



**GEO**



36,000 km

**MEO**



5,000 to 20,000 km

**LEO**



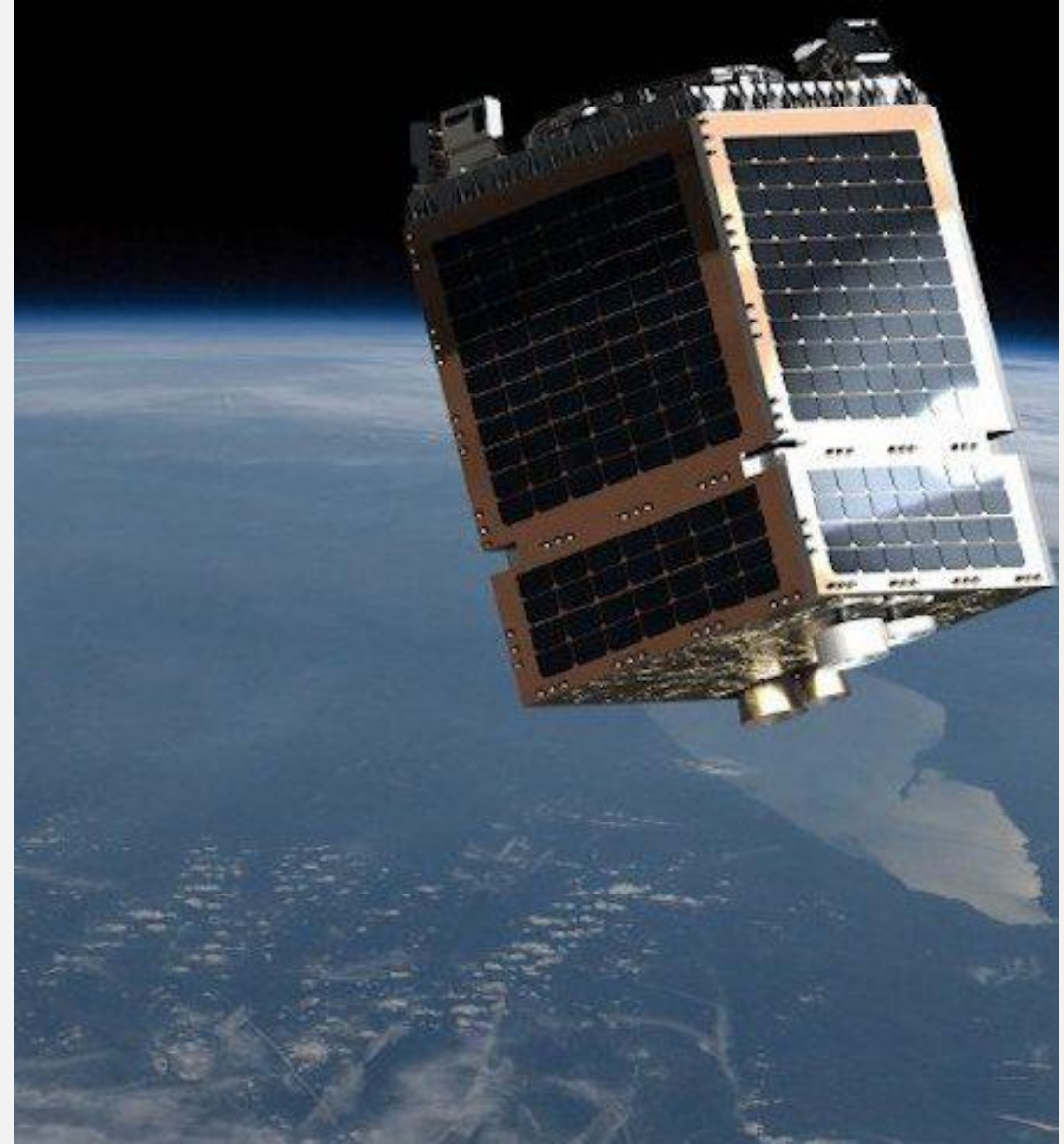
500 to 1,200 km



# Low Earth Orbit (LEO)



## Einführung



16.05.2024



# Low Earth Orbit (LEO)



## Inhalt

- Internationale Raumstation ISS
- LEO-Satelliten
- Satelliten-Tracking-Software
- Antennen-Technik
- Geräte-Technik



# Low Earth Orbit (LEO)



## Internationale Raumstation ISS





# Internationale Raumstation ISS



## ISS

- Umlaufbahnen in einer Höhe zwischen 370 und 460 km.
- Aufgrund der atmosphärischen Reibung fällt es kontinuierlich auf die Erde zu und erfordert regelmäßige Raketenschübe, um die Umlaufbahn wieder zu beschleunigen.
- Die Orbitalneigung der ISS beträgt  $51,6^\circ$ , sodass die ISS 90 % der bewohnten Erde überfliegen kann.





# Internationale Raumstation ISS



## ISS Amateur-Nutzlast

ISS Amateur Radio Frequencies	
<b>Mode V APRS (Worldwide APRS Digipeater) Most common operating mode.</b>	
Uplink	145.825 MHz FM 1200 BPS Packet
Downlink	145.825 MHz FM 1200 BPS Packet
<b>Mode U APRS (Worldwide APRS Digipeater) Rarely used.</b>	
Uplink	437.550 MHz FM 1200 BPS Packet
Downlink	437.550 MHz FM 1200 BPS Packet
<b>Mode V/V Crew Contact (Regions 2 &amp; 3) Rarely used.</b>	
Uplink	144.490 MHz FM
Downlink	145.800 MHz FM
<b>Mode V/V Crew Contact (Region 1) Rarely used.</b>	
Uplink	145.200 MHz FM
Downlink	145.800 MHz FM
<b>Mode V/U FM Voice Repeater Worldwide</b>	
Uplink	145.990 MHz FM
Downlink	437.800 MHz FM
<b>Mode V SSTV Imaging Ocassionally used.</b>	
Downlink	145.800 MHz FM

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## ISS Ham Radio Status

Here's the latest as of Sunday 12-May-2024

### Columbus Module

Currently configured as the Crossband Repeater  
Downlink: 437.800 MHz  
Uplink: 145.990 MHz - PL 67 Hz

### Service Module

Currently configured for packet operations (APRS) on 145.825 MHz  
SSTV radio is currently stowed.

### Next Planned Events

Visit ARISS at Dayton Hamvention - May 17 - 19  
Visit ARISS at American Rocketry Challenge - May 18  
Radio outage for Progress Undocking - May 28  
Radio outage for Progress Docking - June 1

HamTV currently stowed pending installation scheduling.  
Digital Amateur TV Downlink: 2395 MHz

Event timing subject to change

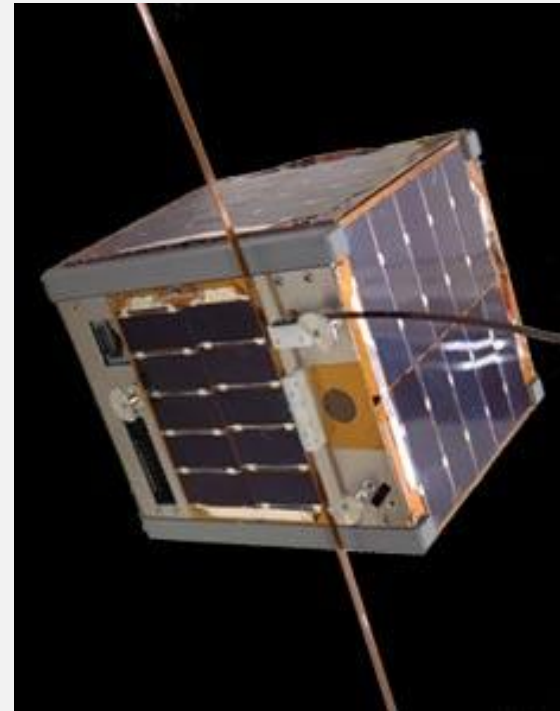




# Low Earth Orbit (LEO)



## LEO-Satelliten





# Low Earth Orbit (LEO)



## CUBE-SAT Simulator



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# LEO-Satelliten



## Zusammenfassung einiger FM-Satellitenfrequenzen

- PC  
<https://www.amsat.org/fm-satellite-frequency-summary/>
- Android/iPhone  
<https://issdetector.com/>
- Funkamateure Neue Satelliten  
[https://www.funkamateure.de/nachrichtendetails/items/satelliten\\_tevel\\_co.html#:~:text=Tevel%201%20%E2%80%93%208,Satelliten%20haben%20die%20gleichen%20Frequenzen](https://www.funkamateure.de/nachrichtendetails/items/satelliten_tevel_co.html#:~:text=Tevel%201%20%E2%80%93%208,Satelliten%20haben%20die%20gleichen%20Frequenzen)





# Low Earth Orbit (LEO)



## Satelliten-Tracking-Software

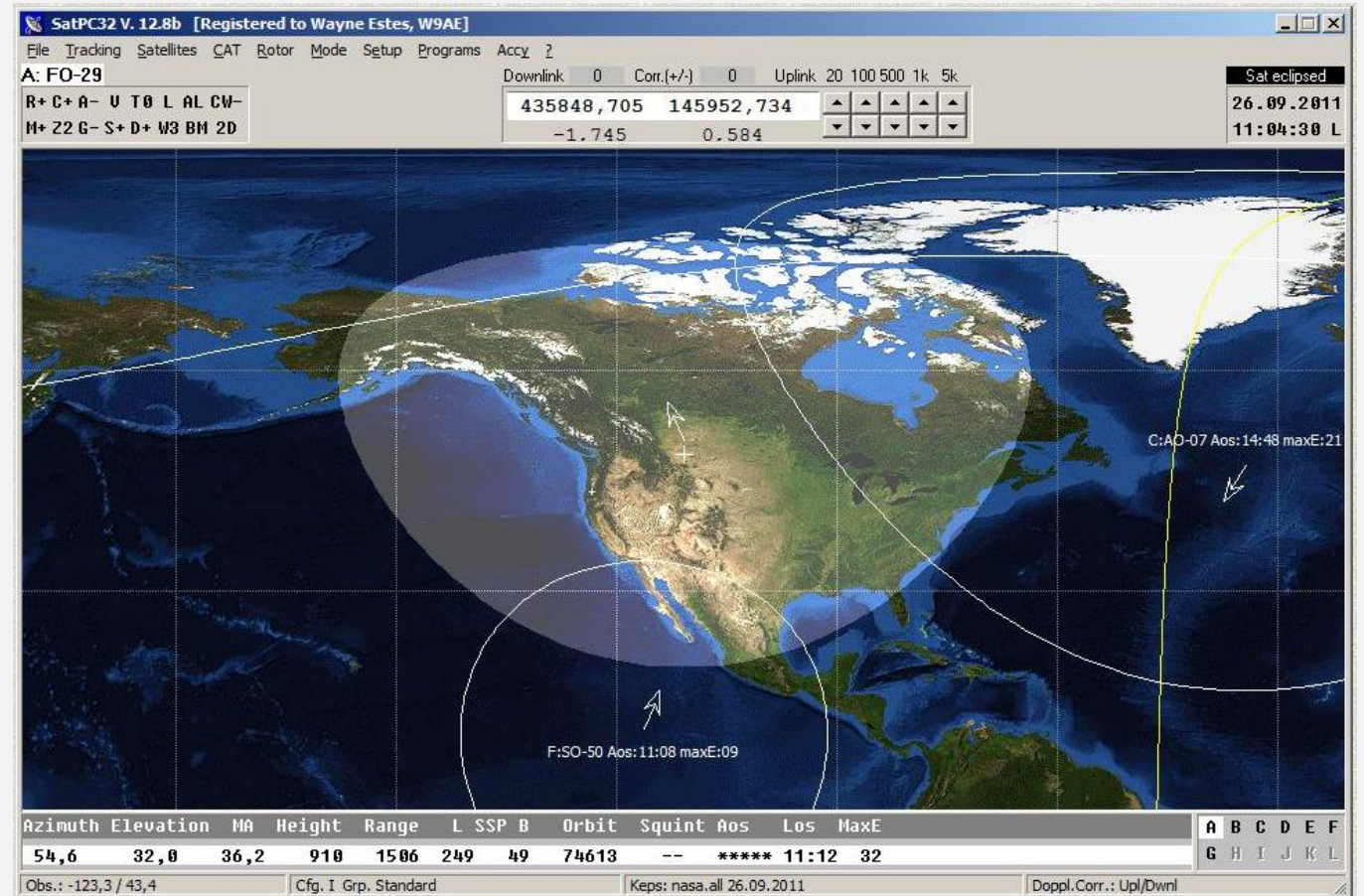


# Satelliten-Tracking-Software



## Software

<https://celestrak.org/software/satellite/sat-trak.php>





# Satelliten-Tracking-Software



## Software

<https://www.n2yo.com/>

The screenshot shows the N2YO.com website interface. At the top, it displays "Tracking 28849 objects as of 14-May-2024" and "HD Live streaming from Space Station". A search bar is present with the text "Find a satellite...". The main navigation bar includes "Home", "Most tracked", "Just launched", "Satellites on orbit", "Alerting tools", "More stuff", and "Sign in". The central part of the page features a world map with satellite orbits overlaid. To the right of the map is a detailed "SPACE STATION" data panel. Below the map, there are checkboxes for "Draw orbits", "Draw footprint", and "Keep selection centered", along with a "Large map" button. At the bottom, there is a featured article titled "HOW MANY SATELLITES CAN WE SAFELY FIT IN EARTH ORBIT?" and a "Partner links" section.

**SPACE STATION**

NORAD ID:	25544
LOCAL TIME:	12:23:37
UTC:	10:23:37
LATITUDE:	-1.18
LONGITUDE:	93.23
ALTITUDE [km]:	415.50
ALTITUDE [mi]:	258.18
SPEED [km/s]:	7.66
SPEED [mi/s]:	4.76
AZIMUTH:	100.5 E
ELEVATION:	-39
RIGHT ASCENSION:	10h 27m 43s
DECLINATION:	-35° 11' 14"
Local Sidereal Time:	02h 59m 53s

The satellite is in day light

SATELLITE PERIOD: 93m

10-DAY PREDICTIONS FOR SPACE STATION

Make A Donation

**Resources**

- [IP2Location IP Geolocation](#)
- [Find your Magnetic Declination](#)
- [Space Station HD Live!](#)
- [Last Minute Stuff!](#)

**Your current location**

Your IP address: **84.114.106.151**

Latitude: **48.20889°**

Longitude: **16.37208°**

Magnetic decl.: **5° 16' E**

Local time zone: **GMT+2**

Is this incorrect? [Set your custom location](#)

**Partner links**

**Live Meteors** - Listen to the sound of meteors as they hit the Earth [Learn more](#)

**HOW MANY SATELLITES CAN WE SAFELY FIT IN EARTH ORBIT?** - Experts have been sounding alarm bells for years that Earth orbit is getting a bit too crowded. So how many satellites can we actually launch to space before it gets to be too much?  
[Read article](#)






# Satelliten-Tracking-Software



<https://www.amsat.org/track/>



AMSAT Online Satellite Pass Predictions

PO Box 27  
Washington, DC 20044-0027  
1-888-322-6728

### AMSAT Online Satellite Pass Predictions

Please select a satellite and provide your latitude, longitude and elevation or calculate them from your grid square. If you choose we will save your position information in a cookie on your system for future predictions.

Show Predictions for:	ISS	for Next	10	Passes
Calculate Latitude and Longitude from Gridsquare:	<input type="text"/>	Calculate Position		
Or				
Enter Decimal Latitude:	<input type="text"/>	North		
Enter Decimal Longitude:	<input type="text"/>	West		
Elevation in meters AMSL:	<input type="text"/>			
Predict				
<input type="checkbox"/> Save my location for later use				

For the best in full featured tracking software visit [The AMSAT Store](#)

Based on the Predict engine, courtesy of John Magliacane, KD2BD  
2024 May 14 00:18:05 UTC


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[Report a bug on this page](#)



# Satelliten-Tracking-Software



<https://www.amsat.org/track/>



PO Box 27  
Washington, DC 20044-0027  
1-888-322-6728

**AMSAT Online Satellite Pass Predictions**

**AMSAT Online Satellite Pass Predictions - Tevel-1**  
[View the current location of Tevel-1](#)

Date (UTC)	AOS (UTC)	Duration	AOS Azimuth	Maximum Elevation	Max El Azimuth	LOS Azimuth	LOS (UTC)
14 May 24	12:01:40	00:02:19	323	1	309	295	12:03:59
14 May 24	19:24:02	00:07:43	111	9	67	11	19:31:45
14 May 24	20:54:01	00:10:05	172	63	284	345	21:04:06
14 May 24	22:28:37	00:05:29	243	3	270	309	22:34:06
15 May 24	08:05:58	00:04:36	57	2	85	112	08:10:34
15 May 24	09:35:31	00:10:00	17	50	126	184	09:45:31
15 May 24	11:07:44	00:08:02	351	10	309	245	11:15:46
15 May 24	20:02:32	00:09:28	138	24	74	359	20:12:00
15 May 24	21:34:14	00:09:19	198	19	263	333	21:43:33
16 May 24	08:44:01	00:08:22	34	11	98	148	08:52:23

**This prediction should not be used for precise scientific analysis**  
Use the form below to request more pass predictions

Show Predictions for:  for Next  Passes

Calculate Latitude and Longitude from Gridsquare:

Or

Enter Decimal Latitude:

Enter Decimal Longitude:

Elevation in meters AMSL:

Save my location for later use



# Low Earth Orbit (LEO)



## Antennen-Technik



# Antennen-Technik







# Antennen-Technik



SAT-Antennenanlage

Bild: @OE6JWD



# Low Earth Orbit (LEO)



## Geräte-Technik



## Handfunkgerät

- Doppler-Effekt  
Die passende Frequenznachführung könnt ihr mit vorgespeicherten Kanälen erledigen.
- Link zu einer Doppler-Shift Demonstration  
<https://youtu.be/a3RfULw7aAY>
- Im Falle des ISS-Crossband-Repeater ist zusätzlich pro Empfangskanal ein passender Sendekanal zu speichern.  
**Achtung: mit steigender Empfangsfrequenz muss die Sendefrequenz kleiner werden.**





## Handfunkgerät

- Frequenztabelle für ISS-Crossband-Repeater

Speicherplatz	RX-Frequenz MHz	TX-Frequenz MHz	RX/TX Mode	CTCSS Hz
1	437.809.5	145.986.8	FM/FM	67
2	437.804.5	145.988.5	FM/FM	67
3	437.800.0	145.990.0	FM/FM	67
4	437.795.4	145.991.5	FM/FM	67
5	437.790.7	145.993.1	FM/FM	67

- Mit aktivierter AFC sollte die Anzahl der Plätze ausreichen. Der Speicherplatz #1 wird zu Beginn ausgewählt, um die ISS von SW her zu empfangen. Wenn die ISS genau über uns ist wird der Speicherplatz 3 ausgewählt und wenn die ISS nach NO zum Horizont verschwindet wird bis zum Platz #5 weiter gedreht.





# Low Earth Orbit (LEO)



## Literatur

- **lutz-electronics.ch**
  - <https://lutz-electronics.ch/amateurfunk/satellitenfunk/>
- **fading.de**
  - [https://www.fading.de/amateurfunk\\_betraege/betrieb\\_ueber\\_amateurfunksatelliten](https://www.fading.de/amateurfunk_betraege/betrieb_ueber_amateurfunksatelliten)
- **Wimo.de**
  - <https://www.wimo.com/de/zubehoer/geraetezubehoer/satellitenfunk#satellite-radio-bottom>



# Amateurfunk und Citizen Science

## Wir wollen es wissen! Wir alle sind Forschung!



- **IceBird-Talk**  
**ÖVSV Landesverbandes Wien**  
**Ing. Kurt Baumann, OE1KBC**
  - Unterstützung von Forschung und Entwicklung
  - Aus- und Weiterbildung im Funkwesen
  - Projekte planen und verwirklichen

<https://oe1.oevsv.at>

