**Kiruna Ground Station: Celebrating 30 years of space excellence**

September 2020 - ESA's Kiruna ground station in northern Sweden celebrates 30 years of space excellence. Near the top of the world, at a latitude of almost 68° north and sited 38 kilometres east of Kiruna town, the Kiruna ground station has been operational for 30 years. Ideally positioned to support polar-orbiting missions, the station is a crucial gateway for much of the data enabling us to study our planet's oceans, water and atmosphere, forecast weather and understand the rapid advance of climate change. With its two sophisticated antennas, it also supports some of ESA’s scientific missions such as Integral and Cluster. The station is part of ESA’s Estrack network linking all Agency missions to the ESOC mission control centre in Darmstadt, Germany.

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| Image | Text |
| 10:00:00:00 | **TITLE: Kiruna Ground Station: Celebrating 30 years of space excellence** |
| 10:00:10:00* Aerial. Kiruna Ground Station – Sweden – September 2020 – ESA
* Still. ESOC News September 1990 – ESA
* Still. Kiruna station Inauguration King Carl Gustaf XVI, Queen Sylvia and Björn Eriksson – September 2020 – ESA
* EXT. Kiruna Ground Station – Sweden – September 2020 – ESA
* INT. Kiruna Ground Station Powerplant – September 2020 – ESA (2shots)
* Aerial. Kiruna Ground Station – Sweden – September 2020 – ESA
* Still. Kiruna Reference Station – ESA
* Aerial. Kir-1 Antenna - Kiruna ground station – Sweden – September 2020 – ESA
* INT. Cleanroom ERS-1 – unknown date – ESA
* EXT. ERS-1 Launch, Kourou, French-Guiana – 1991 – ESA
* Animation: ERS in orbit – unknown date – ESA
* EXT. KIR-2 antenna – Kiruna ground station – Sweden - September 2020 – ESA
* Animation: Envistat in orbit – unknown date – ESA
* EXT. KIR-1 antenna – Kiruna ground station – Sweden - September 2020 – ESA
* Animation: Sentinel-1 in orbit – unknown date - ESA
* Animation: Sentinel-3 in orbit – unknown date - ESA
* Animation: Aeolus in orbit – 2016 - ESA
* Animation: Swarm in orbit – unknown date – ESA
* Animation: Cryosat-2 in orbit – unknown date – ESA
* INT. Cluster in Cleanroom – unknown date – ESA
* Animation: CHEOPS in orbit – 2018 – ESA
* Still: Integral in orbit – unknown date – ESA
 | **On the 6th of September 1990, King Carl Gustaf XVI of Sweden and ESA Director General Reimar Lüst inaugurated Kiruna Station. It consisted of a newly constructed station building, a primary and emergency power plant, roads, data cables, a calibration site and a single 15-metre dish antenna: Kiruna-1. The station was initially conceived for the support of the polar-orbiting ERS missions. ERS-1 launched in 1991, followed by a second satellite, ERS-2, which launched in 1995. In 2000, a second antenna, Kiruna-2, was constructed to support ESA’s Envisat misson, then the world's largest civilian Earth observation satellite. Today, Kiruna is supporting all of the Sentinel satellites flown by ESA as well as ESA’s Earth Explorer satellites Aeolus, Swarm and Cryosat-2 and the scientific missions Cluster, Cheops and ESA’s gamma ray observatory, Integral.** |
| 10:01:14:03* ITW. Luca Milani: Kiruna Station Engineer – ESOC, Darmstadt, Germany – September 2020 – ESA
 | **ITW Luca Milani: Kiruna station engineer, ESA**Kiruna station typically supports Earth observation missions. These missions normally describe polar orbits and polar orbits -- from the name itself -- orbits that are passing close to the poles, every orbit. The speed of Earth observation satellite is typically 7.5 kilometres per second, meaning like every 90-100 minutes, it will do a full revolution around the Earth. Kiruna, therefore, is located very far north, more than a hundred kilometres above the Arctic Circle. In order to provide support to these kind of missions, which are, which will have more occasions to communicate and to have passes in the North Pole with respect to another antenna that could be located, for instance, close to the equator.  |
|  10:02:10:20* EXT. Kiruna ground station – Sweden - Unknown date – ESA
* Animation: Enivsat passing Kiruna Ground Station – unknown date – ESA
* INT. Screens, Estrack Control Center – ESOC, Darmstadt, Germany – September 2020 – ESA (2 shots)
* Animation: Sentinel-5P – 2015 – ESA
* EXT. KIR-1 antenna – Kiruna ground station – Sweden - unknown date – ESA
* Animation: Cryosat-2 orbiting the planet – unknown date - ESA
* Still: Integral in orbit – unknown date – ESA
* Animation: Integral orbit– unknown date - ESA
* COMP. KIR-1 antenna – Kiruna ground station – Sweden - September 2020 – ESA + Downloading graphic - Videoblocks
 | **In a typical month, more than 750 hours of communication link-ups are made between Kiruna and passing satellites, up to 15 different spacecraft in all. This means the station is providing an average tracking support for over 25 hours each day with its two antennas.****For most Earth Observation satellites, these communication ‘passes’ are done in a very tight time window of 8 to 12 minutes, while the satellite is in direct line-of-sight view. For a scientific satellite, like Integral, a pass typically takes more than 50 hours.****These passes enable the station to download vital science data and telemetry and upload fresh commands for the coming orbits.**  |
| 10:02:55:13* ITW. Isabel Rojo: Spacecraft Operations Manager for SEOSat and EarthCARE – ESOC, Darmstadt, Germany – September 2020 – ESA
 | **ITW Isabel Rojo: Spacecraft Operations Manager for SEOSat and EarthCARE, ESA**There are two kinds of data that we collect. So the science data, so to speak, which often gets downloaded over Kiruna. It's saved there after the pass and it's transferred to whatever processing center we're working with, typically ESRIN. Then we also have the housekeeping telemetry, which is the telemetry which indicates the health status of the spacecraft, amongst many, many other things. And this one is also transferred usually after a pass off-line to our systems where we ingest it and process it. [36.8s |
| 10:03:32:24* Still. Map of the Estrack network – unknown – ESA
* EXT. ESA satellite dish – unknown location and date – ESA
* EXT. ESA satellite dish, Santa Maria Station – Unknown date – ESA
* Aerial. ESOC main building\_ Darmstadt, Germany – September 2020 – ESA
* INT. Estrack Control Center – ESOC, Darmstadt, Germany – September 2020 – ESA (2 shots)
* EXT. KIR-2 antenna maintenance – Kiruna ground station – Sweden - Unknown date – ESA
* INT. Kiruna Ground Station, server room – Sweden – September 2020 – ESA (2 shots)
* INT. Kiruna Ground Station, Control room – Sweden – September 2020 – ESA (2 shots)
* Animation: Sentinel-1 separation after launch – unknwon date – ESA
* INT. ESOC Mission Control Center – Darmstadt, Germany - September 2020 – ESA
* Animation: SEOSat in orbit – 2020 – ESA
* Animation: Sentinel-6 in orbit – September 2020 – ESA
* INT. OPS-SAT testing – unknown location – 2019 – ESA
* INT. OPS-SAT flatSat – ESOC, Darmstadt, Germany – 2019 – ESA
* Stock composition: Guy Using VR, woman on the phone + Overlay with globe and satellites – Videoblocks
* INT. Kiruna Ground Station, Control room – Sweden – September 2020 – ESA (2 shots)
* INT. SEOSAT-Ingenio in cleanroom, Airbus Defense & Space, Madrid, Spain – June 2020 – ESA
* Animation: Sentinel-1 orbiting the Globe + Videoblocks Overlay datatransfers – ESA + Videoblocks
 | **Kiruna is part of ESA’s Estrack network, which is a global system of ground stations linking European spacecraft with the Agency's ESOC mission control centre in Darmstadt, Germany. The Kiruna ground station is remotely operated from ESOC during routine operations, while the local maintenance and operations team takes care of day-to-day troubleshooting on site. This local team also provides support to spacecraft during critical phases, such as the hours immediately following launch. Kiruna’s ability to establish real-time contact with newly launched satellites is vitally important for mission controllers. In 2020, Kiruna will support the launches of Seosat and Sentinel-6A, European missions that will deliver critical data on land use and oceans.****As space technology develops further and space becomes increasingly important to daily life, Kiruna station will need to continuously evolve to support new missions and technologies, while the amount of data gathered by satellites grows exponentially.** |
| 10:04:40:09* ITW. Guillermo Lorenzo: Kiruna Ground Station – ESOC, Darmstadt, Germany – September 2020 – ESA
 | **ITW Guillermo Lorenzo: Kiruna Ground Station Manager, ESA**ESA aims at further evolving the station to keep on playing a fundamental role in the support of these missions during critical and routine phases, as well as to serve as a reference facility for the evaluation and troubleshooting of new technological developments. So 30 years have served to consolidate Kiruna as an Estrack reference station for the support of near earth communications. And solid foundations are laid to continue its expansion and development to the support of the missions to come. |
| 10:05:14:22* Aerial. Kiruna Ground Station – Sweden – September 2020 – ESA
* Animation: Sentinel-5P Flyby – 2015 – ESA
* Animation: Solar Orbiter – 2018 – ESA
* INT. Screens, Estrack Control Center – ESOC, Darmstadt, Germany – September 2020 – ESA
* Aerial. Kiruna Ground Station – Sweden – September 2020 – ESA
 | **Kiruna is a vital link between Earth and space. Today space technology is ever-present in our daily lives, and while we might often reflect on the importance of satellites orbiting our planet or spacecraft studying our cosmos, we should not forget the crucial ground stations like Kiruna, how they make space possible and how they help humanity move into the future.**  |
| **10:05:38:22** | **B-ROLL** |
| ITW. Luca Milani: Kiruna Station Engineer – ESOC, Darmstadt, Germany – September 2020 – ESA | **ITW Luca Milani: Kiruna station engineer, ESA – ENGLISH*** Kiruna station typically supports Earth observation missions. These kind of missions, is normally describing polar orbits and polar orbits from the name itself, orbits that are passing close to the poles, every orbit. The speed of Earth observation satellite is typically seven point five kilometres per second, meaning like every 90-100 minutes, it will do a full revolution around the earth. Kiruna, therefore, is located very far north, more than a hundred kilometres above the Arctic Circle. In order to provide support to these kind of missions, which are, which will have more occasions to communicate and to have passes in the North Pole with respect to another antenna that could be located, for instance, close to the equator.
* Kiruna is a reference station for Earth. Earth observation and near Earth missions of ESA, but not only as we often provide support also to external partners. The reason why Kiruna is kept there, the reason why Kiruna is existing is also to provide an asset for the agency for launch and early orbit supports by having inside the network an antenna which is ESA owned. Moreover, Kiruna, it is often the reference for new technologies related to Earth observation satellites, but not only as we often support and we routinely support science missions as well as integral, Cheops and some other missions.
* So in Kiruna, there is always a maintenance and operation team based onsite, which provides support for routine basically and for inspections. Routine inspections of the antenna to make sure that everything is working correctly. Of course, if a new mission is requesting support, starting from the requirements, we will need to adapt the Kiruna station in order to comply with the requirements set by the Mission. In case something is not available, some features are not available at this station, upgrades are performed. And these upgrades are centrally managed by ESOC. A team of engineers is going to Kiruna every time to support the upgrade, together with the local team and the antenna is then handed over to operations again, once the activities are completed. Of course, upgrades and maintenance also comprise obsolescence and activities that are required to keep the antenna in operations 24/7.
* Two antennas are installed in Kiruna-1, with a 15-metres dish and kiruna-2 with a 13 metres dish. Normally, Kiruna-1 is constantly supporting integral. Except for some hours during which it supports also polar missions. Integral is a highly elliptical orbit mission with passes which can reach 50 hours. So very long in time and the antenna is constantly occupied by this science mission. Kiruna-2 instead is used in a completely different way. Kiruna-2 is totally allocated to polar missions, meaning that it will support very short passes from eight to 15 minutes and configure continuously during the day in order to provide support to different missions. We have to, we have to mention that Cutrona is currently supporting up to fifteen satellites. This means that all the equipment is as much as possible generic in order to support and to be reconfigured depending on the mission and the requirements of the mission of interest.
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| 10:10:03:07ITW. Luca Milani: Kiruna Station Engineer – ESOC, Darmstadt, Germany – September 2020 – ESA | **ITW Luca Milani: Kiruna station engineer, ESA – ITALIAN*** **Why is Kiruna good for Polar orbiting satellites?**
* **What are the future challenges for the Kiruna station?**
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| 10:12:34:14ITW. Isabel Rojo: Spacecraft Operations Manager for SEOSat and EarthCARE – ESOC, Darmstadt, Germany – September 2020 – ESA | **ITW Isabel Rojo: Spacecraft Operations Manager for SEOSat and EarthCARE, ESA – ENGLISH*** So Kiruna is basically the backbone ground station for the Earth observation missions. We all know it. We'll use it. It's it works and it's ours. This ensures that we have priority in the critical phases where we actually need it. [17.7s] And when I started using it in two thousand and seven with GOCE, we had most of our passes with that station. Through the years now, this has become more and more busy because we have more Earth observation, satellite flying and even some astronomy missions use it. So we have less passes with Kiruna.
* So generally, what we do is we prepare the commands in advance that we're going to uplink in a certain pass. So typically a kIruna pass these commands will execute Off-line out of coverage mostly. And after that, the following passes, we will check that those commands are successfully on board and that the satellite is behaving as as it should be.
* There are two kinds of data that we collect. So the science data, so to speak, which often gets downloaded over Kiruna. It's saved there after the pass and it's transferred to whatever processing centre we're working with, typically ESRIN. Then we also have the housekeeping telemetry, which is the telemetry which indicates the health status of the spacecraft, amongst many, many other things. And this one is also transferred usually after a pass off-line to to our systems where we ingest it and process it.
* Kiruna, thanks to its polar situation, is a station which will have contact at practically every orbit of the life of the spacecraft. So during the LEOP, maybe nine out of 12 times per day. And this is extremely this is extremely useful for us, especially in a critical phase where we don't really know how the satellite's gonna be behaving. The RF subsystem in typical moments where we transition to higher bitrate.
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| 10:15:02:23ITW. Isabel Rojo: Spacecraft Operations Manager for SEOSat and EarthCARE – ESOC, Darmstadt, Germany – September 2020 – ESA | **ITW Isabel Rojo: Spacecraft Operations Manager for SEOSat and EarthCARE, ESA – SPANISH*** **What is the role of Kiruna in the missions you have flown?**
* **Role of Kiruna during LEOP**
* **Role of Kiruna during SEOSat LEOP**
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| 10:16:36:06ITW. Guillermo Lorenzo: Kiruna Ground Station – ESOC, Darmstadt, Germany – September 2020 – ESA | **ITW Guillermo Lorenzo: Kiruna Ground Station Manager, ESA – ENGLISH*** So the station site is located in the north of Sweden. Thirty eight kilometres east from the Kiruna town. It's a beautiful location surrounded by forest and overseen by auroras. The station comprises two terminals. They're so-called Kiruna-1 and Kiruna -2 of fifteen metre and 13 metre diameter, respectively. Both terminals feature S-band capabilities for the transmission of commands and the reception of telemetry, together with X-band downing capabilities which are mainly used for the reception of high date rates. Both antennas are connected to our common back end which comprises also eight independent modems which provide the station high degree of flexibility and reliability.
* I mean, Kiruna is a strategic asset for within the Estrack core-network, playing a fundamental role for the support of all ESA missions, with our own infrastructure. It's under ESA control and operatived from ESOC, which provides us independency with other... But of course, relationships with commercial operators are established for the support of different missions. And for the areas. In this particular case, a requirement for a polar station was, was there for the increased visibility that the latitude of Kiruna provides.
* I think the relevance of the station is remarked by the inauguration 30 years ago when the king of Sweden himself, together with the former director general of ESA, Dr Reinar Lust, pushed the button that triggered the first track of the antennas, as a symbolic act of the operational life or the beginning of the operational life of the station. The station debut took place in 1991 for the support of ERS-1. And a few years later, in 1995, ERS-2 to joined the tandem. A new chapter, or a recent chapter in the history of the Kiruna operational concept was written with the installation of the second Terminal Kiruna-2 in year 2000, which was established to cope with increased capacity requirements of the upcoming missions. In fact, in twenty, in 2002, Envisat so the largest ever flown a spacecraft within the earth was launched and Kiruna was providing support as prime station for telemetry, tracking and commanded, as well as for X-band reception and processing. Today, one of the main highlights is that the station is providing support to the main Earth Observation European programmes such as the Copernicus satellite constellation or the Earth explorers, which are part of their daily tracking and schedule of the station. And on these highlights, i mean, continuel everyday as we speak. We are currently working on a modernisation of the front-end of the station, as well as an evolution of the monitoring and control system.
* There are several factors. First of all, the polar. First of all the high latitude location of Kiruna is optimal for the support of these polar missions. So it is mainly devoted to the Earth observation missions. [13.8s] But the station as well provides support to missions like Integral, which has very long passes of 48 hours. with the capability to having one of the antenna's mainly devoted to the support of this mission. [00:12:18]So it is highly hetero-genious for very long duration passes 48 hours or more of the integral or scientific missions, to shorter that passes of less than fifteen minutes for the earth observation. So it needs to be highly reconfigurable, flexible and adaptable to the associated performance of each independent mission. The fact that the two antennas are working together, sharing some of the resources of the, of the station is something that makes also the antenna unique.
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| 10:20:46:08ITW. Guillermo Lorenzo: Kiruna Ground Station – ESOC, Darmstadt, Germany – September 2020 – ESA | **ITW Guillermo Lorenzo: Kiruna Ground Station Manager, ESA – SPANISH*** **Purpose of Kiruna?**
* **Why is Kiruna important?**
* **What will the future hold for Kiruna**
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| **10:23:36:01** | **GV’s Kiruna Ground Station****Sweden****September 2020 - ESA** |
| **10:27:09:04** | **Aerials Kiruna Ground Station****Sweden****September 2020- ESA** |
| **10:31:45:22** | **Aerials ESOC****Darmstadt, Germany****September 2020 - ESA** |
| **10:33:46:02** | **ESA OUTRO** |
| **10:33:54:03** | **END OF PROGRAMME** |