



Food and Agriculture
Organization of the
United Nations



Indian Ocean Tuna Commission
Commission des Thons de l'Océan Indien

Navigation & positioning

IOTC ROS SFO TR5

Category: Basic navigation and navigational aids

[IOTC ROS SFO TR5]



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Descriptor

This module aims to provide Observers with the basic understanding of the practical elements of navigation and to explain how a position is determined.

The learning outcomes for this training requirement are:

1. Demonstrate knowledge of navigation and positioning (including latitude/longitude; course and speed);
2. Aware of electronic navigation equipment usage and limitations (GPS; plotters; echo-sounders and sonar); and
3. Familiar with principal functions of electronic fishing aids and the information they provide.



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STANDARD UNITS OF MEASUREMENTS

Before starting on the theory to record positions and electronic navigation systems we need to remind ourselves about some of the basic units of measurement.

Category: Basic navigation and navigational aids



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STANDARD UNITS OF MEASUREMENTS

An observer's prime directive is to capture information during their deployment onboard a vessel

This requires an understanding of a wide range of units of measurement covering

- Lengths
- Weights
- Speed and
- Positions



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An observer's prime directive is to capture information during their deployment onboard a vessel

This requires an understanding of a wide range of measurement that include

- Lengths
- Weights
- Speed and
- Positions

Each of these have their own units and can involve different systems that need to be interrelated.

For example: measurements in metric units which are divisible by 10 or imperial units or imperial units bases on British units or positions which are recorded in angles. Each of these also have abbreviations or shortened forms that must also recognized and correctly recorded. For example:

SI Unit of Measurement	Name	Abbreviation
Length	Meter	m
Mass	Gram	g
Volume	Litre	L



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STANDARD UNITS OF MEASUREMENTS

Let's look at an overview of some of the main units of measurement and their abbreviations

Metric (SI) units for length & weight & speed

Length

- Millimetres = mm
- Centimetres = cm (10 mm)
- Meter = m (100 cm)
- Kilometres = km (1000 m)

Weight

- Grams = g
- Kilograms = kg (1000 g)
- Tonnes = t (1000 kg)

Speed

- Meters per second = (m/s)
- Kilometres per hour = (km/h)



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We need to look at the different unit systems and relate them to each other and also be able to convert from one to the other when required.

The international standard is based on the metric system using centimeters and meters as the basis for length measurements and grams and kilograms for weight. In turn speed is based on meters per second (m/s) or kilometers per hour (km/h)



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STANDARD UNITS OF MEASUREMENTS

Imperial and nautical units for length and speed

Length

- Nautical mile = nm (1852 m or 1.852 km)
- Feet = ft
- Fathom = fm (6 ft) = **1,8288 m**



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In parallel with the metric unit are several imperial and nautical units that are also used internationally, especially related with vessel operations. It is important to understand what these units represent and be able to convert from one system to the other. These requires conversion factors that must be mathematically applied.

The most important unit we deal with is the nautical mile, which is based on the geographical distance of 1-minute of latitude. The other is the unit of depth “fathom” which is equivalent to 6-ft. This is not a unit commonly used as most echosounders are set to record meters. So, the most important factor to recall is really the conversion of fathoms to meters. One Fathom equals 1,8288 m.



STANDARD UNITS OF MEASUREMENTS

Circles Angels and Degrees

A circle is a line that is equidistant (the same distance) from a center point

An angle is formed by any two lines drawn from the center the edge of the circle

Angels are measured in degrees, minutes and seconds [or 10th of a minute] There are

- 360 degrees in a circle
- 60 minutes in a degree
- 60 seconds in a minute



A circle is a line that is equidistant {same distance) from a centre point

An angle is formed by any two lines drawn from the centre point to the edge of the circle

An angel is measured in

- degrees;
- Minutes; and
- seconds;
- [or decimals of a minute (one 10th of)]

There are:

- 360 degrees in a circle
- 60 minutes in a degree; and
- 60 seconds in a minute



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STANDARD UNITS OF TIME

The measurement of time is based on the rotation of the earth around its axis

The earth rotates a full circle [360 degrees] in 24-hours

There are 4 basic expressions of time

- UTC / GMT
- Standard / zone time
- Local time
- Ships time



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The measurement of time is based on the rotation of the earth around its axis every 24 –hours. The earth rotates a full circle [360 degrees] in 24-hours and by dividing 24 into 360 we see that the earth rotates 15 degrees in 1-hour. It is important to remember these facts.

There are 4 basic expressions of time that need to be understood:

- UTC / GMT
- standard, also called “zone time”;
- local time; and
- ships time.



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STANDARD UNITS OF TIME

GMT / UTC

Greenwich Mean Time (GMT) and Coordinated Universal Time (UTC) are two terms for the same time

GMT is the time when the sun passes through the time zone spanning the prime meridian [0° longitude]



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Greenwich Mean Time (GMT) and Coordinated Universal Time (UTC) **are two terms for the same time**. GMT is based on the earth's rotation and solar [sun] time, while UTC is based on an atomic clock.

GMT is the time when the sun passes through the time zone spanning the prime meridian [0° longitude]. It is also the selected “zero” time zone with time to the east being plus “+” or ahead of GMT and time to the west being minus “-” or behind GMT.



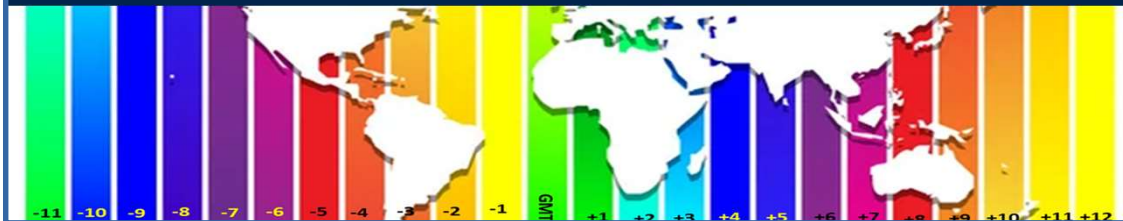
STANDARD UNITS OF TIME

Standard / zone time

Standard Time or Zone Time is a country's time determined by the time zone where it is geographically located

The world is divided into 24 time zones 15 degrees of longitude

- GMT [0] to GMT +12
- GMT (0) to GMT -11



Standard Time or Zone Time

Standard time or zone time is the time used by a country determined by the time zone in which it is geographically located in terms of longitude.

The world is divided into 24 time zones that each time span approximately 15 degrees of longitude and are referred to as:

- GMT to GMT +12
- GMT to GMT -11

With GMT or Greenwich mean time being the time zone that spans the Greenwich Meridian. Therefore, the time in a country that is in the time zone GMT +3, its time would be 3 hours ahead of Greenwich time. For example; if the time in the country was 1300 then the time at Greenwich would be $13:00 - 3 = 10:00$



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STANDARD UNITS OF TIME

Local time

Local time is relevant only to your geographical position

When the sun passes over the meridian running through your position it would be 1200 [noon time]

Important when calculating time of sun set or sun rise and time of nautical dawn or twilight for mitigation measures for seabird by-catch



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Local time

Local time is relevant only to your geographical position at any one time. When the sun passes over the meridian (line of longitude) through your position it would be 1200 [noon time].

Clearly, this would not be practical for reporting, however, it is important when calculating the time of sun set or sun rise and time of nautical dawn or twilight, which are important factors in the mitigation measures used to prevent seabird by-catch from longline vessels.



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STANDARD UNITS OF TIME

Ships Time

Ships time is the time used by the vessel.

On some vessels this is not related to the geographical time zone in which it is operating

It is very important for observers to be aware of the ships time relative to GMT when collecting the times from the vessels logbooks for reporting purposes



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Ships Time

Ships time is the time used by the vessel.

On some vessels the time used is not necessarily related to the geographical time zone in which it is operating. Some vessels retain the time of their home port or controlling country

It is very important for observers to be aware of the ships time relative to GMT when collecting the times from the vessel's logbooks for reporting purposes.



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Cross Referencing Units

Your vessel is setting its line at 9 knots

Time between attaching droppers is 8 seconds

What is the spacing (in meters) between the droppers?



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ANY QUESTIONS?



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