

# Guided Study Program in System Dynamics

System Dynamics in Education Project

System Dynamics Group

MIT Sloan School of Management<sup>1</sup>

## Assignment #16

Assigned on: Friday, January 29, 1999

Due by: Monday, February 15, 1999  
12:00 PM (Noon)<sup>2</sup>

WE WILL REVIEW THE RESPONSES ON MONDAY  
AFTERNOONS, BOSTON TIME.

LATE SUBMISSIONS WILL NOT RECEIVE FULL  
ATTENTION.

*Please email assignment solutions, questions, or comments to:*

*[gsp@sysdyn.mit.edu](mailto:gsp@sysdyn.mit.edu)*

*Save solutions with the filename XYZ-S16.doc*

*(where XYZ are your initials)*

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## Reading Assignment:

Please refer to Road Maps 8: A Guide to Learning System Dynamics (D-4508-1) and read the following paper from Road Maps 8:

- Building a System Dynamics Model Part One: Conceptualization, by Stephanie Albin (D-4597)

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<sup>2</sup> The deadline is in United States Eastern Time, equivalent to Greenwich Mean Time minus 4 hours during US daylight savings time, and Greenwich Mean Time minus 5 hours for the rest of the year.

## **Exercises:**

In this assignment you will conceptualize two systems, following the steps illustrated in D-4597. For each excerpt, you should turn in:

- Definition of the problem, in one or two sentences.
- Purpose of the model and the model audience.
- Endogenous and exogenous components of the model and an explanation of why you chose those components. Identify which elements are stocks and which ones are flows.
- Description of reference modes for the most important variables in the system. You should particularly pay attention to the causal relationships between the reference modes. You may include graphs of the reference modes created in a graphics application, or you may turn in graphs by fax at (617)-258-9405. Please make sure your name appears at the top of each page you fax to us.
- Hypothesis for the dynamics of the model behavior
- Stock and flow diagram of the basic mechanism

### **Excerpt 1**<sup>3</sup>

The debate over Russia's pension system is similar to a debate now underway in the United States, where many conservatives want to supplement or replace parts of Social Security with a system of individual accounts. But Russia's huge number of retirees and shaky economy make the problem far more difficult.

Russia has what economists call a pay-as-you-go approach. That means the benefits of current retirees are paid by the current work force. But decades of Soviet planning have led to a financially strapped system, which gives too little to too many.

The problems are legion, one of the biggest being early retirement age. Russian men customarily retire at 60 and women at 55, years before people in most Western nations. Almost one-fifth of Russia's workers retire at even younger ages. They include coal miners, who have endured a lifetime of dangerous labor, as well as workers whose jobs are neither especially stressful nor hazardous.

Even allowing for lower-than-average life spans, Russia's retirement policies have created an immense army of pensioners. Roughly 38 million Russians receive

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<sup>3</sup> Excerpt taken from "World Bank Vs. Reformers on How to Still Feed Russia When It's 64" by Michael R. Gordon, The New York Times, March 15, 1998.

pensions—about one for every two in the work force. In the United States, by contrast, the ratio is about one pensioner for every four workers.

The benefits are modest and provide little extra reward for especially dedicated or successful workers. The vast majority receive 300 rubles (about \$50) to 400 rubles (about \$67) a month.

The system is also chronically short of cash. Many Russian companies have simply ignored the 28 percent payroll tax that is supposed to go toward retirement. Workers pay a minuscule 1 percent of their income to the pension fund.

Russia has one advantage. The huge casualties it suffered during World War II depressed the birth rate, which means fewer men and women are expected to reach pension age between 2000 and 2007. That will give Russia a chance to get its house in order before the number of retirees begins to climb again.

### **Excerpt 2<sup>4</sup>**

Sydney, Australia — As if in some B-movie thriller, people here are raising a hue and cry about an alien predator that is spreading out of control across the land: a plague of millions of killer house cats run wild.

Interlopers on this isolated island continent like the settlers who brought them here 200 years ago, stray cats have multiplied through Australia's deserts, forests, and urban alleys, driving indigenous species to extinction as they go.

Without any natural enemies to keep them in check as on other continents, perhaps 12 million wild cats have been killing small creatures whose evolution has not taught them that cats are their enemy.

"I'm calling for the total eradication of cats in Australia," proclaimed Richard Evans, a member of parliament, putting the issue on the national agenda last October. Though he now says a cat-free continent may be beyond reach, Evans drew wide support with his proposal to kill all cats by the year 2020 by neutering pets and spreading fatal feline diseases in the wild.

The proposal recalls a partly successful attempt earlier in the century to eliminate rabbits, another species imported to Australia, with a virus popularly known as white blindness. By the thousands, dying rabbits staggered onto highways and were hit by cars, causing widespread alarm. The rabbits, however, were mostly a threat to crops. But with the perception that the survival of the native fauna is at stake, a hatred of cats has swept the nation, causing some cat owners to keep their pets at home to avoid cat-killing vigilantes.

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<sup>4</sup> Excerpt taken from "For Australia's Errant Cats, 9 Lives Might Not Be Enough" by Seth Mydans, The New York Times, January 28, 1997.

D-4748-1

Members of the Cat Protection Society have protested the anti-cat campaign and the Royal Society for Prevention of Cruelty to Animals called Evans's proposals “outrageous and unnecessary.”

Responsible pet ownership and government regulation can solve the problem better than mass killings, which only create a temporary dip in cat population, Hugh Wirth (RSPCA) said.