PPDR Communications: A NATO Perspective

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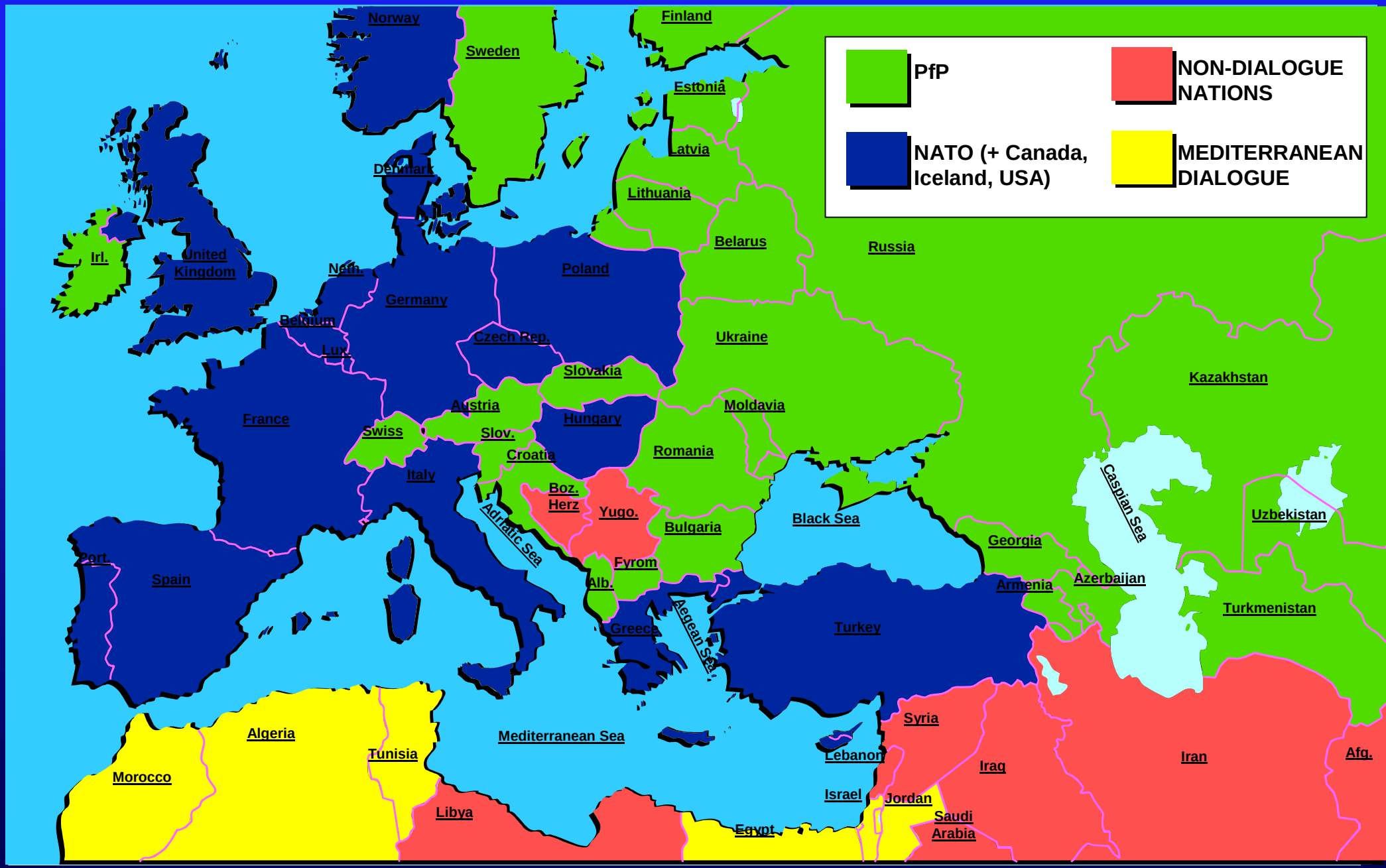
NATO Command, Control and Consultation Agency

NATO C3 AGENCY

NATO

- **NATO - 19 nations**
  - **The fundamental role of NATO is to safeguard the freedom and security of its member countries. It is one of the foundations on which the stability and security of the Euro-Atlantic area depends and it serves as an essential forum for transatlantic consultations on matters affecting the vital security interests of all its members. Its first task is to deter and defend against any threat of aggression against any of them.**
  - **In order to improve security and stability in the area, the North Atlantic Alliance also plays a key role in the field of *crisis management*, by contributing to effective *conflict prevention* and, in the event of a crisis, by taking *appropriate action to resolve the crisis* when there is *consensus among the member countries to do so*.**

NATO, Partnership for Peace and Mediterranean Dialogue



PPDR Regional Activities:
NATO, the North Atlantic Region and beyond

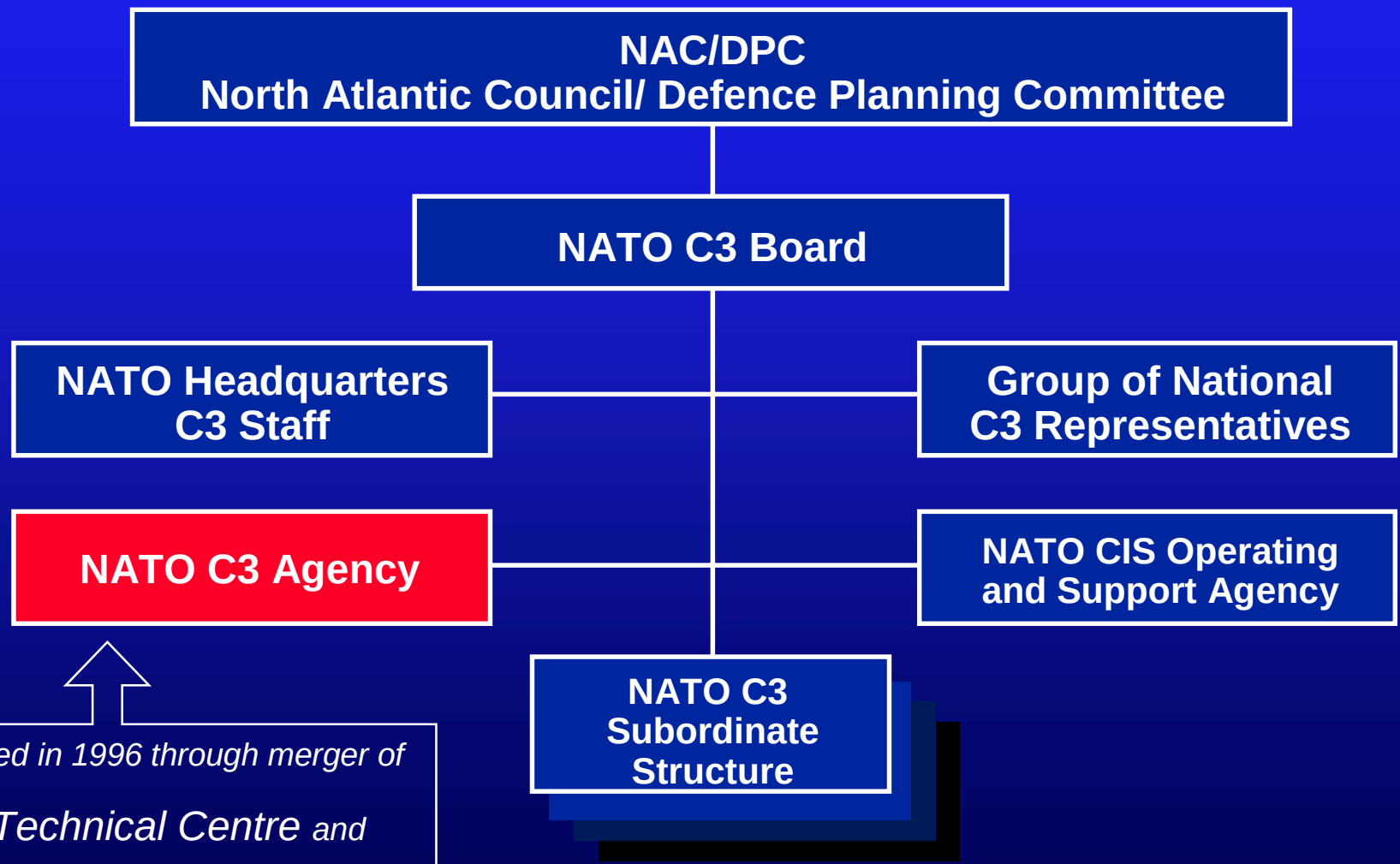
- **Partnership for Peace - 27 nations**
- **NATO + PfP = Euro-Atlantic Partnership Council (EAPC)**
  - *The Euro-Atlantic Partnership Council (EAPC) is a multilateral forum where NATO member and partner countries meet on a regular basis to discuss political and security-related issues and develop cooperation in a wide range of areas. At present, there are 46 members: 19 NATO member countries and 27 partner countries. All EAPC members are members of the Partnership for Peace programme.*
  - **http://www.nato.int/pfp/eapc.htm**
  - Euro-Atlantic Disaster Response Coordinating Centre (EARDCC)
- **Mediterranean Dialogue - 7 nations**
  - *Security in Europe is closely linked to security in the Mediterranean region*
  - **http://www.nato.int/med-dial/home.htm**

NATO's Third Dimension

- **First and Second dimensions of NATO**
  - "The fundamental roles of NATO have always been concerned with security cooperation between member countries and, in more recent years, with Partner countries, in the political and defence fields. These have therefore been regarded as the first and second "dimensions" of the Alliance."

- **Third dimension**
  - **Scientific and Environmental Cooperation**
  - **Responding to civil emergencies**
    - **Civil Communications Planning Committee**

NATO C3 ORGANISATION



NC3A formed in 1996 through merger of

SHAPE Technical Centre and

NATO CIS Agency

NATO C3 Agency

Goal:

NC3A provides managerial, scientific, and technical abilities, resources, and advice in all areas of consultation, command, and control for NATO

Mission:

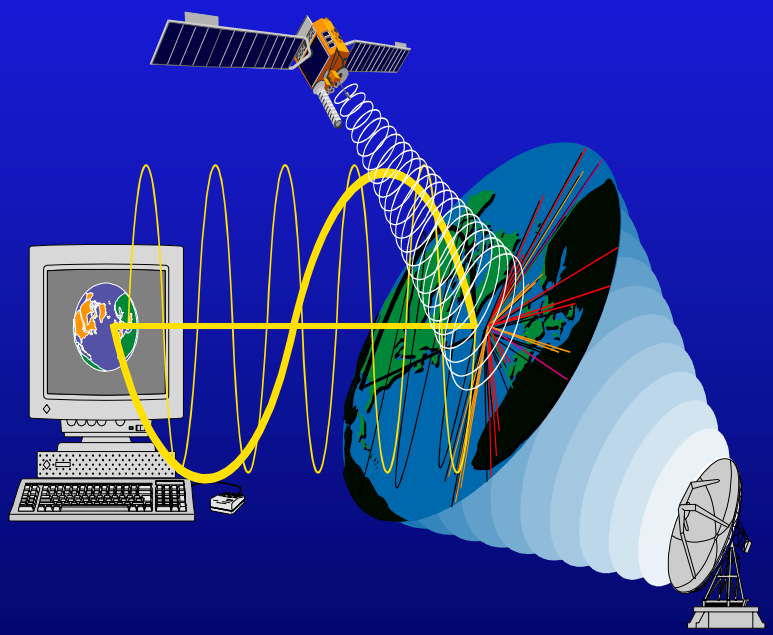
- **Provide unbiased scientific and technological support for NATO**
- **Act as the acquisition and procurement agent for NATO C3**

SCOPE OF NATO C3 Agency

- **Political Consultation**
  - Heads of State and Government
  - NATO Headquarters and Nations
- **Support Major Missions of NATO**
  - Collective Defence
  - Peace Support / Crisis Response
- **Military Command Structures**
  - SC / RC / CC / JSRC
  - ARRC / IRTF(L)
  - CJTF Headquarters
- **Levels of Military Command**
  - Strategic / Operational / Tactical

Effective Use of Science and Technology

"A critical success factor for NATO"



- **STRATEGY:**
  - Understand the environment
    - Definition of the operational architecture
  - Understand the Requirement
    - Close involvement with policy maker, user, technical community and industry
  - Understand technology
    - Close involvement with the Technical community and industry
  - Determine Operational Applications
    - (Test beds / Prototyping)
  - Rapid Implementation
    - (Evolutionary Acquisition)

Crisis Response Scenarios

- **Crisis scenarios where a response is required**
  - **Natural disasters**
    - **Flooding** ***(Czech Republic, Germany, Hungary, Italy, Norway, Poland, UK)***
    - **Earthquakes** ***(Italy, Turkey, USA)***
    - **Hurricanes and Ice storms** ***(Canada, USA)***
  - **Non-natural disasters**
    - **Transport crashes** ***(Canada, Germany, Norway)***
    - **Fires** ***(Germany, Netherlands)***
    - **Terrorism**
- **Crisis Response Operations**
  - **'Traditional' military CRO**
  - **Peace-keeping, peace-support, Operations Other than War etc**

Military and Civil Communications

- In all previous disaster scenarios the military has been involved to support civil emergency services in a co-ordinated manner
- In ‘traditional’ CRO, military works with NGOs, local services etc
- Communications between military and civil emergency services are vital
- Both have effective individual communications systems - the interface between is vital

Effect of Disasters on Telecoms

- Area affected
  - Natural - widespread
  - Man-made - limited
- Effect of disaster on communications
  - Fixed line
    - Congestion and/or disruption
  - Radio
    - Congestion and/or disruption
    - Loss of power
    - Loss of infrastructure
    - Priority mechanisms utilised occasionally

– From Euro-Atlantic Partnership Council,
Civil Communications Planning Committee (N/EAPC U)

Emergency Telecoms: What is needed to overcome disaster effects

- Communications system requirements:
  - Rapidly deployable
  - Easy to use
    - –no time for operator training
  - Self supporting
  - Interconnected to other networks

  - High capacity
    - –Congestion is a recurring problem in many emergency scenarios

SET 11 Prototype Configuration - “Concept validation”

Operational Use:

Highly Mobile
Exercise Support

Specifications:

1.2 m dish
1.8 kW power
~ 500 kg weight
< 15 min setup
COTS equipment

Developed by:

NC3A, CIS Division

Military Use; Civil Technology

GSM “Piconode”

Standalone GSM infrastructure
- BTS, BSC, MSC, NMS

Deployable - 20 kg, 0.6 m^3

Can be connected to other networks
- GSM, PSTN, PABX
- Satellite backhaul
- Tactical Military

Picture courtesy of DERA / Qinetiq (UK)

COTS Services for Emergency Scenarios

GSM & GPS

- GSM data services support useful services for Emergency Operations
  - Position reporting
  - Status monitoring
- Utilises basic Short Message Service of a COTS digital personal communications system
- *Any* digital radio system with SMS type service can do this task

Reasons against “deployed” GSM

- **Security**
  - No end-to-end encryption
- **Services**
  - Services don’t always match requirements
  - GSM not designed for Command & Control use
    ….. but other Professional Mobile Radio systems were
- **Spectrum**
  - Frequency allocation
  - GSM bands usually licensed to commercial operators
- So, GSM is not necessarily the best choice if deploying own infrastructure.
- But it is VERY good if you want to use existing infrastructure

End to end encrypted GSM

- NC3A working with “secure GSM” since 1999
- Valuable capability for certain user groups
- NSK 200
  - Norwegian / Swedish government development
  - Crypto integral to terminal
  - Authentication required
  - Approved to NATO SECRET
  - Tested over GSM, DECT and via Inmarsat
- NC3A workshop on “Secure GSM”- details at
- nc3a.info/GSM

Symposium on
End to End Security in Mobile Cellular Networks
London, 11th February 2003

Call for papers

Contributions are invited on the subjects of:

Secure GSM

3G security

End to end security via satellite services

Network operators viewpoints

Interoperability issues for end to end security

Market differences: Commercial vs military users

For details and submission of abstract (200 words) please contact:
Michael Street, NC3A, The Hague, The Netherlands.
Tel: +31 70 374 3444 or Email. Michael.Street@nc3a.nato.int

This event will be unclassified and attendance open to all

NC3A PCS Study

- Study *all* available Personal Communications Systems
  - terrestrial, satcom, COTS & GOTS - includes GSM
- Evaluate for use against a detailed *Crisis Response* scenario
- Match for suitability
  - users *e.g. military, policing, NGOs, VSOs*
  - applications *e.g. speech, location, data, video*
  - tasks *e.g. liaison, reconnaissance*
  - phases *e.g. initial deployment to long-term peace support*

TETRA - Military Services; Civil Standard

- Developed for Public Safety & Security with C^3 features
  - Group Communication
  - Direct Mode Operation (when no infrastructure)
  - Emergency facilities (call priorities & preemption)
  - Dispatching
- TETRA services ≅ Combat Net Radio features
  - has many large, security conscious user groups
    - Large user groups -- COTS equipment

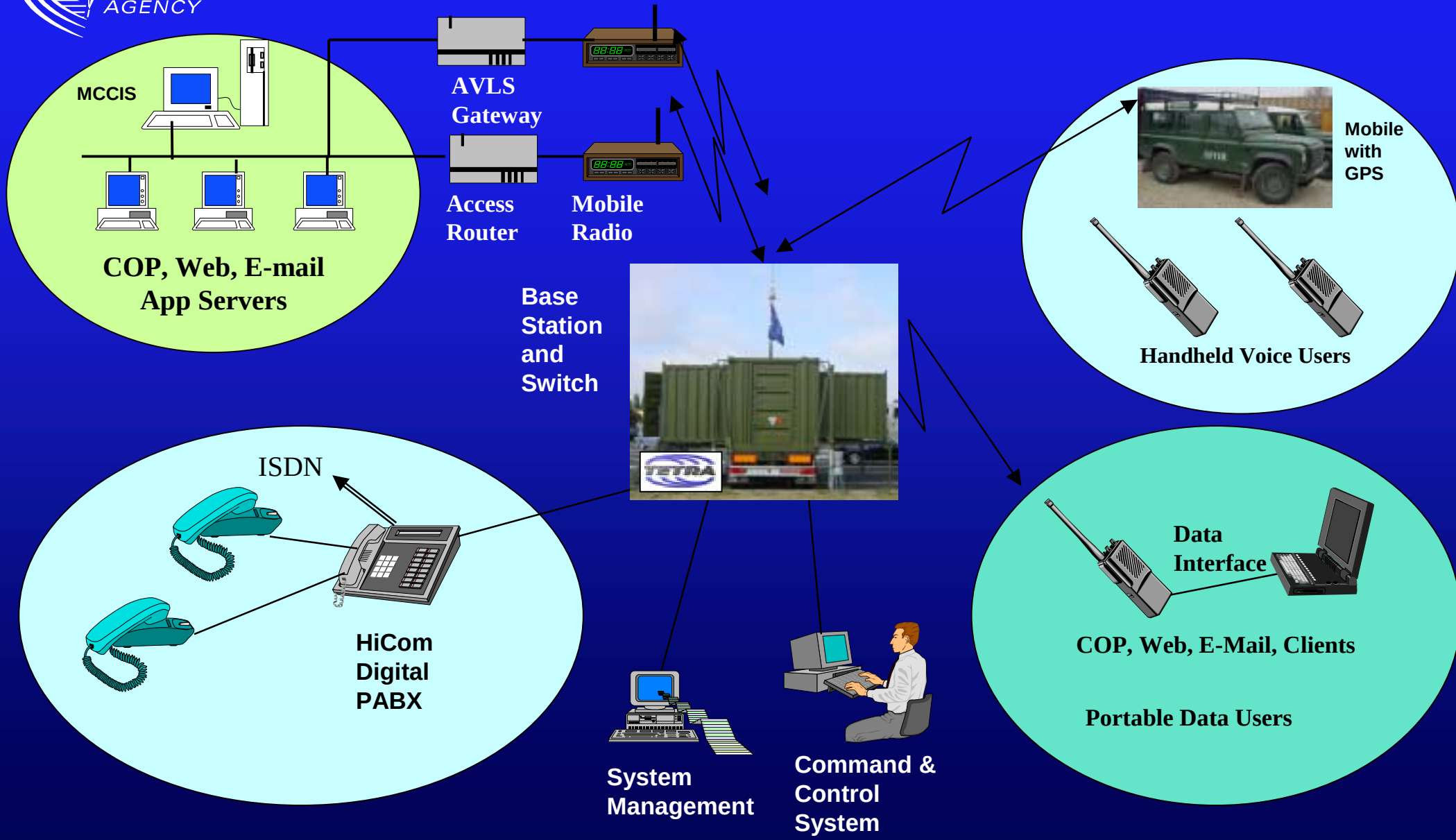
Position Reporting via COTS Mobile Radio

Position reporting through TETRA terminal with C2PC software

Military - Civil Interface

- Interface between COTS TETRA network and military network
- PC running Linux
- NC3A developed interface software
- Converts GPS to OTH/Gold format for MCCIS

Deployable TETRA System Configuration



Civil Standards; NATO Exercises

- NC3A TETRA system is
  - Mobile
  - Deployable
  - Easy to use

- Combined Endeavour 2002, 2001
- Strong Resolve
  - Used to establish comms infrastructure for exercise
- SFOR trial, Banja Luka
  - 2nd (National Communications) Signal Brigade, UK
- JWID 2001

- SFOR trial included detailed coverage & propagation trials
  - Coverage limited by Frequency and Terrain - not technology

Secure Voice Communications

- Military and many public safety users want secure speech services
- In emergency scenarios public safety users may want privacy from media
- Security against eavesdropping and disruption
  - Must consider and protect against emergencies where cause is deliberate
  - Unprotected communications leaves rescuers vulnerable
    - Air interface *and* end-to-end encryption
    - Authentication
    - Key management
- Users still want interoperability - securely

TETRA Security and Fraud Prevention Group

Guidance on implementing end-to-end encryption within ETSI Standards

Prepared with public safety, commercial & military input


TETRA MoU

Security and Fraud Prevention Group

Recommendation 02

End-to-End Encryption

TETRA

Contents

- Introduction
- Overview
- Physical Realisation
- Use of Algorithms
- Key Management
- Interoperability
- Threats
- Specifications

Appendices

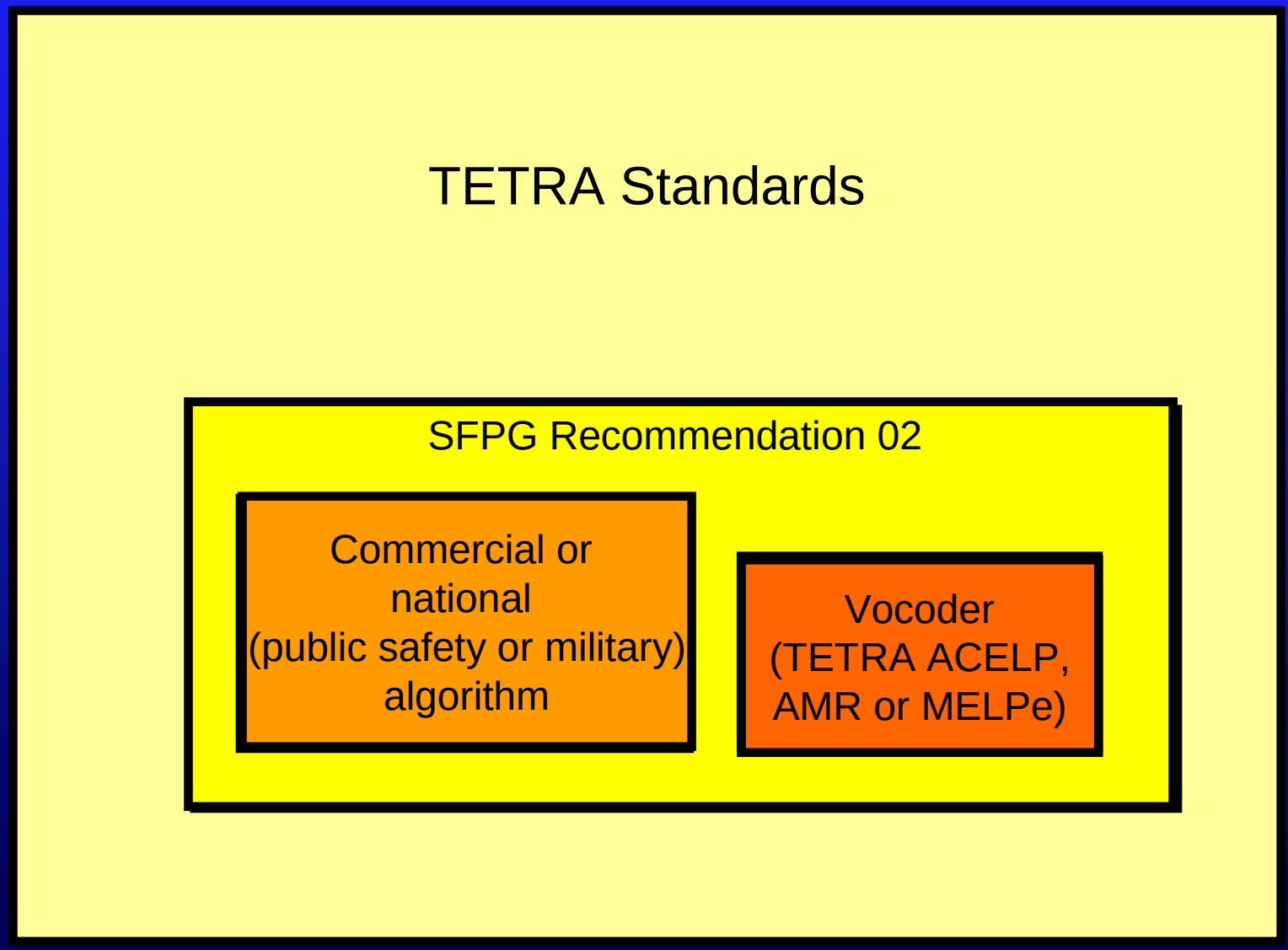
- User profiles
- Additional detail to be specified
- Sample specification (IDEA)
- Sample Test Data


Courtesy of THALES

Courtesy of D Parkinson, BT Exact

ETSI Standards and SFPG Recommendations

- ETSI standards give flexibility on how to implement End to end encryption
- SFPG Rec 02 gives guidance within the standards
- Choice of algorithms up to users
- Support for TETRA Release 2 (additional vocoders)



A Digression on Congestion

Avoiding it: Military Vocoder vs Civil Vocoder

- Congestion is a problem in emergency scenarios
  - Military is used to minimising throughput for low capacity channels
  - Same speech intelligibility, half the throughput
  - Interoperability
- Frequency congestion and allocation is affected by throughput requirements
  - affected by amount and type of traffic

NATO Voice Coder Tests

Noise Conditions:

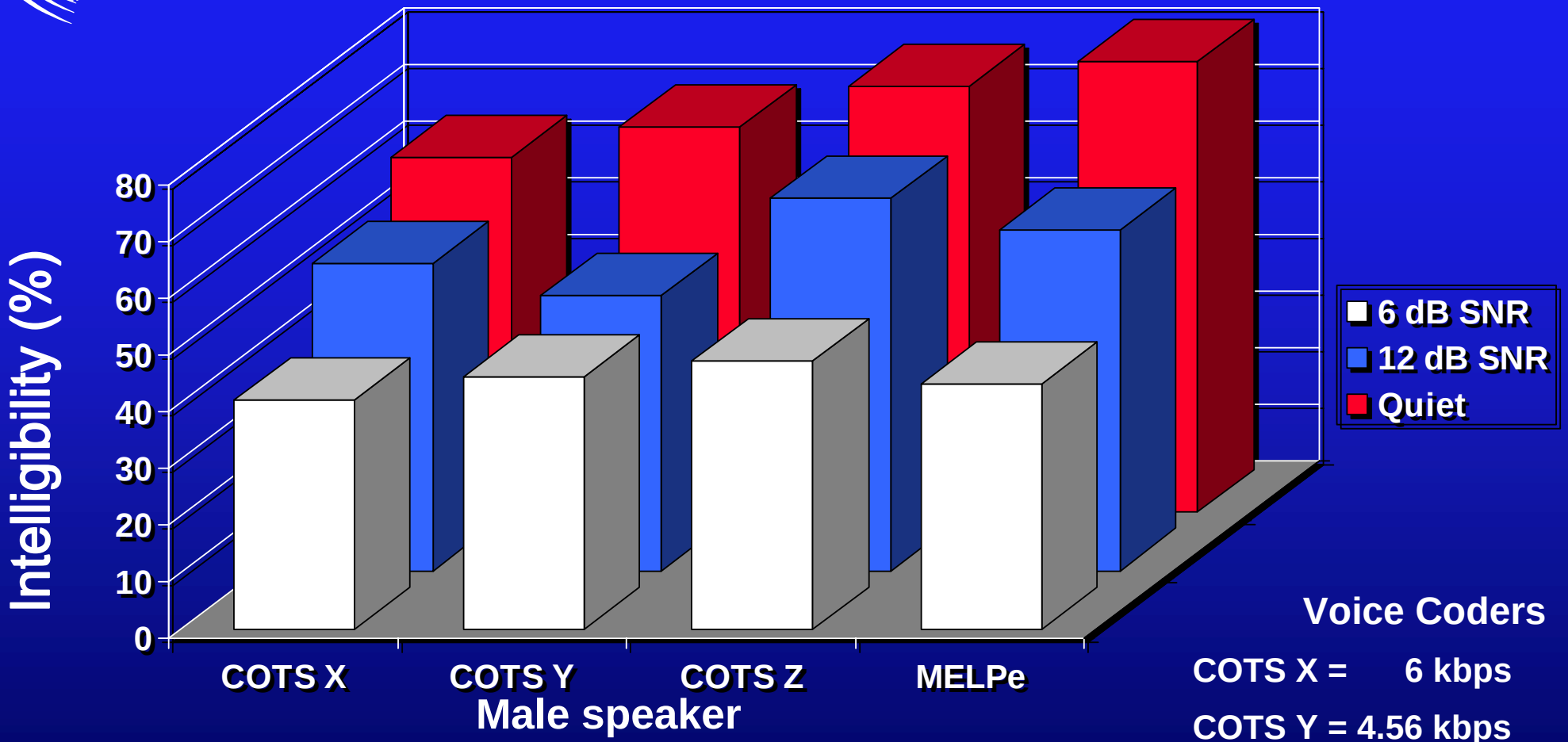
Quiet, Office, Gaussian noise plus ……..

MCE field shelter

HMMWV
Bradley Fighting Vehicle
Le Clerc Tank
Volvo (staff car)

Blackhawk helicopter
Mirage 2000
F-15

A Digression on Congestion



Voice Coders

COTS X = 6 kbps

COTS Y = 4.56 kbps

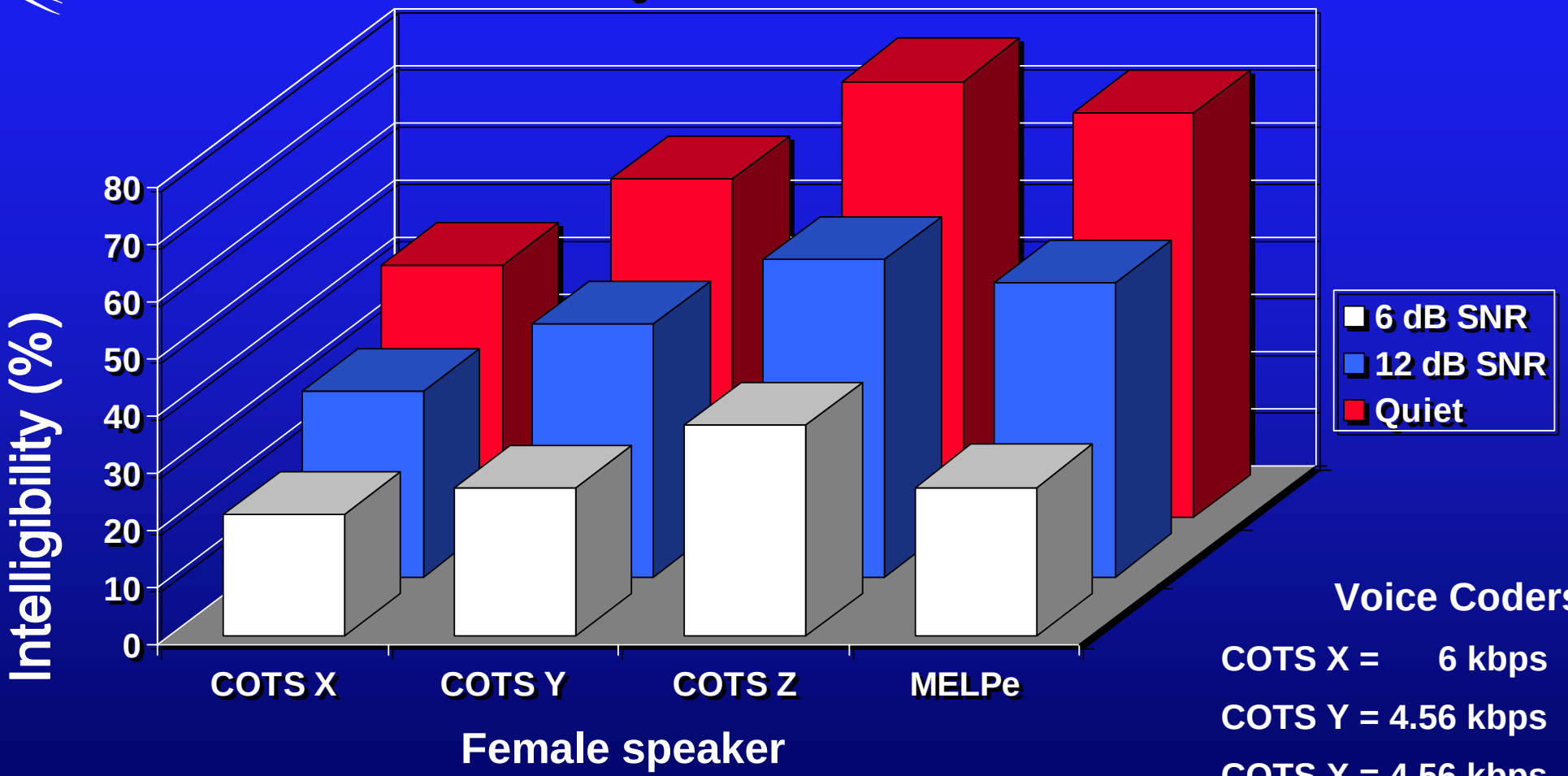
COTS X = 4.56 kbps

MELPe = 2.4 kbps

MELPe is NATO Stanag 4591

Voice coders used in existing COTS PMR systems require higher throughput yet provide similar or worse performance than the NATO voice coder (Stanag 4591)

Avoiding congestion:
Military Vocoder vs Civil Vocoder



Voice Coders

COTS X = 6 kbps

COTS Y = 4.56 kbps

COTS X = 4.56 kbps

MELPe = 2.4 kbps

New NATO Voice coder provides comparable or superior performance at lower throughput

Widespread use improves interoperability

MELPe is NATO Stanag 459

Voice Coders

- NATO Post-2000 Narrow Band Voice Coder (2400& 1200 bps)
  - Outperforms
    - CELP - 4.8k
    - CVSD - 16k
    - LPC10e - 2.4k
- Widely used by other secure users

Introduction to STANAG 4591

The new NATO Voice Coder

NC3A Workshop

October 18th 2002

At TNO-FEL, The Hague, The Netherlands

Topics Include:

Need for a new NATO voice coder
Tests to select Stanag 4591
Language independence testing
Source Code & IPR
Performance
VoIP with S4591
Stanag 4591 in civil telecom standards

Organised by the NATO C3 Agency and the NATO Ad-Hoc Working Group on Narrow Band Voice Coding

For more details please email:
Michael.Street@nc3a.nato.int

Further information on STANAG 4591

Stanag 4591 test and selection process

Street MD and Collura JS, “The test and selection of the future NATO narrow band voice coder”, *RCMCIS - NATO Regional Conference on Military CIS*, Warsaw, Zegrze, October 2001.

http://nc3a.info/Voice/mds_nc3a_nbvc.shtml

MELPe: the selected voice coder

Collura JS and Rahikka DJ, “Interoperable secure voice communications in tactical systems, IEE coll. on *Speech coding algorithms for radio channels*, London, February 2000.

An overview of the MELP voice coder and its use in military environments

http://www.iee.org/OnComms/pn/communications

Collura JS, Rahikka DJ, Fuja TE, Sridhara D and Fazel T, “Error coding strategies for MELP vocoder in wireless and ATM environments”, IEE coll. on *Speech coding algorithms for radio channels*, London, February 2000.

Performance of MELP with a variety of different error correction mechanisms

http://www.iee.org/OnComms/pn/communications

NC3A’s STANAG 4591 Server

http://s4591.nc3a.nato.int

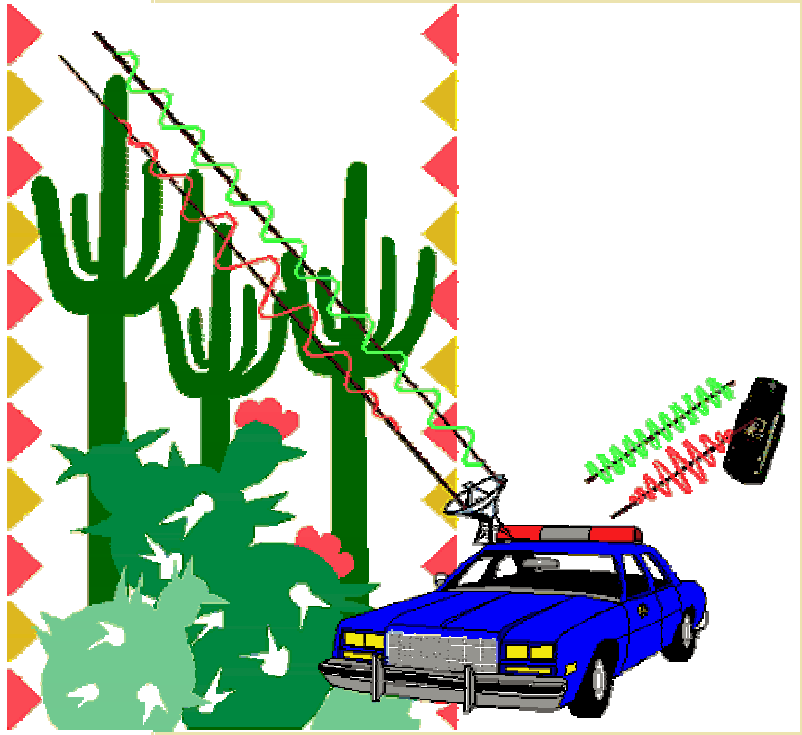
Broadband out there

A Mobile Hotspot With Backhaul Satellite Link

PROJECT MESA

www.projectmesa.org

Service scenario



Future Public Safety Communication Standards

- Voice, Data, VTC etc

- Hot spot interlinking to fixed IP infrastructures via broadband satellite constellation
- Advanced broadband services even throughout remote areas

www.projectmesa.org

Back-haul gateway in space

Project MESA — ETSI — A partnership between — TIA

NC3A Roving Command Vehicle

Concept Demonstrator

Multiple comms systems

- HF BLOS
- Satcom
  - Inmarsat
  - NATO
- VHF
- UHF

Summary

- Long history of military forces working with public safety in emergencies
  - NATO is prepared for this role
    - e.g. NATO Civil Communications Planning Committee
  - Often NATO involved with many other nations
- Current events make military-public safety co-operation more likely and more important

- Need effective, secure communications
- Need commonality for quick and easy interfacing (interconnection and interoperability)
  - requires planning from the start
  - involvement by all in requirement definition and standards process

Questions ?

Email: Michael.Street@nc3a.nato.int

www.nato.int

www.nc3a.nato.int

nc3a.info/MDS