

Special Project

MEO/LEO Constellations: U.S. Laws, Policies, and Regulations on Orbital Debris Mitigation

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Special Project Report

MEO/LEO Constellations: U.S. Laws, Policies, and Regulations on Orbital Debris Mitigation

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Approved

Abstract

This special report focuses on the emerging legal regime for orbital debris mitigation. It contains an overview of the relevant laws, policies, and regulations on orbital debris mitigation and will serve as a useful reference for the space community.

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Foreword

As part of a public policy effort to stem the growth of orbital debris, the American Institute of Aeronautics and Astronautics (AIAA) in October 1992 formed the Orbital Debris Committee on Standards (Commit-tee). The Committee succeeded the AIAA Study Group on Orbital Debris, which was formed in May 1989. The work of the Study Group culminated in the AIAA Special Projects Report on Orbital Debris Mitigation Techniques: Technical, Legal, and Economic Aspects (SP-016-2-1992). The Study Group was chaired by Paul F. Uhler, National Academy of Sciences. The Committee's members are drawn from government and industry, including the insurance and legal communities. While participating in their individual capacities, many Committee members are affiliated with major U.S. aerospace companies and government agencies with space regulatory and operating responsibilities. The Committee is co-chaired by Pamela L. Meredith, Esq., of Zuckert, Scoutt & Rasenberger, L.L.P., and Dr. Darren S. McKnight of Titan Corporation.

At the request of the AIAA Standards Executive Council and Public Policy Committee, the Committee has prepared this overview of the emerging U.S. legal regime for orbital debris mitigation. The overview addresses current U.S. laws, policies, and regulations that impose orbital debris mitigation requirements on U.S. government and commercial space operations. The particular focus is on debris mitigation for commercial space operations, Medium Earth Orbit and Low Earth Orbit (MEO/LEO) satellite constellations.

The focus on debris mitigation was selected since other efforts were either planned or underway at the time the Committee's work began that would assess the debris environment, including the risk and effect of debris impact, debris population distribution, and debris characterization. These include *Orbital Debris: A Technical Assessment* (National Academy of Sciences, National Research Council, 1995); *Interagency Report on Orbital Debris* (Office of Science and Technology

Policy, 1995); *Position Paper on Orbital Debris* (International Academy of Astronautics, 1995); *NASA Safety Standard 1740.14*, "Guidelines and Assessment Procedures for Limiting Orbital Debris," NSS 1740.14 (1995); *NASA Management Instruction 1700.8*, "Policy for Limiting Orbital Debris Generation," NMI 1700.8 (1993) replaced by *NASA Policy Directive 8710.3*, "Policy for Limiting Orbital Debris Generation," NPD 8710.3 (1997); *Protecting the Space Station from Meteoroids and Orbital Debris* (National Research Council, 1997); *Protecting the Space Shuttle from Meteoroids and Orbital Debris* (National Research Council, 1997); *Space Surveillance: DoD and NASA Need Consolidated Requirements and a Coordinated Plan*, GAO/NSIAD-98-42 (1997).

The Committee decided to place particular emphasis on these constellations because they more than any other development of space highlight the need for debris mitigation measures. Indeed, the White House's Office of Science and Technical Policy (OSTP) concluded that "[t]hese constellations could present a significant new concern for the orbital debris environment."¹

The following Committee members deserve special mention for their contribution to this report: William D. English, Esq., Iridium, LLC; Sean P. Fleming, Esq., of Law Offices of Pamela Meredith; Mike Fudge of ITT Systems and Sciences; John B. Gantt, Esq., of Mizrack & Gantt; Dr. Timothy Maclay of Orbital Communications Corporation; Dr. Darren S. McKnight; Pamela L. Meredith, Esq.; and Robert E. Penny of Motorola.

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¹ See OSTP Report, *supra* note 2, at 55.

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The Committee completed all reviews of the document on April 5, 1999.

The Standards Executive Council accepted the document for publication on April 30, 1999.

1 Recent Developments Focusing Attention on Debris Regulation of Commercial Space Operations

1.1 MEO/LEO Constellations

Over the past five years, the U.S. Federal Communications Commission ("FCC") has licensed the operations of 12 MEO/LEO communications constellations with proposed satellites numbering between two and 288 in altitudes ranging from 700 km to 20,182 km.² The orbits of planned MEO/LEO constellations vary not only altitude, but also in inclination and eccentricity. The number of orbital planes per constellation differ along with the dispersion of satellites among the orbital planes. At least twenty-five applications are on file with the FCC for additional MEO/LEO constellations. Several foreign entities are proposing MEO/LEO constellations as well.³ The table below summarizes licensed and planned U.S. MEO/LEO constellations, including approximate orbital altitude (as licensed by the FCC or requested by applicants) and FCC licensing status.⁴

² See In re Application of Motorola Satellite Communications, Inc., for Authority to Construct, Launch, and Operate a Low Earth Orbit Satellite System in the 1616-1626.5 MHz Band, 10 FCC RCD 2268 (1995); In re Application of Loral/Qualcomm Partnership, L.P., for Authority to Construct, Launch and Operate Globalstar, a Low Earth Orbit Satellite System to Provide Mobile Satellite Services in the 1610-1626.5 MHz/2483.5-2500 MHz Bands, 10 FCC RCD 2333 (1995); In re Application of TRW, Inc., for Authority to Construct, Launch, and Operate a Low Earth Orbit Satellite System in the 1610-1626.5 MHz/2483.5-2500 MHz Band, 10 FCC RCD 2263 (1995); In re Application of Mobile Communications Holdings, Inc., for Authority to Construct, Launch and Operate an Elliptical Low Earth Orbit Mobile-Satellite System, 12 FCC RCD 9663 (1997); In re Application of Constellation Communications, Inc. for Authority to Construct, Launch, and Operate a Low Earth Orbit Mobile-Satellite System, 12 FCC RCD 9651 (1997); In the Matter of Application of Orbital Communications Corporation for Authority to Construct, Launch and Operate a Non-Voice, Non-Geostationary Mobile-Satellite System, 9 FCC RCD 6476 (1994); In the Matter of the Application of Starsys Global Positioning, Inc., for Authority to Construct, Launch and Operate a Satellite System in the Non-Voice, Non-Geostationary Mobile-Satellite Service, 11 FCC RCD 1237 (1995); In the Matter of the Application of Volunteers in Technical Assistance for Authority to Construct, Launch and Operate a Non-Voice, Non-Geostationary Mobile-Satellite System, 11 FCC RCD 1358 (1995); In the Matter of Teledesic Corporation Application for Authority to Construct, Launch, and Operate a Low Earth Orbit Satellite System in the Domestic and International Fixed Satellite Service, Order and Authorization, 12 FCC RCD 3154 (1997) [hereinafter "Teledesic Authorization"]; In the Matter of Final Analysis Communication Services, Inc. for Authority to Construct, Launch and Operate a Non-Voice, Non-Geostationary Mobile-Satellite System in the 148-150.05 MHz, 400.15-401 MHz, and 137-138 MHz bands, 13 FCC RCD 6618 (1998); In the Matter of the Application of Leo One USA Corporation for Authority to Construct, Launch and Operate a Non-Voice, Non-Geostationary Mobile Satellite System in the 137-138, 148-150.05, and 400.15-401 MHz Frequency Bands, 13 FCC RCD 2801 (1998); In the Matter of the Application of E-Sat, Inc. for Authority to Construct, Launch and Operate a Non-Voice, Non-Geostationary Mobile-Satellite System in the 137-138 and 148-150.05 MHz Frequency Bands, 13 FCC RCD 10859 (1998). The FCC distinguishes between the "Big LEO" constellations which will operate in the 1600/2400 MHz bands and provide voice and data communications, and the "Little LEO" constellations, whose satellites are smaller and less powerful and which will be used for data communications below the 1000 MHz band.

³ Among the other foreign proposed systems are: ICO Global Communications' ICO (England), Kennett International Technology's KITComm (Australia), Matra Marconi's WEST (France), SAIT Systems' IRIS (Belgium), OHB Teledata's Safir R (Germany), Telespazio's Temisat (Italy), and Russia's Gonets-D and Gonets-R. ASSOCIATE ADM'R FOR COMMERCIAL SPACE TRANSP., FED. AVIATION ADMIN., 1998 LEO COMMERCIAL MARKET PROJECTIONS (May 1998), at 3-9.

⁴ ICO and KITComm are included because they have filed a Letter of Intent with the FCC to access the U.S. satellite services market. See *ICO Services Limited Letter of Intent to Provide Mobile Satellite Service to, From and Within the U.S. Market Within the 2 GHz MSS Frequency Bands 1990-2025 MHz and 2165-2200 MHz*, File No. SAT-LOI-19970926-00163 (Sep. 26, 1997); and *Letter of Intent of KITComm Satellite Communications Ltd.*, File No. SAT-LOI-19980130-00011 (Jan. 30, 1998). Note that the information in the table is based on FCC licensing orders and applications filed at the FCC but does not necessarily reflect current company plans. For example, Motorola will operate at 780 km not 775 km.

<u>Constellation</u>	<u>Owner</u>	<u>Number of Satellites</u>	<u>Location</u>	<u>FCC Status</u>
Iridium	Iridium, LLC	66	775 km	Licensed '95
Globalstar	Loral/Qualcomm	48	1406 km	Licensed '95
Odyssey ⁵	TRW	10	10,000 km	Licensed '95
Ellipso	MCHI	16	Elliptical	Licensed '97
ECCO	Constellation	48	1018 km	Licensed '97
Orbcomm ⁶	Orbital Comm.	36 (48)	775 (825) km	Licensed '94
Starnet ⁷	Starsys	24	1000 km	Licensed '95
Vitasat	VITA	2	800 km	Licensed '95
E-Sat	E-Sat, Inc.	6	1262 km	Licensed '98
GE Americom	GE Americom	24	800 km	Withdrawn
LEO One USA	LEO One USA	48	950 km	Licensed '98
GEMNET	CTA	38	1000 km	Withdrawn
FAISAT	Final Analysis	26	1000 km	Licensed '98
Teledesic	Teledesic Corp.	840 (288)	700 (1375) km	Licensed '97
Teledesic VBS	Teledesic	72	1375 km	Pending
Teledesic KuBS	Teledesic	30	10,320 km	Pending
M-STAR	Motorola	72	1350 km	Pending
Celestri	Motorola	63	1400 km	Pending
Iridium NextGen	Iridium LLC	96	850 km	Pending
SkyBridge	Alcatel	80	1469.3 km	Pending
SkyBridge II	Alcatel	96	1468 km	Pending
LM-MEO	Lockheed Martin	32	10,352 km	Pending
@Contact	@Contact	16	10,400 km	Pending
SpacewayNGSO	Hughes	20	10,352 km	Pending
StarLynx	Hughes	20 (Hybrid)	10,352 km	Pending
HughesLINK	Hughes	22	15,000 km	Pending
HughesNET	Hughes	70	1490 km	Pending
GS-40	Globalstar	80	1440 km	Pending
GS-2	Globalstar	64 (Hybrid)	1420 km	Pending
OrbLink	OrbLink LLC	7	9000 km	Pending
GESN	TRW	15 (Hybrid)	10,355 km	Pending
ICO	ICO Services	10	10,355 km	Pending
Boeing 2 GHz	Boeing	16	20,181 km	Pending
Boeing Ku-Band	Boeing	20	20,182 km	Pending
Pentriad	Denali Telecom	14	Elliptical	Pending
Ellipso 2G	MCHI	26	Elliptical	Pending
Virgo	Virtual Geosatellite	15	Elliptical	Pending
Constellation-II	Constellation	46	2000 km	Pending
KITComm	KITComm	21	2800 km	Pending

⁵ TRW returned its license to the FCC in January 1998. International Bureau, FCC, Public Notice, Rep. No. SPB-114 (Jan. 15, 1998), at 4.

⁶ Orbcomm modified its system to add 12 satellites for a total of 48 satellites and changed the constellation's orbital altitude to 825 km. *In the Matter of Orbital Communications Corporation for Modification of Its Authorization to Construct, Launch and Operate a Non-Voice, Non-Geostationary Mobile-Satellite System in the 137-138, 148-150.05, and 400.15-401 MHz Frequency Bands*, 13 FCC RCD 10828 (1998) [hereinafter "Orbcomm Modification"].

⁷ GE Starsys returned its license to the FCC in August 1997.