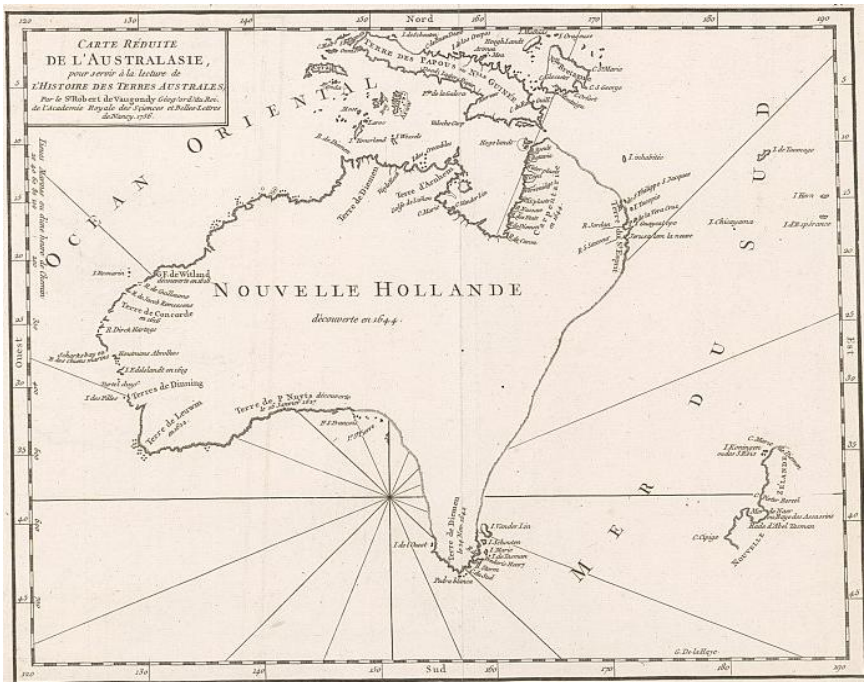
~ EDUCATION RESOURCES ~

Navigators of the Seas



CARTE RESUITE DE L'AUSTRALASIE, POUR SERVIR A LA LECTURE DE L'HISTOIRE DE TERRES AUSTRALES,
Robert de Vaugondy, 1756
Courtesy National Library of Australia

'Being at this time in the Latitude of 37˚..58'S˚ and Long of 210˚..39' West. The Southernmost Point of land we had in sight which bore from us W1/4S I judged to lay in the Latitude of 38˚..0'S˚ and in the Longitude of 211˚ ..07' W from the Meridian of Greenwich. I have named it Point Hicks, because Leuit Hicks was the first who discover'd this land..'

"To the Southward of this point we could see no land and yet it was very clear in that quarter and by our Longitutude compared with that of Tasmans the body of Vandiemens land ought to have been due south from us...'

Extracts from Cook's journals 19th April 1770

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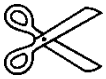
ABOUT THE EDUCATION RESOURCES

These resources should be used in conjunction with the education section of the HMB *Endeavour* Circumnavigation website at www.endeavourvoyages.com.au. Teachers may use these resources and the information on the website as stimulus material pre- or post-visiting the ship. They include content summaries, images and classroom activities for both primary and secondary students. Teachers may also adapt this material to create activities at a suitable level for their students. The activity outcomes link to various individual state and national syllabi and can also be used for a cross-curriculum approach. The icons in each unit identify the skills base for each activity:

	To Write		To Do/ To Create
	To Think		To Discuss
	To Read		To Look at
	To Make		To use the Computer
	To Calculate		To Perform

ABOUT THIS UNIT

The following unit *Navigators of the Seas* examines the concept of navigation and specifically focuses on the following questions: Why was navigation a problem in the 17th and 18th centuries? What advances were made in navigation in the 18th century? How was the *Endeavour* able to complete its voyage around the world without getting lost? The idea of journeying into the unknown and the technology and skills necessary to survive is examined within the framework of Cook's journey.

CURRICULUM LINKS

ENGLISH
HISTORY
HSIE/SOSE
VISUAL ARTS
MATHS
ABORIGINAL STUDIES

Curriculum links for the complete scope of the Education Resources are available on the *Endeavour* website under *Teacher Resources* www.endeavourvoyages.com.au

The Europeans

BACKGROUND READING

HM Bark *Endeavour* at anchor, watercolour by Ross Shardlow
ANMM Collection

What motivates humans to sail into the unknown? Money, prestige, scientific discoveries, a sense of adventure? Since the early 17th century European explorers have searched the Pacific region looking to find goods to trade, land to settle and sometimes flora and fauna to expand scientific knowledge. Many of the first sightings of *New Holland* were by Dutch VOC *ships heading towards Batavia (modern Indonesia). Blown off course, they found themselves near land. Whether an island, a coastline or a continent, they could not be sure.

It took a great deal of courage for a sailor to sign on to a ship bound for uncharted waters, beyond the known world. At this time, many still believed the world was flat and that at some point, they and their ship, would fall off the edge. They told stories and sang of mythic sea monsters. The real danger though, lay in the methods of navigation used to search the seas. Boats like the small Dutch ships *Duyfken* and *Batavia* used navigational techniques that changed minimally from 1606 until the time of the *Endeavour*. Compasses and charts were improving but without accuracy many ships were lost.

Early explorers used the 'Roaring Forties' to sail before the strong westerly winds that prevail between the latitudes of 40˚S and 50˚S. Mariners in the northern hemisphere had always been able to determine their latitude, even if only approximately, by observing the altitude of the Pole Star and measuring the distance north of the equator.

It was not until an accurate way of measuring time at sea was developed that navigators could ensure the relative accuracy of their course. Longitude is the distance east or west of an agreed place. It had long been recognised that longitude could be determined at sea if you knew the exact time at any given reference place. A reliable and accurate clock was needed to keep time on board ship. Invented in the 1730s, this timepiece is called a marine chronometer.

Greenwich, England is now the internationally agreed place for measuring longitude – the Prime Meridian. It is 0˚. For every hour ahead of Greenwich time, you are 15˚ east of Greenwich. For every hour behind, you are 15˚ west.

* Vereenigde Oost-Indische Compagnie (Dutch East India Company)

This globe was made in 1602 by Dutch cartographer Willem Blaue. It shows the constellations in classic mythological style and was an important aid in celestial navigation. It features one of the earliest depictions of the skies of the Southern Hemisphere, including the Southern Cross.

The Blaue Celestial Globe, Willem Blaue 1602
ANMM Collection

The Makassans

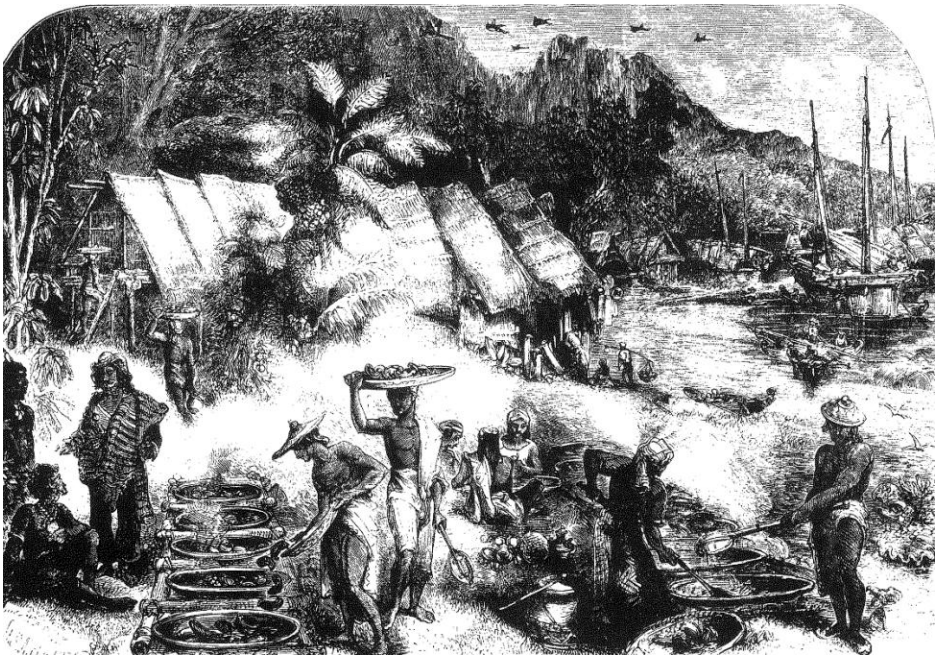


Image titled *Macassans at Victoria, Port Essington*, 1845
by H.S.Melville
From *The Voyage Marege* by C.C MacKnight, 1976
Courtesy Melbourne University Press

BACKGROUND READING

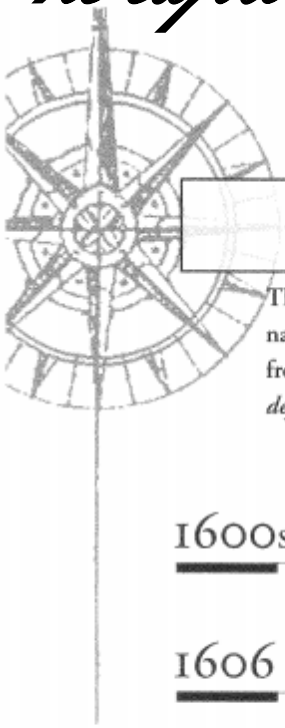
The Makassan people sailed from what is now Indonesia to Northern Australia as early as the 1600s. Their name for this land was Marege. They came to collect trepang – also called bêche de mer - which they used to trade with the Chinese. The relationship between northern aborigines and the traders from the North lasted hundreds of years.

Makassan boats (prahus) were the most advanced maritime technology – basic but efficient. They carried a crew of around 30 plus supplies and utensils. Makassan navigational techniques incorporated seasonal wind direction, changes in sea colour, cloud and star formations.

The traders usually arrived in northern Australia around December. The arrival of the monsoon winds in April signalled it was time to set sail for the return journey to Indonesia.

A Makassan prahu by Louis le Breton, 1839
Courtesy National Library of Australia

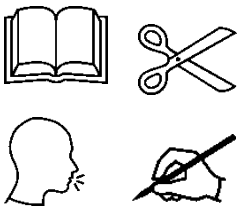
The explorers



TIMELINE

The following timeline highlights some significant events in navigation development. You might like to include some more from your observations during your visit to the NAVIGATORS *defining Australia* exhibition.

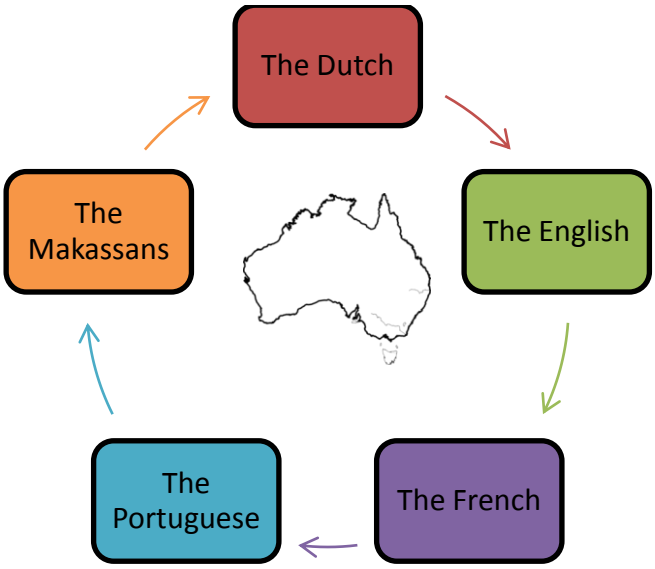
1600s	Makassans sail yearly to Australia
1606	Torres navigates the strait between New Guinea and Australia
1629	*Batavia* is wrecked on the Abrolhos Islands off Western Australia
1642	Tasman names Van Diemen's Land
1750	Sextant invented mid-18th century
1770	James Cook in *Endeavour* charts Eastern Australia
1788	Loss of French expedition led by La Pérouse
1803	Matthew Flinders in *Investigator* completes charting Australia



ACTIVITY: Make a map of exploration and colonisation

HSIE/SOSE, Aboriginal Studies, History

Using the *Background Reading* and the *Timeline* information on the previous pages and the map on page 7, colour the parts of the Australian coastline explored by the following navigators using a different colour for each. Also, mark with arrows and notes the direction from which they came, for example *via Batavia (Indonesia).* Don't forget to make a legend to go with your map.



1. As a class, discuss the relationship between the ideas of exploration, colonisation and navigation. Create a working definition of each. Brainstorm a list of countries that have been colonised by a foreign power, regardless of their status now.

2. Create a graphic organiser which has information and drawings that explain the following:

ACTIVITY: Group research

HSIE/SOSE, History, English, Aboriginal Studies

In groups of three **research** the voyages of one of the following sea explorers:

- Willem Jantz
- Luis Vaez de Torres
- Dirk Hartog
- Abel Tasman
- William Dampier
- Louis-Antoine de Bouganville
- James Cook
- Marc- Joseph Marion Dufresne
- Lois Francois de St Allouarn
- Jean François de Galaup, compte de**Lapérouse**
- The Makassans

Group research should include:

- The **name** of the sea explorer
- The **date** the explorer sailed the Pacific ocean
- The **name of the country** the explorer came from
- An **outline** of the voyages describing the conditions and any hardships encountered
- The **name** of the ship(s) used
- **Reasons** for undertaking the voyages(s)
- A **map** showing the route taken
- **Names** of the places that were newly discovered and any encounters with natives
- What was his **opinion** of what he found
- Your **comments** about what the explorer is mostly remembered for
- Include **events from the timeline** that relate to, or are within a few years of your explorer's date of exploration
- Using the internet, find **the flag** these ships sailed under and draw on your map

The flag of Dutch VOC ships during the 1600s

Presentation of information

Choose from ONE of the following: graphic organiser, chart, mind map, large map of Australia that can be displayed as a poster accompanying the information on the map.

Did you know? Ever since the days of the ancient Greeks, scientists thought there must be a large landmass in the Southern hemisphere in order to balance the Eurasian land mass in the Northern Hemisphere. It was known as *Terra Australis* or unknown southern land.

ACTIVITY: Create an interview, newspaper and poster

English, History, HSIE/SOSE, Visual Arts

Choose a different king/explorer or sailor from the list of European navigators in the Pacific Ocean. Working in pairs**,** write a series of questions and answers for an interview. To be adventurous you could even dress the part!

Enact /present your interview to the class. You could even film your work!

Design and write a front page newspaper article about the explorer you interviewed. Your page should include: a banner with the date, a headline, an illustration, caption headings and two columns of information. The information who, what, where, when, why and how should be included in the copy. Remember, the aim is to get the attention of your audience as well as be informative!

Display the pages on the walls of your classroom.

Design and make advertising posters for you room display to be put around the school.

What questions would you ask James Cook, or any of the early explorers, if you had the chance?

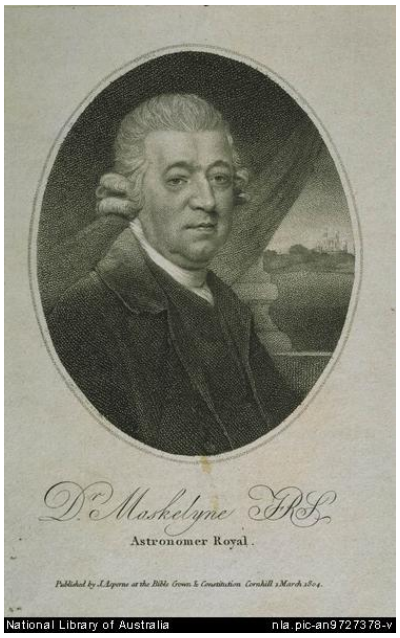
Figurine, Captain James Cook c1845
Staffordshire Pottery
ANMM Collection

Navigation

Background Reading

Sextant ANMM Education Collection

The most common navigation at the time the *Endeavour* left England was **dead reckoning**. Sailors were able to find their latitude by working out the local time, the height of the sun above the earth at noon using a sextant, and then using tables and mathematical calculations. Once the desired latitude was reached they sailed east or west. By using a log line to work out the speed of the ship they would have a rough idea of how far they had travelled, and therefore where they were. It was however difficult to allow accurately for changing winds, storms, tides and currents, so speed and distance were very approximate.



Maskelyne, more than any of the Astronomers Royal before or since, made the improvement of the practical business of navigation his chief aim. None of all the incumbents of the office kept its original charter -- "To find the so much desired Longitude at Sea, for the perfecting the Art of Navigation," so closely before him.

Maskelyne's *Nautical Almanac* was published in 1767. These mathematical tables provided Cook with a series of calculations that used the **lunar distance method** to measure longitude: take the angular distance from the moon to the sun or a star to determine the precise time and compare it with local time, calculated by working out the altitude of the sun, moon or stars.

Left: Dr Maskelyne, Astronomer Royal, 1804

Did you know?

The Metric system was first adopted in France in 1791 during the French Revolution?

ACTIVITY: How good are your calculation skills?

Maths

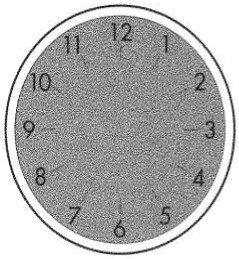
The following exercises are for Stage 2 and Stage 3 students and are designed for use without calculators.

Stage 2 problems

1.

The Cabin Boy was so bored that he just sat and watched the minute hand move slowly around the clock-face.

How long did he watch the clock, if the minute hand moved from the 9 to the 11?



(A) 5 minutes

(B) 9 minutes

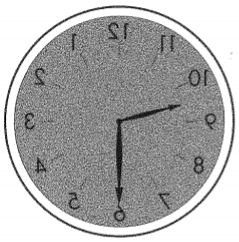
(C) 10 minutes

(D) 11 minutes

2.

The Captain looked into a mirror and saw this clock.

What was the time?



(A) 2.30

(B) 9.00

(C) 9.30

(D) 10.30

3.

If a candle 25 cm long takes 5 hours to burn away, after 3 hours, how much of the candle would be left?

(A) 5 cm

(B) 10 cm

(C) 15 cm

(D) 20 cm

4.

This is a copy of the times for meals on the ship:

Meal	Mon/Fri	Sat/Sun
Breakfast	6.30	7.00
Lunch	12.30	1.00
Dinner	7.30	8.00

How long was it from breakfast to dinner on Wednesday?

(A) 14 and a half hours

(B) 14 hours

(C) 13 and a half hours

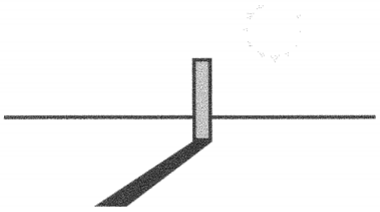
(D) 13 hours

5. Some of the sailors had to cut a length of timber into 6 pieces. If each cut was the same length and took one minute, how long would the job take? (A) 2½ minutes (B) 5 minutes (C) 5½ minutes (D) 6 minutes	6. The Captain told the Second Mate to be at the ship by 0600 hr. The Second Mate arrived at 0540 hr. Was she… (A) 60 minutes early? (B) 20 minutes early? (C) 60 minutes late? (D) 20 minutes late?
7. The Captain started daily walks around the deck at 8 am, noon and 4 pm. If it took him 15 minutes to walk around the deck, how long was it from the time he finished his walk until he started his next walk? (A) 3 and a half hours (B) 3 hours, 45 minutes (C) 4 hours (D) 4 hours, 15 minutes	8. The Cabin Boy was 2 years older than the ship's parrot. Their ages, when added together were 38 years. How old was the parrot? (A) 16 years (B) 18 years (C) 20 years (D) 22 years

Stage 3 problems

1.

The captain noticed that the shadow made by a pole on the wharf was gradually getting longer.



What would this mean?

(A) More daylight tomorrow

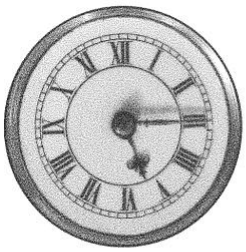
(B) Less daylight tomorrow

(C) It was morning

(D) It was afternoon

2.

This is an old pocket-watch that uses Roman numerals.



What is the time?

(A) 2.15

(B) 3.15

(C) 3.27

(D) 5.15

3.

The crew was whale-watching.

In the first hour, 4 whales were seen, 3 in the second hour, 6 in the third hour, 5 in the fourth hour and 8 in the fifth hour.

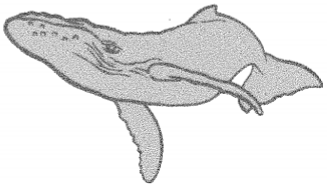
If whales continued to be seen in this pattern, how many would be seen in the sixth hour?

(A) 6

(B) 7

(C) 8

(D) 9



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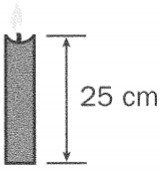
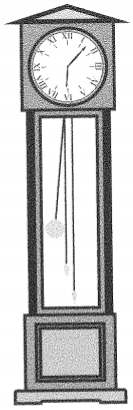
(D) 20 cm



5.

The old grandfather clock gains one minute every 12 hr and the kitchen digital clock loses one minute every 24 hr.



They were both set to the right time at noon on Monday.

When would one clock be 6 minutes faster than the other?

(A) Noon Tuesday

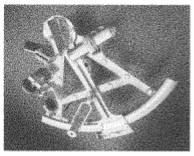
(B) Midnight Tuesday

(C) Noon Wednesday

(D) Midnight Wednesday

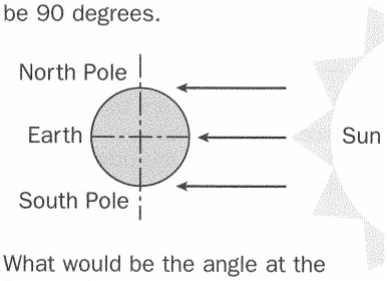
6.

If the Earth was not tilted at an angle towards the sun, a ship's latitude could simply be determined by the angle made by the sun to a vertical post at noon, if the ship was steady.



A sextant was used to measure this angle.

At the South Pole this angle would be 90 degrees.



What would be the angle at the Equator?

(A) Zero degrees

(B) 90 degrees

(C) 180 degrees

(D) 360 degrees

7.

If it takes 3 workers 2 hours to clean the deck, how long would it take 2 workers?

(A) 1 hr

(B) 2 hr

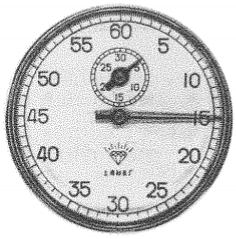
(C) $^{2}/_{3}$ hr altogether

(D) 3 hours altogether

8.

The Captain used this stop-watch to time how long it took to sweep the floor.

How long did it take?



(A) 15 min 4 sec

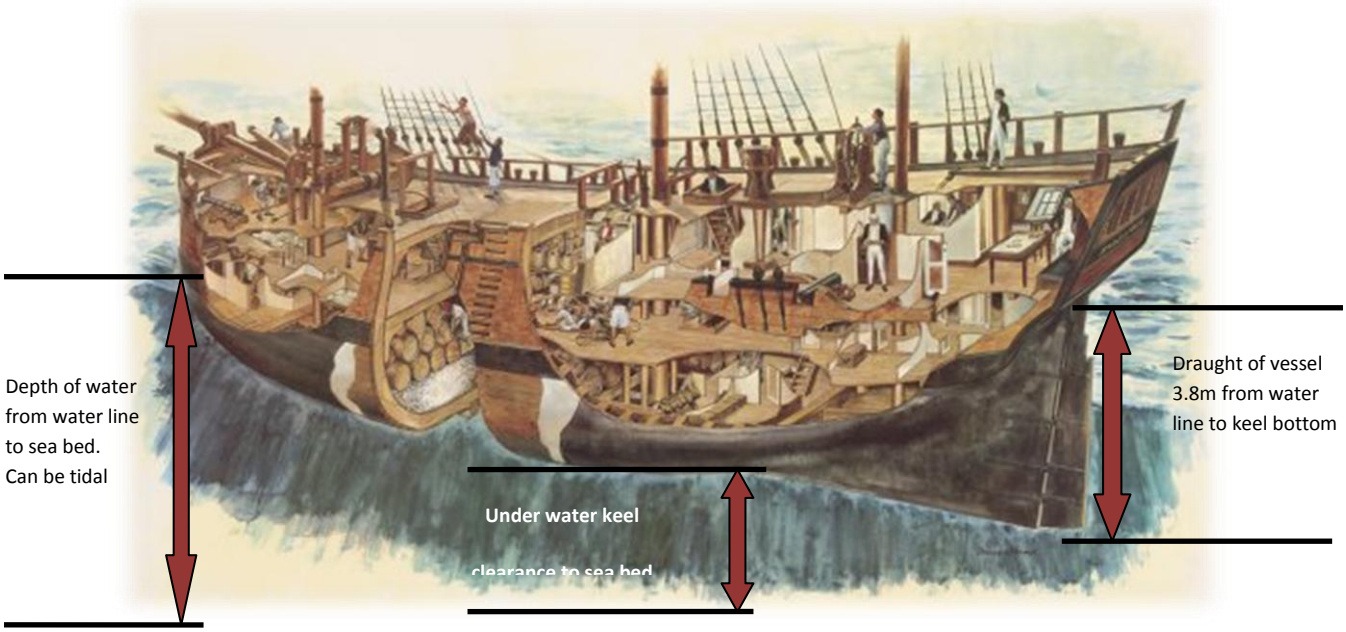
(B) 4 $^{1}/_{4}$ sec

(C) 4 hr 15 min

(D) 4 min 15 sec

Background Reading – Draught

Below: HMB *Endeavour* below decks
© Dennis Adams Estate
Courtesy National Library of Australia



The **depth** of the water is the measurement between the surface of the water and the sea floor. This is a tidal measurement and varies with the phases of the moon. Therefore, all depth measurements are expressed on charts in L.A.T. which is the Lowest Astronomical Tide. In Townsville, the *Endeavour* will go in at high tide – relying on about 1 metre of tidal water under the ship. When the tide drops, the ship will sit on the seabed which is mud cleared of debris. The ship will sit upright, without need for anchors, because of the flat-bottomed shape of the hull.

To discuss: Note that the ship 'draws' or 'displaces water – this is called the **draught.** On the *Endeavour* replica the draught is 3.6 metres at the bow and 3.8 metres at the stern. What does this mean? Which figure is the most important – the bow or stern measurement?

Navigating with lead lines

Lead lines are probably the world's oldest navigational tools. Traditionally, there were two types of lead lines. The inshore version measured down to 50 fathoms, and the deep-sea (pronounced 'dipsey') lead measured down to 200 fathoms. Knots and flags of various colours and materials were tied to the line to indicate fathoms by sight and feel. This allowed the leadsman to find his depth even in total darkness. The older version leads had a hollow in the base to hold sticky lard or fat which picked up bottom sediments – this gave clues to the approximate location of the ship. It also made it possible to see the make-up of the sea bed. Traditionally the measurements of underwater keel clearance were done by using a **lead line.** This is simply a gravity-powered lead weight attached to a line marked in **fathoms**.

One Fathom (six feet) is equal to:

METRIC	
kilometre	0.0018288
metre	1.8288
centimetre	182.88

Lead line ANMM collection

ACTIVITY: Calculate the underwater keel clearance at each port.

This is the distance between the bottom of the hull and the sea floor.

Maths, Science

Look at port map on the *Endeavour* circumnavigation website http://www.endeavourvoyages.com.au.
Use the following table to work out the underwater keel clearance of the ship at each port.
Note that **DEPTH – DRAUGHT = UNDERWATER KEEL CLEARANCE**

PORT	DEPTH in METRES L.A.T.	DRAUGHT	UNDERWATER KEEL CLEARANCE
Port Jackson/ A.N.M.M.	9 mtrs	3.8 mtrs	
Brisbane River/Riverside	5 mtrs	3.8 mtrs	
Gladstone/Gladstone Boat Harbour	4.3 mtrs	3.8 mtrs	
Townsville/Ross River	3.4 mtrs	3.8 mtrs	
Cairns/ Trinity Wharf	8.4 mtrs	3.8 mtrs	
Thursday Island (anchorage only)	5.5 mtrs	3.8 mtrs	
Darwin/Stokes Hill Wharf	6 mtrs	3.8 mtrs	
Broome/ Inner Anchorage (anchorage only)	13 mtrs	3.8 mtrs	
Exmouth/ Gulf (anchorage only)	8.2 mtrs	3.8 mtrs	
Geraldton/ Fishing Boat Harbour	6.4 mtrs	3.8 mtrs	
Freemantle/ Inner Harbour	3.8 mtrs	3.8 mtrs	
Bunbury/ Outer Harbour	3.8 mtrs	3.8 mtrs	
Albany/ Prince Royal Harbour	4.3 mtrs	3.8 mtrs	

Using the Heavens

ACTIVITY: Finding the Southern Cross

Maths, Science

Key terms

Celestial Navigation is a method of finding your way by measuring the position of celestial bodies like stars, sun, the moon and planets in the sky.

Latitude is the distance of a location North or South of the equator and is measured as an angle. It is recorded in degrees, minutes and seconds. The Equator is 0° and the Poles of the Earth are 90°.

Longitude is a position East or West of a designated place on the Earth called the *Prime Meridian*. It is also measured as an angle in degrees, minutes and seconds. Longitude is the time difference (15° per hour) between Greenwich, England (the Prime Meridian at 0°) and a particular location.

How to Navigate by the Southern Cross

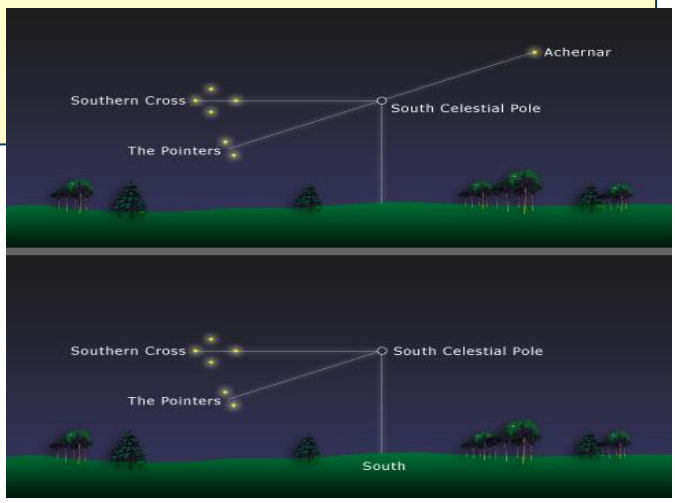
Use the following website to find how to locate the Southern Cross in the night sky:
http://www.teara.govt.nz/en/southern-cross/2/3
There are three ways to locate due south using the Southern Cross:

1. Draw an imaginary line from the top of the cross to the bottom and extend it 4.5 times. Drop a vertical line from this point, which is the South Celestial Pole (SCP), to the horizon – that place is due south.

2. Extend an imaginary line from the dimmer of the two Pointers to a lone bright star called Achernar. The South Celestial Pole is about halfway along this line. Locate south by dropping a vertical line from the South Celestial Pole to the horizon.

3. Imagine a line connecting the Pointers. Midway along this line, extend another line at a right angle to it, until it meets another line drawn down the long axis of the Southern Cross. The meeting place is the approximate location of the South Celestial Pole.
Locate south by dropping a vertical line from here to the horizon.

Above and right: From www.teara.govt.nz/en/southern-cross/2/3



ACTIVITY: Mapping latitude & longitude

Maths, Science

Using the map on page 7 where you traced the different navigators who came to Australia, and an atlas, draw and label latitude and longitude lines for the Australian continent. Next, complete the following chart, showing the co-ordinates each navigator passed through on their exploration:

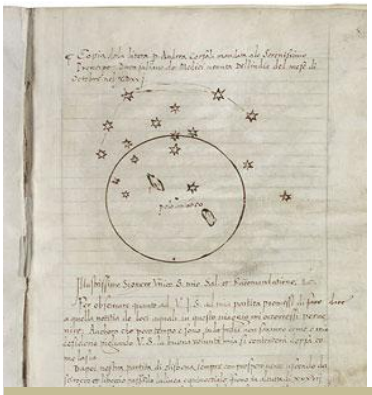
Navigator name	Latitude	Longitude
(Dutch)		
(French)		
(English)		
(Portugese)		
The Makassans*		

*Remember the Makassans navigated using natural features only

ACTIVITY: Make a mobile display

Maths, Science

Research more about navigating by the stars. Working in groups, use your information to make a hanging mobile to illustrate this form of navigation. Give a talk to the class explaining how your model works. These websites are a useful place to start:
http://www.wilderness-survival-skills.com/southern-cross.html
http://museumvictoria.com.au/pages/3305/adult-ed-sw-navigating-stars.pdf



Left: Andrea Corsali (b.1487) Letter to Giuliano de Medici 1516 manuscript on vellum; 29.5 x 22.5cm
Kindly lent to the State Library of New South Wales by the late Dr Bruce Reid, AM, KNO.
Courtesy State Library of New South Wales

This document from 1516 shows an early representation of the Southern Cross

Early European navigators used instruments like octants, quadrants, and later sextants, to determine their latitude and longitude

Little Midshipman with octant, c1795
ANMM Collection

ACTIVITY: Navigation vs space exploration – a comparative study

Science, Maths, English, History, HSIE/SOSE

Read about the original *Endeavour* journey **at** www.endeavourvoyages.com.au then do your own research on space exploration about the following issues:

- The forms and containers in which food and drink could be transported
- How information was transmitted and recorded
- The environmental conditions experienced and how that affects them physically
- The adaptations required to survive in the environment
- The types of state-of-the-art technology used for the journey
- The methods employed to collect information about our solar system and beyond
- The scientific experiments which have added to our understanding of the universe
- The cost

Presentation of information

The information may be presented in one of the following formats:

- Written comparative chart
- Visual comparative chart
- An oral presentation based on one object from each of *Endeavour* and space exploration
- An essay

Class essay

Trace the developments in technology that have enabled us to identify the different components in the night sky.

Class debate

The value of continuing the space program is the same as the continuation of navigation in the time of James Cook.

Hadley's navigational quadrant. England. C. 1770. A portable astronomical quadrant was thought to be on board *Endeavour*. Used to measure the angular distance of the sun from the zenith (the point immediately overhead), from which the accurate latitude and longitude of the observer could be obtained.

ANMM Collection

Did you know? In the Great Cabin of the *Endeavour* replica there is a ***trunnel*** (wooden nail) hammered into the sternpost. It was carried into space by the NASA space shuttle *Endeavour* on her maiden flight in 1992.

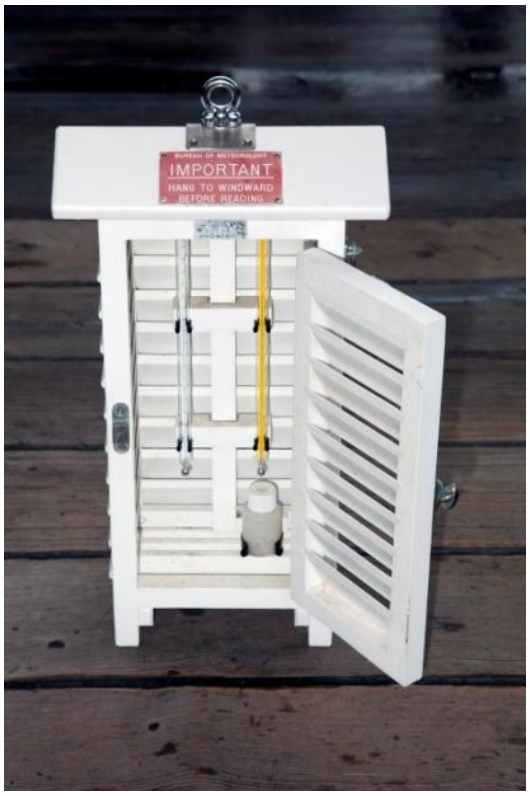
The importance of weather

Background Reading

Watching the weather

The *Endeavour* replica will carry a Stevenson's screen on board as it circumnavigates Australia. This marine screen is an internationally standard shape and size and was designed by Thomas Stevenson (1818-1887), a British civil engineer (and father of the author Robert Louis Stevenson). The World Meteorological Organization (WMO) agreed standard for the height of the thermometers is between 1.25 m (4 ft 1 in) and 2 m (6 ft 7 in) above the ground. The louvred box shields the instruments against precipitation and direct heat radiation from outside sources, while still allowing air to circulate freely.

The purpose of this box is to hold two thermometers in order to measure a parcel of air – dry and saturated. The wet bulb is wrapped in muslin and attached by a wick to a reservoir of water. The measurements should come in at an accuracy of 0.2˚accuracy. The officer of the watch – either the Master, 1st, 2nd or 3rd Officers – will take observations at midnight, 6am, noon and 6pm daily. The screen is always held to windward to get a good flow of air through the slats to make observations. They are entered into the software -http://www.knmi.nl/turbowin/- and emailed to the Bureau of Meteorology headquarters in Melbourne for further use. The instruments are inspected and re-calibrated regularly – when the ship comes into port after at least a three month interval.



Stevenson's screen on board HMB *Endeavour* Replica
Photo ANMM

The Bureau of Meteorology has also installed a new digital barometer for observations. This is kept in the Navigation Room with the charts, sextants, radar and communication equipment. The barometer is a weather watching aid that records air pressure. Over time you can tell whether air pressure is high or low and whether it is rising or falling. These readings can be used to forecast the weather.

GENERAL RULES FOR USING THE BAROMETER TO FORECAST LOCAL WEATHER
Barometric pressure decrease indicates coming stormy weather, rain, wind, heat
Barometric pressure rise indicates fair, dry, colder weather
Slow, regular and moderate fall in pressure indicates low pressure area is passing at a distance Any marked change in weather unlikely
Sudden decrease, even if small, indicates a nearby disturbance; normally bringing wind, and short showers
Large pressure drop signals a coming storm in 5 to 6 hours
Large, slow and sustained decrease indicates a long period of poor weather. Coming weather will be more pronounced if pressure started rising before dropping
Sudden rise of pressure, when the pressure is about average or above average and the weather is fair, indicates approach of a low pressure cell, and the barometer will soon start to come down
Rapid rise when the pressure is low, announces a short period of fair weather
If pressure rise is large and prolonged, count on a many days of good weather ahead

ACTIVITY: Investigating weather

Science, Geography, HSIE/SOSE

Weather is made up of many things. On TV and radio, you see and hear weather reports. The weather person talks about different parts of the weather. Investigate these reports and make a class list of the different components that make up the weather. List as many as you can.
Now **c**omplete the following chart based on your research

Weather concept	Effect on the earth	Effect on people	What I wear for this type of weather
Orbit and the seasons			
Sun			
Atmosphere			
Oceans			

Group work

Divide the class into three groups that will each research ONE of the following topics. Have each group think of a creative way of presenting their findings to the class, for example a news-style weather report, a Powerpoint presentation, a Q&A panel, an interview etc.

1. Demonstrate how difficult and dangerous navigation was in the 1700s based on the use of knots, sextants and chronometers.
2. Show how navigation has improved by weather, wave and ocean forecasting today.
3. Compare the old techniques of using knots to estimate boat speed by with sextants, chronometers and loglines with the modern equipment now available. Compare the accuracy of both old and new techniques.

The Bureau of Meteorology is providing up to 4 buoys each for the Cairns-Thursday island leg and the Exmouth-Geraldton leg which coincides with an increase in the Leeuwin Current. These will be spherical buoys with a ***holey sock drogue**** *that incorporate a sea surface temperature sensor as standard. For meteorological purposes, the sensor suite is expanded to include a barometer (SVP-B). How will this improve the quality of the information in ocean forecasts?*

Courtesy BOM website

*** Look this up**

Right: SVP-B buoy
Courtesy BOM

ACTIVITY: Be a weather maritime forecaster

Science, Geography, HSIE/SOSE

Pre- or post- your excursion, gather data **on** the wind, tides and sea level, temperature and currents at the port where you will visit HMB *Endeavour*. You can also observe the conditions on the day of your visit. **Fill in** the following chart using this information.

What's the weather today?

Weather Observation Table

Location: **Latitude:** **Longitude:**

Day:	Date:	Time:
Temperature:	°C	
Humidity:	%	
Rainfall:	mm	
Air pressure:	hpa	

Wind speed: km/h	**Wind direction:**

Cloud cover:
(make a pie chart of the % of cloud cover)

Seas:

Calm **light** **Choppy** **Rough**

These links to the Bureau of Meteorology website will be useful for this activity:

http://www.bom.gov.au/marine/

http://reg.bom.gov.au/lam/glossary/beaufort.shtml

RESOURCES FOR FURTHER READING AND RESEARCH

Ansted, A (1995), *A Dictionary of Sea Terms*, Brown, Son & Ferguson Ltd, Glasgow
Fisher, D (1995) *Latitude Hooks and Azimuth Rings*, International Marine. Maine.

H.M.Bark Endeavour Foundation () *Captain Cook's Endeavour*, Fremantle, Western Australia

Jeans, PD, (1993) *Ship to Shore*, ABC-CLIO,

Macarthur, S (1997) *His Majesty's Bark Endeavour*, Angus & Robertson,

http://www.nasa.gov
http://www.nma.gov.au/exhibitions/exploration_and_endeavour/take_no_ones_word_for_it/
http://www.crwflags.com
http://southseas.nla.gov.au/journals/
http://southseas.nla.gov.au/journals/maps/17700420.html
http://pinetreeweb.com/bp-nevil-maskelyne.htm
http://www.anmm.gov.au/site/page.cfm?u=1438
http://library.thinkquest.org/C001692/english/index.php3?subject=home
http://www.abc.net.au/navigators/history/earlyexplore.htm
http://en.wikipedia.org/wiki/World_Meteorological_Organization
http://www.bom.gov.au/climate/cdo/about/definitionstemp.shtml
http://www.wmo.int/pages/index_en.html
www.weatherwizkids.com/weather - instruments.htm
www.bobinoz.com
http://www.cmar.csiro.au/remotesensing/oceancurrents/
http://www.bom.gov.au/marine/marine_obs.shtml
http://www.calacademy.org/
http://www.noaa.gov/
http://topics.nytimes.com/top/news/science/topics/space_shuttle/endeavour/index.html?inline=nyt-classifier
http://www.teara.govt.nz/en/southern-cross/2/3

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