

# What is TIDES?



TIDES is a research project designed to encourage the development of communities of interest in Stabilization and Reconstruction, Humanitarian Assistance, Disaster Relief, and Building the Capacity of Partner Nations.

Situations include: domestic and foreign, short term (disaster relief) and long term (displaced persons), military involvement, or not.

Each has different needs.

DoD usually is not in the lead for these efforts, but often is called upon to support others, like DHS/FEMA domestically, and the State Department overseas.

TIDES is not trying to solve all problems in these situations, but is focusing primarily on six infrastructures: shelter, water, power, cooking, cooling/lighting/heating, and Information & Communications Technologies (ICT).

The goal is to build as broad a partnership as possible to deal with the target situations most effectively.



Participation in TIDES does NOT imply endorsement by the US govt.

One goal is to help people live above mere subsistence levels in whatever circumstances they find themselves.

Cultural issues are important--shelters that might raise the standard of living in some foreign refugee camps could be unacceptable for long-term inhabitation by US disaster survivors.

The focus is on low-cost, Transportable Infrastructures, not the capital-intensive infrastructures of the developed world, nor the deployable, integrated (and expensive) ones used by the military.

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# Shelters



The Uni-Fold shelters (#4 on the map) took under 10 minutes to deploy. They have integral plastic floors (waterproof in later models). They cost ~\$2000-2500, in units of 100. They have been used for things like showers and decontamination stations.



The ShelterBox (#2 on the map) from a Rotary Club in Cornwall, England supports up to 10 people with sleeping, cooking, water purification tablets (6 mo), educational materials, etc. Over 50K have been shipped since 2001, supporting over half a million people. A box costs \$1000, shipped. They are sent only through Rotary channels.



The YurtDome (#3 on the map) packs into a large duffle bag and takes a small team an hour to deploy. It costs around \$500 and a range of sizes, up to around 30' across are available. It can last around two years in direct sunlight.



The hexayurt (#1 and #5 on the map) can be quickly made in the field from common sheet goods using tape and boxcutters due to its geometry. It uses 12 or 18 4'x8' panels (6 whole, 6 cut in half.) The 8-foot high version costs about \$200 (\$350 for the 12') and took about 2.5 hours to assemble by first-time amateurs. It is lightweight, and well insulated (R6.5.) In a catastrophe, 100,000 hexayurts per day could be built using materials already in the US building industry supply chain, creating new shelters for 500,000 people a day. The free design lets responders and refugees can build shelters. Low cost flat-pack cardboard versions for the developing will cost around \$100 each. A folding Hexayurt in very durable materials will be commercially available soon.

# Infrastructure



Solar Cookers provide smoke- and fuel-free cooking in a variety of climates. Simple cookers can be made by hand in villages and parabolic designs can reach 400°F. Insulated boxes keep food cooking when it is taken out. Drinking water can be purified in solar cookers at only 170°F, and the WAPI indicator shows when the water reaches this temperature.



Efficient stoves coupled with solar cookers provide "integrated cooking." Wood gasification stoves burn with almost no emissions and use wood 2x - 3x more efficiently than most other stove designs. Rocket stoves can be built anywhere out of almost any materials, including scrap tin cans and mud firebricks. Smoke inhalation from cooking fires is a major public health issue all over the world.



AA battery "microsolar" can provide basic services like lighting, charging cell phones, cooling equipment (if it is efficiently designed, see the SleepBreeze system on display,) and power wood gasification stoves. Batteries are charged at a central station and taken home for use. High efficiency CCFL lights can provide bright, even illumination which makes use of the eye's dark adaptation response.



The GATR inflatable satellite dish is very portable and fits in a duffle bag. It also was up and running shortly after the power came on.

The MTN satellite dish was up and running in less than two hours after the generators were turned on.

PACSTAR bridging equipment links various communications equipment together, such as radios to telephones. This supports a telephone in every shelter.

The Satcom Humvee is optimized for self-contained disaster relief situations.

# Transportable Infrastructure



## The Starting Point

Imagine you are a refugee, one of 100,000 people settled in an open area, with a river five miles away and enough firewood for a few weeks, diminishing fast. Food comes in twice a week by truck, and you queue for hours for your share of the incoming shipment. A handful of aid workers try to provide basic medical and other services, but they are so few, and new refugees come in every day, many in worse condition than you are.

You have no idea if you will be here for six months or ten years. Your uncle was a refugee for half of his life. He might be somewhere in this camp too.

Everything you own is gone, and you have no employment or hope of employment. But at least you survived.

## What Can Infrastructure Do?

The river is dirty. You're 40 miles downstream of a town, and sanitation is poor. Hauling water is a huge task, and when it arrives, it often makes people sick.

Those are infrastructure problems - water transportation might need a truck, or a water line. Water purification might need a solar pasteurizer, or perhaps a high tech unit that serves the whole camp.

Then there's the firewood situation. The three stone fire you cooked on before the stove came required a firewood gathering expedition three times a week. Now you go once every ten days.

The situation is still terrible, but it's less terrible because you have better tools to survive.

	<b>Developed World Civilian Infrastructure</b>	<b>Military Infrastructure</b>	<b>Transportable Infrastructure</b>
<b>How is the service supplied? - power, water etc.</b>	Systems - power stations - water plants	Objects - gensets - RO units	Objects - hand crank / solar - solar water purifiers
<b>How are services distributed and resupplied?</b>	Pipes and Wires - national grid - water pipes	Trucks and Planes - fuel supply chain - bottled water	Limited Supply Chain - some trucking - favor stand alone systems
<b>Who owns the infrastructure?</b>	Companies and Individuals	Governments	Often Individuals - goes home with them
<b>Cost</b>	Cheap - huge capital investment provides very cheap services	Expensive - reliable, global, secure, resilient	Intermediate - solar \$ > grid \$ - but there is no grid - make do with less
<b>Readiness</b>	Proven	Proven	In Development

## Conceptual Development

In 2002, 84 people from a wide variety of backgrounds, including representatives from UNHCR, UN Development Programme, the World Health Organization, the World Food Programme, Refugees International, US AID, the US Navy and others, met at the Sustainable Settlements Charrette, a design workshop hosted by the Rocky Mountain Institute, an environmental think-and-do tank with a specialization in infrastructure. The goal was to understand and improve how refugee situations are handled.

The conclusions of this Charrette became the input to the Hexayurt Project, a volunteer-run free/open source design projects which applied RMI decentralized infrastructure concepts to the needs of refugees, slum and rural populations in the developing world.

The Strong Angel demonstrations, directed by Dr. Eric Rasmussen, laid the foundation for the approach of a broad, diverse, collaborative group including all relevant and affected parties, working together to find new avenues for cooperation and improved practices.

All of these efforts focussed attention on refugee infrastructure as an area where there is room for significant improvements in current systems.

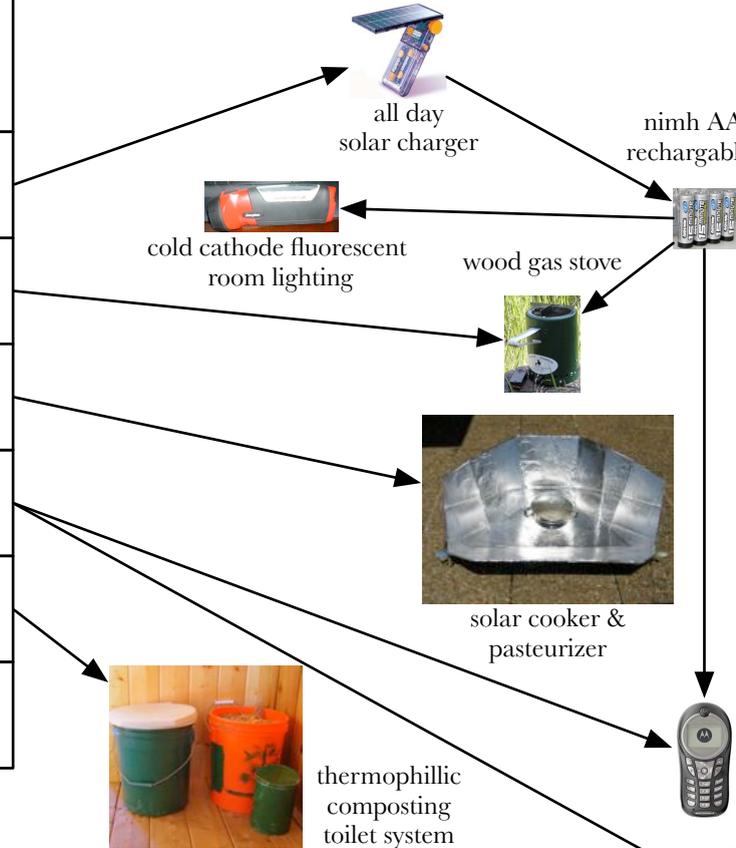
TIDES brings together promising candidate technologies that are inexpensive, lightweight, and simple. Perhaps refugees can take home with these infrastructures with them when the crisis is over, blurring the line between disaster relief and aid.



# Hexayurt Infrastructure

Pipe/Wire	Developed World Civilian Infrastructure	Hexayurt Utilities Package
Electricity	National grid	Solar with rechargeable AA battery storage
Gas	Natural gas system (pipelines, terminals)	Wood Gas Stove Wood and other biomass fuels
Water	Water treatment plants, viaducts	Solar Water Pasturizers
Comms	Wired phone network, cell towers	\$100 computers? Cell phones?
Sewage	Sewer system, sewage treatment plants	Composting toilet
Storm-water	Storm drains	Drainage ditches

## Household Infrastructure Systems



## Village Infrastructure Systems

At 15 minutes per set of batteries, a single solar panel can charge around 40 sets of batteries per day. That might be enough to keep the lights on in 40 to 80 homes. Pull-cord chargers might offer even better performance.

Cooking can be done with either the solar cooker or the wood gasification stove. Solar Cookers International calls an approach like this Integrated Cooking and has very good materials on it. The Hexayurt Utilities Package uses the wood gas stove rather than the Rocket Stove because the highly efficient fan drive stove has nearly zero emissions and therefore may be used indoors as a heater.

Communication and internet systems rest on municipal and regional infrastructure including satellite. The Hexayurt Project "Citadels" concept applies whole systems thinking to municipal infrastructure, while "State In A Box" presents a nation state level design for robust and resilient services. See the CheapID Identity Services Architecture at this demonstration for more details.

### The Hexayurt Utilities Package

The Hexayurt Utilities Package is one kind of transportable infrastructure.

The HUP provides a very simple approach to providing the same essential services as developed world infrastructure systems, but for a total cost of \$100 - \$200 per home. The infrastructure is self-contained and portable, so it can be transported with people when they are resettled at the end of a crisis. These infrastructures are mostly at early stages of development, or adapted commercial products. Testing and development will be required before this system is fully ready for deployment. These systems are very simple and therefore inexpensive to bring to full readiness.

### Property & Ownership

Household systems are usually owned outright by families and individuals. Village infrastructure systems may be owned by a village council or small business. Fitting infrastructure to pre-existing social units helps with security and deployability. Items like a personal battery charger might be purchased by more affluent families to provide the same functions that others get from the village systems. Over a period of time these incremental improvements could lead to a higher standard of living even within a refugee camp.

# TIDES

Transportable Infrastructures for  
Development and Emergency Support

Pentagon Center Court Demonstration

KEY:

- 1 – Hexayurt 1
- 2 – Shelter Box
- 3 – Yurt Dome
- 4 – Unifold
- 5 – Hexayurt 2

ICT – Information &  
Communications  
Technology

PLC – Power, Lighting  
& Cooling

Satcom – Satellite  
Communications  
Provider

