

Remote Sensing License Tiering

Q1 2024

Per 15 C.F.R. § 960.6, the National Oceanic and Atmospheric Administration (NOAA) Commercial Remote Sensing Regulatory Affairs (CRSRA) categorizes each private space-based remote sensing system it licenses based on an analysis of whether the system produces or is capable of producing unenhanced data already available from other entities.

- A system with the capability to collect unenhanced data substantially the same as unenhanced data already available from entities or individuals not licensed under this part, such as foreign entities, is categorized as Tier 1;
- A system with the capability to collect unenhanced data substantially the same as unenhanced data already available, but only from entities or individuals licensed by CRSRA, is categorized as Tier 2; and
- A system with the capability to collect unenhanced data not substantially the same as unenhanced data already available from any domestic or foreign entity or individual is categorized as Tier 3.

Currently, CRSRA has:

- 73 Tier 1 licenses
- 1 Tier 2 license
- 20 Tier 3 licenses

When determining whether unenhanced data are substantially the same as other unenhanced data, factors include but are not limited to: spatial resolution, spectral bandwidth, number of imaging bands, temporal resolution, persistence of imaging, local time of imaging, geographic or other restrictions imposed by foreign governments, and all applicable technical system factors listed in Appendix A of 15 C.F.R. Part 960 and Part D of a NOAA license. The tables below outline certain foreign and United States civil systems and their known capabilities that make available the finest unenhanced data across various types of imagery. Therefore, CRSRA currently uses the below systems as a starting point to differentiate Tier 1 licenses from Tier 2 licenses for several common sensor types.

These parameters are derived exclusively from open-source research and reflect data that are *available*, as the term is defined at 15 C.F.R. § 960.4. In some cases, availability may be dependent upon a specific use of the data.

This information is provided as a reference for the public, and CRSRA intends to provide regular updates. However, CRSRA continually evaluates data availability from foreign and other CRSRA-licensed systems and uses that analysis, considering all applicable factors (not only those listed here), when categorizing any system.

Satellite or Constellation	Country	Resolution ¹ Spectral or Other Information
PANCHROMATIC (PAN)		
Pléiades Neo-3, -4	France	0.30 m
KOMPSAT-3A	S. Korea	0.55m ²
SuperView NEO-1	China	0.30 m ³
Jilin-1 panchromatic	China	0.30–0.8 m ⁴
MULTISPECTRAL (MSI)		
Aleph-1	BVI/ Argentina	0.70 m 4 bands between 400–900 nm ⁵
Pleaidés Neo-3, -4	France	1.2 m 6 Bands between 400–880 nm
Superview-1	China	2.0 m ⁶ 4 bands between 450–890 nm
Jilin-1 DailyVision	China	3.0 m 4 bands (Blue, Green, Red, Near Infrared)
COLOR and VIDEO		
Zhuhai-1 OVS-2, 3	China	0.9 m (video)
Jilin-1 Video	China	0.92 m (RGB color video)
CE-SAT-I	Japan	1.0 m (color)

¹ Resolution types listed in this column refer to spatial resolution, measured in centimeters (cm) or meters (m), spectral resolution, measured in nanometers (nm), and/or thermal accuracy or resolution, and measured in Kelvin (K). As other types of resolution become relevant to the listed capabilities, they will be added to this column.

² Source: Remote Sensing journal posted on Apollo Mapping website. Retrieved: 2 December 2023, https://apollomapping.com/image_downloads/20180502_Updated_Radiometric_Characteristics_K3_K3A.pdf

³ Superview NEO-1 images include red, green, blue and near-infrared bands for multispectral analysis. The two satellites can be advertised to be able to collect 1.5-million square kilometers of 30-cm imagery a day. Source: Apollo Mapping. Retrieved: 30 November 2023. [Buy 30-cm SuperView NEO-1 Satellite Imagery - Apollo Mapping](#)

⁴ Revisit rates vary. Source: <https://www.head-aerospace.eu/eo-satellites>. Retrieved 16 June 2023.

⁵ Satellogic Super Resolution Imagery Data Sheet November 2023. Source: <https://satellogic.com/wp-content/uploads/2022/03/Satellogic-Super-Resolution-Imagery-Data-Sheet-November-2023.pdf>. Retrieved: 2 December 2023.

⁶ Source: <https://www.spacewillinfo.com/SuperView-1English/index.html>. Retrieved: 15 December 2023.

Satellite or Constellation	Country	Details ⁷
HYPERSPECTRAL (HSI)		
GHGSat ⁸	Canada	Spatial resolution (m): 25 m ⁹ Spectral bands: number unknown, VIS, NIR, SWIR 1600-1700 Bandwidth FWHM (nm): unknown ¹⁰
Shakuntala/TD-2 ¹¹	India	Spatial resolution (m): 10 m Spectral bands: >150 bands, 470–900 nm Bandwidth FWHM (nm): varies
Zhuhai-1 Orbita OHS-2, 3	China	Spatial resolution (m): 10 Spectral bands: 32 bands, 400–1000 nm Bandwidth FWHM (nm): 2.5–15 ^{12,13,14}
CHRIS (Compact High-Resolution Imaging Spectrometer) PROBA-1	ESA	Spatial resolution (m): 17 m or 34 m Spectral bands: 200 bands, 415–1050 nm ¹⁵ Bandwidth FWHM (nm): 1.25@400 nm, 11 @1050 nm
Aleph-1	BVI/ Argentina	Spatial resolution (m): 25 ¹⁶ Spectral bands: 600 bands, 430–830 nm ¹⁷ Bandwidth FWHM (nm): 5 ¹⁸
ENMAP	Germany	Spatial resolution (m): 30 Spectral bands: VNIR: 96 bands, 400-1030 nm SWIR: 136 bands, 950–2450 nm Bandwidth FWHM (nm): VNIR 6.5, SWIR 10
HISUI (Hyperspectral Imager Suite)	Japan	Spatial resolution (m): 20 x 30 Spectral bands: 185 bands, 400–2500 nm Bandwidth FWHM (nm): VNIR: 10, SWIR: 12.5

⁷ Resolution types listed in this column refer to spatial resolution, measured in centimeters (cm) or meters (m), spectral resolution, measured in nanometers (nm), and/or thermal accuracy or resolution, and measured in Kelvin (K). As other types of resolution become relevant to the listed capabilities, they will be added to this column.

⁸ Imagery and data collected in a narrow band of the short-wave infrared region of the electromagnetic spectrum. Source: The European Space Agency. Retrieved: 4 December 2023. [GHGSat Overview - Earth Online \(esa.int\)](https://earth.esa.int/eogateway/instruments/ghgsat)

⁹ Source: The European Space Agency. Retrieved: 5 December 2023. [GHGSat - Earth Online \(esa.int\)](https://earth.esa.int/eogateway/instruments/ghgsat)

¹⁰ Source: The European Space Agency. Retrieved: 5 December 2023. [GHGSat - Earth Online \(esa.int\)](https://earth.esa.int/eogateway/instruments/ghgsat)

¹¹ CRSRA notes that Shakuntala is no longer on orbit and is not considered readily or consistently available for uses requiring tasking.

¹² Full Width Half Maximum (FWHM)

¹³ HSI spectral resolution range varies across spectral coverage and from satellite to satellite. Sources: Apollo Mapping, Zhuhai Orbita. Retrieved 16 June 2023.

¹⁴ Minimum operator specified spectral resolution. Source: OBTDATA. Retrieved 16 June 2023.

<https://www.obtdata.com/en/zhuhai1.html>

¹⁵ CHRIS is capable of producing (filtering) up to 200 spectral bands but is constrained to acquiring just 19 bands at a time. The CCD offers the following abilities: (1) increase spectral bandwidth by summing sets of row-signals in the shift register before read-out, (2) bin pairs at the output port to increase across-track spatial resolution by a factor 2, and (3) to restrict images to half swath widths to increase the number of spectral bands that can be read out. Source:

<https://earth.esa.int/eogateway/instruments/chris/description>

¹⁶ Source: The European Space Agency. Retrieved: 6 December 2023. [NewSat \(Aleph-1 Constellation\) - eoPortal](https://earth.esa.int/eogateway/instruments/aleph1)

¹⁷ Source: The European Space Agency. Retrieved: 6 December 2023. [NewSat \(Aleph-1 Constellation\) - eoPortal](https://earth.esa.int/eogateway/instruments/aleph1)

¹⁸ Source: The European Space Agency. Retrieved: 6 December 2023. [NewSat \(Aleph-1 Constellation\) - eoPortal](https://earth.esa.int/eogateway/instruments/aleph1)

DESI ¹⁹	United States/Germany	24 m (spatial) 235 bands between 400-1000 nm 2.55 nm FWHM (spectral bandwidth)
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¹⁹ Alonso, K., et al., 2019, "Data Products, Quality and Validation of the DLR Earth Sensing Imaging Spectrometer (DESI)," *Sensors*, 19(20), 4471. <https://doi.org/10.3390/s19204471>.

Satellite or Constellation	Country	Resolution ²⁰ Spectral or Other Information
ULTRAVIOLET (UV) 280–400 nm²¹		
Sentinel-5P Tropomi	European Space Agency	7 kilometers (km) 270–320 nm
SHORT WAVE INFRARED (SWIR) 1200–3000 nm		
Sentinel-2A, 2B	European Space Agency	20 m • 2 bands centered at 1610 nm (91 nm spectral bandwidth) and 2185 nm (175 nm spectral bandwidth) 60 m • 1 band centered at ~1375 nm (30 nm spectral bandwidth)
ENMAP	Germany	30 m 136 bands between 950–2450 nm 10 nm FWHM
MID-WAVE INFRARED (MWIR) 3000–8000 nm		
NASA CTI ^{22,23}	United States	80 m 1 band between 3300–5400 nm

²⁰ Resolution types listed in this column refer to spatial resolution, measured in centimeters (cm) or meters (m), spectral resolution, measured in nanometers (nm), and/or thermal accuracy or resolution, and measured in Kelvin (K). As other types of resolution become relevant to the listed capabilities, they will be added to this column.

²¹ This table is limited to sensors that detect light in the UV-A and UV-B wavelengths as shorter UV wavelengths are fully attenuated by the atmosphere.

²² S. Korea's KOMPSAT-3A satellite collects 5.5 m MWIR data which is not commercially distributed. 21 Compact Thermal Imager (CTI), NASA. ISS mission 2019-2020. This is a USG system not licensed by NOAA. Sources: <https://earthobservatory.nasa.gov/images/146547/taking-temperatures-from-iss>, <https://altirs.gsfc.nasa.gov/cti.html> (Site viewed on 2 September 2021)

²³ CTI has collected over 10 million images of the earth with 80-meter spatial resolution, in continuous snapshot mode (1 image/sec), alternating bands (MWIR/LWIR). "QWIPs, SLS, Landsat and the International Space Station", M. Jhabvala NASA Goddard Space Flight Center et al. Retrieved 3 September 2021: <https://ntrs.nasa.gov/api/citations/20190033892/downloads/20190033892.pdf>

Satellite or Constellation	Country	Resolution ²⁴ Spectral or Other Information
LONG WAVE INFRARED (LWIR) 8000–14000 nm		
Aleph-1	BVI/ Argentina	90 m 1 band between 8000–14000 nm
CBERS-4 IRMSS ^{25,26}	China / Brazil	80 m 1 band between 10400–12500 nm
Landsat 7 ETM+ ²⁷	United States	60 m 1 band between 10400–12500 nm
NASA ECOSTRESS ²⁸	United States	69 x 38 m 3 bands between 8500–12500 nm Center frequencies: 8800 nm, 10500 nm, 12100 nm 31-61 nm FWHM
NIGHT-TIME IMAGING (NTI)		
EROS B	Israel	0.70 m PAN: 500–900 nm
Jilin-1 SP03-8	China	0.92 m ²⁹ Blue: 437–512 nm, Green: 489–585 nm, Red: 580–723 nm ³⁰
NON-EARTH IMAGING (NEI)		
HEO Robotics	Australia	400–1000 nm

²⁴ Resolution types listed in this column refer to spatial resolution, measured in centimeters (cm) or meters (m), spectral resolution, measured in nanometers (nm), and/or thermal accuracy or resolution, and measured in Kelvin (K). As other types of resolution become relevant to the listed capabilities, they will be added to this column.

²⁵ Source: 2020 Joint Agency Commercial Imagery Evaluation—Remote Sensing Satellite Compendium. Retrieved: 16 June 2023. <https://pubs.usgs.gov/circ/1468/cir1468.pdf>

²⁶ The HuanJing-2B (HJ-2B) IRMSS-2 CRESDA sensor program acquires MWIR/LWIR data at 48/40 meters spatial resolution but has not made this data available. Source: SpaceWill. Retrieved: 16 June 2023. en.spacewillinfo.com.

²⁷ National Aeronautics and Space Administration, Landsat Science, “Enhanced Thematic Mapper Plus (ETM+).” Retrieved: 29 January, 2024. <https://landsat.gsfc.nasa.gov/etm-plus/>.

²⁸ NASA ECOSTRESS, “Instrument.” Retrieved: 29 January, 2023. <https://ecostress.jpl.nasa.gov/instrument>.

²⁹ Source: Apollo Mapping. Retrieved: 16 November 2023. <https://apollomapping.com/jilin-1-nighttime-satellite-imagery>.

³⁰ Source: Apollo Mapping. Retrieved: 16 November 2023. <https://apollomapping.com/jilin-1-nighttime-satellite-imagery>.

Satellite or Constellation	Country	Information Density	Slant Range, Azimuth Resolution ³¹
SYNTHETIC APERTURE RADAR (SAR)³²			
X-Band (9.2–10.4 GHz)			
ICEYE 600 Mhz for 3rd generation ³³	Finland	230 bits/m ²	0.5 m, 0.05 m
TerraSAR/ TanDEM/PAZ	Germany/ Spain	39 bits/m ²	0.5 m, 0.25 m
COSMO SkyMED 2 nd Generation (CSG) ³⁴	Italy	59 bits/m ²	0.17 m, 0.3 m
C-Band (5.25–5.57 GHz)			
Tianxian ^{35,36} (Chaohu-1)	China	8.39 bits/m ²	1.0 m, 0.5 m
Gaofen-3 ³⁷	China	6.1 bits/m ²	0.9 m, 1.0 m
L-Band (1.215–1.30 GHz)			
ALOS-2 ³⁸	Japan	2.7 bits/m ²	1.8 m, 1.0 m

³¹ Slant range and azimuth resolution figures provided for reference only.

³² The SAR primary performance characterization metric has been changed from ground range detected (GRD) square pixel resolution to Information density C (bits/m²) as defined by the Radar General Image Quality Equation (RGIQE) = $\beta \cdot \text{LOG}(1 + \text{SNR})$ where β = bandwidth per unit area on the ground at lowest acceptable grazing angle ($\beta = \text{SQ RT}(\beta_{\text{Range}} * \beta_{\text{Azimuth}})$), SNR = the signal-to-noise ratio = $1/(\text{Noise Equivalent Sigma Zero (NESZ)})$ with MNR = 0 (1 dB). Results are considered comparable if they are within 25%. Slant range resolution provided for reference only and may not represent best resolution as in some cases azimuth resolution may be superior.

³³ Source: European Space Agency. Retrieved: 8 December 2023. <https://earth.esa.int/eogateway/missions/iceye>

³⁴ Published CSK/CSG commercially available resolution statistics: e-geos Price List February 22, 2021 (Page 6).

³⁵ “Chinese partnership to create Tianxian SAR satellite constellation”, Andrew Jones, SpaceNews, 8 October, 2021.

<https://spacenews.com/chinese-partnership-to-create-tianxian-sar-satellite-constellation/>

³⁶ The Hisea-1 Tianxian concept demonstrator has 1 meter spatial resolution, while the newer Chaohu-1 has 0.5 meter resolution.

Source: Earth Observation Satellites Technical Specifications (Brochure), HEAD Aerospace. Retrieved: 22 December 2022.

<https://fsqatar.com/wp-content/uploads/2020/05/HEAD-EO-Technical-Brochure-2020-digital.pdf>

³⁷ Data disseminated through HEAD Aerospace: Resolution is 0.9 x 1.0 m. Source: Head Aerospace EU. Retrieve: 15 June 2023.

<https://head-aerospace.eu/eo-satellites>.

³⁸ Source: Advanced Land Observing Satellite-2. Retrieved: 16 June 2023. [ALOS-2 - Satellite Missions - eoPortal Directory \(esa.int\)](https://www.esa.int/esa.int)

Satellite or Constellation	Country	Resolution (type) ³⁹ Spectral or Other Information
LIDAR		
NASA ICESAT-2 ⁴⁰	United States	13 m footprint 532 nm

³⁹ Resolution types listed in this column refer to spatial resolution, measured in meters (m), spectral resolution, measured in nanometers (nm), thermal accuracy or resolution, and measured in Kelvin (K). As other types of resolution become relevant to the listed capabilities, they will be added to this column.

⁴⁰ National Aeronautics and Space Administration, Icesat-2, "Technical Specs." Retrieved: 29 January, 2024. <https://icesat-2.gsfc.nasa.gov/science/specs>.

Change Log

Publication Date	Page	Description of Change
Q4 2023	1	Updated number of licensed systems in each tier.
	2	Updated KOMPSAT-3A resolution and other information.
	2	Replaced SuperView with SuperView NEO-1.
	2	Replaced Jilin-1 Optical VHR with Jilin-1 Panchromatic.
	2	Updated Aleph-1 resolution or other information.
	2	Replaced Jilin-1 GP-1/02 with Jilin-1 DailyVision.
	3	Added GHGSat.
	3	Updated Shakuntala resolution or other information. Footnote added.
	3	Updated Aleph-1 resolution or other information.
	3	Re-added DESIS. This entry was formerly included as a “Best US” entry.
	5	Re-added NASA CTI. This entry was formerly included as a “Best US” entry.
	6	Re-added NASA ECOSTRESS. This entry was formerly included as a “Best US” entry.
	7	Updated information density associated with ICEYE based upon new reported resolutions and bandwidth.
	8	Re-added NASA ICESAT-2. This entry was formerly included as a “Best US” entry.
	2-8	Updated existing footnotes and added new footnotes to capture more timely, accurate, and accessible systems information
	2-8	Restructuring of resolution or other information column for presentation ease.
	All	Minor editorial revisions.