The High Frequency Active Auroral Research Program

HAARP

Frequently Asked Questions about HAARP

General Questions about HAARP

What is HAARP?

HAARP stands for The High Frequency Active Auroral Research Program. The goal of this program is to further advance our knowledge of the physical and electrical properties of the Earth's ionosphere which can affect our military and civilian communication and navigation systems. The HAARP program operates a world-class ionospheric research facility located in Gakona, Alaska.

What is the name of this research facility?

The facility is called the HAARP Research Station, Gakona.

Who built the HAARP facility?

The prime contractor for construction at the facility was BAE Systems, Advanced Technology (BAE/AT). Major construction at the facility was completed during 2007.

When did the HAARP program start?

The HAARP program began in 1990.

Where is the HAARP facility located?

The HAARP Research Station is located 180 miles ENE of Anchorage, Alaska and approximately 8 miles north of Gakona, Alaska.

What are the geographic coordinates of the facility?

The facility is located at:

62 deg 23.5 min North Latitude
145 deg 8.8 min West Longitude

Why was Alaska chosen for HAARP?

An Alaskan site was required since Alaska is the only state that is in the auroral region. In fact, the site chosen for HAARP is ideal on two accounts:

1. The Alaskan ionosphere over HAARP can be characterized as mid-latitude, auroral or polar depending on how active the sun is at any given time and day. This gives a very wide variety of ionospheric conditions to study.
2. The HAARP research facility consists of two major subsystems: (1) the HF transmitter, and (2)

the other scientific, observational instruments that have been designed and built and which are also being installed at the site. The two subsystems are equal in research importance. The scientific observation instruments require a quiet electromagnetic location. Such quiet locations are only found away from cities and built up areas. This is one reason, for example, that optical telescopes are built on remote mountaintops: to avoid the optical "noise" associated with big cities.

Does the facility operate continuously?

Many of the scientific instruments at the ionospheric observatory operate continuously to monitor the natural geomagnetic environment. Data collected by these instruments are archived and are made available in chart format in real time on our web site.

The HF Transmitter at the HAARP Research Station is used intermittently and is primarily operated to support research campaigns where groups of scientists collaborate to conduct interactive ionospheric research.

Can I visit HAARP?

The HAARP Research Station does not employ sufficient on-site staff to allow routine tours of the facility. Entry to the facility is normally restricted to those having a need to conduct business at the facility.

We recognize that there is great interest in the scientific work of the facility. In response to this interest, HAARP schedules open houses at which any and all are invited to visit the site. Several scientists are usually present at these open houses so that visitors can talk directly with those who use the facility for research. Open houses have been held most years since 1995 and have proven to be a popular event. The most recent open house was held on July 17, 2010.

How can I find out about the Open Houses?

Open Houses are generally held during the summer season. The dates and times are announced in advance in Alaska newspapers and on the HAARP Home Page.

Is there a HAARP visitor's center?

There is currently no visitor's center.

Is HAARP a classified project?

HAARP is not classified. There are no classified documents pertaining to HAARP. The Environmental Impact Process (EIP) documents have always been, are now, and will always be completely descriptive of the program in its entirety. The EIP documents are a matter of public record.

Questions about the research

Why is ionospheric research important?

The fundamental goal of research conducted at HAARP is knowledge; to explore and to understand natural phenomena occurring in the Earth's ionosphere and near-space environment. Information derived from this research will have major value in the design of future communication and navigation systems for both military and civilian use.

What kind of research will be conducted at the HAARP facility?

The research to be conducted at HAARP falls into two broad categories:

1. The study of basic natural processes that occur in the ionosphere under the natural but much stronger influence of solar interaction. This includes studying how the natural ionosphere affects radio signals with the goal of developing techniques that may be available for mitigating these effects to improve the reliability and/or the performance of communication and navigation systems.
2. Development of technology to use effects produced through ionospheric interactions. One example of this is learning how to generate new signals in the ELF range for the real application of subsurface communications.

Where can I read about the research that is conducted at the HAARP Facility?

Research conducted at the HAARP Observatory is generally published in peer-reviewed scientific journals such as the **Journal of Geophysical Research**, **Geophysical Research Letters**, and **Radio Science**. Since the first research campaign at HAARP in 1999, hundreds of scholarly papers have been published in these and other scientific journals or presented at scientific conferences. While the best place to search for results of HAARP research is at a university library, some of these journals provide an on-line search engine for their own publications. For example, to search for HAARP research published in one of the journals of the American Geophysical Union, go to their on-line search site:

AGU Search

Enter the search term "HAARP" and press the search button.

Who are the people that conduct research at HAARP?

The scientists who conduct research at HAARP are university physicists, their students, government scientists and scientists from commercial firms having an interest in communication and radio science theory and applications.

What Universities have participated in the HAARP program?

Several universities have played a major role in HAARP from its inception to the present time including the University of Alaska, The Leland Stanford University, Penn State University (ARL), Boston College, Dartmouth University, Cornell University, Virginia Tech, University of Maryland, University of Massachusetts, MIT, Polytechnic University, UCLA, Clemson University and the University of Florida. The development of the program objectives and initial design concept, selection of the prime contractor, development of diagnostic equipment, and the planning of research campaigns have all been heavily dependent on university involvement. University students and professors make up the majority of attendees at the annual Ionospheric Interactions Workshop where progress in ionospheric research is reported.

Does HAARP have a community outreach program?

To provide support to the local community, the University of Alaska is working with HAARP to conduct a cooperative science program with the Glennallen High School, the Prince William Sound Community College and other schools in the Copper River Valley area.

Questions about the HF Transmitter and Antenna

How frequently is the HF transmitter used?

The HF Transmitter is used during research campaigns to support interactive study of the ionosphere. A typical research period may last one or two weeks and several such campaigns may occur in a given year.

How large is the HAARP antenna array?

The HAARP antenna array consists of 180 antennas on a total land area of about 35 acres. The array, along with its integrated transmitters, has a total radiated power capability of about 3,600 kilowatts.

What is the current development status of the HAARP HF Transmitter?

The HAARP transmitter and antenna array is complete with all of the originally planned 180 antennas installed.

Is there any additional transmitter development planned beyond that described in the EIS?

No.

How does HAARP compare with other high power facilities?

The HAARP HF transmitter and antenna array is similar in function to several other high power transmitters operating in the High Frequency range although its power capability is greater.

How much power will be required to operate the transmitter?

The HF transmitter system is able to produce approximately 3.6 million Watts of radio frequency power. However, the HAARP transmitters have been designed to operate very linearly (in Class AB mode) so that they will not produce radio interference to other users of the radio spectrum. To achieve that degree of linearity, the transmitters operate at an efficiency of only about 45 %. For every 100 Watts of input power 45 Watts of Radio Frequency power is generated and the rest is lost in the transmitter cabinet as heat. (As an analogy, a 75 Watt light bulb gets quite hot while it's producing the light you actually see.) In addition, the on-site diesel generators must provide power for other equipment used by the transmitters including the cooling system and low level amplifier stages. As a result, approximately 10 million Watts of prime power will be required when the transmitter system is operating at full power.

How much power does HAARP take from the power grid?

HAARP draws only housekeeping power, used for lighting, heating, and computers, from the local power grid. During research operations, the HAARP facility is taken off the local power grid completely.

Safety and environmental questions

Was an environmental impact study conducted on HAARP?

An Environmental Impact Study was conducted during 1992-93 in accordance with the National Environmental Policy Act (NEPA).

Why was an environmental impact study conducted?

The National Environmental Policy Act (NEPA) requires all US government agencies to conduct an environmental impact study prior to beginning construction of any major facility.

What impacts did the study find?

The study concluded, "All of the significant environmental impacts associated with [building and operating the HAARP Observatory at Gakona] can be mitigated to an acceptable level. Some insignificant potential impacts, such as lost habitat, socioeconomic, and wildlife impacts, may not be

mitigated."

Who has oversight over HAARP and its operations?

Numerous Federal and State agencies have oversight over one or more aspects of the HAARP Research Station or its operations. There is a **detailed page** on our web site describing this oversight.

Is HAARP capable of affecting the weather?

The HAARP facility will not affect the weather. Transmitted energy in the frequency ranges that will be used by HAARP is not absorbed in either the troposphere or the stratosphere - the two levels of the atmosphere that produce the earth's weather. Electromagnetic interactions only occur in the near-vacuum of the rarefied region above about 70 km known as the ionosphere.

The ionosphere is created and continuously replenished as the sun's radiation interacts with the highest levels of the Earth's atmosphere. The downward coupling from the ionosphere to the stratosphere/troposphere is extremely weak, and no association between natural ionospheric variability and surface weather and climate has been found, even at the extraordinarily high levels of ionospheric turbulence that the sun can produce during a geomagnetic storm. If the ionospheric storms caused by the sun itself don't affect the surface weather, there is no chance that HAARP can do so either.

How long do the effects of ionospheric heating last?

Since the ionosphere is, inherently, a turbulent medium that is being both "stirred up" and renewed by the sun, artificially induced effects are quickly obliterated. Depending on the height within the ionosphere where the effect is originally produced, these effects are no longer detectable after times ranging from less than a second to ten minutes.

A good analogy to this process is dropping a stone into a fast moving stream. The ripples caused by the stone are very quickly lost in the rapidly moving water and, a little farther down the stream, are completely undetectable. A University of Alaska, Geophysical Institute scientist has compared HAARP to an "immersion heater in the Yukon River."

Can HAARP create a hole in the ionosphere?

No. Any effects produced by HAARP are miniscule compared with the natural day-night variations that occur in the ionosphere. Several ionospheric layers completely disappear naturally over a whole hemisphere during the evening hours. HAARP can't come close to producing this effect, even in the limited region directly over the site.

Can HAARP create an artificial aurora?

The natural aurora is created when very high energy particles emitted by the sun, reach the Earth's vicinity, are swept toward the Earth's magnetic poles, and collide with gas molecules existing in the upper atmosphere. The energy involved in this process is enormous but is entirely natural and it has been a normal event throughout Earth's history.

HAARP is so much weaker than these naturally occurring processes that it is incapable of producing the type of optical display observed during an aurora. However, weak and repeatable optical emissions have been observed using HAARP (and reported in the scientific literature) using very sensitive cameras.

Are there any health hazards associated with electromagnetic fields produced by HAARP?

The health and safety of the public (and of the scientific researchers who will be present at the site) has been a primary focus in the design of the HAARP HF transmitter and antenna array. There are no locations on-site or off-site where the E-M fields exceed safety standards for RFR exposure as defined by IEEE/ANSI C95.1-1992 and NCRP Report No 86. In fact, the E-M fields measured at the closest

public access to the site are lower than those existing in many urban environments.

You mention in your graph and accompanying text that the E-M radiation at the closest public point is 10,000 times below the maximum allowed by the standard. What is the field strength on the site itself?

The only points on the site that approach the EM safety standard are close to or directly under the antenna array itself. Numerous computer simulations, confirmed with measurements during tests show that the highest fields are actually near the edge of the ground screen, about 60 - 80 feet away from the nearest antenna element. A fence around the antenna gravel pad, about 60 feet farther out than the ground screen (about 150 feet away from the antennas all around), encloses the limited area under the antennas where fields might exceed the standard.

Outside the fenced antenna pad, the fields drop off very rapidly, and are always below the standard. The closest public access point to the facility at the Tok Highway is about 3,000 feet from the antenna fence and the field at this point has decreased to 10,000 times below the safety standard.

Can HAARP be used to generate ELF?

Yes. However, the HAARP facility does not directly transmit signals in the ELF frequency range. Instead, ELF signals are generated in the ionosphere at an altitude of around 100 km. Frequencies ranging from below one Hz to about 20 kHz can be generated through this ionospheric interaction process.

How strong are the ELF signals generated using HAARP?

Under optimum conditions, signals generated using ionospheric interaction techniques may be measured in the tens of pT range and tend to be strongest at frequencies around 2 kHz.

Is there any safety concern with the ELF signals generated using HAARP?

No. These signals are more than eleven million times weaker (smaller) than the Earth's background field and about one million times weaker (smaller) than the level where researchers have reported biological effects in the literature. Signals generated through ionospheric interaction are so weak, in fact, that sophisticated instruments must be used to observe them. Nevertheless, they are still valuable for scientific purposes and for communication applications.

What about radio frequency interference?

Analyses conducted during the environmental impact process suggest that radio frequency interference could occur for receiver systems that operate in the areas surrounding Gakona. However, other facilities using transmitters and supporting diagnostic instruments similar to HAARP, have achieved compatibility with other users of the radio frequency environment. The government is committed to achieve compatibility with other users of the electromagnetic spectrum and an electromagnetic compatibility program has been established to assure this goal is achieved.

The EIS Record of Decision required HAARP to establish a Radio Frequency Advisory Committee. This committee, with representatives from organizations that are users of the HF spectrum has met regularly since 1994 to inform the groups of progress at the facility and to receive their input and suggestions.

Questions about facility operations

Do you publish a transmitting schedule by frequency and time?

Research activities generally require a specific ionospheric condition to pre-exist before any given experiment can begin. For example, one experiment may require that the D-layer be absent. The D-layer normally disappears after local sunset but the timing may vary from one day to the next depending on solar activity.

HAARP is required to operate on a "Not-to-Interfere-Basis" (NIB). This means that the operating frequency must be selected carefully so as not to disrupt on-going communication activities. In other words, a candidate frequency may have to be re-chosen if the frequency is already being used by someone else.

Also, the optimum frequency for any given experiment changes as the ionosphere undergoes its natural variation throughout the day and this is continually monitored using some of the observational instruments at the site. As a result, it will be virtually impossible to know in advance the exact time or frequency for any day's operation.

I hear a strong interfering signal in the ham bands. Is this HAARP?

HAARP is not authorized to operate in the Ham bands and the transmitter has been "locked out" of those frequencies. In addition, because of the harmonic relationship of the amateur 40 and 80 meter bands, it is not possible for a harmonic of the HAARP transmitter to fall in those bands.

How can I report suspected interference from the HAARP HF Transmitter?

Suspected interference should be reported to the Federal Communications Commission. HAARP maintains an interference reporting "hotline" at the phone number (907) 822-5497. This line is *always* answered during HF Transmitter operations. At all other times, a recording indicates that the transmitter is not in use.

Can HAARP be used for military purposes?

HAARP is not designed to be an operational system for military purposes. The HAARP specifications were developed by a consortium of universities to meet the requirements for a world-class research facility and an expanded group of universities are playing a major role in the design of future research efforts.

The HAARP facility will be used for basic and applied plasma physics and Radio Science research related to the study of the Earth's ionosphere. Because the DoD operates numerous communication and navigation systems whose signals either depend on reflection from the ionosphere or must pass through the ionosphere to satellites, there is obvious DoD interest in understanding the ionosphere's effect on these systems to improve their reliability and performance. A greater understanding of the physics of the ionosphere is expected to result in improvements to commercial applications, such as GPS and LEO communication satellites whose performance is often significantly affected by random ionospheric variations.

Administratively, HAARP is restricted to operate only on a "not-to-interfere-basis" (NIB) by the NTIA and is categorized as an experimental station (XR) in the NTIA spectrum certification document.