TECHNICAL REPORT 6

HEARD ISLAND
SUMMER 2000

BOB TWILLEY
Australian Surveying and Land Information Group

1. Introduction

Heard Island, with an area of 368 km , is the principal island of the Territory of Heard and McDonald Islands (53°05'S, 73°30E). Its major physical feature is Big Ben whose summit, Mawson Peak, is 2745 metres above sea level. Big Ben is an intermittently active volcano with a roughly circular base, some 20 km in diameter, which dominates the shape of the island. Over 80 percent of the island is covered by glacial ice. Coastal cliffs and exposed high rocky beaches around the Island make access from the sea difficult and hazardous.

The Island is relatively rich in flora and fauna with six major plant communities (tussock grassland, meadow herbfield, pool complex, cushion carpet and fellfield). The indigenous mammals of the Island include seven species of seals. The southern elephant seal is by far the most abundant seal on the island and others include the southern elephant seal, the Antarctic fur seal and the sub Antarctic fur seal. Thirty-four bird species have been recorded at Heard Island, the most abundant of which are the penguins which return annually to the island to breed and moult.

Australian research interests were first established on Heard Island in 1929 when Sir Douglas Mawson and nine members of the British Australian and New Zealand Antarctic Research Expedition (BANZARE) stayed for eight days, undertaking surveying, photography, biology and exploration. An Australian National Antarctic Research Expedition (ANARE) station was established in 1947 at Atlas Cove and closed in March 1955. A temporary station was later established at Spit Bay (summer 1991-92) to accommodate five people in the first wintering party since 1954. This 2000-2001 summer season expedition was the first major expedition to the island since then.

Bob Dovers initiated the Heard Island Geodetic Network in the early 1950s when he established a number of geodetic stations in a triangulation network. These stations were last occupied by National Mapping in 1980. The 1980 terrestrial observations (directions and distances) were combined with TRANSIT satellite Doppler fixes at a number of existing and new geodetic control stations. Due to the dominate gale-force westerly winds, access to the top of the steep cliffs on the western and southern sides of the island was virtually impossible by helicopter, so the survey network concentrated mainly on the northern side of the island.

With the advent of the Global Positioning System (GPS), the International GPS Service (IGS) and sophisticated GPS processing software, it is possible to obtain accurate coordinates in terms of the International Reference Framework (ITRF) anywhere in the world. The expedition to Heard Island in 2000 provided the opportunity to establish these coordinates on this remote Island. This report describes the work undertaken to achieve these results. Figure. 1 shows the complete geodetic network with both the previous stations (black triangle) and the new stations established in 2000 (red triangle).

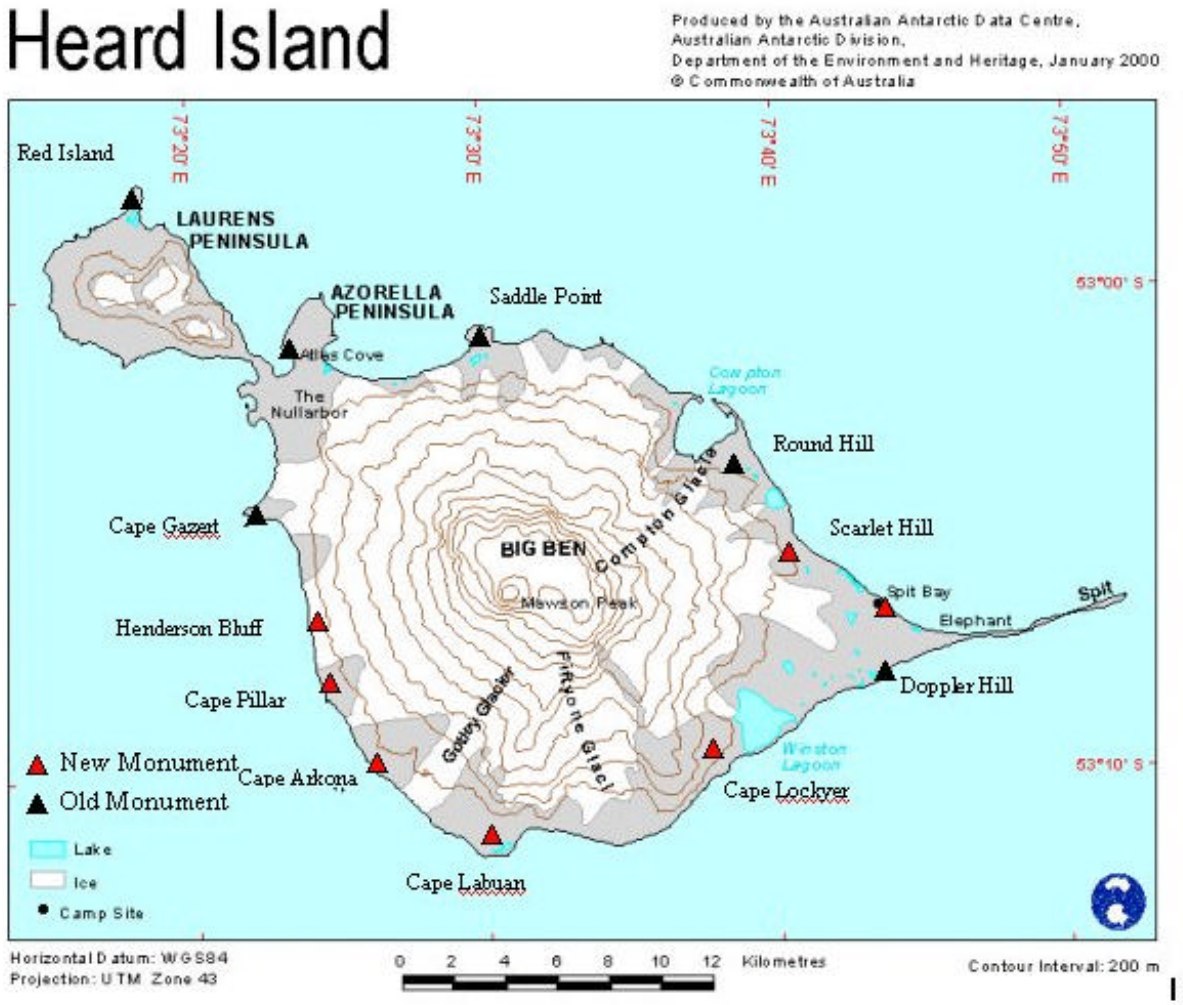


Figure. 1: Geodetic Survey Control Network

2. Objectives

The main objectives of the 2000 geodetic survey of Heard Island were to upgrade and extend the existing geodetic survey network to give a better coverage of the island and to establish accurate, globally compatible coordinates for all spatial data applications on the Island. In addition, GPS observations would provide information for the long-term measurement of horizontal and vertical movement. In the long term, these fundamental positions will provide information on the contemporary motion of Heard Island for comparison with geological records, with special emphasis on the Australia-Antarctic separation and the mid ocean ridge. In the meantime they provide a consistent and globally compatible spatial framework for all other studies on the Island.

To provide this information, geodetic quality GPS observations were made at existing and new survey marks at several sites around the perimeter of the island, with the prime location being the existing survey pillar at Atlas Cove. Geodetic quality GPS receivers and dual frequency antennae were used and the recorded data was transferred to a notebook PC for later processing and analysis.

AUSLIG's Space Geodesy Analysis Centre will combine the collected data with data simultaneously observed at other global sites in the International GPS Service's (IGS) network to produce 3-dimensional International Terrestrial Reference Frame (ITRF) positions with an accuracy of a few cm. These positions can then be used to compare with past and future results.

Ideally, continuous observation would give an ongoing measurement of the Islands movement, as is currently done with sites in the Australian Regional GPS Network. However the logistics of Heard

Island make this continuous operation impossible. Instead, epoch observations, as long as practically possible, are be used to obtain "snapshots" of the movement. The longer the GPS observation, the more confidence there will be in the result, but observations of several weeks ensure an accurate result.

3. Work plan

To meet the objectives, prior to departure an ambitious work plan was produced:

- Construct a geodetic GPS antenna mounting on the fundamental geodetic pillar at Atlas Cove.
- Observe continuous geodetic GPS observations for up to 3 weeks on the existing fundamental mark at Atlas Cove. Longer period of observations to be undertaken if possible if possible.
- Establish and measure local reference marks in the vicinity of the fundamental Pillar to allow future monitoring of possible local movement.
- Locate existing geodetic survey control marks in the vicinity of Round Hill, Cape Gazert, Red Island, Doppler Hill Saddle Point and Pageos ISTS 0044.
- Observe Geodetic GPS baselines of several hours' observation from Atlas Cove to and between the existing geodetic survey control marks as listed above.
- Establish new geodetic survey control stations in the vicinity of Spit Bay, Scarlet Hill, Henderson Bluff, Cape Pillar, Cape Arkona, Cape Labuan or Lavett Bluff and the bluff behind Cape Lockyer.
- Observe Geodetic GPS baselines of several hours duration from Atlas Cove to and between existing and newly established survey marks.
- Obtain short term GPS observations to establish the position of Spit Point.
- Obtain short term GPS observation on Mawson Peak to determine a true height.
- Obtain GPS a position on Sail Rock, Exile Rock and Franklin Rock, for maritime boundary definition.

4. Departure Voyage

The Australian Antarctic Division Voyage 2 expedition to Heard Island started from Fremantle WA onboard the MV Polar Bird, departing on the 7th of October 2000. The voyage to Heard Island was expected to take 8 days, however due to rough seas, strong headwinds and engine problems it was not until the 19th of October that the ship arrived at Atlas Cove.

As there had not been any formal field training for the expeditioners prior to departure it was necessary to run various training sessions during the long voyage to the Island. These sessions were run in small groups by the four Field Training Officers (FTOs), the expedition's medical Doctor and the two helicopter Pilots.

5. Deployment

On arrival at Atlas Cove the bad weather caused high seas and swell, making it impossible to lift the two helicopters (AS350 Squirrels) from the ships hull. It was decided to sail towards the eastern end of the island and look for calmer waters. Anchored between Skua Beach and Brown's Glacier the sea and wind calmed enough to carry out the delicate operation of raising the helicopters from the ship's hull. The helicopters and Inflatable Rubber Boats (IRBs) were used to transfer personnel, equipment and supplies to the base camps. Bad weather and rough seas with high swells continued for a number of days, preventing the immediate deployment of all expeditioners onto the island.

Two permanent base camps were established on the island, Spit Bay camp, located on Try Pot Beach and the primary camp at Atlas Cove on the other end of the island. Another smaller temporary camp was established in the vicinity of Brown's Glacier for the Glaciologists.

Heavy snow falls continued to hamper the deployment of personal and equipment for almost a week and it was not until the 25th of October, six days after arriving at Atlas Cove, that all expeditioners, supplies and equipment were ashore.

As there are no permanent base camps on the Island, specially designed PVC water tanks had been fitted out as living quarters for all expeditioners, The tanks were slung from the ship and placed in position by helicopter. A mess and kitchen tank (larger than the living quarters tank) was also set in place at each base camp. Each of the living quarters tank huts accommodated four expeditioners and space was very tight, but dry, out of the wind and reasonably comfortable. The mess and kitchen tanks were joined together by a timber "cold" porch. The Atlas Cove camp consisted of a mess, kitchen and communications tank huts, with a further six smaller tank huts for expeditioners living quarters.

The primary base camp at Atlas Cove was the headquarters of the Heard Island summer campaign. It was at Atlas Cove camp that most of the expeditioners were based, with up to twenty-three personnel. It was also the base operations for the two Squirrel helicopters as well as the communications centre. Atlas Cove was also the operational centre for the geodetic survey campaign.

With all expeditioners were required to assist in the establishment of the base camp at Atlas Cove, science programs did not commence until the third day after arrival on the Island. The expected length of stay on the island had already been shortened because of the delay in deployment of expeditioners and equipment, and the setting up of the camp further shortened the time that could be spent on the geodetic program.

6. Operation

6.1 Construct a geodetic GPS antenna mounting on the fundamental geodetic pillar at Atlas Cove.

During the Geodetic Survey by National Mapping in 1980 a concrete survey pillar was constructed at Atlas Cove. Transit Doppler and conventional survey observations were performed from this pillar and its Transit Doppler determined position was held fixed in the subsequent network adjustment. The pillar's survey point is a brass pin set in the middle of a brass plaque inscribed *"NM/OS/80"*.

The NM/OS/80 survey pillar is 1.4 metres high and 0.3 metres in diameter (figure 2). The concrete pillar is believed to have been connected to the exposed bedrock during its construction, with reinforcing rods through its centre to form a substantially stable monument.

6.2 Establish and measure local reference marks in the vicinity of the fundamental Pillar to allow future monitoring of possible local movement.

Three brass, mushroom-shaped reference marks (RMs) were placed within close proximity of the survey monument (see Figure 4). Each mark was epoxied into the surface bedrock with the inscription, *"Australia's National Mapping Agency, AUSLIG, AUS 093, Geodetic Control Station"* and stamped RM1, (2 or 3).

A high precision horizontal terrestrial survey was performed between the fundamental mark, AUS 93 and the newly placed reference marks, using the Leica, TC2003 electronic theodolite. The reference object (RO) for this survey was the PAGEOS 58 mark, with an azimuth determined from GPS observations between the two points. Levelling observations were performed to determine

height differences between the RMs and AUS 093, however due to equipment failure the results are not available. This will need to be performed on the next scheduled visit in 2002-2003.

Figure 2: NM/OS/80 Survey Pillar

Figure 3: AUS 093 Geodetic Survey Station

Figure 4. AUS093 RM3

6.3 Observe continuous geodetic GPS observations (up to 3 weeks) on the new survey control point AUS 93 (located over existing fundamental mark at Atlas Cove NM/OS/80). Longer period of observations if possible.

The GPS choke ring antenna was screwed directly onto the threaded spigot of the stainless steel antenna mounting plate. The antenna mounting plate was previously orientated so that when the antenna was screwed firmly down onto the plate it was aligned to within 5 degrees of true north. Therefore, with the antenna fixed onto the plate the vertical height to the Antenna Reference Point (ARP) was zero. Figure 5 shows the GPS antenna mounted directly on top of the stainless steel plate and concrete pillar.

A wind turbine was erected to provide continuous 24 volts DC power to the GPS receiver connected to 2 x 12 volt gel cell batteries. The batteries as well and the GPS receiver were placed in the GPS "warm box" located in the open at the base of the wind turbine pole. Due to the very strong gale-force winds the turbine was unable to limit the output voltage to the maximum of 27 volts and was at times being pushed to output of 35 volts. This caused the batteries to fail and the GPS receiver to power down and reset.

It was decided to relocate the GPS receiver into the communications tank hut where there was uninteruptable 12 volt power was available. A 30 metre antenna cable was used between the antenna and receiver. This was a much better option for the location of the GPS receiver as it would have been virtually impossible to perform the downloading of the daily GPS data files, when located in the warm box out in the open. The portable computer certainly would not have been able to survive the dirty and wet conditions that prevailed at all times.

With the GPS receiver and computer located in the communications hut, the downloading of the data was a lot easier. The communications officer was trained in the art of downloading and archiving the GPS raw data which allowed continuous GPS observation from 27th November 2000 (DOY 320) until 2nd February 2001 (DOY 033) - a total of 90 days.

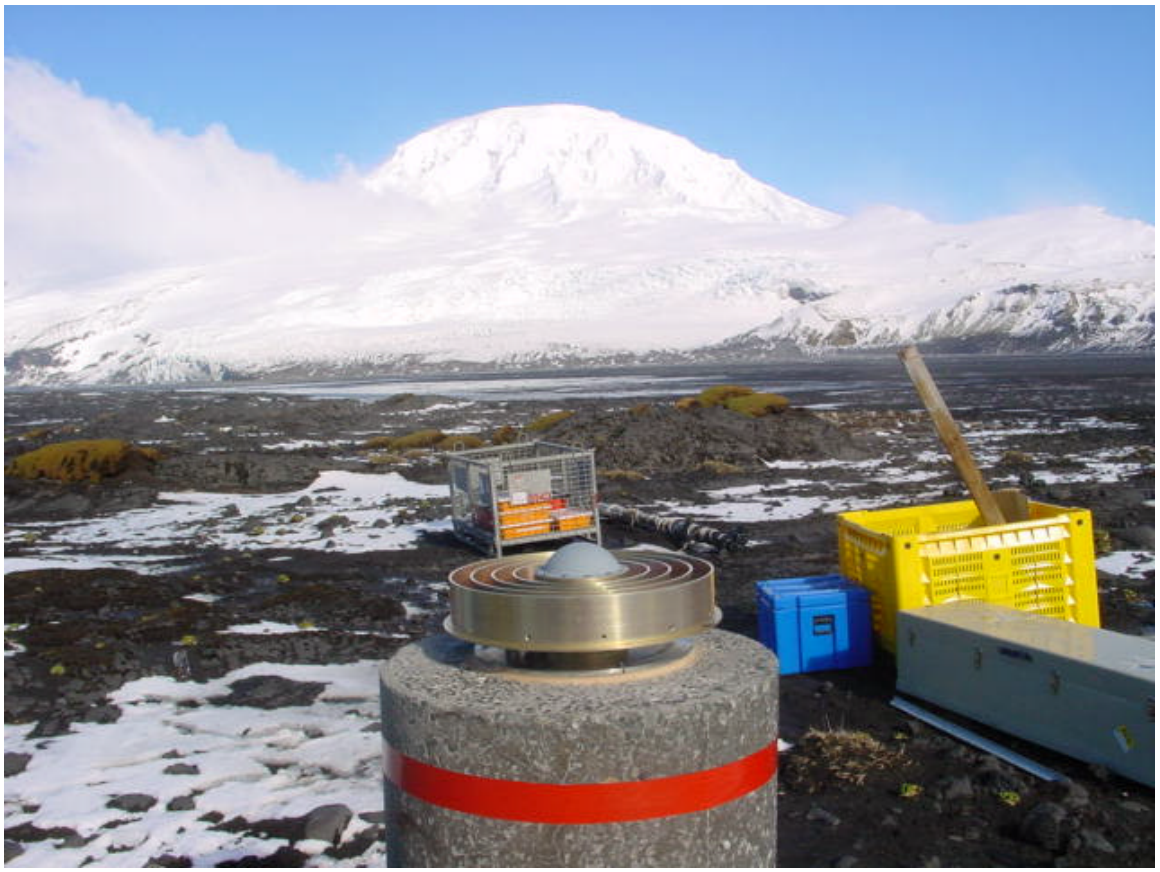


Figure 5. AUS093 Atlas Cove fundamental pillar with GPS antenna

6.4 Locate existing geodetic survey control marks in the vicinity of Round Hill, Cape Gazert, Red Island Doppler Hill Saddle Point and Pageos ISTS 0044. Observe Geodetic GPS baselines ***(several hours duration) from Atlas Cove to and between existing geodetic survey control marks as listed.***

The Survey Control Network project was considered to be very important to the success of the overall Heard Island expedition and as such was given the highest priority by the Australian Antarctic Division's (AAD), Chief Scientist, Michael Stoddard and Heard Island Station leader, Andrew Lock, for the use of the helicopters and field support.

With the GPS base station operating at Atlas Cove, geodetic baseline observations could commence at the selected existing survey control points, but before any GPS observations could be undertaken the points had to be located on the ground.

The following sections of this report document the station marks that were found or established and the GPS observations that were carried out.

6.4.1 Round Hill NM/OS/94

Round Hill is located above Fairchild Beach, north of Browns Glacier. Access is via helicopter directly to the top of hill.

A thorough search for the survey mark in the vicinity of a rock pile, which looked like the remains of a cairn, failed to uncover the star picket at ground level as described on the station summary. However a steel pin with centre point marked was found next to a star picket identifier in the same area. This was assumed to be the survey point and was used for the GPS observations. The GPS antenna was mounted on a survey tripod over the steel pin. To ensure that the antenna setup was secure against the strong winds, the tripod was set up as low as possible and weighted down with rocks. The GPS receiver was housed in a small hard plastic "Pelican case" along with two 12 volt (6 amp/hr) batteries. A 10 metre antenna cable was used and entered the case through a small hole at the rear.

Bad weather prevented a return to Round Hill to collect the equipment for a further two days.

A Log sheet and station summary is available at Annex B.

Figure 6. Round Hill looking northwest

6.4.2 Red Island NM/OS/88

Red Island is located at the northern end of Laurens Peninsular and is a restricted area due to a large colony of Macaroni Penguins, numbering around 1500 birds. Figure 7 shows the penguin colony at the very top of Red Island in the vicinity of the NM/OS/88.

Access is via helicopter to an open area of shingle northwest of Sydney Cove. As I did not have a permit to walk through a penguin colony at this location (or any other) it was necessary to walk to the north around eastern side of the snow-covered hill. It is then a short steep climb back along the

cliff edge to the top. The Penguins covered the whole area at the top of the island and had started to prepare for nesting. It was impossible to search for the existing survey point as there was no doubt it was in the middle of the colony. The birds showed signs of distress and I was advised by the penguin experts that I was not permitted to set up in this area.

Survey Control Mark not found and no GPS observations taken.

Figure 7: Red Island

6.4.3 Cape Gazert NM/OS/96

Cape Gazert is located on the western side of Heard Island, 6km south of Atlas Cove. It is a restricted flight path area due to nesting Albatross.

Access is via. helicopter, landing on the beach to the north of the Cape, with a short steep climb to the station on the first ridge behind the Cape. The station is marked by a 1 metre high rock cairn with a 1.5 metre long centred steel pole. The rock cairn was difficult to dismantle as the rocks were frozen together and the ones at ground level had to knocked away with a mash hammer With the rock cairn dismantled the station mark (steel pin) as described on the station summary was found in good condition.

The GPS antenna was setup on a survey tripod over the steel pin. The tripod was set as low as possible and securely weighted down with rocks. The GPS receiver was housed in a small hard plastic “Pelican case” along with two 12 volt (6 amp/hr) batteries. A 10 metre antenna cable was used and entered the case through a small hole at the rear. When the observations were completed, the rock cairn was re-established with the steel pole positioned over the mark and centred in the cairn.

A Log sheet and station summary is available at Annex B.

Figure 8: Cape Gazert, looking North towards Atlas Cove

6.4.4 Doppler Hill NM/Y/05

Doppler Hill is located on the eastern end of Heard Island between Spit Point and Cape Lockyer. Access is via helicopter directly to the top of the prominent hill.

Using the known position and a Garmin hand-held GPS receiver, what looked liked the remains of a rock cairn was located, but a thorough search of this area failed to find the bonze rod as described on the station summary. However, a steel pin with centre point marked was found in the same area. This was assumed to be the survey point and GPS observations were commenced.

The GPS antenna was setup on a survey tripod over the steel pin. The tripod was set as low as possible and weighted down with rocks. The GPS receiver was housed in a small hard plastic "Pelican case" along with two 12 volt (6 amp/hr) batteries. A 10 metre antenna cable was used and entered the case through a small hole at the rear. A small rock cairn now marks the location of the GPS observation point.

A Log sheet and station summary is available at Annex B.

Figure 9: Doppler Hill with Cape Lockyer in the background

6.4.5 Saddle Point NM/OS/91

Saddle Point is located on the northern coastline, east of Challenger Glacier. Saddle Point is a spectacular rise with a crater void in the centre.

Access is via helicopter to an open shingle area about 500 metres to the south of Saddle Point. Helicopter access could be direct to the top of the hill, however continuous strong winds prevented landing at this site on both occasions. The steep 10 minute climb up the southern face is made difficult by the loose volcanic scree.

The station was marked by a 0.5 metre high rock cairn with an angled star iron picket loosely protruding out the side. The station is positioned on the edge of a small volcanic crater and is battered by continual strong winds. The station mark, the head of a star iron picket, was found after much clearing of the frozen volcanic gravel at the base of the cairn.

The GPS antenna was setup on a survey tripod over the star iron picket. The tripod was set as low as possible and securely weighted down with the light volcanic rocks. The GPS receiver was housed in a small hard plastic “Pelican case” along with two 12 volt (6 amp/hr) batteries. A 10 metre antenna cable was used and entered the case through a small hole at the rear. On completion of the GPS observations, the rock cairn was re-established with new galvanised iron star picket.

A Log sheet and station summary is available at Annex A.

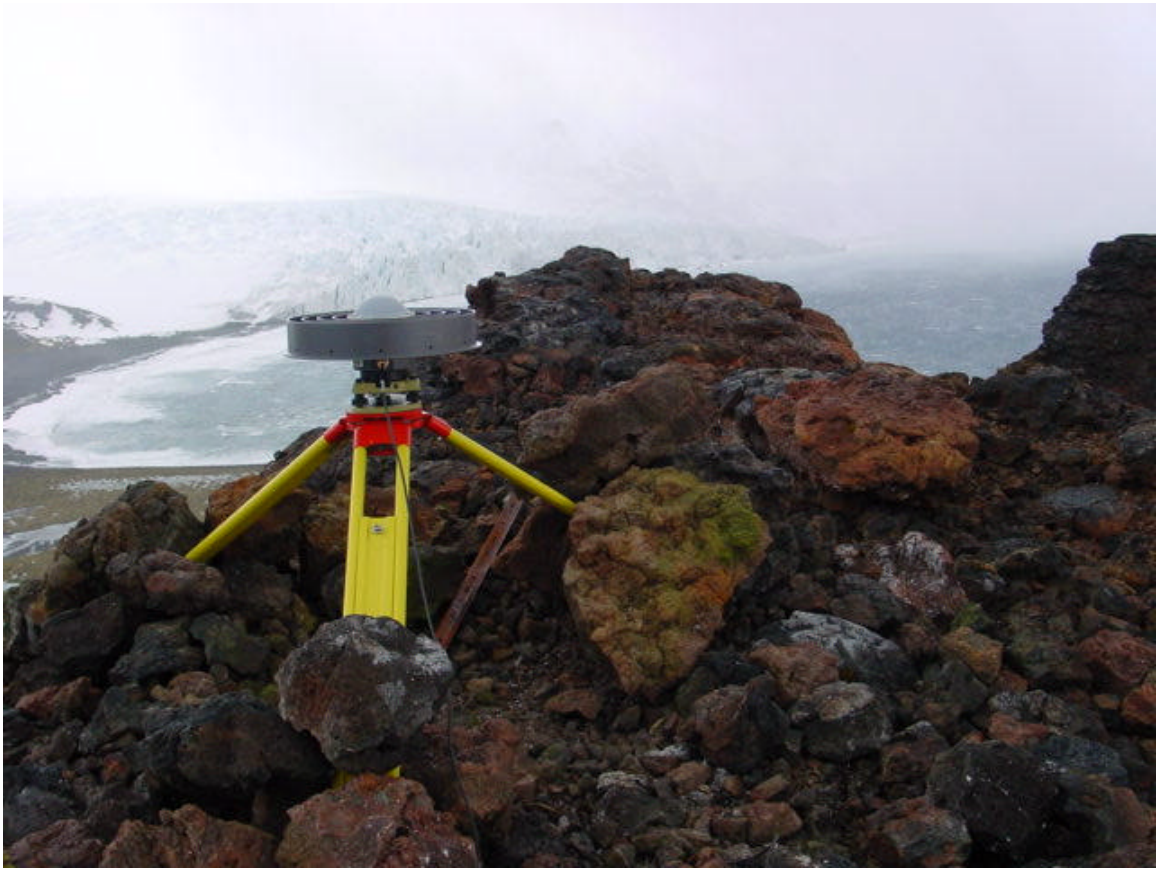


Figure 10: Saddle Point with Challenger Glacier in the background

6.4.6 Pageos ISTS 0044

The Pageos station is located at the Atlas Cove ANARE base, approximately 50 metres south of the fundamental pillar, AUS093. The station mark is a bronze disk set in bedrock and *stamped "0044 1969*" and witnessed by a 0.5 metre high rock cairn over the mark. The GPS antenna was setup on a survey tripod over the bronze disk and the rock cairn was re-established on completion of the GPS observations.

A Log sheet and station summary is available at Annex B.

Figure 11: Pageos ISTS 0044

6.5 Establish new geodetic survey control marks in the vicinity of Spit Bay, Scarlet Hill, Henderson Bluff, Cape Pillar, Cape Arkona, Cape Labuan or Lavett Bluff and the bluff behind Cape Lockyer. Observe Geodetic GPS baselines (several hours) from Atlas Cove to and between newly established survey marks.

6.5.1 West and Southwest Coast reconnaissance

Due to the environmental sensitivity of the area around the existing and proposed survey control points along the western and southern coast, it was decided to carry out a reconnaissance flight with the station leader and other experts in the environment protection area.

There are many Giant Petrels and Albatross nesting along this part of the coastline and there is a risk that the birds may move off their nests if the helicopter flies too close. There are also a number of Macaroni and Gentoo Penguin colonies, with the largest Macaroni colony on the island of over 1 million pairs located at Cape Labuan. The reconnaissance was to locate suitable flight paths and landing pads that would not interfere with the local bird populations. All locations were given the green light, except for Henderson Bluff, which has a large population of nesting Albatross that would most certainly be disturbed with any flights onto or over the Bluff.

6.5.2 Spit Bay AUS 094

Spit Bay is located on the top of a large cube shaped boulder, 20 metres behind the Spit Bay Camp on Try Pot Beach. Access is via helicopter to an area 50 metres northwest of the camp.

The station mark is a stainless steel plate set in rock. The plate is 150mm in diameter and 10mm thick, with a 5/8" Whitworth threaded spigot in the centre. This station will have fundamental importance, being constructed as a geodynamic mark and located at the opposite end of the Island to Atlas Cove.

The GPS antenna was screwed directly onto the spigot and the GPS receiver was housed in a small "Pelican case" along with 2 x 12 volt batteries. A 10 metre antenna cable was used and entered the case through a small hole at the rear.

A Log sheet and station summary is available at Annex B.

Figure 12: AUS 094 Spit Bay Station Mark with Antenna, looking over Try Pot Beach

Figure 13: Spit Bay Base Camp, AUS094 is located on top of the large rock.

Figure 14: AUS094 antenna located next to Automatic Weather Station (AWS) on top of the large rock

6.5.3 Scarlet Hill NM/OS/95

Scarlet Hill is located above Skua Beach, south of Compton Lagoon. Scarlet Hill is a very prominent hill with its deep red coloured slopes of volcanic rock up to almost a pinnacle at the top.

Access is via helicopter to a low saddle below and to the northwest of the steep scree slope, followed by a short steep 10-minute climb up the red volcanic scree slope.

The Scarlet Hill station mark, a star iron picket, was found in a small crevice on the top of the rock summit. This mark was not observed in 1980 and is now considered to be a new geodetic control station.

The GPS antenna was setup on a survey tripod over the star iron picket. The tripod was set as low as possible and securely weighted down with the light volcanic rocks. The GPS receiver was housed in a small hard plastic “Pelican case” along with one 12 volt battery. A 10 metre antenna cable was used and entered the case through a small hole at the rear.

A Log sheet and station summary is available at Annex B.

Figure 15: NM/OS/95 Scarlet Hill overlooking Stephenson Lagoon

6.5.4 Cape Pillar AUS 095

Cape Pillar is located on the western side of the island, between Henderson Bluff and Cape Arkona.

Access to the station is via helicopter to a low flat area about 300 metres to the north of the ridge that runs towards the Cape. There is a short 10 minute walk to the mark located on the ridge line between the highest point and the cliff edge.

This mark is a fundamental geodynamic GPS antenna mount, consisting of a stainless steel plate set in rock. The plate is 150mm in diameter and 10mm thick, with a 5/8" Whitworth threaded spigot in the centre The GPS antenna was screwed directly onto the threaded spigot down to the flat surface of the plate.

The GPS receiver was housed in a small hard plastic "Pelican case" along with two 12 volt (6 amp/hr) batteries. A 10 metre antenna cable was used and entered the case through a small hole at the rear. A galvanised star iron picket witnesses the station.

A Log sheet and station summary is available at Annex B.

Figure 16: Cape Pillar AUS 095 looking towards Lied Glacier

6.5.5 Cape Arkona AUS 096

Cape Arkona is located on the western side of the island, between Cape Pillar and Cape Labuan.

Access is via helicopter to a low flat area about 250 metres to the north of the station, followed by a steep 5 minute climb along the cliff edge to the top of the ridge that travels in a north easterly direction.

The station mark is a galvanised iron star picket, driven to refusal and protruding 0.2 metres above the ground surface.

The GPS antenna was setup on a survey tripod over the star iron picket. The tripod was set as low as possible and securely weighted down with rocks. The GPS receiver was housed in a small hard plastic "Pelican case" along with two 12 volt (6 amp/hr) batteries. A 10 metre antenna cable was used and entered the case through a small hole at the rear. On completion of the GPS observations, a small rock cairn was erected over the star iron picket.

A Log sheet and station summary is available at Annex B.

Figure 17: AUS 096 Cape Arkona with Gotley Glacier in the background

6.5.6 Cape Labuan AUS 097

Cape Labuan is located on the south western side of the island, south of Cape Arkona and to the west of Manning Lagoon.

Due to the large Macaroni Penguin Colony, access to the station was via helicopter to a flat area approximately 1km north of the station, followed by a 15 minute easy walk past Dillon Hill. The station mark is located on a small bluff about 150 metres from the edge of the cliff area and the penguin colony.

This mark is a fundamental geodynamic GPS antenna mount, consisting of a stainless steel plate set in rock. The plate is 150mm in diameter and 10mm thick with a 5/8" Whitworth threaded spigot in the centre. A galvanised iron star picket witnesses the station mark.

The GPS antenna was screwed directly onto the threaded spigot down to the flat surface of the plate.

The GPS receiver was housed in a small hard plastic “Pelican case” along with two 12 volt batteries. A 10 metre antenna cable was used and entered the case through a small hole at the rear.

A Log sheet and station summary is available at Annex B.

Figure 18: AUS 097Cape Labuan looking West

6.5.7 Henderson Bluff

Access to this area was not possible as it is a restricted area (nesting Albatross). No control point was established at this location.

6.5.8 Cape Lockyer

Due to very bad weather conditions access to this area was not possible during the entire stay on the island. No control point was established at this location.

6.6 Short term GPS observations to establish the positions of Spit Point, Mawson Peak, Sail Rock, Exile Rock and Franklin Rock for maritime boundary definition.

6.6.1 Spit Point

Short-term GPS observations were collected at the end of Spit point using the Garmin hand-held GPS receiver to determine an approximate position for Maritime Boundaries.

Position (WGS84):	Latitude:	S53° 06’ 25”
	Longitude:	E73° 52’ 25”

A search for the original Spit Point survey station (NM/Y/03) failed to recover the star picket. The whole Spit Point is covered by thousands of Southern Elephant Seals

Figure 19: Spit Point

6.6.2 Mawson Peak

Due to unfavourable weather conditions it was impossible to get to the top of Big Ben summit, Mawson Peak.

6.6.3 Sail Rock

Access over Sail Rock was not permitted due to environmental restrictions.

6.6.4 Exile and Franklin Rocks

Single point positions were obtained using Garmin hand-held GPS receiver, from a helicopter hovering over the location of the rocks below.

6.6.4.1 Franklin Rock:

Position (WGS84):	Latitude:	S53° 10’ 35”
	Longitude:	E73° 24’ 40”

6.6.4.2 Exile Rock:

Position (WGS84):	Latitude:	S53° 10’ 49”
	Longitude:	E73° 22’ 06”

Figure 20: Franklin Rock

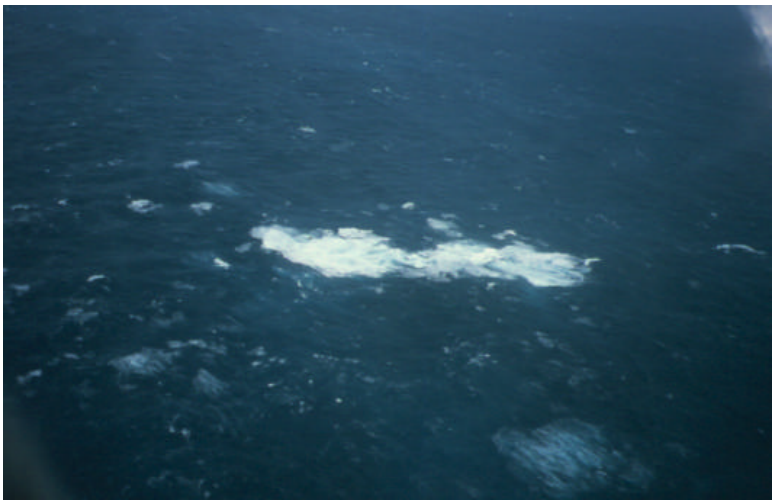


Figure 21: Exile Rock

Annex A.

Atlas Cove AUS093
Local Monitoring Survey Report - October 2000

An accurate local survey was conducted between the Atlas Cove GPS mark (AUS093) and its nearby reference marks on October 27th 2000, to monitor possible local movement.

Survey Results
The Reference Mark survey was performed using a Leica TC2003 Total Station and a set of 3 Leica Precision Prisms. These instruments were used to observe all horizontal and vertical angles and slope distances.

All reduced observations were corrected for temperature, humidity and pressure. The observations were then put into a least squares adjustment program (GEOLAB) to determine the final coordinates, and also to evaluate the quality of the measurements. The network was fixed using the known coordinates of AUS093 and Pageos ISTS 0044.

Datum
AUS093 (ATLA) has been fixed at its ITRF2000 coordinate at an epoch of 2000.0. Accordingly the GRS80 ellipsoid has been used.

Results
The adjusted mark coordinates for the survey are shown below:

Mark	Latitude	Std Dev	Longitude	Std Dev	Ellipsoidal Height	Std Dev
AUS093	-53 01 07.02221	0.0000	73 23 36.26540	0.0000	44.2104	0.0000
RM1	-53 01 06.51290	0.0002	73 23 36.92259	0.0002	44.2104*	0.0001
RM2	-53 01 07.47533	0.0002	73 23 36.55023	0.0002	44.2104*	0.0001
RM3	-53 01 06.92241	0.0002	73 23 35.18523	0.0003	44.2104*	0.0001

Latitude, Longitude and Ellipsoidal height and the associated standard deviation for the RM stations. GRS80 ellipsoid and ITRF2000 @2000.00 co-ordinates adopted at AUS093 (ATLA).

*** There is no height information to enable a height determination for the RM's**

Discussion
The results above show the adjusted coordinated for the Atlas Cove geodynamic mark (AUS93) and its RMs. Unfortunately there is no level information to enable the height differences between these marks to be derived.

Future surveys will need to be conducted to monitor any local movement of this mark.

Field Book References:
2001 Survey – AUSLIG Geodesy #39

Annex B

HEARD ISLAND GPS LOG SHEETS AND STATION SUMMARIES

GPS STATION OCCUPATION REPORT

Fill Out for Each Site Occupation or Receiver Installation

Station Name: **Scarlet Hill** 4-Char. ID: **SCAR** Station ID # **NM OS 95**

Location: **Heard Island, Antarctica** Project: **Antarctic Geodesy Project 1265**

Mark Description: **Star Picket** Mark Inscription: **Nil Inscription**

Approximate Geodetic Coordinates

Latitude: **-53° 06¢** Datum: **WGS84** Source: **Pt. Pos**. Magnetic Declination: ..…..°…....

Longitude: **73° 40¢** **WGS84**. **Pt. Pos.** Annual Change: +/- .....…..……

Height: **449.1 m** **WGS84** **Pt. Pos.** Source of Declination: .....……..

Occupation Summary (Dates)

	Local	UTC	UTC Day Number	Local Time Offset from UTC:
First Observing Day:	**01/11/2000**	**01/11/2000**	**306**	**+7** Hours
Last Observing Day:	**01/11/2000**	**01/11/2000**	**307**	

Total Number of Observing Days at this Station: **2**

Equipment Used

	Type	Model	Serial Number	
Receiver:	**Ashtech**	**ASHTECH Z-II3**		Receiver software & ver: **CD00**
Antenna:	**Ashtech**	**ASH700936E**		Equipment owned by: **AUSLIG**

☑ Tribrach ☑ Tripod ☐ Machined shims under antenna Antenna cable length: **10 metres**

In-Line antenna amplifier ☐ Yes ☑ No

External reference frequency used: ☐ Yes ☑ No Type: ☐Rubidium ☐Hydrogen Maser ☐Other

Power Supply

☐ 240 Volt AC and Power converter ☐ Generator ☐ Type: ..... Watts: .....…….....

12 Volt Battery Type: **12 volt Gel cell**. Number used: **2** ☐ Internal ☑External

Photo of GPS Antenna – Scarlet Hill - NM OS 95 - Heard Island

GPS ANTENNA SET-UP

Station Name: **Scarlet Hill** 4-Char. ID: **SCAR** Station ID # **NM OS 95**

Location: **Heard Island, Antarctica** Project: **Antarctic Geodesy Project 1265**

Mark Description: **Star Picket** Mark Inscription: **Nil Inscription**

Antenna Set-up

Include a sketch of the antenna set-up showing all mounting accessories ie. tripod, pillar, tribrach etc. Show all distances measured from the ground mark to defined points on the antenna indicate whether distances are slant or vertical.

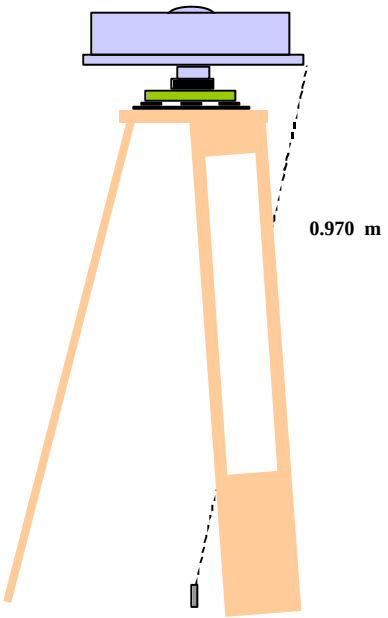
Antenna Height Above Mark in Metres

Record the measured height above the ground mark to as many of the following as possible:
For slant measurements include the horizontal offset distance to the centre of the antenna.

Distance (metres)	Vertical	Slant	Offset Distance
L1 Phase centre:	☐	☐	
L2 Phase centre:	☐	☐	
Base of Antenna	☑	☐	**0.916 - Vertical distance ARP to Mark**
Top of ground plane:	☐	☐	
Bottom of ground plane:	☐	☑	**0.970 – Slant distance BGP to Mark**
Bottom of choke ring:	☐	☐	

Antenna: Make: Ashtech Type: ASH700936E S/N:

SKETCH



GPS DAILY OBSERVATION LOG

Fill Out for Each Observation Session and After Power Failures

Station Name: Station Name: **Scarlet Hill** 4-Char. ID: **SCAR** Station ID # **NM OS 95**

Location: Location: **Heard Island, Antarctica** Project: **Antarctic Geodesy Project 1265**

Mark Description: Mark Description: **Star Picket** Mark Inscription: **Nil Inscription**

Log

Primary Operator: **Bob Twilley** Agency: **AUSLIG** Telephone: **02 62014346** Date: **November 2000**

	Type	Model	Serial number	Firmware & Version
Receiver:	**Ashtech**	**ASHTECH Z-II3**		**CD00**
Antenna:	**Ashtech**	**ASH700718B**		

Collection Interval (sec.): **30** Collection Format: **compact** Elevation Mask **+5°**

Antenna Height above ground mark (metres): Start End ☐ Vertical ☑ Slant

	Start	End
1	**0.970**	**0.970**
2	……	……...
3	…….....	…….

Average: **0.970**

Height Entered into Receiver: **0.0000** ☑ Antenna Aligned with True North

Observation Sessions

Session #: 1	Local Time	Local Date	UTC Time	UTC Date	UTC Day No.
End Time	**06:59:30**	**02/11/2000**	**2359 30**	**01/11/2000**	**306**
Start Time	**12:38:30**	**01/11/2000**	**0538 30**	**01/11/2000**	**306**

Session Duration **approx 18.0 hours** File Name: **SCAR3060.00o** ☐ Power Failure

Session #: 2	Local Time	Local Date	UTC Time	UTC Date	UTC Day No.
End Time	**12:00:30**	**02/11/2000**	**0500 30**	**02/11/2000**	**307**
Start Time	**07:00:30**	**02/11/2000**	**0000 30**	**02/11/2000**	**307**

Session Duration **approx 5.0 hours** File Name: **SCAR3070.00o** ☐ Power Failure

GPS STATION OCCUPATION REPORT

Fill Out for Each Site Occupation or Receiver Installation

Station Name: **Cape Labuan** 4-Char. ID: **LABU** Station ID # **AUS 097**

Location: **Heard Island, Antarctica** Project: **Antarctic Geodesy Project 1265**

Mark Description: **S/S plate set in rock** Mark Inscription: **"…AUSLIG AUS 097…"**

Approximate Geodetic Coordinates

Latitude: **-53° 11¢** Datum: **WGS84** Source: **Pt. Pos**. Magnetic Declination:

…….°……...

Longitude: **73° 29¢** **WGS84**. **Pt. Pos.** Annual Change: +/-

.....…..……

Height: **85.5 m** **WGS84** **Pt. Pos.** Source of Declination:

.....……..

Occupation Summary (Dates)

	Local	UTC	UTC Day Number	Local Time Offset from UTC:
First Observing Day:	**06/11/2000**	**06/11/2000**	**311**	**+7** Hours
Last Observing Day:	**06/11/2000**	**06/11/2000**	**311**	

Total Number of Observing Days at this Station: **1**

Equipment Used

	Type	Model	Serial Number	
Receiver:	**Ashtech**	**ASHTECH Z-II3**		Receiver software & ver: **CD00**
Antenna:	**Ashtech**	**ASH700936E**		Equipment owned by: **AUSLIG**

☐ Tribrach ☐ Tripod ☐ Machined shims under antenna Antenna cable length: **10 metres**

In-Line antenna amplifier ☐ Yes ☑ No

External reference frequency used: ☐ Yes ☑ No Type: ☐Rubidium ☐Hydrogen Maser ☐Other

Power Supply

☐ 240 Volt AC and Power converter ☐ Generator ☐ Type: ..... Watts: .....…….....

12 Volt Battery Type: **12 volt Gel cell**. Number used: **2** ☐ Internal ☑External

Photo of GPS Antenna – Cape Labuan - AUS 097 - Heard Island

GPS ANTENNA SET-UP

Station Name**:** **Cape Labuan** 4-Char. ID**:** **LABU** Station ID **#** **AUS 097**

Location: **Heard Island, Antarctica** Project**: Antarctic Geodesy Project 1265**

Mark Description: **S/S plate set in rock** Mark Inscription: **"…AUSLIG AUS 097…"**

Antenna Set-up

Include a sketch of the antenna set-up showing all mounting accessories ie. tripod, pillar, tribrach etc. Show all distances measured from the ground mark to defined points on the antenna indicate whether distances are slant or vertical.

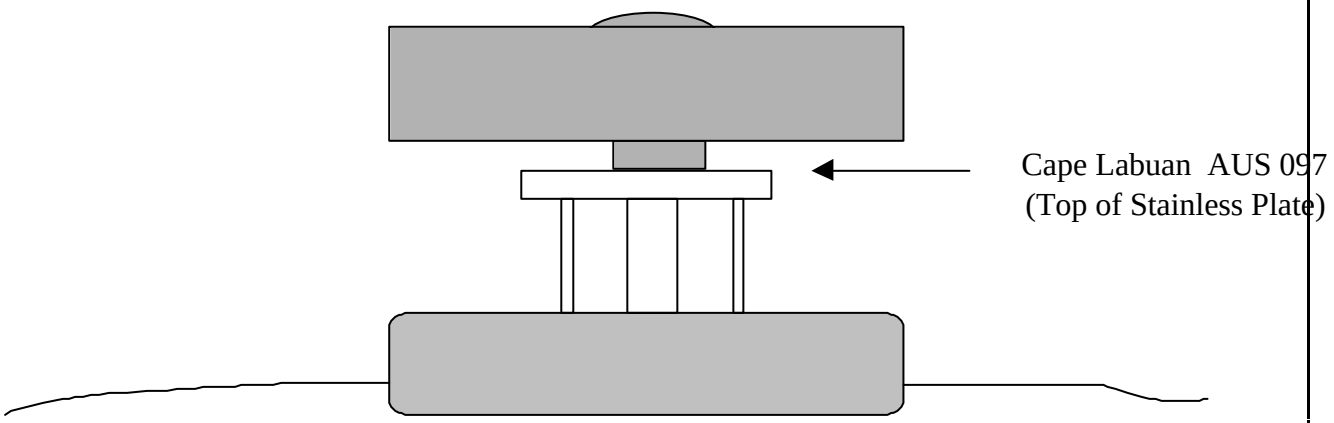
Antenna Height Above Mark in Metres

Record the measured height above the ground mark to as many of the following as possible:
For slant measurements include the horizontal offset distance to the centre of the antenna.

Distance (metres)	Vertical	Slant	Offset Distance
L1 Phase centre:	☐	☐	
L2 Phase centre:	☐	☐	
Base of Antenna	☑	☐	**0.0000 - Antenna mounted on S/S**
Plate			
Top of ground plane:	☐	☐	
Bottom of ground plane:	☐	☐	
Bottom of choke ring:	☐	☐	

Antenna: Make: Ashtech Type: ASH700936E S/N:

SKETCH



GPS DAILY OBSERVATION LOG

Fill Out for Each Observation Session and After Power Failures

Station Name**:** **Cape Labuan** 4-Char. ID**:** **LABU** Station ID **#** **AUS 097**

Location: Location: **Heard Island, Antarctica** Project**:** **Antarctic Geodesy Project 1265** Mark Description: **S/S plate set in rock** Mark Inscription: **"…AUSLIG AUS 097…"**

Log

Primary Operator: **Bob Twilley** Agency: **AUSLIG** Telephone: **02 62014346** Date: **November 2000**

	Type	Model	Serial number	Firmware & Version
Receiver:	**Ashtech**	**ASHTECH Z-II3**		**CD00**
Antenna:	**Ashtech**	**ASH700936E**		

Collection Interval (sec.): **30** Collection Format: **compact** Elevation Mask **+5°**

Antenna Height above ground mark (metres): Start End ☑ Vertical ☐ Slant

	Start	End
1	**0.0000**	**0.0000**
2	…….	....……..
3	....…….....	.....……..

Average: **0.0000**

Height Entered into Receiver: **0.0000** ☑ Antenna Aligned with True North

Observation Sessions

Session #: 1	Local Time	Local Date	UTC Time	UTC Date	UTC Day No.
End Time	**05:16:30**	**07/11/2000**	**2216 30**	**06/11/2000**	**311**
Start Time	**13:42:30**	**06/11/2000**	**0642 30**	**06/11/2000**	**311**

Session Duration **approx 15.0 hours** File Name: **LABU3130.00o** ☐ Power Failure

GPS STATION OCCUPATION REPORT

Fill Out for Each Site Occupation or Receiver Installation

Station Name**:** **PAGEOS ISTS 0044** 4-Char. ID**:** **PAGE** Station ID # **NM OS 87**

Location: **Heard Island, Antarctica** Project**: Antarctic Geodesy Project 1265**

Mark Description: **Bronze Disc set in bedrock** Mark Inscription: **"…ISTS 0044 1969…"**

Approximate Geodetic Coordinates

Latitude: **-53° 01¢** Datum: **WGS84** Source: **Pt. Pos**. Magnetic Declination: ..…..°…....

Longitude: **73° 24¢** **WGS84**. **Pt. Pos.** Annual Change: +/- .....…..……

Height: **41.8 m** **WGS84** **Pt. Pos.** Source of Declination: .....……..

Occupation Summary (Dates)

	Local	UTC	UTC Day Number	Local Time Offset from UTC:
First Observing Day:	**09/11/2000**	**09/11/2000**	**314**	**+7** Hours
Last Observing Day:	**09/11/2000**	**09/11/2000**	**314**	

Total Number of Observing Days at this Station: **1**

Equipment Used

	Type	Model	Serial Number	
Receiver:	**Ashtech**	**ASHTECH Z-II3**		Receiver software & ver: **CD00**
Antenna:	**Ashtech**	**ASH700936E**		Equipment owned by: **AUSLIG**

☑ Tribrach ☑ Tripod ☐ Machined shims under antenna Antenna cable length: **10 metres**

In-Line antenna amplifier ☐ Yes ☑ No

External reference frequency used: ☐ Yes ☑ No Type: ☐Rubidium ☐Hydrogen Maser ☐Other

Power Supply

☐ 240 Volt AC and Power converter ☐ Generator ☐ Type: ..... Watts: .....…….....

12 Volt Battery Type: **12 volt Gel cell**. Number used: **2** ☐ Internal ☑External

Photo of Survey Mark – PAGEOS ISTS 0044 - NM OS 87 - Heard Island

GPS ANTENNA SET-UP

Station Name: **PAGEOS ISTS 0044** 4-Char. ID: **PAGE** Station ID # **NM OS 87**

Location: **Heard Island, Antarctica** Project: **Antarctic Geodesy Project 1265**

Mark Description: **Bronze Disc set in bedrock** Mark Inscription: **"…ISTS 0044 1969…"**

Antenna Set-up

Include a sketch of the antenna set-up showing all mounting accessories ie. tripod, pillar, tribrach etc. Show all distances measured from the ground mark to defined points on the antenna indicate whether distances are slant or vertical.

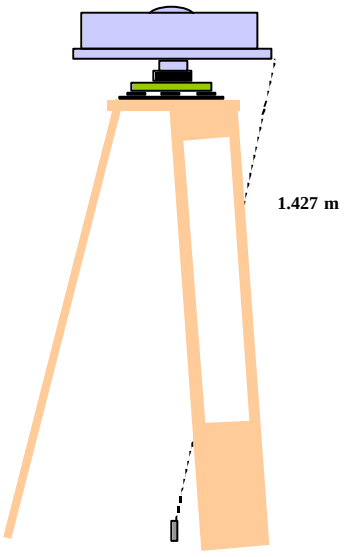
Antenna Height Above Mark in Metres

Record the measured height above the ground mark to as many of the following as possible:
For slant measurements include the horizontal offset distance to the centre of the antenna.

Distance (metres)	Vertical	Slant	Offset Distance
L1 Phase centre:	☐	☐	
L2 Phase centre:	☐	☐	
Base of Antenna	☑	☐	**1.379 - Vertical distance ARP to Mark**
Top of ground plane:	☐	☐	
Bottom of ground plane:	☐	☑	**1.427 – Slant distance BGP to Mark**
Bottom of choke ring:	☐	☐	

Antenna: Make: Ashtech Type: ASH700936E S/N:

SKETCH



GPS DAILY OBSERVATION LOG

Fill Out for Each Observation Session and After Power Failures

Station Name**:** **PAGEOS ISTS 0044** 4-Char. ID**:** **PAGE** Station ID # **NM OS 87**

Location: Location: **Heard Island, Antarctica** Project**: Antarctic Geodesy Project 1265**

Mark Description: **Bronze Disc set in bedrock** Mark Inscription: **"…ISTS 0044 1969…"**

Log

Primary Operator: **Bob Twilley** Agency: **AUSLIG** Telephone: **02 62014346** Date: **November 2000**

	Type	Model	Serial number	Firmware & Version
Receiver:	**Ashtech**	**ASHTECH Z-II3**		**CD00**
Antenna:	**Ashtech**	**ASH700936E**		

Collection Interval (sec.): **30** Collection Format: **compact** Elevation Mask **+5°**

Antenna Height above ground mark (metres): ☐ Vertical ☑ Slant

	Start	End
1	**1.427**	**1.427**
2	………………	………………
3	………………	………………

Average: **1.427**

Height Entered into Receiver: **0.0000** ☑ Antenna Aligned with True North

Observation Sessions

Session #: 1	Local Time	Local Date	UTC Time	UTC Date	UTC Day No.
End Time	**13:49:30**	**09/11/2000**	**0649** ^{30}	**09/11/2000**	**314**
Start Time	**07:43:30**	**09/11/2000**	**0043** ^{30}	**09/11/2000**	**314**

Session Duration **approx 6.0 hours** File Name: **PAGE3140.00o** ☐ Power Failure

GPS STATION OCCUPATION REPORT

Fill Out for Each Site Occupation or Receiver Installation

Station Name: **Round Hill** 4-Char. ID: **ROUN** Station ID # **NM OS 94**

Location: **Heard Island, Antarctica** Project: **Antarctic Geodesy Project 1265**

Mark Description: **Star Picket** Mark Inscription: **Nil Inscription**

Approximate Geodetic Coordinates

Latitude: **-53° 04¢** Datum: **WGS84** Source: **Pt. Pos**. Magnetic Declination: ..…..°…....

Longitude: **73° 39¢** **WGS84**. **Pt. Pos.** Annual Change: +/- ....…..……

Height: **422.5 m** **WGS84** **Pt. Pos.** Source of Declination: .....……..

Occupation Summary (Dates)

	Local	UTC	UTC Day Number	Local Time Offset from UTC:
First Observing Day:	**29/10/2000**	**29/10/2000**	**303**	**+7** Hours
Last Observing Day:	**29/10/2000**	**29/10/2000**	**303**	

Total Number of Observing Days at this Station: **1**

Equipment Used

	Type	Model	Serial Number	
Receiver:	**Ashtech**	**ASHTECH Z-II3**		Receiver software & ver: **CD00**
Antenna:	**Ashtech**	**ASH700936E**		Equipment owned by: **AUSLIG**

☑ Tribrach ☑ Tripod ☐ Machined shims under antenna Antenna cable length: **10 metres**

In-Line antenna amplifier ☐ Yes ☑ No

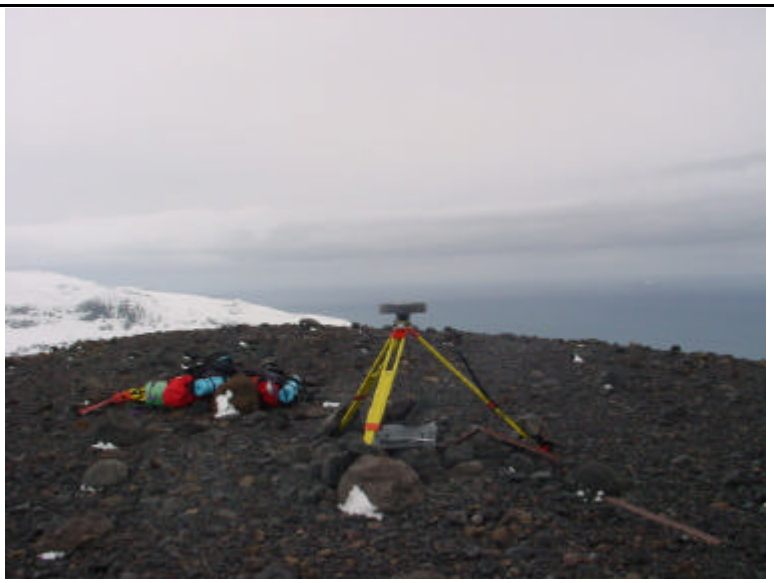
External reference frequency used: ☐ Yes ☑ No Type: ☐Rubidium ☐Hydrogen Maser ☐Other

Power Supply

☐ 240 Volt AC and Power converter ☐ Generator ☐ Type: ..... Watts: .....…….....

12 Volt Battery Type: **12 volt Gel cell**. Number used: **2** ☐ Internal ☑External

Photo of GPS Antenna – Round Hill - NM OS 94 - Heard Island



GPS ANTENNA SET-UP

Station Name: **Round Hill** 4-Char. ID: **ROUN** Station ID # **NM OS 94**

Location: **Heard Island, Antarctica** Project: **Antarctic Geodesy Project 1265**

Mark Description: **Star Picket** Mark Inscription: **Nil Inscription**

Antenna Set-up

Include a sketch of the antenna set-up showing all mounting accessories ie. tripod, pillar, tribrach etc. Show all distances measured from the ground mark to defined points on the antenna indicate whether distances are slant or vertical.

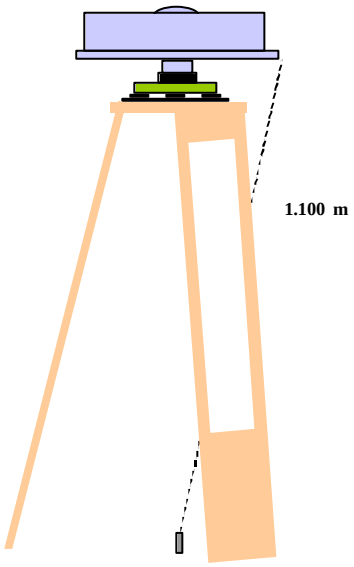
Antenna Height Above Mark in Metres

Record the measured height above the ground mark to as many of the following as possible:
For slant measurements include the horizontal offset distance to the centre of the antenna.

Distance (metres)	Vertical	Slant	Offset Distance
L1 Phase centre:	☐	☐	
L2 Phase centre:	☐	☐	
Base of Antenna	☑	☐	**1.048 - Vertical distance ARP to Mark**
Top of ground plane:	☐	☐	
Bottom of ground plane:	☐	☑	**1.100 – Slant distance BGP to Mark**
Bottom of choke ring:	☐	☐	

Antenna: Make: Ashtech Type: ASH700936E S/N:

SKETCH



GPS DAILY OBSERVATION LOG

Fill Out for Each Observation Session and After Power Failures

Station Name**:** **Round Hill** 4-Char. ID**:** **ROUN** Station ID **#** **NM OS 94**

Location: Location: **Heard Island, Antarctica** Project**: Antarctic Geodesy Project 1265**

Mark Description: Mark Description: **Star Picket** Mark Inscription: **Nil Inscription**

Log

Primary Operator: **Bob Twilley** Agency: **AUSLIG** Telephone: **02 62014346** Date: **October 2000**

	Type	Model	Serial number	Firmware & Version
Receiver:	**Ashtech**	**ASHTECH Z-II3**		**CD00**
Antenna:	**Ashtech**	**ASH700936E**		

Collection Interval (sec.): **30** Collection Format: **compact** Elevation Mask **+5°**

Antenna Height above ground mark (metres): Start End ☐ Vertical ☑ Slant

	Start	End
1	**1.100**	**1.100**
2	.....	.....
3	.....	..... Average: **1.100**

Height Entered into Receiver: **0.0000** ☑ Antenna Aligned with True North

Observation Sessions

Session #: 1	Local Time	Local Date	UTC Time	UTC Date	UTC Day No.
End Time	**00:55:30**	**30/10/2000**	**1911** ^{30}	**29/10/2000**	**313**
Start Time	**17:14:30**	**29/10/2000**	**0416** ^{30}	**29/10/2000**	**313**

Session Duration **approx 15.0 hours** File Name: **ROUN3130.00o** ☐ Power Failure

GPS STATION OCCUPATION REPORT

Fill Out for Each Site Occupation or Receiver Installation

Station Name**: Cape Pillar** 4-Char. ID**: PILL** Station ID # **AUS 095**

Location: **Heard Island, Antarctica** Project**: Antarctic Geodesy Project 1265**

Mark Description: **S/S plate set in rock** Mark Inscription: **"…AUSLIG AUS 095…"**

Approximate Geodetic Coordinates

Latitude: **-53° 08¢** Datum: **WGS84** Source: **Pt. Pos**. Magnetic Declination:

…….°……...

Longitude: **73° 25¢** **WGS84**. **Pt. Pos.** Annual Change: +/-

.....…..……

Height: **180.0 m** **WGS84** **Pt. Pos.** Source of Declination:

.....……..

Occupation Summary (Dates)

	Local	UTC	UTC Day Number	Local Time Offset from UTC:
First Observing Day:	**04/11/2000**	**04/11/2000**	**309**	**+7** Hours
Last Observing Day:	**04/11/2000**	**04/11/2000**	**309**	

Total Number of Observing Days at this Station: **1**

Equipment Used

	Type	Model	Serial Number	
Receiver:	**Ashtech**	**ASHTECH Z-II3**		Receiver software & ver: **CD00**
Antenna:	**Ashtech**	**ASH700936E**		Equipment owned by: **AUSLIG**

☐ Tribrach ☐ Tripod ☐ Machined shims under antenna Antenna cable length: **10 metres**

In-Line antenna amplifier ☐ Yes ☑ No

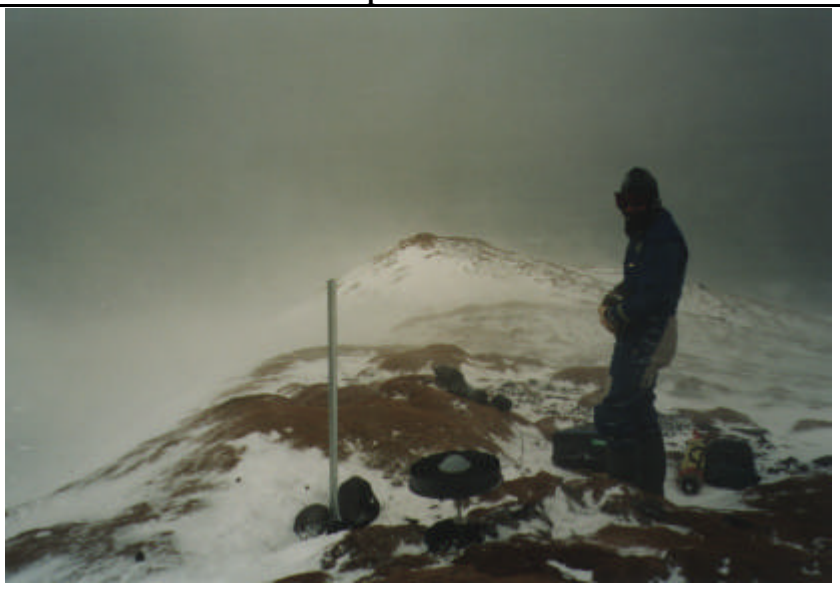
External reference frequency used: ☐ Yes ☑ No Type: ☐Rubidium ☐Hydrogen Maser ☐Other

Power Supply

☐ 240 Volt AC and Power converter ☐ Generator ☐ Type: ..... Watts: .....…….....

12 Volt Battery Type: **12 volt Gel cell**. Number used: **2** ☐ Internal ☑External

Photo of GPS Antenna – Cape Pillar - AUS 095 - Heard Island



GPS ANTENNA SET-UP

Station Name**:** **Cape Pillar** 4-Char. ID**:** **PILL** Station ID **#** **AUS 095**

Location: **Heard Island, Antarctica** Project**: Antarctic Geodesy Project 1265**

Mark Description: **S/S plate set in rock** Mark Inscription: **"…AUSLIG AUS 095…"**

Antenna Set-up

Include a sketch of the antenna set-up showing all mounting accessories ie. tripod, pillar, tribrach etc. Show all distances measured from the ground mark to defined points on the antenna indicate whether distances are slant or vertical.

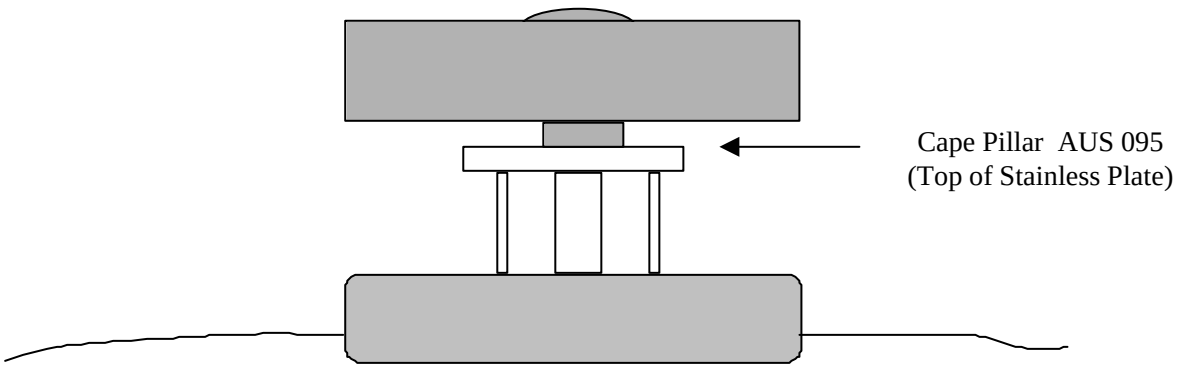
Antenna Height Above Mark in Metres

Record the measured height above the ground mark to as many of the following as possible:
For slant measurements include the horizontal offset distance to the centre of the antenna.

Distance (metres)	Vertical	Slant	Offset Distance
L1 Phase centre:	☐	☐	
L2 Phase centre:	☐	☐	
Base of Antenna	☑	☐	**0.0000 - Antenna mounted on S/S**
Plate			
Top of ground plane:	☐	☐	
Bottom of ground plane:	☐	☐	
Bottom of choke ring:	☐	☐	

Antenna: Make: Ashtech Type: ASH700936E S/N:

SKETCH



GPS DAILY OBSERVATION LOG

Fill Out for Each Observation Session and After Power Failures

Station Name**:** **Cape Pillar** 4-Char. ID**:** **PILL** Station ID **#** **AUS 095**

Location: Location: **Heard Island, Antarctica** Project**:** **Antarctic Geodesy Project 1265**

Mark Description: **S/S plate set in rock** Mark Inscription: **"…AUSLIG AUS 095…"**

Log

Primary Operator: **Bob Twilley** Agency: **AUSLIG** Telephone: **02 62014346** Date: **November 2000**

	Type	Model	Serial number	Firmware & Version
Receiver:	**Ashtech**	**ASHTECH Z-II3**		**CD00**
Antenna:	**Ashtech**	**ASH700936E**		

Collection Interval (sec.): **30** Collection Format: **compact** Elevation Mask **+5°**

Antenna Height above ground mark (metres): Start End ☑ Vertical ☐ Slant

	Start	End
1	**0.0000**	**0.0000**
2	..…….……	.....……..
3	.....…….....	.....……..

Average: **0.0000**

Height Entered into Receiver: **0.0000** ☑ Antenna Aligned with True North

Observation Sessions

Session #: 1	Local Time	Local Date	UTC Time	UTC Date	UTC Day No.
End Time	**19:01:30**	**04/11/2000**	**1201 30**	**04/11/2000**	**309**
Start Time	**11:34:30**	**04/11/2000**	**0434 30**	**04/11/2000**	**309**

Session Duration **approx 7.5 hours** File Name: **PILL3130.00o** ☐ Power Failure

GPS STATION OCCUPATION REPORT

Fill Out for Each Site Occupation or Receiver Installation

Station Name**: Saddle Point** 4-Char. ID**: SADD** Station ID # **NM OS 91**

Location: **Heard Island, Antarctica** Project**: Antarctic Geodesy Project 1265**

Mark Description: **Star Picket** Mark Inscription: **Nil Inscription**

Approximate Geodetic Coordinates

Latitude: **-53° 01¢** Datum: **WGS84** Source: **Pt. Pos**. Magnetic Declination: ..…..°…....

Longitude: **73° 30¢** **WGS84**. **Pt. Pos.** Annual Change: +/- .....…..……

Height: **144.8 m** **WGS84** **Pt. Pos.** Source of Declination: .....……..

Occupation Summary (Dates)

	Local	UTC	UTC Day Number	Local Time Offset from UTC:
First Observing Day:	**08/11/2000**	**08/11/2000**	**313**	**+7** Hours
Last Observing Day:	**08/11/2000**	**08/11/2000**	**313**	

Total Number of Observing Days at this Station: **1**

Equipment Used

	Type	Model	Serial Number	
Receiver:	**Ashtech**	**ASHTECH Z-II3**		Receiver software & ver: **CD00**
Antenna:	**Ashtech**	**ASH700936E**		Equipment owned by: **AUSLIG**

☑ Tribrach ☑ Tripod ☐ Machined shims under antenna Antenna cable length: **10 metres**

In-Line antenna amplifier ☐ Yes ☑ No

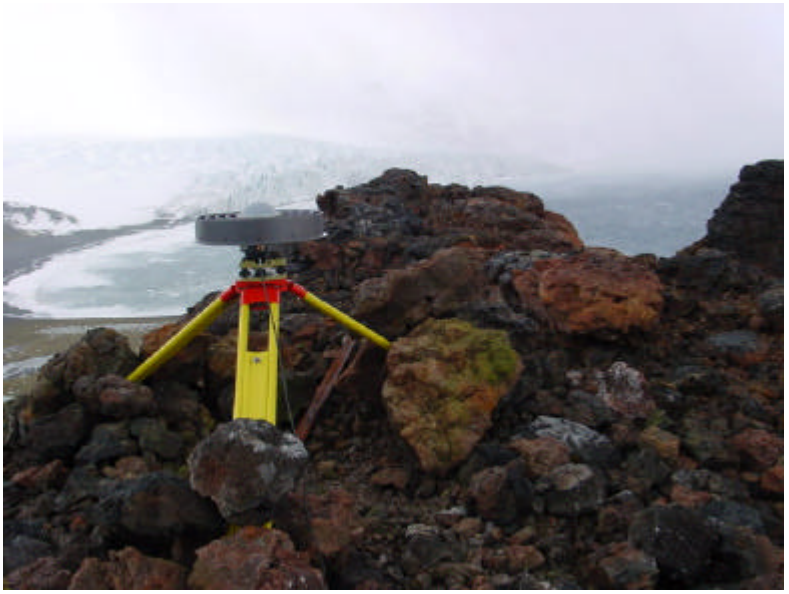
External reference frequency used: ☐ Yes ☑ No Type: ☐Rubidium ☐Hydrogen Maser ☐Other

Power Supply

☐ 240 Volt AC and Power converter ☐ Generator ☐ Type: ..... Watts: .....…….....

12 Volt Battery Type: **12 volt Gel cell**. Number used: **2** ☐ Internal ☑External

Photo of GPS Antenna – Saddle Point - NM OS 91 - Heard Island



GPS ANTENNA SET-UP

Station Name: **Saddle Point** 4-Char. ID: **SADD** Station ID # **NM OS 91**

Location: **Heard Island, Antarctica** Project: **Antarctic Geodesy Project 1265**

Mark Description: **Star Picket** Mark Inscription: **Nil Inscription**

Antenna Set-up

Include a sketch of the antenna set-up showing all mounting accessories ie. tripod, pillar, tribrach etc. Show all distances measured from the ground mark to defined points on the antenna indicate whether distances are slant or vertical.

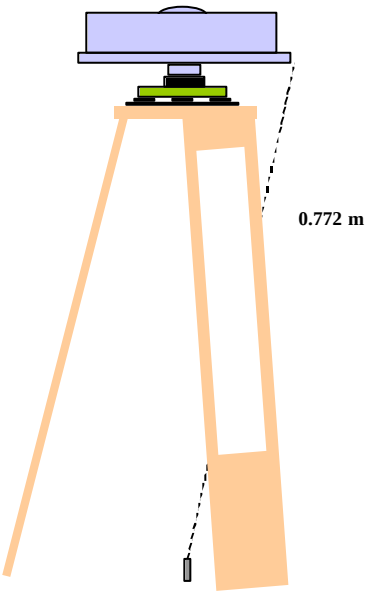
Antenna Height Above Mark in Metres

Record the measured height above the ground mark to as many of the following as possible:
For slant measurements include the horizontal offset distance to the centre of the antenna.

Distance (metres)	Vertical	Slant	Offset Distance
L1 Phase centre:	☐	☐	
L2 Phase centre:	☐	☐	
Base of Antenna	☑	☐	**0.713 - Vertical distance ARP to Mark**
Top of ground plane:	☐	☐	
Bottom of ground plane:	☐	☑	**0.772 – Slant distance BGP to Mark**
Bottom of choke ring:	☐	☐	

Antenna: Make: Ashtech Type: ASH700936E S/N:

SKETCH



GPS DAILY OBSERVATION LOG

Fill Out for Each Observation Session and After Power Failures

Station Name: Station Name: **Saddle Point** 4-Char. ID: **SADD** Station ID # **NM OS 91**

Location: Location: **Heard Island, Antarctica** Project: **Antarctic Geodesy Project 1265**

Mark Description: Mark Description: **Star Picket** Mark Inscription: **Nil Inscription**

Log

Primary Operator: **Bob Twilley** Agency: **AUSLIG** Telephone: **02 62014346** Date: **November 2000**

	Type	Model	Serial number	Firmware & Version
Receiver:	**Ashtech**	**ASHTECH Z-II3**		**CD00**
Antenna:	**Ashtech**	**ASH700936E**		

Collection Interval (sec.): **30** Collection Format: **compact** Elevation Mask **+5°**

Antenna Height above ground mark (metres): Start End ☐ Vertical ☑ Slant

	Start	End
1	**0.772**	**0.772**
2	..……..……	.....……...
3	....…….….....	.....…….

Average: **0.772**

Height Entered into Receiver: **0.0000** ☑ Antenna Aligned with True North

Observation Sessions

Session #: 1	Local Time	Local Date	UTC Time	UTC Date	UTC Day No.
End Time	**00:55:30**	**09/11/2000**	**1755** ^{30}	**08/11/2000**	**313**
Start Time	**17:14:30**	**08/11/2000**	**1014** ^{30}	**08/11/2000**	**313**

Session Duration **approx 7.5 hours** File Name: **SADD3130.00o** ☐ Power Failure

GPS STATION OCCUPATION REPORT

Fill Out for Each Site Occupation or Receiver Installation

Station Name**: Spit Bay** 4-Char. ID**: SPIT** Station ID # **AUS 094**

Location: **Heard Island, Antarctica** Project**: Antarctic Geodesy Project 1265**

Mark Description: **S/S plate set in rock** Mark Inscription: **"…AUSLIG AUS 094…"**

Approximate Geodetic Coordinates

Latitude: **-53° 06¢** Datum: **WGS84** Source: **Pt. Pos**. Magnetic Declination: ..…..°…....

Longitude: **73° 43¢** **WGS84**. **Pt. Pos.** Annual Change: +/- .....…..……

Height: **50.7 m** **WGS84** **Pt. Pos.** Source of Declination: .....……..

Occupation Summary (Dates)

	Local	UTC	UTC Day Number	Local Time Offset from UTC:
First Observing Day:	**02/11/2000**	**02/11/2000**	**307**	**+7** Hours
Last Observing Day:	**04/11/2000**	**04/11/2000**	**309**	

Total Number of Observing Days at this Station: **3**

Equipment Used

	Type	Model	Serial Number	
Receiver:	**Ashtech**	**ASHTECH Z-II3**		Receiver software & ver: **CD00**
Antenna:	**Ashtech**	**ASH700936E**		Equipment owned by: **AUSLIG**

☐ Tribrach ☐ Tripod ☑ Machined shims under antenna Antenna cable length: **10 metres**

In-Line antenna amplifier ☐ Yes ☑ No

External reference frequency used: ☐ Yes ☑ No Type: ☐Rubidium ☐Hydrogen Maser ☐Other

Power Supply

☐ 240 Volt AC and Power converter ☐ Generator ☐ Type: ..... Watts: .....…….....

12 Volt Battery Type: **12 volt Gel cell**. Number used: **2** ☐ Internal ☑External

Photo of GPS Antenna – Spit Bay - AUS 094 - Heard Island

GPS ANTENNA SET-UP

Station Name**:** Station Name**:** **Spit Bay** 4-Char. ID**:** **SPIT** Station ID **#** **AUS 094**

Location: **Heard Island, Antarctica** Project**: Antarctic Geodesy Project 1265**

Mark Description: **S/S plate set in rock** Mark Inscription: **"…AUSLIG AUS 094…"**

Antenna Set-up

Include a sketch of the antenna set-up showing all mounting accessories ie. tripod, pillar, tribrach etc. Show all distances measured from the ground mark to defined points on the antenna indicate whether distances are slant or vertical.

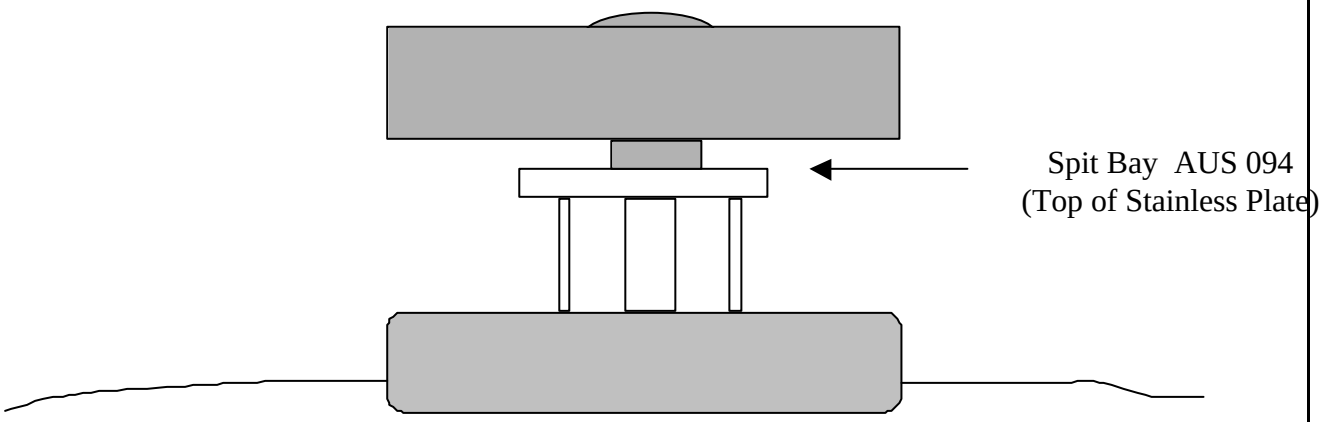
Antenna Height Above Mark in Metres

Record the measured height above the ground mark to as many of the following as possible:
For slant measurements include the horizontal offset distance to the centre of the antenna.

Distance (metres)	Vertical	Slant	Offset Distance
L1 Phase centre:	☐	☐	
L2 Phase centre:	☐	☐	
Base of Antenna	☑	☐	**0.004 - Antenna mounted on S/S**
Plate			
Top of ground plane:	☐	☐	
Bottom of ground plane:	☐	☐	
Bottom of choke ring:	☐	☐	

Antenna: Make: Ashtech Type: ASH700936E S/N:

SKETCH



GPS DAILY OBSERVATION LOG

Fill Out for Each Observation Session and After Power Failures

Station Name**:** **Spit Bay** 4-Char. ID**:** **SPIT** Station ID # **AUS 094**

Location: Location: **Heard Island, Antarctica** Project**:** **Antarctic Geodesy Project 1265**

Mark Description: **S/S plate set in rock** Mark Inscription: **"…AUSLIG AUS 094…"**

Log

Primary Operator: **Bob Twilley** Agency: **AUSLIG** Telephone: **02 62014346** Date: **November 2000**

	Type	Model	Serial number	Firmware & Version
Receiver:	**Ashtech**	**ASHTECH Z-II3**		**CD00**
Antenna:	**Ashtech**	**ASH700936E**		

Collection Interval (sec.): **30** Collection Format: **compact** Elevation Mask **+5°**

Antenna Height above ground mark (metres): ☑ Vertical ☐ Slant

	Start	End
1	**0.004**	**0.004**
2	..…….……	.....……..
3	.....…….....	.....……..

Average: **0.004**

Height Entered into Receiver: **0.0000** ☑ Antenna Aligned with True North

Observation Sessions

Session #: 1	Local Time	Local Date	UTC Time	UTC Date	UTC Day No.
End Time	**06:59:30**	**03/11/2000**	**2359 30**	**02/11/2000**	**307**
Start Time	**07:10:30**	**02/11/2000**	**0010 30**	**02/11/2000**	**307**

Session Duration **approx 24.0 hours** File Name: **SPIT3070.00o** ☐ Power Failure

Session #: 2	Local Time	Local Date	UTC Time	UTC Date	UTC Day No.
End Time	**06:59:30**	**04/11/2000**	**2359 30**	**03/11/2000**	**308**
Start Time	**07:00:30**	**03/11/2000**	**0000 30**	**03/11/2000**	**308**

Session Duration **approx 24.0 hours** File Name: **SPIT3080.00o** ☐ Power Failure

Session #: 3	Local Time	Local Date	UTC Time	UTC Date	UTC Day No.
End Time	**09:29:30**	**04/11/2000**	**0229 30**	**04/11/2000**	**309**
Start Time	**07:00:30**	**04/11/2000**	**0000 30**	**04/11/2000**	**309**

Session Duration **approx 2.5 hours** File Name: **SPIT3090.00o** ☐ Power Failure

STATION SUMMARY

AUSLIG

AUS 096

AUSLIG 2000

AUSLIG 2000

HEARD ISLAND 50 000

Station Mark: Galvanized iron star picket, protruding 0.3 m above the ground level.

Beacon: Small rock cairn

Reference Marks: Nil

Access: By helicopter, to a flat area north east of the station. A steep 5 minute climb along the edge of a cliff to the top of the ridge, which travels in a in a north-easterly direction. See the attached map.

STATION SUMMARY

AUSLIG

AUS 095

AUSLIG 2000

AUSLIG 2000

HEARD ISLAND 50 000

Station Mark: Stainless Steel plate set in rock. The plate is 150mm in diameter and 10mm thick with a 5/8 inch whitworth threaded spigot protruding approx 10mm from the centre. The plate is anchored to the rock by a 200mm long, 12mm diameter threaded rod. The rod was cemented into a 200mm deep drill hole in the rock with epoxy resin.
THIS MARK IS A FUNDAMENTAL GEODYNAMIC GPS ANTENNA MOUNT

Beacon: Nil

Reference Marks: Nil

Access: By helicopter to a flat vegetated area north of a ridge. Short 10 minute climb to the top of the ridge. The station mark is located on a ridge line between the highest point and a cliff edge. See the attached map.

STATION SUMMARY

Authority: AUSLIG

Station Number and Name: AUS 093

Original Station Established by: DIVISION OF NATIONAL MAPPING Date: 1980

Existing Station Marked by: AUSLIG Date: 2000

Map Name: HEARD ISLAND Scale: 1: 50 000

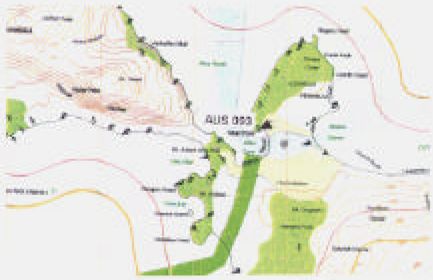
Station Mark: Stainless Steel Plate set on top of a 1.3 metre high pillar. The plate is 300mm in diameter and 10mm thick with a 5/8 inch whitworth threaded spigot protruding approx 10mm from the centre. The plate was placed vertically over the old brass plaque station mark NM/D8/80 on the pillar in October 2000.

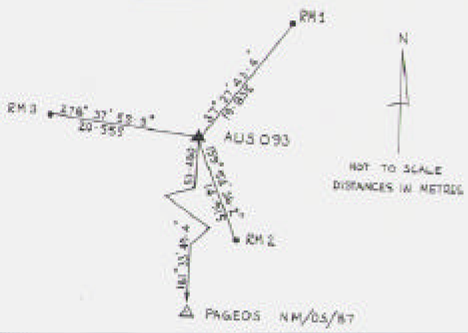
THIS MARK IS A FUNDAMENTAL GEODYNAMIC GPS ANTENNA MOUNT and is inscribed:

"AUSTRALIA'S NATIONAL MAPPING AGENCY
AUSLIG
AUS 093
GEODETIC CONTROL STATION"

Beacon: Nil

Reference Marks: Three RM's placed in bedrock.





NATIONAL MAPPING COUNCIL OF AUSTRALIA
STATION SUMMARY

HEARD ISLAND

Authority: Division of National Mapping

Station Number and Name: NM/Y/05 Doppler Hill (Dealers Settlement)

Original Station Established by: Division of National Mapping Date: 1980

Existing Station Marked by: Division of National Mapping Date: 1980

Reference Group: Nil

Map Name: Heard Island Scale: 1: 50 000

Datum: WGS 72 Doppler 2

SOUTH LATITUDE	EAST LONGITUDE	ZONE	EASTING	NORTHING	CONVERGENCE	HEIGHT
53 0 5.148	73 42 30.713	43	434538.380	4111833.985		77.8

Coordinates and height derived from Doppler satellite fix 1980.

Station Mark : A bronze rod, 4 cm below surface

Beacon : Star picket immediately adjacent to rod and surrounded by a rock cairn.

Reference Marks : Nil

Access : Was by helicopter. Station is on a fairly prominent hillock made up of stabilized glacial till which drops away to meadows to the East.

Revisited November 2000. The Station Mark, a bronze rod, as described, was not found. A round head steel pin 35mm diameter was found in the location of the station mark and GPS observations were logged at this point in November 2000.

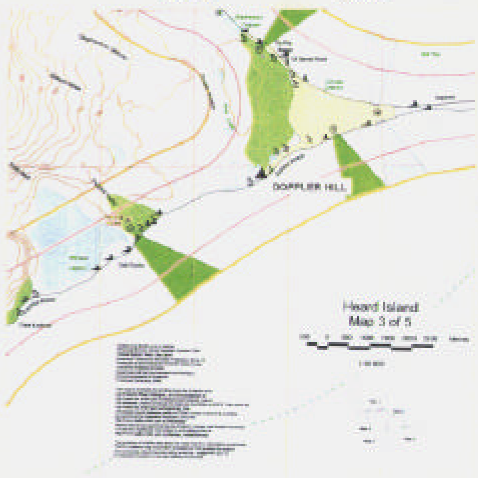


Photo Identification: CAS 9497 Frames 53-56

NATIONAL MAPPING COUNCIL OF AUSTRALIA
STATION SUMMARY

HEARD ISLAND

Authority: Division of National Mapping

Station Number and Name: HM/08/96 Cape Gazert

Original Station Established by: ANARE — Date: 1948

Existing Station Marked by: Division of National Mapping — Date: 1980

Reference Books: NM 13236, 19049, 19052

Map Name: Heard Island — Map Number: — Scale 1: 50 000

DATUM: [redacted] WGS 72

RECTANGULAR COORDINATES [redacted]

GRID BEARING + ADJ AZIMUTH + CONVERGENCE — HEIGHTS [redacted]

Cadastral Location — State — County/District

Parish/Hundred — Allotment/Section/Portion

Access and Locality Sketch — Particulars of station marking and beacon

Station Mark : Star picket set in position of old mark.

Beacon : Rock cairn.

Reference Marks : Nil

Access : By helicopter. Station is on the only vegetated hilltop in the area. Ground access across Fahnel Glacier would require roped mountaineering techniques. A steep 10 minute climb on from the helicopter drop off.

Revisited in November 2000. The station mark a star picket as described was not found. A round steel pin 36mm in diameter was found in the location of the station mark. A 1.5m long pipe was found positioned over the top of the steel pin and a small rock cairn was supporting the pipe. GPS observations were logged over the steel pin in November 2000.

CAPE GAZERT HM/08/96 SECTION HEARDIL SERIAL 17

SOUTH LATITUDE	EAST LONGITUDE	ZONE	EASTING	NORTHING	CONVERGENCE	HEIG
53 08 31.8044	73 22 19.4761	43	390847.471	4118893.336	+1 14 05.35	97.

TO	SERIAL	ADJ AZIMUTH	ADJ LENGTH
AIRBEAT DE LA HMRAM/08/92	16	0 27 53.33	5472.776
RAILWAY STATION HM/08/97	11	11 58 04.54	8422.231
DRYGALSKI HM/08/85	19	21 24 56.14	4622.788

Photo Identification: CAS 3497 Frames 61, 62, 82, 83

Certified free of transcription errors: A J Read — Date: 11-6-81

Approved by: — Date:

AUSLIG

STATION SUMMARY

Authority: AUSLIG

Station Number and Name: AUS 057

Original Station Established by: AUSLIG — Date: 2000

Existing Station Marked by: AUSLIG — Date: 2000

Reconstruction and/or Renovations:

Map Name: HEARD ISLAND — Map Number: — Scale 1: 50 000

DATUM: — SPHEROID:

RECTANGULAR COORDINATES

GRID BEARING = ABJ AZIMUTH + CONVERGENCE. — HEIGHTS in Metres above Mean Sea Level

NORTH/SOUTH LATITUDE * — EAST/WEST LONGITUDE * — ZONE — EASTING — NORTHING — CONVERGENCE — HEIGHT

To

Reference Books:

Cadastral Location: County — State/District/County *

Parish/Hundred * — Allotment/Section/Portion *

Access and Locality Sketch — Particulars of station marking and beacon

Station Mark: Stainless Steel Plate set in large rock. The plate is 150mm in diameter and 10mm thick with a 5/8 inch whitworth threaded spigot protruding approx 10mm from the centre. The plate is anchored to the rock by a 200mm long, 12mm diameter threaded rod. The rod was cemented into a 200mm deep drill hole in the rock with epoxy resin.
THIS MARK IS A FUNDAMENTAL GEODYNAMIC GPS ANTENNA MOUNT

Beacon: Nil

Reference Marks: Nil

Access: By helicopter, landing approximately 1 kilometre north of station. An easy 15 minute walk to a small rise above and north of a 2 million Macaroni Penguin colony. See the attached map.

Photo Identification:

Certified free of transcription errors: — Date:

Approved by: — Date:

* Delete as Aid where necessary

NATIONAL MAPPING COUNCIL OF AUSTRALIA
STATION SUMMARY

HEARD ISLAND

Authority: Division of National Mapping

Station Number and Name: NM/GS/80 Pedestal Atlas Cove

Original Station Established by: Division of National Mapping — Date: 1980

Existing Station Marked by: Division of National Mapping — Date: 1980

Reference Books: NM 13256, 19049, 19051, 19052 — Level Book 13259

Map Name: Heard Island — Scale 1: 50 000

Datum: [illegible] WGS72

Rectangular Coordinates: [illegible] — Doppler 3

PEDESTAL	NM/GS/80		SECTION	HEARDIL	SERIAL 1		
SOUTH LATITUDE	EAST LONGITUDE	ZONE	EASTING	NORTHING	CONVERGENCE	HEIGHT
53 01 07,1572	73 23 15,7631	43	39[illegible]	4124448.544	+1 17 01.0	4.7

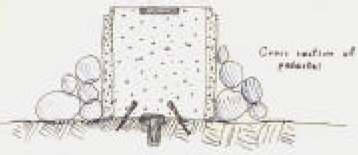
TO		SCALAR	ADJ AZIMUTH	ADJ LENGTH
DRYGALSKI	[illegible]	18	172 21 16.49	2840.232
WAGEON [illegible]	NM/GS/87	3	161 38 23.15	93.59[illegible]
WARNER STATION	NM/GS/87	11	244 46 39.40	140.178

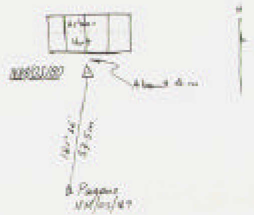
Access and Locality Sketch — Particulars of station marking and beacon

Station Mark: Annular brass plaque embossed 'Australia' and inscribed "NM/GS/80" set in concrete filled reinforced concrete water pipe about 1.3 m high over a circular brass plaque inscribed "Doppler Satellite Station NM/GS/80" which is concreted into bedrock. SEE NOTE

Beacon: Nil

Reference Marks: Three marks placed in bedrock around the station.





NOTE

The Station was re-visited in October and November 2000 and a new stainless steel plate was fixed vertically over the existing brass plaque NM/GS/80 on top of the pillar. This new Station point is now named **AUS 093** and is a Fundamental Geodynamic GPS Antenna Mount. For more information on station mark **AUS 093**, Reference Marks and the updated location sketch see the **AUS 093** Station Summary.

Photo Identification: CAS 9497 Frames 25, 26, 119-121

Certified free of transcription errors: [illegible] — Date: 1/6-92

Approved by: [illegible] — Date: [illegible]

STATION SUMMARY

Authority: AUSLIG

Station Number and Name: AUS 095

Original Station Established by: AUSLIG — Date: 2000

Existing Station Marked by Reoccupation and/or Renovation: AUSLIG — Date: 2000

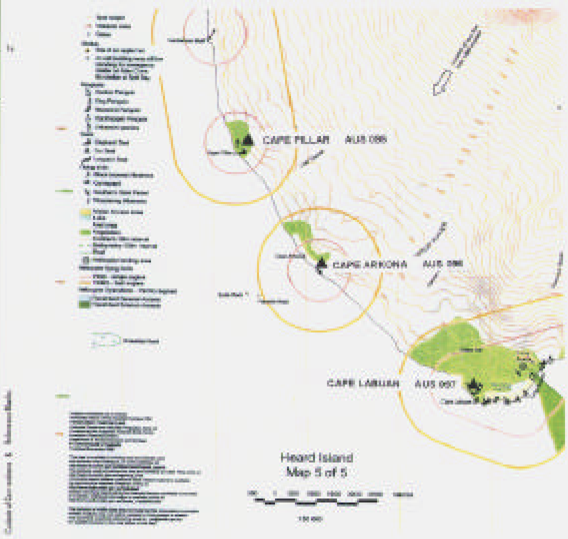
Map Name: HEARD ISLAND — Scale 1: 50 000

Station Mark: Stainless Steel Plate set in rock. The plate is 150mm in diameter and 10mm thick with a 5/8 inch whitworth threaded spigot protruding approx 10mm from the centre. The plate is anchored to the rock by a 200mm long, 12mm diameter threaded rod. The rod was cemented into a 200mm deep drill hole in the rock with epoxy resin.
THIS MARK IS A FUNDAMENTAL GEODYNAMIC GPS ANTENNA MOUNT

Beacon: Nil

Reference Marks: Nil

Access: By helicopter to a flat vegetated area north of a ridge. Short 10 minute climb to the top of the ridge. The station mark is located on a ridge line between the highest point and a cliff edge. See the attached map.



NATIONAL MAPPING COUNCIL OF AUSTRALIA
STATION SUMMARY

HEARD ISLAND

Authority: Division of National Mapping

Station Number and Name: HM/08/87 Pageos 1979 0044

Original Station Established by	USA TOPO COM — Date: 1969
Existing Station Marked by	USA TOPO COM — Date: 1969
Reference Books	HM 13238, 19049, 19051, 19032 — Level 13239

Map Name: Heard Island — Scale 1: 50 000

DATUM: WGS 72 — Doppler 1

PAGEOS 1979 0044 HM/08/87 — SECTION HEARDIL SERIAL 3

SOUTH LATITUDE	EAST LONGITUDE	ZONE	EASTING	NORTHING	CONVERGENCE	HEIGHT
53 01 08.8890	73 23 35.7038	43	392222.075	4124395.423	+1 17 01.15	2.3

TO		SERIAL	ADJ AZIMUTH	ADJ LENGTH
DRYGALSKI	HM/08/45	54	172 09 34.43	1967.868
PROXSTAL	HM/08/80	1	1 36 03.23	53.555

Station Mark : An International Satellite Triangulation bronze disc set in bedrock and stamped "0044 1969".

Beacon : Stone cairn.

Reference Marks : Three bronze discs set in bedrock and stamped "0044 RM1 1969, 0044 RM2 1969, 0044 RM3 1969, respectively.

Access : 40 m East of large building erected by Americans in 1969 on eastern side of ANARE base.

Revisited November 2000. Station mark and Reference marks found. GPS observations were logged during November 2000.

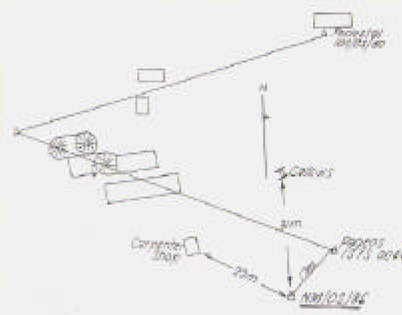


Photo identification: CAS 3497 Frames 21, 26, 119-121

Certified free of transcription errors: AJRead — Date: 11-6-82

NATIONAL MAPPING COUNCIL OF AUSTRALIA
STATION SUMMARY

HEARD ISLAND

Authority: Division of National Mapping

Station Number and Name: HM/08/94 Round Hill

Original Station Established by	ANARE — Date: 1948
Existing Station Marked by	Division of National Mapping — Date: 1980
Reference Books	HM 16318, 16319

Map Name: Heard Island — Scale 1: 50 000

DATUM: WGS 72 — Doppler

ROUND HILL HM/08/94 — SECTION HEARDIL SERIAL 3

SOUTH LATITUDE	EAST LONGITUDE	ZONE	EASTING	NORTHING	CONVERGENCE	HEIGHT
53 04 31.1780	73 38 47.8820	43	409323.578	4119112.380	-1 34 54.49	392.

TO		SERIAL	ADJ AZIMUTH	ADJ LENGTH
STREETER BLUFF	HM/08/81	21	114 00 04.48	4715.460
SAIL ROCK		5	344 07 35.47	19299.421
SHAG ISLAND PEAK		6	345 17 35.47	17374.549

Station Mark : Star picket.

Beacon : Rock cairn

Reference Marks : Nil

Access : Was by helicopter although ground access is possible from Fairchild Beach. Station is located towards southern end of slightly elongated round hilltop.

Revisited November 2000. The Station Mark, a star picket as described was not found. A round head steel pin was found in the location of the station mark. The steel pin is 15 mm in diameter. GPS observations were logged at this point in November 2000.

NOTE

Scholes Trig was found in 1980 but was not positively identified. It was not connected to the new station HM/08/94. Scholes satellite was not found.

Observations were made at both Scholes marks in 1948. Only those observations made at Scholes Trig were used in the 1981 adjustment but they were not related to HM/08/94.

Doppler observations made at HM/08/94 in 1980 are of very low order (5 passes on PE) with a station uncertainty of up to ±50 metres.

Photo identification: CAS 3497 Frames 37, 58-60

Certified free of transcription errors: AJRead — Date: 11-6-81

NATIONAL MAPPING COUNCIL OF AUSTRALIA
STATION SUMMARY

HEARD ISLAND

Authority: Division of National Mapping

Station Number and Name: HM/08/91 Saddle Point

Original Station Established by	ANARE	Date	1948
Existing Station Marked by	Division of National Mapping	Date	1980
Reference Books	NM 15256, 19049, 19051, 16317		

Map Name: Heard Island Scale 1: 50 000

Datum: [redacted] WGS 72

Rectangular Coordinates: [redacted]

Grid Bearing = Adj Azimuth + Convergence Heights in Metres [redacted]

SADDLE POINT HM/08/91 SECTION HEARDIL SERIAL 19

SOUTH LATITUDE	EAST LONGITUDE	ZONE	EASTING	NORTHING	CONVERGENCE	HEIGHT
53 00 46.326"	73 29 51.974"	43	299255.129	4125294.172	+1 11 36.53	103.

TO		SERIAL	ADJ AZIMUTH	ADJ LENGTH
DRYGALSKI	HM/02/86	18	248 25 18.80	7288.088
CORINTH HEAD	HM/08/90	8	275 21 48.56	5585.107
SAIL ROCK		5	21 43 34.95	13086.459
SHAG ISLAND PEAK		6	35 19 44.39	11744.929
DRURY ROCK		22	32 19 12.03	11270.455
MECHANICS 2		20	99 24 24.09	1777.723
RAILWAY STATION	HM/08/97	11	264 23 29.88	7174.873
CORINTH HEAD	HM/08/90	8	275 21 48.56	5585.107

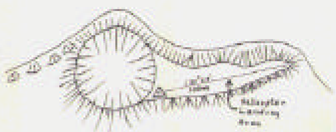
Access and Locality Sketch — Particulars of station marking and beacon

Station Mark : Star picket set in position of old mark

Beacon : Stone cairn.

Reference Marks : Nil

Access : By helicopter to a nearby landing site useable in moderate winds.



Revisited November 2000
Station Mark found and GPS
observations were logged during
November 2000

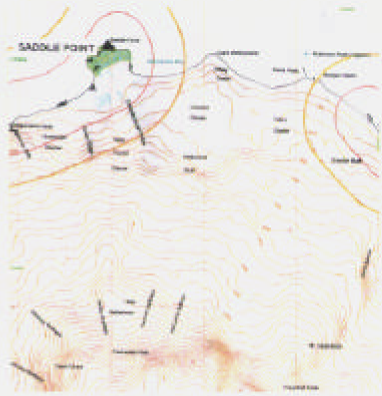


Photo Identification: CAS 5697 Frames 44-47

Certified free of transcription errors: A J Dede Date: 17-6-83

Examined by: Date

NATIONAL MAPPING COUNCIL OF AUSTRALIA
STATION SUMMARY

HEARD ISLAND

Authority: Division of National Mapping

Station Number and Name: HM/08/93 Scarlet Hill

Original Station Established by	ANARE	Date	1948
Existing Station Marked by	Division of National Mapping	Date	1980
Reference Books	NM 16318		

Map Name: Heard Island Scale 1: 50 000

Datum: [redacted]

Rectangular Coordinates: [redacted]

Grid Bearing = Adj Azimuth + Convergence Heights in Metres [redacted]

SOUTH LATITUDE	EAST LONGITUDE	ZONE	EASTING	NORTHING	CONVERGENCE	HEIGHT

To

Access and Locality Sketch — Particulars of station marking and beacon

Station Mark : Star picket in crevice on rock summit.

Beacon : Stone cairn. (small)

Reference Marks : Nil

Access : By helicopter ~~landing on a small flat nearby in winds less than 10 knots~~. then a short steep 10 minute climb to the summit

NB. Station not occupied. Station occupied in Nov 2000
Revisited in November 2000. The station mark was found and
GPS observations logged in November 2000

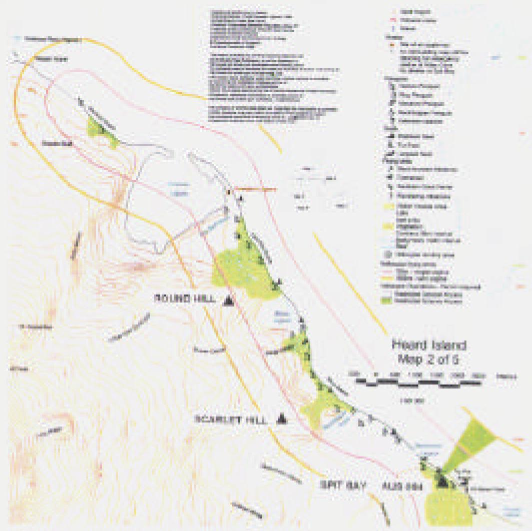


Photo Identification: CAS 5697 Frames 49-52

Certified free of transcription errors: A J Dede Date: 17-6-83

Authority: AUSLIG

STATION SUMMARY

Station Number and Name: AUS 094

Original Station Established by: AUSLIG Date: 2000

Incoming Station Marked by: AUSLIG Date: 2000

Map Name: HEARD ISLAND Map Number: Scale 1: 50 000

Station Mark: Stainless Steel Plate set in rock. The plate is 150mm in diameter and 10mm thick with a 5/8 inch whitworth threaded spigot protruding approx 10mm from the centre. The plate is anchored to the rock by a 200mm long, 12mm diameter threaded rod. The rod was cemented into a 200mm deep drill hole in the rock with epoxy resin.
THIS MARK IS A FUNDAMENTAL GEODYNAMIC GPS ANTENNA MOUNT

Beacon: Nil

Reference Marks: Nil

Access: The station is located on top of a large cube shaped boulder which is positioned behind the Spit Bay Base Camp and adjacent to the Automatic Weather Station and a Hydrographic Survey mark. There are no records of the Hydro mark. See attached map.

Annex C

GPS PROCESSING
ASHTECH SOLUTIONS
Processing Summary
Heard Island

Project file: heard island.spr **Date:** 05/24/01

Adjustment Type:	Not Adjusted
Variance of Unit Weight:	0.0
Adjustment scale factor:	1.00
Vectors Failing Tau Test:	0
Site Pairs Failing Relative Accuracy QA Test:	0
Vector Total:	0
Site Total:	11
Horizontally Constrained Sites:	1
Vertically Constrained Sites:	1
Horizontal Coordinate System:	World Geodetic Sys. 1984
Height System:	Ellips. Ht.
Desired Horizontal Accuracy:	0.010m + 10ppm
Desired Vertical Accuracy:	0.010m + 10ppm
Confidence Level:	95% Err.

Site Positions

heard island

Horizontal Coordinate System: World Geodetic Sys. 1984 **Date:** 05/24/01
Height System: Ellips. Ht. **Project file:** heard island.spr
Desired Horizontal Accuracy: 0.010m + 10ppm
Desired Vertical Accuracy: 0.010m + 10ppm
Confidence Level: 95% Err.
Linear Units of Measure: Meters

Site ID	Site Descriptor		Position	95% Error	Fix Status	Position Status
1	**SPIT**	Lat.	53° 6′ 26.21482″ S	0.020		**Processed**
		Lon.	73° 43′ 14.18197″ E	0.020		
		Elv.	50.695	0.033		
2	**ARKO**	Lat.	53° 9′ 49.06594″ S	0.024		**Processed**
		Lon.	73° 26′ 20.03551″ E	0.063		
		Elv.	259.137	0.045		
3	**DOPP**	Lat.	53° 8′ 9.13098″ S	0.002		**Processed**
		Lon.	73° 43′ 21.19428″ E	0.002		
		Elv.	65.740	0.006		
4	**GAZE**	Lat.	53° 4′ 31.64717″ S	0.008		**Processed**
		Lon.	73° 22′ 20.01715″ E	0.004		
		Elv.	136.491	0.012		
5	**HEAR**	Lat.	53° 1′ 7.02210″ S	0.000	Fixed	**Processed**
		Lon.	73° 23′ 36.27540″ E	0.000	Fixed	
		Elv.	44.247	0.000	Fixed	
6	**LABU**	Lat.	53° 11′ 26.43074″ S	0.006		**Processed**
		Lon.	73° 29′ 27.78867″ E	0.004		
		Elv.	85.502	0.006		
7	**PAGE**	Lat.	53° 1′ 8.75142″ S	0.000		**Processed**
		Lon.	73° 23′ 36.19612″ E	0.000		
		Elv.	43.164	0.000		
8	**PILL**	Lat.	53° 8′ 16.01840″ S	0.022		**Processed**
		Lon.	73° 24′ 45.70108″ E	0.094		
		Elv.	172.012	0.035		
9	**ROUN**	Lat.	53° 4′ 11.68430″ S	0.025		**Processed**
		Lon.	73° 38′ 48.61708″ E	0.065		

		Elv.	423.488	0.059
10	**SADD Processed**	Lat.	53° 0′ 45.97746″ S	0.043
		Lon.	73° 29′ 54.46859″ E	0.182
		Elv.	147.070	0.039
11	**SCAR Processed**	Lat.	53° 5′ 44.86928″ S	0.006
		Lon.	73° 39′ 59.40619″ E	0.006
		Elv.	450.008	0.010