Exhibit 3

Warren C. Havens and Telesaurus Holdings GB LLC
(DBA LMS Wireless)

Lists and maps of FCC Licenses
and related matters

Location and Monitoring (904-910 MHz) (6 MHz licenses)

VHF Public Coast (156/162 MHz) (350 kHz licenses)

AMTS (217-220 MHz) (1 MHz licenses)

220-222 MHz (.25 to 1 MHz per area)

(~1.3 billion MHz Pops total: see last page for comparison with major CMRS operators.)

Exhibit 3 (cont'd)

Location and Monitoring Service (LMS) licenses and coverage map

LMS A-Block licenses[48] (see Exhibit 2 for description of 'A' Block and other LMS sub bands)

Market #	Block	Market Name	Pops	Licensee [49]
BEA001	A	Bangor, ME	533135	FCR, Inc.
BEA002	A	Portland, ME	694793	FCR, Inc.
BEA003	A	Boston-Worcester-Lawrence-Lowell-Brockton, MA-NH	7445016	Havens
BEA004	A	Burlington, VT-NY	568377	Telesaurus
BEA008	A	Buffalo-Niagara Falls, NY-PA	1529735	FCR, Inc.
BEA009	A	State College, PA	798826	Telesaurus
BEA010	A	New York-No. New Jer.-Long Island, NY-NJ-CT-PA-M	23919008	Havens
BEA011	A	Harrisburg-Lebanon-Carlisle ,	1026459	Telesaurus
BEA012	A	Philadelphia-Wilmington-Atl. City, PA-NJ-DE-MD	6915860	Havens
BEA013	A	Washington-Baltimore, DC-MD-VA-WV-PA	7454633	Havens
BEA014	A	Salisbury, MD-DE-VA	290800	Telesaurus
BEA015	A	Richmond-Petersburg, VA	1247627	Havens
BEA016	A	Staunton, VA-WV	301626	Telesaurus
BEA017	A	Roanoke, VA-NC-WV	760378	Telesaurus
BEA018	A	Greensboro-Winston-Salem-High Point, NC-VA	1604323	Havens
BEA019	A	Raleigh-Durham-Chapel Hill, NC	1412330	Havens
BEA021	A	Greenville, NC	743407	Telesaurus
BEA023	A	Charlotte-Gastonia-Rock Hill, NC-SC	1626519	Havens
BEA024	A	Columbia, SC	815834	Havens
BEA027	A	Augusta-Aiken, GA-SC	536809	Telesaurus
BEA028	A	Savannah, GA-SC	550623	Havens
BEA029	A	Jacksonville, FL-GA	1557922	Havens
BEA030	A	Orlando, FL	2836481	Havens
BEA031	A	Miami-Fort Lauderdale, FL	4538394	Havens
BEA032	A	Fort Myers-Cape Coral, FL	487212	Havens
BEA033	A	Sarasota-Bradenton, FL	624323	Havens
BEA034	A	Tampa-St. Petersburg-Clearwater, FL	2067959	FCR, Inc.
BEA035	A	Tallahassee, FL-GA	610116	Havens
BEA036	A	Dothan, AL-FL-GA	307026	Telesaurus
BEA037	A	Albany, GA	415342	Telesaurus
BEA038	A	Macon, GA	626336	Telesaurus
BEA039	A	Columbus, GA-AL	449582	Telesaurus
BEA040	A	Atlanta, GA-AL-NC	4067704	FCR, Inc.
BEA041	A	Greenville-Spartanburg-Anderson, SC-NC	1083199	Havens
BEA043	A	Chattanooga, TN-GA	635535	Telesaurus
BEA044	A	Knoxville, TN	840395	Telesaurus
BEA045	A	Johnson City-Kingsport-Bristol	524270	FCR, Inc.

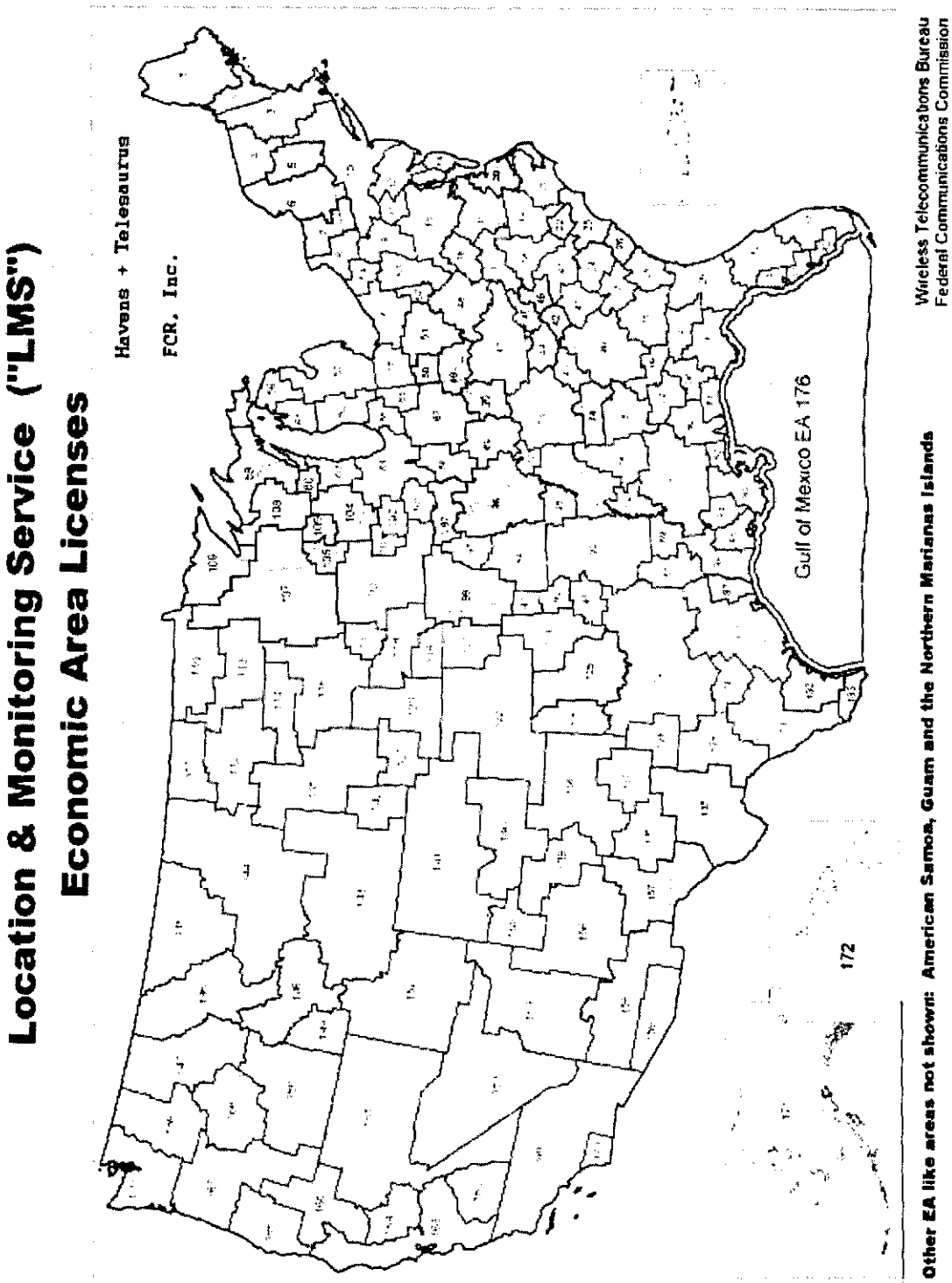
[48] Notes:

1. W. Havens has controlling interest in Telesaurus Holdings.
2. FRC Inc. owner, Bruce Fox, is interested in a joint venture or merger.
3. Other A-block licenses not listed had high bids in second LMS auction from another entity: these are currently subject to petition to deny before FCC.

[49] "Telesaurus" = Telesaurus Holdings GB, LLC. "Havens" = Warren C. Havens.

BEA047	A	Lexington, KY-TN-VA-WV	1731306	Havens
BEA048	A	Charleston, WV-KY-OH	1196043	FCR, Inc.
BEA052	A	Wheeling, WV-OH	346375	FCR, Inc.
BEA053	A	Pittsburgh, PA-WV	3003172	Telesaurus
BEA054	A	Erie, PA	512673	FCR, Inc.
BEA055	A	Cleveland-Akron, OH-PA	4564666	FCR, Inc.
BEA056	A	Toledo, OH	1278722	Telesaurus
BEA057	A	Detroit-Ann Arbor-Flint, MI	6626919	Havens
BEA058	A	Northern Michigan, MI	230066	Telesaurus
BEA061	A	Traverse City, MI	238720	FCR, Inc.
BEA062	A	Grand Rapids-Muskegon-Holland,	1666950	FCR, Inc.
BEA063	A	Milwaukee-Racine, WI	2119557	Havens
BEA064	A	Chicago-Gary-Kenosha, IL-IN-WI	9317947	Havens
BEA065	A	Elkhart-Goshen, IN-MI	864201	Telesaurus
BEA066	A	Fort Wayne, IN	666421	Telesaurus
BEA068	A	Champaign-Urbana, IL	623541	Telesaurus
BEA069	A	Evansville-Henderson, IN-KY-IL	825644	Telesaurus
BEA071	A	Nashville, TN-KY	2002283	Havens
BEA072	A	Paducah, KY-IL	211179	Telesaurus
BEA073	A	Memphis, TN-AR-MS-KY	1687817	Havens
BEA075	A	Tupelo, MS-AL-TN	577246	Telesaurus
BEA076	A	Greenville, MS	257239	Telesaurus
BEA077	A	Jackson, MS-AL-LA	1328647	Havens
BEA078	A	Birmingham, AL	1450463	Telesaurus
BEA079	A	Montgomery, AL	440228	Havens
BEA080	A	Mobile, AL	607965	Havens
BEA081	A	Pensacola, FL	515942	Telesaurus
BEA082	A	Biloxi-Gulfport-Pascagoula, MS	339791	Telesaurus
BEA083	A	New Orleans, LA-MS	1635720	Havens
BEA084	A	Baton Rouge, LA-MS	656284	Havens
BEA085	A	Lafayette, LA	554665	Telesaurus
BEA086	A	Lake Charles, LA	523289	Telesaurus
BEA088	A	Shreveport-Bossier City, LA-AR	555385	Telesaurus
BEA089	A	Monroe, LA	326897	Telesaurus
BEA090	A	Little Rock-North Little Rock, AR	1447083	Havens
BEA091	A	Fort Smith, AR-OK	286113	Telesaurus
BEA092	A	Fayetteville-Springdale-Rogers	285955	Telesaurus
BEA093	A	Joplin, MO-KS-OK	233725	Telesaurus
BEA094	A	Springfield, MO	499681	Telesaurus
BEA095	A	Jonesboro, AR-MO	290104	Telesaurus
BEA098	A	Columbia, MO	321564	Telesaurus
BEA100	A	Des Moines, IA-IL-MO	1604609	Telesaurus
BEA101	A	Peoria-Pekin, IL	523719	Telesaurus
BEA102	A	Davenport-Moline-Rock Island,	548257	Telesaurus
BEA103	A	Cedar Rapids, IA	341001	Telesaurus
BEA110	A	Grand Forks, ND-MN	240827	Telesaurus
BEA111	A	Minot, ND	116054	Telesaurus
BEA112	A	Bismarck, ND-MT-SD	172204	Telesaurus
BEA113	A	Fargo-Moorhead, ND-MN	347670	Telesaurus
BEA114	A	Aberdeen, SD	84696	Telesaurus
BEA115	A	Rapid City, SD-MT-ND-NE	199782	Telesaurus
BEA116	A	Sioux Falls, SD-IA-MN-NE	478307	Telesaurus
BEA117	A	Sioux City, IA-NE-SD	239518	Telesaurus
BEA118	A	Omaha, NE-IA-MO	958815	Telesaurus

BEA119	A	Lincoln, NE	341684	Telesaurus
BEA120	A	Grand Island, NE	277509	Telesaurus
BEA121	A	North Platte, NE-CO	60432	Telesaurus
BEA122	A	Wichita, KS-OK	1094213	Telesaurus
BEA123	A	Topeka, KS	444800	Telesaurus
BEA124	A	Tulsa, OK-KS	1259636	Telesaurus
BEA126	A	Western Oklahoma, OK	144847	Telesaurus
BEA127	A	Dallas-Fort Worth, TX-AR-OK	6180783	Havens
BEA128	A	Abilene, TX	213430	Telesaurus
BEA129	A	San Angelo, TX	189093	Telesaurus
BEA130	A	Austin-San Marcos, TX	922307	Havens
BEA131	A	Houston-Galveston-Brazoria, TX	4567679	Havens
BEA134	A	San Antonio, TX	1741991	Havens
BEA136	A	Hobbs, NM-TX	185128	Telesaurus
BEA137	A	Lubbock, TX	357092	Telesaurus
BEA138	A	Amarillo, TX-NM	448258	Telesaurus
BEA139	A	Santa Fe, NM	208689	Telesaurus
BEA140	A	Pueblo, CO-NM	247124	Telesaurus
BEA141	A	Denver-Boulder-Greeley, CO-KS-NE	3031140	Havens
BEA142	A	Scottsbluff, NE-WY	91975	Telesaurus
BEA143	A	Casper, WY-ID-UT	382095	Havens
BEA144	A	Billings, MT-WY	362513	Telesaurus
BEA145	A	Great Falls, MT	163284	Telesaurus
BEA146	A	Missoula, MT	333984	Telesaurus
BEA147	A	Spokane, WA-ID	691806	Havens
BEA148	A	Idaho Falls, ID-WY	263379	Havens
BEA149	A	Twin Falls, ID	136831	Havens
BEA150	A	Boise City, ID-OR	408246	Havens
BEA151	A	Reno, NV-CA	511004	Havens
BEA152	A	Salt Lake City-Ogden, UT-ID	1635998	Havens
BEA153	A	Las Vegas, NV-AZ-UT	943702	FCR, Inc.
BEA154	A	Flagstaff, AZ-UT	299753	Havens
BEA155	A	Farmington, NM-CO	150155	Telesaurus
BEA156	A	Albuquerque, NM-AZ	762814	Havens
BEA158	A	Phoenix-Mesa, AZ-NM	2365002	Havens
BEA159	A	Tucson, AZ	794180	Havens
BEA160	A	Los Angeles-Riverside-Orange County, CA-AZ	15891818	Havens
BEA161	A	San Diego, CA	2498016	Havens
BEA162	A	Fresno, CA	1168970	Havens
BEA163	A	San Francisco-Oakland-San Jose, CA	8033134	Havens
BEA164	C	Sacramento-Yolo, CA	1935487	Telesaurus
BEA165	A	Redding, CA-OR	307572	Telesaurus
BEA166	A	Eugene-Springfield, OR-CA	689659	Havens
BEA167	A	Portland-Salem, OR-WA	2310060	Havens
BEA168	A	Pendleton, OR-WA	176129	Telesaurus
BEA169	A	Richland-Kennewick-Pasco, WA	545747	Telesaurus
BEA170	A	Seattle-Tacoma-Bremerton, WA	3445064	Havens
BEA171	A	Anchorage, AK	550043	Telesaurus
BEA172	A	Honolulu, HI	1108229	Telesaurus
BEA174	A	Puerto Rico and U.S. Virgin Is	3623846	Telesaurus
BEA176	A	Gulf of Mexico	0	Telesaurus



Note: the numbered areas are EA (Economic Area) markets. Boundaries of the EA's in part follow State boundaries (check any road atlas). We can provide a lists of all EA's listing their component counties and States.

Exhibit 3 (cont'd)

AMTS Licenses

Automated Marine Telecommunications System ("AMTS") licenses of Warren C. Havens.

AMTS, for several decades, has been licensed along much of the US coasts, Great Lakes, and Mississippi River system for commercial shipping. Havens is the first to obtain AMTS for navigable inland waterways used for recreational boating.[50] The waterways below fall into this class. Ralph Haller, former Chief of the FCC Private Radio Bureau and Gary Stanford, a former engineer at the FCC, prepared Havens' AMTS applications.

Although historically allocated for marine traffic, for years AMTS licensees have been permitted by FCC rule to provide land mobile with no limit (and fixed station services) as long as they offer priority to parties desiring service for marine use. Following are key aspects of Havens' AMTS licenses:

- 217.5-218 MHz + 219.5-220 MHz: 1 MHz total (e.g., 40 12.5-kHz channels). (Also includes certain rights, on low power basis, to 250 kHz in 216-217 MHz.)
- Exclusive spectrum (not shared). No incumbents.
- Any modulation and channelization may be use (47 CFR 80.481).
- High power at each station: generally 100 watts or more ERP or higher EIRP.
- Each license has a number of specific station sites licensed (see below: "Primary Stations"): these are high HAAT sites with large coverage and interference-contours.
- Anywhere within the composite interference contour of the primary stations of each multi-site license can be placed "fill-in" sites as long as their coverage contour remains within this composite contour. Primary Stations can be relocated in similar fashion as well.
- CMRS, but may elect to provide PMRS.
- Interconnect and non-interconnect dispatch services permitted.
- Land mobile service permitted on primary-use basis.
- Fixed services permitted on a co-primary basis with mobile operations.
- May also use AMTS frequencies for fixed services on secondary basis to support AMTS system deployment in remote locations at which other communication facilities are not available (47 CFR 80.477).
- 47 dBu service contour coverage maps of each granted license (and pending application) are separately available to appropriate parties.

[50] Outdoor recreation on and around major inland waterways is a large high-growth industry not well covered and served by CMRS and other wireless.

Waterway	Covered Market(s)	# of Primary Stations
Lake Mead	Las Vegas	2
Great Salt Lake	Salt Lake City metro	2
Carson River	Reno	2
Salt River	Phoenix and up Salt River Valley	3
Verde River	Phoenix up to Flagstaff	3
South Platte River	Denver, west to Vail & Aspen, & east to Nebraska	6

In addition to the above granted AMTS licenses, Warren Havens has AMTS applications pending for navigable parts of the following rivers and adjacent covered markets:

Trinity and Brazos Rivers	Dallas–Fort Worth
Colorado and Guadalupe Rivers	Austin and San Antonio
San Antonio River	San Antonio
Lake Mohave	Las Vegas to Laughlin
Upper Rio Grande River	Albuquerque to Santa Fe
Provo River	Provo to Park City
Truckee River	Lake Tahoe to Reno
Arkansas Headwaters	Vail/Aspen to Pueblo/Col. Springs
Arkansas–MCKARNS	Tulsa to Little Rock
Missouri River (nav. channel)	Omaha to Kansas City
Upper Chattahoochee River	Atlanta and northeast
Hawaii coastline	Hawaii Islands
Kings River	Fresno and surrounding Central Valley
Owens River	Owens Valley US-395 corridor
Acadia coastline	Acadia National Park

We can discuss the situation with the pending applications with interested reviewers of this document. We and our advisors believe we have a good case for getting these granted. We intend to pursue administrative and judicial appeals as needed to obtain grants.

Exhibit 3 (cont'd)

VPC Licenses and map

VHF Public Coast ("VPC") licenses of Warren Havens and Telesaurus Holdings GB LLC.

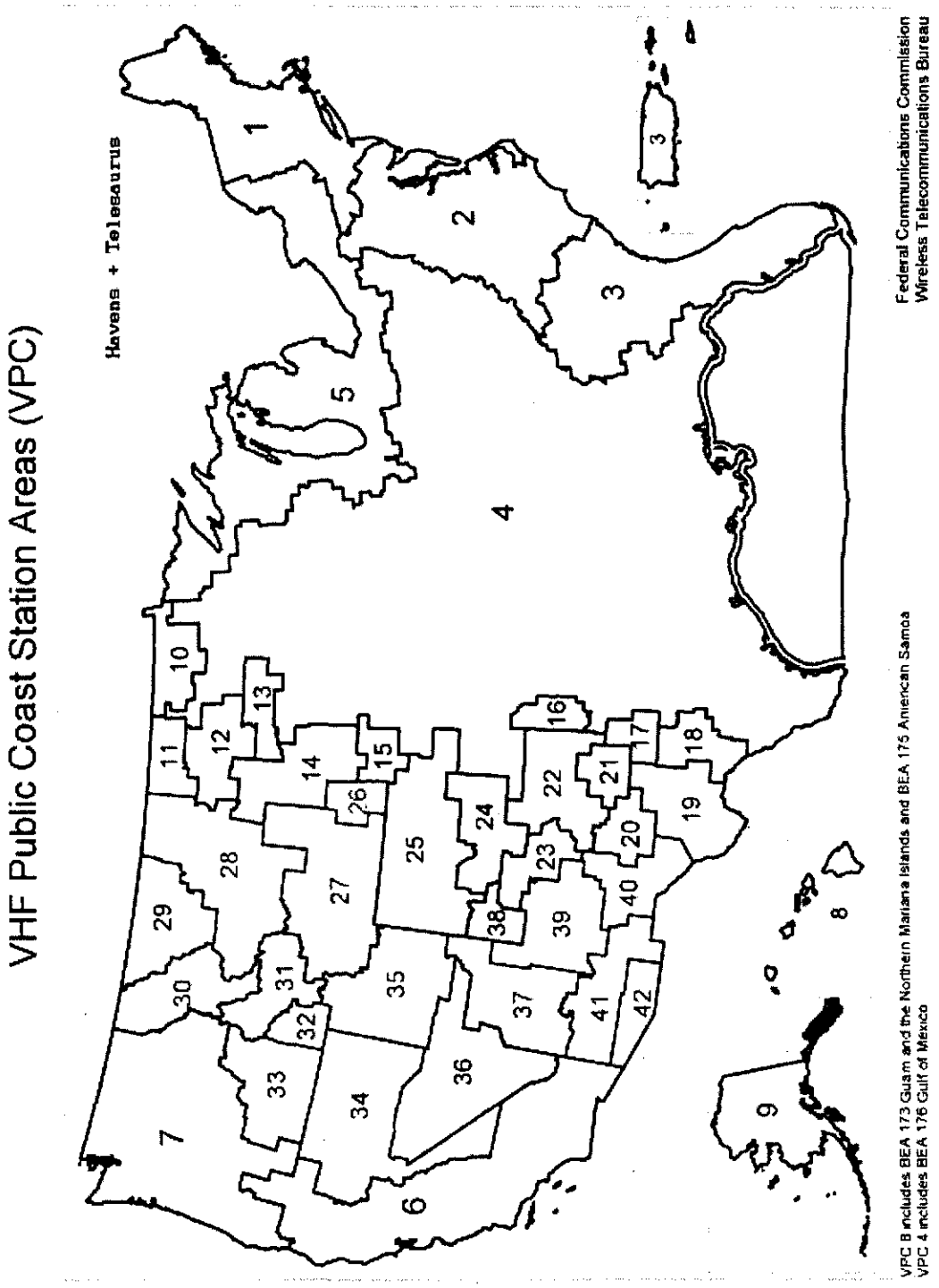
VPC, for many years, has been licensed along much of the US coasts for commercial shipping. In an FCC auction in December 1999, the FCC auctioned the VPC spectrum in geographic licenses (EA areas). In that auction Havens bought the eleven licenses listed below, and in the second VPC auction, in 2001, Telesaurus bought the three licenses listed.

Although they still retain the "Public Coast" nomenclature, these auctioned licenses can be used for land mobile and fixed wireless. Where the licensee elects to provide RF coverage that covers a major waterway (this is not required) the system must provide a "watch" on the nearby marine Channel 16 if the Coast Guard does not provide such a watch. That is the remaining obligation for marine service for inland-EA VPC licensees.

Following are key aspects of Havens' Inland VPC licenses:

- 157 paired with 162 MH: 350 kHz total: 14 12.5-kHz channels or 7 25-kHz channels.
- Exclusive spectrum (not shared). No incumbents in most areas, a few channels encumbered in a few areas (at least, licenses still listed in FCC files).
- EA geographic licenses: can place stations within the EA.
- Interconnect and non-interconnect dispatch services permitted.
- Land mobile service permitted on primary-use basis (see narrative above).
- Fixed services permitted on a co-primary basis with mobile operations.

License	Market Name (EA)	Population	Licensee
VPC011	Minot, ND	116054	Telesaurus Holdings
VPC026	Scottsbluff, NE-WY	91975	Telesaurus Holdings
VPC027	Casper, WY-ID-UT	382,095	Warren C. Havens
VPC028	Billings, MT-WY	362,513	Warren C. Havens
VPC029	Great Falls, MT	163,284	Warren C. Havens
VPC030	Missoula, MT	333,984	Warren C. Havens
VPC031	Idaho Falls, ID-WY	263,379	Warren C. Havens
VPC032	Twin Falls, ID	136,831	Warren C. Havens
VPC033	Boise City, ID-OR	408,246	Warren C. Havens
VPC034	Reno, NV-CA	511,004	Warren C. Havens
VPC035	Salt Lake City-Ogden, UT-ID	1,635,998	Warren C. Havens
VPC037	Flagstaff, AZ-UT	299,753	Warren C. Havens
VPC039	Albuquerque, NM-AZ	762,814	Warren C. Havens
VPC040	El Paso, TX-NM	807501	Telesaurus Holdings
VPC041	Phoenix-Mesa, AZ-NM	2,365,002	Warren C. Havens
VPC042	Tucson, AZ	794,180	Warren C. Havens



Note: the numbered areas from 8 and higher are EA (Economic Area) markets. Boundaries of the EA's in part follow State boundaries (check any road atlas). We can provide lists of all EA's listing their component counties and States.

Exhibit 3 (cont'd)

220-222 MHz Licenses

220-222 MHz licenses of Net Radio Group Communications (nrg) and Warren Havens (wh) obtained at FCC auctions, end 1998 and mid 1999. Mr. Havens founded and has indirect equity and majority debt interests in NRG.)[51]

Rules for this "220 MHz" service are well known. Major features include:

- 5 kHz channels, but adjacent channels can be combined to form wider channels.
  - Note: NRG bought at FCC auction channel blocks (designated below by capital letters, A, B, G, F, etc.) that in large part provided such adjacent channels: 15 kHz and wider when combined. Amount of 220 MHz per EA below ("BEA" is same as "EA") may be determined by adding the kHz figures for all licenses in the EA with the spectrum from the EAG in which such EA falls. (The FCC website, under the 220 MHz first auction, has a cross reference of EAG's and EA's. Generally, the Central/Mountain and Pacific EAG's cover the western 60% of the nation, from about the Missouri River west, including Texas.
- Exclusive spectrum (not shared). Some single-site incumbents in major markets; however, it many of these are not in actual operation and the FCC is currently investigating and will cancel those that are not operating.
- EAG and EA ("BEA" is same as "EA") geographic licenses: can place stations within the EA. An EAG is composed of many EA's to form a multi-state region of the nation.
- Interconnect and non-interconnect-dispatch services permitted.
- Land mobile service permitted on primary-use basis.
- Fixed services permitted on a co-primary basis with mobile operations.

A map of all 220 MHz license areas follows the below list of our licenses. *(Match the license number with the corresponding market on the map to see the coverage of the below listed licenses.)*

In the below, "wh" = Warren Havens; "nrg" = Net Radio Group Communications (in which Warren Havens has equity and debt interests noted above).

[51] Mr. Havens expects to exercise his rights to obtain control of the company or its assets in near future.

License		kHz	Market	Population		Licensee
EAG001	**G**	**150**	**Northeast**	**41,567,654**		----wh
EAG005	**F**	**150**	**Central/Mountain**	**40,926,336**		nrg
EAG005	**G**	**150**	**Central/Mountain**	**40,926,3**		nrg
EAG005	**H**	**150**	**Central/Mountain**	**40,926,336**		nrg
EAG006	**G**	**150**	**Pacific**	**41,437,956**		nrg
EAG006	**H**	**150**	**Pacific**	**41,437,956**		nrg
BEA001	A	100	Bangor, ME	533,135		----wh
BEA001	B	100	Bangor, ME	533,135		----wh
BEA001	C	100	Bangor, ME	533,135		----wh
BEA001	E	100	Bangor, ME	533,135		----wh
BEA002	A	100	Portland, ME	694,793		----wh
BEA004	A	100	Burlington, VT-NY	568,377		----wh
BEA004	B	100	Burlington, VT-NY	568,377		----wh
BEA004	D	100	Burlington, VT-NY	568,377		----wh
BEA006	C	100	Syracuse, NY-PA	1,934,632		----wh
BEA006	D	100	Syracuse, NY-PA	1,934,632		----wh
BEA009	C	100	State College, PA	798,826		----wh
BEA011	A	100	Harrisburg-Lebanon-Carlisle, P	1,026,459		----wh
BEA013	C	100	Washington-Baltimore, DC-MD-VA	7,454,633		----wh
BEA014	D	100	Salisbury, MD-DE-VA	290,800		----wh
BEA016	A	100	Staunton, VA-WV	301,626		----wh
BEA016	C	100	Staunton, VA-WV	301,626		----wh
BEA045	E	100	Johnson City-Kingsport-Bristol	524,270		----wh
BEA053	A	100	Pittsburgh, PA-WV	3,003,172		----wh
BEA053	C	100	Pittsburgh, PA-WV	3,003,172		----wh
BEA058	A	100	Northern Michigan, MI	230,066		----wh
BEA058	D	100	Northern Michigan, MI	230,066		----wh
BEA059	A	100	Green Bay, WI-MI	624,600		----wh
BEA059	C	100	Green Bay, WI-MI	624,600		----wh
BEA060	A	100	Appleton-Oshkosh-Neenah, WI	380,610		----wh
BEA061	A	100	Traverse City, MI	238,720		----wh
BEA061	B	100	Traverse City, MI	238,720		----wh
BEA061	D	100	Traverse City, MI	238,720		----wh
BEA063	B	100	Milwaukee-Racine, WI	2,119,557		----wh
BEA091	E	100	Fort Smith, AR-OK	286,113		----wh
BEA092	D	100	Fayetteville-Springdale-Rogers	285,955		----wh
BEA094	C	100	Springfield, MO	712,422		----wh
BEA105	C	100	La Crosse, WI-MN	220,502		----wh
BEA105	D	100	La Crosse, WI-MN	220,502		----wh
BEA108	A	100	Wausau, WI	451,533		----wh
BEA108	B	100	Wausau, WI	451,533		----wh
BEA109	A	100	Duluth-Superior, MN-WI	340,675		----wh
BEA109	B	100	Duluth-Superior, MN-WI	340,675		----wh
BEA109	C	100	Duluth-Superior, MN-WI	340,675		----wh
BEA109	D	100	Duluth-Superior, MN-WI	340,675		----wh
BEA110	A	100	Grand Forks, ND-MN	240,827		----wh
BEA110	B	100	Grand Forks, ND-MN	240,827		----wh
BEA110	C	100	Grand Forks, ND-MN	240,827		----wh
BEA110	D	100	Grand Forks, ND-MN	240,827		----wh
BEA110	E	100	Grand Forks, ND-MN	240,827		nrg

BEA111	A	100	Minot, ND	116,054	----wh
BEA111	B	100	Minot, ND	116,054	----wh
BEA111	C	100	Minot, ND	116,054	----wh
BEA111	D	100	Minot, ND	116,054	----wh
BEA111	E	100	Minot, ND	116,054	----wh
BEA112	A	100	Bismarck, ND-MT-SD	172,204	----wh
BEA112	B	100	Bismarck, ND-MT-SD	172,204	----wh
BEA112	C	100	Bismarck, ND-MT-SD	172,204	----wh
BEA112	D	100	Bismarck, ND-MT-SD	172,204	----wh
BEA112	E	100	Bismarck, ND-MT-SD	172,204	nrg
BEA113	B	100	Fargo-Moorhead, ND-MN	347,670	----wh
BEA113	C	100	Fargo-Moorhead, ND-MN	347,670	----wh
BEA113	D	100	Fargo-Moorhead, ND-MN	347,670	----wh
BEA113	E	100	Fargo-Moorhead, ND-MN	347,670	nrg
BEA114	C	100	Aberdeen, SD	84,696	----wh
BEA114	D	100	Aberdeen, SD	84,696	----wh
BEA114	E	100	Aberdeen, SD	84,696	nrg
BEA115	C	100	Rapid City, SD-MT-ND-NE	199,782	----wh
BEA115	D	100	Rapid City, SD-MT-ND-NE	199,782	----wh
BEA115	E	100	Rapid City, SD-MT-ND-NE	199,782	nrg
BEA116	A	100	Sioux Falls, SD-IA-MN-NE	478,307	nrg
BEA116	B	100	Sioux Falls, SD-IA-MN-NE	478,307	nrg
BEA116	C	100	Sioux Falls, SD-IA-MN-NE	478,307	nrg
BEA116	D	100	Sioux Falls, SD-IA-MN-NE	478,307	nrg
BEA116	E	100	Sioux Falls, SD-IA-MN-NE	478,307	nrg
BEA117	A	100	Sioux City, IA-NE-SD	239,518	nrg
BEA117	B	100	Sioux City, IA-NE-SD	239,518	nrg
BEA117	C	100	Sioux City, IA-NE-SD	239,518	nrg
BEA117	D	100	Sioux City, IA-NE-SD	239,518	nrg
BEA117	E	100	Sioux City, IA-NE-SD	239,518	nrg
BEA118	B	100	Omaha, NE-IA-MO	958,815	nrg
BEA118	C	100	Omaha, NE-IA-MO	958,815	nrg
BEA118	D	100	Omaha, NE-IA-MO	958,815	nrg
BEA118	E	100	Omaha, NE-IA-MO	958,815	nrg
BEA119	C	100	Lincoln, NE	341,684	nrg
BEA119	E	100	Lincoln, NE	341,684	nrg
BEA120	C	100	Grand Island, NE	277,509	----wh
BEA120	D	100	Grand Island, NE	277,509	----wh
BEA120	E	100	Grand Island, NE	277,509	nrg
BEA121	C	100	North Platte, NE-CO	60,432	----wh
BEA121	D	100	North Platte, NE-CO	60,432	----wh
BEA121	E	100	North Platte, NE-CO	60,432	nrg
BEA122	B	100	Wichita, KS-OK	1,094,213	nrg
BEA122	C	100	Wichita, KS-OK	1,094,213	nrg
BEA122	E	100	Wichita, KS-OK	1,094,213	nrg
BEA126	D	100	Western Oklahoma, OK	144,847	----wh
BEA129	E	100	San Angelo, TX	189,093	----wh
BEA135	E	100	Odessa-Midland, TX	382,517	----wh
BEA137	D	100	Lubbock, TX	357,092	----wh
BEA138	C	100	Amarillo, TX-NM	448,258	----wh
BEA138	D	100	Amarillo, TX-NM	448,258	----wh
BEA139	B	100	Santa Fe, NM	208,689	nrg

BEA139	C	100	Santa Fe, NM	208,689	nrg
BEA139	D	100	Santa Fe, NM	208,689	nrg
BEA139	E	100	Santa Fe, NM	208,689	nrg
BEA140	A	100	Pueblo, CO-NM	247,124	nrg
BEA140	B	100	Pueblo, CO-NM	247,124	nrg
BEA140	C	100	Pueblo, CO-NM	247,124	nrg
BEA140	D	100	Pueblo, CO-NM	247,124	nrg
BEA140	E	100	Pueblo, CO-NM	247,124	nrg
BEA141	C	100	Denver-Boulder-Greeley, CO-KS-NE	3,031,140	nrg
BEA141	D	100	Denver-Boulder-Greeley, CO-KS-NE	3,031,140	nrg
BEA142	C	100	Scottsbluff, NE-WY	91,975	----wh
BEA142	D	100	Scottsbluff, NE-WY	91,975	----wh
BEA142	E	100	Scottsbluff, NE-WY	91,975	nrg
BEA143	A	100	Casper, WY-ID-UT	382,095	nrg
BEA143	B	100	Casper, WY-ID-UT	382,095	nrg
BEA143	C	100	Casper, WY-ID-UT	382,095	nrg
BEA143	D	100	Casper, WY-ID-UT	382,095	nrg
BEA143	E	100	Casper, WY-ID-UT	382,095	nrg
BEA144	A	100	Billings, MT-WY	362,513	nrg
BEA144	B	100	Billings, MT-WY	362,513	nrg
BEA144	C	100	Billings, MT-WY	362,513	nrg
BEA144	D	100	Billings, MT-WY	362,513	nrg
BEA144	E	100	Billings, MT-WY	362,513	nrg
BEA145	A	100	Great Falls, MT	163,284	nrg
BEA145	B	100	Great Falls, MT	163,284	nrg
BEA145	C	100	Great Falls, MT	163,284	nrg
BEA145	D	100	Great Falls, MT	163,284	nrg
BEA145	E	100	Great Falls, MT	163,284	nrg
BEA146	A	100	Missoula, MT	333,984	nrg
BEA146	B	100	Missoula, MT	333,984	nrg
BEA146	C	100	Missoula, MT	333,984	nrg
BEA146	D	100	Missoula, MT	333,984	nrg
BEA146	E	100	Missoula, MT	333,984	nrg
BEA148	A	100	Idaho Falls, ID-WY	263,379	nrg
BEA148	B	100	Idaho Falls, ID-WY	263,379	nrg
BEA148	C	100	Idaho Falls, ID-WY	263,379	nrg
BEA148	D	100	Idaho Falls, ID-WY	263,379	nrg
BEA148	E	100	Idaho Falls, ID-WY	263,379	nrg
BEA149	A	100	Twin Falls, ID	136,831	nrg
BEA149	B	100	Twin Falls, ID	136,831	nrg
BEA149	C	100	Twin Falls, ID	136,831	nrg
BEA149	D	100	Twin Falls, ID	136,831	nrg
BEA149	E	100	Twin Falls, ID	136,831	nrg
BEA150	A	100	Boise City, ID-OR	408,246	nrg
BEA150	B	100	Boise City, ID-OR	408,246	nrg
BEA150	C	100	Boise City, ID-OR	408,246	nrg
BEA150	D	100	Boise City, ID-OR	408,246	nrg
BEA150	E	100	Boise City, ID-OR	408,246	nrg
BEA151	A	100	Reno, NV-CA	511,004	nrg
BEA151	B	100	Reno, NV-CA	511,004	nrg
BEA151	C	100	Reno, NV-CA	511,004	nrg
BEA151	D	100	Reno, NV-CA	511,004	nrg

BEA152	A	100	Salt Lake City-Ogden, UT-ID	1,635,998	nrg
BEA152	B	100	Salt Lake City-Ogden, UT-ID	1,635,998	nrg
BEA152	D	100	Salt Lake City-Ogden, UT-ID	1,635,998	nrg
BEA152	E	100	Salt Lake City-Ogden, UT-ID	1,635,998	nrg
BEA153	C	100	Las Vegas, NV-AZ-UT	943,702	nrg
BEA153	D	100	Las Vegas, NV-AZ-UT	943,702	nrg
BEA154	A	100	Flagstaff, AZ-UT	299,753	nrg
BEA154	B	100	Flagstaff, AZ-UT	299,753	nrg
BEA154	C	100	Flagstaff, AZ-UT	299,753	nrg
BEA154	D	100	Flagstaff, AZ-UT	299,753	nrg
BEA154	E	100	Flagstaff, AZ-UT	299,753	nrg
BEA155	A	100	Farmington, NM-CO	150,155	nrg
BEA155	B	100	Farmington, NM-CO	150,155	nrg
BEA155	C	100	Farmington, NM-CO	150,155	nrg
BEA155	D	100	Farmington, NM-CO	150,155	nrg
BEA155	E	100	Farmington, NM-CO	150,155	nrg
BEA156	A	100	Albuquerque, NM-AZ	762,814	nrg
BEA156	C	100	Albuquerque, NM-AZ	762,814	nrg
BEA156	D	100	Albuquerque, NM-AZ	762,814	nrg
BEA156	E	100	Albuquerque, NM-AZ	762,814	nrg
BEA157	A	100	El Paso, TX-NM	807,501	nrg
BEA157	D	100	El Paso, TX-NM	807,501	nrg
BEA158	B	100	Phoenix-Mesa, AZ-NM	2,365,002	nrg
BEA158	C	100	Phoenix-Mesa, AZ-NM	2,365,002	nrg
BEA159	A	100	Tucson, AZ	794,180	nrg
BEA159	B	100	Tucson, AZ	794,180	nrg
BEA159	E	100	Tucson, AZ	794,180	nrg
BEA162	E	100	Fresno, CA	1,168,970	nrg
BEA164	D	100	Sacramento-Yolo, CA	1,935,487	nrg
BEA164	E	100	Sacramento-Yolo, CA	1,935,487	nrg
BEA165	A	100	Redding, CA-OR	307,572	nrg
BEA165	B	100	Redding, CA-OR	307,572	nrg
BEA165	C	100	Redding, CA-OR	307,572	nrg
BEA165	D	100	Redding, CA-OR	307,572	nrg
BEA165	E	100	Redding, CA-OR	307,572	nrg
BEA169	E	100	Richland-Kennewick-Pasco, WA	545,747	nrg
BEA171	A	100	Anchorage, AK	550,043	nrg
BEA171	B	100	Anchorage, AK	550,043	nrg
BEA171	C	100	Anchorage, AK	550,043	nrg
BEA171	D	100	Anchorage, AK	550,043	nrg
BEA171	E	100	Anchorage, AK	550,043	nrg
BEA172	B	100	Honolulu, HI	1,108,229	nrg
BEA172	C	100	Honolulu, HI	1,108,229	nrg
BEA172	D	100	Honolulu, HI	1,108,229	nrg

QuickTime™ and a
Photo - JPEG decompressor
are needed to see this picture.

Exhibit 3 (cont'd)

Below is a chart from an FCC report with text inserted (in this typeface, as can be distinguished) by LMSW-Havens. [10-3-01: This was originally prepared in year 2000. *The "LMSW-Havens" figures do not include another approx. 200 million MHz Pops of LMS spectrum obtained in 2001.]*

There have been some mergers and acquisitions since the report was written by a number of the listed companies. However, this chart still reflects well the relative potential of LMSW-Havens and ATLIS (as planned) in relation to the largest US mobile wireless operations.

Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of	)
	)
Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993	)
	)
Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services	)

FOURTH REPORT

Adopted: June 10, 1999 Released: June 24, 1999

By the Commission:

Table 3: Mobile Telephone Industry Top 50 Operators
(In Millions)

Company	Cellular POPs (1)	ABC POPs (1)	DEF POPs (1)	Broadband POPs (2) Total	Rank	Broadband MHz-POPs (3) Total	Rank	Unduplicated Brdbnd. POPS (4) Total	Rank
AT&T	81.29	114.85	151.70	347.84	1	6,609.25	1	235.98	2
Sprint PCS		188.89	90.87	279.76	2	6,575.37	2	265.05	1
LMSW-Havens + other cooperative, current						2,675.00	4	270.00	1
LMSW-Havens + other " , after second FCC licensing stage (~Y 2001)						3,776.00	4	270.00	1
ALL LMS band (all 902-928 MHz) (potential)						6,890.00	2	270.00	1 [52]
All ATLIS wide-area as conceived (all LMS band, + 217-222 MHz, not incl. 5.9 GHz)						7,950.00	1	270.00	1 [53]
LMSW-Havens LMS (current, not incl. its VHF & 220 MHz: over 1 bil. incl.)						1,240.00	12	207.00	4 [54]
Nextel Comm.				230.00	3	2,300.00	4	230.00	3
Nextwave Telecom		111.87	53.86	165.73	4	3,894.69	3	165.73	4
Omnipoint Comm.		32.67	98.98	131.65	5	1,772.11	8	93.71	5
AirTouch Comm. (5)	64.67		21.03	85.70	6	1,827.05	6	64.67	8
SBC (6)	45.36	35.55	2.29	83.20	7	2,223.28	5	83.20	6
Western Wireless (7)	7.73	19.99	46.43	74.15	8	1,210.85	12	73.17	7
ALLTEL	35.28		32.40	67.68	9	1,206.05	13	55.63	13
GTE Mobilnet	52.32	11.08		63.40	10	1,640.33	9	61.81	9
BellSouth	38.91	7.72	13.59	60.22	11	1,340.16	11	58.64	11
Primeco		59.08		59.08	12	1,772.31	7	59.08	10
Bell Atlantic (5)	56.80			56.80	13	1,420.00	10	56.80	12
Northcoast Oper. Co.			47.86	47.86	14	478.64	19	47.86	14
Powertel	0.33	17.80	12.74	30.87	15	669.62	16	24.54	19
Ameritech (6)	22.00	8.26		30.26	16	797.76	15	30.11	15
Century Tele. Ent.	9.77		19.72	29.49	17	441.46	20	29.40	16
Aerial Comm.		27.87		27.87	18	836.14	14	27.49	17
US Cellular	25.27			25.27	19	631.67	17	25.27	18
US West		3.56	20.16	23.72	20	237.19	25	23.72	20
Aerforce			21.82	21.82	21	218.18	26	21.55	21
General Wireless	20.38			20.38	22	509.38	18	20.38	22
Comcast (6)	8.26		9.91	18.17	23	305.53	21	11.56	28
Rivgam Comm.			17.32	17.32	24	173.22	29	17.32	23
Telecorp PCS (8)		9.89	4.94	14.83	25	247.15	23	14.83	24
Cook Inlet/WW (SEC) (7)		2.98	9.83	12.81	26	142.95	32	12.81	25
Triton PCS (8)	0.91	11.01		11.92	27	242.90	24	11.92	26
Mercury PCS (PK)		2.50	9.16	11.65	28	129.03	34	11.65	27
Centennial Cellular	7.00	3.77		10.77	29	288.06	22	10.77	29
Dobson Comm. (SEC)	5.58		4.20	9.78	30	181.39	28	9.78	30
Devon Mobile (PK)		0.95	8.54	9.49	31	99.70	40	9.49	31
Urban Comm. PCS (PK)		3.47	4.42	7.89	32	148.28	31	7.89	32
21st Cent. Telesis (PK)		4.32	3.51	7.83	33	99.83	39	7.83	33
Radiofone	2.19		5.22	7.41	34	106.98	38	7.41	34
Pocket Comm.		7.33		7.33	35	109.89	37	7.33	35
Magnacom (PK)		1.77	5.47	7.23	36	81.17	43	7.23	36
McLeod, Inc.			7.15	7.15	37	71.47	46	7.15	37
Puerto Rico Telephone (9)	3.52		3.52	7.04	38	123.27	35	3.52	46
Vanguard Cellular	6.80			6.80	39	170.11	30	6.80	38
Chase Telecom		6.16		6.16	40	184.89	27	6.16	39
American Cellular	5.17			5.17	41	129.35	33	5.17	40

[Nine of the current top 50 companies excluded for this chart to fit on this page.]
[The figures in red: MHz- Pops, are best indicators of capacity.]

[52] Expanded means including the 12 MHz in 902-928 MHz that is currently licensed mostly for short-range ITS communications which should migrate to the ITS 5.9 GHz band over time.
[53] ATLIS = Advanced Technology Land Infrastructure Service, as elsewhere described by Havens.
[54] The LMS held by Warren Havens and by Telesaurus Holdings controlled by Havens.

Notes:
(1) All of the operators' POPs equal their total net POPs. Net POPs are calculated for each individual license by multiplying that license's population by the operator's percentage ownership of the license.
(2) Broadband POPs are the sum of cellular, ABC block PCS, and DEF block PCS POPs.
(3) Broadband MHz-POPs equals cellular POPs multiplied by 25 MHz plus AB block PCS POPs multiplied by 30 MHz plus C block PCS POPs multipled by either 15 MHz or 30 MHz plus DEF block PCS POPs multiplied by 10 MHz.
(4) Unduplicated POPs adjusts Broadband POPs to account for a licensee having multiple licenses in the same geographic area.
(5) PrimeCo is owned by AirTouch (50%), Bell Atlantic (50%).
(6) SBC Communications has announced plans to merge with both Ameritech and Comcast.
(7) Cook Inlet Western is a joint venture in which Western Wireless owns 49.9%.
(8) Telecorp, Triton PCS and Cincinnati Bell have entered into joint ventures with AT&T
(9) Acquired by GTE.

Sources: Unless otherwise noted, Dennis Leibowitz et al, THE WIRELESS COMMUNICATIONS INDUSTRY, Donaldson, Lufkin & Jenrette, Winter 1998/1999, at 100-173.
PK - Paul Kagan Associates, Inc., *Tops in Wireless POPs*, WIRELESS MARKET STATS, Aug. 25, 1997, at 8-9. These figures have been adjusted for the June 1998 C block elections.
SEC - Filings made with the Securities and Exchange Commission.
Nextel Broadband POPs - Paul Kagan Associates, Inc., *Tops in Wireless POPs*, WIRELESS MARKET STATS, Aug. 25, 1997, at 8.
Nextel Broadband MHz-POPs - Calculated assuming an average of 10 MHz across all licenses. *See* John M. Bensche & Briar Mewbourne, *Nextel Communications: Initiating Coverage*, Wireless Services, Lehman Brothers, Sep. 3, 1997, at 8.

Exhibit 4

Part 15 Devices, Trends off of 902-928 MHz to 2.4 and 5 GHz

1. Below information is taken from proprietary research reports purchased by Petitioner from the Consumer Electronics Association. Below is the heading from one of the three years of monthly reports Petitioner purchased for the purpose the purposes noted below.

CEA MARKET RESEARCH DEPARTMENT

MARKET ACTIVITY REPORTS & ANALYSIS PROGRAM

Monthly US Factory Sales of 900 Mhz & 2.4 Ghz Products
CLICK TO THE TAB CORRESPONDING TO THE APPROPRIATE PERIOD
PLEASE NOTE:

The information contained in the following reports is considered confidential, and its use is intended exclusively

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These copyrighted reports document that there has been in recent years and there continues to be increasing percentages of Part 15 consumer devices in the 2.4 GHz range and lesser percentage of such devices in the 902-928 MHz range. (This is also reflected in visits to popular consumer electronic stores: note the increase in 2.4 GHz cordless phones and devices in last few years relative to the 900 MHz devices.)

2. In addition, see the slide show, at www.fcc.gov : "Trends In Unlicensed Trends In Unlicensed, Spread Spectrum Devices Spread Spectrum Devices," a Presentation at the FCC Commission Meeting, May 10, 2001by the FCC Office of Engineering and Technology. This discusses the 2.4 GHz and 5 GHz UNII bands (each much larger than the 902-928 MHz band) and their increasing use by Bluetooth, Wi-Fi 802.11b, Home RF and other technologies. It does not mention the 902-928 MHz band.

Note: these are becoming very popular technologies and will soon involve huge volumes and economies of scale. This will increasingly make products for 902-928 MHz uncompetitive, especially when high-power LMS Multilateration systems are deployed and substantially loaded with traffic.

3. Also, Metricom, the former head of the Ad Hoc Part 15 Association (organized for FCC purposes in LMS rulemaking), informed Petitioner in year 2000 that the vendors of wireless LAN products had almost all moved off of the 902-928 MHz band to these higher bands. Similarly, the same was told to Petitioner by Part 15 device vendors, including WiLan of Calgary, Canada.

Exhibit 5

LMS verses Part 15 in 902-928 MHz, and
Part 15 Safe Harbor Defects in its Purpose.

Below is from another document: "we" means Petitioner.

Part 15 has no sound basis in LMS or any band for a major commercial network. We (and may others who have looked at these matters) do not believe that Part 15 provides a sound basis for a major wide-area or other commercial network. Without license rights, higher power, reasonable antenna height, and ability to select the best technology, the huge cost to build and operate cannot be justified. The cost to operate such a network of Part 15 devices is greater that if license rights (including power, height, and technology choices) were available, and the risk is enormously greater due to having to tolerate noise from more powerful licensed operations. Not a sound business case, and thus, such attempts will likely fail and then such Part 15 ventures in LMS spectrum should subside or end, especially as LMS operations become increasingly established.

Safe Harbor: no vested rights. The Part 15 "Safe Harbor" with respect to LMS does not provide license rights or any vested rights to Part 15 to use spectrum in LMS 902-928 MHz. Part 15 must accept interference from LMS and must not interfere with LMS. However, the Safe Harbor provides Part 15 a measure of protection from claims of interference by LMS. It applies more to systems using Part 15 devices such as Ricochet than to individual devices such as cordless phones. See, e.g., par.32, FCC 97-305; par. 18, FCC 96-115.

Safe Harbor: defects. The Part 15 ad hoc coalition, previously headed by Metricom, lobbied the FCC heavily during LMS rule making in the 1990's. They sought co-equal rights with LMS but did not succeed. The obtained a "Safe Harbor," noted above. That Safe Harbor may be challenged, for one thing, since the FCC did not contemplate closely spaced transmitters in Part 15 (discussed below), nor other things Metricom attempted such as many mobile end-user devices resulting in transmitters at heights higher than allowed in the Safe Harbor : see, e.g., par. 34, FCC 97-305 (geographically close Part 15 transmitters were not contemplated by FCC—this is clear in various paragraphs of the rulemaking). See also below regarding other weaknesses in terms of Part 15 public or private networks (as opposed to devices): end-user devices on the network, mobile applications, etc.

Part 15 not entitled to protection/ and "testing" by LMS with respect to Part 15 systems. See par. 69, FCC 97-305: This is the final pronouncement by the FCC on these issues in the rule making, clarifying previous discussions. Part 15 not entitled to protection from interference by LMS. (LMS narrowband piece of license can operate at up to 300 watts ERP and the wideband up to 30 watts ERP, and transmitters can be placed where we choose and at heights we choose.) LMS has only to show that, where there are *existing systems* of Part 15 devices (these rarely exist), we have to take into consideration a goal of minimizing interference and verify via cooperative testing.

Metricom's CTO told me that his view of this provision is that we could choose the best technology and network topology for our purposes, but if we could execute this one way verses

another, each being roughly equal cost/benefit to us, then we would have to choose the execution that caused less interference to the Part 15 system. We believe this assessment is a fair one-- it is about all this provision, and the related actual rule, requires of LMS in this matter.

End-user Part 15 devices-- Safe Harbor issues. Par. 30, FCC 97-305--("Metricom submits that the safe harbor limits should not apply [*sic*: Metricom must have meant, "should apply"] to mobile and portable devices. [E.g.] [i]t posits that a cordless phone [or Ricochet modem, I assume] being operated off a 50th floor balcony as part of a wireless network should not be subject to complaints of interference from LMS providers.") The FCC did not agree to this. (See Rules.) Thus, when Ricochet subscribers take their modems outdoors and if they are above the height limits of the Safe Harbor, it may be that we can shut them down if interference is caused.

Ricochet [or the like] as *Mobile* Network. Regarding mobile-vehicular high-speed service (Metricom advertises this). The FCC, in LMS rulemaking and rules, discusses LMS Multilateration networks and mobile transmitters. However the FCC did not contemplate Part 15, at least for purposes of the LMS rules, as a wide-area network, especially not a wide-area mobile network. The Safe Harbor was not meant as a tool by which Part 15 networks could, by design or unplanned growth, be shielded from actual systemic harmful interference to LMS operations.

From Safe Harbor rule 90.361:

> . . . Part 15 . . . operations will not be considered to be causing harmful interference to a multilateration LMS system . . . if they are non-video links . . . and at least one of the following conditions are met: . . . (b) **It** does not employ and outdoor antenna; or (c) If **it** does employ an outdoor antenna, the if . . . . The antenna . . . . The antenna . . . .

LMS multilateral systems are described and defined in FCC rules as very wide-area systems or networks to cover highway and road traffic across the nation, etc. In contrast, in such rules' Safe Harbor, the Part 15 being considered is described as a device: "It. . . . it . . . . antenna. . . antenna. . . . antenna. . . " etc. No where in the FCC rules or rulemaking proceeding on LMS does the FCC consider or contemplate wide-area Part 15 networks of the magnitude of current Ricochet networks. Part 15 is unlicensed, and as such, there is no mechanism by which the FCC considers regulation of Part 15 as wide-area networks. It sees, in such rules, Part 15 as devices not spaced close together, not transmitting much of the time, and not permitted to cause interference to the LMS

FCC 97-305, par. 32, 34:

> . . .safe harbor rule . . . to limit the potential for harmful interference. [par. 32] . . . outdoor antennas . . .. less than five meters in height driven by a transmitter with one watt or less of output power . . . will only affect [interfere with] LMS operations that are geographically close. [par. 34]

This reflects my argument above: the FCC did not contemplate close spacing of outdoor transmitters in a Part 15 wide-area network over a market or large area in which a LMS operation must cover (per macrocell-based architecture noted in reference in above footnote) to

provide viable vehicle location services, since this would result in such "geographically close" interference. [There are similar references elsewhere in the rulemaking that I can point out.]

FCC 97-305, par. 38, discussing 90.361, video links are not subject to (not afforded the shield of protection from interference claims by) the Safe Harbor due to interference with LMS. I believe this is due to the Time and Amount involved in such links needed to transmit the high data speeds needed for video. Unlike the technology described by the Part 15 entities at the time the Safe Harbor was created, the current and planned generations of Ricochet involve far higher Time and Amount, as did the video links not afforded Safe Harbor protection.

FCC 95-41, par 32:

> . . .Because Part 15 devices operate at extremely low power and each has a limited area of operation, the record indicates they **can coexist more easily with non-multilateration** LMS systems, which also operate with relatively short range. Conversely, Part 15 commenters generally contend that they will not be able to effectively share the spectrum with multilateration LMS systems . . . . cannot coexist . . . .without a limit in the power and location of the multilateration transmissions . . . .

This shows that the Space aspect or factor in Network Band Usage (see memo of ___ , noted below, re these terms) is understood by the FCC and Part 15 community, and that at the time the LMS rules were made, Part 15 operations in this band were conceived of as having limited areas of operation, not wide-area networks of the current Richochet better-than-CMRS-type. Also reflected here, the Part 15 community sought to limit the Space factor (location/ spacing of transmitters) in LMS wide-area networks of the type , thus, must have assumed Space limitations for their own devices in the field. There is no meaning to "extremely low power" without a Space limitation, since relatively very high power transmitters at high sites in a macrocell LMS network will create much lower field signal strength in most of a covered market than a dense mesh network of such "extremely low power" Part 15 devices. More accurately, see letter: Power, Height, Space, Time, and Amount are all factors in actual Network Band Usage.

[These capitalized terms were from another memo by me, and essentially mean: power of the transmitter, height of transmitter, spacing of transmitters, and amount (percentage) of time transmitters are in use: all factors in determining the effective signal strength over a given metro area being covered and given time period by a Part 15 network or a LMS wide-area network.]

Regardless of the shortcomings in FCC rules in terms of reflecting, but not directly addressing Space, Time, and Amount [Power and Height are addressed], the rules do clearly address the principle that Part 15 may not cause harmful interference to LMS operations. The current design, deployment, and direction of Metricom's nationwide Ricochet network appears to be a major departure from the Part 15 usage contemplated at the time of the rulemaking, and may (per my initial review) be a breach of such principal.

[[ ] Update—again, Metricom is in Chapter 11 and has taken down its Ricochet networks, or at least taken them off the air. The above or similar would apply to other similar wide-area Part 15 networks on 902-928 MHz.]

Exhibit 6

Part 15- LMS Interference Simulator Study Materials,
And Petioner's Research into LMS Multilateration Technology

Exhibit 6, four documents, comprises confidential information and is submitted in a concurrent filing under §0.459 of the Commission Rules.

Exhibit 7

Below is the featured article in the July 2001 Issue of *ITS View*, the journal of the American Transportation Society of America (ITS America).

This journal and this article can be found at the website of ITS American, www.itsa.org . The below was reformatted for presenting below. Underlining added.

This article expresses the need for a dedicated communications architecture and infrastructure, including its wireless infrastructure components, for Intelligent Transportation System applications, discussed how this need is not being met by existing plans and available networks and technologies, and proposes steps toward meeting this need.

The ATLIS Proposal, if realized, would in substantial measure contribute to meeting this need, and takes an approach similar to what Mr. Najarian discusses below: capacity (spectrum in wireless), technology, and network development designed and dedicated for ITS (and other) critical US infrastructure.

July 2001 Issue of *ITS View*

Is a Wireless Architecture the Future of ITS?
By Paul Najarian*

How much spectrum is needed for ITS applications? What is the appropriate spectrum for each ITS application? Where is the proper "home" for these applications? How much additional spectrum will ITS need for emerging applications? These are a sample of the questions that continue to intrigue telecommunications and RF engineers involved in ITS.

When asked such questions, the most common reply is that the industry has witnessed ITS applications occupying parts of the spectrum anywhere from Direct Current (DC) at 50 or 60 Hz to 77 GHz.

The problem of finding real answers is exacerbated by a lack of understanding between the civil and the electrical (or telecommunications) engineering disciplines. But realistically, the main problem arises from the difficulties in clearly identifying ITS requirements without an ITS telecommunications strategic plan or an ITS Telecommunications Architecture.

While these remarks are generally limited to the United States, they may be widely applicable to various regions of the world, as well.

Current ITS Applications

A number of frequency bands have been, somewhat, allocated to (but not exclusively reserved for) ITS
applications. These include:

1) the AM/FM band, where subcarriers have used the DARC standard
2) the 37 MHz private radio channels for highway maintenance
3) the 220 MHz where ITS has 5 pairs of channels in the U.S. that are barely utilized
4) Location and Monitoring Services (LMS) in the 902-928 MHz where 14 MHz are set aside for Electronic Toll Collection (ETC) and Commercial Vehicle Operations (CVO)
5) Dedicated Short Range Communications at 5850-5925 MHz
6) collision avoidance radar at 46.7-46.9 MHz and 76-77 GHz.

Other known applications may be added, such as Vehicle Information and Communication Systems (VICS) at 2.5 GHz, DSRC at 5.8 GHz operating in the Industrial, Scientific and Medical (ISM) band, and collision avoidance radar in the 61 GHz band. Other fixed point-to-point microwave applications should also be acknowledged.

In other words, ITS applications are scattered throughout the frequency spectrum, without, in most cases, a coherent rationale justifying the allocations of such spectrum.

The Problems

1) Limitations with the National Architecture

The National ITS Architecture provides a common framework for planning, defining, and integrating intelligent transportation systems. It defines the functions that are required for ITS, the physical entities or subsystems, and the information flows that connect these functions and subsystems together into an integrated system. These elements are clearly defined in the U.S. National ITS Architecture (commonly referred to as the famous "sausage" diagram) (see Fig.1).

The Architecture recommends four options for implementing the various communication links between the subsystems, without going into further technical specifics or recommendations. These options are simply defined as:

1) wireline communications
2) wide area wireless communications
3) dedicated short range communications
4) vehicle-to-vehicle communications.

In order to maintain neutrality, the Architecture does not make any recommendations for the implementation of a specific technology. For analytical purposes, the Architecture

does analyze implementation processes using analog, cellular (AMPS), cellular digital packet data (CDPD), and Advanced Radio Data Information Service (ARDIS) network.

While the Architecture notes the potential of emerging wireless systems, as well as increased wireline throughput, it is clearly not dynamic enough to continuously accommodate emerging technologies.

2) ITS Telecommunications Policy

Since 1994 in the U.S., the stated ITS telecommunications policy has been that ITS applications should not require dedicated spectrum or exclusive physical layers. It follows from this policy that, to the extent possible, ITS applications should use existing infrastructure established by all telecommunications providers rather than an infrastructure established specifically for such applications.

The ITS telecommunications policy makes sense in so far as the National ITS Architecture is mainly implemented at the Applications Layer (Layer 7).

That policy holds true in all cases of ITS applications except for Dedicated Short-Range Communications (DSRC) and, to some extent, collision avoidance radar. The collision avoidance radar is exempted from this policy for safety reasons.

The Current Process

Although the Architecture and the above-stated telecommunications policy were intended to establish the ground rules for implementation of ITS telecommunications infrastructure and applications, they have instead limited the options available for ITS applications and placed ITS deployers at the mercy of telecommunications providers. It is the telecommunications providers that now determine the extent and nature of ITS deployment. ITS deployers are left to try to make their technology and applications fit the framework imposed on them by the telecommunications providers.

ITS deployers will not be forced to recognize the inherent limitations on them from this situation as long as ITS applications (Layer 7) may be overlaid on the existing telecommunications infrastructure.

The process, up to now, has been to identify emerging technologies driven by the telecommunications industry that may be useful in ITS applications, then to submit unique ITS requirements to the telecommunications industry, and to hope that the telecommunications industry will adopt those requirements. Whether the telecommunications industry will provide the requested ITS applications relies on the marketplace potential for the application, as seen by the telecommunications industry.

For example, in 1995, the ITS industry submitted its requirements to the International Telecommunication Union (ITU) during the ITU's deliberations on Future Public Land

Mobile Telecommunications Services (FPLMTS). Telecommunications providers and manufacturers responded negatively to the request to include ITS requirements. The result is that, today, FPLMTS, which is known as 3G or Third Generation Systems, do not embody any ITS requirements.

The current process clearly shows the limitations inherent in a failure to develop and implement a Strategic Plan and a suitable Architecture for ITS development and deployment.

A Modest Proposal

The ITS industry needs to be more proactive in defining its requirements and developing the technology and infrastructure needed to make those requirements a reality. A separate telecommunications architecture, which is flexible enough to encompass emerging and changing technologies over time, is the key to deploying ITS applications in a coherent and useful manner.

This approach would alleviate interoperability and harmonization issues at the onset rather than leaving those issues to a later date when solving them would require additional technology or technical modifications.

This approach also would lessen the need to modify existing technologies that were not intended for ITS so as to permit the use of ITS applications. An example of the problems of modifying existing technologies is evident in the move to use the IEEE 802.11 standard for ITS applications. IEEE 802.11, currently under consideration for DSRC applications in the U.S., was clearly intended for wireless Local Area Network (LAN) and indoor applications. This standard was never intended for high speed vehicular or other mobile applications. For that reason, the ITS industry is now faced with the task of modifying this existing standard to accommodate ITS requirements.

With a separate ITS telecommunications architecture, harmonized standards for ITS applications would be developed in sync with that architecture.

Finally, the development of an ITS telecommunications architecture would identify vulnerable spectrum or spectrum slated for auctions and permit those to be avoided for future ITS use. The relocation of existing ITS applications has been an issue over the past few years. For example, in 1998, a number of wireless traffic control systems, operating in the 28 and 31 GHz range, were relocated due to the auction of this spectrum for Local Multipoint Distribution Services (LMDS). In the coming year, ITS applications operating in the 24 GHz band are also slated for relocation.

It seems clear that the only way to avoid the many problems facing the ITS industry due to the reliance on an infrastructure that is not made for ITS applications is for the ITS industry to have its own wireless telecommunications infrastructure dedicated to

vehicular applications. It may be that the best way for this structure to be implemented is through ownership of the infrastructure by the vehicle manufacturers.

Proposed Solutions

In April 2001, Working Group 16 (Wide Area Communications) of ISO Technical Committee 204 proposed six draft items covering all three generations of wireless phones, next generation DSRC, Infra Red, Radar, and other millimeter and microwave applications. ITS and telematics applications will certainly flourish across these scattered bands, which further justifies the critical need to develop a wireless architecture.

ITS applications are currently carried over a variety of telecommunications media. They are found in the cellular band, 1800 or 1900 MHz Personal Communication Services (PCS), 2.4 or 5.8 GHz ISM band, 5.9 GHz, LMDS, and collision avoidance radar at 61 and 76 GHz.

Future ITS applications will most likely be carried across 3G and 4G systems, broadband wireless networks, and ultra wideband (UWB) radio and other emerging technologies.

Despite all of the above wireless technology innovations, the FM band remains the most universally harmonized throughout the world.

Although the ITS industry may feel comfortable with merely overlaying ITS applications on existing telecommunications infrastructure, this approach will never resolve interoperability and harmonization problems. One proposed solution is for the ITS industry to develop an ITS telecommunications architecture so that the telecommunications industry would deploy an infrastructure that meets the requirements of the ITS industry rather than having the ITS industry adapt its applications to meet the needs of the telecommunications industry.

The proposed approach would require the ITS industry to seriously undertake a spectrum study for ITS applications, which would result in the convergence of these applications into suitable spectrum bands. No longer would ITS applications be haphazardly scattered throughout the frequency spectrum. The spectrum study would also force the ITS industry to quantify its spectrum needs.

In fact, despite the visionary effort of ISO TC 204 WG 16, the result of such effort will neither produce a wireless architecture nor a convergence toward harmonized bands and applications.

In conclusion, such a spectrum study is long overdue, and is a prerequisite for the development of an ITS telecommunications strategic plan and a wireless architecture.

Hopefully, such a spectrum study would be undertaken with a global or, at least, regional perspective.

I realize that the ITS spectrum study will not be easy to undertake, not undertaking the study will raise the hurdles facing the ITS industry. If the spectrum study is not undertaken, the ITS industry will be left to continue developing on a reactive basis, resulting in increasing barriers to deployment.

These problems are difficult enough for developed nations. They may be insurmountable in developing nations, where spectrum may not be regulated in a cohesive manner.

Paul Najarian is the director of Telecommunications at ITS America. He supervises all of ITS America's telecommunications programs. In addition, he serves as administrator of the ITS America Telecommunications Committee, and is the focal point on ITS telecommunications matters. He also directs the ITS Public Safety programs and supports specialized telematics issues.