

# The Realm of Possibility

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Fort Benning Sustainability  
Summit

10 May 2005



# Overview

- The issue
- The argument
- The realm of possibilities
- The answer
- The trick

# The Issue



Resource Availability

Resource Consumption

*We're at zero balance on earths - we've only got one, no spares.*

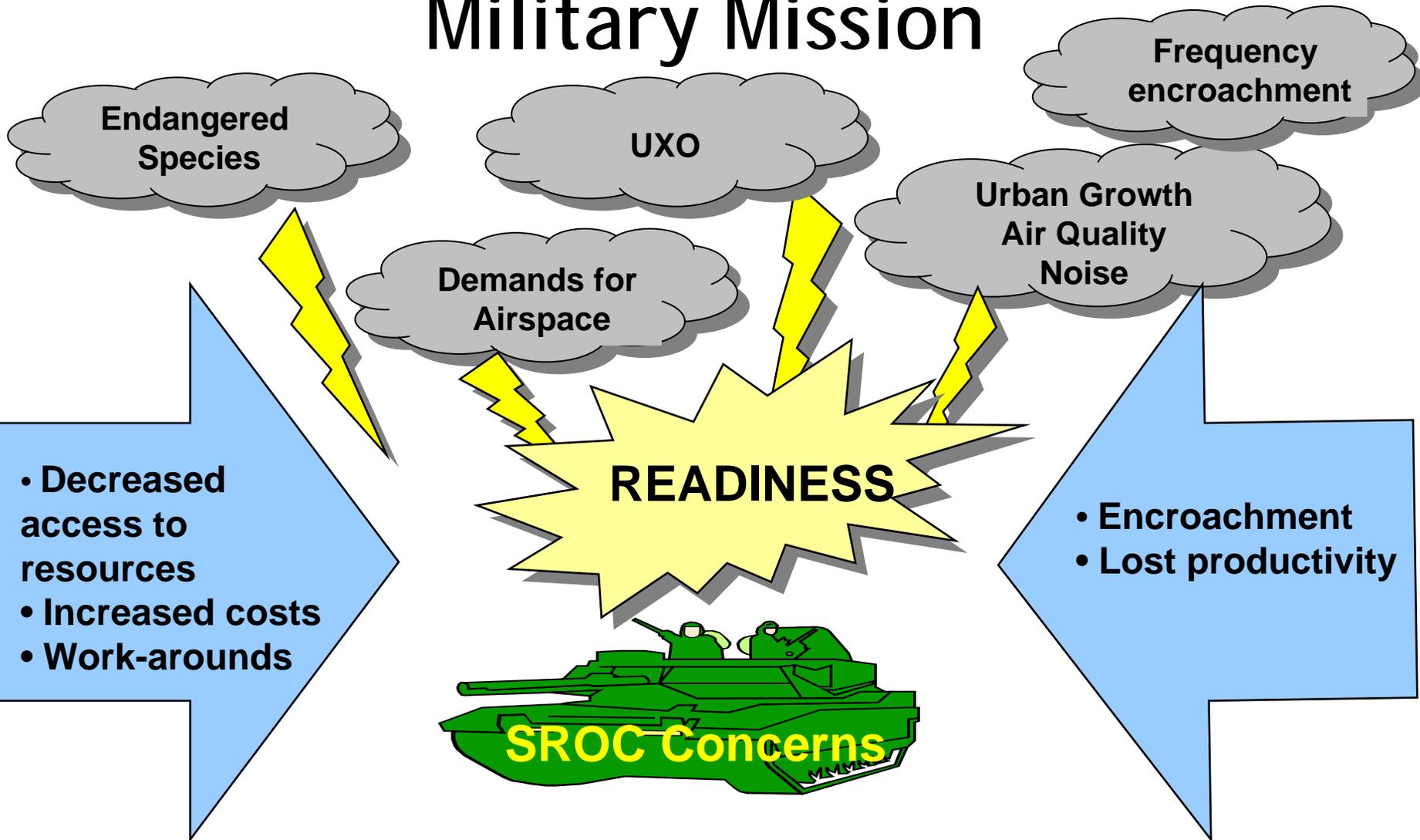


# This has Consequences for the Global...

- Economy
- Community, and
- Environment

...Simultaneously

# Translates into Challenges to the Military Mission



Source: SECDEF Senior Readiness Oversight Council Report to Congress 2001



“We will be a sustainable Army...”

...one that simultaneously meets mission requirements worldwide, protects human health and safety, enhances quality of life, and safeguards the natural environment.

This is a long-term commitment, to **radically** change the way we design, build, buy, transport, and otherwise perform our mission, as we transform our weapons systems, tactics, and installations over the coming decades.

Mr. Ray Fatz

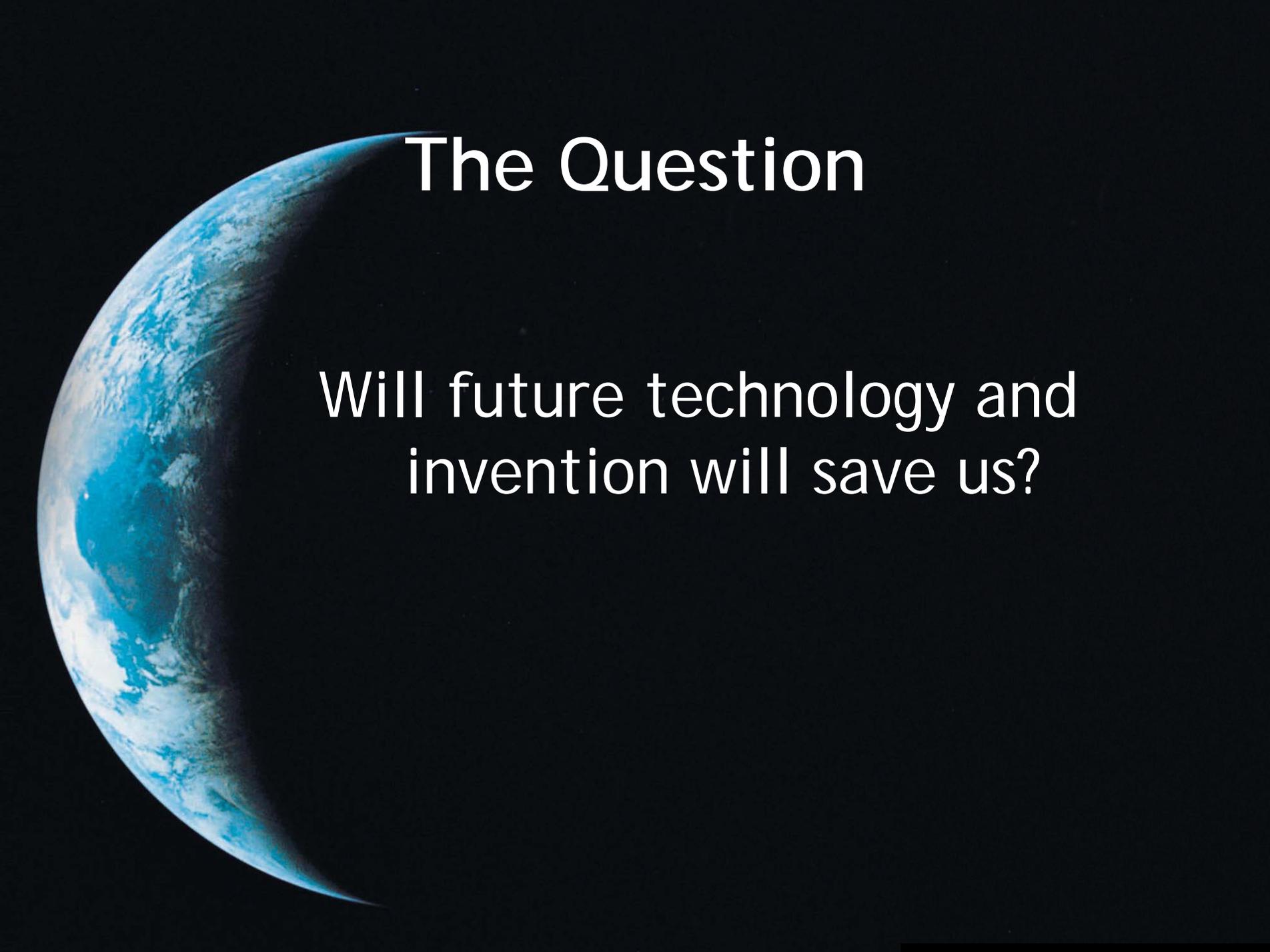
Deputy Assistant Secretary of the Army

April 2004

# For the Army, Sustainability is about Enhancing...



...Simultaneously



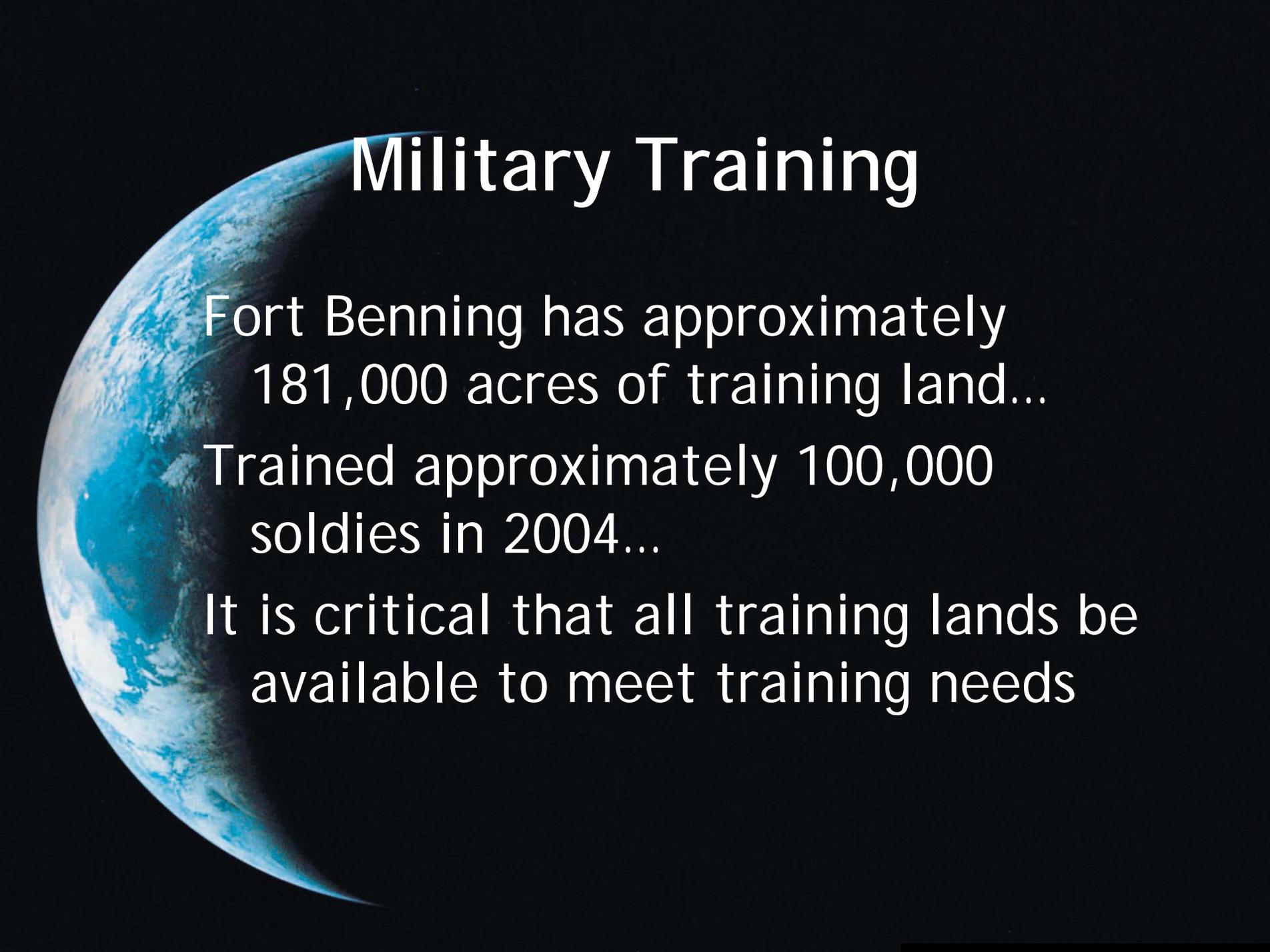
# The Question

Will future technology and  
invention will save us?



# The Realm of Possibilities

- Military Training
- Installation Management
- Procurement
- Regional Interaction



# Military Training

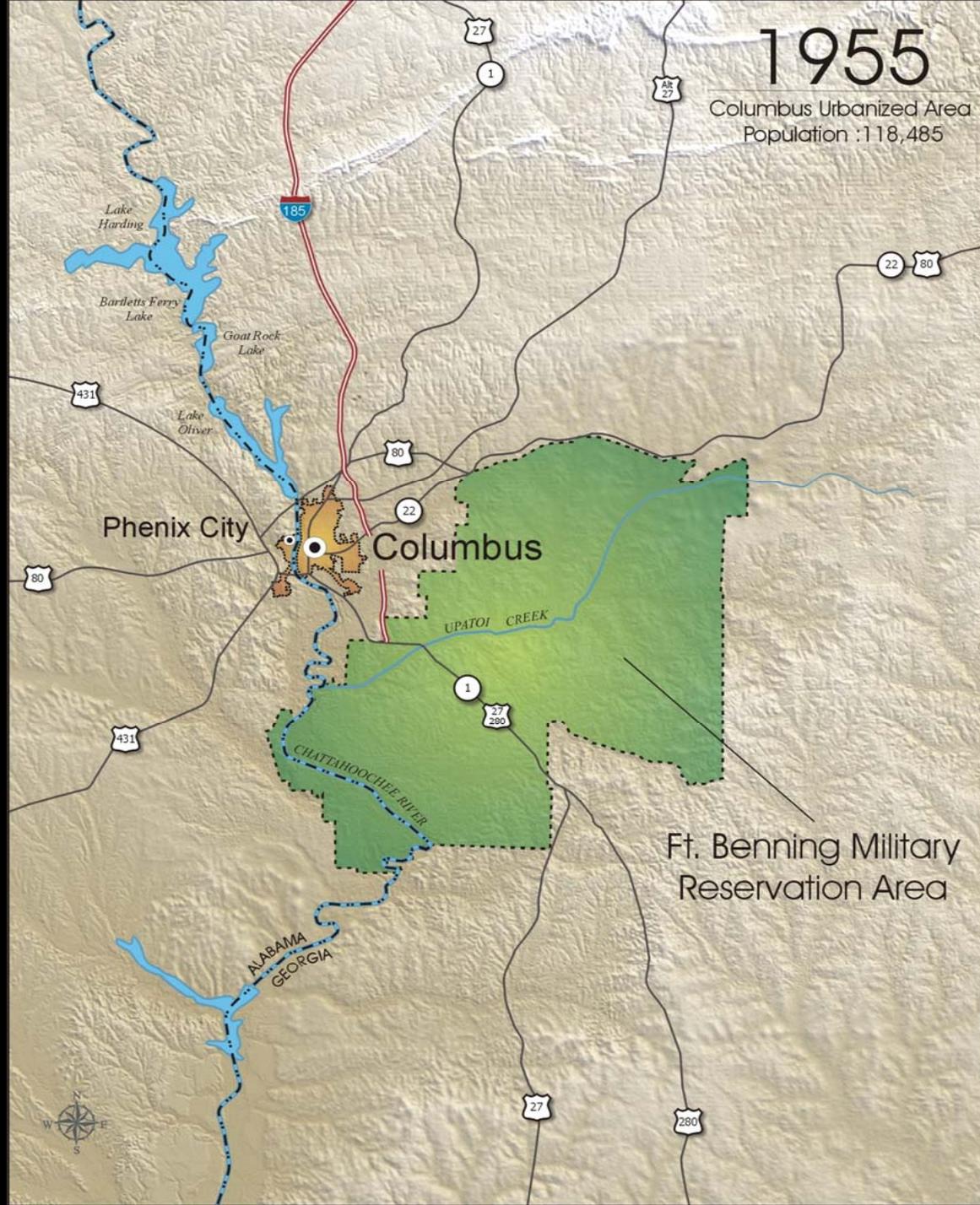
Fort Benning has approximately  
181,000 acres of training land...

Trained approximately 100,000  
soldiers in 2004...

It is critical that all training lands be  
available to meet training needs

# 1955

Columbus Urbanized Area  
Population : 118,485



Phenix City

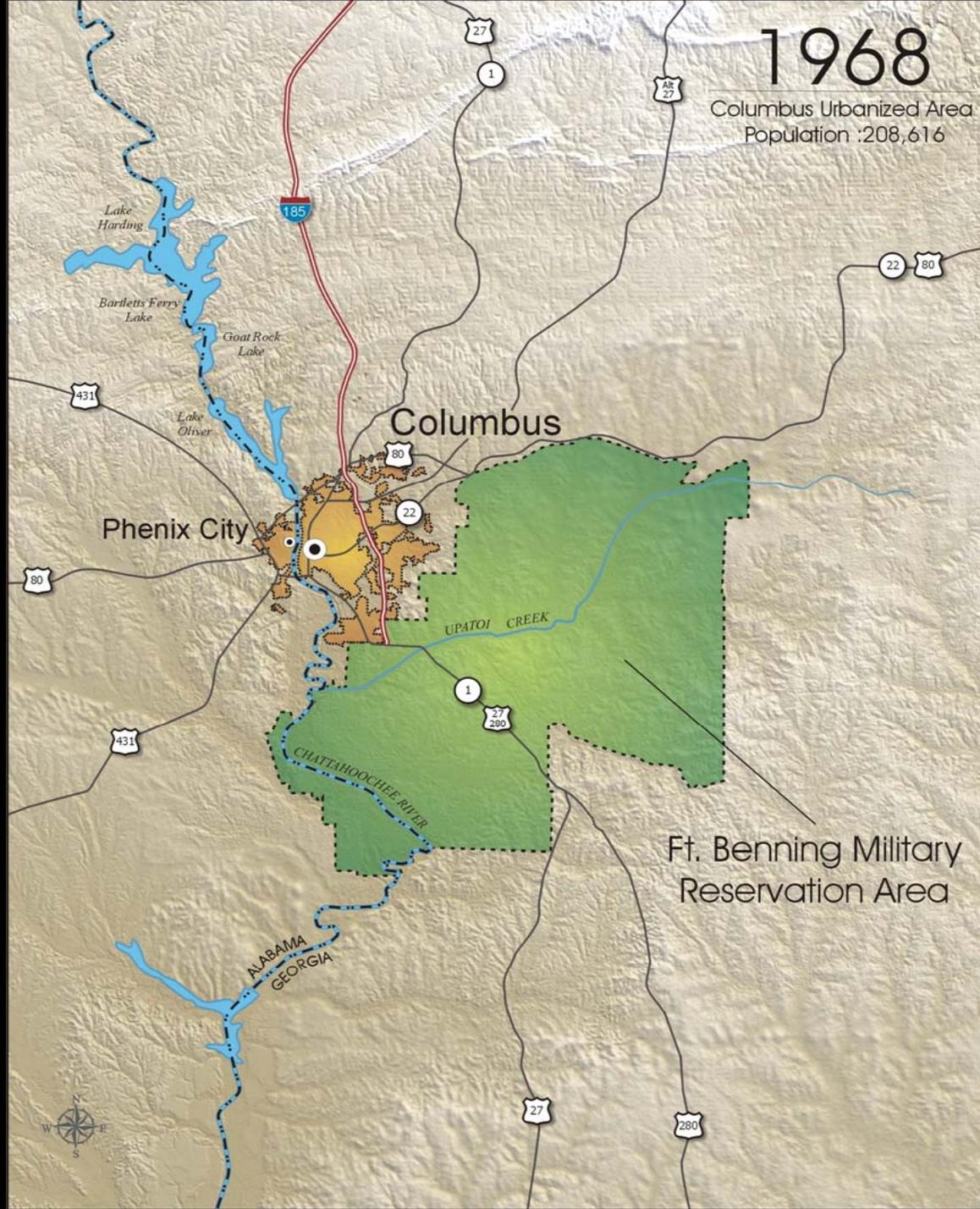
Columbus

Ft. Benning Military  
Reservation Area



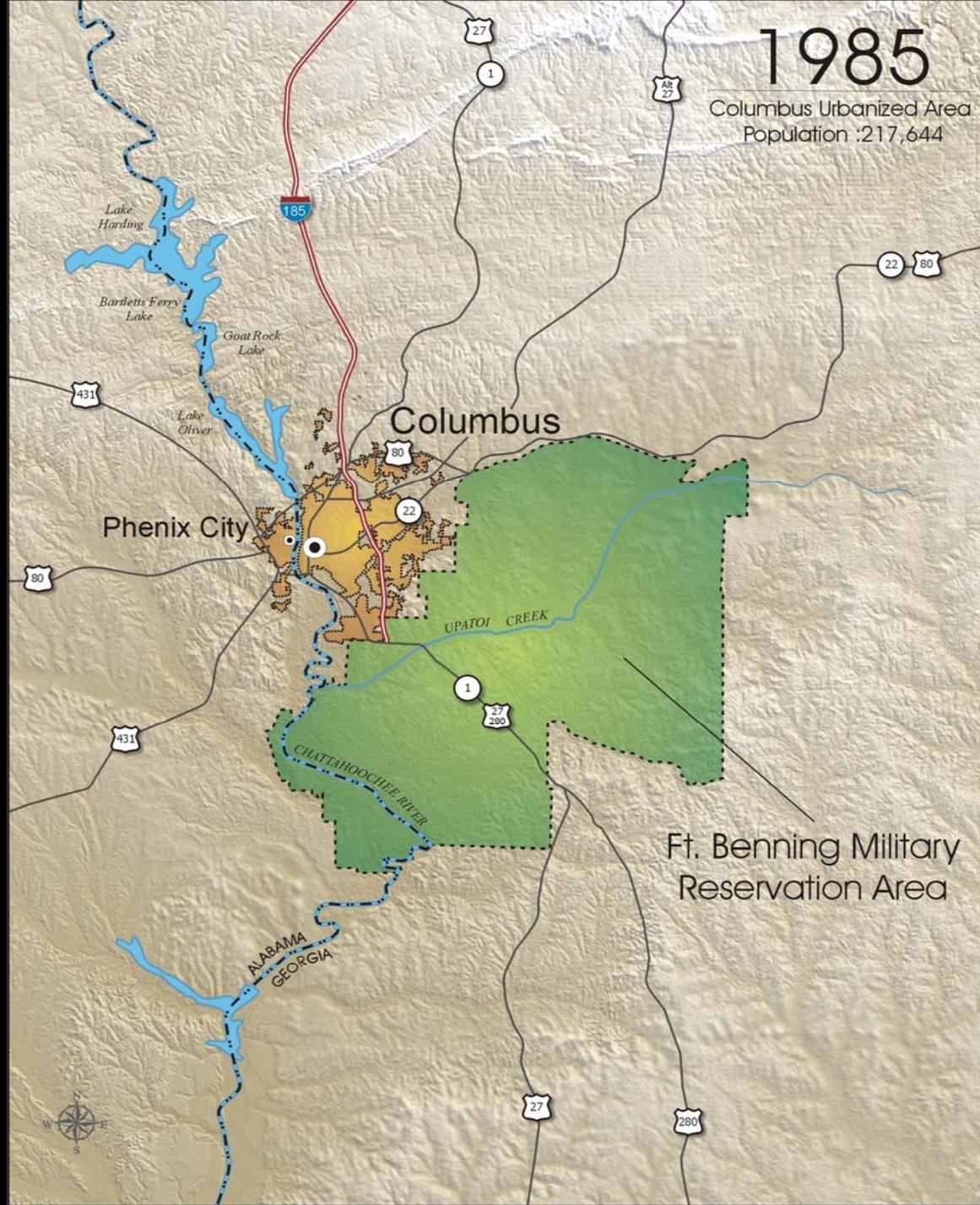
# 1968

Columbus Urbanized Area  
Population :208,616



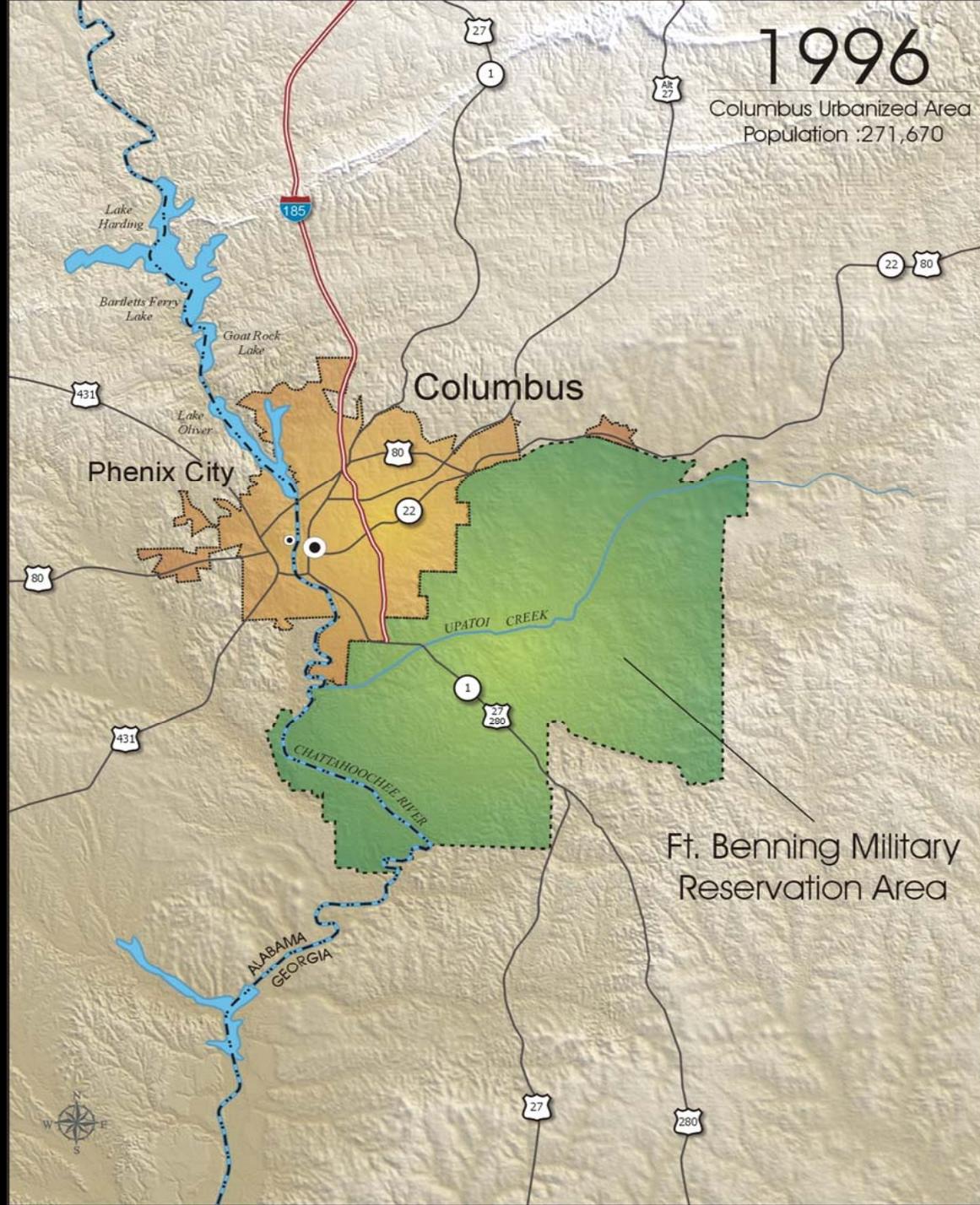
# 1985

Columbus Urbanized Area  
Population :217,644



# 1996

Columbus Urbanized Area  
Population :271,670



Phenix City

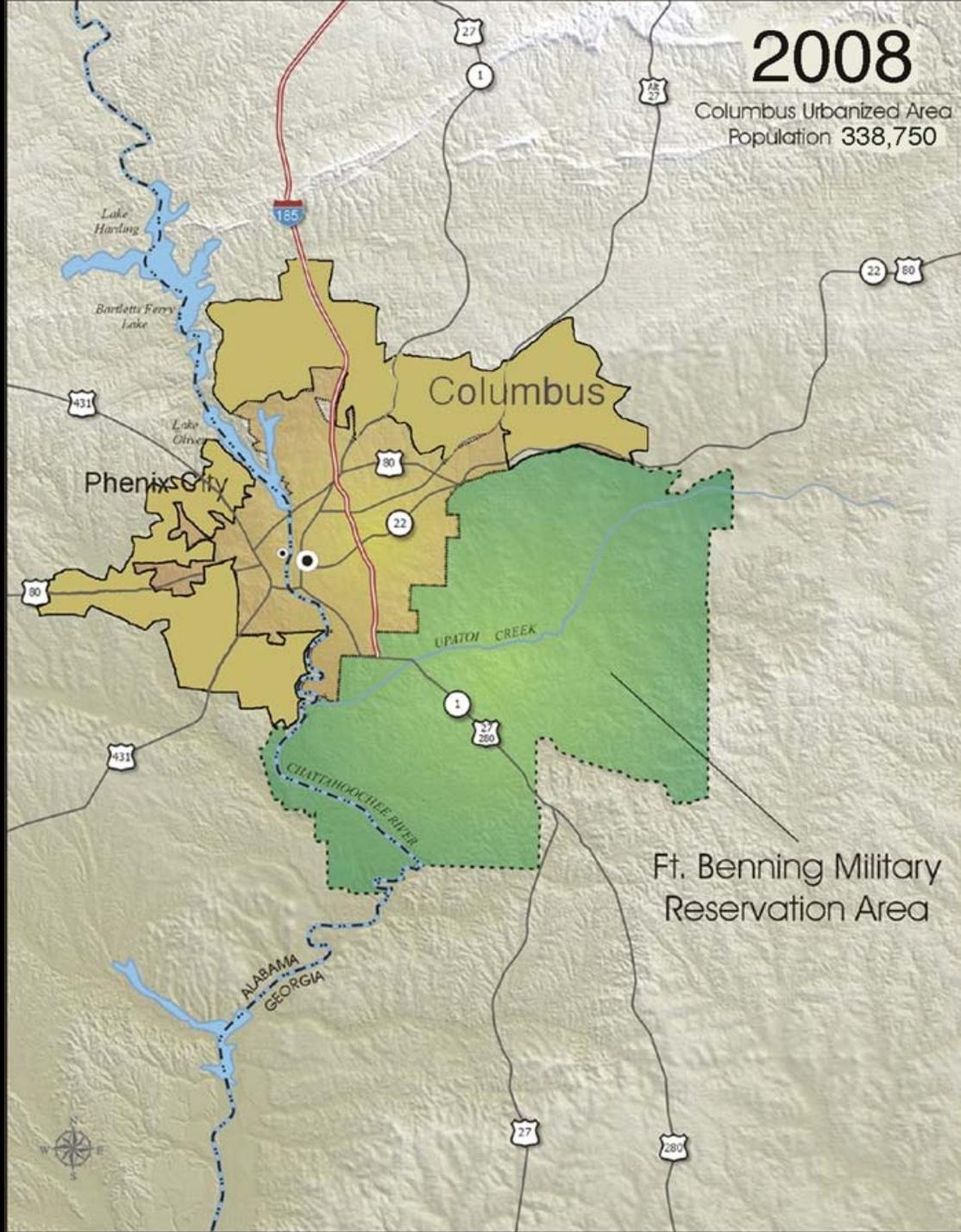
Columbus

Ft. Benning Military  
Reservation Area



# 2008

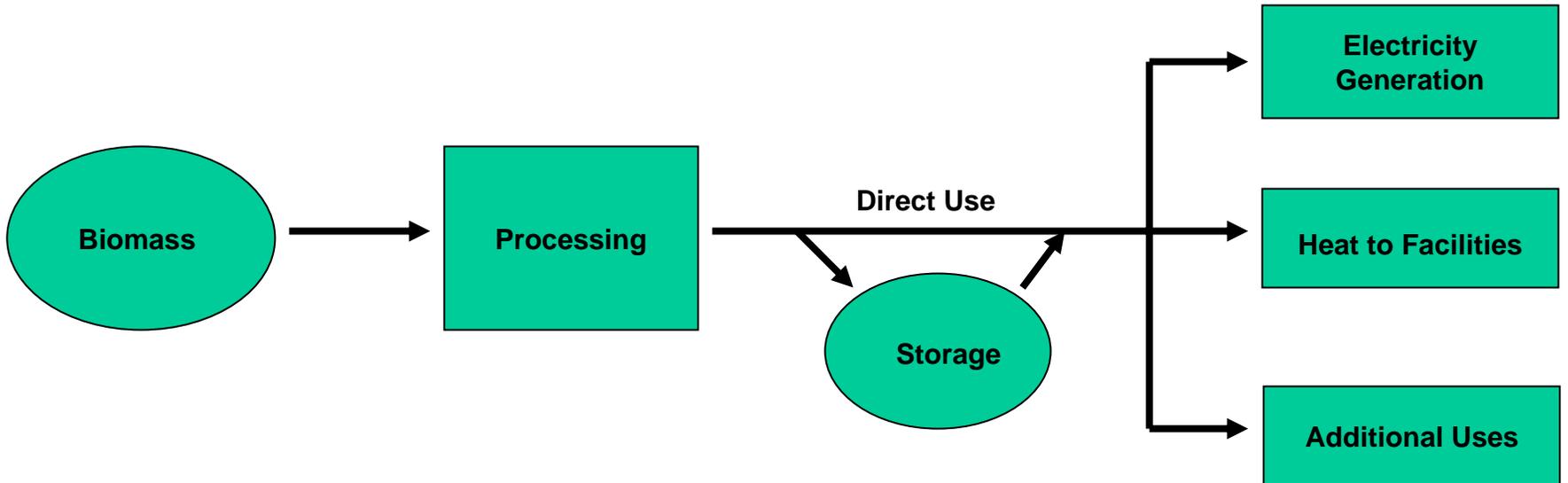
Columbus Urbanized Area  
Population 338,750





Wow - so what do we do?

# Bio-mass Energy Production





# Ft. Bragg Sustainable Sandhills Initiative

By working with the community, Fort Bragg seeks alternative methods to protect its training areas:

- Private Lands Initiative has secured over 17,000 acres of land that will not be developed.
- Fort Bragg is cooperating with 6 county governments in an effort to compile data into GIS data layers that will be used by all communities for future development and environmental analyses.



# Fort Carson

- Remote sense imaging to determine training's environmental effects
- Wild land Fire Program
- Night Training to decrease noise effects
- Zero Footprint Camp
- Weather Training



# Green Training

- Greenbelts
- Green Munitions - bullets, missiles, and grenades
- Virtual training
- Sustainable ranges - R&D with CERL and ATSC
- Zero Footprint Camp

# Tactical Hybrid Vehicles

The Army is moving out on tactical hybrid vehicles.



- UQM 16 Passenger cutaway bus
- Hybrid electric van
- GM hybrid electric Silverado truck
- John Deere hybrid electric Gator
- Harlan hybrid electric tug
- Hybrid electric HMMWV
- Oshkosh hybrid electric HEMMT
- United Defense hybrid electric M113
- Special Forces fuel cell ATV
- SMARTTRUCK
- SMARTTRUCK II
- Delphi solid oxide fuel cell
- Acumentrics solid oxide fuel cell
- American Chariot Military Police

# Army / DARPA Collaboration

## Enabling Future Combat Systems



### Unmanned Air Vehicles



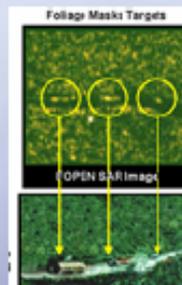
- Diesel Micro Air Vehicle (d-MAV) ACTD
- DP-5X UAV
- Organic Air Vehicle

### Autonomy With Intent – UGCV

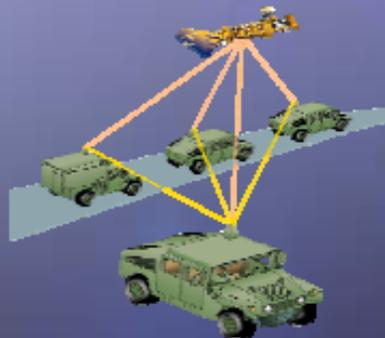


- Armed Robotic Vehicle
  - Advanced mobility
  - Advanced perception
- 
- International Cooperation
  - Studies, Analyses and Experiments
  - Other

### Find the Enemy – ISR



- Affordable Adaptive Conformal ESA Radar (AACER)
- Foliage Penetrating Reconnaissance, Surveillance and Tracking Engagement Radar (FORESTER)
- JIGSAW
- Sensor DART
- Wolfpack



### Network and Battle Command

- FCS Communications
- Mobile Networked Multiple-Input / Multiple-Output (MNM) Communications
- FCS Multi Cell Command and Control (C2)

# Installation Management

Fort Benning consists of over 20M sq. ft. of buildings that require:

- \$16M of energy
- 3.3B gallons of water/year

Fort Benning generated 128,000 tons of waste in 2004 (14.2K garbage, 113K tons of demolition debris)

Fort Benning purchases about \$230M of goods and services annually

Commuters Travel approximately 2.4 M miles /day to Fort Benning



Energy

# Rocky Mountain Institute

- ☞ Super insulated
- ☞ Solar heated
- ☞ Passively cooled
- ☞ Heat exchangers
- ☞ Daylit
- ☞ Water efficiency
- ☞ Efficient lighting, equipment
- ☞ PV arrays

## Savings:

- 😊 90% electrical
- 😊 99% space/water heating
- 😊 10 month payback
- 😊 Power bill \$5/month
- 😊 Market-average cost when built in 1984



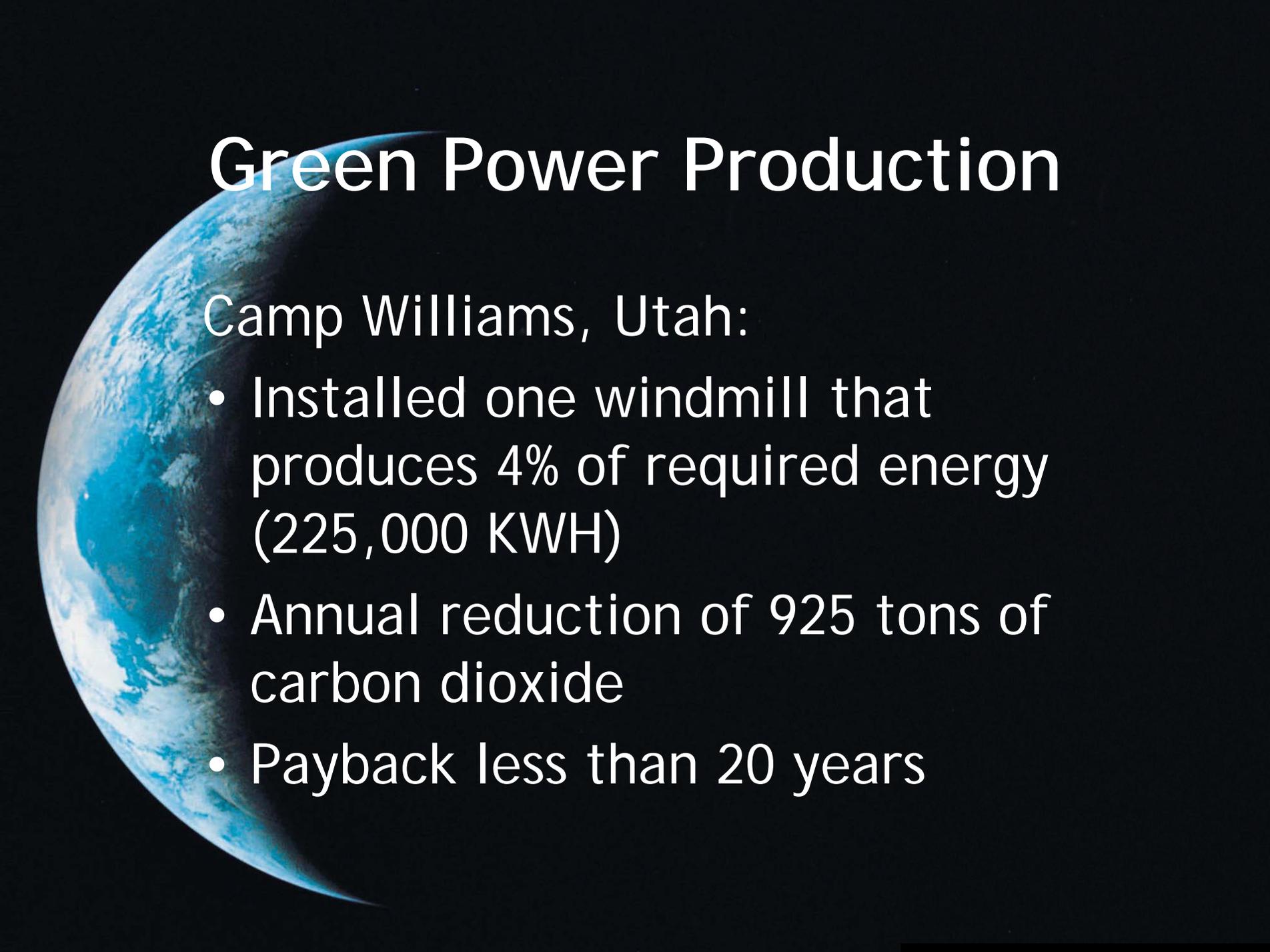
*Grow bananas with  
no furnace at -40°F*



# Secure, Renewable Choices

- **Wind Energy**
  - Cost 3-5 cents/kWh
  - 6,000 MW by 12/03 (\$6Billion investment)
  - 2+ cents/kWh by 2020
  - Down from 40 cents in 1980
- **Solar photovoltaics**
  - \$2 billion global industry
  - Cost 16-25 cents/kWh
  - DOE 2020 goal: 6 cents
  - Down from \$1 in 1980
- **Biomass Power**
  - 350 power plants in U.S.
  - 7,000 MW of power





# Green Power Production

Camp Williams, Utah:

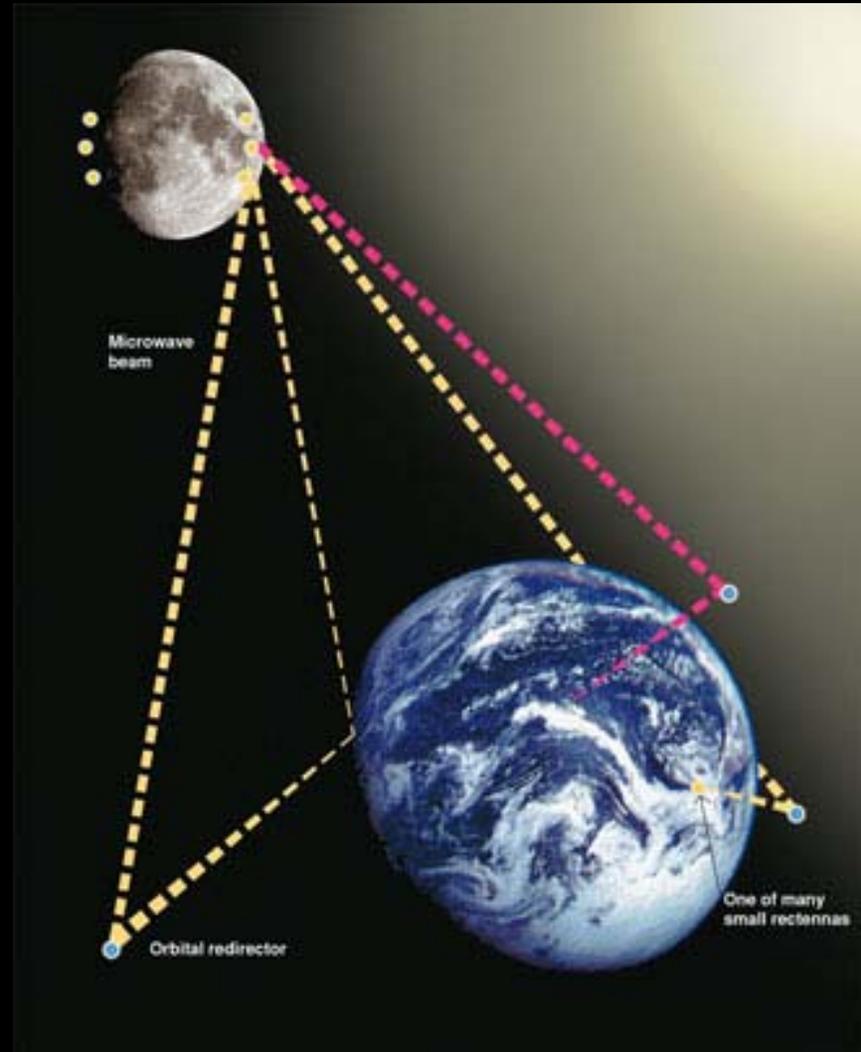
- Installed one windmill that produces 4% of required energy (225,000 KWH)
- Annual reduction of 925 tons of carbon dioxide
- Payback less than 20 years

# Many are doing it better than us...EPA has identified the top purchasers of green power

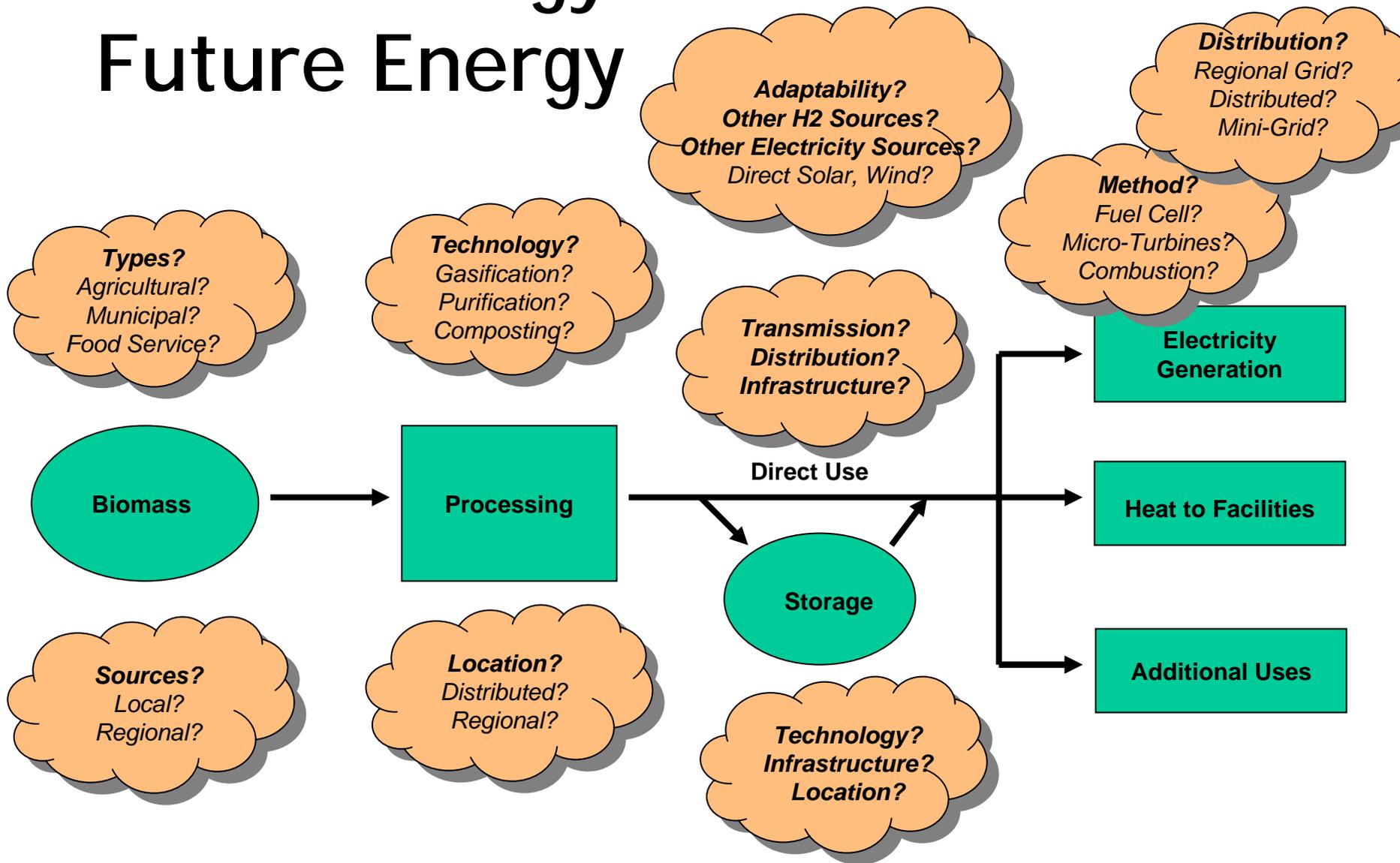


1. **U.S. Air Force**
2. **Johnson & Johnson**
3. **U.S. Environmental Protection Agency**
4. **The World Bank**
5. **U.S. General Services Administration / Region 2**
6. **Whole Foods Market**
7. **City of San Diego, Calif.**
8. **New Jersey Consolidated Energy Savings Program**
9. **WhiteWave Foods**
10. **Austin (Texas) Independent School District**
11. **Staples**
12. **University of Pennsylvania**
13. **Montgomery County, Md.**
14. **Advanced Micro Devices / Austin, Texas Facilities**
15. **Commonwealth of Pennsylvania**
16. **FedEx Kinko's**
17. **East Bay Municipal Utility District/Main Wastewater Plant**
18. **BMW Manufacturing Co. / Greer, S.C. Facilities**
19. **City of Santa Monica, Calif.**
20. **U.S. Navy / Region South**
21. **Harvard University**
22. **Round Rock (Texas) Independent School District**
23. **City of Portland, Ore.**
24. **Pennsylvania State University**
25. **U.S. Department of Energy/Forrestal & Germantown Facilities**

# Solar Energy from the Moon



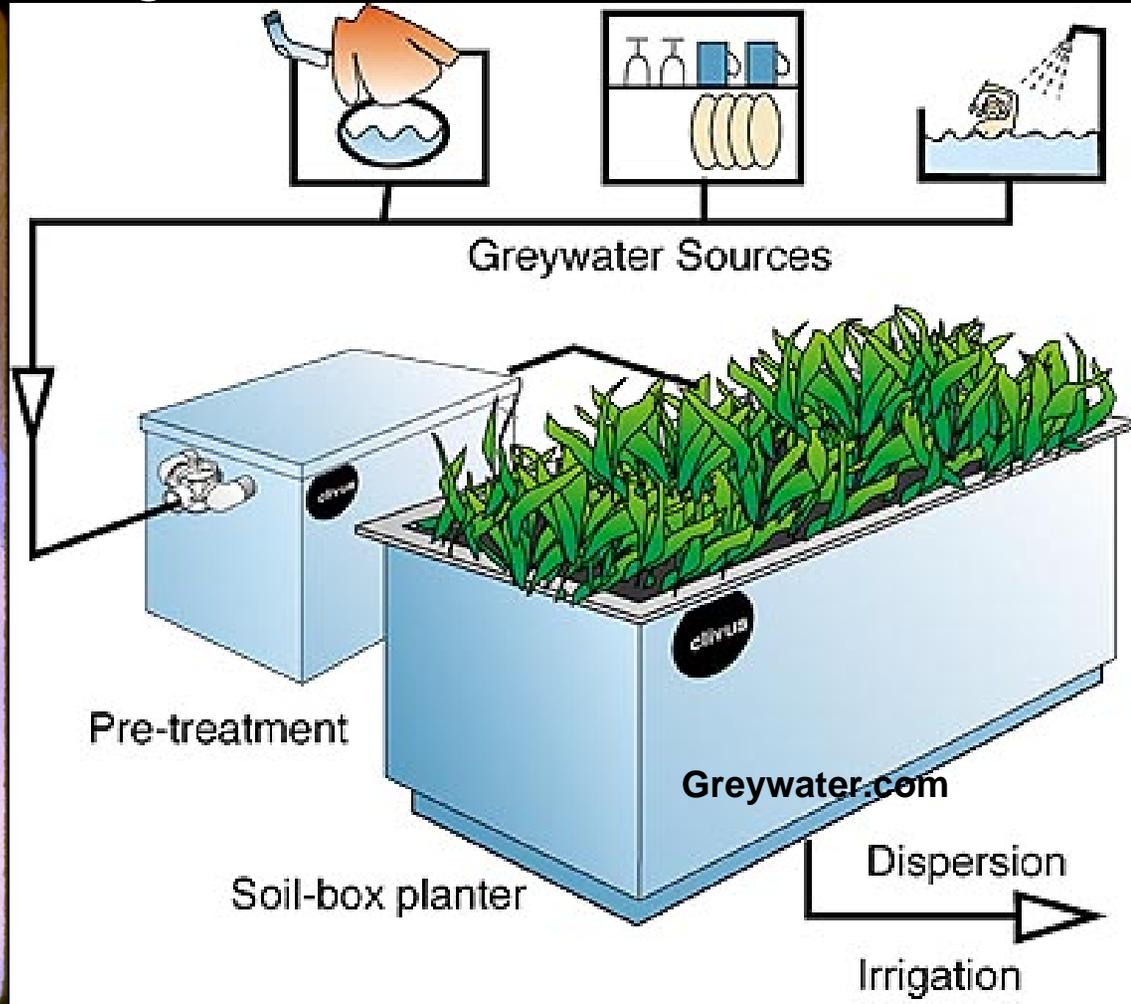
# Bio-mass Energy to Future Energy





Water

# Wastewater Technology is available to cascade water from higher to lower quality needs



# How would you design a sewage plant if you had to live downwind?

Living Machines™ turn sewage into clean water and flowers.



Dr. John Todd



# Building Materials

We can improve our buildings through the materials we choose. We can

- Improve energy efficiency and structural integrity
- Create markets for new products for developing local industry
- Support loops that take waste back into new products
- Reduce waste

# Better Building Materials



Fort Lewis has established a sustainable products showcase for products and materials to be used in their buildings



Fort Bragg is pursuing one as well



# Agri-Board

- Produced from compressed wheat or rice straw
- 2x as energy efficient
- 2X Fire resistant
- Stronger
- Pest resistant
- Reduced lumber framing by up to 90%



# Fort Chaffee Building Deconstruction

- Over 600 large buildings (WWII barracks) at Fort Chaffee
- Salvageable siding, windows, doors, wood
- Over 10 million board feet of old-growth yellow pine
- Value \$20-40M



# Grancrete



- <http://www.worldchanging.com/archives/002006.html>

# Ford Dearborne Plant

Is investing an additional \$8M in a green roof, porous pavement for parking lot (reduced cost), and a constructed wetland for landscaping.

Savings will include elimination of a \$40M storm water management system and \$6M budgeted for landscaping.

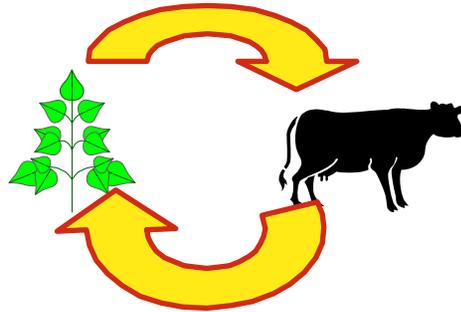




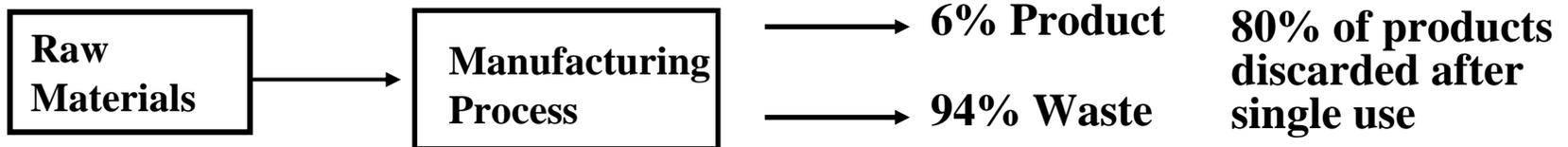
# Procurement

# Material Flows

**In cyclical natural systems, waste does not exist. Waste = Food.**



**Linear Industrial Processes: Waste is created faster than it can be reconstituted to quality resources. Take-make-waste**



(Source: NAE / *Factor 4* p. xx, 1997)

**It is estimated that 99% of the original materials used in the production of, or contained in, the goods made in the US become waste within 6 weeks of sale.**

(Attributed to Paul Hawken, *Factor 4*, 1997)

Step 1 - bauxite is mined in Australia

Step 6 - metal ingot cured and shipped to Germany to be rolled

Step 11 - can is lacquered and coated inside

Step 2 - bauxite is trucked to plant for chemical processing  
1 ton ore yields up to 1/2 of Aluminum Oxide

Step 7 - ingot is heated to 900°F and rolled into coil

Step 12 - cans are palletized, stored, and shipped

Step 3 - shipped to Norway for processing

Step 8 - coil is stored and cold rolled into sheet

Step 14 - bottler cleans and fills with product

Step 4 - oxide sits at smelter site for up to 2 months

Step 9 - sheet metal is shipped to England punched and formed into cans

Step 15 - cans are packed in promotional boxes palletized and shipped to retailer

Step 5 - 2-hour smelting reduces 1/2 of oxide into 1/4 ton of metal

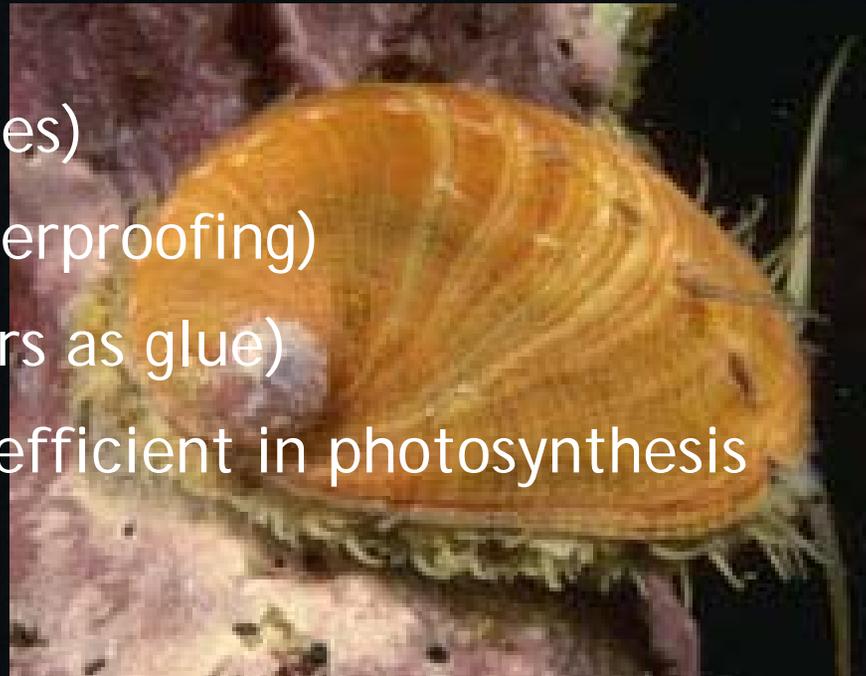
Step 10 - can is washed, dried, primed and painted

Step 16 - Can is purchased, contents consumed within a few minutes and is thrown away



# One Solution - Look to Nature

- Spider Web (thread strength)
- Slug mucous (adhesive)
- Abalone Shell (protective shell)
- Barnacle (adhesives)
- Lotus flower (waterproofing)
- Geckos (small hairs as glue)
- Pond Scum - 95% efficient in photosynthesis





# Look to Suppliers - Product Leasing

- Interface Carpet
- Automobiles
- Furniture
- Red rags
- Paper?

# Candle Wax Rocket Fuel

- Paraffin-based fuel
- By-products are CO<sub>2</sub>, and water, not toxic materials
- Less money because it's cheaper to produce, and less harmful to the environment and workers



# Fuel Cells - The small version

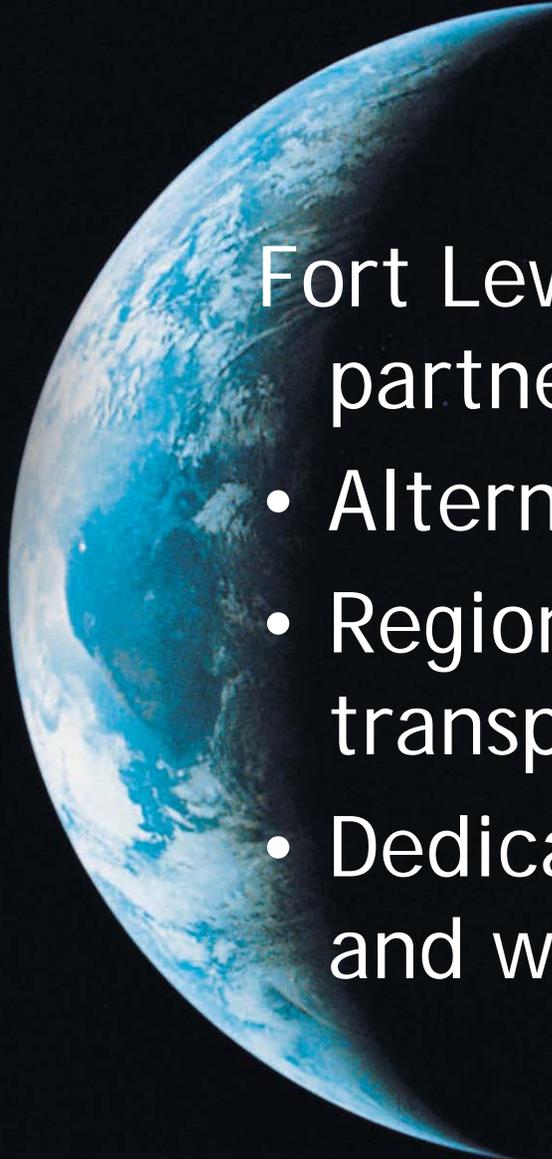
## Bacteria-Driven Battery

- Microbial fuel cell powered by organic household waste
- Produces 8x as much energy as similar fuel cells and no waste
- Estimated cost - \$15
- NEC plans to sell fuel cell- powered computers





# Transportation



# Partnerships

Fort Lewis is exploring various partnerships:

- Alternative fueling station
- Regional sustainability transportation plan
- Dedicated mass transit routes to and within the installation

# New Fuels



Scott Air Force Base is scheduled to use Bio-based diesel fuel blends in 270 vehicles. Bio-based diesel fuel is:

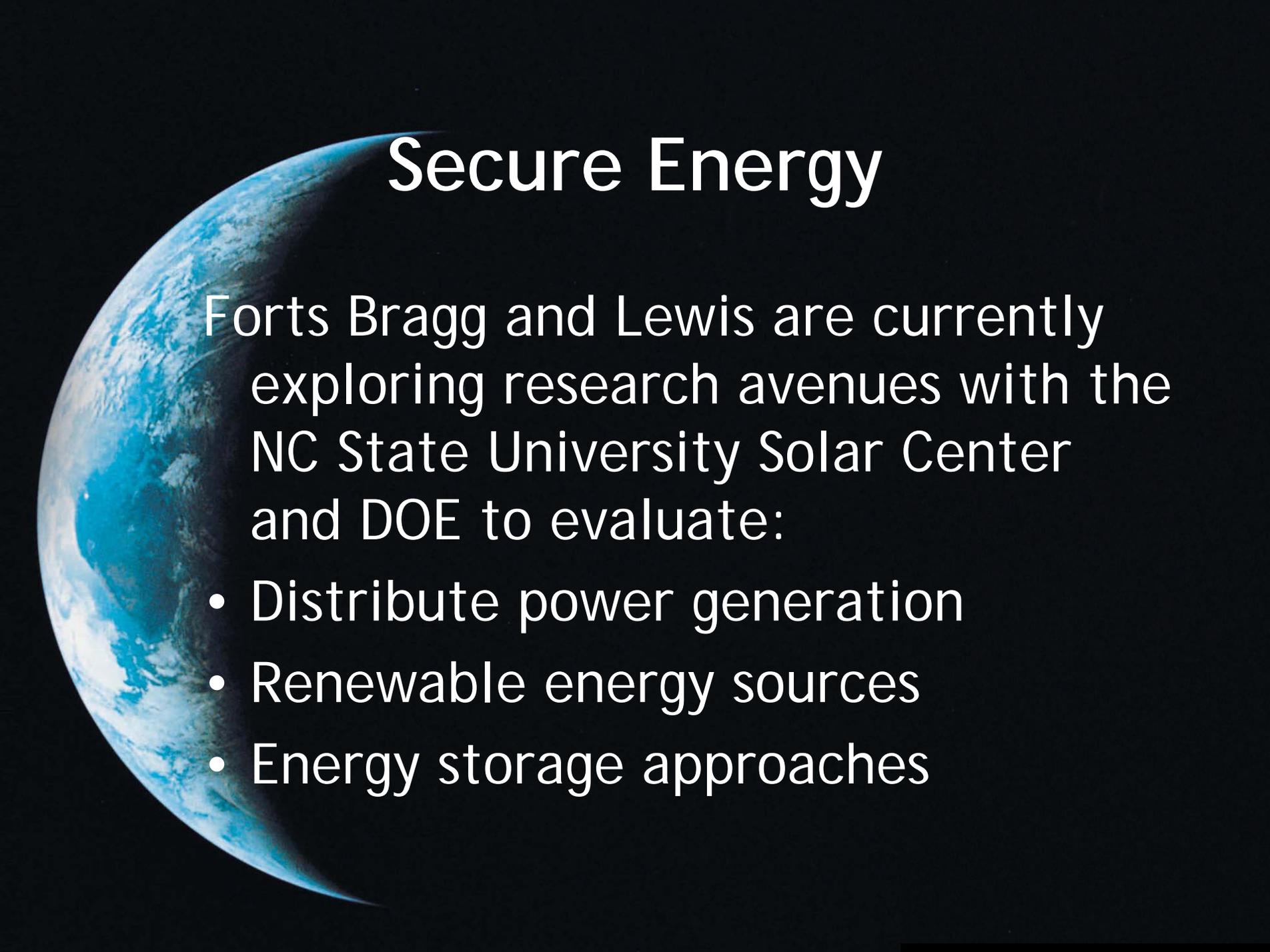
- Composed of soy and other oils and can be blended with petroleum diesel.
- Reduces carcinogenic releases by 75-90%.
- Requires no vehicle modifications.
- Is bio-degradable and sulfur free.

# Off-setting Travel

- Voucher System - The new Mass Transit Voucher System requires government agencies to pay up to \$65/month to cover the costs of employees who take mass transit or van pools to work.
- Terrapass - [www.terrapass.com/index.html](http://www.terrapass.com/index.html) - individual, annual license fees go to purchase greenhouse gas emission credits
- Trees for Travel is an organization that will plant trees to offset the pollutants caused by air and vehicle travel.



# Regional Interaction



# Secure Energy

Forts Bragg and Lewis are currently exploring research avenues with the NC State University Solar Center and DOE to evaluate:

- Distribute power generation
- Renewable energy sources
- Energy storage approaches



# Regional Partnerships

- Fort Bragg Sustainable Sandhills
- Washington State Military Sustainability Partnership

# Working with Community Towards Sustainability

## New York City, the State, and Catskills Watershed

- **New York City has some of the cleanest drinking water in the world**
- **The water source is the Catskill Mountain Watershed (1,600 sq mi)**
- **In 1990 EPA mandated that all public supplies of surface water be filtered for microbes**
- **spend \$4-\$6 billion dollars to meet these mandates**

# Approach

- NYC worked with upstate communities on land use, development planning, and agricultural best management practices that would improve water quality.
- Communities and NYC purchased select properties to be held undeveloped and in public trust.
- NYC spent \$550 million to improve their water system, upgrade aging sewage treatment plants, and replace failing septic systems in the Catskill watershed area
- Another \$278 million has been spent for conservation easements and partnerships to protect forest lands
- The state of New York is also contributing funds to these programs

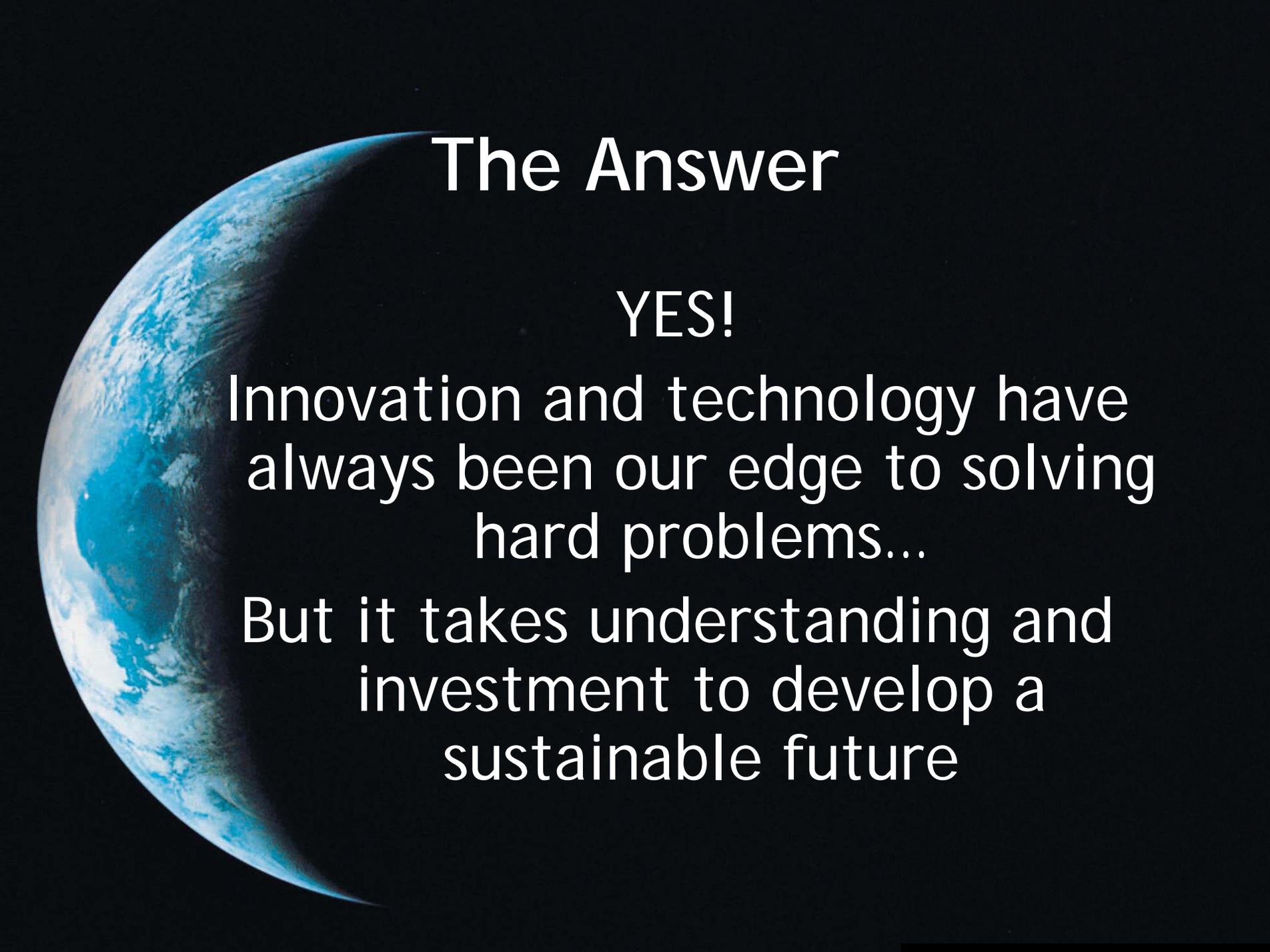
# Results

Water quality improved to the point where the investment in system upgrades for systems within watershed was unnecessary

Cost Avoided = \$6 Billion

Open Space preserved = 258,716 acres

Total investment = \$833 M

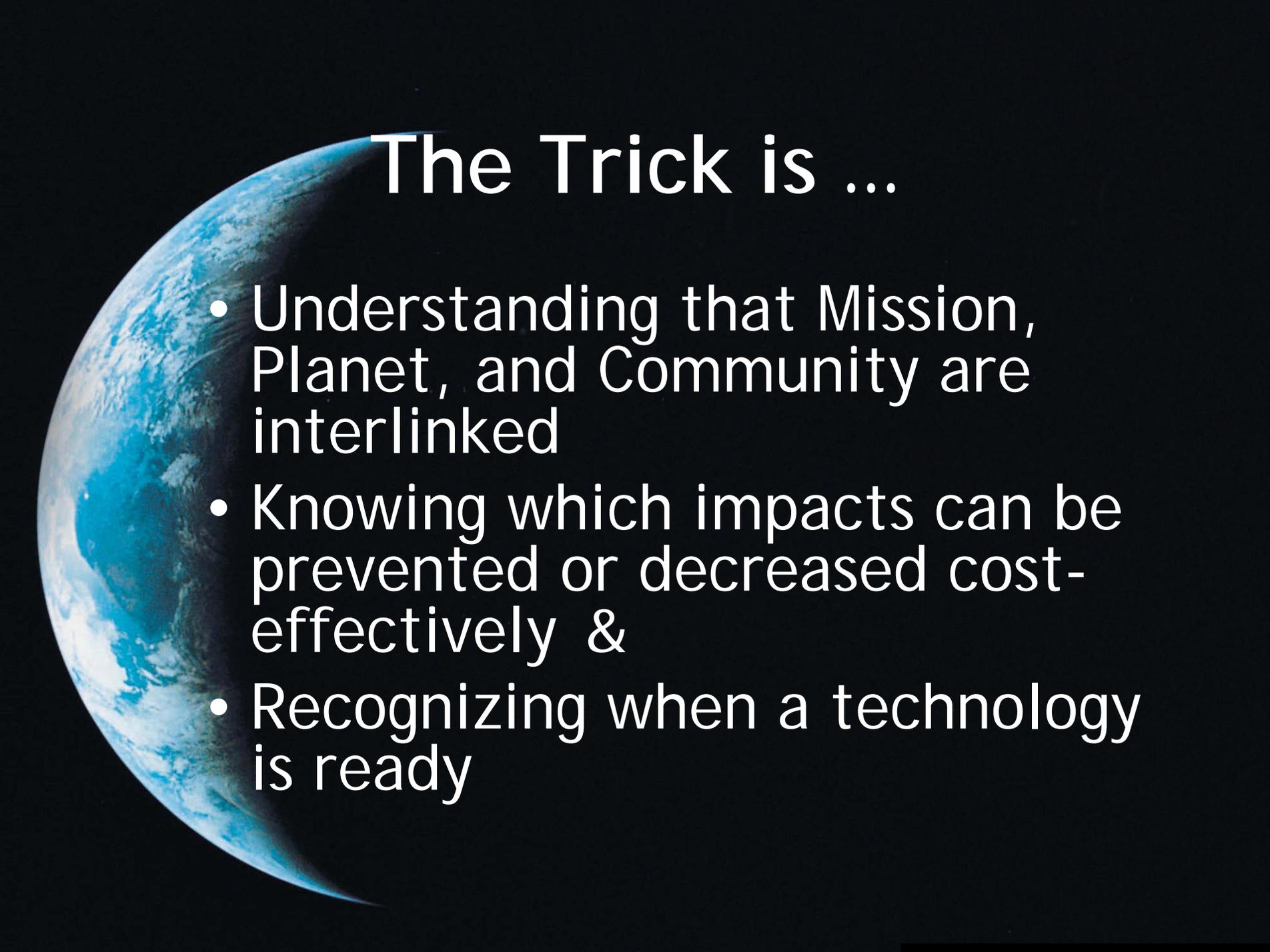


# The Answer

YES!

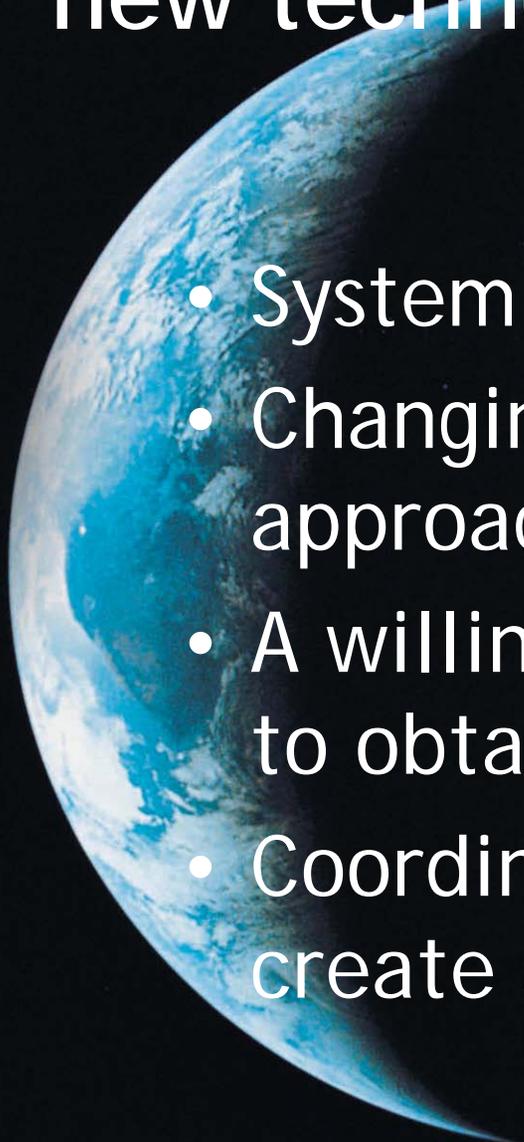
Innovation and technology have  
always been our edge to solving  
hard problems...

But it takes understanding and  
investment to develop a  
sustainable future



# The Trick is ...

- Understanding that Mission, Planet, and Community are interlinked
- Knowing which impacts can be prevented or decreased cost-effectively &
- Recognizing when a technology is ready



The Other Trick is understanding that new technologies don't just happen. It takes:

- System thinking
- Changing mindsets and problem-solving approaches
- A willingness to use future investments to obtain superior technologies
- Coordination with the markets we create and dominate

# The Real Question

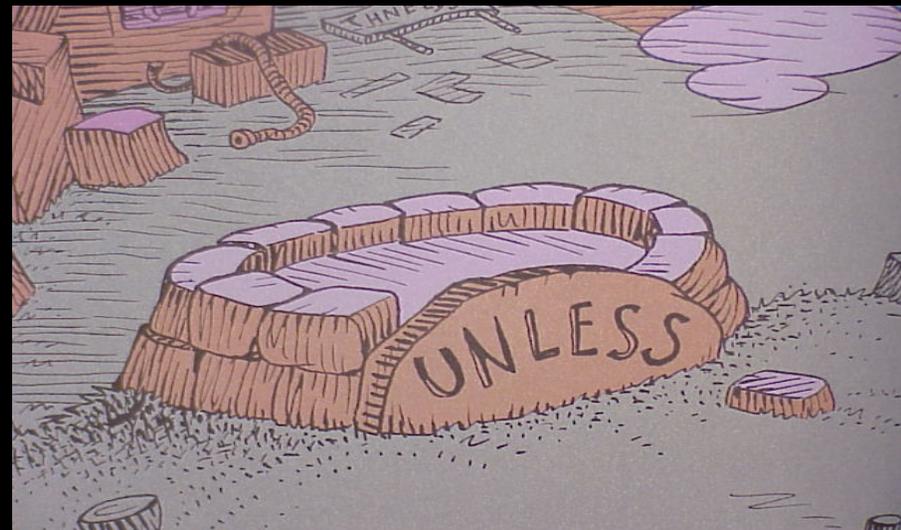
Do we want to leave the world a better place for them?



# Unless...

“Someone like you  
cares a whole awful lot  
Nothing is going to get better  
It's not...”

*The Lorax*  
by Dr. Seuss





# Vision

It begins with the vision to understand that things can and should get better for the next generation.

We have always had visionaries who could see the future and set the world toward change

# Visionaries

We have had visionaries who see the future:

- Jules Verne and his 1863 book “The Earth to the Moon” ,
- Thomas Edison who saw the importance of electricity





**Can We Do it?**

**Can the Government Change  
and in the Process Help  
Change Society?**

A photograph of the Earth from space, showing the blue oceans and white clouds against the black background of space. The Earth is positioned on the left side of the frame, curving towards the right.

# No Excuses

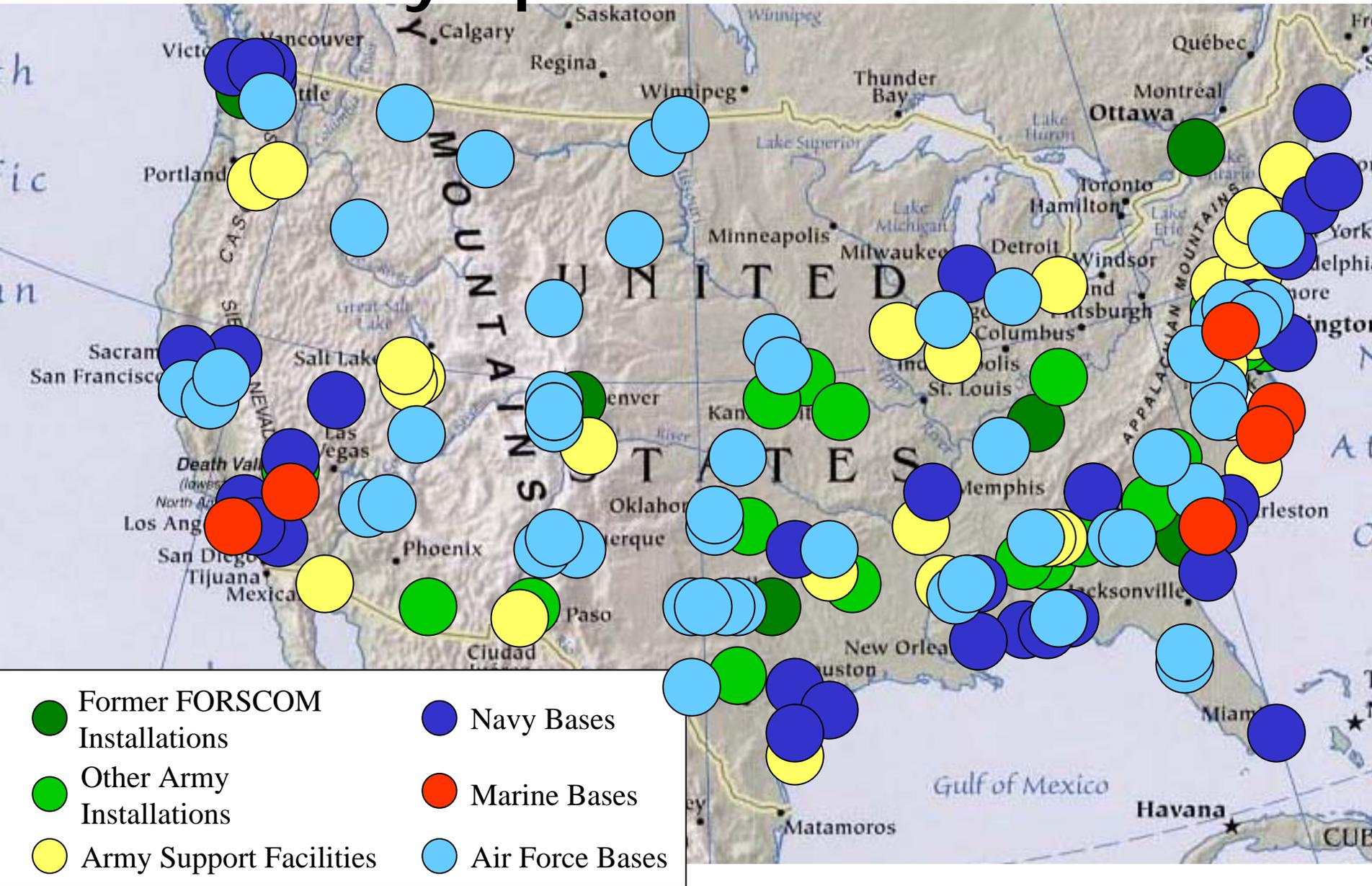
The GDP of the United States is  
\$10Trillion/yr

Purchases of the Federal Government  
account for 17% of the total GDP

That's \$1,700,000,000,000

Fort Benning represents almost 1%  
of the GDP of the State of Georgia

# Military Sphere of Influence





# We Already Do it...

We do it all the time in system development:

- Global Position Satellite Systems
- Fuel Cells
- Solar Technologies
- Radar
- Laser

# For the Soldier



**Today and Tomorrow**