



ASTD Data

The [Cooperative Agreement among the Arctic States Regarding Arctic Ship Traffic Data Sharing](#) outlines access to ASTD and use of its data.

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What is AIS

Automatic Identification Systems (AIS) is technology onboard ships to provide information about the ships type, position (downsampled to 6 minutes for ASTD), course, speed, navigational status and other safety-related information. The information is sent automatically to appropriately equipped shore stations, other ships and to satellites. This information is fed into the ASTD database.

IMO regulation 19 of SOLAS requires AIS to be fitted aboard all ships of 300 gross tonnage and upwards engaged on international voyages; cargo ships of 500 gross tonnage and upwards not engaged on international voyages; and all passenger ships irrespective of size. The requirement became effective for all ships by 31 December 2004.

AIS Class A and B

Two types of AIS transponders are available, Class A and Class B. Class B transponders have been developed to provide the safety and navigation benefits of AIS to smaller vessels with lower cost and simpler installation when compared to Class A. The signal from Class A is stronger and therefore picked up by more land-based stations or Satellite-AIS. Class B also sends fewer messages.

The frequency of AIS signals from Class A depends on the ships position and speed. For example, a ships at the speed of 23 knots sends signals every 2 seconds, whilst ships sailing on between 0-14 knots sends a signal every 10 seconds. AIS receivers vary, but Class A transponders are prioritized to Class B. Therefore, signals from Class B are not recorded as frequently – its signal is only picked up when there is room on the AIS channel receiving the signals. However, the frequency is still very high and very adequate for safety of smaller ships.

AIS signals from all ships is included in ASTD.

AIS Limitations

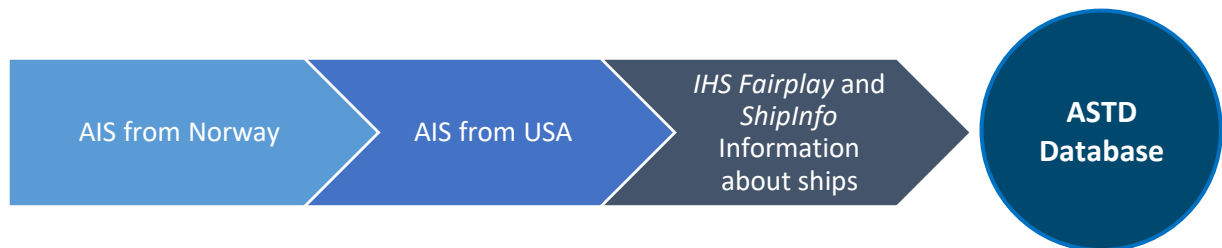
AIS data in the ASTD system does not cover 100% of all ship traffic, identifying smaller pleasure craft and fishing vessels can be a challenge because of limitations in registries and AIS information.

Numerous factors can affect AIS messages, including:

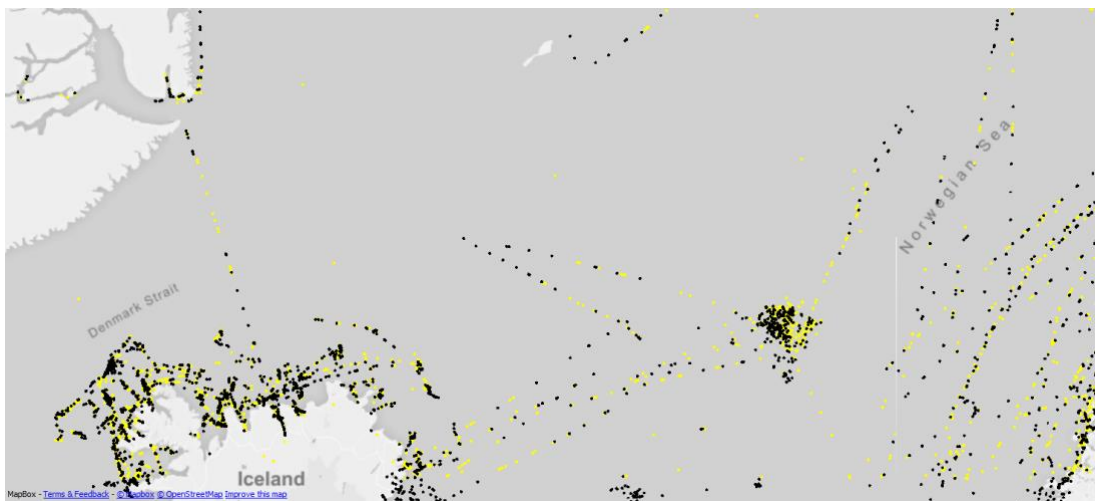
- Technical failure due to faulty infrastructure (vessel and data flow).
- Erroneous onboard installation (vessel infrastructure)
- Problems with data links/networks
- AIS signals being manipulated
- Data noise
- Challenges regarding data coverage

ASTD data collection

The data in ASTD is provided by Helcom, Norway and USA and other sources. Norway has around 50 AIS land-based stations that collect AIS signals, collecting information to around 40-60nm from the coast. These base-stations are located along the Norwegian coastline and in Svalbard. Norway also collects information with four AIS-satellites. USA also provides data for ASTD with 19 satellites orbiting the Arctic. Data in the ASTD is supplemented with information from other data sources, including IHF information about ships, and information from DNV-GL.



The image below shows how the data from USA (yellow dots) supplement the Norwegian data (black dots) to give ASTD a more detailed coverage – therefore providing more accurate information.



ASTD Data quality/accuracy

The data in ASTD is very accurate. The data collected is vast, hundreds of gigabytes every year. Approximately 4 million records are added to the database every 24 hours. As outlined above, AIS signals are not 100% accurate, there are many variables which effect databases like ASTD. There are many other data sources like ASTD, and when comparing data between them, the information might not be 100% aligned. This could for example be differences in satellites who collect AIS signals. However, data quality in ASTD is very high.

Ice data is collected from National Snow and Ice Data Center (NSIDC) and processed by the NCA to fit the purpose. Data is collected on a monthly basis.

Data calculations

Certain data in ASTD is based on calculations with algorithms inserted to the database. This includes all the information in the *Statistics* section in *Arctic area traffic*.

One example is statistics on fuel consumption. The calculation is prepared for each ship. The algorithm utilizes the information from AIS to determine the engine the ship uses, find its KW numbers, adds the speed the vessels travels and calculates the fuel consumption.

Where the fuel type is unknown, it is filled in by looking at a “sister ship” or similar ships (RPM engine).

The fuel consumption is also used to calculate information about emissions from ships. The box to the right shows how emissions are calculated. ASTD has many types of emissions from ships and is capable of showing these emissions in a certain time and for certain areas.

More details on the statistics is provided in the metadata for the statistics in the ASTD system.

$$E_{ij} = \sum_{t=0}^{t=n} \left((P_{ME_i} * \left(\frac{SOG_{i,t}}{V_{max_i}} \right)^3 * EF_{ME_{j,k,l,m}} + D_{AE_{p,i}} * EF_{AE_{j,k,l,m}} + D_{BO_{p,i}} * EF_{BO_{j,m}}) * 1 \text{ hour} \right)$$

Where:

i = ship

j = pollutant

t = time (operating hour, h)

k = engine type

l = engine tier

m = fuel type

p = phase

E_{ij} = emissions (g) for ship i and pollutant j

P_{ME_i} = main engine power (kW) for ship i

$SOG_{i,t}$ = speed over ground (knots) for ship i at time t

V_{max_i} = maximum speed (knots) for ship i

$EF_{ME_{j,k,l,m}}$ = main engine emission factor (g/kWh) for pollutant j , engine type k , engine tier l , and fuel type m

$D_{AE_{p,i}}$ = auxiliary engine power demand (kW) in phase p for ship i

$EF_{AE_{j,k,l,m}}$ = auxiliary engine emission factor (g/kWh) for pollutant j , engine type k , engine tier l , and fuel type m

$D_{BO_{p,i}}$ = boiler power demand (kW) in phase p for ship i

$EF_{BO_{j,m}}$ = boiler emission factor (g/kWh) for pollutant j and fuel type m

Ship types aggregation

All ships need to be registered to be eligible to navigate. Each ship is designated a ship type. ASTD utilizes the *IHS Markit StatCode 5 Shiptype Coding System* to categorize ship types. IHS has 5 category levels which are then aggregated from almost 300 ship types to 15.

For example, level 5 of the IHS Fairplay information has 20 different types of tankers, including *Chemical tanker*, *Vegetable Oil tanker* and *Water tanker*. This information is aggregated to *Chemical tankers* in the ASTD ship types.

However, when downloading data, one can get the information in Level 5, and therefore analyse quite specific shiptypes.

A document that shows how the ship types are aggregated has been produced.

[The Ship type document is available to download here.](#)

Working with data

ASTD requires GIS analysis experts to download and work with data from the system.

Those who have access to ASTD can download data for analysis. The data can be downloaded on different formats, but .CSV is the most common format. CSV stands for comma-separated values and is a delimited text file that uses a comma to separate values. A CSV file stores tabular data in plain text. Each line of the file is a data record. Each record consists of one or more fields, separated by commas. Each .csv file can contain millions of rows and can be very large, up to many gigabytes in size. Smaller .csv files can be opened with Excel, but others require specialized programs to work with them, like CSV Explore, Python or SQL databases like MySQL and PostgreSQL. This work requires not only a data expert, but a powerful computer as well.

Keep this in mind when downloading large amounts of data.

However, smaller data samples can be downloaded by regular users, not specific GIS experts, and analyzed with Excel. One has to download data and convert from CSV but from there analysis can be performed.

Citations

When using data from ASTD, this citation can be used:

PAME - Arctic Ship Traffic Data. (insert date when data is collected). Retrieved from ASTD.is.

Sources:

- <http://www.imo.org/en/OurWork/Safety/Navigation/Pages/AIS.aspx>
- <https://www.oceantimemarine.com/class-a-and-class-b-automatic-identification-system-ais/>