required to agree on a protocol that describes the most basic level of NWN operation, a potentially insurmountable task as coverage expands and adjacencies are daisy chained together.[45]

NWN has been designed as a nationwide system. Seamless compatibility could not be realized if providers were licensed on any smaller geographic basis. Any boundaries will create exclusion zones or require a massive coordination effort between adjacent systems. The degree of computing power required by the system and the intelligence within the system are fundamental to NWN. Absent common operational control, it is highly unlikely that any two licensees will be able to create systems that will compatibly interchange terminal tracking information, simulcasting synchronization data, zoning data, forward and reverse channel time allocation data, and the myriad of other data necessary to integrate multiple NWN systems on a functional level. Without compatibility at this basic level, no jointly operated NWN system could operate at the speed necessary to achieve the efficiencies that are the cornerstone of NWN.

VIII. CONCLUSION

In view of the foregoing, the Commission should promptly adopt a Notice of Proposed Rulemaking designating Mtel as a tentative selectee for a Pioneer Preference. The proposed Nationwide Wireless Network service contains significant technological innovations which can greatly enhance consumer and business capabilities. Moreover, through its

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[45] Due to the simulcast nature of NWN, a system between two NWN systems cannot be coordinated with both adjacent systems unless all three operate on the same schedule. As NWN service approaches nationwide seamless coverage, all NWN providers would be required to synchronize operations.

extensive developmental and testing program, Mtel has fully documented that NWN is technically and commercially feasible. Accordingly, grant of a preference to Mtel is clearly warranted and consistent with the Commission's Pioneer Preference policies.

Respectfully submitted,

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Dated: June 16, 1992

CERTIFICATE OF SERVICE

I, Kim Riddick, hereby affirm that on this 16th day of June, 1992, I have caused copies of the foregoing "Reply Comments" to be delivered, First Class Mail, postage pre-paid, to the following, except where service by hand is indicated:

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TAB A

Preliminary Views of Demand for a Nationwide Wireless Network Offering

Barry E. Goodstadt, Ph.D.
Clifford A. Bean

Telecommunications Practice
North American Consulting Directorate
Arthur D. Little, Inc.

Arthur D. Little is currently developing a quantitative estimate of the market for the Nationwide Wireless Network offering. To accomplish this objective we are carrying out a number of activities, including a review of prior, related work on nationwide messaging, focus groups with likely end-users, and a projectable quantitative survey of a nationwide sample of households.

This document describes preliminary results from a reanalysis of prior research and from two of the focus groups with likely end-users. A subsequent report based upon the quantitative survey will provide statistically rigorous results pertaining to demand and requirements for the Nationwide Wireless Network.

Addressable Market for Nationwide Wireless Network Offering

In an analysis of prior studies of the market for intercity paging/messaging, we identified an addressable market for such offerings. These estimates were constructed on the basis of data compiled on the growth of 800 occupations by the U.S. Census. Within this universe of occupations, we identified 130 specific occupations with substantial need for and penetration of mobile communications services. In further analysis, we pinpointed the extent of intercity travel within the target 130 mobile communications-intensive occupations.

Based upon that analysis, Arthur D. Little, Inc estimates of the addressable market for intercity paging/messaging as follows:

Year	Number of Potential Users of Intercity Mobile Communications Paging Messaging Services (000s)
1992	2,069
1993	2,281
1994	2,501
1995	2,729

Based upon our industry knowledge and recent focus groups, we conclude that the nationwide wireless network offering will garner a significant share of this addressable market.

The specific size of the NWN share of this market is the subject of the market survey which is now in the field.

The Need for Nationwide vs. Regional/Local Coverage

Two elements of our work to date are relevant to the issue of whether the need for mobile messaging services is local, regional or national in nature.

First, in prior work on nationwide paging/messaging surveys, we had undertaken a projectable statistical survey among 200 business travelers who resided in the Washington, D.C.-to- Boston corridor and who took at least twelve trips in the prior year (in 1986). This work indicated that:

- Business travelers experience substantial communication problems (such as "telephone tag") when they travel, regardless of their travel destination; and

- Among those travelers who specifically experience "telephone tag" (44% of travelers), their travel patterns include destinations which are well beyond the Washington-Boston corridor. Thus, we observed the following travel patterns within the Washington-Boston corridor:

City Traveling To	Percent Traveling	Average Number of Trips in the Past 12 Months
– Baltimore	18%	6.1
– Boston	30%	5.1
– Hartford	15%	4.0
– New York	44%	6.7
– Philadelphia	32%	4.1
– Washington	42%	5.7

- We also observed the following travel pattern outside of the Washington-Boston corridor:

City Traveling To	Percent Traveling	Average Number of Trips in the Past 12 Months
– Atlanta	42%	4.2
– Austin	7%	2.2
– Chicago	45%	3.6
– Dallas	38%	3.6
– Denver	19%	3.0
– Houston	20%	4.1
– Los Angeles	44%	3.9
– Miami	24%	2.7
– New Orleans	8%	2.7
– Phoenix	12%	4.2
– St. Louis	15%	2.8
– San Antonio	8%	1.9
– San Diego	12%	1.9
– San Francisco	35%	3.1
– Seattle	9%	1.6
– Other	60%	7.4

These data make it clear that the totality of trips in this population of travelers is greater outside of the Northeast corridor than it is within the corridor, thereby suggesting that regional service alone cannot meet user needs for communications when they are mobile.

This further suggests to us that any system which can only provide a partial solution to user communication needs will be less likely to be adopted, will generate less traffic, and will therefore be less likely to be successful.

Additional evidence supporting the need for nationwide coverage comes from results of recent focus groups conducted in Chicago in June, 1992 with small samples of users of laptop/palmtop PCs and electronic organizers. These groups suggested that in terms of nationwide coverage, potential customers felt that local or regional service was less than optimal. Their reasoning was that they tended to travel out of town on business. For this reason, local coverage could not fully serve their needs. Regional coverage was also not adequate to meet their needs as users reported that they travel to a variety of locations which stretch beyond the region in which they live and work (i.e., they travel from Chicago to Oklahoma and to California). For this reason, they reported that a nationwide offering would be the only option which could effectively address the totality of their messaging requirements.

As part of the current survey, we are examining the utility that potential users attach to local, regional and nationwide services. This survey will provide a quantitative and statistically projectable basis for evaluating our working hypothesis that nationwide service is better suited to customer needs.

Desired Message Size

The focus groups also examined the issue of the size of the messages users were likely to send and receive. Most users reported that the messages they would be likely to send and receive would be less than two pages in length. While one or two participants suggested that their messaging requirements were more substantial (10+ pages), they noted that the service could still meet their needs because they could send a short message to identify their requirements for information and then use other more cost-effective or efficient means (e.g. fax, down-load files into PC from e-mail system) to obtain the needed information.

The results of our initial work suggest the following working hypotheses need to be tested in the current survey:

1) Over the next few years NWN offerings have the potential to garner a significant share of an addressable market of 2.7 million users;

2) Nationwide rather than regional or local services are likely to be preferred by business travelers and by those who use laptop/palm top PCs and electronic organizers; and

3) Mobile messaging activity is likely to involve relatively short messages (one or two pages of about 2,000 bytes each) rather than file transfers of more lengthy documents.

TAB B

MPR Teltech Ltd

TITLE:	**Comparison of Maximum Capacity of PageMart and Mtel Messaging Services**
DOCUMENT NUMBER:	
ISSUE NUMBER:	1
DATE:	June 10, 1992
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Comparison of Maximum Capacity of PageMart and Mtel Messaging Systems

This brief report examines the comparative maximum system capacities of the messaging protocols proposed for the PageMart Personal Information Messaging Service (PIMS) and the Mtel Nationwide Wireless Network (NWN) Service. Capacities are compared on a level playing field, i.e. the same message sizes, subscriber busy hour call rates for a system serving the same geographic coverage area with the same block of spectrum. The number and location of base stations or remote receiver stations is not considered, although the effective RF coverage is assumed to be identical, yielding the same message transmission success rates.

The conditions assumed for comparison are given as follows:

- One geographic serving area equivalent in size to a large metropolitan city.
- 250khz block of spectrum available, allocated as required by each system's protocol and modulation design.
- 3000 character average message size, in the forward direction (network to subscriber)
- Only acknowledgment /ARQ traffic in the reverse direction (subscriber to network)
- 13% busy hour call rate (1.3 messages/subscriber over a 10 hour period)
- 95% message transmission success rate (1.05 transmissions per message)
- 80% channel utilization

PageMart PIMS System Capacity

A previous report by MPR Teltech[1] examined the protocol structure proposed for the PIMS system and concluded that the limiting factor in system capacity was the transaction rate on the poll channel. PIMS protocol structure led to the following limits:

- 2 poll messages/packet required on the poll channel
  = 4 codewords
  = 1 transaction
- Poll channel codeword rate = 131.8 codewords/sec
  (considering POCSAG structure, base station call signs and 4800 bps bit rate).
- Poll channel transaction rate:
  32.9 transactions/sec * 95% success rate * 80% batching efficiency
  = 25 transactions/sec
  = 90014 transactions/hour
- 3000 character message
  = 1200 codewords (20 bits per BCH(32,21) codeword)
  = 75 POCSAG batches (16 codewords/batch)
  = 15 packets (5 POCSAG batches/packet)

Total system message rate = 90014 / 15 = 6001 messages/hour

1. TR92-1896, "Comments on the Petition for Rulemaking by PageMart Inc.", MPR Teltech Ltd., June 1992

At 13% bhcr, 6001 messages/hour = 46161 subscribers

Note this is the best case, since we not yet considered the further limits imposed by a proper return link protocol. As noted in the previously mentioned report, the return link protocol design is in error and cannot support the maximum poll channel transaction rate, and in fact, may limit the transaction rate to less than half.

Mtel NWN System Capacity

A previous report by MPR Teltech[1] examined the protocol structure proposed for the Mtel NWN system and found the message capacity per zone (equivalent to a MSA) depends on the message size, error protection coding format and ratio of forward to reverse channel traffic, and other factors. This relationship was expressed by the equation

$$T_{cycle} = T_{fixed} + (N / 10) * T_{BH} + N * L + N * T_{ack}$$

where:

T_{cycle}	= 30.0 sec (length of cycle)
T_{fixed}	= 200 msec (fixed overhead per cycle)
T_{BH}	= 34 msec (length of a roll-call batch header)
T_{ack}	= 7.3 msec (effective length of ack)
L	= message length, including FEC or CRC overhead
N	= number of messages per cycle
N / 10	= number of roll-call batch headers required

Message Length: In the PageMart system, messages were packetized in packet lengths of 5 POCSAG batches, which is 200 characters per packet. Assuming the same packet length for the Mtel systems would derive

- 15 packets/message
- 372.2 packets/cycle in the CRC encoding format, or
- 265.3 packets/cycle in the FEC encoding case.

Allowing for 95% message success rate, and 80% channel utilization, this works out to

- 2977 messages/hour in the CRC encoding format, or
- 2122.5 messages/hour in the FEC encoding format.

These figures are for a single 50 khz channel. Allowing for 5 concurrent systems, to occupy the entire 250khz spectrum, yields:

Total system message rate = 2977 * 5 = 14885 messages/hour

1. TR92-1883, "Performance and Efficiency Considerations for the MTEL Nationwide Wireless Network (NWN) Protocol, MPR Teltech Ltd., May 1992.

At 13% bhcr, 14885 messages/hour = 114500 subscribers

This brief analysis shows that the Mtel NWN system supports nearly 2.5 times as many subscribers as the PageMart PIMS system, when considering the bits delivered per frequency domain, time domain and space domain.