The Design Competition ‘Shelter Me’ was hosted by Design It, an online competition project. The competition guidelines asked designers to design a temporary emergency shelter for deployment in a natural disaster and challenges designers to present a cost-effective short-term shelter that is affordable, lightweight, strong and easily deployed.

Launched in 1994 by UNESCO and Felissimo, Design 21 was an international design competition to promote the sharing of ideas and values between young creators around the world. DESIGN 21: Social Design Network continues this objective with Design It, an online competition program. The competition requires one 72dpi, 400x400 pixel image of less than 1MB along with a 300-word description of the design. Competition deadline June 17, 2007.

“In the past two years, widespread catastrophic events have called forth large-scale relief efforts throughout both urban and rural areas of the world. How would you design an emergency relief structure to be used in the relief efforts of a natural disaster, such as a flood, earthquake or hurricane?” –Shelter Me competition guidelines

FLOATING SHELTER – emma cubitt

PART 1: What is a natural disaster?

Are natural disasters becoming more prevalent?

What type of emergency management is generally given?

PART 2: Precedent emergency shelter prototypes

Desirable conditions for a natural disaster temporary emergency shelter

PART 3: My Design : The Floating Shelter

PART 1

What is a natural disaster?

A natural disaster is caused by a physical event such as a volcanic eruption, an earthquake or a landslide. Disasters occur when hazards meet vulnerability[i]. Some natural hazards are related. For example earthquakes can lead to tsunamis and drought can lead to famine and disease. Natural disasters can be divided into five groups: geological, water, climatic, fire, and health/disease.

<u>Geological natural disasters</u>

Avalanche, landslide, lahar, earthquake, and volcanic eruption are geological natural disasters. Landslides and avalanches can be caused by earthquakes, volcanic eruptions, or general instability in the surrounding land. In a landslide rocks, trees, houses, and other debris swept up moves down a mountain. And in a mudslide heavy rainfall causes loose soil on steep terrain to collapse and slide downwards. A lahar involves mud, rock, and ash sliding down the side of the volcano at a rapid pace. Volcanic eruptions today are less frequently fatal due to continuous seismic monitoring.

Earthquakes can be very devastating. One of the largest earthquakes in recorded history, The 2004 Indian Ocean earthquake, triggered an enormous tsunami. The 2005 Kashmir earthquake in Pakistan resulted in the loss of 79,000 lives and the July 2006 Java earthquake also triggered an enormous tsunami. The deadliest earthquakes of the past century were the Tangshan, China earthquake of 1976 (at least 255,000 killed); the earthquake of 1927 in Xining, China (200,000); the Great Kanto earthquake which struck Tokyo in 1923 (143,000).

The1970 Ancash Earthquake and subsequent landslide was the most catastrophic natural disaster ever recorded in Peru. The reported death toll from the avalanche totaled approximately 50,000 deaths. It was a system-wide disaster, impacting such a widespread area that the regional infrastructure of communications, commerce, and transportation was destroyed. The Pan-American Highway was also damaged, which made the arrival of humanitarian aid difficult.

Natural disasters involving water

Natural disasters involving water including floods and tsunami can have devastating impacts on entire regions. A flood can be caused by prolonged rainfall from a storm, tropical cyclone, snow melt, or rivers which swell from excess precipitation. Floods are fairly common and often cause great damage. Some of the most tragic floods occurred from China's Hung He (Yellow River), which had major floods in 1887, 1931, and 1938 and caused the deaths of nearly 1 million or greater residents with each flood[ii]. The 1998 Yangtze River Floods, also in China, left 14 million people homeless. The 2000 Mozambique flood covered much of the country for three weeks, resulting in thousands of deaths, and leaving the country devastated for years afterward.

A tsunami is a wave of water caused by the displacement of a body of water, and can be caused by undersea earthquakes or landslides. The Indian Ocean earthquake/tsunami of 2004 was the eighth most deadly natural disaster in recorded history with a death toll of 280,000.

Climatic natural disasters

Climatic natural disasters include: blizzard, hail/ice storm, drought, heat wave, hurricane, and tornado. While blizzards, hailstorms, and ice storms often damage property and land extensively, fatalities are often limited. A drought is an abnormally dry period when there is not enough water to support agricultural, urban or environmental water needs. Extended droughts can result in deaths by starvation or disease, and wildfires. Some of the most devastating droughts in the past century have occurred in India in 1900, the Soviet Union in 1921-22, and in China in 1928-30, 1936 and 1941. In all these cases between 1/4 – 5 million people died due to famine and starvation[iii]. Scientists warn that global warming may result in more extensive drought in coming years.

A famine is a social and economic crisis that is commonly accompanied by widespread malnutrition, starvation, epidemic disease and increased mortality. Although some famines occur by natural factors, it can and often is a result of economic or military policy that deprives people of the food that they require to survive. In recent years, famine has hit Sub-Saharan Africa the hardest, although the number of victims of modern famines is much smaller than the number of people killed by the Asian famines of the 20th century. The famine of 1958-61 in China had an extraordinary death toll of approximately 20- 43 million fatalities.

A hurricane is caused by evaporated water that comes off of the ocean and becomes a storm. The deadliest hurricane ever was the 1970 Bhola cyclone in India which killed approximately 500,000 people. Another notable hurricane is Hurricane Katrina, which devastated the Gulf Coast of the United States in 2005 and caused 1,836 total casualties. Tornadoes are violent, rotating columns of air. The United States has the most tornadoes of any country, however surrounding areas of eastern India suffer from tornadoes of equal severity to those in the US with more regularity.

Another natural disaster which might be increased due to global climate change are heat waves. The worst heat wave in recent history was the European Heat Wave of 2003. In France over 14,000 people, mostly the elderly, died due to the heat and approximately 4,000 died in Italy and Spain.

Are natural disasters becoming more prevalent?

There are two major factors that affect the recent increase in heat waves, drought, flooding and wildfires. Climate change is one factor, and uneven socioeconomic distribution another. Data from the Center for Research on the Epidemiology of Disasters in Brussels as well as the Red Cross and the insurance industry show that the number of disasters affecting at least 100 people or resulting in a call for international assistance has increased from an average of about 100 per year in the late 1960s to 500- 800 per year by the early twenty-first century[iv]. This increase in natural disasters is due to vulnerability because of growing populations, expanding economies, rapid urbanization, and migrations to coasts and other exposed regions.

According to the most recent Intergovernmental Panel on Climate Change report (IPCC April 2007), world-wide drought affected areas are likely to increase and increased heavy precipitation will augment flood risk. There is a predicted increase in deaths due to due to increased heat waves, flood, storms, fires and droughts as well as malnutrition and infectious disease resulting from global climate change. The IPCC (2001) also report predictions for increased avalanche and mudslide damage[v].

Any increases in the frequency and intensity of extreme events would adversely impact human health in a variety of ways. These natural hazards can cause direct loss of life and injury and can effect health indirectly through loss of shelter, population displacement, contamination of water supplies, loss of food production (leading to hunger and malnutrition), increased risk of

infectious disease epidemics, and damage to infrastructure for provision of health services[vi]. If cyclones were to increase regionally, devastating impacts often would occur, particularly in densely settled populations with inadequate resources.

The second risk factor for increased natural disasters is what the IPCC refers to as the "observed upward trend in historical disaster losses"[vii] linked to socioeconomic factors such as population growth, increased wealth, and urbanization in vulnerable areas. Disasters disproportionately harm people in poor countries because those countries typically have densely populated coastal regions, poorly constructed buildings, and sparse infrastructure. Poor land use exacerbates flooding and landslides. Thus, while the world's poorest 35 countries make up only about 10 percent of the world's population, they suffered more than half of the disaster-related deaths between 1992 and 2001[viii].

What type of emergency management is generally given?

Emergency management is the process by which individuals, groups, and communities manage hazards in an effort to ameliorate the impact of a natural disaster. Emergency management involves four phases: mitigation, preparedness, response, and recovery.

While mitigation and preparedness are precautionary, the response phase includes the mobilization of the necessary emergency services and first responders in the disaster area. The aim of the recovery phase is to restore the affected area to its previous state. One of the first steps in this process might be the construction of emergency shelters for short-term habitation and also may involve rebuilding destroyed property, re-employment, and the repair of other essential infrastructure. The recovery phase starts when the immediate threat to human life has subsided.

International Emergency Management groups

National and International Red Cross/Red Crescent societies often have pivotal roles in responding to emergencies, along with the United Nations. Within the United Nations system responsibility for emergency response rests with the Resident Coordinator within the affected country. However, in practice international response will be coordinated, if requested by the

affected country's government will deploy a UN Disaster Assessment and Coordination team. Many countries also have emergency management agencies of their own.

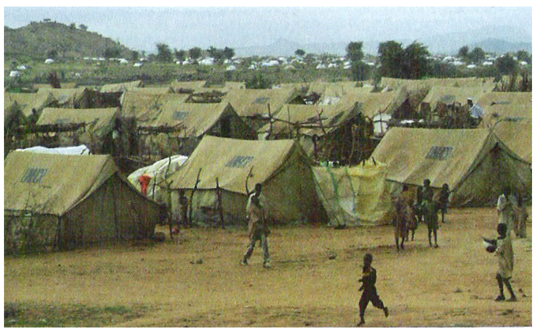
What temporary emergency shelters have been made for these victims?

Temporary emergency shelters are often set up by non-profit organizations like the UNHCR (United Nations High Commission for Refugees), the Red Cross/Red Crescent, or governmental emergency management departments in response to natural disasters. They tend to use tents or other temporary structures, or are in buildings normally used for another purpose, such as a church or school.

Temporary shelters come in many different shapes and sizes, along with a variety of costs. The Federal Emergency Management Agency (FEMA) trailers after Hurricane Katrina were an example of a more high-tech (and expensive) response to temporary shelter. There are many different types of disasters in different regions, and each shelter may need to adapt to a particular people group and site. There are five different temporary shelters typologies that will be considered in the following section: the tent, the dome, rubble-built or indigenous material, shipping pallets, prefab, and shed structures.

PART 2

In recent years there has been significant interest by designers in the problem of how to design a better temporary shelter for victims of both natural disasters and man-made disasters such as war. The ubiquitous canvas tent has had several renditions of improvement in its design, and alternate structures that are larger, more durable, more livable, or perhaps more sustainable (only to name a few characteristics) have become the focus of attention. A selection of these structures will be studied in the following pages in order to determine trends in temporary shelter design. Some designs have begun to focus on longer-term shelter, which might be the topic of a future study, however the shelters focused on in this study are ideally built for six months of use by either one or two families.



Some of the designs have been dreams of their inventor for several decades, others were inspired by the camping tent design field, and finally others were designed for competitions such as the 1999 Transitional Housing Competition for refugees returning from Kosovo sponsored by Architecture for Humanity. Many of these designs were found in the 2006 book by Architecture for Humanity entitled *Design Like You Give a Damn*, however various sources and websites have been accessed for the following precedent studies. This study of temporary shelters found is that there is not a lack of interest in these types but rather an already intense amount of energy that has gone into these designs. At the end of this section is a chart which compares the various qualities of each precedent.

Precedent 1: the Tent

UNHCR Canvas and Lightweight Emergency Tent

The tent has been, and remains, the primary typology for emergency relief. While prefabricated structures to shipping containers and polyurethane yurts have all been suggested for emergency situations, these are often perceived as "too permanent", "too late" or "too costly." In the case of a natural disaster, an agency will often first send out emergency sheeting. Next a more durable ridge-style or centre-pole double fly tent made of canvas will be sent. Canvas tents have several drawbacks, however: they are heavy (up to four people are needed to carry a canvas tent), cumbersome to carry, costly to ship, and they cannot be stockpiled for long periods due to deterioration[ix].

In 2002 the UNHCR began testing a new nylon tent design by Ghassem Fardanesh for the family tent that is more durable and has a longer shelf-life, but the primary consideration was its weight and size. Privacy was another major concern in the design, where a center dividing curtain creates two semiprivate spaces within the tent. The new tents have been tested successfully in both Chad and affected areas of Indonesia after the December 2004 tsunami, however with an enormous stockpile for canvas tents it may take years for the white nylon tents to become standardized in disaster relief situations[x].

Cardboard Tent :

Designed by a father-daughter team (Daniel and Mia Ferrara) in 2002, laminated corrugated cardboard huts can be unfolded and built by two people in less than an hour with only simple tools. While the shelters have a reasonable life span, they are difficult to transport. Although the houses pack flat, where 500 to 1,000 tents can be sent on a standard shipping container, only 88 of these cardboard units can be shipped. They are also currently 4 times more expensive than the nylon tent[xi].

Inflatable Tent: Advanced Containment Systems QuickFlate

The QuickFlate[xii] rapid deployment self-contained inflatable shelter can be blown up by one person in 3-5 minutes. Inflation is simple using an electric or manual pump and the shelter will stay inflated for days without refilling. The shelter's 8-inch Air Beam structure is manufactured from Ethylene Propylene Diene Monomer (EPDM) with seams and attachments chemically welded to provide robust construction for repetitive and long-term use. The shelter is designed to be lightweight, resilient, easy to inflate, and stable. Fully inflated, the tent is rigid enough to be relocated by four persons.

Precedent 2: The Dome

Many unique dome-shaped emergency shelters have been designed over the past half century, and most designers pay homage to Buckminster Fuller's dome. In fact, Fuller's early designs were envisioned for temporary shelter situations. Temporary shelter domes have been made out of a variety of materials, including plastic tarp, earth, and cardboard.

World Shelter – Shelter Frame Kit

Initially designed in 1983, the shelter frame kit is intended to turn plastic sheeting that is typically supplied by the UN, US AID and other agencies into a structure. The kit includes S-hooks, PVC pipe, cord, and connectors. The shelters have been used in Guam, Mozambique, Iraq, Kosovo, Sri Lanka, Indonesia, India, Venezuela, El Salvador, and the United States after Hurricane Katrina. The kits are lightweight and easy to erect by following the pictorial reference manual[xiii].

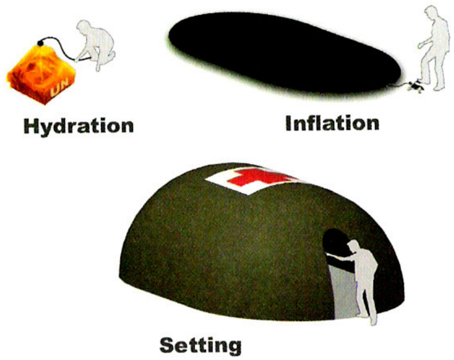
Icosa Village Pod by Sanford Ponder

Designed in 2002, the Icosa Village Pod is inventor Sanford Ponder's improvement to Buckminster Fuller's original paperboard dome concept. The pod is constructed by folding identical sheets of precision die-cut material together to form an icosahedron-shaped structure.

The design aim was a light, sturdy, wind-resistant, waterproof, well insulated structure, which required no special skills or tools to assemble. Pod structures originally came as flats of cardboard but later revisions changed the material to 3mm extruded plastic. The pods are easily built in a day, can be weather resistant for all four seasons, and are 100% recyclable. The roof and walls include translucent operable windows and the pods' walls are double-sided, allowing the hollow interior to be filled with insulation in cooler environments.

The 125-square foot Icopod sleeps two to four people, and pods designed to last 3-5 years cost $750, while models which last a summer are under $500. The pods are highly transportable, as plans can be sent to any industrial cardboard-cutter in a nearby major city where thousands of cardboard walls could be manufactured within hours. Pod design also brings a greater sense of dignity to its inhabitants: made to be homes, the pod walls dampen sound and the windows allow natural light. "My shelter has to be spiritually uplifting and emotionally supporting," says Ponder. "It can't be some depressing place that just keeps the rain off somebody's head. I believe in the power of architectural spaces to transform people."[xiv]

The Icopod was voted as invention of the year by Time Magazine in 2004. Easily transportable and needing no skills or specialist tools to erect, the Pod was an ideal form of shelter for the victims of the recent south Asian earthquake. In the aftermath, many survivors were left in need of shelter as the freezing winter set in. The pods have also been used after the 2006 earthquake in Pakistan.



Inflatable Concrete Canvas

Invented by Peter Brewin and William Crawford at the Royal College of Art in 2003, these shelters are a unique response to natural disaster housing although their design is not yet successful for most applications. The shelters come in a small, incredibly heavy bag, making transport difficult. The bag is first hydrated with water (which is often a scare commodity in an emergency situation), then inflated. After the shelter is full-size, doors are cut out and the concrete-impregnated canvas is allowed to harden overnight, when it is then complete. Because the shelter hardens into a concrete yurt-like structure, they may not be ideal for short-term shelter as reuse or discard of the shelter may be difficult.[xv]

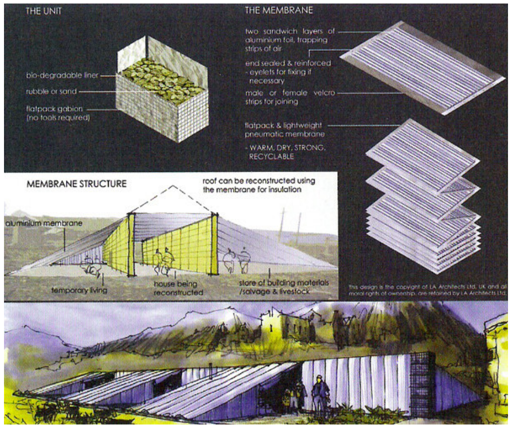
Precedent 3: Rubble-built or Indigenous material

Sandbag Shelter by Nader Khalili

Iranian architect Nader Khalili believes that the need for emergency shelter housing can be addressed through earth construction. After extensive research into vernacular earth building methods in Iran, in the early 1990s Khalili has developed the sandbag or 'superadobe' system. The basic construction technique involves filling sandbags with earth and laying them in courses in a circular plan. The circular courses are corbelled near the top to form a dome. Barbed wire is laid between courses to prevent the sandbags from shifting and for earthquake resistance.

These shelters serve as a prototype for temporary housing using inexpensive means to provide safe homes that can be built quickly and have the high insulation values necessary in arid climates. Their curved form was devised in response to seismic conditions, and employs vernacular forms, integrating load-bearing and tensile structures, and a remarkable degree of strength and durability.

Rather than external systems applied to a territory, Khalili's structures grow out of their context, recycling available resources for the provision of housing. The sustainability of this



approach is further strengthened because the construction of the sandbag shelters does not require external intervention but can be built by the occupants themselves with minimal training. The system is also highly flexible: the scale of structures and arrangement of clusters can be varied and applied to different ecosystems to produce settlements that are suitable for different numbers of individuals or groups with differing social needs. Due to their strength, the shelters can also be made into permanent housing, transforming the outcome of natural disasters into new opportunities[xvi].

<u>Rubble-Built structures</u>

Following a similar calling to Khalili, in 1999 the British firm LA Architects tackled how to rebuild housing with rubble. Many crises leave behind large quantities of rubble, usually from buildings destroyed by natural disaster. These rubble structures uses gabion baskets of galvanized steel mesh or woven aluminum strips and a aluminum membrane roof. The gabions are flat packed and a trial shelter took 10 people 6 hours to build. So far, only one prototype has been built[xvii].

<u>Woven Matt tent</u>

Built in 2004 for refugees in the Darfur province of the Sudan, the walls of these tents are made from grass matts. Designed by Scott Mulrooney and Isaac Boyd, these small tents (67ft^2) are both inexpensive, utilize local materials, and employed 3,000 primarily female residents in Darfur to weave matts for shelter. The tents were constructed of bamboo frames lashed together with cord made from recycled tires. Easy to construct, they have only moderate durability as some did not withstand a heavy rain storm. The primary success of these tents was that was in creating income for refugee women, along with the use of native, sustainable resources.

Precedent 4: Shipping Pallets

I-Beam Design has been experimenting with pallet design for temporary housing since the 1999 Architecture for Humanity competition where they won honorable mention. They have built a variety of structures, the most recent in Sri Lanka as an alternative to the tent for temporary housing. In cooler climates, the pallet shelters may be insulated with wattle-and-daub or other appropriate insulation. Pallet shelters are labour-intensive and come in a multitude of sizes and materials, however they also re-use a natural resource (wood) and can be very flexible in their form. When shipping pallets are donated, they can be an inexpensive form of temporary shelter[xviii].

Precedent 5: Prefab Buildings

<u>D&D-Fast Response Building</u>

Located in Istanbul, *D&D Flat-Pack Fast Response Buildings*[xix] create modular temporary shelters made of structurally insulated panels, or SIPS. Used in construction of the floor, walls and roof, the SIPs are manufactured using tensioned steel structurally-bonded to high-performance Styrofoam extruded-insulation produced by Dow Chemical. The units are designed to fit on standard shipping and air-dropping pallets and can be assembled or disassembled in 15 minutes. The units are durable, require little or no sitework, and are highly insulative.

Precedent 6: Shed Shelters

<u>International Red Cross/Red Crescent temporary housing</u>

One year after the devastating tsunami, efforts to get tens of thousands of tsunami survivors out of tents began to take shape in the Indonesian province of Aceh with the assembly of a custom-made temporary shelter from the International Federation of Red Cross/ Red Crescent Societies. The Federation and the United Nations brought 20,000 shelters by ship, and immediately began training local employees in how to assemble them. The sturdy units were specially designed by construction engineers for local conditions, ease of delivery and speed of assembly. Each unit can be easily anchored to withstand almost any conditions with little or no ground preparation, and should take a small team less than a day to assemble one structure.

The following table compares the various precedent shelters.

	Weight	Ship-ability	Carry & Set up?	Cost	Durability	Livability
UNHCR Canvas Tent	176-242 lb	Simple, large	Difficult, heavy	-	Moderate	Poor
UNHCR Nylon Tent	91 lb	Simple, small	Easy	$100	Good	Moderate
Cardboard tent	-	Difficult, large dimensions	Moderate	$400	Good - lasts 8-12 months	Moderate
Blow-up tent	149 lb	Simple	Easy	Expensive	Good	Good
Poly tarp dome (World Shelter)	66 lb	Simple	Easy	$350	Too durable?	Moderate
IcoPod	-	Moderate	Moderate, half a day to set up	$500	1-5 years	Good
"Building in a Bag"	507lb	Small, yet very heavy	Too heavy to carry, but simple to set up	$2,000	Too durable	Moderate - no windows
Rubble shelter	-	Local material, easy	Difficult, 1 day	n/a	Too durable	Moderate
Sandbag dome	n/a	local materials	Moderate, 1-2 days	$150	Long-term	Good
Woven mats	light	local materials	Easy	$90	Moderate-Poor	Good
Shipping Pallets	n/a	pallets found locally	Moderate labour	$200 (if donated)	Moderate	Poor
Prefab Buildings	Heavy	Moderate	15 min. set up	-	Durable	Good
Shed Shelter	-	Moderate	Half day	Expensive	Durable	Good

Desirable conditions for a natural disaster temporary emergency shelter

The previous precedent shelters each reflect various qualities that are important to consider in designing a temporary emergency shelter. Often a disaster will include a lack of road access, making air delivery particularly vital. Such would often be the case in a flood or earthquake disaster. While the large panel system of the *D&D Fast Response* building may not be easily deliverable by air, the *QuickFlate* comes in a 16ft^2 bag which can be dropped from a plane and other shelters utilize local materials, remitting the necessity of delivery all together. Ease and speed of construction is another important consideration. There are many other considerations that are significant in designing a temporary emergency shelter, and what might be an ideal shelter for one disaster might not work well at all for another. The following list includes a variety of criteria that might be important in designing an emergency shelter:

<u>Primary considerations:</u>

- Weight & size: ease and cost of transport to the disaster site
- Ability to mass produce in a short amount of time
- Cost of shelter
- Availability of materials
- Use of local (to disaster site) materials or recycled/reused materials
- Ease of construction for local humanitarian workers &refugees
- Minimal/no need for groundwork
- Speed of construction
- Flexibility/adaptability of use
- Livability: comfort of inhabitants
- Durability (varies according to individual needs, but generally six months is ideal before shelter becomes too permanent and other issues arise)
- Structural integrity / earthquake resistance
- Ability to withstand strong winds/heavy rain (especially in hurricane areas)
- Issues of insulation & heating (cold climate) and ventilation (warm climate)
- Ease of reuse/disposal of shelter
- ‘Dignity’ and beauty in design, privacy

In Al Gore's film *An Inconvenient Truth,* images of costal regions (this one showing Florida) project a global endemic in flooding due to glacier runoff, tropical storms, and other natural disasters. Due to such significant flooding circumstances, my design takes into consideration flooding by incorporating a boat into a temporary shelter condition.

PART 3

My Design : Floating Shelter

According to the most recent Intergovernmental Panel on Climate Change report (IPCC April 2007), world-wide increase in heavy precipitation will augment flood risk. There is a predicted increase in deaths due to increased natural disaster events, such as a tsunami, heat wave, flood, storms, and fire. The 1998 Chinese *Yangtze* River Floods left 14 million people homeless and the 2000 Mozambique flood covered much of the country for three weeks, resulting in thousands of deaths and leaving the country devastated. The Floating Shelter was seen as a response to the expected rise in floods worldwide.

Stored and transported in a small carrying case, the boats are modeled on the *Zodiac*[xx] inflatable boat company's specifications for pleasure craft. In the case of a flood, residents who seek higher ground on a roof or hilltop are provided with a shelter by emergency aid workers. Using an enclosed foot pump, the shelter can be fully inflated in ten minutes. Once inflated, the shelter can fit up to five adults in its cabin. Large buoyancy tubes provide the shelter with a low center of gravity, allowing stability of the craft.

Once inside the boat, a system of high-tension plastic tubes can be inserted as supports for a arch-shaped roof. The polyester cover is breathable, includes a mosquito screen and provides shelter from rain and sun. The Floating Shelter is a first response for flood victims, and would not be used for more than two weeks in total before alternative shelter on dry land is provided.

The Floating Shelter is seen as a solution to the first response needs of flood victims. By creating a comfortable, livable space on the floating craft, those who may have not survived a flood may be saved due to these highly transportable inflatable boats.

The previous list of considerations can act as a tool to determine the usefulness of the Floating Shelter Design.

<u>Weight & Size</u> – the shelter is determined to be considerably light – approximately 108 lbs due to comparison with similar Zodiac pleasure craft specifications. The units fold into an easy to carry 8ft2 bag and are easy to carry by 2 individuals.

<u>Ability to Mass Produce</u> – Shelters would need to be manufactured before a disaster for immediate use by victims. Shelters should be stockpiled in communities prone to flooding conditions.

Cost – Although it is difficult to determine a cost, the inflatable structure is determined to be average compared to other shelters.

Availability of Materials/ Use of Local Materials – Due to the essential floating nature of the craft, materials are synthetic and non-local.

Ease of construction – Inflation and deployment of shelter are simple and can be done by anyone within approximately ten minutes.

Adaptability of Use – Shelter is both a rescue source (boat) and shelter, making it highly adaptable.

Livability – Due to its boat-like conditions, the shelter is only moderately livable. It is only intended for short-term (2 week max) use.

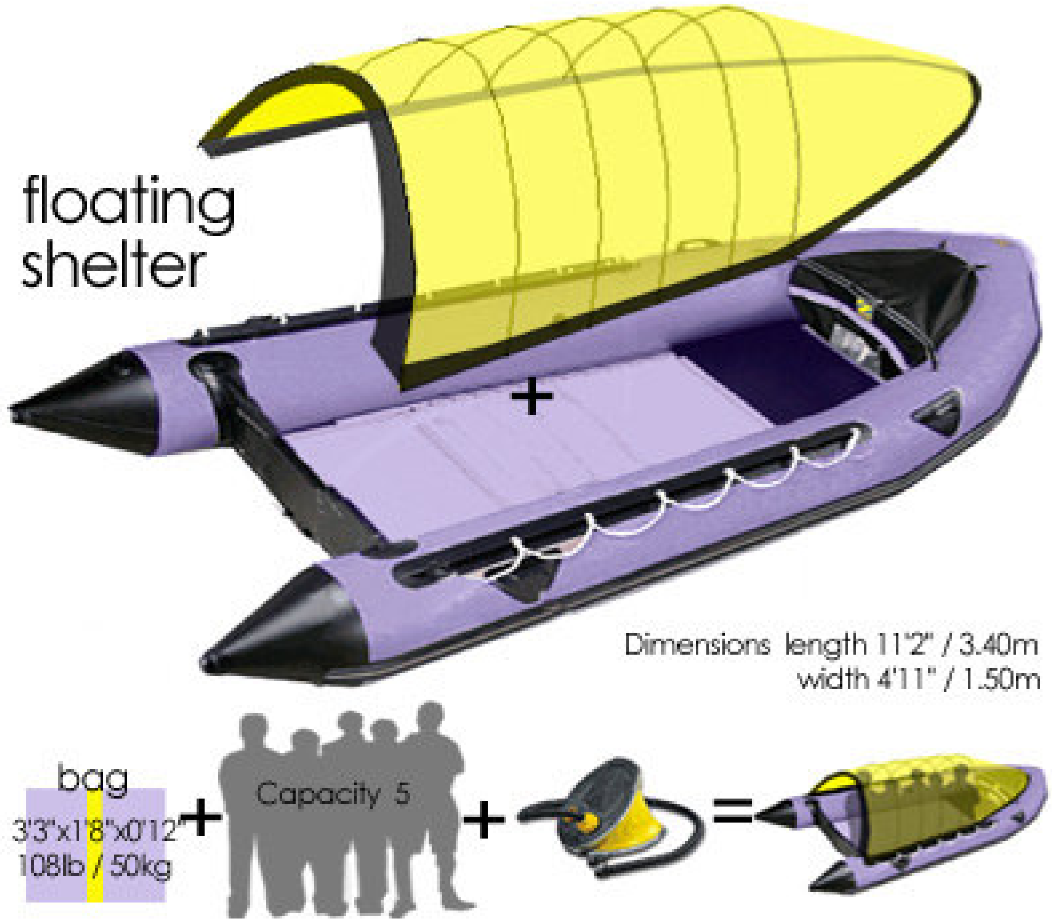
Durability – Shelter is made of durable synthetics and can be re-used in a variety of emergency flood situations.

Issues of Insulation/Heating and Ventilation – Ventilation is provided through a breathable nylon roof and attached mosquito netting.

Disposal of shelter – Once the usefulness of the floating shelter is complete (and it has survived several emergency situations) it must be discarded of and is not recyclable.

Dignity in design – A floating shelter provides safety for what might otherwise have been a life-threatening situation for flood victims. Its simple form is utilitarian, however the design s accented with creative color schemes.

The following page reveals the competition design for the Floating Shelter:


floating
shelter
Dimensions length 11'2" / 3.40m
width 4'11" / 1.50m
bag
3'3"x1'8"x0'12"
108lb / 50kg
Capacity 5

End Notes

[i] B. Wisner, P. Blaikie, T. Cannon, and I. Davis (2004). *At Risk - Natural hazards, people's vulnerability and disasters*. Wiltshire: Routledge

[ii] The estimated death toll for the floods of the *Hueng He* River in China are: 1887: 900,000-2,000,000, 1931: 1,000,000-4,000,000, 1938: 500,000-900,000.

[iii] Well-known historical droughts include: 1900 drought in India, killing between 250,000 and 3.25 million. 1921-22, Soviet Union, in which 250,000 to 5 million perished from starvation due to drought. The 1928-30 drought of northwest China, resulting in over 3 million deaths by famine. Finally, the 1936 and 1941 droughts in *Sichuan* Province, China, resulting in 5 million and 2.5 million deaths respectively.

[iv] Global warming and natural disasters: http://gristmill.grist.org/story/2005/1/6/162641/5470

[v] IPCC 4th Assessment Report: Summary for Policymakers http://www.ipcc.ch/

[vi] IPCC 4th Assessment Report: Summary for Policymakers http://www.ipcc.ch/

[vii] IPCC 4th Assessment Report: Summary for Policymakers http://www.ipcc.ch/

[viii] IPCC 4th Assessment Report: Summary for Policymakers http://www.ipcc.ch/

[ix] In Architecture for Humanity, ed. *Design Like You Give a Damn*. 2006. p 62.

[x] In Architecture for Humanity, ed. *Design Like You Give a Damn*. 2006. p 63.

[xi] In Architecture for Humanity, ed. *Design Like You Give a Damn*. 2006. p 74.

[xii] http://www.acsi-us.com/products/portable/deconshelters/qf1015decon_shelter.aspx

[xiii] In Architecture for Humanity, ed. *Design Like You Give a Damn*. 2006. p 64-67.

[xiv] Quote from http://realchangenews.org/2003/2003_02_20/features/dreamer.html

[xv] In Architecture for Humanity, ed. *Design Like You Give a Damn*. 2006. p 86.

[xvi] In Architecture for Humanity, ed. *Design Like You Give a Damn*. 2006. p 117.

[xvii] In Architecture for Humanity, ed. *Design Like You Give a Damn*. 2006. p 72-3.

[xviii] In Architecture for Humanity, ed. *Design Like You Give a Damn*. 2006. p 115-6.

[xix] http://www.army-technology.com/contractors/field/dnd-frb/dnd-frb5.html

[xix] www.zodiacmarineusa.com