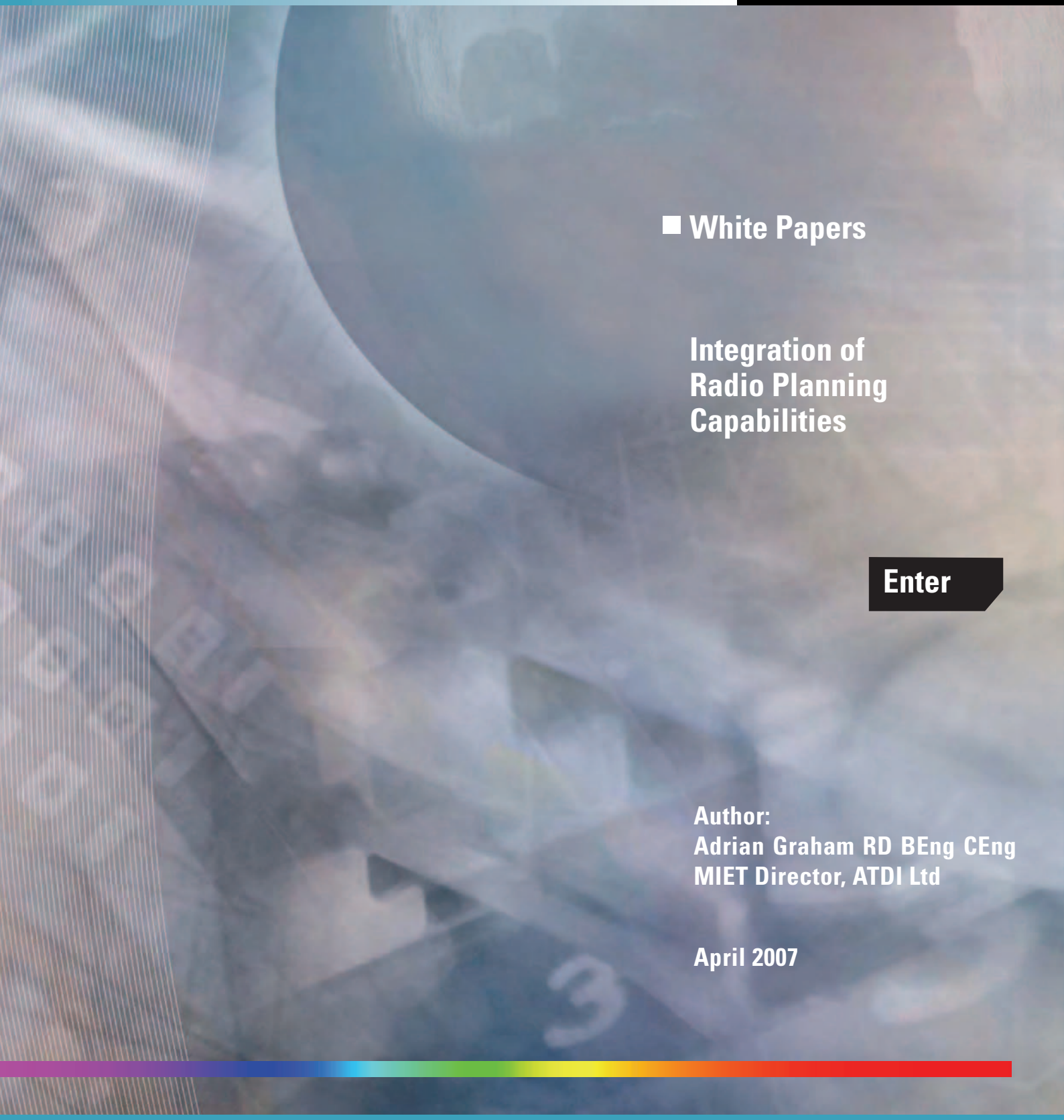

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Integration of Radio Planning Capabilities

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Solutions in Radiocommunications

Integration of Radio Planning Capabilities

Overview:

In the past, radio planning has been a distinct business activity within organisations, often only loosely connected with the operational part of the business. Given the planning tasks and technology available at the time, this was a justified approach and the overall business process did not suffer unduly. However, with modern business models, radio technology design demands and the sophisticated tools available, it is appropriate to re-visit this approach and identify whether it is possible to better integrate radio planning capabilities into the overall business process. In this context, 'business' means the activities of any organisation; it could be a commercial company, or it could equally be a government department, military or emergency service.

Integration Approaches

Integration can be achieved either on a process basis or on a system basis. By process integration, we mean that data interfaces exist between different parts of the business, and relevant information flows in a timely manner across those interfaces. An example of this is illustrated in Figure 1, which shows how the business can incorporate new information and take action based upon it. This might be typical of a point-to-multipoint network being rolled out. A potential new customer enquiry is received by the sales department. They pass the customer data on to the operations department, who see if the customer can be served by an existing node; if not, the information is passed to the design team, who take this and other information to identify a potential site and the equipment configuration needed to create the new site. The details of the selected site are passed back to the acquisition team so that the site can be acquired, and on to the installation team. They pass the expected in-service date back to the operations department and sales team so that the customer can be informed of when the service will commence. When ready, the installation team goes out and actually installs the new site.

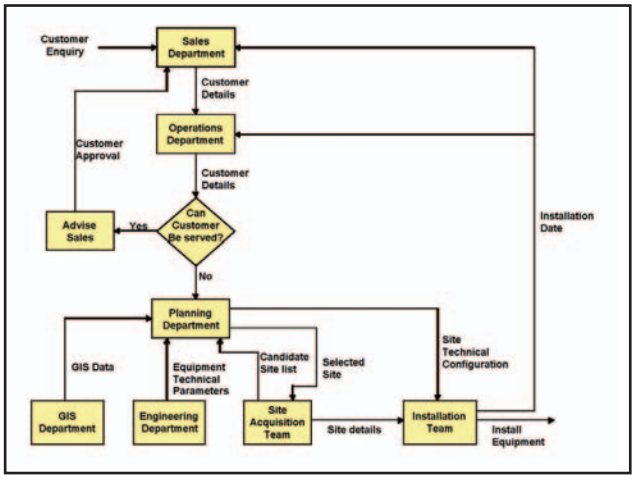

Figure 1: Integration of data across the business

It can clearly be seen that the speed that information flows through this process, the faster it can be completed. Also, the more automated the process is, the more efficient it will be.

System integration provides for the possibility of fully automatic provision of radio planning services within a larger system. This could be as an embedded system within a mission control system or as a component of a mission planning system. Figure 2 shows an example for a military system, where the complete system comprises of a number of components that can be accessed as required, either manually or as part of an automated system. The radio planning aspects of the system are only one part of its overall functionality, and may indeed be a relatively small one.

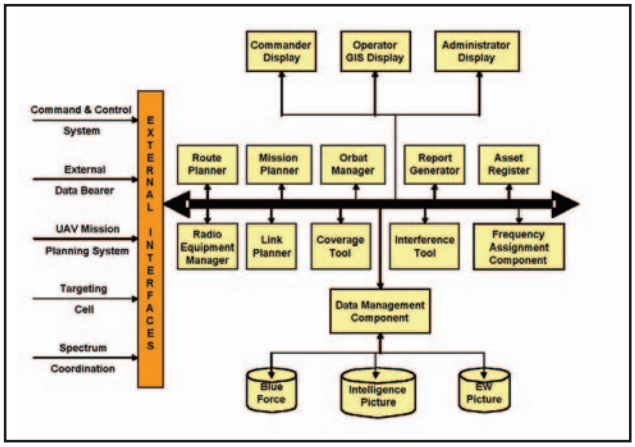

Figure 2: System integration

The component-based design means that it is possible to add or change components as necessary without affecting the rest of the system. This can be of major benefit for maintenance and to avoid introducing system instability when it is upgraded.

Potential Benefits of Integration

Successfully integrating radio planning into the business process can lead to a number of benefits, whether the approach taken is process-based or system-based.
For process-based integration, the benefits include:

- The process of designing for integration is beneficial in itself, since it is common to find efficiency improvements when examining current methods,
- Faster movement of data allows faster processing and thus tasks are completed more quickly,
- A single, automated and documented approach minimises errors and decreases the probability that inefficient and possibly incorrect methods are used by some staff in their place. As well as improving quality, this approach is also amenable to automated auditing,
- Correctly implemented and followed, it can lead to an improved corporate culture and a reduction of instances where departments see each other as competitors rather than as being part of the same team.

The degree of benefit seen will depend on the degree of automation obtained. In general, the more automated the system is and the easier it is to use, the better.

For system integration, the benefits can be more tangible and can include:

- Embedding functionality in another system, with its own user interface, may mean that a separate interface is not necessary for the radio planning process, but rather that a few extra dialogue boxes are added to the existing interface. This minimises the requirements for user training and skill maintenance and reduces requirements for different interfaces that often have similar features (for example, a GIS system used for mission planning may well have common GIS features to a separate radio planning tool),
- The display and functionality of such a system can be focussed on operational requirements, rather than simply the radio planning aspects. In general, the communications are required to support an operational activity. In many cases it is this that the operator should be presented with, rather than a technical interface that expresses radio links in terms that are not easy to translate to the operational requirements. If the system can provide the operator with operationally-focussed messages about radio performance, then this will reduce the requirement to have specialist radio planning experts,
- Linking at the system level means that processes can be entirely automated so that, for example, if an operator moves the location of a vehicle in the command and control system, a radio communications link test is automatically carried out and the operator warned if the new location is likely to lead to failed communications,
- When provided as a component-based service, it is possible to enhance component features or add additional functionality without working on the entire system.

Potential Drawbacks of Integration

Nothing can normally be achieved without there being some potential downfalls or adverse effects, and this is true of integration. Some of the key drawbacks center on cost and risk.

Cost will always be an issue when designing new systems and processes. Even where no software changes are to be made, the process of identifying necessary tasks, making improvements to the processes performed, documenting the new processes, training staff and ensuring that the processes are followed and are effective in real operation implies cost and, during implementation, disruption. It is also possible that apportioning tasks to different groups and departments can be divisive and lead to acrimony. It may be seen as an attempt to empire-build or alternatively to push unpopular tasks to other staff. In general, the only mitigation against that is to ensure that any activity to bring new processes into service is conducted sensitively and that where possible staff are kept fully briefed on the need for change and encouraged to participate in the activity.

Cost will also be an issue for system integration. This will be particularly true if major software development has to be performed to provide the necessary interfaces and functionality. And, as ever in software design, project risk is never far behind. This means that system integration projects must be carefully managed. This is particularly true because it is likely that several organisations may be involved in the process, each responsible for their own parts of the system. The timely and accurate passing of information in a useful manner is essential to the design process and this can often be difficult to achieve in practice.

In many cases, the drawbacks are outweighed by the benefits. However, it is important to ensure that any project to implement new changes is carefully managed and great care taken to ensure that an appropriate method has been selected. In fact, recognising the possible approaches available and selecting the best is generally the key to success for the project.

Integration Approaches – the Sliding Scale

Figure 3 illustrates the sliding scale of approaches that can be taken for system integration projects, with a traffic-light identifier (good-medium-bad) for risk and flexibility. The least complex to implement is the use of COTS (commercial off-the-shelf) products that have already been designed and tested. The risk associated with this is low, but the system is likely to be inflexible. The next step up is the scripted solution, in which functionality present in the COTS product is 'wired together' in a script that completes a defined process. This increases the flexibility of the tool to complete complex, routine tasks with minimal operator input and reduced training requirements. For example, a design process that takes 80 individual key presses to complete might be completed in one or two key presses using the scripted method. MOTS (mostly-off-the-shelf) products are those that are mostly COTS but are enhanced to meet the user need. Normally, there will be an associated additional cost to achieve this, but the cost and risk are both likely to be lower than the bespoke solution option, which is generally the riskiest and most costly. Software components, which are effectively COTS (or sometimes MOTS) products that have been implement tested, but which need to be integrated to other systems, provide a way of providing radio planning services into other, larger systems such as command and control systems, mission planning tools and spectrum management systems. In all cases, there is a sliding scale that extends to the bespoke solution, when the COTS parts of the system are small compared to the new development activity.

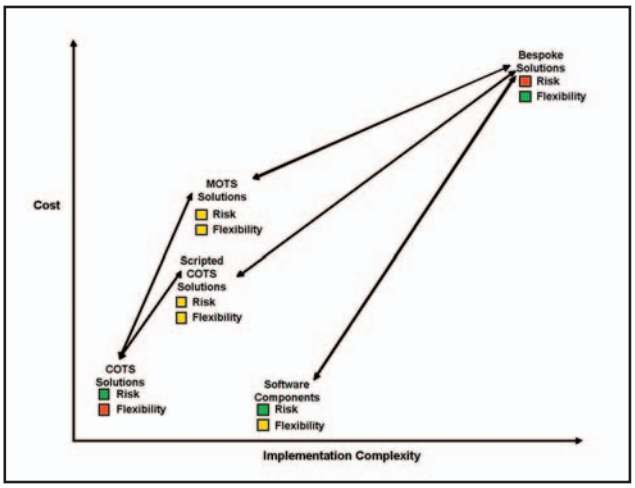

Figure 3: Implementation strategies for system integration

Ideally, it would be good to keep as close as possible to the bottom left hand corner of the graph, while still meeting the overall requirements. *How can this be achieved?* There are a number of considerations that can support this, mostly to do with the selection criteria for COTS products:

- When considering the purchase of COTS systems, examine how flexible the system is. Planning systems such as ICS Telecom are built to provide easy data import and export to and from a wide variety of data sources as standard, and are able to link to most databases. The system also features a TCP/IP interface and other more specialist interfaces. The point is that if the COTS tool can integrate to other systems as standard, there may be no need to have a large integration project at all,
- Does the system have a companion scripting tool, and how easily can it be used? Again, if the scripting tool adds sufficient flexibility, then it may be possible to achieve integration without a great deal of effort,
- How easy would it be to have changes made to the product? If it can be changed or enhanced relatively cheaply and quickly (ideally at the developer's risk), then again this will probably be a preferable solution compared to a bespoke development. It is important to identify whether the product is continually being developed or whether the existing code is archived. If it is archived, it can often be impossible to change within a reasonable budget,
- Consider the non-functional requirements of the wanted system, such as the time to complete tasks. COTS and MOTS will do their core functions quickly, but other aspects may be sub-optimal in terms of speed, and thus it may be necessary to go down the component route or even the bespoke development route,
- Make sure you understand the full capabilities of the system you already have before looking for alternative solutions. It could well be you already have the solution you need, but are unaware of the fact.

These considerations should help in identifying a suitable approach to achieving an integrated approach. Depending on your organisation and the tasks it performs, achieving integration may have major cost and responsiveness benefits, so it is an area that is well worth looking into.

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