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Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554
FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of

Amendment of the Commission's
Rules to Establish New
Narrowband Personal
Communications Services

-) GEN Docket No. ~~92-514~~
-) ET Docket No. 92-100
-) RM-7617, RM-7760, RM-7782,
-) RM-7860, RM-7977, RM-7978,
-) RM-7979, RM-7980, PP-4, PP-5,
-) PP-11, PP-14, PP-35 through
-) PP-40, PP-53, PP-69, PP-79
-) through PP-85

ECHO GROUP L.P.
PETITION FOR RECONSIDERATION

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Summary

Echo Group L.P. ("Echo") has developed Mobile Data Radio Service ("MDRS") technology, a spectrum-efficient and extremely cost-effective two-way data transmission system, which satisfies all of the Commission's requirements for a pioneer's preference in the narrowband Personal Communications Services ("PCS"). Echo has presented its proposal to the Commission in numerous filings which have included full documentation of the numerous innovative advantages of Echo's system.

In the First Report and Order in the PCS proceeding, the Commission denied Echo's request for a pioneer's preference while at the same time granting a preference to a system developed by Mobile Telecommunications Technologies Corporation ("Mtel"). The Commission based its denial of Echo's request on four factors, none of which are valid in light of the Commission's decisions on pioneer's preferences, its goals for the establishment of PCS, and the facts concerning MDRS that have been presented. Echo's technology is far more cost-effective than Mtel's. MDRS uses less than a third of the spectrum needed to operate Mtel's system is more efficient in operation, and has 10 to 30 times greater capacity than Mtel's. Echo's system is a two-way, real-time system, while Mtel's is a store-and-forward technology.

Because the Commission's explanations for the denial of Echo's request are inconsistent with its rules and with the facts presented, Echo respectfully requests that the Commission reconsider its decision and grant Echo's request for a pioneer's preference.

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of) GEN Docket No. 90-314
) ET Docket No. 92-100
Amendment of the Commission's) RM-7617, RM-7760, RM-7782,
Rules to Establish New) RM-7860, RM-7977, RM-7978,
Narrowband Personal) RM-7979, RM-7980, PP-4, PP-5,
Communications Services) PP-11, PP-14, PP-35 through
) PP-40, PP-53, PP-69, PP-79
) through PP-85

ECHO GROUP L.P.
PETITION FOR RECONSIDERATION

Echo Group L.P. ("Echo"), by its counsel, hereby files this Petition for Reconsideration of the Commission's denial of Echo's request for a pioneer's preference in the narrowband Personal Communications Services ("PCS") as released July 23, 1993 in the Commission's First Report and Order ("Report and Order") in the above-captioned proceeding.¹

I. **Echo Has Satisfied the Requirements for a Pioneer's Preference.**

In its Order adopting rules for awarding pioneer's preferences, the Commission set forth specific guidelines to evaluate preference requests. Proponents of a preference must develop an innovative proposal that leads to the establishment of

¹ **Amendment of the Commission's Rules to Establish New Narrowband Personal Communications Services**, (rel. July 23, 1993).

a service not currently provided or a substantial enhancement of an existing service.² The Commission specifically recognized that (1) an added functionality, (2) a technology that yields efficiencies in spectrum use, speed, or quality of information transfer, or (3) a development that significantly reduces costs to the public could each merit a pioneer's preference.³ To obtain a preference, a proponent must demonstrate its role (or that of its predecessor-in-interest) in advancing the innovative technology.⁴

In requesting a pioneer's preference for the development of its Mobile Data Radio Service ("MDRS"), Echo demonstrated its qualifications under the above standard. MDRS is a nationwide system, designed to operate on ten 5 kHz channels, that is based on highly efficient transmission protocols and frequency reuse between base stations to offer full duplex, real-time data delivery. MDRS introduces five major improvements to existing data delivery services:

1. **Frequency Reuse.** The system uses spectrum shaping techniques and allows the equivalent of cell-splitting, giving a 5-to-15-fold increase in spectral efficiency.⁵

² Establishment of Procedures to Provide a Preference to Applicants Proposing an Allocation for New Services, 6 F.C.C. Rcd. 3488, 3494 (1991).

³ Id.

⁴ The Commission's standards also require that the rules adopted for the new or existing service be a reasonable outgrowth of the applicant's proposal and lend themselves to the grant of a preference and a license to the pioneer. Id. Echo's proposal meets this standard as well. Echo proposed 50 kHz license allocations for nationwide and regional providers of advanced messaging services, primarily for data delivery. This was adopted in the Report and Order.

⁵ In Echo's Consolidated Reply Comments, submitted June 16, 1992, at 6 - 8, this efficiency increase was inaccurately understated. The correct figures, as originally stated in the MDRS Progress Report submitted June 1, 1991, are reflected herein.

2. **Base Station Synchronous Protocol.** The MDRS two-way base stations transmit an error-checked, addressed packet to the end users, commanding that data be returned in a specific time slot. Automatic correction methods are used to eliminate errors. In combination, these techniques provide two to three times the transmission efficiency of other message protocols. For example, Echo's system operates with an overhead of only 10%⁶ (i.e., 90% of its transmission is message data and only 10% is used to operate the system), while the system developed by Mobile Telecommunication Technologies Corporation ("Mtel"), which received a pioneer's preference, uses 33% of its capacity for non-message system overhead.⁷
3. **Increased Reliability for "Bursty" Data.**⁸ The patented single-bit Status Request involves constant inquiries from the base station to each mobile unit to determine when the user desires to originate a data transmission. Through this method MDRS avoids the instability commonly associated with the delivery of typical bursty messages under heavy channel loading conditions.
4. **Base Station Beacon.** The cost of the MDRS user system is reduced through the use of low-cost crystals in each mobile unit which can be

⁶ MDRS Progress Report, § 3.3 (June 1, 1991).

⁷ Mtel's Petition for Rulemaking (November 12, 1991) at A12.

⁸ "Bursty" data is data which arises infrequently but requires a rapid response when it does arise.

digitally locked onto the frequency of the base station transmitter, in which frequency is controlled by a more precise crystal or "beacon."

5. **Low Cost System Design.** Because the base station and user units incorporate several off-the-shelf components along with proprietary elements which facilitate miniaturization, MDRS saves both costs and space.

These innovations result in a spectrum-efficient data delivery system with a remarkably low user cost. Echo's system will open the door to real-time two-way wireless data communications for millions of potential users who are now locked out by prohibitively high costs. Thus, Echo's MDRS merits the grant of a pioneer's preference.⁹

II. The **Report and Order** Overlooks or Misapplies Several Features of MDRS in Its Denial of Echo's Request for Pioneer's Preference.

In the Report and Order the Commission specifically grounded its denial of Echo's request on four factors in which it found Echo's request deficient. However, on careful examination of Echo's previous submissions it is apparent that the Commission has either overlooked or misapplied several principal features of Echo's MDRS proposal.

First, what appears to be the principal reason for the denial of Echo's request is that the Commission found that Echo failed to differentiate MDRS from other two-

⁹ These innovations are examined in greater detail in the MDRS Progress Report submitted June 1, 1991.

way data services being provided or proposed in the cellular service.¹⁰ Although two-way data services are already authorized and are being provided through other technologies in other parts of the spectrum, these other technologies are incapable of providing two-way data services at anywhere near the low cost of Echo's technology. Pioneer preferences are appropriately awarded to developers of technologies that significantly reduce the costs of providing existing services to the public.¹¹ One of the major advantages of Echo's MDRS is the low cost of its components. Echo has explicitly and repeatedly stated that although the base stations of comparable equipment currently on the market sell for as much as \$250,000, the cost of Echo's two-way base stations, with redundancy, is estimated at \$5,000 each.¹² No cost estimates for Mtel's base station equipment, which includes base station receivers and base station wide-area transmitters, were included in its Petition for Rulemaking or its Request for Pioneer's Preference.¹³ Similarly, comparable portable units using other technologies cost approximately \$1,500 each, but Echo's mobile units will cost about \$85.¹⁴ Compare this to the wholesale cost of \$299 to \$380 per mobile unit in the Mtel system for which the Commission awarded a pioneer's preference.¹⁵ An

¹⁰ Report and Order at ¶ 93.

¹¹ 6 F.C.C. Rcd. at 3494 and Establishment of Procedures to Provide a Preference to Applicants Proposing an Allocation for New Services, 69 R.R.2d 141, 149 (1991).

¹² MDRS Progress Report, § 3.5.

¹³ See, e.g., Mtel's Request for Pioneer's Preference (November 12, 1991) at 17.

¹⁴ MDRS Progress Report, § 3.5.

¹⁵ Reply Comments of Mtel, June 16, 1992.

equipment cost reduction of up to 98 per cent without a corresponding loss in quality or capacity certainly constitutes a significant development. Nevertheless, the Report and Order fails even to address this aspect of Echo's proposal.

Second, in the Report and Order, the Commission states that Echo failed to demonstrate the innovativeness of its technology, given that two-way mobile data operations currently exist in other areas of the spectrum.¹⁶ In doing so, however, the Commission again has incorrectly focused on the similarity of the services offered rather than the technologies employed by MDRS and other two-way data providers. Just as Mtel's technology is capable of transmitting 24 kilobits of information per second (kbps) "in a single 50 kHz channel,"¹⁷ Echo has developed a system that transmits 2.4 kbps in a 5 kHz channel and has proposed 10 channels for its system. A simple multiplication demonstrates that Echo's system can, at the very least, deliver the same data flow rate as Mtel's in the 50 kHz of spectrum requested. However, Echo's subdividing the channels allows flexible assignment and frequency reuse within an urban area, giving 5 to 15 times the spectrum efficiency. With its capability for extensive frequency reuse and its more efficient overhead, Echo's system has 10 to 30 times greater capacity than Mtel's.¹⁸ Moreover, unlike Mtel's store-and-forward proposal, and those of some others who requested a pioneer's preference, Echo's

¹⁶ Report and Order at ¶ 93.

¹⁷ Id. at ¶ 58.

¹⁸ See Appendix A, attached.

MDRS provides wireless services on a real-time basis. Yet Mtel received a pioneer's preference and Echo's request was denied.

This dissimilar treatment of similarly situated parties is unsupported by the record. Both Echo and Mtel proposed a new innovative technology that each has demonstrated will significantly enhance the provision of its respective service. If Mtel's work establishes the threshold for pioneer's preferences in narrowband PCS, then Echo's achievements are well above that threshold. The Commission has stated that in situations where several innovative parties meet an eligibility standard, it is appropriate to award preferences to each such eligible applicant.¹⁹ Because Echo submitted an innovative proposal that resulted in the Commission's adoption of rules that permit the use of Echo's technology and service, as apparently Mtel did, the Commission should also award Echo a preference.

Third, the Report and Order asserts that Echo relied upon existing technologies for its MDRS.²⁰ Although MDRS would build upon certain existing technologies, Echo's significant innovative developments warrant the grant of a pioneer's preference. At this time, only working prototypes of MDRS equipment have been thoroughly tested and such equipment has not yet been mass-produced much less been used to provide commercial service. Further, although MDRS is based in part on the

¹⁹ 6 F.C.C. Rcd. at 3495.

²⁰ Report and Order at ¶ 93.

work of Echo's predecessor-in-interest, as well as improvements made by Echo, the Commission has explicitly approved this approach.²¹

In any event, in its MDRS Progress Report, Echo clearly detailed the data management technique underlying its MDRS technology for which a U.S. patent has been issued.²² Briefly stated and simplified, the MDRS base station transmits an error-checked, addressed packet to the user, commanding that the data be returned in a specified time slot. Automatic correction methods are used to eliminate errors. This fully synchronous, centrally controlled technique eliminates multiple layers of protocols and synchronized overhead common to other systems. Only the data bits actually needed for the radio transmission are sent through scarce spectrum. For short messages, the efficiency (data bits ÷ [data bits + control bits]) is two to three times higher than other message protocols.²³ The patented single-bit Status Request of the Echo system increases throughput at least two times on typical bursty messages. Thus, on MDRS, even when channel-loading reaches 80-90%, virtually all messages sent will be successfully received.²⁴ Moreover, the dynamically variable data word

²¹ 47 C.F.R. § 1.402 (a). Additionally, although several opponents to Echo's Request contended that much of the research and development of MDRS had taken place prior to the establishment of the Commission's pioneer's preference rules, the Commission correctly rejected these contentions consistent with its established policies. 6 F.C.C. Rcd. at 3496.

²² MDRS Progress Report, § 3.3. The Report and Order does not question the validity of Echo's technical feasibility study. See also Echo's Petition for Reconsideration, filed September 14, 1992, at 6, for a more complete discussion of the five major improvements to existing data delivery services that MDRS presents.

²³ MDRS Progress Report, § 3.4 and Figures 3 and 4.

²⁴ Id., § 3.3, Appendix II, at Section on "Modulation Spectrum in the Remote Packet Radio" at Figure 12.

length allows different services to simultaneously be provided without loss of efficiency. Echo's Progress Report explains that the portability of Echo's mobile units is enhanced by a proprietary switched capacitor integrated circuit and a proprietary antenna design. By decreasing the size without affecting the performance of mobile units, these inventions facilitate the use of MDRS with laptop computers and two-way pagers.²⁵ With full details of these achievements before it, in light of its own rules and decisions, the Commission erred in failing even to address these significant technological innovations.²⁶

Fourth, according to the Commission, Echo failed to demonstrate the specific innovative development for which it is responsible that permits provision of MDRS on PCS frequencies.²⁷ As Echo detailed in its Request for Pioneer's Preference, its work has built upon the work of its predecessor-in-interest and improved the spectrum shapes of packet radio transmissions to decrease interference, improved the sensitivity of radio receivers to reduce error rates, improved digital frequency control software to improve stability and maintain low product costs, and developed low cost frequency reuse techniques.²⁸ In its statement of the standards it uses to evaluate

²⁵ Id., § 3.6.

²⁶ In contrast to its treatment of Echo, the Commission acknowledged that Mtel did not invent the multi-carrier modulation concept that underlies its proposed system, yet the Commission awarded a pioneer's preference to Mtel for its role as the "innovator of these technologies for PCS." Report and Order at ¶ 73.

²⁷ Id. at ¶ 93.

²⁸ Echo Group L. P. Request for Pioneer's Preference (July 30, 1991) at 8-9. The initial design of Echo's MDRS was developed by Dr. Bruce B. Lusignan, Professor of Electrical Engineering at Stanford University and Chairman of the Board of TransTech International ("TTI"), Echo's predecessor-in-interest in MDRS. Echo has joined with Dr. Lusignan

pioneer's preference requests for PCS, the Commission listed both increased spectrum efficiency and reduced cost to the public.²⁹ Echo's MDRS, with its combination of narrow channels, frequency agile spectrum reuse, patented data management technique, and ability to handle "bursty" data, is uniquely able to bring new levels of spectrum efficiency to the mobile data field. In its denial of Echo's request the Report and Order completely ignored this specific innovation as well as the low cost of MDRS, which is fully consistent with the Commission's criteria for granting pioneer's preferences and also directly furthers the Commission's goals for establishing PCS.³⁰

Finally, the Report and Order seems to take issue with the fact that MDRS has been developed through testing on land mobile and cellular frequencies in the 800 and 900 MHz bands.³¹ There is simply nothing in this fact that is relevant to Echo's qualifications for a pioneer's preference. Thorough field testing has been conducted to provide the Commission with concrete evidence of the feasibility and practicality of

and has provided ongoing technical and financial support to the development of the technology.

²⁹ Personal Communications Services, 7 F.C.C. Rcd. 5676, 5734-35 (1992).

³⁰ In addition, the Commission has misapplied the comparison that Echo made between its MDRS and the two-way data system developed by IBM and major cellular carriers. See Report and Order at n. 71. As stated above, Echo's system is more cost-effective and more efficient in data throughput and spectrum use than that of Mtel and certainly more cost-effective than the proposed IBM system. The Report and Order overlooked the fact that MDRS will provide service at a cost to consumers that is a fraction of that charged for two-way data services currently in use or under development for use in the cellular band. It is precisely Echo's ability to provide a spectrum-efficient system at a low consumer cost that constitutes the innovative and substantial contribution deserving of a pioneer's preference in PCS.

³¹ Report and Order at ¶ 93.

its MDRS technology. The Commission found it in the public interest to grant an experimental license in these bands. In fact, Mtel conducted testing in the same frequency bands.³² The fact that MDRS has been tested in another band does not mean that it is not appropriately suited for use in the allocated PCS spectrum, which has essentially the same characteristics as the spectrum in which MDRS was tested.

Conclusion

For all of the above reasons, Echo respectfully requests that the Commission reconsider its decision and grant Echo's request for a pioneer's preference.

Respectfully submitted,

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Dated: September 10, 1993

³² See "Report on Field Tests of the Nationwide Wireless Network Service" filed by Mtel on June 29, 1992.

Appendix A — Spectral Efficiency Analysis¹

In reviewing the action taken by the Commission with respect to Echo Group L.P.'s ("Echo") MDRS system in the Report and Order, the Commission has apparently misinterpreted the efficiency factors provided in the "Mobile Data Radio System Progress Report" submitted as part of the MDRS filing. It has overlooked spectral efficiency between 10 and 30 times greater than the Mtel system which was awarded a pioneer's preference.

In Section 4.0 of the Progress Report filed by Echo on June 1, 1991, spectral efficiency is calculated by giving detailed analysis of services provided to a mix of users: Delivery Service Verification, Dispatch Service, Point-of-Sale Terminals, Burglar Alarm Monitoring, Acknowledgment Paging Service and Electronic Mail. The calculations illustrate the ability of the single patented data protocol to serve a wide variety of applications simultaneously.

The model in the Progress Report is based on the use of MDRS in a Metropolitan Statistical Area ("MSA"), an urban complex such as San Francisco or the Los Angeles basin, and use of only five 5 kHz channels. (The MDRS

¹ This analysis was prepared by Professor Bruce B. Lusignan, Chairman of TransTech International and Director of Stanford University's Communications Satellite Planning Center and a member of Stanford University's Center for Telecommunications. Dr. Lusignan is well-known in the industry and to the Commission for his pioneering work in satellites and mobile radio at Stanford University. He developed the concept of direct broadcast satellite television in the 1970s and worked with the Commission, NASA, the State of Alaska, and industry to bring it into reality. In the 1980s, under contract to the Commission's UHF Task Force on spectrum utilization, Dr. Lusignan developed Amplitude Companded Side Band ("ACSB") radio, which is able to deliver voice services on 5 kHz channel spacing. The ACSB technique has led to Commission allowance of 5 kHz channel splitting in mobile radio bands and to the allocation of the 5 kHz assignments in the 220-222 MHz band.

proposal is for ten 5 kHz channel allocations, twice the capacity as that used in the Progress Report model.) System capacity for the MSA is based on 85% system loading during the busy hours of the day.

The typical MDRS system in the Progress Report model can simultaneously serve 3,200 Delivery Trucks, 3,600 Taxis, 7,200 POS terminals, 48,000 Alarms, 216,000 pagers and 6,912 electronic mail boxes. With this user mix a total of over 25,000 typical two-way customers and over 200,000 acknowledgment paging customers can be served in only one MSA. Echo, however, has requested twice as many frequency allocations to provide MDRS service on a nationwide basis. If Echo were granted a nationwide 50 kHz license, in 200 MSAs it would be able to serve approximately 400 times as many customers.²

Echo's proposed nationwide MDRS system thus could simultaneously serve over 5 million typical two-way customers and 80 Million acknowledgment paging customers. (The capacity is so large that clearly the paging service would use less than the assumed capacity of 12.5%.)

Before clarifying where the dramatic capacity improvement comes from, it should be pointed out that the actual nationwide capacity of Echo's MDRS system is closer to three times greater than the foregoing calculations. The calculations assume a five fold frequency reuse within an MSA, based on the initial cell size used in the first phase of cellular telephone services. As the Commission is aware, as traffic grows cells are sectorized into smaller coverage areas, typically

² Note that even in smaller MSAs, MDRS can employ the same frequency reuse, if necessary, to achieve similar system capacity.

increasing frequency reuse about three times. The MDRS system which uses such reuse techniques, will also sector cells as needed.

In evaluating Echo's system compared to Mtel's, the Commission did not focus on the differences between each system's capacity to serve customers with a 50 kHz frequency allocation on a nationwide basis. Mtel's can serve between 600,000 and 800,000 users while Echo's can serve at least 10 to 30 times that number, depending upon the mix of customer uses and how much frequency reuse is employed. In this regard, the Commission seems to have overlooked the source of Echo's dramatically improved spectral efficiency. In modulation design both systems have the same efficiency, 24 kb/sec in 50 kHz of bandwidth vs. 2.4 kb/sec in 5 kHz of bandwidth. The factor of five improvement of the MDRS system comes from the five-fold channel splitting of the spectrum that allows cellular-like frequency reuse in the MSA. Five fold frequency reuse occurs in the first phase and fifteen-fold frequency reuse occurs in the second phase if needed.

The other factor of two increase comes from the patented data handling system that virtually strips almost all overhead from the data packets when they enter the radio spectrum. The centrally managed data flow allows the data to be transmitted error free with a wide mix of users very near the theoretically highest efficiency.

Because the MDRS system is patented and is on public record, the Progress Report described in detail the data protocols and the way the different services are handled simultaneously. Echo's system is at the very least an order of magnitude greater in spectral efficiency than the Mtel system or than any other

system proposed or in existence. This is sufficient improvement to label the system "innovative" and qualify it for a pioneer's preference.

In its review the Commission may have been confused by comparing the wrong parameters or by equating MSA capacities (used in the Progress Report) with nationwide capacity used in Mtel's application. In any event it is submitted that the foregoing analysis will provide the Commission with a fair basis to evaluate Echo's request for a pioneer's preference.

Declaration of Dr. Bruce Lusignan

I, Bruce Lusignan, declare under penalty of perjury that: I am Chairman of TransTech International and Director of Stanford University's Communications Satellite Planning Center and a member of Stanford University's Center for Telecommunications. I developed MDRS in conjunction with Echo Group L.P. ("Echo") and prepared for Echo the MDRS Progress Report filed with the Federal Communications Commission on June 1, 1992. I have read the foregoing "Petition for Reconsideration" prepared on behalf of Echo and the facts stated therein as well as in the Appendix thereto are true and correct.


Bruce Lusignan

Dated: Sept 9, 1993

CERTIFICATE OF SERVICE

I, David H. Pawlik, do hereby certify that on this 9th day of September, 1993 that I have served a copy of the foregoing Petition for Reconsideration of Echo Group L.P. via first class mail, postage prepaid to the parties on the service list below.



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