

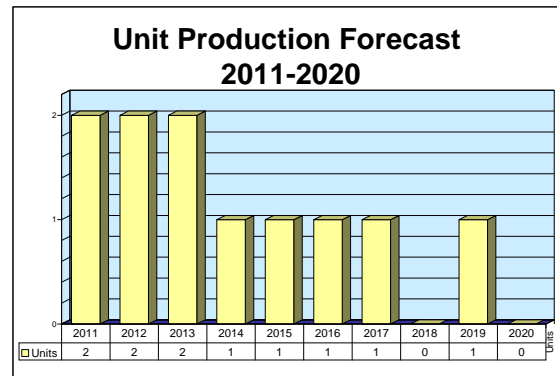
ARCHIVED REPORT

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SES Global

Outlook

- ASTRA 3B launched in May 2010
- SES SIRIUS rebranded SES ASTRA AB
- SES ASTRA awarded EADS Astrium a contract for four new satellites, to be delivered between 2012 and 2014
- SES Americom and SES New Skies merged into single division



Orientation

Description. SES Global, Betzdorf, Luxembourg, operates the ASTRA system through its SES ASTRA segment.

Sponsor. SES Global was formed in March 2001 when Société Européenne des Satellites (SES, owner of ASTRA) acquired the assets of GE American Communications.

Status. Operational; the ASTRA fleet consists of 13 satellites. The ASTRA 1H, 1KR, 1L, and 1M operate together at 19.2° E. ASTRA 3A and 3B operate at 23.5° E. ASTRA 4A and 1E operate at 5° E, while ASTRA 1G and 2C operate at 31.5° E. ASTRA 2A, 2B, and 2D are located at 28.2° E. In addition, SES Global has access to satellites from AsiaSat, Star One, Nahuelsat, QuetzSat, and SES WORLD SKIES.

Total Produced. Eighteen ASTRA satellites have been produced.

Application. SES ASTRA provides satellite capacity for European direct-to-home TV, radio, and IP-based content. The company also provides services to the Middle East and Africa.

Price Range. Estimated unit cost of the ASTRA 1A, based upon the Satcom 4000 bus platform, is \$45 to \$65 million. The ASTRA 1C and 1D cost approximately \$125 million each, while the total cost for a 1E, including launch and insurance, was \$320 million. The ASTRA 1K satellite costs about \$280 million.

Contractors

Prime

Boeing 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 (Boeing-601HP Bus; Boeing-601 Satellite)
Lockheed Martin Space Systems - Sunnyvale	http://www.lockheedmartin.com/ssc/ , 1111 Lockheed Martin Way, Sunnyvale, CA 94088-3504 United States, Tel: + 1 (408) 742-4321, Prime (A2100 Bus)

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Subcontractor

Adcole	http://www.adcole.com , 669 Forest St, Marlboro, MA 01752 United States, Tel: + 1 (508) 485-9400, Fax: + 1 (508) 481-6142 (Sun Sensor Assembly)
Astrium Satellites	http://www.space.eads.net , 37, Ave Louis Breguet, BP 1, Velizy-Villacoublay, 78146 France, Tel: + 33 1 39 45 25 00, Fax: + 33 1 39 45 25 55 (Eurostar 2000 Bus)
COM DEV Ltd, Headquarters and Manufacturing Plant	http://www.comdev.ca , 155 Sheldon Dr, Cambridge, N1R 7H6 Ontario, Canada, Tel: + 1 (519) 622-2300, Fax: + 1 (519) 622-1961, Email: gary.calhoun@comdev.ca (Transponder Input and Output Multiplexer & Filter)
Hexcel Corp	http://www.hexcel.com , 19819 84th Ave S, Kent, WA 98032-1223 United States, Tel: + 1 (800) 227-2147, Fax: + 1 (253) 395-4063 (Solar Array Substrate)
Honeywell Aerospace	http://www51.honeywell.com/aero , 1944 E Sky Harbor Circle, Phoenix, AZ 85034 United States, Tel: + 1 (602) 231-1000, Fax: + 1 (602) 365-2075 (Rate Measurement Assembly)
Pacific Electro Dynamics Inc	11465 Willows Rd, Redmond, WA 98052-2501 United States (Reaction Engine Assembly)
Thales Alenia Space	http://www.thaleson-line.com/space , 26 ave JF Champollion, BP 1187, Toulouse, 31037 France, Tel: + 33 05 34 35 36 37, Fax: + 33 05 61 44 49 90 (Spacebus 3000B3S)

Comprehensive information on Contractors can be found in Forecast International's "International Contractors" series. For a detailed description, go to www.forecastinternational.com (see Products & Samples/Governments & Industries) or call + 1 (203) 426-0800.

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. GE Astro-Space (now Lockheed Martin Commercial Space Systems) designed the ASTRA 1A system for SES using its Satcom 4000 series satellite. ASTRA 1A utilizes two deployable solar panels that extend outward perpendicular to the main satellite body. It also has a small receiver antenna on its Earth-pointing face.

ASTRA 1A's 16 active and six spare signal transponders are each powered by a 45-watt traveling wave tube amplifier (TWTA). The six spare transponders provide backup facilities in the event of a system failure, or options for expansion of existing capabilities. During an eclipse, the satellite relies upon thermal battery systems to generate equivalent current.

The ASTRA 1B satellite purchased from GE Astro-Space is the former Satcom K3, a 5000 series bus previously owned by DBS Crimson Satellite Associates.

The ASTRA 1C and 1D satellites ordered from Hughes (now Boeing) are each equipped with 18 Ku-band, 63-watt transponders, plus six spare transponders. The ASTRA 1E and 1F satellites also use the Boeing-601, but are dedicated to digital television and radio transmission. The Boeing-601-based Astro 1G and 1H feature more transponders and greater power.

In 1996, SES asked Hughes to modify ASTRA 1H with a Ka-band payload for interactive applications across

Europe. Those two Ka-band transponders allow SES to launch services for point-to-point or point-to-multipoint interactive applications across Europe.

ASTRA 2A and 2C are upgraded Boeing-601HP models, similar to ASTRA 1G and 1H but with a xenon ion propulsion system (XIPS) for orbital control. ASTRA 2A and 2C have 32 active Ku-band transponders for the first five years; they operate in the Broadcast Satellite Service (BSS) frequency (11.70 to 12.5 GHz).

ASTRA 2D is a Boeing-376HP satellite equipped with 15 Ku-band transponders; it is expected to operate for 12 years. ASTRA 3A uses a Boeing-376 platform and features 20 Ku-band transponders. The spacecraft has an optimized footprint for direct-to-home (DTH) reception.

Based on Astrium's Eurostar 2000 bus, ASTRA 2B features a steerable beam for targeting television programming to Eastern Europe, India, or Africa. Up to 16 transponders can be switched to this steerable beam.

Alcatel Space (now Thales Alenia Space) built the ASTRA 1K on the Spacebus 3000B3S platform. The spacecraft was designed for a 13-year lifetime using chemical propulsion only, but was placed into useless orbit by a failed Proton launch. Had it achieved orbit, it would have been a powerful and versatile spacecraft, with highly accurate pointing and a long lifespan. It was

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equipped with nine antenna reflectors and two Ka-band and 52 high-power Ku-band transponders, all fully eclipse-protected.

ASTRA 1K set a number of records for a civil communications satellite: 5,250 kilograms at liftoff, 13 kW end-of-life power, total span of 37 meters, height of 6.6 meters, 10 different antenna reflectors. It also incorporated some innovative onboard technologies, including plasma propulsion, ultra-light reflectors with dual deployment, and a six-panel solar array delivering 13 kW of power at end-of-life.

In June 2003, SES ASTRA contracted Lockheed Martin to develop and deliver on-orbit two A2100-based high-powered communications satellites to the 19.2° E position. Both satellites feature 15-year design lives, a pan-European footprint, and a TWTA output of

140 watts. The first satellite, the ASTRA 1KR, features 32 active Ku-band transponders in the FSS band. Its primary mission is to replace the ASTRA 1B and 1C, launched in 1991 and 1993, respectively. ASTRA 1KR was launched on an Ariane 5 in April 2006.

The second satellite, ASTRA 1L, will ensure further fleet optimization by allowing the release of ASTRA 2C from its current location of 19.2° E. The spacecraft will feature 29 active Ku-band transponders, as well as a two-transponder Ka-band payload for interactive applications such as ASTRA BBI (Broadband Interactive). ASTRA 1L was launched on an Ariane 5 in May 2007.

All ASTRA satellites have been three-axis stabilized with the exception of ASTRA 2D and 3A.



The Lockheed Martin A2100 bus is widely prevalent in the AMC fleet.

Source: Lockheed Martin

Variants/Upgrades

SES ASTRA

ASTRA 1E. Boeing 601 satellite bus (5° E)

ASTRA 1G. Boeing-601 satellite bus (31.5° E)

ASTRA 11H. Boeing-601 satellite bus (19.2° E)

ASTRA 1KR. Lockheed Martin A2100X bus (19.2° E)

ASTRA 1L. Lockheed Martin A2100AX bus (19.2° E)

ASTRA 1M. Eurostar E3000 (19.2° E)

ASTRA 2A. Boeing-601HP satellite bus (28.2° E)

ASTRA 2C. Boeing-601HP satellite bus (31.5° E)

ASTRA 2B. Astrium Eurostar 2000 satellite bus (28.2° E)

ASTRA 2D. Boeing-376HP satellite bus (28.2° E)

ASTRA 3A. Boeing-376HP satellite bus (23.5° E)

ASTRA 3B. Eurostar E3000 (23.5° E)

ASTRA 4A. Lockheed Martin A2100 (5° E)

Program Review

Background. The ASTRA program is the result of several earlier efforts by the Grand Duchy of Luxembourg (GDL) to set up a direct broadcast satellite (DBS) network with funding from private companies. Various groups and companies submitted proposals, beginning in 1979.

In 1983, the GDL announced that it would develop its own DBS satellite plan, despite French and German pressures to avoid competition with their own planned DBS systems. The plan was also not well received by major European satellite operators, Intelsat and Eutelsat.

Luxembourg set up a company, called Coronet for the purpose of developing the satellite system. However, by 1984 Coronet had been liquidated in the face of growing financial problems and a rift between the company and the government. In 1985, the Société Européenne des Satellites (SES) was formed. The new company had stronger backing from the Luxembourg government and commercial financiers than did its predecessor.

The International Frequency Registration Board (IFRB) and International Telecommunications Union (ITU) approved SES's plans to locate the ASTRA 1A satellite at 19.2° E in 1987. The RCA-built satellite was launched on an Ariane 4 in 1988, followed by ASTRA 1B, also built by RCA, in 1991.

Purchases Create Behemoth Operator

In 1999, SES started expanding, buying a 34.1 percent stake in AsiaSat. The following year it acquired a 50 percent interest in Scandinavian Sirius satellite operator Nordic Satellite AB (NSAB was renamed SES SIRIUS and has now been completely merged into SES ASTRA) and a 20 percent interest in Embratel's satellite division, operator of Star One, with an option to acquire an additional 10 percent interest.

SES completed a 100 percent acquisition of GE Americom in 2001, creating SES Global. SES acquired the company's stock and other assets for \$5 billion through a \$2.7 billion cash offering and 15.4 million shares in SES Global. SES Global later changed the designation of GE's satellites from GE to Americom (AMC).

In March 2006, SES Global acquired New Skies Satellites in a deal valued at over \$1 billion. Under the terms of the deal, SES paid \$22.52 per share in cash for New Skies, for a total of \$760 million. SES also assumed an additional \$400 million in debt, bringing the total value of the deal to \$1.16 billion. SES's New Skies and Americom divisions have merged into a single division, named SES WORLD SKIES.

ASTRA 3A Launched. SES ASTRA's 13th satellite, the 3A, was successfully deployed on March 29, 2002. An Ariane 44L carried the 3A from Kourou, French Guiana, to its 23.5°/24.2° E orbital slot over Europe, where it is fully operational. It replaced Deutsche Telekom's DFS Kopernikus satellite at the 23.5° E orbital slot and assumed all of its traffic.

While One Satellite is Lost...

The ASTRA 1K satellite was lost in the failed November 2002 launch of an ILS Proton rocket. A malfunction in the rocket's RSC-Energia-built Block DM upper-stage engine left the ASTRA 1K satellite stranded in a 175.5-kilometer (94.8-nm) circular orbit, instead of the planned 3,300-kilometer geosynchronous transfer orbit. International Launch Services (ILS) and SES ASTRA ultimately opted to destroy the satellite. The ASTRA 1K's engine was fired, sending it hurtling back to Earth, where it burned up over the Pacific Ocean.

Alcatel Space built the ASTRA 1K on its Spacebus 4000 bus. It carried 52 Ku-band and two Ka-band transponders and was to replace three ASTRA satellites in orbit and serve as an orbital spare for four others. The project cost SES ASTRA \$277.5 million, but the firm carried full insurance on the satellite and its loss did not affect the company's services at 19.2° E.

...Two More are Ordered

In June 2003, SES ASTRA contracted Lockheed Martin to develop and deliver on-orbit two A2100-based high-powered communications satellites to the 19.2° E position. Both satellites feature 15-year design lives, a pan-European footprint, and a TWTA output of 140 watts. The first satellite, the ASTRA 1KR, features 32 active Ku-band transponders in the FSS band. Its primary mission is to replace the ASTRA 1B and 1C, launched in 1991 and 1993, respectively. ASTRA 1KR was launched on an Ariane 5 in April 2006.

The second satellite, ASTRA 1L, ensures further fleet optimization by allowing the release of ASTRA 2C from 19.2° E. ASTRA 2C was redeployed to 31.5° E. The spacecraft will feature 29 active Ku-band transponders, as well as a two-transponder Ka-band payload for interactive applications such as ASTRA BBI (Broadband Interactive). ASTRA 1L was launched on an Ariane 5 in May 2007.

Hellas-Sat Agreement Signed. SES ASTRA and the Greek satellite operator Hellas-Sat signed a framework agreement for utilization of Hellas-Sat 2 satellite capacity by SES ASTRA. The agreement allows

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SES ASTRA to integrate transponder capacities on the Hellas-Sat 2 satellite – at the 39° E orbital position – into its offerings.

Kourou Flight Lofts ASTRA Bird

An Ariane 5 launched the ASTRA 1L and Galaxy 17 spacecraft in May 2007. ASTRA 1L weighed 4,500 kilograms at launch and carried a mix of Ku- and Ka-band transponders. The spacecraft operates at 19° E and provides communications services across Europe. Galaxy 17 is a Thales Alenia Space Spacebus 3000B3 spacecraft that weighed 4,100 kilograms at launch and carries C- and Ku-band transponders.

GE and SES Make a Deal

GE Capital agreed to sell its stake in satellite operator SES Global back to the company in exchange for an on-orbit satellite, cash, and stakes in several other companies. SES will get GE's 19.5 percent stake in the company and in return will take control of a new holding company, SES International Holdings. That company's assets consist of \$765 million in cash, the AMC-23 satellite currently in operation in GEO, and SES's stakes in SatLynx, AsiaSat, Star One, and ORBCOMM. The deal is designed to remove the "overhang" caused by GE's stake in SES that had been depressing the company's shares, SES executives said. GE had owned a part of SES since the merger of SES with GE Americom in 2001.

SES Global Secures 10 Future Launches

In an effort to secure slots in increasingly crowded launch manifests, European satellite operator

SES Global signed launch agreements for 10 future satellites with Arianespace and International Launch Services. SES signed separate agreements in June 2007 with Arianespace and ILS for five launches from each company in the 2009-2013 period, with the total value of the agreements estimated to be \$700 million. The agreements are designed to cover most of SES's launch requirements during that period. The long-term deal also ensures that the company will have spots in launch manifests that have become more crowded in recent years, driving up launch prices and forcing satellite operators to scramble to find launches.

SES ordered four new satellites from EADS Astrium in November 2009. The satellites will be based on the Eurostar 3000 satellite bus and will be deployed to 28.2° E and 31.5° E. The four satellites will be named ASTRA 2E, ASTRA 2F, ASTRA 2G, and ASTRA 5B, and will be launched between 2012 and 2014. SES secured EUR522.89 million (\$645.4 million) in credit from French export credit agency COFACE to help fund the purchase.

The ASTRA 3B was delivered to Kourou Space Center in February 2010. It was originally scheduled to launch in March, but the launch was delayed by issues with the Ariane 5 launch vehicle. The satellite was finally launched on May 24, 2010.

In May 2011, ASTRA 1N was delivered to Kourou in preparation of a July launch.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Mar	1985	Formation of SES to oversee ASTRA program
May	1986	RCA awarded satcom supply contract from SES
Jun	1987	ASTRA's orbital position approved by IFRB and ITU
Dec	1988	Launch of ASTRA 1A on Ariane 4
Mar	1991	Launch of ASTRA 1B on Ariane 4
May	1993	Launch of ASTRA 1C on Ariane 4
Nov	1994	Launch of ASTRA 1D on Ariane 4
Oct	1995	Launch of ASTRA 1E on Ariane 42L
Apr	1996	Launch of ASTRA 1F on Proton
Dec	1997	Launch of ASTRA 1G on Proton
Aug	1998	Launch of ASTRA 2A on Proton
Jun	1999	Launch of ASTRA 1H on Proton
Sep	2000	Launch of ASTRA 2B on Ariane 5
Dec	2000	Launch of Launch of ASTRA 2D launched on Ariane 5
Nov	2001	SES buys GE Americom, forming SES ASTRA and SES Americom
Jun	2001	ASTRA 2C launched on Proton
Jul	2001	ASTRA 1A ends commercial service at 19.2° E; moved to inclined orbit at 5.2° E
Mar	2002	Launch of ASTRA 3A on Ariane 5
Nov	2002	ASTRA 1K stranded in useless orbit; later destroyed
Mar	2006	SES Global acquires New Skies Satellites

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Apr	2006	Launch of ASTRA 1KR on Ariane 5
May	2007	Launch of ASTRA 1L on Ariane 5
Jul	2008	SES New Skies and SES Americom merged into single division
Nov	2008	Launch of ASTRA-1M on Proton-M/Breeze-M
May	2010	Launch of ASTRA 3B on Ariane 5
Jul	2011	ASTRA 1N expected to launch on Ariane 5

Worldwide Distribution/Inventories

SES ASTRA Satellites in Orbit (as of May 2011)

Satellite	Location	Orbit	Launch Date	Services
ASTRA 1E	5° E	Inclined	October 1995	Backup for ASTRA 4A
ASTRA 1G	31.5° E	Stable	December 1997	Transmission of broadcast and broadband multimedia services
ASTRA 1H	19.2° E	Stable	June 1999	Direct-to-home broadcast services to continental Europe
ASTRA 1KR	19.2° E	Stable	April 2006	Direct-to-home broadcast services to continental Europe
ASTRA 1L	19.2° E	Stable	April 2007	Direct-to-home broadcast services to continental Europe, and Ka-band services
ASTRA 1M	19.2° E	Stable	November 2008	Direct-to-home broadcast services to continental Europe
ASTRA 2A	28.2° E	Stable	August 1998	Direct-to-home broadcast services to the U.K. and Ireland
ASTRA 2B	28.2° E	Stable	September 2000	Direct-to-home broadcast services to the U.K. and Ireland and Internet and telecommunications services to West Africa
ASTRA 2C	31.5° E	Stable	June 2001	Direct-to-home broadcasting, cable contribution, and DTT feeds to eastern and southern Europe
ASTRA 2D	28.2° E	Stable	December 2000	Direct-to-home broadcasting to the U.K. and Ireland
ASTRA 3A	23.5° E	Stable	March 2002	Provides capacity for direct-to-cable broadcasting
ASTRA 3B	23.5° E	Stable	May 2010	Direct-to-home, direct-to-cable broadcast services, and provision of high-speed Internet access to Europe and the Middle East
ASTRA 4A	5° E	Stable	November 2007	Direct-to-home broadcast services, cable TV feeds, occasional transmissions, and broadband solutions to Nordic and Baltic nations, eastern Europe, and sub-Saharan Africa

Forecast Rationale

SES Global is in the midst of a capital spending program that began in 2010 and will run to 2014. Under the program, the company expects to take delivery of 11 satellites. The company will also own capacity on two other satellites, QuetzSat-1 and Yahsat 1A, which will also launch during this period. SES's ASTRA division will continue to be a major driver of purchases during this timeframe. After the fleet modernization program has been completed, SES will continue to purchase satellites to increase capacity and replace retiring satellites, but deliveries will be at a lower pace.

In 2010, SES added 76 transponders to its in-orbit capacity. Under the capital spending program, the company-wide fleet will expand from 40 satellites to about 50, representing a 28 percent increase in the number of transponders in orbit. Spending on satellites will reach a high in 2011 and decline from there, but deliveries for these orders will continue through 2014.

SES ASTRA awarded a contract for four satellites to EADS Astrium in November 2009. The satellites will be delivered between 2012 and 2014. In total, the order for these four satellites plus launch services and

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operations is expected to cost about EUR605 million (\$849 million). At the end of 2010, ASTRA reported an on-orbit satellite fill rate of 90.9 percent. The company will likely attempt to reduce that figure to a more manageable rate.

Once the fleet capitalization has been completed in 2014, SES will begin taking deliveries of a lower

number of satellites. Forecast International expects deliveries of satellites to ASTRA to remain steady at about one per year through the end of the forecast period. These satellites will be purchased primarily to replace older satellites that will reach the end of their expected lifespans during the next decade.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program	High Confidence				Good Confidence			Speculative			Total	
	Thru 2010	2011	2012	2013	2014	2015	2016	2017	2018	2019		2020
Astrium												
ASTRA 1N <> EUROSTAR 3000 <> SES ASTRA												
	0	1	0	0	0	0	0	0	0	0	0	1
ASTRA-2E <> EUROSTAR 3000 <> SES ASTRA												
	0	0	0	1	0	0	0	0	0	0	0	1
ASTRA-2F <> EUROSTAR 3000 <> SES ASTRA												
	0	0	1	0	0	0	0	0	0	0	0	1
ASTRA-2G <> EUROSTAR 3000 <> SES ASTRA												
	0	0	0	1	0	0	0	0	0	0	0	1
ASTRA-5B <> EUROSTAR 3000 <> SES ASTRA												
	0	0	0	0	1	0	0	0	0	0	0	1
Subtotal	0	1	1	2	1	0	0	0	0	0	0	5
Space Systems/Loral												
ASTRA 4B <> 1300 <> SES ASTRA												
<small>Note: Formerly SIRIUS 5. Carries Ku-band and C-band payloads. C-band payload is dubbed SES-5</small>												
	0	0	1	0	0	0	0	0	0	0	0	1
QuetzSat-1 <> 1300 <> SES GLOBAL/QuetzSat												
	0	1	0	0	0	0	0	0	0	0	0	1
Subtotal	0	1	1	0	0	0	0	0	0	0	0	2
MFR Not Selected												
ASTRA FOLLOW-ONS <> SES ASTRA												
	0	0	0	0	0	1	1	1	0	1	0	4
Total	0	2	2	2	1	1	1	1	0	1	0	11