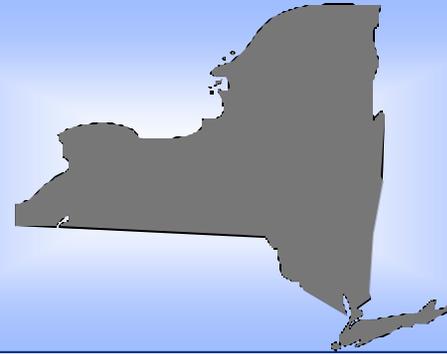


Tompkins County Radio Project



Radio Project Overview

*COMCAP Meeting
January 23, 2001*

Project Tasks

Phase 1

- Task 1: Needs analysis task to form the basis of the functional requirements.
 - A needs-analysis survey and follow-up interviews performed and
 - Physical radio sites were audited of current communications system.
- Task 2: Assess the geographic, and demographic, features of the County through the use of GIS data sets.
 - Results will support EIS process and RFP.
- Task 3: Review current Tompkins County radio communications technology and identify wireless communication options for meeting these needs through;
 - An upgrade, or
 - The implementation of a new system.

Project Tasks

Phase 2

- Task 4: Utilize the results of Tasks 1-3 to identify “notional systems designs,” which will provide the basis for the range of reasonable EIS alternatives, when considering the objectives and capabilities of the County. The “notional systems” can be potential, viable systems that could be candidate solutions to provide public-safety communications in the county.
- Task 5: Provide technical assistance to Tompkins County to develop a functional Request for Proposal (RFP) for the preferred alternative. Review vendor proposals and help negotiate with vendor for system procurement.

Task 1: Fundamental Requirements

Fundamental Requirements of Public Safety mobile (“on the move”) wireless communications

- Mainly used by professionals, public safety/public service personnel, as oppose to civilians/consumers.
- Point-to-Multipoint calls and user groups (Dispatch operations)
- Fast call throughput (Push-to-Talk, low connection time)
- Ubiquitous coverage (ability to communicate all over)
- Priority calling (ability to manage communications loading of the network)
- Call preemption (ability to interrupt a transmission for emergencies)
- Wireless regulatory constraints (RF transmission is regulated and requires licensing from the federal government)

Task 1: Surveys and Interview Data

- List of 243 names drawn up of County public safety communications users.
 - Surveys distributed (243) on Wednesday, November 22, 2000.
 - Surveys returned on Wednesday, December 13th.
 - A few followed later by mail
 - 199 Surveys were returned to NYSTEC.
 - Interviews conducted from December 18th through 20th.
 - 33 people interviewed in both single and group sessions.
-

Task 1: Surveys and Interview Results

Current shortcomings of the existing system are:

- **Lack of Interoperability** - Because of the use of so many different radio systems in so many different frequency bands the subscriber's only opportunity for interoperability with other agencies is through the network which is currently inefficient both because of technical and operational reasons.
- **Lack of Required Coverage** – The users indicated that none of the current radio systems are built to deliver sufficient radio coverage to satisfactorily complete the operations they are meant to support.
- **Radio Congestion During Significant or Multiple Incidents** – Fire, EMS and Law Enforcement all reported radio traffic congestion or confusion during significant incidents when multiple agencies were involved or when separate incidents occurred at the same time.

Task 1: Surveys and Interview Results

(Cont.) Current shortcomings of the existing system are:

- **Obsolete** - Much of the existing communications infrastructure and dependent technology lacks functionality and some of it (like the microwave) is in a serious state of decay and may seriously impact the operational readiness of agencies to deliver services.
- **Operational** - Numerous problems have contributed to the system not meeting the needs of the user in the field. There is a perceived (and real) safety concern.
- **Lack of Situational Awareness** - The system relies on unsecured single-call-path communications. Officers and Firefighters lack situational awareness, i.e., difficulty discerning who is talking to whom about what, in almost all transmission with caller and dispatcher.
- **Limited Capacity** - The voice system overlays can not handle more than one call at a time.

Task 1: Existing Radio Site Conditions

Method

A site audit is performed to get information that can be used to:

- Assess if any problems in service can be attributed to site conditions,
 - Determine an upgrade and maintenance plan,
 - Assess the level of surge and lightning protection provided,
 - Assess the grounding system.
- Determine the future viability of the site.

Task 1: Existing Radio Site Conditions

Results

- Radio Sites fall significantly below modern standards
 - Are not suitable for modern trunking equipment,
 - All existing sites would require significant upgrading if used in a new system plan,
 - Currently surge and lightning protection poor or non existent, and
 - Existing grounding systems substantially under developed.
- Most existing radio site locations are not well suited for substantial upgrading.

Wooden “tower” at Conn. Hill seen here with trees growing along side



Task 1: Existing Radio Site Conditions

- Serious conditions exist with microwave system.
 - Many of the radios in this system are 25 years old.
 - They simply are not supported by the manufacturer.
 - Almost all of this critical support system has experienced some degree of “cannibalization” to keep it going.
 - The only link with a back-up standby or “hot standby” is the one between Central Fire and the rest of the network.
 - This lack of standby links is a ticking time bomb waiting to go off and seriously inhibit services to the public at some critical moment of need.

Task 1: Tompkins County Requirements

- Specific County Requirements are:
 - Need to have reliable portable coverage in the city and the villages,
 - Need portable coverage in the suburban and rural areas that may be supported by a near by mobile, and
 - Some areas are so steep that coverage may never be practical from radio siting alone, these area need tactical coverage.

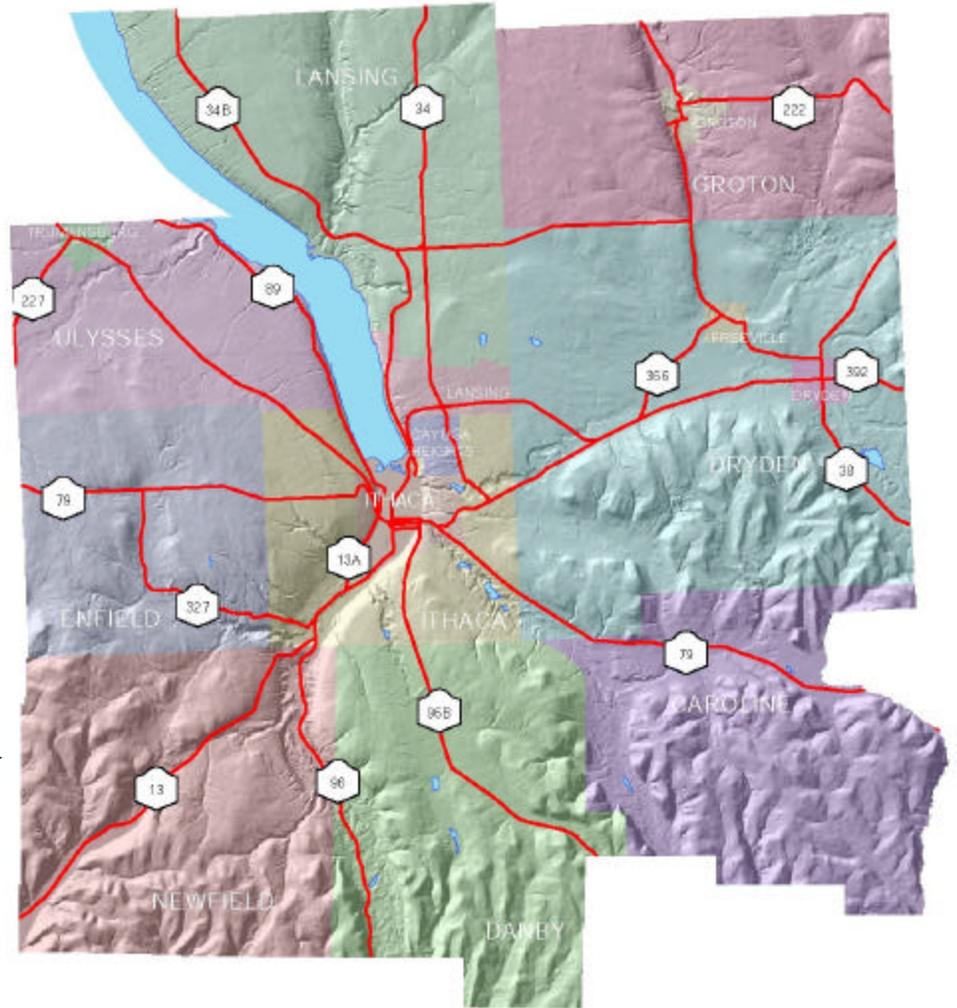
Task 2: Wireless Requirements Applied to Tompkins County

Considerations:

- What is the physiography of the County?
 - The County is actually two unique areas divided by an escarpment.
- Where is network supported portable coverage needed and how is it to be accomplished?
 - Most all users outside urban areas are associated with a vehicle that could act as a radio platform.
- Where are the difficult areas in the County that will challenge radio siting and how much exists?
 - Areas with an inclination of 20% or greater were deemed Areas of Aggressive Terrain.

Task 2: Physiography of the County

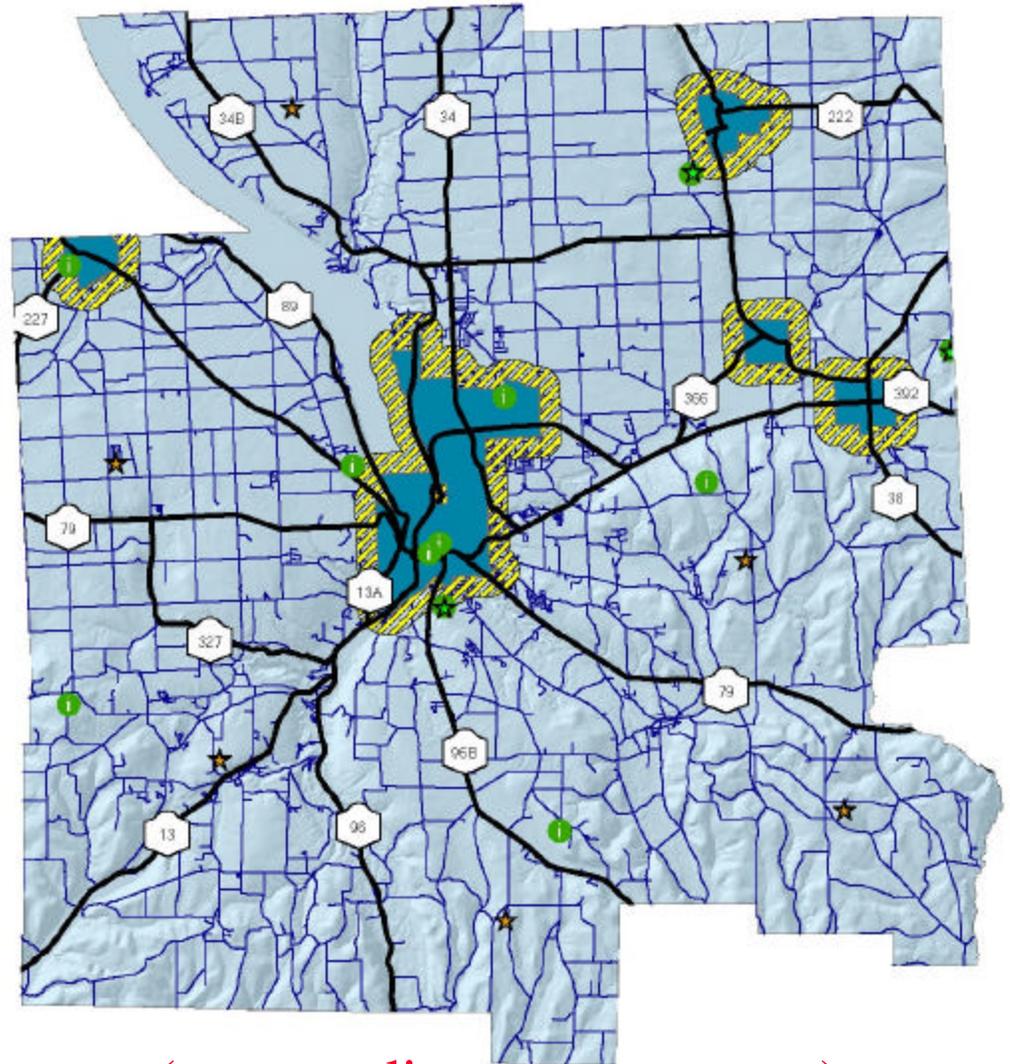
- The Northern portion of the county has a lower overall roughness than the south.
- Southern portion has high relief, rough terrain.
- Central Portion has an escarpment that runs along Rt. 366 north of Ithaca and around Rt. 13 south of Ithaca.



Task 2: Coverage Needs

Requirement Areas:

- 17.5 sq. miles of portable coverage
- 24 sq. miles of transition area
- 419 sq. miles of mobile or Tactical coverage area

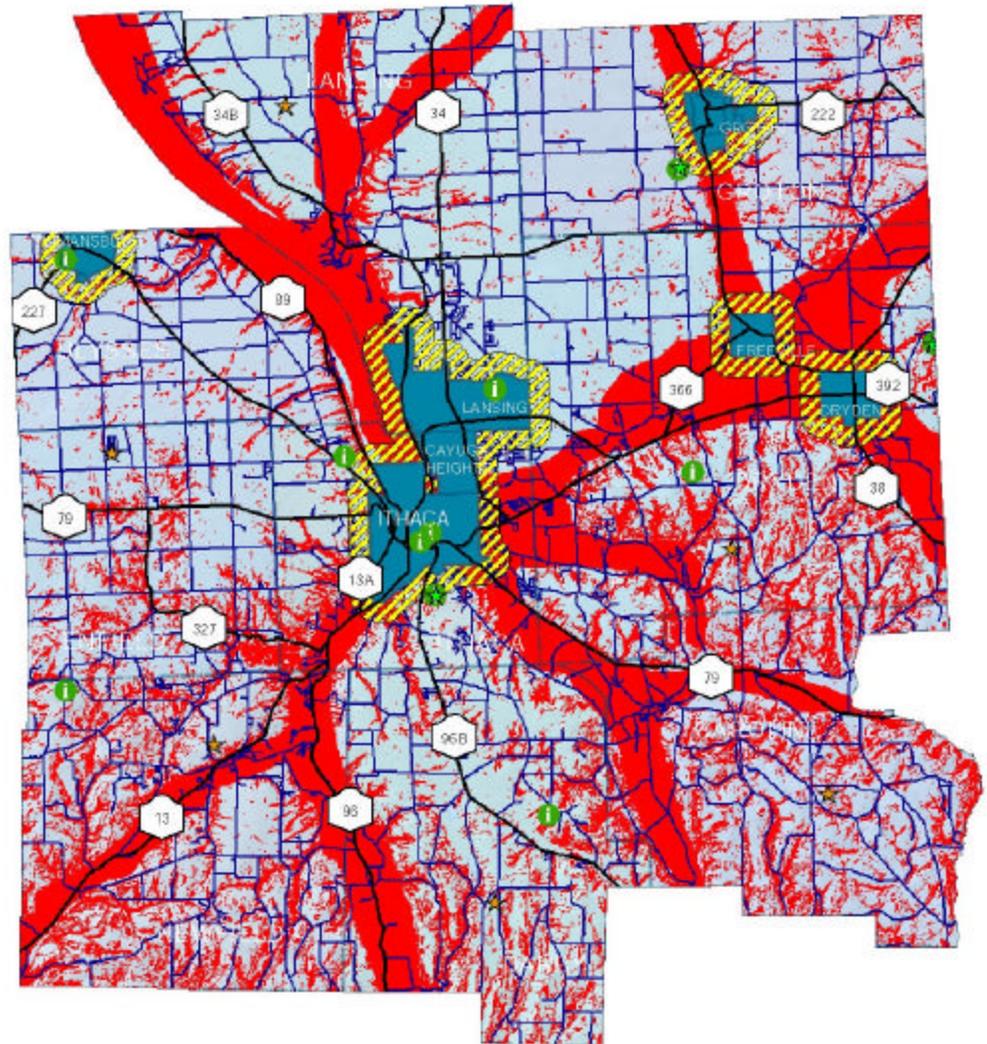


(not a radio coverage map)

Task 2: Coverage Needs

Requirement Areas:

- 17.5 sq.miles of portable coverage
- 24 sq. miles of transition area
- 283 sq.miles of portable with mobile repeater, and
- 137 sq. miles of *potential* tactical terrain



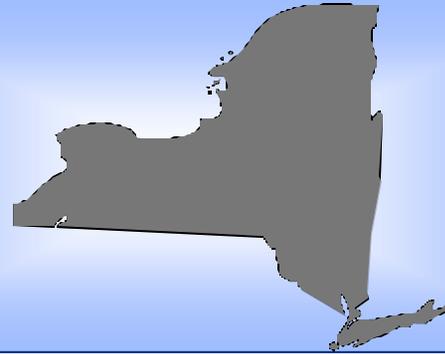
(*not* a radio coverage map)

Task 3: Current Communications Technology

Task 3: Reviews technologies as they may apply to the County's public safety communications needs. Areas covered are:

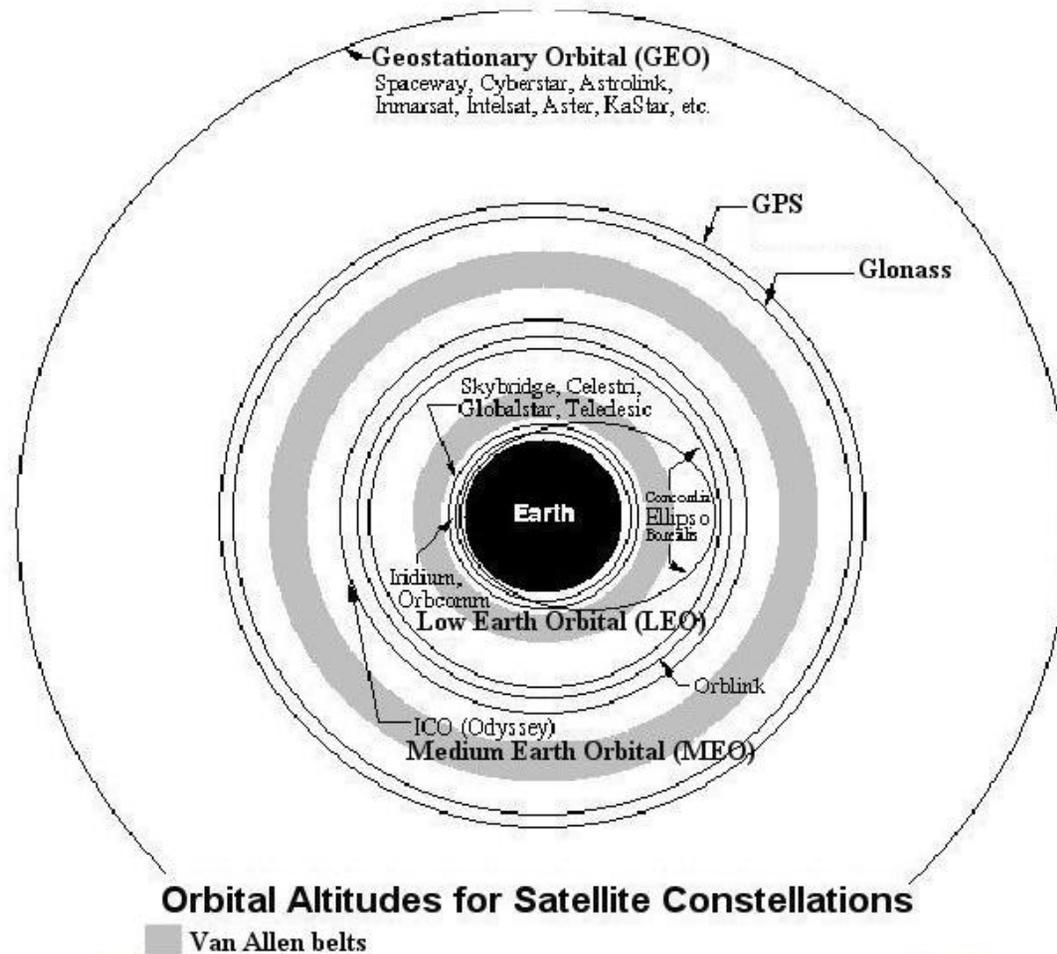
- Satellites
- LMR (Land-Mobile Radio)
 - Requirements
 - Conventional vs. Trunked Technology
 - LMR vs. Commercial Services Technology
 - Proprietary vs. Standard Technology
- The SWN (Statewide Wireless Network)

Tompkins County Radio Project



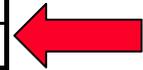
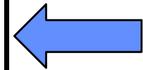
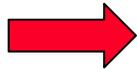
Communications Satellites

Satellite Orbit: LEO vs. MEO vs. GEO



Voice Satellite Systems

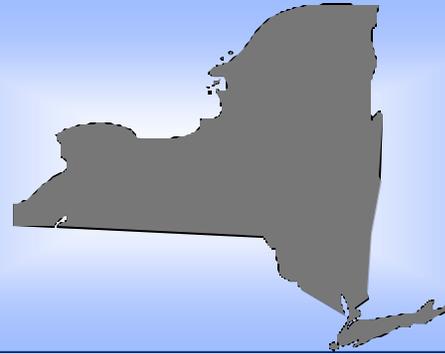
Voice Satellite Systems					
	Iridium	Globalstar™	ICO	Ellipso™	SkyCell
Company	Motorola	Loral/QUALCOMM®	ICO Global Communications	Mobile Communications Holdings	American Mobile Satellite Corporation
Number of Satellites	66	48	10	14	1
Orbital Planes	6 Circular Polar 86.5°	8 Circular Inclined 52°	2 Circular Inclined 45°	2 Elliptical Inclined 116.6°	1
Orbital Altitude (km)	780 (LEO)	1,400 (LEO)	10,355 (MEO)	520 to 7,846 (MEO)	35,780 (GEO)
Satellites per Plane	11	6	5	4 per elliptical; 6 per equatorial	1
Beams per Satellite	48	16	163	61	1 satellite with 4 spot beams
Costs	Not in Service	\$1.50-\$2.99 per minute; \$1,500 per user handset.	\$1.00-\$2.00/minute; \$1000 handset costs	\$0.50 a minute	\$0.95 to \$1.5 per minute with transportables about \$3000
Dispatch	No	TBD	No	No	Yes



Satellite Summary

- Because of the physical constraints and costs of its operations, satellites are a very limited option for communities like the Tompkins County. The utility for users “on the move”, such as public safety field personnel, is limited because of:
 - Long call set up times
 - Long delay times in transmissions severely hinder two-way voice communications
 - Direct line of sight to the satellites required, thus no obstructed coverage, e.g., in-building or heavily forested areas
 - Bulky mobile and portable user equipment
 - Expensive per minute charges for service

Tompkins County Radio Project



Land-Mobile Radio (LMR) Systems

Fundamental Requirements of Public-Safety Wireless Communications

- Point to Multipoint and Dispatch
- Fast Call Throughput
- Ubiquitous coverage “on the move”
- Priority Calling
- Call Preemption

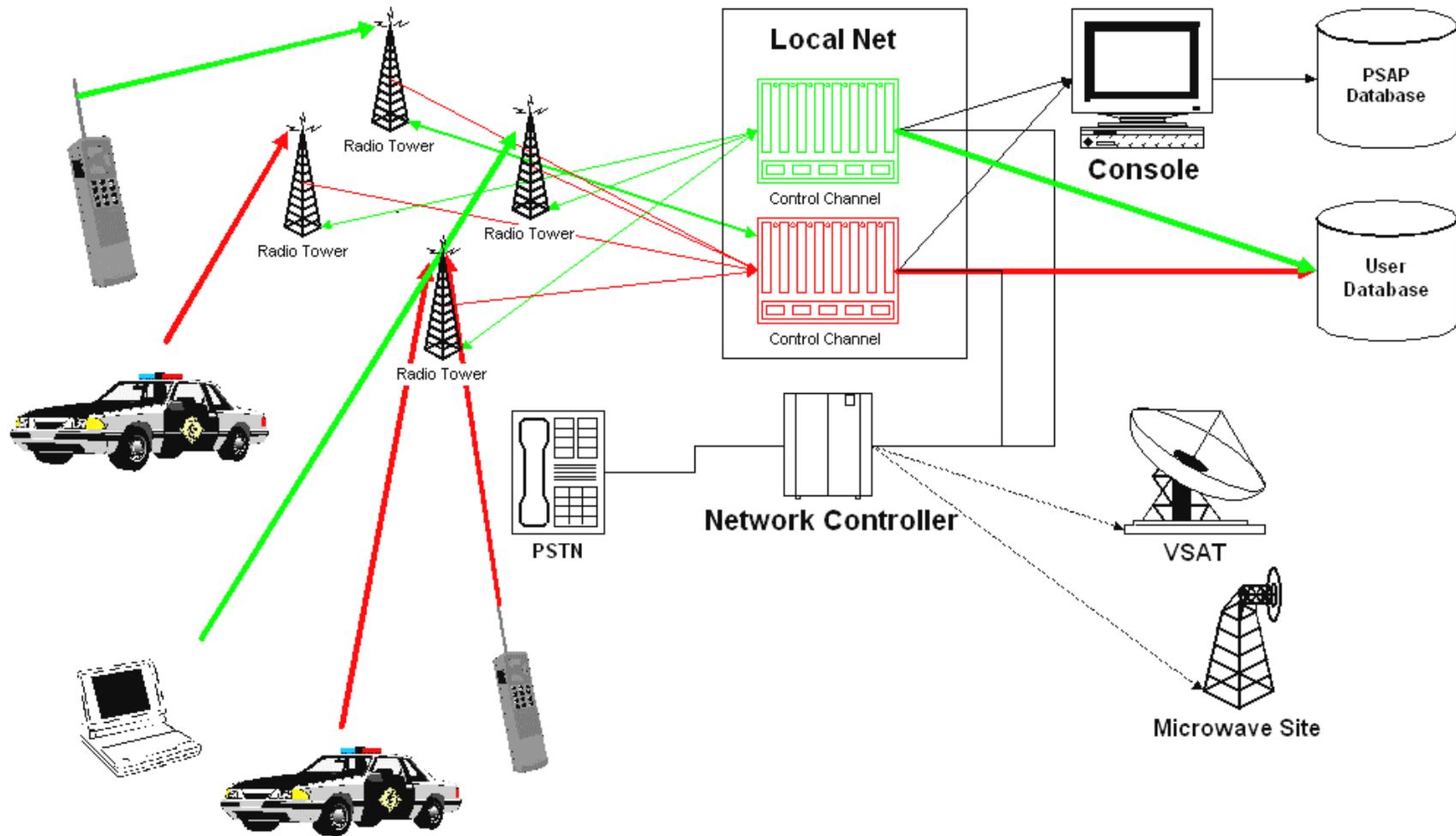
LMR designed to meet these needs



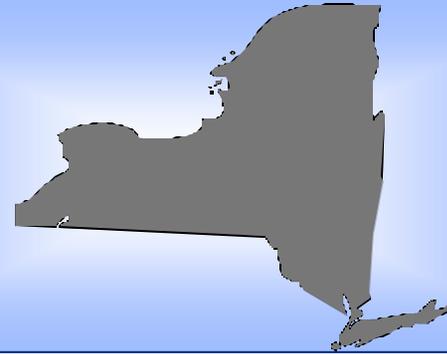
Fundamental Aspects of Public-Safety LMR Systems

- Mainly used by professionals, public service/ public safety personnel.
- Systems are generally owner managed.
- Low connection times, typically less than one second.
- User groups and point to multi-point calls.
- RF Transmission is regulated. Public service systems require licensing.
- Typical to have a central dispatcher, or telecommunicator.

LMR Topology

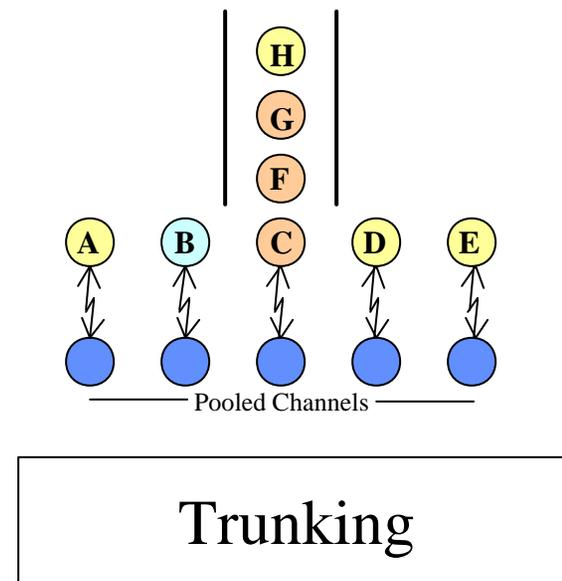
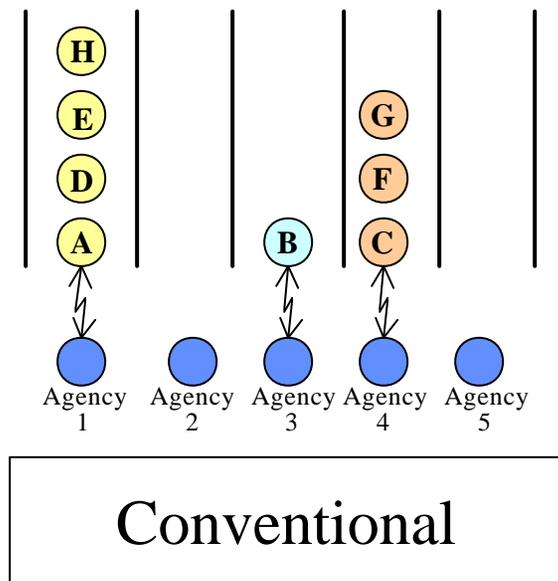


Tompkins County Radio Project



Conventional vs. Trunking Technologies

Conventional vs. Trunking: Supermarket vs. Banking Analogy

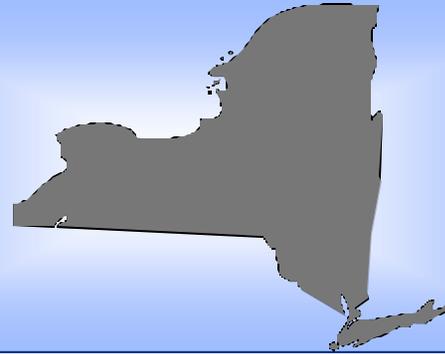


Conventional vs. Trunked Radios

- All users share a “pool” of frequencies
- Users are partitioned into “**talk groups**”
 - An individual user may be included in multiple talk groups
 - Dynamic assignment and cross-patching of groups by system manager
- Frequencies are assigned on as needed

Consideration	Conv.	Trunked	Comments
Radio Simplicity	✓		Subscriber equipment is widely used and the level of complexity in the radio is not a problem, the network is more complex
Spectrum Efficiency		✓	Trunked systems greatly increase spectrum efficiency and overall system capacity
Legacy systems	✓		All of the Tompkins County radios are conventional
Flexibility		✓	Trunking allows the rapid establishment of new talk groups
Interoperability		✓	Integration with other trunked systems is relatively simple. Allows restricted access to desired individuals in other agencies.
Security		✓	The dynamic reassignment of operating frequencies makes trunked systems more difficult to monitor.

Tompkins County Radio Project



LMR vs. Commercial Services

LMR vs. Commercial Services

- Commercial services include cellular/PCS (*e.g.*, OmniPoint, NEXTEL, *etc.*) and satellites (*e.g.*, Iridium, Globalstar, *etc.*)

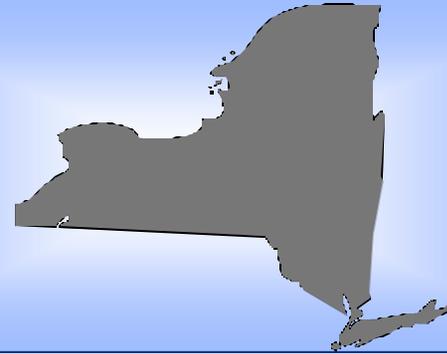
LMR

- Point-to-multipoint dispatch
- Time critical
- Ubiquitous coverage
- Priority to direct and coordinate

Commercial Services

- Point-to-point
- Telephone and paging set-up time
- Coverage of populated areas only
- Shared availability

Tompkins County Radio Project

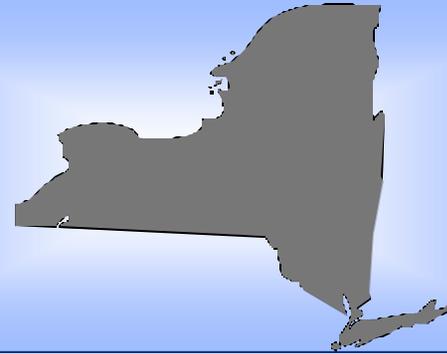


Proprietary *vs.* Open Standards

Proprietary vs. Open Standards

- Most existing LMR systems are based on proprietary designs and interface
 - Equipment from different manufacturers will not work together
 - e.g., Motorola SmartNet, Com-Net Ericsson EDACS, Tyco OpenSky
 - Limits competition once a system is purchased
- Standards are being developed for LMR equipment
 - APCO Project 25
 - TETRA (Terrestrial (formerly, Trans European) Trunked Radio)
- Adoption of Open Standards will:
 - Foster competition
 - Lower costs
 - Improve interoperability

Tompkins County Radio Project

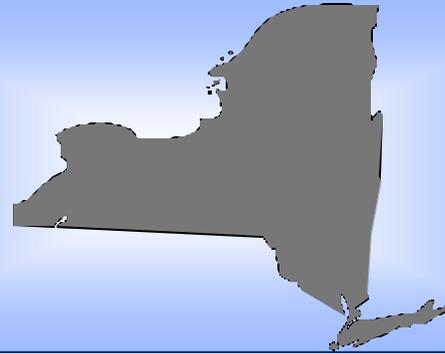


The Statewide Wireless Network (SWN) Project

The SWN

- Network anticipated to be a 700/800 MHz digital trunked network with mobile (on the road) coverage in the 3-4 years
- Network would be “leased” by the state for use by all state and local agencies
 - State agencies *required* to use it, local agencies *invited*
 - Agencies only provide their own subscriber equipment
- The SWN Project office anticipated to have significant announcements by late February 2001

Tompkins County Radio Project



Summary and Recommendations

Tompkins County Urgency

- Tompkins County *must* continue the process of replacing the current radio systems;
 - Existing system not worth upgrading, can not be fixed to fully meet the requirements.
 - VHF trunking does not seem possible because of lack of spectrum and proper pairing.
 - UHF trunking does not seem possible because of lack of spectrum
 - Microwave transport desperately needs addressing

Recommendation for Tompkins County

- A digital trunked 800-MHz LMR network best meets the requirements
- Because SWN will be a similar network, NYSTEC recommends that Tompkins County plan to become part of it
 - Need to do so in a coordinated manner since SWN is in a dynamic state
- Continue with the acquisition process for system up through the evaluation of proposals from vendors.
 - At that time the County can evaluate the viability and status of SWN relative to the timetable the County wants to follow.

Benefits

- Primary risk is some additional cost while maintaining schedule
 - There are costs for the County associated with the development of a Request for Proposal (RFP) and evaluation of vendor proposals, while the State continues with the progression of the SWN project.
 - This parallel approach, however, reduces the risk to the County. Should SWN turn out not to be viable to meet the County's needs, the County has not lost valuable time in getting a system procured and implemented.
 - Approach ensures County requirements are met
 - If SWN project and its timetable clearly becomes suitable for the County, the RFP will serve to define explicitly to the SWN project the requirements of the County, thus better assuring that the system will meet the County's needs.
-