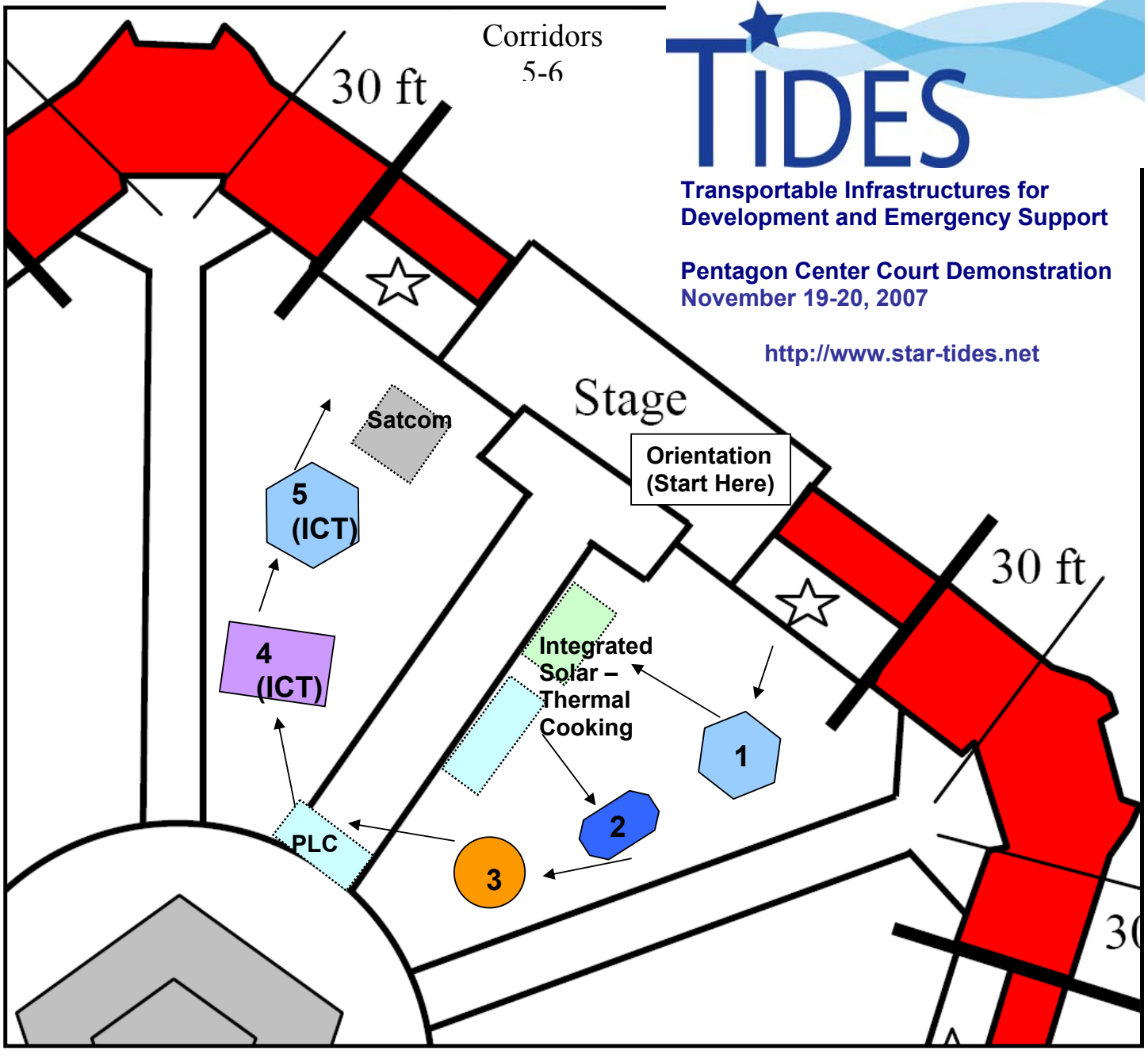
KEY:

1 – Hexayurt 1
2 – Shelter Box
3 – Yurt Dome
4 – Unifold
(collaboration tools)
5 – Hexayurt 2
(network operations)

ICT – Information & Communications Technology

PLC – Power, Lighting & Cooling

Satcom – Satellite Communications Provider



TIDES

Transportable Infrastructures for Development and Emergency Support

Pentagon Center Court Demonstration
November 19-20, 2007

http://www.star-tides.net

What is TIDES?

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 seven infrastructures: shelter, water, sanitation, 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 inhabitance 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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Transportable Infrastructures (1)

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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 retail ($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, some 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 refuges build shelters. Low cost flat-pack cardboard versions for the developing world will cost around $100 each. A folding Hexayurt in very durable materials will be available soon.

The ShelterBox (#2 on the map) developed through a Rotary Club in Cornwall, England supports up to 10 people with sleeping, cooking, water purification tablets (6 mo), educational materials, etc. Over 50,000 have been shipped since 2001, supporting over half a million people. A box costs $1000, shipped. They are distributed 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.

UniFold concertina folded plastic panel structures (#4 on the map) come in prefab versions that are easily assembled onsite. This model took less than 10 minutes to deploy. They cost ~$2000-$2500 in quantity, and have been used for storage, showers and decontamination stations.

Many other types of low-cost shelters are available.

Transportable Infrastructures (2)


CooKit Panel Solar Cooker

Solar Cookers provide smoke- and fuel- free cooking in a variety of climates. Simple cookers can be made by hand in villages and more robust manufactured versions also are available. Insulated boxes keep food cooking when direct heat isn't available. Water can be purified for drinking at only 65 degrees C (149°F), and simple indicators are available to show when the water reaches this temperature.


Wood Gasification Stove

Efficient stoves coupled with solar cookers provide "integrated cooking" when sunlight isn't available. Wood gasification stoves use wood much more efficiently and reduce emissions compared with other stoves. Other kinds of efficient stoves (such as "Rocket Stoves") can be built anywhere out of almost any materials. Integrated approaches to cooking, water purification and heating can reduce fuel use, deforestation, and smoke-related illnesses.


Microsolar Power

"Microsolar" power approaches 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. AA batteries are charged at a central station and taken home for use. High efficiency lights can provide bright, even illumination which makes use of the eye's dark adaptation response.

Information and Communications Technologies (ICT) and Information Sharing are at the heart of TIDES. Communications in stressed environments must deploy quickly and be independent of the power grid. Earlier TIDES ICT demonstrations were completely "off the grid," using portable generators and sometimes solar power.

Soon after generator start-up, transportable commercial systems provided satellite connectivity, global and inter-shelter phone service, ties among different radio types, world-wide teleconferencing, reach-back support, operational displays and collaboration services. Self-contained emergency operations vehicles and solar-powered satellite and WiFi backpacks were available. Low cost ID and credentialing services were prototyped.

Transportable Infrastructures (3)

TIDES

Other Infrastructures

In addition to the infrastructures noted earlier, other areas such as sanitation, medical support, and security/protection need to be addressed. TIDES examined several types of composting toilets, but none was fully suited for the demonstration. Some were too expensive, others not yet ready. Sanitation needs significantly more research in the TIDES context. Medical support will be added to future phases of TIDES.

Differing Categories of Stressed Populations

The needs of different stressed populations vary greatly, as do the responsibilities for dealing with them.

- Domestically, in Humanitarian Assistance/Disaster Relief (HADR) environments, DoD is likely to support DHS and FEMA. Capital-intensive infrastructures like power, water and sewerage may have been disrupted, but probably exist and can eventually be repaired. Emergency shelter may be needed quickly, but soon will have to be replaced by mid-to-long term lodging. Clean water may become a critical need. Communications independent of the power grid will be essential for coordination. Identification and credentialing will be important.
- Internationally, disaster victims still require emergency shelter, but key service infrastructures may not exist or may take much longer to be restored. Villages may be isolated, and supply lines fragile. DoD is likely to support State/USAID/Office of Foreign Disaster Assistance (OFDA). Support will be guided by complex calculations involving indigenously available materials, cultural issues, transportation, etc.
- Very long term stays in austere camps may be the rule for displaced persons (average stays in camps exceed seven years). People in these situations may face shortages in all infrastructures, as well as serious deforestation.
- A key element in stabilization and reconstruction operations is to provide services in SWEAT (Sewer, Water, Electricity and Trash). The solutions for small, remote villages may be very different from those of mid-sized cities like Fallujah (over 300,000 people).
- Any of the above situations may be encountered while working to build the capacity of partner nations to reduce the likelihood of conflict.

Whatever the circumstances, it is essential that DoD be able to share UNCLASSIFIED information with civil-military partners outside the boundaries of the Department. The social, political and economic goals for which the military was committed can't be achieved without such sharing.

	Developed World Civilian Infrastructure	**Military Infrastructure**	**Transportable Infrastructure**
How is the service supplied? **- power, water etc.**	Systems - power stations - water plants	Objects Systems - generators - reverse osmosis units	Objects - hand crank / solar - solar water purifiers
How are services distributed and resupplied?	Pipes and Wires - national grid - water pipes	- fuel supply chain - bottled water	Limited Supply Chain - some trucking - favor stand alone systems
Who owns the infrastructure?	Companies and Individuals	Governments	Often Individuals - goes home with them
Cost	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
Readiness	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 many other groups interested in development and refugee issues 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 identify areas where current practices in disaster relief and refugee situations could be improved through innovation.

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 (http://strongangel3.net), 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.

The needs of US disaster victims may vary greatly from those of people in stabilization operation operations abroad, or long term residents of refugee camps. No one solution fits all, and no one has all the answers. TIDES emphasizes information sharing to link potential users with promising candidate approaches that are inexpensive, lightweight, and simple.

Hexayurt Infrastructure

TIDES

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

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.

Household Infrastructure Systems


all day solar charger

nimh AA rechargables


cold cathode fluorescent room lighting

wood gas stove


solar cooker & pasteurizer


thermophillic composting toilet system

Property & Ownership
Household systems are usually owned outright by families and individuals,. Village infrastructure systems may 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.

Village Infrastructure Systems

15 minute fast charger


large solar panel

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.


inexpensive cell phone

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.


low cost, low power computer