MAWSON'S HUTS 2002

FIELDWORK REPORT

Prepared for the Australian Antarctic Division

Dr Ian Godfrey
Department of Materials Conservation
Western Australian Museum

REPORT

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6 January – 2 February 2002

Background:

January 2002 was an unusually warm month, illustrated by the following data obtained from the Meteorological Office of the nearby French Station at Dumont D'Urville.

- There were 6 days of fog in January (to January 23)
- 'Pure' rain was recorded for the first time
- The highest maximum ever recorded (9.9 ^{o}C) was reached during this month
- There were 5 days with temperatures above 9 ^{o}C in January (to January 23), with an average of 9.6 ^{o}C for these days

It is worth noting that 9.6 ^{o}C was the previous highest recorded maximum temperature at Dumont D'Urville since recording commenced in 1956.

The time spent at Cape Denison was also characterised by light winds, overcast skies and only short periods of snowfall. On the 2 days when snow fell, it was quickly lost due to the stored heat in the rocks and surroundings. Melt streams flowed past the eastern side of the Main Hut to Boat Harbour, in the valley between the Main Hut and the Granholm Hut and extensively from the moraine line to lower regions. Melt streams also flowed to the sea in the area in front of the Sorensen Hut.

The unusually warm conditions exposed the entire artefact scatter on the rocky outcrop in front of the Main Hut, increased exposure to the east of the Main Hut and workshop and also uncovered many artefacts near the southern walls of the building (Figures 1 – 4). Interestingly, although a few formerly buried artefacts and modern materials were uncovered on the western side of the Main Hut, the melt pool on this side of the Main Hut was not as extensive as for the summer of 2000/01.

Due to the extensive artefact exposure the proposed work plan was varied. Advantage was taken of the broad level of exposure to firstly remove all newly exposed, post-BANZARE material and then to broadly document the extent of the artefact scatter. As this latter task was too big to be conducted as meticulously as standards would normally dictate, a broad-brush approach was adopted, with particular attention paid to artefacts that appeared significant or interesting to the author. Documentation of the artefact scatter was carried out immediately following a collection of all of the post-1931 materials that had been exposed by the melt.

Figure 1: *Artefact scatter, north of the Main Hut 2002*

Figure 2: *Artefact scatter, north-east corner of the Main Hut 2002*

Figure 3: *Artefacts and melt stream, north-east corner of the Workshop 2002*

Figure 4: *Artefacts near the southern wall of the Main Hut 2002*

Rubbish Removal:

The large and unusual melt revealed many modern materials that had previously been buried near the main area of historic and archaeological interest. At the first opportunity these objects were collected and assembled on a rocky area near Boat Harbour (to prevent their loss through reburial in the case of a blizzard). Materials collected for removal included the following:

- A large LPG gas cylinder located near the landing at the southern end of Boat Harbour
- A small acetylene cylinder found near the LPG cylinder
- 4 large galvanised pipes (approximately 6 cm diameter and up to 2 m long)
- 4 smaller iron pipes (approximately 1.5 cm diameter and 1.5m long)
- Assorted wood off-cuts from the 97/98 AAP Mawson's Huts program
- Numerous lead sheets and fragments from the 1978 ANARE restoration program
- Small star picket pieces and modern tent pegs
- Synthetic ropes used to tie down the Weather Haven tent (97/98 program)
- A large crow bar which had been embedded in the ice near the landing at the end of Boat Harbour
- A half 44 gallon drum and lid

In addition many large, modern wooden timbers were found to the west of the Main Hut. Those considered potentially useful for future restoration work were stored with the other timbers near the Granholm Hut. A large snow shovel with an aluminium blade was also found near the rock ridge in front of the Main Hut. This was stored in the rafters just inside the Workshop door.

Also recovered was a large, white, heavy-duty plastic bag that contained an assortment of aged, small timber fragments. Located near this bag were other small and some larger wooden pieces that appeared to be of the same vintage. As these were consistent in appearance with original pieces from the Main Hut and Workshop they were collected and stored in the Granholm Hut. The bag of wood was placed on the lower bunk in the Granholm with an explanatory note attached. The larger pieces of wood were placed on the upper shelf on the eastern side of the Granholm Hut. One of these pieces was clearly labelled with the AAE and SY AURORA logos.

A small ANARE pennant, attached by drawing pins near the roofline inside the Auroral observatory, was also removed. This was retained to see if it is of interest to the original 1978 ANARE team or some other ANARE expeditioner who may have placed it there. A piece of wood, released in 1985 as part of an experiment by the Project Blizzard team, was also recovered (about 50 metres from the Hut slightly to the north-east of the Hut).

The melt also revealed a large number of star pickets and 2 shovels near the Sorensen Hut. The star pickets were placed under the Sorensen Hut while the shovels were tied down with other shovels at the site.

An aluminium ladder, embedded in the ice at the southern–most point of Boat Harbour and apparently left there by the 97/98 AAP team, was removed by the crew of the Sir Hubert Wilkins.

Artefact Scatter:

The rocky outcrop to the north of the Workshop was completely exposed. As there was insufficient time to fully document the site, photographs were taken of the overall site and of selected items. Appendix 1 lists some of the photographs that were taken of the artefact scatter and the interiors/exteriors of the historic buildings (Film rolls A-P).

Of particular interest were the following:

- Part of a sled and some broken components (Figure 4)
- A full box of finnesko boots (Figure 5)
- The bowl of a hand-made wooden pipe (Figure 6)
- A collapsible boat and paddle (bamboo shaft with a tear drop blade, Figures 3, 7)
- A blubber scraper (?) (Figure 8)
- Assorted clothing, boots and shoes (many showing evidence of repairs, Figure 9)
- A knee length boot in the melt stream

Figure 5: *Box of finnesko boots, located near the north-east Workshop corner 2002*

Figure 6: *Wooden pipe bowl, cotton reel and assorted artefacts 2002*

Figure 7: *Paddle with bamboo shaft near box of finnesko boots 2002*

Figure 8: *Blubber scraper (?) 2002*

Figure 9: *Clothing showing evidence of repairs 2002*

Exposure of some artefacts, but not all, will cause them to deteriorate more rapidly than when they were covered by snow. This applies especially to organic artefacts made of fabric, leather, skin/fur and plant matter. Fabrics in fast-flowing melt streams, damp finnesko boots, straw insulation, jumpers and other items of clothing, exposed to the sun, are particularly at risk of accelerated photochemical decay.

Despite the increased risk of photochemical damage, no organic artefacts were moved from their positions in the artefact scatter. The most sensitive of the exposed artefacts, the finnesko boots and items of clothing, appeared to be in very good condition. It was considered that there was no pressing need to move these artefacts to other locations, especially as for some of the more sensitive of these artefacts (wet fabrics), there was considered to be a greater risk of damage if this course of action was adopted. Without access to appropriate supporting materials, lifting and moving wet fabrics is likely to lead to physical damage due to the inability of the fibres to support their waterlogged weight. Reburial of these artefacts by snow will restore them to the environment that has maintained them for the past 90 years, while allowing time for considered decisions to be made about their long-term futures.

Other freshly exposed objects, while not at immediate risk of physical deterioration, are at risk of being taken as ‘souvenirs’ by those with a propensity for such behaviour. An inspection of the site at the conclusion of the visit, while not comprehensive, indicated that none of the more attractive artefacts (nor even the less attractive) had been taken as souvenirs.

Of concern to some of the tourists on this trip was the possibility of recently exposed artefacts being blown into Commonwealth Bay. The likelihood of such loss should be determined by examining the extensive artefact record that has been built up over many years by Estelle Lazer. This will allow conclusions to be drawn about the mobility of artefacts and the relationships that exist between the retention of artefacts and their material type, size, shape and site location. My casual observations of small, light objects indicate that they are not easily lost from the artefact scatter. For example, a small bore shotgun cartridge, visible in the summer of 2001 and situated in an exposed area of the artefact scatter, was still in the same location when the site was revisited in 2002.

Documentation of the Main Hut and Workshop – Roofs, Walls and Interior

Interior Spaces

At the completion of the 2000/01 AAP Mawson’s Huts Expedition, plastic sheets were left in the centre of the workshop and below the southern skylight in the Main Hut in order to measure the amount of snow ingress in these areas. There was no snow found on either of these sheets, indicating that either the work done in 1997/98 (re-cladding the Workshop roof) and that completed in 2000/01 on the southern skylight and surrounding roof areas had been effective in sealing these areas or that the exceptional melt had caused the accumulated snow to be lost. The former explanation is the most probable as increased snow accumulation was recorded in other parts of the Main Hut (see below), accumulations which had not been lost in the very warm conditions experienced this summer.

There was no fresh snow to indicate that drift had penetrated the Workshop in other areas. Visual inspection of the workshop only revealed evidence of ablation of the snow and ice that was formerly present in this space. The warm summer temperatures had resulted in snow and ice loss in some areas. This was especially noticeable on the western wall of the Workshop where melt had uncovered a small section of the bench located on this wall. Artefacts were also seen under the bench (Figure 10). These were not visible during the 2000/01 summer.

Figure 10: *Artefacts under the Workshop bench, west wall 2002*

There was evidence of ice and snow loss in some areas and increased deposition of the same in other areas inside the Main Hut. Specifically the following areas appeared to be more exposed:

- the north-eastern corner - more of the ceiling space was exposed
- above the door to the main living area – bottles were partially exposed on shelves above the entrance
- above the darkroom – magazines and a bowl were visible on the ceiling directly above the darkroom (compare Figures 11, 12)
- above Hurley's bunk - the snow in this area was melting at the time of inspection. During this process a red liquid was observed to stain the snow and ice and the artefacts (including potatoes) on the floor below (Figures 13, 14).

Figure 11: *View to the darkroom 2001*

Figure 12: *View to the darkroom 2002*

Figure 13: *Stained ice above Hurley's bunk 2002*

Figure 14: *Stained artefacts on the floor below Hurley's bunk 2002*

Increased deposition of snow and ice was apparent along the southern extremities of the main living space. In particular:

- the south-eastern corner. During the 2000/01 summer it was possible to access boards that lined Mawson's room on the eastern side. These were now covered with overhanging snow and melting ice (Figure 15).
- Mawson's room – snow now covered Mawson's chair and considerable areas of the floor and the shelves around the room (Figures 16, 17)
- Snow was found on the tongue and groove boards stored on the southern edge of the platform.

Figure 15: *View to the south east corner of the Main Hut 2002*

Figure 16: *Mawson's room 2001*

Figure 17: *Mawson's room 2002*

While ablation of snow and ice resulted in more spaces being exposed in the Hut there has been a price to pay for this. For instance, as snow and ice was lost from above the darkroom, melt penetrated this formerly ice-free space and subsequently refroze. Ice 'stalactites' were visible, hanging from shelves in the darkroom and ice had formed on some parts of the northern and eastern walls (Figure 18). This refrozen water is much harder and more difficult to remove than less compacted snow. Where ice forms over and around artefacts there is an increased risk of damage during ice removal and excavation.

In addition, melt from areas above the northern, outer wall of Mawson's room had dripped onto books, newspapers and other artefacts located on the shelves below. The newspapers in particular, are now in a more delicate condition than when they were dry (Figure 19). Nothing was done to treat these waterlogged artefacts as it was considered best to leave them to naturally freeze-dry when cooler conditions prevail in the Hut. They are however, more susceptible to mould attack. To minimise further damage to these artefacts, residual snow and ice was removed from the boards above, which were then moved further away on the platform to dry. When dried they were replaced but with a layer of black plastic on top of them to prevent a similar recurrence in future warm summers.

Figure 18: *Northern wall of the darkroom 2002*

Figure 19: *Wet newspaper - shelves outside Mawson's room 2002*

Main Hut Roof and Walls

All roof and wall surfaces were photographed so that they could be compared with photographs taken during the 2000/01 season. Particular focus was placed on the numbers of battens retained on these surfaces. The situations in 2000/01 and 2002 for the south-facing roof are shown in Figures 20 - 23 while a summary of changes for most roof and wall surfaces is given in Table 1. Areas from which battens have been lost previously (including the period between the 2000/01 and 2001/02 expeditions) are indicated by dark outlines and raised nails.

Figure 20: *South-facing roof and walls of the Main Hut 2001*

Figure 21: *South-facing roof and walls of the Main Hut 2002*

Figure 22: *South-facing roof of the Main Hut 2001*

Figure 23: *South-facing roof of the Main Hut 2002 showing missing battens*

Table 1: Comparisons of roofs and walls of the Main Hut 2000/01 and 2001/02

Surface	Missing Battens	Loose Battens (rotating)
South roof	2	2
South wall*	-	-
West roof	2	2
West wall	-	2
East roof	2	3
East wall	-	-

* Although no apparent differences were detected this data is not conclusive as there were different degrees of exposure between 2001 and 2002.

Of particular concern is the rope that is attached to the sailcloth remnants. These rope pieces are in quite good condition but are at great risk of being lost in a blizzard. Intervention is needed to prevent their loss.

There were four significant gaps in the tongue and groove boards to the east of the skylight on the southern roof of the Main Hut. These gaps, which ranged in length from 260 cm to 40 cm, are the most likely entrance points for snow that has built up in the south-eastern corner of the Main Hut. Attempts were made to seal these gaps (see later).

Workshop Roof

Photographs were taken to illustrate the effects of weathering on the Intergrain finish of the Workshop roof. Although all surfaces are starting to deteriorate, the Intergrain finish still provides protection for the underlying wood in most places. Most deterioration has occurred near the ridge capping and at other places where either moisture retention is enhanced or physical abrasion has been greatest. As chemical breakdown by sunlight is most significant in the presence of moisture, areas of greatest exposure to these agents generally deteriorate at a faster rate. The loss of the Intergrain finish from the eastern roof surface is illustrated below (Figures 24, 25).

It is significant that on the southern workshop roof both chemical deterioration and physical abrasion are occurring (Figure 26). Isolated parts of this surface, which bears the brunt of the katabatic winds, have developed small ridges and troughs due to loss of wood substance from the less dense earlywood regions of the pine.

Transit Hut and Magnetograph House:

Images of the Transit Hut and the Magnetograph House, taken in 2001, were compared with those taken in January 2002. Although no structural differences were evident in these images, slight changes were noted in the Intergrain finish on the roof of the Magnetograph House.

Figure 24: *East-facing roof of the Workshop 2002*

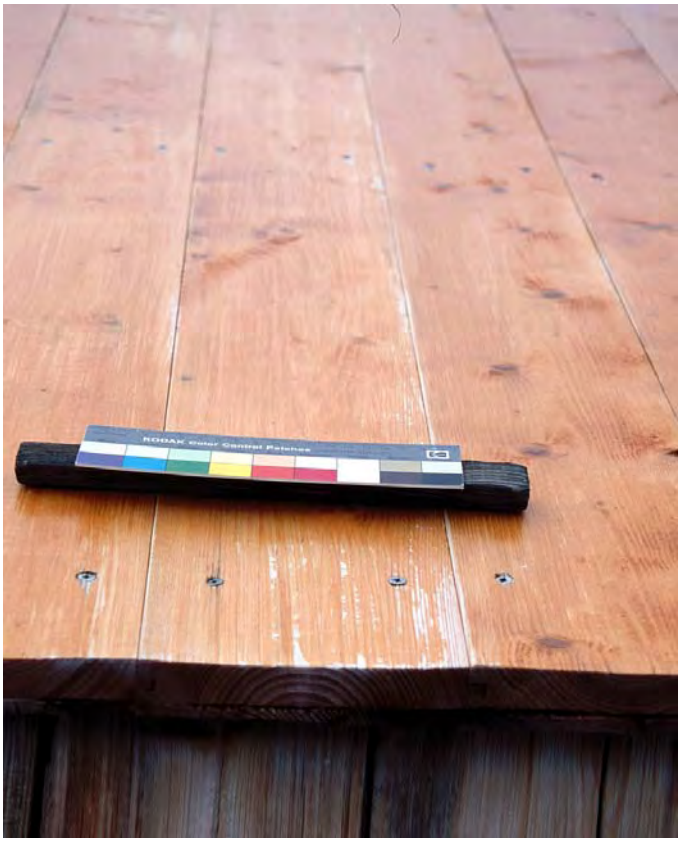

Figure 25: *East-facing roof of the Workshop 2002*

Figure 26: *South-facing roof of the Workshop 2002*

Visible Light and Ultra-Violet Radiation Levels:

Overcast skies, warm temperatures and light winds were predominant during the stay at Cape Denison. Typical readings for ambient light intensities and ultra-violet levels for the different roof surfaces are given below. Measurements were taken by laying the light meter on the roof surface.

18 January 2002

Overcast day, the heavily filtered sun had a northerly aspect (12.00 pm)

Roof surface	*Light intensity* *lumens*	*Ultra-violet* *mW/m^2 (μW/lumen)*
Western	33430	22060 (663)
Southern	40570	26740 (665)
Eastern	31750	20530 (658)
Northern	28440	18910 (657)

20 January 2002

Bright sunny day with cloudless sky (18.00 – sun in the western sky)

Roof surface	*Light intensity* *lumens*	*Ultra-violet* *mW/m^2 (μW/lumen)*
Western	103140	51800 (500)
Southern	17010	19900 (1120)
Eastern	7970	14710 (1891)
Northern	63810	24060 (393)

These data were comparable to those recorded in the summer of 2000/2001 and will be correlated with photochemical changes in the wood surfaces in a later report.

General Observations:

January 16 2002

It was a warm day with drizzling rain. Inside the Main Hut water dripped into the main living space from the skylights. Specifically water dripped from the:

- **western** skylight from the upper and northern edges.
- **northern** skylight from the upper edge and also ran down the ceiling boards from the NW corner. There were no water droplets on the glass.
- **eastern** skylight from the upper edge. Water also ran down from the NE and SE corners. There were droplets of water on the entire glass surface.
- **southern** skylight from the upper edge. There were droplets of water on the glass surface.

January 17 2002

As the thaw continued, a raspberry coloured liquid dripped from the bunk immediately above Hurley's, staining both the snow and ice with which it made contact and potatoes and other artefacts located on the floor below (see Figures 13, 14).

Installation of Monitoring Equipment:

Staff of the Aeronautical and Maritime Research Laboratories (AMRL) of the Defence Science and Technology Organisation (DSTO), Melbourne prepared aluminium-wound CLIMAT bolts and copper-steel coupons for installation in and around the Main Hut. When recovered and analysed, the corrosion cells and coupons will provide quantitative information about the corrosivity of the internal and the external environments, thereby supplementing the information provided by the temperature and relative humidity logging systems that are installed in the building. Following ice-removal and the subsequent installation of further sets of identical

monitoring equipment, the corrosivity of the internal environment will be able to be unambiguously assessed and compared with that associated with what is currently a substantially ice-filled building.

Qualitative information on the internal microenvironments will be provided by agar plates (mould growth) and by experimental paper and leather artefacts. Controls are kept in a stable environment in the laboratories of the Western Australian Museum for comparison. During installation, gloves and a face-mask were used to prevent fungal contamination of the experimental artefacts. The agar plates were stored in heat sealed bags until they were placed in their monitoring positions in the Main Hut, Workshop and the Magnetograph House. As agar is a water-based medium there is a possibility that the plates will dehydrate over the monitoring period.

The corrosion cells and coupons and the mould monitoring equipment were prepared and placed in various locations on 18 January 2002 (Figures 27 – 29). Locations were chosen to ensure that as many different microenvironments as possible were monitored. One set of corrosion cells was attached to a bracket on the Workshop roof. As there was only a single point of attachment it was considered somewhat tenuous in light of the extreme wind conditions experienced in this area. For this reason a second set of corrosion cells was attached to the framework of the automatic weather station on nearby Anemometer Hill.

Figure 27: *Monitoring equipment - corrosion cells/coupons and experimental artefacts*

Figure 28: *Data logger and monitoring equipment in the Magnetograph House*

Figure 29: *Monitoring equipment in the Workshop (southern wall shelving)*

Of the internal locations, corrosion cells and artefact trays were placed in areas in which temperature and relative humidity data is currently being gathered (eastern wall, western wall, shelves outside Mawson's room and Magnetograph House) and also in areas that were considered likely to have different microenvironments. A brief description of each location is given below. Information given in brackets refers to the codes used for the trays and corrosion monitoring equipment that was placed in each of the locations. MH codes are used to differentiate the trays that contain the leather, paper and agar plates (eg MH 2) while numbers (eg 2701) are assigned to specific sets of CLIMAT bolts and corrosion coupons.

- Eastern wall – cells and artefacts are on an ice-free shelf above the upper bunk, CL 1912 (MH 4, 2706).
- Western wall - cells and artefacts are on an ice-free shelf above the upper bunk immediately outside the darkroom (MH 5, 2707).
- Outer, northern wall of Mawson's room - cells and artefacts are on the shelf which holds the books and newspapers (MH 3, 2705).
- Magnetograph House - cells and artefacts are on the bench in the north-east corner of this substantially ice-free building (Figure 28, MH 8, 2710).
- Mawson's room – cells and artefacts are on the lower shelf on the northern wall. The room has a layer of ice on the floor and lightly compacted snow and ice on some of the shelves on the eastern and northern shelves (MH 1, 2703)
- Darkroom – cells and artefacts are on the lower shelf adjacent to the developing tank. This room is substantially ice-free, with only small 'stalactites' of ice on some of the shelves and small areas of ice on the northern and eastern walls (due to melt penetrating from the snow and ice on the ceiling) (MH 2, 2704)
- Centre of Workshop – cells and artefacts are in the centre of the workshop, sitting on a plastic sheet. Apart from a tunnel from the veranda door to the entrance to the Main Hut, the Workshop is completely filled with snow and ice to the level of the collar ties (MH 6, 2708).
- Workshop – southern wall – cells and artefacts are on a shelf just inside the entrance to the workshop. This area is almost completely 'surrounded' by snow and ice. It is an area in which the shelving brackets appear to be corroding at a higher rate than those in more open, ice-free areas (Figure 29, MH 7, 2709).

Ice Removal:

There was a considerable build up of snow and compacted, solid ice in Mawson's room. There was a substantial amount on his chair and on the shelving around the room. It appeared that there had been significant snow ingress since January 2001, with loose snow overhanging the bed. The top shelf on the southern wall appeared to be bowing under the weight of this accumulated snow and ice (Figure 30).

After consulting Rob Easther of the Antarctic Division it was decided that the snow and compacted ice should be removed to minimise further damage to the shelving, the brackets and possibly also to the bed and pillow below. As the only possible source of ingress was the accumulated snow and ice on the ceiling of this room, some of this was removed prior to removing snow and ice from the room itself.

Figure 30: *Snow and ice on shelving on the south and east walls of Mawson's room 2002*

Figure 31: *Mawson's room, post-ice removal 2002*

A total of 370 kg of snow and ice was removed from the area above Mawson's room with a further 280 kg removed from the shelving in his room (Figure 31) and 75 kg from his chair and the surrounding floor areas. Heavy duty plastic was used to cover Mawson's bed and pillow to prevent any accidental damage from falling snow and ice during this latter ice removal process. Damaged shelving was revealed when most of the snow and ice was these areas (Figure 32).

Figure 32: Damaged shelving in Mawson's room 2002

Snow and ice were also removed from the tongue and groove timbers that had been stored on the platform outside Mawson's room. These timbers were then dried before being replaced. As problems had been caused by melt from snow dripping from these timbers onto the artefacts below, a sheet of black plastic was placed on the dried timbers. This should divert any future melt from deposited snow away from the artefacts on the shelving below.

There is a substantial amount of solid ice on the floor of Mawson's room, built up after thaw-freeze cycles. This is very slippery and will complicate the excavation of embedded artefacts.

Effect of Thaw on Ice and Snow in Veranda Areas:

Part of the debate over ice removal from the interior of the Main Hut and Workshop has revolved around the 'anchoring' effect that the ice has on the building. As this summer produced an unusually high melt at Cape Denison, documentation of the residual snow and ice in the verandas was considered critical as this will be the primary 'anchor' for the building if snow and ice is removed from the interior spaces.

Photographs and measurements were taken to record the amount of residual snow and ice in the veranda areas (Figures 33-41). Despite the considerable melt and the

presence of a melt stream flowing from under the hut, at the junction of the Main Hut and the workshop, there is still a considerable mass of ice that is firmly attached to the building foundations Where possible, distances from the extremities of the building to the solid ice core were determined using a length of wood and measuring tape (NE and NW corners of the Workshop only).

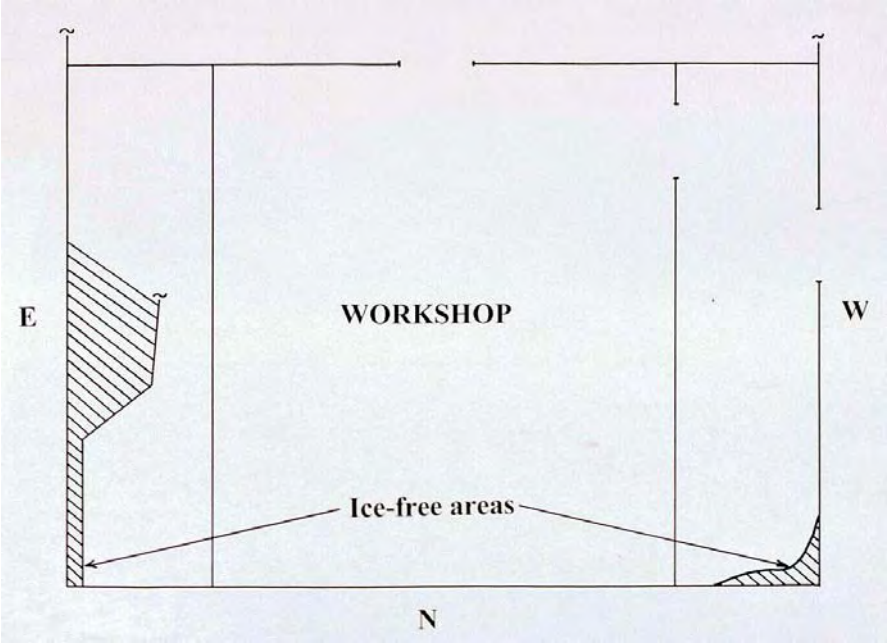

Figure 33: *Plan of the Workshop showing the extent (approx.) of ice in the verandas*

Despite the presence of a melt stream, which flowed quite strongly from under the veranda of the Main Hut at the eastern junction of the Main Hut and the workshop, solid ice could still be seen under and between the veranda boards at the NE corner of the workshop (Figures 34, 35). This block of ice and snow was about 17 cm in from the veranda's edge and was visible for about 170 cm to the south. Unfortunately it was not possible to determine distances to solid ice in the eastern and southern veranda sections of the Main Hut, as the veranda walls extended to the bedrock in these areas. Although there has been a very large melt during the 2001/02 summer, there still appears to be a substantial mass of ice in all veranda areas (Figures 34-41) for which observations and measurements were possible.

What appears to be a dog chain could be seen hanging below the veranda boards about 2.2 m from the NE corner of the workshop.

Distance from the NE Corner	*Distance to solid ice from the edge of the veranda*
0 – 1.7 m	0.17 m
2.15 m	0.90 m
3.4 m	1.00 m

Figure 34: *North-east corner of the Workshop veranda showing residual ice below the wall 2002*

Figure 35: *North-east corner of the workshop veranda – view to the south 2002*

Figure 36: *North-west corner of the Workshop veranda – view to the south 2002*

Figure 37: *Workshop veranda just inside the entrance – view to the north 2002*

Figure 38: *North-west corner of the Main Hut veranda – view to the south 2002*

Figure 39: *South-west corner of the Main Hut veranda – view to the north 2002*

Figure 40: *South-west corner of the Main Hut veranda 2002*

Figure 41: *South-west corner of the Main Hut veranda – view to the east 2002*

Roof Repairs:

As there were insufficient appropriate fastenings and tools to prepare and attach replacement wood to cover holes in the tongue and groove timbers of the south-facing roof of the Main Hut, repair work was limited. The highest priority was assigned to reattaching loose and/or split battens that were at risk of being blown from the roof under blizzard conditions. An inspection of the southern, western and eastern sections of the Main Hut roof revealed a number of battens that were attached at one end only. These were given priority. This was necessary because of the limited number of appropriate fastenings that were available. Easily identifiable, modern screws were used to attach 5 battens to the southern roof, one to the western roof and 3 to the eastern roof (Figure 42). In some instances loose battens were not in their original positions (as indicated by weathering patterns, nails and nail holes). They were repositioned prior to reattachment.

Figure 42: *Securing of a split batten – south roof of Main Hut 2002*

Sections of the southern roof of the Main Hut appeared to have deteriorated considerably since the summer of 2000/01. In particular 4 joins, approximately 2.6 m, 1.5 m, 0.8 m and 0.4 m in length respectively, were identified as being in urgent need of repair. These gaps in the tongue and groove timbers were found in an area of the roof above and slightly to the east Mawson's room, an area in which increased snow accumulation had been observed inside the Main Hut. It was considered important to prevent further ingress of snow in this area of the building as the build up on the ceiling of Mawson's room is leading to damage inside the room itself.

Three lengths of modern wood were found and screwed to the existing roof to cover the two largest gaps in the roofing timbers (Figure 43). Two of these pieces had to be joined to cover one gap. A small amount of silicone was used to seal the join of these pieces. Additional silicone was also used to cover a hole near the ridge capping for which no timber or fastenings were available (Figure 44).

As silicone had been used as a temporary repair measure during the 2000/01 season, it was considered reasonable to also use it in this instance, in the absence of any preferable alternative.

Figure 43: *Repair to the south roof of the Main Hut 2002*

Figure 44: *Silicone repair to the south roof of the Main Hut 2002*

DISCUSSION AND RECOMMENDATIONS

Having visited Cape Denison in consecutive summers (2000/01 and 2002) it was possible to assess recent changes in the condition and deterioration of the Main Hut and the associated artefacts. Especially significant were the unusual weather conditions that prevailed during the most recent trip. High temperatures had melted snow and ice both inside and outside the Main Hut and allowed observations to be made of the impact of this melt on structures and artefacts.

Katabatic winds and windborne snow and ice have contributed to and will continue to cause quite rapid deterioration of the external wooden building components, especially those with a southerly aspect. Associated with this physical deterioration of the building fabric is an increase in the amount of snow and ice entering the building. Contrary to some previously expressed opinions, this ingress is far from being a benign protector of the internal structures and artefacts that remain in the interior spaces. Melt – freeze cycles produce ice that encapsulates objects and structures and applies physical stresses to load-bearing features. In the past this, and the sheer mass of accumulated snow and ice, have led to the collapse of the platform in the Main Hut, breakage of some structural timbers and tongue and groove boards in the ceiling of the Workshop, the collapse of shelving and the deformation of shelving brackets (Figures 45, 46).

Figure 45: *Damaged shelving on the south wall of the Workshop 2002*

Figure 46: *Broken platform timbers in the Main Hut 1997/98 (© A McGregor)*

Summer seasons, such as the one just experienced, inevitably lead to increased relative humidity (RH) inside the Main Hut and the Magnetograph House. Quantitative and qualitative data is currently being accumulated (corrosion cells/coupons and experimental artefacts) which will allow conclusive statements to be made regarding the impacts that such changes in the interior microenvironments have on the deterioration of artefacts, structural components and fastenings (bolts etc). Without access to this data, it is still reasonable to expect that RH increases, in conjunction with warmer temperatures, will lead to increased rates of corrosion and mould formation in susceptible objects.

An additional direct impact of the higher temperatures experienced this summer was the damage caused by melt-water saturating artefacts and structures. In the Main Hut, the outer layers of newspapers on the shelves on the northern wall of Mawson's room, were saturated by water dripping from melting snow and ice that had accumulated above the ceiling of Mawson's room and on the adjacent platform timbers. Although it is anticipated that the paper will naturally freeze-dry during the cooler autumn and winter seasons there is a slight risk that some of the pages may fuse together. Other paper and wooden artefacts were similarly saturated and all are likely to be affected by disfiguring mould formation. Damp and wet metal artefacts will corrode more rapidly. Melt water from a large mass of accumulated snow on the bunk immediately above Hurley's, mobilised an unknown, bright pink substance which then stained the snow below it as well as artefacts that were on the floor below. Potatoes and other objects on the floor are now stained pink!

A further problem is the impact of accumulated water that refreezes after being trapped inside building voids, such as at the roof and wall junctions. Snow and ice are present in the spaces between the exterior roofing boards and the ceiling boards. As the snow and ice melts, accumulates in the lower regions of these spaces and then expands as it refreezes, physical damage to the building fabric is likely. This is a likely cause of the severe damage that has occurred to the structural timbers in the workshop roof and to the tongue and groove boards in the same area. Circumstantial evidence for this process is provided by the extreme damage done to the structural timbers and ceiling boards at plate height on the southern workshop wall. Large masses of solid ice can be seen protruding from these shattered timbers.

Gaps in the roof of the Main Hut have allowed snow to penetrate similar spaces in the roof lining of this building. Unless action is taken it is possible that similar damage will occur in this building.

Allowing snow and ice to remain in the interior spaces of the Main Hut and Workshop has the potential to damage spaces such as the darkroom and Mawson's room. As snow melted from the area above the darkroom, water entered this room and then refroze. The slow process of filling this previously snow and ice-free room has begun, with the formation of ice 'stalactites' clinging to shelves and sheet ice on the walls (Figure 18). Subsequent summers will see this ice melt and then refreeze on the floor, an area that contains many artefacts. While the full implications of the presence of snow and ice on artefact deterioration are still being investigated, there can be no dispute about the problems that are caused when artefacts are encased in solid ice. Excavation is more difficult and artefacts are subsequently at greater risk of damage. This can be prevented by stopping the ingress of snow and by removing that which is already present, especially in the relatively artefact-free upper regions of the building.

While many of the above observations and statements are not based on hard evidence, continuing to allow snow and ice to penetrate the roof spaces and interior of the Main Hut will subject this building to unacceptable risks. Further, allowing the existing snow and ice to remain in the building, on the balance of probabilities, is far more likely to cause further damage than is likely to be caused by its removal. I therefore most strongly recommend that the following occur:

- The roof of the Main Hut be over-clad to protect the original timbers, battens, sail cloth and rope from further physical damage and loss and to stop the further ingress of snow.
- All walls of the Main Hut also be over-clad to provide physical protection for these structures.
- The above works be undertaken sympathetically so that the new exterior still evokes the same feelings that are generated by the aged timbers. The final appearance of the new roof should resemble that of the building in its current state (with replica battens, rope and sail cloth fragments attached).
- All snow and ice be removed from the interiors of the Main Hut and the Workshop, but retained in the verandas.
- Monitoring of the internal microenvironments and the impact of the microenvironments on corrosion cells and artefacts continue so that the effects of the ice/snow removal process can be objectively evaluated.

- Monitoring be extended to include gathering data on the vibration/movement of internal structural timbers so that the impacts of high winds can be determined on the integrity of the building.
- Condition reports be prepared for all artefacts currently located inside the building and for those artefacts that are revealed during any ice-removal.
- The significance be determined of artefacts located around the Main Hut and in surrounding areas and where appropriate, recommendations be made regarding conservation, preservation and possible relocation.
- A thorough assessment be made of the subfloor conditions to determine the extent of the 'ice foundations' and their possible anchoring effect on the building.

Over-cladding is one way in which the original roof timbers and battens can be protected. This will not be a simple task but in my opinion is the only realistic way in which the existing original fabric can be retained and physically protected and the building sealed. Over-cladding the veranda walls will not only provide protection for these timbers but will also allow the new roof line to be seamlessly matched with the veranda. There may be problems in accommodating the existing skylights and the junction with the workshop with a higher roofline on the Main Hut.

This recommended approach is similar to that used centuries ago by wooden ship builders. Shipwrights attached a sacrificial skin, comprised of pine timbers, to the more important, structural oak planks. This outer pine layer suffered physical, chemical and biological (marine borers etc) deterioration. When sufficiently degraded the sacrificial timbers were simply replaced. Obvious comparisons can be made with the Main Hut and Workshop at Cape Denison and I believe that such an approach should be applied to these structures. If this is not done, I foresee the situation in which there will be no original timbers left on the southern-facing exterior walls and roofs of the building – it will eventually end up in a similar state to that of Nelson's flagship, the *Victory*, in which only about 10% of the ship is comprised of the original timbers. By sealing the building with a combination of sacrificial planking and possibly an underlying membrane, it should be possible to prevent snow ingress and protect the original timbers.

While I realise that I am stepping out of my area of expertise in making the following suggestion, and will happily stand corrected by those with expertise in architectural heritage matters, I believe that it would be preferable to fix new 'battens' to the existing, underlying structural timbers (to which the original, external tongue and groove boards are presently attached). New roofing boards could then be affixed to these new 'battens', thereby minimising the impact of the new roof on the original tongue and groove boards and at the same time allowing for easy replacement and repair of the new roof as it inevitably wears and ages. This approach would raise the new roof above the level of the original battens and allow for easy access to the original roofing fabric should this be necessary. I firmly believe that this is preferable to the piecemeal approach of dealing with leaks and holes in the roof as and when they appear, or are noticed. This latter approach will not be effective as visits to the site by the Antarctic Division are too infrequent to ensure that a regular maintenance program can be instituted or maintained. A 'whole of hut' approach is needed now. As the original timbers have lasted for about 90 years, a protective outer layer and snow barrier could conceivably provide significant protection for many decades.

If the above approach is adopted, it may be necessary to allow for drainage of any melt from snow that may penetrate the new cladding. If this is not done then the new roof may eventually be responsible for damaging the underlying original timbers. There are numerous ways in which this potential problem can be addressed but this is an area best left to those with experience and expertise in roofing design.

In addition to ensuring that the building is protected and preserved, it is also very important to prepare condition reports for all artefacts currently located inside the building, for those recovered during any ice removal process and for any significant artefacts located outside the buildings. Baseline information for the internal artefacts will help to guide future conservation decisions and will also provide qualitative information on the internal environment when monitoring of this ceases.

I defer to my colleagues who specialise in the heritage architecture field as to the possibilities and ethics associated with the suggestions that I have made with respect to the method by which the roof and verandas should be sealed and physically protected. I do not, however resile from my recommendations that immediate action must be taken that will allow the current problems to be overcome and will simultaneously allow future repair work to be as simple as possible. The external timbers on the southern walls and roof must be physically protected and snow ingress minimised.

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I would also like to thank Stephanie Pfennigwerth and Rob Easther of the Australian Antarctic Division for their assistance, support and friendship. Their efforts ensured that my involvement in the 2002 expedition was as enjoyable as it was well organised.

Dr Ian Godfrey
Head, Department of Materials Conservation
Western Australian Museum

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APPENDIX 1: Film Rolls and Contents

ROLL A

Frames

1 –3	loose board – found on W side of Hut, with other timber from the 97/98 AAP expedition
4 – 8	Sled – southern wall of Main Hut (see also Roll J, frames 15-22)
9	Cans immediately east of sled
10	Boxes (unopened and opened) – west of the sled
11	broken sled fragment
12	weather screen (?) – south of boxes and cans above
13	sled fragment (?)
14 – 18	South roof of Main Hut
19 – 23	Kerosene tins and boxes/debris at SE corner of Main Hut
24 – 29	wireless masts and anchor points etc
30 – 32	panorama of the debris field (see also Roll C, frame 16, Roll I, frame 37)
33 – 35	rock graffiti (BM) – east of the Main Hut
36	SE Hut corner debris (boxes, cans etc)

ROLL B

1,2	director's chair – E of workshop, above the seal skins
3,4	paddle with bamboo handle
5 – 8	Finnesko – box of reindeer boots/liners
9 – 13	Collapsible boat – E side near workshop
14,15	Box of straw insulation (E of boat)
16	"Downstream" – NNE of the workshop
17 – 19	Views of the debris field (to the W, N and NW resp.)
20, 21	Location and close-up of skylight (?) cover
22 – 30	Northern most mast (?) and associated debris
31	Cairn – NNE of Hut
32 – 35	Seal kill and location
36 –37	Dog chain and collar, view to Boat Harbour

ROLL C

1	close-up of dog collar and chain
2, 3	Finnesko and location
4, 5	Boots, bowl and cans
6 – 8	Frame, boots and cans
9 – 13	Clothing dump and close-ups, including shaving tin (?) – mirror but blades missing
14, 15	sheep foot
16 – 37	debris field NNE of workshop
16	panorama of site
17	boots
18	pipe bowl, cotton reel etc

19	bottle opener
20	boot repairs/modifications
21	marlin spike sheath (?)
22	wooden handle
23	metal boot sole (?)
24	'wood pile'
25	main artefact scatter
26	boots, bones and brush
27	boot repair
28	oven door
29	accordion or other bellows-like object
30, 31	unknown bamboo object
32 – 34	unknown bamboo object 2
35 – 37	wet patches near NE corner

ROLL D

1 – 22	views immediately N of the workshop
23	water flowing out from under the workshop walls (Eastern side)
24	sheep carcass, 1.5m NE of the workshop corner
25 – 27	Box fragments behind the first large rock (N of the NE workshop corner)
28, 29	Meat skewer (?)
30 – 37	Junction of the workshop and the Main Hut (toilet etc)

ROLL E

1 – 4	The plateau from Sorensen Hut
5 - 12	Magnetograph House
13	Water flowing past NE corner of workshop
14 – 16	NE corner of the workshop – showing ice still in the corner of the verandah and water under the rest
17, 18	Junction of the Main Hut and the Workshop showing flowing out point of meltwater
19	SE corner of Hut- meltwater
20	Low level of slowly flowing water at the base of the Main Hut, in line with the skylight. The water disappears here under rocks and reappears at the junction of the Main Hut and the Workshop
21, 22	Ice at the base of the SE corner of Hut verandah
23 – 26	Cylinders at the SE corner of he Main Hut verandah
27, 28	Wedges – 1.5 m south of the Main Hut near the cans and the 'weather screen'
29 – 32	Eastern roof of the Main Hut
33 – 36	Eastern wall of the Main Hut
37	Electroscope fitting

ROLL F

1 – 4	Eastern roof of the workshop
5	12th complete board along from the junction with the Main Hut

6 – 9	Northern roof of workshop
10 – 14	Northern wall of workshop
15 – 19	Western roof of workshop
20 – 24	Western wall of workshop
25 – 29	Western roof of the Main Hut
30 – 32	Western wall of the Main Hut
33 – 37	Southern wall of the Main Hut

ROLL G

1 – 6	Snow and ice above Mawson's room (pre-removal)
7 – 12	ice removal from above Mawson's room (see also 28 – 31)
13 - 15	View north along the western Workshop veranda (from just inside door)
16	broken shelf just inside the Workshop (southern wall)
17	Under the bench, west wall of the Workshop
18, 19	West wall of the Workshop
20 – 27	Inside Hurley's darkroom
28 – 31	above Doug's room (?)
32	Biological area near NE (?) corner of Doug's room
33, 34	above the darkroom
35 – 37	Inside Doug's room

ROLL H

1 – 6	Pre-ice removal in Mawson's room
7 – 13	Ice removal, Mawson's room
14	Rusty bracket (formerly encased in ice – south wall of Mawson's room)
15 – 19	unknown objects (2) in the snow near Boat Harbour (sled?) – see also
20 – 22	'Raspberry' staining of melting ice above Hurley's bunk and floor areas
23	Clothing hanging above Hurley's bunk (behind overhanging ice)
24 - 31	Mawson's room – post-ice removal
32 - 35	Floor and walls of the darkroom

ROLL I

1 –4	NW corner of workshop veranda (ice documentation)
5 – 7	Just inside the workshop door looking North
8, 9	Toilet
10, 11	NW corner of the Main Hut, looking south
12 – 14	SW corner of Main Hut, looking north
15 – 17	SW corner of hut looking east
18 – 20	NE corner of workshop looking south
21 – 27	Hut shots and Magnetograph House without Gadget Hut!
28 – 32	Southern facing roof of the workshop (showing loss of intergrain finish and also surface weathering, with loss of less dense earlywood areas
33 – 36	North-facing roof of the Main Hut
37	Panorama of the artefact scatter (good shot)

ROLL J

14	Toilet outlet and broken penguin eggs
15 – 22	artefacts adjacent to the SW corner and S wall of the Main Hut
23	Tongue and groove boards on top of sheep skin (S of SE corner of the Main Hut
24	Artefact scatter and meltstream (NE corner of MH)
25 – 27	Artefacts and meltstream (SE corner of MH)
28	Sealskins/chair – E of workshop
29	Door – E of the MH
30	Meltwater/artefacts – NE corner of the workshop
31	Artefact scatter – N of workshop
32	Chairs and cans (unknown location)
33 – 35	Artefact scatter/Hut/meltstreams

ROLL K

1 – 4	Peter Coleman filming in the MH
8	Kerosene drums/boxes – view of MH from the SW
9	MH – view from the W
10 – 13	Artefact scatter – N of MH
14 – 37	Inside Mawson's Huts – ice documentation

ROLL L

1 – 14	Artefact trays and locations – MH 1,2, 3,6 and 8
15, 16	Magnetograph House – internal views to W and E walls
17, 18	Unknown object near Boat Harbour (sled ?) – see also K 15 – 19
19, 20	ANARE pennant removed from top of Auroral Observatory
21, 22	Seal carcass with rope around neck – W side of Boat Harbour
23 – 25	Metal cables leading into Boat Harbour (North of Main Hut)
26	View of S-facing wall of Transit Hut
27	View to Hut from E side of Boat Harbour
28 – 32	Seal killing fields – East side of Boat Harbour (NE of hut)

ROLL M

1	View to the Workshop from the Main Hut
2 - 5	View from the Main Hut entrance into the living space
6	Workshop ceiling
7	Broken shelving – S wall of Workshop
8	View into the Workshop from the door
9 – 11	Workshop floor
12 - 14	Sensor locations – Vinod Daniel's monitoring equipment
15 – 19	Wet artefacts and shelving (main living space of Hut)
20	Wet platform timber
21	Wet timber around the skylight
22	Electroscope housing and ceiling

23	View from the plateau to Mawson's Hut
24	Sir Hubert Wilkins (view from the plateau)
25	Man-hauling to the plateau
26, 27	Mawson's Hut from the plateau
28	Stuart Hammond, Peter Coleman and Ian X on the plateau
29 – 33	Blubber scraper (?)
34, 35	Project Blizzard wood sample
36	View from Boat Harbour to Main Hut

ROLL N

1,2	Seal kills west of Magnetograph House
3	Waterlogged newspaper in the Main Hut
4	Ice stalactites, waterlogged artefacts in Main Hut
5	Electroscope housing
6	Snow and ice above Hurley's bunk
7	West wall inside the Main Hut - snow/ice documentation
8 – 10	Outside Doug's room - snow/ice documentation
11	Outside the darkroom - snow/ice documentation
12 – 15	Inside Doug's room - snow/ice documentation
16	Ice stalactites on and near the frame of Doug's door
17, 18	Above Doug's room - snow/ice documentation
19	Upper NE corner inside the Main Hut – snow/ice documentation
20	Water, snow and ice on artefacts/shelves in the Main Hut
21	SE corner inside the Main Hut - snow/ice documentation
22	East wall inside the Main Hut - snow/ice documentation
23	Above Doug's room, west side - snow/ice documentation
24	SW corner inside the Main Hut - snow/ice documentation
25	View to the SE inside the Main Hut - snow/ice documentation
26, 27	View to the SW inside the Main Hut - snow/ice documentation
28	Darkroom/kitchen - snow/ice documentation
29	View to the NE corner of the Main Hut - snow/ice documentation
30	Sensor location – west wall of the Main Hut
31	Chemicals and ice in the darkroom
32	Pipe, cotton reel in artefact scatter – N of the Main Hut

ROLL P (there is no Roll O)

1 – 5	Panorama of Mawson's Hut, Boat Harbour and the plateau
6	Snow on glass in N skylight of the Main Hut
7, 8	Batten repair – S roof of the Main Hut
9, 10	Repair - S roof of the Main Hut
11	Silicone fill – S roof of the Main Hut