

Before the  
Federal Communications Commission

JUL - 8 1993

FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

\_\_\_\_\_ )  
 In the Matter of )  
 )  
 AMENDMENT OF PARTS 2, 22 & 25 )  
 OF THE COMMISSION'S RULES )  
 )  
 for an Allocation of Frequencies )  
 and Other Rules for a New )  
 Nationwide Hybrid Space/Ground )  
 Cellular Network for Personal/ )  
 Mobile Communications Services )  
 \_\_\_\_\_ )

RM-7927

**AMENDMENT TO PETITION FOR RULE MAKING**

CELSAT, Inc. ("CELSAT") hereby amends its Petition for Rule Making in the above-captioned proceeding for a shared allocation for nationwide *Hybrid Personal Communications Services* ("HPCS"). CELSAT has special strength in the fields of space satellite and spread spectrum technologies. Its vision of space/ground mobile personal communications is the newest and perhaps ultimate evolution in the merging families of personal communications services (PCS), personal communications networks (PCNs), and Mobile Satellite Services ("MSS"). CELSAT's specific HPCS system design is known as CELSTAR.

In support of this amended petition, CELSAT states as follows:

**SUMMARY**

A Hybrid Personal Communications Service is one offered as a fully integrated combination of space and terrestrial cellular and microcellular mobile personal communication services, operated within a relatively small amount of common spectrum under one license, and capable of both interservice and intraservice sharing. Full integration of the space and terrestrial elements means that a subscriber enjoys transparent access to the full range of personal communication services -- from within microcellular campus-like service areas to

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ubiquitous roaming anywhere in the United States -- without ever having to consciously switch between modes, and all provided through a single very low power handset.

CELSAT's original February 1992 petition for an HPCS rulemaking<sup>1</sup> set forth the basic HPCS system concept and identified two frequency alternatives which, at that time, seemed most appropriate. While CELSAT's Initial Petition has been tentatively denied in one limited respect, much has happened in the interim to support a change in those initial band choices and which also tends to support the shared HPCS concept.

This amendment updates CELSAT's earlier petition to propose that the Commission provide for a service allocation for shared hybrid personal communications services. Specifically, CELSAT requests an allocation by rule change of one particular band pair in the Emerging Technologies ("ET") segments at 1970-1990 MHz up and 2160-2180 MHz down (the "ET Space Band").

At present these bands are heavily occupied by private and common

band interference sharing between at least two hybrids or an HPCS and an MSS system. Prudent limits on such sharing are requested, however.

The serendipitous benefits of a ubiquitous, truly integrated orchestration of space, terrestrial, and microcellular elements; all operating under common air and hardware interfaces, common spectrum and a common license; and supporting any voice, data, compressed video, or digital service up to 144 kbps, open vast new horizons in terms of functionality and national benefits, much greater than the sum of HPCS' parts. To best manage and allocate the spectrum required to support this service will likewise require integrated licensing rules and procedures beyond those that have traditionally supported merely the individual elements of HPCS (i.e., traditional cellular, land mobile, space-only MSS, and, soon, PCS). The framework for such rules are included in Appendix. Accordingly, CELSAT urges prompt consideration and adoption of the rules proposed in this Amendment to Petition for Rule Making.

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*I. THE REASONS FOR THIS AMENDMENT*

FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY

CELSAT's CELSTAR HPCS system is the first proposal to the FCC of a hybrid plan whereby the space and ground segments would be operated under one license using common frequencies. CELSAT's petition for rule making in the above captioned case has been pending for nearly 18 months. While the Commission has acknowledged CELSAT's filing in the context of the so-called MSS/RDSS proceeding, the Commission has not yet acted on CELSAT's specific proposal for the



The contemporaneous co-use of certain subbands from within the HPCS allocation by re-assignment from space to ground for one or other type of HPCS terrestrial component will not be predetermined but will be market driven; such subchannels will be operated on a secondary basis to the space component; and the amount and choice of frequencies used on the ground will vary from space cell-to-space cell. Consequently, the hybrid use of certain subbands by the HPCS operator in certain geographic areas will not detract from the principal fact that HPCS is an MSS space-based system *with ground enhancements* and, as such, it will be operated in an MSS satellite communications mode (subject to interservice sharing constraints). Thus, it is appropriate that the requested allocation be treated and considered as a space-based and not as a terrestrial allocation.

## II. **BRIEF REVIEW OF THE CELSAT HYBRID PERSONAL COMMUNICATIONS SERVICE (HPCS) CONCEPT AND ITS SPECTRAL PLAN**

CELSTAR and HPCS will set a new standard of service, cost effectiveness, and spectral efficiency in mobile communications. HPCS will provide full, ubiquitous geographic coverage for mobile users anywhere in the United States, Hawaii, Alaska, Puerto Rico and the Virgin Islands for the widest possible array of services and mobile communications functions, including position determination, paging/messaging, voice, data (up to 144 kbps or more), and compressed video.

The top level features of CELSAT's proposed HPCS system, CELSTAR, are summarized as follows:<sup>3</sup>

- **CELSTAR/HPCS will cut cellular prices substantially:** CELSAT's very high capacity HPCS design offers major construction and operating cost advantages.

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<sup>3</sup> See, CELSAT Petition for Rulemaking, RM 7927, filed February 6, 1992, (hereafter, CELSAT's "Initial Petition"). See, also, CELSAT's Request for Pioneers Preference, filed February 10, 1992 (File No. PP-28) (hereafter "CELSAT PP Request"), and CELSAT's Consolidated Reply RM 7927 and PP-28, filed April 23, 1992.

- *CELSTAR/HPCS will provide important new features and functions:* In addition to conventional mobile voice and messaging, CELSTAR can provide position determination, data speeds up to 144 kbps, compressed video, and more.
- *CELSTAR/HPCS will be safe to use:* HPCS will use very low power devices (1/5th to 1/20th the power of other systems), ensuring maximum human safety. Low power consumption will also permit smaller, longer life batteries and very compact devices.

■ *CELSTAR/HPCS promises greatest circuit capacity.* CELSTAR's CEO

The satellite component is the backbone of an HPCS system. Universal access and ubiquitous communications will be available upon launch of a single satellite and nationwide services could commence immediately after initial satellite checkout. As proposed by CELSAT, hybrid service would begin as a domestic-only offering. However, subject to the future availability of suitable (but not necessarily identical) spectrum for hybrid use throughout other World Regions, HPCS systems will eventually spread internationally.

CELSTAR's three satellite configuration will offer up to 60,000 channels of voice grade (VG) or equivalent capacity deliverable from the space components alone, with thousands more channels available by replicating the cells on the ground.<sup>5</sup> This enormous capacity, in turn, will permit a very low retail price per minute and a broad array of wider bandwidth functions and applications.<sup>6</sup> Other hybrid configurations will be possible, achieved through different satellite orbits (e.g., LEO/MEO), smaller or greater numbers of satellites, or system designs that focus on different functionalities. CELSAT has chosen a design which optimizes capacity and available end user bandwidth, while minimizing power requirements and transmission costs. CELSAT's design average handset power will be a very safe 0.1 watt through the satellite and 20 mw over the ground.

#### **B. HPCS' HIERARCHICAL OPERATING STRUCTURE**

A hybrid system such as proposed by CELSAT will function like four wireless systems combined into one:

- (1) a nationwide mobile satellite/radio determination/messaging system (MSS/RDSS);
- (2) a metropolitan ground cellular telephone system;

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<sup>5</sup> Three satellites not only ensure a high level of instant-response back up, but also ensure signal diversity -- an important element for signal continuity between the satellite and a fast moving mobile unit.

<sup>6</sup> CELSAT has tentatively chosen to limit commercial service offerings to up to 144 kbps (corresponding to a basic rate ISDN capacity). But technically the HPCS concept is capable of meeting the needs of even faster data rate applications.

- (3) a public or proprietary microcell PCS system; and
- (4) a capability for limited within building wireless LANs or other cordless communications.

Operation at multiple terrestrial service levels will be discretionary; but each system level will be capable of providing full functionality, including full access to all the user bandwidth, using the same, very low power handset or other personal/mobile device and without any dual-mode switches. Mode switching will be under central network control.

High density metropolitan areas will obviously generate the greatest traffic and demand a greater variety of service functions. These areas will therefore be served primarily in the terrestrial mode from hybrid ground-based cellular-like subsystems. Terrestrial channels will be preferred in such areas because they permit smaller cells, and hence maximum reuse of the same hybrid spectrum. They will be constructed incrementally as additional capacity is warranted in clusters of contiguous, conventional mobile cell sites, thereby further leveraging the effective capacity of the hybrid system overall.<sup>7</sup> As ground cells begin to absorb a greater share of the HPCS traffic load they will thereby eliminate for the majority of users the "round trip" satellite signal delay which can be perceptible in certain end user applications.

#### C. *HPCS SPECTRUM PLAN*

CELSAT is proposing an allocation, ultimately to be shared by multiple HPCS licensees and/or another MSS operator subject to the requirement that all systems in the band use code division multiple access (CDMA) technology (or equivalent band-spreading techniques).<sup>8</sup> CELSAT has selected for itself a

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<sup>7</sup> As explained in CELSAT's Consolidated Reply and its Initial Petition, the many very small satellite space cells or beams are technically clustered around "hubs," with one earth station/hub servicing about ten contiguous (or non-contiguous) space cells or beams.

<sup>8</sup> As will be discussed further, we recommend that the initial allocation be for a single such system in a band, with MSS band sharing postponed until such date as the band is largely cleared of incumbent fixed service occupants.

basic CDMA modulation and multiple access protocol which will be compatible with the emerging CDMA ground cellular standard, but which will be operated in the higher Emerging Technologies 2-GHz band. The entire allocation in each direction would be subdivided into approximately fifteen 1.25-MHz CDMA subbands (assuming a 20 MHz paired allocation), and a 1.25-MHz "pilot" channel (downlink only).<sup>9</sup> Every subband will have the capacity to carry a substantial number of simultaneous voice grade (VG) or equivalent communications, and will be 100% reusable: (i) by each satellite in the CELSTAR system, and (ii) within each "space cell" or satellite beam. Any subband will be reassignable within every satellite beam for terrestrial use with virtually negligible impact on its space capacity.<sup>10</sup>

Spectrum for CELSAT's terrestrial cellular subsystems will consist of two or more 1.25-MHz CDMA subbands "split off" from the requested full hybrid allocation and re-assigned for ground use on a beam-by-beam basis. Not every satellite beam would necessarily split off subbands for ground use; different subbands could be split off in different satellite beams; and all subbands will be dynamically adaptive to changing traffic needs over the long term. To optimize spectral efficiency it is preferable that the entire band be allocated for both space and ground mobile services so that subbands can be assigned dynamically, and interchangeably for space or ground use. It is also preferable that the space and terrestrial components be allocated together in a contiguous band such as proposed herein (although a hybrid system can also operate in non-contiguous space and terrestrial bands).<sup>11</sup>

Once a ground system is deployed in any space beam each mobile terminal within range of both ground and space signals will be assigned a

communications channel in one mode or the other by the network controller based on interference information and other assignment criteria. Handoffs back and forth and between space and/or ground cell subbands will occur automatically as a function of capacity, signal blockage, channel availability, threats of interference, and other criteria. All handoffs will be soft and transparent to the end user.

Expansion of a ground cellular network within each space cell or satellite beam is relatively unconstrained. Adaptive growth is possible simply by reusing the reassigned subbands, both in new immediately adjacent ground cells and at non-contiguous cell sites in other cellular market areas within the same satellite beam coverage area. This HPCS expansion feature will serve to minimize the need for future additional allocation requests to meet requirements of growing demand.

Once intraservice band sharing commences among multiple (i.e., two) HPCS systems, however, it may be necessary to segregate those subchannels which may be used for terrestrial purposes. This is because simultaneous full band interference sharing in both space and ground in the same spectrum band is not practical. Accordingly, this petition proposes that the sharers first be permitted to negotiate either a coordinated or structural approach to sharing up to four subchannels within the allocation for terrestrial use and, if such negotiations prove unsuccessful, that the solution default to a form of mini-band segmentation of only the four terrestrial subchannels, each sharer getting exclusive access to 2 subchannels to use at it deems best.

### **III. CELSAT'S ORIGINAL PETITION FOR RULEMAKING**

CELSAT's Initial Petition for rule making in February, 1992. This was just before the beginning of WARC-92;<sup>12</sup> in the middle of the heavily contested "Big LEO" proceeding; well before the Commission's *Tentative Decision*

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<sup>12</sup> See, International Telecommunications Union, Final Acts of the World Administrative Radio Conference and Addendum and Corrigendum to the Final Acts of the World Administrative Radio Conference ("WARC-92"), Malaga-Torremolinos, Spain, March, 1992.

and Notice of Proposed Further Rulemaking in the PCS docket (but just shortly before the release of the text in the Emerging Technologies docket),<sup>13</sup> and, of course, well before the MSS Negotiated Rulemaking. Nevertheless, in all but one respect CELSAT's pending Initial Petition and its original HPCS concept remain sound and fully intact -- technically, economically and politically. The only aspect of its plan which has been affected by these events is its choice of spectrum.

A. *SPECTRUM ALLOCATIONS INITIALLY REQUESTED BY CELSAT*

There is no spectrum allocation which permits both space and terrestrial mobile services to be operated under one common license in the same band, let alone on a primary basis relative to any other lesser use. Therefore CELSAT petitioned the Commission to allocate either of two possible spectrum choices specifically for such hybrid personal communications systems. Of course, the Commission has not yet done so; it has, however, issued a ruling tentatively disapproving one of CELSAT's initial selections; CELSAT's other choice appears to have been negated by WARC-92.

1. *CELSAT's Original Alternative A:*

CELSAT's original preference was the band pair consisting of 2110-2129 MHz and 2410-2428 MHz ("Band A"). This pair was being proposed for generic

CELSAT was not eligible as a potential applicant in this band because an application cut-off had already taken effect.<sup>14</sup> The Commission dismissed CELSAT's petition as to these bands, but for other reasons.

**B. THE COMMISSION'S MSS TENTATIVE DECISION**

In its *Notice of Proposed Rule Making and Tentative Decision*<sup>15</sup> in the so-called "Big LEO" proceeding the Commission tentatively allocated the 1610-1626.5 MHz and 2483.5-2500 MHz bands exclusively for mobile satellite and RDSS services. The Commission sought further comment on its initial allocation and, based in part on the response, it also instituted a negotiated rulemaking<sup>16</sup> to permit the MSS industry proponents one additional opportunity to devise a method by which these bands could be shared effectively among multiple MSS systems, particularly those proposed by the six pending MSS LEO applications.<sup>17</sup> Further, the Commission tentatively denied a pioneer's preference to all the pending LEO applicants. It did not, however, dismiss CELSAT's pioneer's preference request (which is still pending).<sup>18</sup>

In the course of arriving at its tentative conclusion the Commission took certain preliminary actions which, on the one hand, appeared to preclude

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<sup>14</sup> See, Public Notice, 6 FCC Rcd 2083 (1991).

<sup>15</sup> In the *Matter of Amendment of Section 2.106 of the Commission's rules to Allocate the 1610-1626.5 MHz and the 2483.5-2500 MHz Bands for Use by the Mobile Satellite Service, Including Non-Geostationary Satellites*, RM-7771, RM 7773, RM 7805, RM 7806, PP-29, PP-30, PP-31, PP-32 and PP-33, *Notice of Proposed Rule Making and Tentative Decision*, ET Docket No. 92-28, released September 4, 1992 ("MSS Tentative Decision"), 7 FCC Rcd 6414.

<sup>16</sup> See, Public Notice, CC Docket No. 92-166, DA 92-1085, released August 7, 1992, hereafter "MSS Negotiated Rulemaking."

<sup>17</sup> CELSAT was not then, nor is it currently an "applicant" for satellite spectrum in the full legal sense. This is due, in part, to the fact that there has not been a spectrum allocation within which to file an application for a full hybrid space/ground system. In other words, CELSAT has faced a "chicken and egg" dilemma -- without a specific allocation there is no place in the spectrum to apply for a license.

<sup>18</sup> See, CELSAT Request for Pioneer's Preference, ET File No. PP-28, filed February 10, 1992.

CELSAT from immediate consideration in the RDSS L/S Bands while, on the other, signaled encouragement for the HPCS concept -- if not in the RDSS band, then in some other band.

1. *The Partial Dismissal of CELSAT's RDSS Request*

Apparently due to CELSAT's early failure to more fully explain both its geostationary satellite characteristics and the alternative multiple operating modes of CELSAT's HPCS system, and due perhaps to the high profile of the competing LEO system applicants, the Commission tentatively dismissed CELSAT's Initial Petition in two respects:

- (i) *CELSAT's proposal for operation of a geostationary satellite in the same RDSS L/S band which the Commission thought to be more suitable only for LEO satellites; and*
- (ii) *CELSAT's proposal for a terrestrial spectrum component for its HPCS system in the same RDSS space band.<sup>19</sup>*

As to the first point, the Commission may have thought that GEO and LEO satellites are inherently incompatible. They are not.<sup>20</sup> As to the latter, the Commission based its decision on the fact that WARC-92 did not allocate the subject RDSS band for worldwide terrestrial use. CELSAT believes that it should not have mattered insofar as its hybrid use will be closely confined to within U.S. borders,<sup>21</sup> and that the Commission could accommodate such limited non-conforming use either by rule change or rule waiver.

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<sup>19</sup> See, *MSS Tentative Decision*, 7 FCC Rcd at 6416, n 15.

<sup>20</sup> See, *MSSAC Report*, *infra*; n. 23.

<sup>21</sup> Another advantage of the HPCS design proposed by CELSAT is that its many very small beams across the United States give a degree of power control and coordination ability relative to conflicting Canadian, Mexican and even Inmarsat interests heretofore unrealizable by other satellite-based systems. Consequently, CELSAT believes that it can more readily coordinate with these parties by tightly controlling its beam emissions to conform to international requirements along borders which cannot be attained by other systems.

## 2. *CELSAT's Petition for Reconsideration*

CELSAT pointed out in its Petition for Reconsideration that LEOs and GEOs can operate together.<sup>22</sup> Its proof lead to the recognition of this fact during the MSS Negotiated Rulemaking proceeding where it was accepted without challenge that:

"[i]n principle, both geostationary and non-geostationary satellite systems can operate in the MSS bands on an interference sharing basis provided that system parameters are chosen appropriately. No restriction on choice of orbits needs to be placed on applicants."<sup>23</sup>

CELSAT has since further demonstrated, and the majority of the MSS system participants in the MSS Negotiated Rulemaking proceedings have agreed that CELSTAR can share effectively with any of the proposed spread spectrum CDMA LEO systems.<sup>24</sup>

Until the Commission acts on CELSAT's pending Petition for Reconsideration, the *MSS Tentative Decision* appears to foreclose CELSAT from near

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<sup>22</sup> See, CELSAT Petition for Reconsideration, at p 9; CELSAT Comments, ET Docket 92-28, filed November 27, 1992 at pp. 6-8 and Appendix B "LEO and GEO Comparability".

<sup>23</sup> See, *Report of the Above 1 GHz Negotiated Rulemaking Committee* ("MSSAC Report"), Annex 1, Report of Informal Working Group 1, Attachment 1 thereto, "Final Report of the Majority of the Active Participants of Informal Working Group 1 to Above 1 GHz Negotiated rulemaking Committee" ("MSS Majority Report"), at p. 8-13, ¶8.4.4.

<sup>24</sup> Specifically, the MSS Majority Report summarily concluded, among other findings, that:

-- "There is sufficient spectrum to accommodate all of the pending applicants . . . and CELSAT";

-- "[Interference sharing] is the only approach that allows the pending applicants to share on a co-frequency, co-coverage basis with each other and permits entrance by CELSAT"; and

-- "In recognition of the substantial net increase in U.S. MSS capacity to be realized through the addition of yet another CDMA applicant such as CELSAT and the incremental public benefit which would flow therefrom, and subject to the limitations and rights of current applicants under the cutoff rules, the IWG1 Majority Report recommends that the CELSAT system receive the fair consideration to which it is entitled as a new entrant when and if it chooses to formalize the work which it has done with respect to band sharing in an FCC application." [Emphasis added.]

MSS Majority Report, *Id.*, at Summary, pp. i -iii, and Section 8.4 thereto.

term access to the RDSS band, particularly for the terrestrial component. CELSAT believes, of course, that the Commission now has good grounds for reversing its initial decision as to CELSAT's place in the MSS/RDSS band for its space component, and it still desires that the Commission act favorably on its reconsideration request. Meanwhile, in hopes of moving out of this limbo, CELSAT is submitting this revision to its Initial Petition.

3. *FCC Commitment to Consider Alternative Bands for HPCS*

The Commission was apparently sufficiently impressed with CELSAT's HPCS concept, however, to neither dismiss CELSAT's petition totally nor deny CELSAT's pioneers preference request. Instead, the Commission tentatively merely put CELSAT's request aside:

"[w]e note also that the system proposed by CELSAT would not conform to the WARC-92 allocation for the United States. In particular, the terrestrial component of its proposal is inconsistent with the international allocations. We therefore are dismissing CELSAT's proposed request for use of the RDSS frequency band. As an alternative to the RDSS bands, CELSAT proposed that the 2110-2129 MHz and 2410-2428 MHz bands be allocated for the hybrid space and terrestrial mobile service. We intend to address this alternative request separately." [Emphasis added], *MSS Tentative Decision*, 7 FCC Rcd at 6416, n. 15.

Now that over one year has passed since the final pleadings were submitted, and because so much new information has surfaced (primarily as a result of the MSS Negotiated Rulemaking process), CELSAT's pending Petition for Rulemaking is now ripe for amendment and for Commission action.

C. *OTHER INTERVENING DEVELOPMENTS  
BEARING ON CELSAT'S AMENDMENT*

The following other intervening yet encouraging developments further compel this update to CELSAT's initial proposal and immediate Commission action.

1. *WARC-92 Allocations*

The World Administrative Radio Conference held in Malaga-Torremolinos (WARC-92) concluded about one month after CELSAT's RM petition was filed in 1992. Among its many outcomes was a new allocation at 1970-1990 MHz paired with 2160-2180 MHz for both space and terrestrial mobile services, effective in the U.S.

in 1996. This opened a new, and much more desirable option for HPCS which did not exist at the time of CELSAT's Initial Petition.

## 2. *ET Docket 92-9/PCS Proceedings*

While the concepts of "emerging technologies" and "personal communications services" were both under consideration prior to CELSAT's Initial Petition, it was only after its HPCS petition was filed that developments emerged in these proceedings relating to CELSAT's HPCS proposal.

### a. ET Docket 92-9 proposed new spectrum

On February 7, 1992 (one day after CELSAT's Initial Petition), the Commission released its Notice of Proposed Rule Making in the Emerging Technologies proceeding.<sup>25</sup> Among other things, it identified 220 MHz in the 2 GHz band which it proposed to allocate for use by new technologies and/or new services. It also proposed a mechanism by which incumbent licensees might be relocated to free the spectrum for such new uses or technologies. Fortuitously, the 1970-1990 MHz and 2160-2180 MHz bands which were allocated for both ground and satellite mobile services at WARC-92 were included among those bands recommended for tentative re-allocation for emerging technologies.

Clearly, CELSAT's HPCS concept and its proposed new HPCS services meet any test of an "emerging technology." As such, HPCS is a natural candidate for an allocation in these bands and therefore deserves serious consideration under this important new spectrum program.

### b. PCS Proceedings Invite Satellite Comments

In its *Tentative Decision and Memorandum Opinion and Order* ("PCS Tentative Decision") in the PCS proceeding, Gen Docket No. 90-314, 7 FCC Rcd. 5676 (1992) released well after CELSAT's Initial Petition and well into the MSS

issues in ET Docket 92-28, the Commission, in a first ever mention of satellite spectrum in the context of PCS, stated:

"[w]e do not intend our proposal to preclude future offerings of satellite-based PCS. We invite comment on the prospect for future satellite-based offerings for both domestic and international services, and how such offerings may be integrated into the technical and regulatory rules proposed in this proceeding."<sup>26</sup>

CELSAT and other satellite proponents filed comments urging that the Commission reserve the ET tentative spectrum allocations at 1970-1990 MHz and 2160-2180 MHz for mobile satellite purposes and not allocate any of this spectrum for conventional PCS use. CELSAT, however, was the only truly responsive party to highlight the role of satellites in promoting PCS as part of a space/ground *hybrid* personal communications service ("HPCS").<sup>27</sup>

Briefly, CELSAT made the following points in the PCS proceeding:

-- Urged the Commission to allocate the spectrum at 1970-1990 MHz and 2160-2180 MHz for *hybrid personal communications services*;

-- Recommended, in the alternative, that the FCC allocate the 1975-1990 portion for HPCS use on a primary basis, and the 1970-1975 MHz portion of the lower band for such use on a secondary

-- Emphasized that an HPCS system could be deployed nationwide in the shortest possible time frame, and that its internal network and end user service requirements would create major new demands for infrastructure and mobile device products and development support; and

-- Showed how the HPCS licensing structure would accommodate a diversity of ownership interests, including substantial minority opportunity.

For CELSAT this intervening development was particularly timely because it provided the opportunity to refine its HPCS concept in the context of PCS and demonstrate that, indeed, satellites can play a role in facilitating -- technically, economically and politically -- the ultimate PCS network and PCS services.

3. *FCC MSS Negotiated Rulemaking and its Failure to Reach Consensus on Sharing*

The most recent development bearing on this amendment is the disappointing outcome of the MSS Negotiated Rulemaking.<sup>28</sup> While that effort was enormous, and while its technical output will prove useful to both the Commission and the industry participants, it failed to resolve the threshold issue -- namely, whether and, if so, how can the apparently conflicting technologies represented by Motorola's IRIDIUM and the six CDMA systems all be accommodated within the same RDSS L/S spectrum bands?<sup>29</sup>

As is well known, the MSS Negotiated Rulemaking Advisory Committee could not reach consensus. The disagreement centered around the fact that Motorola's IRIDIUM LEO system is designed to operate on a time delayed basis

of that process. The Commission can and therefore should move along with HPCS, irrespective of whether progress can be made with the Big LEOs.

a. Full Band Sharing in the RDSS Bands Effectively Precludes an Integrated HPCS Terrestrial Component

It is especially noteworthy that a significant constituency of the MSS Negotiated Rulemaking Advisory Committee -- namely, CELSAT joined by all of the other five MSS proponents of CDMA spread spectrum sharing -- concurred in the MSS Majority Report which proved that such sharing among at least six multiple MSS satellite systems, mixed LEO and GEO, can be technically accommodated within the RDSS L/S spectrum band.<sup>30</sup> This, by itself, is a major advancement in support of contemporary spectrum utilization.

Insofar as any opportunity for full HPCS in the RDSS L/S band is concerned, however, CELSAT has two reservations about the CDMA sharing demonstration offered by the MSS Majority Report which further compel this amendment. First, assuming that the Commission would adopt future rules favoring the position of the CDMA sharing proponents, any such requirement to share the RDSS L/S spectrum with up to five or more additional satellite-based systems would leave no spectrum within the same contiguous band for a hybrid terrestrial component.<sup>31</sup> While CELSAT can interface with a terrestrial component in any non-contiguous portion of the 2 GHz spectrum, CELSAT believes that the real efficiency of a hybrid system is maximized when it can selectively re-assign subbands from within the same spectrum allocation for either terrestrial or space purposes as its needs dictate from time-to-time and from satellite beam-to-satellite beam.

Further, although CELSAT supports the MSS Majority Report insofar as the technical feasibility and superior benefits of CDMA spread spectrum sharing

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<sup>30</sup> See, Summary Conclusions of the MSS Majority Report, Id., n. 27.

<sup>31</sup> Because of the near-far problem between satellite component mobiles and the terrestrial component hubs, it is not sensible to accommodate the terrestrial component in the same subband, in the same cell, at the same time as it is being used for mobile satellite service. This is true in both the forward and return direction.

are concerned, CELSAT is concerned that these same parties will use every legal means to keep CELSAT from participating in the RDSS L/S-Band, notwithstanding their recent unequivocal acknowledgements of CELSAT's deserving place in this band.<sup>32</sup> CELSAT and HPCS should not be detained indefinitely by their anticipated tactics.

b. The Possibility that the Commission Might Rule  
In Favor of IRIDIUM To the Exclusion of CDMA

Finally, it is possible that the Commission may rule in favor of IRIDIUM to the exclusion of all others in the MSS/RDSS bands. Thus, the RDSS L/S-Band either might not be allocated for shared MSS use after all or, if it is, the level of planned participation in these bands by so many other sharers for pure MSS LEO services will practically, if not legally, preclude HPCS operation in the same bands in any reasonably near term time frame. These concerns,

There are two main disadvantages, however:

- a. In order for the various coverage regions or "cells" to be "sufficiently separated" it often requires further band segmentation by frequency or time slots within a given provider's allocation so that adjacent cells do not reuse the same frequency subbands at the same time. This commonly results in a "cluster" size "n" of 7 to 13 cells, and reduction of the usable bandwidth

were endorsed and adopted by the MSS majority participants.<sup>34</sup> In effect, the parties finally verified what they had been urging before the Commission all along, but had until then failed to prove convincingly even to themselves, let alone to others. The concept of default control values for the necessary sharing control parameters, as well as the working default values themselves were also accepted (again essentially as originally put forth by CELSAT (MSSAC/IWG1-68 and MSS Majority Report, Annex 2.1)), thereby ensuring that the sharing concept could be made to work in practice as well as in theory.

These were milestone industry accomplishments which should not go unrecognized and unrewarded; one way or another, the Commission needs urgently to advance these important contemporary concepts as a matter of public policy and in operational reality.

### 3. *LEO-GEO Compatibility*

Initial concerns about GEO vs. LEO band sharing incompatibility were fully resolved in the MSS Negotiated Rulemaking process. CELSAT's contributions (MSSAC/IWG1-68 and MSS Majority Report, Annex 5.1) demonstrated that the key to equitable sharing between diverse satellite systems is simply that each system must be subject to the same PFD and Area Aggregate EIRP density limits,  $\rho$  and  $\epsilon$  at the earth surface, and that so long as such limits are satisfied, both the ground subscriber units and the satellite receivers of diverse satellite systems can operate at the same interference sharing efficiency factor -- that is, equitably, irrespective of antenna gains, or altitude, and irrespective of whether LEO or GEO.

Thus, the LEO/GEO issue has been put to bed and, consistent with this finding, CELSAT's HPCS proposal places no restrictions on the type of satellite orbit which might be used in a hybrid configuration.

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<sup>34</sup> These include that the down-links must be subject to a common power flux density limit,  $\rho$  W/m<sup>2</sup>/Hz per system, and the uplinks must be subject to an EIRP density (brightness) limit,  $\epsilon$  W/m<sup>2</sup>/Hz, per system, averaged over cell sized areas.

#### 4. *Current MSS LEO Systems Fall Short of Optimum*

The MSS Negotiated Rulemaking proceedings afforded an unusual opportunity to compare first hand the relative merits of LEO vs GEO systems for MSS service. Historically, AMSC proposed the first fully developed MSS satellite system, a geostationary orbit system. However, as a result of a combination of other design factors, the subscriber unit is necessarily fairly large, high-powered, and requires directive antennas. It was natural to associate these severe disadvantages with the extra space loss associated with the much greater range (22,000 nm) to geostationary orbit versus the relative nearness of LEO/MEO orbits (650-10,500 nm). Thus, much of the original impetus for Low and Medium Earth Orbit satellites evidently sprang from this perception.

The CELSAT design is also geostationary, but takes fullest advantage of other power reducing features including low-rate error-correction coding, more recent voice encoding advances, and most importantly, very large satellite antennas. The CELSAT design shows that the range disadvantage of geostationary orbit is more than overcome by the very large antennas (which it believes to be practical only in geostationary orbit). The upshot is that the CELSAT geostationary design, largely confirmed in the fire of the MSS Negotiated Rulemaking process, was shown to afford significantly lower cost circuits, and larger CONUS capacity all at significantly lower subscriber unit handheld power than any of the LEO/MEO designs. This is mostly attributable to the large number of very small sized geostationary HPCS space cells afforded by the large antennas. Smaller beams mean more cells and therefore higher frequency reuse, as well as more economical use of limited satellite transmitter power. The CELSAT geostationary system thereby attains approximately ten times the CONUS capacity of any of the LEO/MEO systems at almost 1/10th the individual subscriber power and 1/10 to 1/30 of the cost per circuit.