

A SYSTEMS APPROACH FOR CREATING HIGH-PERFORMANCE, RESILIENT CITIES

Robert Daniels
Executive Director
In-Harmony Foundation
750 NE 61st Street # 201
Miami, FL 33137
+1-305-751-7200; rdaniels@bellsouth.net

<http://in-harmony.net/download-area/>

Key Words

Resilient, Futuristic City, System Design, Self-Sustaining City, High-Performance,

Summary

It is of Strategic Level importance that the existing vulnerabilities and disruptive causal agents of the National Infrastructure Protection Plan be examined and replaced to increase Full Spectrum Resilience. America's Cities, the central core of National Infrastructure, were never designed to withstand the current and increasing threats to our civilization. Existing buildings, city and regional structures; transportation and energy infrastructure; water and food production; are grossly vulnerable. Remediation to correct these vulnerabilities is impossible (pigs can't be made to fly). Therefore, we are "Re-Inventing Civilization" using Systems Design Analysis, under a unique paradigm that eliminates the vulnerabilities and thus solves certain civilization collapse as extreme Climate Change increases.

Greatest Threat to the United States – Natural Disasters

- The greatest and most constant threat to infrastructure disruption is natural disasters
- As the Arctic ice melts from Global Warming caused by released CO₂, a closed-loop reaction occurs that accentuates Climate Change extremes felt all over the U.S. causing extreme hardship on people and the economy. (1) (2)
- This threat is now recognized by many leaders of both U.S. parties and the military (3)
- Business already suffers from disrupted energy and transportation that cost \$Billions annually (4)
- Hundreds of lives are lost from temperature exposure and drowning from floods
- Insurance companies are increasing rates to cover skyrocketing liabilities (5)
- Sea Level Rise is encroaching upon our shores & destabilizing the built environment(6)

- Food Supplies are tenuous as agriculture relies upon stable growing condition of heat, moisture and low wind activities to produce high yields. (7) (7a)
- Over 1/3 of the US is in drought conditions that are increasing toward full desertification (8)
- Temperature extremes create high energy demands for heating and cooling (HVAC) (9)
- We already have major disaster increases with only 0.6 deg. C rise and a CO2 level of 392ppm CO2! We need to prepare for a minimum of 500ppm CO2 and 4 deg. C rise in temperature. Imagine natural disasters increasing TEN-FOLD (a winter of solid blizzards and summer of draught with 100+ deg F temps)! (10)

Weaknesses of Current Infrastructure

- Existing cities are easily penetrated from outside. They have indefensible boundaries to defend against mayhem, chaos, invasion, terrorism and pandemic diseases (11)
- Many of America's largest cities are vulnerable to Sea Level Rise (12)
- Sprawl does not lend itself to energy efficiency or maintainability of physical infrastructure
- The American Society of Civil Engineering rates most infrastructure maintenance at D+ level.(13)
- 90% of building envelopes are not adequately insulated against transfer of heat and cold (14)
- 95% of buildings are not structurally adequate to protect against wind and seismic anomalies. (15)
- Many areas are susceptible to flooding during increasing frequency of extreme rain events (16)
- Exposed power & communication lines are susceptible to damage from Nature and terrorists (17)
- Water sources may be drought-affected or waste-contaminated - too much dependency on surface or ground water (18)
- Ancient techniques can be used to collect and save water (19)
- Inefficient waste collection and recycling – We generate extreme amounts of solid & liquid waste polluting the environment.(20)
- Dependency on long distance supply of food, energy and other necessities.(21)
- Industrial Food Production needs large amounts of water that may disappear in draught, resulting in lower yields and less food availability for a growing population (22)
- Transportation may be delayed and/ or suffer maintenance damage caused by Climate Change anomalies.

To Repair or Replace – Can existing cities adapt to Climate Change extremes?

- The mandate of the NIPP is to upgrade infrastructure to higher asset protection.

- Many elements covered within the Sector Specific Areas (Energy, Transportation, City’s Built Environment and Agriculture) are actual Causal Agents of Natural Disasters. It will be necessary to alter these sectors that currently generate problems so they solve problems instead
- In order to proactively prevent threats, it is critical to adapt the infrastructure system to the strongest level, a comprehensive systems approach that incorporates an “all-around defensive posture”, in combination with an “all-hazards” approach, as discussed by (23).
- As Nature strengthens its attacks upon us with increasing natural disasters caused by rising CO2 levels; will we waste our efforts strengthening the same poorly designed built environment or seek new methods of adaptation that are stronger, less vulnerable and more resilient?
- Natural Disaster will increase in frequency and intensity. The existing built environment was not created to withstand extreme temperature swings, high winds and record setting floods. “Our nation needs to construct safer communities and reduce overall fragility with much stronger building codes.” (24)
- How can we possibly upgrade our complicated infrastructure to higher tactical levels when they cannot even be maintained correctly now? We need to simplify our civilization
- To achieve Full Spectrum Resilience, we must create a new paradigm of urban design and infrastructure resilience based on System Engineering; where a dozen different elements of Sector Specific areas are interwoven to achieve resistance/ resilience and continued operation no matter how much perturbation is received. This includes “built-in redundancy to minimize or eliminate downtime by having an integrated safeguard implementation”. (25)

ARC City – A Look into the Future of a secure, high-performance, resilient city

A. Overview

- The first major change in urban living patterns in 6,000 years
- The first truly self-sustainable, high-performance city (rated for 7 deg increase in Global Warming)
- Ecologically viable within its own Sustainable Footprint
- The first zero-carbon, non-polluting city that mitigates Climate Change causes.
- Structurally resistant to high winds, floods, draughts, earthquakes, and hail
- Resistant to terrorism attacks: both cyber and physical
- Resistant to pandemic disease infiltration, both natural and terrorist induced
- Self-generation of oxygen, through electrolysis of water, caused by depletion of atmospheric oxygen
- It is structurally able to resist floods, 500 mph winds and 10.0 earthquakes
- Elimination of cars, trucks and roads. Only bicycle paths and farm access roads will occur.

B. Building

- Live, Work and Play at one location with Mega-structure design
- Inclement weather (wind, cold & rain) is no longer a factor in a self-contained city
- Spacious, modern lifestyle with all amenities available within 10 minute walk
- Residential space averages from 100 sq. ft. to 600 sq. ft. per person depending on economic variables
- Common Areas have hotels, shopping, restaurants, night clubs and entertainment
- Building insulation and structural shape eliminate heat transfer and external temperature variations that effect HVAC usage inside.
- It is structurally able to resist floods, 500 mph winds and 10.0 earthquakes
- Air Purification System to disinfect germs and remove dust and pollen that cause allergies
- Oxygen supplementation from CO2 scrubbers and electro-hydrolysis when needed
- Beautiful, Energy Efficient Lighting throughout
- Elimination of heat islands and wind obstructions by reduced footprint and aerodynamic shape
- Infra-structure supply line requirements (plumbing, electrical, communication) are minimized due to concentrated nature of central high density building, instead of sprawling suburbia.
- Long-lasting, compact infrastructure (± 500 years) that looks amazing, functions flawlessly and is easy to maintain

C. Transportation

- Intra-City Vertical Transportation by high-speed elevators
- Intra-City Horizontal Transportation by foot
- Intra-site underground trams to move food into City-structure and people out to food production areas
- Point-to-Point Inter-City Transportation with Elevated Mass transit of people by Commuter Trains and subway freight to all other major destinations
- Eliminating 2,319,000 miles (2004) of paved roads and many of the 500,000 bridges in U.S. will greatly reduce a huge maintenance burden.

D. Energy

- Collection of Renewable Energy from Solar, Wind & Geothermal when possible
- Installation of New Non-Carbon emitting Energy source (Liquid Fluoride Thorium Reactor) that generates ample electricity for 365 day usage in each city w/ direct 3 mile cabling to City Center.
- Energy Storage of heat & electrical for independent use 24x7
- Creation of Geothermal Heat Storage, Industrial processing heat, freshwater desalinization, co-generation of waste heat, heat & light for winter greenhouse production
- Energy Efficient built environment using 15% of a typical modern city due to improved building envelop and reduced infrastructure demands of non-sprawl high density central city.
- Generation of hydrogen for mobile energy uses
- Electrical empowerment of elevated and subway trains

- Small mobile nuclear units to power ships, trains and air ships.
- Elimination of Smart Grid – Energy loss in transmission has increased since Smart Grid started
- Local generation of energy – develop Supra- Grid for emergency for energy sharing

E. Food Production & Consumption

- On-site Food Production reducing transportation energy by 98%
- Environmentally controlled Greenhouses for 365 day food production
- Permanent bed, organically grown food in greenhouses, field & orchard crops
- Soils rejuvenated and invigorated to better within Climate Change variations
- Fish and Algae food production in adjacent lakes
- Harvested Food transferred to City in re-useable containers
- Community Food Processing
- Community Food Storage for minimum of 4 months sustainability
- Community Kitchens & Restaurants of great variety and cuisine
- Nutritious, Organically grown Food served in healthy meals

F. Water Supplies, Storage and Usage

- Rainwater collection from greenhouse roof with common gutter drainage
- Six month supply utilizing underground water storage cistern at the base of the city structure
- Water maintained at mean annual ground temperature through geo-thermal dynamics
- Water used in conjunction with building cooling requirements
- Water filtered and monitored for any microbial presence
- Daily water usage above compensated by pumping to elevated storage containers
- Water routed for secondary and tertiary use in multi-piped drainage system
- Reduced overall water consumption due to secondary and tertiary recycling

G. Waste Recycling

- Multi-use waste segregation and collection system
- Close-loop nutrient recycling back into fields
- Natural waste processing by Dr. John Todd “living machines” (bio-remediation)
- Elimination of solid waste generation (Reliance upon throw-away packaging)
- Each City becomes a “re-cycling mechanism” to replace scarce, depleted resources used within and from collecting waste materials from outside from the existing cities.

H. Healthy Living

- Exercise, Sports and Recreational facilities, both inside the City and outside on the grounds.
- Schools available for K thru 12 plus college and research
- Child Care with emphasis on science, social interaction and nature studies
- On-site Health Clinic and Medical Care only 5 minutes away from any part of the City

- On-site schools K-14 with specialized higher learning at specific cities
- On-site child care for working parents
- Churches for all faiths will all have equal access to space
- City Administration to organize city operations and maintenance

I. Communications

- Intra-city verbal com through Wi-Fi with transceiver points on each floor
- Intra-city Internet com ports through Wi-Fi
- Infra-structure computer control through closed-circuit secure lines
- Inter-city Internet and verbal communication to exist on “cloud firewall”.
- All interior city operations and communications to filtered for hacking and cyber-terrorism
- All intra-city traffic, both interior and exterior, to be monitored by central city video control centers

J. Safety & Security

- Safety and Security guaranteed for all inhabitants inside and out
- Surveillance and law enforcement throughout city and compound operated by City
- Security checkpoint scans of persons at entrances for weapons, unwanted visitors and germs
- Triple ring of canals for flood protection
- Site Perimeter Boundary Wall and exterior “buffer zone” for protection against intrusion

J. Economics/Industry

- Stable factory environment with a steady, healthy, easily accessible work force
- Large factory areas with access to receiving and shipping warehouse that are part of the subway freight train system connecting to other hub cities for completion of more advanced assemblies.
- Factories organized into Material Flow Systems for sub-assembly to assembly
- Economics tied to new system for slow, steady growth
- Energy Efficient factory equipment to utilize minimum energy consumption
- Demolition and recycling of collapsing cities
- Fabrication facilities- machine shop, woodworking, clothing mills, electronics assembly, health and medical supplies
- Specialized industries, foods and trade with other cities

Special Applications

- Military bases must have the highest resistance to natural threats (lowest vulnerabilities). Bases that are damaged, destroyed or rendered inoperative by natural threats cannot support fast reaction deployment outside in emergencies.(26)

- Case in point – Norfolk Naval Base is now regularly flooded during storms with off-base sailors unable to report for duty in extreme weather events.(27)
- The U.S. wants to create one or more Arctic Deep-sea ports. Arctic cities are currently built the same way as a tropical city, even though environmental conditions are entirely different.(28)

Risk Management (discussed in National Infrastructure Protection Plan & Sector Specifics)

- Re-Assess Risks by the greatest disruptor to our infrastructure Natural Disasters
- Re-Assess dollar value of these loses compared all other threats, placing priorities to prepare against this greatest threat.
- Re-Assess projections of increasing Natural Disasters as CO2 & methane (CH4) release increases
- Re-assess the vulnerabilities of our present system and create a long-term plan to mitigate vulnerabilities to disruption within and also supply line of basic necessities.
- Re-Assess Consequences of Causal Agents that generate CO2 and methane (CH4) creating environmental deterioration. Then create a plan to mitigate these sources by phasing out and replacing them with non-GHG generation activities (energy, city structure and transportation)
- Using System Design, create a new system (Re-Inventing Civilization) that creates a superior Critical Infrastructure Protection Plan with greatly reduced risk!
- Establish priorities to Rebuild America with a new System that has reduced vulnerabilities
- Implement Program with funding to rapidly rebuild before Abrupt Climate Change occurs – Rebuilding America with a 21st Century high-performance system.(29)

Conclusion

The Earth is rapidly changing due to the exponential growth of the human population, energy usage and consumption. At the start of the Anthropogenic Extinction in 1750 (Industrial Age), we had a population of 1 billion people, zero energy units used and a baseline consumption level of one. In only 260 years, human population has grown to over 7 billion; energy mechanization has increased a thousand fold with resultant per capita consumption and pollution equivalent to over TRILLION. This would infer that the human presence on the Earth has increased exponentially 7,000 times. The Ecological Footprint of humanity is now exceeding the Earth's capacity to replenish and sustain our lifestyle.(30) We are literally draining the Earth of all surface life, hence the first Great Extinction caused by a species rather than an extra-terrestrial impact (comet or meteorite). The effects of Climate Change, that we are now starting to observe, are a result of the environmental imbalances caused by the rapid growth of humanity and its subsequent consumption patterns.

We are at an unprecedented cross-road in human history. We have instigated a cascade of environmental degradation that will cause the collapse of all nations, either directly or by attack

from neighbors. Already, there are over ten nations that are in the process of social/economic implosion. They are poor, with large populations, who have little rainfall and food production capabilities. As Climate Change increases, causing more desertification, one nation after another will fail. Dr. Jared Diamond, in his book “Collapse: How Societies Choose to Fail or Succeed” (31) historically documents how countries and regions have repeatedly collapsed when they expanded in plentiful times, only to ignore troubling environmental signs and hence collapse. Never before has humanity created such a worldwide civilization that will experience either partial or complete loss of productivity.

We must STRATEGICALLY change our lifestyle patterns to survive! (32) TACTICALLY repairing and upgrading our traditional built-environment worldwide will not slow the increasing frequency of natural disasters that are gradually defeating our National Infrastructure. It is only through adaptation that we will be able to survive. The ARC City/ In-Harmony System uses Systems Design to find a common denominator of solutions to mitigate human environmental disruption; methods to insure human survival through self-sustaining resilient cities; and ways to improve economic efficiency through high-performance interaction. We must learn new ways to exist sustainably and survive the increasing upheaval currently facing us. To this end, I present the ARC City/ In-Harmony System as a viable solution to Full Spectrum Resilience of the National Infrastructure Protection Plan.

-
- (1) CIER (Center for Integrative Environmental Research), *The US Economic Impacts of Climate Change and the Costs of Inaction*, Oct. 2007 Univ. Maryland, p. 40-42
 - (2) Robert Mendelsohn & James E. Neumann, *The Impact of Climate Change on the United States Economy*, 1999, Cambridge Univ. Press, p. 328-330
 - (3) Joe Romm, “Senior Military leaders announce support for climate bill”, *Climate Progress*, April 29, 2010
 - (4) CIER, Op.Cit, p. 8-10
 - (5) Teresa Dixon Murray, “Flurry of storms driving homeowner's insurance premiums up, increases likely to continue”, *The Plain Dealer*, Sept 5, 2011
 - (6) DM FitzGerald (et. al), “Coastal Impacts Due to Sea Level Rise”, 2007, Darchive, pp 3-5
 - (7) Richard Adams, et.al., “Economic Effects of Climate Change on U.S. agriculture”, 1999, Cambridge Univ. Press, pp.47& 48
 - (7a) David Pimentel, “Climate Changes and Food Supply”, 1993, *Forum for Applied Research and Public Policy* 8 (4): 54-60.
 - (8) Deborah Zabarenko, “US drought to spread in California, Florida, government forecasts”, Reuters, Feb. 21, 2013
 - (9) Christopher R. Adams, “Impacts of Temperature Extremes”, 2005, Cooperative Institute for Research in the Atmosphere, Colo. St. Univ. pp.2-3
 - (10) UNIPCC, “Managing the Risks of Extreme Events and Disasters to Advanced Climate Change Adaptation:”, 2012, Cambridge Univ. Press, pp.54-55
 - (11) Michael Sorkin, *Indefensible Space: The Architecture of the National Insecurity State*, 2007, Routledge, pp.163-176

- (12) Susan Goldenberg, "US coastal cities in danger as sea levels rise faster than expected", *The Guardian*, Nov. 27, 2012
- (13) ASCE, "2009 Report Card for America's Infrastructure", *American Society for Civil Engineering*, pp.15-140
- (14) UNEP, "Buildings and Climate Change: Summary for Decision-Makers,2009", *UNEP Sustainable Buildings & Climate Initiative*, pp. 12-136
- (15) Joe Nasvik, "Resisting Wind and Seismic Forces", *Residential Concrete* May-June 2007.
- (16) NWF, "Heavy Rainfall and Increased Flooding Risk; Global Warming's Wake-Up Call", *National Wildlife Federation*, 2008 p. 1-4
- (17) Section 5.4.2 Risk Assessment - "Severe Winter Storm/ Extreme Cold", *DMA 2000 Hazard Mitigation Plan*, p.1
- (18) Robert Glennon, *Water Follies*, 2002, Island Press pp. 24-33
- (19) Brad Lancaster, *Rainwater Harvesting for Drylands & Beyond*, Rainsource Press, Tucson 2008, pp.5-6
- (20) EPA, "Facts & Figures-Municipal Solid Waste in U.S.", Environmental Protection Agency, 2007, p.155
- (21) R.J. Jacob, "When Supply Lines Go Down", *The Daily Attack*, Nov. 5, 2012
- (22) Lester R. Brown, *Outgrowing the Earth*, W.W.Norton, 2004, pp. 49-116
- (23) E. Wayne Boone & Steven D.Hart, "Full Spectrum Resilience",2012 Critical Infrastructure Symposium ,2012 Arlington VA, pp.3-4,
- (24) Ibid, p.9
- (25) Ibid, p.18
- (26) Army Reg. 525-27, Army Emergency Management Program, Dept. of the Army, April 2009, pp. 1, 5-8
- (27) Jennifer Weeks, "Sea-level rise: Whatever you call it, water is rising in Norfolk", *The Climate*
- (28) MCDA, "Alaska Deep Draft Arctic Ports Site Study", State of Alaska, 2012, pp.3-6
- (29) Robert Daniels, "Re-Building America", In-Harmony Foundation, Miami, FL 2012
- (30) Wackernagel, Mathis & Rees, *Our Ecological Footprint*, New Society Pub. 1996
- (31) Jared Diamond, *Collapse: How Societies Choose to Fail or Succeed*, Penguin Books,2005
- (32) Boone & Hart, Op Cit, pp. 15-16