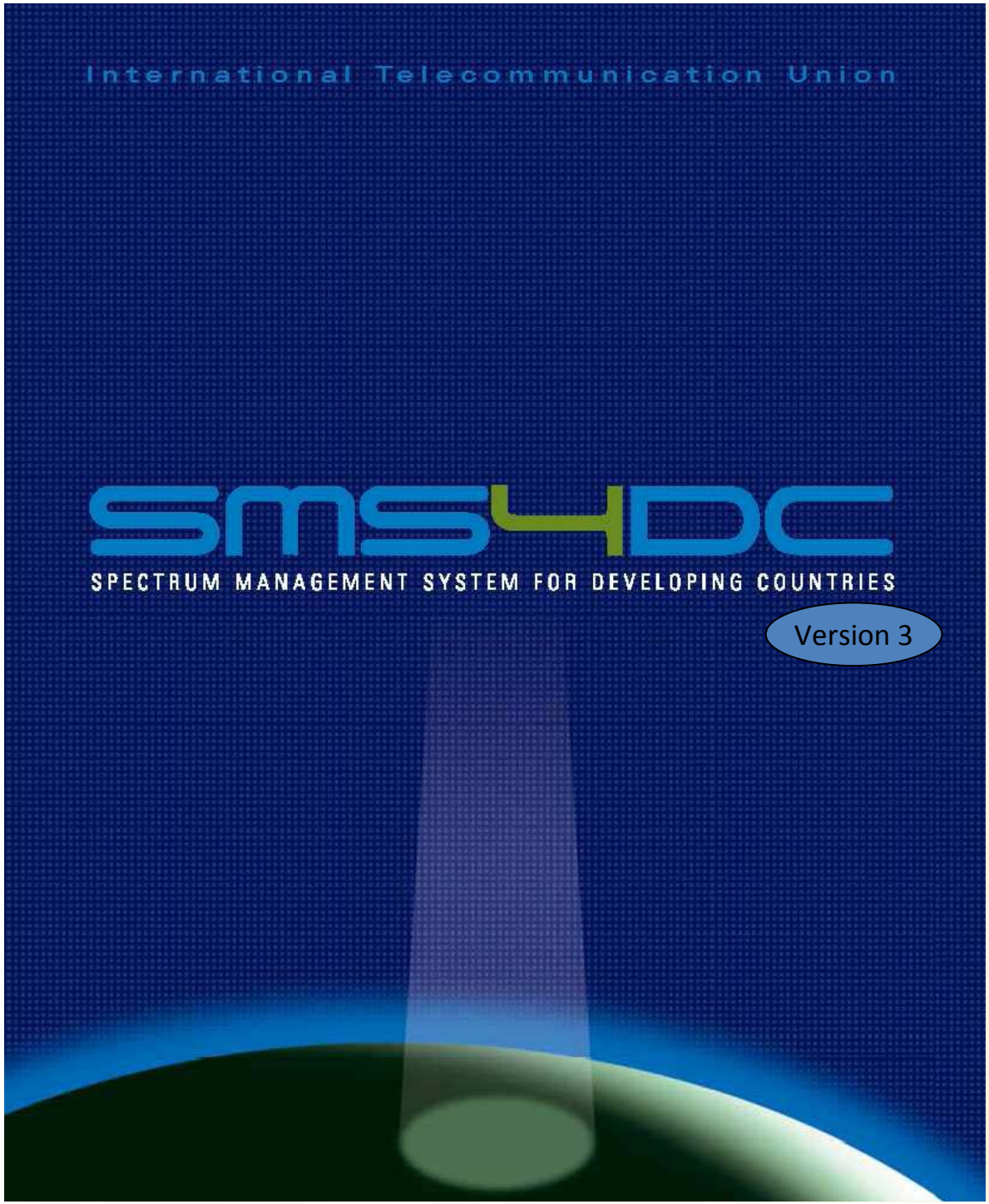


Spectrum Management Fundamentals

Part 1 - International

The Need for Spectrum Management

International Telecommunication Union
Committed to connecting the world

Presentation Roadmap

- The *Radio Spectrum*
- *Users* of the resource
- A look at *trends and challenges*.
- Major functions of *Spectrum Management*.
- *Benefits* of efficient and effective spectrum management.

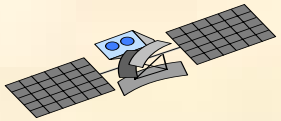
What is "*Spectrum*"?

- Radio frequencies - 10 kHz to 3000 GHz
- A scarce but renewable public resource
- Cannot be confined within national borders
- Used and managed through international treaties and national policies
- Vital to economic, social & cultural life

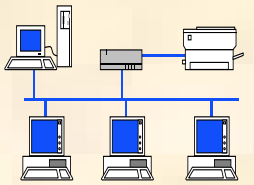
A Limited Resource?

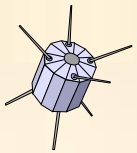
- The radio frequency spectrum is not an inexhaustible resource. It is a very precious resource which must be managed to ensure efficient and equitable access for the services which use it.

The Spectrum Environment

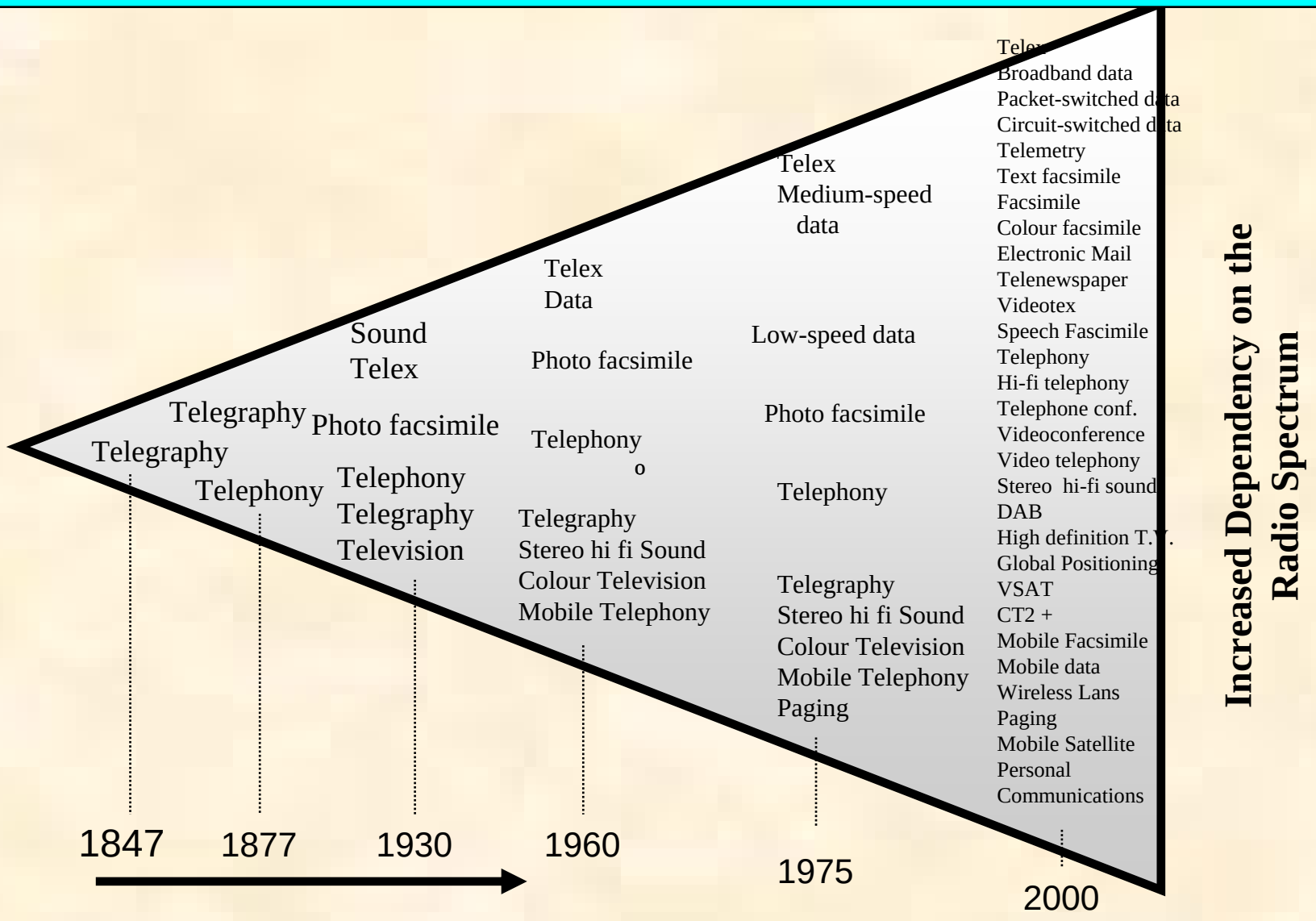


- Existing Allocations
  - growth industry 1.3 million licences and increasing by CAGR 7% p.a. since 1970
- Major New Allocations
  - radio local area networks (LAN's)
  - personal communications services (PCS)
  - digital radio broadcasting (DRB)
  - mobile satellite services
  - wireless local access
  - high definition television



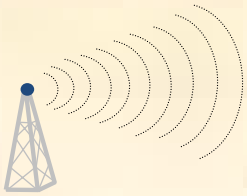


Spectrum Dependent Telecommunications Services to the Year 2000



Uses of the Radio Spectrum

- radio & television AM, FM, TV
- microwave & satellite
- mobile radio
  - taxi, courier, trucking, cellular, paging
- safety services
  - air traffic control, police, fire, ambulance, marine
- manufacturing
  - arc welders, plastic sealers, gluing machines
- energy
  - pipeline control, security
- health
  - heart monitors
- consumer devices
  - cordless telephones, garage door openers, microwave ovens



Management Variables

- There are several variables one must consider when managing the spectrum resource
  - Political issues, both national and international
  - The effect of spectrum use on society
  - Economic impacts
  - Technical considerations

The Political Issues

- The political issues include:
  - Access to global and national spectrum resources;
  - International cooperation;
  - Sovereignty
  - Culture and national identity
  - National economic wellbeing
  - The state of national technological Development

A Global Resource

- The radio frequency spectrum is freely available to whomever wants to use it.
- But when one service uses an available portion of the spectrum it is no longer available for other services without mutual interference.
- Eventually, as users demand access, the scarce resource will be fully used.

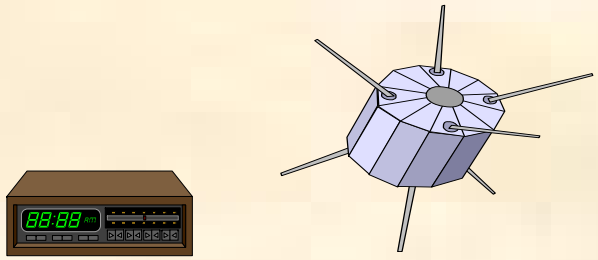
Control of Information

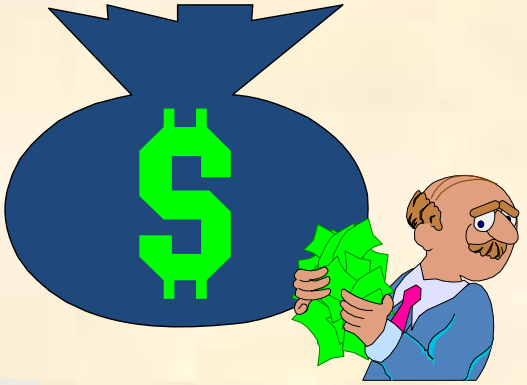
- The demand for access to the spectrum resource will inevitably increase as society moves through the “information age”, creating a need for ever more “Information Bandwidth.”
- Whoever controls the access to the spectrum will also control much of the means of conveying information.

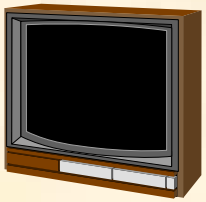
No Access?

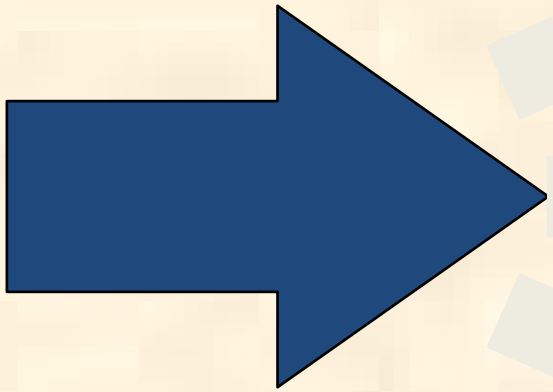
- But what if access to spectrum resources is denied?
- There certainly will be dire social and economic consequences:
  - national identity and culture can be affected;
  - economic transactions are more difficult and infrequent;
  - undesirable political outcomes can ensue.

Spectrum Management: a multiplier of wealth

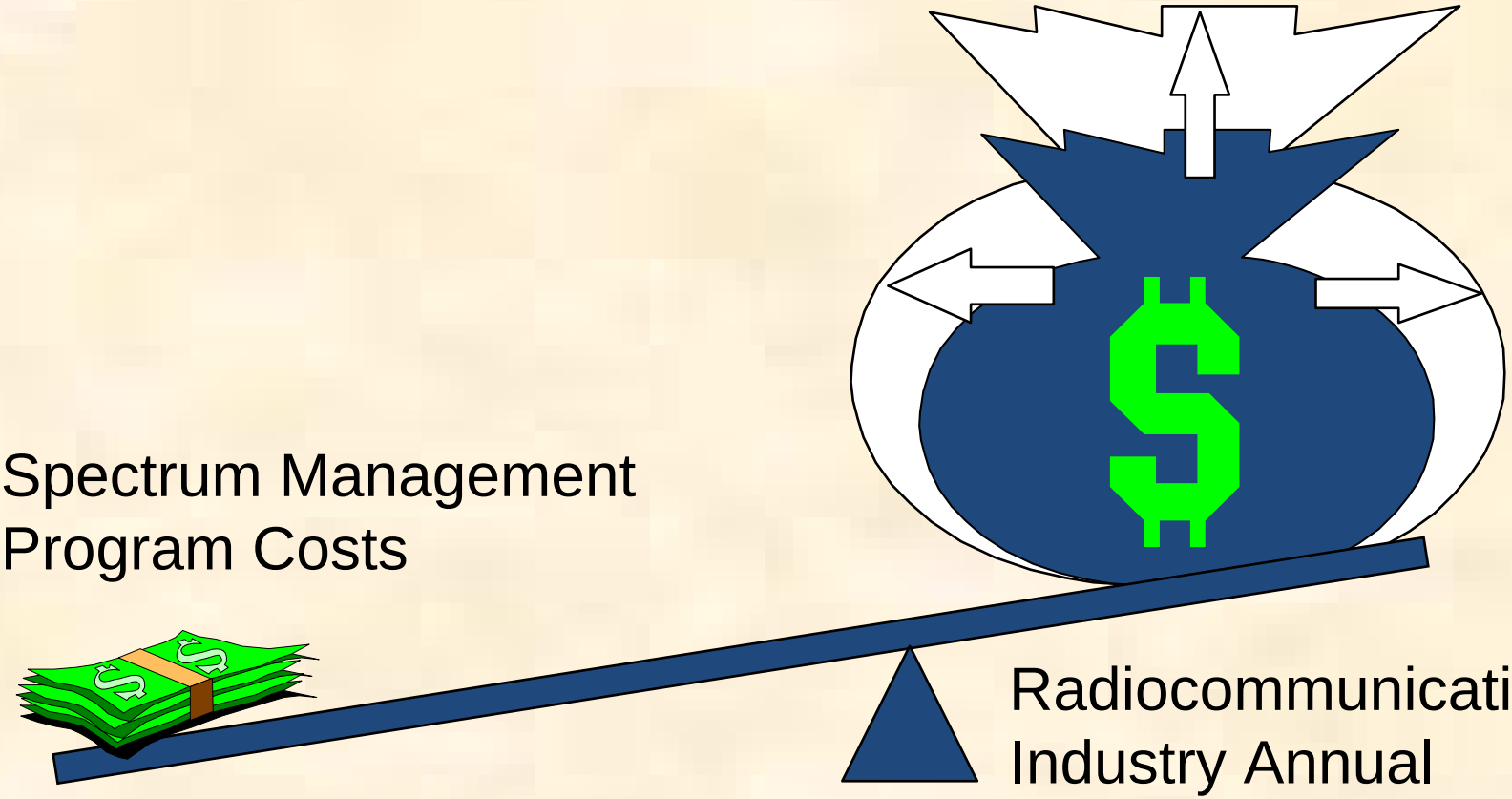








The Multiplier Effect



Spectrum Management
Program Costs

Radiocommunication
Industry Annual
Revenues

Leverage 62x

New Opportunities for Country

Spectrum - An Essential Ingredient

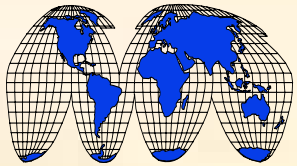
Product & Service Definition, Development & Marketing

Jobs & National Wealth

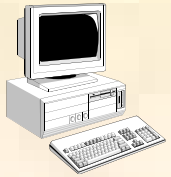
Trends in the Management of the Spectrum

- Significant and rapid growth

- Globalization of services



- Implications of the internet



- Integration of services

- Safety, privacy issues

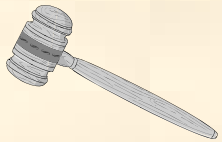
Trends in the Management of the Spectrum (cont'd)

- Unexplored regions of spectrum

- New technology

- Collaboration with industry

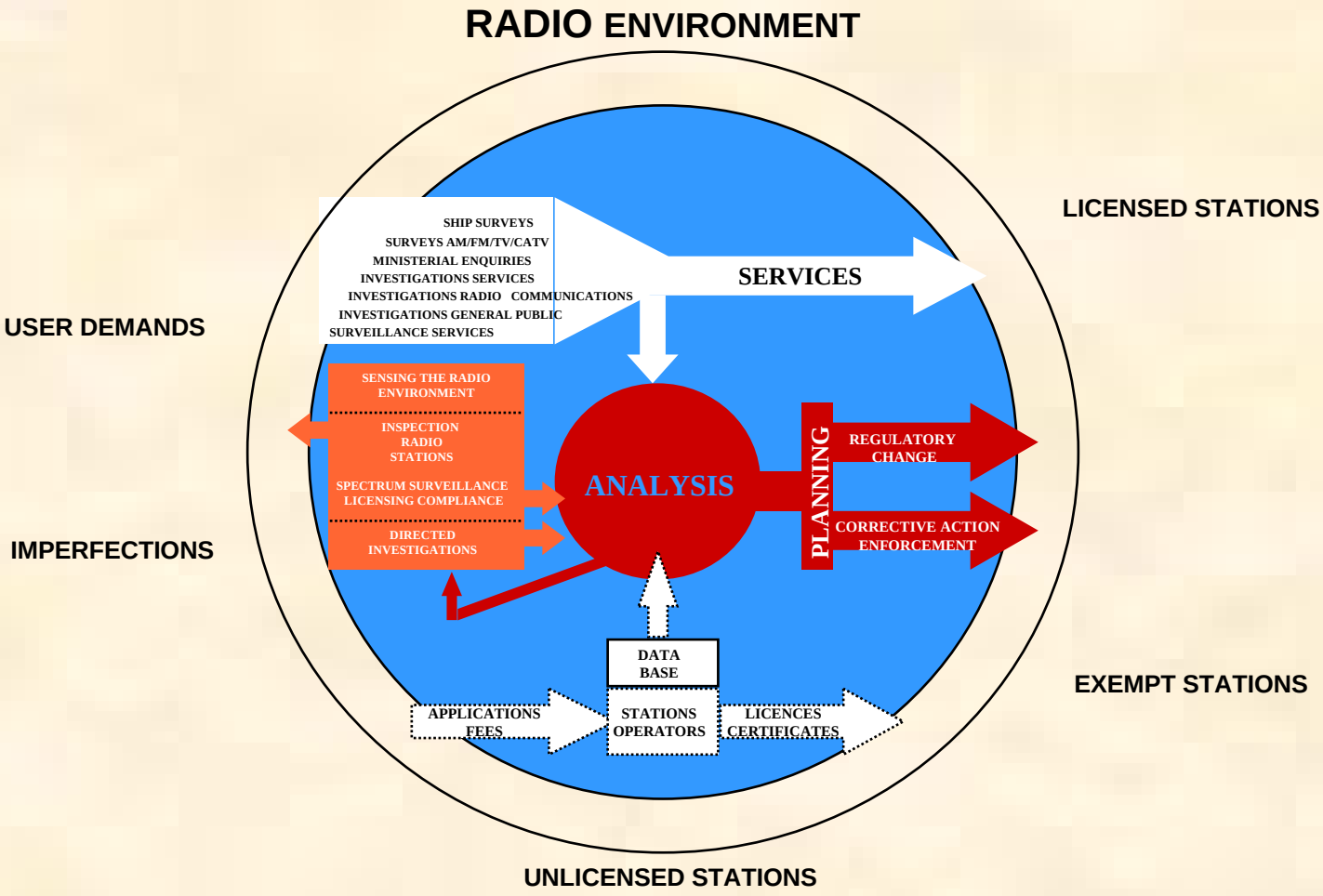
- Alternative spectrum licensing processes



SPECTRUM MANAGEMENT

- Administration of a natural resource --- key to economic health of telecommunications.
- Addresses international and domestic components
- Ensures interference-free access to the radiofrequency spectrum for *as many users* and *as many uses* as is possible
- Large revenue generator

SPECTRUM MANAGEMENT MODEL



International Cooperation

- It is only natural that each nation wants sole access to their share of the global resource, to use for their own purposes.
- But the nature of the medium is that electromagnetic energy does not respect man-made national boundaries.
- Thus coordination of access to the spectrum depends on international cooperation.

International Citizenship

- Because access to the radio frequency spectrum is vital to meet national political, cultural, social and economic objectives, it is in the national interest for nations to participate in international cooperative processes: to be good international citizens.
- To coordinate the many activities and agreements that ensure cooperation, the International Telecommunications Union (or ITU) is charged with developing the processes whereby the coordination is brought about.
- National concerns over access to the spectrum centre on issues of sovereignty: the right for a nation to determine for itself how the spectrum resource will be applied to the national benefit.

Communications and Society

- There are many uses of communications technology which advance the structure of society.
- Without telecommunications, commerce is limited, extra pressure is placed on other less advanced (and more expensive) infrastructure, and the sense of national community disintegrates

Examples

- Telephones reduce the need for people to travel to maintain contact:
  - this at once reduces the pressure on roads and other transport infrastructure; and
  - develops a broader sense of community and family, by extending the distances over which communication is practical.
- Broadcasting can efficiently and effectively convey a sense of national purpose.
  - It can also significantly contribute to a sense of national culture and identity.
  - In times of emergency, broadcasting provides a means of rapid communication with the people.
- Mobile communications facilitate the movement of goods; the timely availability of services; better public safety; enhanced national defence capability, and so on.
  - Mobile communications also mean better personal communications and faster business decisions.

Reduction in the “Information Float”

- These examples serve to illustrate the role of communications in the collapse of “the information float”, in which the speed and frequency of transactions increases, because the delays in communication are reduced.

Radiocommunication and Culture

- In the national context, it is considered important to maintain a sense of identity through culture.
- Broadcasting, using the national spectrum resource, facilitates the development of a cultural ethos – a national identity.
- The cultural identity, established through reliable and efficient mass communication, reinforces societal structures; it consolidates language; and it helps to develop a common national purpose.

Beyond Culture

- Modern “Information Societies” would be incapable of functioning without the services provided by radio communications.
- The conduct of commerce, the means by which we generate wealth in an information society, depends on the availability of reliable communications.

Radio Services

- The infrastructure that allows us to engage in commerce is also critical, including:
  - national defence;
  - public safety, including police and emergency services;
  - navigation, including marine, air – and increasingly land vehicular;
  - business and industrial communications;
  - personal communication - pagers, mobile phones, fax and mobile data services.

Spectrum as a Commodity

- The radio frequency spectrum has economic value in its own right: as a traded resource or a commodity.
- Like any other commodity, it can be assigned a commercial value and licences to use the spectrum can be sold to users.

Adding Value

- Communications technology also adds value to other economic activity.
- It does this by:
  - increasing the speed and volume of possible transactions;
  - reducing the time required to compete transactions (ie. reducing the “information float”);
  - enlarging the potential reach of products into a global market place instead of a small village or cottage industry.

Gaining Access

- While the spectrum resource is potentially available to all, access is only available to those who have the technology to make use of it.
- Even with the technology, spectrum space is only available if somebody else is not already using it, or there is no interference making the spectrum channel unusable.

Technological Complexity

- As technology increases in complexity, it can be made to better use the spectrum: technological complexity can be traded to accommodate more services in a given spectrum space.
- The technological complexity needed in a system is determined by the demands users place on the system.

The Need for Coordination

- The full benefits of the available spectrum capacity can only be realised if the service provisions are effectively and efficiently coordinated to match the national needs as they are identified, now and into the future.
- Thus the coordinating authority must be aware of what demands will be placed on the spectrum into the future.

Minimising Interference

- If the available spectrum capacity is to be used for productive services, the sources of interference unproductively using the spectrum must be minimised.
- These sources can include natural or environmental noise, man-made noise (from machinery or industrial processes), or from wanted signals inadvertently appearing in unwanted parts of the spectrum.

Spectrum Managers' Roles

- The spectrum manager has the task of ensuring fair, open and flexible access to the spectrum, with the aim of providing the best possible service to users of the spectrum.
- The spectrum manager also has a responsibility for forward planning, so that new services can be provided as they are needed.
- Thus spectrum managers can ensure timely access to the spectrum by forward planning, regulation and the application of consistent regulatory procedures.
- National processes will ideally operate in a framework of international regulatory standardisation.

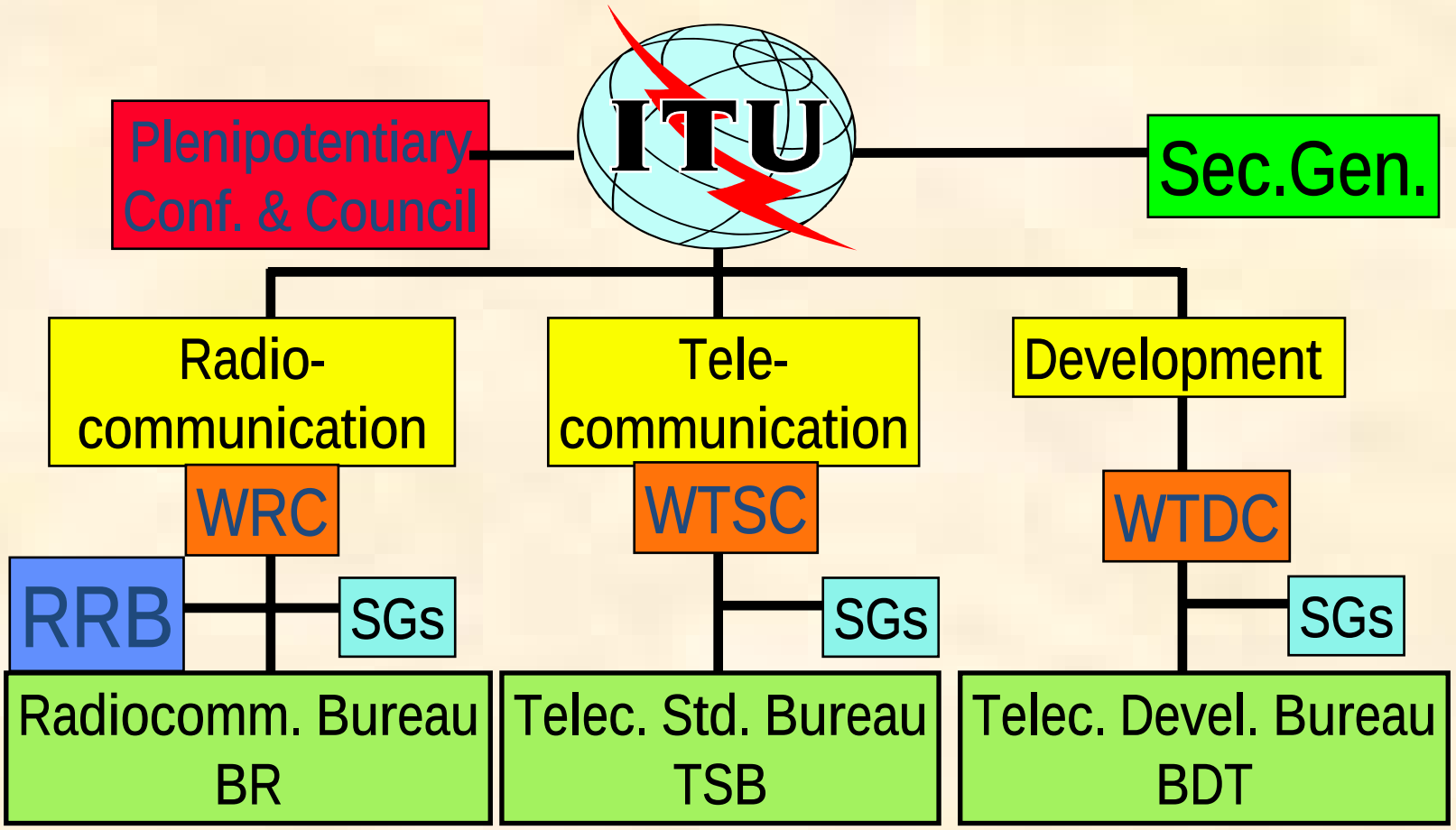
The Role of the ITU

- The ITU, through a process of consultation and review, promulgates regulations designed to coordinate the provision of various radio services.
- The ITU Radiocommunication Sector is responsible for these activities. The ITU Radiocommunication Sector consists of:
  - The ITU Radio Communication Bureau
  - The ITU Radio Regulation Board
  - The ITU Radiocommunication Study Groups.

The ITU

- Intergovernmental UN- affiliated organization
- Membership: 185 countries & organizations
- Annual budget: US$ 150 million
- Employees: 900
- Location: Geneva (headquarters) & 12 regional offices

ITU Structure



ITU Radiocommunication Sector

ADMs

STUDY GROUPs

Conferences (WRC)

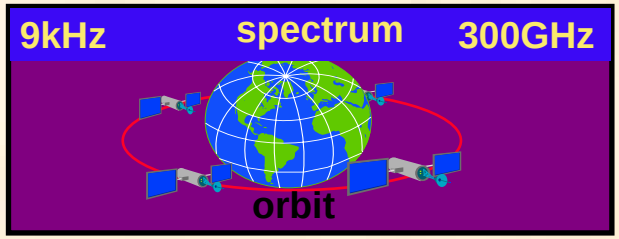
Radiocom. BUREAU (BR)

Radio Regulations BOARD (RRB)

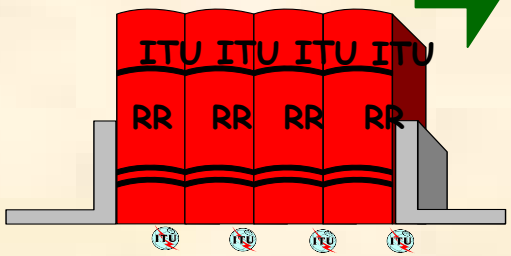
Recommendations

Radio Regulations

Rules of Procedures



ITU Radio Regulations

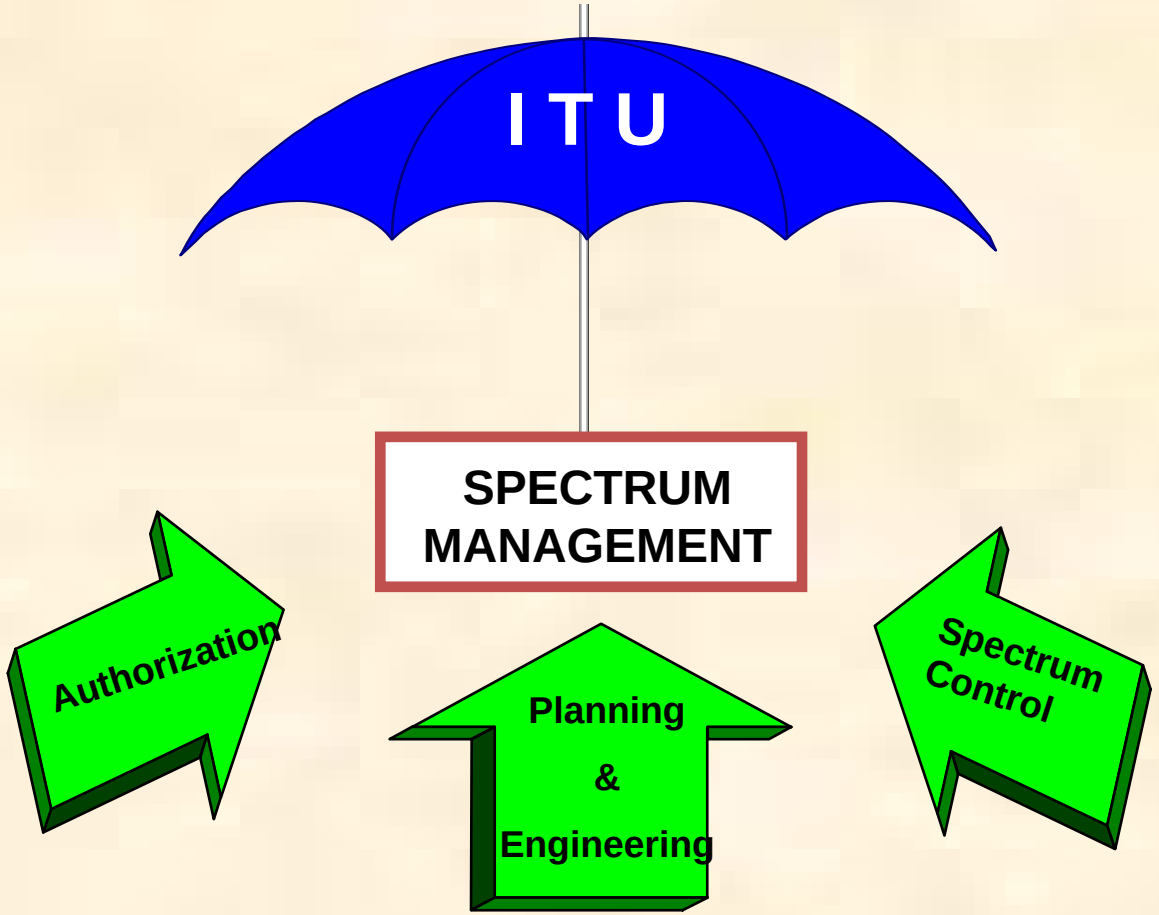


- **TABLE OF FREQUENCY ALLOCATION**
- **REGULATORY PROCEDURES**
  - advance publication / coordination / notification & plans

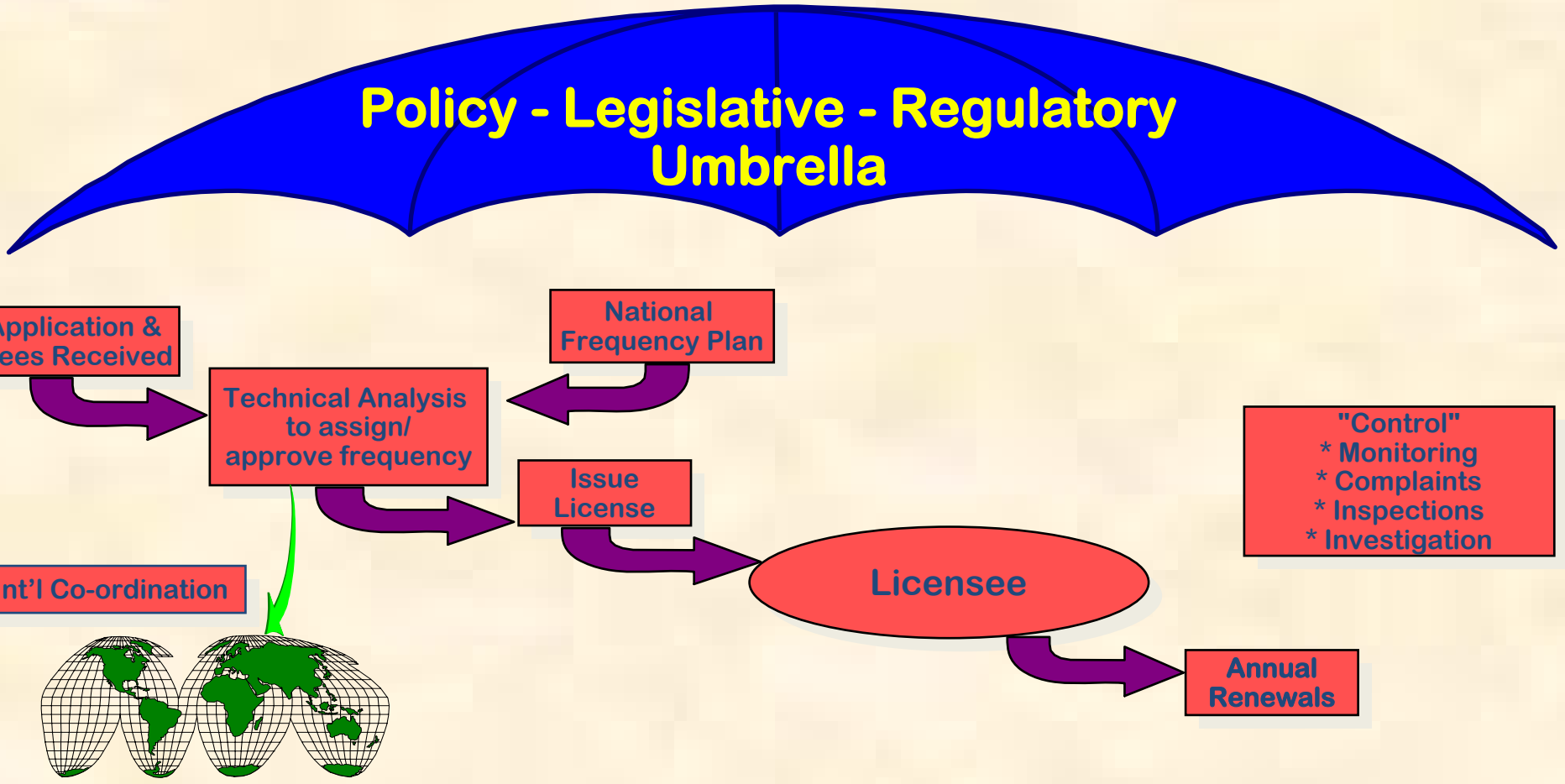
RR

- ARTICLES
- APPENDICES
- RESOLUTIONS

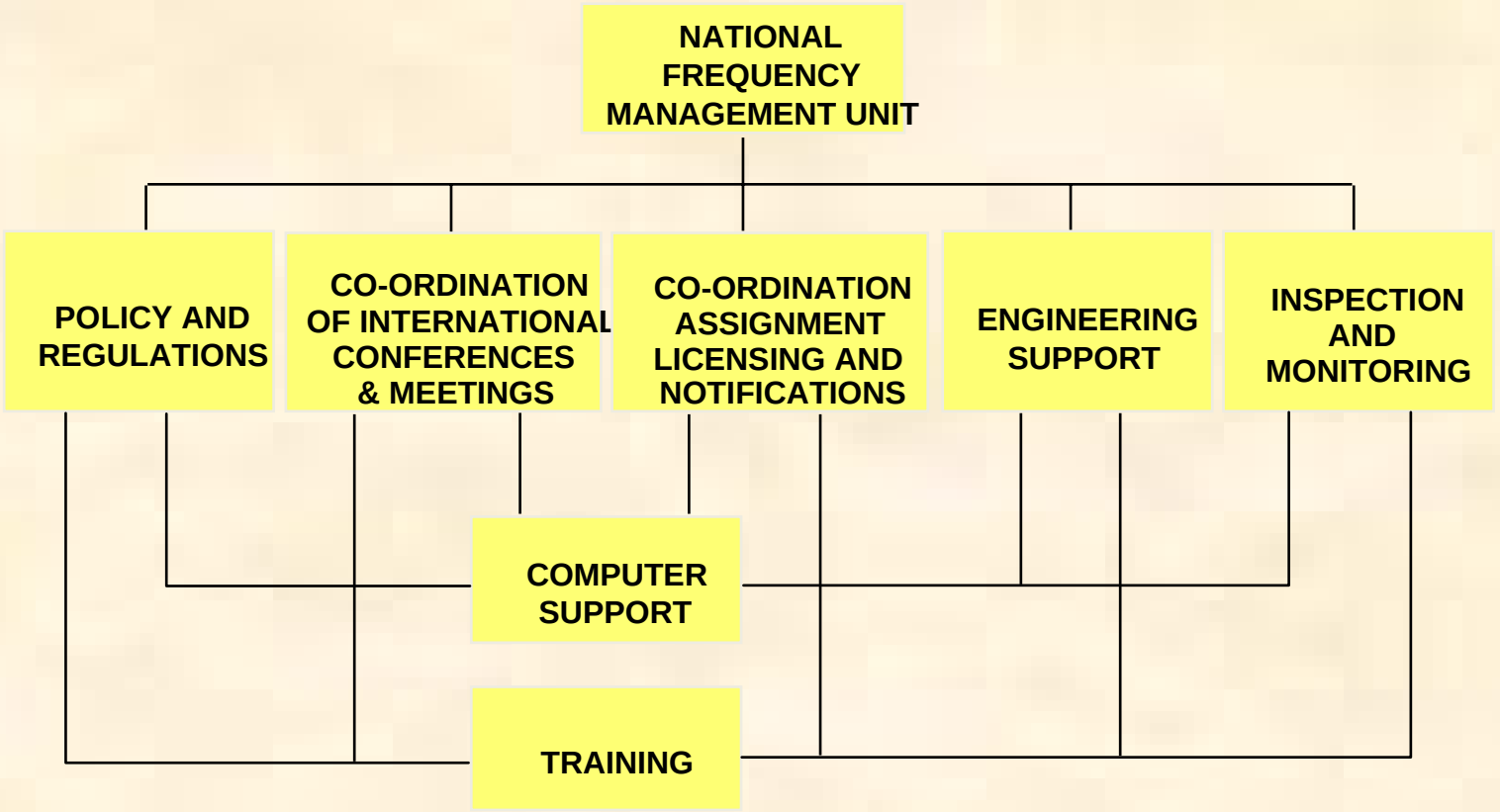
Major Elements of Spectrum Management



ITU


Policy - Legislative - Regulatory Umbrella
Application & Fees Received
National Frequency Plan
Technical Analysis to assign/ approve frequency
Issue License
"Control"
* Monitoring
* Complaints
* Inspections
* Investigation
Int'l Co-ordination
Licensee
Annual Renewals

ITU MODEL


NATIONAL FREQUENCY MANAGEMENT UNIT
POLICY AND REGULATIONS
CO-ORDINATION OF INTERNATIONAL CONFERENCES & MEETINGS
CO-ORDINATION ASSIGNMENT LICENSING AND NOTIFICATIONS
ENGINEERING SUPPORT
INSPECTION AND MONITORING
COMPUTER SUPPORT
TRAINING

Radiocommunication Bureau

- The ITU Radiocommunications Bureau:
  - maintains a data base on spectrum use, and analyses and publishes data from the database;
  - publishes and provides training in regulations, administrative procedures and standards;
  - investigates cases of harmful interference;
  - provides assistance to the Radiocommunication Study Groups.

Radio Regulation Board

- The ITU Radio Regulation Board plays an arbitration and formal review role, ensuring consistency of application of conference decisions and the resolution of extraordinary matters.

Radiocommunication Study Groups

- The ITU Radiocommunication Study Groups study Questions and formulate Recommendations on:
  - use of the radio frequency spectrum in terrestrial and space radiocommunication (and of geostationary orbiting satellites);
  - Characteristics and performance of radio systems;
  - Operation of radio stations;
  - radiocommunication aspects of distress and safety matters.

Summary

- Formal, standardised regulatory processes facilitate optimal use of the finite global resource that is the electromagnetic spectrum.
- National governments and regulatory agencies have a responsibility to participate in the optimisation process.
- National social, economic and technical interests are enhanced by regulating access to the spectrum resource to ensure fair, equitable and timely access to potential users.
- The national regulatory environment operates in an international framework.
- National spectrum managers should have due regard to the international regulatory processes and practices, while optimising national spectrum use in the national interest.
- The ITU provides a consistent international framework for efficient and effective regulatory practices.

For More Information

- *ITU Handbook on National Spectrum Management. Geneva: ITU* Radiocommunication Bureau. Chapter 1
- An internet tutorial guide containing learning outcomes and discussion questions is available through the ITU.
- E-mail discussion sessions are available to enrolled course participants.

Thank you!

Any Questions please?