western

(NASA-CR-159837) THE 30/20 GHz NET MARKET ASSESSMENT (Western Union Telegraph Co.) 151 p HC A08/MF A01 CSCL 12B

N80-26109

Unclas
G3/66 22352

30/20 GHz NET ACCESSIBLE MARKET ASSESSMENT

Prepared for

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
NASA LEWIS RESEARCH CENTER
NAS-3-21359

MARKET ASSESSMENT
FOR 30/20 GHz
SATELLITE SYSTEMS

BY: J. ROGERS, P. REINER
WESTERN UNION TELEGRAPH COMPANY

FOR: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LEWIS RESEARCH CENTER
CONTRACT NAS3-21359

1. Report No. CR-159837	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle 30/20 GHz Net Accessible Market Assessment - Task 9		5. Report Date February 1980 6. Performing Organization Code
7. Author(s) J. Rogers, P. Reiner		8. Performing Organization Report No.
9. Performing Organization Name and Address Western Union Telegraph Company 1 Lake Street Upper Saddle River, New Jersey 07458		10. Work Unit No. 11. Contract or Grant No. NAS 3-21359
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Lewis Research Center Cleveland, Ohio 44135		13. Type of Report and Period Covered Contractor Report 14. Sponsoring Agency Code
15. Supplementary Notes Project Manager, Steven Stevenson Communications and Applications Division		

16. Abstract

Starting with the potential communications traffic for 30/20 GHz systems developed in Task 6, this study estimates the net accessible market traffic which is likely to be implemented on these systems for years 1990 and 2000. By creating a number of market scenarios, variations dealing with network types, network sizes and service price levels can be analyzed for their impact on market demand. Each market scenario represents a market demand forecast with results for voice, data and video service traffic expressed in peak load megabits per second.

17. Key Words (Suggested by Author(s)) Market Value, Parametric Network Cost Model, Satellite Market Demand, Net Accessible Market, Common Network, Trunking Network	18. Distribution Statement		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 65	22. Price*

* For sale by the National Technical Information Service, Springfield, Virginia 22161

NASA-C-168 (Rev. 10-75)

30/20 GHz NET ACCESSIBLE MARKET ASSESSMENT

TASK 9

TABLE OF CONTENTS

APPENDIX

TASK 9 - ACCESSIBLE MARKET FOR 30/20 GHz SERVICES

SECTION 1

STATEMENT OF WORK

Starting with the potential traffic (voice, data and video) for 30/20 GHz systems developed in Task 6, the contractor shall estimate the actual traffic that would likely be implemented on such systems for the years 1990 and 2000. Eleven scenario variations shall be investigated: nine of a "common network" approach and two dealing with a "trunking network" approach. Each scenario element would represent a market demand based on certain network size and service price assumptions. The demand results for voice, data and video traffic shall be expressed in peak load megabits per second.

SECTION 2

OBJECTIVES AND SCOPE

2.0 INTRODUCTION

2.1 Initial 30/20 GHz Market Demand Assessment

This market identification study was preceded by a market demand assessment encompassing the telecommunications environment of the United States. The primary goal of that study, now referred to as Phase 1, was to estimate the market demand for 30/20 GHz satellite systems over the period 1980-2000. Achieving that goal required completion of the following tasks elements within that study.

- Projection of communication traffic volumes to year 2000
- Assessment of the relationship of traffic volume to:
  - Mileage band distance distribution
  - Population density
  - U.S. geographical distribution
- Price sensitivity
- Identification of service traffic volumes by major user category
- Analysis of traffic demand within a representative metropolitan area
- Comparison of present and future service costs
- Evaluation of the demand for communications services as a function of reliability and real vs. non-real time delivery

The study report provided by this document, now considered Phase II, is the follow-on study to the above Service Demand Assessment study completed by Western Union in July 1979. The purpose of these market studies conducted by NASA is to promote the commercial applications of 30/20 GHz band.

2.2 Objectives

The overall objective of the Task 9 study effort is to quantify the net accessible 30/20 GHz satellite systems market demand through a series of scenario variations. From the eleven different scenarios which consider differences in network type, network size and service price, an optimized approach for system implementation may emerge. This preferred approach should reflect the best matching of system size to an accessible market demand fill level.

2.3 Scope

The 11 market scenarios created as part of this study effort define two basic approaches to 30/20 GHz system implementation: the common network or specialized carrier model, and the trunking network or public carrier model. Each approach includes an analysis of network characteristics which affect the accessible market demand and serving capabilities.

The market scenarios permit the conversion of the 30/20 GHz systems net addressable market into the net accessible market over the 1990-2000 period. The net addressable market is that portion of the total satellite market which is capable of being served by 30/20 GHz satellite systems.

It can also be defined as the resultant traffic volume after consideration has been given to user operating characteristics, system technical constraints on service applications, and economic advantages of satellite versus terrestrial means. The net accessible market is the portion of the net addressable demand which is likely to be implemented on 30/20 GHz satellite systems.

It includes such factors as:

- Economic feasibility of particular networks
- Geographic coverage
- Service compatibility with network market objectives
- System availability and timing constraints with regard to services offered.

Market penetration by competing specialized carriers is the final element required to actually size a common network utilization. Penetration factors for individual carriers have not been projected in this study.

The common or specialized carrier network service demand is evaluated on the basis of three different earth station networks: minimum, most efficient and, largest network sizes; with consideration given to three different service price levels: equal to Ku-band services, 20% below Ku-band and 40% below.

Two trunking network configurations were evaluated, both based on the geographical market coverage provided by the network. One contained ten earth station locations, the other 20 locations, Additional variations were not considered to be particularly useful for the purposes of this analysis.

SECTION 3

TASK OVERVIEW

The two major families of market scenarios, common and trunking networks, are based on distinctly different network types. The common network is characterized by services with limited geographic coverage due to the lack of extensive terrestrial distribution facilities.

The trunking or public network, on the other hand, will employ extensive distribution of traffic terrestrially on the type of facilities available only to a "Bell"-type network.

3.1 Common (Specialized Carrier) 30/20 GHz Network Market Models

Specialized common carriers do not have extensive terrestrial distribution systems augmenting a satellite network. These carriers must use a network approach which strategically locates a number of earth stations close to the major areas of market demand. Terrestrial distribution must be limited for economic reasons, linking subordinate areas of market demand within 50 miles. The terrestrial extensions are required to create the "critical mass" of market demand necessary for a viable network. Areas of market demand may include multiple corporate users, joint (shared) user groups and dedicated users. Earth stations may be equipped with small, medium or large antennas depending on the type and quantity of traffic projected to be handled.

A series of market models for this network approach were investigated. The associated net accessible market demand for three distinct network sizes was developed: the market for the minimum number of earth stations representing something near the smallest viable network; a number of terminal locations representing the most efficient size, and, a larger number of earth terminals representing the upper limits of marginal utility of the 30/20 GHz system.

Each earth station location serves the local Standard Metropolitan Statistical Area (SMSA), plus terrestrial extension to all neighboring SMSA's of a minimum threshold market size. The number of earth station locations within a given network also provides insight into the point of diminishing return where the incremental traffic is insufficient to support an additional earth station.

The effect of user and operating requirements were included in the determination of the net addressable satellite markets developed in Phase I; however, these characteristics were reevaluated when determining the net accessible markets for the two discrete satellite carrier markets. Common networks normally seek to attract different market segments than trunking networks, therefore it was necessary to develop a new mixture of service traffic comprising each network.

The market addressable to 30/20 GHz systems was assessed by examining the price relationship between Ku-band and 30/20 GHz satellite systems. It was appropriate that at least three variations in price be analyzed. A price above that charged for comparable Ku-band systems will not yield practical results and was not considered. The three choices for pricing were: equal to Ku-band service; 20 percent less than Ku-band services; and, 40 percent less. These service costs are in relative terms-no actual costing of systems were a part of this task. Ku-band service costs were developed via construction of a parametric satellite facility cost model, discussed in Section 5.2. Market issues not specifically included were: market inertia, the effect on market demand caused by slow user acceptance in the marketplace; and, the competitive marketplace influences.

The selection of three pricing variations required each of the previous three network size scenarios to be further subdivided. The common network scenario thus contains nine subscenarios, each yielding a separate projection of the net accessible market demand. The flow of network sizing analysis and identification of the 30/20 GHz net accessible market is shown in Figure 1.

3.2 Trunking (Public Carrier) 30/20 GHz Network Market Models

A "Bell"-type system requirement may influence a decision to offer 30/20 GHz satellite systems transmission as an adjunct to the terrestrial distribution system as well as timing of implementation. This possibility was evaluated through the creation of a scenario family with appropriate subscenarios.

The trunking network would require a limited number of high volume earth station locations serving large geographical areas. Two market coverage models for the trunking approach were investigated. The first is based on ten earth station locations, the second on 20 locations. Market coverage for each model was calculated through use of computer-based optimization algorithms. The choice of two market coverage models introduced two permutations into this basic scenario. Each permutation required separate analysis and estimates of market demand.

Market assumptions and constraints included in the trunking network addressable market are similar to those developed for the common network. Analysis of the 30/20 GHz addressable market was somewhat different for the trunking network scenario due to the types of traffic expected to be carried. Each of the three or four major service categories now offered on the nationwide telephone system were analyzed to determine the quantities of traffic likely to be implemented on a 30/20 GHz system. The categories include business and residential MTS and private line service.

Market demand projections for all eleven scenarios are expressed in the appropriate service units (i.e., channels, transponders and bits per second) for voice, video and data services, as well as peak load megabits per second.

30/20 GHz SATELLITE MARKET SIZING

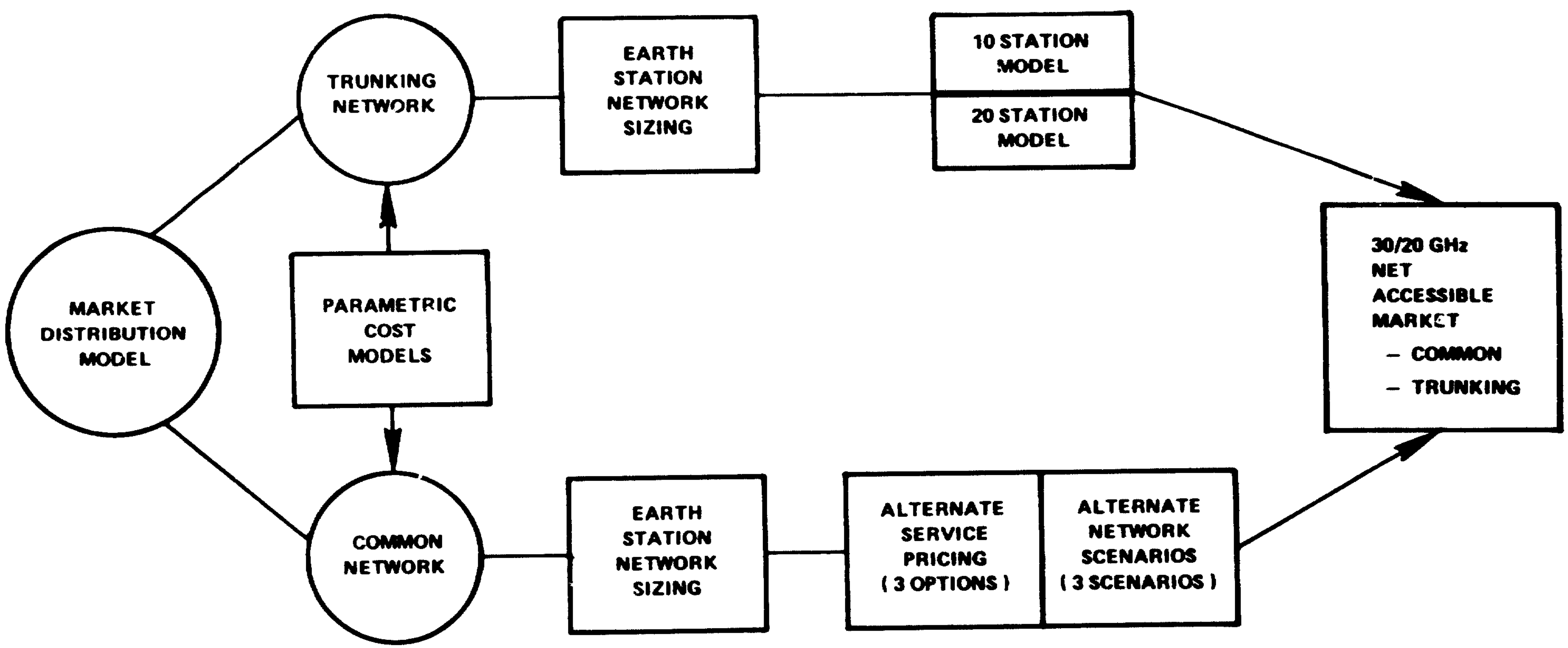


FIGURE 1

SECTION 4

FUTURE MARKET CONSIDERATIONS

4.1 Market Specialization

There are a limited number of prime orbital slots for domestic satellites that serve the voice, data and video needs of business, government and private users. Congestion of the orbital arc will restrict the future entry of new major carriers into the satellite transmission market. The saturation of available C and Ku-band capacity will promote the use of new, higher frequency satellite systems in the 30/20 GHz spectrum. A 30/20 GHz system has less restrictive orbital spacing requirements than C and Ku-band systems, and will help towards satisfying the demand for wideband and specialized transmission services.

The first domestic communications satellite systems were designed in the early 1970's to satisfy the needs of private line data users, as the primary market, and video/audio broadcasters, as a secondary market. At the end of the 1970's, satellite carriers began to establish dominance in several of the existing market segments based on marketing skills and strategies rather than the technical characteristics of their satellite system. Two of the best examples of market niche concentration and domination are RCA Americom in the CATV market, and American Satellite Corporation in both the government and commercial wideband data markets.

Opportunity exists for satellite carriers to expand into new market segments with high growth potential. Competitors will position themselves to capitalize on their marketing strengths. Each carrier will concentrate its efforts towards one, perhaps two, market segments only. Existing carriers have already begun to implement this strategy. New carriers will establish themselves in markets without a dominant competitor (e.g. Electronic Mail and Message Systems). To illustrate this point, Table 1 depicts the competitive market structure in the late 1970's and the probable scenario for the 1980's.

There are four primary market segments, from a satellite transmission point of view, that exist today: commercial private line, government private line, message toll service (MTS), and video/audio broadcasting. Electronic mail and message systems (EMMS) and teleconferencing will be added to this list in the 1980's. A seventh category, specialized applications, will include a variety of services most with low volume transmission requirements.

Competitive Satellite Service Market

Carrier \ Service Market	Specialized Applications	Commercial Private Line	EMMS	Gov't Private Line	MTS	Teleconferencing	Video/Audio
AT&T/GTE					X		
American Satellite		X		X			
RCA		X		X			X
Western Union		X		X			X

1970's

Carrier \ Service Market	Specialized Applications	Commercial Private Line	EMMS	Gov't Private Line	MTS	Teleconferencing	Video/Audio
AT&T/GTE		S			P	S	S
American Satellite		S		P			
RCA		S		S			P
SBS		P	P			S	
Western Union		S	P	S			P
XTEN		P	P			S	
Others	P						

1980's

P: Primary Market
S: Secondary Market

Table 1

The two service categories with high growth potential between 1980 and 2000 are data and teleconferencing. Data services include the subcategories data transmission, EMMS, and EFTS/POS. Market demand for total data services will increase twentyfold between 1980 and 2000. The demand for transponder space to satisfy teleconferencing applications will also increase significantly; tenfold over the same time period. Each of the four service categories may require a satellite system dedicated to satisfying market demand for the service. Available satellite capacity for each service may constrain the market demand. Latent market demand for high speed digital data transmission and teleconferencing can be partly attributed to the inadequate transmission facilities now in existence. Specially designed satellite systems may solve this problem.

There are several services not now available, but that are expected to emerge in the late 1980's, that may require specialized satellite system designs. Examples of such services include remote monitoring systems for flood, fire and environmental control, remote and mobile emergency medical communications, and transportable earth stations systems to provide emergency communications channels during times of catastrophe. Each of these services are likely to utilize portable or small aperture earth station antennas and high power satellite systems.

These service markets may not be large enough to attract the attention of major satellite carriers. Small specialized carriers would be able to enter a highly competitive market by providing these neglected transmission services. Other service categories that offer opportunity to specialized carriers are land mobile radio communications, secure voice, and bulk mail volume transfer for the USPS. Satellite systems dedicated to these services could be specially designed to satisfy the unique transmission requirements.

Satellite systems dedicated to a limited range of service capabilities, and carriers specializing in one or two market segments, may best serve the customer's needs. Designing a single dedicated system, with a high degree of complexity is more economical than installing many high cost earth stations with complexity built into the ground segment. When market demand for a new satellite transmission service is sufficient it may be easier to design and develop a new system rather than attempt to adapt an existing one. Reliability and quality usually accompanies specialization in a given service or product.

4.2 Timing of 30/20 GHz Satellite Systems

The time frame for the introduction of higher frequency satellite systems will be heavily influenced by a number of different factors. Among these factors are technology developments, service costs, competition, regulation, orbital slot availability and the overall growth in the nation's economy. Some of these factors are addressed below in further detail.

The technology needs of a first generation 30/20 GHz system have been identified in a preliminary manner by two systems contractors. Development of multiple spot beam antennas, variable powered spacecraft amplifiers, large data handling capacities and low cost earth terminals are some of the technologies which system users must overcome. Thus, the speed of technological developments for 30/20 GHz systems will play an important role in the timing of its implementation. The use of these new technologies in actual satellite systems will help to reduce satellite service costs.

Likewise, market factors will influence the use of 30/20 GHz satellite systems. Market saturation of the already large capacities for C and Ku-band satellites may occur much later than anticipated. Right now, the primary marketing advantage satellite delivery has over terrestrial delivery, is lower service cost. The success of planned direct-to-user systems will detemine the future demand and the rate of growth for high capacity wideband satellite systems.

Both competition and reguation have ways of influencing the timing of the introduction of new satellite systems. Bell Laboratories has reported research on scanning spot beam satellites and both AT&T and GTE have conducted operating tests at 18 and 28 GHz frequencies. Other competing satellite carriers may also be thinking about their third generation of domestic satellites.

The results of the WARC '79 conference may establish new regulations for the use of higher frequencies. Nations are attempting to reserve parking space in-orbit for future national communications satellites. The United States may find itself, by the mid 1980's with few orbital slots to place additional satellites for optimum communication. Changes in the minimum number of degrees of orbiting satellite spacing will affect the availability of desirable slots.

Other competing approaches to 30/20 GHz satellites may influence the timing, and perhaps even the eventual introduction of satellite systems. A new generation of satellites which may be used during the 1990's will provide area coverage by a large number of spot beams operating in several frequencies. Multiple frequency reuse on spot beams could lead to satellites with usable capacities equivalent to 300 present-day 36 MHz transponders. Others foresee the 1980's as a period of transition in satellite communications. The benefits of large capacity systems may result in the employment of large geostationary platforms by the 1990's with multiple carriers sharing its use.

Predictions for much higher fuel costs will add to the demand for all types of communications systems, at the expense of personal travel.

Rising real growth in the U.S. Gross National Product will create the economic environment necessary to support advanced satellite systems.

Thus, there are many factors which will influence the timing of the use of 30/20 GHz systems. The most likely timing for its introduction would be in the 1992-1995 timeframe, but this could vary if some of the factors discussed substantially change during the 1980's.

SECTION 5

COMPUTER MODELLING

The use of various computer models and operations research techniques permitted the evaluation of a number of alternative traffic models for each of the eleven market scenarios. The Market Distribution Model (MDM) was also used to analyze the various network parameters and to develop specific market values for eleven different network sizes. Market value represents a relative measure of communications traffic between all 275 SMSA's. This model was updated and enhanced to enable the projection of market values for the years 1990 and 2000.

5.1 Market Distribution Model (MDM)

Several new traffic indicator data bases were added to the MDM for this study. These included Population Forecasts, Effective Buying Income forecasts, and Equipment Shipment Values. Equipment Shipment Values are a Commerce Department indicator of manufacturing production within an SMSA. These data bases and several others were used after relative weightings, to determine the market values of the 275 SMSA's in the Model. A trend projection technique was employed to extend several data bases through the years 1990 and 2000. This served to influence the relative importance of all SMSA's over time. However, it should be recognized that several other data bases remained unchanged during the time forecast period. This is due to the static nature of the distribution of the data bases through time. The Market Distribution Model (MDM) provided a complete traffic distribution between all of the 275 SMSA's. This was accomplished by combining weighted static and dynamic flow data bases. The static data bases are converted to a dynamic flow by an algorithm employing a distance sensitivity measure. For an overview of this procedure, see Figure 2. The same process was used for both a common network market distribution and a trunking network market distribution.

5.2 Parametric Crossover Distance Model

For the specialized carrier network scenarios, the Parametric Crossover Distance Model developed in Task 5 was revised to reflect the different mixture of services and to facilitate the separation of terrestrial and satellite traffic. The crossover mileage distance it produced determined the distance at which the satellite pricing has a 20% advantage over the corresponding terrestrial service pricing.

Crossover distances were combined in a weighted form for both key years involved and the changing service mix of traffic. Variations to this mileage distance criteria, where satellite service was equal to Ku-band service, were evaluated for alternatives of both 20% and 40% below Ku-band service.

MARKET DISTRIBUTION MODEL

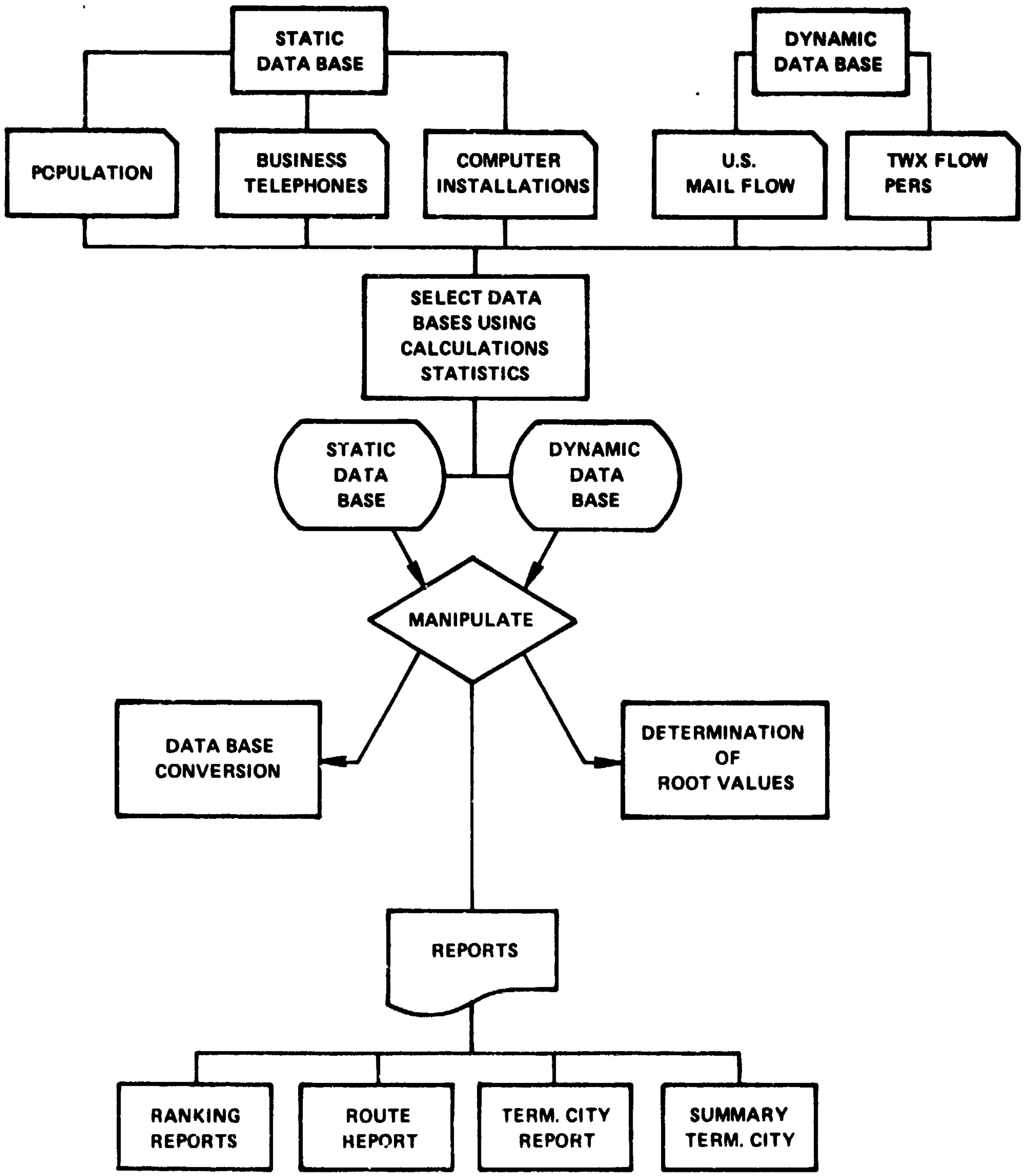


FIGURE 2

Four kinds of traffic were considered in the specialized carrier network crossover distance model. Figure 3 shows the alternative combinations of traffic. The four traffic alternatives are known as satellite inter-station traffic, intra-cellular traffic, terrestrial inter-SMSA traffic and satellite inter-SMSA traffic. In the example, it is assumed that the distance between the two earth stations A and A^1 is greater than the minimum crossover mileage. The circles surrounding the earth station locations represent the maximum SMSA hubbing distance (radius) of 50 miles. The satellite inter-station traffic between A and A^1 is included in the network market values.

The SMSA marked as "B" is subordinated to the earth station "A" because it falls within the hubbing distance (50 miles) and its traffic called intra-cellular, is carried terrestrially.

A third type of traffic is between two subordinated SMSA's within different earth station cells. Traffic between "B" and "C" is considered to be terrestrial inter-SMSA if either: the distance between the two points is less than 100 miles or the distance between these points is less than the mileage crossover advantage of satellite vs. terrestrial.

Traffic between two subordinated SMSA's such as "B" to "D", which are greater than 100 miles apart is called satellite inter-SMSA and its market value is included in the satelite traffic model.

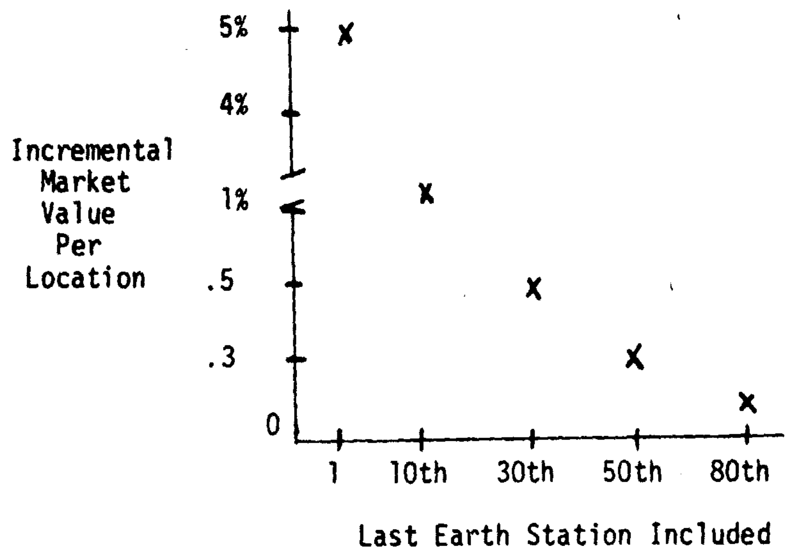
5.3 Market Optimization Model

The market optimization method is a new technique developed with the objective of attaining the maximum market value by means of exclusion of the least amount of common network. This means that in any network of "N" earth station locations, a process of reduction (contraction) occurs whereby the station with the least incremental market value is eliminated until the desired threshold value for the total remaining coverage is achieved.

By subordinating SMSA's to their closest earth station locations within its area of coverage, the market optimization insured an optimal earth station network. In addition, it provided networks which met economic cross-over criteria for the common network scenarios.

The satellite market value of all locations are interrelated since half of the market value resides in the termination of traffic in another earth station or in a subordinate SMSA. The market optimization method is based on the fact that the earth station excluded at any points the earth station which exclusively serves the smallest market value. The graph of the incremental market values per location versus the number of earth stations included in the network is shown in Exhibit 1.

Exhibit 1



Through the development of minimum traffic thresholds for each earth station network model, the determination of the various network sizes were made. These criteria of minimum traffic levels for common networks are discussed in Section 6.

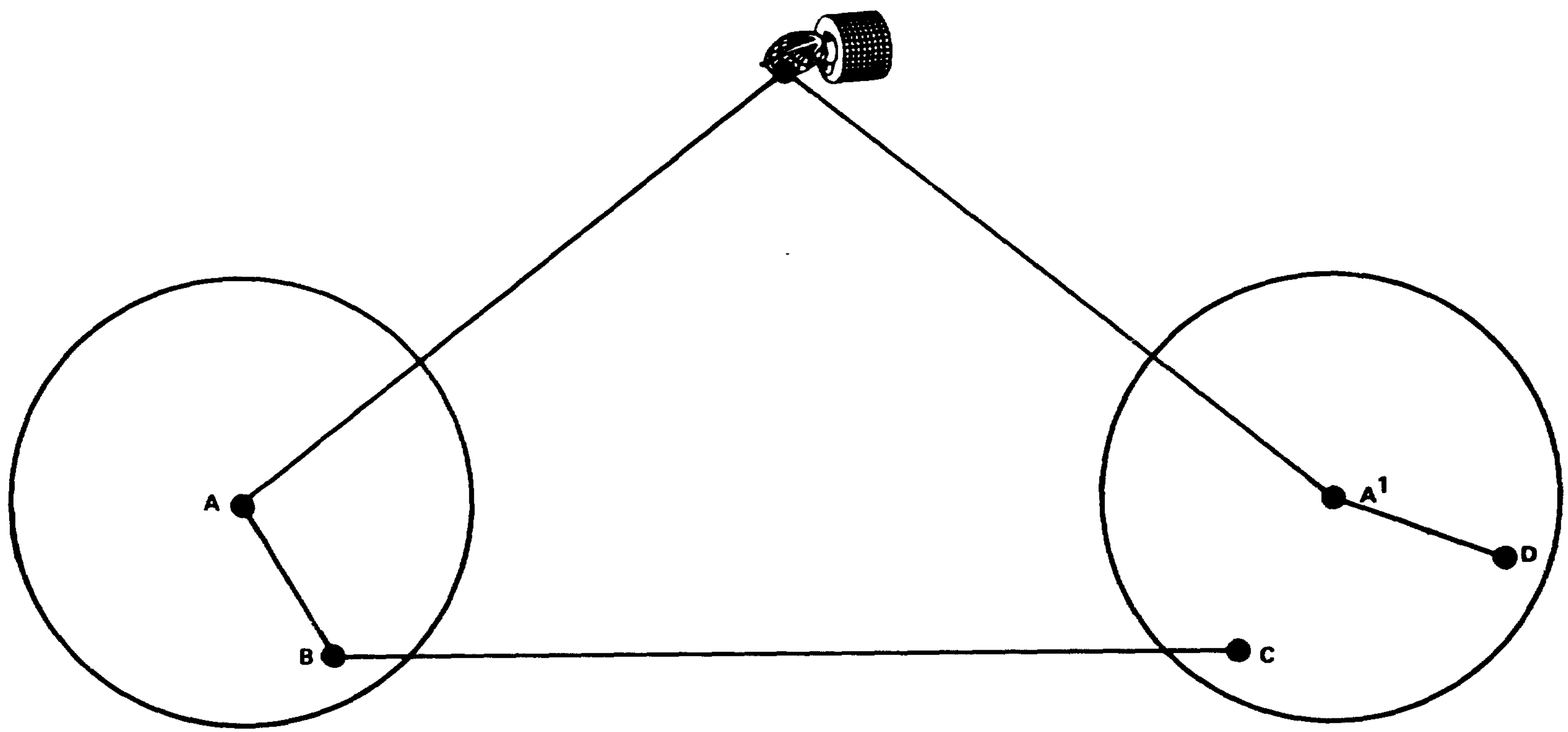
It was determined from the BDP, for instance, that with a total of 164 earth station locations all 275 SMSA's could be served by a common or specialized carrier network. However, it is neither necessary nor economically viable to place 30/20 GHz earth stations at all 164 locations.

Additional computer modelling was also utilized to develop the most important 10 and 20 trunking earth station locations. Through careful geographic analysis of major hubbing locations, a ranking of the most suitable locations for trunking earth stations was developed.

The use of computer modelling also enabled the translation of the cumulative market value of a certain network scenario into a traffic forecast of potential service demand by network scenario type.

The results of these computer modelling efforts to analyze the various network size alternatives are displayed in a flow diagram in Figure 4.

TRAFFIC DISTANCE CRITERIA



TRAFFIC LEGEND

A–A[1]: SATELLITE INTER-STATION

B–A: INTRA-CELLULAR

B–C: TERRESTRIAL INTER-SMSA

B–D: SATELLITE INTER-SMSA

FIGURE 3

30/20 GHz SATELLITE MARKET SCENARIO NETWORK SIZING — ACCESSIBLE MARKET

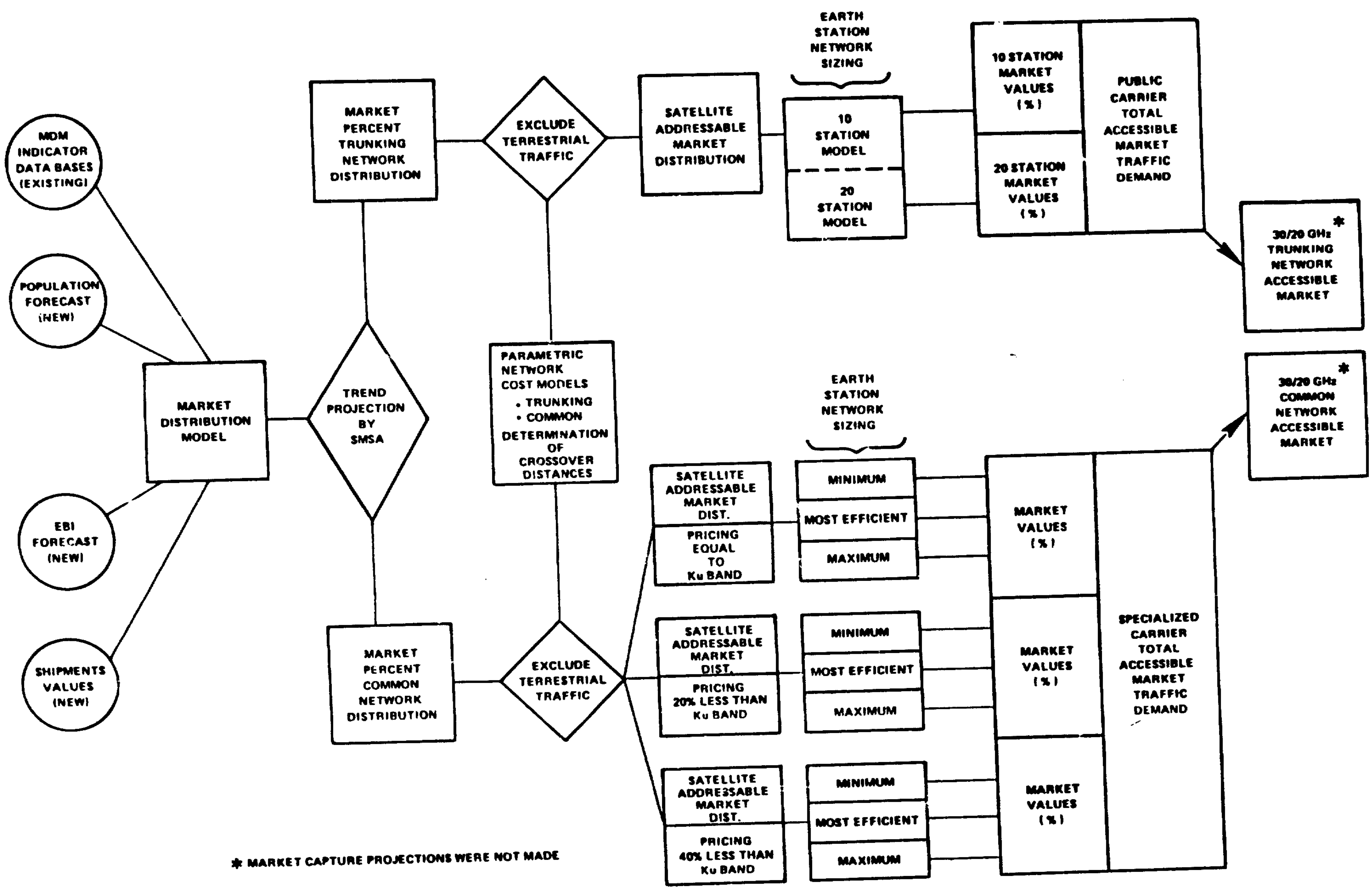


FIGURE 4

SECTION 6

COMMON NETWORK 30/20 GHz MARKET MODEL

6.1 Network Definition

A common network is generally provided by specialized common carriers using a networking approach which strategically locates a number of earth stations close to major markets. Lacking an extensive terrestrial distribution system, careful placement of earth stations to maximize market is vital.

For economic reasons, linking of subordinate market areas within a limited mileage radius must also be carefully analyzed. The terrestrial extensions which provide interconnection is required to create the critical threshold of market demand to justify serving any one location. Traffic distribution requirements will also require the lease of local loops to interconnect the earth station to the user's premises. Market demand within this type network will come from multiple corporate users, joint or shared facility users and individual, large dedicated users. These types of users may require direct transmission to their on-premises 30/20 GHz earth stations.

There are likely to be variations in user demand for transmission quality levels as well as delivery time in common networks. Teleconferencing users, for example, will require point-to-point real-time transmission; electronic messages, on the other hand, may be delayed several hours before completing delivery. By far, the most common type of traffic on 30/20 GHz networks will be private line voice and data.

One final characteristic of common networks is that the earth station size and capacity will vary significantly depending on the market to be served. Obviously, the earth station serving Los Angeles will have a vastly greater capacity than the one serving Cincinnati. The flexibility of the served network locations will have to be matched with the communication satellite.

6.2 Network Scenarios

A total of nine network scenarios were examined for the common network market models. First, it was appropriate to select models representing three distinctive network sizes. These are minimum, most efficient and maximum network size. These network scenarios were selected to provide a broad range to the net accessible market and the geographic market coverage.

The least number of earth stations represents the smallest network which could attain economic viability. This network is characterized by large earth stations serving a relatively small number of the 275 Standard Metropolitan Statistical Areas (SMSA's).

The largest number of earth stations identifies the broadest market coverage with the smallest earth station while still achieving the minimum market and economic criteria.

In between these two network models is a most efficient number of earth stations. This network size examines the effects of other carrier's competition to determine the smallest incremental location which meets minimum market and economic thresholds.

It was determined from both previous market analysis and a review of local access tariffs that terrestrial extension coverage could viably extend to all neighboring SMSA's within 50 airline miles of the earth station location. Where a particular neighboring SMSA was of a significant market size, this hubbing criteria was extended an additional 15 miles.

One of the most important considerations in the segregation of net accessible 30/20 GHz market is the pricing relationship between Ku-band and 30/20 GHz satellite systems. Therefore, three price variations were analyzed for their price/demand relationships. The three pricing alternatives are:

- Equal to Ku-band service
- 20 percent less than Ku-band service
- 40 percent less than Ku-band service

The effects of these pricing alternatives have been reevaluated solely in relative terms - no actual costing of 30/20 GHz systems has been done. The effects on market demand of service price variations is calculated through the parametric network cost model and its associated distance crossovers. This is discussed in more detail in Section 6.3.4.

The choice of three pricing variations for each of the three network scenarios caused a total of nine subscenarios to be created. The common network scenario thus contains nine subscenarios, each yielding a variation in the net accessible market demand.

6.3 Methodology and Approach

6.3.1 Approach

Development of the common network net accessible market involved a series of steps to generate the appropriate market sizing. The essential steps are shown in Figure 5 and indicate that the product of these efforts is the network market values. The market value represents a relative measure of communications traffic between all SMSA's.

The Market Distribution Model was used to establish a market profile for the specialized carrier market. A revised parametric network cost model was developed to reflect the competitive service pricing of a specialized carrier network. The application of mileage crossover distances resulting from the cost model yielded the satellite accessible market. The establishment of a common network terrestrial hubbing criteria indicated the market scope.

Sizing of the three distinct networks was accomplished through consideration of dynamic programming analysis, market value threshold criteria and adjustment for competition within geographic areas. The nine separate traffic forecasts, expressed in terms of cumulative network market values, were generated as a result of the market scenario service pricing and network sizing assumptions.

6.3.2 Market Development Methodology

The profile of the common network is based on the scenarios discussed in Section 6.2. There were four assumptions for the common network profile:

- Cost effective routes which met the minimum economic crossover distance threshold in comparison with terrestrial routes
- Earth stations were located at the largest (ranked by market value) SMSA's. The market value reflects the communications traffic distribution between a set of SMSA routes and is expressed in percentage form
- Earth station coverage extended to a 50-65 mile radius of coverage
- Subordinate SMSA's were linked to principal earth station locations if within this 50+ mile radius.

SPECIALIZED CARRIER NETWORK MARKET SIZING

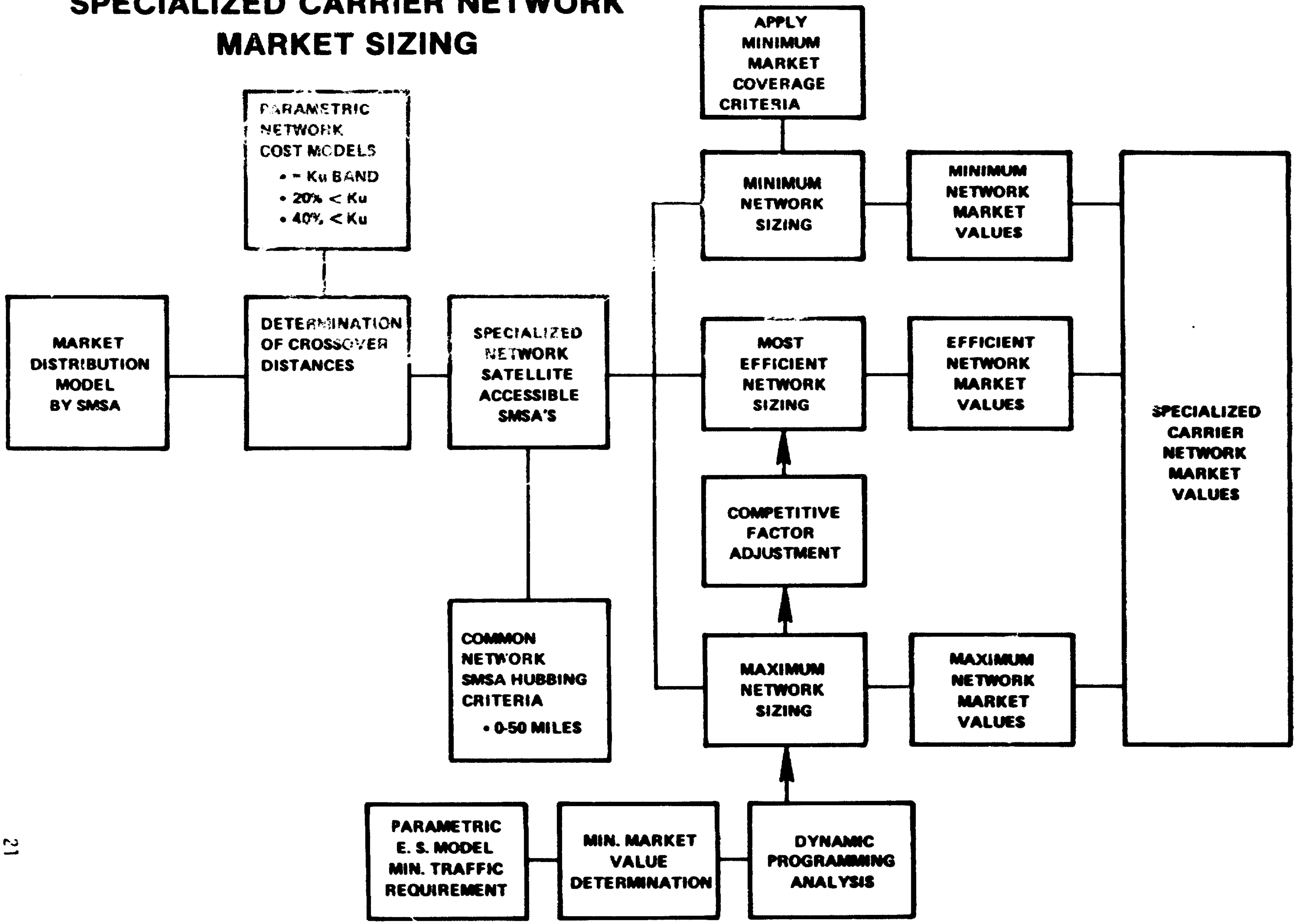


FIGURE 5

A parametric network cost model was developed for the specialized carrier network. The cost model produced the minimum crossover distances for each of the three pricing variations where satellite service is cost effective in comparison with terrestrial service. Only those SMSA route pairs which met the minimum distance criteria were included in the accessible market.

Rather than locating an earth station in a small SMSA which had two or more larger SMSA's surrounding it, the market profile assumed that earth stations would only be in principal SMSA's. Therefore, the earth station SMSA could not have a single subordinated SMSA which had a greater market value.

6.3.3 Market Distribution Model

The Market Distribution Model (MDM) contains a series of databases which reflect the relative demand for communication services by SMSA and route. Its geographic coverage includes 275 SMSA's in the contiguous U.S. and contains over 72% of the U.S. population and 37,675 possible route combination. It represent the entire market universe for this study.

The MDM was updated by the addition of more current information for existing databases and three new databases: population forecasts for 1980, 1990 and 2000, effective buying income by location for the same three periods and equipment shipment values for 1978-79.

Six principal databases were used in the MDM to reflect the common network market profile. They were weighted individually and combined statistically within the model. The six selected databases were:

- Business Telephones
- U.S. Population
- Computer Mainframes
- Manufacturing Shipments
- TWX Messages
- Effective Buying Income

The total demand represented by the MDM database indicators represents values for both terrestrial and satellite traffic. These market values were "normalized" to reflect only the satellite portion. That is, if the satellite demand represented 40% of the total, that 40% was adjusted to reflect 100% market distribution for the 30/20 GHz satellite market.

Once completed, the MDM was ready for consideration of the distance crossover criteria which yielded a smaller geographic market coverage.

6.3.4 Parametric Network Cost Model

A Parametric Cost Model was developed originally in Task 5 of the first phase of this study. In that study, a satellite system cost model for both C and Ku-band was constructed. However, that model did not reflect either the earth station network size or service distribution of a specialized carrier network. To account for these changes, revisions were made to the original model for end-to-end Ku-band service costs. The revisions were:

- The number of earth stations were increased from 10 to 40
- Average earth station utilization rate increased from 60% to 80%
- A greater proportion of medium and high speed (9.6 and 56 Kbps) data channels over voice services.

As a result of these model revisions, the service channel cost for the Ku-band TDMA satellite network was reduced for years 1990 and 2000. A 20% premium was added to these basic service costs to provide the necessary incentive for conversion from terrestrial to satellite transmission. A sample output for year 2000 of the Parametric Cost Model is shown in Table 2.

By weighting the model's crossover distances by the traffic distribution of each of the four services (voice, low, medium and high speed data) and average crossover distance for Ku-band (equal to 30/20 GHz) service in 1990 and 2000 was developed. The combined average crossover distance of the two key time periods in the base price case was 397 miles.

The Parametric Cost Model also produced crossover mileages for reduction in price from Ku-band service. As a result, in each case, the average crossover distances for 1990/2000 were lowered. Comparison of the three satellite circuit costs and crossover distances derived from the specialized carrier network cost model is displayed in Tables 3 and 3A.

30/20 GHz Parametric Cost Model
Comparison of Distance Crossover Mileages

Price	Crossover Distances (Miles)		
	1990	2000	Average
Equal to Ku-Band	410	385*	397
20% Below Ku-Band	251	222	236
40% Below Ku-Band	107	87	97

Table 3

*Shown as example in Table 2.

PARAMETRIC FACILITY COST MODEL

CROSSOVER DISTANCES WHERE

SATELLITE PRICING EQUAL TO KU-BAND
YEAR 2000

MODEL	YEAR	E S SYSTEM	SPEED	WEIGHT	ES+EL	CHAN/ES	SPACE	CH COST	TOTAL	TOTAL/CH	LOOP	CH+LOOP	CROSSOVER DISTANCE (MILES)
40 E S	2000	C - BAND TDMA	VOICE	49.98	6684383	204	1999020	569856	9253259	2268	1122	3390	310
40 E S	2000	C - BAND FDM	VOICE	18.90	2011366	204	1663454	2162400	5837220	1431	1122	2553	170
40 E S	2000	K - BAND TDMA	VOICE	49.98	5028195	204	4747673	636[illegible]0	10411868	2552	1122	3674	360
40 E S	2000	K - BAND FDM	VOICE	18.90	1388932	204	3950704	2162400	[illegible]02036	1839	1122	2961	240
40 E S	2000	C - BAND TDMA	300 B	14.99	2005315	612	599706	6349824	[illegible]954845	732	638	1370	20
40 E S	2000	C - BAND FDM	300 B	5.67	603410	612	499036	6838272	7940718	649	638	1287	10
40 E S	2000	K - BAND TDMA	300 B	14.99	1508459	612	1424302	6349824	9282584	758	638	1396	20
[illegible]	[illegible]	[illegible] BAND FDM	300 B	5.67	416679	612	1185211	6838272	8440163	690	638	1328	20
40 E S	2000	C - BAND TDMA	9.6KB	20.09	2686860	82	803528	2507366	5997754	3657	1996	5653	0
40 E S	2000	C - BAND FDM	9.6KB	7.60	808490	82	668643	3144384	4621518	2818	1996	4814	0
40 E S	2000	K - BAND TDMA	9.6KB	20.09	2021137	82	1908378	2533824	6463340	3941	7548	11489	830
40 E S	2000	K - BAND FDM	9.6KB	7.60	558296	82	1588028	3144384	5290708	3226	7548	10774	710
40 E S	2000	C - BAND TDMA	56 KB	14.94	1998762	61	597746	512870	3109378	2549	22580	25129	250
40 E S	2000	C - BAND FDM	56 KB	67.83	7217254	61	5968866	9005760	[illegible]2191880	18190	22580	40770	780
40 E S	2000	K - BAND TDMA	56 KB	14.94	1503529	61	1419647	572400	3495576	2865	22580	25445	260
40 E S	2000	K - BAND FDM	56 KB	67.83	4983813	61	14176056	9005760	[illegible]8165629	23087	22580	45667	950

KEY

Network Model - 40 Earth Stations

Study Period - Year 2000

Earth Station Systems - C or Ku-band, FDM or TDMA

Transmission Speed Weight - Proportion of total expected traffic by service

ES + EL - Earth station and entrance link costs

Chan/ES - No. channels per earth stations

KEY

Space - Space Segment, including launch costs

Ch. Cost - Cost of channelizing equipment

Total - Sum of earth station, entrance link, space segment and channel costs

Total/Ch - Total cost divided by total number two-way system channels

Loop - Local loop leased cost

Ch + Loop - Total annual cost per end-to-end channel

Crossover Distance - Mileage where satellite is lower

TABLE 2

Satellite Circuit Costs
Ku-Band - TDMA

	1990	2000
Equal to Ku-Band	$6400	$8200
20% Less Than Ku-Band	5100	6500
40% Less Than Ku-Band	3800	4900

Table 3A

As the incremental market value became progressively smaller until the last earth station location is included, it was necessary to identify the threshold where the incremental market value of adding N+1 earth stations could not be economically justified.

A specialized carrier earth station site cost model was developed to serve this purpose. The operative premise was that the incremental revenue/traffic accessible by any principal SMSA had to be sufficiently large to cover the annual cost of capital and operations of a 30/20 GHz earth station in that SMSA. Market penetration of that incremental traffic was not a factor at this point.

For the earth station site model, cost data was derived from the Hughes Aircraft Co. "18/30 GHz Satellite Communication System Study" of June 7, 1979. The direct to user, FDMA multi-beam network model was selected because it seemed to represent the closest available model for a common network-type earth station. The FDMA model was also used because it appeared to be more efficient for supporting a multi-beam interconnected network, especially voice traffic, and its cost was higher, so that a more conservative cost model would be used.

The minimum traffic requirement for each earth station location was derived from the following model elements shown in Table 4:

- Annual earth station cost ($873,000)

- Weighted average bandwidth per circuit (2 Mbps)

- Average annual revenue per circuit ($103,500)

The annual cost of an earth station was divided by the average circuit revenues to determine the minimum number of circuits which must be sold to justify the expense. The resultant 8.5 circuits when multiplied by 2 Mbps, as adjusted by a market inertia factor of 1.25, produces a minimum market demand of 21 Mbps for each earth station location. The market inertia factor, which was first mentioned in the Phase I study, acknowledges that regardless of price, service or coverage only some of the customers in any locations will ever switch from terrestrial service.

The final step in determining the minimum incremental SMSA traffic size involved transforming the minimum traffic size in Mbps to a market value or percent of the accessible market to be served. This was done by dividing the minimum traffic size of 21 Mbps by the overall net addressable 30/20 GHz market demand. Section 8.2 discusses how the net addressable 30/20 GHz demand was developed in greater detail.

Specialized Carrier Earth Station
Site Cost Model

Earth Station Cost	($000)
FDMA Earth Station Installed Cost	2167*
Return on Investment (22%)	476
Depreciation (4 Years)	180
Operations and Maintenance	217
Total Annual Cost/E.S.	873

Revenue Development

Service	Distribution of Services	Annual Revenue/ Circuit*	Weighted Revenue
Voice/Data - 64 Kbps	52%	$ 6,700	$ 3,500
High Speed Data - 1.544 Mbps	23%	80,000	18,500
Video - 6.3 Mbps	25%	326,000	81,500
Average Bandwidth Per Circuit - 2 Mbps	Average Annual Revenue Per Circuit		$103,500

Minimum Traffic Requirement

$$\frac{\text{Annual Cost/E.S.}}{\text{Average Revenue/Circuit}} \quad \frac{\$873}{103} \quad 8.5 \text{ circuits}$$

Therefore, 8.5 circuits @ 2 Mbps/circuit x 1.25 =

21 Mbps minimum market demand/earth station location

*Hughes Aircraft Final NASA Study Report, June 7, 1979

Table 4

The application of the average crossover distances to the total addressable 30/20 GHz satellite market is instrumental in determining the accessible market for the three pricing scenarios.

6.3.5 Network Sizing Criteria

The previously outlined market analysis determined the total addressable market for 30/20 GHz satellite systems. At this point it was necessary to select the geographic coverage provided by the three earth station network sizes and develop the corresponding market values.

As previously discussed, three network sizes were to be identified for the specialized carrier or common network: minimum, most efficient and maximum. Each network size represent a 30/20 GHz system consisting of earth stations located in principal SMSA's and a number of subordinated SMSA's within a 50-65 mile radius.

6.3.5.1 Minimum Earth Station Network

The minimum network size is defined as the smallest viable network based on geographical market coverage. From other common carrier experience it has become clear that a network serving only a few markets and offering limited market coverage could not remain viable. In the early years of the specialized microwave carriers, for example, it took time for them to expand their network coverage to sufficient geographical coverage to attract new customers. Large communications users have a need to communicate to most of the principal U.S. cities and normally will seek a competitively priced carrier which offers service to these largest 15-20 metropolitan areas.

From marketing experience, it was determined that the minimum required market coverage is 30% of the total accessible market. At a 30% coverage level almost all of the principal centers of business activity will be served. Accordingly, an analysis was conducted to determine the total number of SMSA market values necessary to generate a 30% market coverage. Results of that analysis are shown in Section 6.4.

6.3.5.2 Maximum Network Size

Determination of the maximum or largest earth station network involved consideration of economic trade-offs. The dynamic programming techniques discussed in Section 5 (Computer Modelling) provided the foundation for the network sizing analysis. The computer modelling determined that with a total of 164 earth station SMSA's and the remaining 111 SMSA's subordinated to the 164 largest locations, 100% of the accessible market could be served.

The minimum market value threshold for each additional SMSA is shown with the three price alternatives.

Service Price	Minimum Market Value/Earth Station Location
. Equal to Ku-Band	.11%
. 20% Below Ku-Band	.10%
. 40% Below Ku-Band	.10%

The dynamic programming model which developed the incremental market values for the 164 earth station SMSA's indicated how far it was possible to go into the ranking before the minimum incremental market value per SMSA was no longer achieved. At that point where the last incremental SMSA added a duplex market value equal to the network minimum market value, the earth station network size was defined for all three pricing variations. These results are displayed in Section 6.4.

6.3.5.3 Most Efficient Network Size

The earth station network which represents the most efficient size is the number of stations where each one incrementally generates sufficient traffic to economically justify it within a competitive carrier environment. An important element in this analysis was to attempt to define the extent of the competition in the 1990-2000 time period for 30/20 GHz markets.

A competitive market scenario was created in which as many as four specialized carriers will be operating 30/20 GHz satellite networks. It is foreseen that the need for greater capacity and the availability of this higher frequency spectrum may attract four major specialized carrier competitors.

A further effort is to define the relative market shares of each of these competitors for 30/20 GHz traffic. In the absence of any perceived clear-cut advantage one carrier may have over the others, it was decided that their respective market shares would be divided equally in fourths or 25% of the accessible market traffic in all locations served.

Thus, given a market environment, where, due to competition, only 25% of the accessible market was available to one specialized carrier network, a minimum traffic requirement level could be established for the smallest SMSA.

For the maximum network scenario, the minimum traffic level per location was converted into minimum market value per end location required to economically justify locating a 30/20 GHz common earth station in a SMSA. The most efficient network sizing minimum market value criteria was developed with the assumption that only one-fourth of the SMSA's accessible traffic would be available to justify locating the 30/20 GHz earth station. Therefore, the minimum market value per end location has been increased by a factor of four:

Service Price	Minimum Market Value/Earth Station Location
. Equal to Ku-Band	.44%
. 20% Below Ku-Band	.42%
. 40% Below Ku-Band	.40%

An analysis of the dynamic programming model of the 164 SMSA earth stations indicated the point at which the incremental market value of each SMSA could justify locating a 30/20 GHz earth station. At that number of earth stations, which was different for each of the three pricing alternatives, the smallest earth station would still have sufficient accessible market traffic to support it in a competitive market environment. The results of this scenario analysis are displayed in Section 6.4.

6.4 Network Analysis Results

As a result of the previously outlined methodology, nine earth station network scenario sizes were developed. Each network covers a varying number of earth station locations and subordinated SMSA's representing different geographical area coverage. The market coverage represented by these common networks is expressed in terms of the proportion of the served accessible market. The market coverage also represents the satellite communications activity in the SMSA's being served by the common network earth stations. The 30/20 GHz market forecasts by service and peak load can be found in Section 8.

6.4.1 Minimum Network Size

The minimum number of terminals for the smallest viable network was developed for the three service price alternatives to Ku-band.

A thorough analysis of the economics of operating a communications network combined with the number of major market demand centers in the U.S., indicate that about 30% of the accessible market represents the minimum viable coverage.

A satellite network must serve this minimum portion of the market to attract a sufficient number of customers and subsequent traffic load to its network.

The Market Distribution Model criteria for the minimum network size were set at identifying the number of SMSA's and subordinate locations within a 50 mile radius of the earth station which will cumulatively **represent** a 30% market value. The resulting analysis indicates that all three price variations a total of 16 earth station locations representing 52 SMSA's will yield a market value approximating 30%.

Figure 6 is a map of the U.S. which identifies the sixteen 30/20 GHz earth station selected locations. The Appendix contains the computer analysis for the minimum network model by principal and subordinate SMSA and their associated market values.

While the number of locations and the SMSA's are identical for all three crossover distances, there are two differences among the three networks. First, the SMSA order of ranking and individual market values change with the reduction in the crossover distance. For example, Houston is the 5th ranked earth station SMSA where the service price is equal to Ku-band (397 mile crossover) it dropped to 9th place when the service price is 20% below Ku-band (236 mile crossover). In effect, as the crossover mileage shrinks with service price reductions, the SMSA's in the densely packed Eastern Corridor increase in market value.

The second difference is a slight change in the cumulative market values of the 16 SMSA's (plus subordinates) between 1990 and 2000. Table 5 summarizes the cumulative market values for the common model variations in the year and service price level.

Common Network Model
Minimum Network Size

	1990		2000	
	No. E.S. Locations	Cumulative Mkt. Values	No. E.S. Locations	Cumulative Mkt. Values
Service Price				
Equal to Ku	16	31.07%	16	30.88%
20% Below Ku	16	31.30%	16	31.14%
40% Below Ku	16	31.40%	16	31.19%

Table 5

30/20 GHz SATELLITE NETWORK
COMMON EARTH STATION LOCATIONS
MINIMUM NETWORK SIZE

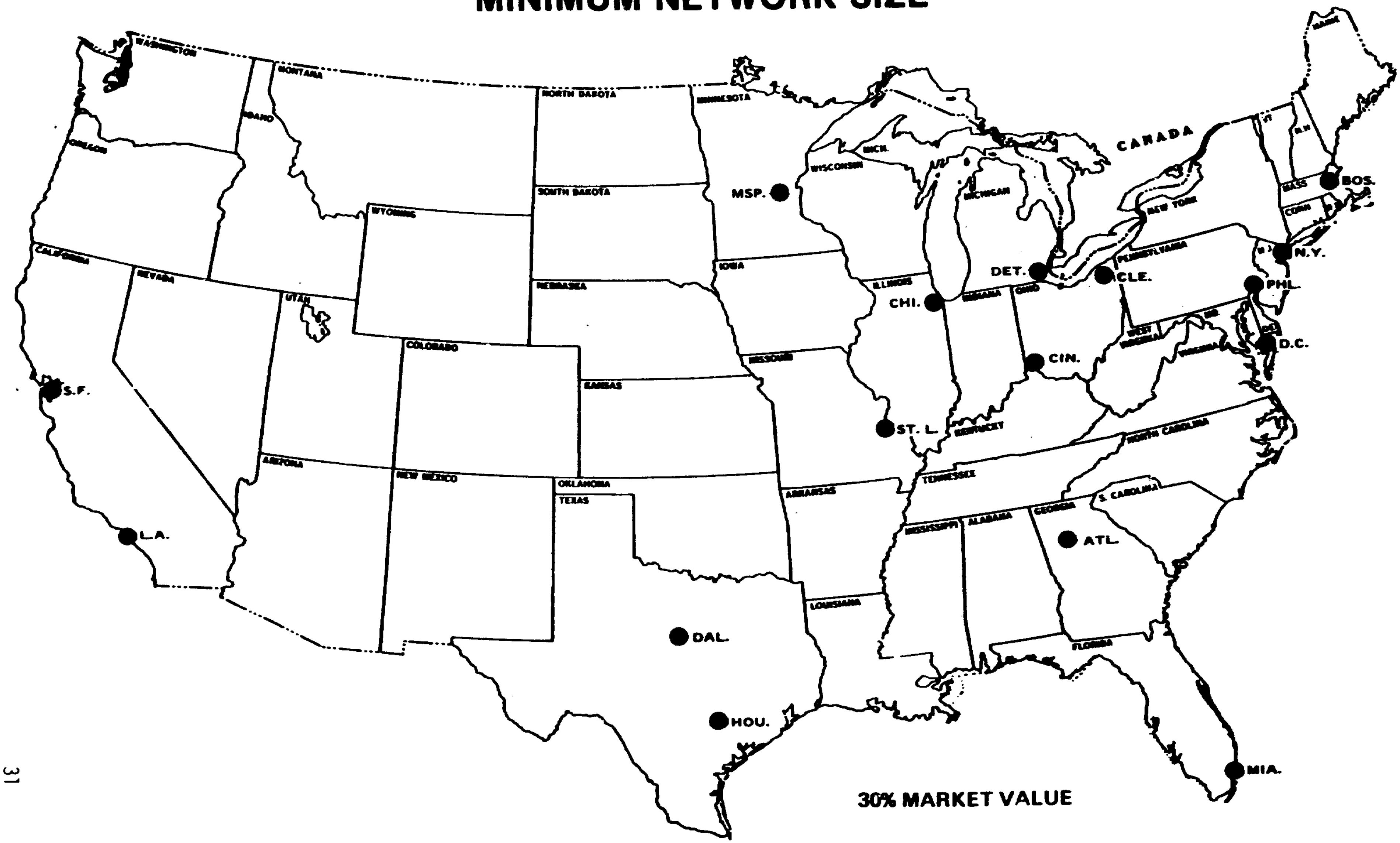


FIGURE 6

6.4.2 Maximum Network Size

The maximum network size employed a market analysis methodology which involved creation of an earth station site cost model to determine the smallest amount of traffic in an SMSA location to economically justify placement of a specialized carrier earth station. The smallest market values were also developed and displayed in Table 4.

Using the previously developed computer-based market model. the threshold point in the SMSA ranking was determined. The smallest market value for the last principal SMSA location was about .11% for each of the three service price variations. This represented a different number of earth stations, total SMSA's served and cumulative market value as shown in Tables 6 and 7. The apparent trend in these results is that as the service price and satellite crossover distances decline, the number of viable earth station locations and cumulative market value served increases. Thus, at a service price 40% below Ku-band, more than 82% of the market can be served, with the smallest or last ranked SMSA still generating a sufficient amount of traffic.

Common Network Model
Maximum Network Size

Year 1990

Service Price	No. Of Earth Stations	No. Of Total SMSA's	Cumulative Market Value
Equal to Ku	80	174	60.30%
20% Below Ku	89	189	73.04%
40% Below Ku	99	203	82.26%

Table 6

Common Network Model
Maximum Network Size

Year 2000

Service Price	No. Of Earth Stations	No. Of SMSA's	Cumulative Market Values
Equal to Ku	82	180	60.68%
20% Below Ku	90	191	73.16%
40% Below Ku	99	203	83.15%

Table 7

The individual names of the earth station locations are too numerous to display on a map but can be found along with their subordinated SMSA's and market values in the Appendix. The ranked order is based on the total market value of the principal SMSA plus all of its subordinates located within a 50+ mile radius for hubbing purposes.

6.4.3 Most Efficient Network

The most efficient common network has been defined as one in which the smallest incremental SMSA generates sufficient communications traffic within a competitive carrier environment. In the selected competitive market scenario for the 30/20 GHz satellite market four carriers will be vying for an equal share of each principal SMSA. Therefore, the minimal amount of traffic per location will have to be four times larger than in the maximum network model. This roughly translates into a minimum market value for any SMSA of .44% of the accessible market.

A similar market analysis of the previously discussed market model yielded different numbers of SMSA's, each of which overcame the minimal traffic hurdle. Assuming each specialized carrier obtained an approximately equal market share of all served SMSA's, the number of earth stations contained in the most efficient common network will range from 28 to 36, depending on the service price alternative. These market value results for 1990 and 2000 are displayed in Tables 8 and 9. The earth station locations are shown in Figure 7.

Common Network Model
Most Efficient Network Size

Year 1990

Service Price	No. Of Earth Stations	No. Of SMSA's	Cumulative Market Values
Equal to Ku	28	95	35.46%
20% Below Ku	34	105	46.97%
40% Below Ku	36	113	53.47%

Table 8

Common Network Model
Most Efficient Network Size

Year 2000

Service Price	No. Of Earth Stations	No. Of SMSA's	Cumulative Market Values
Equal to Ku	28	95	35.38%
20% Below Ku	34	105	46.86%
40% Below Ku	36	112	53.30

Table 9

30/20 GHz SATELLITE NETWORK
COMMON EARTH STATION LOCATIONS
MOST EFFICIENT NETWORK SIZE

(SERVICE PRICE 40% BELOW Ku - BAND)

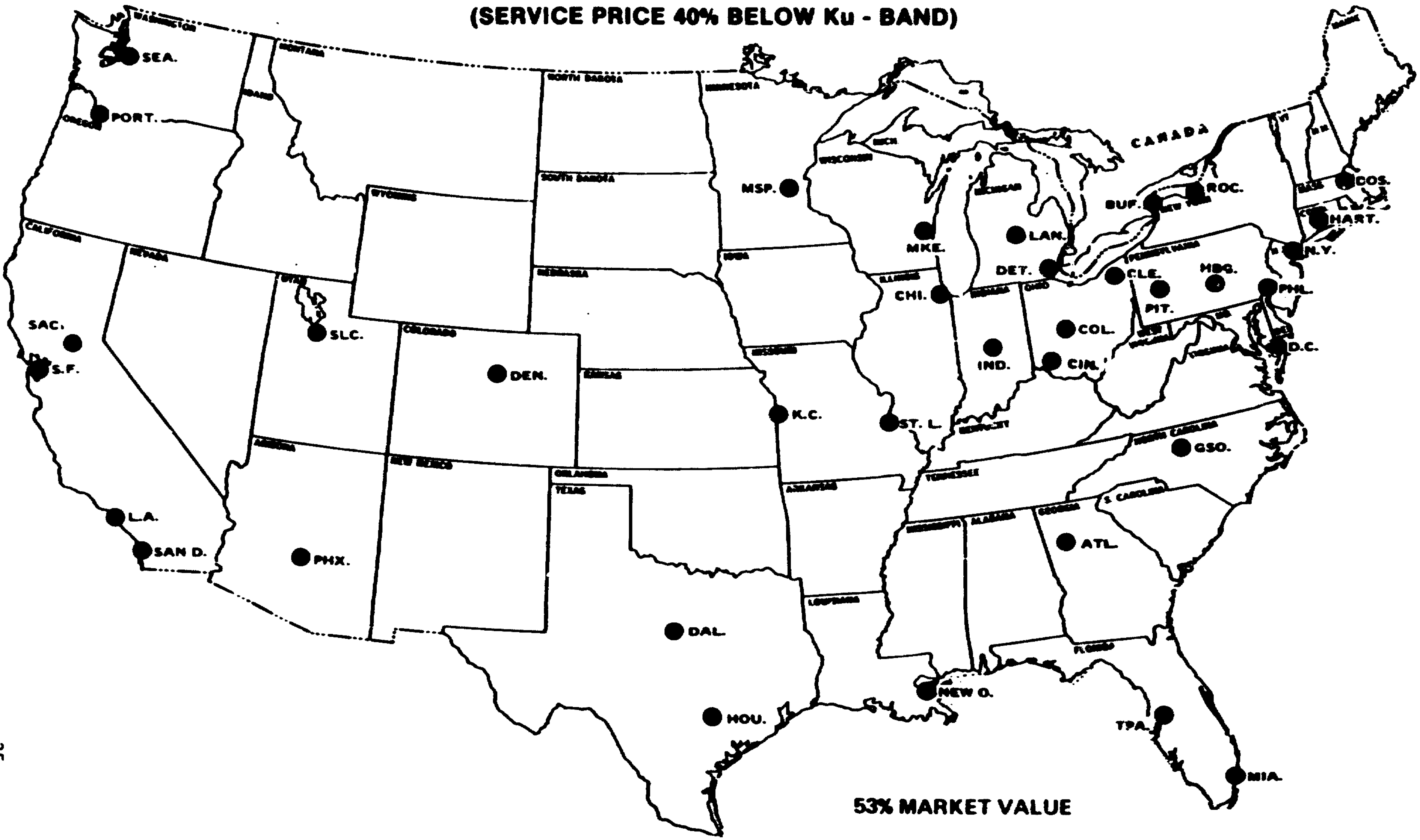


FIGURE 7

SECTION 7

TRUNKING NETWORK 30/20 GHz MARKET MODEL

7.1 Network Definition

A public carrier or satellite trunking network can be characterized as a system composed of a limited number of high volume earth stations serving as an adjunct to an extensive terrestrial system. Such a satellite system could be used by a Bell-type carrier to off-load terrestrial facilities, carry high volume or wideband traffic or provide other services best suited for such a system (e.g. Broadcast, Audio and Video).

The public carrier network earth stations will have large traffic capacities, higher cost and locations only in the highest traffic volume areas.

The existence of extensive inter-SMSA terrestrial facilities will permit terrestrial extensions to a greater radius than was economically feasible for the specialized carrier, which owned none of these facilities.

The public carrier will have message toll service as its largest proportion of nationwide traffic.

7.2 Methodology and Approach

Two market coverage models for the 30/20 GHz trunking network approach were analyzed. The first market model contained 10 earth station locations, the second contained 20 locations. Calculations of the respective market coverages and net accessible markets for each model were made, taking into account the terrestrial extensions necessary to reach the maximum market. Variations in service price were not considered because a public carrier's justification for use of a 30/20 GHz satellite system may have little to do with service price. For a public carrier, the use of a high capacity satellite system may be based on it providing network backup, the more efficient handling of specialized service, or competitive necessity.

The two key market parameters for the trunking network are the optimal selection of the SMSA earth station locations and the hubbing distance determination.

The Market Distribution Model was used for the earth station location selection and to rank the terminating traffic values for all 275 SMSA's in years 1990 and 2000. The numerical descending order for the trunking model was based on the weighting of five market databases:

- Business Telephones
- U.S. Population
- Computers
- TWX Billing Messages
- Manufacturing Shipments

A selection of the first ten and second ten most important locations was based upon a minimum of 235 mile separation between all earth station SMSA's. This distance factor represented two times the subordinate SMSA hubbing mileage (118 miles) and also permits separation of satellite beams if required. This criteria resulted in Philadelphia traffic hubbed to New York and San Diego traffic hubbed to Los Angeles.

The crossover distance for 30/20 GHz satellite trunking traffic was based on a simplified economic model. All trunking network traffic was assumed to be grouped in T-1 (1.544 Mbps) wideband channels. A comparison was made of the current satellite rate for a T-1 channel versus the projected year 2000 terrestrial T-1 rate. The economic model was developed to yield the maximum mileage distance where terrestrial hubbing would be more economically attractive than satellite interconnection. That distance was found to be 118 miles and is based on the data shown in Table 10.

Trunking Network Cost Model

Annual rate per 30/20 GHz T-1 channel		$96,000 *
Projected terrestrial T-1 rate		
Fixed Charge:	$24,000/year	
Mileage Charge:	$612/mile	

Crossover Distance: $\frac{\$96,000 - \$24,000}{\$612/\text{mile}} = 118$ miles

Table 10

*Estimated T-1 30/20 GHz based on a parametric cost model prepared previously for NASA-LRC.

The 118 mile cost crossover represents the internal cost with appropriate incentive for a public carrier to divert suitable terrestrial traffic to more cost effective satellite facilities. Therefore, in most cases, any SMSA within a 0-117 mile distance of an earth station location will be hubbed terrestrially to that station. An SMSA market value threshold was developed so that any SMSA with a higher market value which is within a 118-165 mile radius would be included in the value for the earth station SMSA. The market value threshold was based on a minimum market size which warranted extension to an outer limit of 165 miles. This threshold was established at a 0.1% market value which was determined on the basis of market judgement of traffic thresholds.

Through this selection process of optimum locations for 10 and 20 trunking earth stations, along with extending coverage to the subordinate SMSA's, two carrier network models were created for years 1990 and 2000. The largest market value coverage of the accessible 30/20 GHz market was obtained for these network sizes as a result. The market sizing process for the public carrier network is shown in Figure 8.

7.3 Network Analysis Results

Two trunking earth station network models were created as a result of the previous methodology. The market coverage of these networks is expressed in terms of the proportion of the served accessible market. The market values also represent the satellite communications activity being served by the trunking network earth stations. The 30/20 GHz market forecasts by service and peak traffic load is presented in Section 8.

7.3.1 Ten Earth Station Network

The ten earth station locations selected for the trunking network are displayed in Figure 9. These locations, representing the optimum market coverage, are:

1. New York
2. Los Angeles
3. Chicago
4. Detroit
5. Washington, D.C.
6. San Francisco
7. Boston
8. Cincinnati
9. Atlanta
10. Houston

PUBLIC CARRIER NETWORK MARKET SIZING

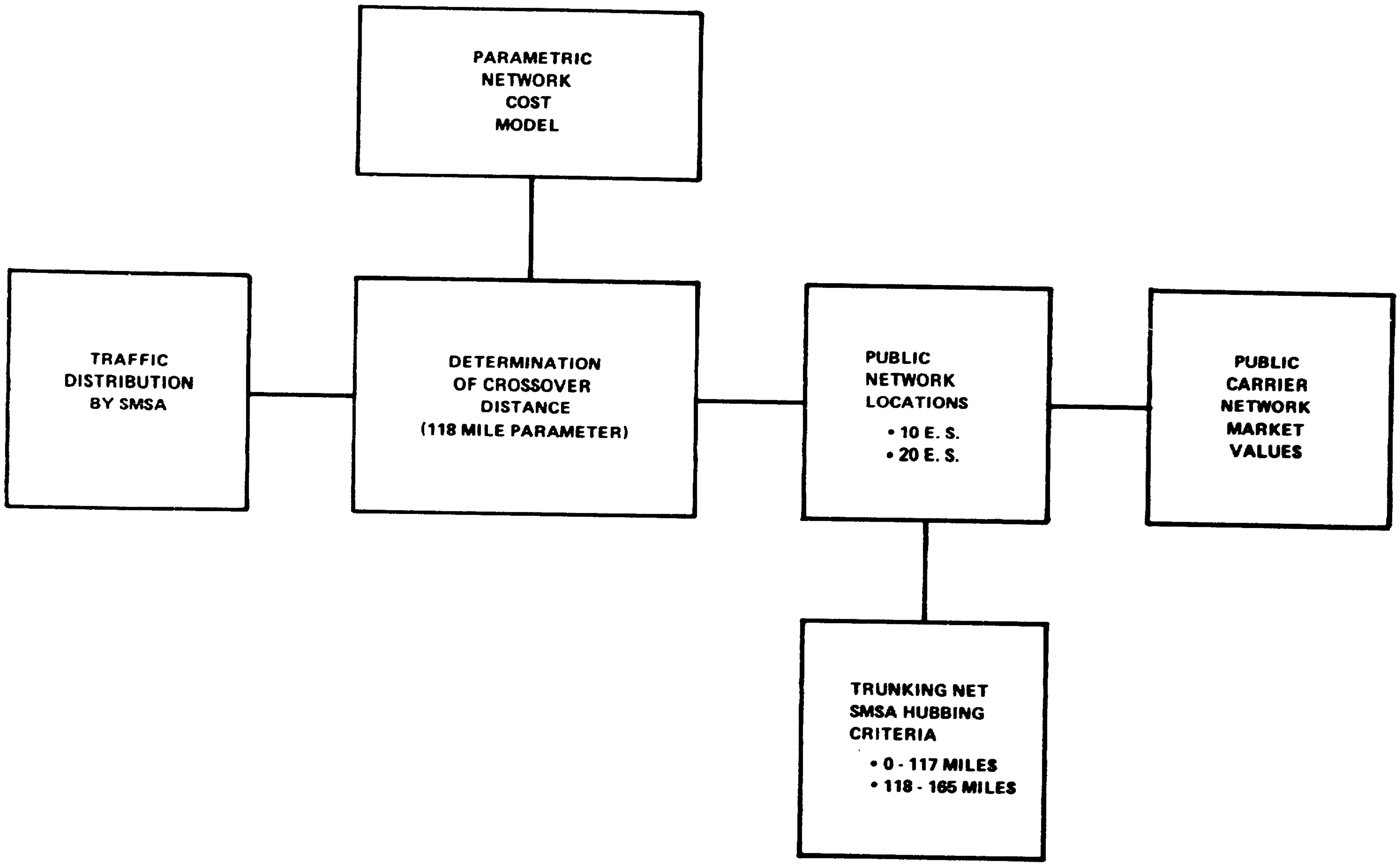
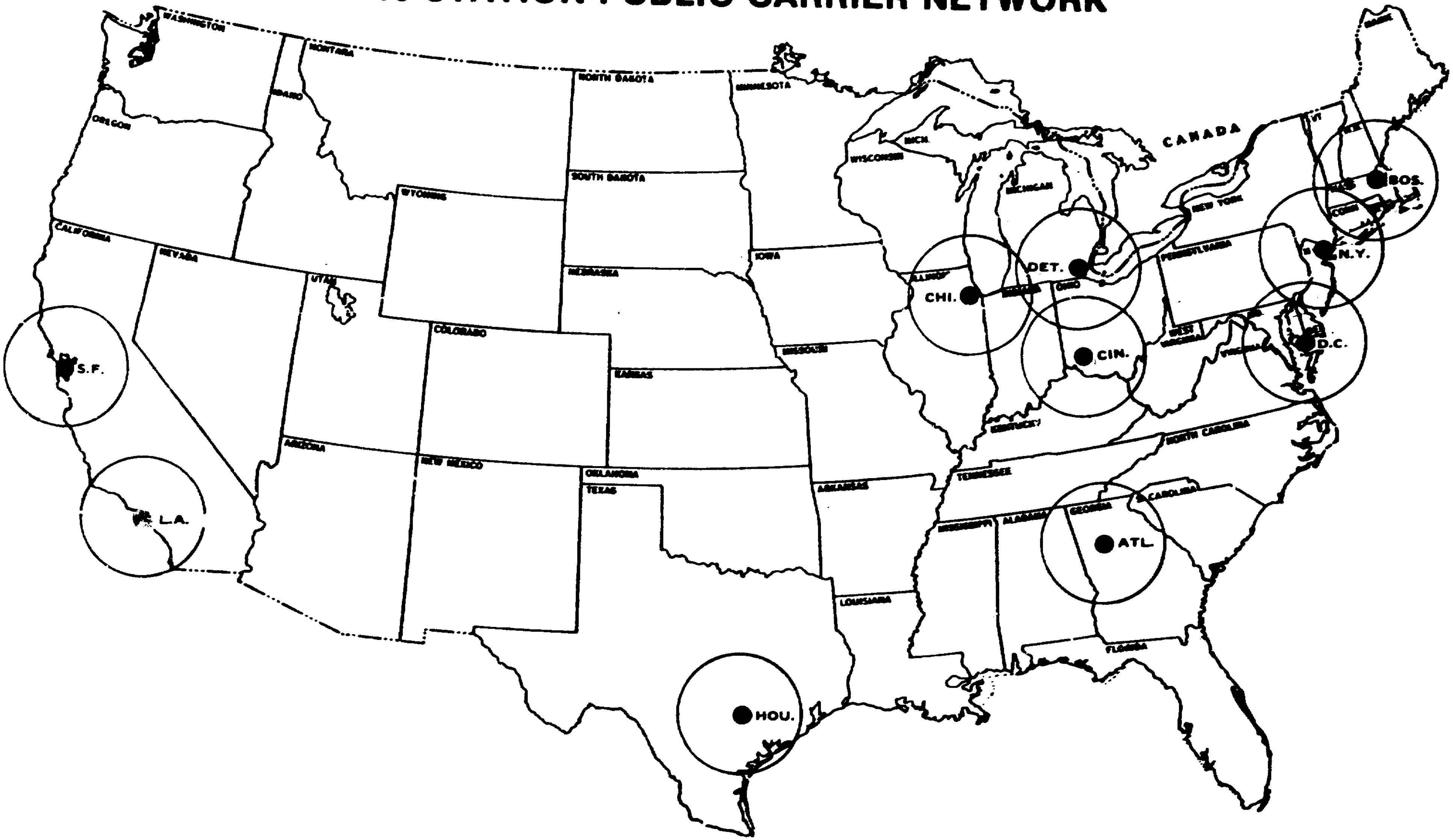


FIGURE 8

30/20 GHz SATELLITE NETWORK
TRUNKING EARTH STATION LOCATIONS
10 STATION PUBLIC CARRIER NETWORK



The 10 locations plus their subordinate SMSA's would provide market coverage for more than 34% of the accessible market. In addition to the ten principal locations, a total of 117 subordinate SMSA's would be interconnected to the trunking network. The market values for both 1990 and 2000, produced as a print-out from the Market Distribution Model, are in the Appendix.

7.3.2 Twenty Earth Station Network

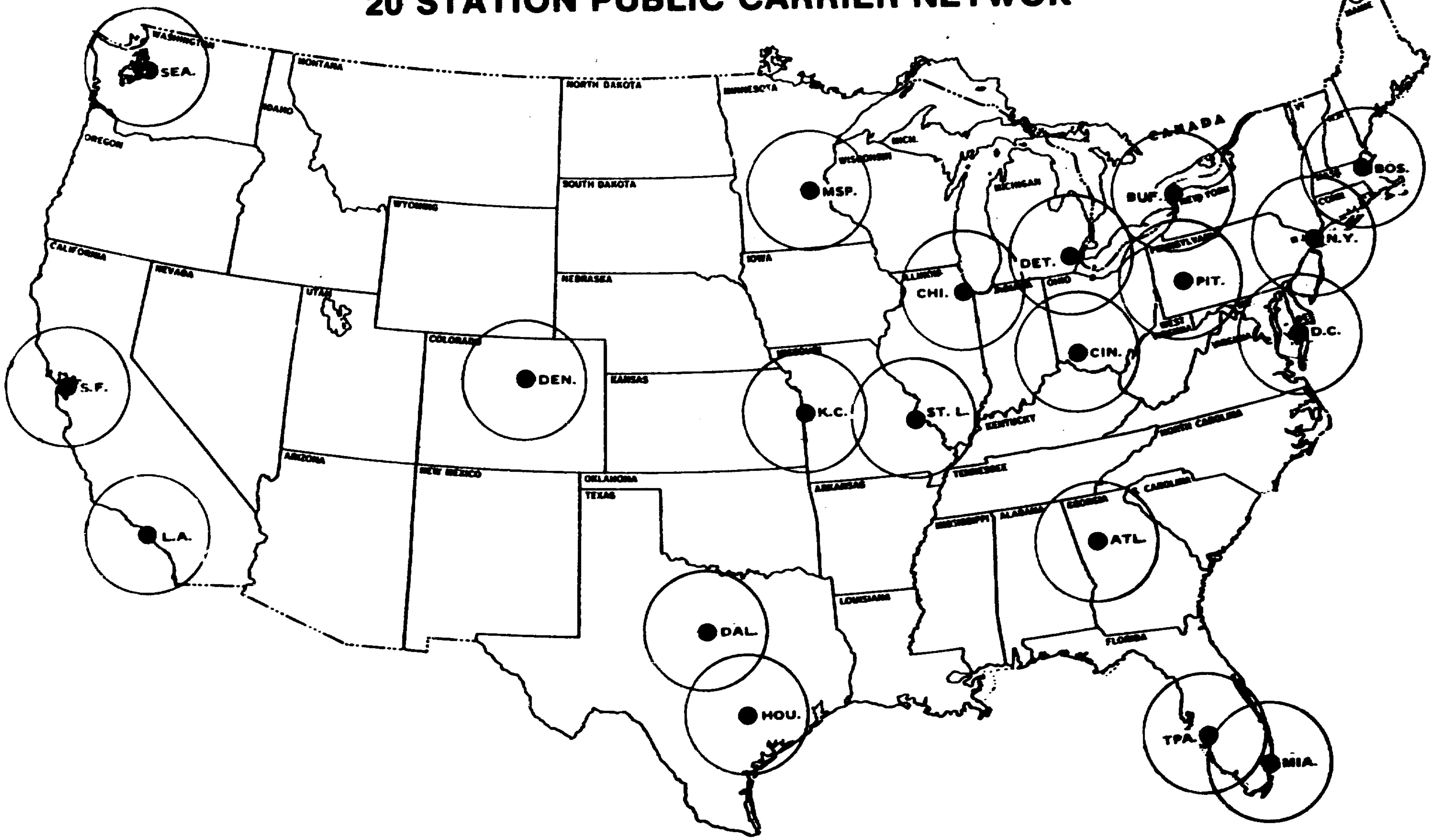
The optimal 20 trunking earth station's approximate geographical coverages are shown in Figure 10. It was determined that the first 10 stations were identical in both the twenty and ten station model because of their very large market values. However, the market values for these top ten locations were greater in the twenty station network because their universe of communications (19 other stations plus their subordinate SMSA's) is larger than the ten station network. For example, New York and its subordinate SMSA's have a market value of 7.5% in the ten station model and 9.8% in the larger model.

The twenty earth station locations selected for the trunking model are:

1. New York
2. Los Angeles
3. Chicago
4. Detroit
5. Washington, D.C.
6. San Francisco
7. Cincinnati
8. Boston
9. Atlanta
10. Houston
11. Pittsburgh
12. Dallas
13. Miami
14. Tampa
15. Minneapolis
16. St. Louis
17. Denver
18. Buffalo
19. Kansas City
20. Seattle

The 20 locations plus their 148 subordinate SMSA's provide market coverage of more than 56% of the accessible satellite market. The market model printouts for 1990 and 2000 are in the Appendix.

30/20 GHz SATELLITE NETWORK
TRUNKING EARTH STATION LOCATIONS
20 STATION PUBLIC CARRIER NETWOK



SECTION 8

NET ACCESSIBLE 30/20 GHz MARKET

8.1 Market Definition

Development of the Net Accessible Market for 30/20 GHz systems began with the net addressable market forecast presented in Task 6C and Appendix G of the Phase I study. That forecast incorporated a number of factors which rendered the total satellite traffic more suitable for a 30/20 GHz system. Principal among them are operational characteristics such as weather induced service outages, technical considerations such as message distribution and economic decisions based on the comparative prices for all service alternatives.

It was recognized that the type of services likely to be carried on trunking networks is likely to differ from those carried on common networks. For example, a high proportion of MTS business and residential traffic will be carried on a trunking network, whereas the common network may carry little or none. Therefore, a different mixture of service volumes was developed for each network.

The existence of an operating 30/20 GHz satellite system was assumed to have an impact on the market demand for such a system. This assumption has been validated by earlier satellite systems and services where demand was stimulated simply by the existence and user awareness of a new service mode. The effect of implementation and general availability of 30/20 GHz systems during the 1990's was to lower the demand in 1990 and to increase it in the year 2000.

Application of these factors to the Scenario 2 net addressable market resulted in the traffic volumes shown in Table 10 for the specialized carrier and in Table 11 for the public carrier. The net accessible market for each type of network is very close in overall traffic volume but do exhibit variations in service mix. Conversion of individual service units to Megabits per second (MBPS) is based on the same criteria previously specified in Task 6C of the Phase I study.

8.2 Market Development

Both the specialized and public carrier accessible 30/20 GHz markets were developed from the same source: the net addressable market traffic forecast prepared for Task 6C of the Phase I market study. In that task effort three market scenarios for the 30/20 GHz satellite market were created. Scenario 2, which assumed a service price equal to Ku-band and a lower service quality, was selected as the basis for the accessible market development.

TOTAL ACCESSIBLE MARKET TRAFFIC

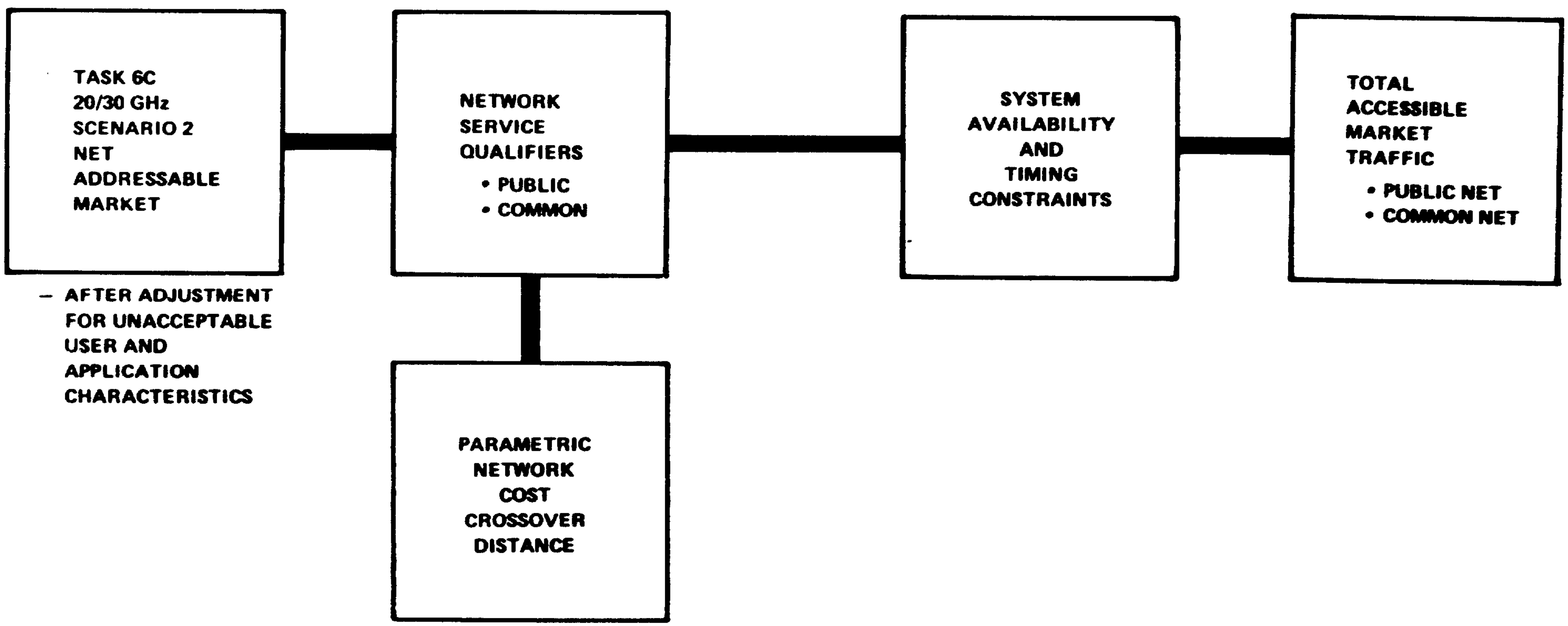


FIGURE 11

30/20 GHz Specialized Carrier
Total Accessible Market Demand Traffic

	1990	Mbps.		2000	Mbps	
Data (Terabits)						
. Data Transmission	2669			12,491		
. Electronic Mail	720			1,838		
. Electronic Funds Transfer	19			115		
. Miscellaneous	156			694		
TOTAL	3564	(1753)	9.6%	15,138	(6766)	12.1%
Voice (Half Circuits)						
. Private Line	456,000			1,262,500		
. MTS-Business	17,500			152,500		
. Miscellaneous	4,000			10,500		
TOTAL	477,500	(15280)	83.6%	1,425,500	(45616)	81.7%
Video (Transponders)						
. Network	0.2			0.7		
. Occasional	0.8			1.6		
. CATV	6.2			9.6		
. Teleconference	17.8			57.4		
TOTAL	25.0	(1250)	6.8%	69.3	(3465)	6.2%
		(18283)			(55847)	

Table 10

30/20 GHz Public Carrier Network
Total Accessible Market Demand Traffic

	1990	Mbps		2000	Mbps	
Data (Terabits)						
. Data Transmission	2956			13,879		
. Electronic Mail	1440			3,696		
. Electronic Funds Transfer	96			576		
. Miscellaneous	156			694		
TOTAL	4648	(2291)	12.5%	18,845	(8415)	15.4%
Voice (Half Circuits)						
. Private Line	456,000			1,262,500		
. MTS-Business	-			38,000		
. MTS-Public	-			23,500		
. Miscellaneous	4,000			10,500		
TOTAL	460,000	(14720)	80.6%	1,334,500	(42704)	78.2%
Video (Transponders)						
. Network	0.2			0.7		
. Occasional	0.8			1.6		
. CATV	6.2			9.6		
. Teleconference	17.8			57.4		
TOTAL	25.0	(1250)	6.9%	69.3	(3465)	6.4%
		(18261)			(54584)	

Table 11

Figure 12 shows the final step in development of the 30/20 GHz net accessible market. This step is the application of the market values obtained in the network sizing efforts discussed in Section 6 and 7 to the accessible market demand traffic. The addressable market assumes nationwide geographic coverage, whereas the cumulative market values for each network reflect only the markets actually served by the 30/20 GHz earth stations and their subordinate SMSA's. By applying the market values, defined by specific geographic coverage for each of the eleven earth station networks, the net accessible market forecasts for 1990 and 2000 were developed.

8.3 Specialized Carrier Common Network Market Forecasts

A total of nine network scenarios were developed which dealt with variations in service price and earth station network size. The market values discussed in Section 6.4 (Network Analysis Results) were separately applied to the 30/20 GHz common network addressable market demand in a similar manner by service. The result was a series of forecasts of the 30/20 GHz common network's net accessible service demand. Service demand has been expressed in the associated service units of volume: terabits for data services, half circuits for voice services, and wideband channels for video services.

Analysis of the 30/20 GHz specialized carrier indicates that voice traffic will be the dominant service for the foreseeable future. The specialized carrier voice traffic will contain a combination of MTS business traffic and switched private line services. These customers would be more likely to accept reduced quality (higher outages) service at considerably reduced prices. Consequently, voice channels (at 32 Kbps per half circuit) will tend to dominate the market accessible by common networks.

The accessible market forecasts for the nine common networks by service for year 2000 are shown in Table 12. It shows that the number of half voice circuits increases dramatically between the minimum network size (with a 31% market coverage) and the maximum network size (covering 60% of the addressable market). The impact of the service price reduction from the Ku-band service level is also shown. For the most efficient size network, a price 20% below Ku-band increases the market size by 50.7%. The relative proportions of the net accessible market where price is 20% less than Ku-band for the most efficient market is shown in Figure 13.

Conversion of the individual service units to Mbps was based on the same conversion factors explained in Task 5C, Phase I study. Re-

30/20 GHz NET ACCESSIBLE MARKET FORECAST

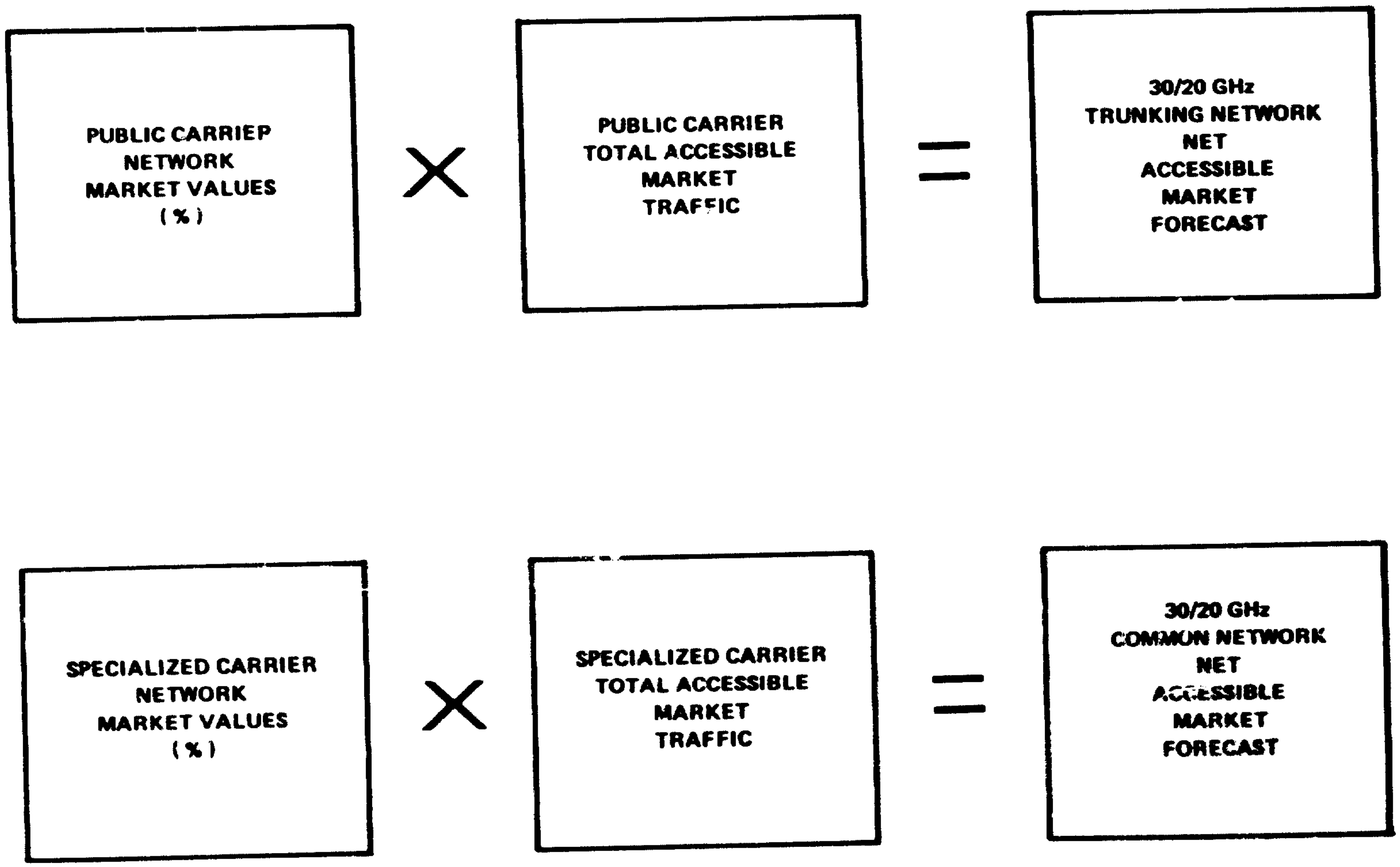


FIGURE 12

30/20 GHz Common Network
Net Accessible Market Service Demand

Year 2000

Market /Network Scenario/ Size	Data (Terabits/Year)	Voice (Half Circuits)	Video (Wideband Channels)
Price = Ku-Band			
Minimum Network	4676	880,000	21.4
Most Efficient Network	5356	1,008,000	24.5
Maximum Network	9185	1,729,000	42.0
Price 20% Ku-Band			
Minimum Network	4714	888,000	21.6
Most Efficient Network	7092	1,335,000	32.5
Maximum Network	11,075	2,085,000	50.7
Price 40% Ku-Band			
Minimum Network	4700	885,000	21.5
Most Efficient Network	8069	1,519,000	36.9
Maximum Network	12,587	2,370,000	57.6

Table 12

30/20 GHz COMMON NETWORK
NET ACCESSIBLE MARKET
MOST EFFICIENT NETWORK
PRICE 20% BELOW Ku-BAND

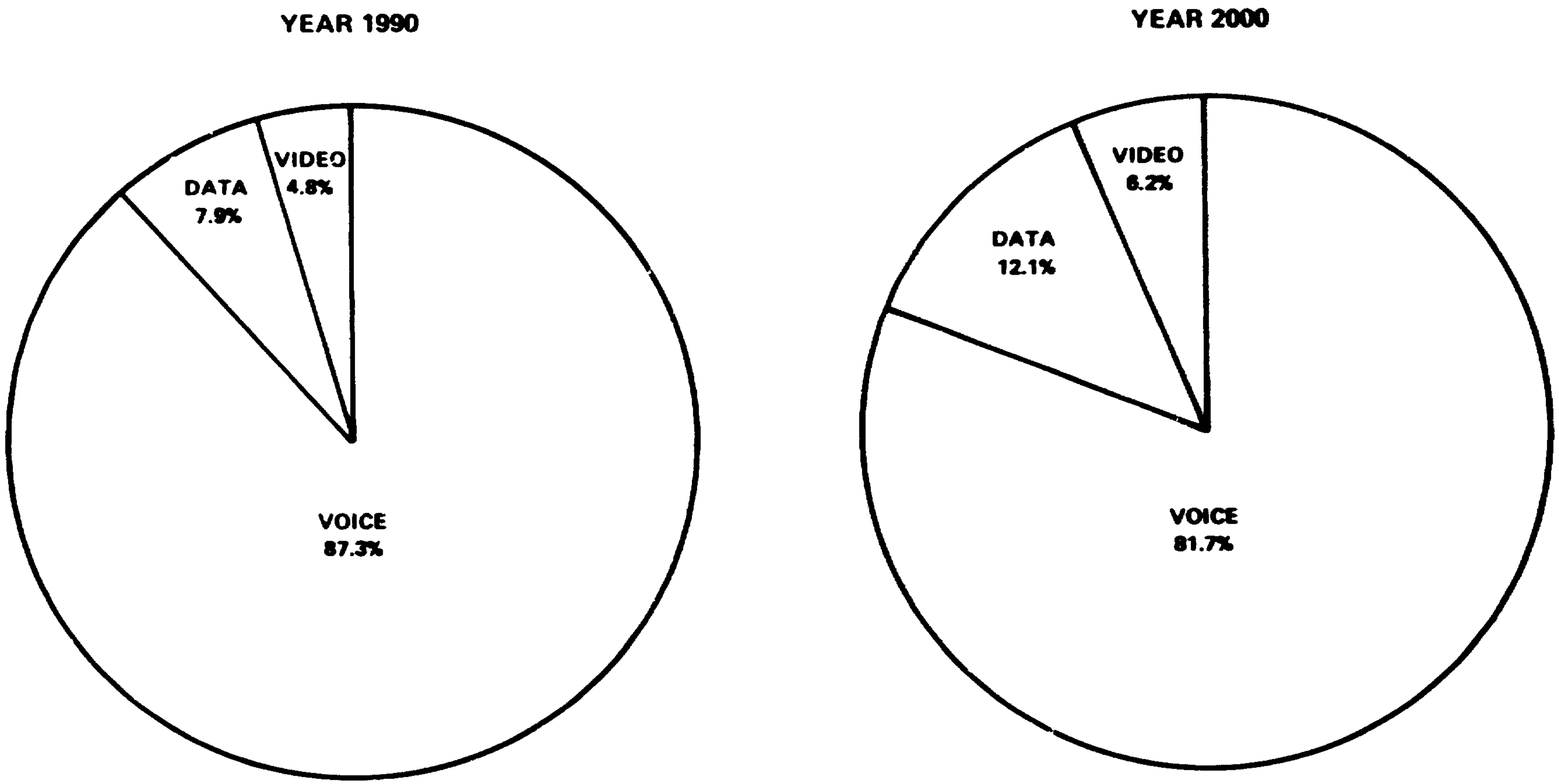


FIGURE 13

sults of these conversions can be seen in Table 13 for the service price equal to Ku-band; Table 14 for price 20% below Ku-band. A summary comparison of the three common networks market traffic is displayed in Figure 14.

In Table 13, voice services represent the largest market traffic; 81.7% of total Mbps demand. A comparison of the three network sizes indicates that the maximum network size, which contains 80 earth stations, has about twice the net accessible market as the minimum network. This should be compared with the fact that there are five times the number of earth stations in the maximum network scenario.

In Table 14, the most efficient network has a net accessible market in year 2000 which is 50% greater than the minimum network, while its earth stations number 34, approximately twice as large as the smaller network. Table 15 indicates that the maximum networks' total demand is 167% greater than the minimum network while the comparison of the number of earth stations, 99 versus 16, shows a much higher ratio. This analysis indicates that a significant fall-off begins to occur after the 20-25 largest markets are covered; incremental earth stations add proportionally smaller market traffic.

8.4 Public Carrier Trunking Network Market Forecasts

The net accessible market for the trunking network is heavily oriented to voice services, especially Message Toll Service. It is also characterized as concentrated in large population centers because much of the traffic is between and among regional centers. There are also more subordinate SMSA's terrestrially connected to the SMSA's containing earth stations for satellite transmission.

Traffic forecasts for the trunking network are expressed in two measures of traffic volume: specific service units (i.e., terabits, half circuits, wideband channels), and in peak hour megabits per seconds. The conversion factors from service units to Mbps are the same as those used in Task 5C, Phase I study.

The 10 trunking station market demand is displayed in Table 16 for the years 1990 and 2000. A large growth in this ten year span is projected for the data services market segments, achieving almost a quadrupling in size. The voice services accessible market is growing at a smaller rate of 11% because MTS, while starting from a much larger base, is projected to grow at an annual rate of 8.5%. The impact of these relative service proportions is shown in Figure 15.

Table 17 displays the 20 trunking station network market projections by service. Once again, the data services accessible market is the fastest growing segment. Note also, that the twenty station market is not twice the size of the ten station market. This happens because the additional ten earth station locations do not contribute a market value equal to the first ten largest locations. The total market value for the ten station model is 34.3%; the 11-20 stations in the twenty earth station model have a total incremental market value of 12.8%.

Common Network Net Accessible Market
Year 2000 Service Demand

MBPS

	Price = Ku-Band			
	Data Services	Voice Services	Video Services	Total Demand
Minimum Network	2090	14090	1065	17245
Most Efficient Network	2394	16139	1225	19758
Maximum Network	4105	27679	2104	33888

Table 13

Common Network Net Accessible Market
Year 2000 Service Demand

MBPS

	Price 20% Below Ku-Band			
	Data Services	Voice Services	Video Services	Total Demand
Minimum Network	2106	14202	1077	17385
Most Efficient Network	3170	21374	1620	26164
Maximum Network	4950	33372	2535	40857

Table 14

Common Network Net Accessible Market
Year 2000 Service Demand

MBPS

	Price 40% Below Ku-Band			
	Data Services	Voice Services	Video Services	Total Demand
Minimum Network	2101	14165	1076	17342
Most Efficient Network	3606	24313	1847	29766
Maximum Network	5626	37929	2882	46437

Table 15

30/20 GHz COMMON NETWORK
NET ACCESSIBLE MARKET TRAFFIC
YEAR 2000

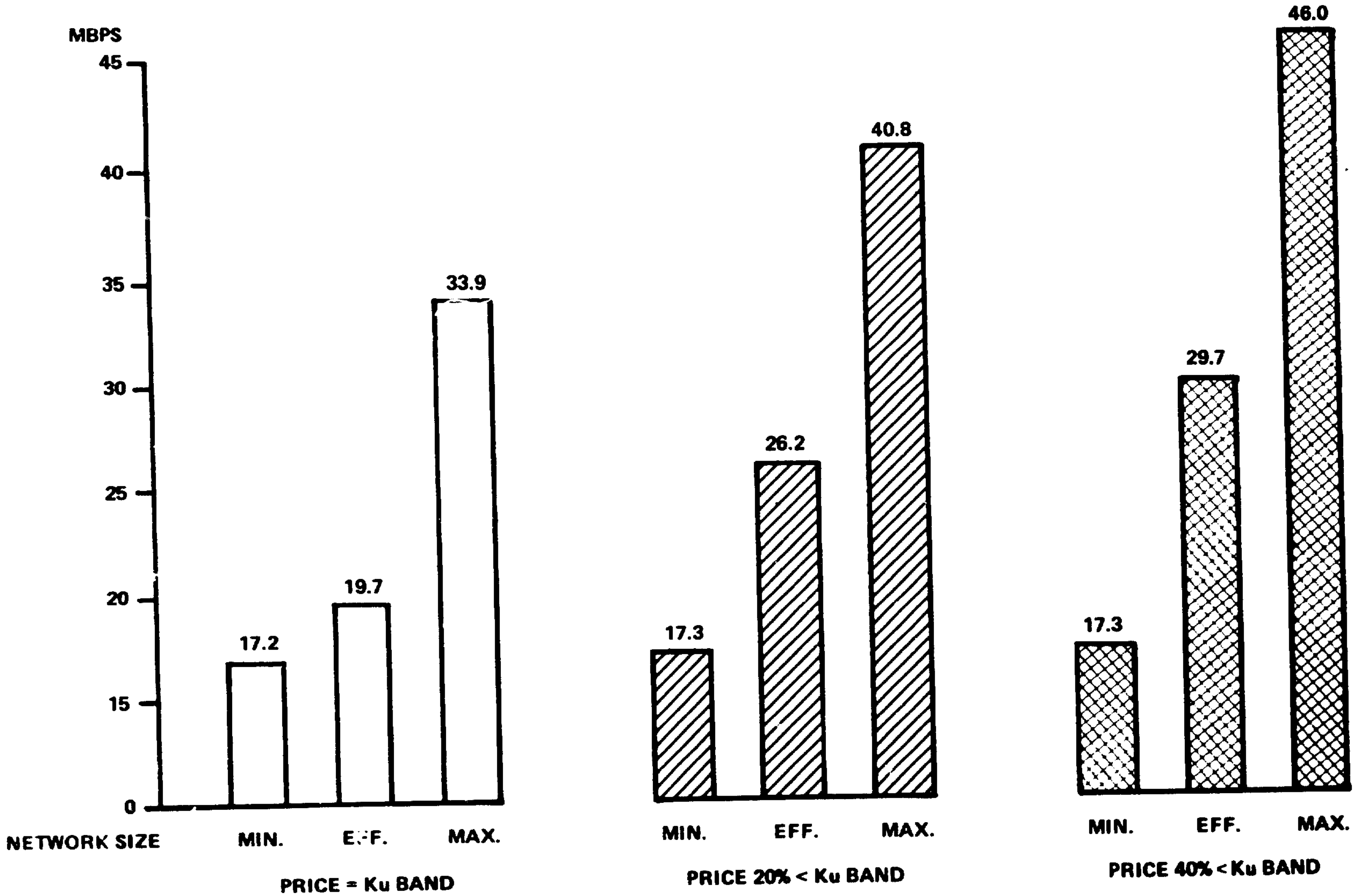


FIGURE 14

30/20 GHz Trunking Network
Net Accessible Market Demand
10 Station Network

Service	1990	2000
Data (Terabits/Year)	1625	6455
Voice (Half Circuits)	321,000	915,000
Video (Wideband Channels)	9	24

Table 16

30/20 GHz TRUNKING NETWORK RELATIVE MARKET SEGMENTS NET ACCESSIBLE MARKET

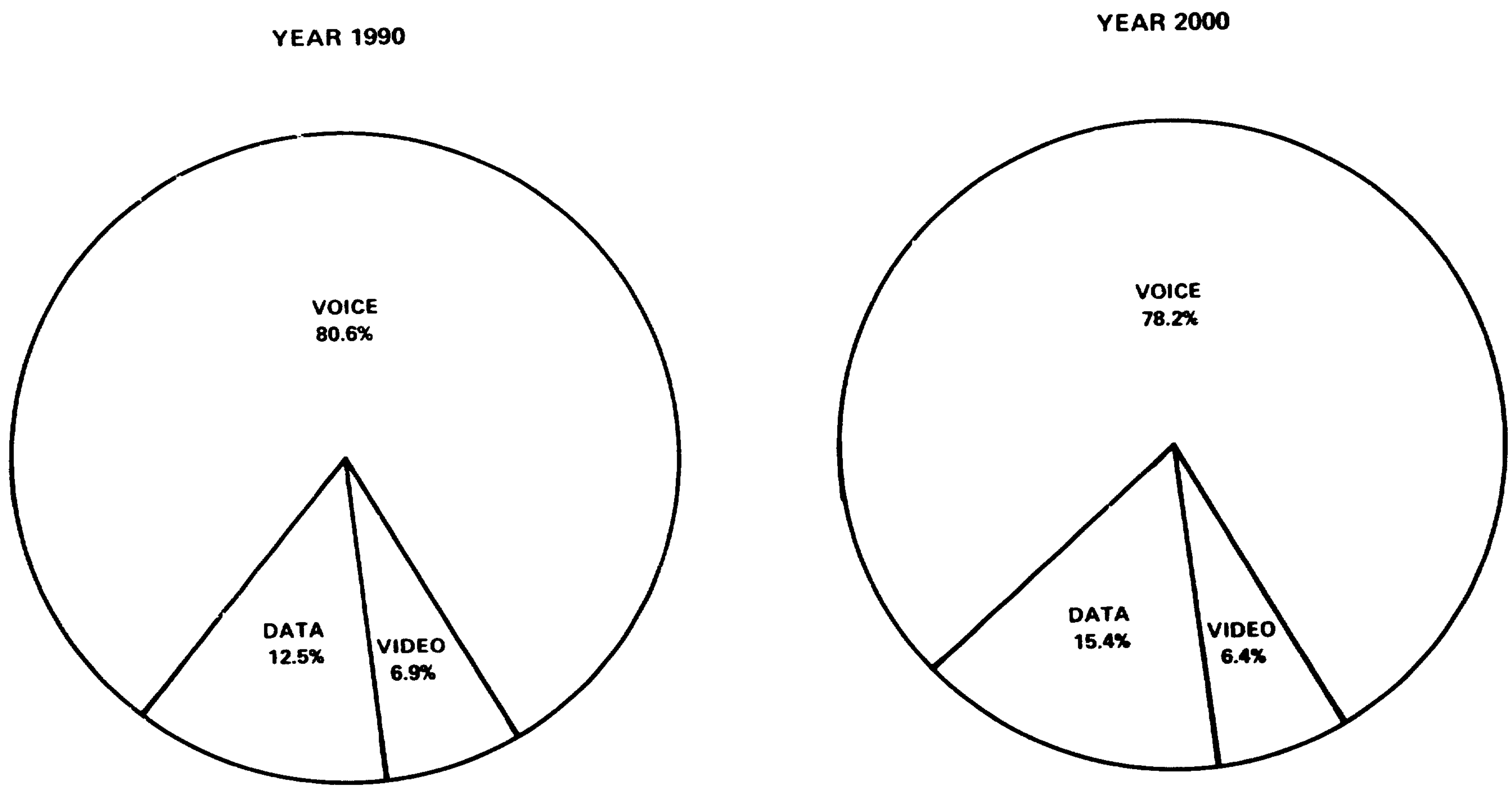


FIGURE 15

30/20 GHz Trunking Network
Net Accessible Market Demand
20 Station Network

Service	1990	2000
Data (Terabits/Year)	2658	10651
Voice (Half Circuits)	525,000	1,510,000
Video (Wideband Channels)	14	39

Table 17

The conversion of the net accessible market by service to peak hour megabits per second resulted in Tables 18 and 19. Table 18 compares the 10 and 20 station networks for year 1990. Table 19 compares the same two network sizes for year 2000. Figure 16 provides a similar comparison. The 30/20 GHz net accessible market for trunking networks is projected to triple between 1990 and year 2000. This is mostly due to the expected rapid growth in voice and data services. Voice services traffic is projected to grow at a 12.5% Average Annual Growth Rate, Compounded (AAGR) while data services traffic is projected to grow even faster, at a 16.5% AAGR.

As was discussed previously, the total net accessible market of 10.3 Gbps (1990) or 30.9 Gbps (2000) represent a market that could be accessed by a 30/20 GHz trunking system. The actual traffic carried on such a system by a public carrier may differ as a result of considerations other than market accessibility.

30/20 GHz Trunking Network
Net Accessible Market Traffic
Year 1990

(MBPS)

Service	10 Station Network	20 Station Network
Data	718	1188
Voice	5136	8400
Video	450	700
TOTAL	6304	10288

Table 18

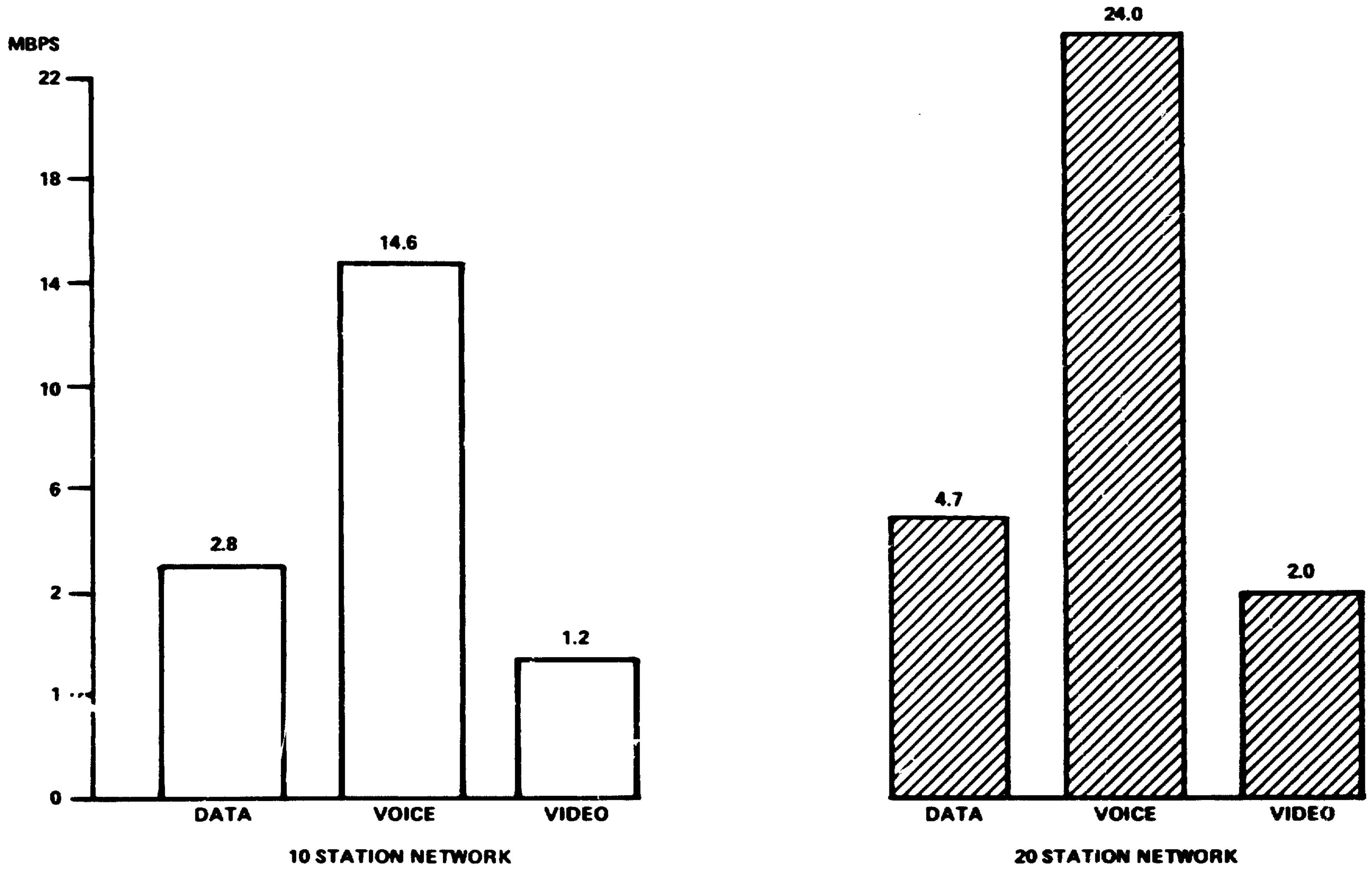
30/20 GHz Trunking Network
Net Accessible Market Traffic
Year 2000

(MBPS)

Service		10 Station Network		20 Station Network
Data		2855		4761
Voice		14643		24162
Video		1188		1960
	TOTAL	18686	TOTAL	30883

Table 19

30/20 GHz TRUNKING NETWORK
NET ACCESSIBLE MARKET TRAFFIC
YEAR 2000



SECTION 9

CONCLUSIONS

Several overview statements can be made as a result of performing this 30/20 GHz satellite market study. These comments are derived both as a result of performing the research as well as examining the model's traffic forecast results.

1. The net accessible market, in total, should only be used as a rough measure of the potential amount of traffic placed on 30/20 GHz satellite systems. A number of non-marketing considerations may affect the actual size of a single satellite system. These considerations were previously identified in 4.2.

2. Competitive factors may play a large role in the use of 30/20 GHz frequencies and the amount of traffic any single carrier may have on its network.

3. Future service price for 30/20 GHz satellite services will have a major impact on market demand. Service price equal to or higher than Ku-band will delay demand for the higher frequency services, especially if service quality is lower than Ku-band.

4. It is interesting that the maximum common network market (with price equal to Ku-band) is only slightly larger (33 Mbps vs. 30 Mbps) than the larger trunking network's market. This is despite the fact the maximum common network contains 80 earth stations versus 20 trunking earth stations.

5. Regardless of the market penetration levels achieved by the common or trunking network carriers, the model's earth station locations are likely to be those selected by the satellite carriers. Whether a small network of 10-16 stations or a large network consisting of 80 stations, the market modelling efforts have produced the sites of greatest market value for future satellite systems.

APPENDIX

The purpose of the Appendix is to provide a level of in-depth information which is too detailed for the main report. The Appendix contains two sections, both dealing with computer printouts which were developed by the two marketing models. The first section contains the satellite system service cost and crossover distance calculations derived from the parametric network cost model. The second section contains the individual network scenario market values for both the common and trunking network models. References to these reports have been made in the main study volume.

Section I - Parametric Cost Model Results

A parametric cost model was created for the specialized carrier network scenarios to account for a larger number of earth stations and higher operating efficiency than was assumed in the Phase I study parametric cost model. The specialized carrier satellite cost model contained 40 earth stations which fits well into the size of the most efficient common network. Crossover distances were determined where terrestrial costs were 20% higher than 30/20 GHz system service costs for three cases: service price equal to Ku-band, 20% below and 40% below Ku-band.

The results of the service price distance crossover model for year 2000 were displayed in the main report. The following charts show the details of the parametric cost model for both years 1990 and 2000 and the 20% and 40% below Ku-band crossover distance comparisons.

It should be noted that while it appears that the total cost for each end-to-end channel remains unchanged in the three price variation cases, internally the model adjusted the end cost to reflect the reduced satellite rate and the corresponding crossover distance.

Section II - Market Distribution Model Market Values

The Market Distribution Model was used to reflect a set of criteria established for both the specialized and public carrier networks. These criteria dealt with mileage distance crossovers and length of hubbing extensions for terrestrial interconnection to earth station location. The results were developed in the form of market values, the proportion of the total market served by the principal or earth station SMSA plus its subordinate SMSA's.

A. Trunking Network Models

There are four reports of the resulting market values shown on the following computer generated displays. These cases deal with the 10 and 20 earth station models for the two years 1990 and 2000.

Each report shows the principal or earth station location, ranked by its total market value, including the number of subordinates. The subordinate SMSA's and their distance to the earth station and their individual market values are also displayed. Also provided is the cumulative market value of the earth stations and subordinate locations as the ranking continues lower. The cumulative value shown for the last principal location is the total market values for the entire network.

B. Common Network Models

A total of nine common network market models were developed to generate the various network size combinations. The following reports are grouped by network size model: minimum networks, most efficient networks, and maximum networks. For each network grouping the three price alternatives have also been generated.

The market values increase in a corresponding manner to the growth in the size of the network. New York and its subordinate SMSA's, for example, have a market value of 3.7% in the minimum network model, a 3.9% market value in the most efficient network model, and grows to a 5.1% value in the maximum network model.

As before, the cumulative market value for the ranked group of earth station locations is provided at each point in the ranking.

The sequential ordering of the nine computer generated reports are:

- Minimum Network
  - Price = Ku-band
  - Price 20% below
  - Price 40% below
- Most Efficient Network
  - Equal Ku-band
  - 20% below
  - 40% below
- Maximum Network
  - Equal Ku-band
  - 20% below
  - 40% below

APPENDIX

PARAMETRIC FACILITY COST MODEL

CROSSOVER DISTANCES WHERE
TERRESTRIAL COSTS ARE 20 % HIGHER THAN SATELLITE COSTS AND
SATELLITE PRICING EQUAL TO KU-BAND
YEAR 1990

MODEL	YEAR	E S SYSTEM	SPEED	WEIGHT	ES;EL	CHAN/ES	SPACE	CH COST	TOTAL	TOTAL/CH	LOOP	CH+LOOP	% DIST
40 E S	1990	C - BAND TDMA	VOICE	64.94	9566909	265	2597403	922522	13086833	2469	1122	3591	350
40 E S	1990	C - BAND FDM	VOICE	34.37	3892843	265	2199455	3500640	9592939	1810	1122	2932	240
40 E S	1990	K - BAND TDMA	VOICE	64.94	7600675	265	6168831	1029600	14799106	2792	1122	3914	100
40 E S	1990	K - BAND FDM	VOICE	34.37	2861299	265	5223706	3500640	11585645	2186	1122	3308	300
40 E S	1990	C - BAND TDMA	300 B	13.99	2061398	571	559667	7380173	10001238	876	638	1514	40
40 E S	1990	C - BAND FDM	300 B	7.41	838798	571	473920	7947878	9260596	811	638	1449	30
40 E S	1990	K - BAND TDMA	300 B	13.99	1637730	571	1329209	7380173	10347112	906	638	1544	40
40 E S	1990	K - BAND FDM	300 B	7.41	616529	571	1125561	7947878	9689968	849	638	1487	30
40 E S	1990	C - BAND TDMA	9.6KB	12.99	1913382	53	519481	2016538	4449400	4198	1996	6194	0
40 E S	1990	C - BAND FDM	9.6KB	6.87	778569	53	439891	2528856	3747316	3535	1996	5531	0
40 E S	1990	K - BAND TDMA	9.6KB	12.99	1520135	53	1233766	2037816	4791717	4520	7548	12068	930
40 E S	1990	K - BAND FDM	9.6KB	6.87	572260	53	1044741	2528856	4145857	3911	7548	11459	830
40 E S	1990	C - BAND TDMA	56 KB	8.09	1191351	33	323450	337075	1851876	2806	22580	25386	260
40 E S	1990	C - BAND FDM	56 KB	51.36	5817230	33	3286733	5918880	15022843	22762	22580	45342	940
40 E S	1990	K - BAND TDMA	56 KB	8.09	946490	33	768194	376200	2090893	3168	22580	25748	270
40 E S	1990	K - BAND FDM	56 KB	51.36	4275752	33	7805991	5918880	18000624	27274	22580	49854	1160

ORIGINAL PAGE IS
OF POOR QUALITY

PARAMETRIC FACILITY COST MODEL

CROSSOVER DISTANCES WHERE
TERRESTRIAL COSTS ARE 20°/° HIGHER THAN SATELLITE COSTS AND
SATELLITE PRICING 20°/° LESS THAN KU-BAND
YEAR 2000

MODEL	YEAR	E S SYSTEM	SPEED	WEIGHT	ES+EL	CHAN/ES	SPACE	CH COST	TOTAL	TOTAL/CH	LOOP	CH+LOOP	% DIST
40 E S	2000	C - BAND TDMA	VOICE	49.98	6684383	204	1999020	569856	9253259	2268	1122	3390	200
40 E S	2000	C - BAND FDM	VOICE	18.90	2011366	204	1663454	2162400	5837220	1431	1122	2553	90
40 E S	2000	K - BAND TDMA	VOICE	49.98	5028195	204	4747673	636000	10411868	2552	1122	3674	240
40 E S	2000	K - BAND FDM	VOICE	18.90	1388932	204	3950704	2162400	7502036	1839	1122	2961	140
40 E S	2000	C - BAND TDMA	300 B	14.99	2005315	612	599706	6349824	8954845	732	638	1370	0
40 E S	2000	C - BAND FDM	300 B	5.67	603410	612	499036	6838272	7940718	649	638	1287	0
40 E S	2000	K - BAND TDMA	300 B	14.99	1508459	612	1424302	6349824	9282584	758	638	1396	0
40 E S	2000	K - BAND FDM	300 B	5.67	416679	612	1185211	6838272	8440163	690	638	1328	0
40 E S	2000	C - BAND TDMA	9.6KB	20.09	2686860	82	803528	2507366	5997754	3657	1996	5653	0
40 E S	2000	C - BAND FDM	9.6KB	7.60	808490	82	668643	3144384	4621518	2818	1996	4814	0
40 E S	2000	K - BAND TDMA	9.6KB	20.09	2021137	82	1908378	2533824	6463340	3941	7548	11489	440
40 E S	2000	K - BAND FDM	9.6KB	7.60	558296	82	1588028	3144384	5290708	3226	7548	10774	340
40 E S	2000	C - BAND TDMA	56 KB	14.94	1998762	61	597746	512870	3109378	2549	22580	25129	80
40 E S	2000	C - BAND FDM	56 KB	67.83	7217254	61	5968866	9005760	22191880	18190	22580	40770	500
40 E S	2000	K - BAND TDMA	56 KB	14.94	1503529	61	1419647	572400	3495576	2865	22580	25445	90
40 E S	2000	K - BAND FDM	56 KB	67.83	4983813	61	14176056	9005760	28165629	23087	22580	45667	640

PARAMETRIC FACILITY COST MODEL

CROSSOVER DISTANCES WHERE
TERRESTRIAL COSTS ARE 20 o/o HIGHER THAN SATELLITE COSTS AND
SATELLITE PRICING 40 o/o LESS THAN KU-BAND
YEAR 2000

MODEL	YEAR	E S SYSTEM	SPEED	WEIGHT	ES+EL	CHAN/ES	SPACE	CH COST	TOTAL	TOTAL/CH	LOOP	CH+LOOP	% DIST
40 E S	2000	C - BAND TDMA	VOICE	49.98	6684383	204	1999020	569856	9253259	2268	1122	3390	90
40 E S	2000	C - BAND FDM	VOICE	18.90	2011366	204	1663454	2162400	5837220	1431	1122	2553	40
40 E S	2000	K - BAND TDMA	VOICE	49.98	5028195	204	4747673	636000	1041'868	2552	1122	3674	110
40 E S	2000	K - BAND FDM	VOICE	18.90	1388932	204	3950704	2162400	7502036	1839	1122	2961	60
40 E S	2000	C - BAND TDMA	300 B	14.99	2005315	612	599706	6349824	8954845	732	638	1370	0
40 E S	2000	C - BAND FDM	300 B	5.67	603410	612	499036	6838272	7940718	649	638	1287	0
40 E S	2000	K - BAND TDMA	300 B	14.99	1508459	612	1424302	6349824	9282584	758	638	1396	0
40 E S	2000	K - BAND FDM	300 B	5.67	416679	612	1185211	6838272	8440163	690	638	1328	0
40 E S	2000	C - BAND TDMA	9.6KB	20.09	2686860	82	803528	2507366	5997754	3657	1996	5653	0
40 E S	2000	C - BAND FDM	9.6KB	7.60	808490	82	668643	3144384	4621518	2818	1996	4814	0
40 E S	2000	K - BAND TDMA	9.6KB	20.09	2021137	82	1908378	2533824	6463340	3941	7548	11489	70
40 E S	2000	K - BAND FDM	9.6KB	7.60	558296	82	1588028	3144384	5290708	3226	7548	10774	20
40 E S	2000	C - BAND TDMA	56 KB	14.94	1998762	61	597746	512870	3109378	2549	22580	25129	0
40 E S	2000	C - BAND FDM	56 KB	67.83	7217254	61	5968866	9005760	22191880	18190	22580	40770	220
40 E S	2000	K - BAND TDMA	56 KB	14.94	1503529	61	1419647	572400	3495576	2865	22580	25445	0
40 E S	2000	K - BAND FDM	56 KB	67.83	4983813	61	14176056	9005760	28165629	23087	22580	45667	320

MARKET DISTRIBUTION MODEL (MDM)

FILE 392 - NASA T-10 TRUNKING NETWORK - 118 MILEAGE CROSSOVER - 117/165 RADIUS
SMSA'S IT MARKET VALUE - YEAR 1990
SUBORDINATES 117/165 MILES OR LESS

RANK	SMSA	PRINCIPAL		MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
1	5600	NEW YORK	NY-NJ	3.8064	7.5659	7.5659	24	160*	ALBANY-SCH	NY	134	0.1768
								240*	ALLENTOWN-	PA-NJ	78	0.1392
								1160*	BRIDGEPORT	CT	52	0.1093
								1170*	BRISTOL	CT	85	0.0149
								1930	DANBURY	CT	54	0.0325
								3640	JERSEY CIT	NJ	3	0.1198
								4410	LONG BRANC	NJ	31	0.0807
								4960*	MERIDEN	CT	83	0.0126
								5380	NASSAU-SUF	NY	20	0.4495
								5440*	NEW BRITAI	CT	90	0.0267
								5460	NEW BRUNSW	NJ	30	0.1256
								5480*	NEW HAVEN-	CT	68	0.1108
								5640	NEWARK	NJ	10	0.5702
								5760	NORWALK	CT	39	0.0405
								6040	PATERSON-C	NJ	16	0.1334
								6160*	PHILADELPH	PA-NJ	82	1.1222
								6460	POUGHKEEPS	NY	68	0.0328
								6680*	READING	PA	106	0.0718
								8040*	STAMFORD	CT	33	0.0937
								8480*	TRENTON	NJ	54	0.0942
								8760*	VINELAND-M	NJ	103	0.0279
								8880*	WATERBURY	CT	75	0.0499
								560	ATLANTIC C	NJ	99	0.0274
								5745	NORTHEAST	PA	102	0.0969
											1515	3.7595
2	4480	LOS ANGELE	CA	2.8250	4.5701	12.1359	6	360	ANAHEIM-SA	CA	25	0.6722
								6000	OXNARD-SIM	CA	55	0.1222
								6780	RIVERSIDE-	CA	55	0.2671
								7320	SAN DIEGO	CA	113	0.5176
								7480	SANTA BARB	CA	88	0.0863
								680	BAKERSFIEL	CA	102	0.0797
											438	1.7451

MARKET DISTRIBUTION MODEL (MDM)

FILE 592 - NASA T 10 TRUNKING NETWORK - 118 MILEAGE CROSSOVER - 117/165 RADIUS
SMSA'S BY MARKET VALUE - YEAR 1990
SUBORDINATES 117/165 MILES OR LESS

RANK	SMSA	PRINCIPAL		MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
3	1600	CHICAGO	IL	2.9456	4.5464	16.6824	14	2960	GARY-HAMMO	IN	25	0.1492
								3000*	GRAND RAPI	MI	125	0.1360
								3720*	KALAMAZOO-	MI	109	0.0687
								3800	KENOSHA	WI	50	0.0491
								5080	MILWAUKEE	WI	82	0.5223
								5320	MUSKEGON-N	MI	117	0.0353
								6120	PEORIA	IL	130	0.1223
								6600	RACINE	WI	59	0.0572
								3740	KANKAKEE	IL	54	0.0202
								3920	LAFAYETTE-	IN	108	0.0347
								6880	ROCKFORD	IL	80	0.0920
								7800	SOUTH BEND	IN	73	0.0692
								4720	MADISON	WI	122	0.1236
								1960	DAVENPORT-	IA-IL	154	0.1210
											1288	1.6009
4	2160	DETROIT	MI	1.6488	3.8216	20.5040	16	80	AKRON	OH	118	0.1935
								440	ANN ARBOR	MI	33	0.1286
								780	BATTLE CRE	MI	110	0.0336
								1320	CANTON	OH	137	0.0934
								1680	CLEVELAND	OH	91	0.[illegible]40
								2640	FLINT	MI	58	0.1331
								3520	JACKSON	MI	70	0.0580
								4040	LANSING-EA	MI	82	0.1316
								4440	LORAIN-ELY	OH	75	0.0786
								8400	TOLEDO	OH-MI	54	0.2254
								9320	YOUNGSTOWN	OH	151	0.1120
								2360	ERIE	PA	153	0.0715
								4800	MANSFIELD	OH	112	0.0401
								2760*	FORT WAYNE	IN	138	0.1000
								800	BAY CITY	MI	98	0.0193
								6960	SAGINAW	MI	89	0.0701
											1569	2.1728

MARKET DISTRIBUTION MODEL (MDM)

FILE 592 NASA T-10 TRUNKING NETWORK - 118 MILEAGE CROSSOVER - 117/165 RADIUS
SMSA'S BY MARKET VALUE - YEAR 1990
SUBORDINATES 117/165 MILES OR LESS

RANK	SMSA	PRINCIPAL	MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
5	8840	WASHINGTON DC-MD-	1.3752	3.1560	23.6600	8	720	BALTIMORE MD	36	0.7851
							5680	NEWPORT NE VA	137	0.0958
							5720	NORFOLK-VI VA-NC	148	0.2430
							6760	RICHMOND VA	97	0.2686
							9160*	WILMINGTON DE-NJ-	99	0.1238
							9280*	YORK PA	76	0.0575
							3240*	HARRISBURG PA	95	0.1368
							4000*	LANCASTER PA	88	0.0702
									-----	-------
									776	1.7808
6	7360	SAN FRANCI CA	1.5360	2.9706	26.6305	9	6920	SACRAMENTO CA	74	0.3217
							7120	SALINAS-SE CA	89	0.0608
							7400	SAN JOSE CA	43	0.6611
							7485	SANTA CRUZ CA	61	0.0362
							7500	SANTA ROSA CA	49	0.0641
							8120	STOCKTON CA	63	0.0792
							8720	VALLEJO-FA CA	24	0.0535
							5170	MODESTO CA	78	0.0614
							2840	FRESNO CA	162	0.0966
									-----	-------
									643	1.4346
7	1120	BOSTON MA	1.2703	2.4130	29.0435	15	1200	BROCKTON MA	20	0.0518
							2480	FALL RIVER MA-RI	46	0.0322
							2600	FITCHBURG- MA	42	0.0206
							3280*	HARTFORD CT	93	0.2227
							4160	LAWRENCE-H MA-NH	25	0.0793
							4560	LOWELL MA-NH	24	0.0663
							4760	MANCHESTER NH	49	0.0483
							5350	NASHUA NH	35	0.0493
							5520*	NEW LONDON CT-RI	88	0.0258
							6320	PITTSFIELD MA	113	0.0234
							6480*	PROVIDENCE RI-MA	42	0.2287
							8000*	SPRINGFIEL CT-MA	81	0.1042
							9240*	WORCESTER MA	39	0.0913
							5400	NEW BEDFOR MA	52	0.0449
							6400	PORTLAND ME	99	0.0537
									-----	-------
									848	1.1426

MARKET DISTRIBUTION MODEL (MDM)

FILE 592 - DASA T 10 TRUNKING NETWORK - 118 MILEAGE CROSSOVER - 117/165 RADIUS
SMSA'S BY MARKET VALUE - YEAR 1990
SUBORDINATES 117/165 MILES OR LESS

RANK	SMSA	PRINCIPAL		MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
8	1640	CINCINNATI	OH-KY-	0.5571	2.3654	31.4089	12	400	ANDERSON	IN	93	0.0292
								1020	BLOOMINGTO	IN	109	0.0195
								1480	CHARLESTON	WV	164	0.0790
								1840*	COLUMBUS	OH	101	0.4348
								2000	DAYTON	OH	49	0.3037
								3200	HAMILTON-M	OH	21	0.0678
								3480*	INDIANAPOL	IN	100	0.3579
								4520	LOUISVILLE	KY-IN	90	0.3172
								5280	MUNCIE	IN	89	0.0285
								7960	SPRINGFIEL	OH	68	0.0396
								4280	LEXINGTON-	KY	73	0.0961
								4320	LIMA	OH	115	0.0352
											1072	1.8283
9	520	ATLANTA	GA	0.8589	1.8147	33.2236	9	1000	BIRMINGHAM	AL	141	0.2888
								450	ANNISTON	AL	84	0.0236
								1560	CHATTANOOG	TN-GA	104	0.1459
								1800	COLUMBUS	GA-AL	95	0.0637
								2880	GADSDEN	AL	95	0.0232
								4680	MACON	GA	77	0.0733
								3840	KNOXVILLE	TN	155	0.1361
								3440	HUNTSVILLE	AL	143	0.1085
								5240	MONTGOMERY	AL	147	0.0926
											1041	0.9558
10	3360	HOUSTON	TX	1.2755	1.6790	34.9025	4	640	AUSTIN	TX	147	0.2202
								2920	GALVESTON-	TX	47	0.0545
								840	BEAUMONT-P	TX	80	0.1051
								1260	BRYAN-COLL	TX	88	0.0238
											362	0.4035

MARKET DISTRIBUTION MODEL (MDM)

FILE 592 - NASA T-10 TRUNKING NETWORK - 118 MILEAGE CROSSOVER - 117/165 RADIUS
SMSA'S BY MARKET VALUE - YEAR 2000
SUBORDINATES 117/165 MILES OR LESS

RANK	SMSA	PRINCIPAL		MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
1	5600	NEW YORK	NY-NJ	3.6561	7.2986	7.2986	24	160*	ALBANY-SCH	NY	134	0.1684
								240*	ALLENTOWN-	PA-NJ	78	0.1377
								1160*	BRIDGEPORT	CT	52	0.1062
								1170*	BRISTOL	CT	85	0.0139
								1930	DANBURY	CT	54	0.0316
								3640	JERSEY CIT	NJ	3	0.1132
								4410	LONG BRANC	NJ	31	0.0795
								4960*	MERIDEN	CT	83	0.0119
								5380	NASSAU-SUF	NY	20	0.4299
								5440*	NEW BRITAI	CT	90	0.0250
								5460	NEW BRUNSW	NJ	30	0.1228
								5480*	NEW HAVEN-	CT	68	0.1059
								5640	NEWARK	NJ	10	0.5509
								5760	NORWALK	CT	39	0.0394
								6040	PATERSON-C	NJ	16	0.1284
								6160*	PHILADELPH	PA-NJ	82	1.0895
								6460	POUGHKEEPS	NY	68	0.0317
								6680*	READING	PA	106	0.0714
								8040*	STANFORD	CT	33	0.0916
								8480*	TRENTON	NJ	54	0.0948
								8760*	VINELAND-M	NJ	103	0.0294
								8880*	WATERBURY	CT	75	0.0475
								560	ATLANTIC C	NJ	99	0.0278
								5745	NORTHEAST	PA	102	0.0940
											-----	-------
											1515	3.6425
2	4480	LOS ANGELE	CA	2.7317	4.5101	11.8087	6	360	ANAHEIM-SA	CA	25	0.6858
								6000	OXNARD-SIM	CA	55	0.1237
								6780	RIVERSIDE-	CA	55	0.2846
								7320	SAN DIEGO	CA	113	0.5153
								7480	SANTA BARB	CA	88	0.0892
								680	BAKERSFIEL	CA	102	0.0798
											-----	-------
											438	1.7784

MARKET DISTRIBUTION MODEL (MDM)

FILE 592 - NASA T-10 TRUNKING NETWORK - 118 MILEAGE CROSSOVER - 117/165 RADIUS
SMSA'S BY MARKET VALUE - YEAR 2000
SUBORDINATES 117/165 MILES OR LESS

RANK	SMSA	PRINCIPAL		MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
3	1600	CHICAGO	IL	2.8375	4.4143	16.2230	14	2960	GARY-HAMMO	IN	25	0.1464
								3000*	GRAND RAPI	MI	125	0.1328
								3720*	KALAMAZOO-	MI	109	0.0662
								3800	KENOSHA	WI	50	0.0510
								5080	MILWAUKEE	WI	82	0.5160
								5320	MUSKEGON-N	MI	117	0.0336
								6120	PEORIA	IL	130	0.1227
								6600	RACINE	WI	59	0.0548
								3740	KANKAKEE	IL	54	0.0194
								3920	LAFAYETTE-	IN	108	0.0335
								6880	ROCKFORD	IL	80	0.0888
								7800	SOUTH BEND	IN	73	0.0664
								4720	MADISON	WI	122	0.1256
								1960	DAVENPORT-	IA-IL	154	0.1197
											-----	-------
											1288	1.5769
4	2160	DETROIT	MI	1.5842	3.6788	19.9018	16	80	AKRON	OH	118	0.1803
								440	ANN ARBOR	MI	33	0.1292
								780	BATTLE CRE	MI	110	0.0319
								1320	CANTON	OH	137	0.0889
								1680	CLEVELAND	OH	91	0.6411
								2640	FLINT	MI	58	0.1323
								3520	JACKSON	MI	70	0.0567
								4040	LANSING-EA	MI	82	0.1338
								4440	LORAIN-ELY	OH	75	0.0760
								8400	TOLEDO	OH-MI	54	0.2239
								9320	YOUNGSTOWN	OH	151	0.1080
								2360	ERIE	PA	153	0.0695
								4800	MANSFIELD	OH	112	0.0380
								2760*	FORT WAYNE	IN	138	0.0955
								800	BAY CITY	MI	98	0.0182
								6960	SAGINAW	MI	89	0.0713
											-----	-------
											1569	2.0945

MARKET DISTRIBUTION MODEL (MDM)

FILE 592 - NASA T-10 TRUNKING NETWORK - 118 MILEAGE CROSSOVER - 117/165 RADIUS
SMSA'S BY MARKET VALUE - YEAR 2000
SUBORDINATES 117/165 MILES OR LESS
9

RANK	SMSA	PRINCIPAL	MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
5	8840	WASHINGTON DC-MD-	1.3555	3.1207	23.0224	8	720	BALTIMORE	MD	36	0.7731
							5680	NEWPORT NE	VA	137	0.0932
							5720	NORFOLK-VI	VA-NC	148	0.2426
							6760	RICHMOND	VA	97	0.2682
							9160*	WILMINGTON	DE-NJ-	99	0.1207
							9280*	YORK	PA	76	0.0572
							3240*	HARRISBURG	PA	95	0.1393
							4000*	LANCASTER	PA	88	0.0707
										-----	--------
										776	1.7652
6	7360	SAN FRANCI CA	1.5342	3.0017	26.0242	9	6920	SACRAMENTO	CA	74	0.3252
							7120	SALINAS-SE	CA	89	0.0597
							7400	SAN JOSE	CA	43	0.6804
							7485	SANTA CRUZ	CA	61	0.0392
							7500	SANTA ROSA	CA	49	0.0644
							8120	STOCKTON	CA	63	0.0770
							8720	VALLEJO-FA	CA	24	0.0545
							5170	MODESTO	CA	78	0.0680
							2840	FRESNO	CA	162	0.0991
										-----	--------
										643	1.4676
7	1120	BOSTON MA	1.2117	2.3345	28.3587	15	1200	BROCKTON	MA	20	0.0550
							2480	FALL RIVER	MA-RI	46	0.0314
							2600	FITCHBURG-	MA	42	0.0199
							3280*	HARTFORD	CT	93	0.2126
							4160	LAWRENCE-H	MA-NH	25	0.0775
							4560	LOWELL	MA-NH	24	0.0651
							4760	MANCHESTER	NH	49	0.0496
							5350	NASHUA	NH	35	0.0504
							5520*	NEW LONDON	CT-RI	88	0.0236
							6320	PITTSFIELD	MA	113	0.0226
							6480*	PROVIDENCE	RI-MA	42	0.2291
							8000*	SPRINGFIEL	CT-MA	81	0.1003
							9240*	WORCESTER	MA	39	0.0896
							5400	NEW BEDFOR	MA	52	0.0436
							6400	PORTLAND	ME	99	0.0525
										-----	--------
										848	1.1228

MARKET DISTRIBUTION MODEL (MDM)

FILE 592 - NASA T-10 TRUNKING NETWORK - 118 MILEAGE CROSSOVER - 117/165 RADIUS
SMSA'S BY MARKET VALUE - YEAR 2000
SUBORDINATES 117/165 MILES OR LESS

RANK	SMSA	PRINCIPAL		MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
8	1640	CINCINNATI	OH-KY-	0.5237	2.2980	30.6568	12	400	ANDERSON	IN	93	0.0284
								1020	BLOOMINGTO	IN	109	0.0192
								1480	CHARLESTON	WV	164	0.0787
								1840*	COLUMBUS	OH	101	0.4242
								2000	DAYTON	OH	49	0.2899
								3200	HAMILTON-M	OH	21	0.0874
								3480*	INDIANAPOL	IN	100	0.3445
								4520	LOUISVILLE	KY-IN	90	0.3080
								5280	MUNCIE	IN	89	0.0270
								7960	SPRINGFIEL	OH	68	0.0364
								4280	LEXINGTON-	KY	73	0.0976
								4320	LIMA	OH	115	0.0331
											-----	--------
											1072	1.7743
9	520	ATLANTA	GA	0.8743	1.8363	32.4930	9	1000	BIRMINGHAM	AL	141	0.2942
								450	ANNISTON	AL	84	0.0228
								1560	CHATTANOOG	TN-GA	104	0.1455
								1800	COLUMBUS	GA-AL	95	0.0609
								2880	GADSDEN	AL	95	0.0221
								4690	MACON	GA	77	0.0736
								3840	KNOXVILLE	TN	155	0.1396
								3440	HUNTSVILLE	AL	143	0.1058
								5240	MONTGOMERY	AL	147	0.0974
											-----	--------
											1041	0.9619
10	3360	HOUSTON	TX	1.3738	1.8056	34.2986	4	640	AUSTIN	TX	147	0.2406
								2920	GALVESTON-	TX	47	0.0554
								840	BEAUMONT-P	TX	80	0.1099
								1260	BRYAN-COLL	TX	88	0.0258
											-----	--------
											362	0.4718

MARKET DISTRIBUTION MODEL (MDM)

FILE 593 - NASA T-20 TRUNKING NETWORK - 118 MILEAGE CROSSOVER - 117/165 RADIUS

SMSA'S BY MARKET VALUE - YEAR 2000

SUBORDINATES 117/165 MILES OR LESS

RANK	SMSA	PRINCIPAL		MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
1	5600	NEW YORK	NY-NJ	4.8094	9.7634	9.7634	24	160*	ALBANY-SCH	NY	134	0.2311
								240*	ALLENTOWN-	PA-NJ	78	0.1908
								1160*	BRIDGEPORT	CT	52	0.1433
								1170*	BRISTOL	CT	85	0.0186
								1930	DANBURY	CT	54	0.0426
								3640	JERSEY CIT	NJ	3	0.1506
								4410	LONG BRANC	NJ	31	0.1074
								4960*	MERIDEN	CT	83	0.0163
								5380	NASSAU-SUF	NY	20	0.5715
								5440*	NEW BRITAI	CT	90	0.0336
								5460	NEW BRUNSW	NJ	30	0.1653
								5480*	NEW HAVEN-	CT	68	0.1446
								5640	NEWARK	NJ	10	0.7307
								5760	NORWALK	CT	39	0.0527
								6040	PATERSON-C	NJ	16	0.1713
								6160*	PHILADELPH	PA-NJ	82	1.5160
								6460	POUGHKEEPS	NY	68	0.0429
								6680*	READING	PA	106	0.0959
								8040*	STAMFORD	CT	33	0.1224
								8480*	TRENTON	NJ	54	0.1332
								8760*	VINELAND-M	NJ	103	0.0469
								8880*	WATERBURY	CT	75	0.0642
								560	ATLANTIC C	NJ	99	0.0390
								5745	NORTHEAST	PA	102	0.1292
											1515	4.9540
2	4480	LOS ANGELE	CA	3.4716	5.7553	15.5186	6	360	ANAHEIM-SA	CA	25	0.8755
								6000	OXNARD-SIM	CA	55	0.1592
								6780	RIVERSIDE-	CA	55	0.3690
								7320	SAN DIEGO	CA	113	0.6601
								7480	SANTA BARB	CA	88	0.1149
								680	BAKERSFIEL	CA	1v2	0.1049
											438	2.2836

MARKET DISTRIBUTION MODEL (MDM)

FILE 593 - NASA T-20 TRUNKING NETWORK - 118 MILEAGE CROSSOVER - 117/165 RADIUS
SMSA'S BY MARKET VALUE - YEAR 2000
SUBORDINATES 117/165 MILES OR LESS

RANK	SMSA	PRINCIPAL		MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
3	1600	CHICAGO	IL	3.6536	5.7017	21.2204	14	2960	GARY-HAMMO	IN	25	0.1883
								3000*	GRAND RAPI	MI	125	0.1786
								3720*	KALAMAZOO-	MI	109	0.0893
								3800	KENOSHA	WI	50	0.0658
								5080	MILWAUKEE	WI	82	0.6693
								5320	MUSKEGON-N	MI	117	0.0458
								6120	PEORIA	IL	130	0.1566
								6600	RACINE	WI	59	0.0705
								3740	KANKAKEE	IL	54	0.0250
								3920	LAFAYETTE-	IN	108	0.0441
								6880	ROCKFORD	IL	80	0.1147
								7800	SOUTH BEND	IN	73	0.0908
								4720	MADISON	WI	122	0.1586
								1960	DAVENPORT-	IA-IL	154	0.1507
											1288	2.0481
4	2160	DETROIT	MI	2.0163	4.1221	25.3424	12	440	ANN ARBOR	MI	33	0.1667
								780	BATTLE CRE	MI	110	0.0436
								1680*	CLEVELAND	OH	91	0.7854
								2640	FLINT	MI	58	0.1716
								3520	JACKSON	MI	70	0.0766
								4040	LANSING-EA	MI	82	0.1807
								4440	LORAIN-ELY	OH	75	0.0958
								8400	TOLEDO	OH-MI	54	0.2912
								4800	MANSFIELD	OH	11[illegible]	0.0481
								2760*	FORT WAYNE	IN	138	0.1296
								800	BAY CITY	MI	98	0.0237
								6960	SAGINAW	MI	89	0.0929
											1010	2.1058
5	8840	WASHINGTON	DC-MD-	1.7351	4.0319	29.3744	8	720	BALTIMORE	MD	36	0.9924
								5680	NEWPORT NE	VA	137	0.1209
								5720	NORFOLK-VI	VA-NC	148	0.3100
								6760	RICHMOND	VA	97	0.3507
								9160*	WILMINGTON	DE-NJ-	99	0.1689
								9280*	YORK	PA	76	0.0765
								3240*	HARRISBURG	PA	95	0.1642
								4000*	LANCASTER	PA	88	0.0935
											776	2.2968

MARKET DISTRIBUTION MODEL (MDM)

FILE 593 - NASA T-20 TRUNKING NETWORK - 118 MILEAGE CROSSOVER - 117/165 RADIUS
SMSA'S BY MARKET VALUE - YEAR 2000
SUBORDINATES 117/165 MILES OR LESS

			MARKET -- VALUES							MARKET
RANK	SMSA	PRINCIPAL	PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	VALUE
6	7360	SAN FRANCI CA	1.9235	3.7976	33.1720	9	6920	SACRAMENTO CA	74	0.4153
							7120	SALINAS-SE CA	89	0.0771
							7400	SAN JOSE CA	43	0.8614
							7485	SANTA CRUZ CA	61	0.0499
							7500	SANTA ROSA CA	49	0.0819
							8120	STOCKTON CA	63	0.0970
							8720	VALLEJO-FA CA	24	0.0696
							5170	MODESTO CA	78	0.0866
							2840	FRESNO CA	162	0.1351
									-----	-------
									643	1.8741
7	1640	CINCINNATI OH-KY-	0.6715	2.9761	36.1481	12	400	ANDERSON IN	93	0.0392
							1020	BLOOMINGTO IN	109	0.0250
							1480	CHARLESTON WV	164	0.1015
							1840*	COLUMBUS OH	101	0.5371
							2000	DAYTON OH	49	0.3729
							3200	HAMILTON-M OH	21	0.1129
							3480*	INDIANAPOL IN	100	0.4657
							4520	LOUISVILLE KY-IN	90	0.3967
							5280	MUNCIE IN	89	0.0367
							7960	SPRINGFIEL OH	68	0.0479
							4280	LEXINGTON- KY	73	0.125[illegible]
							4320	LIMA OH	115	0.0437
									-----	-------
									1072	2.3046
8	1120	BOSTON MA	1.4980	2.9753	39.1234	15	1200	BROCKTON MA	20	0.0689
							2480	FALL RIVER MA-RI	46	0.0426
							2600	FITCHBURG- MA	42	0.0255
							3280*	HARTFORD CT	93	0.2889
							4160	LAWRENCE-H MA-NH	25	0.0959
							4560	LOWELL MA-NH	24	0.0806
							4760	MANCHESTER NH	49	0.0625
							5350	NASHUA NH	35	0.0618
							5520*	NEW LONDON CT-RI	88	0.0322
							6320	PITTSFIELD MA	113	0.0305
							6480*	PROVIDENCE RI-MA	42	0.3098
							8000*	SPRINGFIEL CT-MA	81	0.1361
							9240*	WORCESTER MA	39	0.1211
							5400	NEW BEDFOR MA	52	0.0554
							6400	PORTLAND ME	99	0.0657
									-----	-------
									848	1.4773

MARKET DISTRIBUTION MODEL (MDM)

FILE 593 - NASA T-20 TRUNKING NETWORK - 118 MILEAGE CROSSOVER - 117/165 RADIUS
SMSA'S BY MARKET VALUE - YEAR 2000
SUBORDINATES 117/165 MILES OR LESS

79

RANK	SMSA	PRINCIPAL		MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
9	520	ATLANTA	GA	1.1159	2.3483	41.4716	9	1000	BIRMINGHAM	AL	141	0.3774
								450	ANNISTON	AL	84	0.0289
								1560	CHATTANOOG	TN-GA	104	0.1848
								1800	COLUMBUS	GA-AL	95	0.0777
								2880	GADSDEN	AL	95	0.0282
								4680	MACON	GA	77	0.0938
								3840	KNOXVILLE	TN	155	0.1824
								3440	HUNTSVILLE	AL	143	0.1351
								5240	MONTGOMERY	AL	147	0.1240
											1041	1.2323
10	3360	HOUSTON	TX	1.7530	2.2945	43.7662	4	640	AUSTIN	TX	147	0.2988
								2920	GALVESTON-	TX	47	0.0704
								840	BEAUMONT-P	TX	80	0.1403
								1260	BRYAN-COLL	TX	88	0.0320
											362	0.5415
11	6280	PITTSBURGH	PA	0.9507	1.7056	45.4718	8	80*	AKRON	OH	91	0.2314
								1320*	CANTON	OH	77	0.1304
								8080	STEUBENVIL	OH-WV	33	0.0372
								9000	WHEELING	WV-OH	46	0.0397
								9320*	YOUNGSTOWN	OH	57	0.1797
								280	ALTOONA	PA	85	0.0367
								3680	JOHNSTOWN	PA	58	0.0613
								6020	PARKERSBUR	WV-OH	116	0.0386
											563	0.7550
12	1920	DALLAS-FOR	TX	1.4957	1.6292	47.1010	3	7640	SHERMAN-DE	TX	60	0.0242
								8640	TYLER	TX	92	0.0472
								8800	WACO	TX	87	0.0622
											239	0.1336
13	5000	MIAMI	FL	0.8909	1.6175	48.7185	2	2680	FORT LAUDE	FL	24	0.4707
								8960	WEST PALM	FL	64	0.2559
											88	0.7266

MARKET DISTRIBUTION MODEL (MDM)

FILE 593 - NASA T-20 TRUNKING NETWORK - 118 MILEAGE CROSSOVER - 117/165 RADIUS
SMSA'S BY MARKET VALUE - YEAR 2000
SUBORDINATES 117/165 MILES OR LESS

RANK	SMSA	PRINCIPAL	MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
14	8280	TAMPA-ST P FL	0.6817	1.4174	50.1359	6	1140	BRADENTON	FL	33	0.0475
							3980	LAKELAND-W	FL	46	0.0979
							4900	MELBOURNE-	FL	111	0.1000
							5960	ORLANDO	FL	79	0.3283
							7510	SARASOTA	FL	43	0.0829
							2700	FORT MYERS	FL	97	0.0790
										409	0.7357
15	5120	MINNEAPOLI MN-WI	1.2153	1.3406	51.4765	3	2290	EAU CLAIRE	WI	88	0.0351
							6820	ROCHESTER	MN	77	0.0471
							6980	ST CLOUD	MN	60	0.0431
										225	0.1253
16	7040	ST LOUIS MO-IL	1.1013	1.2885	52.7651	2	2040	DECATUR	IL	107	0.0633
							7880	SPRINGFIEL	IL	86	0.1239
										193	0.1872
17	2080	DENVER-BOU CO	0.9358	1.2078	53.9729	4	3060	GREELEY	CO	50	0.0331
							6560	PUEBLO	CO	104	0.0450
							1720	COLORADO S	CO	63	0.1294
							2670	FORT COLLI	CO	58	0.0645
										275	0.2720
18	1280	BUFFALO NY	0.4891	0.9925	54.9653	2	6840	ROCHESTER	NY	66	0.4029
							2360*	ERIE	PA	81	0.1004
										147	0.5033
19	3760	KANSAS CIT MO-KS	0.6908	0.8276	55.7929	3	4150	LAWRENCE	KS	37	0.0157
							7000	ST JOSEPH	MO	48	0.0362
							8440	TOPEKA	KS	59	0.0849
										144	0.1368

MARKET DISTRIBUTION MODEL (MDM)

FILE 593 - NASA T-20 TRUNKING NETWORK - 118 MILEAGE CROSSOVER - 117/165 RADIUS
SMSA'S BY MARKET VALUE - YEAR 2000
SUBORDINATES 117/165 MILES OR LESS

			MARKET -- VALUES								
RANK	SMSA	PRINCIPAL	PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
20	7600	SEATTLE-EV WA	0.6129	0.7867	56.5796	2	8200	TACOMA	WA	26	0.1388
							9260	YAKIMA	WA	111	0.0349
										-----	-------
										137	0.1737

[illegible]

FILE 593 [illegible] - 118 MILEAGE CROSSOVER - 117/165 RADIUS

[illegible] MARKET VALUE - YEAR [illegible]

SUBORDINATES 117/165 MILES OR LESS

RANK	SMSA	PRINCIPAL		MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
1	5600	NEW YORK	NY-NJ	4.9936	10.0851	10.0851	24	160*	ALBANY-SCH	NY	134	0.2416
								240*	ALLENTOWN-	PA-NJ	78	0.1919
								1160*	BRIDGEPORT	CT	52	0.1470
								1170*	BRISTOL	CT	85	0.0198
								1930	DANBURY	CT	54	0.0437
								3640	JERSEY CIT	NJ	3	0.1588
								4410	LONG BRANC	NJ	31	0.1086
								4960*	MERIDEN	CT	83	0.0172
								5380	NASSAU-SUF	NY	20	0.5955
								5440*	NEW BRITAI	CT	90	0.0358
								5460	NEW BRUNSW	NJ	30	0.1685
								5480*	NEW HAVEN-	CT	68	0.1507
								5640	NEWARK	NJ	10	0.7535
								5760	NORWALK	CT	39	0.0540
								6040	PATERSON-C	NJ	16	0.1774
								6160*	PHILADELPH	PA-NJ	82	1.5545
								6460	POUGHKEEPS	NY	68	0.0441
								6680*	READING	PA	106	0.0959
								8040*	STAMFORD	CT	33	0.1248
								8480*	TRENTON	NJ	54	0.1318
								8760*	VINELAND-M	NJ	103	0.0386
								8880*	WATERBURY	CT	75	0.0672
								560	ATLANTIC C	NJ	99	0.0382
								5745	NORTHEAST	PA	102	0.1324
											1515	5.0915
2	1600	CHICAGO	IL	3.7775	5.8473	15.9324	14	2960	GARY-HAMMO	IN	25	0.1910
								3000*	GRAND RAPI	MI	125	0.1822
								3720*	KALAMAZOO-	MI	109	0.0922
								3800	KENOSHA	WI	50	0.0630
								5080	MILWAUKEE	WI	82	0.6743
								5320	MUSKEGON-N	MI	117	0.0479
								6120	PEORIA	IL	130	0.1552
								6600	RACINE	WI	59	0.0732
								3740	KANKAKEE	IL	54	0.0259
								3920	LAFAYETTE-	IN	108	0.0455
								6880	ROCKFORD	IL	80	0.1185
								7800	SOUTH BEND	IN	73	0.0742
								4720	MADISON	WI	122	0.1553
								1960	DAVENPORT-	IA-IL	154	0.1515
											1288	2.0698

MARKET DISTRIBUTION MODEL (MDM)

FILE 573 - NASA I-20 TRUNKING NETWORK - 118 MILEAGE CROSSOVER - 117/165 RADIUS
SORTED BY MARKET VALUE - YEAR 1990
SUBORDINATES 117/165 MILES OR LESS

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
3	4480	LOS ANGELE CA	3.5760	5.8045	21.7369	6	360	ANAHEIM-SA CA	25	0.8536
							6000	OXNARD-SIM CA	55	0.1564
							6780	RIVERSIDE- CA	55	0.3444
							7320	SAN DIEGO CA	113	0.6597
							7480	SANTA BARB CA	88	0.1106
							680	BAKERSFIEL CA	102	0.1040
									438	2.2286
4	2160	DETROIT MI	2.0901	4.2525	25.9894	12	440	ANN ARBOR MI	33	0.1651
							780	BATTLE CRE MI	110	0.0457
							1680*	CLEVELAND OH	91	0.8331
							2640	FLINT MI	58	0.1718
							3520	JACKSON MI	70	0.0780
							4040	LANSING-EA MI	82	0.1769
							4440	LORAIN-ELY OH	75	0.0985
							8400	TOLEDO OH-MI	54	0.2938
							4800	MANSFIELD OH	112	0.0505
							2760*	FORT WAYNE IN	138	0.1352
							800	BAY CITY MI	98	0.0250
							6960	SAGINAW MI	89	0.0909
									1010	2.1624
5	8840	WASHINGTON DC-MD-	1.7505	4.0545	30.0439	8	720	BALTIMORE MD	36	1.0023
							5680	NEWPORT NE VA	137	0.1235
							5720	NORFOLK-VI VA-NC	148	0.3088
							6760	RICHMOND VA	97	0.3492
							9160*	WILMINGTON DE-NJ-	99	0.1724
							9280*	YORK PA	76	0.0764
							3240*	HARRISBURG PA	95	0.1795
							4000*	LANCASTER PA	88	0.0921
									776	2.3041

MARKET DISTRIBUTION MODEL (MDM)

FILE 593 NASA I-20 [illegible] NETWORK 118 MILEAGE CROSSOVER - 117/165 RADIUS

[illegible] BY MARKET VALUE - YEAR 1990

SUBORDINATES 117/165 MILES OR LESS

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
6	7360	SAN FRANCI CA	1.9174	3.7392	33.7831	9	6920	SACRAMENTO CA	74	0.4084
							7120	SALINAS-SE CA	89	0.0781
							7400	SAN JOSE CA	43	0.8326
							7485	SANTA CRUZ CA	61	0.0458
							7500	SANTA ROSA CA	49	0.0810
							8120	STOCKTON CA	63	0.0993
							8720	VALLEJO-FA CA	24	0.0680
							5170	MODESTO CA	78	0.0777
							2840	FRESNO CA	162	0.1309
									643	1.8217
7	1120	BOSTON MA	1.5642	3.0619	36.8450	15	1200	BROCKTON MA	20	0.0645
							2480	FALL RIVER MA-RI	46	0.0434
							2600	FITCHBURG- MA	42	0.0262
							3280*	HARTFORD CT	93	0.3012
							4160	LAWRENCE-H MA-NH	25	0.0977
							4560	LOWELL MA-NH	24	0.0818
							4760	MANCHESTER NH	49	0.0607
							5350	NASHUA NH	35	0.0601
							5520*	NEW LONDON CT-RI	88	0.0350
							6320	PITTSFIELD MA	113	0.0314
							6480*	PROVIDENCE RI-MA	42	0.3080
							8000*	SPRINGFIEL CT-MA	81	0.1409
							9240*	WORCESTER MA	39	0.1230
							5400	NEW BEDFOR MA	52	0.0568
							6400	PORTLAND ME	99	0.0668
									848	1.4977
8	1640	CINCINNATI OH-KY-	0.6858	3.0487	39.8937	12	400	ANDERSON IN	93	0.0401
							1020	BLOOMINGTO IN	109	0.0253
							1480	CHARLESTON WV	164	0.1012
							1840*	COLUMBUS OH	101	0.5473
							2000	DAYTON OH	49	0.3889
							3200	HAMILTON-M OH	21	0.1130
							3480*	INDIANAPOL IN	100	0.4815
							4520	LOUISVILLE KY-IN	90	0.4065
							5280	MUNCIE IN	89	0.0385
							7960	SPRINGFIEL OH	68	0.0519
							4280	LEXINGTON- KY	73	0.1225
							4320	LIMA OH	115	0.0462
									1072	2.3629

MARKET DISTRIBUTION MODEL (MDM)

FILE 593 - NASA I-20 TRUNKING NETWORK - 118 MILEAGE CROSSOVER - 117/165 RADIUS
MERITS BY MARKET VALUE - YEAR 1990
SUBORDINATES 117/165 MILES OR LESS

RANK	SMSA	PRINCIPAL		MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
9	520	ATLANTA	GA	1.0698	2.3065	42.2001	9	1000	BIRMINGHAM	AL	141	0.3682
								450	ANNISTON	AL	84	0.0297
								1560	CHATTANOOG	TN-GA	104	0.1841
								1800	COLUMBUS	GA-AL	95	0.0807
								2880	GADSDEN	AL	95	0.0295
								4680	MACON	GA	77	0.0928
								3840	KNOXVILLE	TN	155	0.1768
								3440	HUNTSVILLE	AL	143	0.1378
								5240	MONTGOMERY	AL	147	0.1171
											1041	1.2167
10	3360	HOUSTON	TX	1.6162	2.1192	44.3194	4	640	AUSTIN	TX	147	0.2718
								2920	GALVESTON-	TX	47	0.0688
								840	BEAUMONT-P	TX	80	0.1332
								1260	BRYAN-COLL	TX	88	0.0292
											362	0.5030
11	6280	PITTSBURGH	PA	1.0029	1.7901	46.1095	8	80*	AKRON	OH	91	0.2468
								1320*	CANTON	OH	77	0.1362
								8080	STEUBENVIL	OH-WV	33	0.0404
								9000	WHEELING	WV-OH	46	0.0419
								9320*	YOUNGSTOWN	OH	57	0.1850
								280	ALTOONA	PA	85	0.0384
								3680	JOHNSTOWN	PA	58	0.0587
								6020	PARKERSBUR	WV-OH	116	0.0398
											563	0.7871
12	1920	DALLAS-FOR	TX	1.4818	1.6132	47.7227	3	7640	SHERMAN-DE	TX	60	0.0236
								8640	TYLER	TX	92	0.0454
								8800	WACO	TX	87	0.0624
											239	0.1314
13	5000	MIAMI	FL	0.8339	1.4957	49.2184	2	2680	FORT LAUDE	FL	24	0.4423
								8960	WEST PALM	FL	64	0.2195
											88	0.6617

MARKET DISTRIBUTION MODEL (MDM)

FILE 593 - SMSA I-20 TRUCKING NETWORK - 118 MILEAGE CROSSOVER - 117/165 RADIUS

SMSA'S BY MARKET VALUE - YEAR 1990

SUBORDINATES 117/165 MILES OR LESS

RANK	SMSA	PRINCIPAL	MARKET - VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
14	5120	MINNEAPOLI MN-WI	1.2502	1.3745	50.5929	3	2290	EAU CLAIRE WI	88	0.0362
							6820	ROCHESTER MN	77	0.0470
							6980	ST CLOUD MN	60	0.0411
									225	0.1243
15	7040	ST LOUIS MO-IL	1.1084	1.2968	51.8897	2	2040	DECATUR IL	107	0.0635
							7880	SPRINGFIEL IL	86	0.1249
									193	0.1884
16	8280	TAMPA-ST P FL	0.6301	1.2947	53.1844	6	1140	BRADENTON FL	33	0.0384
							3980	LAKELAND-W FL	46	0.0819
							4900	MELBOURNE- FL	111	0.1028
							5960	ORLANDO FL	79	0.2986
							7510	SARASOTA FL	43	0.0817
							2700	FORT MYERS FL	97	0.0612
									409	0.6646
17	2080	DENVER-BOU CO	0.9025	1.1692	54.3536	4	3060	GREELEY CO	50	0.0295
							6560	PUEBLO CO	104	0.0454
							1720	COLORADO S CO	63	0.1339
							2670	FORT COLLI CO	58	0.0579
									275	0.2667
18	1280	BUFFALO NY	0.5257	1.0499	55.4034	2	6840	ROCHESTER NY	66	0.4215
							2360*	ERIE PA	81	0.1027
									147	0.5241
19	3760	KANSAS CIT MO KS	0.7220	0.8639	56.2674	3	4150	LAWRENCE KS	37	0.0167
							7000	ST JOSEPH MO	48	0.0368
							8440	TOPEKA KS	59	0.0884
									144	0.1419

MARKET DISTRIBUTION MODEL (MDM)

FILE 593 - NASA 3 20 TRUNKING NETWORK - 118 MILEAGE CROSSOVER - 117/165 RADIUS
SMSA'S BY MARKET VALUE - YEAR 1990
SUBORDINATES 117/165 MILES OR LESS

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
20	7600	SEATTLE-EV WA	0.6341	0.8138	57.0812	2	8200	TACOMA	WA	26	0.1450
							9260	YAKIMA	WA	111	0.0346
										137	0.1797

MARKET DISTRIBUTION MODEL (MDM)

FILE 604 - NASA 16 COMMON NETWORK MODEL W/397 CROSSOVER AND 50 MILE RADIUS
SMSA'S BY SATELLITE ACCESSABLE MARKET VALUE - YEAR 2000
Pricing = Ku-Band
Minimum Network Size

RANK	SMSA	PRINCIPAL		MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
1	5600	NEW YORK	NY-NJ	4.3097	5.8718	5.8718	8	3640	JERSEY CIT	NJ	3	0.1178
								4410	LONG BRANC	NJ	31	0.0698
								5380	NASSAU-SUF	NY	20	0.3936
								5460	NEW BRUNSW	NJ	30	0.1498
								5640	NEWARK	NJ	10	0.5520
								5760	NORWALK	CT	39	0.0466
								6040	PATERSON-C	NJ	16	0.1164
								8040	STAMFORD	CT	33	0.1161
											182	1.5622
2	4480	LOS ANGELE	CA	3.0633	3.7222	9.5940	1	360	ANAHEIM-SA	CA	25	0.6589
											25	0.6589
3	1600	CHICAGO	IL	3.3896	3.5675	13.1615	2	2960	GARY-HAMMO	IN	25	0.1279
								3800	KENOSHA	WI	50	0.0499
											75	0.1779
4	7360	SAN FRANCI	CA	1.5612	2.4017	15.5632	3	7400	SAN JOSE	CA	43	0.7567
								7500	SANTA ROSA	CA	49	0.0458
								8720	VALLEJO-FA	CA	24	0.0381
											116	0.8405
5	3360	HOUSTON	TX	1.6679	1.7438	17.3971	1	2920	GALVESTON-		47	0.0759
											47	0.0759
6	2160	DETROIT	MI	1.5301	1.6974	19.0045	1	440	ANN ARBOR	MI	33	0.1673
											33	0.1673

MARKET DISTRIBUTION MODEL (MDM)

FILE 604 - NASA 16 COMMON NETWORK MODEL W/397 CROSSOVER AND 50 MILE RADIUS
SMSA'S BY SATELLITE ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
7	6160	PHILADELPH PA-NJ	1.2023	1.6849	20.6893	5	240	ALLENTOWN- PA-NJ	49	0.1474
							6680	READING PA	49	0.0670
							8480	TRENTON NJ	29	0.1026
							8760	VINELAND-M NJ	33	0.0281
							9160	WILMINGTON DE-NJ-	26	0.1375
									186	0.4825
8	1120	BOSTON MA	0.9211	1.4886	22.1780	9	1200	BROCKTON MA	20	0.0272
							2480	FALL RIVER MA-RI	46	0.0239
							2600	FITCHBURG- MA	42	0.0148
							4160	LAWRENCE-H MA-NH	25	0.0573
							4560	LOWELL MA-NH	24	0.0451
							4760	MANCHESTER NH	49	0.0330
							5350	NASHUA NH	35	0.0368
							6480	PROVIDENCE RI-MA	42	0.2427
							9240	WORCESTER MA	39	0.0867
									322	0.5676
9	1920	DALLAS-FOR TX	1.4087	1.4087	23.5867	0				
									0	0.0000
10	8840	WASHINGTON DC-MD-	0.8674	1.3878	24.9745	1	720	BALTIMORE MD	36	0.5204
									36	0.5204
11	520	ATLANTA GA	1.1181	1.1181	26.0926	0				
									0	0.0000
12	5000	MIAMI FL	0.7778	1.0998	27.1924	1	2680	FORT LAUDE FL	24	0.3220
									24	0.3220
13	5120	MINNEAPOLI MN-WI	1.0797	1.0797	28.2721	0				
									0	0.0000

MARKET DISTRIBUTION MODEL (MDM)

FILE 604 - NASA 16 COMMON NETWORK MODEL W/397 CROSSOVER AND 50 MILE RADIUS
SMSA'S BY SATELLITE ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
14	7040	ST LOUIS MO-IL	0.9649	0.9649	29.2370	0				
									0	0.0000
15	1640	CINCINNATI OH-KY-	0.4756	0.8564	30.0934	2	2000	DAYTON OH	49	0.2989
							3200	HAMILTON-M OH	21	0.0819
									70	0.3808
16	1680	CLEVELAND OH	0.6015	0.7963	30.8897	2	80	AKRON OH	31	0.1149
							4440	LORAIN-ELY OH	26	0.0799
									57	0.1948

MARKET DISTRIBUTION MODEL (MDM)

FILE 605 NASA 16 COMMON NETWORK MODEL W/236 MILEAGE CROSSOVER AND 50 MILE RADIUS
SMSA'S FT SATELLITE ACCESSABLE MARKET VALUE - YEAR 2000

Pricing = 20% below Ku-Band
Minimum Network Size

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
1	5600	NEW YORK NY-NJ	3.7383	5.1294	5.1294	8	3640	JERSEY CIT NJ	3	0.1019
							4410	LONG BRANC NJ	31	0.0598
							5380	NASSAU-SUF NY	20	0.3373
							5460	NEW BRUNSW NJ	30	0.1361
							5640	NEWARK NJ	10	0.5009
							5760	NORWALK CT	39	0.0427
							6040	PATERSON-C NJ	16	0.1058
							8040	STAMFORD CT	33	0.1065
									182	1.3911
2	4480	LOS ANGELE CA	3.2619	3.9557	9.0851	1	360	ANAHEIM-SA CA	25	0.6938
									25	0.6938
3	1600	CHICAGO IL	3.6317	3.8166	12.9017	2	2960	GARY-HAMMO IN	25	0.1300
							3800	KENOSHA WI	50	0.0550
									75	0.1850
4	7360	SAN FRANCI CA	1.9500	2.8239	15.7257	3	7400	SAN JOSE CA	43	0.7895
							7500	SANTA ROSA CA	49	0.0452
							8720	VALLEJO-FA CA	24	0.0391
									116	0.8739
5	2160	DETROIT MI	1.6491	1.7925	17.5181	1	440	ANN ARBOR MI	33	0.1433
									33	0.1433
6	6160	PHILADELPH PA-NJ	1.2314	1.7370	19.2552	5	240	ALLENTOWN- PA-NJ	49	0.1515
							6680	READING PA	49	0.0809
							8480	TRENTON NJ	29	0.1034
							8760	VINELAND-M NJ	33	0.0287
							9160	WILMINGTON DE-NJ-	26	0.1410
									186	0.5056

MARKET DISTRIBUTION MODEL (MDM)

FILE 605 -- NASA 16 COMMON NETWORK MODEL W/236 MILEAGE CROSSOVER AND 50 MILE RADIUS
SMSA'S BY SATELLITE ACCESSABLE MARKET VALUE -- YEAR 2000

				MARKET -- VALUES							
RANK	SMSA	PRINCIPAL		PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
7	1120	BOSTON	MA	1.0341	1.6268	20.8819	9	1200	BROCKTON MA	20	0.0302
								2480	FALL RIVER MA-RI	46	0.0268
								2600	FITCHBURG- MA	42	0.0159
								4160	LAWRENCE-H MA-NH	25	0.0586
								4560	LOWELL MA-NH	24	0.0492
								4760	MANCHESTER NH	49	0.0342
								5350	NASHUA NH	35	0.0394
								6480	PROVIDENCE RI-MA	42	0.2430
								9240	WORCESTER MA	39	0.0953
										322	0.5927
8	8840	WASHINGTON	DC-MD-	1.0183	1.5582	22.4402	1	720	BALTIMORE MD	36	0.5399
										36	0.5399
9	3360	HOUSTON	TX	1.4294	1.4979	23.9380	1	2920	GALVESTON- TX	47	0.0684
										47	0.0684
10	1920	DALLAS-FOR	TX	1.2107	1.2107	25.1487	0				
										0	0.0000
11	1680	CLEVELAND	OH	0.7954	1.1090	26.2577	2	80	AKRON OH	31	0.2151
								4440	LORAIN-ELY OH	26	0.0985
										57	0.3136
12	5120	MINNEAPOLI	MN-WI	1.0762	1.0762	27.3339	0				
										0	0.0000
13	7040	ST LOUIS	MO-IL	1.0009	1.0009	28.3348	0				
										0	0.0000
14	520	ATLANTA	GA	0.9775	0.9775	29.3123	0				
										0	0.0000

ORIGINAL PAGE IS
OF POOR QUALITY

MARKET DISTRIBUTION MODEL (MDM)

FILE 605 - NASA 16 COMMON NETWORK MODEL W/236 MILEAGE CROSSOVER AND 50 MILE RADIUS
SMSA'S BY SATELLITE ACCESSABLE MARKET VALUE - YEAR 2000

			M A R K E T -- V A L U E S							MARKET
RANK	SMSA	PRINCIPAL	PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	VALUE
15	5000	MIAMI FL	0.6666	0.9426	30.2549	1	2680	FORT LAUDE FL	24	0.2760
									-----	-------
									24	0.2760
16	1640	CINCINNATI OH-KY-	0.5171	0.8817	31.1366	2	2000	DAYTON OH	49	0.2883
							3200	HAMILTON-M OH	21	0.0764
									-----	-------
									70	0.3646

MARKET DISTRIBUTION MODEL (MDM)

FILE 606 - NASA 16 COMMON NETWORK MODEL W/97 MILEAGE CROSSOVER AND 50 MILE RADIUS
SMSA'S BY SATELLITE ACCESSABLE MARKET VALUE - YEAR 2000

Pricing = 40% below Ku-Band
Minimum Network Size

RANK	SMSA	PRINCIPAL		MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
1	5600	NEW YORK	NY-NJ	4.2561	5.8178	5.8178	8	3640	JERSEY CIT	NJ	3	0.1167
								4410	LONG BRANC	NJ	31	0.0666
								5380	NASSAU-SUF	NY	20	0.3786
								5460	NEW BRUNSW	NJ	30	0.1500
								5640	NEWARK	NJ	10	0.5782
								5760	NORWALK	CT	39	0.0427
								6040	PATERSON-C	NJ	16	0.1231
								8040	STAMFORD	CT	33	0.1058
											182	1.5616
2	4480	LOS ANGELE	CA	2.9043	3.5220	9.3398	1	360	ANAHEIM-SA	CA	25	0.6177
											25	0.6177
3	1600	CHICAGO	IL	3.3019	3.4933	12.8331	2	2960	GARY-HAMMO	IN	25	0.1421
								3800	KENOSHA	WI	50	0.0493
											75	0.1914
4	7360	SAN FRANCI	CA	1.7363	2.5144	15.3475	3	7400	SAN JOSE	CA	43	0.7030
								7500	SANTA ROSA	CA	49	0.0403
								8720	VALLEJO-FA	CA	24	0.0348
											116	0.7781
5	1120	BOSTON	MA	1.3456	2.1286	17.4760	9	1200	BROCKTON	MA	20	0.0362
								2480	FALL RIVER	MA-RI	46	0.0321
								2600	FITCHBURG-	MA	42	0.0196
								4160	LAWRENCE-H	MA-NH	25	0.0811
								4560	LOWELL	MA-NH	24	0.0612
								4760	MANCHESTER	NH	49	0.0422
								5350	NASHUA	NH	35	0.0570
								6480	PROVIDENCE	RI-MA	42	0.3311
								9240	WORCESTER	MA	39	0.1225
											322	0.7829
6	8840	WASHINGTON	DC-MD-	1.3935	2.1007	19.5767	1	720	BALTIMORE	MD	36	0.7072
											36	0.7072

MARKET DISTRIBUTION MODEL (MDM)

FILE 606 - NASA 16 COMMON NETWORK MODEL W/97 MILEAGE CROSSOVER AND 50 MILE RADIUS
SMSA'S BY SATELLITE ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL		MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
7	2160	DETROIT	MI	1.5487	1.6998	21.2765	1	440	ANN ARBOR	MI	33	0.1511
											33	0.1511
8	6160	PHILADELPH	PA-NJ	1.2228	1.6894	22.9659	5	240	ALLENTOWN-	PA-NJ	49	0.1391
								6680	READING	PA	49	0.0721
								8480	TRENTON	NJ	29	0.1044
								8760	VINELAND-M	NJ	33	0.0256
								9160	WILMINGTON	DE-NJ-	26	0.1255
											186	0.4666
9	3360	HOUSTON	TX	1.3474	1.4083	24.3742	1	2920	GALVESTON-	TX	47	0.0609
											47	0.0609
10	1920	DALLAS-FOR	TX	1.1526	1.1526	25.5268	0					
											0	0.0000
11	1680	CLEVELAND	OH	0.7402	1.0261	26.5529	2	80	AKRON	OH	31	0.1959
								4440	LORAIN-ELY	OH	26	0.0899
											57	0.2859
12	5120	MINNEAPOLI	MN-WI	0.9583	0.9583	27.5111	0					
											0	0.0000
13	1640	CINCINNATI	OH-KY-	0.5244	0.9425	28.4537	2	2000	DAYTON	OH	49	0.3310
								3200	HAMILTON-M	OH	21	0.0872
											70	0.4182
14	7040	ST LOUIS	MO-IL	0.8912	0.6912	29.3448	0					
											0	0.0000

MARKET DISTRIBUTION MODEL (MDM)

FILE 606 - NASA 16 COMMON NETWORK MODEL W/97 MILEAGE CROSSOVER AND 50 MILE RADIUS
SMSA'S BY SATELLITE ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL		MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
15	520	ATLANTA	GA	0.8703	0.8703	30.2152	0			------	--------
										0	0.0000
16	5000	MIAMI	FL	0.5935	0.8393	31.0544	1	2680	FORT LAUDE FL	24	0.2457
										------	--------
										24	0.2457

MARKET DISTRIBUTION MODEL (MDM)

FILE 615 - NASA 28 DOMAIN NETWORK MODEL FOR YEAR 2000 W/397 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

Most Efficient Network
Price = Ku-Band

RANK	SMSA	PRINCIPAL		MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
1	5600	NEW YORK	NY-NJ	3.8757	5.3248	5.3248	8	3640	JERSEY CIT	NJ	3	0.1081
								4410	LONG BRANC	NJ	31	0.0661
								5380	NASSAU-SUF	NY	20	0.3631
								5460	NEW BRUNSW	NJ	30	0.1415
								5640	NEWARK	NJ	10	0.5143
								5760	NORWALK	CT	39	0.0413
								6040	PATERSON-C	NJ	16	0.1099
								8040	STAMFORD	CT	33	0.1047
											182	1.4491
2	4480	LOS ANGELE	CA	2.7401	3.5280	8.8528	2	360	ANAHEIM-SA	CA	25	0.5860
								6780	RIVERSIDE-	CA	55	0.2019
											80	0.7879
3	1600	CHICAGO	IL	2.9974	3.1108	11.9636	1	2960	GARY-HAMMO	IN	25	0.1133
											25	0.1133
4	7360	SAN FRANCI	CA	1.5774	2.3622	14.3258	3	7400	SAN JOSE	CA	43	0.7056
								7500	SANTA ROSA	CA	49	0.0429
								8720	VALLEJO-FA	CA	24	0.0365
											116	0.7849
5	2160	DETROIT	MI	1.3297	1.6584	15.9843	2	440	ANN ARBOR	MI	33	0.1435
								8400	TOLEDO	OH-MI	54	0.1852
											87	0.3287
6	6160	PHILADELPH	PA-NJ	1.1041	1.5505	17.5347	5	240	ALLENTOWN-	PA-NJ	49	0.1364
								6680	READING	PA	49	0.0630
								8480	TRENTON	NJ	29	0.0954
								8760	VINELAND-M	NJ	33	0.0254
								9160	WILMINGTON	DE-NJ-	26	0.1262
											186	0.4463

MARKET DISTRIBUTION MODEL (MDM)

FILE 615 - NASA 28 COMMON NETWORK MODEL FOR YEAR 2000 W/397 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S BY MARKET VALUE YEAR 2000

RANK	SMSA	PRINCIPAL		MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
7	3360	HOUSTON	TX	1.4642	1.5315	19.0663	1	2920	GALVESTON-	TX	47	0.0674
											47	0.0674
8	1120	BOSTON	MA	0.8923	1.4459	20.5122	9	1200	BROCKTON	MA	20	0.0268
								2480	FALL RIVER	MA-RI	46	0.0238
								2600	FITCHBURG-	MA	42	0.0142
								4160	LAWRENCE-H	MA-NH	25	0.0554
								4560	LOWELL	MA-NH	24	0.0425
								4760	MANCHESTER	NH	49	0.0328
								5350	NASHUA	NH	35	0.0346
								6480	PROVIDENCE	RI-MA	42	0.2382
								9240	WORCESTER	MA	39	0.0854
											322	0.5536
9	8840	WASHINGTON	DC-MD-	0.8176	1.2945	21.8067	1	720	BALTIMORE	MD	36	0.4767
											36	0.4767
10	1920	DALLAS-FOR	TX	1.2706	1.2706	23.0772	0					
											0	0.0000
11	5000	MIAMI	FL	0.6631	1.0707	24.1479	2	2680	FORT LAUDE	FL	24	0.2765
								8960	WEST PALM	FL	64	0.1311
											88	0.4076
12	520	ATLANTA	GA	0.9815	0.9815	25.1294	0					
											0	0.0000
13	5120	MINNEAPOLI	MN-WI	0.9793	0.9793	26.1087	0					
											0	0.0000

MARKET DISTRIBUTION MODEL (MDM)

FILE 615 — NASA 28 COMMON NETWORK MODEL FOR YEAR 2000 W/397 CROSSOVER MI
SMSA'S BY ACCESSABLE MARKET VALUE — YEAR 2000

RANK	SMSA	PRINCIPAL		MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	
14	1680	CLEVELAND	OH	0.5341	0.8558	26.9644	4	80	AKRON	OH	31	0.1103
								1320	CANTON	OH	51	0.0639
								4440	LORAIN-ELY	OH	26	0.0711
								9320	YOUNGSTOWN	OH	61	0.0763
											169	0.3216
15	7040	ST LOUIS	MO-IL	0.8421	0.8421	27.8066	0					
											0	0.0000
16	2080	DENVER-BOU	CO	0.7578	0.7786	28.5851	1	3060	GREELEY	CO	50	0.0208
											50	0.0208
17	1640	CINCINNATI	OH-KY-	0.4048	0.7380	29.3232	2	2000	DAYTON	OH	49	0.2616
								3200	HAMILTON-M	OH	21	0.0716
											70	0.3332
18	3280	HARTFORD	CT	0.2426	0.6894	30.0126	9	1160	BRIDGEPORT	CT	49	0.0956
								1170	BRISTOL	CT	16	0.0121
								1930	DANBURY	CT	48	0.0302
								4960	MERIDEN	CT	18	0.0080
								5440	NEW BRITAI	CT	9	0.0256
								5480	NEW HAVEN-	CT	35	0.1001
								5520	NEW LONDON	CT-RI	42	0.0227
								8000	SPRINGFIEL	CT-MA	24	0.0996
								8880	WATERBURY	CT	25	0.0528
											266	0.4468
19	7600	SEATTLE-EV	WA	0.5759	0.6752	30.6878	1	8200	TACOMA	WA	26	0.0994
											26	0.0994
20	3760	KANSAS CIT	MO-KS	0.6348	0.6700	31.3579	2	4150	LAWRENCE	KS	37	0.0098
								7000	ST JOSEPH	MO	48	0.0255
											85	0.0352

rff. network = nu.band

MARKET DISTRIBUTION MODEL (MDM)

FILE 615 OASA 23 COMMON NETWORK MODEL FOR YEAR 2000 W/397 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

ORIGINAL PAGE IS OF POOR QUALITY

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
21	5080	MILWAUKEE WI	0.4822	0.5799	31.9377	2	3800*	KENOSHA WI	32	0.0454
							6600	RACINE WI	24	0.0523
									56	0.0977
22	8280	TAMPA-ST P FL	0.4104	0.5450	32.4827	3	1140	BRADENTON FL	33	0.0207
							3980	LAKELAND-W FL	46	0.0653
							7510	SARASOTA FL	43	0.0486
									122	0.1346
23	7320	SAN DIEGO CA	0.4972	0.4972	32.9799	0				
									0	0.0000
24	6280	PITTSBURGH PA	0.4630	0.4959	33.4758	2	8080	STEUBENVIL OH-WV	33	0.0190
							9000	WHEELING WV-OH	46	0.0139
									79	0.0329
25	1300	BURLINGTON NC	0.0189	0.4940	33.9698	2	3120	✓GREENSBORO NC	20	0.2789
							6640	RALEIGH-DU NC	49	0.1962
									69	0.4751
26	6200	PHOENIX AZ	0.4831	0.4831	34.4530	0				
									0	0.0000
27	6440	PORTLAND OR-WA	0.4129	0.4657	34.9187	1	7080	SALEM OR	44	0.0529
									44	0.0529
28	3480	INDIANAPOL IN	0.3765	0.4652	35.[illegible]839	4	400	ANDERSON IN	34	0.0273
							1020	BLOOMINGTO IN	46	0.0198
							3850	KOKOMO IN	49	0.0150
							5280	MUNCIE IN	50	0.0266
									179	0.0887

MARKET DISTRIBUTION MODEL (MDM)

FILE 617 - NASA 34 COMMON NETWORK MODEL FOR YEAR 2000 W/236 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

Most Efficient Network
Price = 20% below Ku-Band

			MARKET VALUES							
RANK	SMSA	PRINCIPAL	PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
1	5600	NEW YORK NY-NJ	4.4806	6.1888	6.1888	8	3640	JERSEY CIT NJ	3	0.1253
							4410	LONG BRANC NJ	31	0.0762
							5380	NASSAU-SUF NY	20	0.4122
							5460	NEW BRUNSW NJ	30	0.1705
							5640	NEWARK NJ	10	0.6177
							5760	NORWALK CT	39	0.0488
							6040	PATERSON-C NJ	16	0.1322
							8040	STAMFORD CT	33	0.1253
									182	1.7082
2	4480	LOS ANGELE CA	3.5579	4.5613	10.7501	2	360	ANAHEIM-SA CA	25	0.7533
							6780	RIVERSIDE- CA	55	0.2501
									80	1.0034
3	1600	CHICAGO IL	3.8567	4.0033	14.7534	1	2960	GARY-HAMMO IN	25	0.1466
									25	0.1466
4	7360	SAN FRANCI CA	2.1867	3.1449	17.8983	3	7400	SAN JOSE CA	43	0.8637
							7500	SANTA ROSA CA	49	0.0501
							8720	VALLEJO-FA CA	24	0.0443
									116	0.9581
5	2160	DETROIT MI	1.7411	2.1047	20.0030	2	440	ANN ARBOR MI	33	0.1522
							8400	TOLEDO OH-MI	54	0.2114
									87	0.3636
6	6160	PHILADELPH PA-NJ	1.7923	2.0950	22.0980	5	240	ALLENTOWN- PA-NJ	49	0.1825
							6680	READING PA	49	0.0900
							8480	TRENTON NJ	29	0.1262
							8760	VINELAND-M NJ	33	0.0334
							9160	WILMINGTON DE-NJ-	26	0.1706
									186	0.6027

FILE 617 - NASA 34 COMMON NETWORK MODEL FOR YEAR 2000 W/236 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S ... ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL		MARKET — VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
7	8840	WASHINGTON	DC-MD-	1.2286	1.8778	23.9757	1	720	BALTIMORE	MD	36	0.6492
											36	0.6492
8	1120	BOSTON	MA	1.1772	1.8735	25.8492	9	1200	BROCKTON	MA	20	0.0351
								2480	FALL RIVER	MA-RI	46	0.0314
								2600	FITCHBURG-	MA	42	0.0183
								4160	LAWRENCE-H	MA-NH	25	0.0687
								4560	LOWELL	MA-NH	24	0.0549
								4760	MANCHESTER	NH	49	0.0416
								5350	NASHUA	NH	35	0.0438
								6480	PROVIDENCE	RI-MA	42	0.2914
								9240	WORCESTER	MA	39	0.1112
											322	0.6963
9	3360	HOUSTON	TX	1.5597	1.6342	27.4834	1	2920	GALVESTON-	TX	47	0.0745
											47	0.0745
10	1680	CLEVELAND	OH	0.8329	1.4478	28.9312	4	80	AKRON	OH	31	0.2235
								1320	CANTON	OH	51	0.1263
								4440	LORAIN-ELY	OH	26	0.1048
								9320	YOUNGSTOWN	OH	61	0.1603
											169	0.6149
11	1920	DALLAS-FOR	TX	1.3570	1.3570	30.2882	0					
											0	0.0000
12	5120	MINNEAPOLI	MN-WI	1.1940	1.1940	31.4822	0					
											0	0.0000
13	5000	MIAMI	FL	0.6791	1.1304	32.6127	2	2680	FORT LAUDE	FL	24	0.292[illegible]
								9960	WEST PALM	FL	64	0.1368
											88	0.4314

MARKET DISTRIBUTION MODEL (MDM)

FILE 617 - NASA 34 COMMON NETWORK MODEL FOR YEAR 2000 W/236 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
14	7040	ST LOUIS MO-IL	1.0996	1.0996	33.7123	0				
									0	0.0000
15	520	ATLANTA GA	1.0783	1.0783	34.7906	0				
									0	0.0000
16	1640	CINCINNATI OH-KY-	0.5620	0.9665	35.7571	2	2000	DAYTON OH	49	0.3162
							3200	HAMILTON-M OH	21	0.0883
									70	0.4045
17	6280	PITTSBURGH PA	0.8359	0.8997	36.6568	2	8080	STEUBENVIL OH-WV	33	0.0367
							9000	WHEELING WV-OH	46	0.0271
									79	0.0638
18	3280	HARTFORD CT	0.3012	0.8482	37.5049	9	1160	BRIDGEPORT CT	49	6.1156
							1170	BRISTOL CT	16	0.0150
							1930	DANBURY CT	48	0.0361
							4960	MERIDEN CT	18	0.0101
							5440	NEW BRITAI CT	9	0.0318
							5480	NEW HAVEN- CT	35	0.1264
							5520	NEW LONDON CT-RI	42	0.0274
							8000	SPRINGFIEL CT-MA	24	0.1196
							8880	WATERBUR. CT	25	0.0650
									266	0.5470
19	2080	DENVER-BOU CO	0.8075	9.8297	38.3346	1	3060	GREELEY CO	50	0.0222
									50	0.0222
20	5080	MILWAUKEE WI	0.6520	0.7809	39.1155	2	3800	KENOSHA WI	32	0.0598
							6600	RACINE WI	24	0.0691
									56	0.1289

FILE 817 - RANK 34 COMMON NETWORK MODEL FOR YEAR 2000 W/235 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
21	3760	KANSAS CIT MO-KS	0.6969	0.7362	39.8517	2	4150	LAWRENCE KS	37	0.0107
							7000	ST JOSEPH MO	48	0.0287
									85	0.0394
22	7600	SEATTLE-EV WA	0.6098	0.7163	40.5681	1	8200	TACOMA WA	26	0.1066
									26	0.1066
23	1300	BURLINGTON NC	0.0247	0.6653	41.2333	2	3120	✓GREENSBORO NC	20	0.3867
							6640	RALEIGH-DU NC	49	0.2539
									69	0.6405
24	6200	PHOENIX AZ	0.6138	0.6138	41.8471	0				
									0	0.0000
25	8280	TAMPA-ST P FL	0.4364	0.5791	42.4263	3	1140	BRADENTON FL	33	0.0220
							3980	LAKELAND-W FL	46	0.0689
							7510	SARASOTA FL	43	0.0518
									122	0.1428
26	3480	INDIANAPOL IN	0.4664	0.5717	42.9980	4	400	ANDERSON IN	34	0.0313
							1020	BLOOMINGTO IN	46	0.0255
							3850	KOKOMO IN	49	0.0178
							5280	MUNCIE IN	50	0.0308
									179	0.1053
27	1840	COLUMBUS OH	0.5193	0.5570	43.5551	1	7960	SPRINGFIEL OH	43	0.0378
									43	0.0378
28	7320	SAN DIEGO CA	0.5417	0.5417	44.0968	0				
									0	0.0000

MARKET DISTRIBUTION MODEL (MDM)

FILE 617 - NASA 34 COMMON NETWORK MODEL FOR YEAR 2000 W/236 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL		MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
29	6440	PORTLAND	OR-WA	0.4381	0.4946	44.5914	1	7080	SALEM	OR	44	0.0565
											44	0.0565
30	8120	STOCKTON	CA	0.0891	0.4736	45.0650	2	6920	/SACRAMENTO	CA	45	0.3342
								5170	MODESTO	CA	28	0.0504
											73	0.3845
31	1280	BUFFALO	NY	0.4568	0.4568	45.5218	0					
											0	0.0000
32	6520	PROVO-OREM	UT	0.0466	0.4549	45.9767	1	7160	/SALT LAKE	UT	38	0.4083
											38	0.4083
33	5560	NEW ORLEAN	LA	0.4437	0.4437	46.4204	0					
											0	0.0000
34	6840	ROCHESTER	NY	0.4370	0.4370	46.8574	0					
											0	0.0000

MARKET DISTRIBUTION MODEL (MDM)

FILE 619 - NASA 36 COMMON NETWORK MODEL FOR YEAR 2000 W/97 CROSSOVER MILEAGE AND 50 MILE RA

SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

Most Efficient Network
Price = 40% below Ku-Band

RANK	SMSA	PRINCIPAL	MARKET VALUES PRIME	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
1	5600	NEW YORK NY-NJ	5.5332	7.5917	7.5917	8	3640	JERSEY CIT NJ	3	0.1547
							4410	LONG BRANC NJ	31	0.0905
							5380	NASSAU-SUF NY	20	0.4959
							5460	NEW BRUNSW NJ	30	0.2047
							5640	NEWARK NJ	10	0.7577
							5760	NORWALK CT	39	0.0542
							6040	PATERSON-C NJ	16	0.1626
							8040	STAMFORD CT	33	0.1381
									182	2.0584
2	4480	LOS ANGELE CA	3.6961	4.7149	12.3066	2	360	ANAHEIM-SA CA	25	0.7644
							6780	RIVERSIDE- CA	55	0.2545
									80	1.0189
3	1600	CHICAGO IL	4.095[illegible]	4.2753	16.5819	1	2960	GARY-HAMMO IN	25	0.1797
									25	0.1797
4	7360	SAN FRANCI CA	2.2110	3.1832	19.7650	3	7400	SAN JOSE CA	43	0.8761
							7500	SANTA ROSA CA	49	0.0510
							8720	VALLEJO-FA CA	24	0.0451
									116	0.972[illegible]
5	8840	WASHINGTON DC-MD-	1.7517	2.6477	22.4127	1	720	BALTIMORE MD	36	0.8960
									36	0.8960
6	1120	BOSTON MA	1.6028	2.5564	24.9691	9	12[illegible]	BROCKTON MA	20	0.0447
							2480	FALL RIVER MA-RI	46	0.0399
							2600	FITCHBURG- MA	42	0.0238
							4160	LAWRENCE-H MA-NH	25	0.0974
							4560	LOWELL MA-NH	24	0.0724
							4760	MANCHESTER NH	49	0.0536
							5350	NASHUA NH	35	0.0652
							6480	PROVIDENCE RI-MA	42	0.4071
							9240	WORCESTER MA	39	0.1495
									322	0.9535

MARKET DISTRIBUTION MODEL (MDM)

FILE 619 - NASA 36 COMMON DEMAND MODEL FOR YEAR 2000 W/97 CROSSOVER MILEAGE AND 50 MILE RA
SMSA'S IN ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
7	2160	DETROIT MI	1.9434	2.3954	27.3645	2	440	ANN ARBOR MI	33	0.1903
							8400	TOLEDO OH-MI	54	0.2587
									87	0.4490
8	6160	PHILADELPH PA-NJ	1.6777	2.3303	29.6948	5	240	ALLENTOWN- PA-NJ	49	0.1961
							6680	READING PA	49	0.0991
							8480	TRENTON NJ	29	0.1423
							8760	VINELAND-M NJ	33	0.0350
							9160	WILMINGTON DE-NJ-	26	0.1781
									186	0.6506
9	3360	HOUSTON TX	1.6533	1.7291	31.4239	1	2920	GALVESTON- TX	47	0.0758
									47	0.0758
10	1680	CLEVELAND OH	0.9447	1.5970	33.0209	4	80	AKRON OH	31	0.2362
							1320	CANTON OH	51	0.1344
							4440	LORAIN-ELY OH	26	0.1136
							9320	YOUNGSTOWN OH	61	0.1680
									169	0.6523
11	1920	DALLAS-FOR TX	1.4492	1.4492	34.4700	0				
									0	0.0000
12	5120	MINNEAPOLI MN-WI	1.2154	1.2154	35.6854	0				
									0	0.0000
13	1640	CINCINNATI OH-KY-	0.6673	1.1817	36.8671	2	2000	DAYTON OH	49	0.4051
							3200	HAMILTON-M OH	21	0.1093
									70	0.5144

MARKET DISTRIBUTION MODEL (MDM)

FILE 617 SMSA 30 COMMON NETWORK MODEL FOR YEAR 2000 W/97 CROSSOVER MILLAGE AND 50 MILE RA
SORTED BY ACCESSABLE MARKET VALUE YEAR 2000

RANK	SMSA	PRINCIPAL		MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
14	5000	MIAMI	FL	0.7217	1.1685	38.0356	2	2680	FORT LAUDE	FL	24	0.3034
								8960	WEST PALM	FL	64	0.1434
											88	0.4468
15	7040	ST LOUIS	MO-IL	1.1353	1.1353	39.1709	0					
											0	0.0000
16	6280	PITTSBURGH	PA	1.0518	1.1296	40.3005	2	8080	STEUBENVIL	OH-WV	33	0.0452
								9000	WHEELING	WV-OH	46	0.0326
											79	0.0778
17	520	ATLANTA	GA	1.0966	1.0966	41.3971	0					
											0	0.0000
18	3280	HARTFORD	CT	0.4413	1.0495	42.4466	9	1160	BRIDGEPORT	CT	49	0.1230
								1170	BRISTOL	CT	16	0.0165
								1930	DANBURY	CT	48	0.0380
								4960	MERIDEN	CT	18	0.0113
								5440	NEW BRITAI	CT	9	0.0361
								5480	NEW HAVEN-	CT	35	0.1407
								5520	NEW LONDON	CT-RI	42	0.0307
								8000	SPRINGFIEL	CT-MA	24	0.1356
								8880	WATERBURY	CT	25	0.0761
											266	0.6082
19	2080	DENVER-BOU	CO	0.8207	0.8433	43.2898	1	3060	GREELEY	CO	50	0.0226
											50	0.0226
20	5080	MILWAUKEE	WI	0.6716	0.8067	44.0965	2	3800*	KENOSHA	WI	32	0.0628
								6600	RACINE	WI	24	0.0723
											56	0.1351

MARKET DISTRIBUTION MODEL (MDM)

FILE 619 - AREA 36 CURRENT METHODS MODEL FOR YEAR 2000 W/97 CROSSOVER MILEAGE APP 50 MILE RA
RANKED BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRIN	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
21	3760	KANSAS CIT MO KS	0.7162	0.7504	44.8469	2	4150	LAWRENCE KS	37	0.0109
							7000	ST JOSEPH MO	48	0.0293
									85	0.0401
22	7600	SEATTLE-EV WA	0.6340	0.7424	45.5892	1	8200	TACOMA WA	26	0.1083
									26	0.1083
23	3480	INDIANAPOL IN	0.5864	0.7168	46.3061	4	400	ANDERSON IN	34	0.0410
							1020	BLOOMINGTO IN	46	0.0310
							3850	KOKOMO IN	49	0.0201
							5280	MUNCIE IN	50	0.0383
									179	0.1304
24	1300	BURLINGTON NC	0.0262	0.6906	46.9967	2	3120	✓GREENSBORO NC	20	0.3942
							6640	RALEIGH-DU NC	49	0.2703
									69	0.6644
25	1840	COLUMBUS OH	0.6202	0.6632	47.6599	1	7960	SPRINGFIEL OH	43	0.0430
									43	0.0430
26	7320	SAN DIEGO CA	0.6333	0.6333	48.2932	0				
									0	0.0000
27	6200	PHOENIX AZ	0.6230	0.6230	48.9162	0				
									0	0.0000
28	8280	TAMPA ST P FL	0.4607	0.6094	49.5256	3	1140	BRADENTON FL	33	0.0231
							3980	LAKELAND-W FL	46	0.0713
							7510	SARASOTA FL	43	0.0543
									122	0.1487

FILE 619 - MASA 33 COMMON NETWORK MODEL FOR YEAR 2000 W/97 CROSSOVER MILEAGE AND 50 MILE RA
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	MASA	PRINCIPAL		MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
29	1280	BUFFALO	NY	0.5244	0.5244	50.0500	0					
											0	0.0000
30	6440	PORTLAND	OR-WA	0.4587	0.5174	50.5674	1	7080	SALEM	OR	44	0.0587
											44	0.0587
31	8120	STOCKTON	CA	0.0904	0.4816	51.0489	2	6920	✓SACRAMENTO	CA	45	0.3400
								5170	MODESTO	CA	28	0.0512
											73	0.3912
32	6520	PROVO-OREM	UT	0.0474	0.4620	51.5110	1	7160	✓SALT LAKE	UT	38	0.4146
											38	0.4146
33	6840	ROCHESTER	NY	0.4616	0.4616	51.9726	0					
											0	0.0000
34	5560	NEW ORLEAN	LA	0.4498	0.4498	52.4223	0					
											0	0.0000
35	2640	FLINT	MI	0.1502	0.4398	52.8621	3	4040	✓LANSING-EA	MI	48	0.1956
								800	BAY CITY	MI	42	0.0196
								6960	SAGINAW	MI	32	0.0744
											122	0.2895
36	3240	HARRISBURG	PA	0.2488	0.4397	53.3017	2	9280	YORK	PA	23	0.0993
								4000	LANCASTER	PA	35	0.0916
											58	0.1909

MARKET DISTRIBUTION MODEL (MDM)

FILE 616 - NASA 82 COMMON NETWORK MODEL FOR YEAR 2000 W/397 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

Maximum Network
Price = Ku-Band

RANK	SMSA	PRINCIPAL		MARKET - VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
1	5600	NEW YORK	NY-NJ	5.1628	7.1513	7.1513	8	3640	JERSEY CIT	NJ	3	0.1484
								4410	LONG BRANC	NJ	31	0.0911
								5380	NASSAU-SUF	NY	20	0.4902
								5460	NEW BRUNSW	NJ	30	0.1935
								5640	NEWARK	NJ	10	0.7129
								5760	NORWALK	CT	39	0.0551
								6040	PATERSON-C	NJ	16	0.1529
								8040	STAMFORD	CT	33	0.1443
											182	1.9885
2	4480	LOS ANGELE	CA	3.5984	4.6463	11.7976	2	360	ANAHEIM-SA	CA	25	0.7699
								6780	RIVERSIDE-	CA	55	0.2780
											80	1.0479
3	1600	CHICAGO	IL	3.8265	3.9792	15.7768	1	2960	GARY-HAMMO	IN	25	0.1527
											25	0.1527
4	7360	SAN FRANCI	CA	2.0089	3.0181	18.7949	3	7400	SAN JOSE	CA	43	0.9044
								7500	SANTA ROSA	CA	49	0.0563
								8720	VALLEJO-FA	CA	24	0.0485
											116	1.0092
5	6160	PHILADELPH	PA-NJ	1.5342	2.1624	20.9573	5	240	ALLENTOWN-	PA-NJ	49	0.1938
								6680	READING	PA	49	0.0891
								8480	TRENTON	NJ	29	0.1334
								8760	VINELAND-M	NJ	33	0.0348
								9160	WILMINGTON	DE-NJ-	26	0.1770
											186	0.6282
6	2160	DETROIT	MI	1.6880	2.1051	23.0624	2	440	ANN ARBOR	MI	33	0.1813
								8400	TOLEDO	OH-MI	54	0.2358
											87	0.4171

FILE 818 - NASA 82 COMMON NETWORK MODEL FOR YEAR 2000 W/397 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL		MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
7	1120	BOSTON	MA	1.2431	2.0242	25.0866	9	1200	BROCKTON	MA	20	0.0382
								2480	FALL RIVER	MA-RI	46	0.0342
								2600	FITCHBURG-	MA	42	0.0209
								4160	LAWRENCE-H	MA-NH	25	0.0769
								4560	LOWELL	MA-NH	24	0.0577
								4760	MANCHESTER	NH	49	0.0445
								5350	NASHUA	NH	35	0.0461
								6480	PROVIDENCE	RI-MA	42	0.3377
								9240	WORCESTER	MA	39	0.1199
											322	0.7762
8	3360	HOUSTON	TX	1.8466	1.9336	27.0203	1	2920	GALVESTON-	TX	47	0.0870
											47	0.0870
9	8840	WASHINGTON	DC-MD-	1.1580	1.8096	28.8299	1	720	BALTIMORE	MD	36	0.6516
											36	0.6516
10	1920	DALLAS-FOR	TX	1.6196	1.6196	30.4495	0					
											0	0.0000
11	5000	MIAMI	FL	0.8354	1.3594	31.8089	2	2680	FORT LAUDE	FL	24	0.3539
								8960	WEST PALM	FL	64	0.1702
											88	0.5241
12	5120	MINNEAPOLI	MN-WI	1.2849	1.2849	33.0939	0					
											0	0.0000
13	520	ATLANTA	GA	1.2234	1.2234	34.3173	0					
											0	0.0000

ORIGINAL PAGE IS
OF POOR QUALITY

MARKET DISTRIBUTION MODEL (MDM)

FILE 616 - NASA 82 COMMON NETWORK MODEL FOR YEAR 2000 W/397 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL		MARKET - VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
14	1680	CLEVELAND	OH	0.7024	1.1451	35.4623	4	80	AKRON	OH	31	0.1550
								1320	CANTON	OH	51	0.0876
								4440	LORAIN-ELY	OH	26	0.0934
								9320	YOUNGSTOWN	OH	61	0.1067
											169	0.4426
15	7040	ST LOUIS	MO-IL	1.0561	1.0561	36.5184	0					
											0	0.0000
16	2080	DENVER-BOU	CO	0.9715	0.9989	37.5174	1	3060	GREELEY	CO	50	0.0274
											50	0.0274
17	3280	HARTFORD	CT	0.3341	0.9535	38.4708	9	1160	BRIDGEPORT	CT	49	0.1314
								1170	BRISTOL	CT	16	0.0164
								1930	DANBURY	CT	48	0.0403
								4960	MERIDEN	CT	18	0.0113
								5440	NEW BRITAI	CT	9	0.0358
								5480	NEW HAVEN-	CT	35	0.1384
								5520	NEW LONDON	CT-RI	42	0.0319
								8000	SPRINGFIEL	CT-MA	24	0.1397
								8880	WATERBURY	CT	25	0.0743
											266	0.6193
18	1640	CINCINNATI	OH-KY-	0.5235	0.9496	39.4204	2	2000	DAYTON	OH	49	0.3326
								3200	HAMILTON-M	OH	21	0.0935
											70	0.4261
19	7600	SEATTLE-EV	WA	0.7285	0.8580	40.2784	1	8200	TACOMA	WA	26	0.1294
											26	0.1294
20	3760	KANSAS CIT	MO-KS	0.7976	0.8427	41.1211	2	4150	LAWRENCE	KS	37	0.0124
								7000	ST JOSEPH	MO	48	0.0326
											85	0.0451

FILE 018 - WASH 82 COMMON NETWORK MODEL FOR YEAR 2000 W/397 CROSSOVER MILEAGE AND 50 MILE R
RANKED BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL		MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
21	5080	MILWAUKEE	WI	0.6296	0.7585	41.8796	2	3800A	KENOSHA	WI	32	0.0603
								6600	RACINE	WI	24	0.0686
											56	0.1289
22	6280	PITTSBURGH	PA	0.6155	0.6620	42.5417	2	8080	STEUBENVIL	OH-WV	33	0.0267
								9000	WHEELING	WV-OH	46	0.0198
											79	0.0466
23	7320	SAN DIEGO	CA	0.6414	0.6414	43.1831	0					
											0	0.0000
24	6200	PHOENIX	AZ	0.6353	0.6353	43.8184	0					
											0	0.0000
25	1300	BURLINGTON	NC	0.0241	0.6348	44.4533	2	3120	✓GREENSBORO	NC	20	0.3551
								6640	RALEIGH-DU	NC	49	0.2557
											69	0.6108
26	8280	TAMPA-ST P	FL	0.5370	0.6291	45.0824	2	1140	BRADENTON	FL	33	0.0276
								7510	SARASOTA	FL	43	0.0646
											76	0.0921
27	3480	INDIANAPOL	IN	0.4841	0.5995	45.6819	4	400	ANDERSON	IN	34	0.0359
								1020	BLOOMINGTO	IN	46	0.0256
								3850	KOKOMO	IN	49	0.0197
								5280	MUNCIE	IN	50	0.0341
											179	0.1154
28	6440	PORTLAND	OR-WA	0.5273	0.5974	46.2793	1	7080	SALEM	OR	44	0.0701
											44	0.0701

MARKET DISTRIBUTION MODEL (MDM)

FILE 818 - SMSA 82 COMMON NETWORK MODEL FOR YEAR 2000 W/3%/ CROSSOVER MILEAGE AND 50 MILE R

RANKING BY ACCESSIBLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRIN	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
29	6520	PROVO OREM UT	0.0565	0.5378	46.8171	1	7160	✓SALT LAKE UT	38	0.4813
									38	0.4813
30	5960	ORLANDO FL	0.2745	0.5014	47.3185	2	3980*	LAKELAND-W FL	42	0.0861
							4900	MELBOURNE- FL	42	0.1408
									84	0.2269
31	1840	COLUMBUS OH	0.4622	0.4972	47.8156	1	7960	SPRINGFIEL OH	43	0.0349
									43	0.0349
32	8120	STOCKTON CA	0.0787	0.4902	48.3058	2	6920	✓SACRAMENTO CA	45	0.3585
							5170	MODESTO CA	28	0.0530
									73	0.4115
33	5560	NEW ORLEAN LA	0.4885	0.4885	48.7944	0				
									0	0.0000
34	4360	LINCOLN NE	0.1134	0.4666	49.2609	1	5920	✓OMAHA NE-IA	50	0.3531
									50	0.3531
35	5880	OKLAHOMA C OK	0.4352	0.4352	49.6961	0				
									0	0.0000
36	4920	MEMPHIS TN AR-	0.4289	0.4289	50.1251	0				
									0	0.0000

[illegible]

[illegible] 610 [illegible] OVER MILEAGE AND 50 MILE R [illegible]
[illegible] ACCESSIBLE MARKET VALUE [illegible] 2000

RANK	[illegible]	PRINCIPAL	MARKET VALUES [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	SUBORDINATES	DIST	MARKET VALUE
37	780	BATTLE CRE MI	[illegible]	0.4076	50.[illegible]	3	3520	JACKSON MI	40	0.0720
							3720*	KALAMAZOO- MI	21	0.0976
							4040*	✓LANS[illegible] MI	43	0.1780
									104	0.3476
38	1000	BIRMINGHAM AL	0.3581	0.4054	50.9381	1	8600	TUSCALOOSA AL	49	0.0473
									49	0.0473
39	1520	CHARLOTTE- NC	0.3638	0.3638	51.3019	0			0	0.0000
40	3600	JACKSONVIL FL	0.3575	0.3575	51.6594	0			0	0.0000
41	8560	TULSA OK	0.3537	0.3537	52.0131	0			0	0.0000
42	1660	CLARKSVILL TN-KY	0.0395	0.3508	52.3640	1	5360	✓NASHVILLE- TN	41	0.3114
									41	0.3114
43	7240	SAN ANTONI TX	0.3501	0.3501	52.7141	0			0	0.0000
44	4520	LOUISVILLE KY-IN	0.3253	0.3253	53.0394	0			0	0.0000
45	1280	BUFFALO NY	0.3204	0.3204	53.3598	0			0	0.0000

FILE 616 - [illegible] MODEL FOR YEAR 2000 W/ 377 CROSSOVER MILEAGE AND 50 MILE R
[illegible] ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRIN	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
46	3240	HARRISBURG PA	0.1715	0.3192	53.6790	2	9280	YORK PA	23	0.0662
							4000	LANCASTER PA	35	0.0814
									58	0.1476
47	6140	PETERSBURG VA	0.0369	0.3175	53.9965	1	6760	✓RICHMOND VA	23	0.2806
									23	0.2806
48	5680	NEWPORT NE VA	0.0848	0.2977	54.2942	1	5720	✓NORFOLK-VI VA-NC	13	0.2129
									13	0.2129
49	6840	ROCHESTER NY	0.2920	0.2920	54.5863	0				
									0	0.0000
50	640	AUSTIN TX	0.2860	0.2860	54.8723	0				
									0	0.0000
51	160	ALBANY-SCH NY	0.2374	0.2671	55.1394	1	6320	PITTSFIELD MA	29	0.0297
									29	0.0297
52	8160	SYRACUSE NY	0.1745	0.2458	55.3852	1	8680	UTICA-ROME NY	47	0.0713
									47	0.0713
53	1040	BLOOMINGTO IL	0.0503	0.2432	55.6284	2	6120	✓PEORIA IL	35	0.1425
							1400	CHAMPAIGN- IL	47	0.0504
									82	0.1929
54	6000	OXNARD-SIM CA	0.1279	0.2328	55.8612	1	7480	SANTA BARB CA	34	0.1050
									34	0.1050

FILE 616 - NASA 82 COMMON NETWORK MODEL FOR YEAR 2000 W/397 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S BY ACCESSABLE MARKET VALUE YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
55	760	BATON ROUG LA	0.2281	0.2281	56.0893	0				
									0	0.0000
56	9040	WICHITA KS	0.2240	0.2240	56.3133	0				
									0	0.0000
57	3000	GRAND RAPI MI	0.1777	0.2232	56.5365	1	5320	MUSKEGON-N MI	35	0.0455
									35	0.0455
58	3160	GREENVILLE SC	0.2219	0.2219	56.7584	0				
									0	0.0000
59	2640	FLINT MI	0.1358	0.2209	56.9793	2	800	BAY CITY MI	32	0.0178
							6960	SAGINAW MI	32	0.0672
									74	0.0851
60	1760	COLUMBIA SC	0.2100	0.2100	57.1892	0				
									0	0.0000
61	6025	PASCAGOULA MS	0.0481	0.2099	57.3991	2	920	BILOXI-GUL MS	21	0.0339
							5160	MOBILE AL	38	0.1279
									59	0.1618
62	2120	DES MOINES IA	0.2051	0.2051	57.6042	0				
									0	0.0000
63	4400	LITTLE ROC AR	0.1706	0.1914	57.7956	1	6240	PINE BLUFF AR	40	0.0207
									40	0.0207

MARKET DISTRIBUTION MODEL (MDM)

FILE 618 - NASA 82 COMMON NETWORK MODEL FOR YEAR 2000 W/397 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
64	7880	SPRINGFIEL IL	0.1206	0.1856	57.9812	1	2040*	DECATUR	IL	38	0.0650
										38	0.0650
65	1720	COLORADO S CO	0.1375	0.1778	58.1590	1	6560	PUEBLO	CO	41	0.0403
										41	0.0403
66	8520	TUCSON AZ	0.1752	0.1752	58.3342	0					
										0	0.0000
67	1560	CHATTANOOG TN-GA	0.1727	0.1727	58.5069	0					
										0	0.0000
68	200	ALBUQUERQU NM	0.1717	0.1717	58.6786	0					
										0	0.0000
69	2320	EL PASO TX	0.1710	0.1710	58.8495	0					
										0	0.0000
70	3840	KNOXVILLE TN	0.1596	0.1596	59.0091	0					
										0	0.0000
71	840	BEAUMONT-P TX	0.1588	0.1588	59.1680	0					
										0	0.0000
72	2760	FORT WAYNE IN	0.1536	0.1536	59.3215	0					
										0	0.0000

MARKET DISTRIBUTION MODEL (MDM)

FILE 816 - NASA 82 COMMON NETWORK MODEL FOR YEAR 2000 W/397 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
73	1480	CHARLESTON WV	0.0813	0.1534	59.4747	1	3400	HUNTINGTON WV-KY-	44	0.0722
									44	0.0722
74	460	APPLETON-O WI	0.0882	0.1512	59.6262	1	3080	GREEN BAY WI	27	0.0631
									27	0.0631
75	3440	HUNTSVILLE AL	0.1501	0.1501	59.7762	0				
									0	0.0000
76	4720	MADISON WI	0.1438	0.1438	59.9200	0				
									0	0.0000
77	1360	CEDAR RAPI IA	0.1035	0.1429	60.0630	1	8920	WATERLOO-C IA	50	0.0394
									50	0.0394
78	1960	DAVENPORT- IA-IL	0.1375	0.1375	60.2005	0				
									0	0.0000
79	4120	LAS VEGAS NV	0.1233	0.1233	60.3237	0				
									0	0.0000
80	3560	JACKSON MS	0.1219	0.1219	60.4456	0				
									0	0.0000
81	2840	FRESNO CA	0.1210	0.1210	60.5666	0				
									0	0.0000

MARKET DISTRIBUTION MODEL (MDM)

FILE 618 - NASA 82 COMMON NETWORK MODEL FOR YEAR 2000 W/397 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET - VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
82	5745	NORTHEAST PA	0.1197	0.1197	60.6862	0				
									-----	-------
									0	0.0000

FILE 618 - NASA 90 COMMON NETWORK MODEL FOR YEAR 2000 W/236 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

Maximum Network
Price = 20% Below Ku-Band

RANK	SMSA	PRINCIPAL		MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
1	5600	NEW YORK	NY-NJ	5.7521	8.0064	8.0064	8	3640	JERSEY CIT	NJ	3	0.1675
								4410	LONG BRANC	NJ	31	0.1019
								5380	NASSAU-SUF	NY	20	0.5388
								5460	NEW BRUNSW	NJ	30	0.2239
								5640	NEWARK	NJ	10	0.8218
								5760	NORWALK	CT	39	0.0625
								6040	PATERSON-C	NJ	16	0.1753
								8040	STAMFORD	CT	33	0.1627
											182	2.2543
2	4480	LOS ANGELE	CA	4.3193	5.5542	13.5606	2	360	ANAHEIM-SA	CA	25	0.9145
								6780	RIVERSIDE-	CA	55	0.3204
											80	1.2349
3	1600	CHICAGO	IL	4.6700	4.8556	18.4163	1	2960	GARY-HAMMO	IN	25	0.1857
											25	0.1857
4	7360	SAN FRANCI	CA	2.5839	3.7478	22.1641	3	7400*	SAN JOSE	CA	43	1.0463
								7500	SANTA ROSA	CA	49	0.0624
								8720	VALLEJO-FA	CA	24	0.0552
											116	1.1639
5	6160	PHILADELPH	PA-NJ	1.9026	2.6916	24.8557	5	240	ALLENTOWN-	PA-NJ	49	0.2420
								6680	READING	PA	49	0.1174
								8480	TRENTON	NJ	29	0.1641
								8760	VINELAND-M	NJ	33	0.0427
								9160	WILMINGTON	DE-NJ-	26	0.2227
											186	0.7890
6	2160	DETROIT	MI	2.1883	2.6604	27.5160	2	440	ANN ARBOR	MI	33	0.1976
								8400	TOLEDO	OH-MI	54	0.2745
											87	0.4721

ORIGINAL PAGE IS
OF POOR QUALITY

FILE 618 - NASA 90 COMMON NETWORK MODEL FOR YEAR 2000 W/236 CROSSOVER W LEAGUE AND 50 MILE R
SMSA'S BY ACCESSIBLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL		MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
7	8840	WASHINGTON	DC-MD-	1.6025	2.4488	29.9649	1	720	BALTIMORE	MD	36	0.8464
											36	0.8464
8	1120	BOSTON	MA	1.5259	2.4421	32.4070	9	1200	BROCKTON	MA	20	0.0461
								2480	FALL RIVER	MA-RI	46	0.0415
								2600	FITCHBURG-	MA	42	0.0248
								4160	LAWRENCE-H	MA-NH	25	0.0899
								4560	LOWELL	MA-NH	24	0.0704
								4760	MANCHESTER	NH	49	0.0535
								5350	NASHUA	NH	35	0.0554
								6480	PROVIDENCE	RI-MA	42	0.3899
								9240	WORCESTER	MA	39	0.1447
											322	0.9163
9	3360	HOUSTON	TX	1.9224	2.0148	34.4218	1	2920	GALVESTON-	TX	47	0.0924
											47	0.0924
10	1680	CLEVELAND	OH	1.0401	1.8112	36.2330	4	80	AKRON	OH	31	0.2799
								1320	CANTON	OH	51	0.1579
								4440	LORAIN-ELY	OH	26	0.1332
								9320	YOUNGSTOWN	OH	61	0.2001
											169	0.7711
11	1920	DALLAS-FOR	TX	1.6900	1.6900	37.9230	0					
											0	0.0000
12	5120	MINNEAPOLI	MN-WI	1.4857	1.4857	39.4087	0					
											0	0.0000
13	5000	MIAMI	FL	0.8536	1.3900	40.7987	2	2680	FORT LAUDE	FL	24	0.3614
								8960	WEST PALM	FL	64	0.1749
											88	0.5364

MARKET DISTRIBUTION MODEL (MDM)

FILE 618 - NASA 90 COMMON NETWORK MODEL FOR YEAR 2000 W/236 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL		MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
14	7040	ST LOUIS	MO-IL	1.3856	1.3856	42.1843	0					
											0	0.0000
15	520	ATLANTA	GA	1.3280	1.3280	43.5123	0					
											0	0.0000
16	1640	CINCINNATI	OH-KY-	0.7004	1.2208	44.7331	2	2000	DAYTON	OH	49	0.4055
								3200	HAMILTON-M	OH	21	0.1149
											70	0.5204
17	6280	PITTSBURGH	PA	1.0539	1.1373	45.8704	2	8080	STEUBENVIL	OH-WV	33	0.0479
								9000	WHEELING	WV-OH	46	0.0355
											79	0.0834
18	3280	HARTFORD	CT	0.3962	1.1167	46.9871	9	1160	BRIDGEPORT	CT	49	0.1519
								1170	BRISTOL	CT	16	0.0192
								1930	DANBURY	CT	48	0.0461
								4960	MERIDEN	CT	18	0.0133
								5440	NEW BRITAI	CT	9	0.0422
								5480	NEW HAVEN-	CT	35	0.1644
								5520	NEW LONDON	CT-RI	42	0.0372
								8000	SPRINGFIEL	CT-MA	24	0.1589
								8880	WATERBURY	CT	25	0.0873
											266	0.7206
19	2080	DENVER-BOU	CO	1.0038	1.0320	48.0192	1	3060	GREELEY	CO	50	0.0282
											50	0.0282
20	5080	MILWAUKEE	WI	0.7942	0.9518	48.9710	2	3800*	KENOSHA	WI	32	0.0736
								6600	RACINE	WI	24	0.0840
											56	0.1576

FILE 618 ... 70 CONRAIL NETWORK MODEL FOR YEAR 2000 W/235 CROSSOVER MILEAGE AND 50 MILE R
... ACCESSABLE MARKET VALUE YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
21	3760	KANSAS CIT MO-KS	0.8667	0.9160	49.8869	2	4150	LAWRENCE KS	37	0.0134
							7000	ST JOSEPH MO	48	0.0359
									85	0.0493
22	7600	SEATTLE-EV WA	0.7382	0.8694	50.7563	1	8200	TACOMA WA	26	0.1312
									26	0.1312
23	1300	BURLINGTON NC	0.0300	0.8078	51.5641	2	3120	✓GREENSBORO NC	20	0.4659
							6640	RALEIGH-DU NC	49	0.3118
									69	0.7778
24	6200	PHOENIX AZ	0.7523	0.7523	52.3164	0				
									0	0.0000
25	3480	INDIANAPOL IN	0.5839	0.7177	53.0341	4	400	ANDERSON IN	34	0.0401
							1020	BLOOMINGTO IN	46	0.0322
							3850	KOKOMO IN	49	0.0227
							5280	MUNCIE IN	50	0.0388
									179	0.1338
26	1840	COLUMBUS OH	0.6548	0.7024	53.7366	1	7960	SPRINGFIEL OH	43	0.0477
									43	0.0477
27	7320	SAN DIEGO CA	0.6681	0.6681	54.4047	0				
									0	0.0000
28	8280	TAMPA-ST P FL	0.5458	0.6392	55.0439	2	1140	BRADENTON FL	33	0.0280
							7510	SARASOTA FL	43	0.0655
									76	0.0934

MARKET DISTRIBUTION MODEL (MDM)

FILE 618 - NASA 70 COMMON NETWORK MODEL FOR YEAR 2000 W/236 CROSSOVER MILEAGE AND 50 MILE R

SMSA'S BY ACCESSIBLE MARKET VALUE YEAR 2000

RANK	SMSA	PRINCIPAL		MARKET - VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
29	6440	PORTLAND	OR-WA	0.5349	0.6060	55.6499	1	7080	SALEM	OR	44	0.0711
											44	0.0711
30	8120	STOCKTON	CA	0.1081	0.5905	56.2403	2	6920	✓SACRAMENTO	CA	45	0.4204
								5170	MODESTO	CA	28	0.0619
											73	0.4824
31	1280	BUFFALO	NY	0.5645	0.5645	56.8048	0					
											0	0.0000
32	6520	PROVO-OREM	UT	0.0586	0.5634	57.3683	1	7160	✓SALT LAKE	UT	38	0.5049
											38	0.5049
33	5560	NEW ORLEAN	LA	0.5404	0.5404	57.9087	0					
											0	0.0000
34	6840	ROCHESTER	NY	0.5285	0.5285	58.4372	0					
											0	0.0000
35	4360	LINCOLN	NE	0.1246	0.5114	58.9486	1	5920	✓OMAHA	NE-IA	50	0.3869
											50	0.3869
36	5960	ORLANDO	FL	0.2796	0.5102	59.4588	2	3980*	LAKELAND-W	FL	42	0.0873
								4900	MELBOURNE-	FL	42	0.1433
											84	0.2306
37	4920	MEMPHIS	TN-AR-	0.5030	0.5030	59.9618	0					
											0	0.0000

MARKET DISTRIBUTION MODEL (MDM)

FILE 618 - NASA 90 COMMON NETWORK MODEL FOR YEAR 2000 W/236 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S BY ACCESSIBLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
38	4520	LOUISVILLE KY-IN	0.4692	0.4692	60.4310	0				
									0	0.0000
39	6140	PETERSBURG VA	0.0501	0.4610	60.8921	1	6760	✓ RICHMOND VA	23	0.4110
									23	0.4110
40	780	BATTLE CRE MI	0.0685	0.4599	61.3520	3	3520	JACKSON MI	40	0.0825
							3720*	KALAMAZOO- MI	21	0.1090
							4040*	✓ LANSING-EA MI	43	0.2000
									104	0.3914
41	5880	OKLAHOMA C OK	0.4555	0.4555	61.8075	0				
									0	0.0000
42	1660	CLARKSVILL TN-KY	0.0472	0.4353	62.2428	1	5360	✓ NASHVILLE- TN	41	0.3881
									41	0.3881
43	1520	CHARLOTTE- NC	0.4306	0.4306	62.6735	0				
									0	0.0000
44	1000	BIRMINGHAM AL	0.3805	0.4303	63.1038	1	8600	TUSCALOOSA AL	49	0.0498
									49	0.0498
45	5680	NEWPORT NE VA	0.1166	0.4290	63.5327	1	5720	✓ NORFOLK-VI VA-NC	13	0.3124
									13	0.3124
46	3240	HARRISBURG PA	0.2326	0.4284	63.9611	2	9280	YORK PA	23	0.0883
							4000	LANCASTER PA	35	0.1075
									58	0.1958

MARKET DISTRIBUTION MODEL (MDM)

FILE 618 - NASA 90 COMMON NETWORK MODEL FOR YEAR 2000 W/236 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRIN	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
47	3600	JACKSONVIL FL	0.3962	0.3962	64.3574	0				
									0	0.0000
48	8560	TULSA OK	0.3766	0.3766	64.7340	0				
									0	0.0000
49	7240	SAN ANTONI TX	0.3701	0.3701	65.1040	0				
									0	0.0000
50	8160	SYRACUSE NY	0.2388	0.3230	65.4270	1	8680	UTICA-ROME NY	47	0.0842
									47	0.0842
51	160	ALBANY-SCH NY	0.2767	0.3113	65.7383	1	6320	PITTSFIELD MA	29	0.0345
									29	0.0345
52	1040	BLOOMINGTO IL	0.0639	0.3032	66.0415	2	6120	✓ PEORIA IL	35	0.1775
							1400	CHAMPAIGN- IL	47	0.0619
									82	0.2394
53	640	AUSTIN TX	0.2942	0.2942	66.3357	0				
									0	0.0000
54	6000	OXNARD-SIM CA	0.1483	0.2774	66.6131	1	7480	SANTA BARB CA	34	0.1291
									34	0.1291
55	3000	GRAND RAPI MI	0.2094	0.2672	66.8804	1	5320	MUSKEGON-N MI	35	0.0578
									35	0.0578

MARKET DISTRIBUTION MODEL (MDM)

FILE 618 - NASA 90 COMMON [illegible] MODEL FOR YEAR 2000 W/233 CROSSOVER MILEAGE AND 50 MILE R

SORTED BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
56	3160	GREENVILLE SC	0.2575	0.2575	67.1379	0				
									0	0.0000
57	2640	FLINT MI	0.1554	0.2548	67.3927	2	800	BAY CITY MI	42	0.0209
							6960	SAGINAW MI	32	0.0785
									74	0.0994
58	760	BATON ROUG LA	0.2539	0.2539	67.6465	0				
									0	0.0000
59	2120	DES MOINES IA	0.2454	0.2454	67.8919	0				
									0	0.0000
60	9040	WICHITA KS	0.2438	0.2438	68.1357	0				
									0	0.0000
61	7880	SPRINGFIEL IL	0.1535	0.2326	68.3684	1	2040*	DECATUR IL	38	0.0791
									38	0.0791
62	4400	LITTLE ROC AR	0.2042	0.2294	68.5978	1	6240	PINE BLUFF AR	40	0.0252
									40	0.0252
63	6025	PASCAGOULA MS	0.0512	0.2289	68.8267	2	920	BILOXI-GUL MS	21	0.0376
							5160	MOBILE AL	38	0.1401
									59	0.1777
64	1760	COLUMBIA SC	0.2269	0.2269	69.0536	0				
									0	0.0000

ORIGINAL PAGE IS OF POOR QUALITY

MARKET DISTRIBUTION MODEL (MDM)

FILE 618 - NASA 96 COMMON NETWORK MODEL FOR YEAR 2000 W/236 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S [illegible] ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
65	1430	CHARLESTON WV	0.1189	0.2217	69.2753	1	3400	HUNTINGTON WV-KY-	44	0.1027
									44	0.1027
66	1560	CHATTANOOG TN-GA	0.2005	0.2005	69.4757	0			0	0.0000
67	3840	KNOXVILLE TN	0.1858	0.1858	69.6616	0			0	0.0000
68	200	ALBUQUERQU NM	0.1848	0.1848	69.8463	0			0	0.0000
69	8520	TUCSON AZ	0.1846	0.1846	70.0309	0			0	0.0003
70	1720	COLORADO S CO	0.1400	0.1810	70.2119	1	6560	PUEBLO CO	41	0.0410
									41	0.0410
71	460	APPLETON-O WI	0.1023	0.1778	70.3896	1	3080	GREEN BAY WI	27	0.0755
									27	0.0755
72	2320	EL PASO TX	0.1768	0.1768	70.5665	0			0	0.0000
73	4720	MADISON WI	0.1759	0.1759	70.7424	0			0	0.0000

MARKET DISTRIBUTION MODEL (MDM)

FILE 618 - NASA 90 CONNECT NETWORK MODEL FOR YEAR 2000 W/236 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
74	2760	FORT WAYNE IN	0.1719	0.1719	70.9144	0				
									0	0.0000
75	840	BEAUMONT-P TX	0.1717	0.1717	71.0861	0				
									0	0.0000
76	1960	DAVENPORT- IA-IL	0.1699	0.1699	71.2560	0				
									0	0.0000
77	3440	HUNTSVILLE AL	0.1689	0.1689	71.4249	0				
									0	0.0000
78	1360	CEDAR RAPI IA	0.1136	0.1605	71.5855	1	8920	WATERLOO-C IA	50	0.0469
									50	0.0469
79	4640	LYNCHBURG VA	0.0614	0.1567	71.7421	1	6800	ROANOKE VA	45	0.0953
									45	0.0953
80	5745	NORTHEAST PA	0.1496	0.1496	71.8917	0				
									0	0.0000
81	4120	LAS VEGAS NV	0.1386	0.1386	72.0303	0				
									0	0.0000
82	3560	JACKSON MS	0.1377	0.1377	72.1680	0				
									0	0.0000

MARKET DISTRIBUTION MODEL (MDM)

FILE 618 - NASA 90 COMMON NETWORK MODEL FOR YEAR 2000 W/236 CROSSOVER MILEAGE AND 50 MILE R
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET — VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
83	2440	EVANSVILLE IN-KY	0.1667	0.1325	72.3605	1	5990	OWENSBORO KY	29	0.0259
									29	0.0259
84	6880	ROCKFORD IL	0.1323	0.1323	72.4328	0				
									0	0.0000
85	2840	FRESNO CA	0.1247	0.1247	72.5575	0				
									0	0.0000
86	3660	JOHNSON CI TN-VA	0.1241	0.1241	72.6816	0				
									0	0.0000
87	4280	LEXINGTON- KY	0.1217	0.1217	72.8033	0				
									0	0.0000
88	7120	SALINAS-SE CA	0.0767	0.1216	72.9249	1	7485	SANTA CRUZ CA	30	0.0449
									30	0.0449
89	7800	SOUTH BEND IN	0.1204	0.1204	73.0454	0				
									0	0.0000
90	2360	ERIE PA	0.1171	0.1171	73.1624	0				
									0	0.0000

MARKET DISTRIBUTION MODEL (MDM)

FILE 620 - NASA 99 COMMON NETWORK MODEL FOR YEAR 2000 W/97 CROSSOVER MILEAGE AND 50 MILE RA
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

Maximum Network
Price = 40% below Ku-Band

RANK	SMSA	PRINCIPAL		MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
1	5600	NEW YORK	NY-NJ	6.9980	9.6688	9.6688	8	3640	JERSEY CIT	NJ	3	0.2028
								4410	LONG BRANC	NJ	31	0.1188
								5380	NASSAU-SUF	NY	20	0.6410
								5460	NEW BRUNSW	NJ	30	0.2645
								5640	NEWARK	NJ	10	0.9844
								5760	NORWALK	CT	39	0.0712
								6040	PATERSON-C	NJ	16	0.2105
								8040	STAMFORD	CT	33	0.1776
											182	2.6709
2	4480	LOS ANGELE	CA	4.4936	5.7520	15.4208	2	360	ANAHEIM-SA	CA	25	0.9321
								6780	RIVERSIDE-	CA	55	0.3263
											80	1.2584
3	1600	CHICAGO	IL	5.0933	5.3188	20.7396	1	2960	GARY-HAMMO	IN	25	0.2255
											25	0.2255
4	7360	SAN FRANCI	CA	2.6279	3.8078	24.5474	3	7400*	SAN JOSE	CA	43	1.0601
								7500	SANTA ROSA	CA	49	0.0635
								8720	VALLEJO-FA	CA	24	0.0563
											116	1.1799
5	8840	WASHINGTON	DC-MD-	2.1810	3.2982	27.8456	1	720	BALTIMORE	MD	36	1.1173
											36	1.1173
6	1120	BOSTON	MA	1.9713	3.1485	30.9942	9	1200	BROCKTON	MA	20	0.0560
								2480	FALL RIVER	MA-RI	46	0.0503
								2600	FITCHBURG-	MA	42	0.0304
								4160	LAWRENCE-H	MA-NH	25	0.1192
								4560	LOWELL	MA-NH	24	0.0884
								4760	MANCHESTER	NH	49	0.0654
								5350	NASHUA	NH	35	0.0769
								6480	PROVIDENCE	RI-MA	42	0.5061
								9240	WORCESTER	MA	39	0.1845
											322	1.1772

MARKET DISTRIBUTION MODEL (MDM)

FILE 620 - NASA 99 COMMON NETWORK MODEL FOR YEAR 2000 W/97 CROSSOVER MILEAGE AND 50 MILE RA

SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
7	6160	PHILADELPH PA-NJ	2.1931	3.0575	34.0516	5	240	ALLENTOWN- PA-NJ	49	0.2600
							6680	READING PA	49	0.1308
							8480	TRENTON NJ	29	0.1859
							8760	VINELAND-M NJ	33	0.0462
							9160	WILMINGTON DE-NJ-	26	0.2414
									186	0.8644
8	2160	DETROIT MI	2.4655	3.0284	37.0800	2	440	ANN ARBOR MI	33	0.2379
							8400	TOLEDO OH-MI	54	0.3250
									87	0.5629
9	3360	HOUSTON TX	2.0757	2.1722	39.2522	1	2920	GALVESTON- TX	47	0.0965
									47	0.0965
10	1680	CLEVELAND OH	1.1765	2.0000	41.2522	4	80	AKRON OH	31	0.2971
							1320	CANTON OH	51	0.1677
							4440	LORAIN-ELY OH	26	0.1453
							9320	YOUNGSTOWN OH	61	0.2133
									169	0.8234
11	1920	DALLAS-FOR TX	1.8444	1.8444	43.0966	0				
									0	0.0000
12	5120	MINNEAPOLI MN-WI	1.5228	1.5228	44.6194	0				
									0	0.0000
13	1640	CINCINNATI OH-KY-	0.9222	1.4640	46.0834	2	2000	DAYTON OH	49	0.5033
							3200	HAMILTON-M OH	21	0.1385
									70	0.6418

ORIGINAL PAGE IS
OF POOR QUALITY

FILE 520 - DASA 97 COMMON NETWORK MODEL FOR YEAR 2000 W/97 CROSSOVER MILEAGE AND 50 MILE RA
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL		M A R K E T - V A L U E S PRIMP	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
14	5000	MIAMI	FL	0.8843	1.4402	47.5236	2	2680	FORT LAUDE	FL	24	0.3764
								8960	WEST PALM	FL	64	0.1795
											88	0.5559
15	7040	ST LOUIS	MO-IL	1.4398	1.4398	48.9634	0					
											0	0.0000
16	520	ATLANTA	GA	1.4178	1.4178	50.3812	0					
											0	0.0000
17	6280	PITTSBURGH	PA	1.2981	1.3965	51.7776	2	8080	STEUBENVIL	OH-WV	33	0.0570
								9000	WHEELING	WV-OH	46	0.0414
											79	0.0984
18	3280	HARTFORD	CT	0.5423	1.3333	53.1110	9	1160	BRIDGEPORT	CT	49	0.1615
								1170	BRISTOL	CT	16	0.0211
								1930	DANBURY	CT	48	0.0484
								4960	MERIDEN	CT	18	0.0149
								5440	NEW BRITAI	CT	9	0.0473
								5480	NEW HAVEN-	CT	35	0.1824
								5520	NEW LONDON	CT-RI	42	0.0405
								8000	SPRINGFIEL	CT-MA	24	0.1751
								8880	WATERBURY	CT	25	0.0999
											266	0.7911
19	2080	DENVER-BOU	CO	1.0168	1.0455	54.1564	1	3060	GREELEY	CO	50	0.0286
											50	0.0286
20	5080	MILWAUKEE	WI	0.8455	1.0147	55.1711	2	3900*	KENOSHA	WI	32	0.0785
								6600	RACINE	WI	24	0.0907
											56	0.1692

MARKET DISTRIBUTION MODEL (MDM)

FILE 620 - NASA 99 COMMON NETWORK MODEL FOR YEAR 2000 W/97 CROSSOVER MILEAGE AND 50 MILE RA
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	MARKET VALUES TOTAL	MARKET VALUES CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
21	3760	KANSAS CIT MO-KS	0.9094	0.9599	56.1311	2	4150	LAWRENCE KS	37	0.0138
							7000	ST JOSEPH MO	48	0.0367
									85	0.0505
22	3480	INDIANAPOL IN	0.7394	0.9029	57.0339	4	400	ANDERSON IN	34	0.0513
							1020	BLOOMINGTO IN	46	0.0386
							3850	KOKOMO IN	49	0.0259
							5280	MUNCIE IN	50	0.0477
									179	0.1635
23	7600	SEATTLE-EV WA	0.7621	0.8750	57.9289	1	8200	TACOMA WA	26	0.1328
									26	0.1328
24	1300	BURLINGTON NC	0.0327	0.8523	58.7812	2	3120	GREENSBORO NC	20	0.4890
							6640	RALEIGH-DU NC	49	0.3306
									69	0.8196
25	1840	COLUMBUS OH	0.7797	0.8338	59.6150	1	7960	SPRINGFIEL OH	43	0.0541
									43	0.0541
26	6200	PHOENIX AZ	0.7676	0.7676	60.3827	0				
									0	0.0000
27	7320	SAN DIEGO CA	0.7644	0.7644	61.1470	0				
									0	0.0000
28	8280	TAMPA-ST P FL	0.5753	0.6732	61.8202	2	1140	BRADENTON FL	33	0.0292
							7510	SARASOTA FL	43	0.0687
									76	0.0979

MARKET DISTRIBUTION MODEL (MDM)

FILE 620 - NASA 99 COMMON NETWORK MODEL FOR YEAR 2000 W/97 CROSSOVER MILEAGE AND 50 MILE RA
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
29	1280	BUFFALO NY	0.6417	0.6417	62.4620	0				
									0	0.0000
30	6440	PORTLAND OR-WA	0.5559	0.6250	63.0910	1	7080	SALEM OR	44	0.0732
									44	0.0732
31	8120	STOCKTON CA	0.1100	0.6014	63.6923	2	6920	√SACRAMENTO CA	45	0.4284
							5170	MODESTO CA	28	0.0629
									73	0.4914
32	780	BATTLE CRE MI	0.0929	0.5707	64.2632	3	3520	JACKSON MI	40	0.1001
							3720*	KALAMAZOO- MI	21	0.1323
							4040*	√LANSING-EA MI	43	0.2455
									104	0.4779
33	6520	PROVO-OREM UT	0.0594	0.5705	64.8337	1	7160	√SALT LAKE UT	38	0.5111
									38	0.5111
34	6840	ROCHESTER NY	0.5630	0.5630	65.3967	0				
									0	0.0000
35	3240	HARRISBURG PA	0.3154	0.5619	65.9586	2	9280	YORK PA	23	0.1252
							4000	LANCASTER PA	35	0.1213
									58	0.2465
36	5560	NEW ORLEAN LA	0.5497	0.5497	66.5083	0				
									0	0.0000

MARKET DISTRIBUTION MODEL (MDM)

FILE 620 -- NASA 99 COMMON NETWORK MODEL FOR YEAR 2000 W/97 CROSSOVER MILEAGE AND 50 MILE RA
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL		MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
37	5960	ORLANDO	FL	0.2985	0.5394	67.0477	2	3980*	LAKELAND-W	FL	42	0.0924
								4900	MELBOURNE-	FL	42	0.1485
											84	0.2409
38	4360	LINCOLN	NE	0.1296	0.5331	67.5808	1	5920	OMAHA	NE-IA	50	0.4034
											50	0.4034
39	4920	MEMPHIS	TN-AR-	0.5300	0.5300	68.1108	0					
											0	0.0000
40	6140	PETERSBURG	VA	0.0586	0.5102	6J.6210	1	6760	✓RICHMOND	VA	23	0.4516
											23	0.4516
41	4520	LOUISVILLE	KY-IN	0.5099	0.5099	69.1309	0					
											0	0.0000
42	5680	NEWPORT NE	VA	0.1371	0.4917	69.6226	1	5720	✓NORFOLK-VI	VA-NC	13	0.3546
											13	0.3546
43	5880	OKLAHOMA C	OK	0.4897	0.4897	70.1123	0					
											0	0.0000
44	1660	CLARKSVILL	TN-KY	0.0530	0.4741	70.5864	1	5360	✓NASHVILLE-	TN	41	0.4211
											41	0.4211
45	8160	SYRACUSE	NY	0.3402	0.4711	71.0576	1	8680	UTICA-ROME	NY	47	0.1310
											47	0.1310

ORIGINAL PAGE IS
OF POOR QUALITY

MARKET DISTRIBUTION MODEL (MDM)

FILE 620 - NASA 99 COMMON NETWORK MODEL FOR YEAR 2000 W/77 CROSSOVER MILEAGE AND 50 MILE RA
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
46	1000	BIRMINGHAM AL	0.4128	0.4659	71.5235	1	8600	TUSCALOOSA AL	49	0.0530
									49	0.0530
47	1520	CHARLOTTE- NC	0.4596	0.4596	71.9831	0				
									0	0.0000
48	160	ALBANY-SCH NY	0.4002	0.4386	72.4217	1	6320	PITTSFIELD MA	29	0.0384
									29	0.0384
49	3600	JACKSONVIL FL	0.4164	0.4164	72.8381	0				
									0	0.0000
50	8560	TULSA OK	0.4162	0.4162	73.2543	0				
									0	0.0000
51	7240	SAN ANTONI TX	0.3922	0.3922	73.6465	0				
									0	0.0000
52	640	AUSTIN TX	0.3642	0.3642	74.0107	0				
									0	0.0000
53	1040	BLOOMINGTO IL	0.0798	0.3452	74.3559	2	6120	✓PEORIA IL	35	0.1957
							1400	CHAMPAIGN- IL	47	0.0697
									82	0.2654
54	3000	GRAND RAPI MI	0.2765	0.3387	74.6946	1	5320	MUSKEGON-N MI	35	0.0622
									35	0.0622

MARKET DISTRIBUTION MODEL (MDM)

FILE 620 - NASA 99 COMMON NETWORK MODEL FOR YEAR 2000 W/97 CROSSOVER MILEAGE AND 50 MILE RA
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL		MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
55	2640	FLINT	MI	0.1888	0.3067	75.0013	2	800	BAY CITY	MI	42	0.0245
								6960	SAGINAW	MI	32	0.0934
											74	0.1179
56	6000	OXNARD-SIM	CA	0.1533	0.2869	75.2882	1	7480	SANTA BARB	CA	34	0.1336
											34	0.1336
57	3160	GREENVILLE	SC	0.2789	0.2789	75.5671	0				0	0.0000
58	7880	SPRINGFIEL	IL	0.1824	0.2767	75.8438	1	2040*	DECATUR	IL	38	0.0944
											38	0.0944
59	2120	DES MOINES	IA	0.2665	0.2665	76.1104	0				0	0.0000
60	760	BATON ROUG	LA	0.2616	0.2616	76.3720	0				0	0.0000
61	1480	CHARLESTON	WV	0.1417	0.2602	76.6322	1	3400	HUNTINGTON WV-KY-		44	0.1185
											44	0.1185
62	9040	WICHITA	KS	0.2587	0.2587	76.8908	0				0	0.0000
63	1760	COLUMBIA	SC	0.2419	0.2419	77.1327	0				0	0.0000

MARKET DISTRIBUTION MODEL (MDM)

FILE 620 NASA 99 COMMON NETWORK MODEL FOR YEAR 2000 W/97 CROSSOVER MILEAGE AND 50 MILE RA

SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
64	6025	PASCAGOULA MS	0.0524	0.2405	77.3732	2	920	BILOXI-GUL MS	21	0.0388
							5160	✓MOBILE AL	38	0.1493
									59	0.1881
65	4400	LITTLE ROC AR	0.2142	0.2398	77.6130	1	6240	PINE BLUFF AR	40	0.0256
									40	0.0256
66	2760	FORT WAYNE IN	0.2378	0.2378	77.8508	0				
									0	0.0000
67	5745	NORTHEAST PA	0.2319	0.2319	78.0826	0				
									0	0.0000
68	1560	CHATTANOOG TN-GA	0.2153	0.2153	78.2980	0				
									0	0.0000
69	3840	KNOXVILLE TN	0.2095	0.2095	78.5075	0				
									0	0.0000
70	4720	MADISON WI	0.2089	0.2089	78.7163	0				
									0	0.0000
71	1960	DAVENPORT- IA-IL	0.2030	0.2030	78.9193	0				
									0	0.0000
72	460	APPLETON-O WI	0.1151	0.2002	79.1195	1	3080	GREEN BAY WI	27	0.0852
									27	0.0852

MARKET DISTRIBUTION MODEL (MDM)

FILE 620 - NASA 79 COMMON NETWORK MODEL FOR YEAR 2000 W/77 CROSSOVER MILEAGE AND 50 MILE RA
SMSA'S BY ACCESSAL'S MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL		MARKET -- VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES		DIST	MARKET VALUE
73	8520	TUCSON	AZ	0.1931	0.1931	79.3126	0					
											0	0.0000
74	200	ALBUQUERQU	NM	0.1885	0.1885	79.5011	0					
											0	0.0000
75	1360	CEDAR RAPI	IA	0.1351	0.1860	79.6870	1	8920	WATERLOO-C	IA	50	0.0508
											50	0.0508
76	1720	COLORADO S	CO	0.1419	0.1835	79.8705	1	6560	PUEBLO	CO	41	0.0416
											41	0.0416
77	2320	EL PASO	TX	0.1809	0.1809	80.0514	0					
											0	0.0000
78	3440	HUNTSVILLE	AL	0.1790	0.1790	80.2304	0					
											0	0.0000
79	4640	LYNCHBURG	VA	0.0707	0.1786	80.4090	1	6800	ROANOKE	VA	45	0..179
											45	0.1079
80	840	BEAUMONT-P	TX	0.1774	0.1774	80.5864	0					
											0	0.0000
81	2840	FRESNO	CA	0.1665	0.1665	80.7528	0					
											0	0.0000

MARKET DISTRIBUTION MODEL (MDM)

FILE 620 - NASA 99 COMMON NETWORK MODEL FOR YEAR 2000 W/97 CROSSOVER MILEAGE AND 50 MILE RA
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
82	4120	LAS VEGAS NV	0.1608	0.1608	80.9136	0				
									0	0.0000
83	2440	EVANSVILLE IN-KY	0.1219	0.1503	81.0639	1	5990	OWENSBORO KY	29	0.0284
									29	0.0284
84	3560	JACKSON MS	0.1479	0.1479	81.2119	0				
									0	0.0000
85	960	BINGHAMTON NY-PA	0.1225	0.1463	81.3581	1	2335	ELMIRA NY	46	0.0238
									46	0.0238
86	7800	SOUTH BEND IN	0.1436	0.14[illegible]	81.5018	0				
									0	0.0000
87	6880	ROCKFORD IL	0.1411	0.1411	81.6428	0				
									0	0.0000
88	2360	ERIE PA	0.1366	0.1366	81.7794	0				
									0	0.0000
89	3660	JOHNSON CI TN-VA	0.1360	0.1360	81.9154	0				
									0	0.0000
90	4280	LEXINGTON- KY	0.1302	0.1302	82.0456	0				
									0	0.0000

MARKET DISTRIBUTION MODEL (MDM)

FILE 820 - NASA 77 COMMON NETWORK MODEL FOR YEAR 2000 W/77 CROSSOVER MILEAGE AND 50 MILE RA
SMSA'S BY ACCESSABLE MARKET VALUE - YEAR 2000

RANK	SMSA	PRINCIPAL	MARKET VALUES PRINC	TOTAL	CUM	SUBS	SMSA	SUBORDINATES	DIST	MARKET VALUE
91	680	BAKERSFIEL CA	0.1292	0.1292	82.1748	0				
									0	0.0000
92	7680	SHREVEPORT LA	0.1263	0.1263	82.3012	0				
									0	0.0000
93	7120	SALINAS-SE CA	0.0789	0.1245	82.4257	1	7485	SANTA CRUZ CA	30	0.0457
									30	0.0457
94	2580	FAYETTEVIL AR	0.0514	0.1234	82.5491	1	2720	FORT SMITH AR-OK	49	0.0720
									49	0.0720
95	3810	KILLEEN-TE TX	0.0550	0.1231	82.6722	1	8800	WACO TX	46	0.0673
									46	0.0673
96	5240	MONTGOMERY AL	0.1215	0.1215	82.7937	0				
									0	0.0000
97	600	AUGUSTA GA-SC	0.1210	0.1210	82.9147	0				
									0	0.0000
98	1440	CHARLESTON SC	0.1205	0.1205	83.0352	0				
									0	0.0000
99	1880	CORPUS CHR TX	0.1187	0.1187	83.1539	0				
									0	0.0000