MASSACHUSETTS INSTITUTE OF TECHNOLOGY
ESD.04/1.041J

Frameworks and Models in Engineering Systems (FAMES)
Spring 2006

In-class Midterm Exam

Open Book and Open Notes

Instructor: Prof. Joseph Sussman

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100 points total

This exam deals with the New York Times article dated March 20th, 2006 entitled "Oil Spill Raises Concerns on Pipeline Maintenance." The associated questions are designed to allow you to demonstrate your understanding of CLIOS Systems, and how one thinks about them. And as you already know, there is no one right answer. So read the article carefully and dive in!

The CLIOS System we are concerned about deals with *the transportation of oil in Alaska*. The article gives you a lot of background, but you should feel free to draw upon your own broader understanding of the issues surrounding this CLIOS System. (You do know something about energy now!). Of course, as you know from class, your CLIOS System may have other "smaller" CLIOS Systems within it and may exist within the context of larger CLIOS Systems as well. You should feel free to explain both those inward and outward connections as you answer this question.

1. First, prepare the three CLIOS process checklists—characteristics (10 items, maximum); opportunities/ issues/ challenges (5 items maximum); preliminary CLIOS System goals (5 items maximum). (20 points)

2. Identify the subsystems of your CLIOS System in the physical domain and then draw *one* of the subsystem diagrams (your choice, of course). To give you a sense of scale, 12 components is about right. We provide a blank sheet in the back to give you more space to draw the CLIOS diagram. (20 points)

3. Identify the major actor groups for your CLIOS System. And then, identify the actors. Here especially, we suggest you think about the larger CLIOS Systems in which your CLIOS System is embedded. (10 points)

4. We have spent time in class discussing both nested complexity and evaluative complexity as characteristics of the Complex Large-Scale Interconnected Open Socio-Technical systems with which we deal. Describe how these two concepts (nested complexity and evaluative complexity) appear in your CLIOS System. Here again, we would suggest taking a broad view in responding to this part of the question. (10 points)

5. "*Uncertainty is everywhere; deal with it*" has been a touchstone of this class so far. There are a number of uncertainties prevalent in this CLIOS System. Please identify what you think are the three most important ones and discuss briefly—about 1/4 page maximum for each. (10 points)

6. We now ask you to identify strategic alternatives for improving the performance of your CLIOS System. We ask you to think creatively and broadly about these strategic alternatives. One can certainly imagine strategic alternatives concerned with technology development, operating policies, changes on the institutional sphere, and so forth. Please identify up to eight strategic alternatives and provide us with a sentence or so describing each. Then describe the three you consider most interesting in no more than 1/2 page. (20 points)

7. Finally, you, as a one-person consulting firm, are bidding on a contract to design a pipeline inspection strategy for BP Exploration Alaska. Please list up to five performance measures you believe are appropriate. (10 points)

CLIOS DIAGRAM SUBSYSTEM: _____
NAME: _____