# Case Frontlines

Simulation-Based Engineering and Science (SBE&S).

## Competitiveness

### Competitiveness Frontline

#### 1. China can’t beat us at innovation – R and D, Chinese barriers and US leadership durable

Dieter Ernst, Senior Fellow, East-West Center, 6-15-11, [“China not an immediate threat to US tech leadership, expert tells Review Commission,” Testimony To the U.S.-China Economic and Security Review Commission Hearing on China’s Five Year Plan, Indigenous Innovation and Technology Transfers, and Outsourcing, http://www.eastwestcenter.org/news-center/east-west-wire/china-not-an-immediate-threat-to-us-tech-leadership-expert-tells-review-commission/] E. Liu

And yet the gap in innovation capacity persists, and China’s leadership is very conscious that the US retains a strong lead in R&D and per capita number of scientists and engineers (slide 11), and in patent applications (slides 12-14). A telling example is that no Chinese company is among the top 20 global R&D spenders in the IT industry (slide 15)[11]. According to WIPO, China owns just two percent of worldwide patents, with 95% of China’s patents being in force in China only. And all 15 leading companies with the best record on patent citations are based in the United States (9 in the IT industry). Root causes for China’s persistent innovation gap range from severe quality problems in education to plagiarism in science, and barriers to entrepreneurship and private R&D investment. An important weakness of China’s innovation policy are elaborate lists of products and technologies that are constructed to assess compliance with China’s standardization and certification requirements. These lists risk being quickly outdated and bypassed. Even more important for China’s objective to foster indigenous innovation is that such control lists focus on existing technologies, rather than on the future innovations that they are designed to promote. In addition, China’s progress in innovation is likely to be stifled by China’s policy on Information Security Standards and Certification. In its current form, this policy would create unintended disruptive side effects for the upgrading of China’s innovation capacity and could create potentially serious trade conflicts (Ernst, 2011, chapter II).

#### 2. Other countries already have ITS – That’s in their Ezell evidence – That means the plan only catches us to catch up, not deploy more advanced military technology – Parity does not equate to leadership

#### 3. Lack of funding doesn’t prevent scientific leadership – Other factors matter too

Gregory J. Hather, department of statistics, University of California Berkeley, et al., Winston Haynes1,3, Roger Higdon1,2,4, Natali Kolker2,4, Elizabeth A. Stewart1,2, Peter Arzberger5, Patrick Chain6,7,8, Dawn Field9, B. Robert Franza10,11, Biaoyang Lin12,13,14, Folker Meyer15,16, Vural Ozdemir17, Charles V. Smith18,19, Gerald van Belle20,21, John Wooley5, Eugene Kolker, 8-16-10, [“The United States of America and Scientific Research,” <http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0012203>] E. Liu

In addition, given the results of our analysis, we must consider “How will the US continue to foster its scientific strengths?” These results illustrate that the US financial commitment to research has plateaued in recent years, although the federal government has shifted more of its funding towards basic and applied research, while industry continues to concentrate on development. As science is founded on rigor and quality, it will be a mistake to be distracted by sheer quantity. A point in its favor is that the US currently has a very strong system of university research. In fact, in the 2009 Academic Ranking of World Universities, 17 of the top 20 universities were in the US [49]. However, at the same time, students in US K-to-12 schools are lagging behind students from many countries [50]. It is crucial that the US focus ever more diligently not only on the quality of the science it produces, but also on the quality of its scientific workforce. Therefore, focusing on K-12 education in general and, specifically, on STEM (Science-Technology-Engineering-Mathemat​ics)becomes vitally important for the US [50].

#### 4. Ezell says they solve for ITS leadership – That has no relation to the military technology necessary to sustain forward deployment or in some way make it more effective at deterring people

#### 5. Defense cuts now crush defense innovation and new technologies won’t be purchased

Forbes, 2-7-12, [“Self-Inflicted Blindness: The Austerity Threat To Innovation,” Nick Schultz, <http://www.forbes.com/sites/nickschulz/2012/02/07/self-inflicted-blindness-the-austerity-threat-to-innovation/print/>] E. Liu

In this age of ballooning U.S. debt, it’s hardly surprising that many Democrats and Republicans are pushing to reduce American military spending. But a closer examination of what’s at stake reveals just how troubling the embrace of defense austerity will prove to be—for our nation’s security, for the future of U.S. military innovation, and (of particular interest to this column) for American technological leadership. Consider the White House proposal to eliminate tens of thousands of military personnel positions. Historian Fred Kagan has pointed out the danger of the planned reductions. “Those military personnel are a repository of knowledge about how to conduct complex, lethal operations across a wide area in distributed formations,” notes Kagan, who has spent considerable time with soldiers and commanders in Iraq, Afghanistan, and elsewhere. “They are not merely the world’s leading experts on counterinsurgency but also the leading experts on exactly the kind of targeted operations [President] Obama’s strategy envisions.” In one key respect, haste truly is waste. Experienced American military personnel are not just some budgetary liability. They possess enormous sums of valuable human capital, accumulated at great cost, that is jeopardized by injudicious cuts. “Over a decade of conflict, our troops have refined formations, doctrine, techniques and theory to the highest level ever,” Kagan notes. “Rapidly reducing the force will flush away much of that expertise before it can be institutionalized.” Now, it is true that military spending increased in response to 9/11. So some might argue that after a decade of fighting, we’ve entered an acceptable period where the nation can cut back sharply. But as defense analyst Mackenzie Eaglen, a new colleague of mine at the American Enterprise Institute, observes, “the defense budget increases of the past decade have been hollow, lacking next-generation investments.” The focus, she says, has been on investing for a kind of “lower-end conflict.” This made some sense given the nature of the post-9/11 threat from radical Islamists. But in a world with a rapidly rising China, an unstable Russia, and troublemakers from Iran to North Korea, the United States has short-changed something important as a result. “Instead of staying on the cutting-edge of new defense technologies and innovation,” Eaglen says, “Washington has decided that 40-year old programs will instead suffice for today, since the budget continues to shrink.” The threats to American national security outlined by Kagan and Eaglen that will result from proposed budget cuts should give all Americans pause; but I want to focus on another consequence of ill-considered budget austerity – the potential loss to American technological innovation. The American military has been one of the great catalysts for American innovation. A recent report from The Breakthrough Institute highlights the vital role played by public–private partnerships in driving American innovation, particularly collaboration between the military and the private sector.

#### 6. Hegemony is not key to stability – empirically proven

Fettweis 10 (Christopher, Assistant professor IR @ Tulane, Threat and Anxiety in US Foreign Policy, Survival (00396338); Apr/May, Vol. 52 Issue 2, p59-82, 24p)

One potential explanation for the growth of global peace can be dismissed fairly quickly: US actions do not seem to have contributed much. The limited evidence suggests that there is little reason to believe in the stabilising power of the US hegemon, and that there is no relation between the relative level of American activism and international stability. During the 1990s, the United States cut back on its defence spending fairly substantially. By 1998, the United States was spending $100 billion less on defence in real terms than it had in 1990, a 25% reduction.29 To internationalists, defence hawks and other believers in hegemonic stability, this irresponsible ‘peace dividend’ endangered both national and global security. ‘No serious analyst of American military capabilities’, argued neo-conservatives William Kristol and Robert Kagan in 1996, ‘doubts that the defense budget has been cut much too far to meet America’s responsibilities to itself and to world peace’.30 And yet the verdict from the 1990s is fairly plain: the world grew more peaceful while the United States cut its forces. No state seemed to believe that its security was endangered by a less-capable US military, or at least none took any action that would suggest such a belief. No militaries were enhanced to address power vacuums; no security dilemmas drove insecurity or arms races; no regional balancing occurred once the stabilising presence of the US military was diminished. The rest of the world acted as if the threat of international war was not a pressing concern, despite the reduction in US military capabilities. Most of all, the United States was no less safe. The incidence and magnitude of global conflict declined while the United States cut its military spending under President Bill Clinton, and kept declining as the George W. Bush administration ramped the spending back up. Complex statistical analysis is unnecessary to reach the conclusion that world peace and US military expenditure are unrelated.

### XTN #1 – Leadership Now

#### US latent capability for innovation solves for leadership

Teryn Norris, leading young policy strategist and serves as president and founder of Americans for Energy Leadership and Neil K. Shenai, PhD Candidate at the Johns Hopkins University School of Advanced International Studies, Summer/Fall 10, [“Dynamic Balances: American Power in the Age of Innovation,” SAIS Review, Volume 30, Number 2, Summer-Fall 2010, pp. 149-164, <http://muse.jhu.edu/journals/sais/summary/v030/30.2.norris.html>] E. Liu

Thus far, this paper has established that technological development lies at the heart of economic growth, particularly in advanced economies. Ad- ditionally, the capacity of states to use wealth-generating technological progress for the accu- mulation of hard power is one of the primary intervening variables of global power dynamics. International economic and technological com- petition is thus inevi- table, given the power dynamic inherent in the international system. Today, the United States and China share strong national interests in promoting innovation within the clean energy sector, which carries significant strategic economic and security benefits. Dynamic Balances Today, the United States and China share strong national interests in promoting innovation within the clean energy sector, which carries sig- nificant strategic economic and security benefits. This is largely due to the short-term benefits associated with capturing clean energy market potential and reducing reliance on foreign energy imports. However, innovation in the clean energy industry also carries major positive externalities associ- ated with the mitigation of climate change, reduction of air pollution, and development of cheaper and more distributed forms of energy to power global development. Beyond the clean energy sector, this paper has shown that the win- ner of the next generation of economic competition is far from certain. Although the Chinese have played their hand well over the last decade, the United States still boasts greater latent capability for innovation than China. The challenge for the United States, then, is to convert this latent capability into useable innovative capacity. The result of this qualifying factor shows that the economic race between the United States is far from over.

### China Weak Now

#### China’s innovation has systemic problems – Central control, false patents, censorship

Adam Segal, Ira A. Lipman Senior Fellow at the Council on Foreign Relations, 3-10-11, [“Why American innovation will beat out China's,” CNN Blog, <http://globalpublicsquare.blogs.cnn.com/2011/03/10/why-american-innovation-will-beat-out-china/>] E. Liu

There are serious shortcomings within China’s innovation system. The government retains strong central control of research agendas and the careers of researchers. There is cultural deference toward authority. The state’s intervention in the market, which is motivated by a desire to reduce dependence on foreign technology, perversely creates incentives for copying and reverse engineering rather than bold innovation. Patent filings have been driven up by tax breaks and other policy incentives. Ultimately, many of these filings have very little to do with innovation and are instead designed to position Chinese companies to sue foreign firms as they enter local markets for alleged patent infringement. Chinese policymakers are aware of these problems. They are addressing them. But progress will be slow because these problems are beyond just policy – they are at their heart social and political. Take Google’s departure from the Chinese market. While it was the attacks on human rights dissidents and the theft of the search giant’s intellectual property that garnered the most attention outside of China, those hurt the most may have been Chinese scientists. Of the 784 Chinese scientists who responded to a survey conducted by Nature, 84 percent said that Google’s departure would “somewhat or significantly” hamper their research. History suggests that it will be difficult to build a truly innovative economy while tightly controlling information.

### Investment Now

#### ARRA investment now boosts broad scientific research – It’s sustainable in the future

Eric Benhamou, founder of Benhamou Global Ventures, LLC. Benhamou Global Ventures, started in 2003, invests and plays an active role in innovative high tech firms throughout the world, adjunct professor of Entrepreneurship and Family Enterprise at INSEAD from 2004 till 2010. He is now a visiting professor at IDC Herzliya's Arison School of Business, et al., Jon Eisenberg and Randy H. Katz, 2-10, [“Assessing the Changing U.S. IT R&D Ecosystem ,” COMMUNICATIONS OF THE ACM | FEBRUARY 2010 | VOL. 53 | NO. 2, <http://bnrg.cs.berkeley.edu/~randy/Papers/RHKPubs07-11/065.pdf>] E. Liu

The recent global financial crisis has had a major effect on the U.S. IT in- dustry, which appeared to be recover- ing following the shocks of the early part of the decade; 2008 was the first year in almost two decades when there were no IT initial public offerings on U.S. stock exchanges. Even high-flying Internet companies like Google have sustained layoffs, though modest. The effect is not limited to the U.S.; the slowdown is evident throughout the globalized IT industry. The American Recovery and Rein- vestment Act of 2009 (http://www.irs. gov/newsroom/article/0,,id=204335,00. html) provides significant funding for infrastructure and research investment as part of the U.S. government’s recent economic stimulus package. The Act provides $2.5 billion for distance learn- ing, telemedicine, and broadband in- frastructure for rural communities. An additional $4.7 billion is available for broadband infrastructure proj- ects, including for expanding public access to computers, such as through community colleges and public librar- ies. And an additional $4.5 billion is available to upgrade the electric grid for enhanced electricity delivery and energy reliability, and will likely make extensive use of IT in the process. The Department of Energy recently estab- lished the Advanced Research Projects Agency-Energy (http://arpa-e.energy. gov/), with initial funding of $400 mil- lion; initial science and technology research awards were announced in February 2009. Another $2 billion is available to coordinate deployment of advanced health IT. Finally, the Nation- al Science Foundation’s annual budget is being enhanced by $2.5 billion, es- sentially increasing its annual budget by 50%. This provides a much-needed increment in foundational research funding in IT. While this is intended as a one-time increase in funding, we are optimistic that the Obama administra- tion’s and Congress’s commitment to science and technology will continue.

### Investment Now – Comparative

#### US R&D funding crushes China’s fifteen to one – Solves leadership gap

Teryn Norris, leading young policy strategist and serves as president and founder of Americans for Energy Leadership and Neil K. Shenai, PhD Candidate at the Johns Hopkins University School of Advanced International Studies, Summer/Fall 10, [“Dynamic Balances: American Power in the Age of Innovation,” SAIS Review, Volume 30, Number 2, Summer-Fall 2010, pp. 149-164, <http://muse.jhu.edu/journals/sais/summary/v030/30.2.norris.html>] E. Liu

Benchmarking National Innovation Capacity Any state’s capacity for technological innovation depends on a number of complex factors, including their macroeconomic environment, individual and firm-level microeconomic incentives, and institutional and cultural pre- dispositions. Many of these factors, such as culture, are difficult to measure and lie beyond the scope of this article. This paper uses three measures of national innovation capacity: research and development (R&D), science and engineering education, and technology scaling. R&D is measured by the total and relative expenditure of each state on dedicated research and development. Science and engineering education is measured by numbers of graduates from institutions of higher education. And technology scaling refers to conditions that help diffuse new tech- nologies throughout the marketplace and establish knowledge-intensive industries, ranging from enabling infrastructure and market creation to intellectual property and the ease of doing business. Along with R&D and education, this a key measure of innovation capacity, since realizing the productivity gains of new technologies requires their diffusion throughout the economy. In short, by these three metrics, China is improving its national in- novation system but still lags significantly behind the United States. In terms of R&D, total U.S. investment as a percentage of GDP has remained relatively constant since the mid-1980s, hovering around 2.7 percent, with the federal share of total R&D consistently declining. The National Science Foundation (NSF), which publishes one of the most comprehensive reports on international inno- vation capacity, recently found that China’s investments in R&D grew by over 20 percent annually between 1996 and 2007, compared to less than 6 percent annual growth in the United States. These high growth rates ignore the low starting point of China’s R&D expenditures; China’s R&D intensity in 2007 was still 1.5 percent, just over half the U.S. level. Moreover, this measure ignores the large difference in total GDP between the countries as well. By total expenditure, the United States dwarfs China by an approximate ratio of fifteen to one.21

### AT: Investment Key

#### IT and computer sciences are a substantial force despite government austerity

Eric Benhamou, founder of Benhamou Global Ventures, LLC. Benhamou Global Ventures, started in 2003, invests and plays an active role in innovative high tech firms throughout the world, adjunct professor of Entrepreneurship and Family Enterprise at INSEAD from 2004 till 2010. He is now a visiting professor at IDC Herzliya's Arison School of Business, et al., Jon Eisenberg and Randy H. Katz, 2-10, [“Assessing the Changing U.S. IT R&D Ecosystem ,” COMMUNICATIONS OF THE ACM | FEBRUARY 2010 | VOL. 53 | NO. 2, <http://bnrg.cs.berkeley.edu/~randy/Papers/RHKPubs07-11/065.pdf>] E. Liu

IT and its effect on the economy continue to grow in size and impor- tance. According to estimates of the U.S. government’s Bureau of Econom- ic Analysis (http://www.bea.gov/), for 2006 the IT-intensive “information- communications technology produc- ing” industries accounted for about 4% of the U.S. economy but contributed over 14% of real gross domestic prod- uct (GDP) growth. As a point of refer- ence, U.S. federal funding in fiscal year 2008 for computer science research was around $3 billion, less than 0.025% of GDP. This substantial contribution to the economy reflects only a portion of the overall long-term benefits from IT research investment. It is in all gov- ernments’ interest for these benefits to continue to grow and accrue.

### XTN #3 – Spending Not Key

#### China’s growth means they’ll always spend more – Relying on soft institutions is key to lead

Adam Segal, Ira A. Lipman Senior Fellow at the Council on Foreign Relations, 3-10-11, [“Why American innovation will beat out China's,” CNN Blog, <http://globalpublicsquare.blogs.cnn.com/2011/03/10/why-american-innovation-will-beat-out-china/>] E. Liu

In the West, the dominant policy recommendation in response to the rise of China has been to spend more on R&D and train more scientists and more engineers. U.S spending on R&D was $395 billion in 2010. This is more than two and a half times larger than China’s expenditures of $141 billion. But given the size of the Chinese economy and current growth rates, that gap will close. Additional funding, especially for basic research and development, is necessary, but the United States cannot compete over the long term on raw numbers alone. Nevertheless, the United States should take heart. It has significant advantages, which it needs to exploit. It has great social and cultural strengths, including the ability to conduct cutting-edge, interdisciplinary research; recognize new markets and consumer demands; manage across time, distance, and culture; tolerate risk and support entrepreneurship; and welcome new ideas and talent no matter what their origin. Openness is essential, and the United States must remain the place where the most talented and skilled still yearn to come. This means we must make some changes: First, visa regulations must be reformed and the path to citizenship for highly-skilled immigrants made much smoother. Second, the United States needs to remain open to the flow of money since foreign investment is essential to its economic health and innovative capability. In particular, money must flow to early-stage start-ups. Under the Obama Administration’s “Startup America” Initiative the government will launch a $1 billion early-stage innovation fund that will provide a 1:1 match to private capital raised by early stage funds. Cuts in payroll taxes help lower the cost of hiring new workers, but the government should also consider reducing or eliminating capital gains taxes for investments in start-ups. The single-minded focus on increasing the absolute numbers of scientists is distracting from the other work that must occur. Third, what it means to be a scientist must be expanded. The range of skills a scientist develops must be broadened, and there should be new pathways to careers in science. The Alfred P. Sloan Foundation now helps universities develop a professional science master’s degree, which includes two years of graduate-level coursework in math and science, interdisciplinary research, and classes in business management as well as the fostering of communication, teamwork, and entrepreneurship skills. Future competiveness will be assured not by trying to match China in raw numbers, but by strengthening the software of U.S. innovation – the social, political, and cultural institutions that move ideas from labs to marketplace and have made America the center of innovation for decades.

### XTN #4 – ITS Not Key

#### No military interest in broader information technologies now despite competitions

Eric Benhamou, founder of Benhamou Global Ventures, LLC. Benhamou Global Ventures, started in 2003, invests and plays an active role in innovative high tech firms throughout the world, adjunct professor of Entrepreneurship and Family Enterprise at INSEAD from 2004 till 2010. He is now a visiting professor at IDC Herzliya's Arison School of Business, et al., Jon Eisenberg and Randy H. Katz, 2-10, [“Assessing the Changing U.S. IT R&D Ecosystem ,” COMMUNICATIONS OF THE ACM | FEBRUARY 2010 | VOL. 53 | NO. 2, <http://bnrg.cs.berkeley.edu/~randy/Papers/RHKPubs07-11/065.pdf>] E. Liu

Objective 1. Strengthen the effective- ness of federally funded IT research. University research is focused largely on basic research, while industrial re- search concentrates on applied R&D, meaning that much of the feedstock for long-term innovation is to be found in the nation’s universities. As a result, support for university education and research is essential to generating the stream of innovations that nourish the rest of the ecosystem. Measures to en- hance the productivity of university re- search funding, as well as that of other R&D funding, would increase the pay- off from these investments. Although the advances in IT over the past 50 years have been breathtaking, the field remains in its relative infancy, and continuing advances over the com- ing decades can be expected but only as long as the IT R&D ecosystem’s capac- ity to sustain innovation is preserved and enhanced. Current decisions about how the U.S. should make investments—both civilian and military—in basic IT re- search do not seem to reflect the full ef- fect of IT on society and the economy. The government’s own data indicates the U.S. lags behind Europe and Japan in civilian funding for IT R&D. Mean- while, the European Union and China have aggressive plans for strengthen- ing their global positions in IT through substantial and increasing IT R&D in- vestment.

### XTN #5 – Military Cuts Now

#### Military cuts specifically undermine private cooperation and innovation

Forbes, 2-7-12, [“Self-Inflicted Blindness: The Austerity Threat To Innovation,” Nick Schultz, <http://www.forbes.com/sites/nickschulz/2012/02/07/self-inflicted-blindness-the-austerity-threat-to-innovation/print/>] E. Liu

It’s important to note that the private sector invested heavily in the program to satisfy its obligation under the public-private partnership. Now the government is threatening to go back on its promise. If the government slashes its budget, it will send a bad signal to other private sector firms that might be asked to partner with the military—they could see such partnerships as too financially risky. “The U.S. role as a leader in the international geospatial technology market,” Pomfret says, “would likely decline as companies would be less willing, or financially able, to take risk on future innovation.” The first order of business of any elected official is to defend the country. Commercial satellite imagery helps do that, one reason a bi-partisan group of Congressmen, including Senate Select Committee on Intelligence members Mark Warner (D-Va.), Mark Udall (D-Colo.), and Roy Blunt (R-Mo.), sent a letter to Secretary of Defense Leon Panetta requesting full support for the program. The nation’s debt crisis is largely an entitlement crisis, not a defense spending crisis. There’s no need to undermine successful public-private partnerships that protect the country and have beneficial economic and technological spillover effects to boot.

### XTN #6 – Hegemony Doesn’t Solve War

#### US actions don’t contribute to peace of stability – There’s no correlation and a negative correlation existed in the 90s, where spending was decreased and the US became less capable and no power vacuums or arms races developed, that’s Fettweis 10

#### No data to support hegemonic stability

Fettweis 10 (Christopher, Assistant professor IR @ Tulane, 2/17, “Grand Strategy for a Golden Age,” http://citation.allacademic.com//meta/p\_mla\_apa\_research\_citation/4/1/6/8/5/pages416851/p416851-1.php)

Believers in hegemonic stability as the primary explanation for the long peace have articulated a compelling logic, but rarely cite much evidence to support their claims. In fact, the limited empirical data we have suggests that there is little connection between the relative level of U.S. activism and international stability. During the 1990s, the United States cut back on its defense spending fairly substantially. By 1998, the United States was spending $100 billion less on defense in real terms than it had in 1990, a twenty-five percent reduction. 53 To internationalists, defense hawks and other believers in hegemonic stability, this irresponsible “peace dividend” endangered both national and global security. “No serious analyst of American military capabilities,” argued Kristol and Kagan, “doubts that the defense budget has been cut much too far to meet America’s responsibilities to itself and to world peace.” 54 On the other hand, if the pacific trends were not based upon U.S. hegemony but a strengthening norm against interstate war, one would not have expected an increase in global instability and violence.

## Computational Science

### Computational Science Frontline

#### 1. The plan is temporary stimulus for computational science that doesn’t create new technology

Martin Head-Gordon, professor of chemistry at the University of California, Berkeley and is a Faculty Chemist in the Chemical Sciences Division of Lawrence Berkeley National Laboratory working in the area of computational quantum chemistry, 09, [“INTERNATIONAL ASSESSMENT OF RESEARCH AND DEVELOPMENT IN SIMULATION-BASED ENGINEERING AND SCIENCE,” Chatper 6, [www.wtec.org/sbes/SBES-GlobalFinalReport.pdf](http://www.wtec.org/sbes/SBES-GlobalFinalReport.pdf)] E. Liu\

However, in light of the long software development process, there are also specific challenges in obtaining funding for simulation software development within the United States. A typical funding initiative will involve a high level of research support for a period such as 3 to 5 years, sometimes with the option for a second renewal period subject to achieving satisfactory performance in the first grant. Such a timescale is only marginally suitable for new software construction – though it can be very valuable for enhancing software that is already established. In general, however, short-term U.S. (and overseas) initiatives do not promote the long-term health of innovation-driven software development – rather they tend to encourage novel applications of the tools that already exist. In turn this reduction in applications software development in the United States is leading to reduced production of appropriately trained students which will threaten our long-run competitive position. Indeed several European investigators commented on the fact that there have been numerous short-term initiatives to build new U.S.-based codes that have then ceased or stagnated when funding ended. They also commented that this situation tended to make U.S.-based scientists somewhat unreliable partners for long-term software development projects. While the academic simulation software development situation is not entirely satisfactory in either Europe or Asia either, it is nonetheless striking that Europe in particular has been able to better sustain a strong tradition of both community and commercial code development. European researchers complained that they were unable to hire personnel specifically for programming tasks, and that obtaining genuinely long-term support for software development was very hard. One exception is that long-term software maintenance of community chemistry codes is supported to a modest degree in the United Kingdom by several long-term Computational Chemistry Projects (CCP’s).

#### 2. The advantage is not reverse causal – Even if the plan has marginal effects on computer science, the status quo is sustainbale because we won’t just give up on developing new technology

#### 3. No US key warrant – Computational goals will be pursued regardless of nation

Rick Stevens, associate laboratory director for Computing, Environment, and Life Sciences at Argonne National Laboratory, and professor of computer science at the University of Chicago, Winter 08, [“The Globalization of Large-Scale Computational Science,” SCIDAC Review, [www.scidacreview.org/0804/pdf/editorial.pdf](http://www.scidacreview.org/0804/pdf/editorial.pdf)] E. Liu

During recent trips to Europe it has became clear to me that the international scientific community is beginning to chal- lenge the historical U.S. dominance in high-performance scientific computing. Many people in the United States have responded by saying that the nation should back off on its investments in leadership-class systems as being too expen- sive, while others argue that national security requirements demand that the United States go it alone in investments for high-end systems research and development. I maintain, however, that the United States should welcome the “rise of the rest” as the natural maturing of the global scientific com- puting community. I see this situation as an opportunity for the United States to continue to lead in high-end comput- ing as the “trusted and honest broker”: one that can organ- ize the global effort and forge long-term relationships that span the global community to ensure that systems will be developed, that software will be available, and—most important—that the best computational science targets will be pursued regardless of national boundaries.

#### 4. Lack of trained scientists prevents innovation or computational science

WTEC, World Technology Evaluation Center, nation's leading organization in conducting international technology assessments, Sponsors include most of the Federal research agencies: NSF, ONR, DARPA, EPA, NIH, AHRQ, NASA, NIST, FDA, AFOSR, ARO, et al, 09, [“INTERNATIONAL ASSESSMENT OF RESEARCH AND DEVELOPMENT IN SIMULATION-BASED ENGINEERING AND SCIENCE,” Executive Summary, [www.wtec.org/sbes/SBES-GlobalFinalReport.pdf](http://www.wtec.org/sbes/SBES-GlobalFinalReport.pdf)] E. Liu

Finding 2: Inadequate education and training of the next generation of computational scientists threatens global as well as U.S. growth of SBE&S. This is particularly urgent for the United States; unless we prepare researchers to develop and use the next generation of algorithms and computer architectures, we will not be able to exploit their game-changing capabilities. There was grave concern, universally voiced at every site in every country including the United States, that today’s computational science and engineering students are ill-prepared to create and innovate the next generation of codes and algorithms needed to leverage these new architectures. Much of this appears to arise from insufficient exposure to computational science and engineering and underlying core subjects beginning in high school and undergraduate and continuing through graduate education and beyond. Increased topical specialization beginning with graduate school was noted as a serious barrier to a deep foundation in simulation and supporting subjects. There is a clear gap in the preparation students receive in high performance computing and what they need to know to develop codes for massively parallel computers, let alone petascale and massively multicore architectures. Worldwide, students are not learning to “program for performance.” Nearly universally, the panel found concern that students use codes primarily as black boxes, with only a very small fraction of students learning proper algorithm and software development, in particular with an eye towards open-source or community code development. Students receive no real training in software engineering for sustainable codes, and little training if any in uncertainty quantification, validation and verification, risk assessment or decision making, which is critical for multiscale simulations that bridge the gap from atoms to enterprise. Moreover, in many countries, the very best computational science and engineering students leave research for finance companies (this was, until recently, a particularly huge problem in Switzerland). Despite the excitement about manycore and petascale computing, the panel noted universal concern that the community is not prepared to take advantage of these hardware breakthroughs because the current generation of algorithms and software must be rethought in the context of radically new architectures that few know how to program.

### XTN #1 – Plan Doesn’t Solve

#### The US is focused on gathering funding – One of many factors undermining scientific dominance

Celeste Sagui, professor of physics at North Carolina State University, received her doctorate in

physics from the University of Toronto and performed postdoctoral work at McGill University and at the National Institutes of Environmental and Health Sciences (NIEHS). She continues to hold an Intergovernmental Personnel Act (IPA) position in the Laboratory of Structural Biology at NIEHS , 09, [“INTERNATIONAL ASSESSMENT OF RESEARCH AND DEVELOPMENT IN SIMULATION-BASED ENGINEERING AND SCIENCE,” Chatper 11, [www.wtec.org/sbes/SBES-GlobalFinalReport.pdf](http://www.wtec.org/sbes/SBES-GlobalFinalReport.pdf)] E. Liu\

Problems that especially affect the SBE&S fields include the following: 1. Loss of international students: This is due to both visa restrictions and the diminution of the country’s “attractiveness” to foreigners. 2. Loss of PhD students and faculty: The scientific field is no longer attractive to U.S. students; faculty and principal investigators and staff researchers in national labs are being lost to industry and other markets. 3. Lack of adequate training of students in SBE&S: Students are knowledgeable in running existing codes (with visualization), but they are unable to actually write code or formulate a mathematical framework. 4. Rigid “silo” academic structure: The entire academic structure (budgets, courses, curricula, promotion, and tenure, etc.) is aimed at maintaining a vertically structured, relatively insulated disciplinary environment. The system promotes departmental loyalty and highly discourages interdisciplinary work. 5. Serious danger of compromising creativity and innovation: In the present funding environment, many alliances are made for the purpose of seeking funding, independent of the scientific value of the research.

### XTN #2 – Other Countries Solve Now

#### Science is always net-growing globally – Shifting away from the US but its benefits get spread

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The decline of the US economy relative to the rest of the world is facilitating the strengthening of science elsewhere. An evolving multi-polar world economy is leading to multiple centers of science—the United States, the European Union, Japan, China, Russia, and possibly India. The increasing wealth of several of these societies is enabling them to lure back many younger scientists trained abroad in the world’s leading institutions.14 A remarkable change has been the emergence of China as an important power in science. For example, China was fourteenth in the world in production of science and engineering papers in 1995; by 2005, as the Chinese economy boomed, it was fifth, according to Thomson Reuters ISI; and by 2007 it was second. Between 1994 and 2008, the number of natural sciences and engineering doctoral degrees awarded in China increased tenfold, so that by 2007 China had surpassed the United States for the largest number awarded in the world. Moreover, in recent years more and more senior expatriate scientists have been returning to China. Of course, such indicators tell us little about highly creative achievement at the level of the individual—but they do have implications about the future trends for creativity in China. As we reflect on the future of US scientific creativity, there are several possible scenarios to consider. One possibility is that the American system will continue to perform extraordinarily well with a continued exponential growth in the number of research articles and journals. 17 A second scenario is similar to what is occurring in the world of business. Just as business firms are becoming increasingly globalized, the organization of science will also become more global in nature, with scientists having greater mobility, moving back and forth among labs in Germany, the United Kingdom, Singapore, China, Australia, India, the United States, Scandinavia, etc. While certain geographical locations will remain stronger than others, there will be increasing convergence in the structure of research organizations, labs, and their performance across major regions of the world.

#### Other countries have computational science – Breakthroughs are spread globally

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Within the thematic areas of the study, the panel observed that SBE&S is changing the way disease is treated and surgery is performed, the way patients are rehabilitated, and the way we understand the brain; the way materials and components are designed, developed, and used in all industrial sectors; and aiding in the recovery of untapped oil, the discovery and utilization of new energy sources, and the way we design sustainable infrastructures. In all of these areas, there were ample examples of critical breakthroughs that will be possible in the next decade through application of SBE&S, and in particular through the following four major trends in SBE&S: Finding 1: Data-intensive applications, including integration of (real-time) experimental and observational data with modeling and simulation to expedite discovery and engineering solutions, were evident in many countries, particularly Switzerland and Japan. Modeling and simulation of very large data sets characterized some of the most cutting-edge examples of SBE&S in life sciences and medicine, especially with regards to systems biology. Big data already plays a prominent role in elementary particle physics, climate modeling, genomics, and earthquake prediction. The trend will become even more prominent globally with petascale computing.

### Leadership Low Now – Simulations

#### US leadership in simulations has greatly declined – Other countries fill in

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Our impression is that on the whole, American leadership in applications software development for simulation- based science and engineering has diminished quite noticeably relative to a decade ago (2008 versus 1998). In some areas, U.S.-based applications software development is now clearly trailing competitive efforts in Europe particularly. Japan also has some examples of flagship software development (such as supercomputing applications), but their impact in terms of widespread distribution for mid-range capacity computing has been more limited. One examples of such an area is computational condensed matter physics, discussed below. The related area of computational quantum chemistry codes has increasingly strong world-wide competition, but the most widely used commodity codes are still American-developed. In other areas, Europe has also made large strategic investments in software development, such as preparing for the Large Hadron Collider (LHC) experiment, and thus the strategic balance is changing. The panel found that China at present (2008) is not a major player in software development for simulation-based science and engineering. However the strong push to raise the level of excellence of the leading Chinese universities is leading to a new generation of talented academic scientists who are training talented students in increasingly large numbers, and we should expect a greatly increased Chinese presence in simulation software development in the future. India is also increasingly laying the groundwork for a future presence in simulation software development, due to the combination of a strong presence in commercial software development, a strong academic tradition at its leading universities, and now increasing government investment.

### Software Alternative Cause

#### The US has no simulation software – Other countries solve

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Modern software for simulation-based engineering and science is sophisticated, tightly coupled to research in simulation models and algorithms, and frequently runs to millions of lines of source code. As a result, the lifespan of a successful program is usually measured in decades, and far surpasses the lifetime of a typical funding initiative or a typical generation of computer hardware. Finding 1: Around the world, SBE&S relies on leading edge (supercomputer class) software used for the most challenging HPC applications, mid-range and desktop computing used by most scientists and engineers, and everything in between. Simulation software is too rich and too diverse to suit a single paradigm. Choices as disparate as software targeting cost-effective computer clusters versus leading edge supercomputers, or public domain software versus commercial software, choices of development tools etc, are mapped across the vast matrix of applications disciplines. The best outcomes seem to arise from encouraging viable alternatives to competitively co-exist, because progress driven by innovation occurs in a bottom-up fashion. Thus strategic investments should balance the value of supporting the leading edge (supercomputer class) applications against the trailing vortex (mid- range computing used by most engineers and scientists). Finding 2: Software development leadership in many SBE&S disciplines remains largely in U.S. hands, but in an increasing number of areas it has passed to foreign rivals, with Europe being particularly resurgent in software for mid-range computing, and Japan particularly strong on high-end supercomputer applications. In some cases, this leaves the United States without access to critical scientific software. In many domains of SBE&S, the US relies on codes developed outside the US, despite having led previously in the theoretical research that formed the intellectual basis for such codes. A major example of that is in first principles codes for materials, the theoretical framework for which the United States won the 1998 Nobel Prize in Chemistry. Just one decade later, the WTEC panel learned of American defense researchers denied access to foreign-developed electronic transport software as a matter of principle, with no equivalent U.S. codes available as a substitute.

### Workforce Alternative Cause

#### US is losing modeling leadership because of workforce migrations – Other countries solve

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World-class research exists in SBE&S in molecular dynamics, systems biology, and biophysical modeling throughout the United States, Europe, and Japan, and, in some areas, China. The United States has historically played a leadership role in a number of research areas that have driven the development of new algorithms, architectures, and applications for molecular dynamics (MD) simulations. However, this role is now endangered by a lack of sustained investment at all federal agencies, and by the loss of PhD students and faculty to other disciplines and to the private sector. • The quality of leading researchers within this field in the United States is comparable to that of leading researchers in Europe and Japan. • Infrastructure (access to computing resources and software professionals) and funding models to support ambitious, visionary, long-term research projects are much better in Europe and Japan than in the United States. • Funding models and infrastructure to support multi-investigator collaborations between academia and industry are much more developed in Europe than in the United States.

### Solves Alternative Energy

#### Other country’s simulations solve energy concerns now – US can’t do it from student deficits

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The search for alternative energy sources and cleaner fuels, and for long-term sustainable infrastructures, is one of the greatest and most serious challenges facing the planet over the next decade. The role for SBE&S is enormous and urgent. Broad and extensive simulation-based activities in energy and sustainability exist in all regions. However, the scarcity of appropriately trained students in the U.S. (relative to Europe and Asia) is seen as a substantial bottleneck to progress. Finding 1: In the area of transportation fuels, SBE&S is critical to stretch the supply and find other sources. • Recognition that future energy sources for transportation cannot be substituted for traditional sources in the short term is motivating the simulation of oil reservoirs to optimize recovery, refinery processes to optimize output and efficiency, and the design of more fuel-efficient engines, including diesel and hybrid engines. • The use of SBE&S in oil production and optimizing the fossil-fuel supply chain has traditionally been led by the United States. The panel found significant activity in Europe, including new funding models and leveraging strengths in development of community codes for applications to this important problem. Finding 2: In the discovery and innovation of alternative energy sources – including biofuels, batteries, solar, wind, nuclear – SBE&S is critical for the discovery and design of new materials and processes. • Nuclear energy is a major source for electricity in the United States and abroad. Rapid progress and increased investment in SBE&S-driven materials design for nuclear waste containment are urgently needed. France leads the world in nuclear energy and related research (e.g., containment). • Tax incentives for green sources of energy, despite lower energy density, are driving extensive R&D efforts for more efficient wind energy and tidal energy systems, especially in Europe. • Alternative fuels such as biodiesel are constituted from a complex mixture of plant-derived organic chemicals. Optimal engine combustion designs require the thermophysical properties of such complex mixtures, and in view of the myriad possible compositions faced by the experimentalist, simulations provide the only viable option.

### XTN #3 – US Not Key

#### Other countries are rapidly surpassing the US in simulation technology now

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The panel identified three overarching issues that specifically threaten U.S. leadership in SBE&S. Finding 1: The world of computing is flat, and anyone can do it. What will distinguish us from the rest of the world is our ability to do it better and to exploit new architectures we develop before those architectures become ubiquitous. First and foremost, many countries now have and use HPC – the world is flat! A quick look at the most recent Top 500 list of supercomputers shows that Japan, France, and Germany in particular have world-class resources. They also have world class faculty and students and are committed to HPC and SBE&S for the long haul. In terms of hardware, Japan has an industry-university-government roadmap out to 2025 (exascale), and Germany is investing nearly US$1 billion in a new push towards next-generation hardware in partnership with the European Union. It is widely recognized that it is relatively inexpensive to start up a new SBE&S effort, and this is of particular importance in rapidly growing economies (e.g. India, China, Finland). Furthermore, already there are more than 100 million NVIDIA graphics processing units with CUDA compilers distributed worldwide in desktops and laptops, with potential code speedups of up to a thousand-fold in virtually every sector to whomever rewrites their codes to take advantage of these new general programmable GPUs. Aggressive, well-funded initiatives in the European Union may undermine U.S. leadership in the development of computer architectures and applied algorithms. Examples of these initiatives include the Partnership for Advanced Computing in Europe (PRACE) which is a coalition of 15 countries and led by Germany and France, and based on the ESFRI Roadmap (ESFRI 2006); TALOS – Industry-government alliance to accelerate HPC solutions for large-scale computing systems in Europe; and DEISA – Consortium of 11 leading European Union national supercomputing centers to form the equivalent of the U.S. TeraGrid. There is also some flux, with some alliances dissolving and new consortia being formed. Already, the European Union leads the United States in theoretical algorithm development, and has for some time; these new initiatives may further widen that lead and create new imbalances.

### XTN #4 – Alternative Cause – Training

#### The US is falling behind in student attraction now – Other countries are rising

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Finding: Continued progress and U.S. leadership in SBE&S and the disciplines it supports are at great risk due to a profound and growing scarcity of appropriately trained students with the knowledge and skills needed to be the next generation of SBE&S innovators. This is particularly alarming considering that, according to numerous recent reports, • The U.S. lead in most scientific and engineering enterprises is decreasing across all S&E indicators; • The number of U.S. doctorates both in the natural sciences and in engineering has been surpassed by those in the European Union and by those in Asia. • Countries in the European Union and Japan are scampering to recruit foreign students to make up for the dwindling numbers of their youths. This is driving fierce competition for international recruiting. The United States is sitting at exactly the “fertility replacement rate” and only a small percentage of its population joins scientific and engineering professions. China and India, on the other hand, are likely to become increasingly strong SBE&S competitors. The panel observed many indicators of increased focus on SBE&S education in China and in Europe: • The European Union is investing in new centers and programs for education and training in SBE&S––all of an interdisciplinary nature. New BSc and MSc degrees are being offered in SBE&S through programs that comprise a large number of departments. In many cases, a complete restructuring of the university has taken place in order to create, for instance, MSc degrees, graduate schools, or international degrees in simulation technology. • European and Asian educational/research centers are attracting more international students (even from the United States). Special SBE&S programs (in English) are being created for international students. The United States is seeing smaller increases in international enrollment compared to other countries. This is due not only to post-9/11 security measures but also—and increasingly—to active competition from other countries. All countries, however, share many of the same challenges when it comes to SBE&S education and training: • Students are trained primarily to run existing codes rather than to develop the skills in computational mathematics and software engineering necessary for the development of the next generation of algorithms and software. There are pitfalls in interdisciplinary education such as computational science and engineering, including a tradeoff between breadth and depth. In order to solve “grand challenge” problems in a given field, solid knowledge of a core discipline, in addition to computational skills, are crucial. • Demand exceeds supply. There is a huge demand in the European Union and Asia for qualified SBE&S students who get hired immediately after their MSc degrees by industry or finance: there is both collaboration and competition between industry and academia. This phenomenon in the United States may be tempered in the future due to the current economic situation. However, one might argue that the need for increased physics-based modeling and simulation in macroeconomics and financial economics, and in industry in general as it cuts costs while preserving the ability for innovation, has never been more urgent.

#### Predictive evidence says other countries will compete very soon

Celeste Sagui, professor of physics at North Carolina State University, received her doctorate in

physics from the University of Toronto and performed postdoctoral work at McGill University and at the National Institutes of Environmental and Health Sciences (NIEHS). She continues to hold an Intergovernmental Personnel Act (IPA) position in the Laboratory of Structural Biology at NIEHS , 09, [“INTERNATIONAL ASSESSMENT OF RESEARCH AND DEVELOPMENT IN SIMULATION-BASED ENGINEERING AND SCIENCE,” Chatper 11, [www.wtec.org/sbes/SBES-GlobalFinalReport.pdf](http://www.wtec.org/sbes/SBES-GlobalFinalReport.pdf)] E. Liu\

Ultimately, population matters. In this sense both China, India and now Saudi Arabia, have big winning cards, and even if they are not top competitors right now, chances are that they will be in the not-so-distant future. They are major sources of international students and now are also becoming major emerging destinations for international students in S&E. Countries in Europe and Japan are in a race to get a share of the human capital in the developing world.

### Education Is Key Internal Link

#### Education is necessary to computer simulation competitiveness

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The development and improvement of computer simulations in diverse fields represent one of most important successes in science and engineering in the last thirty years. For the United States to remain competitive in the Sciences and Engineering, the proper teaching of computer modeling and simulation methods and tools in colleges and universities becomes of paramount importance. In the words of Tinsley Oden at the WTEC U.S. Baseline SBE&S Workshop (2007), “Our educational institutions must be prepared to equip tomorrow’s scientists and engineers with the foundations of modeling and simulation and the intellectual tools and background to compete in a world where simulation and the powerful predictive power and insight it can provide will be a cornerstone to many of the breakthroughs in the future.” The United States used to lead the way in education for simulation-based engineering and science (SBE&S). For instance, U.S. certificate programs in Computational Science and Engineering (CSE) were among the first in the world for SBE&S. However many of these programs have not embraced new developments in the last decade.

### Code/Software

#### The United States lack software applications and codes that are key to use technology

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For example, the panel found that community code development projects are much stronger within the European Union than the United States, with national strategies and long-term support. Many times the panel was told that the United States is an “unreliable partner” in these efforts due to our inability to commit for longer than typically three years at a time. Both this perception and the reality means that the United States has little influence over the direction of these community codes and at the same time is not developing large codes of its own. As one alarming example of this, six of the top seven electronic structure codes for materials physics today \ come from the European Union, despite the fact that the original science codes are from the United States (and for which the United States won the Nobel Prize), and the scientific advances underlying the codes are distributed evenly between the United States and European Union. Indeed, the U.S. lead in scientific software applications has decreased steadily since 1998. One consequence of this lack of involvement and influence is that, in some cases, codes may not be available to U.S. researchers. As one critical example, a major new code for electronic transport from Spain/United Kingdom is effectively off limits to U.S. defense labs. The panel found universal agreement (although the disparity is greatest in the United States) that investment in algorithm, middleware, and software development lags behind investment in hardware, preventing us from fully exploiting and leveraging new and even current architectures. This disparity threatens critical growth in SBE&S capabilities needed to solve important worldwide problems as well as many problems of particular importance to the U.S. economy and national security. A related issue is evidenced lack of support and reward for code development and maintenance. It is widely recognized within the SBE&S community that the timescale to develop large complex code often exceeds the lifetime of a particular generation of hardware. Moreover, although great scientific advances achieved through the use of a large complex code is highly lauded, the development of the code itself often goes unrewarded. The United Kingdom, which once led in supporting long-term scientific software development efforts, does not provide the support it once did. The panel found worldwide recognition that progress in SBE&S requires crossing disciplinary boundaries, which is difficult in many countries due to outdated university structures. The United States is perceived to be a leader in pulling together interdisciplinary teams for large, complex problems, with the caveats noted above.

#### No economic incentive to develop software and the process is slow

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Of course the reason that simulation codes are generally not directly developed in industry is because they are only a means towards a vastly more valuable end – the target drug, or fuel cell or aerospace product, which is the real goal of corporate activity. In fact, because the market for simulation codes is so small (perhaps 100 leading chemical companies, perhaps 100 oil companies, perhaps 100 drug companies, etc.), there is only marginal value in a software industry to produce the simulation software directly. The value equation is further tilted by the fact that the simulation software is more often than not directly based on new results from research into simulation models and algorithms. Thus the production of software is inseparable from long-range basic research into models and algorithms. The third (and strongly related) factor disfavoring direct industrial development of simulation software is discussed in more detail in the section on the complexity inherent in state- of-the-art simulation software. This means that the development time can be very long. For all these reasons, in fields such as materials design, drug design, and chemical processing, where these software factors are at play, software development at universities and national laboratories plays a crucial role. In effect they serve as engines to produce vastly subsidized products for use in industrial research and development – products that for the reasons discussed above would probably not otherwise exist. This transfers direct costs and risk away from the industries that benefit from the use of the resulting software, but would likely not be willing to directly support the real cost of the development of the tools. Of course, in some other fields, such as computer-aided design and computer-aided manufacturing, where the market is larger and the tools are more standardized, this is not so much the case in 2008. However, the closer we are to the frontier applications areas of simulation, the greater the role of universities and national laboratories becomes in pioneering the new simulation capabilities and directly providing the software necessary to deploy such capabilities.

### Software Is Key Internal Link

#### Software is the key internal link for the use of computational sciences

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The practical applications of computational engineering and science are built around effective utilization of the products resulting from software development. These products span a huge range of uses that impact research and development in industries ranging from pharmaceutical and chemical, to semiconductor microelectronics, to advanced materials, to engineering design in automotive and aerospace sectors and many more. The economic significance of these industries is very large – vastly greater than the relatively small companies that typically produce the software itself. Their task is to create integrative tools that bridge basic advances in computer science and the physical and biological sciences from universities with the need for turnkey solutions in engineering design, research and development.

### AT: Plan Solves

#### They don’t solve academic spending and other countries still outspend

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physics from the University of Toronto and performed postdoctoral work at McGill University and at the National Institutes of Environmental and Health Sciences (NIEHS). She continues to hold an Intergovernmental Personnel Act (IPA) position in the Laboratory of Structural Biology at NIEHS , 09, [“INTERNATIONAL ASSESSMENT OF RESEARCH AND DEVELOPMENT IN SIMULATION-BASED ENGINEERING AND SCIENCE,” Chatper 11, [www.wtec.org/sbes/SBES-GlobalFinalReport.pdf](http://www.wtec.org/sbes/SBES-GlobalFinalReport.pdf)] E. Liu\

The United States still provides strong public investment in R&D, but other countries are also taking important initiatives to provide funding for education and to foster industrial collaboration in order to earn an edge in the global SBE&S innovation environment. This trend is clearly seen in Figure 11.2 and also in the somewhat alarming results presented in Figure 11.8 (left) that show the academic share of all R&D for the United States lagging behind that of several important competitors. Although specific statistics for SBE&S do not exist, it is the impression of this panel, as analyzed in various chapters, that the U.S. leadership in application software development in SBE&S is decreasing, due in part to relatively less funding.

### AT: Students Coming Now

#### Students immediately go to commercial industry – Takes out basic research

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physics from the University of Toronto and performed postdoctoral work at McGill University and at the National Institutes of Environmental and Health Sciences (NIEHS). She continues to hold an Intergovernmental Personnel Act (IPA) position in the Laboratory of Structural Biology at NIEHS , 09, [“INTERNATIONAL ASSESSMENT OF RESEARCH AND DEVELOPMENT IN SIMULATION-BASED ENGINEERING AND SCIENCE,” Chatper 11, [www.wtec.org/sbes/SBES-GlobalFinalReport.pdf](http://www.wtec.org/sbes/SBES-GlobalFinalReport.pdf)] E. Liu\

There is huge demand for qualified SBE&S students, who get hired immediately after earning their MSc degrees and often do not even go into PhD programs. Students go to different industrial settings: to pharmaceutical, chemical, oil, (micro)electronics, IT, communications, and software companies; to automotive and aerospace engineering; or to finance, insurance, environmental institutions, and so forth. This is good insofar as it maintains a dynamic market workforce, but academia would like to see more students continue a tradition of unattached, basic research.

### Bioterror Firstline

#### Computing in biology doesn’t resolve basic problems in biological research

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It might be readily obvious by now in this essay that the ‘‘decline’’ of media interest and the potential diminution of the linguistic use of ‘‘bioinformatics’’ might not reflect the knee-jerk explanation of ‘‘too much promise’’. As we have suggested above, expectations in the past 15 years have generally been modest and realistic within the community of computational biology. Despite the great challenges of managing outside expectations, commercial opportunity, legal and ethical issues, educational and training needs, as well as multiple disruptive technologies, from the Web to mobile devices, the field has not only contributed to the omics revolution, but also has established a basis for a transformation of biology into a quantitative science. In that sense, an alternative, perhaps fairer, explanation for this apparent decline might be that, indeed, there has been too much progress, if anything. To catalog some of the recent efforts, in an ad hoc manner, one can mention links to synthetic biology [75,76], protein docking [77], systems medicine or physiology [78,79], translational [80] and personal- ized medicine [81], or genome-wide association studies [82]. Despite some negative press coverage at times [83], there has been tremendous progress towards the establishment of computing in virtually every realm of life sciences. Yet, old problems remain with us and should not be neglected, for instance database searches, multiple alignment, orthology detection, structure- function or species relationships, and protein annotation [84]. With a whole new level in data volumes, all these problems come back with a vengeance—including training, once again [85].

#### Bioterrorism is too complicated – Other measures would be used

William R. Clark, emeritus professor in Immunology at UCLA, 08, [“Bracing for Armageddon?: The Science and Politics of Bioterrorism in America,” 2008, pg. 183, http://gen.lib.rus.ec/get?nametype=orig&md5=cb56329566e5d8036ca8cf8d3d8a376c]

In the end, what may well stop groups like Al-Qaeda from using bioweapons to achieve their aims against us is that it is just too much trouble. Not only are biological weapons exceedingly diffi cult to build and operate, the United States has now developed vaccines or drugs to counter most known conventional pathogens. Countermeasures for the rest should be available over the next few years. We have the Strategic National Stockpile, Push Packages, and vendor-managed inventories, as well as the ability to deliver these materials and more to an attack site within a matter of hours. We could suffer casualties, yes, but not mass casualties. Conventional bombs and chemicals are much easier to obtain and use, and can achieve much the same ends with less risk. Sophisticated terrorist groups may well agree with virtually all professional of the military establishments around the world that actually had effective bioweapons in hand: they are simply not worth the bother. For at least the near future, bioterrorism for Al-Qaeda and its ilk may be a non-starter.

#### Disease doesn’t cause extinction – Transmission and survivors are inversely related

Leah R. Gerber, Associate Professor of Ecology, Evolution, and Environmental Sciences, 8-05, ["Exposing Extinction Risk Analysis to Pathogens: Is Disease Just Another Form of Density Dependence?,” Ecological Society of America, Jstor] Zheng

The density of it population is an important parameter for both PVA and host-pathogen theory. A fundamental principle of epidemiology is that the spread of an infectious disease through a population is a function of the density of both susceptible and infectious hosts. If infectious agents are supportable by the host species of conservation interest, the impact of a pathogen on a declining population is likely to decrease as the host population declines. A pathogen will spread when, on average, it is able to transmit to a susceptible host before an infected host dies or eliminates the infection (Kermack and McKendrick 1927, Anderson and May l99l). If the parasite affects the reproduction or mortality of its host, or the host is able to mount an immune response, the parasite population may eventually reduce the density of susceptible hosts to a level at which the rate of parasite increase is no longer positive. Most epidemiological models indicate that there is a host threshold density (or local population size) below which a parasite cannot invade, suggesting that rare or depleted species should be less subject to host-specific disease. This has implications for small, yet increasing, populations. For example, although endangered species at low density may be less susceptible to a disease outbreak, recovery to higher densities places them at increasing risk of future disease-related decline (e.g., southern sea otters; Gerber ct al. 2004). In the absence of stochastic factors (such as those modeled in PVA), and given the usual assumption of disease models that the chance that a susceptible host will become infected is proportional to the density of infected hosts (the mass action assumption) a host specific pathogen cannot drive its host to extinction (McCallum and Dobson 1995). Extinction in the absence of stochasticity is possible if alternate hosts (sometimes called reservoir hosts) relax the extent to which transmission depends on the density of the endangered host species.

### Doesn’t Solve XTN

### No Bioterror XTN

#### Terrorists won’t use bioweapons because they’re hard to make and disperse and vaccines exist that can be rapidly deployed – They would prefer alternative conventional methods because they’re far easier to use and cause the same damage, that’s Clark 08

### Disease XTN

#### Diseases won’t cause extinction because as a disease kills people off, the rate of transmission will be decreased – That means that any disease deadly enough to wipe populations out would quickly be unable to find enough hosts to sustain itself and burn out, that’s Gerber 05.

#### Lethal diseases burn out fast, pandemic is unlikely

Stephen Morse, director of the Center for Public Helth Preparedness, at the Mailman School of Public Health of Columbia University, 04, [“Emerging and Reemerging Infectious Diseases: A Global Problem", ActionBioscience.org, http://www.actionbioscience.org/newfrontiers/morse.html] Zheng

Morse: A pandemic is a very big epidemic. It requires a number of things. There are many infections that get introduced from time to time in the human population and, like Ebola, burn themselves out because they kill too quickly or they don’t have a way to get from person to person. They are a terrible tragedy, but also, in a sense, it is a lucky thing that they don’t have an efficient means of transmission. In some cases, we may inadvertently create pathways to allow transmission of infections that may be poorly transmissible, for example, spreading HIV through needle sharing, the blood supply, and, of course, initially through the commercial sex trade. The disease is not easily transmitted, but we provided, without realizing it, means for it to spread. It is now pandemic in spite of its relatively inefficient transmission. We also get complacent and do not take steps to prevent its spread.

### Warming Firstline

#### The plan only creates new models and simulations for warming – That’s not key because we know that warming exists – They do nothing to avoid economic goals of developing countries or make alternative energy commercially viable – Computational science itself does nothing to reduce emissions

#### Massive amounts of data from multiple sources solve adaption now

Jonathan T. Overpeck, climate system scientist at the University of Arizona, where he is also the Director of the Institute of the Environment, as well as a Professor of Geosciences and a Professor of Atmospheric Sciences, et al., Gerald A. Meehl, Sandrine Bony, David R. Easterling, 2-11-11, [“Climate Data Challenges in the 21st Century,” VOL 331, 700, SCIENCE, <http://www.astr.ucl.ac.be/users/fmasson/700.full.pdf>] E. Liu

Finally, there has been an explosion in data from numerical climate model simulations, which have increased greatly in complexity and size. Data from these models are expected to become the largest and the fastest-growing segment of the global archive (Fig. 2). The archiving and sharing of output from climate models, particularly those run with a common experimental framework, began in the mid-1990s, starting with output from the early global coupled atmosphere-ocean general circulation models (AOGCMs) used for making future climate change projections (6). This led to the Coupled Model Intercomparison Project (CMIP), organized by the World Climate Research Program (WCRP), inviting all the modeling groups to make increasingly realistic simulations of 20th-century and possible future 21st-century climates (7–9). Recently, CMIP3 involved 16 international modeling groups from 11 countries, using 23 models and submitting 36 terabytes of model data, all archived by the Program for Climate Model Diagnosis and Intercomparison (PCMDI), signaling a “new era in climate change research” (10). This activity has made it possible for anyone to openly access these state-of-the-art climate model outputs for analysis and research. Climate model data have been archived and accessed,exchanged,andsharedprimarilywithin thephysicalclimatescienceresearchcommunity, although there has been growing interest in the use of these climate model data by other communities of researchers. CMIP was designed to providethisbroaderaccesstoclimatemodeloutput for researchers from a wide range of communities. The Intergovernmental Panel on Climate Change (IPCC) was also able to use CMIP multi model data sets to provide state-of-the-art assessments of what the models as a group indicate about possible future climate change (10). Now climate models are beginning to be used for much more than climate research. In particular, they are expected to inform decisions that society must take at global to local scales to adapt to natural climate variations as well as to anthropogenic climate change, and to guide the implementation of possible mitigation measures. This puts new demands on the variety, scale,and availability of observational data needed for model evaluation and development, and expands, yet again, the volume of climate data that must be shared openly and efficiently (Fig. 2). An illustration of the challenges and possibilities posed by the future interaction of fine scale observational data with more complex models is the evaluation of clouds and the hydrologic cycle. These processes are critical for simulating atmospheric dynamics and regional precipitation, as well as predicting natural climate variability and how much Earth,andlocalpartsofit,couldwarm for a given amount of greenhouse gas forcing. New high-resolution active remote sensing observations from satellite instruments (such as CALIPSO lidar or CloudSat radar) are revealing the vertical distribution of clouds for the first time. However, to facilitate the comparison of model outputs with these complex new observations effectively, it has been necessary to develop and distribute new diagnostic tools (referred to as “observation simulators”) visualizing what these satellites would see if they were flying above the simulated atmosphere of a model (11, 12). Thanks to these developments, it will soon be possible to rigorously assess the realism of cloud simulations in the latest generation of models; for the price of an additional 6% [160 terabytes (TB)] of CMIP5-related climate data that must be shared.

### Data Now XTN

#### Complexity and amount of environmental and climate data has never been higher – It has shaped investigations of the IPCC and we’re already able to predict precipitation, climate variability, and cloud coverage – This is already shaping mitigation and adaptation measures, that’s Overpeck et al. 11

#### Massive amounts of data now – Interpretation is key to use

Jonathan T. Overpeck, climate system scientist at the University of Arizona, where he is also the Director of the Institute of the Environment, as well as a Professor of Geosciences and a Professor of Atmospheric Sciences, et al., Gerald A. Meehl, Sandrine Bony, David R. Easterling, 2-11-11, [“Climate Data Challenges in the 21st Century,” VOL 331, 700, SCIENCE, <http://www.astr.ucl.ac.be/users/fmasson/700.full.pdf>] E. Liu

The burgeoning types and volume of climate data alone constitute a major challenge to the climate research community and its funding bodies. Institutional capacity must exist to produce, format, document, and share all these data, while, at the same time, a much larger community of diverse users clamors to access, understand, and use climate data. These include an ever-increasing range of scientists (ecologists, hydrologists, social scientists, etc.) and decision-makers in society who have real money, livelihoods, and even lives at stake (resource managers, farmers, public health officials, and others). Key users also include those with public responsibilities, as well as their constituents in the general public who must support and understand decisions being made on their behalf. As a result, climate scientists must not only share data among themselves, but they must also meet a growing obligation to facilitate access to data for those outside their community and, in doing so, respond to this broader user community to ensure that the data are as useful as possible. In addition to the latest IPCC assessment, various ongoing national climate assessment and climate services activities are being initiated that will need to access and use climate data, just as a growing number of climate adaptation and mitigation efforts around the globe will need to be better informed by climate data. These efforts will succeed only if climate data are made readily accessible in forms useful to scientists and nonscientists alike.

#### Petabytes of climate data now – Organizing it comes first

Jonathan T. Overpeck, climate system scientist at the University of Arizona, where he is also the Director of the Institute of the Environment, as well as a Professor of Geosciences and a Professor of Atmospheric Sciences, et al., Gerald A. Meehl, Sandrine Bony, David R. Easterling, 2-11-11, [“Climate Data Challenges in the 21st Century,” VOL 331, 700, SCIENCE, <http://www.astr.ucl.ac.be/users/fmasson/700.full.pdf>] E. Liu

An increasingly daunting aspect of having tens and eventually hundreds of petabytes of climate data openly available for analysis(Fig.2) is how to actually look at and use the data, all the while understanding uncertainties. More resources need to be dedicated to the development of sophisticated software tools for sifting through, accessing, and visualizing the many model versions, experiments, and model fields (temperature, precipitation, etc.), as well as all of the observed data that is online. In parallel, it is becoming increasingly important to understand complex model results through a hierarchy of models, including simple or conceptual models (17). Without this step, it will be extremely difficult to make sense of such huge archived climate data sets and to assess the robustness of the model results and the confidence that may be put in them. Again, fulfilling the needs of all types of interdisciplinary users needs to be the metric of success. Increasingly, climate scientists and other types of scientists who work effectively at the interface between research and applications are working closely together, and even “coproducing” knowledge, with climate stakeholders in society (18, 19). These stakeholders, along with the interdisciplinary science community that supports them, are the users that must drive the climate data enterprise of the future.

## Disasters

### Disasters Frontline

#### 1. Knowledge causes people to take risks – Increases disaster damage

Robert Meyer, Gayfryd Steinberg Professor and Co-Director of Wharton's Risk Management and Decision Processes Center, 12-4/5-08, [“Why We Fail to Learn from Disasters,” Paper prepared for “The Irrational Economist” Conference, <http://www.theirrationaleconomist.com/abstracts/Meyer_Why%20we%20fail%20to%20learn.pdf>] E. Liu

The above accounts still leave us with one remaining puzzle. In principle, the better we are at recalling the past and the advanced our scientific knowledge is about hazards and mitigation, the lower our losses should be from them. But the reality seems to be the opposite. The data suggest that as rapidly as we have seen increases in the science of mitigation, we have witnessed even faster increases in material losses from disasters. As an example, while hurricanes have plagued communities along the United States Atlantic and Gulf coasts for decades—often with greater frequency and severity than we are seeing today—the inflation adjusted losses imposed by recent storms dwarf those imposed by past storms. Seven of the hurricanes that made landfall in 2004 and 2005, for example, were among the 20 most costly insurance disasters of all time (Wharton Risk and Decision Processes Center 2009). The typical explanation for this is that the more that we know about hazards and how to survive them, paradoxically the more we are to expose ourselves and our property to risk. In other words, when it comes to protecting against hazards, more knowledge can be a dangerous thing. A good example of this paradox of knowledge is the fate of the town of Indianola, Texas. In the 1875 Indianola was a thriving Gulf-coast town of 5,000 that was home to the second most important port in Texas, behind Galveston. In September of that year, however, Indianola was destroyed by a major hurricane and accompanying tidal surge. Not to be dissuaded, the community rapidly recovered from this disaster and rebuilt--only to see the town destroyed yet again by a hurricane in 1886. Lacking any knowledge of hurricane climatology, and knowing little about how one might prevent such a disaster from happening yet again, the surviving residents reached the only sensible conclusion they could: this was simply not a good spot to build a town, and the residents moved elsewhere. What remains of Indianola still exists, but as a ghost town that serves as rare monument to sensible prudent decision making under uncertainty. In contrast, the far more advanced knowledge that we have today about hurricane risks and mitigation tends to produce something of the opposite reaction among communities and individuals: the belief that storms and other hazards are both survivable and predictable has induced aggregate risk taking, with the dominant migration pattern being to coastal zones that would have been deemed too unsafe for sensible development in earlier, less knowledgeable, times. In short, we suffer more from hazards today because of inflated beliefs about the degree to which we can survive them.

#### 2. Disasters won’t cause extinction or even be that bad – Empirically, all of them have been localized and easily recovered from

#### 3. Storms won’t get worse in the future

Marian Radetzki, Professor in the Department of Economics, Lulea University of Technology, and a Senior Research Fellow at Studieforbundet Naringsliv och Samhalle (Center for Business and Policy Studies), a Stockholm think tank, 3-6-10, [“The Fallacies of Concurrent Climate Policy Efforts,” <http://www.iva.se/PageFiles/9680/IVA%20V%C3%A4gval%20energi%20Marian%20Radetzki%20090610.pdf>] E. Liu

The Stern Review (2006) claims that global warming will result in more frequent extreme weather events including a rising intensity of storms. In the same vein, IPCCs (2007) most recent Assessment Report (Working Group II, Technical Summary, p. 64) asserts that ‘‘confidence has increased that some weather events and extremes will become more frequent, more widespread and/or more intense during the twenty first century.’’ Media have jumped upon and exaggerated these asserions. Violent and frequent hurricanes are widely seen as a compelling consequence of warming. Yet, there is neither observational nor scientific support for this relationship. In fact Christopher Landsea of the Atlantic Oceanographic & Meteorological Laboratory, a leading contributor to IPCCs Second and Third Assessment Reports on the subject of hurricanes, resigned in disgust from the same assignment for the Fourth Assessment Report, precisely because he felt that IPCCs leadership insisted on a politically correct statement which was not affirmed by science.3 Recent work by Vecchi and Soden (2007) support Landsea’s scientific position as does the straightforward statement by eminent atmospheric scientist Richard Lindzen (2005) that all models of global warming envisage a reduction of temperature differences between the polar and tropical regions, thereby reducing the tendency for hurricanes to form. Statistics for hurricanes that have landed on the US coast over two consecutive 50-year periods confirm this view. Between 1900 and 1949, there was a total of 101 such hurricanes, of which 39 were classed as particularly intense. Between 1956 and 2005, the corresponding numbers were 83 and 34 (Solomon 2008). Based on IPCC material, the Pew Center reports the absence of any increasing trend in the number of global tropical cyclones (<http://www.pewclimate.org/hurricanes.cfm>).

### Risk Turn XTN

#### Early warning and certainty programs dramatically increase damage from disasters – Recent storms are more devastating because certainty about survivability increases the incentives to take risks and for people to move onto coastlines and other vulnerable places – That’s Meyer 08

#### Multiple psychological reasons people will push survivability with certainty

Robert Meyer, Gayfryd Steinberg Professor and Co-Director of Wharton's Risk Management and Decision Processes Center, 12-4/5-08, [“Why We Fail to Learn from Disasters,” Paper prepared for “The Irrational Economist” Conference, <http://www.theirrationaleconomist.com/abstracts/Meyer_Why%20we%20fail%20to%20learn.pdf>] E. Liu

What explains this effect? Past research on risk-taking and learning in other domains suggests three complementary mechanisms. The first is that the tendency for knowledge to foster risk-taking can be seen as the mirror image of the well-known tendency for individuals to avoid risky decisions when the odds of different outcomes are unknown or ambiguous. For example, while a decision maker may be willing to take a bet for which there is an 50% chance of winning $10 and a 50% chance of losing $2, he or she will be less likely to take that same bet if the odds of the two outcomes are either unknown, or are randomly drawn from a uniform distribution with a mean of 50% (Camerer andWeber 1992). Hence, by reverse implication, the more precisely one can express the odds of a gamble, the more likely a person will be to play it. The second mechanism is the widespread finding that individuals are less dissuaded by risks whose odds are perceived as controllable. For individuals who engage in risky health behaviors (such as cigarette smoking and exposure to AIDS) have been found to do so, in part, because they feel that their personal odds of suffering ill effects are simply less than that faced by others; while others are at risk, they are less so because their superior ability to control it (e.g., Menon, Block, and Ramanathan 2002). Hence, the more easily it is for a coastal resident to envision how they might survive a hurricane through stronger windows, better roofing, government aid after the storm, etc., the more likely they are to believe that damage is something that will happen to other residents, not them. The final mechanism might be termed the mortality effect; individuals will be less inclined to want to experiment with risky actions if there is a perceived real possibility—no matter how small--of a fatal outcome. Even if one suspected that a certain belief may not be factually well-grounded—such as a belief that a certain coastal location was “cursed” to receive a disproportionate share of hurricanes, or that abstaining from bean soup might prevent floods--if the consequences of being wrong are sufficiently catastrophic the experiment needed to reject the belief would never be conducted. As an extreme example, the ancient Aztecs routinely conducted human sacrifices in the belief that they were necessary to prevent the end of the world1. This custom, clearly, had little evolutionary basis in objective reinforcement learning; presumably no one had any direct evidence that the world would end without the sacrifices. But it nevertheless persisted due to the joint effects of fictitious reinforcement via the re-telling of myths, and, most importantly, the understandable reluctance of the Aztecs to undertake the experiment necessary to find out whether the myth was true or not. In contrast, the less lethal hazards are perceived to be, the more willing individuals and communities may be to experimentally push the boundaries of survivability. At long as there is uncertainty about the likelihood that a given location will be subject to a disaster, the possibility exists that forecasts of doom will go unfulfilled, particularly in the short time horizon of expected residence--and the only way to find for sure is to undertake the experiment of living there.

### Storms Not WorseX TN

#### Weather won’t get more dangerous in the future – Claims of extreme and catastrophic events are exaggerated – Credible researchers for the IPCC have resigned because they felt the events are being exaggerated, and the future reduction in temperature differences is likely to reduce storm incident, that’s Radetzki 10

## Economy

### Economy Frontline

#### 1. Congestion declining now – Economy and gas

Peter Samuel, 5-21-12, [“Traffic congestion dropped off 30% in 2011 INRIX says - weak economy, higher gas prices,” <http://www.tollroadsnews.com/node/5947>] E. Liu

2012-05-21 21:30: 2011 saw a dramatic drop in traffic congestion in the US - 30% fewer hours wasted in congested traffic according to INRIX, the nation's leading provider of traffic data. The 2011 improvement is only outmatched in the years since INRIX has been measuring congestion by the financial crisis year of 2008, when congestion dropped 34%. In 2009 congestion was up 1% and 2010 saw a 10% regrowth of congestion. But now we learn 2011 saw congestion drop again, and well below 2008 levels. In a press statement the Seattle area based company says the decline in congestion is attributable to the "'Stop-’N’-Go Economy' where lack of employment combined with high fuel prices is keeping Americans off the roads." Bryan Mistele INRIX chief executive: "The economic recovery on Wall Street has not arrived on Main Street. Americans are driving less and spending less fueled by gas prices and a largely jobless recovery."

#### 2. ITS makes congestion worse – People travel in counterproductive and risky ways

Dinesh Mohan, Professor for Biomechanics and Transportation Safety and Coordinator of the Transportation Research and Injury Prevention Programme at the Indian Institute of Technology, Delhi, 9-21-09, [“INTELLIGENT TRANSPORTATION SYSTEMS (ITS) AND THE TRANSPORTATION SYSTEM,” <http://tripp.iitd.ac.in/course/lecture2010/mohan/module1/ITS%20DM.pdf>] E. Liu

The use of ITS has elevated the expectations of society and the individual traveler, based on the promise of the technologies involved. In addition, the producers and marketers of these technologies have at times introduced unnecessary hype in what is possible in the future. The results have been mixed. The less than expected performance in the real world for some promised solutions is partly because human beings change behavior when the system around them changes. In other words, people adapt to what other people and technologies require of them to function according to their own expectations. Such adaptations produce unintended or unexpected results. Some examples are given below: • If an ITS feature increases perception of safety in a road user then the road user may start behaving in riskier ways. Perceived safety usually increases if there is feedback, convincing the driver there is increased safety. For example, drivers of vehicles equipped with Antilock Braking Systems (ABS) have shown an adaptation to this feature by taking on more risk including hard brake maneuvers since they do not expect their vehicles to skid. Drivers with vehicles equipped with ABS therefore have changed the patterns of crashes they are involved in and overall crash reductions are much less than expected. ITS systems that improve the handling characteristics of vehicles may lead to increased use of those vehicles under adverse weather conditions like heavy rain, snow or ice. This is not to say that all safety devices produce such adaptations. Use of helmets, seat belts and airbag equipped cars do not seem to have the same result because the driver has no instant feed back that the system has become safer. These latter devices only provide protection once you have a crash and most of the motorists never have this experience. • Onboard driver assist systems can produce a task overload when several tasks compete for attention of the driver. The addition of visual or auditory attention by ITS can distract the driver from the main driving task and result in errors or slowed reactions. Both can increase the risk of a collision and also divert the driver's attention to tasks that are not related to driving. These tasks, for instance the operation of route guidance systems, can distract the driver to take away time from the driving task. • Route guidance and traffic information systems can help drivers chose roads and streets that they normally do not use, are unfamiliar with and do not know their way around. This can result in a redistribution of traffic through areas where high traffic densities are not desired and end up increasing traffic on all roads. This redistribution of traffic may not correspond with what is desirable from a societal point of view. Short cuts through residential areas may increase probability of crashes, pollution and noise. In such a situation local residents could find ways to prevent these negative impacts by physical road blocks or traffic calming measures, thus negating the original benefits of the ITS system. • If the effect of ITS is to reduce the drivers’ role in active control of the vehicle then they may adapt to it and over time depend completely on these systems. Then they are likely to be less sensitive and incapable of taking active control in complex situations. Overdependence on ITS systems can also produce task under load and make the driving task very monotonous resulting in attention deficit. The knowledge about these effects is still in its primitive stage and it is very difficult to predict how human beings adapt to such changes over a long period of time. • Experts concerned with pollution, energy consumption and global warming issues have also cautioned us about the effect of technologies that making driving much more pleasurable and less difficult. Creation of new trips because drivers feel comfortable going to unknown destinations with less uncertainty will lead to an undesired increase in the use of motor vehicles.

#### 3. Evidence for transportation enhancing growth is tenuous and disputed

Tom Rye, Professor of Transport Policy & Mobility Management in the School of Engineering and the Built Environment and David Scotney, Edinburgh Napier University, 11, [“ DOES REDUCING JOURNEY TIMES IMPROVE THE ECONOMY – AND, IF NOT, WHAT ARE THE IMPLICATIONS FOR TRANSPORT ASSESSMENT?,” STSG, <http://www.stsg.org/star/2011/TomRye.pdf>] E. Liu

This section of the paper considers the question of how far the available empirical evidence supports the view that new surface transport infrastructure investment will help to increase GDP – both in terms of the immediate employment impact of the investment itself as a public works project, and then more widely, as a stimulus to general economic activity? Nested within this, it also considers the extent to which can we be confident that the agglomeration productivity benefits that have become part of UK transport appraisal in the past few years can actually be realised. SACTRA12 in their report on the links between transport and economic growth stated (p 12) that ‘…we are provided with a strong theoretical expectation that all or part of a successfully achieved transport cost reduction may subsequently be converted into a

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range of different Transport and the economy wider economic impacts. This, in principle, provides for the possibility of improved economic performance. Empirical evidence of the scale and significance of such linkages is, however, weak and disputed. We conclude that the theoretical effects listed can exist in reality, but that none of them is guaranteed. Our studies underline the conclusion that generalisations about the effects of transport on the economy are subject to strong dependence on specific local circumstances and conditions.’ More recently, the Eddington Report13 was commissioned by the UK Treasury. It states (Vol 1 p 3): ‘Today, in mature economies like the UK, with well-established networks and where connectivity between economic centres is already in place, the evidence suggests that there is considerably less scope for transport improvements to deliver the periods of rapid growth seen historically.

#### 4. Congestion is linked with economic growth – It’s indicative of economic productivity

Eric Dumbaugh, associate professor and interim director at the School of Urban and Regional Planning at Florida Atlantic University, 6-1-12, [“Rethinking the Economics of Traffic Congestion,” The Atlantic Cities, <http://www.theatlanticcities.com/commute/2012/06/defense-congestion/2118/>] E. Liu

But this begs the question: is traffic congestion really a drag on the economy? Economies are measured not in terms of vehicle delay or the amount of travel that people do, but in terms of the dollar value of the goods and services that they produce. If it is true that congestion is detrimental to a region’s economy, then one would expect that people living in areas with low levels of traffic congestion would be more economically productive, on a per capita basis, than those in areas with high levels of congestion. This is a testable assertion. With the help of my research assistant Wenhao Li, I sought to determine whether vehicle delay had a negative effect on urban economies. I combined TTI’s data on traffic delay per capita with estimates of regional GDP per capita, acquired from the U.S. Bureau of Economic Analysis. I used 2010 data for both variables, converted them to their natural logs, and modeled them using regression analysis. And what did I find? As per capita delay went up, so did GDP per capita. Every 10 percent increase in traffic delay per person was associated with a 3.4 percent increase in per capita GDP. For those interested in statistics, the relationship was significant at the 0.000 level, and the model had an R2 of 0.375. In layman’s terms, this was statistically-meaningful relationship. Such a finding seems counterintuitive on its surface. How could being stuck in traffic lead people to be more productive? The relationship is almost certainly not causal. Instead, regional GDP and traffic congestion are tied to a common moderating variable - the presence of a vibrant, economically-productive city. And as city economies grow, so too does the demand for travel. People travel for work and meetings, for shopping and recreation. They produce and demand goods and services, which further increases travel demand. And when the streets become congested and driving inconvenient, people move to more accessible areas, rebuild at higher densities, travel shorter distances, and shift travel modes.

#### 5. Economic decline doesn’t cause war.

Jervis 11 [Robert, Adlai E. Stevenson Professor of International Politics in the Department of Political Science, and a Member of the Arnold A. Saltzman Institute of War and Peace Studies at Columbia University. Force in Our Times Saltzman Working Paper No. 15 July 2011 http://www.siwps.com/news.attachment/saltzmanworkingpaper15-842/SaltzmanWorkingPaper15.PDF]

Even if war is still seen as evil, the security community could be dissolved if severe conflicts of interest were to arise. Could the more peaceful world generate new interests that would bring the members of the community into sharp disputes? 45 A zero-sum sense of status would be one example, perhaps linked to a steep rise in nationalism. More likely would be a worsening of the current economic difficulties, which could itself produce greater nationalism, undermine democracy, and bring back old-fashioned beggar-thy-neighbor economic policies. While these dangers are real, it is hard to believe that the conflicts could be great enough to lead the members of the community to contemplate fighting each other. It is not so much that economic interdependence has proceeded to the point where it could not be reversed – states that were more internally interdependent than anything seen internationally have fought bloody civil wars. Rather it is that even if the more extreme versions of free trade and economic liberalism become discredited, it is hard to see how without building on a pre-existing high level of political conflict leaders and mass opinion would come to believe that their countries could prosper by impoverishing or even attacking others. Is it possible that problems will not only become severe, but that people will entertain the thought that they have to be solved by war? While a pessimist could note that this argument does not appear as outlandish as it did before the financial crisis, an optimist could reply (correctly, in my view) that the very fact that we have seen such a sharp economic down-turn without anyone suggesting that force of arms is the solution shows that even if bad times bring about greater economic conflict, it will not make war thinkable.

### XTN #1 – Congestion Low Now

#### Congestion is low now from recession and gas prices – People are used to it

Washington Post, 5-20-09, [“Traffic Congestion Dips As Economy Plunges,” Chris L. Jenkins, <http://www.washingtonpost.com/wp-dyn/content/article/2009/05/19/AR2009051903534.html>] E. Liu

Don't thank innovative transit systems or better highways. A worsening economy, combined with record-high gas prices last spring, made the big difference, according to a study to be released today by the Metropolitan Council of Governments. COG did a traffic count using aerial photos taken over three days last spring. Traffic had dropped 3.1 percent from 2005, including a sharp reduction in congestion in several choke points in the area. It was the first time the number of miles traveled declined in the 15 years the study has been conducted. "This is certainly not the way we want to solve the region's traffic problem," said Ron Kirby, transportation planning director for COG, which led the triennial study. He said traffic congestion might have eased even more as the economy worsened this past winter. "The impacts of the economy are here." Of course, some maddening spots across the region have gotten worse. Those include a stretch of Interstate 395 from Fourth Street in the District over the 14th Street bridge to Route 1 in Alexandria during the evening rush; parts of the outer loop of the Capital Beltway from 8 to 9 a.m.; and an eastbound stretch of Interstate 66 in Fairfax County during the evening rush. Gas prices have started to increase again in the region, but they are nowhere close to the record highs of 2008. A year ago, a gallon of regular unleaded cost $3.81. This year, the price is $2.21. But experts don't expect more people to start taking to the roads. Motorists have been driving less across the country, but declines in Virginia, Maryland and the District were particularly sharp. Motorists in the region drove a total of 600 million fewer miles in November 2008 than a year earlier, according to the American Automobile Association. "People just stopped driving when prices were so high," said John Townsend, manager of public and government affairs for AAA Mid-Atlantic. "By the time those same prices declined, people were in the throes of the recession. They had grown accustomed to driving less, and they were concerned about their economic well-being." The study analyzed 80,000 aerial photographs taken during morning and evening rush hours. It surveyed the region's 300-mile freeway system, including major interstates such as the Beltway (Interstate 495), but not smaller, interior roadways such as Route 29. Even more striking than the decrease in vehicle miles traveled was the drop in the amount of congestion measured during the morning and afternoon rushes. The report found congestion during those three-hour peak travel times declined 24 percent, to levels not seen since 2002. Officials said the study's results also support increased investment in transit by suggesting that it is effective in reducing highway congestion.

### XTN #2 – ITS Doesn’t Solve

#### ITS empirically fails to decrease congestion – Empirics and communication

Mark Carter, Vice President / Division Manager at SAIC Transportation Research Division. He manages a diverse staff of over 200 employees and sub-contractors, including engineers, operations researchers, human factors specialists, economists, marketing professionals and Brandy Hicks, SAIC, 12-00, [“WHAT HAVE WE LEARNED ABOUT INTELLIGENT TRANSPORTATION SYSTEMS?, Department of Transportation Federal Highway Administration, Chapter 3, ntl.bts.gov/lib/jpodocs/repts\_te/13316.pdf] E. Liu

ACS has limited deployment in the United States. Several factors have limited its use, including cost, system complexity, and uncertainty in the benefits of adaptive systems. Current adaptive control system benefits do not appear to be proven to traffic engineers. Several participants in the ITE roundtable discussion mentioned they are not convinced or even aware of ACS benefits. ACS is particularly sensitive to installation. For example, a limited SCOOT installation in Anaheim, California, produced little improvement and, in some cases, actually increased delay. During peak traffic periods, the system experienced delays that were 10 percent greater than baseline conditions. However, during nonpeak periods, the delay was decreased by 5 percent. According to a U.S. Department of Transportation-sponsored evaluation of the system, the reason for sub-optimal performance was most likely in placement of the detectors. Also, the benefits of ACS depend on the base case condition. In areas characterized by fluctuations in traffic demand and low growth, ACS offers few benefits over well- maintained fixed-time/time-of-day signals. The consensus of engineers in the ITE roundtable discussion was that the benefits of traditional ACS over well-maintained fixed-time plans are unproven (although, as was demonstrated previously, such well- maintained fixed-time plans are the exception, not the rule). Participants also expressed concern about the complexity of adaptive control systems. Additional training is normally required to operate such systems, which are not considered user-friendly. Different terminology causes problems for U.S. traffic engineers. In the Hennepin County, Minnesota, deployment, system operators found the SCATS system difficult to learn, even though extensive training was provided. Operators had difficulty working with the complex user interface. In a similar fashion, ACS systems are highly dependent on the communications network, as well as the traffic detectors. If problems arise with communications, the system does not work efficiently, as occurred in Hennepin County, Minnesota, where the communications system was unreliable, and arterial traffic signals experienced ongoing communications failures (Booz-Allen & Hamilton 1999). Finally, cost appears to be a major obstacle to widespread ACS deployment, even for those who appear convinced of its benefits. This concern extends to both the capital and the operations and maintenance costs of ACS. For example, one of the biggest selling points offered by ACS proponents is that over the long term, the systems are more cost-effective than traditional signal timing approaches. They argue that the operations and maintenance costs associated with ACS are much lower than those associated with signal re-timing. However, as Table 3-5 illustrates, the equation is not that simple, for while signal re-timing costs decrease, other costs such as loop maintenance increase. Table 3-5.Operations and Maintenance Costs for SCOOT Compared to Furthermore, even if the operations and maintenance costs were lower, practitioners have expressed concern about the large capital costs associated with ACS. While these costs vary widely depending on the size of deployment, they can (as Table 3-6 indicates) be quite significant. Even some of the practitioners who feel the benefits of ACS justify and outweigh these costs have difficulty in securing the large amounts of capital funding necessary to deploy ACS. Many municipal budgets are not structured to support such large, one-time costs for their arterial network. What does the future hold for ACS? According to the ITS deployment tracking database, only five other sites expect to use an adaptive control system by the year 2005—a rather dismal outlook for ACS. However, most participants in the ITE roundtable discussion believed ACS had the potential to provide significant benefits. These benefits have not yet been convincing or made well-known. Participants agreed that a database of ACS benefits may be helpful in choosing between a traditional traffic signal system and adaptive control. Furthermore, despite the rather low level of domestic deployment, ACS has enjoyed relatively widespread use outside the United States. For example, SCOOT has been deployed at more than 100 sites worldwide, while SCATS has been deployed in nine countries. While the reasons for this discrepancy are not fully understood, it has been suggested that off-shore development of these systems may be the factor limiting their adoption here. To illustrate, some practitioners have argued that these traditional, foreign-designed systems are insensitive to a number of unique, yet critical, aspects of U.S. signal control, such as pedestrian clearance times.

### AT: Plan Solves Latent Demand

#### Improvements are not immune to latent demand – Making travel easier recongests roads

Brian D. Taylor, associate professor of urban planning and Director of the Institute of Transportation Studies at the

University of California, Los Angeles, Fall 02, [“Rethinking Traffic Congestion,” Access, <http://courses.washington.edu/cee320ag/CEE%20320/Readings/Access%2021%20-%2003%20-%20Rethinking%20Congestion.pdf>] E. Liu

G iven that latent/induced demand may help to recongest roadways following capac- ity expansion, some argue that we should instead emphasize operational improve- ments (such as coordinated signal timing and ramp metering) and transit-capacity expansions (like added rail transit and express bus service). Such improvements may be wise investments, but they are no less vulnerable to the recongesting effects of latent/induced demand than road widenings. When capacity is expanded on a congested facility, delay is reduced in the short term, and traffic speeds increase. Increased speeds reduce the time costs of trips, making travel more attractive. Travelers who were previously dissuaded by congestion from making car trips begin to do so, and the facility gradually becomes congested again. This, in a nutshell, is the latent-demand effect. But the effects of latent/induced demand are not limited to road widenings. If a new ramp-metering program smoothes traffic flow and reduces delay in the short-term, it has the same effect as increased capacity on the time-cost of travel; so does a new rail line that lures a substantial number of travelers off a parallel roadway. This is why congestion on the San Francisco-Oakland Bay Bridge was only temporarily reduced when BART opened in the 1970s. Absent some corresponding increase in the monetary price of a trip, any change that reduces delay and travel times is subject to these effects.

### XTN #3 – Transportation Doesn’t Solve

#### Transport enhancements don’t solve travel time –empirical studies prove

Tom Rye, Professor of Transport Policy & Mobility Management in the School of Engineering and the Built Environment and David Scotney, Edinburgh Napier University, 11, [“ DOES REDUCING JOURNEY TIMES IMPROVE THE ECONOMY – AND, IF NOT, WHAT ARE THE IMPLICATIONS FOR TRANSPORT ASSESSMENT?,” STSG, <http://www.stsg.org/star/2011/TomRye.pdf>] E. Liu

We have already noted the consistency in average travel time per trip in the UK over recent times in the previous section. The UK National Travel Survey (NTS) has however measured average daily travel time per person since 1972/73. This now amounts to just over 1 hour per day, but this has changed very little over the whole period (possibly marginally upwards). However car ownership has doubled and the average distance travelled increased by 60%. Since the early-1970s there has been a considerable investment in transport enhancements across the UK (>£100 billion), with it would seem virtually no reductions in overall travel time (despite this being one of the main objectives for the investment) and indeed an increase in distance travelled. Studies do show that there are time savings for vehicles with speedier journeys related to transport enhancements, but there seem to be a dearth of studies showing actual travel time savings for users. However this does not mean that travel time savings do not exist in possibly the short term in relation to specific enhancements, although it may be concluded that these overall in some way disappear over time. One empirical study of a new motorway in Melbourne, Australia, was presented by Odgers and Low at the World Conference on Transport Research 20109. This actually showed that the time savings predicted to result from the construction of the road did not arise either on the corridor itself nor on the wider transport network in the city; in fact they decreased, to the extent that the forecast Benefit-Cost Ratio was seriously eroded. So we must ask ‘what has been achieved’ – does travelling further actually yield net economic, social and environmental (dis)benefits?

#### Tradeoff between dollars invested and congestion benefits are tiny

Matthias Sweet, PhD candidate at the University of Pennsylvania City and Regional Planning Department, 11, [“Does Traffic Congestion Slow the Economy?,” Journal of Planning Literature, 2011 26: 391 originally published online 5 October 2011, <http://jpl.sagepub.com/content/26/4/391.abstract>] E. Liu

At the federal level, transportation legislation has targeted congestion reduction through various federal programs. How- ever, existing research suggests that public-sector investments have been largely ineffective at reducing congestion. For example, Winston and Langer (2006) evaluated congestion- reduction policies in seventy-five major U.S. urban areas, find- ing that for every dollar spent, only eleven cents of congestion- reduction benefit accrued. Granted, not all of these investments were justified exclusively as congestion-reduction measures; however, Winston and Langer (2006) interpret the low rate of return as suggesting a need to rethink existing policies. They recommend increasing the use of congestion pricing (discussed in the next section).

### AT: Creates Growth

#### Studies show growth from transportation is taken from elsewhere, not created

Tom Rye, Professor of Transport Policy & Mobility Management in the School of Engineering and the Built Environment and David Scotney, Edinburgh Napier University, 11, [“ DOES REDUCING JOURNEY TIMES IMPROVE THE ECONOMY – AND, IF NOT, WHAT ARE THE IMPLICATIONS FOR TRANSPORT ASSESSMENT?,” STSG, <http://www.stsg.org/star/2011/TomRye.pdf>] E. Liu

There are few empirical studies that have unequivocally been able to demonstrate significant economic development benefits as a result of transport investments. Banister and Berechman17 review case studies of the M25 and a new LRT in Buffalo in the US; neither case studies reveals economic growth that can be seen to be additional to that which would have occurred without that transport investment. As noted in the Strategic Business Case for High Speed Rail to Scotland18: ‘Development which occurs in Glasgow and Edinburgh following the opening of any high speed link will likely be redistributed from elsewhere rather than new development. This is the conclusion of previous studies, which suggest that up to 95% of development following investment in transport links is redistributed from other areas.’ Lian and Ronnevik19 reviewed 102 major road investments completed in Norway between 1993 and 2005. They were unable to establish any relationship between infrastructure investments and employment, income and industrial development, although they did find some evidence that these investments led to some agglomeration effects in regional centres, reducing leakage from them to larger Norwegian cities. Some positive labour market effects were also observed by their colleagues Gjerdåker and Engebretsen20 due to regions being strengthened by road investment.

### AT: Boosts GDP

#### Other factors outweigh the effects of transportation on GDP

Tom Rye, Professor of Transport Policy & Mobility Management in the School of Engineering and the Built Environment and David Scotney, Edinburgh Napier University, 11, [“ DOES REDUCING JOURNEY TIMES IMPROVE THE ECONOMY – AND, IF NOT, WHAT ARE THE IMPLICATIONS FOR TRANSPORT ASSESSMENT?,” STSG, <http://www.stsg.org/star/2011/TomRye.pdf>] E. Liu

For this paper the authors have reviewed links between GDP, GDP growth and transport infrastructure investment in western EU member states (the “old” member states). The results are shown in the figures below, and indicate once again that there appears to be very little link between transport infrastructure investment and GDP – or, more probably, that GDP and GDP growth are much more affected by other factors and the effect of transport investment is so minimal as to be difficult to pick up.

### XTN #4 – Congestion Not Bad

#### Congestion is indicative of growth, doesn’t hurt the economy, and isn’t high in the US

Brian D. Taylor, associate professor of urban planning and Director of the Institute of Transportation Studies at the

University of California, Los Angeles, Fall 02, [“Rethinking Traffic Congestion,” Access, <http://courses.washington.edu/cee320ag/CEE%20320/Readings/Access%2021%20-%2003%20-%20Rethinking%20Congestion.pdf>] E. Liu

W e frequently read staggering estimates of the costs traffic congestion imposes on society. The Texas Transportation Institute, for example, placed the cost of metropolitan traffic congestion in 75 of the over 300 US metropolitan areas at $68 billion in the year 2000. Given such estimates, we can’t help but conclude that the economic health of metropolitan areas is threatened by congestion. While nobody likes being stuck in traffic, I think we overestimate its costs. Cities exist because they promote social interactions and economic transactions. Traffic congestion occurs where lots of people pursue these ends simultaneously in limited spaces. Culturally and economically vibrant cities have the worst congestion problems, while declining and depressed cities don’t have much traffic. By some esti- mates, New York and Los Angeles are America’s most congested cities. But if you want access to major brokerage houses or live theater, you will find them easier to reach in congested New York than in any other metropolitan area. And if your firm needs access to post-production film editors or satellite-guidance engineers, you will reach them more quickly via the crowded freeways of LA than via less crowded roads elsewhere. Despite congestion, a larger number and wider variety of social interactions and eco- nomic transactions can be consummated in large, crowded cities than elsewhere. Seen in this light, congestion is an unfortunate consequence of prosperity and a drag on otherwise high levels of accessibility, not a cause of economic decline and urban decay. So while we can view congestion as imposing costs on metropolitan areas, the costs of inaccessibility in uncongested places are almost certainly greater. The terrible economic and environmental tolls that congestion exacts in places like Bangkok, Jakarta, and Lagos are undeniable. But mobility is far higher and congestion levels are far lower here in the US, even in our most crowded cities. That’s why, for now, we don’t see people and capital streaming out of San Francisco and Chicago, heading for cities like Alturas, California, and Peoria, Illinois.

### Adaptation Solves

#### Human adaptation solves congestion impacts – Their models underestimate that

Matthias Sweet, PhD candidate at the University of Pennsylvania City and Regional Planning Department, 11, [“Does Traffic Congestion Slow the Economy?,” Journal of Planning Literature, 2011 26: 391 originally published online 5 October 2011, <http://jpl.sagepub.com/content/26/4/391.abstract>] E. Liu

Regardless of value of time du jour, the arguments that congestion-induced travel delay results in lost productivity are tenuous (Stopher 2004). A body of literature indicates that individuals respond to travel delays by changing their behavior. System users are adept at substituting for trips by traveling at alternative times, on alternative routes, or using alternate modes (Choo and Mokhtarian 2008; Downs 1992; Ory et al. 2004; Salomon and Mokhtarian 1997). Downs (1992) explains how congestion would return using the principle of triple con- vergence, according to which system users adjust their travel behavior in three ways: modal convergence (transferring from transit to auto or vice versa), temporal convergence (adjusting an individual’s departure time and shortening the peak hour), and spatial convergence (altering route choices; Downs 1992). Although short-run responses to travel delays or travel time savingsmore closely reflect the assumption of fixed origins and destinations, long-term adjustments suggest that travelers alter travel behavior in ways that maintain relatively stable travel budgets. In response to congestion-induced travel delay, users may simply forego access to additional locations in response to higher travel times. Or conversely, as Metz (2008) argues, users may simply consume travel time savings by accessing more distant opportunities. Metz (2008) thus attributes the entire long-run economic impact of changing travel speeds to the marginal value of gained (or lost) access to particular des- tinations. As such, measuring the economic cost of congestion by using the value of travel delay in comparison with free-flow speeds underestimates the role of individual adaptations through changed travel behavior. While researchers estimating the value of time have had difficulty distinguishing economic costs from foregone noneconomic opportunities, this literature has had even more difficulty distinguishing a more comprehen- sive range of economic outcomes.

#### People adapt – High wages incentivize it

Eric Dumbaugh, associate professor and interim director at the School of Urban and Regional Planning at Florida Atlantic University, 6-1-12, [“Rethinking the Economics of Traffic Congestion,” The Atlantic Cities, <http://www.theatlanticcities.com/commute/2012/06/defense-congestion/2118/>] E. Liu

Stated another way, people adapt to congested environments. Because cities provide greater access to job opportunities than do rural areas, as well as wages that are more than 30 percent higher than their non-metropolitan counterparts they have a powerful economic incentive to do so. Fortunately for our cities and their economies, urban environments are precisely what is sought by the millennial generation. 88 percent of millennials report that they would prefer to live in urban environments, and they are already driving less and riding transit more than their Gen X and boomer counterparts. Indeed, many millennials view driving as a vice, with 55 percent indicating that they have made a deliberate effort to reduce the amount of driving that they do. They are also leading a surge in cycling in cities like Seattle, Minneapolis, Denver, and Washington, D.C., all of which have seen their share of bike commuting double over the last decade. These trends are of great concern to the auto industry.

### AT: Freight

#### Congestion doesn’t hurt freight – That travel occurs in non-congested zones

Eric Dumbaugh, associate professor and interim director at the School of Urban and Regional Planning at Florida Atlantic University, 6-1-12, [“Rethinking the Economics of Traffic Congestion,” The Atlantic Cities, <http://www.theatlanticcities.com/commute/2012/06/defense-congestion/2118/>] E. Liu

While behavioral adaptations and changes in consumer preferences have already begun to address the issue of personal transportation in congested environments, a second issue remains unanswered: how do congested areas deal with freight and goods movement? A common argument is that if a region’s roadways are congested, goods will be unable to get to market and its economy will falter. Yet even the most casual glance at our most congested regions - New York, Los Angeles, and San Francisco to name three - quickly dispels this idea. These are not places where consumer choices are limited, nor are they areas with stagnant economies. Quite the contrary. They are precisely the areas where one finds not only the most vibrant economies, but also the greatest variety of goods and services. How is this possible? It is important to recognize that major manufacturing and freight activities rarely occur in congested city centers, where land values are too high to make these activities economically viable. Likewise, long-haul truck drivers, who are paid on a per-mile travelled basis, have a powerful economic incentive to avoid traveling through urban areas during congested time periods, which reduces the number of miles per hour they can travel, and thus the number of dollars per hour they receive for their time. Urban economies naturally encourage these activities to move away from congested areas and time periods.

### AT: Productivity

#### Travel time doesn’t trade-off with productivity gains

Matthias Sweet, PhD candidate at the University of Pennsylvania City and Regional Planning Department, 11, [“Does Traffic Congestion Slow the Economy?,” Journal of Planning Literature, 2011 26: 391 originally published online 5 October 2011, <http://jpl.sagepub.com/content/26/4/391.abstract>] E. Liu

While researchers agree that the value of time is related to the regional wage rate (Miller 1989; Small 1992), they do not agree on how to determine its present value. Many cite half of the wage rate, while the range extends from virtually nothing to values greater than the wage rate (Rouwendal and Nijkamp 2004). Differences stem from two factors. First, it is not clear what proportion of travel delay (if any) results in lost produc- tivity (Stopher 2004). If an employee finds that his or her commute is 15 min longer due to congestion, they may leave for work earlier or may depart from work later in order to make up the additional work time. Similarly, 15 min of congestion delay would not replace economically productive time for an individual traveling to a social event after shopping. While foregone recreational time would certainly be valuable from a CBA perspective, it is not economically productive and is therefore more difficult to quantify. Second, individuals may simply change their travel destinations despite maintaining a constant travel time budget (Metz 2008). Researchers have found that, individuals average 1 hr of travel over the course of a day. In a discussion of time valuation for new transport investments, Metz (2008) argues that travel time savings would not exist in the long term and that there is little reason to value long-term travel time savings. Instead, faster travel times would be spent to access a greater range of activity locations (Metz 2008). When applying this logic to congestion-induced delay, individuals would choose closer activity locations in order to maintain stable travel times despite slower travel speeds.

### XTN #5 – No War

#### No causal or historical relation to war

Ferguson 6 [Niall, MA, D.Phil., is Laurence A. Tisch Professor of History at Harvard University and William Ziegler Professor of Business Administration at Harvard Business School. He is also a Senior Research Fellow at Jesus College, Oxford University, and a Senior Fellow at the Hoover Institution, Stanford University, Foreign Affairs, Sept/Oct, “The Next War of the World”]

Nor can economic crises explain the bloodshed. What may be the most familiar causal chain in modern historiography links the Great Depression to the rise of fascism and the outbreak of World War II. But that simple story leaves too much out. Nazi Germany started the war in Europe only after its economy had recovered. Not all the countries affected by the Great Depression were taken over by fascist regimes, nor did all such regimes start wars of aggression. In fact, no general relationship between economics and conflict is discernible for the century as a whole. Some wars came after periods of growth, others were the causes rather than the consequences of economic catastrophe, and some severe economic crises were not followed by wars.

### US Not Key

U.S. not key to the global economy.

Caryl 10 [Christian, Senior Fellow at the Center for International Studies at the Massachusetts Institute of Technology and a contributing editor to Foreign Policy. His column, "Reality Check," appears weekly on ForeignPolicy.com, Crisis? What Crisis? APRIL 5, 2010, http://www.foreignpolicy.com/articles/2010/04/05/crisis\_what\_crisis?page=full]

Many emerging economies entered the 2008-2009 crisis with healthy balance sheets. In most cases governments reacted quickly and flexibly, rolling out stimulus programs or even expanding poverty-reduction programs. Increasingly, the same countries that have embraced globalization and markets are starting to build social safety nets. And there's another factor: Trade is becoming more evenly distributed throughout the world. China is now a bigger market for Asian exporters than the United States. Some economists are talking about "emerging market decoupling." Jonathan Anderson, an emerging-markets economist at the Swiss bank UBS, showed in one recent report how car sales in emerging markets have actually been rising during this latest bout of turmoil -- powerful evidence that emerging economies no longer have to sneeze when America catches a cold. Aphitchaya Nguanbanchong, a consultant for the British-based aid organization Oxfam, has studied the crisis's effects on Southeast Asian economies. "The research so far shows that the result of the crisis isn't as bad as we were expecting," she says. Indonesia is a case in point: "People in this region and at the policy level learned a lot from the past crisis." Healthy domestic demand cushioned the shock when the crisis hit export-oriented industries; the government weighed in immediately with hefty stimulus measures. Nguanbanchong says that she has been surprised by the extent to which families throughout the region have kept spending money on education even as incomes have declined for some. And that, she says, reinforces a major lesson that emerging-market governments can take away from the crisis: "Governments should focus more on social policy, on health, education, and services. They shouldn't be intervening so much directly in the economy itself."

## Hazmat

### Hazmat Frontline

#### Not all carriers can afford hazmat system adoption – That’s key

Vincent Pearce, Senior Associate. Booz•Allen & Hamilton Inc, 12-00, [“WHAT HAVE WE LEARNED ABOUT INTELLIGENT TRANSPORTATION SYSTEMS?, Department of Transportation Federal Highway Administration, Chapter 2, ntl.bts.gov/lib/jpodocs/repts\_te/13316.pdf] E. Liu

HAZMAT incident management systems decrease the time needed to identify the cargo and respond, increasing effectiveness of the response. First responders estimated a 34 percent reduction in time to recognize and identify a hazardous cargo. Operation Respond indicated similar results in Atlanta, Georgia, and in Tonawanda and Buffalo, New York. However, a study of the HAZMAT incident management field operational tests concluded that there must be broad, nearly universal enrollment of carriers for implementing agencies to realize full benefits of such systems. Obtaining participation of smaller or less sophisticated motor carriers is more difficult, as they are both more financially constrained and realize less total benefit from enrollment. Cost was not an obstacle to agencies’ interest in participat- ing in the Operation Respond system test, the initial software and training costs totaling less than $700 for the first year and $350 for succeeding years (U.S. DOT, Hazardous Material Response, Sept. 1998).

## Solvency

### Solvency Frontline

#### 1. ITS technologies are being implemented now despite government austerity

Market Watch, 5-29-12, [“Investment in Smart Transportation Systems Will Continue to Grow Despite Public Sector Cutbacks, According to Pike Research,” http://www.marketwatch.com/story/investment-in-smart-transportation-systems-will-continue-to-grow-despite-public-sector-cutbacks-according-to-pike-research-2012-05-29

press release] E. Liu

BOULDER, Colo., May 29, 2012 (BUSINESS WIRE) -- The intelligent transportation systems (ITS) sector is now going through an evolution driven by the maturation of communications technologies and their increasing adoption in major cities worldwide. The widespread availability of high-speed networks, both fixed and wireless, along with the ability to embed intelligence in physical objects throughout the urban environment and the diffusion of mobile devices that can send and receive real-time vehicle or infrastructure information, is driving the adoption of smart transportation systems in cities across the developed world and in major emerging economies. According to a recent report from Pike Research, these deployments are likely to continue to grow even as public infrastructure spending flattens or even declines in many cases. The cleantech market intelligence firm forecasts that global investment in four key applications for smart transportation systems will total $13.1 billion between 2011 and 2017. "Even as governments seek to reduce their debt, ITS will not see significant cutbacks and will, in fact, benefit as transportation agencies seek to optimize their existing infrastructure, rather than fund major new capital projects," says senior analyst Lisa Jerram. "Cities, transit operators, and other owners of transportation assets see smart transportation technologies as tools to help them enhance mobility, reduce fuel consumption and emissions, improve safety, and strengthen economic competitiveness." The area of heaviest investment in smart transportation will be traffic management systems, which encompass a range of applications, including traveler information, congestion charging, and adaptive signaling. By the end of the forecast period, these systems will be ubiquitous, with virtually every major city offering such a service. What will change over the forecast period is that these systems will become increasingly dynamic, with cities adding alternate route instructions or predictive traffic easement.

#### 2. Lack of skilled individuals block success of ITS – More funding doesn’t solve

David J. Wise, Director, Physical Infrastructure, GAO, 3-12, [“INTELLIGENT TRANSPORTATION SYSTEMS Improved DOT Collaboration and Communication Could Enhance the Use of Technology to Manage Congestion,” Report to the Committee on Science, Space, and Technology, House of Representatives, [www.gao.gov/products/GAO-12-308](http://www.gao.gov/products/GAO-12-308)] E. Liu

ITS is a rapidly developing field that requires a specialized workforce familiar with emerging technologies. Staff responsible for managing ITS systems need knowledge in a variety of areas, including project management and systems engineering, according to two FHWA division office ITS engineers.44 Workforce demographic changes, the competitive labor market, new technologies, and new expectations in the transportation industry combine to make attracting and retaining a capable workforce difficult for state and local transportation agencies. In addition, a 2011 National Cooperative Highway Research Program study found that U.S. universities produce too few skilled applicants for state and local DOTs.45 These issues combine to affect the ability of state and local agencies, especially smaller agencies, to manage ITS.46 Many state and local transportation agencies struggle to maintain in- house staff with the skills and knowledge needed to manage ITS projects. Eight of the 15 experts we spoke with noted that agencies face challenges in maintaining staff with the expertise and skills needed for ITS. For example, 1 expert noted that ITS requires skills that civil engineers—with whom transportation agencies are generally well staffed—are not specifically trained in, such as understanding electrical systems, communication networks, and interagency relationship building. Another expert noted difficulty finding staff with other skills necessary to ITS management, such as contract management, systems integration, and information technology troubleshooting skills. In addition, the fast pace of technological change and resource limitations put more demands on transportation officials and limit training opportunities. RITA officials told us that transportation agencies need systems engineers to manage ITS deployment and operations but do not have them in sufficient numbers. For example, a local government official told us he has been unable to fill a vacant ITS-related engineering position because of a hiring freeze that has been in effect for over 3 years. According to this official, this makes it difficult to complete ITS projects even when funds for projects are available. Once ITS professionals have needed skills, agencies find it difficult to retain them. Eight of the 15 experts we spoke with noted that retention of qualified staff is a challenge for agencies. Limitations in salary and career opportunities can limit the ability of state and local governments to retain staff. One expert noted that the ITS staff at his state DOT could double their salary by going elsewhere, and another mentioned a state DOT employee who had multiple job offers from the private sector and whom the state DOT could no longer afford. Additionally, officials from 10 transportation and stakeholder agencies we interviewed noted that retaining staff was a challenge. For example, officials from several transportation and stakeholder agencies noted that, because of budget restrictions, they have been unable to hire ITS staff to replace those who have retired. This is a particular issue for small agencies, according to two FHWA division office ITS engineers. The agencies controlling arterial roadways and intersections, including traffic signals, are typically county and city governments and are smaller in terms of funding and personnel, on average, than agencies controlling freeways, which are typically state governments. For example, the National Transportation Operations Coalition’s 2007 National Traffic Signal Report Card Technical Report found that agencies operating very small signal systems scored markedly lower on signal operations than all other agencies, likely because of staff not having specialized knowledge of signal systems operations and maintenance.47 Additionally, the report found almost one-half of all 417 survey respondents did not have staff or resources committed to monitor or manage traffic signal operations on a regular basis. According to a paper by two FHWA division office ITS engineers in California, small to medium-size agencies in the state lack qualified staff and, as a result, find it difficult to implement complex ITS projects successfully. The engineers noted that these agencies are not able to maintain staff with project management and systems engineering expertise because of insufficient ITS activity to justify a full-time staff position, high turnover of staff, and difficulty in obtaining ITS training. In the paper, the FHWA engineers proposed several potential solutions for these agencies, such as sharing technical staff within the same agency, sharing ITS staff between agencies, hiring consultants, or hiring another agency to perform some of the needed functions.

#### 3. Tradeoff turn

#### ITS directly trades-off with maintenance and development of roads

JayEtta Z. Hecker, Director of Transportation Advocacy at the Bipartisan Policy Center, Director, Physical Infrastructure Issues, GAO, 9-05, [“Intelligent Transportation Systems’ Promise for Managing Congestion Falls Short, and DOT Could Better Facilitate Their Strategic Use,” United States Government Accountability Office Report to Congressional Committees, [www.gao.gov/new.items/d05943.pdf](http://www.gao.gov/new.items/d05943.pdf)] E. Liu

According to transportation officials we spoke with, one barrier to ITS deployment is that in light of a high number of potential projects competing for limited transportation funds, system enhancements such as ITS are sometimes less appealing than transportation investment options that improve the physical condition of the roads.31 Demand for transportation funding usually exceeds the supply of these funds. For example, in the San Francisco Bay area, the MPO estimates that it needs an additional $419 million above its available funding to fully deploy the area’s regional operations programs—including ITS applications. Furthermore, state and local governments face difficult decisions regarding the allocation of their highway and transit funds, especially when federal and state budget deficits exist. Within these funding constraints, transportation officials must prioritize and make trade-offs between projects that add new or preserve infrastructure and those that enhance the existing infrastructure, such as ITS. Thus, ITS must compete with other highway investments that add new infrastructure or preserve existing roads.32 In previous work, we found that state and regional transportation decision makers are increasingly giving priority to highway investments that preserve the existing infrastructure.33

#### Deficient roads and bridges constrains all benefits of infrastructure

Ellen Dannin, Fannie Weiss Distinguished Faculty Scholar and Professor of Law, Penn State Dickinson School of Law, Winter 11, [“Crumbling Infrastructure, Crumbling Democracy: ¶ Infrastructure Privatization Contracts and Their ¶ Effects on State and Local Governance ¶ ,” NORTHWESTERN JOURNAL OF LAW AND SOCIAL POLICY, <http://ssrn.com/abstract=1776350>] E. Liu

The August 1, 2007 collapse of the I-35 bridge in Minneapolis10 was a wake-up call about the danger of deferred maintenance which all states face today.11 It is all but impossible to overstate the poor condition of our public infrastructure. When he introduced the yet to be enacted Surface Transportation Authorization Act of 2009, Congressman James Oberstar, then Chair of the House Committee on Transportation and Infrastructure, presented the bleak facts: Currently, many segments of the nation’s surface transportation infrastructure are reaching or have exceeded their useful design life. Today, almost 61,000 miles (37 percent) of all lane miles on the NHS [National Highway System] are in poor or fair condition; more than 152,000 bridges—one of every four bridges in the United States—are structurally deficient or functionally obsolete; and more than 32,500 public transit buses and vans have exceeded their useful life. The nation’s largest public transit agencies face an $80 billion maintenance backlog to bring their rail systems to a state of good repair and, within the next six years, almost every transit vehicle (55,000 vehicles) in rural America will need to be replaced. The American Society of Civil Engineers grades our surface transportation system as follows: Roads D- Bridges C Transit D Rail C12 Deficient infrastructure is dangerous and expensive in terms of lives and injuries, impediments to commerce, inefficient and unnecessarily costly transportation, and degradation of the environment.13

#### 4. Even if ITS solves in theory, poor implementation and staffing mitigates its impact

JayEtta Z. Hecker, Director of Transportation Advocacy at the Bipartisan Policy Center, Director, Physical Infrastructure Issues, GAO, 9-05, [“Intelligent Transportation Systems’ Promise for Managing Congestion Falls Short, and DOT Could Better Facilitate Their Strategic Use,” United States Government Accountability Office Report to Congressional Committees, [www.gao.gov/new.items/d05943.pdf](http://www.gao.gov/new.items/d05943.pdf)] E. Liu

The status of ITS in the four metropolitan areas we visited—two that were rated high by DOT and were therefore counted toward meeting the ITS deployment goal and two that were rated low by DOT and therefore were not counted toward meeting the goal—illustrate the shortfalls of DOT’s ITS deployment goal and measures. While the two metropolitan areas we visited that were counted toward meeting the goal have both made considerable investments in ITS technologies, both have limitations in terms of the level of operations of deployed ITS technologies, which may reduce their potential impact on congestion. Officials from the two metropolitan areas we visited that were considered not to have met the goal indicated that they had appropriate levels of ITS given their local conditions and needs. (See app. 3 for additional information on activities each metropolitan area has taken to support ITS deployment.) Specifically, we found: • The San Francisco Bay Area, which was ranked by the Texas Transportation Institute as the fifth most congested area in 2003,25 was rated high by DOT in part because of its level of ITS deployment—4,700 traffic sensing detectors on its over 2,800 freeway miles. As a result, 29 percent of the freeways featured sensing devices spaced every 1 mile or less, and 40 percent of the freeways featured sensing devices spaced every 2 miles or less in order to provide local transportation agencies information on traffic data such as speed and volume. However, about 45 percent of these devices are out of service, reducing the ability of staff to collect traffic data.26 According to DOT Resource Center’s Operations Technical Service Leader, while having about half of the traffic detectors out of service happens in other areas, it is not typical. • Chicago, which the Texas Transportation Institute ranked as the fourth most congested area in 2003, was also rated high by DOT, partly because area transportation agencies have the potential to monitor 55 percent of the area’s freeway miles. A combination of traffic sensors and management centers provide the area the ability to quickly spot traffic problems and take appropriate action such as providing the traveling routes or options during special events affecting traffic to avoid traffic delays, and dispatching appropriate officials to clear incidents quickly to decrease delays. We found, however, that six of the ten traffic management centers do not have any staff dedicated to monitoring traffic conditions and that an additional center has only one part-time staffer. Periodically, staff will go to the centers to change message signs to alert travelers to likely congestion due to a planned event such as a construction project or sports game. However, without staff dedicated to monitoring traffic conditions on a regular basis, the centers can not be used to respond to unplanned or non-recurring incidents such as traffic accidents, which limit congestion mitigation benefits. • Indianapolis, which the Texas Transportation Institute ranked as the 25th most congested city in the nation in 2003, was rated low by DOT because of a lack of investment in ITS technologies, and therefore was not counted toward meeting the goal. However, Indianapolis officials stated that the current level of ITS deployment and integration meets the area’s needs, as they do not consider the area very congested, and they do not see the need for many ITS technologies. • Las Vegas, which the Texas Transportation Institute ranked as the ninth most congested city in the nation in 2003, was also rated low by DOT, partly because in order for a metropolitan area to be rated medium, it must meet the threshold of having either at least 20 percent of its freeways covered by ITS technologies or at least 33 percent of its transit covered by ITS technologies (to be rated high it would have to meet these thresholds plus additional thresholds). However, Las Vegas transportation officials told us that the metropolitan area has experienced high levels of congestion on the arterial roadways and relatively low levels of congestion on freeways. Therefore, rather than focusing on freeways or transit, transportation agencies in the Las Vegas metropolitan area have made considerable investments in deploying and integrating ITS technologies on their arterial roadways and only recently have begun investing in ITS technologies for freeways. Las Vegas transportation officials said that this strategy made the most sense for their specific local conditions.

#### 5. Default to neg ev – ITS advocacy articles are promotional and provide a one-sided picture

Elizabeth Deakin, Professor of City and Regional Planning at UC Berkeley, where she also is an affiliated faculty member of the Energy and Resources Group and the Master of Urban Design group. She formerly served as Director of the University of California Transportation Research Center (1998-2008) and co-director of the UC Berkeley Global Metropolitan Studies Initiative (2005-2008), et al., SangHyun Cheon, Jason Ni, Adam Leigland, Sungjin Park, and Manish Shirgaokar , 11-02, [“To Develop Effective Strategies for Mainstreaming Intelligent Transportation Systems (ITS),” STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION , <http://trid.trb.org/view.aspx?id=919270>] E. Liu

A key finding from the literature review was that the vast majority of publications on intelligent transportation systems are either highly technical or highly promotional. Some articles focus on the details of how electronic components of intelligent transportation systems are manufactured, how software for ITS works, etc. (1) While technical specialists who develop new systems undoubtedly benefit from these articles, they are far too detailed to be useful to policy-makers and planners. Many other articles on intelligent transportation systems are written by enthusiasts who make large claims for ITS - that intelligent transportation systems will resolve congestion problems, make transportation systems safe, make travel carefree, etc. (2) Such articles often describe ITS applications in clear language but provide very little information on costs of deployment or any "downside" that the technology applications might have. (3) The articles are intended, in many cases, to create a "vision" of ITS that is attractive and compelling. (4) Unfortunately, to an outside reader the claims for ITS seem unsubstantiated and unconvincing.(5) Relatively few articles described how implementation occurred - who was involved, how the projects were paid for, or what they accomplished in terms of travel time savings, cost reductions, environmental improvements, or other valued results. The articles and reports that did provide this information often were for projects implemented as "demonstration projects" or "early deployment initiatives". In fact, the US DOT's Early Deployment reports (6) are one of the best sources for details on ITS project implementation. Nearly 100 such deployment plans have been completed to date; most document such activities as identifying "stakeholders" (e.g., the state DOT, the MPO, local government traffic engineers, freight operators) and agreements reached about the needed "architecture" (functions to be performed) for various ITS applications such as ramp metering and arterial signal coordination.(7) Far from being mainstreamed, however, these projects were supported by special funding, organized by research and development divisions of government agencies or private companies, and carried out by specialized staff. Most of the plans leave to the future the integration of recommended high-priority activities into the state or MPO plans and programs. Thus, while the findings on the performance of the ITS technologies and applications were usable, institutional, procedural, and funding approaches provide little guidance for mainstreaming efforts.

### XTN #1 – Investment Now Solves

#### ITS technologies will be developed by the private sector – Their authors have incentives to lobby for public spending

Elizabeth Deakin, Professor of City and Regional Planning at UC Berkeley, where she also is an affiliated faculty member of the Energy and Resources Group and the Master of Urban Design group. She formerly served as Director of the University of California Transportation Research Center (1998-2008) and co-director of the UC Berkeley Global Metropolitan Studies Initiative (2005-2008), et al., SangHyun Cheon, Jason Ni, Adam Leigland, Sungjin Park, and Manish Shirgaokar , 11-02, [“To Develop Effective Strategies for Mainstreaming Intelligent Transportation Systems (ITS),” STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION , <http://trid.trb.org/view.aspx?id=919270>] E. Liu

Twenty-six of the respondents felt that it was not so much funding availability per se that was limiting ITS implementation, but rather the lack of a clear picture of what would be gotten for the money. Several respondents used traveler information systems as an example. “We already have [radio traffic advisories] ”, one respondent argued. “They tell you what has been reported, whether it is one person who phoned in or several, they check the information with the CHP [California Highway Patrol] and Caltrans and tell you what they have to say…That is pretty good. People already can get a cheap add-on for their [hand- held computer] that will give them alternate routes, if they don’t know them already, and believe me, commuters figure out every alternate route in the first two weeks on the job. If we are going to keep spending public money on traveler information, somebody is going to have to make it clear what the government is going to give you that we don’t already have from the private sector.” Another respondent, voicing similar sentiments, added, “It is not just that we could make it better. You have to show that the added expenditures make sense at the margin, that it will be enough better that I should be willing to pay for it.” Several expressed concerns that evaluations were being performed by ITS advocates; as one put it, “ People who spend their days promoting new systems are not the right people to be evaluating them” Speaking of funding and priorities, 20 of the 51 respondents suggested that at least some ITS technologies should now be left to the private sector to further develop and market. One respondent put it this way: “ There are a lot of projects that have positive benefit-cost ratios. The issue is how these beneficial projects stack up against each other. And when we are looking at a field where the private sector is already active, providing us with a range of products, free to pretty expensive, I want to see some evidence that a public expenditure will produce a worthwhile added benefit. Another respondent said, “I don’t want to just fund some ITS project just because there is a Not Invented Here attitude among the ITS staff. If the public sector has done a lot of work but now the private sector has moved in and taken off with an idea, great. Declare it a victory and move on to something else. ”

#### ITS applications exist now – That causes broader acceptance – They put it in extraneous places

Elizabeth Deakin, Professor of City and Regional Planning at UC Berkeley, where she also is an affiliated faculty member of the Energy and Resources Group and the Master of Urban Design group. She formerly served as Director of the University of California Transportation Research Center (1998-2008) and co-director of the UC Berkeley Global Metropolitan Studies Initiative (2005-2008), et al., SangHyun Cheon, Jason Ni, Adam Leigland, Sungjin Park, and Manish Shirgaokar , 11-02, [“To Develop Effective Strategies for Mainstreaming Intelligent Transportation Systems (ITS),” STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION , <http://trid.trb.org/view.aspx?id=919270>] E. Liu

An interesting finding of the study is that many California leaders and national experts believe that many intelligent transportation system applications are already mainstream. California elected officials and other leaders commented that ITS is being implemented fairly quickly overall (especially considering funding shortfalls.). National leaders suggested that freeway monitoring, ramp metering, traffic signal timing, automatic vehicle location for transit, and many traveler information systems are already mainstream technologies, especially in California. (4) Like the California leaders group, they see funding shortfalls as a major impediment to faster deployment of these ITS applications. This view contrasts sharply with the views of staff members, 83% of whom agreed that ITS implementation has been slow and spotty. One reason for the difference in views between staff members and others appears to be that staff members think that the main benefits of ITS will come from area-wide, corridor, and system-wide applications. Staff members also think that such wider applications are needed to make significant improvements in transportation capacity and efficiency. Both California leaders and national experts seem more comfortable with project-level gains, at least for many applications such as traffic signal upgrades and bus information (where applications can be done for particular groups of signals or for key routes only and still produce important benefits.) As some of the national experts commented, spotty coverage is the normal way for technology implementation to begin; a few early innovators are followed by more widespread adoption, first gradual then faster, as others see the benefits of a practice or technology and that practice or technology becomes an accepted way of doing things. In fact, some of the national experts cautioned that attempts to promote system-wide or area-wide applications might not be cost-effective, putting advanced technologies in locations where they are not really needed - a perspective not articulated by any of the staff members who responded to our survey or participated in interviews.

### AT: Technology Development Key

#### The technology exists now – It’s just too expensive for public deployment

DOT FHA, Department of Transportation Federal Highway Administration, 12-00, [“WHAT HAVE WE LEARNED ABOUT INTELLIGENT TRANSPORTATION SYSTEMS?, Introduction, ntl.bts.gov/lib/jpodocs/repts\_te/13316.pdf] E. Liu

One overarching conclusion of this study is that the quality of technology is not a major barrier to the deployment of ITS. Off-the-shelf technology exists, in most cases, to support ITS functionality. An area where important questions about technology quality still remain is algorithms. For example, questions have been raised about the efficacy of software to perform adaptive traffic signal control. Also, the quality of collected information may be a technical issue in some applications. That is not to say that issues do not remain on the technology side. In some cases, technology may simply be considered too costly for deployment, operations, and maintenance, particularly by public agencies that see ITS costs as not commensurate with the benefits to be gained by their deployment. Or, the technology may be too complex to be operated by current agency staff. Also, in some cases, technology falters because it is not easy to use, either by operators or transportation customers. Nonintuitive kiosks and displays for operators that are less than enlightening are two examples of the need to focus more on user interface in providing ITS technologies.

### XTN #2 – No Skills

#### Lack of experts greatly hinders deployment of ITS

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Transportation experts have offered a variety of hypotheses to explain why ITS implementation has not been as fast or easy as its supporters had hoped: • ITS research and development has been carried out by new technology experts and traffic operations analysts - specialists who are not usually involved in policy development, planning, and programming. • Many of the public officials and staff members responsible for transportation plans and programs are only vaguely familiar with ITS technologies and what they can do. • Few regional or local agencies have developed staff positions with specific ITS responsibilities, so few have internal advocates for ITS. • It’s not clear what funds a region or locality could or should use for ITS projects. • Commonly available planning and evaluation tools do not address ITS very well if at all, so analysts don’t know how to incorporate ITS options into their evaluations and don't know how to calculate the value added by ITS. • There is relatively little information on the costs and benefits of the various ITS options. • Planners and analysts need training on ITS, but it is not readily available either in university curricula or in continuing education and training courses. • Current planning regulations, e.g., for air quality plans or CEQA mitigation, do not address ITS or are unclear about how it figures in. 7 • Prior commitments represented by long range plans and multi-year programs crowd out ITS options. • The image of ITS that many public officials have is fully automated guideways and vehicles, options that are seen as too far in the future to be worth analyzing as part of ongoing planning efforts. • Public awareness of near-term ITS options is low. • Some ITS technologies suggest central control over facilities and services that currently are controlled separately, raising political and institutional issues that have not been resolved.

### Takes Out Economy Solvency

#### Qualified staff are necessary for garnering congestion benefits to ITS

JayEtta Z. Hecker, Director of Transportation Advocacy at the Bipartisan Policy Center, Director, Physical Infrastructure Issues, GAO, 9-05, [“Intelligent Transportation Systems’ Promise for Managing Congestion Falls Short, and DOT Could Better Facilitate Their Strategic Use,” United States Government Accountability Office Report to Congressional Committees, [www.gao.gov/new.items/d05943.pdf](http://www.gao.gov/new.items/d05943.pdf)] E. Liu

Progress has been made toward achieving DOT’s deployment goal, but DOT’s goal and measures have limitations and fall short of capturing ITS’s impact on congestion. According to DOT, 62 of the 75 metropolitan areas had met its goal of deploying integrated ITS infrastructure in 2004. DOT defined the Secretary’s goal of complete intelligent transportation infrastructure to include two elements—deployment, meaning the extent that certain technologies are installed over certain areas such as freeways, and integration, meaning the extent of coordination between different agencies that deploy ITS technologies. However, although the Secretary’s goal calls for a “complete” ITS infrastructure, according to DOT’s criteria, metropolitan areas with relatively low thresholds of ITS infrastructure— such as 20 percent of freeway miles and 33 percent of signalized intersections covered by certain ITS technologies—may meet the goal. DOT officials stated they established these relatively low thresholds because they did not have a way to determine the extent to which ITS should be deployed in each metropolitan area, and they also stated that complete deployment is a very long-term goal that perhaps will never be reached. In addition, although DOT’s goal and measures give a sense of progress of ITS deployment, they fail to capture a number of important dimensions of evaluating the status of ITS that the Secretary alluded to in his 1996 speech: they do not take into account the level of ITS needed to accomplish local goals and priorities; they do not capture the extent to which deployed ITS technologies are being effectively operated; and they do not evaluate the impact or cost-effectiveness of ITS. The lack of evaluation of outcomes, including impact or cost effectiveness, also has been identified as a limitation of other highway programs. The status of ITS in the four metropolitan areas we visited illustrate the shortfalls of DOT’s ITS deployment goal and measures. Although San Francisco and Chicago, both of which DOT counted toward meeting the deployment goal, have made considerable strides in implementing ITS, they face limitations related to operating their ITS technologies. For example, Chicago developed 10 traffic management centers, which monitor traffic conditions and can respond to traffic incidents by dispatching emergency vehicles to quickly clear highway accidents, thus reducing traffic delays. However 7 of the 10 centers do not have full-time operators, which limits the centers’ potential congestion mitigation benefits. Similarly, although neither Indianapolis nor Las Vegas were rated by DOT as contributing toward meeting the deployment goal, transportation officials in these metropolitan areas stated they had deployed the amount of ITS needed to meet their local needs. For example, Las Vegas was rated as not meeting the goal because the area had not yet deployed ITS technologies on freeways—a key measure in DOT’s rating of ITS deployment. However, Las Vegas officials said they had focused on deploying ITS on arterial roadways because they experienced more congestion on the arterials than on the freeways.

### AT: Consultants Solve

#### Skills deficit for ITS extends to consultants

JayEtta Z. Hecker, Director of Transportation Advocacy at the Bipartisan Policy Center, Director, Physical Infrastructure Issues, GAO, 9-05, [“Intelligent Transportation Systems’ Promise for Managing Congestion Falls Short, and DOT Could Better Facilitate Their Strategic Use,” United States Government Accountability Office Report to Congressional Committees, [www.gao.gov/new.items/d05943.pdf](http://www.gao.gov/new.items/d05943.pdf)] E. Liu

According to metropolitan transportation officials and as we previously reported in a 1997 report, another barrier state and local transportation agencies face when selecting and implementing ITS is a lack of appropriate skills and knowledge needed for selecting and operating ITS technologies.38 This lack of skills exists both in transportation agencies and, according to transportation officials in one metropolitan area, in consultants that agencies hired to help them purchase and deploy ITS technologies. According to DOT officials, it is often hard to find people who are knowledgeable in both of two fields that are important for fully understanding ITS applications—traffic systems and electrical engineering. Consequently, some transportation agencies hire contractors to perform some of the technology functions associated with ITS. In Las Vegas, however, transportation officials told us that consultants lacked needed skills as well. As a result, localities may face difficulties selecting and procuring appropriate systems for their areas. For example, according to an FHWA official, a lack of business knowledge led a San Francisco Bay Area agency to lease rather than purchase telecommunications lines needed for transmitting data from roadway sensors—a decision that ended up costing the agency money in the long run.

### AT: Federal System Solves

#### Lack of qualified workforce is an institutional system for ITS – Takes out the system

DOT FHA, Department of Transportation Federal Highway Administration, 12-00, [“WHAT HAVE WE LEARNED ABOUT INTELLIGENT TRANSPORTATION SYSTEMS?, Introduction, ntl.bts.gov/lib/jpodocs/repts\_te/13316.pdf] E. Liu

An important barrier to success in the deployment of new technologies and applications embodied in ITS is a lack of people to support such systems. The ITS environment requires skilled specialists representing new technologies. It also needs broad generalists with policy and management skills who can integrate advanced thinking about transportation services based on new technologies (Sussman 1995). The ITS community has recognized these needs, and various organizations have established substantial programs for human resource development. FHWA’s Professional Capacity Building program is a premier example, but hardly the only one. Universities, including the University of Michigan and the Virginia Polytechnic Institute, have developed programs, as has CITE (Consortium for Intelligent Transportation Education), housed at the University of Maryland. These programs, along with graduate transportation programs undergoing substantial ITS- related changes around the country, can provide a steady stream of talented and newly skilled people for the industry. However, we must emphasize that institutional changes in transportation organizations are needed if these people are to be used effectively and retained, as people with high-technology skills can often demand much higher salaries than are provided by public sector transportation organizations. Cultural change along with appropriate rewards for operations staff, for example, will be necessary in organ- izations where the culture strongly favors conventional infrastructure construction and maintenance. The need for political champions for ITS has long been understood in the ITS community. Here, though, we emphasize the need at all levels of implementing organizations for people with the ability to effectively deploy ITS.

### XTN #3 – Tradeoff Turn Link

#### ITS investments tradeoff with broader road improvement budget

David J. Wise, Director, Physical Infrastructure, GAO, 3-12, [“INTELLIGENT TRANSPORTATION SYSTEMS Improved DOT Collaboration and Communication Could Enhance the Use of Technology to Manage Congestion,” Report to the Committee on Science, Space, and Technology, House of Representatives, [www.gao.gov/products/GAO-12-308](http://www.gao.gov/products/GAO-12-308)] E. Liu

Improvement programs are eligible to be used for the deployment and operations of ITS technologies.56 Although funding of ITS technologies is not specifically tracked, FHWA officials estimate that approximately 3 to 5 percent, or between $800 million and $1.3 billion for fiscal year 2010, of federal aid highway program funds have been used for ITS technologies.57 For the most part, this funding is not for pure ITS projects but rather for ITS technologies that are incorporated into larger road and bridge improvement projects. According to FHWA officials, an internal analysis found that a similar percentage of funds, or between about $800 million and $1.3 billion, of FHWA’s American Recovery and Reinvestment Act funds were used for ITS deployments, with the majority of the total American Recovery and Reinvestment Act funds being obligated between early 2009 and March 2011.58 In fiscal year 2010, RITA obligated approximately $28.2 million for research on emerging uses of ITS technologies and obligated an additional $12.3 million to programs supporting the deployment of ITS, including the Professional Capacity Building program.59

### Long Term Magnifier

#### ITS requires multi-year funding – Trades off for a long time

DOT FHA, Department of Transportation Federal Highway Administration, 12-00, [“WHAT HAVE WE LEARNED ABOUT INTELLIGENT TRANSPORTATION SYSTEMS?, Introduction, ntl.bts.gov/lib/jpodocs/repts\_te/13316.pdf] E. Liu

While ITS can provide less expensive solutions, they are not free. There are up- front infrastructure costs (see section following on “Mainstreaming”) and additional spending on operating and maintaining hardware and software. Training staff to support operations requires resources. Spending for ITS is of a different nature than spending for conventional infrastructure, with less up front and more in the out years. Therefore, planning for operations requires a long-term perspective by transportation agencies and the political sector. For that reason, it is important to institutionalize operations within transportation agencies. Stable budgets need to be provided for operations and cannot be the subject of year-to-year fluctuation and negotiation, which is how maintenance has traditionally been, if system effectiveness and efficiency are to be maintained. Human resources needs must be considered as well (see section on “Human Resources”).

### XTN #3 – Tradeoff Turn Impact

#### Maintenance is a prerequisite to ITS making sense AND technological delay makes ITS useless

Elizabeth Deakin, Professor of City and Regional Planning at UC Berkeley, where she also is an affiliated faculty member of the Energy and Resources Group and the Master of Urban Design group. She formerly served as Director of the University of California Transportation Research Center (1998-2008) and co-director of the UC Berkeley Global Metropolitan Studies Initiative (2005-2008), et al., SangHyun Cheon, Jason Ni, Adam Leigland, Sungjin Park, and Manish Shirgaokar , 11-02, [“To Develop Effective Strategies for Mainstreaming Intelligent Transportation Systems (ITS),” STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION , <http://trid.trb.org/view.aspx?id=919270>] E. Liu

A key reason cited for including ITS in the state and regional plans is that it can be considered as an alternative and compared to other ways of making improvements - major capital investments, travel system management, and so on. All of the interviewees felt that ITS applications needed to be carefully evaluated with their lifecycle costs considered, and that it would be a mistake to assume that new technologies will be cost-effective for every possible project. As one put it, "ITS isn't the answer for all operations problems. You need performance standards and you need to consider total costs including realistic maintenance costs. It doesn't make sense to detectorize a road and then let 30% of the detectors be dead or malfunctioning at any time [because of a lack of maintenance funds.] It doesn't make sense at current costs to instrument the entire interstate system because much of it doesn't have problems we could solve with instrumentation." 38 Some, however, were skeptical about the utility of detailed cost-benefit analyses. One interview participant commented: "It is just about impossible to admit that some of these ideas aren't that useful. For example, roadside phones: We finally did these after most people had cell phones." That participant went on to say that the benefit-cost analysis had shown that the phones had a high benefit-cost ratio, but made unrealistic assumptions about the phones' utility to the public. Several of those interviewed also commented that it was not just evaluation as part of project decision- making, but evaluation of implemented projects, that was needed, expressing concerns about traveler information in particular: "Worthless information undermines the value of variable message signs, e.g., signs that say "construction next five miles" placed at start of construction zone where you can see the construction yourself. The same holds for travel information systems that give bad information - tell you there will be delays due to construction and when you get there, having left half an hour early, you see that they aren't working that day." One interview participant had doubts about the ability of transportation agencies to do good evaluations, and expressed concern about what he saw as an unrealistic belief in the power of marketing: "We are really bad at [consumer] surveys and market studies. We confuse market studies and marketing, and act like marketing can overcome lack of interest in products that don't really do much." Overall, the interview participants thought that better benefit-cost work was necessary, but recognized that evaluations of proposed projects of any sort can be too rosy or can otherwise miss the mark.

### Uniqueness Solves Affirmative

#### They focus too much on technology – Mainstream improvements to transportation include ITS

Elizabeth Deakin, Professor of City and Regional Planning at UC Berkeley, where she also is an affiliated faculty member of the Energy and Resources Group and the Master of Urban Design group. She formerly served as Director of the University of California Transportation Research Center (1998-2008) and co-director of the UC Berkeley Global Metropolitan Studies Initiative (2005-2008), et al., SangHyun Cheon, Jason Ni, Adam Leigland, Sungjin Park, and Manish Shirgaokar , 11-02, [“To Develop Effective Strategies for Mainstreaming Intelligent Transportation Systems (ITS),” STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION , <http://trid.trb.org/view.aspx?id=919270>] E. Liu

The findings from the interviews reveal a variety of reasons why intelligent transportation systems aren't being implemented faster and "mainstreamed" in California. But not all of the hypotheses we considered were confirmed. The study supported the hypothesis that ITS research and development has been carried out by new technology experts and traffic operations analysts - specialists who are not usually involved in policy development, planning, and programming - and that their expertise doesn't usually extend to the deft handling of planning, evaluation, and programming issues. While a technological focus is clearly needed when new technologies are being developed and when standards and protocols are being established, different expertise is called for in planning and evaluation. Missteps have sometimes occurred when deployment efforts have been narrowly focused on technological issues and systems performance, with insufficient attention to the human side of implementation. Where technology specialists have worked in partnership with planners and decision-makers, ITS projects often do get implemented as part of "mainstream" efforts to improve transportation operations and services.

### XTN #4 – No Deployment

#### Multiple barriers block deployment of ITS – People won’t know funding is out there

JayEtta Z. Hecker, Director of Transportation Advocacy at the Bipartisan Policy Center, Director, Physical Infrastructure Issues, GAO, 9-05, [“Intelligent Transportation Systems’ Promise for Managing Congestion Falls Short, and DOT Could Better Facilitate Their Strategic Use,” United States Government Accountability Office Report to Congressional Committees, [www.gao.gov/new.items/d05943.pdf](http://www.gao.gov/new.items/d05943.pdf)] E. Liu

Transportation officials in the four metropolitan areas we visited identified four barriers that our previous work and DOT officials acknowledge limit the deployment and integration of ITS in metropolitan areas. These barriers include the limited appeal of ITS as an option for congestion mitigation, the difficulty of obtaining funding for implementing and operating ITS technologies along with confusion about the fact that ITS operational costs are eligible for federal funding, a lack of technical training in deploying and operating ITS technologies, and a lack of technical standards to help ensure that ITS technologies will be able to be integrated with other ITS systems within and across metropolitan and rural areas. These barriers have limited the amount of ITS deployed and therefore have likely limited the impact of ITS on mitigating congestion on our nation’s roads.

### XTN #5 – Prefer Our Evidence

#### Their evidence is non-objective and doesn’t compare benefits to costs

Elizabeth Deakin, Professor of City and Regional Planning at UC Berkeley, where she also is an affiliated faculty member of the Energy and Resources Group and the Master of Urban Design group. She formerly served as Director of the University of California Transportation Research Center (1998-2008) and co-director of the UC Berkeley Global Metropolitan Studies Initiative (2005-2008), et al., SangHyun Cheon, Jason Ni, Adam Leigland, Sungjin Park, and Manish Shirgaokar , 11-02, [“To Develop Effective Strategies for Mainstreaming Intelligent Transportation Systems (ITS),” STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION , <http://trid.trb.org/view.aspx?id=919270>] E. Liu

A number of the respondents, and in particular elected officials, interest group representatives, and planners, commented on the quality of the information available on ITS. They characterized most of the available information as “too technical” and “way too long”. Many also thought the literature was too promotional. As one planner put it, “they list a large number of benefits but it is hard to find cost information, or any sense of “compared to what”?” Twenty of the respondents specifically commented on the lack of believable, dispassionate evaluation of the ITS options.

#### ITS is hyped to promote benefits

DOT FHA, Department of Transportation Federal Highway Administration, 12-00, [“WHAT HAVE WE LEARNED ABOUT INTELLIGENT TRANSPORTATION SYSTEMS?, Introduction, ntl.bts.gov/lib/jpodocs/repts\_te/13316.pdf] E. Liu

Almost from its earliest days, ITS has unfortunately been subject to over- expectations and over-selling. Advocates have often resorted to “hype” to promote the benefits of ITS technologies and applications and have minimized the difficulties in system integration during deployment. Often ITS has been seen by the public and politicians as a solution looking for a problem. Overtly pushing ITS can be counterproductive. Rather, ITS needs to be put to work in solving problems that the public and agencies feel truly exist.

### AT: Seed Funding Key

#### ITS implementation will only get harder – They’ve picked the low-hanging fruit

Joseph M. Sussman, Interim Director, MIT Engineering Systems Division JR East Professor of Civil and Environmental Engineering and Engineering Systems, 12-00, [“WHAT HAVE WE LEARNED ABOUT INTELLIGENT TRANSPORTATION SYSTEMS?, Department of Transportation Federal Highway Administration, Chapter 9, ntl.bts.gov/lib/jpodocs/repts\_te/13316.pdf] E. Liu

So, what have we learned about ITS? We are at the end of the beginning. The low hanging fruit is gone from the tree, and much has been achieved by choosing clear- cut, sure winners—an appropriate strategy for the first generation of any technology. However, for true deployment success, we must reach higher into the tree, focusing on integrated, regional, and market-driven systems.

# Generics

## Politics

### No Advocates for Computational Science

#### No advocates for compu sci

Sharon C. Glotzer, Professor of Chemical Engineering and Professor of Materials Science and Engineering at

the University of Michigan, Ann Arbor, 09, [“INTERNATIONAL ASSESSMENT OF RESEARCH AND DEVELOPMENT IN SIMULATION-BASED ENGINEERING AND SCIENCE,” Chatper 1, [www.wtec.org/sbes/SBES-GlobalFinalReport.pdf](http://www.wtec.org/sbes/SBES-GlobalFinalReport.pdf)] E. Liu

Yet because it is often viewed more as an enabling technology for other disciplines, rather than a discipline in its own right, investment in and support of computational science and engineering is often not prioritized as it should be at all levels of the R&D enterprise. The 2005 PITAC (Benioff 2005) report writes, “The universality of computational science is its intellectual strength. It is also its political weakness. Because all research domains benefit from computational science but none is solely defined by it, the discipline has historically lacked the cohesive, well-organized community of advocates found in other disciplines. As a result, the United States risks losing its leadership and opportunities to more nimble international competitors. We are now at a pivotal point, with generation-long consequences for scientific leadership, economic competitiveness, and national security if we fail to act with vision and commitment.”

### Plan Popular

#### Plan is non-ideological and popular – Public and pragmatism

Samuel J. Palmisano, current Chairman and CEO of IBM. He was elected Chairman in October 2002, and has served as Chief Executive Officer since March 2002. Prior to his appointment, Palmisano was President and Chief Operating Officer since 2000, 5-5-10, [“A Smart Transportation System: Improving ¶ Mobility for the 21st Century,” IBM, <http://www.ibm.com/smarterplanet/us/en/transportation_systems/article/palmisano_itsa_speech.html>] E. Liu

Smarter transportation is not some grand, futuristic ideal. For one thing, the ¶ examples I’ve mentioned are real, and more are being deployed right now, around the ¶ world. ¶ For another, smarter transportation is practical because it is non-ideological. Yes, debates ¶ will continue to rage on many contentious issues that impact transportation—from energy, ¶ to security, to climate change, to the economy. But no matter which viewpoints ultimately ¶ prevail, the system that results will have to be smarter: more transparent, more efficient, ¶ more accessible, more resilient, more innovative. ¶ And that’s one final reason for hope. Making transportation smarter is in everyone’s ¶ interest. For a whole spate of reasons, the boldest action and the most pragmatic action ¶ are now one. ¶ We find ourselves today at a unique ¶ moment. The key precondition for real ¶ change now exists: People want it. And they ¶ are hungry for leadership. Such a moment ¶ doesn’t come around often, and it will not ¶ last forever.

### Sequestration Turns Science

#### Sequestration slashes science

Jeffrey Mervis, deputy news editor of Science magazine in Washington, 1-6-12, [“Research Remains a Favored Child in Budget Decisions,” Science 6 January 2012: Vol. 335 no. 6064 pp. 25-26, <http://www.sciencemag.org/content/335/6064/25.full>] E. Liu

The Super Committee was created this summer by Congress to reach a bipartisan agreement on a 10-year deficit-reduction plan, and its abject failure has triggered automatic cuts that are supposed to go into effect starting in January 2013. The process laid out in the Budget Control Act, enacted in August, calls for “sequestration” or spending cuts of roughly $1 trillion over 9 years, divided between domestic and military discretionary programs. That would remove $35 billion a year from the accounts that fund all nondefense programs, including all civilian science activities. That number is the basis for warnings from science lobbyists that agency science budgets could be slashed by 7% to 8% in 2013 and by a similar amount in subsequent years. On the other hand, the sequestration's delayed start gives Congress and the White House a full year to come up with another way to meet the Budget Act targets for reducing the deficit. If Congress finds an alternative to the automatic cuts, then all bets are off on what science agencies will receive in 2013 and beyond.

## Sprawl

### AT: Link Turn

#### ITS increases auto use and sprawl – Smart planning applications are ignored now

Elizabeth Deakin, Professor of City and Regional Planning at UC Berkeley, where she also is an affiliated faculty member of the Energy and Resources Group and the Master of Urban Design group. She formerly served as Director of the University of California Transportation Research Center (1998-2008) and co-director of the UC Berkeley Global Metropolitan Studies Initiative (2005-2008), et al., SangHyun Cheon, Jason Ni, Adam Leigland, Sungjin Park, and Manish Shirgaokar , 11-02, [“To Develop Effective Strategies for Mainstreaming Intelligent Transportation Systems (ITS),” STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION , <http://trid.trb.org/view.aspx?id=919270>] E. Liu

• Insufficient attention has been paid to consumer conveniences, environmental benefits, and neighborhood enhancements that ITS could provide, e.g., multi-purpose transportation and parking cards, emissions monitoring devices, neighborhood permit parking cards. • Concerns persist that ITS technologies enhance auto use and in so doing have adverse impacts on transit use, lead to more emissions and energy use, further support sprawl, and harm the central city and older suburbs. In short, a variety of social, economic, environmental, institutional, and political factors have been implicated in ITS’ mixed reception to date. Yet there has been remarkably little work done to confirm or refute these hypotheses, and to overcome barriers to ITS.

## States

### Innovation/Modeling

#### State ITS is innovative and causes other local modeling

Joshua D. Prok, Executive Articles Editor for the Transportation Law Journal, Fall 08, [“Intelligent Transportation Systems: From Hometown Solutions to World Leadership,” Transportation Law Journal 35 Transp. L. J. 293, <https://litigation-essentials.lexisnexis.com/webcd/app?action=DocumentDisplay&crawlid=1&doctype=cite&docid=35+Transp.+L.+J.+293&srctype=smi&srcid=3B15&key=3f26d3adac7fbaddf0486857d019664b>] E. Liu

To acknowledge the pervasive reach of intelligent transportation systems (ITS) technology, both in the U.S. and abroad, this note explores ITS from many levels. Primarily, the federal legal framework calling for development and implementation of ITS at the regional level is described and illustrated. Then, choice of technology and technological adaptation are discussed as methods to alleviate privacy concerns implicated by ITS implementation both in the U.S. and the European Union. Next, challenges to ensuring broader interoperability are contemplated by comparing disputes over the use of transponder technology in the U.S. and the European Union. The note concludes with a discussion of the continuing future importance of ITS and the opportunity for the U.S. to catalyze industry innovation making energy efficiency a goal in global ITS development. At the outset, however, it should be noted that the states spur innovation within the federal framework of the U.S., “serv[ing] as laboratories for the development of new social, economic, and political ideas.”1 The Supreme Court made this contention numerous times, affirming that “state innovation is no judicial myth.”2 To a large extent, this spirit of learning from local efforts prompted the exposure of several innovative ITS deployments in the author’s home town of Parker, Colorado that follows. Therefore, by looking inward to the States, and outward to the European Union, this note offers diverse examples of ITS innovations that can enhance efficiency and safety in transportation infrastructures, services, and industries across the globe.

## Topicality

### Plan Isn’t Capital Expenditure

#### Plan isn’t capital expenditure

JayEtta Z. Hecker, Director of Transportation Advocacy at the Bipartisan Policy Center, Director, Physical Infrastructure Issues, GAO, 9-05, [“Intelligent Transportation Systems’ Promise for Managing Congestion Falls Short, and DOT Could Better Facilitate Their Strategic Use,” United States Government Accountability Office Report to Congressional Committees, [www.gao.gov/new.items/d05943.pdf](http://www.gao.gov/new.items/d05943.pdf)] E. Liu

We have previously reported that there are a range of strategies to mitigate the effect of increasing congestion, including building capacity through construction, corrective and preventative maintenance, rehabilitation, managing system use through pricing or other techniques, and operations and system management, including the use of ITS.3 We have also reported that using the full range of these strategies offers the promise of being more effective than placing emphasis on any one technique. For example, building new infrastructure can ease congestion, but it is not always a viable solution due to constraints such as the cost of construction or limited availability of land. Moreover, improving system operations, management, and performance through the strategic use of ITS technologies has the potential to reduce congestion without major capital investments. ITS technologies range in complexity from ramp meters, which are small traffic light-like devices that control the traffic flow on ramps leading to freeways or tollways, to fully integrated systems in which several technologies work together to process information and respond to traffic conditions. For example, a traffic-sensing device could collect data on traffic flow by monitoring traffic volume and speed, which could be used to alter the timing of freeway ramp meters and arterial road traffic signals to improve traffic flow as well as to alert travelers to specific traffic conditions using variable message boards or other devices.

## Tradeoff

### Yes Tradeoff

#### ITS projects compete with other projects for funding

Stephen Ezell, Senior Analyst, ¶ Information Technology and Innovation Foundation, led the Global Service Innovation Consortium, 1-10, [“ Intelligent Transportation ¶ Systems¶ Explaining intErnational it application lEadErship,” The Information Technology¶ & Innovation Foundation, <http://trid.trb.org/view.aspx?id=911843>] E. Liu

Currently, ITS projects often have to compete ¶ with conventional transportation projects for ¶ funding, such that ITS projects, which are poised ¶ to deliver greater long term benefits, may have ¶ to compete with projects that, while they may ¶ be immediately pressing, are not positioned ¶ to deliver as great long-term benefits, such as ¶ road repair or even new road construction. In ¶ addition to a lack of funding (which tends to ¶ exacerbate focus on more immediate concerns ¶ at the expense of a longer-term vision of ¶ the benefits of deploying ITS applications), ¶ bureaucratic inertia or a lack of interest, ¶ technical skill, or knowledge of ITS benefits ¶ have made it more difficult for ITS projects ¶ to compete with conventional transportation ¶ projects out of the same funding pools.

### Yes Tradeoff – Money Tight Now

#### States that fund the plan are overstretched now – Makes ITS A low priority

Elizabeth Deakin, Professor of City and Regional Planning at UC Berkeley, where she also is an affiliated faculty member of the Energy and Resources Group and the Master of Urban Design group. She formerly served as Director of the University of California Transportation Research Center (1998-2008) and co-director of the UC Berkeley Global Metropolitan Studies Initiative (2005-2008), et al., SangHyun Cheon, Jason Ni, Adam Leigland, Sungjin Park, and Manish Shirgaokar , 11-02, [“To Develop Effective Strategies for Mainstreaming Intelligent Transportation Systems (ITS),” STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION , <http://trid.trb.org/view.aspx?id=919270>] E. Liu

Another put it: "In states where district offices have considerable authority, it can be hard for headquarters to steer [priorities], especially when the districts have been delegated the lead for operations and maintenance…. Most [districts] will put their money in snow removal and fixing pavements first and foremost, and they don't have enough money for that, so ITS is pretty low on the list." In addition, several of the participants felt that ITS leadership was confined to a comparatively small number of states. The reasoning was that, to date, ITS has been used by state DOTs primarily as a strategy for improving system operations and level of service. However, not all states have major operations and level of service concerns. As one interview participant said, "For many states, that [level of service, congestion] is not a serious or widespread problem and where it is a problem, there usually are a strong constituency and the resources for adding new lanes or new facilities. The comparison group has to be other urbanized states with severe congestion and difficulties adding capacity - a much smaller group."

### Yes Tradeoff – Not Funded Now

#### ITS has to compete with traditional construction but it’s not trading off now

Elizabeth Deakin, Professor of City and Regional Planning at UC Berkeley, where she also is an affiliated faculty member of the Energy and Resources Group and the Master of Urban Design group. She formerly served as Director of the University of California Transportation Research Center (1998-2008) and co-director of the UC Berkeley Global Metropolitan Studies Initiative (2005-2008), et al., SangHyun Cheon, Jason Ni, Adam Leigland, Sungjin Park, and Manish Shirgaokar , 11-02, [“To Develop Effective Strategies for Mainstreaming Intelligent Transportation Systems (ITS),” STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION , <http://trid.trb.org/view.aspx?id=919270>] E. Liu

Several of the MPOs in California have been active in promoting various ITS technologies, and several California cities likewise have been early implementers. (See, e.g., 5, 6, 7, 8, 9.) Overall, however, there is general agreement that ITS implementation has been spotty, both in California and in other states and metropolitan areas. In addition, there are cases where ITS elements have been proposed for certain projects only to be dropped when funding ran short. In other cases ITS elements have not been able to compete effectively against more traditional construction, operations, and maintenance projects and have been given relatively low priority for implementation.

### Yes Tradeoff – Zero-Sum

#### All projects have to wait for limited funding – ITS takes from higher priorities

Elizabeth Deakin, Professor of City and Regional Planning at UC Berkeley, where she also is an affiliated faculty member of the Energy and Resources Group and the Master of Urban Design group. She formerly served as Director of the University of California Transportation Research Center (1998-2008) and co-director of the UC Berkeley Global Metropolitan Studies Initiative (2005-2008), et al., SangHyun Cheon, Jason Ni, Adam Leigland, Sungjin Park, and Manish Shirgaokar , 11-02, [“To Develop Effective Strategies for Mainstreaming Intelligent Transportation Systems (ITS),” STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION , <http://trid.trb.org/view.aspx?id=919270>] E. Liu

At the same time, many of the respondents noted that there was not enough transportation funding to go around, and even projects with considerable popular support and strong technical merit had to wait for funding. Prior commitments represented by long-range plans and multi-year programs took precedence, and crowd out ITS options. Local officials and interest group members added that projects like traffic calming and sidewalk installation and repair had plenty of public support but couldn’t compete with large regional projects; it took federal legislation to make funding available for these measures, and even then they have a hard time competing unless the MPO has set aside funds for them. In this context, 15 of the respondents advocated earmarking funds for ITS, but a larger number (28) commented that giving ITS special precedence seemed unfair, especially after so many years of heavy funding. “ITS has gotten a lot of research and development money over the last 10 or 15 years,” one respondent said.. “It’s time to start showing what all that money was good for. If these are good ideas, they should be able to compete on their own, and not need further special treatment.” Several respondents argued that Caltrans should be spending the money under its control for ITS if it believes these are high priority investments. “Lead by example”, one respondent put it. Another put it, “Caltrans has been funding the research. If it has produced good products, Caltrans should get on with it and implement them.” Variable message signs, weather advisories, automated tolls, mainline flow metering as well as ramp metering, freeway patrol services tied to detector and camera data, telecommuting and teleconferencing for employees were some of the measures that respondents mentioned as items that Caltrans could implement on its own.

# Cyberinfrastructure CP

### Advantage Counterplan 1NC

#### The United States federal government should guarantee funding for the National Science Foundation’s Cyber-infrastructure Framework for 21st Century initiative.

#### The NSF CIF21 is key to stable cyberinfrastructure

Subra Suresh, director of the U.S. National Science Foundation, served as Engineer- ing School dean and Vannevar Bush Professor of Engineering at the Mas- sachusetts Institute of Technology, 7-11, [“Subra Suresh Discusses Strategies to “Sustain the U.S. Innovation Engine” ,” Vol. 63 No. 7 • JOM, nanomechanics.mit.edu/papers/2011\_07\_JOM\_Suresh\_Interview.pdf] E. Liu

While each of the divisions has a dif- ferent emphasis, their work is coordi- nated and complementary, spanning from discovery of new phenomena and materials to the efficient and ef- fective use of engineering materials in applications. Supported research includes theory, simulation, modeling and experiment. Many efforts combin- ing one or more of these areas. I have already touched on SEES and BioMaPS as areas of interest for materials scientists and engineers in FY 2012. Also important to the ma- terials community is NSF’s focus on the Cyber-infrastructure Framework for 21st Century Science and Engi- neering (CIF21). This initiative aims to develop and deploy a comprehen- sive, integrated, sustainable, and se- cure cyberinfrastructure to accelerate research and education and new func- tional capabilities in computational and data-intensive science and engi- neering. This will transform our abil- ity to effectively address and solve the many complex problems facing science and society. CIF21 efforts will serve to support materials scientists and engineers who are expected to rely increasingly on Integrated Computa- tional Materials Engineering (ICME) approaches in their work.

#### Cyberinfrastructure is key to use computational science data and bolster innovation leadership

Andrea Tapia, Associate Professor of Information Sciences and Technology at the Pennsylvania State University, et al., Bridget Blodgett, Jinsung Jang, 9-27-09, [“THE MERGING OF TELECOMMUNICATIONS POLICY AND SCIENCE POLICY THROUGH BROADBAND STIMULUS FUNDING,” presentation at The 37th TPRC Research Conference on Communication, Information and Internet Policy, <http://ssrn.com/abstract=1997778>] E. Liu

eScience, or computational science, is defined as a rapidly growing multidisciplinary field that uses advanced computing capabilities to understand and solve complex problems. Computational science constitutes what many call the third pillar of the scientific enterprise, a peer alongside theory and physical experimentation. eScience is fundamentally collaborative, multi-disciplinary, multi-agency, multi-sector and multi-organizational. This form of scientific activity must be supported by what has come to be known as cyberinfrastructure. The term cyberinfrastructure describes the new research environments that support advanced data acquisition, data storage, data management, data integration, data mining, data visualization and other computing and information processing services over the Internet. According to Lazowska, Lee, Elliott and Smarr (2008) “Today we are at the dawn of a second revolution in discovery – a revolution that will have far more pervasive impact. The focus of this new approach to science – called eScience – is data; specifically: the ability to manage orders of magnitude more data than ever before possible; the ability to provide this data directly and immediately to a global community; the ability to use algorithmic approaches to extract meaning from huge volumes of data.” In the opening chapter of their book, Scientific Collaboration on the Internet, Olson, Bos and Zimmerman (2008) claim that the changing nature of much scientific research, including shifts from collocation to distributed collaboration and increasing size and complexity of data sets and requirements, has required the rise of technological and social systems that are capable of handling new research demands. Technology has been advancing rapidly by not only researching and developing new forms but by also exploring the synergistic opportunities that using technologies together in new ways produce. By expanding upon these capabilities technology had been able to cross “…thresholds that now make possible a comprehensive cyberinfrastructure on which to build new types of scientific and engineering knowledge environments and organizations and to pursue research in new ways and with increased efficacy. (pg. 1)” (Atkins 2003) This crossing has resulted in increased ability to support the changing needs of scientific research. Grid computing has risen as an important focus of computational research since it helps researchers gain a handle on the problem of raw data storage and sharing across institutional boundaries (Avery 2007; Chervenak, Deelman et al. 2007). Grid computing is a network of computers across the participating research institutions that “[…] contribute compute cycles to enable data analysis of the vast data sets.(Olson et al, 2008, pg 67)” This sharing of the cost of computing data allows the many researchers involved in these projects to engage in the research without shutting down any single site completely. Broad, (2008) stated, “infrastructure is an essential precursor to social and economic progress. Whether it is upgrading and expanding the electrical grids that power society or improving the roads and bridges that link people and commerce, infrastructure is essential to the future. Today, a new type of strategically important infrastructure may be less publicly visible but is, arguably, more essential to the future success of colleges and universities: cyberinfrastructure.” Research universities are the central engine of the innovation economy (Lazowska, Lee, Elliott and Smarr, 2008). This role depends critically on having state-of-the-art cyberinfrastructure as a foundation for eScience research and education activities. Like the physical infrastructure of roads, bridges, power grids, and water systems that support modern society, cyberinfrastructure refers to the distributed computer, information and communication technologies combined with the personnel and integrating components that provide a long-term platform to empower the modern scientific endeavor (NSF, 2003, http://www.nsf.gov/od/oci/reports/toc.jsp). In order for eScience to be enabled through cyberinfrastructure, the broadband connections between entities engaged in the research must secure, fast, reliable, and able to handle very large amounts of data in multiple forms. While the basic goals of science have remained the same over the last few decades, the questions that many researchers are dealing with have become more complex. Data has gone Tapia, Blodgett, Jang, TPRC 2009 4 from being files that can be stored on a single computer and handled by a single lab of researchers to massive petabytes of information that are handled by many distributed groups (Newman, Ellisman et al. 2003; 2008). Projects such as the CERN Large Hadron Collider or the Sloan Digital Sky Survey are capable of producing more information in a short period of that can reasonable be stored in a single area, let alone analyzed by the single laboratory of older research model. The authors call this “imminent deluge of data” one of the main drivers for change in the next years as science adapts itself to handle the needs that projects of such scope demand (Hey and Trefethen 2003). In addition to sheer volume, the nature of the data being collected by scientists in such large scale projects are also changing. While some remains fairly similar in their characteristics, other fields are dealing with data that are increasingly incongruent. This makes not only the storing the data difficult but also changes how scientists need to approach the process of analyzing the data. Hey and Trefethen (2005) point out that the field of bioinformatics is facing such a dilemma since the information they gather comes from many different sources as well as in many different formats that must be made compatible before analysis can begin or findings drawn.

### Funding Key/Solvency

#### More funding is key to adoption of cyber infrastructure – Funding is needed for adoption

Mark C. Sheehan, Fellow with the EDUCAUSE Center for Applied Research ( ECAR), 08, [“Higher Education IT and Cyberinfrastructure: Integrating Technologies for Scholarship,” Higher Education IT and Cyberinfrastructure

ECAR Research Study 3, 2008, net.educause.edu/ir/library/pdf/ers0803/rs/ERS0803w.pdf] E. Liu

That question gained new focus when in 2003, the National Science Foundation (NSF) crystallized years of thought about IT’s role in research and education by identifying cyberinfrastructure (CI) as an essential enabler of future scientific research. Distinguishing cyberinfrastructure both from commodity resources and from the specialized tools used in particular projects, the NSF described it as a platform “for the empowerment of specific communities of researchers to inno- vate and eventually revolutionize what they do.” Technologies such as high-performance computing, mass storage, advanced networks, and collaborative tools would collectively constitute, in the NSF’s vision (and in similar visions around the world often described as e-science or e-research), a sort of scientific commons where all kinds of knowledge could be exchanged, analyzed, and integrated. But the revolutionizing described in the vision extended beyond research results. Funding and governing CI demands significant changes in the cottage-industry research model of project-oriented grant funding, investigator ownership of resources, and relative lab inde- pendence. An effective cyberinfrastructure will have to be integrated deeply into the enterprise and the wider world beyond. These changes in turn suggest a new phase in the relationship between the different IT cultures of central IT and the research units—and that’s what brought us to this study. Campus IT leaders today are keen to support institutional strategic goals, and there’s nothing more strategic for higher education than research and the educational mission it supports. Providing and supporting cyberinfrastructure is likely to take central involvement; questions of standardization, integration, scale, and funding loom large. But how much central IT involvement is enough, and what form should it take? How can IT leaders overcome the skepticism they confront when they tell researchers, “I’m from central IT, and I’m here to help”? This study began with just such questions within the higher education IT community. In July 2007, EDUCAUSE hosted a summit of higher education leaders and others to discuss ideas about supporting research in general and cyberinfrastructure in particular. Ideas were plentiful; empirical data about how insti- tutions used CI technologies, funded them, and supported them was not. The group recommended to EDUCAUSE Vice President Mark Luker that EDUCAUSE conduct a survey of CI practices among its member institutions. Partnering with Mark and his Net@EDU team, ECAR carried out the survey in December 2007 and January 2008, and we are now proud to present ECAR Fellow Mark Sheehan’s fine study assessing the results. As in previous ECAR studies relating to the research mission,1 we found our CIO respondents deeply if selectively involved in IT support for research and concerned about improving its performance. The much-discussed fragmentation of campus CI usage and funding was apparent; for four of the five CI technologies we asked about, access was most commonly provided by researchers and their labs. Yet central IT was the second most common source for all of these technologies, and it was the primary source for the highly strategic fifth technology, advanced networking. Given this mix of distribution and central IT involvement, and taking into account the CIO mandate to promote enterprise aware- ness, perhaps it’s not surprising that our respondents gave low to mediocre marks to researchers’ collaboration in the use of CI resources, to their institutions’ ability to achieve economies of scale in CI, and to the existence of incentives for researchers to pursue these goals. CIOs, however, did not present themselves as wandering in an ungov- ernable CI wilderness. Contrary to a common worry that research use of IT is simply too complex and atomized to be comprehended, let alone managed, our respondents gener- ally agreed that they could find out what they needed to know, that they had knowledge- able executive colleagues, and that they had the authority they needed to meet their CI responsibilities. What our respondents said they lacked—or rather, what they thought would help them the most—was increased funding and better communication and outreach with the research community. On the whole, our study results provide good reason to believe that the low-grade culture war that has sometimes character- ized central IT and research relationships can and will abate in a mutual recognition that different parts of campus bringing complementary skills can work together to realize the promises of cyberinfrastructure. We especially hope that this study will give higher education CIOs a sense of where and how they can make their most effective contributions to CI support and the institu- tional success it engenders.

### Solvency – Biology

#### Scientists can’t access computational science resources now – Cyberinfrastructure is key

Lincoln D. Stein, scientist and leader in bioinformatics and computational biology at the Ontario Institute for Cancer Research, 9-08, [“Towards a cyberinfrastructure for the biological sciences: progress, visions and challenges,” SEPTEmBER 2008 | volUmE 9, Nature, [www.nature.com/nrg/journal/v9/n9/abs/nrg2414.html](http://www.nature.com/nrg/journal/v9/n9/abs/nrg2414.html)] E. Liu

Twenty years ago, although the computer was a handy gadget to have around when writing a paper or grant, it was certainly not an essential piece of laboratory equipment like an electrophoresis box. But times have changed. The advent of e‑mail, web sites and WIKIs has made the personal computer as essential as the telephone for establishing and maintaining scientific collaborations. Furthermore, for many biologists, particularly those in genetics, molecular biology and evolutionary biology, the way they practice science has been fundamentally changed by easy online access to genome sequencing and other large‑scale data sets. For these researchers, trying to practice biology without a computer and a broadband network connection would be like trying to do cell biology without a tissue‑culture hood. Yet despite the dramatic changes that the compu‑ ter has already brought to biology, its potential is far greater. In particular, the computer brings to biologi‑ cal research the ability to create predictive, quantita‑ tive models of complex biological processes within a cell or an organ system, or among a community of organisms. However, the tools for doing this are inaccessible to all but a few experimental biologists. Even the more prosaic task of integrating informa‑ tion from different specialties, such as data sets from population biology, genomics and ecology, requires specialized training in mathematics, statistics and software development. In recognition of the transformative nature of the computer and the internet on biological research, scientific funding agencies are increasingly prioritiz‑ ing the development and maintenance of something called the ‘biological cyberinfrastructure’. For example, the US National Science Foundation (NSF) recently announced a US$50 million 5‑year programme to cre‑ ate a Plant Science Cyberinfrastructure Collaborative (PSCIC), an organization that would foster “new con‑ ceptual advances through integrative computational thinking [...] to address an evolving array of grand challenge questions in plant science.” The National Cancer Institute (NCI) is now 4 years into its Cancer Bioinformatics Grid (caBIG) project, which receives approximately $20 million per year1. The European Union’s Framework Programme 7 (FP7) research infra‑ structure programme, which totals 27 million euros per year over 5 years, also includes a substantial component for biology cyberinfrastructure. And the Biomedical Informatics Research Network2 (BIRN; approximately $14 million per year), established in 2001 by the National Center for Research Resources, has been developed to provide a geographically distributed virtual community using cyberinfrastructure to facilitate data sharing and to foster a biomedical collaborative culture.

### Solvency – Warming

#### Cyberinfrastructure is key to collaboration and dissemination of climate data

C Pettit, Department of Primary Industries, Lincoln Square, et al., I Bishop, A Borda, P Uotila, V Sposito, L Raybould2 ABM Russel, Affiliations include University of Melbourne, Victorian eResearch Strategic Initiative, Monash University, 1-28-10, [“An E-Science Approach To Climate Change Adaptation,” <http://vro.dpi.vic.gov.au/dpi/vro/vrosite.nsf/pages/climate_vcapp_e-science_approach_climate_change_adaptation>] E. Liu

E-Science is associated with a global approach to developing new ways of undertaking collaborative research. As such, it has been promoted under different labels in different contexts. In the United States e-Science mainly goes under the name of ‘cyberinfrastructure’, in Australia the term ‘eResearch’ is used, and the European effort tends to be labelled ‘e-infrastructure’. These combined efforts are relatively recent, emerging in the last five to ten years, but they are assuming an ever greater part of the agenda of research funding agencies and policy makers. Regardless of the different labels, the policy documents and guidelines for research are in agreement about promoting ‘openness’, collaboration and sharing. The latter can take place between research groups, between projects, between institutions, between disciplines and between different locations. Ecoinformatics Ecoinformatics is an approach to e-Science which focuses on the concept of virtual collaboration for managing and sharing environmental data and information products across organisations. The significance of ecoinformatics is it provides an integrated technology systems approach for supporting multidisciplinary research in addressing complex problems. Within the fields of ecology and environmental science, a number of ecoinformatic initiatives have developed software tools and products to address issues with data discovery, access, management, analysis, modelling and visualisation. The National Centre for Ecology and Synthesis (NCEAS) in partnership with the Long Term Ecological Research Network (LTER), San Diego Supercomputer Centre (SDSC) and Texan Tech University (TTU) are behind the Science Environment for Ecological Knowledge (SEEK) project which, in addition to promoting data access and management, also produced Kepler, the scientific workflow system. This open source visual programming tool allows scientists to design and execute scientific workflows efficiently using emerging grid-based approaches to distributed computation. The benefits achieved by harnessing computer resources for high-power grid computing are also being exploited for environmental modelling by Natural Environment Research Council (NERC) projects within the UK e-Science Program including Grid for Ocean Diagnostics, Interactive Visualisation and Analysis (GODIVA), Global Coastal Ocean Modelling (GCOM) and Grid ENabled Integrated Earth system modelling (GENIE). There is also a significant body of research exploring the application of the Semantic Web to ecoinformatics for improved data discovery and integration within projects such as SEEK, Semantic WildNet, Ecosystem Location Visualisation and Information System (ELVIS), Global Lake Ecological Observatory Network (GLEON), Coral Reef Observatory Network (CREON) and Long Term Ecological Research (LTER). Ecoinformatics provides the broader context for which our research is a subset as illustrated in Fig. 1, with an initial focus on climate informatics. The ecoinformatics platform includes: socioeconomic, topographical, biophysical and climatic data which are necessary to derive a number of climate change and land use impact (risk) models. The outputs from these complex climate and risk models are then visualised using technologies such as digital globes (Google Earth) and collaborative virtual environments (Spatial Information Exploration Virtual Environment - SIEVE) (Stock et al., 2008). All data, models and visualisation outputs are accessible and can be shared via a collaboration platform where different levels of access and authorisation are given to a broad range of end users.

#### Data is sufficient now – Making it available for use is key

John Tribbia, Department of Sociology, University of Colorado-Boulder, and Susanne C. Moser, Institute for the Study of Society and Environment (ISSE), National Center for Atmospheric Research (NCAR), 08, [“More than information: what coastal managers need to plan for climate change,” environmental science & policy 11 (2008) 315–328, <http://www.sciencedirect.com/science/article/pii/S1462901108000130>] E. Liu

Interviewees frequently mentioned information they would like to use but do not have. Several mentioned the declining or general lack of funding for ongoing monitoring of current environmental conditions. For them, this problem loomed larger than the lack of information about future conditions (i.e., climate change and its impacts). Interviewees pointed to difficulties in access to available information rather than the complete lack of information as a big problem. As one federal agency interviewee stated, ‘‘the more information and the better access we have to it, I think, that will help our decisionmaking process.’’ To summarize, interviewees identified various information management needs and specific ways to make available information more accessible and userfriendly, including: ? Better collaboration and exchange of relevant information among all agencies (at federal, state, and local levels) in coastal management. ? Inventory and integration of existing (and additionally developed) information into common formats, e.g., geographic information systems. ? Development of an integrated database accessible by managers at different levels of governance; data ideally would be aggregated or disaggregated to various levels of spatial resolution (e.g., state, local, watershed/littoral cell levels) and for different temporal resolutions (e.g., calculation of erosion over a variety of specified time increments of 10, 20, 50 years). ? Regular exchange of information among coastal states, and among coastal communities about their management responses to climate change-related impacts and risks (Luers and Moser, 2006, pp. 21–23). As one state official aptly summed it up, ‘‘There are so many pieces; we need a basic structure to integrate the information that we do have. Then we can find out what else we need to know. I don’t have enough information at my fingertips to even say what doesn’t exist.’’

### Localized Computing Bad

#### Isolated computing is inefficient and diverts resources

Lincoln D. Stein, scientist and leader in bioinformatics and computational biology at the Ontario Institute for Cancer Research, 9-08, [“Towards a cyberinfrastructure for the biological sciences: progress, visions and challenges,” SEPTEmBER 2008 | volUmE 9, Nature, [www.nature.com/nrg/journal/v9/n9/abs/nrg2414.html](http://www.nature.com/nrg/journal/v9/n9/abs/nrg2414.html)] E. Liu

The computational infrastructure. The computational side of a cyberinfrastructure might be a less familiar concept. This part of the infrastructure gives researchers access to the hardware and software needed to perform computation‑intensive tasks. Examples include using image‑analysis software to measure the distribution of nucleur sizes in a set of histological slides, building a phylogenetic tree from a collection of gene sequences, and modelling a network of biochemical reactions using a kinetic simulation package. In biology, most of this work is done locally in the researcher’s own laboratory or institution; if the researcher needs more compute power, he buys more central processing units (CPUs). The major exceptions to this are a limited number of genomics tools, such as the BlAST6 sequence search and alignment algo‑ rithm, which require access to such large and unwieldy data sets that the software is usually hosted by the same organization that maintains the data repository. Relying entirely on local compute resources has drawbacks, however. It can be inefficient: one labora‑ tory is probably not using all its compute resources 100% of the time and so the machines are left idle. A larger drawback is that there is significant overhead for install‑ ing, configuring and maintaining computational biology software. This job can keep a postdoctoral researcher or system administrator busy for a long time. Physicists, astronomers and atmospheric scientists long ago figured out how to lessen this problem by relying on shared supercomputer centres for their hardware and person‑ nel needs. This where the idea of ‘compute grids’ comes in. These are systems in which geographically scattered compute clusters are combined through the internet into a virtual supercomputer centre. When a researcher is not actively using his own cluster, other groups around the world are using its otherwise idle time.

### Doesn’t Link to Politics

#### Science fudning avoids the politics link – Small cost, piece-meal funding, and big constituencies

Jeffrey Mervis, deputy news editor of Science magazine in Washington, 1-6-12, [“Research Remains a Favored Child in Budget Decisions,” Science 6 January 2012: Vol. 335 no. 6064 pp. 25-26, <http://www.sciencemag.org/content/335/6064/25.full>] E. Liu

Science is also “a cheap date,” says Joel Widder, a former head of NSF's legislative affairs shop and now a lobbyist for the Oldaker Law Group in Washington, D.C. The amount of money needed to boost basic research at most agencies is relatively small compared with the massive federal deficit, he points out. And asking for it entails little political risk. “Nobody gets criticized for being a supporter of science,” he notes. A third factor is the decentralization of science funding across the federal government. Funding for science is taken up piece-meal by Congress each year as it determines the budgets for individual agencies, a dozen of which support more than $100 million a year in research. While in the past some have advocated a Department of Science as a more efficient mechanism for managing federal dollars, the current arrangement serves two important purposes. One, it builds a bigger political constituency for research by making science part of the portfolio of many federal agencies and congressional committees. Two, it creates steep obstacles to any attempt to curb spending across the government on any particular research topic. This year's assault by House Republicans on climate science, for example, was blunted by the fact that research on the topic is supported by several federal agencies. Opponents had to settle for knocking out the Administration's plans for a National Climate Service within the National Oceanic and Atmospheric Administration, a tiny piece of the government's overall $2-billion-a-year climate change research program.

# Privatization CP

### Privatization Counterplan 1NC

#### The United States federal government should deregulate and privatize transportation infrastructure necessary for the deployment of a national Intelligent Transportation System.

#### ITS is at its core a private concept – Market systems are key for deployment

Joseph M. Sussman, Interim Director, MIT Engineering Systems Division JR East Professor of Civil and Environmental Engineering and Engineering Systems, 12-00, [“WHAT HAVE WE LEARNED ABOUT INTELLIGENT TRANSPORTATION SYSTEMS?, Department of Transportation Federal Highway Administration, Chapter 9, ntl.bts.gov/lib/jpodocs/repts\_te/13316.pdf] E. Liu

So, what have we learned about ITS? We are at the end of the beginning. The low hanging fruit is gone from the tree, and much has been achieved by choosing clear- cut, sure winners—an appropriate strategy for the first generation of any technology. However, for true deployment success, we must reach higher into the tree, focusing on integrated, regional, and market-driven systems. That ITS can be an important component of surface transportation is beyond question, but so much more can be done. It is the Internet age and the public’s expectations are changing. People, including travelers, are using sophisticated information technology and telecommunications equipment in their everyday lives. The ability to access information from multiple sources with the click of a mouse or television switch is a trend poised to continue. Intelligent transportation systems are the transportation community’s opportunity to be part of this revolution and to advance transportation and the transportation profession. In 1997, the prestigious Annals of the American Academy of Political and Social Science published a special issue entitled “Transport at the Millennium.”1 Comprised of 18 essays, it provides a broad perspective on the transportation field: where it has been, where it is now, and where it is likely to go in the future. Two themes dominated: 1. The need for fundamental change in the relationship between the public and private sectors in the transportation industry. These changes involve letting the market work through deregulation and privatization. 2. The use of pricing to create a more rational transportation system by overcoming market failure from “unpriced” externalities—such as congestion, environmental impacts, etc.— caused by the operation of transportation systems. Clearly ITS has both these ideas at its core and can build on them to make a major contribution for years to come.

#### Private companies are key to road innovations and solving congestion – Causes broader modeling

Kenneth A. Small, Professor and Chair of Economics at the University of California at Irvine, 8-25-08, [“Private Provision of Highways: Economic Issues,” Show-Me Institute, St. Louis, Missouri, ideas.repec.org/p/irv/wpaper/080917.html] E. Liu

The use of private firms to provide highway infrastructure can expand the range of funding sources available for timely investments, due to fiscal and political constraints on governments and the desire to avoid economic distortions resulting from high tax rates. There are sources of private funds whose desire for long-term stability and ability to diversify over project-specific risks make road investments a good fit. Furthermore, private firms can usually react more quickly to opportunities than can the public sector, and thus they can speed up the process of coping with a backlog of needed infrastructure investments. The use of private firms can produce substantial benefits related to risk-bearing. However, their use should not be viewed simply as a way for the public sector to shed risk. Rather, through the franchising process it is possible to specify flexible forms of risk-sharing that allow each entity to bear the risk it is most suited for. The overall public interest is enhanced when a franchise agreement provides incentives for each party to minimize the adverse consequences of uncertain events, by taking measures either to reduce the likelihood of such 33 events occurring or to reduce the financial consequences to which such events expose them. As for bearing the remaining irreducible uncertainty, there is no strong reason to believe that either the private or the public sector has much advantage; rather, the balance depends on specific situations. There are theoretical reasons to expect private firms to realize some cost efficiencies relative to direct public provision of the same services. However, the reasons are less strong in the highway sector than others because many of the same firms will be involved with either form of provision, whether as contractors or as private partners, and many of them are large enough to already have reaped scale economies and expertise. Furthermore, there is little empirical evidence for such cost savings for private highways. Rather, it appears that the most important factor is the nature of managerial incentives, which varies widely within both the public and private sectors but does not vary systematically between them. Private partnerships do perform more closely to the original budgets and time schedules; but those plans are almost certainly affected by whether the provider is public or private, so this observation offers little if any evidence for actual cost savings. Because road services cannot plausibly be made to look like a competitive market, any use of private operators needs to be accompanied by various controls. Most obviously, some restraint on market power is almost certainly in the public interest, unless the need for a funding source is so great that it overwhelms other considerations. Such restraint can be achieved by toll regulation, but doing so will tend to eliminate desirable price flexibility and requires information about future conditions that cannot plausibly be known in the case of a long-term contract. A more promising approach is an auction that specifies a particular financial target, the amount of which is the subject of the firms’ bids, allowing toll rates and the duration of the franchise to adjust to achieve the target that is agreed on. Other public concerns can also be addressed in an auction and the subsequent franchise agreement: for example safety, environmental goals, service quality, and financial stability of the private provider. Private provision of express lanes, in direct competition with a publicly owned free road, is a special case. Express lanes require an especially difficult balancing act for setting tolls or related financial targets. This is because their social benefit depends critically on balancing the traffic between the two roadways, so as to allow the express lanes to offer a premium service (beneficial when users differ considerably in the value they place on fast and reliable service) but 34 not to produce too much congestion on the free road (which becomes highly inefficient when extreme). In most cases, the public interest is best served if express lanes are priced somewhat below a level that would cover their construction cost. More generally, whenever a toll road has a reasonably close substitute that is free or low-priced and congested, it is desirable to keep the toll lower than otherwise in order to help relieve that congestion. Private highway provision can produce useful experimentation with pricing structures. When there is congestion, a private operator has an incentive to adopt time-of-day variation in toll rates because the resulting increased value to users can be at least partly captured in revenues. This type of pricing is quite similar to the kinds of congestion pricing that are increasingly recognized as a key to making urban roads more efficient. Thus by demonstrating viability and stimulating improvements in charging technology and implementation, valuable lessons from the private sector can be applied more widely. This possibility especially argues for the importance of designing franchises or toll regulations that give pricing flexibility to the operator.

### 1NC Politics Net Benefit

#### Not using tax money solves public and political opposition to infrastructure

Ellen Dannin, Fannie Weiss Distinguished Faculty Scholar and Professor of Law, Penn State Dickinson School of Law, Winter 11, [“Crumbling Infrastructure, Crumbling Democracy: ¶ Infrastructure Privatization Contracts and Their ¶ Effects on State and Local Governance ¶ ,” NORTHWESTERN JOURNAL OF LAW AND SOCIAL POLICY, <http://ssrn.com/abstract=1776350>] E. Liu

McNulty was wrong, and his comments came a year too late. Had he read the ¶ Northwest Parkway privatization contract4 he would have learned that under its “adverse ¶ action” provisions, the contractors had the right to object to new or improved roads and ¶ mass transit systems. In addition, the contractors had the right to receive compensation ¶ for lost anticipated revenues if those roads or transit systems were built during the term of ¶ the ninety-nine year contract.5 Most people would be surprised to learn that contracts to ¶ privatize major infrastructure, such as the Northwest Parkway, Chicago parking meters, ¶ proposed Indianapolis parking meters, and proposed Pennsylvania Turnpike contracts ¶ give private contractors these rights.6 ¶3 ¶ Moreover, this was the case even though neither McNulty nor any member of the ¶ public could have raised objections to the contract before it was consummated, for the ¶ terms were not released until after the deal was signed.7 Agreeing to multi-decade ¶ infrastructure privatization contracts, despite providing no opportunity for public scrutiny ¶ of the contract terms or right to object, is not unique to the Northwest Parkway lease. For ¶ example, in 2008, Mayor Richard Daley insisted that the Chicago City Council approve ¶ the seventy-five year lease of the city’s parking meters within two days after council ¶ members first saw the terms of the complex 279 page document.8 ¶4 ¶ However, even when contract terms are made public, few people read or ¶ understand their effects. Reporter Steve Katula explained: ¶ Virginia’s contract for the Beltway HOT lanes are not just far from ¶ free to taxpayers and even worse if people carpool. The structure of the ¶ deal ultimately minimizes public outrage until it’s too late, saddling ¶ taxpayers with a high bill and no voice. ¶ . . . . ¶ Most Northern Virginians were completely unaware of the VDOT ¶ “Megaproject” prior to construction, and this illustrates the problematic ¶ nature of complex contracts that promise free stuff. ¶ ¶ When taxpayer dollars are (supposedly) not involved, citizens (and ¶ even politicians) retract from the process, especially from boring ¶ contractual details . . . . [T]he supposedly free and complex, “black-box” ¶ nature of the HOT lanes deal served to discourage input and criticism. ¶ Despite VDOT following legally-mandated procedures for public input, ¶ the result was an opaque deal-making process, and a bad deal for ¶ Virginians. ¶ . . . . ¶ But with the cards now on the table, one must ask what was wrong ¶ with the original estimates? Why the promise they could do the project on ¶ a totally private basis, followed by the late-in-the-game change? Why did ¶ politicians, VDOT, The Washington Post, and the public believe the ¶ almost magic promises, and why was there so little reaction when the ¶ nature of the project funding changed, but the reward mechanism to the ¶ private contractor did not?9

## Privatization Block

### Solvency – Disinvestment

#### Federal spending inhibits ITS deployment and causes states to disinvest – Takes out half of solvency

Jayetta Z. Hecker, Director of Transportation Advocacy at the Bipartisan Policy Center, 3-08, [“SURFACE TRANSPORTATION Restructured Federal Approach Needed for More Focused, Performance-Based, and Sustainable Programs,” United States Government Accountability Office, [www.gao.gov/new.items/d08400.pdf](http://www.gao.gov/new.items/d08400.pdf)] E. Liu

State DOT officials have noted that congressionally directed spending may limit states’ ability to implement projects and efficiently use transportation funds. Additionally, tools to make better use of existing infrastructure, such as intelligent transportation systems and congestion pricing, have not been deployed to their full potential. Finally, increases in federal spending for transportation appear to reduce state spending for the same purpose, reducing the return on the federal investment—research estimates that 50 percent of each additional federal grant dollar for the highway program displaces funds that states would otherwise have spent on highways.

### Solvency – Federal Bad

#### Federal government is comparatively worse at using new technologies

Jayetta Z. Hecker, Director of Transportation Advocacy at the Bipartisan Policy Center, 3-08, [“SURFACE TRANSPORTATION Restructured Federal Approach Needed for More Focused, Performance-Based, and Sustainable Programs,” United States Government Accountability Office, [www.gao.gov/new.items/d08400.pdf](http://www.gao.gov/new.items/d08400.pdf)] E. Liu

Tools to make better use of existing infrastructure have not been deployed to their full potential, in part because their implementation is inhibited by the current structure of federal programs. Research has shown that a variety of congestion management tools, such as Intelligent Transportation Systems (ITS) and congestion pricing67 are effective ways of increasing or better utilizing capacity.68 Although such tools are increasingly employed by states and localities, their adoption has not been as extensive as it could be given their potential to decrease congestion. One factor contributing to this slow implementation is the lack of a link between funding and performance in current federal programs—projects with a lower return on investment may be funded instead of congestion management tools such as ITS. Furthermore, DOT’s measures of effects fall short of capturing the impact of ITS on congestion, making it more difficult for decision makers to assess the relative worth of alternative solutions. State autonomy also contributes to the slowed rollout of these tools. Even though federal funding is available to encourage investment in ITS, states often opt for investments in more visible projects that meet public demands, such as capacity expansion.69

### Solvency – Leadership

#### Private companies lead ITS systems and learn from the best examples

Mildred E. Warner, Professor in the Department of City and Regional Planning at Cornell University, 12, [“Privatization and urban governance: The continuing challenges of efficiency, voice¶ and integration,” Cities xxx (2012) xxx–xxx, Forthcoming, <http://www.sciencedirect.com/science/article/pii/S0264275112001035>] E. Liu

Cities are sites of innovation. Agglomeration creates challenges but also opportunities as urban residents see the possibilities for shared services and exchange (Webster and Lai, 2003). New mar- kets emerge and new technologies of service delivery are devel- oped. New ‘‘smart city’’ technology is emerging in transportation and energy sectors. Social networking technologies create the opportunities for better congestion management and service inte- gration – in real time across sectors. Private sector firms often lead in this innovation. They have the capital for research and develop- ment, the opportunity to work around the world where cities have the funds to explore new innovations, and they can share knowl- edge across a wide range of cities. The Smart Cities World Expo, held in Barcelona in 2011, offers an example of the innovation pos- sibilities (www.smartcityexpo.com). The challenge is to harness this innovation in ways that extend the benefits to more cities and more neighborhoods within them. New urban service delivery technologies have the power to splin- ter as well as integrate the city. We are seeing a process of ‘splin- tering urbanism’ – where some sections of the city receive superior integrated service while the vast majority of residents are left with older infrastructure not connected to the new (Graham & Marvin, 2001). This is quite common in high tech enclaves in Indian cities like Mumbai and Bangalore. This undermines the universal infra- structure ideal (O’Neill, 2010) and makes infrastructure and urban service delivery a mechanism for reifying difference.

### Solvency – Innovation

#### Private companies can create an innovative nationwide ITS system

David J. Wise, Director, Physical Infrastructure, GAO, 11-09, [“Efforts to Address Highway Congestion through Real-Time Traffic Information Systems Are Expanding but Face Implementation Challenges,” GAO, Report to Congressional Requesters, [www.gao.gov/products/GAO-10-121R](http://www.gao.gov/products/GAO-10-121R)] E. Liu

Increased partnerships with the private sector—While some private companies currently partner with state and local transportation agencies, several experts envisioned a nationwide system that would have even more private sector involvement. Some of these experts noted that the private sector is using more advanced technology and that a nationwide system should take advantage of this innovation. Examples are as follows: • Two experts envisioned a private company contracted by either DOT or state and local transportation agencies. In the first vision, DOT would contract with a private company, and the single contract with DOT could help ensure the collection of consistent data nationwide. In the second vision, which would replicate the I-95 Corridor Coalition’s business model on a national level, state and local transportation agencies within a region would jointly contract with a single private company to collect and aggregate data and translate the data into real-time traffic information. The state and local transportation agencies would disseminate the information to the public and might also collect and disseminate additional information beyond the data provided to the region under the private contract. • Another expert envisioned that DOT would contract with several private companies to collect and aggregate data on behalf of state and local transportation agencies. In this vision, the private sector would perform most operations needed to support the nationwide system, and DOT would establish data quality standards and other specific requirements, such as requirements to ensure consistency in the information collected and disseminated. Information could be disseminated to the public by either or both entities.

### Solvency – Skills

#### Contracting out ITS is key to develop skills to handle ITS

DOT FHA, Department of Transportation Federal Highway Administration, 12-00, [“WHAT HAVE WE LEARNED ABOUT INTELLIGENT TRANSPORTATION SYSTEMS?, Introduction, ntl.bts.gov/lib/jpodocs/repts\_te/13316.pdf] E. Liu

An important barrier to success in the deployment of new technologies and applications embodied in ITS is a lack of people to support such systems. The ITS environment requires skilled specialists representing new technologies. It also needs broad generalists with policy and management skills who can integrate advanced thinking about transportation services based on new technologies (Sussman 1995). The ITS community has recognized these needs, and various organizations have established substantial programs for human resource development. FHWA’s Professional Capacity Building program is a premier example, but hardly the only one. Universities, including the University of Michigan and the Virginia Polytechnic Institute, have developed programs, as has CITE (Consortium for Intelligent Transportation Education), housed at the University of Maryland. These programs, along with graduate transportation programs undergoing substantial ITS- related changes around the country, can provide a steady stream of talented and newly skilled people for the industry. However, we must emphasize that institutional changes in transportation organizations are needed if these people are to be used effectively and retained, as people with high-technology skills can often demand much higher salaries than are provided by public sector transportation organizations. Cultural change along with appropriate rewards for operations staff, for example, will be necessary in organ- izations where the culture strongly favors conventional infrastructure construction and maintenance. The need for political champions for ITS has long been understood in the ITS community. Here, though, we emphasize the need at all levels of implementing organizations for people with the ability to effectively deploy ITS. The political realities may require public sector organizations to “contract in” staff to perform some of the high-technology functions inherent in ITS, as opposed to permanently hiring such individuals. Also, “contracting out”—having private sector organizations handle various ITS functions on behalf of the public sector—is another option. In the short run, these options may both form useful strategies. In the long run, developing technical and policy skills directly in the public agency has important advantages for strategic ITS decision-making.

### AT: Plan Pays for Itself

#### Self sustaining plan supercharges the private sector – It opens the opportunity for an expanded role

Ellen Hanak, senior fellow and director of research at the Public Policy Institute of California, where she holds the Thomas C. Sutton chair in policy research and Kim Rueben, senior research associate at the Tax Policy Center, a joint venture of the Urban Institute and the Brookings Institution, 3-06, [“Funding Innovations for California Infrastructure: ¶ Promises and Pitfalls,” USC Keston Institute for Infrastructure, [www.urban.org/publications/1000943.html](http://www.urban.org/publications/1000943.html)] E. Liu

Private equity financing has potential at the margin, but is not a widespread solution, except perhaps for investments in dedicated goods movement. The opportunities to leverage projects using private resources are greatest when the benefits can be used to repay the costs and the return on investment is well defined. Similarly, there is room for more flexible contracting arrangements with private entities using design-build or design-build-operate contracts. These contracting agreements can help the public sector take advantage of new technology. They also can help coordinate incentives in contracts and may lead to cost savings and limit contract overruns. Even if these cost savings do not materialize, they can speed up job completion. However, these relationships are relatively untried in California in the key area of transportation. To be successful, they need to be integrated into the Caltrans system and get the support of current employees. Finally, while increasing the role of the private sector in providing for future infrastructure, it will be important to understand the contracting risk/return tradeoff and who is ultimately liable to pay for unsuccessful projects.

### PPP – Other Countries

#### Other countries prove leadership on partnerships are key to effective ITS implementation

Stephen Ezell, Senior Analyst, ¶ Information Technology and Innovation Foundation, led the Global Service Innovation Consortium, 1-10, [“ Intelligent Transportation ¶ Systems¶ Explaining intErnational it application lEadErship,” The Information Technology¶ & Innovation Foundation, <http://trid.trb.org/view.aspx?id=911843>] E. Liu

An important lesson from the success of Japan’s VICS ¶ and Smartway travel information systems is the need ¶ to view intelligent transportation systems platforms as ¶ “multi-use infrastructure.” VICS and Smartway were ¶ designed and built using a strategic roadmap that envi-¶ sioned multiple use cases for the intelligent transporta-¶ tion systems infrastructure, including of course safety ¶ applications and the public provision of real-time traf-¶ fic information, but also viewing the infrastructure as ¶ a platform for the private sector to introduce value-¶ added ITS applications. For example, while the “VICS ¶ Consultative Liaison Council” was convened in March ¶ 1990 by the National Police Agency, Ministry of In-¶ ternal Affairs and Communications, and Ministry of ¶ Land, Infrastructure, Tourism and Transport, within ¶ eighteen months industry and academia were enrolled ¶ in the development process through the “VICS Pro-¶ motion Council,” formed in September 1991. The ¶ essential point is that in designing the VICS system, ¶ Japan’s government partnered with its private sector ¶ to understand how commercially viable business mod-¶ els for value-added ITS services could be built off the ¶ VICS platform. ¶ The ability to forge successful public-private partner-¶ ships (PPPs) has been a key differentiator for Japan and ¶ South Korea’s leadership in intelligent transportation ¶ systems. The United States has found it more difficult ¶ to forge public-private partnerships in intelligent trans-¶ portation systems, for many reasons, including legal, ¶ institutional, political, and leadership hurdles. Insuffi-¶ cient guidelines exist to guide development of public-¶ private partnerships of ITS in the United States, and ¶ several of the failed experiences to date risk tarnish-¶ ing perspectives towards PPPs. The contrast between ¶ Japan’s and South Korea’s, as compared to the United ¶ States’, efforts to forge public-private partnerships in ¶ the collection and dissemination of real-time traffic in-¶ formation, as documented earlier, could not be more ¶ stark.¶ Whatever the reason, it appears clear that leading coun-¶ tries, including Japan, South Korea, and Singapore, ¶ have demonstrated superior ability than the United ¶ States to forge ITS-related public-private partnerships. ¶ Testaments to this include VICS and Smartway in Ja-¶ pan and South Korea’s close cooperation with the Ko-¶ rea Expressway Corporation on the implementation of ¶ intelligent transportation systems and the provision of ¶ real-time traffic information. In Singapore, the Land ¶ Transport Authority partnered with privately-owned ¶ taxis to turn them into probe vehicles. Part of the na-¶ tional leadership vision for ITS in the United States ¶ should be to not only lead the states and regions, but ¶ also the private sector, in the development of intelligent ¶ transportation systems.

### PPP – Solves Institutions

#### The CP isn’t a PPP

Vincent Pearce, Senior Associate. Booz•Allen & Hamilton Inc, 12-00, [“WHAT HAVE WE LEARNED ABOUT INTELLIGENT TRANSPORTATION SYSTEMS?, Department of Transportation Federal Highway Administration, Chapter 2, ntl.bts.gov/lib/jpodocs/repts\_te/13316.pdf] E. Liu

Ongoing assessment of system performance is a growing trend. Most ITS-based programs yield the greatest benefit if deployed on a regional basis; thus, they often cross jurisdictional boundaries. In incident management, for example, many agencies are also involved, even within a single jurisdiction. Success in this environment requires involvement by each stakeholder, achievement of consensus, and thorough understanding of roles and responsibilities by all participants. This approach requires recognizing and addressing the differences between stake- holders, as big differences may characterize what each can afford, staff, or justify. Partnerships between the public and private sectors require a clear understanding of the motivations and capabilities of each side, and of how to best leverage what each partner brings to the bargaining table. Integration, both technically and institutionally, can yield benefits, but it is a complex undertaking that will eventually need to address linkages across systems, modes, and functions. Although standards and increased interoperability will significantly ease such integration, the standards development process itself is consensus-driven and requires an extended period to accomplish its goals. The approaches to operations are also changing. Public agencies, traditionally seen as responsible for operating systems that support the public roadways, may experience great difficulty in hiring and retaining technical expertise, also in great demand from the private sector. Thus, trends toward contract operation and maintenance and system privatization are emerging. ITS project types from which this assessment was prepared range from technology demonstrations to full-scale implementations. They represent hundreds of millions of dollars of investment. Though not every lesson learned is universally applicable, many are relevant across project types. Some technical lessons, such as early problems with geolocation using cellular phones, have been overcome by technological advancement. The greatest impediments to ITS continue to be institutional, but they, too, will begin to diminish as new models of interagency and public-private partnerships are developed. Lessons from operations and management are just now becoming evident.

### Institutions Key

DOT FHA, Department of Transportation Federal Highway Administration, 12-00, [“WHAT HAVE WE LEARNED ABOUT INTELLIGENT TRANSPORTATION SYSTEMS?, Introduction, ntl.bts.gov/lib/jpodocs/repts\_te/13316.pdf] E. Liu

The final example in the previous section suggests another kind of integration that will be important for the future of ITS, namely institutional integration. The integration of public and private sector perspectives on ITS, as well as the integration of various levels of public sector organizations, are central to advancing the ITS agenda. Indeed, an important result of this study is that the major barriers to ITS deployment are institutional in nature. This conclusion should come as no surprise to observers of the ITS scene; the very definition of ITS speaks of applying “well-established technologies,” so technological breakthroughs are not needed for ITS deployment. But looking at transportation from an intermodal, systemic point of view requires a shift in institutional focus that is not easy to achieve. Dealing with intra- and interjurisdictional questions, budgetary frameworks, and regional-level perspectives on transportation systems; shifting institutional foci to operations rather than construction and maintenance; and training, retaining, and compensating qualified staff are all institutional barriers to widespread deployment of ITS technologies. Thinking through how to overcome various institutional barriers to ITS is the single most important activity we can undertake to enhance ITS deployment and develop successful implementations.