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The Virtual Centre Model

Summary

Impressum:

1 - Introduction

Since the late 1980's the European ANS system has gradually become unable to cope with growing traffic demand. The Single European Sky initiative of the European Commission is meant to overcome the failing performance of the European ANS system by the means of a comprehensive and structured framework. The SES intends to optimise ANS performance, in particular through the defragmentation of the patchwork of ill coordinated national ANS systems.
The SES capitalises on 2 main features to achieve defragmentation, namely operational and technical interoperability, and Functional Airspace Blocks.
Eight years after the entry into force of the SES legislation, and in spite of a second legislative package to strengthen the regulatory framework, the SES, in general, and the FABs, in particular, still fail to deliver the expected results.
The causes for the lack of meaningful progress have been traced to numerous factors, which need to be recognised without complacency. Absence of political will by some States is certainly such a factor. But one of the most compelling reason for the unsatisfactory development is the failure of all stakeholders to agree on a common, realistic and practical business model for the organisation and provision of Air Navigation Services, which will support the delivery of performance.

2 - The need for virtual consolidation

Defragmentation of ATS facilities and services has been identified as a potential enabler to generate economies of scale, to facilitate the establishment of cross-border service provision, and to remove inefficient interfaces between operational units within FABs.
Defragmentation can take many forms, some of which raise sensitive issues. For that reason, the principle of defragmentation by the means of physical consolidation has never found its way either into the SES Regulations or in any of the current FAB programmes. Further, isolated initiatives for the physical defragmentation of some facilities (e.g. the Swiss proposal for a trinational "Border Triangle" centre) have failed to gain support. Also, the economic effectiveness of physical consolidation have been challenged by the practical experience made by some ANSPs.
Aviation reality has to deal with the social, political, economic and regulatory environment of the ANS industry. Progress is only viable if it is politically and socially acceptable and thus sustainable for the whole aviation value chain.
The lesson from the early years of the SES is that defragmentation of ANS facilities remains a promising and necessary solution. However, in the light of the highly sensitive issues at stake, for the foreseeable future such defragmentation can not occur through physical consolidation but must be virtual, and should take the form of "virtual centres".

3 - The Virtual Centre Model

A virtual centre is a group of air traffic services units (under the responsibility of one or several ANSPs) operating from different locations which use fully standardised methods of operation, information, procedures, technical means and equipment in such a manner that they are perceived as a single system from an airspace user's perspective.

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3.1 Operational vision

The Virtual Centre Model is based on an operational vision which aims to offer a concrete, practical and effective answer to all the requirements for the establishment of FABs[1] namely:

- Common operational requirements;
- Cross-border service provision;
- A performance driven approach;
- Enhanced cooperation among service providers.

Under the Virtual Centre Model, the existing service providers remain in place and are not required to consolidate physically their facilities. By establishing a virtual centre, however, the participating ANSPs achieve a virtual defragmentation through arrangements which ensure the joint management of the airspace falling within the responsibility of the centre. Such virtual defragmentation would certainly also have consequences in terms of personal management.

These arrangements support full technical and operational interoperability among the participating ANSPs, which, in turn, allows sectors assigned to a specific unit to be temporarily transferred under the operational responsibility of another. For instance, at times of low traffic, sectors from different units can be merged into a single, large block of airspace, which can be managed with the same level of operational performance, but at a lower cost for the participating ANSPs, as some of employees of one or several centre(s) will not be on duty. Sectors can also be transferred to another unit in the event that the necessary operational resources are missing with the unit normally in charge of it.

The airspace management policy also prescribes that, when sectors are temporarily assigned to another ANSP, they are transferred to the best performing service provider. Under this operational approach, the size, shape and configuration of airspace sectors within the operational envelope of a virtual centre is meant to reflect a performance optimum at any given time.

3.2 Enablers

The Virtual Centre Model is based on two key concepts which are interlinked by an European standard:

- a standardised workstation for controllers (which we call **"common controller cockpit"**) based on open systems and certified/protected "plug-in" applications.
- several licensed data/information service providers operating on standardised but open systems, security protected which guarantee data sovereignty for the states (which could ultimately result in the creation of a **"protected ATM information cloud"**).

Both these concepts require common standardised interfaces.

The Virtual Centre Model has been inspired by the development of aircraft cockpits and by the concept of cloud computing. Cockpits today present a similar interface (at least within the same aircraft manufacturer) and common functions throughout a particular aircraft family, and regardless of the aircraft's operator.

The cockpit equipment and functionalities are highly standardised. However, the technical equipment downstream from the cockpit may be based on very different systems provided by a wide range of potential suppliers. There will be a major difference between airline cockpits and the common controller cockpit: the latter will be developed over time by adding standardised "plug-in" applications on open platforms (see 3.2.1).

As for cloud computing, all the technology required is already available and deployed in other industries. The concept is not new; but the time has come to extend it to air navigation services.

[1] *A FAB is defined as "an airspace block based on operational requirements and established regardless of State boundaries, where the provision of air navigation services and related functions are performance-driven and optimised with a view to introducing, in each functional airspace block, enhanced cooperation among air navigation service providers or, where appropriate, an integrated provider".*

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3.2.1 The common controller cockpit

The "common controller cockpit" (CCC) concept breaks away from conventional integrated and monolithic ANS system thinking. The CCC concept assumes that the part of the system which is genuinely of common strategic importance to ANS providers is the controller's workstation or human/machine interface (HMI).

In the Virtual Centre Model, the controller's workstation, the architecture, its functionalities but also the related procedures (CONOPS) will be fully standardised over time to permit common working processes throughout Europe's ANS industry. As a precondition HMIs have to be based on open systems. Therefore, the transition can take place step by step by the use of "plug-in" applications. The model recognises that the ANS operating environment is not homogeneous and that various regional or local specificities exist. The Virtual Centre Model consequently offers a broad selection of European-certified and security protected "plug-in" applications to perform particular functions: certain approach control operations, services in complex airspace, safety and forecasting tools and similar. The communications tools concerned must all be interlinked and fully compatible.

3.2.2 The information/data centres

The information/data centres provide ANSPs with a security protected way to procure information services instead of technical equipment. When it comes to flight data processing, an ANSP should be able to purchase not an item of equipment but a service: the provision of the data that are required by its common controller cockpits. Such data services can either be delivered by multiple industry providers or, as an intermediate step, by ANSPs. Under this model, an ANSP will also be free to purchase a full radar data processing system to connect to its workstations, or to purchase flight data directly from another ANSP or a commercial data supplier. The Virtual Centre Model thus assumes that the provision of the technical equipment downstream from the controller's workstation need no longer form a part of the system owned or operated by an individual ANSP. The networking of information/data centres could ultimately result in the creation of an "information cloud".

3.2.3 The common standardised interfaces

For all the above to happen, of course, it will be critical to give high priority to the standardisation of the interfaces between the common controller cockpit and the systems providing the input. For illustration purposes, this is comparable in many ways to a standardised hardware connector, such as an USB.

It should also be emphasised that the implementation of the Virtual Centre Model does not require participating ANSPs to purchase identical equipment or systems supplied from the same manufacturer. As long as these systems are interoperable and operate as open platforms in conformity with the agreed standards, ANSPs will remain free to acquire their equipment from any manufacturer.

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4 - Benefits

The Virtual Centre Model will deliver major benefits to the ANS industry, and more specifically to airspace users, which extend well beyond economies of scale. It will also be a powerful concept for supporting the development of FABs as well as the overarching FAB network.

The Virtual Centre Model will increase the FABs performance, by introducing effective load sharing processes. It also contributes to functional convergence of equipment by automatically solving the uneven spread of performance arising from different levels of sophistication in the operational concepts and technical support. It will allow ANSPs to close down certain facilities at times of low traffic (e.g. at night). It also offers an attractive option in terms of contingency facilities, as any centre built on virtual centre principles will feature the redundancy required in the event of a failure of one of its constituent elements. Airspace sectors could also be more flexibly assigned among the centre's units, depending on the resources available at any given time. While these benefits will initially arise at the individual ANSP level, the virtual centre concept will also allow multiple ANSPs to pool their resources in the longer term, in particular within FABs.

By standardising the architecture and the interfaces between workstations and the equipment downstream, the Virtual Centre Model opens data processing and supply activities up to competition. Individual ANSPs will no longer be compelled to purchase a fully-fledged system of their own, but will be able to acquire a service from a competitive supplier or share equipment with another provider, such as within the framework of an FAB project. This will reduce both investment costs and the overall costs of providing the services concerned.

In itself, the concept of a common controller cockpit will reduce the cost of complexity of the European ANS system by supporting common operational tools and procedures based on innovative and certified "plug-in" technology. It will also facilitate controller mobility, by making it easier for a controller to adapt to another facility. It can thus be assumed that the CCC model would also be the most acceptable to the social partners.

The benefits expected from the Virtual Centre Model are quantitative and can be measured. A preliminary estimate, based on practical experience so far, suggests that the implementation of virtual centres across Europe could yield recurring cost effectiveness improvements in an order of magnitude of 1 billion euro per year, once the model is fully implemented after a transition period of 15-20 years. This outcome is mainly the result of efficiency enhancements in the range of 15-20% through the partial closure of centres overnight/off peak as well as reduced operating costs and investments.

Performance is also expected to be improved in the following domains:

- Less complex systems and processes resulting in enhanced robustness and safety
- Business continuity (almost 100%)
- Capacity increases (10% overall)

The European Commission has undertaken to request a study from an independent body such as the PRU or NM to verify these estimates.

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5 - Challenges

The Virtual Centre Model is an ambitious proposal, which is not void of challenges. These must be clearly identified and mitigated.

First, security and networks are vital issues here as are sovereignty-related data. The experience gathered through precursor programmes, such as the European AIM Data-base (EAD) demonstrates that the security concerns related to the protection, processing and use of shared aeronautical data can be addressed to the satisfaction of States and other stakeholders involved.

Second, a flexible airspace management concept involving the transfer of sectors among ANSPs naturally raises limitations associated with licensing of air traffic controllers. The concept must, however, rely on processes that retain the envelop of necessary qualification of individual controllers within a reasonable and manageable measure.

Challenges are deemed to become more manageable with the implementation inside one single FAB (with the characteristics of a model case realised and on a smaller operational scale than European wide).

6 - Virtual Centre Model and the European institutions

The implementation of the Virtual Centre Model can be used as a common reference model to align the actions and programmes of the European bodies. Above all it might also contribute to clarify their respective roles.

6.1 The European Commission

The European Commission will have a central role to play in facilitating the deployment of the Virtual Centre Model. As explained below, this will require an appropriate regulatory framework to lead and steer the implementation of the model in a consistent and coherent manner. That framework will also determine the roadmap and the incentives required for a progressive expansion.

6.2 SESAR

It is important to emphasise that the virtual centre concept is not a technology initiative, and even less an alternative to the SESAR programme. The virtual centre is a business model, which is not only considered to be fully compatible with the objectives defined under the SESAR programme, but is also precisely meant to offer a solid platform for the implementation of SESAR deliverables. For its successful adoption, however, it will be essential to prioritise certain SESAR activities and to formalise the principle of open HMI platforms (including standardised and certified "plug-in" applications) and the interfaces between controller workstations and the equipment downstream (such as being currently developed within the SESAR project SWIM). High priority must also be given to defining the various standards under the SESAR umbrella. At the same time, the implementation and funding of the Virtual Centre Model should be separately overseen. Finally, the SESAR deployment phase shall set the priorities required to enable the implementation of the Virtual Centre Model.

6.3 FABs

The FABs shall offer a framework to govern the implementation of the Virtual Centre Model. In order to ensure a consistent and coordinated deployment across Europe, this will require a common steering body (e.g. an F9), comprising representatives from all FAB programmes. The implementation of the Virtual Centre Model should be combined with the SESAR deployment.

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6.4 PRB

The PRB also has an important role to play in the implementation of the Virtual Centre Model. The achievement of the targets defined under the European performance plan will require bold and ambitious initiatives from the service providers. The Virtual Centre Model offers realistic and effective means to reach these targets.

6.5 Eurocontrol

Eurocontrol is in the process of redefining its future. Because of its unique experience and expertise and its privileged position as a performer of common European functions.

The current Eurocontrol initiative for the creation of Centralised Services targets ancillary services. This should be the starting point to consolidate core services as well, especially the data service provision infrastructure.

Eurocontrol in our view is a prime candidate for the development of a first European data business model and/or data centre. It is primarily important for standardisation and quality purposes. At a later stage in the implementation of the Virtual Centre Model, the operation of data centres shall be open to other data providers.

In addition, Eurocontrol could also be appointed as a certification body for "plug-in" applications.

Finally, the Virtual Centre Model and the Network Management Plan should be closely and mutually connected. Virtual centres are expected to be primary actors in the overall European network and to provide for the flexibility which will be required for an efficient network management. This has been acknowledged in the sense that the main principles of the Virtual Centre Model have already been incorporated in the draft Network Management plan[2].

7 - The transition phase

One of the major arguments supporting the Virtual Centre Model is that it does not require an immediate and simultaneous synchronisation of the technical development plans of all Europe's ANSPs. As such, it offers a more realistic path than a "Big Bang" approach. The model allows those ANSPs and FABs which are able to do so in respect of their system lifecycle to adopt the new standards as soon as they are defined. It also allows those ANSPs which need more time to amortise their existing or already planned systems to more gradually adopt the new (business) model. This in turn will translate into lower investment and transition costs. A clear road map, though, supported by appropriate EC regulation and defining the successive steps and funding mechanisms, now needs to be drawn up.

8 - The regulatory approach

For the Virtual Centre Model to materialise, its underlying principles must be rapidly incorporated into the European regulatory framework. This regulatory approach can (and indeed must) remain light and focused. But a transition period of no longer than 15-20 years should be prescribed.

Ideally, the regulatory foundation required should take the form of an EC implementing rule which establishes a requirement to standardise the HMI functions and interfaces with the controller workstations to permit equipment downstream to be replaced by information services. The various standards here will also need to be formalised in law.

Support via European funding is very important here. Those ANSPs which are able to meet the standards defined should benefit from funding support. Given the upcoming pressure of the European Performance Scheme, targeted funding will enhance this effect.

Part of the funding available should also be dedicated to the further development of the Virtual Centre Model.

[2] *c.f. Draft Network Strategy Plan 2012-2019, pages 12 (2.2.4), 15 (3.1.4), 22 (SO2) and 27 (6.2.2)*

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9 - Conclusions

The underlying principles of the Virtual Centre Model are not new. They have been implemented successfully in many other industries before and all the supporting technologies are readily available. The time has come to translate these principles in the European ANS industry.

The main merit of the Virtual Centre Model is that it offers a realistic answer to the limitations encountered until now in respect of FAB implementation. It is particularly attractive in the sense that it promises measurable performance benefits, while:

- pursuing a technical and operational transition which allows each participating ANSP to opt-in at its own pace;
- being politically acceptable since it does not require the closure of any centre;
- being socially acceptable, because it does not impose forced mobility upon ANS staff.

The Virtual Centre Model addresses the shortcomings of the European ANS system as a whole. It is consequently meant as an European initiative. It will however require individual ANSPs to act as pioneers to validate the concept, at national level, or as teams of ANSPs from different countries. Skyguide is in the process of demonstrating the model in practice, by operating its facilities in Geneva and Zurich as a virtual centre. It also aims to extend the validation through a partnership with one or several "Sister Centre(s)" within the FABEC.

This paper pictures the outcome of a process that developed over the past 2 years. Its contents have already been shared and coordinated with several stakeholders in Europe and the FABEC. For the Virtual Centre Model to further progress towards implementation, it will be necessary for the international, national and regional aeronautical authorities to actively support and promote the concept and to consider the potentially achievable benefits of the Virtual Centre Model from a "total ANS" perspective.