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

Petition of Orbital Communications Corporation for Amendment of Section 2.106 of the Commission's Rules to Establish a Mobile Data Service Using Low-Earth Orbit Satellites	)	RM-7334

PETITION FOR RULEMAKING

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SUMMARY

Orbital Communications Corporation ("ORBCOMM") requests the Commission to initiate promptly a rulemaking so that it can offer a mobile data and positioning service using a constellation of low-earth orbiting satellites. By operating 20 small satellites 600 miles above the earth's surface (compared to 22,300 miles for a geosynchronous satellite), the ORBCOMM system will allow for low-power, low-cost portable subscriber terminals that will enable ORBCOMM to meet unserved and underserved communications needs. Advances in launch vehicles and small satellite technology make this innovative commercial low-earth satellite system practical for the first time. ORBCOMM will offer position determination (using the Doppler characteristics of low-earth orbit satellites) and low-speed, two-way data communications (i.e., non-voice) for use in emergency communications (including the capability to meet the needs identified by the Commission in the PELTS proceeding), data acquisition, tracking and messaging.

The use of low-earth orbit satellites will provide virtually continuous coverage throughout the United States as the satellites constantly move relative to the earth's surface; in addition, the same satellites will cover the rest of the world, allowing global coverage with only the addition of earth stations in other parts of the world. This global coverage will allow ORBCOMM to export service, and thereby reduce the telecommunications foreign trade deficit. The Commission must act quickly, however, if the U.S. is to take advantage of its current technological lead in this new mobile service, because

other nations are working on similar launch vehicle and small satellite technologies. In order to speed implementation, ORBCOMM is concurrently filing an application to construct its satellite system, and requests that the Commission process the application and rulemaking in parallel.

ORBCOMM requests that the Commission authorize it to use 898 KHz in the UHF and VHF bands under a "modified primary" status. By guaranteeing no harm to currently authorized licensees in these bands, ORBCOMM will be able to provide important communications services to between ten and twenty million U.S. subscribers without displacing any present licensees, and using less than 1 MHz of spectrum. As demonstrated in the petition for rulemaking and application to construct, the public interest would be well served by Commission authorization of ORBCOMM's pioneering, low-earth orbit satellite service.

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I. Introduction

Orbital Communications Corporation ("ORBCOMM"), by its attorneys, hereby petitions the Commission to initiate a rule-making proceeding that will allow the rapid implementation of a new mobile satellite data communications and position determination service utilizing a constellation of small satellites placed into low-earth orbit ("LEO"). Advances in launch vehicles and small satellite technologies, combined with the relatively low power requirements of satellite operations in LEO, make possible the ubiquitous, efficient and economical provision of a variety of services that will meet unserved and underserved needs. As set forth in greater detail herein and in the application to construct such a system being filed concurrently by ORBCOMM, the public interest would be well served by Commission adoption of the proposed rules. Moreover, expeditious action by the Commission is necessary to allow the U.S. to secure

a leadership role in the global provisioning of this innovative communications technology.

ORBCOMM is the separate subsidiary formed by Orbital Sciences Corporation ("OSC") to develop the ORBCOMM system. OSC, the parent corporation, was formed eight years ago to develop and operate space transportation systems and to engage in other space-related businesses in both the commercial and government sectors. In its brief history, OSC has developed several major advanced space transportation products, including the Transfer Orbit Stage (TOS®) orbit transfer vehicle and the Pegasus™ Air-Launched Space Booster now in production and preparing to launch payloads for customers including the National Aeronautics and Space Administration ("NASA") and the Department of Defense. In addition, OSC's Space Data Division is a leading developer and manufacturer of suborbital rockets, launch facilities, space payloads, and associated electronics and data systems for customers such as the military, NASA, the National Oceanic and Atmospheric Administration ("NOAA") and the Strategic Defense Initiative Organization.[1/] OSC's Space Systems Division personnel have designed, fabricated and qualified for space flight numerous small commercial satellites.

While non-geosynchronous orbit satellites are not in and of themselves a new technology, the combination of reliable,

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1/ OSC presently has about 600 employees, of which approximately 275 are graduate engineers and technicians with experience in systems engineering, guidance and control, aerodynamics, propulsion, electronics and software, communications systems, structures and mechanisms, thermal control and related disciplines.

low-cost launch vehicles, miniaturized and highly advanced electronics, and low-earth orbit operations, creates the opportunity at this time for an innovative mobile satellite system with numerous cost and service advantages over current terrestrial offerings and planned mobile satellite services. In addition, the use of a constellation of small LEO satellites circling the globe allows for worldwide coverage with only a minimal additional investment in earth stations abroad.[2/] The United States, however, will lose its pioneering role (and accompanying economic and trade benefits) in bringing this new service to the rest of the world if others are permitted to take advantage of the regulatory process to delay needlessly ORBCOMM's implementation of the proposed system and services.

ORBCOMM is concurrently filing its application for authority to construct its proposed system so as to provide the Commission the ability to evaluate the concept of a LEO mobile data satellite service with a specific, concrete proposal before it. ORBCOMM believes that the concurrent processing of its application with this rulemaking is vitally important to ensure that the U.S. can gain a leading position in this new worldwide market -- a lead based on ORBCOMM's technical superiority. Moreover, such a parallel processing of the rulemaking and application will speed the implementation of the system and

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[2/] In this regard, we are urging the Commission to seek the necessary modifications to the international frequency allocations at the upcoming WARC to make this service available globally.

thereby make the benefits of this new service available at the earliest possible opportunity.[3/]

II. Service Description

A. The Proposed Low-Earth Orbiting Satellite System

As described in greater detail in the accompanying application, ORBCOMM proposes to construct and operate an innovative system of 20 small satellites placed in circular orbits 970 kilometers (600 statute miles) above the earth. Two of the small satellites will be placed in polar orbits, and 18 of the satellites will be placed in 40 degree inclined orbits. This low-earth orbiting satellite system will provide critical two-way data communications and position determination services to subscribers throughout the 50 states, Puerto Rico, the Virgin Islands, and the U.S. Pacific Islands. The satellite system also will have the capability to provide coverage throughout the world through reuse of the space segment.

Use of the new Pegasus launch vehicle developed by OSC will permit for the first time the cost-effective deployment of a commercial low-earth orbiting communications satellite system. The low altitude of the satellites decreases the power required for communications by a factor of up to 1,000 compared with

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[3/] The Commission has the authority to conduct parallel processing of a rulemaking and an application, and it has previously recognized the benefits of such a procedure. E.g., Radiodetermination Satellite Service, 60 RR 2d 298 (1986) at fn. 2; National Ass'n of Broadcasters v. F.C.C., 740 F.2d 1190, 1221 (D.C.Cir. 1984) (approving parallel processing of rulemaking and application to expedite implementation of a new DBS service).

geostationary satellites, and makes practical the use of VHF and UHF frequencies for portable and mobile satellite services. With such relatively low power requirements, and at these low frequencies, subscriber equipment can be built taking advantage of existing high volume, low cost VHF and UHF components and simple omnidirectional antennas to achieve unit retail prices below $50 for a basic communications terminal and under $150 for a combination communications/position determination terminal. Finally, the use of low-earth orbiting satellites intrinsically provides Doppler frequency shift that will be used in the baseline ORBCOMM system to compute the location of subscriber terminals.

The ORBCOMM satellite constellation will provide geographic coverage of every spot on earth. In the coverage area between 70 degrees north and south latitudes, subscriber access to and from the satellites will exceed 95% in terms of time. Availability delays will be occasional, spread throughout the 24 hour day, and of very short duration, typically less than one minute. As one satellite proceeds out of view, another will come into view to provide communications coverage. ORBCOMM will achieve this near-continuous coverage by deploying three satellite planes with six satellites each in inclined orbits, along with two satellites in two polar orbit planes.

Each satellite will weigh approximately 150 kgs (330 pounds), including fuel, at the beginning of life. The satellites will be three-axis body stabilized and will maintain precisely their pointing accuracy and relative position in the

constellation throughout their seven-year lives. Communications between the satellites and earth stations will operate at VHF and UHF frequencies using a total of 898 KHz of bandwidth, potentially serving between ten and twenty million U.S. subscribers.[4/]

Subscriber terminals will transmit to the satellites at 1,200 bps over 15 KHz channels, using 2 watts for portable units and 5 watts for mobile terminals. Subscriber terminals will receive data from the satellites at 4,800 bps, utilizing 27 KHz channels. Communications between the nine U.S. Regional Gateways (earth station hubs) and the satellites will operate at 56 Kbps, using 100 KHz channels.[5/] A 50 KHz UHF downlink channel will be used to retransmit time signals (accurate to one-millionth of a second) received from Global Positioning Satellites ("GPS"), a stable 400 MHz frequency standard, and satellite position coordinates for use in calculating subscriber geographic position. As a side benefit, the time signal will be made available to any user worldwide at no charge.

[4/] The actual number of subscribers that will be served by the ORBCOMM system depends on the usage mix that ultimately develops. The system is engineered to provide service to over 10 million customers for emergency and safety services on an occasional basis, and several million customers using the service on a more frequent, daily basis. A detailed description of the system and capacity is set forth in the application to construct the ORBCOMM system being filed concurrently.

[5/] The Regional Gateways will be linked in a star network by terrestrial facilities to the Network Master Control Center in Virginia.

communications device.[6/] The two-way communications and position determination capabilities of the ORBCOMM system will be applied, inter alia, to search and rescue services, medical emergencies, collection of environmental data, recovery of stolen vehicles, tracking of valuable cargo, communications for the handicapped, and personal and business communications where short, yet critical information can be transmitted by no other means or only at much higher cost.

III. The Public Interest Would Be Well Served By Commission Adoption Of The Proposed Rules To Establish A Mobile Data Service Using Low-Earth Orbit Satellites

A. The Proposed Mobile Data System Using Low-Earth Orbit Satellites Will Meet The Unserved And Underserved Demand For The Services That Will Be Provided Over That System

The proposed ORBCOMM system will economically serve the needs of customers on "thin-routes" for emergency services, data acquisition, tracking and two-way messaging. Although some of

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[6/] For example, one important potential application is the installation of terminals in automobiles, connected to the air bag trigger. In the event of a severe accident, the activated terminal would automatically report the accident and transmit the car's position to ORBCOMM's control center, which in turn would alert the proper authorities. With the addition of a small key board and display, the driver will be able to use the same basic communications capability installed in the car to call for roadside assistance and to send messages; or, if the car were stolen, it could be tracked on command from the network control center. Based on design and manufacturing studies, ORBCOMM estimates that incorporating the basic emergency communications and position determination capability in a vehicle (either as a factory option or an aftermarket installation) will cost the subscriber less than $200 for the terminal, and under $50 per year in subscriber fees (which could be included in service insurance policies, serve as an offset to insurance fees, or be covered by automobile service club charges).

B. The Services That Will Be Provided By The ORBCOMM System

The two-way data communications and position determination services proposed by ORBCOMM will fill service, geographic and economic gaps in the existing telecommunications network. Using a terminal about the size of a pocket calculator, a subscriber will be able to send short alphanumeric messages to, and receive messages from, any other place in the country. The system's data communications and position location capability will support a wide variety of applications, which we have grouped into Emergency Services, Data Acquisition Services, Tracking Services, and Message Services. The large demand projected for these services is based on a unique combination of features and benefits made possible by the system design:

- Two-way Communications (Including Acknowledgement of Message Receipt)
- Intrinsic Position Determination Capability
- Pocket Portability of Subscriber Terminals (Including Small and Inexpensive Antennas)
- Subscriber Equipment and Usage Charges Roughly One-Tenth of Alternative Satellite-Based Systems
- Global Geographic Coverage Including Areas Not Covered By Any Communications System
- Long Battery Life Resulting from Low Power Requirements, Light Duty Cycle and Short Message Lengths

ORBCOMM projects that a significant number of subscribers will be for emergency "911" type services where the customer requires assistance and is not able to make use of a telephone or another

these services can be obtained in urban America, these same services are not presently available throughout much of the United States. Moreover, while there are proposed systems under development that may be able to provide some of the services to be offered by the ORBCOMM system, those systems cannot match the expansive coverage (including the capability of worldwide coverage) and low cost that the low-earth orbit satellite system makes possible.

In the accompanying application, ORBCOMM documents and quantifies in great detail the demand for the services to be offered over the ORBCOMM system. The Commission has elsewhere recognized the need to make available to the American public emergency services,[7/] and the Commission is also aware that these services are not universally available, particularly for hikers and campers in remote parts of the country.[8/] Likewise, the Commission has indicated that data acquisition, two-way messaging, tracking and position determination services are in the public interest.[9/] While alternative suppliers provide some of these services in some parts of the country, and while ORBCOMM

7/ E.g., Amendment of Parts 0, 1, 2, and 95 of the Commission's Rules Regarding the Establishment of a Personal Emergency Locator Transmitter Service, 4 FCC Rcd 8657 (1989) ("PELTS NPRM"); Development and Implementation of a Public Safety National Plan, 3 FCC Rcd 905 (1987).

8/ E.g., PELTS NPRM at para. 10. Cf., Amendment of the Commission's Rules for Rural Cellular, 3 FCC Rcd 6401 (1988) (established five-year fill in period for rural cellular).

9/ E.g., Land Mobile Satellite Service (AMSC Authorization), 4 FCC Rcd 6041 (1989); Radiodetermination Satellite Service, 60 RR 2d 298 (1986); Stolen Vehicle Recovery Systems, 4 FCC Rcd 7558 (1989).

contemplates working with such suppliers to enhance their existing services, no other system will offer these services throughout the United States at comparable costs, and no other system has the same potential to provide global coverage at such low additional cost.

By way of comparison, cellular service, which has the potential to meet some of these needs (e.g., two-way messaging and emergency services via 911), has been implemented in the largest metropolitan areas, and plans have been made to provide cellular service in many rural areas as well. However, vast portions of the United States may not be served by even the rural cellular systems, but a critical demand for emergency and search and rescue services is likely to arise in these sparsely populated areas such as national and state parks and forests.[10/] Conversely, some of the proposed geostationary satellite systems that can provide coverage throughout the United States cannot provide the contemplated emergency services on an economically practical basis, because the equipment necessary to operate at the power levels required by those systems is not available at sufficiently low weight and cost. For example, the geostationary system proposed by AMSC will be focused on voice and some data applications, yet based on subscriber terminal price information made available in public statements by AMSC managers, the ORBCOMM subscriber terminal prices are expected to be significantly less than the estimated prices of terminals operating with such

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10/ PELTS NPRM at para. 3.

geostationary satellites. Likewise, the QUALCOMM and Geostar position determining systems will utilize terminals significantly larger and more expensive than the ORBCOMM terminals, and will serve different demographic markets. In sum, ORBCOMM is uniquely suited to meet the demand for these important low-cost services.

B. The Proposed ORBCOMM System Can Meet This Unmet And Underserved Demand Quickly And Efficiently

The proposed ORBCOMM system will combine state-of-the-art small satellites deployed in low-earth orbit together with low cost launch vehicles developed by OSC to produce a satellite-based communications system well suited to meet the demand for emergency service, data acquisition, tracking and two-way messaging on "thin routes." Moreover, it will be possible to get the system "up and running" in a relatively short period, because the manufacture and launch of the small satellites will take substantially less time than a conventional, geostationary satellite system.

1. The Satellites Can Be Placed Into Orbit Rapidly And At Low Cost

The ORBCOMM system is designed to operate with 20 small satellites in low-earth orbit. OSC has developed the Pegasus Air-Launched Space Booster specifically for the purpose of quickly and efficiently placing the small satellites into low-earth orbit. Pegasus payloads are integrated into the vehicle at ground level, and the vehicle is carried by an aircraft to an altitude of approximately 43,000 feet before it is released and the rocket engine is ignited. The Pegasus is designed to achieve

more efficient performance than a comparable ground launched rocket due to several factors: the energy imparted by the velocity and altitude of the carrier aircraft, reduced drag at launch altitudes, better propulsion efficiency at high ignition altitudes, and reduced gravity losses attributed to the Pegasus wing. Other factors that contribute to the greater efficiency of the Pegasus include flexibility in selection of launch point, the availability of a wide range of possible orbit inclinations and more gentle payload environments. In addition, Pegasus provides the flexibility to launch when desired without having to wait for a "piggy back" launch on a large booster.

Twenty ORBCOMM satellites will be launched on twenty Pegasus launch vehicles within fifteen months, at a rate of four launches every three months. The Pegasus vehicle's ability to accommodate such a rapid launch schedule also will prove valuable in the event of an in-orbit satellite failure. A replacement satellite can be launched to the correct orbital location within two to three weeks.[11/]

The satellites in the ORBCOMM system will each weigh 150 kgs (330 pounds) at the beginning of service and measure 7.9 meters (26 feet) in overall length from the tip of the antenna to the top of the stabilizing boom. Based on analysis by a major spacecraft manufacturer and OSC studies, as well as OSC's own

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11/ In contrast to the situation with geostationary satellites, a satellite failure in the ORBCOMM system would not shut down service; service quality would only be marginally degraded until a replacement satellite is launched, because the remaining 95% of the satellites (19 of 20) would still be providing service.

experience in building satellites (including construction of the DataSat™ experimental satellite), ORBCOMM expects the satellites to cost approximately $3 million each. The relatively low cost reflects the bulk nature of the purchase (since a total of 22, including two spares, will be acquired), the simple attitude control system, and the simplified requirements of a satellite providing only position determination and data services operating in low-earth orbit. Moreover, ORBCOMM estimates that it will only take 28 months to complete the design, development and production of the first satellites.

The use of the Pegasus launch vehicles, combined with the relatively short construction time required for the small satellites, results in a satellite system that can be fully operational by 1994,[12/] assuming authorization to proceed is granted by the Commission before March, 1991. By way of comparison, other mobile communications systems, such as rural cellular and geostationary satellites, generally require a longer implementation period.

Not only will ubiquitous service be available quickly under the ORBCOMM system, but the service will be relatively inexpensive to initiate. The total space segment cost, including the relatively low cost of the launches, the relatively low cost of the small satellites, and the system design of 22 satellites

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12/ While the system will not be completely operational until all 20 satellites are deployed, limited service will be available two months following the first satellite launch in October 1993. For some applications, such as environmental monitoring and polled data acquisition, this limited service availability will be fully adequate.

(20 operational satellites in-orbit and two on-ground spares), is estimated to total roughly $198 million. This compares favorably with the cost of other existing and proposed geosynchronous satellite systems intended to serve much narrower geographic and demographic markets.

2. The Proposed ORBCOMM System Will Operate With Very Low Cost Mobile Units

The ORBCOMM system will employ satellites at an orbit altitude of approximately 965 km (600 statute miles), some 95% closer to the user terminals than the 35,887 km (22,300 mile) altitude of satellites operating in geosynchronous orbit. As a result, even with omnidirectional antennas, the energy path loss for the ORBCOMM system is a factor of some 150 to 1,000 less than for a corresponding geostationary satellite system, and the corresponding power, size, and cost dimensions of ORBCOMM user terminals are expected to be five to ten times less than similar end user terminals operating with geostationary satellite systems, and will require simpler antennas. In addition, operation of the ORBCOMM system at the proposed frequencies will further reduce the cost of the end user terminals, which ORBCOMM estimates will be priced between $50-$400, depending on the features and services.[13/]

The low cost of the satellite system (and resulting low usage rates needed to recover the investment), in conjunction

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13/ The cost estimates were derived from detailed internal studies, and have been confirmed in discussions with a major electronics manufacturer.

with the expected low weight and cost of terminals, will allow ORBCOMM economically to meet the demand that would otherwise go unfulfilled for service in a variety of new applications, in "thin routes," and in demographic segments not yet served by existing mobile communications technology. For example, the emergency communications system needs identified in the PELTS proceeding would be provided by the ORBCOMM system at a very reasonable cost to hikers and campers in all remote areas of the United States.[14/] Similarly, ORBCOMM expects car manufacturers to incorporate emergency communications and positioning capabilities into automobiles as an option, in light of the relatively low cost and ensuing benefits to the motoring public.[15/] In sum, the innovative design of the ORBCOMM system will make available economical two-way data and positioning capabilities throughout the United States (and throughout the rest of the world without any additional space segment costs), for a broad range of applications by existing and new consumers of communications services.

14/ Moreover, the ORBCOMM system has the added advantage of positioning capabilities that were not part of the terrestrial radio proposal in the Commission's PELTS NPRM. The PELTS NPRM assumes that the person requiring assistance will know his or her location to be able to direct rescuers, or will be able to trigger the homing transmitter. ORBCOMM terminals will calculate and transmit position on command by the user or by the network control center.

15/ The value of the ORBCOMM system to fulfill such automotive sector needs has been confirmed in discussions with emergency road service companies and a major U.S. automobile manufacturer.

C. Prompt Authorization By The FCC Will Allow The United States To Establish Global Preeminence In These LEO Satellite Services

1. The United States Will Benefit If We Are The First Country To Implement A LEO Satellite System With Global Capabilities

The Commission is well aware of the negative trade balance the United States has developed for telecommunications goods and services.[16/] The ORBCOMM system can produce significant trade benefits for the United States to help offset the current telecommunications trade deficit. Although designed (and financially justified) as a U.S. domestic service, one major advantage of operating in low-earth orbit is the global coverage provided by the satellite constellation -- capacity that can be tapped throughout the world with only a minimal, incremental investment in ground stations and with complete reuse of the space segment.

If the United States is the first nation to deploy such a low-earth orbiting system, then it will be well positioned to "export" this service to other countries, since the capability is inherent in the non-geostationary system. Indeed, ORBCOMM estimates that revenues and licensing fees from foreign use of the ORBCOMM system could exceed $650 million over the life of the satellites. Moreover, given the lead time U.S. manufacturers would have over foreign producers, ORBCOMM estimates that some $200 million in telecommunications equipment for foreign gateways would be exported by U.S. manufacturers. In addition, assuming a

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16/ E.g., Regulatory Policies and International Telecommunications, 4 FCC Rcd 7387 (1988).

strong domestic manufacturing base is established as a result of the U.S. lead, then subscriber equipment exports could exceed several hundred million dollars.

2. The Commission Must Act Promptly In Order To Secure These Foreign Trade Benefits

Although we believe that ORBCOMM, an American company, presently leads the rest of the world in development of the technology needed to construct, launch and operate a low-earth orbiting satellite system, it is by no means clear that this current U.S. advantage will continue past the next two to three years. If the Commission allows others to use the regulatory approval process to delay this service, or if the regulatory process itself needlessly delays the ORBCOMM system, then other countries may surpass ORBCOMM and deploy systems before implementation in the U.S., eliminating the potential foreign trade benefits, and even potentially threatening the provision of service within this country by U.S. suppliers.[17/]

At present, at least nine other nations (including the Soviet Union, United Kingdom, India, Israel and Brazil) have or are pursuing the development of launch vehicles capable of placing small satellites into low-earth orbit. Several other countries have or are developing small satellites. Attendant with ORBCOMM's filing of its application for construction of the low-earth orbit satellites and this petition, the commercial

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17/ Subsidized launches on vehicles uncompetitive with Pegasus might be provided by some countries, thereby eliminating ORBCOMM's natural timing advantage.

potential for a low-orbit mobile satellite system (and supporting documentation) will become public knowledge. Other nations developing launch vehicles can be expected to try to copy ORBCOMM's plan, and might succeed and deploy their system first if ORBCOMM is delayed by the regulatory process in the U.S. Thus, failure of the Commission to act promptly could nullify current American preeminence in this field and forfeit substantial, potential foreign trade benefits from the export of ORBCOMM services and technology.

In addition to prompt grant of this petition and ORBCOMM's concurrent application, the Commission can help secure global availability of ORBCOMM service (and attendant benefits) by seeking to ensure that under international frequency allocation guidelines, ORBCOMM service can use these frequencies throughout the world.[18/] The upcoming WARC-92 proceeding provides the mechanism for such an allocation. We urge the U.S. to seek at the WARC-92 the minor changes to the international table of frequency allocations that will allow global operation.[19/]

18/ ORBCOMM intends to license local carriers in foreign countries, which will allow other nations (including underdeveloped or less densely populated nations) to obtain these communications services as quickly as possible, and with only a small investment in earth stations to serve as gateways. By operating with, rather than trying to compete against, foreign carriers, ORBCOMM hopes to minimize any international opposition to the ORBCOMM system.

19/ The frequencies requested by ORBCOMM are already allocated to satellite services internationally, so that the only modification required would be to specify that the provision of low-speed, mobile data services is allowed in these bands.

3. The ORBCOMM Proposal Will Further The Public Interest By Making More Efficient Use Of The Spectrum

ORBCOMM proposes that in the U.S. the service be granted a "modified primary" status. Under this proposal, ORBCOMM would ensure that the ORBCOMM service did not cause any harmful interference to current, authorized occupants of the spectrum requested herein. Thus, we do not seek "co-primary" status with respect to the present users, and we stand ready to solve any potential interference problems with those licensees.[20/] However, as a "modified primary" licensee, ORBCOMM would be granted "primary" status vis-a-vis any future applicants for spectrum in these frequencies. Under this approach, ORBCOMM would be protected against interference from any future applicants in these bands.

The "modified primary" status that ORBCOMM seeks, although non-standard, would allow ORBCOMM to deploy its highly spectrum-efficient service in these bands, without displacing the current licensees. Thus, the public benefit from efficient technology would emerge, while the costs normally associated with the obsolescence of current technology would be avoided. Under these circumstances, the public interest clearly would be furthered by a grant to ORBCOMM of authority to use the frequencies requested under a "modified primary" status.

[20/] As detailed in the concurrently filed application, the frequency plan, system design and traditional coordination techniques should eliminate any potential interference problems with current licensees.

IV. ORBCOMM Use Of The Particular Spectrum Sought In This Petition For Rulemaking Will Further The Public Interest

In this petition for rulemaking, ORBCOMM seeks the use of a total of 898 KHz of bandwidth for a low-earth orbiting satellite system. ORBCOMM proposes to utilize 370 KHz of bandwidth in the 137-138 MHz band for earth-to-space transmissions, and 478 KHz of bandwidth in the 148-149.9 band for space-to-earth transmissions.[21/] In addition, ORBCOMM proposes to use 50 KHz of bandwidth at 400.075 to 400.125 MHz to transmit time information and a standard frequency in accordance with currently specified usage.

A. These Frequencies Are Well Suited For The Proposed ORBCOMM Service

ORBCOMM seeks to use presently unused and underused spectrum in the VHF and UHF bands. Operation in these bands is critical to the economics and operating efficiencies of the low-earth orbiting satellite system. Frequencies below 50 MHz encounter severe propagation problems that will result in inadequate system reliability and availability. Operating above the UHF spectrum requires inordinate bandwidth for Doppler compensation. In addition, the low cost of subscriber terminals

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21/ Although ORBCOMM's strong preference is to use frequencies in the 148-149.9 band, ORBCOMM has preliminarily identified other potential spectrum that might prove suitable. Blocks of spectrum in the 400.15-401 MHz band, 401-402 MHz band, and/or the 402-403 MHz band can practically be used for the low-earth orbiting satellite system. However, use of those frequencies would likely necessitate a redesign of the satellite system, and ORBCOMM has not yet performed an interference analysis for those frequencies.

that help make the system so attractive would be nullified, because the terminal manufacturers would not have available the enormous low-cost VHF and UHF components base, and the terminals would require unique antennas (so that for automotive use, shared use of an antenna would not be possible). The particular frequencies requested by ORBCOMM are operationally and economically the best suited spectrum for the low-earth orbiting satellite system.

B. ORBCOMM's Operation In This Spectrum Will Not Cause Any Harmful Interference

In this petition for rulemaking, ORBCOMM requests authority to operate, on a "modified primary" basis, the low-earth orbiting satellite system in frequencies that do not currently encompass such service. Under the "modified primary" status, ORBCOMM will operate in a manner that will not cause harmful interference to other existing users (but will be granted primary status versus any new services or users proposed in these frequencies). At present, only NASA, NOAA, military mobile radio and a few non-government users are authorized to operate in these VHF bands, and ORBCOMM will be able to ensure that those present licensees will operate without interference from ORBCOMM.[22/] A detailed interference analysis is included in the ORBCOMM application being filed concurrently. In sum, that study shows that the specific frequencies and channel bandwidth will be

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22/ Conventional coordination techniques should allow operation by both ORBCOMM and the present licensees. If necessary, however, ORBCOMM will assume the expense of moving the current military mobile users to another band.

compatible with existing users and will not cause harmful interference, and the frequency plan has been designed with that objective.

C. ORBCOMM Is Proposing A Highly Spectrum Efficient System

As discussed above, ORBCOMM proposes to use 898 KHz of bandwidth in the VHF and UHF frequency bands.[23/] By using digital packet switching technology and confining the system to non-voice, low-speed, alphanumeric transmission only, ORBCOMM calculates that the system ultimately will have the capability of serving between 10 and 20 million U.S. subscribers, over 85% of whom fall into the emergency services category. This means that the system will support 10,000 to 20,000 subscribers per KHz of

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[23/] ORBCOMM proposes to utilize the spectrum as follows:

Proposed Frequency Plan

	Frequency(Mhz)	Channels	Required Bandwidth Occupied KHz Per Channel		Total KHz
Downlink					
Subscrib Term	137.000-137.270	8	27		270
Regional Gtwy	137.300-137.400	1	90		100
Time/Frequency	400.075-400.125	1	40		50
Uplink					
Subscrib Term	148.000-148.378	20	15		378
Reg Gateway	148.700-148.800	1	90		100
				TOTAL	898
Memo: Inter-Satellite Link					
GPS Sat (Receive Only)	1,575.42				

bandwidth -- a subscriber-to-bandwidth ratio that ORBCOMM believes is unmatched by any other two-way communications service. Moreover, under the "modified primary" proposal of ORBCOMM, presently authorized users will not be displaced.

The ORBCOMM system will provide both two-way data communications and position determination using the same bandwidth. The system will use the Doppler effect of the low-orbit satellites -- the change in frequency of an approaching and departing radio signal relative to any point on earth -- to calculate geographic position. Essentially the Doppler principle is a "free" side benefit of the architecture of the system.

Finally, ORBCOMM will make available free of charge to any user, a stable 400 MHz frequency beacon and time signals (accurate to one-millionth of a second). Each satellite will be equipped with a GPS receiver centered at 1,575.42 MHz, and that signal will be retransmitted by the satellite at 137 MHz and 400 MHz. This transmission will be used for position determination in ORBCOMM's subscriber equipment having one or two receive frequencies, but many other potential uses could be made of the reliable time and date information, such as automatic update of VCRs and automotive clocks, automatic correction for time zone changes and changes from standard to daylight time, etc.

V. Proposed Regulatory Treatment

In order to speed the implementation of this beneficial service, ORBCOMM proposes that the Commission process the concurrently filed application for a low-earth orbiting satellite service in parallel with the rulemaking for spectrum allocation. The Commission should promptly place ORBCOMM's application on public notice. In order to facilitate Commission review of the application, and to place a specific, concrete proposal before the Commission, ORBCOMM in its application has provided the information specified in the Part 25 Rules and the information required by Appendix B to the Commission's domestic satellite processing order.[24/]

With respect to the ORBCOMM terminals, ORBCOMM proposes a blanket license authorization scheme for type-approved devices. The vast number of expected subscribers, totalling in the millions, mandates the application of such a procedure. It clearly would not be practical for the Commission to process individual applications, particularly in light of the Commission's limited resources. Moreover, the Commission has found in other similar contexts that the combination of type-approval and blanket authorizations to the system operator serves as an effective means of monitoring the deployment and use of

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[24/] The Commission should require that should any other applicants timely file for a similar system, they too must provide the same information set forth in ORBCOMM's application, including system design, financial information and service proposals, and demonstrate that ORBCOMM's proprietary property is not being used without authorization.