

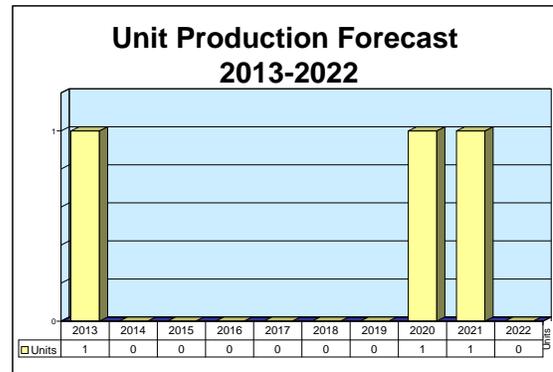
ARCHIVED REPORT

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Satellite Radio

Outlook

- XM-5 launched in 2010; Sirius FM-6 expected to launch sometime in 2013
- ONDAS Media hopes to replicate North American success of Sirius XM in Europe using leased satellite capacity



Orientation

Description. Satellite Radio refers to satellite systems designed to provide consumers with digital audio radio service (DARS) via compact, portable receivers, or specially designed car radios.

Sponsor. Sirius XM Satellite Radio and 1worldspace.

Status. Sirius XM has launched nine satellites. The company does not publish the number of active satellites it currently operates. 1worldspace is currently owned by an investment vehicle created by the founder of the company, Noah Samara. ONDAS Media will offer services on the Internet and on leased satellite capacity. The company has no plans to launch its own satellites.

Total Produced. Five XM and four Sirius satellites have been launched. In addition, ground spares for both the XM and Sirius fleets are in storage. Three satellites have been produced for 1worldspace.

Application. Sirius XM provides DARS to subscribers in North America. 1worldspace provides radio services to nations in Africa, Asia, and the Middle East and has plans to deliver these services to Western Europe as well.

Price Range. The manufacturing cost for three XM satellites is approximately \$300 million. Launch costs for two XM satellites are estimated at \$170 million. The ground segment for the system is worth \$320 million, and launch insurance was \$50 million.

The estimated cost to build four Sirius satellites is \$240 million. Sirius Satellite spent approximately \$255 million for three Proton launches.

The cost to manufacture and launch three 1worldspace satellites is approximately \$600 million. 1worldspace also spent an additional \$60 million for a spacecraft control center in Toulouse, France.

Contractors

Prime

Boeing Defense, Space & Security, Satellite Development Center

<http://www.boeing.com/defense-space/space/bss/>, 2260 E Imperial Hwy, El Segundo, CA 90245 United States, Tel: + 1 (951) 340-2492, Prime

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Space Systems/Loral	http://www.ssloral.com , 3825 Fabian Way, Palo Alto, CA 94303-4604 United States, Tel: + 1 (650) 852-4000, Fax: + 1 (650) 852-5656, Email: lewisw@ssd.loral.com, Prime
Thales Alenia Space France	http://www.thalesgroup.com , 26 ave JF Champollion, BP 1187, Toulouse, 31037 France, Tel: + 33 05 34 35 36 37, Fax: + 33 05 61 44 49 90, Prime

Subcontractor

Spectrolab Inc	http://www.spectrolab.com , 12500 Gladstone Ave, Sylmar, CA 91342-5373 United States, Tel: + 1 (818) 365-4611, Fax: + 1 (818) 361-5102 (Solar Array Panel)
Thales Alenia Space	http://www.thalesgroup.com/Markets/Space/Home/ , 100 boulevard du Midi, BP99, Cannes la Bocca, 06156 France, Tel: + 33 4 92 92 70 00, Fax: + 33 4 92 92 31 40 (XM Payload)

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Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown, CT 06470, USA; rich.pettibone@forecast1.com

Technical Data

Design Features

XM Fleet. The Boeing-702 satellites built for XM have been described as some of the most powerful satellites Boeing has ever produced. To maintain 18 kilowatts for approximately 15 years, each satellite's two solar wings have five panels of dual-junction gallium arsenide solar cells.

The satellites employ an advanced, economical xenon ion propulsion system (XIPS) for station keeping. The unit combines light weight with high specific impulse to produce a system 13 times more efficient than a liquid-fueled system. The Boeing-702 XIPS has four 25-centimeter thrusters that perform all station keeping and can help raise the spacecraft into final orbit.

Since the XIPS needs only 5 kilograms of fuel per year for station keeping – a fraction of what bipropellant or arcjet systems consume – using the system for final orbit insertion phases can save even more mass.

The 13.3-kilowatt digital audio radio payload consists of two active transponders. Each contains 16 active and six spare 228-watt traveling wave tube amplifiers.

To reach areas dubbed "urban canyons," XM has installed 1,700 ground repeaters in 70 locations across the U.S.

	<u>Metric</u>	<u>U.S.</u>
Dimensions		
Height Stowed	7 m	23 ft
Width Stowed	3.3 m x 3 m	11 ft x 10 ft
Length Deployed	40.4 m	132.5 ft
Width Deployed	14.2 m	46.6 ft
Antenna Width	5 m	16.4 ft
Weights		
Launch Weight	4,450 kg	9,810 lb
In Orbit	2,950 kg	6,505 lb
Performance		
Antenna S-band (downlink frequency)	2	
X-band Global Receiver (uplink frequency)	1	
Solar Panels	5	
Power		
Beginning of Life	18 kW	
End of Life	15.5 kW	
Design Life	15 yr	

Sirius Fleet. Sirius spacecraft are based on custom-designed for Sirius and include an S-band SS/Loral's 1300 platform. The satellites were communications package. A bipropellant propulsion

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system and a momentum-bias system are used for station keeping and orbital stability. High-efficiency solar arrays and nickel-hydrogen batteries provide electrical power. The design life of the satellite is 15 years.

Because of the altitude of the orbiting spacecraft, Sirius does not need as many ground receivers as XM. Sirius has installed 105 ground repeater stations at 46 locations across the U.S.

	<u>Metric</u>	<u>U.S.</u>
Performance		
Design Life	15 years	
Communications	S-band	
Orbit (Elliptical)	47,000 x 24,000 km	29,187 x 14,904 mi

1worldspace. 1worldspace chose the Eurostar 2000 platform for its three identical satellites. Each satellite transmits three L-band beams that provide coverage of

14 million square kilometers (5.4 million sq mi). Ground stations provide an X-band uplink. All three satellites have 96 L-band transponders.

	<u>Metric</u>	<u>U.S.</u>
Weights		
At Liftoff	2,777 kg	6,123 lb
Dry Weight	1,205 kg	2,657 lb
Performance		
Design Life	15 yr	
Uplink	X-band	
Downlink	L-band	
Power	5.5 kW	

Variants/Upgrades

XM Fleet (Sirius XM). Four Boeing-702 satellites provide DARS to subscribers in the continental United States. A fifth satellite – ordered in 2005 – is based on the SS/L 1300.

Sirius Fleet (Sirius XM). A satellite constellation based on the 1300 platform built by SS/Loral. A fourth satellite was launched in 2006.

1worldspace. Built by EADS Astrium, each 1worldspace satellite is designed to provide DARS to a specific region of the world, including Africa, Asia, Europe, and the Middle East.

ONDAS Media. A European company based in Madrid, ONDAS was scheduled to begin programming

and Web-enabled services for subscription-based, advertising-free commercial services in late 2010, addressing a European market opportunity of approximately 240 million vehicles and up to 500 million inhabitants. However, as of early 2012, the service had yet to begin broadcasting.

In December 2007, ONDAS issued an Authorization to Proceed for Space Systems/Loral to start developing the satellite infrastructure.

Global Radio. Company liquidated. Global Radio was to launch three satellites around the fourth quarter of 2005 to provide DARS throughout Europe.

Program Review

Background. In 1997, after a two-day auction, the FCC awarded both CD Radio (Sirius) and American Automobile Radio Corp (XM Satellite Radio) licenses to operate digital audio radio service. Primosphere LP of New York and Seattle-based Digital Satellite Broadcasting Corp were shut out after 12 rounds of bidding. Sirius bid \$83.3 million and XM bid \$89.9 million. The licenses were issued later that year when the FCC was ready to accept payment.

DARS Providers Line Up Early Automotive Deals

Sirius XM. Immediately after the licenses were awarded, Sirius formed partnerships with a number of automobile and truck manufacturers, giving it exclusive rights to the following vehicles: BMW, Chrysler, Mercedes-Benz, Jeep, Freightliner and Sterling Trucks, Ford, Lincoln, Mazda, Jaguar, and Volvo. Installation of Sirius radios began in 2001-model cars. Sirius has also formed alliances with various merchants and

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electronics manufacturers that will sell radios for installation on all older-model cars.

XM formed exclusive agreements with General Motors, Honda, and Pana-Pacific for the installation of its own satellite radio service. Sony, Audiovox, and various retailers produced and/or marketed its receivers.

Sirius was forced to delay its commercial service entry several times in order to conduct proper market research and ready its fleet. Sirius launched all three of its satellites separately in 2000 aboard Proton launch vehicles from Baikonur Cosmodrome, Kazakhstan.

XM followed suit in 2001 with the launch of its "Rock" and "Roll" satellites on Sea Launch's Zenit-3SL. XM Radio launched its service in October 2001 and raised over \$129 million through a public offering. In addition, the company was able to raise \$66 million through a debt restructuring with Boeing Capital Services. The new financing was to cover all operating costs for 2002.

FCC Deals a Heavy Blow

In 2002, the FCC authorized AM/FM radio stations to broadcast digital signals. Essentially, this made one of satellite radio's bigger selling points – high-definition sound quality – free to the public.

iBiquity Digital has developed IBOC (in-band on-channel) technology, which enables broadcasters to send both analog and digital signals. IBOC operates with standard AM/FM car stereos.

The two U.S. satellite radio providers, Sirius and XM, reached two major milestones late in 2003. In October, XM Satellite Radio counted its one millionth customer, and in December, Sirius reached its 200,000-customer milestone. By the end of 2003, total satellite radio subscribers in the U.S. approached 1.5 million, representing threefold growth over the previous year.

Boeing-702 Flaw Forces XM Order

Defective mirrors that do not properly reflect light to solar panels were the culprits in several Boeing-702 partial failures of several satellites (see separate report in Tab A), two of which are operated by XM Satellite Radio (XM-1 and -2). The satellites experienced premature solar panel degradation and consequently will have shorter-than-expected design lives. Boeing quickly identified and resolved the problem; however, the two XM birds already on orbit could not be fixed and will have a shortened lifespan.

In April 2003, Sirius entered into an exclusive arrangement with the auto rental company Hertz to provide satellite radio connectivity to top Hertz models. Hertz charges \$5 per day to access onboard satellite

radio. Hertz and Sirius agreed upon a 50/50 revenue split.

In December 2003, Sirius signed a marketing and broadcast deal with the U.S. National Football League (NFL) to broadcast all professional football games, starting with the 2004 season. In a seven-year deal worth \$220 million, the NFL would receive \$188 million in cash and \$32 million in Sirius stock. The deal also granted the NFL the ability to purchase an additional 50 million shares. Then, in October 2004, Sirius signed radio personality Howard Stern to a five-year, \$500 million contract. Sirius hoped these moves would attract new subscribers to the radio provider.

In December 2004, the FCC rejected a request to consider holding satellite radio to the same decency standards that govern traditional radio. The request was filed October 28, 2004, by Mt. Wilson FM Broadcasters Inc of Los Angeles, California, just three weeks after Sirius signed Howard Stern.

Both Sirius and XM posted strong subscriber growth in 2004, as they more than doubled their rolls from the previous year. XM had approximately 3.1 million subscribers by the end of 2004, and Sirius reached the one-million-subscriber milestone.

In October 2004, XM and Major League Baseball (MLB) signed a deal to allow XM to broadcast all of the league's baseball games. The contract with MLB totaled roughly \$650 million over the 11-year duration of the deal. XM began broadcasting games with the 2005 season. Under terms of the deal, XM also acquired the rights to use MLB's logo of a batter in silhouette and the emblems of the league's 30 teams. MLB service was included in the basic subscription service offered by XM.

XM has picked up almost three million new subscribers since 2004, bringing the provider nearly six million subscribers at the end of 2005. Sirius more than doubled its subscriber base from 2004, and by the end of 2005, was hovering around three million subscribers.

In February 2005, XM-3 was launched. Based on the Boeing-702, XM-3 does not have the same problems that plague XM-1 and XM-2.

In July 2005, XM Satellite Radio invested \$25 million in the common stock of Iworldspace Inc. XM was also expected to cooperate with Iworldspace to develop satellite radio products and networks.

In November 2005, DirecTV started carrying 72 XM channels for broadcast over the DirecTV constellation to the subscribers of the satellite television service. Dish Network had already signed Sirius to broadcast radio in

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May 2004. These arrangements have continued with the merged entity.

Latest XM Bird Handed Over On Orbit

The XM-4 satellite was handed over to XM Satellite Radio Inc in 2006. The successful transfer of the Boeing-702 satellite to XM Satellite Radio followed 44 days of on-orbit testing to ensure the spacecraft was operational. Launched on October 30, 2006, the fourth Boeing-built satellite for XM Satellite Radio joined its sister satellite, XM-3, to complete the "Rhythm" and "Blues" satellite duo. XM-4 had been ordered when XM found out that XM-1 and XM-2 would have shorter-than-planned life spans.

XM finished the third quarter of 2006 with 285,000 new subscribers, bringing the total XM subscription base to more than 7.2 million. Rival Sirius finished the same quarter with 441,101 new subscriptions for a grand total of 5.1 million Sirius subscribers.

Space Systems/Loral built the Sirius FM-5 satellite, a 1300-series spacecraft, for delivery in 2009. The total cost of the spacecraft, including insurance and launch on a previously ordered Proton rocket, was \$260 million; Loral provided a \$100 million vendor-financing facility, although Sirius said in a statement it didn't plan to draw on that facility at that time. Unlike Sirius' existing three SS/L-built satellites, which operate in highly elliptical orbits, FM-5 was to be placed in GEO. Sirius has a fourth satellite that is a ground spare, and has no current plans to launch it.

Sirius, XM Merge to Form Single Company

The FCC formally approved the merger of the two satellite radio providers in the United States in July 2008, ending an effort started 17 months earlier. On a 3-2 vote, the five FCC commissioners approved the merger of Sirius Satellite Radio with XM Satellite Radio. The approval came with conditions, including a three-year freeze on subscriber rates and nearly \$20 million in fines for failing to create interoperable radios and violating FCC rules for signal-boosting terrestrial equipment. The combined company had 18 million subscribers at the time of the merger.

While the merger put the company in an enviable position competitively, Sirius XM has a number of challenges ahead. Sirius XM's stock price continues to remain low. The company experiences a high customer churn rate due to the cyclical spending habits of consumers, especially during economic difficulties. Sirius XM faces strong competition from Internet radio providers.

Despite the challenges, the company successfully launched Sirius FM-5 into geosynchronous orbit on

board an International Launch Services' Proton booster rocket in July 2009. XM-5 was launched in October 2010, and will serve as an in-orbit spare. Sirius FM-6 was scheduled to launch in early 2012. The company also announced that it had reached the 20-million subscriber mark in November 2010. By the end of 2011, the company reported 21.9 million subscribers – the largest gain in subscribers since the companies merged in 2008.

Sirius XM has also begun rectifying contract issues that previously caused concern. Contracts for popular celebrities such as Howard Stern, which originally attracted listeners, neared an end in 2010. It was not clear if any of these celebrities would continue to work exclusively with Sirius XM or how much it would cost to resign them. However, in December 2010, Howard Stern was resigned for another five years. Other celebrities such as Dr. Laura Schlessinger (known as Dr. Laura), signed in 2010 as well.

1worldspace. 1worldspace was established in 1990 by CEO and Chairman Noah Samara. Its services were similar to those of Sirius XM, but its marketing strategy was completely different. Instead of battling it out in the U.S., 1worldspace introduced its service to developing countries. Samara's original idea was geared toward humanitarian causes, with commercialization of the services merely a way to financially support this underlying mission.

It was estimated that 25 million households in Africa would be able to afford to buy 1worldspace's compact, portable receivers, built by Hitachi, JVC, Panasonic, and Sanyo. The company had elected not to charge a subscriber fee until the whole fleet was up and running; and then charged approximately \$5 to \$10, depending on the package chosen and the region that the subscriber lived in. 1worldspace also earned revenues through lease payments from broadcasters and the sale of commercial advertising time.

In 1999, 1worldspace began servicing Africa and the Middle East via AfriStar, including offering free educational programs to developing nations. Shortly after service began, problems with AfriStar's solar panels were discovered. The glitch did not affect the satellite's operating capacity, but did shorten its lifespan. AsiaStar and AmeriStar (now AfriStar-2) were fitted with Astrium solar panels to avoid future mishaps. AsiaStar was launched in 2000 to service India, Indonesia, Singapore, and other parts of Asia.

1worldspace planned to offer broadcasting services to Latin America, South America, and the Caribbean via AmeriStar. The satellite's launch on an Ariane rocket was delayed while Alcatel adjusted the beam patterns so AmeriStar did not encroach on U.S. soil or interfere

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with DoD L-band communications. AmeriStar now operates as AfriStar-2, providing service to France, Germany, and Italy. Meanwhile, 1worldspace shifted focus from Latin America and South America to Europe.

1worldspace partnered with Alcatel Space (now Alcatel Alenia Space) on a commercial European service venture to use capacity on AfriStar to beam DARS to the region. Alcatel Space secured access to the 9° E and 45° E orbital slots through the French government.

After struggling to revamp a strategy in order to remain in business, 1worldspace decided that it would not attempt to broadly penetrate new markets in Africa and Asia, where it currently operated spacecraft. The new focus would be on three countries: China, India, and France. 1worldspace planned to target the top 20 percent of households in China and India in terms of purchasing power. The top 20 percent in China translates into 73 million households. In India, 1worldspace receiver sales averaged 300 per week at the end of 2003.

1worldspace had hoped to place its AfriStar-2 satellite in orbit in 2009 in order to focus on France, Germany, and Italy, but the satellite was never launched.

Slow demand for satellite radio in Europe and Asia forced the company to offer service "free to air," which then created a severe cash flow problem. The company resolved the problem by converting \$1.8 billion in debt into royalty payments on receiver sales and by severely reducing operating costs. Over 300,000 receivers were sold.

1worldspace Granted FCC Clearance for AfriStar Satellite

The FCC granted permission for 1worldspace to launch its "replacement" satellite AfriStar-2 at 21° E, giving 1worldspace and its European subsidiary Viatis a ready-made satellite for providing DARS to Europe. The FCC also granted 1worldspace authorization to operate downlinks related to the new satellite. AfriStar-2 is the already manufactured, but reconfigured, AmeriStar. With the FCC in this case working as the conduit of the International Telecommunication Union, the matter of 1worldspace's satellite capacity and related spectrum was essentially closed, barring an appeal from either of the two would-be competitors.

1worldspace filed for Chapter 11 bankruptcy protection in October 2008, citing over \$2 billion in debt. The company, based in Maryland, filed for Chapter 11 after

an extended period of financial problems, hoping to secure outside funding through a recapitalization of the company or the sale of the company or its assets.

A \$28 million deal to sell the company's assets to Yenura Pte Ltd was concluded in March 2009. However, when Yenura was not able to meet the payment schedule on time, creditors terminated the agreement in September of that year.

A number of other buyers such as Liberty Media toyed with the idea of purchasing 1worldspace's assets. However, none of these came to fruition. Eventually, Yazmi USA purchased the company's assets for \$5.5 million. Yazmi is an investment vehicle of 1worldspace founder Noah Samara. Under the purchase agreement, 1worldspace is no longer protected under bankruptcy laws. Samara's future plans for the company are unclear.

Global Radio. Global Radio SA, a Luxembourg-based company that aimed to establish a European satellite radio system, never realized its ambitions and was liquidated in 2003. The company had planned to roll out a commercial digital radio service throughout Europe. Starting in 2005, three spacecraft were to be launched into highly elliptical orbits. Keeping with industry standards, the receivers were to be compatible with terrestrial-based digital radio systems.

Late in 2002, Global Radio SA was seeking its second round of funding to implement its plans for a European satellite radio system. The company had hired S.G. Cowen Securities Corporation to facilitate this process, but the financing was never realized. In February 2003, Global Radio SA was liquidated, leaving 1worldspace as the only European-based DARS hopeful at that time.

ONDAS. ONDAS Media began operations in Europe, hoping to replicate Sirius' and XM's success in North America. The company originally planned to launch three S-band satellites into highly elliptical orbit. However, when the company was not able to secure broadcast rights in the S-band over Europe, ONDAS decided to partner with satellite operators that already had rights to use S-band over Europe. The poor economic environment also made raising money to purchase its own satellites difficult for ONDAS.

ONDAS plans to offer radio services both over the Internet and by satellite. The company has already signed agreements with Nissan, BMW, and Renault to be the exclusive satellite radio provider for their cars in Europe.

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Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Apr	1997	Licenses awarded to XM Satellite Radio and Sirius
Oct	1997	FCC issues two licenses for satellite radio broadcasting
May	1998	1worldspace orders ground spare from Astrium
Oct	1998	AfriStar launched aboard an Ariane 44L
Oct	1999	1worldspace begins service to some cities in Africa and the Middle East
Mar	2000	AsiaStar launched aboard an Ariane 5
Jul	2000	Sirius-1 launched aboard a Proton rocket
Sep	2000	Sirius-4 (spare) damaged at SS/Loral Labs
Sep	2000	Sirius-2 launched aboard a Proton rocket
Nov	2000	Sirius-3 launched aboard a Proton rocket
Mar	2001	Launch of XM-2 (Rock) aboard Sea Launch's Zenit-3SL
May	2001	Launch of XM-1 (Roll)
Feb	2003	Global Radio SA liquidated
Feb	2005	Launch of XM-3 on Sea Launch Zenit 3SL
Oct	2006	XM-4 launched on Sea Launch Zenit 3SL
Jul	2008	FCC approves merger of Sirius and XM
Jul	2009	Launch of Sirius FM-5
Oct	2010	Launch of XM-5
	2013	Planned launch of FM-5

Forecast Rationale

The North American market is dominated by a single satellite radio company – Sirius XM Radio Inc, the result of a 2008 merger between rivals Sirius and XM. The new company faces a number of challenges that will affect its ultimate success; however, for the foreseeable future, Sirius XM will remain the primary satellite radio provider in North America.

Outside North America, a viable provider of satellite radio services has yet to develop. With a single company dominating the North American market and no viable companies in the rest of the world, satellite sales for radio services are forecast to be low until the next decade.

Despite hardships such as poor economic growth and high customer churn rates, Sirius XM continues to make strides. For example, the company has recently experienced a net gain in subscribers.

Sirius XM is not expected to take delivery of a high number of satellites during the next decade. The FM-6 is the only satellite expected to be delivered before the 2020s. The company's current fleet of satellites will

likely be able to handle all customer demand. New satellites will be needed in the 2020s to replace current satellites as they age.

Outside North America, the satellite radio market remains underdeveloped. For a time, 1worldspace attempted to provide satellite radio to Africa, Asia, and Europe. However, the company could not turn a profit and was forced to declare bankruptcy. Another company, ONDAS Media, has plans to offer satellite radio services in Europe. However, the company will not purchase its own satellites, and will instead lease capacity on satellites already in orbit. This move will reduce costs and eliminate the need for the company to get permission from European authorities to broadcast signals over the continent.

With the dominance of Sirius XM in North America and lack of satellite radio providers in the rest of the world, production of satellites for radio broadcasting will be low during the forecast period. With ONDAS Media the only viable satellite radio operator outside of North America, satellite sales beyond the United States will be nonexistent.

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Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program	High Confidence					Good Confidence			Speculative			Total
	Thru 2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
Space Systems/Loral												
SIRIUS-6 (SATRADIO) <= 1300 <= SIRIUS SATELLITE RADIO												
	0	1	0	0	0	0	0	0	0	0	0	1
MFR Not Selected												
SIRIUS XM Follow-Ons												
	0	0	0	0	0	0	0	0	1	1	0	2
Total	0	1	0	0	0	0	0	0	1	1	0	3