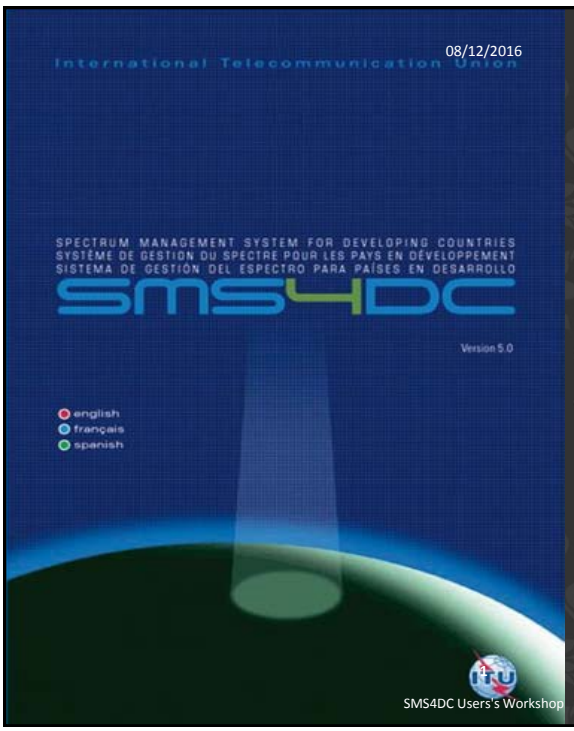

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The Need of the Computer-Aided Spectrum Management

Spectrum Management Training Program
Module EM1-6
Introduction

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- The need for use of computer-aided spectrum management systems
- The benefits of computer-aided spectrum management
- Steps to acquire computer-aided spectrum management
- Training and maintenance

Background

- The use of computers in the spectrum management process has become crucial for most Administrations that are faced with the ever-increasing use of the radio frequencies.
- Some crucial aspects in the establishment of a computer-aided spectrum management are
  - Engineering issues
    - Frequency assignment, service area, interference, et
    - Frequency coordination

Background (cont'd)

- Administrative procedures (registration and issuing of licenses)
- Notifications of assignments to the ITU according to the Radio Regulations

The need for use of computer-aided SM systems

- Is it really needed?

  The definitive answer in every case is "Yes"

  However, it shall be properly designed
- For success of any computer-aided spectrum management system following areas should be addressed:
  - Existence of a regulatory infrastructure for spectrum management.

The need for use of computer-aided SM systems (cont'd)

- Definition of scope and project objectives for applying a computer-aided spectrum management system.
  - What portions of processes or tasks within each spectrum management unit are to be considered for automation?

Are some manual processes better left untouched?

The need for use of computer-aided SM systems (cont'd)

- Determination of available internal and external resource allocations.
  - An assessment must be made as to what financial and human resources will be required and dedicated to the project.
  - Will it be necessary to obtain special funding authority?

The need for use of computer-aided SM systems (cont'd)

- How is the system developed or implemented?
  - In-house resources
  - Contract
  - Purchasing available software
  - A combination of these

The need for use of computer-aided SM systems (cont'd)

- Does the administration possess the necessary regulatory and technical experts or will it require assistance?
- What limits or boundaries, are to be imposed in automation development?

  Will the magnitude of the project dictate its development over many phases or years?

The need for use of computer-aided SM systems (cont'd)

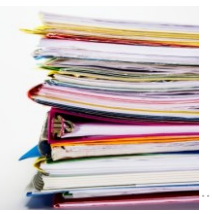
- Identification of operational requirements
  - Each task or activity contains its own operational requirements that must be easily interpreted into a sequence of steps such as e.g. flow charts
- Establishment of functional and technical specifications
  - These specifications chart out the development of the system and are the basis of the detailed design.

The need for use of computer-aided SM systems (cont'd)

- Development of work plans and schedules showing project phases, tasks and status reporting milestones.
  - The use of any graphical illustrations, such as Gantt charts, for the work plan and scheduling should be considered.
- Definition of user specifications
  - Needs and requirements of the end users must be clearly defined to ensure their proper translation to detailed design specifications.
  - Any contract to be awarded must contain a clear and comprehensive statement of work.

The need for use of computer-aided SM systems (cont'd)

- Availability of organizational and procedural documentation of existing systems and operations
  - System developers will need access to this documentation as they will invariably need to become themselves quasi-regulatory/technical experts before the translation of existing operations and procedures can begin.



The need for use of computer-aided SM systems (cont'd)

- If contractors are to be considered, their performance history must be examined.
  - Does the contractor have the requisite skilled or experienced system developers to see the project through to completion and implementation?
  - Previously delivered contracts should be reviewed to determine or assess any related experience that can be applied to the proposed contract.

The benefits of computer-aided SM

- Computer-aided techniques have become commonplace in administrations in order for them to be able to manage data and to perform the necessary analytical studies associated with spectrum management.
- Administrations may benefit from an integrated system through timeliness and effectiveness of the following tasks:

The benefits of computer-aided SM (cont'd)

- Verification of the compliance of frequency assignment requests with the national and international table of frequency allocations and their associated footnotes;
- Verification that a set of equipment (transmitter, receiver and antenna) proposed to be used in a certain radio link has previously been submitted and passed the appropriate certification process or meets other mutual recognition agreement standards;

The benefits of computer-aided SM (cont'd)

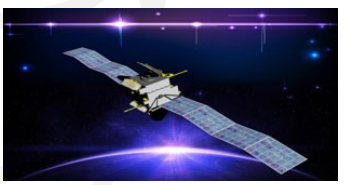
- More accurate and optimized response to frequency assignment requests, through the selection of appropriate channels taking into account details such as terrain characteristics;
- Automatic and decentralized on-line issue and renewal of licenses and invoices (law must allow for electronic signatures);
- Appropriate treatment of radio monitoring data (See ITU-R Monitoring Handbook);

The benefits of computer-aided SM (cont'd)

- The establishment of a more expeditious and fully documented, timely billing of customers for their use of the spectrum;
- More accurate preparation and electronic submission of notification forms to be sent to ITU;
- The availability of electronic exchange of data between administrations or between an administration and the ITU;
- Increased transparency and data availability to users inside and outside the administration.

The benefits of computer-aided SM (cont'd)

- Many ITU activities have been automated.
- The Radiocommunication Bureau's Terrestrial Analysis System (TeRaSys) and the Space Network System (SNS) and the related software applications are the computerized tools used by the Bureau to process the frequency assignment notices submitted by administrations.



Steps to acquire computer-aided SM

- Several factors should be taken into account before starting the transition from a manual or semi-manual spectrum management operation to a computerized system:
  - There is an infrastructure that should be analyzed, planned and carried out before starting an automated system.

Steps to acquire computer-aided SM (cont'd)

- One of the steps required for this planning is a study of the methods that can be used to adapt established manual procedures to an automated system, including:
  - The possible acceptance of the new procedures by users;
  - Training of the core of specialized staff for carrying out the automated task;
  - Consideration of the source of funds required for automation;
  - Consideration and analysis of the level of data to be made available to the automated system;

Steps to acquire computer-aided SM (cont'd)

- The changeover from a manual to an automated process will initially create new types of challenges and requirements;
- The initial period of system development and implementation may be costly.

  The user should realize that it requires time before he can receive all the advantages and financial benefits of an automated system.

Steps to acquire computer-aided SM (cont'd)

- Each administration uses a unique set of documents (licenses, application forms, allocation plans, invoices, etc.) in its spectrum management operations.

- These documents may be in paper or electronic form.

In order to effectively transition to an automated spectrum management system, it is absolutely essential that these existing documents be considered carefully in order to meet the specific needs of the administration for spectrum management and to provide the requested output formats.

Steps to acquire computer-aided SM (cont'd)

- A successful transition between the existing and the newly implemented automated system is critically dependent on the scheduling of the transition period and the effort invested in meeting these specific requirements and converting the necessary documents for use by the new system.

Steps to acquire computer-aided SM (cont'd)

- It is best to design a transition process that recognizes the significant effort needed by all parties to ensure the process works smoothly.
- It is important to adhere to a formal process to document the existing data collection processes and data sources as follows:

Steps to acquire computer-aided SM (cont'd)

- Identify the type and format of all existing data, including

  operational and management data, such as general administrative data (department, region codes, fee rules, workflow steps, types of licenses, types of equipment certificates, types of holders, etc.) as well as general technical data (types of services, types of stations, types of equipment, types of mobiles, frequency plans, protection ratios, off-channel rejection curves, etc.)
- Validation of the data is essential !

Steps to acquire computer-aided SM (cont'd)

- Define a detailed strategy to migrate the existing data including a list of the data to be migrated.

The format and timetable for delivery of the data by the administration, the timetable for conversion of the data by the contractor, the tests that will be used to verify that the conversion process has been successful and complete.

- Users are responsible for the quality of the data!

Steps to acquire computer-aided SM (cont'd)

- While many functions of the spectrum management process can be automated, many cannot.
- As an administration considers automation of its processes, it should expect the following facilities from automation:
  - A system to facilitate processing of applications and licenses.
  - An accounting system to administer fee collection.

Steps to acquire computer-aided SM (cont'd)

- Engineering analysis tools to allow analysis to avoid interference.
- Geographic maps and a geographic information system.
- A readily available and straightforward interface to spectrum monitoring facilities.

Steps to acquire computer-aided SM (cont'd)

- A regulatory agency should not expect the following facilities from automation:
  - Automatic assignment of frequencies.
  - Automated frequency-site planning.
  - Quality of service of cellular or broadcasting systems.

Steps to acquire computer-aided SM (cont'd)

- There are different ways to approach automation of spectrum management:
  - A national spectrum management operation can be automated all at once.
  - Or just certain parts of an operation can be automated.

Steps to acquire computer-aided SM (cont'd)

- Modularity is a very important consideration

Since spectrum management is ever growing and ever expanding, because of population growth and technological advances that give rise to new uses of the radio spectrum, a system needs to be expandable, flexible and modular so that it can grow as required over time.

Steps to acquire computer-aided SM (cont'd)

- The financial aspects of automating spectrum management must be considered by a regulatory agency.

  Automation costs money, and an administration must consider its requirements and the cost of satisfying these requirements.

  An administration should only acquire what it can afford. If it can only afford a limited initial capability, it should incrementally acquire its automated capability and ensure that the system is modular and can be easily expanded.

Steps to acquire computer-aided SM (cont'd)

- A regulatory agency should also consider the fact that spectrum management can be a source of self-financing for automation.
  - ✓ Fees for licenses and renewals and fines for violations are a source of revenue that can fund the acquisition of automation of spectrum management -procedures.
  - ✓ Chapter 6 of the Handbook on National Spectrum Management (edition 2015) provides more detail on the economics of spectrum management.

Training and maintenance

- Training is essential for any personnel who perform functions of spectrum management which are automated.
  - Spectrum managers should be proficient in the use of computers, or they must be trained as computer users.
  - Spectrum managers need to be trained on any newly automated functions in their operation.

Training and maintenance

- Maintenance of an automated system is greatly facilitated by:
  - The ability of a computerized system to include built-in test equipment (BITE).
  - To be able to perform self-tests of its operation to detect faults or failures, and display on computer monit information about any problem

For further reading:

- ITU Handbook - Computer-Aided Techniques for Spectrum Management (CAT), 2015, http://www.itu.int/pub/R-HDB-01
- ITU Handbook on National Spectrum Management, 2015, http://www.itu.int/pub/R-HDB-21
- SMS4DC User Guide (http://www.itu.int/pub/D-STG-SPEC-2012-V4.0), 2010
- ITU Handbook on Spectrum Monitoring, 2011, http://www.itu.int/pub/R-HDB-23
- Recommendation ITU-R SM 1370-2, 2013, http://www.itu.int/rec/R-REC-SM.1370-2-201308-I/en
- Recommendation ITU-R SM 1537-1, 2013, http://www.itu.int/rec/R-REC-SM.1537-1-201308-I/en
- Recommendation ITU-R SM.1604, 2003, http://www.itu.int/rec/R-REC-SM.1604-0-200302-I/en

THANK YOU !!

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