

# Atlanta Mobility

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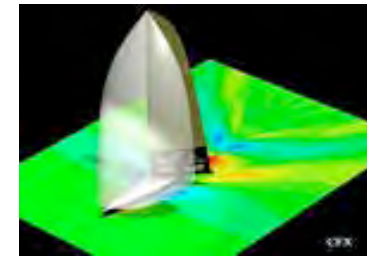
Atlanta, Georgia 30332

USA



# Who am I?

- Born in The Netherlands
- MS in Mechanical Engineering from the University of Twente (1987)
- Worked at the Maritime Research Institute of The Netherlands – MARIN (1987-1988)
- Ph.D. in Operations Research from University of Houston (1992)
- Faculty in the School of Mechanical Engineering since 1992
- Research interest: Sustainable Design and Manufacturing



**Prof. Bert Bras**  
Mechanical Engineering



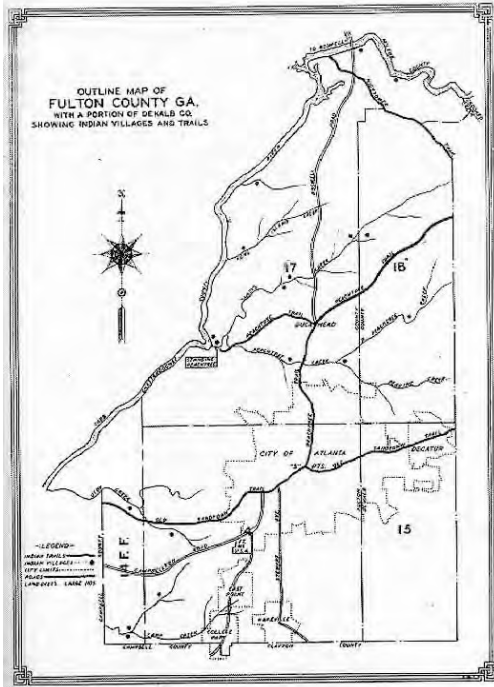
How much longer?!?!

# What we are trying to do

- Identify (technical) options for improved urban mobility in Atlanta area
  - Ranging from “traditional” to “innovative”
- Assess impact in terms of financial, environmental and social benefits/costs
  - Use existing and new assessment models
- Create an engineering design type framework
  - Managing requirements and desired functions with appropriate solutions
- Pursue pilot implementations around Georgia Tech
  - Lead and verify by example
- Create a research thrust area around “sustainable mobility”
  - Including industrial goods movement



# Why Atlanta?



A map showing roads and Indian trails circa 1815, with late 19th century Fulton County and City of Atlanta outlines overlaid.



In 1907, Peachtree Street, the main street of Atlanta, was busy with streetcars and automobiles



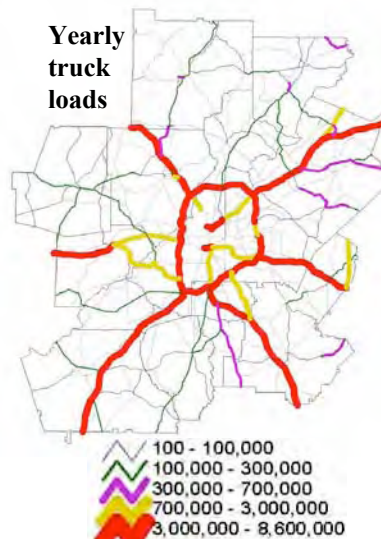
Centennial Park with Olympic Rings and fountains. CNN Studio, World of Coca-Cola, Georgia Aquarium all surround this park

The Midtown and Downtown areas of Atlanta have experienced tremendous growth and revitalization since the 1996 Olympics

**Between 2000 and 2006, the Atlanta metropolitan area grew by 20.5%, making it the fastest growing metropolitan area in the US.**

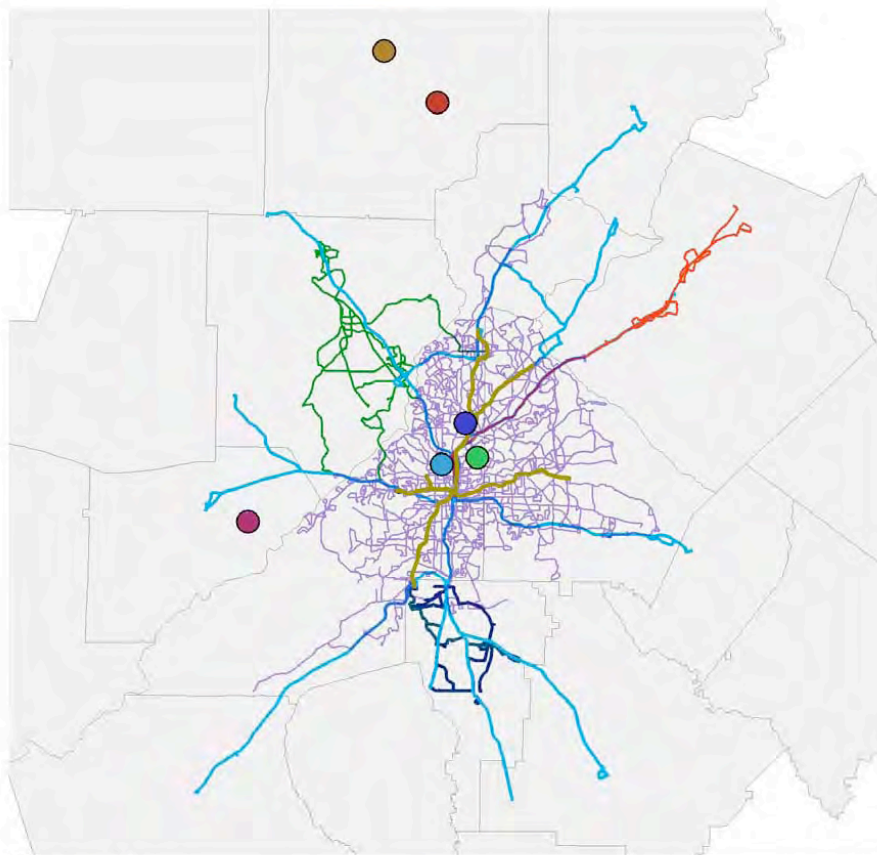
***Forecasted population growth between 2005 and 2030: about 56%***

# Transportation Challenges



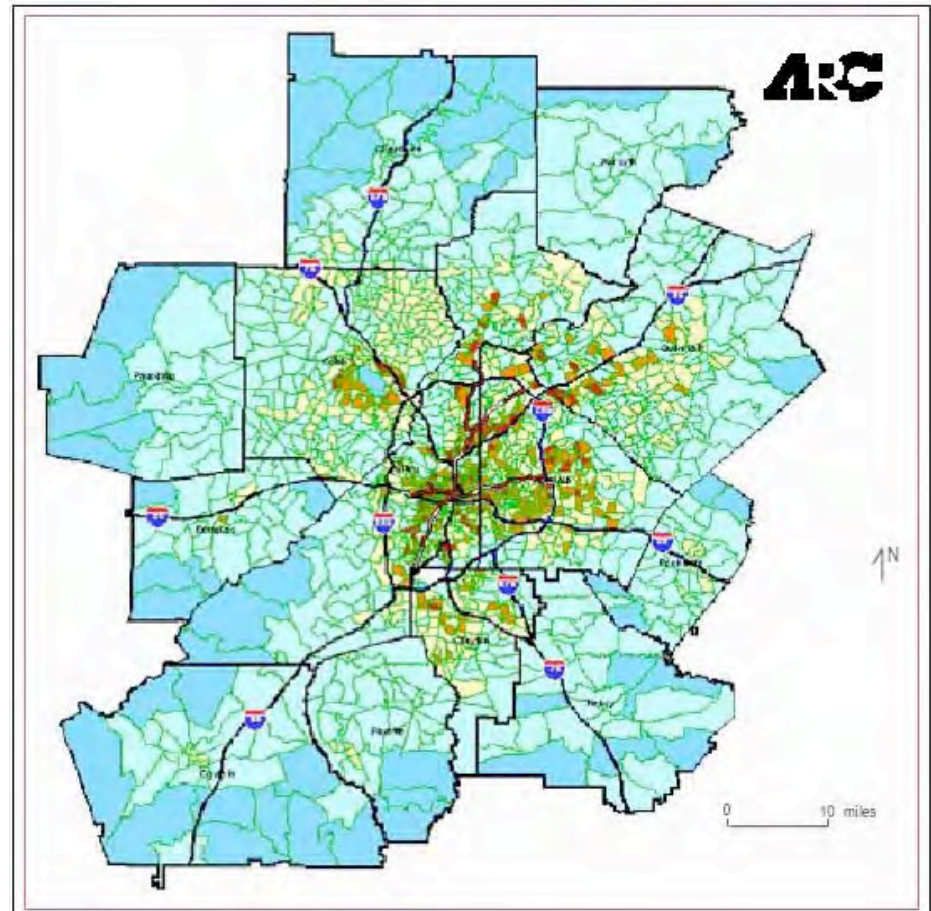
- **Money:**
  - Atlanta's commutes are costliest in U.S. A family with two commuters here can expect to pay more than \$4,500 at the gas pump.
  - Congestion costs each commuter \$1,100-\$1,600/year
- **Time:**
  - 60 hours/year wasted in traffic delays
- **Commuting Distance:**
  - Atlantans commute 100,000,000 miles/day = 200 RT to the moon per day!
- **Accidents:**
  - Total vehicle crashes in the Atlanta region increased almost 12%, from 173,000 crashes in 2000 to 194,000 in 2004.
- **Commerce:**
  - Atlanta region ranks fourth in the nation in warehouse inventory, a major contributor to the truck traffic on the region's transportation system.
- **Health:**
  - Atlanta Named 2007 "Asthma Capital" by Asthma and Allergy Foundation of America: Atlanta is the worst U.S. city to live in for asthma sufferers. Atlanta earns its "worst" score from the city's high asthma death rate, high pollen levels, and severe air pollution

# Existing Transit Service and Propensity



## Legend

- |  |   |
|--|---|
|  MARTA Rail Lines       |  BUCK                    |
|  MARTA Local Bus Routes |  CATS                    |
|  Gwinnett Express Bus   |  CCTMA                   |
|  GRTA Express Bus       |  City of Canton          |
|  C-Tran Routes          |  Douglas County Van Pool |
|  CCT Bus Routes         |  GA Tech Trolley         |



## Transit Propensity

- |   |
|---|
|  Very Low  |
|  Low       |
|  Average   |
|  High      |
|  Very High |

# “Public” Transportation Challenges

## Issues:

- How to get to transportation
- Convenience
- Time
- Safety

Ridership is low,  
but rising

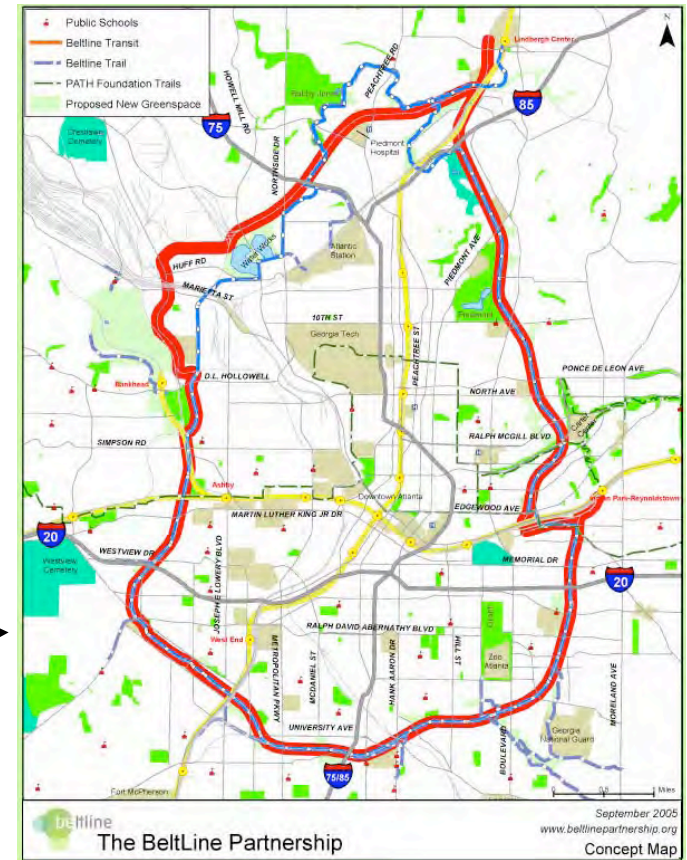
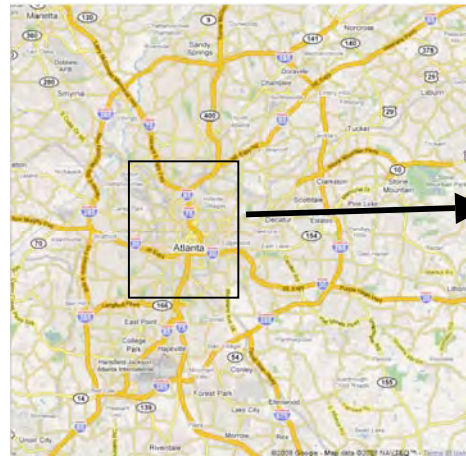


Access Mode	MARTA		CCT	Gwinnett/ Clayton	Total
	Bus	Rail			
Walked	92,588 67%	33,173 41%	4,838 55%	112 33%	130,711 57%
Bicycle	728 1%	600 1%	66 1%	2 1%	1,396 1%
Rode with someone who parked	2,046 1%	2,494 3%	79 1%	6 2%	4,625 2%
Shuttle\Vanpool	1,215 1%	1,201 1%	54 1%	2 1%	2,472 1%
Taxi	1,185 1%	1,205 1%	282 3%	3 1%	2,675 1%
Drove a car and parked	2,357 2%	25,219 31%	577 7%	109 32%	28,262 12%
Transferred from bus	12,875 9%	7,138 9%	903 10%	26 8%	20,942 9%
Was dropped off by someone	6,281 5%	7,420 9%	994 11%	27 8%	14,722 6%
Transferred from MARTA rail	18,621 14%	2,454 3%	1,009 11%	53 16%	22,137 10%
<b>Total</b>	<b>137,896</b> <b>100%</b>	<b>80,904</b> <b>100%</b>	<b>8,802</b> <b>100%</b>	<b>340</b> <b>100%</b>	<b>227,942</b> <b>100%</b>

# Changing Times and Opportunities



- The Beltline
- The Golden Mile on Peachtree
- Light Rail connections with Athens, Macon, etc.
- MARTA expansions
- Armour Yard project
- ...



# Citizen Groups are becoming active...

## Inner Core DMU: Conceptual Overview



## VISUALIZE WORLD-CLASS TRANSIT IN ATLANTA



*But what makes the most sense?*



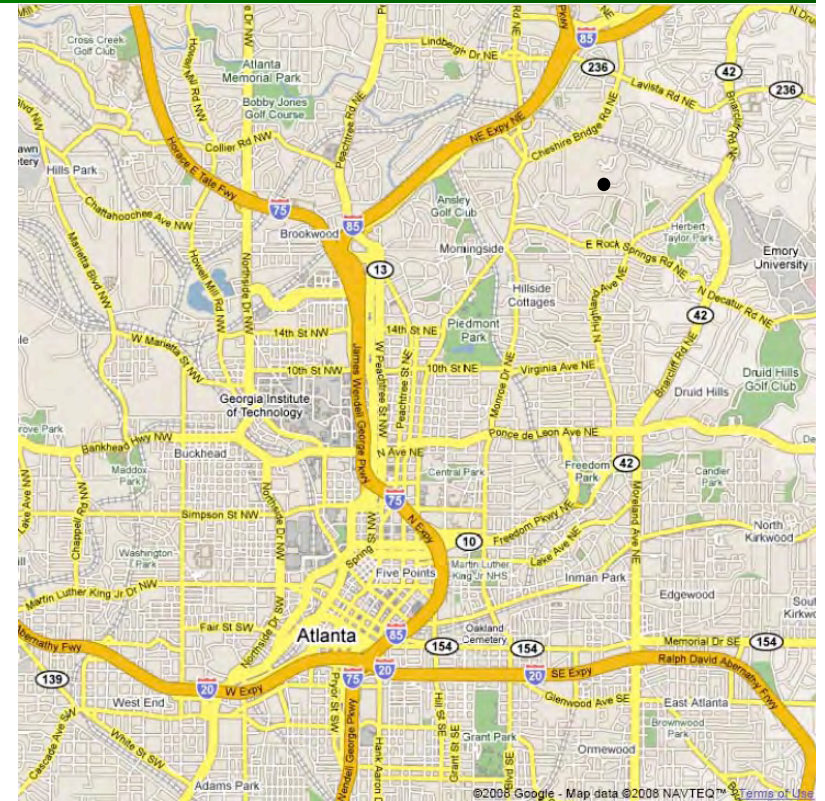
Promotional graphic produced by the Colorado Railcar Co.

The Inner Core DMU proposal is a compelling concept for quality transit service on the C-Loop rail corridor that also provides MARTA connectivity to the BeltLine. The project would take advantage of new "diesel multiple unit" (DMU) rail vehicles – a recent advance in transit technology that allows for high-frequency urban rail service on existing railroad corridors. Several critical transit mobility needs would be addressed, including reliable connections to the Emory/CDC area, rail access to the west side of downtown Atlanta, and a new intermodal station serving Maynard H. Jackson International Terminal on the east side of H-JAIA.



# Stakeholder Meetings Needed

- **Government**
  - Governor’s Congestion Mitigation Taskforce
  - City of Atlanta – Mayor’s Office
- **NGOs**
  - Atlanta Regional Commission
  - Livable Communities Coalition
  - Clean Air Campaign
  - Midtown Alliance
  - Central Atlanta Progress
- **Chamber of Commerce**
- **Educational Institutions**
  - Georgia Tech/Georgia State/Emory
    - GT Stinger & Trolley shuttle route - NextBus
    - Emory-CDC Cliff shuttle route
- **Employers**
  - Coca-Cola
  - Home Depot
  - Delta
- **Main Atlanta transit organizations**
  - MARTA – serves Fulton and DeKalb counties through bus/rail system
  - C-tran - serves Clayton County, linking to MARTA rail service at the airport station
  - Gwinnett County Transit - Express buses on 6 routes that use HOV lanes on I-85 with drop off and pick up at MARTA Five Points and Arts Center Stations
  - Xpress - Serves 12 metro-Atlanta counties
  - The buc - Free shuttle service to employees, visitors and residents of the Buckhead area
  - CCT, Cobb Community Transit - Bus system that serves Cobb County, linking to MARTA at Arts Center Station, the Dunwoody Station and the Holmes Station
  - Railroads (Norfolk Southern, CSX, etc)



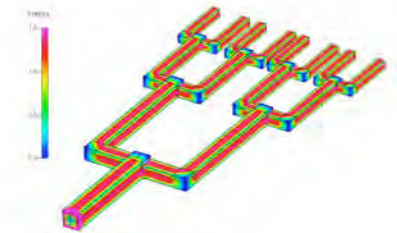
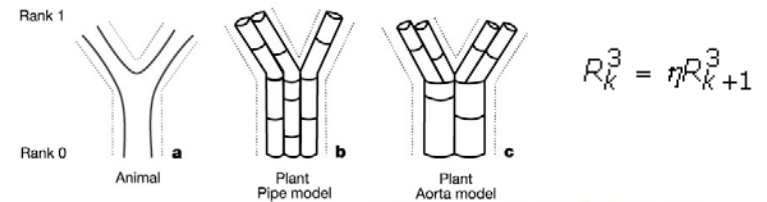
# Shifting Gears: What can Nature teach us?

- Nature has been sustainable for a long time.
- What can we learn from past & present biological systems?
  - Including extinct systems...
- Can we derive design guidelines from Nature that will result in inherently sustainable mobility systems?



# Areas for Bio-Inspiration (1)

- **Network Scaling Properties in Biological Systems**
  - Physical properties of the vascular (fluid transport) system of plants and animals have well known relationships to organism size (Murray's Law)
- **Signaling and Self-Organization in Biological Systems**
  - Biological systems are self organizing, and emphasize distributed decision making based on local control and information feedback.
  - Signaling processes lead to feed-back loops that cause changes in organism behavior (e.g., ant column formations), which frequently lead to environmental modulation of signaling that further reinforces particular behavioral patterns (e.g., trail formation).



# Areas for Bio-Inspiration (2)

- **Structural Food Web Analyses (May, Pimm, Odum)**

- Mobility options (cars, buses, etc) can be thought of as consumers that require fuel and/or passengers as “food”
- Extensive biological and ecological literature exists on food webs, species, and their interactions
- Limitations in feeding periods caused by environmental fluctuations lead organisms to depend upon intermittent, intense feedings. Organisms specialize on certain resources because they must take advantage of these fluctuations. This suggests a rational structure contingent on the stability of resources (fuels).

- **Mutualistic Behavior and Networks (e.g., Bascompte et al)**

- Individuals of two different species provide resources for one another to derive a benefit, e.g., increased survivorship (e.g., pollination)
- Major properties are:
  - Heterogeneity – most species in a network have few interactions but some have many (a homogenous network would have roughly the same number of interactions per species)
  - Nesting – specialized species interact with a small subset which interacts with a more general set which, in turn, interacts with a still more general subset forming a box-in-box pattern of interactions
  - Weak asymmetric links – Most species are not strongly dependent; when strong dependences occur, they are one-sided arrangements with one species depending far more on the other than vice versa.
- Certain mobility options (trains, planes) have a mutualistic association with other options (taxis, buses), but each option competes with others in that class (planes and rail both compete for passengers) .

# Areas for Bio-Inspiration (3)

- **Succession Principles (e.g., Clements, Gleason, Odum)**
  - Climax ecosystems and those moving toward climax exhibit different dimensional values than pioneer (early stage) ecosystems. It may be possible to classify different types of fuel and mobility systems as pioneer, transitional or climax based on Odum's succession trends.
  - An intriguing question is whether biological succession principles could be a scientific basis for [policies](#) aimed at promoting and implementing new mobility infrastructures and technologies.

#	Area of Study	Succession Trend
1	Energetics	Biomass, inorganic detritus both increase
2		Gross production increase in primary
3		Net production decreases
4		Respiration increases
5		Production to respiration ratio moves toward unity
6		Biomass to production ratio increases
7	Nutrient Cycling	Element cycles increasingly closed
8		Increasing turnover time and storage of essential materials
9		Cycling ratio increases
10		Nutrient retention and conservation increases
11	Species and Community Structure	Species composition changes
12		Diversity-richness increases
13		Diversity-evenness increases
14		r-strategists replaced by K-strategists
15		Life cycles increase in length and complexity
16		Organism size and offspring size increase
17	Mutualistic symbiosis increases	
18	Stability	Resistance increases
19		Resilience decreases
20	Overall Strategy	Increase efficiency of energy and nutrient utilization

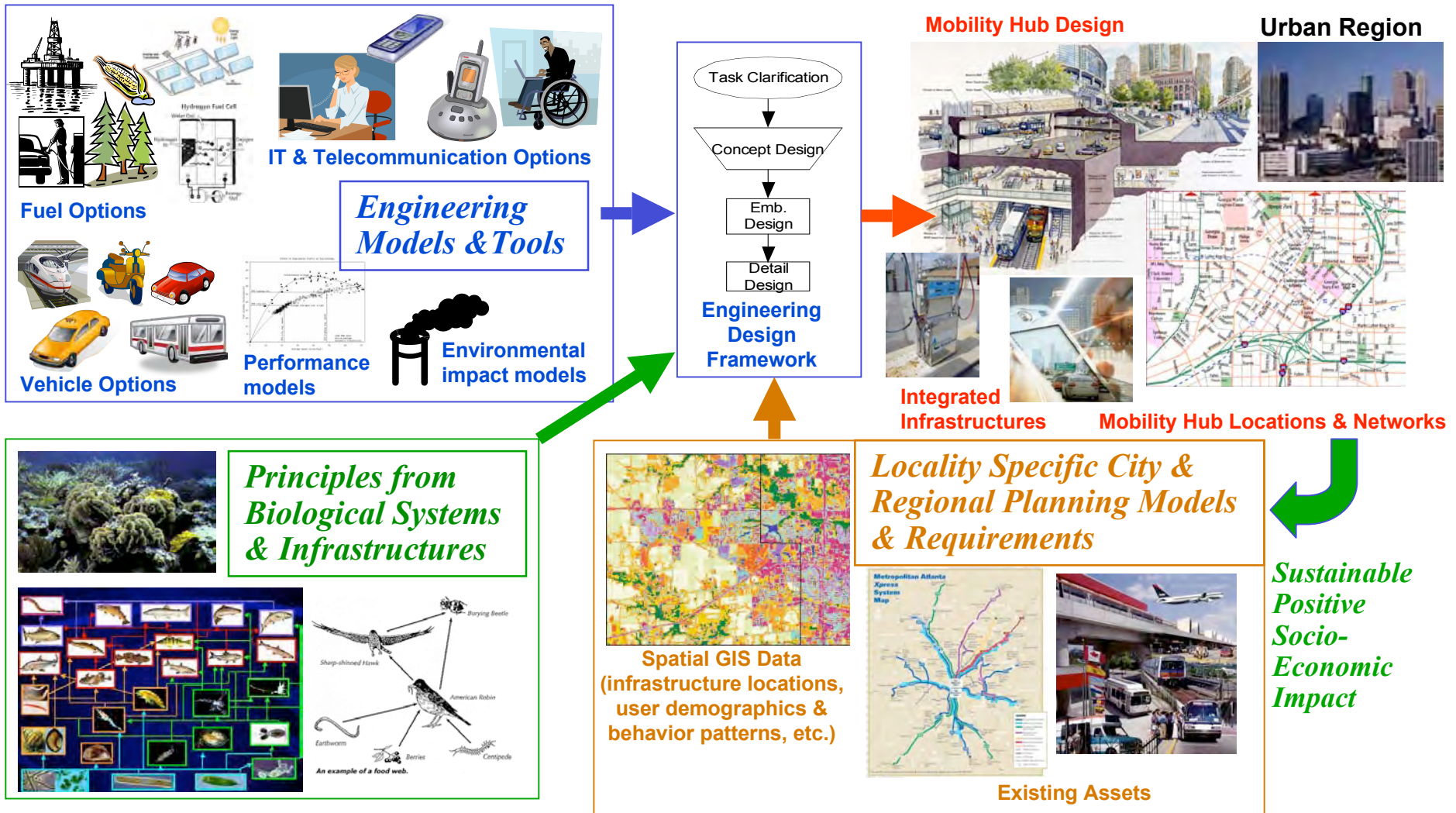
Of course, all within limits...



Nature also has traffic jams  
and some species would prefer  
better mobility too...



# In Summary: A Picture of our Research



# Jacoby eyes MARTA rail to Ford site

Atlanta Business Chronicle - Friday, June 6, 2008



**Like Atlanta has done  
before, new growth  
arises out of ashes**

## Thank you!

- Jacoby Development Inc. is talking to regional transit officials about expanding MARTA rail service into Hapeville, where Jacoby plans a mixed-use redevelopment at the former Ford plant.
- Jacoby -- which has the Ford plant under contract and is close to closing on the 122-acre property, according to a source with direct knowledge of the process -- met with MARTA during the past few weeks.
- While Jacoby was already planning to run shuttle buses from the development to nearby Hartsfield-Jackson Atlanta International Airport, and the project does not hinge on new MARTA rail lines, preliminary discussions about taking MARTA into Hapeville could foreshadow a bigger real estate trend.
- **Developers, taking notice of record-high gas prices, are seeing the stars align for more transit-oriented developments near existing or potential MARTA lines.**