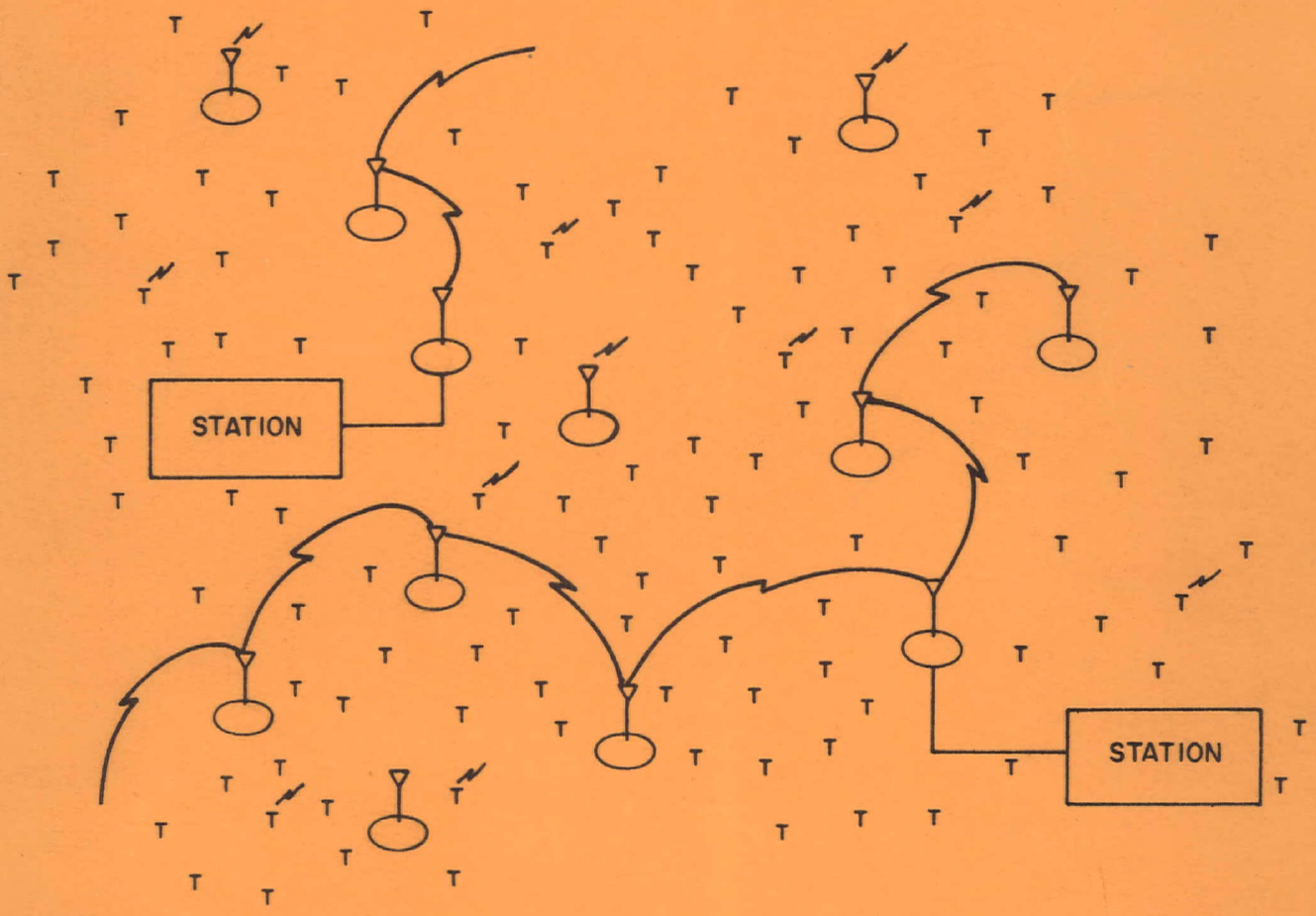
Government of Canada

Department of Communications

MOBILE DIGITAL COMMUNICATIONS



TELECOMMUNICATION REGULATORY SERVICE

JUNE 1977

DEFINITION

MOBILE DIGITAL COMMUNICATIONS IS THE TECHNOLOGY CONCERNED WITH THE EXCHANGE OF DIGITAL MESSAGES BETWEEN FIXED AND MOBILE RADIO STATIONS

THE LAND-MOBILE DIGITAL REVOLUTION, WHILE STILL IN ITS INFANCY, HAS ALREADY CREATED MANY UNIQUE DIGITAL APPLICATIONS FROM A SYSTEMS POINT OF VIEW. THE PRESENT FUNCTIONAL CAPABILITIES OF AVAILABLE DIGITAL GEAR (PAGING, STATUS REPORTING, TEXTUAL TRANSMISSIONS WITH HARD AND SOFT COPY READOUTS, AUTOMATIC TRANSMITTER IDENTIFICATION, ETC.) HAVE GIVEN RISE TO BOTH ONE-WAY AND TWO-WAY REQUIREMENTS, TO OPERATIONS THAT BOTH SHARE WITH AND OPERATE INDEPENDENT OF VOICE SYSTEMS, AND TO MANY COMBINATIONS OF OTHER SYSTEM DESIGN PARAMETERS.

CONSIDERABLE INTEREST

INTERVIEWS WITH USERS AND MANUFACTURERS OF LAND-MOBILE RADIO SYSTEMS, AND WITH ASSOCIATIONS THAT REPRESENT SELECTED GROUPS OF SUCH USERS, FOUND A VERY CLEAR INTEREST IN DIGITAL EQUIPMENT. THE EXTENT OF THIS INTEREST VARIED, FROM CASUAL AND LOCALIZED, TO MORE SERIOUS AND BROAD, BUT THE OVERALL IMPRESSION IS THAT OF A COMMUNITY OF USERS WHO SEE UNIQUE BENEFITS IN PARTICULAR DIGITAL CAPABILITIES.

DIGITAL TECHNIQUES ARE NOT NEW TO MANY OF THE PEOPLE THAT WERE INTERVIEWED. IN FACT, MUCH OF THE INFORMATION OBTAINED ON MARKET PENETRATION CAME FROM INDIVIDUALS WHO WERE AWARE OF DIGITAL SYSTEMS ALREADY IN OPERATION IN AN AREA OF PARTICULAR INTEREST, AND WHO WERE FOLLOWING THE EXPERIENCE WITH SUCH INSTALLATIONS CLOSELY.

IMPACT ON RADIO SPECTRUM CONSERVATION (I)

MOST USERS RECOGNIZE THAT A DIGITAL STATUS REPORT CAN BE SENT AND ACKNOWLEDGED USING MUCH LESS SPECTRUM SPACE THAN ITS ANALOG COUNTERPART, AND THAT OTHER DIGITAL APPLICATIONS CAN PROVIDE SIMILAR ADVANTAGES. HOWEVER, SEVERAL PERSONS INTERVIEWED WERE NEVERTHELESS APPREHENSIVE THAT EXPANSION OF THE DIGITAL MARKET WOULD RESULT IN AN OVERALL INCREASE IN TOTAL SPECTRUM REQUIREMENTS. THEY REACH THIS CONCLUSION BY NOTING THE HIGHER EXPECTED TRAFFIC VOLUMES THAT DIGITAL SYSTEMS HAVE CREATED (A TYPICAL EXAMPLE THAT IS REFERENCED IS UP TO 10 TIMES INCREASE IN DATA BASE INQUIRIES FOR LAW ENFORCEMENT AGENCIES THAT HAVE ADDED MOBILE DATA TERMINALS), AND THE FACT THAT THERE WILL BE NEW FUNCTIONS THAT DIGITAL SYSTEMS WILL BE CALLED ON TO PERFORM THAT ARE NOT NOW BEING PROVIDED BY VOICE COMMUNICATIONS. THE CROWDED CONDITIONS THAT CURRENTLY EXIST ON LAND-MOBILE CHANNELS IN MAJOR URBAN MARKETS SUGGEST TO THIS GROUP THAT A CAUTIOUS APPROACH TO DIGITAL SYSTEM IMPLEMENTATION BE TAKEN, TO BE SURE THE PRESENT SITUATION IS NOT AGGRAVATED.

IMPACT ON RADIO SPECTRUM CONSERVATION (II)

THE MAJORITY OF THE USERS DO NOT TAKE THIS VIEW. THEY SEE DIGITAL EQUIVALENTS TO VOICE TRANSMISSIONS AS A WAY TO REDUCE MESSAGE LENGTHS AND THEREFORE DO MORE WITHIN THE SAME ALLOCATION STRUCTURE. WHILE THEY RECOGNIZE THAT NEW APPLICATIONS FOR DIGITAL SYSTEMS WILL CONSUME SPECTRUM SPACE, THEY CONSIDER THIS AS PROVIDING ADDITIONAL BENEFITS TO THE USER, AND CAN SEPARATE THESE BENEFITS FROM THOSE THAT ARE ACCRUED BY TRADING OFF ANALOG OPERATIONS FOR EQUIVALENT DIGITAL ONES.

ROLE OF DIGITAL COMMUNICATIONS

A LARGE PERCENTAGE OF USERS HAVE APPARENTLY NOT SUFFICIENTLY IDENTIFIED THEIR DIGITAL COMMUNICATIONS REQUIREMENTS TO THE EXTENT OF BEING ABLE TO SPECIFY AREAS OF NEED, SYSTEM OPERATIONAL REQUIREMENTS, OR HARDWARE SOPHISTICATION/FEATURES/COST TRADEOFFS. MANY BELIEVE THAT MUCH OF THE DIGITAL MARKET IS AND WILL BE CREATED BY PUBLIC SAFETY SERVICE NEEDS, AND ARE CONTENT AT THIS TIME TO SEE WHAT HARDWARE RESULTS AND HOW IT MIGHT BE ADAPTED. THIS VIEWPOINT IS NOT TAKEN BY ALL USERS, BUT CERTAINLY BY A GOOD MANY OF BOTH SMALL AND LARGE ACTIVITIES.

A MAJOR CONSIDERATION IN USER UNCERTAINTY OF THE DIGITAL MARKET FOR SPECIFIC LAND-MOBILE APPLICATIONS IS COST. THIS IS OBVIOUSLY OF GENERAL CONCERN, BUT HAS BEEN PARTICULARLY EMPHASIZED BY BOTH INDUSTRIAL AND COMMERCIAL USERS.

WIDEST APPEAL - PAGERS

WHILE INDIVIDUALS WHO WERE INTERVIEWED DISCUSSED UNIQUE DIGITAL REQUIREMENTS THAT WERE OFTEN PECULIAR TO THAT USER OR SERVICE, THERE WAS ONE CLASS OF DIGITAL DEVICE THAT INTIATED BROAD COMMENT. THAT CLASS WAS PAGERS.

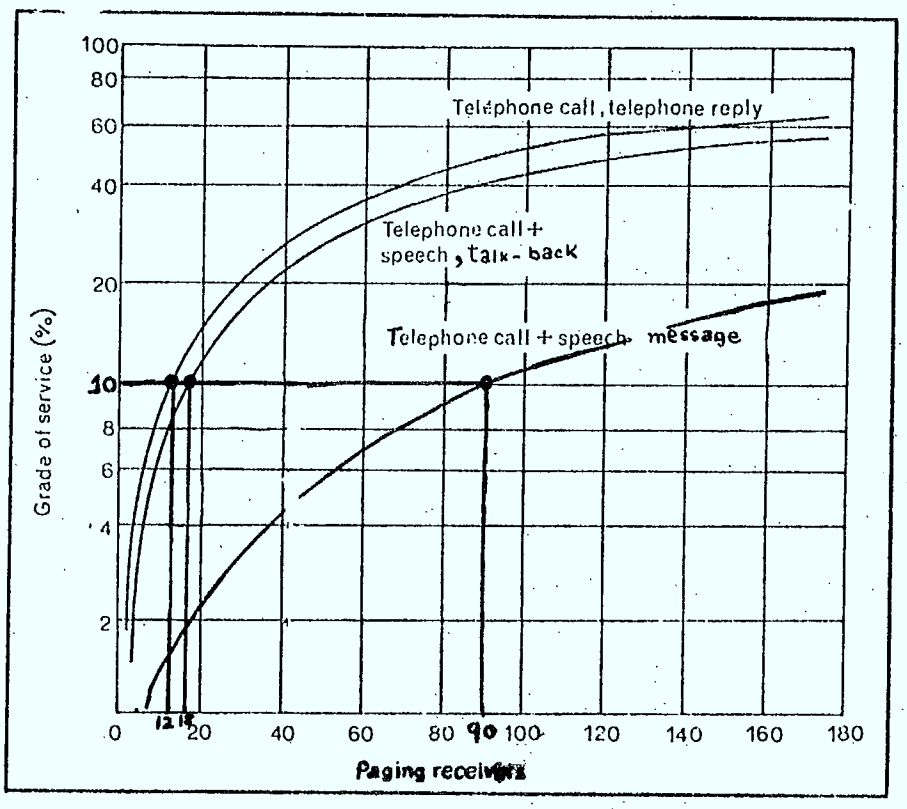
MANY OF THE INDIVIDUALS INTERVIEWED INDICATED THAT THEY EXPECTED THEIR ORGANIZATION OR SERVICE TO HAVE GREATER DEMANDS FOR PAGERS OVER THE NEXT SEVERAL YEARS. THESE REQUIREMENTS WERE NOT QUANTIFIED, BUT THEY OCCURRED OFTEN AND CONSISTENTLY ENOUGH TO SUGGEST BROADER USAGE OF SUCH DEVICES. THIS ACCEPTANCE TOOK PLACE IN SPITE OF CHANNEL ACCESS PROBLEMS CITED IN OPERATING PAGERS ON TWO-WAY CHANNELS, AND IN MAINTAINING CHANNEL DISCIPLINE ON PAGING-ONLY CHANNELS.

PAGERS

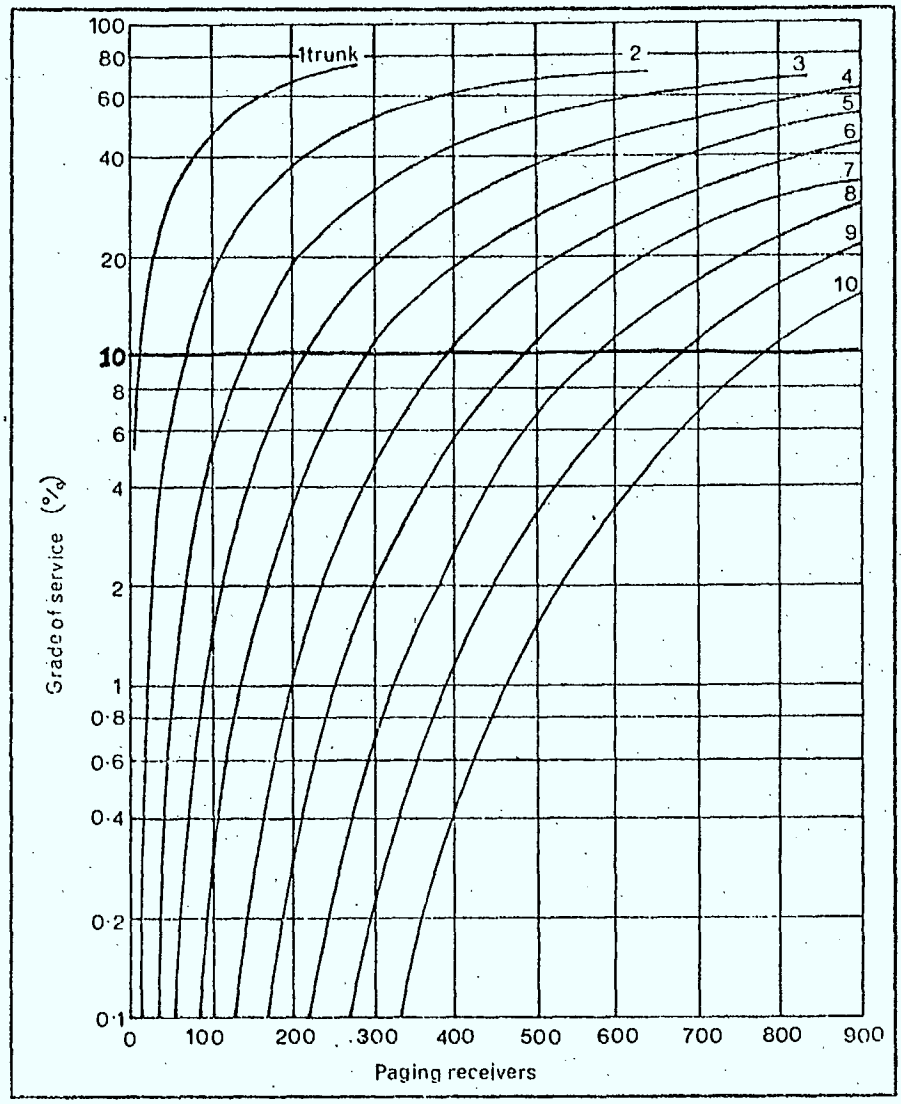
PAGERS MAY BE DEFINED AS "SELECTIVE BROADCAST" DEVICES. THEY HAVE ONE-WAY-ONLY COMMUNICATION CAPABILITY, WITH PARTICULAR TRANSMISSIONS DIRECTED TOWARD ONE, OR A GROUP OF RECEIVERS ON A SELECTIVE BASIS. THEY MAY BE CATEGORIZED AS:

- SIGNALLING CODE ONLY (USUALLY BY ONE OR MORE TONES) - THE RECEIVER THAT RESPONDS TO THE CODE ADDRESS USED WILL IDENTIFY THIS FACT THROUGH AUDIO, VISUAL OR OTHER MEANS.
- SIGNALLING CODE PLUS VOICE - SAME AS ABOVE, FOLLOWED BY A SHORT VOICE MESSAGE.
- SIGNALLING CODE PLUS DIGITAL - SAME AS SIGNALLING, FOLLOWED BY A SHORT DIGITAL MESSAGE.

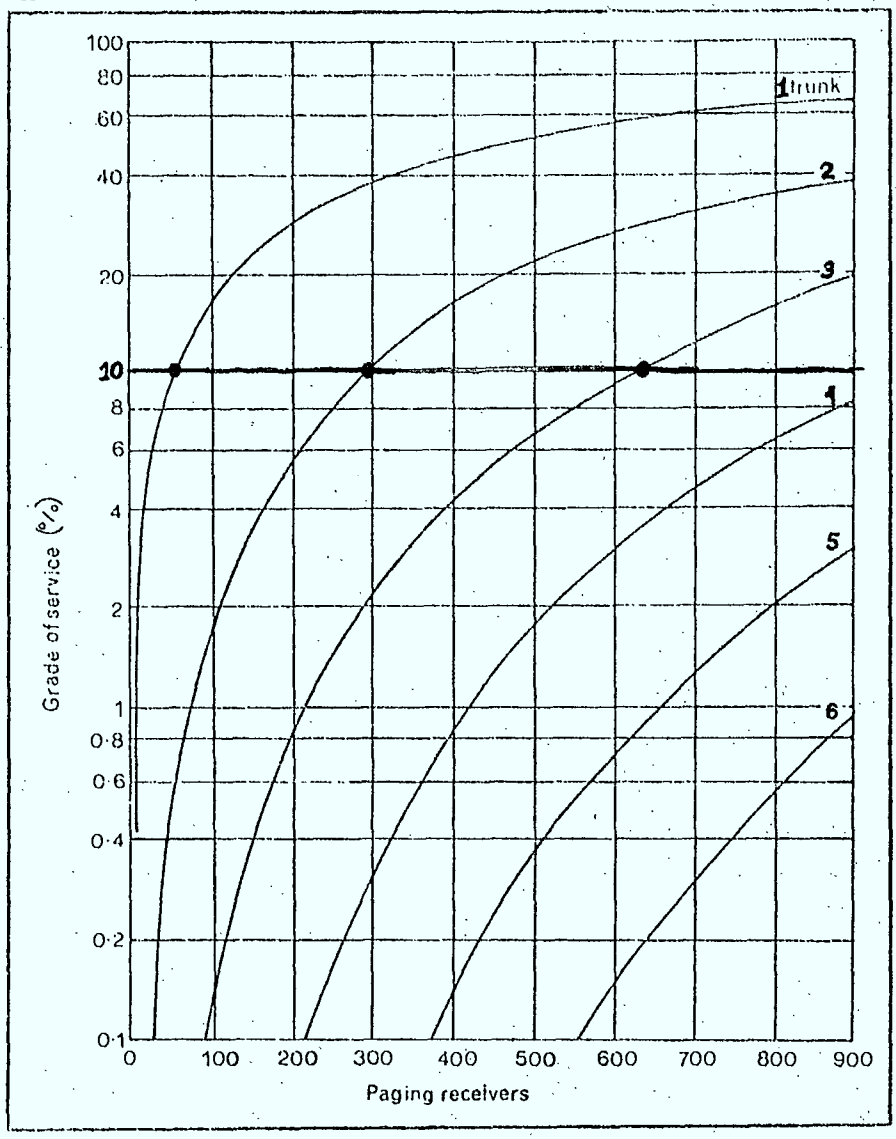
SINGLE TRUNK ANALOG



MULTIPLE TRUNK ANALOG



MULTIPLE TRUNK DIGITAL



SECOND WIDEST APPEAL - STATUS REPORTING

BESIDES PAGERS, LAND-MOBILE RADIO USERS ALSO EXPRESSED STRONG INTEREST IN STATUS REPORTING. THIS INTEREST WAS MORE EMBRIONIC THAN THAT FOR PAGERS, BUT COLLECTIVELY PRESENTED A POSITIVE ATTITUDE TOWARD TRANSMISSION OF STANDARDIZED MOBILE-TO-BASE MESSAGES.

ALMOST EVERY PERSON INTERVIEWED SAW AT LEAST ONE APPLICATION FOR SHORT STANDARDIZED DIGITAL MESSAGES THAT WERE OPERATOR-INITIATED, OR AUTOMATICALLY TRIGGERED WHEN A PARAMETER EXCEEDED A DISIGNATED LIMIT. APPLICATIONS OFFERED INCLUDED EMERGENCY ALERTS, FAREBOX STATUS, ENGINE LOSS OF OIL PRESSURE, AND OTHERS. HERE AGAIN, NO SPECIFIC MARKET PROJECTIONS WERE MADE, AND THE INTEREST WAS SOMETIMES QUALIFIED (E.G., IF IT DOESN'T COST TOO MUCH), BUT THE GENERAL IMPRESSION WAS ONE OF HAVING APPLICATIONS FOR THIS TYPE OF DIGITAL TECHNIQUE IN MIND.

MOBILE DATA TERMINAL - DATA BASE AVAILABILITY

THE MAJOR FACTOR THAT WILL INFLUENCE THE MARKET FOR MOBILE DATA TERMINALS IS BELIEVED TO BE THE AVAILABILITY OF ONE OR MORE COMPREHENSIVE DATA BASES THAT ARE USEFUL TO FIELD PERSONNEL. IT HAS BEEN THE HIERARCHY OF SUCH AUTOMATED FILES THAT HAS SPURRED THE HARDWARE MANUFACTURERS AND SOME MEMBERS OF THE LAW ENFORCEMENT COMMUNITY TO INVEST IN MOBILE DATA TERMINALS. THESE FILES PROVIDE THE PURPOSE AND IMPETUS FOR THE TYPES AND VOLUMES OF DIGITAL INFORMATION THAT MDTs OFFER. WHILE OTHER SERVICE USERS HAVE MENTIONED THE NEED FOR DATA BASES TO MEET THEIR SPECIAL NEEDS, NONE OF THESE FILES APPEAR TO HAVE REACHED THE STATE OF DEVELOPMENT THAT HAVE BEEN ACHIEVED BY THE POLICE.

AS A RESULT, THE MAIN THRUST OF MDT SALES WILL UNDOUBTEDLY REMAIN WITH LAW ENFORCEMENT. IT WILL REMAIN THIS WAY UNTIL COMPUTERIZED INVENTORY SYSTEMS, COMPUTERIZED BUS AND TRAIN SCHEDULES, COMPUTERIZED BOXCAR LOCATION FILES, ETC., ARE AVAILABLE AND IN DEMAND BY MOBILE PERSONNEL.

TERMINALS

THE MAIN TERMINAL TYPES CURRENTLY AVAILABLE ON THE MARKET ARE:

- MAINLY OUTPUT
- MAINLY INPUT
- INTERACTIVE

FUNCTIONS

THE MAIN FUNCTIONS THAT TERMINALS MAY BE CALLED ON TO PERFORM, DEPENDING ON THE APPLICATION ARE:

- IDENTIFY THE VEHICLE
- REPORT THE STATUS OF THE VEHICLE E.G. - FREE, EN ROUTE, AT THE SCENE, OUT OF SERVICE
- REPORT ON THE FUNCTION BEING PERFORMED AND TIME TAKEN
- MESSAGE OUTPUT
- PROVIDE A QUERY CAPABILITY - TO THE DISPATCH CENTRE OR A DATA BASE
- REPORT THE LOCATION OF THE VEHICLE - MANUAL INPUT OR AN AVM SYSTEM (IN THE FUTURE).

USES

Digital Preamble to voice

ID and Status

Mobile Teleprinter

Mobile Data Terminal

Tone/impulse signalling

Digital Remote Control

Alarm/Function Monitor

Digitized Voice

Automatic Vehicle Location

* DIGITAL PREAMBLE TO VOICE - DIGITAL MESSAGE THAT IS TRANSMITTED WHEN THE PUSH-TO-TALK SWITCH IS DEPRESSED, AND PRECEDES THE VOICE MESSAGE. TYPICALLY, ID AND STATUS ARE CODED, AND A TRANSMISSION TIME OF 250 MILLISECONDS IS INVOLVED.

* ID & STATUS - DIGITAL MESSAGE THAT IS INITIATED BY PUSH-BUTTON CONTROLS. TYPICALLY, ABOUT 8-12 MESSAGE FUNCTIONS ARE PROVIDED, AND SOME EQUIPMENTS HAVE CHANNEL MONITORING, ACKNOWLEDGEMENT, MESSAGE REPEAT AND OTHER FEATURES.

* MOBILE TELEPRINTER - DEVICE FOR OBTAINING HARD-COPY ALPHANUMERIC MESSAGES IN A VEHICLE.

* MOBILE DATA TERMINAL - DEVICE THAT CAN PROVIDE A TWO-WAY EXCHANGE OF ALPHANUMERIC INFORMATION TO AND FROM A VEHICLE. OUTPUTS ARE USUALLY PROVIDED THROUGH A "SOFTCOPY" (CRT, LED) DISPLAY. TRANSMISSION TIMES ARE UNDER 2 SECONDS.

* PORTABLE DATA TERMINAL - DEVICE THAT CAN PERFORM THE SAME CLASS OF FUNCTIONS AS A MOBILE DATA TERMINAL, EXCEPT THROUGH A PORTABLE UNIT.

* DIGITAL REMOTE CONTROL - REMOTE CONTROL OF VEHICLES, MACHINERY, PROCESSES, AND DEVICES.

* TONE/IMPULSE SIGNALLING - TECHNIQUE USED TO ESTABLISH OR MAINTAIN VOICE COMMUNICATIONS TO SELECTED USERS; INCLUDES PAGERS.

* ALARM/FUNCTION MONITOR - REMOTE DIGITAL MONITORING OF BOTH CRITICAL AND NON-CRITICAL FUNCTIONS, AND THE ABILITY TO TAKE ACTION TO CONTROL THESE FUNCTIONS, IF APPROPRIATE.

* DIGITIZED VOICE - VOICE MESSAGE THAT IS CODED IN DIGITAL FORM FOR TRANSMISSION IN REAL-TIME.

* AUTOMATIC VEHICLE LOCATION - THE ABILITY TO LOCATE A VEHICLE ANYWHERE IN ITS OPERATING AREA OR REGION THROUGH DIGITAL TECHNIQUES.

USERS

POLICE

FIRE

SPECIAL EMERGENCY

RAILROAD

BUS

TAXICAB

MOTOR CARRIER

UTILITIES

PETROLEUM

BUSINESS AND SERVICE ORIENTED ORGANIZATIONS

POLICE FORCES

THE DIGITAL REQUIREMENTS OF THE POLICE RADIO SERVICE DOMINATE EQUIVALENT REQUIREMENTS OF OTHER LAND-MOBILE SERVICES, EXCEPT IN THE PAGER AREA. IN LARGE PART, THIS IS DUE TO THE GENERAL CONCERN AND INTEREST IN THE COUNTRY'S PUBLIC SAFETY NEEDS AND TO THE AVAILABILITY OF THE TYPES OF DATA BASES AND INTERCONNECTIONS THAT CAN PROVIDE PATROLMEN WITH NEEDED, UP-TO-DATE, OPERATIONAL INFORMATION.

THE MARKET FOR MOBILE TELEPRINTERS IS NOT EXPECTED TO BE AS GREAT AS FOR MOBILE DATA TERMINALS IN THIS SERVICE. THIS IS BECAUSE A ONE-WAY HARD-COPY MESSAGE CAPABILITY MAY BE DIFFICULT TO JUSTIFY WHEN THE CAPABILITIES AND ADVANTAGES OF LAW ENFORCEMENT DATA BASE ACCESS ALREADY EXISTS.

MARKET SIZE: 3000 - 5500 INTERACTIVE TERMINALS BY 1978
4000 - 8000 STATUS BOX TERMINALS BY 1978
4000 - 6000 PORTABLE* TERMINALS BY 1978

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*FOR STATUS REPORTING, EMERGENCY REPORTING AND LIMITED DATA BASE INQUIRY.

FIRE TRUCKS

THE CRITICAL TIME PERIOD FOR FIRE SYSTEMS IS BETWEEN RECEIPT OF A FIRE CALL AND GETTING THE FIRST TRUCK ROLLING;EXCEPT FOR DIGITIZED BOX ALARM SYSTEMS, DIGITAL RADIO SYSTEMS CAN PROVIDE NO HELP IN THIS REGARD. HOWEVER, ONCE TRUCKS ARE MOVING, THERE APPEAR TO BE APPLICATIONS FOR STATUS REPORTING AND MOBILE TELEPRINTERS. MOBILE DATA TERMINALS WILL HAVE A MARKET ONLY IF FIRE-ORIENTED DATA BASES ARE DESIGNED AND DEVELOPED, AND THERE IS ONLY LIMITED INDICATION SUCH DATA BASES ARE BEING PLANNED. MOREOVER, THE ONES BEING DEVELOPED (BOX ALARM TO STREET ADDRESS CONVERSION, FIRE COMPANY MOVE-UP PLANS) ARE NOT PRIMARILY ORIENTED TOWARD VEHICLE NEEDS.

HEAVY USAGE OF PAGERS AND OTHER SIGNALLING DEVICES, POSSIBLY SOME ALARM MONITORING, AND CONTINUED INVESTIGATIONS OF REMOTE CONTROL TECHNIQUES (SUCH AS REMOTE NOZZLE CONTROL) IS ANTICIPATED. ALSO, EXPANDED USE OF RADIO FIRE ALARM BOXES IS EXPECTED, AND THE DEVELOPMENT OF DIGITAL PERSONAL PORTABLES WITH SPECIALIZED STATUS AND EMERGENCY REPORTING CAPABILITIES FOR FIRE SCENE COMMUNICATIONS IS ANTICIPATED.

MARKET SIZE: 100 TELEPRINTERS

400 - 500 STATUS BOX TERMINALS

SPECIAL EMERGENCY

THE REQUIREMENTS OF THIS SERVICE ARE SIMILAR IN MANY RESPECTS TO THOSE OF THE FIRE SERVICE. THE INVESTIGATION INDICATES THAT THE MAJOR NON-VOICE CONCERNS CENTER AROUND PRESENT LIMITED SPECTRUM SPACE FOR PAGING CAPABILITIES IN URBAN-SUBURBAN AREAS. THERE IS MILD INTEREST IN STATUS REPORTING TYPE EQUIPMENT IN AMBULANCES, AND FOR DIGITAL DISPLAY PAGERS. NO UNIQUE DIGITAL REQUIREMENTS WERE IDENTIFIED.

MARKET SIZE: ≈100 STATUS BOX TERMINALS

RAILROAD

THIS SERVICE ALREADY MAKES SIGNIFICANT USE OF DIGITAL TECHNIQUES. SOME RAILROADS CURRENTLY EMPLOY TONE AND DIGITAL SIGNALLING FROM TRAIN TO DISPATCHER, REMOTE LOCOMOTIVE CONTROL OVER A UHF PAIR (INCLUDING REPEATERS TO MAINTAIN CONTROL THROUGH TUNNELS), AND YARD SWITCH ENGINE CONTROL (AT 160 MHZ). THERE ARE ACTIVE INVESTIGATIONS UNDERWAY TO DEVELOP EQUIPMENT FOR DIGITAL MONITORING OF ROLLING STOCK, AND FOR A FIXED-ROUTE AVL SYSTEM USING SIGNPOSTS 20-40 MILES APART. OTHER REQUIREMENTS INVOLVE USE OF A DISPATCHER-TO-TRAIN TELEPRINTER NETWORK TO PROVIDE HARD-COPY ORDERS TO CREWS, MOBILE AND PORTABLE DATA TERMINALS TO ACCESS A TRAIN-SCHEDULE DATA BASE FOR A VARIETY OF REASONS INCLUDING ALERTING TRACK MAINTENANCE CREWS OF AN APPROACHING TRAIN, AND USING A SIGNPOST SCHEME TO MONITOR THE CONDITION OF REEFER (REFRIGERATOR) CARS.

BUS

BUS AVL SYSTEMS, PARTICULARLY THE CHICAGO AND TORONTO SYSTEMS, HAVE CREATED CONSIDERABLE INTEREST IN BUS LOCATION. HOWEVER, NO CLEAR INDICATION HAS BEEN OBTAINED OF THE MARKET FOR SUCH SYSTEMS, EXCEPT THAT IT APPEARS TO BE AN UNECONOMICAL CONCEPT WHEN LESS THAN 250-300 BUSES ARE INVOLVED AND WOULD THEREFORE BEST ATTRACT THE FAIRLY LARGE CITIES.

WHAT SEEMS TO BE OF MORE IMMEDIATE INTEREST TO USERS OF THIS SERVICE IS ID AND STATUS REPORTING. THIS INCLUDES EMERGENCY ALARMS, FAREBOX ALARMS, ENGINE PARAMETER REMOTE MONITORING (TEMPERATURE, OIL PRESSURE, ETC.), PASSENGER COUNTS, AND BUS STATUS (AHEAD OF SCHEDULE, BEHIND SCHEDULE, END OF RUN, ETC.,). FOR A NON-FIXED ROUTE SERVICE SUCH AS DIAL-A-RIDE, THERE ARE APPLICATIONS FOR MOBILE TELEPRINTERS.

MARKET SIZE: ≈10,000 TERMINALS BY 1980

TAXI

THE DEVELOPMENT OF DIGITAL RADIO SYSTEMS IN THE TAXICAB SERVICE IS ALSO UNCERTAIN, PRIMARILY BASED ON COST CONSIDERATIONS. THIS GROUP GENERALLY HAS A "WAIT AND SEE" ATTITUDE; IT OFTEN HAS INTER-COMPANY PROBLEMS THAT ARE CREATED BECAUSE OF THE REQUIREMENT TO SHARE RADIO CHANNELS, AND IT IS NOT CLEAR HOW DIGITAL COULD HELP IN THIS REGARD.

WHILE SOME ACTIVITY HAS BEEN GOING ON (E.G., THE TORONTO VOICE-SHARED, RANDOM CHANNEL ACCESS, DIGITAL PREAMBLE SYSTEM), IT IS BELIEVED THAT DIGITAL DEVELOPMENT IN THIS SERVICE WILL PROCEED SLOWLY. IT WILL PROBABLY GO IN THE DIRECTION OF ID AND STATUS PREAMBLES, WITH A CALL POLLING CAPABILITY ADDED IN MORE SOPHISTICATED SYSTEMS.

MARKET SIZE: ≈11,000 TERMINALS*(TAXI FLEETS WITH MORE THAN 200 CARS)

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*MAIN FUNCTIONS ARE ID, STATUS AND AVL

MOTOR CARRIER

THE MAJOR DIGITAL REQUIREMENTS OF THIS SERVICE SEEM TO CENTER AROUND A NEED TO KNOW CARGO INVENTORY AND ROUTING INFORMATION FOR MESSENGER AND FREIGHT TRANSIT OPERATIONS. SYSTEMS THAT CAN SEND STATUS MESSAGES, INVENTORY AND DESTINATION LISTS, AND PERHAPS FUEL CONSUMPTION DATA MOBILE-TO-BASE ARE ENVISIONED. WHILE MOBILE TELEPRINTERS HAVE BEEN CONSIDERED FOR ORDER PLACEMENT, LARGE DISTRIBUTORS WHO CAN BENEFIT MOST FROM TELEPRINTERS ARE PROCEEDING VERY SLOWLY, AND AT LEAST TO THIS POINT IT DOESN'T APPEAR THAT TELEPRINTER SYSTEMS HAVE BEEN DETERMINED TO BE COST-EFFECTIVE.

INTEREST SEEMS MIXED REGARDING THE GENERAL NEED FOR AN AUTOMATED TRUCK LOCATION SYSTEM, ALTHOUGH A SCHEME TO KEEP TRACK OF VALUABLE CARGO LOCATIONS (BRINKS TRUCKS, NUCLEAR PRODUCTS) IS CONSIDERED DESIRABLE. LESS THAN A CONTINUOUS LOCATION TECHNIQUE MAY BE ACCEPTABLE, SUCH AS A SIGNPOST SYSTEM AT STRATEGIC ENTRIES TO MAJOR CITIES.

MARKET SIZE: 2000 TERMINALS BY 1980

1200 - 1600 TERMINALS IN READY-MIX CONCRETE TRUCKS

UTILITIES

THE DETAILED DIGITAL NEEDS OF THE POWER SERVICE DO NOT APPEAR TO BE CLEARLY DEFINED, ALTHOUGH INVESTIGATIONS IN THE AREAS OF LOAD CONTROL, OF AUTOMATIC UTILITY METER MONITORING, AND OF ENVIRONMENTAL PARAMETER (AIR QUALITY, WATER QUALITY) MONITORING HAVE BEEN INITIATED OR ARE UNDER CONSIDERATION. STATUS REPORTING BY FIELD PERSONNEL HAS ALSO BEEN MENTIONED.

TESTS OF REMOTE METER MONITORING SYSTEMS ARE CURRENTLY UNDERWAY. IT IS REPORTED THAT PROPRIETARY STUDIES HAVE BEEN PERFORMED SHOWING THAT REMOTE READING USING A RADIO LINK VIS A VIS WIRELINE IS THE MORE COST-EFFECTIVE APPROACH. HOW THE DESIGN OF A REMOTE METER READING SYSTEM INTERFACES WITH A LOAD MANAGEMENT SYSTEM IS STILL UNCLEAR, AND WHETHER IT IS CONSIDERED COST-EFFECTIVE INDEPENDENT OF LOAD MANAGEMENT IS ALSO UNCLEAR. THE REMOTE METER READING TECHNIQUE HAS BEEN SUGGESTED AS HAVING PARTICULAR APPLICATION IN HIGH CRIME RATE AREAS, WHERE IT MAY BE DANGEROUS TO USE METER READERS, ALTHOUGH IT OBVIOUSLY HAS BROADER APPLICATIONS.

A NUMBER OF LOAD MANAGEMENT SYSTEMS ARE IN OPERATION RANGING FROM THE CONTROL OF 200,000 HOT-WATER HEATERS BY DETROIT EDISON, TO EFFORTS BY CENTRAL VERMONT PUBLIC SERVICE, BUCKEYE POWER, AND OTHERS. INDICATIONS ARE THAT MORE AND MORE UTILITIES WILL BE EXPERIMENTING WITH LOAD MANAGEMENT DURING THE NEXT FEW YEARS.

MARKET SIZE: $\approx$4500 TERMINALS

PETROLEUM

USERS CITE A VARIETY OF ALARM MONITORING AND REMOTE CONTROL FUNCTIONS TO BE PERFORMED WITHIN THIS SERVICE. THESE RANGE FROM REMOTE OPERATION OF MINE TRAINS AND OVERHEAD CRANES, TO CONTROLLING WATER WELLS, TO ALARMING MINE EXHAUST FANS. A CAPABILITY TO CONTROL SELECTED FUNCTIONS ON OFFSHORE OIL PLATFORMS FROM SHORE IS ALSO DESIRED. VERY LIMITED APPLICATIONS FOR EITHER MOBILE TELEPRINTERS OR AVL WERE IDENTIFIED, BUT INTEREST IN STATUS REPORTING WAS EXPRESSED.

BUSINESS

MANY LAND-MOBILE RADIO USERS PROVIDE A SERVICE FUNCTION DIRECTLY TO CONSUMERS, OR TO AN INTERMEDIARY IN THE DISTRIBUTION AND MAINTENANCE CHAIN TO CONSUMERS. SUCH USERS INCLUDE FUEL DELIVERY TRUCKS, RETAIL MERCHANT DISTRIBUTION SYSTEMS, YARD-TRUCK OPERATORS, AND MANY OTHERS.

THIS GROUP SEEMS TO HAVE MANY COMMON DIGITAL DATA REQUIREMENTS. THEY CENTER AROUND THE NEED TO PROVIDE NEXT ASSIGNMENTS TO VEHICLES IN AN EFFICIENT MANNER, AS WELL AS TO FURNISH THE DISPATCHER WITH STATUS INFORMATION ON HIS VEHICLES; STATUS REPORTING AND BASE-TO-MOBILE HARD-COPY REQUIREMENTS EXIST. THE GROUP ALSO MAKES EXTENSIVE USE OF PAGERS.

THE MOST FREQUENT "NEW" DIGITAL APPLICATION MENTIONED BY SERVICE-ORIENTED ORGANIZATIONS IS THE POSSIBILITY OF REMOTE ACCESS AND UPDATING OF INVENTORY RECORDS. WHILE THIS CAPABILITY HAS BEEN AND IS BEING EXPLORED BY A NUMBER OF LARGE WHOLESALE AND RETAIL CORPORATIONS, THERE IS THUS FAR NO EVIDENCE OF SERIOUS CONSIDERATION TO IMPLEMENT THIS APPROACH.

PROJECTED USAGE OF DIGITAL EQUIPMENT

USERS	DIGITAL PREAMBLE TO VOICE	ID & STATUS	MOBILE TELEPR.	MOBILE DATA TERMINAL	PORTABLE DATA TERMINAL	TONE/ IMPULSE SIGNAL'G	DIGITAL REMOTE CONTROL	ALARM/ FUNCT. MONITOR	DIGI-TIZED VOICE	AVL	TYPES OF DATA BASES AVAILABLE OR SUGGESTED
POLICE	4	4	2	4	2	2	0	0	2	1	CRIMINAL RECORDS, FIREARMS, VEHICLE & OPERATOR, VARIOUS OTHERS
FIRE	2	2	2	0	0	5	1	3	0	0	ALARM BOX ADDRESSES, MOVE UP PLANS, FILES ON SPECIFIC STRUCTURES
SPECIAL EMER-GENCY	2	2	1	0	0	5	0	0	0	0	
RAILROAD	1	3	2	1	1	4	4	0	0	3	TRAIN SCHEDULES, CAR LOCATIONS
BUS	2	3	2	0	0	0	0	0	0	2	BUS SCHEDULES
TAXICAB	2	2	0	0	0	0	0	0	0	0	
MOTOR CARRIER	2	2	1	2	0	0	0	2	0	2	CARGO INVENTORIES
UTILITIES	2	3	2	1	0	4	4	4	0	0	DISTRIBUTION SYSTEM STATUS
PETRO-LEUM	2	3	1	1	0	4	4	4	0	0	DISTRIBUTION SYSTEM STATUS
BUSINESS & SERV. ORIENTED ORGANIZ.	2	2	3	2	0	4	0	2	1	1	INVENTORY RECORDS

5 - HEAVY INVESTMENT IN THIS TYPE EQUIPMENT
4 - SIGNIFICANT IMPLEMENTATION OF A DEMONSTRATED NEED
3 - MODEST ACCEPTANCE & PROCUREMENT OF THIS TYPE EQUIPMENT
2 - SPECIFIC APPLICATIONS DEFINED, LIMITED UTILIZATION
1 - SPECIFIC APPLICATIONS DEFINED, SUBSTANTIALLY NO UTILIZATION
0 - SUBSTANTIALLY NO UTILIZATION; NO SPECIFIC REQUIREMENTS

CANADIAN USERS

* Toronto Transit System
* Toronto Metro Police
* Mississauga Taxi
* Diamond Taxi (Montreal)
* Blue Line Taxi (Ottawa)
* B.C. Railways
* Bell Canada

MAJOR
SYSTEM CONFIGURATIONS

* ONE-WAY DIGITAL OPERATIONS THAT SHARE THE CHANNEL WITH VOICE MESSAGES ON A CONTENTION BASIS. SUCH ARRANGEMENTS CURRENTLY ALLOW DIGITAL USAGE ON A SECONDARY BASIS.
* TWO-WAY DIGITAL OPERATIONS THAT ALSO SHARE THE CHANNEL WITH VOICE MESSAGES ON A CONTENTION BASIS.
* TWO-WAY DIGITAL OPERATIONS THAT USE A DIGITAL-ONLY DEDICATED CHANNEL, AND ACCESS THIS CHANNEL ON A CONTENTION BASIS.
* TWO-WAY OPERATIONS THAT EMPLOY DIGITAL TECHNIQUES, AND USE TRUNKING CONTROL OF A NUMBER OF RADIO CHANNELS.

ONE-WAY, VOICE-SHARED, CONTENTION MODE

DIGITAL MESSAGES ARE INITIATED BY PUSH-BUTTONS AND ARE TRANSMITTED IMMEDIATELY OR DELAYED AUTOMATICALLY UNTIL A CHANNEL-MONITORING RECEIVER INDICATES THAT THE RADIO CHANNEL IS AVAILABLE FOR USE.

ALTERNATIVELY, DIGITAL MESSAGES MAY BE TRANSMITTED AS PREAMBLES TO VOICE-MESSAGES. THE DIGITAL MESSAGE TO BE SENT IS SET-UP BY PUSH-BUTTONS WITH THE TRANSMISSION INITIATED WHEN THE MICROPHONE PUSH-TO-TALK SWITCH IS DEPRESSED.

THE ONE-WAY DIGITAL LINK IS GENERALLY USED FROM A MOBILE OR PORTABLE TO THE DISPATCHER, WITH THE EXCEPTION OF ONE-WAY TONE OR TONE PLUS VOICE PAGING.

PROBABILITIES OF ACCESSING A RELATIVELY HEAVILY LOADED VOICE/DIGITAL CHANNEL WITH REPEATED DIGITAL MESSAGES

	DIGITAL MESSAGE RATE		
	1 MESSAGE EVERY 500 SEC.	1 MESSAGE EVERY 50 SEC.	1 MESSAGE EVERY 5 SEC.
PROBABILITY OF MESSAGE GETTING THROUGH IN 2 TRYS	.8	.78	.6
PROBABILITY OF MESSAGE GETTING THROUGH IN 3 TRYS	.85	.84	.76
PROBABILITY OF MESSAGE GETTING THROUGH IN 4 TRYS	.93	.92	.89

MEAN VOICE MESSAGE LENGTH - 10 SEC.
MEAN DIGITAL MESSAGE LENGTH - 1 SEC.
MEAN VOICE MESSAGE RATE - 1 MESSAGE EVERY 50 SEC.

PROBLEMS

- NO DIGITAL ACKNOWLEDGEMENT

  THERE IS NO CAPABILITY OF DIGITAL ADKNOWLEDGEMENT. IN APPLICATIONS WHERE MESSAGE RECEIPT IDENTIFICATION IS IMPORTANT, VOICE ACKNOWLEDGEMENT COULD BE PROVIDED.

- DELAY TO TRANSMIT VOICE

  THE EXISTANCE OF A DIGITAL PREAMBLE AHEAD OF VOICE MESSAGE INTRODUCES AN ADDITIONAL DELAY OF ABOUT 200-400 MILLISECONDS.

- CHANNEL ACCESS

  WHEN DIGITAL SIGNALS SHARE A RADIO CHANNEL WITH VOICE TRANSMISSION, DIGITAL MESSAGES OF SHORT DURATION COMPETE WITH MUCH LONGER VOICE MESSAGES.

TWO-WAY, VOICE SHARED, CONTENTION MODE

MOST DIGITAL SYSTEMS HAVE GONE FROM A ONE-WAY DIGITAL CAPABILITY TO A TWO-WAY CAPABILITY SINCE A NUMBER OF ADDITIONAL OPERATIONAL FEATURES CAN BE PROVIDED.

TWO-WAY DIGITAL NETS OFFER THE VERSATILITY OF MESSAGE ACKNOWLEDGEMENT, FEEDBACK CONTROL, INTERACTIVE MESSAGE EXCHANGES AS WELL AS DATA BASE ACCESS.

CHANNEL LOADING (I)

(STATUS REPORTING)

VOICE ONLY

$\lambda_a = 0.028$/SEC

$1/\mu_a = 10$ SEC

$\omega = 3.9$ SEC/MESS

VOICE AND DIGITAL

$\lambda_a = 0.021$/SEC $\quad \lambda_d = 0.007$/SEC

$1/\mu_a = 10$ SEC $\quad 1/\mu_d = 1$ SEC

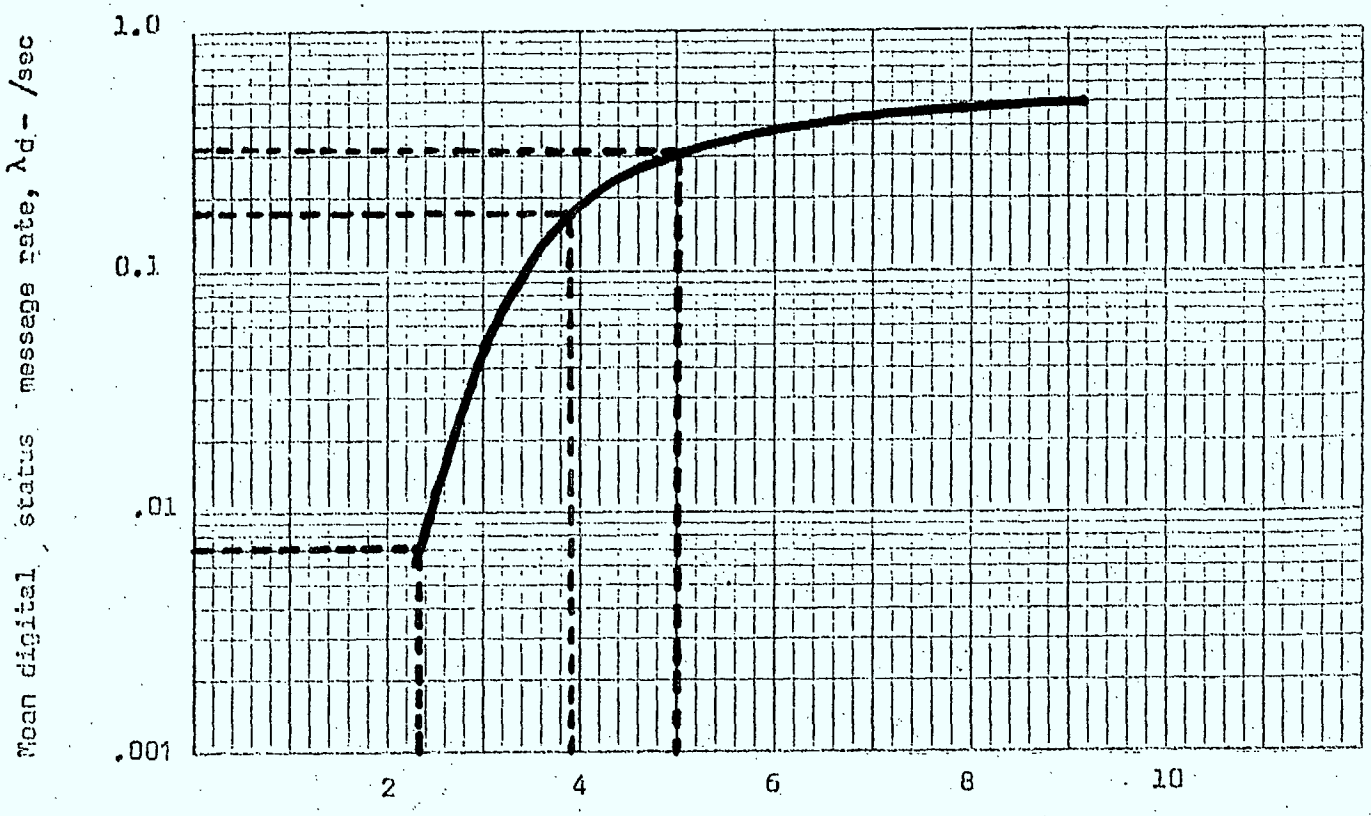
$\omega = 2.35$ SEC/MESS

$\omega = 3.9$ SEC/MESS IF $\lambda_d = 30 \times 0.007$

$\omega = 5.0$ SEC/MESS IF $\lambda_d = 50 \times 0.007$

IMPROVED SPECTRUM EFFICIENCY RESULTS FROM DIGITAL STATUS REPORTING.

EFFECT OF THE DIGITAL STATUS MESSAGE RATE OF A
SHARED VOICE/DIGITAL CHANNEL ON MEAN WAITING TIME



for $\lambda_{o.} = .021$

$\mu_{o.} = .1$

$\mu_d = 1$

CHANNEL LOADING (II)

(DATA BASE ACCESS)

VOICE ONLY

$\lambda_\alpha = 0.028$/SEC

$1/\mu_\alpha = 10$ SEC

$\omega = 3.9$ SEC/MESS

VOICE AND DIGITAL

$\lambda_\alpha = 0.02$/SEC $\quad \lambda_d = 0.008$/SEC

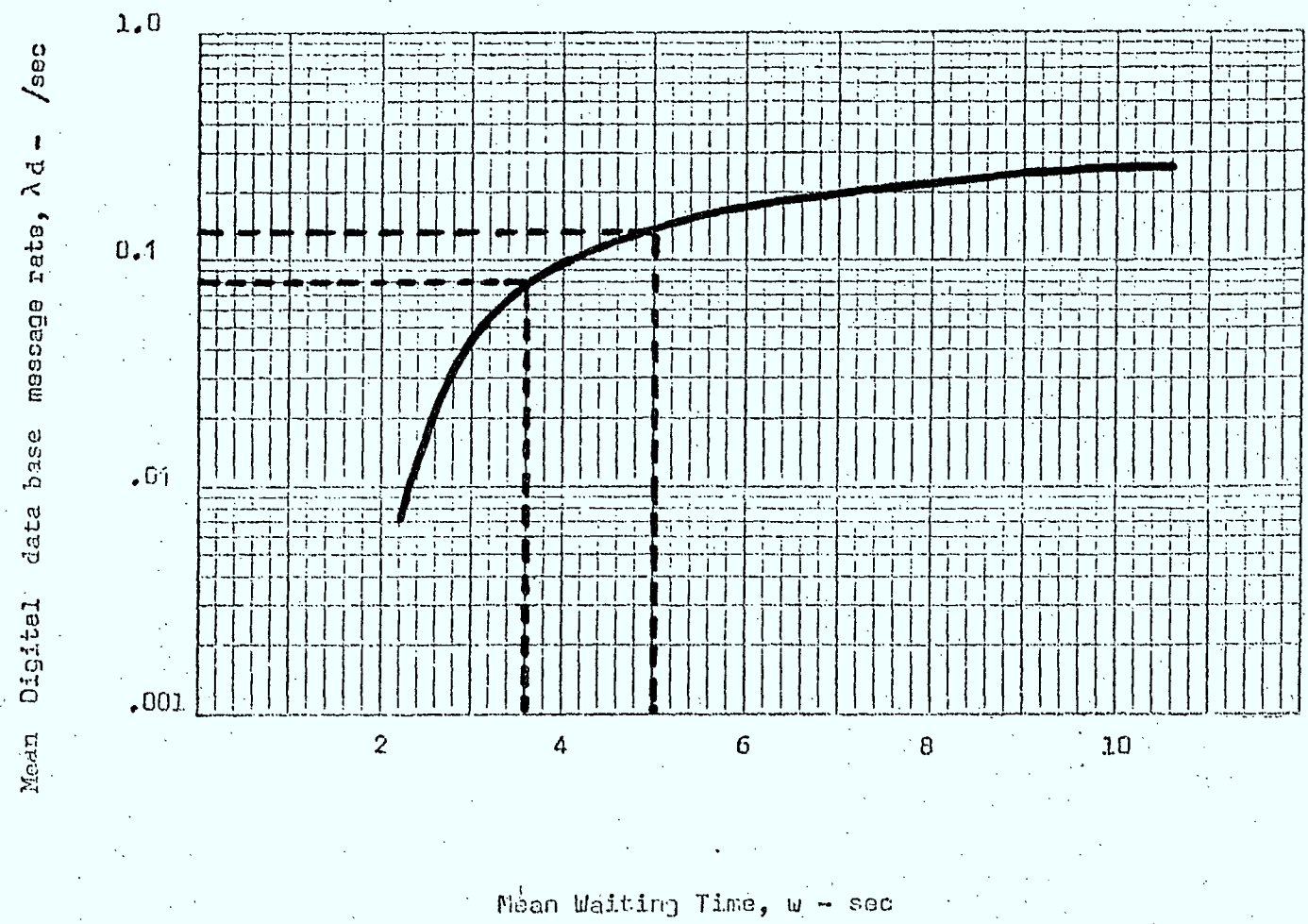
$1/\mu_\alpha = 10$ SEC $\quad 1/\mu_d = 2$ SEC

$\omega = 3.6$ SEC/MESS

$\omega = 5.0$ SEC/MESS IF $\lambda_d = 18 \times 0.008$

IMPROVED SPECTRUM EFFICIENCY RESULTS FROM CONVERSION TO DIGITAL DATA BASE INQUIRIES.

EFFECT OF THE DIGITAL DATA BASE MESSAGE RATE OF A SHARED VOICE/DIGITAL CHANNEL ON MEAN WAITING TIME



for $\lambda_{av} = .021$

$\mu_{av} = .1$

$\mu_d = .5$

TWO-WAY, DEDICATED, CONTENTION MODE

WHEN SIGNIFICANT DIGITAL TRAFFIC IS ANTICIPATED (SUCH AS THE USE OF MOBILE DATA TERMINALS IN 100-200 VEHICLES FOR DATA BASE ACQUISITION USE), IT IS APPROPRIATE TO CONSIDER USING ONE OR MORE DEDICATED-DIGITAL RADIO CHANNELS. A SINGLE LARGE DIGITAL-EQUIPPED FLEET MIGHT JUSTIFY SUCH A REQUIREMENT, OR A NUMBER OF SMALLER SYSTEMS WITH DIGITAL NEEDS MIGHT BE ABLE TO SHARE USE OF A CHANNEL.

THE CHIEF ADVANTAGE OF A DEDICATED CHANNEL FOR DATA COMMUNICATIONS IS THE AVOIDANCE OF COMPETITION WITH VOICE SIGNALS.

CHANNEL AVAILABILITY

THE MAJOR LIMITATION TO THIS APPROACH IS THE AVAILABILITY OF ENOUGH SPECTRUM TO PROVIDE THE ULTIMATELY NEEDED NUMBER OF DEDICATED DIGITAL CHANNELS. IN URBAN AREAS, THE MAJOR HOPE FOR DEDICATED CHANNELS IN THE IMMEDIATE FUTURE LIES IN THE UHF, TV AND 900 MHZ BANDS. IMPORTANT CRITERIA IN DECIDING ON AN ASSIGNMENT FOR DIGITAL USE ONLY MUST BE THE EFFICIENCY WITH WHICH SUCH A CHANNEL WILL BE USED, AND THE TRAFFIC LOADING THAT WILL RESULT.

TWO-WAY, DEDICATED, CONTROL MODE

THE HARDWARE MANUFACTURERS SEE GREAT POTENTIAL IN TRUNKED RADIO SYSTEMS FOR THE LAND-MOBILE SERVICES. TRUNKING PROVIDES THE FIRST OPPORTUNITY TO BREAK AWAY FROM THE CONCEPT OF A FIXED RADIO CHANNEL ON WHICH LAND-MOBILE EQUIPMENT WILL OPERATE. IT OFFERS THE BEST POTENTIAL FOR EFFICIENT SPECTRUM USAGE, BY CONTROLLING THE FREQUENCY ON WHICH A USER REQUESTING ACCESS TO THE SYSTEM WILL OPERATE. IT CAN BE USED TO TRUNK DIGITAL AS WELL AS VOICE SIGNALS, BUT IN EITHER CASE WOULD USE A DIGITAL PREAMBLE ON EACH MESSAGE AND DIGITAL SWITCHING OF USERS TO APPROPRIATE UNOCCUPIED CHANNELS.

DIGITAL VOICE

At least two companies have developed digitized voice systems that have potential for operating in a standard 25 KHz voice channel, and can provide the reliabilities necessary for use in the Land-Mobile Service. If that is the case, then it is not unreasonable to expect to see trunked digital channels handling voice (in digital form) as well as data messages. The advantages of this capability are great, since all messages can be processed in the same way, regardless of content, and the same hardware can accomodate both classes of signals. The trunked arrangement is particularly attractive as far as digitized voice is concerned, because digitized voice messages will continue to be significantly longer than data messages.

STANDARDIZATION

THE UNIT CONTROLLING THE TRUNKING SYSTEM MUST BE ABLE TO IDENTIFY WHO WANTS TO ACCESS THE SYSTEM AND WHO HE WANTS TO TALK TO; AND THIS IDENTIFICATION MUST BE INDEPENDENT OF ANY PARTICULAR MANUFACTURER'S EQUIPMENT. THIS CAN ONLY OCCUR IF EQUIPMENT SUPPLIERS DESIGN TO A COMMON DATA FORMAT.

COMPETING DATA SYSTEMS

THERE ARE AS MANY MODULATION/DATA RATE/BIT STREAM STRUCTURES CURRENTLY BEING USED FOR DIGITAL DATA TRANSMISSION AS THERE ARE EXISTING DESIGNS. THE LACK OF A STANDARDIZED APPROACH BY THE VARIOUS HARDWARE MANUFACTURERS, AND EVEN AMONG DIFFERENT MODELS OF A GIVEN MANUFACTURER, IS UNDERSTANDABLE AT THIS POINT IN LAND-MOBILE DIGITAL SYSTEM DEVELOPMENT. HOWEVER, LITTLE IS KNOWN REGARDING THE SUSCEPTIBILITY OF ONE SYSTEM TO ANOTHER IF BOTH SHARE THE SAME CHANNEL. THIS MAY NOT BE A PROBLEM UNDER MOST CIRCUMSTANCES, BUT SHOULD BE EXPLORED.

EQUIPMENT MANUFACTURER	MODEL	ERROR D + C CODES	MOD. TECHN.	DATA RATE (BITS/SEC)	NO. OF MESSAGE CHAR.	FUNCTIONS	MESSAGE BITS	OVERH'D	TOTAL BITS
Harris Corporation Controls Division	105SS	6 bit primative polynomial code	FSK	333 baud		Locomotive Remote Control	44	6	50
Harris Corporation RF Communication Division	RF2910,2922 St/SD/SP 2925 YD/YP 2925		continously variable slope delta modul.	24 kilobits/sec (a)		Secure voice base,mobile and portable VHF equipment			
Kustom Data Communications	MCT 10	parity check	synchr. PSK	1300 (option of 867 for MCT-10)	256 max.	Mobile Data Terminal	7 bit ASCII	360 ms preamble	2260 max.
	MP 10				8 per sec	MCT-10 Printer	35/char		
	ED-102A	parity bit	synchr. PSK	1300 or 866 baud		Encoder/ Decoder	6 bit ASCII plus parity bit		
Motorola	MODAT Mobile Data Terminal	parity check, each message sent twice	PSK	800 baud	64 max.	ID, Status Mobile Data Terminal	Optional VP-100 teleprinter has 85 bits/ char		Optional VP-100 teleprinter has 80 bits/ char
	MODAT Status/ Massage		Decimal FSK			ID, Status			
RCA	PSR-1 Status Reporter TD1-5 Xmtr ID	2 out of 5 code	PSK	300 or 150 baud	8	ID, Status	5	3	8 per char.
	PDH-1 Voice plus control head	5 level, 8 unit, 2 out of 5 code	PSK	150 baud	8	ID, Status from mobile, freq. select & ID interrog. from base	5 per char.	3 per char.	8 per char.

RECOMMENDATIONS

ESTABLISH GENERAL ACCESS PAGING POOL

ESTABLISH GENERAL ACCESS DIGITAL POOL(S)

ESTABLISH AUTHORIZATION RULES FOR DIGITAL VOICE

ESTABLISH CHANNEL MONITORING REQUIREMENTS, ETC.

DEVELOP A TEST AND DATA ACQUISTITION PROGRAM

INVESTIGATE THE ROLE OF TONE-PLUS-DIGITAL PAGERS

INVESTIGATE THE ROLE OF PLMRS DIGITAL COMMUNICATIONS

INVESTIGATE THE COST/BENEFIT TRADEOFFS OF LOAD MANAGEMENT

INVESTIGATE THE ROLE THAT POLLING SYSTEMS CAN PLAY

ESTABLISH GENERAL ACCESS PAGING POOL, INCLUDING THE FOLLOWING:

NUMBERS OF CHANNELS

DIVISION OF PAGER TYPES, MODULATIONS

CHANNEL LOADING MEASURE (ERLANGS) AND LOADING CRITERIA

AUTHORIZATION PROCEDURES

PAGING REPRESENTS THE SINGLE FASTEST GROWING MARKET IN THE PLMRS OVER THE NEXT FIVE YEARS. D.O.C. SHOULD GIVE HIGH PRIORITY TO THE TASK OF PROVIDING FOR THE ORDERLY DEVELOPMENT AND USE OF PAGERS, AND THE CONTROL OF PROBLEMS THAT HAVE RESULTED BOTH ON VOICE/DIGITAL AND ON PAGING-ONLY SHARED CHANNELS.

ESTABLISH GENERAL ACCESS DIGITAL POOL(S), INCLUDING THE FOLLOWING:

- NUMBERS OF CHANNELS
- MODULATIONS (F2 & F9, PLUS F3 FOR STATION ID ONLY)
- CHANNEL LOADING MEASURES (NUMBER OF VEHICLES/PORTABLES)
- CHANNEL SUBPOOLS AND LOADING CRITERIA FOR EACH
- TWO SECOND LIMITS
- USE OF TONE AND DIGITAL SIGNALLING
- AUTHORIZATION PROCEDURES
- CONDITIONS FOR WAIVING BANDWIDTH, MESSAGE LENGTH, OTHER REQUIREMENTS

THE ESTABLISHMENT OF DIGITAL-ONLY CHANNELS WILL GIVE WEIGHT TO THE EMERGING DIGITAL LAND-MOBILE MARKET AND PROVIDE FOR THE ORDERLY DEVELOPMENT OF THAT MARKET. THE POOL CONCEPT AS OUTLINED IN THIS REPORT OFFERS THE DEGREE OF FLEXIBILITY NEEDED; IT CAN RESPOND TO A BROAD SPECTRUM OF USER DEMANDS, AND AT THE SAME TIME OFFERS POTENTIAL FOR EFFICIENT CHANNEL LOADING OVER THE NEAR TERM.

ESTABLISH AUTHORIZATION RULES FOR DIGITAL VOICE, INCLUDING

FREQUENCY BANDS

MODULATION TYPE (F3Y)

PRIMARY/SECONDARY STATUS

EMISSION LIMITS

COORDINATION DISTANCES

TYPE ACCEPTANCE TESTS

SINCE THE TECHNOLOGY CAN NOW ACCOMMODATE DIGITAL VOICE IN STANDARD CHANNEL WIDTHS, AND SINCE DIGITAL VOICE HARDWARE EXISTS OR IS EMINENT, THE D.O.C. SHOULD MOVE WITH DISPATCH TO MAKE THIS CAPABILITY AVAILABLE.

ESTABLISH CHANNEL MONITORING REQUIREMENTS, COORDINATION PROCEDURES AND EQUIPMENT TECHNICAL STANDARDS TO BE IMPOSED ON SHARED DIGITAL AND PAGER CHANNELS.

THE KEY TO ACHIEVING A HIGH LEVEL OF CHANNEL EFFICIENCY IS THE ESTABLISHMENT OF SPECIFICATIONS AND PROCEDURES THAT WILL COORDINATE AND SIMPLIFY THE TASK OF USER SHARING. THIS CAN INCLUDE RIGID CHANNEL MONITORING (EITHER AUTOMATIC OR MANUAL), AND THE CONTROL OF EQUIPMENT TECHNICAL PARAMETERS TO THE EXTENT NECESSARY TO PROVIDE GOOD SYSTEM IMMUNITY TO INTERFERENCE.

DEVELOP A TEST AND DATA ACQUISITION PROGRAM FOR COLLECTED LOADING INFORMATION ON EXISTING DIGITAL CHANNELS, AND USING THE DATA TO COMPARE MEASURED AND COMPUTED WAITING TIMES, NUMBERS OF CHANNEL USERS, ETC.

IT IS IMPORTANT THAT MEANINGFUL METHODS BE DEVELOPED FOR ASSESSING CHANNEL LOADING AND ESTABLISHING LOADING CRITERIA. A WELL-ORGANIZED TEST PROGRAM TO EVALUATE THESE METHODS IS NECESSARY.

INVESTIGATE THE ROLE OF TONE-PLUS-DIGITAL PAGERS IN THE NEXT 5-15 YEAR TIME FRAME, AND ITS IMPACT ON THE MARKET AND SPECTRUM REQUIREMENTS FOR TONE-ONLY AND TONE-PLUS-VOICE UNITS.

AS TIME APPROACHES FOR INTRODUCTION OF TONE-PLUS DIGITAL PAGERS INTO THE PLMRS MARKET, A LOOK AT THE EFFECTS OF THAT INTRODUCTION SHOULD BE PERFORMED. THIS CLASS OF PAGER, IF PRICED RIGHT, CAN CORNER A SIGNIFICANT PORTION OF THE VOICE-PAGING MARKET. IN ADDITION, THE D.O.C. COULD CHOOSE TO TAKE A POSITION THAT WOULD ENCOURAGE SUCH A CHANGE-OVER.

INVESTIGATE THE ROLE OF PLMRS DIGITAL COMMUNICATIONS IN THE NEXT 5-20 YEAR TIME FRAME, AND THE IMPACT ON VOICE CHANNEL LOADING.

IN THE NEXT 2-3 YEARS, A CLEARER PICTURE SHOULD BEGIN TO EMERGE ON THE DIRECTIONS THE LAND-MOBILE USER IS GOING AS FAR AS DIGITAL SYSTEMS IS CONCERNED, ON THE FUTURE COSTS OF DIGITAL HARDWARE, AND ON THE POTENTIAL OF NEW TECHNIQUES THAT COULD MEET USER GOALS WHILE EMPLOYING CONSIDERABLY LESS RADIO SPECTRUM. A MEDIUM TO LONG-RANGE DIGITAL PLAN SHOULD BE DEVELOPED AT THAT TIME.

INVESTIGATE THE COST/BENEFIT TRADEOFFS AND ALTERNATIVES FOR LOAD MANAGEMENT AND REMOTE METER READING APPLICATIONS

THE D.O.C. SHOULD ESTABLISH THE GUIDELINES UNDER WHICH LOAD MANAGEMENT AND REMOTE METER READING CAN USE THE SPECTRUM. IT IS IMPORTANT TO DESIGNERS OF THAT TYPE OF HARDWARE TO KNOW IF THEY MUST SHARE A CHANNEL, IF THEY HAVE TO OPERATE AT NIGHT, ETC.

INVESTIGATE THE ROLE THAT POLLING SYSTEMS CAN PLAY IN THE PLMRS, WITH PARTICULAR ATTENTION TO SPECTRUM USAGE AND THE LOADING OF EQUIVALENT CONTENTION SYSTEMS.

THERE ARE USERS OF THE PLMRS THAT ARE DESIGNING DIGITAL SYSTEMS THAT EMPLOY POLLING. GUIDANCE IN THIS REGARD ON THE PART OF D.O.C. SEEMS APPROPRIATE, SO THAT DEVELOPERS DO NOT SPEND THEIR MONEY UNNECESSARILY.

STANDARDS

AS THE LAND-MOBILE DIGITAL FIELD DEVELOPS, THE CATEGORY OF STANDARDS THAT WILL PROVIDE A DEGREE OF COMMONABILITY BETWEEN DIVERSE HARDWARE UNITS WILL COME INTO PLAY. SUCH STANDARDS MAY DEAL WITH THE MINIMUM TECHNICAL REQUIREMENTS OF BASE/MOBILE/PORTABLE RADIO EQUIPMENT THAT WILL PROCESS DIGITAL SIGNALS, THE RADIO/DIGITAL PROCESSING ELECTRONIC INTERFACE, COMPATIBLE INTER-CONNECTION AND MECHANICAL INTERFACE BETWEEN THE RF AND TERMINAL EQUIPMENT, TERMINAL EQUIPMENT STANDARDS, COMPUTER/DIGITAL SIGNAL INTERFACE REQUIREMENTS, AND THE LIKE. WHILE IT IS PREMATURE TO MANDATE SUCH STANDARDS AT THIS TIME, D.O.C. SHOULD ENCOURAGE THEIR DEVELOPMENT THROUGH COOPERATIVE INDUSTRY INITIATION, AND SHOULD PROVIDE ASSISTANCE AND SUPPORT TO THESE PROGRAMS UPON REQUEST.

PACKET RADIO

THE KEY FEATURE OF PACKET RADIO THAT MAKES IT ATTRACTIVE FOR CONSIDERATION BY THE LAND-MOBILE COMMUNITY IS ITS POTENTIAL OF PROVIDING A HIGH LEVEL OF SPECTRUM EFFICIENCY - EVEN HIGHER THAN CONVENTIONAL TRUNKING. HOWEVER, A PACKET RADIO SYSTEM FOR PLMRS WOULD HAVE TO TAKE INTO ACCOUNT THE UNIQUE REQUIREMENTS AND CHARACTERISTICS OF THAT SERVICE.

PACKET SWITCHING OFFERS ADVANTAGES WHEN DEALING WITH LARGE DATA BASES BUT WHETHER OR NOT IT COULD BE CONSIDERED IN THE PLMRS FOR ANYTHING BUT LAW ENFORCEMENT USE SHOULD BE EXPLORED.

Recommendations contained in a study of Mobile Data Communications prepared by Woods, Gordon & Co. and submitted to the CRC in May 1974.

THE CRC SHOULD INITIATE RESEARCH WORK WITHIN DOC ON:

- THE LIKELY IMPACT OF INCREASED DIGITAL RADIO COMMUNICATIONS TRAFFIC.
- THE DESIRABILITY OF SEPARATE RADIO CHANNELS FOR DIGITAL MESSAGES.
- THE DESIRABILITY OF WIDER CHANNELS FOR DIGITAL MESSAGES.
- METHODS BY WHICH VOICE AND DIGITAL MESSAGES CAN SHARE SINGLE CHANNELS.

THE CRC SHOULD ALSO COORDINATE (OR INITIATE) RESEARCH ON:

- OPTIMUM NOMINAL TRANSMISSION SPEED FOR MAXIMUM EFFECTIVE SPEED IN AN URBAN ENVIRONMENT
- MODULATION TECHNIQUES
- ERROR CORRECTION TECHNIQUES
- TRANSMISSION CODES
- GUIDELINES FOR CHOOSING BETWEEN POLLING AND CONTENTION SYSTEMS
- AUTOMATIC VEHICLE LOCATION TECHNIQUES
- HUMAN FACTORS INVOLVED IN THE USE OF MOBILE TERMINALS
- ANALYSIS OF POLICE VOICE TRAFFIC PATTERNS.

THE CRC'S FUTURE ROLE IN THE DEVELOPMENT OF MOBILE DATA COMMUNICATIONS SYSTEMS AND TERMINALS SHOULD BE ONE OF INITIATING FURTHER RESEARCH WORK (ESPECIALLY IN AREAS WHERE DOC AND THE CRC HAVE SPECIAL COMPETENCE) AND ACTING AS THE COORDINATOR OF CANADIAN EFFORTS IN RELATION TO THE MANY DIFFERENT TYPES OF MOBILE SYSTEMS. THE OVERALL OBJECTIVE OF THIS ROLE WOULD BE TO FOSTER THE DEVELOPMENT OF CANADIAN SYSTEMS EXPERTISE AND MANUFACTURING CAPABILITY IN THE FIELD OF MOBILE DIGITAL COMMUNICATIONS OVER RADIO.

DATE DUE
DATE DE RETOUR
