AN INTRODUCTION TO
INTELLIGENT TRANSPORTATION SYSTEMS

1.212

SPRING 2005

Professor Joseph M. Sussman

Mon/Wed 2:30 -4:00

BLOCK 1

(Lectures 2, 3)

INTRODUCTION TO ITS

Basic Concepts

Continued

SPEAKER: Joseph M. Sussman
MIT

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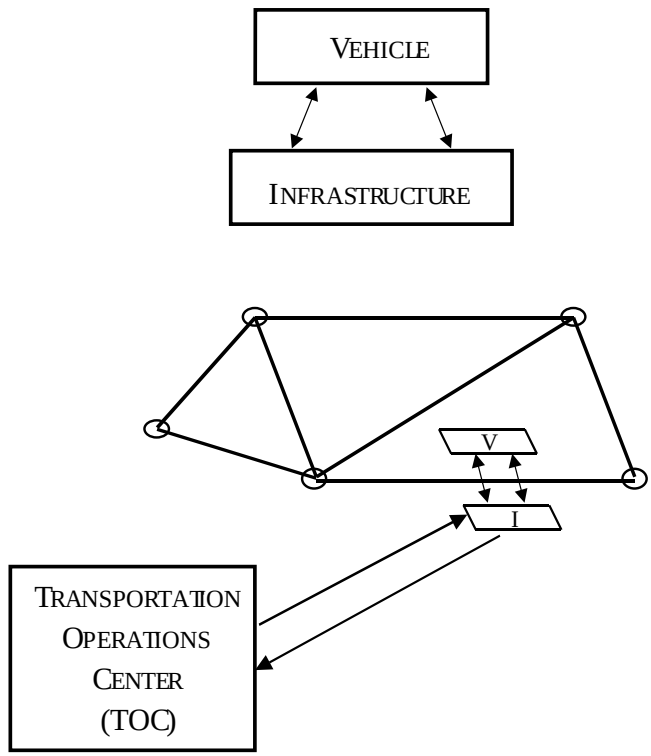
INSTITUTIONAL ISSUES

- Privacy/enforcement
- Anti-trust
- Who is in Charge?
  - Public/Private Partnership
- International Cooperation
- Tort Liability
- Procurement
- Marketplace

INSTITUTIONAL ISSUES

- Interagency Coordination and Cooperation
  - Metropolitan Area Traffic Management
  - Federal and State Departments and Agencies
- Adaptation of Existing Posers and Organizational Forms
- Collaborative vs. Adversarial Approaches
- Public/Private Partnership Agreements

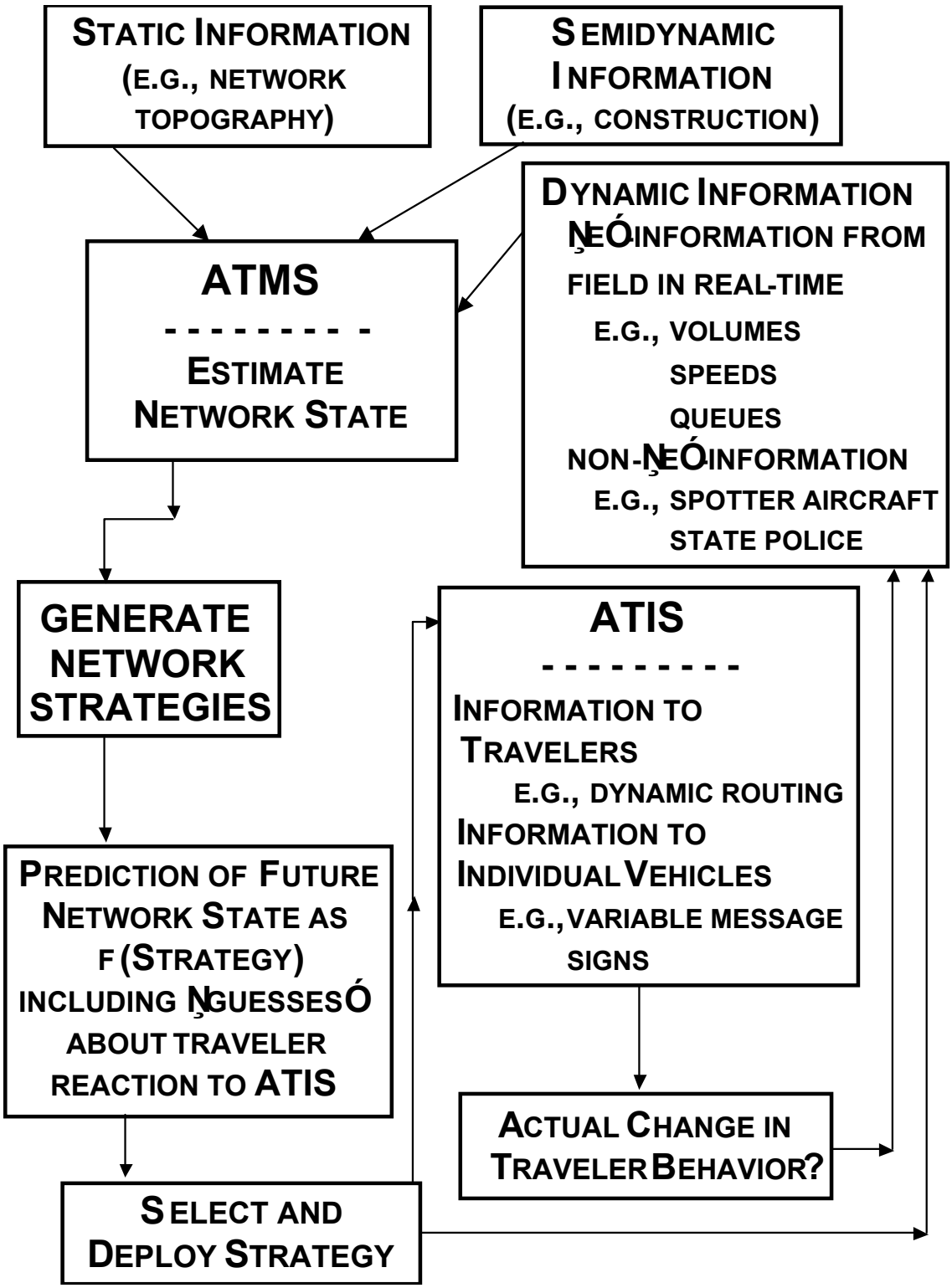
INTELLIGENT TRANSPORTATION SYSTEMS (ITS)



ATMS - - ADVANCED TRANSPORTATION MANAGEMENT SYSTEM
(OPERATOR)

ATIS - - ADVANCED TRAVELER INFORMATION SYSTEM
(CUSTOMER)

DISCUSSION: What specific actions can ATMS take to improve network performance?


STATIC INFORMATION
(E.G., NETWORK TOPOGRAPHY)
SEMIDYNAMIC INFORMATION
(E.G., CONSTRUCTION)
DYNAMIC INFORMATION
ŅEÓ INFORMATION FROM FIELD IN REAL-TIME
E.G., VOLUMES
SPEEDS
QUEUES
NON-ŅEÓ INFORMATION
E.G., SPOTTER AIRCRAFT
STATE POLICE
ATMS
- - - - - - - - -
ESTIMATE NETWORK STATE
GENERATE NETWORK STRATEGIES
ATIS
- - - - - - - - -
INFORMATION TO TRAVELERS
E.G., DYNAMIC ROUTING
INFORMATION TO INDIVIDUAL VEHICLES
E.G., VARIABLE MESSAGE SIGNS
PREDICTION OF FUTURE NETWORK STATE AS
F (STRATEGY)
INCLUDING ŅGUESSESÓ ABOUT TRAVELER REACTION TO ATIS
ACTUAL CHANGE IN TRAVELER BEHAVIOR?
SELECT AND DEPLOY STRATEGY

ITS Subsystems

ATMS	Advanced Transportation Management Systems	Network management, including incident management, traffic light control, electronic toll collection, congestion prediction and congestion-ameliorating strategies.
ATIS	Advanced Traveler Information Systems	Information provided to travelers pre-trip and during the trip in the vehicle. ATMS helps provide real-time network information.
AVCS	Advanced Vehicle Control Systems	A set of technologies designed to enhance driver control and vehicle safety. This ranges up to Automated Highway Systems (AHS), where the driver cedes all control to the system.

ITS Subsystems (Continued)

CVO	Commercial Vehicle Operations	Technologies to enhance commercial fleet productivity, including weigh-in-motion (WIM), pre-clearance procedures, electronic log books, interstate coordination.
APTS	Advanced Public Transportation Systems	Passenger information and technologies to enhance system operations, including fare collection, intramodal and intermodal transfers, scheduling, headway control.
ARTS	Advanced Rural Transportation Systems	Mostly safety and security technologies (e.g., May-day) for travel in sparsely-settled areas.

TRANSPORTATION AND CHANGE

Our transportation system provides fundamental and basic services to society, and has done so for thousands of years.

- However, as we begin the 21st century, the field is subject to many changes.
- These transitions occur on the dimensions of technology, systems and institutions and characterize the field in its broadest sense.

TRANSITIONS

- What are these transitions?
- What do they mean for the education of the “New Transportation Professional”?

CLIOS

Complex
Large-scale
Integrated
Open
Systems

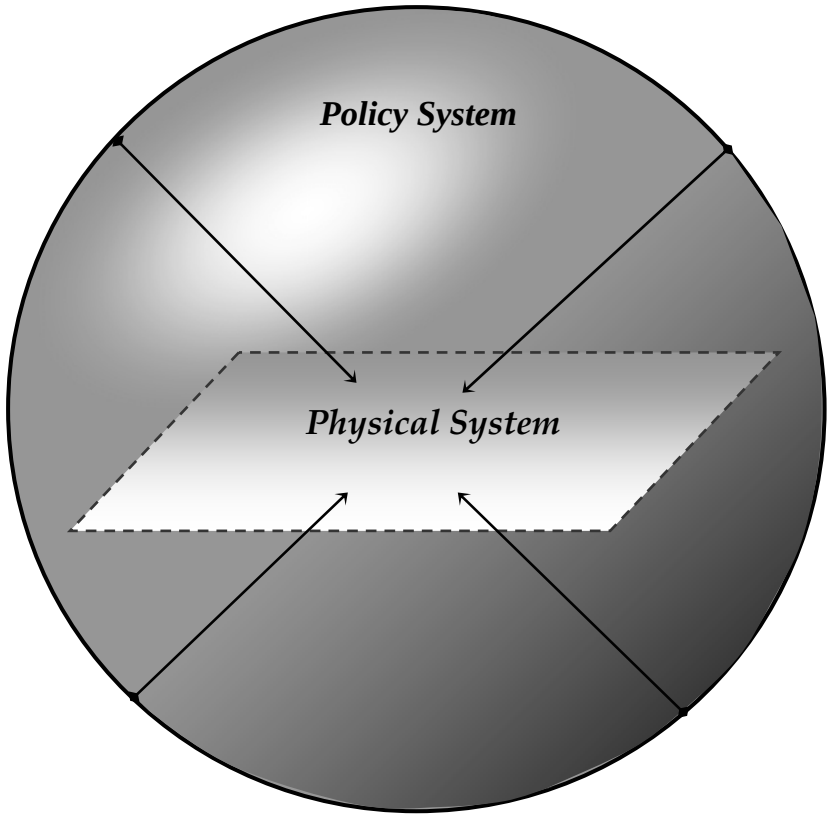
COMPLEXITY

Complexity as in CLIOS

(Sussman, “The New Transportation Faculty: The Evolution to Engineering Systems”, *Transportation Quarterly*, Summer 1999):

- A system is *complex* when it is composed of a group of related units (subsystems), for which the degree and nature of the relationships is imperfectly known. Its overall behavior is difficult to predict, even when subsystem behavior is readily predictable. Further, the time-scales of various subsystems may be very different (as we can see in transportation -- land-use changes, for example, vs. operating decisions).

NESTED COMPLEXITY



SUMMARY OF TRANSITIONS

	FROM		TO
1.	CAPITAL PLANNING	→	MANAGEMENT AND OPERATIONS FOCUS
2.	LONG TIMEFRAMES	→	REAL-TIME CONTROL
3.	URBAN SCALE PLANNING AND OPERATIONS	→	REGIONAL SCALE PLANNING AND OPERATIONS
4.	EMPHASIS ON MOBILITY	→	EMPHASIS ON ACCESSIBILITY (THE TRANSPORTATION / LAND-USE CONNECTION)
5.	"ONE SIZE FITS ALL" SERVICE	→	CUSTOMER ORIENTATION
		→	QUALITY
		→	PRICING FOR SERVICE

	FROM		TO
6.	ALLOCATE CAPACITY BY QUEUING	→	ALLOCATE CAPACITY BY PRICING
7.	AGGREGATE METHODS FOR DEMAND PREDICTION	→	DISAGGREGATE METHODS FOR DEMAND PREDICTION
8.	EPISODIC DATA FOR INVESTMENT PLANNING	→	DYNAMIC DATA FOR INVESTMENT PLANNING (AND OPERATIONS)
9.	PUBLIC FINANCING FOR INFRASTRUCTURE AND OPERATIONS	→	PRIVATE AND PUBLIC/ PRIVATE PARTNERSHIPS FOR FINANCING OF INFRASTRUCTURE AND OPERATIONS USING HYBRID RETURN ON INVESTMENT MEASURES
10.	INFRASTRUCTURE CONSTRUCTION AND MAINTENANCE PROVIDERS	→	NEW HIGH-TECHNOLOGY PLAYERS

	FROM		TO
11.	STATIC ORGANIZATIONS AND INSTITUTIONAL RELATIONSHIPS	→	DYNAMIC ORGANIZATIONS AND INSTITUTIONAL RELATIONSHIPS
12.	PROFESSIONAL EMPHASIS ON DESIGN OF PHYSICAL INFRASTRUCTURE	→	PROFESSIONAL EMPHASIS ON TRANSPORTATION AS A COMPLEX, LARGE-SCALE, INTEGRATED, OPEN SYSTEM (CLIOS)
13.	ECONOMIC DEVELOPMENT	→	SUSTAINABLE DEVELOPMENT
14.	COMPUTERS ARE "JUST A TOOL"	→	UBIQUITOUS COMPUTING

15.	FROM	TO	AND ON TO
	SUPPLY-SIDE PERSPECTIVE →	SUPPLY/DEMAND EQUILIBRIUM FRAMEWORK →	SYSTEMS THAT NEVER REACH EQUILIBRIUM

	FROM		TO
16.	INDEPENDENT CONVENTIONAL INFRASTRUCTURE PROJECTS	→	LINKED ADVANCED INFRASTRUCTURE PROJECTS REQUIRING A SYSTEM ARCHITECTURE
17.	VEHICLES AND INFRASTRUCTURE AS INDEPENDENT	→	VEHICLES AND INFRASTRUCTURE AS ELECTRONICALLY LINKED
18.	REDUCING CONSEQUENCES OF CRASHES	→	CRASH AVOIDANCE

19.	FROM	TO	AND ON TO
	MODAL PERSPECTIVE →	INTERMODAL PERSPECTIVE →	SUPPLY CHAIN MANAGEMENT

20.	NARROW TRANSPORTATION SPECIALISTS	→	THE NEW TRANSPORTATION PROFESSIONAL

Change and the Interstate

- Expansion of trucking industry; financial blow to railroads; deregulation
- “Unprecedented and Unequaled Mobility”; regional transportation concept; MPOs
- New urban structures; edge cities
- Post WWII economic expansion
- “Stop the highway” backlash; build vs .no-build factions

Change and ITS

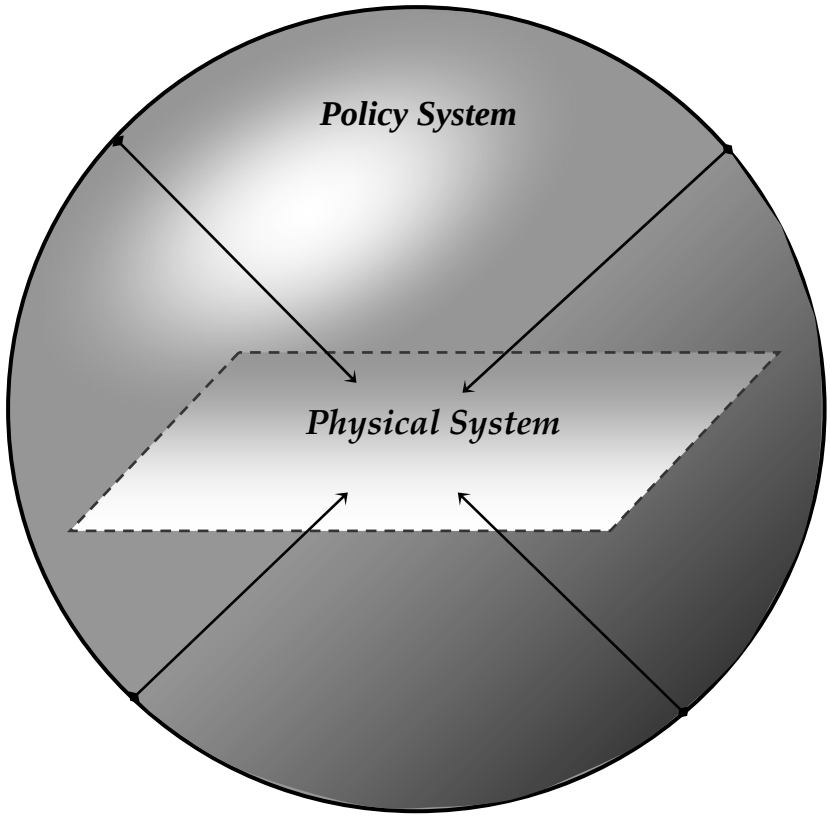
- Reinvention of logistics.
- New transportation players
- Changes in academia.
- New public sector partnerships at regional scale
- New public/private partnerships

Regional Deployment: A Strategic Vision (Sussman)

"*The strategic vision for ITS, then, is as the integrator of transportation, communications, and intermodalism on a regional scale.*"

Quite different than the 1991 Strategic Plan vision!

NESTED COMPLEXITY



THE T-SHAPED TRANSPORTATION PROFESSIONAL