PROFESSOR: What struck me immediately on September 11th was the fact that-- at least as far as we know, there were no bombs involved in these attacks, and the energy that caused all this destruction was the energy, as John pointed out that's concentrated and held in the very systems that we rely on. And the terrorists did an unfortunately successful job of turning those systems in on themselves-- turning our systems in on themselves. And that's a striking fact in that it points to the sense, which has always been the case, that our own technologies are both potential saviors and potential tombs and potential weapons.

It's also quite striking the degree of engineering talent that went into this attack. At least several of the attackers themselves were engineers. I was struck to learn that Bin Laden himself was trained as a civil engineer and that his family comes out of the construction business. So it's natural, in a sense, that he thinks about buildings when he would think about attacks, and that's been proven in the embassy attacks in Africa as well.

I think that's an important fact for people at MIT to contemplate. In no way indicts the entire engineering profession, but one of the reasons this attack is so disturbing is that we at a place like MIT are not comfortable with the idea of cool calculation being turned toward these murderous ends. It's a similar issue that was raised during the Holocaust, it's a similar issue that was raised during the Vietnam War with the overuse of systems analysis in that context. That very fact, in a sense, puts a paradox into the way that we think about technology.

MIT, by its own definition in a way, is a place that seeks to improve science and technology for the betterment of humankind. In general, disasters like this blow a hole in our technological world. In this case, literally. The systems that we rely on every day, not just airliners and buildings, are revealed in ways that we don't see them ordinarily. And I can think of many of them, I'll list a few here, that are ordinarily just under our public radar screen. Of course, there are people on campus who think about these systems all the time.

So as we mentioned, air traffic, aircraft themselves, the air traffic control system, communication systems, cryptography. The security systems around the airport. General information, systems use of the internet, world wide web for planning. The emergency response system in New York City and in Washington in response to the Pentagon attack.

Of course, cell phones. Remarkable closing of the loop on the cell phones aboard one of the airliners, and there's a distinct possibility that the presence of either cell phones or seat back phones actually thwarted that effort. And strikingly, the language that's used on virtually all sides of the current discourse has to do with systems and networks.

I would remind you that the very language that people use to talk about the terrorists and Al Qaeda organizations is as networks with cells, connections, nodes, investigation systems, law enforcement systems, again, using the various information and other types of systems. Security systems to track the hijackers.

Some of these things we praise, obviously. Others of them are not as comforting for us, but truly, the way that this event opens up what Manuel Castells' called "The network society" is very revealing, and one of the unpleasant facts about it is that we are so dependent on these technological systems, and yet, by their very nature, they're flexible and open.

This is one of the reasons they're so successful. You can hop on an aircraft with an hour's worth of time and be across the coast. Ditto for other types of systems, and yet, their very flexibility and openness is partly what makes them vulnerable.

And in some sense, one of the prices we will always live with for our flexible, open, large-scale systems, which we use every day is the fact that these shadow or parasite systems, terrorist systems, drug dealing systems other types of nefarious systems will live on their underbelly, and in some way, we have to come to terms with that. Of course, the flexibility in this case was a great advantage. I think the flexibility of the systems-- the urban system in New York City-- is truly astonishing. Financial networks, electric power networks.

One day, I would love to do just a study of the way they rewired the entire Southern Manhattan electric grid in order to get the stock market up to speed. But these are the same kinds of concerns that make the Al Qaeda network difficult to target and difficult to remove, although there are some interesting ideas in the press being thrown around about how you deal with those kinds of networks. One more idea to close with is also the issue of symbolism in this story.

What's striking about-- as someone who thinks about symbolic technologies and the symbolic power of technology is the way that these two technologies at least, if not others, that we think of as symbolic of American or general technological life that would be the aircraft, which is-- for Americans, has often been a symbol of freedom, a symbol of speed, a symbol of release from worldly concerns was, again, turned in on itself. Also, aircraft being one of America's most proud industrial products, Boeing aircraft.

And ditto the World Trade Centers, of course, standing for capitalism, American capitalism, even global financial networks, and part of the reason that these attacks are so devastating to the American culture is because of that symbolic dimension. And yet, at the same time, there is no sense that this is a purely symbolic attack. These were very real technologies, real machines, real people died. Real families lost family members, and it points to the fact that what we consider symbolic and what we consider technological are increasingly difficult to disentangle, and that there always is a material element to what we choose to present as symbolic of our culture and that material element has two sides to it.