6 A Catalogue of "Temporary Field Accommodation Systems for Use in Antarctica"

The aim of this component of the Field Accommodation Project is to develop a comprehensive catalogue of the field accommodation systems that are suitable for a variety of applications in Antarctica. This *Guide* will not recommend particular products for specific situations, but rather act as a reference source for expedition planners and others who have identified the requirements and constraints of their projects. The Guide will consolidate in one document the information necessary to apply the Accommodation Selection Process outlined in Chapter 3.

6.1 Objectives

The objectives of this component of the Field Accommodation Project are to:

1. Identify existing field accommodation systems that are used in Antarctica, or products available on the market that are not currently used but offer potential.
2. Develop a method of condensing information about individual products to produce a catalogue of field accommodation systems for use as a reference document by ANARE personnel in planning expeditions.

6.2 Proposed Program for developing the Field Accommodation Catalogue

This project was approached with little experience of the use of field accommodation systems in the Antarctic environment, and the following program for developing the field accommodation catalogue was proposed. This process has been followed in conjunction with the production of the other components of the field accommodation project, as detailed in this report.

1. Identify via personal discussion the specific needs and desires of the different Division sections that are impacted by the selection of field accommodation. Eg. Users, logistics, energy supply, accounting, field training officers, environment etc.

2. Develop a draft submission of catalogue fields for the specific product types, eg. Fabric, collapsible rigid, or permanent rigid shelters. Considerations should include aspects such as: floor area, floor type, height, insulation, cost, warranty, erection time, shipping packages with dimensions and individual weights, windows, doors, modularity, country of origin, method of attaching to ground, etc.

3. Circulate the draft to the relevant Sections for review and comment.

4. Contact equipment suppliers for the required data.

5. Compile the responses of suppliers to produce a comprehensive guide to the current options available for field accommodation in Antarctica.

6. Submit the draft guide for review and comment.

7. Publish the Guide, including web delivery, and promote availability.

6.3 Progress to date of the Field Accommodation Catalogue

1. The existing systems that serve ANARE were identified in the Historic Review in Chapter 5 (Appendix C). Potential suppliers of alternative field accommodation systems have been identified by market research efforts, and by pursuing retained knowledge within the Division.
2. An initial summary has been produced of suitable Temporary Field Accommodation Systems, outlining the general system styles and prominent suppliers. This information follows.
3. A draft document has been developed (and introduced in Appendix B) to capture standard data from product suppliers for production of the catalogue, via input from appropriate AAD personnel. Some product suppliers are currently responding to enquiries made with the draft document.
4. This component of the larger Project is on-going as new products will continually emerge, however, once the process has been formalised, maintenance of the field accommodation Guide will be less labour intensive.

6.4 Summary of Antarctic Field Accommodation Products

The following information documents the preliminary results of an ongoing review investigating field accommodation systems for use in Antarctica. Components of the review have included analysis of the temporary accommodation systems deployed in the past by the AAD, and identification of the specific design factors that must be considered when selecting or designing future accommodation systems. These components are not directly addressed in this information.

Three broad categories of temporary shelter systems have been identified, and are examined in this document. The categories are:
1. Fabric structures – Erecting
2. Rigid structures – Low Weight
3. Rigid structures – Durable

In addition, two further categories will be examined due to potential applications within the activities of the Division. The categories include:
1. Fabric structures – Large capacity
2. Fabric structures - Inflatable

For each category, a brief analysis is made of the standard characteristics of the products present in the category and review of the product suppliers as identified at this time.

Notice should be taken that although a large number of suppliers exist around the world for a diverse array of temporary accommodation products, many are not designed for deployment in polar conditions. This fact has been well recognised by the Division in the past and this review seeks to broaden the field of potential suppliers of products to the Division. Identification of suitable products is difficult, and inputs of direct or associated experience are encouraged.

Fabric Structures – Erecting

With the advantages of low structural weight, limited shipping volume, minimum environmental impact, and reduced initial costs, traditional 'tent' shelters are available in a wide variety of sizes, shapes, quality levels and performance standards. Focusing on products that offer a balance between erection complexity, user comfort, and ease of deployment (but excluding smaller hiking tents), at least five manufacturers have been identified as offering fabric structures suitable for meeting the needs of the Division. An additional advantage of these shelters is the flexibility to combine multiple shelters to increase total length. Disadvantages include the low thermal mass of the shelters and the increased complexity of assembly. Refer to Figures 1 & 2 over.

Two manufacturers (*Weatherhaven* and *Alaska Industrial Resources*) are internationally recognised as leaders in the market for extreme-environment shelters, can claim extensive field experience in Antarctica, and both offer sophisticated product solutions to meet a wide variety of applications. The quality and reputation of these products does come at a high initial price, particularly with the current AUD/US$ exchange rates.
Summary: High quality, proven performance, low weight & volume, high $.

An alternate manufacturer (*Rac-Tent Shelter Systems*), new to the market from NZ, offers a similar product to the two leaders, but at a significant cost saving. Field experience, although limited in Antarctica to multiple seasons at a NASA project near McMurdo, should not be discounted with excellent performance reported by the manufacturer. Contact is being established with the supplier to confirm availability of the product, prices, and specifications. This product has high potential to offer quality, low cost, and readily portable accommodation in Antarctica.
Summary: High potential, limited performance proof, low weight and volume, low $.

Other products include military-styled rapid erect shelters or industrial-style fabric shelters. Many of the products appear generally to not meet the specifications required for deployment in coastal polar regions (primarily wind speeds) or offer little thermal comfort for occupants. However, for specific applications such as vehicle shelters, these products may be suitable.

Figures 1 & 2: Examples of erecting fabric shelter systems.
Images courtesy of Weatherhaven.

Rigid structures - low weight

These structures offer greater structural support and thermal insulation when compared to fabric shelters, without significant increases in shipping weights and volumes. Rigid shelters constructed from low weight materials have a long history of deployment in Antarctica. Examples of such buildings include the well-proven Apple huts and Googies, both locally manufactured from fibreglass. A variety of other products are also available, such as the recently trialed tank huts of Heard Island.

Low weight rigid shelters appear to generally be small in size, but offer the advantage of an insulated, readily deployable shelter that can often be transported by helicopter and left in the field for extended periods of time. Some products allow the expansion of individual modules to increase total shelter size, but this capability is not common to all systems. Although not an extensive list, products available in this category include:

Apple huts and *Googies* – locally manufactured for over a decade, the Apple huts are a proven accommodation solution for small numbers of occupants or as emergency shelters. Also locally manufactured, the Googie shelters have been deployed successfully in a number of polar environments. Although smaller in size than the Googies, the Apple huts bear the advantage of being disassemble-able for transport. Further disadvantages with the Googies included large shipping volumes required relative to their interior volume and the need for dedicated ring-mounts for the shelters. An additional complication to the deployment of Googies is that they are no longer in production and components of the design were never completed. Refer to Figures 3 & 4 over.
Summary: Proven performance, low weight and volume, low but rising $.

Figures 3 & 4: Apple hut and Googie.
AAD Image.

Tank huts – deployed for the first time in 2000-1, the tank huts were a novel solution to providing accommodation in the sub-Antarctic. With the advantages of low weight and potential low cost, and further development of the design to overcome a number of faults identified through field use, the tank huts represent a versatile solution to future accommodation needs. Opportunity exists to develop custom-designed tank huts to address specific needs such as Communications huts, ready for rapid deployment in field environments. At present, the tank huts are not an ideal shelter system and efforts are underway to improve the design and operation. Refer to Figure 5 below.
Summary: Developing design, custom fit out, low weight, low $.

Figure 5: Tank huts deployed on Heard Island.
AAD Image.

Weatherhaven MECC containers – (Mobile Expanding Container System) this product combines fabric structure technology with standard ISO shipping containers to produce a hybrid shelter capable of increasing floor area by 300% within minutes via expanding panels. Although heavier than the other low-weight options presented, the rugged construction of the self-contained MECC module provides durability and interior storage capacity during transport with the bonus of a large interior volume upon deployment. The MECC system can include internal electrical systems and lighting, although these systems do not comply to relevant Australian standards and modifications must be undertaken at additional cost in Australia. The MECC system was reported to have performed well for the German Antarctic Program during a winter in the Antarctic environment. As with the fabric-only structures from this market leader in extreme-environment structures, the quality of Weatherhaven products comes at a relatively high price. Refer to Figure 6 below.
Summary: high quality, limited performance data, 300% expansion of volume, high $.

Figure 6: the Weatherhaven MECC expandable shelter.
Image courtesy of Weatherhaven.

Fibreglass modular shelters – A number of fibreglass (or concrete) based portable building systems are available on the general market that apply similar principles to the Apple huts identified above. Many offer variations in shelter size and shape via an assortment of panel components to offer a versatile solution to shelter needs. However, little analysis has been done of the capabilities of such systems to perform in the Antarctic environment and so such systems are not considered as viable at this time.

Summary: low weight, limited polar design, unknown polar performance, unknown $.

Aluminium containers (*light weight*) – The design of these light weight shelters was initiated previously by the Division to meet a need for durable, self-contained accommodation modules that could be deployed by helicopter. Prototype construction (incomplete) suggests that the project would succeed but at potentially high cost. The prototype model could be completed with limited additional investment, but this shelter system is not available for use at present.
Summary: undeveloped, low weight, durable, high $.

Rigid Structures - Durable

Substantial portable structures such as shipping containers can offer durable design characteristics for long service lives, high thermal performance for reduced running costs, and the capability of extensive interior fit out to fill a variety of roles. Standard ISO container sizes allow use of common handling equipment and ship loading. Also, individual modules can often be combined to form larger self-contained installations. The high durability of such facilities allows them to be deployed for longer periods of time than less robust accommodation systems. The disadvantages posed by rigid structure accommodation systems are their limited ability for aerial deployment due to increased weight, higher capital cost, and fixed shipping volume.

Accommodation systems utilising *container style modules* are common to many industries around the world, however, not all the products available are suitable for deployment in polar conditions due to increased insulation and snow-ingress requirements. A variety of international or national companies offer products that may be suitable for use, but these have not been assessed at this time.
Summary: high durability, fixed volume, limited polar design, unknown polar performance, flexible interior fit out, high weight, high $.

An alternative to the purchase of standard ISO-container based systems is the development of *custom container-style modules*. The AAD has previously initiated development of this style of shelter, utilising AANBUS panels secured to a steel carcase. Although showing promise, this system has not been completed and so is not available at present.
Summary: not developed, custom sizes, improved insulation, unknown $.

Fabric structures – large capacity

Larger scale temporary structures can compliment accommodation modules without requiring the same interior comfort characteristics. Review of the market for large-scale temporary structures has illustrated that although there are several international and local suppliers involved in this market, very few are capable of supplying products suitable for use in Antarctica. Additional design constraints imposed by specific applications (such as height) or environments (high coastal winds) further restricts the range of products available for deployment.

Figure 10: Wide-span large capacity fabric shelter.
Images courtesy Weatherhaven.

The principal manufacturers capable of meeting almost all requirements for large-scale shelters are again the market leaders in extreme environment products, *Weatherhaven* and *Alaska Industrial Resources*. Their products are well designed, field proven, and expensive. In some circumstances, alternative suppliers do not exist, however, previous manufacturers that have been utilised by the Division include *Parcol* and *Norseman* shelters.

Fabric structures – inflatable

Although little data has been gathered at present, an option open for consideration as either accommodation or utility shelters are inflatable fabric structures. Most structures available appear to have been developed for military applications but may not be suitable for polar deployment. However, reports have been made of the BAS using such structures in the past as aircraft hangers.

References:

Weatherhaven http://www.weatherhaven.com/product3.htm
Norseman http://www.norseman.ca/
Rac Tent http://www.ractent.com