AN INTRODUCTION TO
INTELLIGENT TRANSPORTATION SYSTEMS

1.212
SPRING 2003

Professor Joseph M. Sussman

Mon/Wed 2:30 - 4:00

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BLOCK 1

(Lectures 1, 2)

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)

DISCUSSION: What specific actions can ATMS take to improve network performance?
STATIC INFORMATION (E.G., NETWORK TOPOGRAPHY)

SEMIDYNAMIC INFORMATION (E.G., CONSTRUCTION)

DYNAMIC INFORMATION NEÓ INFORMATION FROM FIELD IN REAL-TIME E.G., VOLUMES SPEEDS QUEUES NON-NEÓ INFORMATION E.G., SPOTTER AIRCRAFT STATE POLICE

ATMS

- - - - - - - - E.G., VOLUMES ESTIMATE SPEEDS NETWORK STATE QUEUES

- - - - - - - - E.G., SPOTTER AIRCRAFT STATE POLICE

GENERATE NETWORK STRATEGIES

PREDICTION OF FUTURE NETWORK STATE AS F (STRATEGY) INCLUDING NGUESSESÓ ABOUT TRAVELER REACTION TO ATIS

SELECT AND DEPLOY STRATEGY

ATIS

- - - - - - - - INFORMATION TO TRAVELERS E.G., DYNAMIC ROUTING INFORMATION TO INDIVIDUAL VEHICLES E.G., VARIABLE MESSAGE SIGNS

ACTUAL CHANGE IN TRAVELER BEHAVIOR?
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

• 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

Policy System

Physical System
## SUMMARY OF TRANSITIONS

<table>
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<th>From</th>
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<td>1. <strong>CAPITAL PLANNING</strong></td>
<td><strong>MANAGEMENT AND OPERATIONS</strong>&lt;br&gt;<strong>FOCUS</strong></td>
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<td>2. <strong>LONG TIMEFRAMES</strong></td>
<td><strong>REAL-TIME CONTROL</strong></td>
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<td>3. <strong>URBAN SCALE PLANNING AND OPERATIONS</strong></td>
<td><strong>REGIONAL SCALE PLANNING AND OPERATIONS</strong></td>
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<td>4. <strong>EMPHASIS ON MOBILITY</strong></td>
<td><strong>EMPHASIS ON ACCESSIBILITY</strong>&lt;br&gt;(<strong>THE TRANSPORTATION / LAND-USE CONNECTION</strong>)</td>
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<td>5. <strong>“ONE SIZE FITS ALL” SERVICE</strong></td>
<td><strong>CUSTOMER ORIENTATION</strong>&lt;br&gt;<strong>QUALITY</strong>&lt;br&gt;<strong>PRICING FOR SERVICE</strong></td>
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<td>FROM</td>
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<td>6. <strong>ALLOCATE CAPACITY BY QUEUING</strong></td>
<td><strong>ALLOCATE CAPACITY BY PRICING</strong></td>
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<td>7. <strong>AGGREGATE METHODS FOR DEMAND PREDICTION</strong></td>
<td><strong>DISAGGREGATE METHODS FOR DEMAND PREDICTION</strong></td>
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<td>8. <strong>EPISODIC DATA FOR INVESTMENT PLANNING</strong></td>
<td><strong>DYNAMIC DATA FOR INVESTMENT PLANNING (AND OPERATIONS)</strong></td>
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<td>9. <strong>PUBLIC FINANCING FOR INFRASTRUCTURE AND OPERATIONS</strong></td>
<td><strong>PRIVATE AND PUBLIC/PRIVATE PARTNERSHIPS FOR FINANCING INFRASTRUCTURE AND OPERATIONS USING HYBRID RETURN ON INVESTMENT MEASURES</strong></td>
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<td>10. <strong>INFRASTRUCTURE CONSTRUCTION AND MAINTENANCE PROVIDERS</strong></td>
<td><strong>NEW HIGH-TECHNOLOGY PLAYERS</strong></td>
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<td><strong>11.</strong> STATIC ORGANIZATIONS AND INSTITUTIONAL RELATIONSHIPS</td>
<td>DYNAMIC ORGANIZATIONS AND INSTITUTIONAL RELATIONSHIPS</td>
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<td><strong>12.</strong> PROFESSIONAL EMPHASIS ON DESIGN OF PHYSICAL INFRASTRUCTURE</td>
<td>PROFESSIONAL EMPHASIS ON TRANSPORTATION AS A COMPLEX, LARGE-SCALE, INTEGRATED, OPEN SYSTEM (CLIOS)</td>
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<td><strong>13.</strong> ECONOMIC DEVELOPMENT</td>
<td>SUSTAINABLE DEVELOPMENT</td>
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<td><strong>14.</strong> COMPUTERS ARE “JUST A TOOL”</td>
<td>UBIQUITOUS COMPUTING</td>
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<td><strong>15.</strong> FROM SUPPLY-SIDE PERSPECTIVE</td>
<td>TO SUPPLY/D EMAND EQUILIBRIUM FRAMEWORK</td>
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16. FROM INDEPENDENT CONVENTIONAL INFRASTRUCTURE PROJECTS TO LINKED ADVANCED INFRASTRUCTURE PROJECTS REQUIRING A SYSTEM ARCHITECTURE

17. FROM VEHICLES AND INFRASTRUCTURE AS INDEPENDENT TO VEHICLES AND INFRASTRUCTURE AS ELECTRONICALLY LINKED

18. FROM REDUCING CONSEQUENCES OF CRASHES TO CRASH AVOIDANCE

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

20. FROM NARROW TRANSPORTATION SPECIALISTS TO THE NEW TRANSPORTATION PROFESSIONAL
NESTED COMPLEXITY

Policy System

Physical System
THE T-SHAPED TRANSPORTATION PROFESSIONAL

Breadth in:

- Transportation Fundamentals
- Technology
- Systems
- Institutions

In-depth knowledge within a transportation specialty.