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ANN BAVENDER*
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PAUL J. FELDMAN
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KATHLEEN VICTORY
JENNIFER DINE WAGNER*
HOWARD M. WEISS
ZHAO XIAOHUA*
* NOT ADMITTED IN VIRGINIA

FLETCHER, HEALD & HILDRETH, P.L.C.
ATTORNEYS AT LAW
11th FLOOR, 1300 NORTH 17th STREET
ARLINGTON, VIRGINIA 22209-3801
(703) 812-0400
TELECOPIER
(703) 812-0486
INTERNET
www.fhh-telcomlaw.com

RETIRED MEMBERS
RICHARD HILDRETH
GEORGE PETRUTSAS
CONSULTANT FOR INTERNATIONAL AND INTERGOVERNMENTAL AFFAIRS
SHELDON J. KRYS
U. S. AMBASSADOR (ret.)
OF COUNSEL
EDWARD A. CAINE*
MITCHELL LAZARUS
EDWARD S. O'NEILL*
WRITER'S DIRECT

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February 7, 2000

703-812-0440
lazarus@fhh-telcomlaw.com

BY HAND DELIVERY
Magalie R. Salas, Esq.
Secretary
Federal Communications Commission
445 12th Street, SW, Room TW-B204
Washington, DC 20554

Re: Docket No. RM-9797

Allocation of Electromagnetic Spectrum Pursuant to Title III of the Balanced Budget Act of 1997

Amendment of Part 90 of the Rules to Establish a New Sub-Part Y – Personal Location and Monitoring Service

Dear Ms. Salas:

Transmitted herewith are an original and 4 copies of the Comments of AeroAstro, Inc., to be filed in the above-referenced Docket.

If you need further information, please call me directly.

Respectfully submitted,

Mitchell Lazarus
Counsel for AeroAstro, Inc.

ML:deb

Enclosures

cc: Service List

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Before the
Federal Communications Commission
Washington DC 20554

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In the Matter of	)	
	)	
Allocation of Electromagnetic Spectrum Pursuant to Title III of the Balanced Budget Act of 1997	)	RM-9797
	)	
Amendment of Part 90 of the Rules to Establish a New Sub-Part Y -- Personal Location and Monitoring Service	)	

COMMENTS OF AEROASTRO, INC.

AeroAstro, Inc. hereby comments on the Petition for Rulemaking filed by MicroTrax in the above-captioned proceeding.[1]

SUMMARY

AeroAstro supports the MicroTrax allocation request, together with the request for nationwide licensing. AeroAstro also supports MicroTrax's notion of uniform technical rules. However, where MicroTrax proposes specific technical and service rules that favor its proposed Personal Location and Monitoring Service (PLMS), AeroAstro advocates broadly based rules compatible not only with PLMS, but with other technologies as well.

I. THE COMMISSION SHOULD ALLOCATE AND AUCTION THE BANDS REQUESTED BY MICROTRAX.

AeroAstro agrees with MicroTrax that the Commission should promptly commence a rulemaking to allocate certain bands newly made available pursuant to Title III of the Balanced

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[1] Petition for Rulemaking of MicroTrax, Inc. (filed Nov. 22, 1999); *see* Report No. 2376 (released Jan. 7, 2000).

Budget Act of 1997.[2] Recent experience has shown that development of new spectrum can generate economic growth with benefits to every sector of society.

Although the particular bands at issue are relatively narrow, they can still carry valuable services. Notwithstanding the recent surge of interest in broadband services, primarily for multimedia Internet access, other useful functions can be delivered at far lower data rates. MicroTrax provides one example in its Petition. AeroAstro offers another, below. The auction mechanism will ensure that the bands are put to their most valuable potential use.

Nationwide licensing. AeroAstro agrees further with MicroTrax that at least some of these bands should be auctioned on a nationwide basis.[3] The Commission's past preferences for BTA and regional licensing may reflect an outmoded view of communications markets. Historically, to be sure, telecommunications once tended to be a local enterprise. Telephony, broadcasting, cable, and traditional mobile radio all originated with local providers serving local communities. Today, however, telecommunications activities increasingly operate on a national scale, and often globally. Satellite communications cover large parts of the world without regard to man-made boundaries. The Internet could not operate if regulated separately by each locality. Even wireless telephony, the original success story for BTA and regional licensing, today is

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[2] MicroTrax's Petition addresses 1385-1390, 1390-1400, 1427-1432, 1432-1435, 1670-1675, 1710-1755, 1990-2110, 2110-2150, 2300-2305, 2385-2390, and 4635-4660 MHz. AeroAstro takes no position on the bands at 1390-1400 and 1427-1432 MHz.

[3] Petition at 2, 16.

offered under national brand names, free of roaming and interstate charges. The new mobile satellite services extend similar local-calling convenience to every part of the world.[4]

Older technologies as well benefit from nationwide treatment. When the Commission adopted nationwide licensing for ordinary narrowband voice channels at 220-222 MHz, it noted:

> Without a specific nationwide set-aside, . . . establishment of nationwide systems in this band would be impractical or impossible. An applicant would have to obtain numerous individual authorizations and, possibly, use different frequencies throughout the nation. Development of these technologies as they are applied to nationwide systems will ultimately provide a broader base of radio technology support for the marketplace.[5]

Each of the Commission's points applies with equal force to the bands identified by MicroTrax. Rather than auction them piecemeal, yielding a geographic patchwork of unrelated, inefficient service offerings, the Commission should encourage licensees to seek the economies of scale that can only be obtained by serving the public nationally.

II. RULES FOR THESE BANDS SHOULD BE TECHNOLOGY NEUTRAL.

AeroAstro supports MicroTrax's notion of uniform technical rules across the bands at issue.[6] Although the proposed standards may ultimately require some adjustment, they are technology neutral, and should facilitate flexible use of the band for a wide range of applications and technologies.

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[4] *See* Amendment of Parts 2 and 25 to Implement the Global Mobile Personal Communications by Satellite Memorandum of Understanding and Arrangements 14 FCC Rcd 5871 (1999) (international import and use of mobile satellite handsets).

[5] Use of the 220-222 MHz Band by the Private Land Mobile Radio Services, 6 FCC Rcd 2356, 2361 at ¶ 34 (1991).

[6] MicroTrax omits 1710-1755, 1990-2110, and 4635-4660 MHz from its proposed technical rules. Elsewhere, MicroTrax proposes maximum in-band power of 4 watts EIRP, and suggests out-of-band attenuation limits.

In the same Petition, however, MicroTrax also asks the Commission to allocate some or all of these bands exclusively to its proposed Personal Location and Monitoring Service (PLMS),[7] which MicroTrax describes as a service for location, tracking, and monitoring individuals and small personal assets.[8] Permitted power in those bands would be limited not only to the 4 watt cap, but also to maximum average power over a 60-second interval of 0.25 watts.[9] MicroTrax proposes highly specific service rules for the PLMS bands:

- A "substantial portion" of services provided must use transmitters small enough to be worn on the body or hidden in small personal items.
- Location performance must be materially the same for transmitters operated indoors and outdoors.
- Location accuracy must be 125 meters or less using root mean square methodology.
- Service must be nationwide, covering 25 metropolitan areas with a combined population of 150 million within five years after service is initiated.
- Satellite operation is prohibited.
- Voice transmission is prohibited.
- Data transmission must be limited to that associated with monitoring the person or property associated with the device.
- At least one type of mobile unit must be capable of local control by the user.
- At least one type of mobile unit must be capable of remote control.

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[7] Petition at 15.

[8] Petition at 12-13.

[9] Petition at 5.

- Mobile units must be capable of being integrated into other applications, such as pagers and wireless telephones.[10]

Plainly these rules are crafted to suit MicroTrax's particular technology. Although AeroAstro agrees there is a likely market for a location service using small, inexpensive transmitters,[11] rules that unnecessarily favor a particular technology are counter to the public interest. First, they limit the scope of technologies and services ultimately available to the public. Even if the Commission had the prescience to pick out the one technology that can make the best use of a given band, future developments would soon render that decision obsolete. The market is much better at making these decisions than even the best intentioned and best informed of regulators. Second, overly specific rules diminish the auction value of the spectrum by reducing the demand to the relatively few entities that can use it. AeroAstro, for example, could not profitably bid on PLMS spectrum under MicroTrax's rules. AeroAstro's system (described below) will use satellites for economical wide-area coverage, while the MicroTrax rules would bar satellite operation outright.[12] But there is little doubt that participation in the auction by AeroAstro, and others whose plans do not fit MicroTrax's rules, would stimulate bidding and thus enhance the value of the spectrum.

The Commission has long insisted that its rules be technology neutral to the maximum practical extent. The Chairman put it plainly:

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[10] Petition at 14-15, 19-20, 21.

[11] Indeed, as described below, AeroAstro is presently developing a service that is similar to MicroTrax's in some respects.

[12] Petition at 14. AeroAstro does not seek space-to-earth operation in any of the bands at issue.

> The challenge for us is to make sure we are creating a regulatory environment that is technology neutral so we get as many players on the field as possible.[13]

AeroAstro agrees that the rules for these bands should accommodate MicroTrax's technology. But they should not accommodate *only* that technology. The highly specific rules that MicroTrax requests would disserve the public by closing off alternative services and means of delivery.

III. THE PUBLIC WILL BENEFIT IF COMPANIES SUCH AS AEROASTRO CAN BID ON ANY OF THE ALLOCATED BANDS.

AeroAstro's Satellite Enabled Notification System (SENS), now under active development, resembles MicroTrax's Personal Location and Monitoring Service in that it locates small objects at low cost. SENS differs from PLMS in several other respects, however. SENS provides GPS-level precision, transmits user data in addition to location information, and employs satellites for maximum coverage. Technical and service rules that are technology neutral will enable SENS, and doubtless other systems as well, to compete with MicroTrax on such criteria as quality of service, coverage, and cost.

Unlike PLMS, SENS is fundamentally a one-way data messaging service that enables users to transmit short data messages from any location on the globe, for receipt via the Internet in near-real-time. The system has three key components: (a) mobile ground terminals, (b) small

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[13] Remarks by Chairman, William E. Kennard at the National Association of Telecommunications Officers and Advisors 19th Annual Conference, Atlanta, GA (Sept. 17, 1999). *See also, e.g.*, Multiple Address Systems, 12 FCC Rcd 7973 (1997) ("Policies should encourage the use of the most spectrally efficient approaches while remaining technology neutral"); Operation of Unlicensed NII Devices in the 5 GHz Frequency Range, 12 FCC Rcd 1576 (1997) ("[W]e will allow U-NII devices in this band to operate on a technology-neutral basis. We believe this will provide manufacturers flexibility in designing U-NII products and thus will provide consumers with greater choices.")

space stations, and (c) fixed ground receiver stations. The mobile terminals transmit low-power, spread-spectrum modulated messages to the satellites, which act as bent pipes to relay the data down to the nearest ground receiver station.

SENS user terminals have the lowest cost, complexity, size, and weight, and require the least supporting infrastructure, of any space-based communications system to date. In commercial quantities, the terminals will cost only a few dollars each to manufacture. A global quasi-real-time service will need only two small launches of clusters of very low cost microsatellites. Thus, both the user's terminal and access costs will be very low.

Small size and minimal cost will enable SENS to provide critical services not presently available. Using inexpensive GPS technology, SENS can report basic position as well as status data on millions of deployed, highly miniaturized, autonomous terminals. These will eventually be small enough to build into a wristwatch, a bracelet, or a shoe. Early users of SENS terminals will include hikers, hunters, surveyors, and others whose occupation or pastime puts them at risk in the outdoors. Anywhere in the United States, and eventually the world, the push of a button will provide an alert and position fix. In some applications, units will transmit automatically at fixed time intervals or in response to specified external events. SENS terminals may ultimately become a standard feature in children's shoes, military ID bracelets, and even clothing of people who travel or recreate in wilderness areas. Their families and associates can receive frequent updates via the Internet on the traveler's status and position, with histories over time.

Many of the applications for SENS overlap those that MicroTrax foresees for its PLMS. Like PLMS, SENS can be used to enhance personal safety and security. Older and infirm persons can use SENS to call for assistance. Children can have SENS terminals clipped to their

clothing at amusement parks and similar sites where there is a risk of becoming separated from caregivers. Motorists stranded in isolated areas can summon help. Anyone can use SENS as a personal security device, possibly dangling from a key chain.

The tiny, low-cost, low-power SENS uplink terminal can be attached to packages, utility poles, cattle, fleet vehicles, railroad cars, and other deployed capital assets to monitor their positions and conditions. Trucking companies can gather data on speed, mileage, even engine temperature. Soft-drink and other vending machines can report low-stock conditions. The terminals are so low in cost and small in size that they can be distributed over an agricultural area to monitor water, fertilizer, and pesticide concentrations, along a border crossing to monitor immigration, at building doors and windows to report intruders, on smoke, heat, and flood alarms for remote monitoring, or around an airport to monitor sound levels.

In short, SENS combines personal security, asset and resource management, communications, and remote sensing applications in a communications network. It will be a pathfinder for new services, a first point of entry for many clients into wireless and satellite-based services, and a catalyst for other similar systems. Once the system is in place, users no doubt will identify dozens of other applications.

Technical information. Using direct sequence spread spectrum, very low power, and a very high gain satellite-based receiving antenna, SENS emissions are highly spectrum efficient and non-interfering. SENS transmitters comply with the Commission's technical requirements for spread spectrum devices.[14] Like other spread spectrum applications, SENS signals can share spectrum with narrowband or other spread spectrum signals with little risk of harmful

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[14] *See* 47 C.F.R. § 15.247.

interference. Terminal data message length is restricted to 128 bits. Data rate will be 100 bits/second, for a transmission time per message of 1.28 seconds. Terminals can be programmed to transmit 2-3 messages in a 24 hour period, as well as to transmit on command from an attached sensor (to report a button press or an alarm condition). Output RF power from a terminal will be approximately -33 dBm/Hz. Low power output makes the terminals safe in any application.

Development process. AeroAstro is taking advantage of SENS's extraordinary flexibility by developing the system in a stepwise manner, according to fixed milestones in the following sequence:

1. A simple ground-based line-of-sight demonstration with 5-10 terminals and a single receiver/decoder station. This phase is now under development pursuant to an FCC experimental license.

2. The same system demonstrated with an airborne receiver to extend its range.

3. A single operating satellite demonstrating the system in orbit. AeroAstro has arranged with Arianespace for a free piggyback payload launch in 2001-2002. AeroAstro is prepared to fund construction of the satellite from its own resources.

4. The entire constellation of spacecraft will be launched to provide global coverage.

System development for SENS is projected to take approximately 5 years.

CONCLUSION

AeroAstro commends MicroTrax for taking the initiative in seeking the prompt allocation of several bands for commercial use. AeroAstro endorses MicroTrax's request for an early

auction, agrees with MicroTrax on the need for nationwide licensing, and supports MicroTrax's notion of uniform technical rules.

The sole point of disagreement concerns MicroTrax's request that some bands be allocated *a priori* to its Personal Location and Monitoring Service, with those bands subject to technical and service rules tailored to favor MicroTrax's technology. AeroAstro supports MicroTrax's right to bid on spectrum for its service, but asks that it do so under rules that are technology neutral, so that AeroAstro and others can compete on equal terms.

Respectfully submitted,

Mitchell Lazarus
FLETCHER, HEALD & HILDRETH, P.L.C.
1300 North 17th Street, 11th Floor
Arlington, VA 22209
703-812-0440
Counsel for AeroAstro, Inc.

February 7, 2000

APPENDIX -- About AeroAstro

Since its founding in 1988, AeroAstro has focused exclusively on lowering the cost of working in space so as to make space activities accessible to a broader community. The company has brought space to students at high school through post-graduate level, scientists operating on very limited research budgets, small start-up businesses, and the general public. In doing so, AeroAstro has pioneered new uses of space and spacecraft that are appropriate to our low cost, highly accessible approaches to aerospace engineering.

AeroAstro's first satellite, ALEXIS, is a small spacecraft developed for the Los Alamos National Laboratory to provide high resolution maps of low-energy x-ray sources and ionospheric physics. AeroAstro designed and built the spacecraft bus and the ground station, and also supported the launch and ground operations activities. ALEXIS was launched in April 1993 and is still operational over six years later, far exceeding its design lifetime of six months.

HETE (High Energy Transient Experiment) is a small satellite developed at AeroAstro for the Massachusetts Institute of Technology. Its mission is detection and observation of high energy events in the gamma ray, X-ray, and UV spectra. AeroAstro provided the spacecraft bus, ground stations, and all payload integration and tests. HETE was launched but lost due to a Pegasus XL failure on November 4, 1996.

TERRIERS (Tomographic Experiment using Radiative Recombinative Ionospheric Extreme Ultraviolet and Radio Sources) is AeroAstro's most recently completed satellite, developed at AeroAstro for Boston University. Its mission is to demonstrate global ionospheric tomography and to utilize this technique for the study of ionospheric/ thermospheric processes. AeroAstro provided the spacecraft bus, ground stations, and all payload integration and tests. TERRIERS launched successfully in May 1999.

AeroAstro built the S-band spacecraft radios and S-band tracking ground stations for each of the three spacecraft described above, and developed internally all of the software for both the spacecraft and ground stations. In addition, AeroAstro recently built a set of S-band radios for the Swedish FREJA spacecraft, which have been functioning in orbit for more than 6 months.

In 1997, AeroAstro completed the system architecture and design for a LEO spacecraft-based messaging system for an Australia-based firm, KITComm. This system shares some design features with the proposed SENS system, although it is substantially more complex.

Through the NASA Small Business Innovation Research (SBIR) program, AeroAstro is developing compact, power-efficient, inexpensive X-band radios for nanosatellites. The initial design phase has been completed and prototyping is beginning, with an ultimate objective of developing a product suitable for commercialization. These X-band transponders were also recently selected to provide Earth/Space communications for the NASA New Millennium Program's ST5 mission. This mission, the Nanosatellite Constellation Trailblazer, will provide validation of innovative, new technologies for future space missions.

AeroAstro has performed dozens of system designs and studies for organizations including Jet Propulsion Laboratory, Los Alamos National Laboratory, Naval Research Laboratory, NEC, Canadian Space Agency, NASA, Nissan, Philips Labs, and numerous U.S. universities. The company has also developed numerous spacecraft system components for these clients, including sun sensors, NiCad and Li-Ion batteries, mass memories, processor boards, power controllers, cold gas thrusters, electromagnetic torquers, and attitude control software.

CERTIFICATE OF SERVICE

I, Deborah N. Lunt, a secretary for the law firm of Fletcher, Heald & Hildreth, P.L.C., hereby certify that a true copy of the foregoing "Comments of AeroAstro" was mailed first class, postage prepaid, this 7th day of February, 2000, to the following:

Chairman William E. Kennard*
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Commissioner Harold Furchtgott-Roth*
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Commissioner Michael Powell*
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Commissioner Susan Ness*
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Commissioner Gloria Tristani*
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Dale Hatfield, Chief*
Office of Engineering and Technology
Federal Communications Commission
445 12th Street, S.W., Room 7C-155
Washington, D.C. 20554

D'wana R. Terry, Chief*
Private Wireless Division
Wireless Telecommunications Bureau
Federal Communications Commission
445 12th Street, SW, 4-C321
Washington, D.C. 20554

Julius Knapp, Chief*
Policy & Rules Division
Federal Communications Commission
445 12th Street, S.W., Room 7B-133
Washington, D.C. 20554

Tom Gerenge, Chief*
Spectrum Policy Branch
Office of Engineering and Technology
Federal communications Commission
445 12th Street, S.W., Room 7A-140
Washington, DC 20554

George Sean White, Esq.*
Spectrum Policy Branch
Office of Engineering and Technology
Federal Communications Commission
445 12th Street, S.W., Room 7A-133
Washington, D.C. 20554

Charles Iseman, Chief*
Electromagnetic Compatibility Division
Office of Engineering and Technology
Federal Communications Commission
445 12th Street, S.W., Room 7A-363
Washington, D.C. 20554

Gregg P. Skall, Esq.
Pepper & Corazzini, LLP
1776 K Street, NW, Suite 200
Washington, DC 20006-2334
Counsel for MicroTrax, Inc.

*By Hand Delivery

Deborah N. Lunt