to evaluate, control, budget, motivate, promote, celebrate, learn, and improve. Unfortunately, no single performance measure is appropriate for all eight purposes. Consequently, public managers should not seek the one magic performance measure. Instead, they need to think seriously about the managerial purposes to which performance measurement might contribute and how they might deploy these measures. Only then can they select measures with the characteristics necessary to help achieve each purpose. Without at least a tentative theory about how performance measures can be employed to foster improvement (which is the core purpose behind the other seven), public managers will be unable to decide what should be measured.

Robert D. Behm

1 www.eurocontrol.int 2003 delay cost indicator

This fictional example shows that the perception of performance can be very different. The ATCO pair working the traffic has exceeded their required performance (more traffic than planned, in a difficult working environment – CB, radio blockage); the supervisor did not achieve the required system performance as he was unable to keep all 13 sectors opened. The over-delivery of traffic to the sector indicates a poor performance by the flow management unit at the center and at the regional level. The Head of the Unit has endangered his set performance target and the ANSP has been earmarked for poor system performance by the end user. Safety has not been impaired, but no performance value has been established for these 120 minutes as nothing has happened. No mention of the real cost of providing ATC at the collapsed sector (107 instead of 80 aircraft in 120 minutes) was quoted; nor was the total amount cashed in by the ANSP (which might be only for 76 medium sized aircraft, due to the current cost-recovery mechanism and the KM/ton formula). So maybe the controller pair worked this traffic without actually covering the costs to provide the service – and some of airlines (users) are saving money on this Friday afternoon while over flying this sector.

General view of IFATCA

Whilst the production and use of Performance Indicators (PI) by Air Navigation Service Providers (ANSP) cannot be controlled by IFATCA, we can examine the type of PIs typically used and question their relevance to the ATC system, and perhaps suggest more relevant PIs For flights operating within and between specific classes of airspace. As can be seen, these are from a “user” perspective. Indeed there is no particular problem with these definitions from that point of

view and they are a fair indication for the user of the system as a whole. IFATCA does understand the necessity for government to act as a control mechanism of commercialized ANSPs.

But are they a true measurement of the ATM system from the ATCO’s perspective? Arguably not. There can be many factors beyond the control of any individual ATCO, or ATC Centre, that will influence the outcome of these measurements. Some of these influences are: equipment capability, capacity and serviceability, military activity, traffic priorities, resourcing, training, airspace design, and over-demand etc. These concerns can be particularly valid for “cost effectiveness” PIs where so much can be influenced by the structure and use of the base data. Also, these results can be markedly different dependant upon whether they are measured at a system level, national level, district level or unit / facility level. Controllers and Members Associations must be extremely careful where these results are broken down further to sector, console or individual ATCO level.

From the ATCO’s perspective, perhaps such PIs could best be summarized as “quantitative” rather the “qualitative”. For example, “Safety” PIs tend to measure rates of occurrences per distance flown or numbers of flights per volume etc. They measure “reported events” after the fact. They can be more indicative of the robustness of the reporting system than the actual number of events. But do they measure “preventative” actions by the ATCO’s? Can they measure professionalism, caution and separation assurance? Whilst the PIs may “infer” the success of these factors by low occurrence rates, are these successes then reflected “negatively” in the “efficiency”, “accessibility” and “cost effectiveness” PIs?

Similarly, “delay” PIs can only be assessed qualitatively from an ATCO perspective if all possible contributory factors are taken in account. A delay expectation from the user perspective cannot be seen as a true measure of ATC performance. IFATCA concludes that PIs as usually assessed and published by ANSPs should not be read as being totally indicative of ATC performance from an individual, sector or unit perspective.

These PIs are published for general or at least, industry use. They are an indication of overall “system” efficiency, but not directly ATC performance. IFATCA is also aware of such PIs being published within ATC units on a daily basis, for all on duty ATCO’s to see. IFATCA has some concerns about the “passive influence” on operational ATCO’s of having this sort of data displayed in operational areas. Will the ATCO change his controlling techniques after reading these PIs on his way to the console? What could they do differently? Be ultra safe that shift at the expense of efficiency? Any such suggestions would be to denigrate the professionalism and training of ATCO’s. Indeed most of the PIs as currently used have little direct relevance to the operational ATCO. IFATCA is firmly of the belief that Performance Indicators must never be linked to the pay and conditions of operational ATCO’s

With the increase in ANSPs being privatized or corporatized, more and more managers of ATC facilities, down to lower and

lower levels, are moving to contract employment. IFATCA is also aware of some circumstances where managers receive bonuses if various PI targets are met. Such PIs can include average cost per flight, and average delay per flight. IFATCA has concerns about PIs being linked to pay received by operational managers. As stated above, most of these factors are beyond the control of the individual ATCO's on a day-to-day basis. Any such linkage between managers' pay or bonuses should be restricted to higher level managers, and only those not having direct operational supervision.

So far, IFATCA is not aware of PIs being used that perhaps more accurately measure the operational performance of an ANSP. Such PIs have been suggested to be developed. These could include: number of ATCO's trained to operational working level, training successes; number of occurrence reports received vs. investigated; number of recommendations from investigations made/accepted/implemented; success of change management process.

Conclusions

Air Traffic Management (ATM) has moved from government managed public service to a more commercialized and even privatized environment. Governments keep control at least in commercialized ATM providers through either direct control (ownership) or indirect control (corporate governance). Both forms of control need to satisfy sovereign and public service expectations while improving the quality of service. This can be achieved through lower route charges, less delays. By remaining sufficiently independent in managing the operational business, it is more attractive for managers to invest their career in such a non – profit business. At the same time, Governments will always try to reduce political impact of negative performance outcome by the commercialized providers (accident, lack of funds and/or continuity of service). This is achieved inter alia by setting performance targets in the form of company strategies that must be achieved by the ATM provider. IFATCA Members have experienced their daily efforts not meeting the set performance targets by owners and the managers of the ATM providers. Very often elementary trade-offs are made at the local ATCO level between meeting expected performance targets of a unit and “production pressure”. This has led many times to frustration, disillusion or incomprehension of the expectations at the “coalface”. The experiences of IFATCA members has shown the potential for dangerous practices, particularly where performance objectives have been misused by ANSPs (e.g. bonus payment for those willing to work unregulated traffic – “supercontrollers”; supervisors having to work missing shifts of their team in order not to be sanctioned; withheld safety incident reports in order to meet the safety target etc.).

As performance measurement is still a very young trend in ATM management, the impact of it on the overall performance of a unit or a region cannot be quantified. At the ATCO level it is perceived either as a nuisance or a hindrance. At the ATM systemic level the increased transparency for the various stakeholders (such as users and political institutions), makes sense, if these stakeholders are willing to understand

the limitation of such performance measurement system. Experience in Europe shows that the qualitatively good work (robustness of the figures, neutrality and transparency) of the Performance Review Commission is sometimes being misused for quick (and not well analyzed) conclusions. This has led in past to a reduced willingness by the ATM Providers to report the real figures, which in some countries has led to a snoozing of the political masters and neglect of their oversight function and responsibilities.

ICAO has chosen a good approach by outlining what has to be provided by way of performance in the future so that sustainable growth of aviation can be achieved. This forward-looking way of having ATM performance measurement established could be a way to positively improve the overall, global ATM service. Experiences at local, national or regional level have shown to IFATCA that there is still a long way to go before ATM performance measurement will not be perceived as a hindrance to improving the overall performance of the ATM system.

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