

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

DA 00-2581

In the Matter of	)	
	)	Application File No.
<b>AstroVision International, Inc.</b>	)	SAT-LOA-20000518-00090/91
	)	
For Authority to Launch and Operate a	)	
Private Remote Sensing Satellite System	)	
in Geostationary Orbit.	)	

**ORDER AND AUTHORIZATION**

Adopted: November 15, 2000

Released: November 16, 2000

By the Chief, International Bureau:

**I. INTRODUCTION**

1. By this Order, we grant AstroVision International, Inc. ("AstroVision") authority to construct, launch, and operate a commercial land remote-sensing<sup>1</sup> satellite system in geostationary satellite orbit (GSO). This global land remote-sensing satellite system, to be known as the AstroVision System, will use passive electro-optical sensors on-board satellites designed to measure light reflected, refracted and/or transmitted from the Earth's surface. These measurements will then be transmitted to ground stations and processed into useable information about natural and man-made phenomena. AstroVision intends to use the data to provide real-time information for meteorology, crisis management, limited military intelligence, environmental studies, land and marine resource management, entertainment production, and news reporting. Granting this application will increase competition in the market for satellite imagery data and will advance U.S. leadership in the field of remote sensing technology.

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<sup>1</sup> "Land Remote Sensing" is defined as "the collection of data which can be processed into imagery of surface features of the Earth from an unclassified satellite or satellites, other than an operational United States Government weather satellite." Land Remote Sensing Policy Act of 1992, Pub. L. No.102-555, § 3(5), 106 Stat.4164, 4165 (1992), 15 USC 82 §§ 5621-5658. The term "remote sensing space system" is defined as "any instrument or device or combination thereof and any related ground based facilities capable of sensing the Earth's surface from space by making use of the properties of the electromagnetic wave emitted, reflected, or diffracted by the sensed objects...." 15 C.F.R. § 960.3.

## II. BACKGROUND

2. In 1984, Congress enacted the Land Remote-Sensing Commercialization Act,<sup>2</sup> which transferred the government-owned remote sensing satellite system, Landsat, to the private sector and permitted the licensing of other commercial remote-sensing satellite systems. In 1992, the Land Remote Sensing Policy Act was enacted, incorporating the 1984 Act. This legislation vested concurrent responsibility for licensing private systems to the Department of Commerce through the National Oceanic and Atmospheric Administration ("NOAA") and the Federal Communications Commission (Commission).<sup>3</sup> The Department of Commerce, in conjunction with the Departments of State and Defense, ensures that the collection of remote sensing data does not compromise national security or foreign policy. The Commission is responsible for licensing radio transmitting facilities associated with data collection and for coordinating the frequencies used for these transmissions. The Commission also determines whether the proposed operations will cause radio frequency interference to other system operations and whether any other operational or technical requirements should be imposed.<sup>4</sup>

3. AstroVision filed its application for a space station license on May 18, 2000.<sup>5</sup> On June 2, 2000 AstroVision's application was placed on Public Notice.<sup>6</sup> AstroVision's proposed system consists of two satellites in geostationary satellite orbit, two earth stations for data downlinks, and telemetry, tracking, and command ("TT&C")<sup>7</sup> operations and one alternate earth station for contingency communications. The satellites will be located at 90° W.L. and 160° W.L. AstroVision explains that the satellite located at 90° W.L. will provide optimal views of North America, Central America and South America and that the satellite located at 160° W.L. will provide optimal views of the Pacific region. The system will operate in the 8025-8400 MHz band for data downlink transmission, and the 2025-2110 MHz band for uplink TT&C operations. Each satellite will have at least one wide-field and two narrow-field cameras plus sensors for near-infrared observation and electromagnetic sensors for lightning observation. These cameras will be capable of providing a new image every few seconds, showing the Earth's full disk at a resolution of 5.5 kilometers, and close-up views at a resolution as good as 0.5 kilometer. Finally, AstroVision requests authority to operate as a non-common carrier.

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<sup>2</sup> The 1984 Act is codified at 15 U.S.C. § 4201.

<sup>3</sup> Section 205(e) of the Land Remote Sensing Policy Act of 1992, P.L. 102-555, made clear that "nothing in [the 1984 Act] shall affect the authority of the Federal Communication Commission pursuant to the Communications Act of 1934." 15 USC §5625(e).

<sup>4</sup> The Commission is also responsible for the submission of publication, coordination, and notification information of radio frequency assignments for satellite systems with the International Telecommunication Union (ITU) Radiocommunication Bureau, pursuant to the International Radio Regulations of the ITU. *See* 47 C.F.R. § 25.111(b).

<sup>5</sup> Satellite Application for Commercial Land Remote Sensing Service, SAT-LOA-20000518-00090/91.

<sup>6</sup> Public Notice, SAT-00046 dated June 2, 2000.

<sup>7</sup> TT&C operations control and monitor a satellite's electrical function and orbit from a fixed-earth station and allow information to be transmitted to the satellite that can alter the electrical function of the spacecraft and, if necessary, adjust its orbit. TT&C functions may be conducted in bands allocated to the space operation service or in the band on which the underlying service is being provided. 47 C.F.R. § 2.1.

4. AstroVision requests authority to transmit in the 8025-8400 MHz band from its two satellites to receiving earth stations in the United States. Specifically, AstroVision proposes to operate its system's two wideband downlink channels at center frequencies of 8065 MHz and 8330 MHz, with a bandwidth of 80 MHz each for transmitting compressed data from sensors, and telemetry data on the health and status of the spacecraft. Additionally, AstroVision requests authority to use the 8370.995-8371.005 MHz band for contingency downlink on the health and status of the satellite. AstroVision also requests authority to use the 2025-2110 MHz band, specifically the 2059.995-2060.005 MHz band for uplink TT&C and sensor tasking, and the 2069.995-2070.005 MHz band for contingency uplink TT&C operations. The primary ground stations for TT&C and mission data will be located at Stennis, Mississippi for the satellite located at 90° W.L., and at Poway, California for the satellite located at 160° W.L. Both satellites will deliver data from the onboard sensors to their respective ground stations. As a contingency feature and for severe weather conditions, each ground station can be used as a backup for the other. Also, an alternate ground station will be located at Maui, Hawaii for contingency operations for both satellites.<sup>8</sup> The Commission received no objections in response to AstroVision's application. EarthWatch, a licensee in the Earth Exploration Satellite Service (EESS), filed comments.

### III. DISCUSSION

5. Land remote-sensing satellites provide a variety of information that is used to study, monitor, and understand both natural and man-made phenomena. For example, the collected information can be used for mapping, conservation, resource monitoring, law enforcement, environmental monitoring, and forecasting, as well as for carrying out national security functions. AstroVision asserts that recent studies identified a variety of industries that would benefit from satellite remote sensing information, including agriculture, forestry, non-renewable resources (minerals), energy, transportation, real estate development, utilities, environment, media, education/simulation, insurance, and research.<sup>9</sup> AstroVision cites studies estimating that the remote sensing data market will grow to a few billion dollars over the next five years, and asserts that the AstroVision system will both stimulate and address this commercial demand<sup>10</sup>.

6. EarthWatch is the only party that filed comments in response to AstroVision's application. EarthWatch urges the Commission to consider the potential interference that would be caused by AstroVision's system to non-geostationary orbiting ("NGSO") EESS systems that may be launched in the future. EarthWatch acknowledges that AstroVision has done a credible job of addressing potential interference with existing NGSO EESS systems and does not oppose granting the application, but instead asks the Commission to impose conditions on AstroVision's license to restrict its operations.<sup>11</sup> EarthWatch suggests that AstroVision's use of left-hand circular polarization<sup>12</sup> (LHCP) for its downlinks

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<sup>8</sup> This Order and Authorization is a license for AstroVision's space stations, however, AstroVision must request separate authorization for any associated earth stations.

<sup>9</sup> AstroVision's Application at 18-19.

<sup>10</sup> *Id* at 19.

<sup>11</sup> EarthWatch's Comment at 2.

<sup>12</sup> Left-Hand Circular Polarization is defined as circular polarized wave, in which the electric field vector, observed in any fixed plane, normal to the direction of propagation, whilst looking in the direction of propagation, rotates with time in a left-hand or anti-clockwise direction. 47 C.F.R. § 2.1.

may limit EarthWatch or other satellite systems future use of LHCP links.<sup>13</sup> EarthWatch also claims that AstroVision's system will use the frequency spectrum continuously and, therefore, should be capable of being switched off in order to accommodate current and future NGSO systems downlinking into the same regions of the United States.<sup>14</sup> Further, EarthWatch claims that AstroVision has not adequately demonstrated the impact of its system downlink on collocated ground stations.<sup>15</sup>

7. In response, AstroVision asserts that it has provided evidence that it can share with the other non-geostationary orbiting EESS licensed systems in the 8025-8400 MHz band, and that it will coordinate in good faith with any future EESS applicant.<sup>16</sup> AstroVision also claims that it has offered a full assessment of all possible cases of harmful interference to any other EESS earth station within the United States,<sup>17</sup> and that EarthWatch's concern regarding future use of "left hand circular polarization" for other system downlinks is readily dispelled by the inter-system isolation assured by spatial diversity.<sup>18</sup> According to AstroVision, the technical design of its satellites assures a broad range of opportunities for implementing spatial diversity isolation between AstroVision's system and other EESS licensed systems.<sup>19</sup> AstroVision also notes that, the vast majority of NGSO satellite passes will occur well beyond the line-of-sight between an AstroVision ground station and the AstroVision GSO satellites.<sup>20</sup> Therefore, AstroVision asserts that "there will be only a very limited number of NGSO passes that present any risk of interference from the AstroVision system."<sup>21</sup> In response to EarthWatch's suggestion that the Commission require AstroVision to switch off its satellites to accommodate other current and future EESS systems, AstroVision states that its system has been designed to communicate with alternate earth stations in the event harmful interference occurs or other operational anomalies require it to do so. AstroVision further asserts that the spatial diversity technique used by its system makes the need to switch off a downlink exceptionally improbable since the satellite will be using a single beam for its downlink rather than multiple beams.<sup>22</sup>

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<sup>13</sup> EarthWatch's Comment at 2.

<sup>14</sup> *Id.* at 2

<sup>15</sup> *Id.* at 3

<sup>16</sup> AstroVision's Replied Comments at 1.

<sup>17</sup> Appendix of AstroVision's Application.

<sup>18</sup> Spatial diversity is the ability of a system to communicate with alternative earth stations in the event interference or other operational anomalies so requires. AstroVision Reply Comment at 3.

<sup>19</sup> *Id.* at 3.

<sup>20</sup> *Id.*

<sup>21</sup> *Id.* at 3-4.

<sup>22</sup> *Id.* at 4 and AstroVision's Application.

## **A. Coordination with NGSO EESS systems**

8. In order to address concerns about interference to EarthWatch and other EESS licensees, AstroVision submitted a detailed analysis that provides assurance that it will protect existing EESS licensees from interference.<sup>23</sup> AstroVision asserts that the level of interference from the closest AstroVision satellite to co-located NGSO EESS earth stations is more than 10 dB below the permissible interference margin of the hypothetical NGSO EESS system design that was used for the analysis.<sup>24</sup> In fact, the analysis appears to demonstrate that in the case of co-located ground stations, the worst-case interference model is for interference from NGSO EESS satellite systems into AstroVision earth stations, not AstroVision's satellites into NGSO EESS earth stations. Even in the worst-case interference scenario, there is little likelihood of harmful interference being caused by AstroVision. To the extent AstroVision may receive interference from EarthWatch, AstroVision states that it is "prepared to coordinate and resolve the potential interference issue, relying if necessary, on spatial diversity."<sup>25</sup> EarthWatch did not offer any response to AstroVision's assertions.

9. In any case, we expect the licensees to resolve any potential interference problems through private coordination efforts. The Commission expects licensees to act in good faith during any necessary coordination discussions. Licensees must also avoid causing unacceptable interference to other licensees.<sup>26</sup> Moreover, at this time, we find no benefit in imposing a specific requirement on AstroVision that is different from EarthWatch or other EESS licensees with regard to future NGSO EESS or other operations in these frequency bands at issue here. Therefore, we decline to impose any specific coordination conditions on AstroVision's application, as requested by EarthWatch.

## **B. Other Coordination Issues**

10. AstroVision proposes to use the 8025-8400 MHz frequency band to transmit data collected from its satellites for transmission to its receiving earth stations located in the United States. In the U.S. Table of Frequency Allocations, the 8025-8400 MHz frequency band is allocated by footnote to non-government EESS<sup>27</sup> on a primary basis<sup>28</sup> subject to case-by-case interference analysis with government

<sup>23</sup> AstroVision in its analysis, in the case of earth station co-location, assumes the following: (1) the transmit EIRP for an NGSO EESS system is 26.4 dB; (2) the altitude of an NGSO EESS satellite is 814.79 Km; (3) no cross-polarization isolation; and (4) no antenna pointing losses.

<sup>24</sup> *Id.* at 6.

<sup>25</sup> AstroVision Reply at 6.

<sup>26</sup> *See, e.g.*, Section 25.274 of the Rules, 47 C.F.R. § 25.274.

<sup>27</sup> Remote sensing systems are intended to operate in the EESS allocation. EESS is defined as "[a] radiocommunication service between earth stations and one or more space stations, which may include links between space stations in which: (1) information relating to the characteristics of the Earth and its natural phenomena is obtained from active or passive sensors on earth satellites; (2) similar information is collected from air-borne or earth-based platforms; (3) such information may be distributed to earth stations within the system concerned; and (4) platform interrogation may be included." 47 C.F.R. § 2.106.

<sup>28</sup> Services allocated on a co-primary basis have equal rights to operate in a particular frequency band. Stations operating in primary services can claim protection from harmful interference from stations in secondary services. Moreover, stations operating in a secondary service allocation cannot cause harmful interference to, nor claim protection from, harmful interference from stations of a primary service. 47 C.F.R. §§ 2.104(d) and 2.105(c).

facilities operating in the band.<sup>29</sup> Because AstroVision's system will be using the 8025-8400 MHz frequency band continuously for data downlink, AstroVision is required to coordinate in good faith with all other licensed systems currently operating in this band and to accommodate future systems.

11. AstroVision proposes to use the 2025-2110 MHz band for TT&C functions. In the U.S. Table of Frequency Allocations, this band is allocated by footnote US90 to authorized non-government systems operating in the EESS for earth-to-space transmission, subject to any conditions that may be applied on a case-by-case basis.<sup>30</sup> As required by the Table of Frequency Allocations, non-government EESS earth-to-space transmissions can not cause harmful interference to other non-government radio stations.<sup>31</sup> Therefore, use of the 2025-2110 MHz frequency band for uplink TT&C by AstroVision, will be on a non-harmful interference basis with respect to all other systems operating on a primary or secondary basis in accordance with the U.S. Table of Frequency Allocations. AstroVision will also be required to accept any interference to its system that is caused by any primary or secondary allocated services. We anticipate, however, that AstroVision will be able to coordinate its uplink TT&C operations with existing users in the band so as not to cause harmful interference. Nevertheless, AstroVision will need to demonstrate in its Earth station application how it plans to operate in order to protect users in the primary and secondary services, operating on these proposed TT&C uplink frequencies.

12. In addition, AstroVision will be required, as a U.S. licensee, to complete the appropriate advance publication, coordination and notification procedures as prescribed by the International Telecommunication Union's Radio Regulations. AstroVision will also be required to provide the Commission with all information necessary to accomplish international advance publication, coordination and notification of its satellite system.

### **C. Qualification Requirements**

13. We find that AstroVision is qualified to be a licensee in the EESS service. The Commission has a statutory obligation to ensure that an applicant is qualified before granting a space station license.<sup>32</sup> To satisfy this obligation, the Commission may prescribe qualifications, including those relating to technical and financial ability. In the satellite area, these requirements have traditionally been formulated to reflect special characteristics of a particular service.<sup>33</sup>

14. AstroVision appears technically qualified to hold a license. When possible, we prefer to leave matters of spacecraft design decisions to the space station licensees because the licensees are in a better position to determine how to tailor their systems to meet the particular needs of their customer base. If a proposal appears technically sufficient and will permit additional entrants, we generally authorize the

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<sup>29</sup> See 47 C.F.R. § 2.106, US Footnote 258.

<sup>30</sup> 47 C.F.R. § 2.106, US Footnote 90.

<sup>31</sup> 47 C.F.R. § 2.106.

<sup>32</sup> 47 U.S.C. § 308(b).

<sup>33</sup> See, e.g., Second Report and Order in Gen. Docket No. 84-1234, 2 F.C.C. Rcd. 485, 488 (1987).

system if it is otherwise in the public interest.<sup>34</sup> AstroVision's proposed system appears to be technically sufficient and its operation will not preclude other commercial remote sensing systems. AstroVision has demonstrated sufficient use of spatial diversity techniques that will maximize the potential for entry by new remote-sensing systems. Moreover, it may be possible for other remote-sensing systems to share frequencies with AstroVision by coordinating their operating parameters and the location of earth stations.

15. Financial qualifications applied to applicants in a particular satellite service reflect the specific characteristics of that service. Historically, the Commission has fashioned financial requirements on the basis of the entry opportunities in the service being licensed. Where a grant to one applicant will not prevent another applicant from going forward, the requirement for a financial demonstration may be waived. For example, in the radiodetermination satellite service, where all applicants could be accommodated with our mandated system architecture and future entry was possible, the commission only required that applicants submit a detailed business plan.<sup>35</sup> Further, the Commission has waived the fixed-satellite service financial requirement of demonstrating full, irrevocable financing when additional entry is possible. Here, grant of a license to AstroVision will not prevent others from pursuing and implementing competing remote-sensing satellite systems. Given the entry opportunities, we do not find it necessary to hold AstroVision to any particular financial standard at this time. This result is consistent with the conclusions reached in the licensing of other EESS applicants, EarthWatch and Space Imaging.<sup>36</sup> To ensure that AstroVision implements its system in a timely fashion and does not impede entry by delaying deployment of its system, we will require AstroVision to adhere to the satellite implementation milestones set forth in this *Order and Authorization* and to file annual reports to the Commission regarding the status of spacecraft construction. We expect that AstroVision will be able to achieve these milestones because these milestones reflect the projections in AstroVision's application.<sup>37</sup>

#### **D. Regulatory Treatment**

16. Section 332(c)(5) of the Communication Act, as amended, states that "nothing in this section shall prohibit the Commission from continuing to determine whether the provision of space segment capacity . . . shall be treated as common carriage."<sup>38</sup> Pursuant to this authority, we grant AstroVision's request that it be regulated as a non-common carrier. According to its application, AstroVision will not be providing communication services to any other party on a common carrier basis. All communications to and from the AstroVision's satellites will be for the internal and exclusive use of AstroVision, in conjunction with AstroVision's U.S. commercial remote sensing business. Because AstroVision is not providing any service from the AstroVision system directly to end users, we grant AstroVision's request to operate as a non-common carrier.

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<sup>34</sup> See, e.g., Amendment of the Commission's Rule to Establish Rules and Policies Pertaining to a Non-Voice, Non-Geostationary Mobile-Satellite Service, 8 F.C.C. Rcd. 8450 (1993).

<sup>35</sup> Amendment of the Commission's Rule to Allocate Spectrum for, and to Establish Other Rules and Policies Pertaining to, a Radiodetermination Satellite Service, 104 F.C.C.2d 650 (1986).

<sup>36</sup> See EarthWatch Incorporated DA 95-1707 (August 1, 1995), and Space Imaging L.P. DA 95-1849 (August 23, 1995)

<sup>37</sup> AstroVision application at 39.

<sup>38</sup> 47 U.S.C. § 332 (c)(5).

#### IV. CONCLUSION

17. We find that AstroVision is qualified to hold a space station license in the Earth exploration-satellite service and that grant of its application will serve the public interest, convenience, and necessity. Authorizing AstroVision to launch and operate two remote-sensing geostationary space stations will encourage the development of space and ground station technology in the Earth exploration-satellite service, which will result in the development of new markets and services in the remote-sensing satellite industry.

#### V. ORDERING CLAUSES

18. Accordingly, IT IS ORDERED that, pursuant to Section 0.261 of the Commission's rules, Application File Nos. SAT-LOA-20000518-00090/91 IS GRANTED and AstroVision ARE AUTHORIZED to construct, launch, and operate two geostationary satellite orbit space stations in accordance with the technical parameters set forth in its applications.

19. IT IS FURTHER ORDERED that, unless extended by the Commission for good cause shown, this authorization shall become null and void without the need for any further Commission action in the event the space stations are not constructed, launched and successfully placed into operation in accordance with the technical parameters and terms and conditions of the authorization by the following dates:

	<u>Commence Construction</u>	<u>Complete Construction</u>	<u>Launch</u>
First Satellite	March 2001	June 2003	September 2003
Second Satellite	December 2003	June 2004	December 2004

20. IT IS FURTHER ORDERED that AstroVision shall, within 10 days after a required implementation milestone as specified in this license, certify to the Commission by affidavit that the milestone has been met or notify the Commission by letter that it has not been met. At its discretion, the Commission may require the submission of additional information (supported by affidavit of a person or persons with knowledge thereof) to demonstrate that the milestone has been met.

21. IT IS FURTHER ORDERED that the license term for each space stations is ten years and will commence on the date the licensee certifies to the Commission that the satellite has been successfully placed into orbit and the operations fully conform to the terms and conditions of this authorization.

22. IT IS FURTHER ORDERED that this authorization nor any right granted by this authorization, shall be transferred, assigned or disposed of in any manner, voluntarily or involuntarily, or by transfer of control of any corporation holding this authorization, to any person except upon application to the Commission and upon a finding by the Commission that the public interest, convenience and necessity will be served thereby.

23. IT IS FURTHER ORDERED that any use of the 2025-2110 MHz band by AstroVision, must be on a non-harmful interference basis to all other systems operating under a primary or secondary status in accordance with the Table of Frequency Allocations. In addition, as a non-conforming user, AstroVision will be required to accept any interference to its system that is caused by any of these allocated services.



24. IT IS FURTHER ORDERED that AstroVision, as required by Section 25.211 of the Commission's Rules, 47 C.F.R. § 25.211, to prepare any necessary submissions to the International Telecommunication Union (ITU) for advance publication, coordination and notification of its space stations in accordance with the ITU Radio Regulations. AstroVision will also be required to make any payment directly to the ITU or thru the Commission for any cost associated with any ITU filings.

25. IT IS FURTHER ORDERED that AstroVision is afforded thirty days from the date of release of this Order and Authorization to decline this authorization as conditioned. Failure to respond within that period will constitute formal acceptance of the authorization as conditioned.

26. IT IS FURTHER ORDERED that this Order and Authorization is effective upon release.

FEDERAL COMMUNICATIONS COMMISSION

Donald Abelson  
Chief, International Bureau