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

In the Matter of	)	
	)	
Utilities Telecom Council and Winchester Cator, LLC	)	RM-11429
	)	
	)	
Petition for Rulemaking to Establish Rules Governing Critical Infrastructure Industry Fixed Service Operations in the 14.0-14.5 GHz Band	)	

OPPOSITION OF THE SATELLITE INDUSTRY ASSOCIATION

SATELLITE INDUSTRY ASSOCIATION

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I. INTRODUCTION AND SUMMARY

The Satellite Industry Association ("SIA"),[1] in response to the Commission's May 27, 2008 Public Notice,[2] hereby files this opposition to the above- referenced Petition for Rulemaking submitted on behalf of the Utilities Telecom Council ("UTC") and Winchester

[1] SIA Executive Members include: Arrowhead Global Solutions Inc.; Artel Inc.; The Boeing Company; DataPath, Inc.; The DIRECTV Group; Hughes Network Systems LLC; ICO Global Communications; Integral Systems, Inc.; Intelsat, Ltd.; Iridium Satellite LLC; Lockheed Martin Corp.; Loral Space & Communications Inc.; Mobile Satellite Ventures LP; Northrop Grumman Corporation; SES Americom, Inc.; and TerreStar Networks Inc. Associate Members include: ATK Inc.; Comtech EF Data Corp.; EchoStar Corporation; EMC Inc.; Eutelsat Inc.; Inmarsat Inc.; Marshall Communications Corp.; New Skies Satellites, Inc.; Spacecom Ltd.; Spacenet Inc.; Stratos Global Corp; SWE-DISH Space Corp: Telesat and WildBlue Communications, Inc. Additional information can be found at www.sia.org.

[2] *See Consumer and Governmental Affairs Bureau, Reference Information Center, Petitions For Rulemaking Filed*, Public Notice, Report No. 2868 (rel. May 27, 2008).

Cator, LLC ("Winchester," and with UTC, the "Petitioners").[3] SIA is a U.S.-based trade association providing worldwide representation of the leading satellite operators, service providers, manufacturers, launch service providers, remote sensing operators, and ground equipment suppliers. SIA is the unified voice of the U.S. satellite industry on policy, regulatory, and legislative issues affecting the satellite business. With the knowledge gained from its members, SIA is uniquely positioned to understand the problematic technical and policy issues raised by the Petitioners' proposal.

In the Petition, Winchester and UTC request that the Commission amend Parts 2 and 101 to permit a new secondary fixed service allocation in the 14.0–14.5 GHz band. The Petitioners claim that the proposed new service allocation would meet the needs of critical infrastructure industries ("CII") for high-reliability, high capacity links in limited areas during times of emergency. At the same time, the Petition contemplates allowing the spectrum to be leased for full-time, nationwide commercial use subject to pre-emption to meet CII requirements. As shown below, this proposed use of the 14.0-14.5 GHz band would cause unacceptable and unresolvable levels of interference both to existing and future satellite services and to the proposed new terrestrial service. As a result, SIA urges the Commission to deny this Petition.

II. BACKGROUND

Without providing any supporting evidence, Petitioners claim that there is a critical need for additional spectrum to be used by CII for public safety, homeland security, and emergency response. To obtain this spectrum, Petitioners request a new secondary, fixed service allocation

[3] Utilities Telecom Council and Winchester Cator, LLC, Petition for Rulemaking to Establish Rules Governing Critical Infrastructure Industry Fixed Service Operations in the 14.0–14.5 GHz Band (filed May 6, 2008) ("Petition").

in the 14.0-14.5 GHz band.[4] Specifically, Petitioners urge the FCC to adopt rules to allow the deployment of fixed and temporary fixed stations to provide point-to-point and point-to-multipoint services in the 14.0–14.5 GHz band on a secondary basis.[5]

Additionally, Petitioners propose that the FCC grant a license to a single, nationwide CII licensee, who, they claim, will coordinate and manage all new fixed services in the band. Petitioners suggest that this nationwide CII licensee could resolve interference issues, but also lease the 14.0–14.5 GHz band on a secondary, pre-emptible basis for non-CII commercial operations. While seemingly allowing the FCC to make a determination regarding who might qualify as this single, nationwide licensee, Petitioners do suggest that Winchester, led by "industry pioneers" Raj Singh and Jared Abbruzzese, has "expertise in the technology and business of satellite and terrestrial telecommunications," implying that this might make them well-suited to control such a license.

Before considering additional services for the 14.0–14.5 GHz band, it is critical to understand the many services that already extensively use this frequency band. The 14.0–14.5 GHz band is heavily used satellite spectrum. This band is allocated on a primary basis for Fixed Satellite Service (Earth-to-space) uplinks. SIA estimates there are over 600,000 blanket-licensed VSAT remote terminals operating in the United States, and more are added every year. Earth stations on vessels ("ESVs") also use this band pursuant to the Commission's decision allowing

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[4] The Commission allocates many frequency bands for both primary and secondary uses. Services allocated on a secondary basis may not cause harmful interference to primary users of the frequency band, and cannot claim interference protection from primary users, including those primary users who have assigned frequencies or to whom frequencies may be assigned at a later date.

[5] Petition at 3.

such operations under the primary FSS allocation.[6] Additionally, over 1500 individually licensed earth stations are authorized to operate in this band, including VSAT hubs and other earth stations used for point-to-point communications.

This spectrum is also heavily used by aeronautical and terrestrial mobile services pursuant to the secondary allocation for Mobile Satellite Service (Earth-to-space) uplinks. The FCC has pending proceedings to adopt service rules for the operation of Aeronautical Mobile Satellite Service ("AMSS")[7] and vehicle-mounted earth stations ("VMES")[8] in the band, and is considering whether these services, like ESVs, should be licensed on a primary basis. Pending the adoption of rules, the FCC has already authorized The Boeing Company,[9] ARINC,[10] and ViaSat[11] to deploy Ku-band aircraft earth stations. Other similar applications are before the

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[6] *Procedures to Govern the Use of Satellite Earth Stations on Board Vessels in the 5925-6425 MHz/ 3700-4200 MHz Bands and 14.0-14.5 GHz/11.7-12.2 GHz Bands*, Report and Order, IB Docket No. 02-10, FCC 04-286, 20 FCC Rcd 674 (2005).

[7] *Service Rules and Procedures to Govern the Use of Aeronautical Mobile Satellite Service Earth Stations in Frequency Bands Allocated to the Fixed Satellite Service*, Notice of Proposed Rulemaking, IB Docket No. 05-20, FCC 05-14 (rel. Feb. 9, 2005).

[8] *Amendment of Parts 2 and 25 of the Commission's Rules to Allocate Spectrum and Adopt Service Rules and Procedures to Govern the Use of Vehicle-Mounted Earth Stations in Certain Frequency Bands Allocated to the Fixed-Satellite Service*, FCC 07-86, Notice of Proposed Rulemaking (released May 15, 2007).

[9] *See The Boeing Company Application for Blanket Authority to Operate Up to Eight Hundred Technically Identical Transmit and Receive Mobile Earth Stations Aboard Aircraft in the 14.0-14.5 GHz and 11.7-12.2 GHz Frequency Bands*, Order and Authorization, 16 FCC Rcd 22645 (2001).

[10] *ARINC Incorporated, Application for Blanket Authority for Operation of Up to One Thousand Technically Identical Ku-Band Transmit/Receive Airborne Mobile Stations Aboard Aircraft Operating in the United States and Adjacent Waters*, Order and Authorization, 20 FCC Rcd 7553 (IB & OET 2005); *ARINC Incorporated, Request to Communicate with Non-U.S. Satellite*, Order and Authorization, 22 FCC Rcd 19955 (IB & OET 2007).

[11] *ViaSat, Inc., Application for Blanket Authority for Operation of 1,000 Technically*

Commission.[12] Moreover, Space Research, Radionavigation and Radio Astronomy services operate in the 14.0–14.5 GHz band on a secondary basis, and the government has fixed and mobile operations with secondary status in the upper 100 MHz of this band, from 14.4-14.5 GHz.[13]

As described in the "First Responder's Guide to Satellite Communications" provided as Annex 3, the existing and widespread satellite services are a vital part of U.S. public safety networks.[14] Satellites are used for critical services on a day-to-day basis by federal, state, and local governments, public safety agencies and commercial entities. During emergencies, satellites reliably provide critical communications capabilities, including, in particular, when terrestrial infrastructure is destroyed, impaired or insufficient to satisfy capacity requirements.[15] As satellite technology continues to evolve, the ability of satellites to provide emergency communications services will only expand. Consequently, the FCC must not permit operations in the 14.0-14.5 GHz band that could cause interference with existing critical communications

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(Continued . . .)
Identical Ku-Band Aircraft Earth Stations in the United States and Over Territorial Waters, Order and Authorization, 22 FCC Rcd 19964 (IB & OET 2007).

[12] *See Satellite Communications Services Re: Satellite Radio Applications Accepted for Filing*, Report No. SES-01036, File No. SES-LIC-20080508-00570 (May 28, 2008) (application to operate up to 1,000 technically-identical aeronautical-mobile satellite service transmit/receive Earth stations (AES), aboard commercial and private aircraft).

[13] 47 C.F.R. § 2.106.

[14] *See* Annex 3, Satellite Industry Association, First Responder's Guide to Satellite Communications at 4 (in areas affected by disasters, satellites provided the ONLY source of communications in the hours, days, and weeks following these events.).

[15] *See* Satellite Industry Association, First Responder's Guide to Satellite Communications at 7 ("In times of disaster recovery, solutions provided via satellite are more reliable than communications utilizing land-based connections.").

services already authorized to operate in this band or in any way limit the future deployment of these satellite services.

III. THE PETITIONERS' PROPOSED USE OF THE 14.0-14.5 GHZ BAND WOULD CAUSE UNACCEPTABLE INTERFERENCE TO PRIMARY SATELLITE SERVICES AND WOULD IMPAIR THE DEVELOPMENT OF SECONDARY SATELLITE SERVICES.

A. The Winchester/UTC Proposal Does Not Adequately Protect Primary FSS Uplinks.

The Petition claims that secondary fixed service use of the 14.0-14.5 GHz band is possible without creating harmful interference to existing satellite uses of the spectrum, relying on a technical appendix prepared by RKF Engineering ("RKF Report"). The RKF Report, however, is fundamentally flawed, because it assumes a level of allowable interference that is inconsistent with the proposed secondary status. Specifically, the RKF Report relies on an interference allowance of 6% of the total noise on the grounds that a $\Delta T/T$ of 6% sets the interference threshold for coordination according to the "ITU Radio Regulations in Appendix 5, Table 5-1".[16] However, this interference threshold applies to co-primary operations, not to the secondary transmissions proposed here.[17] For secondary users, the appropriate interference threshold is set forth in Recommendation ITU-R S.1432, which provides that FSS links should be designed to allow for an aggregate allowance of 1%.[18] This is far less interference than the

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[16] Petition, Technical Appendix at 2.

[17] The 6% $\Delta T/T$ value in the ITU Radio Regulations is one of the coordination triggers for the coordination between two GSO satellite networks operating under a primary allocation. Its application to the current situation, i.e. interference from a station in the fixed service operating under a secondary allocation into a space station operating under a primary allocation, is completely out of place. .

[18] *See* Recommendation ITU-R S.1432, Apportionment of the Allowable Error Performance Degradations to Fixed-Satellite Service (FSS) Hypothetical Reference Digital Paths Arising from Time Invariant Interference for Systems Operating Below 15 GHz.

6% standard used as the basis of the RKF Report's analysis.[19]

SIA's technical analysis, provided as Annex 1, shows that deployment of just a few terrestrial transmitters systems would increase the noise floor sufficiently to cause unacceptable interference to FSS uplinks.[20] Indeed, in ITU Regions 1 and 3 where the Ku-band uplink spectrum is shared with terrestrial systems, administrations have had to restrict the type and number of earth stations permitted in order to accommodate sharing.[21] For example, in Europe, VSATs are limited to the lower part of the band (14.0-14.3 GHz) where there is not widespread terrestrial use. In the upper part (14.3-14.5 GHz), earth stations must be individually licensed and coordinated with terrestrial systems. These approaches are in stark contrast to the Winchester and UTC proposal under which millions of transmitters could be deployed.[22]

Even more troubling for satellite users that rely on this spectrum is the virtual impossibility of ensuring that any new terrestrial operations conform to their secondary status. The critical factor for determining interference to FSS uplinks is not the effect of a single new terrestrial terminal but the aggregate impact of multiple terrestrial signals. As a result, when a satellite experiences interference, there will be no way to pinpoint and shut down a responsible transmitter among the multitude of terminals that would be contributing to the received

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[19] Moreover, the impact of interference on networks using smaller (non-conforming) earth station antennas licensed at reduced power under Section 25.220 of the FCC's rules would be even greater. The power reductions required of these earth stations to preserve the compatibility of FSS networks in a 2 degree spacing environment makes their signals more sensitive and therefore less capable of absorbing additional interference.

[20] *See* Annex 1.

[21] The United States, on behalf of satellite operators, lobbied extensively to preserve use of the full band for satellite spectrum without sharing in Region 2.

[22] The RKF Report claims that as many as 1,350,000 temporary fixed terminals per 50 MHz could be deployed without causing excessive interference to satellite uplinks. This means that potentially 13,500,000 could be deployed in 500 MHz.

interference. Even if a reasonable ceiling for the number of terminals is set, enforcing this upper limit is not practical because, in the event of harmful interference, the Commission would have no basis for deciding which transmitters in the band to shut down.

Antenna pointing errors by terrestrial transmitters (*i.e.*, failure to avoid the geostationary satellite arc by 5 degrees) will further exacerbate interference. Such interference into FSS uplinks will be particularly difficult to remedy during emergencies, when transportable fixed uses would be prevalent and terrestrial operators are unlikely to take the time necessary to install equipment properly. Of course, when emergency events occur is also the time during which it is most critical to prevent interference to satellite operations, which will be in high demand to support homeland security and public safety networks and provide back-up to damaged terrestrial infrastructure.

B. The Winchester/UTC Proposal Would Impose Unacceptable Coordination Obligations on Existing Secondary Users.

The proposal by Winchester and UTC would also impose unacceptable coordination obligations on existing secondary users of the Ku-band. AMSS is currently classified as a secondary service. The Petition does not address how terrestrial transmitters would share the 14.0-14.5 GHz band with aeronautical earth stations ("AES"). Any sort of coordination framework that placed restrictive obligations on the operation of AES would have severe effects on the service. The mobile nature of transmitters on aircraft could also make coordination particularly challenging. At a minimum, the FCC should adopt service rules in the pending AMSS and VMES rulemaking proceedings before considering the Winchester/UTC proposed new fixed allocation.

C. The Petitioners' Proposal Would Impair Future FSS Service Flexibility.

The Petitioners' proposed secondary allocation to the fixed service also threatens the

ability of FSS operators to continue to develop and deploy new technologies to benefit consumers and increase operational efficiency. For more than three decades, satellite operators and users have invested billions of dollars in state-of-the art communications equipment. Over that time, the technology has evolved, expanded and improved greatly, with new applications being deployed that make ever more efficient use of the spectrum allocated.

Unless all FSS services are adequately protected, not only would existing services be harmed but the development of new, more sensitive FSS technologies will also be inhibited, including the continued development of VMES, ESV and AMSS services, which are essential to important government programs and homeland security initiatives. In sum, the additional background interference that would result from the proposed fixed services could lock satellite operators and users into existing technology and impede the introduction of new, more advanced FSS applications that may be more susceptible to terrestrial interference into their uplinks.

IV. WINCHESTER/UTC'S SECONDARY SERVICE PROPOSAL UNDERESTIMATES POTENTIAL INTERFERENCE FROM FSS EARTH STATIONS AND IS INCONSISTENT WITH THE STATED COMMUNICATIONS NEEDS OF PROSPECTIVE CII USERS.

SIA has demonstrated above that the proposal to sanction new terrestrial services in the 14.0-14.5 GHz band will result in unacceptable interference to satellite services. Just as importantly, however, the purported new terrestrial users would suffer significant and unavoidable interference from FSS operations that would prevent CII systems from achieving their stated service requirements. First, the proposed interference mitigation techniques will not be effective, resulting in debilitating interference to the proposed fixed services. Second, the ubiquitous deployment of VSATs throughout the band makes coordination with critical infrastructure networks impossible. As a result, any critical infrastructure systems cannot be deployed in the 14.0-14.5 GHz band without the newly deployed services being subjected to

substantial and unavoidable interference, a result wholly inconsistent with the nature and purpose of critical infrastructure services.

A. The Interference Mitigation Techniques Proposed To Address Interference Are Inadequate.

The proposed interference mitigation techniques are entirely inadequate because they depend on the flawed assumption that FSS earth stations in the 14.0-14.5 GHz band are transmitting narrowband signals. Indeed, Section 4.a. of the RKF Report asserts that "[t]he key to sharing in the crowded VSAT environment is to take advantage of the fact that the interference is narrowband."[23] This fundamental misunderstanding of operations in the 14.0-14.5 GHz band fatally undermines the report's conclusion that the proposed mitigation techniques can be effective in preventing interference.

To state what SIA thought would have been obvious, not all communications in the 14.0-14.5 GHz band are narrowband. For example, the number of VSATs transmitting spread spectrum signals is growing significantly as smaller earth stations are deployed and the same off-axis EIRP density constraints have to be met. In addition, VMES and AMSS, which are the subject of on-going proceedings at the FCC, but which are already in use today, also primarily transmit spread signals, as do many ESVs. VSATs utilizing wideband data signals are also beginning to be deployed. Finally, large antenna, high power earth stations typically have wideband signals and can access multiple transponders on a satellite. The occupied bandwidth of a wideband carrier can be up to 36 MHz corresponding to a typical transponder bandwidth, and the satellite payload can support multiple wideband carriers within 500 MHz. A single earth station can access multiple transponders, a FCC earth station license typically allows access to the full 500 MHz and some produce signals across the entire 500 MHz band.

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[23] RKF Report at 21.

Interference from these spread spectrum applications and from TDMA/FDMA applications would not be easily avoided. Many VSAT terminals operate by transmitting in hub assigned channels and time slots. The net effect is that any single VSAT is silent most of the time and will then appear to hop over a wide range of frequencies. In this environment, there is no way for a nearby fixed service terminal to predict "safe" frequencies which will be avoided by the VSAT. In addition, as detailed below, VSATs, VMES, AMSS earth stations, and ESVs are deployed throughout the spectrum band without their locations being made publicly available. The assertion that "[s]pread spectrum techniques can thereby be used to mitigate the effects of narrowband interference from VSAT terminals"[24] does not apply if the interfering signal is wideband as no interference reduction will result from de-spreading the desired signal at the UTC receiver.

In addition to blanket licensed VSAT terminals, more than 1,500 earth stations have been individually licensed by the FCC in the 14.0-14.5 GHz band. These include hubs of VSAT networks and other earth stations used for point-to-point communications. These earth stations will generally be transmitting wideband signals and, as discussed above, their interference to UTC receivers cannot be mitigated by the de-spreading that takes place at these receivers.

Instead, to operate without harmful interference, a UTC receiver has to be a certain distance from the interfering earth station. This required separation distance depends on several factors, including: (i) earth station EIRP; (ii) orientation of the earth station and UTC antenna main beams and associated gain patterns; (iii) terrain along the interfering path; and (iv) allowable interfering power at the UTC receiver input to ensure the desired availability of the UTC link. In the absence of specific details about the UTC signal characteristics, the carrier-to-

[24] Petition at 16.

interference ratio that would be required at the UTC receiver cannot be estimated and illustrative examples of the required separation distance cannot be developed. In any case, for a target availability of 99.999%, as specified in the RKF Report, separation distances are likely to be larger than 100 kilometers. In order to illustrate the difficulty of geographically separating the proposed UTC receivers from licensed earth stations, the map in Annex 2 plots the location of the earth stations individually licensed by the FCC for transmissions in the band 14.0-14.5 GHz. Around each of these locations a 100 km circle is drawn to represent a hypothetical avoidance area. The 100 km radius is merely illustrative. For an availability target of 99.999%, it is expected that distances larger than 100 km will often be applicable. Moreover, the map in Annex 2 does not show any of the more than 600,000 blanket licensed VSATs, transportable earth stations (such as those utilized by SNG services), or other mobile services (such as ESVs or existing and potential future VMESs) that also need to be avoided. Clearly then, it would be difficult, if not impossible, to prevent excessive interference to an UTC receiver in a significant portion of the U.S. territory.

As a result, Petitioners' proposed interference mitigation techniques will not adequately protect critical infrastructure services from existing primary services or from the anticipated expansion of these services.

B. The Ubiquitous Deployment Of Blanket Licensed VSATs In This Band Makes Avoidance of FSS As A Spectrum Sharing Mechanism Impossible.

The Winchester/UTC proposal also ignores the realities of how the 14.0-14.5 GHz band is licensed and used. First, the 14.0-14.5 GHz band is one of the few satellite bands with blanket licensing. Due to the likelihood of interference between FSS earth stations and terrestrial services, blanket licensing of FSS earth stations historically occurs only in frequency bands where there is no co-primary allocation for terrestrial services and where deployment of

terrestrial stations is limited.[25] Blanket licensing substantially increases the difficulty of spectrum sharing. Consistent with blanket licensing, there are a large number of earth stations deployed in this band. The RKF Report makes an unsupported estimate that there are approximately 250,000 earth stations deployed in this band.[26] In reality, the number of earth stations is more than 600,000.

Second, the locations of deployed VSATs are not publicly available. The Petition recognizes that fixed service receivers and FSS earth stations must be geographically separated to prevent interference.[27] However, the Petitioners do not explain how this requirement can possibly be met when there is no source of information available to proposed fixed service users regarding where deployed VSATs are located. Given this geographical separation requirement and the large number of existing and future earth stations, CII fixed services could be deployed within a relatively limited geographic area. The Petitioners seem to imply that the use of spreading techniques will by itself ensure the protection of UTC receivers from interference generated by blanket licensed VSATs. However, as discussed above, this is not a valid assumption.

Third, even if information about initial VSAT locations was available, VSATs are frequently deployed on a short-term basis and are regularly moved. As a result, CII entities will have no way to determine where VSATs are in operation. This constant location changing of

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[25] *See, e.g., Redesignation of the 17.7-19.7 GHz Frequency Band, Blanket Licensing of Satellite Earth Stations in the 17.7-20.2 GHz and 27.5-30.0 GHz Frequency Bands, and the Allocation of Additional Spectrum in the 17.3-17.8 GHz and 24.75-25.25 GHz Frequency Bands for Broadcast Satellite-Service Use*, Report and Order, 15 FCC Rcd 13430, ¶ 1 (2000) (authorizing the "blanket licensing of satellite earth stations in the bands where the Fixed Satellite Service ("FSS") is the sole primary designation").

[26] RKF Report at 19.

[27] *Id.* at 19-20.

blanket licensed VSATs will make it extremely unlikely that UTC could avoid unwanted interference into its proposed deployment of millions of terrestrial terminals.

Fourth, FSS licensees are increasingly deploying mobile applications in the band. These mobile applications may be in use at any time and in any location. Accordingly, such applications will cause intermittent, unexpected, and unavoidable interference to fixed services sites, especially to those located near major transportation routes, including ports, highways and air routes.

Finally, FSS services are extensively utilized during emergencies in the vicinity of the emergency occurrence. Winchester/UTC also plans to utilize this spectrum intensively during emergencies in these locations.[28] With both satellite and terrestrial services being heavily loaded in the same geographic area and at the same time, the likelihood of interference will be especially high during emergencies, the time when both types of services are absolutely critical. The combination of these factors makes coordination between FSS and CII impossible.

C. Interference From Primary Satellite Networks' Earth Stations Is Wholly Incompatible With Petitioners' Proposed CII Use.

Petitioners state that CII communications systems are a "vital part of the nation's homeland security infrastructure" and seeks an extremely high availability of 99.999%.[29] This

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[28] Petition at 4-5.

[29] While the Winchester/UTC proposal is cloaked in the needs of public safety, the FCC has repeatedly rejected the argument that CII communications rise to the level of public safety communications. *See, e.g., Service Rules for the 698-746, 747-762 and 777-792 MHz Bands*, Second Report and Order, FCC 07-132, ¶ 142 (2007) ("we do not find a sufficient public interest rationale for creating any exception . . . from the current, established practice of subjecting CII to competitive bidding for spectrum that serves their commercial infrastructures"); *Implementation of Sections 309(j) and 337 of the Communications Act of 1934, as Amended*, Report and Order and Further Notice of Proposed Rulemaking, FCC 00-403, ¶¶ 99, 102 (2000) (noting that "[w]hile critical infrastructure industries have legitimate spectrum needs, we do not believe these needs warrant removing frequencies from the I/B Pool" for CII and finding that "[t]here is no basis upon which to infer" that Congress intended to include CII in its definition of public safety

equates to 26 seconds of outage per month, a portion of which Petitioners would allocate to interference from FSS. Given the substantial likelihood of interference to the proposed CII services, achieving this level of availability is extremely improbable.

Notwithstanding that satellite services would be primary and terrestrial services secondary, public policy issues would arise when both services cannot co-exist. Once services and devices are deployed, it is extremely difficult to fix interference problems when they occur. Recalls are generally ineffective as they only result in a small percentage of devices being returned. In addition, once services are deployed and relied on by critical infrastructure entities, it is virtually impossible to terminate or change the parameters of those services. For example, in 2002, the satellite industry experienced significant interference caused by radar detectors illegally operating in their frequency bands.[30] While the radar detector manufacturers modified their specifications to protect satellites from harmful interference caused by new radar detectors, nothing was done to address the millions of offending detectors that were already on the roads and in stores. Similarly, in 2005, when military land mobile communications were causing interference to consumer garage door openers, the only resolution was to encourage consumers to purchase new garage door openers.[31]

Because interference undercuts the viability of Winchester/UTC's proposed secondary service there is concern that, once deployed, Winchester/UTC would realize the extent of the

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(Continued . . .)
radio services).

[30] *See, e.g.*, Paul Davidson, USA Today, New Radar Detectors Zing Small Satellite Systems (June 16, 2002), at www.usatoday.com/money/tech/2002-06-17-radar.htm (last viewed June 16, 2008).

[31] *See Consumers May Experience Interference to their Garage Door Opener Controls Near Military Bases*, Public Notice, DA 05-424 (Feb. 15, 2005).

problem and seek an elevation to primary status, including technical and/or operational restrictions on the FSS. Such an action might still prove ineffective in ensuring the protection of UTC receivers from the interference produced by the more than 600,000 critical incumbent VSATs and other earth stations. However, it would still have the potential to significantly limit the future deployment of earth stations. Such an approach is clearly not in the public interest when, as here, interference can be prevented before devices are deployed through the use of alternate spectrum.

V. PETITIONERS HAVE ALTERNATIVE SPECTRUM OPTIONS.

Petitioners make unsubstantiated claims that access to the 14.0-14.5 GHz band is necessary to meet critical infrastructure's growing spectrum needs.[32] CII entities currently utilize spectrum in a variety of spectrum bands licensed under Part 101 of the FCC's rules for fixed point-to-point and point-to-multipoint communications.[33] Petitioners, however, do not provide any factual evidence that this spectrum is at capacity or that additional spectrum is needed. More specifically, Petitioners provide no evidence showing insufficient spectrum for fixed point-to-point and point-to-multipoint communications or supporting its spectrum scarcity claims or increased spectrum requirements. Nor have Petitioners supported the alleged need for exclusive CII spectrum or the need for a full 500 MHz of spectrum. Finally, Petitioners have not even identified UTC's members, the CII users, or the intended CII service application(s), or demonstrated why these for-profit, investor-owned, commercial entities cannot obtain sufficient spectrum already allocated to commercial fixed services.

Nevertheless, if CII entities have legitimate demand for additional spectrum, there are

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[32] Petition at 3-8.

[33] *See* 47 C.F.R. Part 101.

less disruptive means of obtaining supplemental capacity. For example, CII entities could lease this capacity on FSS licensees' networks. All incumbent FSS licensees currently sell capacity on their networks for a variety of uses, including point-to-point and point-to-multipoint communications. CII users also could obtain additional microwave licenses in a variety of spectrum bands. Alternatively, CII could lease capacity or spectrum from other terrestrial wireless licensees or buy spectrum at auction. These alternatives are wholly consistent with the FCC's established practice of requiring CII to purchase the right to use spectrum that serves their commercial infrastructures.[34]

The Petitioners' primary goal appears to be to enable Winchester to obtain free access to this spectrum so that it may lease it to others on a commercial basis. Specifically, the Petition proposes allowing Winchester, who will presumably be the unprecedented single nationwide CII licensee for this spectrum, to enter into commercial spectrum leasing arrangements that would allow non-CII use of the 14.0-14.5 GHz band. The Petition, however, provides little information on Winchester or its planned commercial service arrangements for a variety of point-to-point or point-to-multipoint uses, such as cellular backhaul.[35] Instead, it merely states that "[s]uch commercial wireless services would use point-to-point fixed service links, would be technically similar [but not identical] to the operations of CII entities, and could be used to facilitate communications by commercial entities during times of emergencies."[36] This undefined commercial use could cause greater interference to satellite services than that anticipated from CII use. As a result, such limited information is hardly sufficient for the Commission to judge

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34 *See supra* n. 4.

35 *See* Petition at 17-20.

36 *Id.* at 10.

the impact of such operations on incumbent primary satellite services. Even without this information, however, it is clear that Winchester would have a clear conflict of interest in serving as both the frequency coordinator for CII use and the entity profiting from the commercial use of the same spectrum.

VI. CONCLUSION.

As evidenced above, the interference issues that result from the proposed allocation of 14.0-14.5 GHz spectrum to CII services make such an allocation intrinsically incompatible with the services currently provided in this frequency band. Given the alternative spectrum available to CII service providers, there is no reason for the FCC to expend time pursuing this proposal. Consequently, the FCC should deny this petition for rulemaking.

Respectfully submitted,

By: _____

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Dated: June 26, 2008

CERTIFICATE OF SERVICE

I, Pam Conley, do hereby certify that on June 26, 2008, I served a copy of the Opposition of the Satellite Industry Association upon the following parties by U.S. first-class mail, postage pre-paid:

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_/s/ Pam Conley_____
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ANNEX 1

Interference from Proposed Fixed Transmitters to FSS Uplinks in the Band 14.0-14.5 GHz

1. General

The terrestrial terminals proposed in the Winchester/UTC petition include high-powered transmitters capable of creating interference to FSS uplinks operating in the band 14.0-14.5 GHz.

The operational parameters of the proposed transmitters as stated in the Petition are as follows[1]:

1. The stations shall off-point at least 5 degrees away from the geostationary satellite arc.
2. Antenna diameters shall be 45 cm or greater.
3. Power control shall be required on all links in order to minimize excess margin.
4. The maximum EIRP shall be 28 dBW/MHz per station.

The following additional requirements would only apply to Point-to-Multipoint stations:

5. The fixed base station shall have a minimum antenna gain of 17 dBi and offpoint at least 5 degrees from the geostationary arc.
6. The maximum transmit power of a base station shall be 11 dBW/MHz.

2. Interference Allowances

According to Recommendation ITU-R S.1432, FSS links should be designed apportioning:

- 20% or 25% for the interference from other FSS systems (depending on whether the interfered-with link practices frequency re-use or not);
- 6% for other systems having co-primary status;
- 1% for all other sources of interference.

As the Petition proposes that Winchester/UTC transmitters operate under a secondary

[1] See Petition at 13.

allocation, the corresponding interference allowance would have to be a fraction of the 1% allowance given to all other sources of interference operating under a non-primary allocation. It is proposed here that a 0.5% allowance be considered in the calculations that follow.

3. Interference Calculations

The analysis of the impact of Winchester/UTC transmitters to FSS links has been performed utilizing two different scenarios with respect to the discrimination of the fixed transmitter antenna towards the geostationary orbit. Scenario 1 considers realistic assumptions about this discrimination while Scenario 2 corresponds to an extreme and unlikely situation in which very a high discrimination towards the geostationary orbit is assumed.

For each of these scenarios two methodologies are considered:

- Uplink Noise Increase
- Degradation to a Typical VSAT Satellite Link

The results of both methodologies under both scenarios have yielded the same conclusion, *i.e.*, the deployment of just a few fixed transmitters with the characteristics proposed in the Petition will significantly impact the FSS operations.

Discrimination of the Fixed Transmitter Antenna Towards the Geostationary Orbit

Under Scenario 1, as described below, point-to-point ("P2P") and temporary fixed terminals ("TFTs") have different emission characteristics and are considered separately from base stations ("BS").

Scenario 1A: P2P and TFT

The terrestrial antenna has a 20 dB gain discrimination in the direction of the FSS satellite. The 20 dB discrimination value is the minimum radiation suppression for angles 5 to 10 degrees from centerline of main beam, as defined in part 101 of the FCC rules for FS antennas in the frequency range of interest.

Scenario 1B: BS

The 17 dBi base station (BS) antenna sees the satellite at an elevation angle of 10 degrees, yielding 23.2 dB of discrimination, based on Recommendation ITU-R F.1336-2. This would be the case for a BS on the West Coast with respect to a satellite at 60º W.L.

Scenario 2: P2P and TFT

The terrestrial P2P or TFT antenna has a 0 dB gain in the direction of the FSS satellite. This is a very unrealistic assumption because all terminals would have to be pointing significantly away from the geostationary orbit.

Other Assumptions

The satellite noise temperature is assumed to be 600 K, typical for an FSS spacecraft. The fixed transmitter is assumed to be within the 2 dB contour of a Ku-band satellite with a peak gain of 35 dBi. Figure 1 shows a typical uplink gain contour of an FSS Ku-band satellite with CONUS coverage.

Figure 1. Typical Uplink Gain Contour for a Ku-band FSS Satellite with CONUS Coverage.

<u>Uplink Noise Increase</u>

The uplink I/N can be computed as:

I/N = (Fixed Terminal EIRP Towards the Satellite – Free Space Loss + Satellite Antenna Gain Towards Fixed Terminal) – (T + Boltzman's Constant)

In the calculations below the free space loss is taken to be -206.6 dB (at sub-satellite point for 14.25 GHz).

Under Scenario 1A, and taking into account Section 1 above, P2P and TFTs will radiate 8 dBW/MHz or -52 dBW/Hz towards the FSS satellite. Therefore:

I/N = (-52 dBW/Hz – 206.6 + 33) – (10log600 -228.6) = -24.8

and a margin of 1.8 dB exists with respect to the required value of -23 dB.[2] This margin can accommodate the emission from only 1 P2P or TFT transmitter.

Similarly, under Scenario 1B, the BS antenna would radiate -55.2 dBW/Hz towards the FSS satellite. Therefore:

I/N = (-55.2 dBW/Hz – 206.6 + 33) – (10log600 -228.6) = -28.0

This results in a margin of 5 dB to the criteria, equivalent to 3 BS transmitters. Although this shows the possibility of slightly more potential interferers than the previous case, the BS stations have a broad azimuth omni-directional antenna pointed south, so that virtually all of the BS transmitters in an area would affect the satellite.

Under Scenario 2 and assuming in addition that P2P and TFTs have a gain of 34.5 dB, each of these terminals will radiate -6.5 dBW/MHz or -66.5 dBW/Hz towards the FSS satellite. Therefore:

I/N = (-66.5 dBW/Hz – 206.6 + 33) – (10log600 -228.6) = -39.3

and a margin of 16.3 dB exists with respect to the required value of -23 dB. This margin can accommodate the emissions from 42 P2P or TFT transmitters.

[2] 0.05% expressed in dB.

Degradation to a Typical VSAT Satellite Link

If the 0.5% interference allowance is associated with the total link the required uplink C/I can be written as:

$(C/I)_{req}=(C/N)_{req}$ + 23 dB

For a typical QPSK VSAT carrier with a rate 3/4 coding:

$(C/N)_{req}$ = 7.8 dB

and therefore

$(C/I)_{req}$ = 30.8 dB

For a 1.2 m VSAT antenna (Transmit Gain = 43 dB) a typical power spectral density at the input of the antenna is -54 dBW/Hz. This leads to an uplink EIRP density of -11 dBW/Hz.

Assuming for simplification that the VSAT and the fixed transmitter are at the same satellite receive gain contour the following C/I ratios will result:

C/I = -11 – (-52) = 41 dB	for Scenario 1A P2P and TFT
C/I = -11 – (-55.2) = 44.2 dB	for Scenario 1B BS
C/I = -11 – (-66.5) = 55.5 dB	for Scenario 2 P2P and TFT

Comparing these C/I values with the required C/I demonstrates that there is a margin of 10.2 dB for Scenario 1A P2P and TFT, of 13.4 dB for Scenario 1B BS and of 24.7 dB for Scenario 2 P2P and TFT.

4. Conclusions

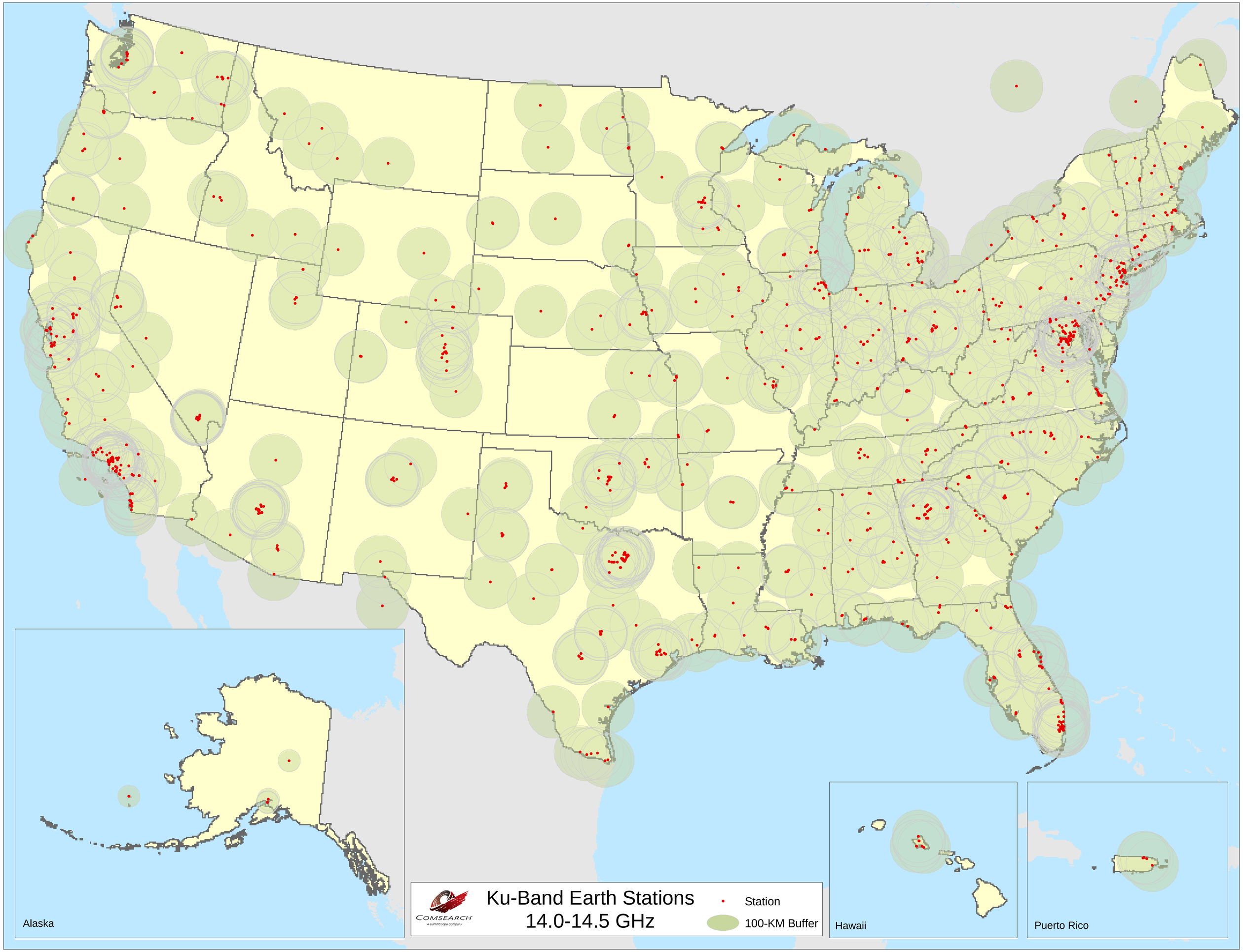
The results of the calculations conducted in Section 3 are summarized in Table 1, and the maximum number of simultaneous transmitters over CONUS resulting from this analysis are compared with the maximum number of terminals alleged to be feasible in the Petition.

Calculation Assumptions		I/N_{uplink} = 0.5%			I/N_{total} = 0.5%			As Predicted in the Petition		
		Discrimination Towards GSO (dB)								
		P2P & TFT		BS	P2P & TFT		BS			
		20	34.5	23.2	20	34.5	23.2	P2P	TFT	BS
Number of Terminals	In 50 MHz	1	42	5	10	295	21	376,000	1,350,000	873,000
	In 500 MHz	10	420	50	100	2,950	210	3,760,000	13,500,000	8,730,000

Table 1. Maximum Number of Simultaneous Fixed Transmitters in CONUS

Under realistic assumptions, only 100 P2P or TFT transmitters (at most 10 per 50 MHz segment) or 210 BS transmitters (at most 21 per 50 MHz segment) could simultaneously transmit in CONUS without causing excessive interference to FSS links. This is in stark contrast to the millions of UTC transmitters predicted in the Petition. Therefore the potential of interference to FSS links makes the two systems intrinsically incompatible, and co-frequency operation is not possible.

ANNEX 2


Ku-Band Earth Stations
14.0-14.5 GHz
COMSEARCH
A CommScope Company
Station
100-KM Buffer
Alaska
Hawaii
Puerto Rico

ANNEX 3

Satellite Industry Association,
First Responder's Guide to Satellite Communications

BROUGHT TO YOU BY:

SIA
SATELLITE INDUSTRY ASSOCIATION

FIRST RESPONDER'S GUIDE TO SATELLITE COMMUNICATIONS

SATELLITES AS PART OF THE SOLUTION

Access Intelligence

WHEN TERRESTRIAL COMMUNICATIONS INFRASTRUCTURE IS DAMAGED, DESTROYED, OR OVERLOADED, SATELLITES = OPERABILITY

For more information and an electronic version of the guide, please visit **www.sia.org** and click on the link *FIRST RESPONDER'S GUIDE TO SATELLITE COMMUNICATIONS*.

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SATELLITE INDUSTRY ASSOCIATION WELCOME LETTER

Following the 2005 hurricane season, the Asian Tsunami, the earthquake in Pakistan, and the 9/11 terrorist attacks, satellite communications immediately stepped in to fill the communications and command and control gap created by the devastation of the terrestrial network. The lack of operable, terrestrial communications infrastructure resulting from these disasters severely impeded command and control functions, situational awareness, and therefore, the disaster relief and recovery efforts of first responders.

When the telephone and broadcast networks went down, satellites remained on the job. Satellites connected emergency personnel and other first responders. Satellites reunited families. Satellites reconnected communities. Satellites enabled the world to witness the devastation of these disasters and also the many acts of heroism.

In many of the affected areas, satellites provided the ONLY source of communications in the hours, days, and weeks following these events. Satellites provided the basic 'operability' that terrestrial networks could not provide following those disasters.

The Satellite Industry Association (SIA) and its member companies thank you for reading the *First Responder's Guide to Satellite Communications*. We hope the information in this guide provides users in public safety, homeland security, and emergency preparedness with the basic fundamental information needed to effectively incorporate satellite communications into the preparations for the next natural or man-made disaster.

SIA is a U.S.-based trade association providing worldwide representation of the leading satellite operators, service providers, manufacturers, launch services providers, and ground equipment suppliers. SIA is the unified voice of the U.S. satellite industry on policy, regulatory, and legislative issues affecting the satellite business. Additional information can be found at www.sia.org.

SIA Executive Members include: Artel Inc.; The Boeing Company; The DirecTV Group; Globalstar LLC; Hughes Network Systems LLC.; ICO Global Communications; Integral Systems, Inc.; Intelsat, Ltd.; Iridium Satellite LLC; Lockheed Martin Corp.; Loral Space & Communications Ltd.; Mobile Satellite Ventures LP; Northrop Grumman Corporation; PanAmSat Corporation; SES Americom, Inc.; and TerreStar Networks Inc.; and Associate Members; ATK Inc.; EMC Inc.; Eutelsat Inc.; Inmarsat Ltd.; IOT Systems; Marshall Communications Corp.; New Skies Satellites Inc.; Spacecom Corp.; Stratos Global Corp.

LETTER FROM THE ASSOCIATION OF PUBLIC-SAFETY COMMUNICATIONS OFFICIALS

Dear Colleagues:

The Association of Public-Safety Communications Officials (APCO) International is pleased to work with the Satellite Industry Association in order to provide a better understanding of the unique resource satellite communications brings to the field of public safety communications. While no single technology can fully support all of public safety's communications' requirements, the features of a non-terrestrial based platform provide a unique and important method for public safety to plan around the hazards of earth-based infrastructures that can be susceptible to all manners of natural and manmade catastrophes.

Public safety has been deeply impacted by the 2005 hurricane season. The lessons learned have forced agencies to look outside of their comfort zone and truly assess the requirements to provide for the continuity of operations that must occur when the rest of our infrastructure is in a state of failure. As a result, the satellite industry has responded quickly and effectively to the recent natural disasters.

Communications is ultimately responsible for providing sense and order to chaotic events. All agencies should review their state of preparedness and evaluate their entire communications requirements for events of epic proportions. Our first responders must be able to communicate with each other as well as within their chain of command in order to effectively respond. Public safety managers must be able to manage and control their field resources and be able to communicate their needs and response to the rest of the world. This requires a complete tool kit of communications resources.

APCO International hopes that this "First Responder's Guide to Satellite Communications," a joint educational effort, will be the first step for the first-responder community towards a better understanding of the resources available to them. By understanding the wide range of technical capabilities and limitations of the technology, the public safety community will be better prepared for the next disaster.

Sincerely,

Wanda McCarley
President
APCO International

SATELLITE =

→ SATELLITE COMMUNICATIONS ARE:

- Highly **Survivable** (Physical Survivability and Robustness)
- **Independent** of Terrestrial Infrastructure
- Able to Provide The Load Sharing and **Surge Capacity Solution** for Larger Sites
- Best for Redundancy: They add a Layer of **Path Diversity** and **Link Availability**

→ SATELLITE SYSTEMS PERFORM EFFECTIVELY WHEN:

- **Terrestrial** infrastructure is damaged, destroyed, or overloaded
- **Interconnecting** widely distributed networks
- Providing **interoperability** between disparate systems and networks
- Providing **broadcasting** services over very wide areas such as a country, region, or entire hemisphere
- Providing connectivity for the **"last mile"** in cases where fiber networks are simply not available
- Providing **mobile/transportable** wideband and narrow-band communications
- Natural disasters or terrorist attacks occur. Satellites are the best and most reliable platform for communications in such situations — fiber networks or even terrestrial wireless can be disrupted by tsunamis, earthquakes, or hurricanes. Satellites are **instant infrastructure**.

BENEFITS OF USING SATELLITE:

- **Ubiquitous Coverage:** A group of satellites can cover virtually all of the Earth's surface.

- **Instant Infrastructure:** Satellite service can be offered in areas where there is no terrestrial infrastructure and the costs of deploying a fiber or microwave network are prohibitive. It can also support services in areas where existing infrastructure is outdated, insufficient, or damaged.

- **Independent Of Terrestrial Infrastructure:** Satellite service can provide additional bandwidth to divert traffic from congested areas, provide overflow during peak usage periods, and provide redundancy in the case of terrestrial network outages.

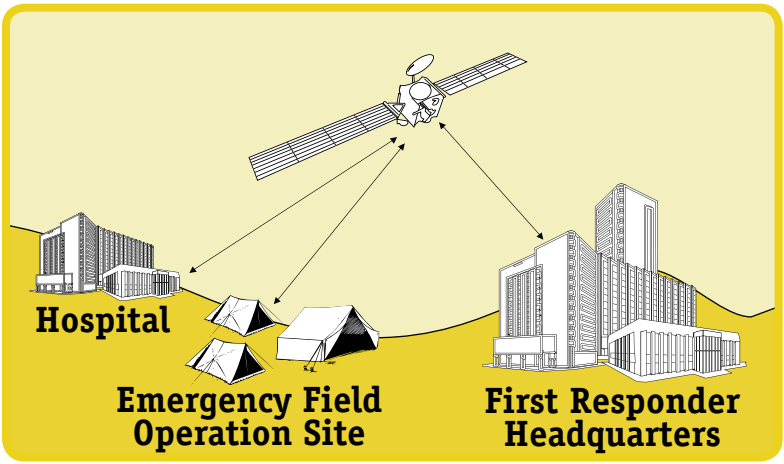
- **Temporary Network Solutions:** For applications such as news gathering, homeland security, or military activities, satellite can often provide the only practical, short-term solution for getting necessary information in and out.

- **Rapid Provisioning Of Services:** Since satellite solutions can be set up quickly, communications networks and new services can be quickly recovered and reconfigured. In addition, you can expand services electronically without traditional terrestrial networks. As a result, you can achieve a high level of communications rapidly without high budget expenditures.

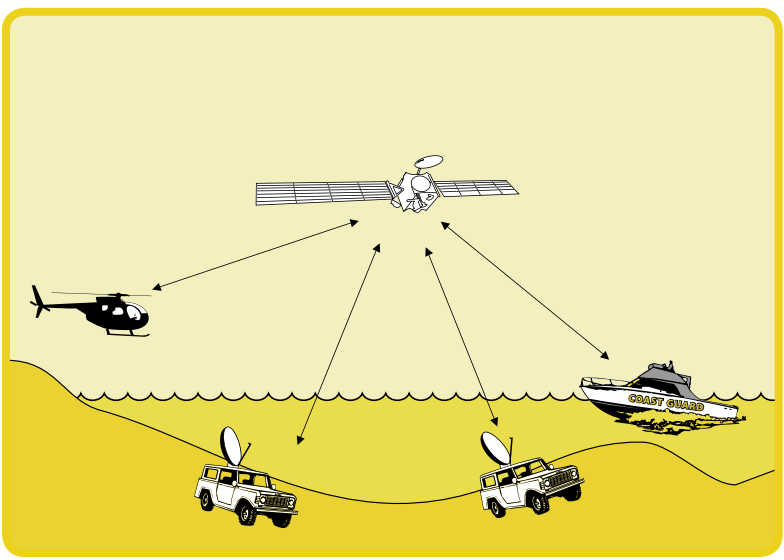
In times of disaster recovery, solutions provided via satellite are more reliable than communications utilizing land-based connections.

CAPABILITIES

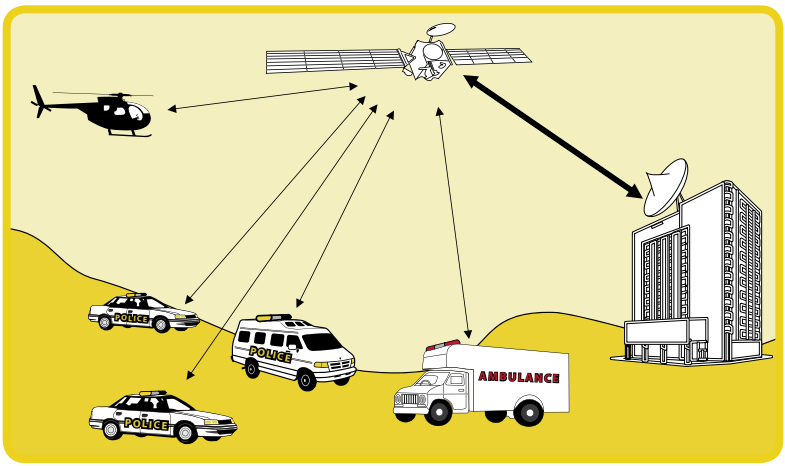
FIXED-TO-FIXED



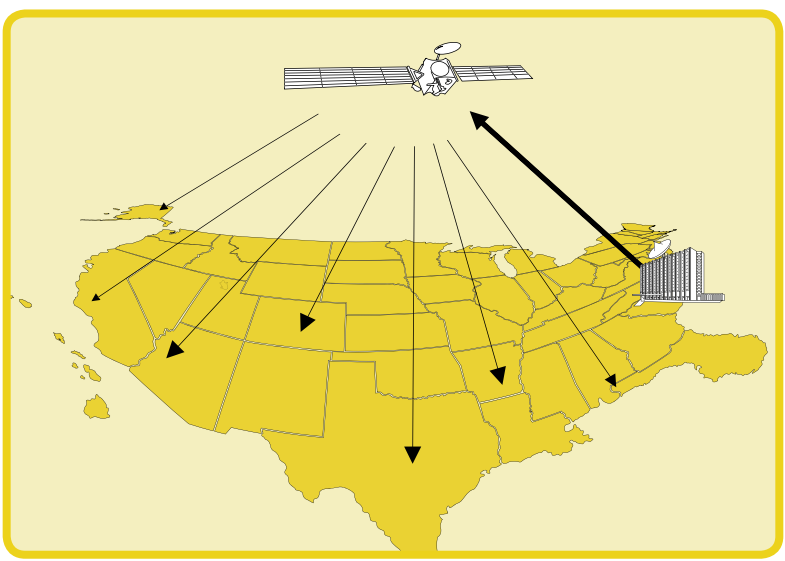
MOBILE-TO-MOBILE



FIXED-TO-MOBILE

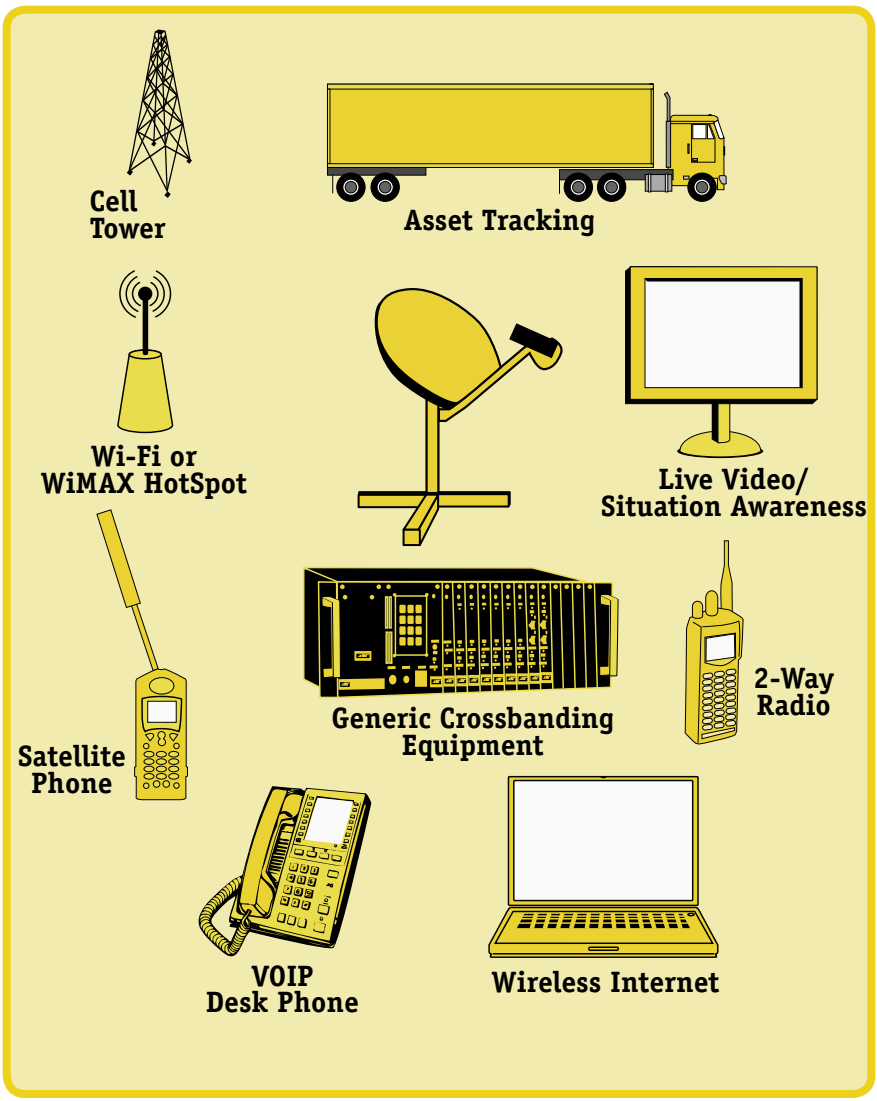


POINT-TO-MULTIPOINT



INTEROPERABILITY

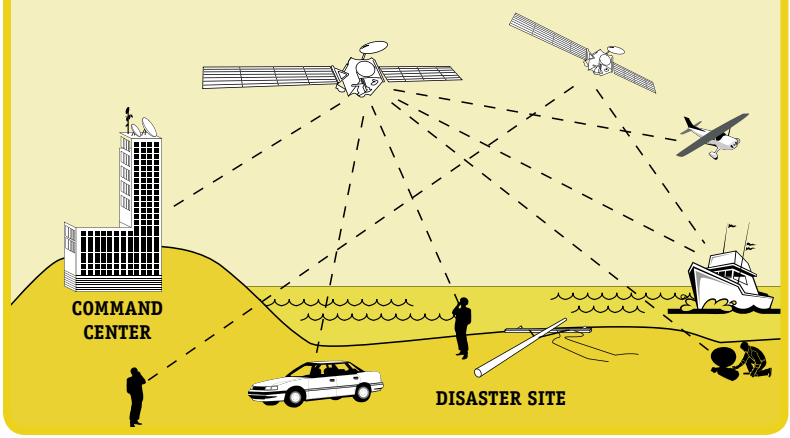
» Satellite communications can interconnect with any other communications solution (i.e. LMR, Cellular, WiFi, etc.) via generic crossbanding equipment.



SOURCE: IRIDIUM

MSS

Mobile Satellite Service (MSS) uses portable satellite phones and terminals. MSS terminals may be mounted on a ship, an airplane, truck, or an automobile. MSS terminals may even be carried by an individual. The most promising applications are portable satellite telephones and broadband terminals that enable global service. In addition, emerging mobile communication networks will also offer voice, video and data services via "smart" chips inserted in handheld devices (i.e. cell phones, LMR's, PDA's, laptops, etc.) that integrate cellular and satellite technology.



→ MSS APPLICATIONS:

- Mobile Telephony
- Push to Talk Radio
- Emergency Response Coordination
- Dispatch Coordination
- Communications On The Move
- Asset Tracking
- Data Transfer
- Lone Worker Protection
- Environmental Monitoring
- Event Reporting
- Messaging

Mobile Telephony

Water, shock & dust resistant for rugged environments

One-touch dialing

Use phone to transmit and receive data

Headset/hands-free capability
Provides up to 30 hours of standby time
Provides up to 3.6 hours of talk time

Call forwarding capability

Two-way SMS capability

4 EASY STEPS TO CONNECT

STEP 1: MEASURING BATTERY LIFE

Most satellite phones display the battery level on the main menu. Read the battery life specifications provided by the phone manufacturer. Be aware that the battery life will vary depending on the use. Talk time ranges from 2 to 3.5 hours on average; stand-by time ranges from 20 to 40 hours depending on the phone.

STEP 2: FINDING A CLEAR LINE-OF-SIGHT TO THE SATELLITE

You need to be outside when using a satellite phone. Make sure you have a clear view of the sky and that you are away from buildings and obstacles.
Rotate and extend the antenna, and point it straight up to the sky. Talk with the antenna above your head and vertical to the ground.

STEP 3: PLACING A CALL

Some satellite phones require that you dial 00 before the country code; others require you to dial a “1” before the area code if you are dialing inside the United States; or that you dial a particular code before calling to another satellite phone on the same service. Make sure to carefully read the instructions given by your service provider.

STEP 4: SENDING A 911 CALL

Most satellite phones can make 911 calls.

Mobile Voice/Data

ABOUT

Capable of e-mail, Internet, VPN, and telephone applications

Offers broadband data up to 492kbps

Offers streaming data rates on demand up to 256kbps

Responders can speak to off-site leadership, while sending a live video update

No technical expertise required

Easily carried in a backpack for quick mobility

Coverage available across U.S., Central and Eastern Canada

Encrypted Air Interface

Communications-on-the-move terminals are available for vehicles

Seamless Coverage: Satellites act as one big radio tower for all of North America. Users don't have to worry about service interruptions associated with roaming, because it is all one network.

Interoperability: Talk groups can be configured to allow for interagency communications between local, regional, and national emergency response organizations, including terrestrial-based two-way radio systems and two-way cellular networks.

Network Flexibility: Two-way radios can be interfaced with existing terrestrial fleet communications infrastructures or make a telephone call.

Secure Communications: The network employs the IMBE (Improved Multi-Band Excitation) voice codec compatible with Project 25 digital voice coder. Digital coding and scrambling prevents casual eavesdropping or monitoring of calls.

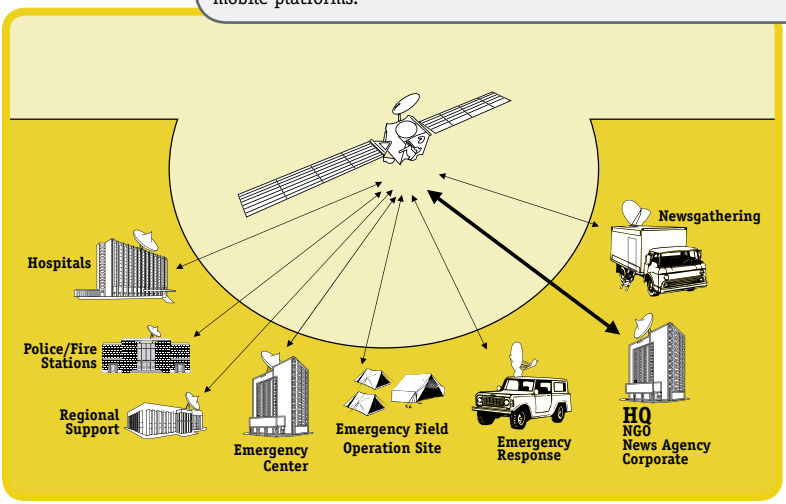
Satellite Two-Way Radios can be installed in a fixed location or can be used in mobile environment while driving.

VIDEO/DATA

SOURCE: HUGHES NETWORK SYSTEMS, GETTY IMAGES.

FSS

Fixed Satellite Service (FSS) has traditionally referred to a satellite service that uses terrestrial terminals communicating with satellites in geosynchronous orbit. New technologies allow FSS to communicate with mobile platforms.



→ FSS APPLICATIONS:

- Cellular Restoration
- Wi-Fi Restoral
- Emergency Phone Bank
- Communications On The Move
- PSTN Backhaul
- Voice-over-IP
- Broadband Internet Access
- Live Video
- Telemedicine
- Video Conferencing

Broadband Connectivity

SATELLITE VSAT NETWORKS:

- A satellite Very Small Aperture Terminal (VSAT) network consists of a pre-positioned, fixed, or transportable VSAT that connects to a hub station to provide broadband communications to hospitals, command posts, emergency field operations and other sites.
- VSAT(s) are low-cost, 2 to 4 foot antennas equipped with a fixed mount that can be made survivable to over 100 mph winds. There are also variants of VSATs that are transportable which can be on-the-air within 30 minutes and require no special tools or test equipment for installation.
- Remote FSS VSAT equipment requires standard AC power for operation, but comes equipped with lightweight, 1 and 2KW, highly efficient, and self-contained power generator equipment for continuous operation, regardless of local power availability.
- Turnkey FSS communications packages can be provided with satellite bandwidth and ground equipment fully integrated.
- Internet access and Internet applications (i.e. VoIP) are supported through the remote VSAT back through the FSS provider teleport location which is connected to the PSTN and/or the Internet.
- A typical VSAT used by a first responder may have full two-way connectivity up to several Mbps for any desired combination of voice, data, video, and Internet service capability.
- VSATs are also capable of supporting higher bandwidth requirements of up to 4 Mbps outbound and up to 10+ Mbps inbound.
- The FSS network topology consists of remote point-to-multi-point and two-way satellite IP connectivity.
- Delivered bandwidth can support a substantial number of phone lines (i.e. phone bank).

Transportable FSS VSATs providing high-speed Internet, data, voice, and/or video access with automatic set-up and simple operation.

Network Restoration

TERRESTRIAL BROADBAND, LMR, CELLULAR, OR WIMAX AND WIFI INFRASTRUCTURE RESTORATION:

- VSAT networks are able to provide high-speed, two-way emergency communications restoration in the wake of a natural or man-made disaster when all other forms of high-speed communication are unavailable.

- VSAT networks provide connectivity for restoral and contingency communications, providing for higher volume VoIP telephony, data, video and Internet access, thereby connecting remote locations to the rest of the world in a time of crisis.

APPLICATIONS SUPPORTED:

- **Telco Terrestrial and WiMAX/WiFi Infrastructure Restoration**

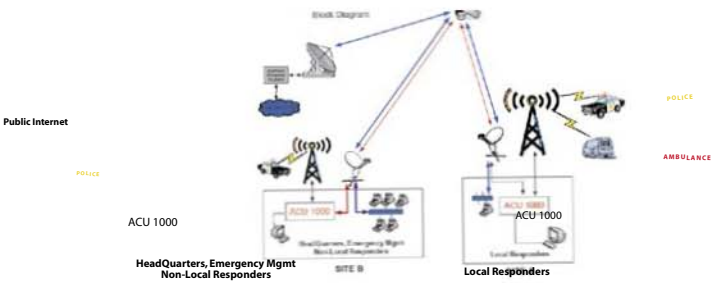
  VSAT networks provide for restoration of the Public Switched Telephone Network (PSTN) and Internet access to meet emergency communications demand, with high-speed connections that are independent of the local Telco ground system infrastructure to re-establish voice, data, and video connectivity.

  VSAT networks equally provide for restoration of wireless cellular nodes and WiMAX (Worldwide Interoperability for Microwave Access) WAN (Wide Area Network) networks to be re-established for private First Responder networks or to reconstitute local Telcos and Internet Service Providers (ISPs).

- **Wireless Handheld Interoperability**

  FSS VSAT networks are fully compliant to support IP based Ethernet data to/from P25 wireless handheld radio systems.

  FSS VSAT networks may provide for IP phone signaling, acting as a redundant link between remote fire, rescue and other first responder's operations centers to support any radio system with IP connectivity, [i.e. 700 MHz].



Communications On The Move (COTM)

MOBILE COMMAND AND CONTROL COMMUNICATIONS:

FSS and MSS COTM solutions can provide fully mobile IP data and voice services to vehicles on the move up to 60 mph. The comprehensive FSS COTM offering includes the terminal, teleport, and satellite capacity to provide high performance COTM IP connectivity.

TYPICAL APPLICATIONS SUPPORTED:

- Any vehicle can also serve as a mobile command post while in-route and as a fixed command access point for personnel upon arrival at the designated location when local Telco terrestrial and wireless infrastructure are not available.
- A full 10 Mbps downlink channel is delivered via FSS to the vehicle and 512 Kbps uplink channel transmitted from the vehicle to the Internet using IP support for voice, video and data simultaneously.
- Support for 802.11x wireless access allows vehicle to function as wireless hot spot access point for a First Responder convoy while in-route or a fixed hot spot for personnel upon arrival.

MSS Comm-on-the-Move Equipment

FSS Comm-on-the-Move Command Post

GLOSSARY

SATELLITE COMMUNICATIONS TECHNOLOGY TERMS AND DEFINITIONS

ANTENNA
A device for transmitting and receiving signals. An antenna is part of an Earth Station.

BACKHAUL
A terrestrial communications channel linking an earth station antenna to a local switching network or population center.

BANDWIDTH
A measure of spectrum (frequency) use or capacity. For instance, a voice transmission by telephone requires a bandwidth of about 3000 cycles per second (3KHz).

CHANNEL
A frequency band in which a specific broadcast signal is transmitted. Channel frequencies are specified in the United States by the Federal Communications Commission.

DOWNLINK
The link from the satellite down to the Earth Station.

EARTH STATION
The buildings, hardware, software and antennas used to communicate with a satellite.

FDMA
Frequency Division Multiple Access. A way of sharing a channel by assigning different frequencies to different users.

FOOTPRINT
The area of the Earth's surface from which an Earth Station can transmit to or receive from a particular satellite.

FREQUENCY BANDS
Internationally, frequencies are divided into well-defined bands. For satellites, the relevant bands are:

- **L-Band**
  As defined by IEEE std 521, the frequency range from 1 to 2 GHz. The L-band term is also used to refer to the 950 to 1450MHz frequency range used for mobile communications. L-band is used for Mobile Satellite Services and offers good penetration through adverse weather conditions and foliage.

- **C-Band**
  The frequency range from 3.7 to 6.2 GHz. Transmissions are less affected by atmospheric conditions such as snow and rain. However, C-band transmissions have low power, so Earth Stations must be rather large to compensate dish size. Applications include public switched networks and Internet trunking.

- **X-Band**
  The frequency range from 8.0 – 12.0 GHz. The X-band frequency enables high power operations with very small terminals. Applications include COTM, manpacks, emergency communications and airborne and shipboard platforms. X-band is also less vulnerable to rain fade and adjacent satellite side lobe interference than other frequencies.

- **Ku-Band**
  The frequency range from 11.7 to 14.5 GHz. Ku-band has higher power than C-band allowing for smaller dishes to be used. However, the higher frequency of Ku-band makes it more susceptible to adverse weather conditions than C-band. Applications include VSAT, rural telephony, satellite news gathering, videoconferencing, and multimedia.

- **Ka-Band**
  The frequency range from 17.7 to 21.2 GHz. Has a higher power than Ku-band allowing for smaller dishes to be used and therefore, will be used for high-bandwidth interactive services such as high-speed Internet, videoconferencing, and multimedia applications. Ka-band transmissions are more sensitive to poor weather conditions than Ku-band.

HUB
The master station through which all communications, to, from and between terminals must flow.

KBPS
Kilobits per second. Refers to transmission speed of 1,000 bits per second.

KHZ
KiloHertz. One KiloHertz is the equivalent of one thousand Hertz, or one thousand cycles per second. Used to measure frequency and bandwidth.

LAN
Local Area Network. A geographically localized network.

MHZ
MegaHertz. One MegaHertz is equivalent of one million Hertz, or one million cycles per second. Used to measure frequency and bandwidth.

SPOT BEAM
A satellite beam with concentrated geographic coverage.

TDMA
Time Division Multiple Access. A way of sharing a channel by assigning different time slots to different users.

TERMINAL
One of the communications stations that receives, processes, and transmits signals between itself and a satellite.

TRANSPONDER
A device located on board the satellite which receives signals uplinked from an earth station and transmits them back to earth on a different frequency.

UPLINK
The link from the earth station up to the satellite.

VSAT
Very small aperture terminal. Refers to small earth stations, with antennas usually in the 1.2 to 2.4 meter range. Small aperture terminals under 0.5 meter are sometimes referred to Ultra Small Aperture Terminals (USAT's)

WIFI
Wireless Fidelity - A brand originally licensed by the Wi-Fi Alliance to describe the underlying technology of wireless local area networks based on the IEEE 802.11 specifications. A person with a Wi-Fi device, such as a computer, telephone, or personal digital assistant (PDA) can connect to the Internet when in proximity of an access point. The region covered by one or several access points is called a hotspot.

WIMAX
WiMAX is a wireless communications technology that provides high-throughput broadband connections for considerably longer distances than that offered via WiFi (Wireless Fidelity) LAN (Local Area Network).

FREQUENTLY ASKED QUESTIONS

WHAT IS A COMMUNICATIONS SATELLITE?

A communications satellite is a device used to receive and transmit radio signals in space. The satellite has communications equipment including receive and transmit antennas, power, and electronic components which enable it to receive a signal from a satellite terminal/user and then transmit that same signal to another satellite terminal/user.

WHAT IS A SATELLITE TERMINAL?

A satellite terminal is anything you use to receive or transmit a signal via a satellite, such as a satellite phone, satellite radio, satellite dish/antenna or Very Small Aperture Terminal (VSAT).

DO SATELLITE PHONES WORK JUST LIKE CELL/WIRELESS PHONES?

Satellite phones offer many of the same characteristics as cellular phones including a similar user interface and design. Satellite phones are slightly larger in size than cellular phones because the antenna required to communicate on the satellite frequencies must be larger than a cellular phone antenna. Another fundamental difference between traditional wireless phones and satellite phones is that when the phone is in satellite mode, it must be within line-of-sight of the satellite in order to complete calls (i.e. you need to have a clear view of the sky). Therefore, a traditional satellite phone cannot be used indoors. However, some satellite phones will work indoors in cellular mode when the user is within a cellular-serviced area.

ARE SATELLITE SERVICES AND EQUIPMENT RELIABLE?

Yes. Overall, satellite service and equipment are reliable. A significant portion, if not the majority, of the problems encountered in the field with dropped service are traceable to "operator error" resulting from a lack of training/familiarity with the equipment.

AREN'T SATELLITE COMMUNICATIONS COST PROHIBITIVE FOR ANYONE EXCEPT DOD?

Today, satellite communications can be a sound economical option for any federal, state, or local first responder – especially when equipment and service plans are purchased in bulk and for an extended period of time. For instance, satellite phones can be purchased for hundreds of dollars with service rates available for less than a dollar a minute.

WHY ARE SATELLITES AN ESSENTIAL COMPONENT IN ALL CRITICAL TELECOM NETWORK PLANNING?

To enable rapid deployment and/or restoration and truly mobile communications, emergency personnel should incorporate satellite services and networks as a redundancy requirement in any communications network or architecture. Satellite systems should be emphasized and included in the early planning of these initiatives to ensure there is a back-up communications solution when the terrestrial network is damaged or destroyed. Without a satellite component to any future emergency response communications network, the emergency communications network will be rendered useless for First Responders when the terrestrial network next sustains damage in overloading.

SATELLITE SOLUTIONS PROVIDERS

Point of Contact: north_ america@inmarsat.com
Telephone Number: (703) 647-4760
Website: www.inmarsat.com
Solutions: Mobile Satellite Services (MSS); Broadband Global Area Network (BGAN)

Point of Contact: John Schroeder
Telephone Number: (301) 571-6265
Website: www.iridium.com
Solutions: Mobile voice, data and tracking capabilities on an immediate basis.

Point of Contact: Amir Dehdashty
Telephone Number: (301) 601-2674
Website: www.hughes.com
Solutions: Broadband satellite networks, backup services, continuity of operations and other managed network services.

Point of Contact: Robert W. Turner
Telephone Number: (202) 478-7121
Website: www.ses-newskies.com
Solutions: Fixed Satellite Services to include voice, data, video and Internet connectivity.

eutelsat
communications via satellite

Point of Contact
info@eutelsatinc.com
Telephone Number: (202) 756-1460
Website: www.eutelsatinc.com
Solutions: Fixed satellite video applications, broadband IP connectivity, mobile data and telephony communications.

Point of Contact: Britt Lewis
Telephone Number: (301) 571-1210
Website: www.intelsatgeneral.com
Solutions: Ground infrastructure, mobile and fixed satellite systems, technical expertise, and secure communications network solutions.

Point of Contact: Larry Haughey
Telephone Number: (301) 590-7402
Website: www.xtarllc.com
Solutions: Fixed and COTM X-band communications services.

Point of Contact: info@msvlp.com
Telephone Number: (800)-216-6728
Website: www.msvlp.com
Solutions: Interoperable two-way radio, telephone, and mobile data solutions.

communications.

Globalstar
GO FURTHER. DO MORE.

Point of Contact: Len Corasaniti
Telephone Number: (301) 361-0091
Website: www.globalstarusa.com/en/
Solutions: High quality, cost effective satellite voice and data communications to over 120 countries

Point of Contact: info.americom@americom-gs.com
Telephone Number: 703-610-0988
Website: www.americom-gs.com
Solutions: FSS fixed, deployable, and mobile Internet, voice and data broadband connectivity.

TerreStar NETWORKS

Point of Contact: Jim Frelk
Telephone Number: (571) 921-4619
Website: www.terrestar.com
Solutions: Next generation mobile communications that seamlessly integrates cellular and satellite networks through customized IP-based applications.

Point of Contact: Jennifer Brooks
Telephone Number: (301) 968-1972
Website: www.stratosglobal.com
Solutions: Multiple VSAT/MSS solutions for emergency and contingency communications.

MARSHALL★ COMMUNICATIONS

Point of Contact: Sonny Marshall
Telephone Number: (571) 223-2010
Website: www.marshallcomm.com
Solutions: Secure content delivery, mobile VSAT, and custom turnkey communications solutions.

For more information and an electronic version of the guide, please visit **www.sia.org** and click on the link *FIRST RESPONDER'S GUIDE TO SATELLITE COMMUNICATIONS*.

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