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A BIG LUMP OF COAL

President & Congress Give A Christmas Present To The Federal Science Agencies

This marks another year that provides further proof of a congressional budget process that is completely dysfunctional.

After months of intense hand-wringing about the dire situation of the physical sciences in the United States due to the long-term stagnation of research funds; after congressional approval and President Bush's signature on a vast "authorization" bill aimed at doubling federal funding of research for the physical sciences; after countless hearings and studies warning the country of "a gathering storm"; after all this and a lot more, the physical sciences received a monumental shaft in the $515.7 billion Consolidated Appropriations Act (HR-2764) approved by Congress during the week of December 17.

The National Science Foundation, the National Institute for Standards and Technology (NIST) and the Department of Energy's Office of Science are reeling after Congress and the President decided that virtually every other aspect of government spending should take precedence over their modest programs. It is no longer worth believing a word out of any national politician's mouth when he or she starts talking about the importance of science and technology to the nation's future.

Now that there is an appropriations bill, the much ballyhooed America Creating Opportunities to Meaningfully

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In Economic Development, It's The States Versus Foreign Governments

In the global battle to attract industry and jobs, the states are at a big disadvantage against nations that are investing substantial resources into economic development. The U.S. federal government has opted out of the international competition to attract industry and jobs, leaving that task up to the states, which do not have the resources to compete.

Nowhere is this more apparent than in the area of science and research parks created to spur investment in private-sector research, manufacturing facilities and high-tech employment. "With globalization increasing, countries and regions across the world are using research and science parks as a way to jumpstart their knowledge economies," says Rick Weddle, president and CEO of the Research Triangle Foundation of North Carolina, which operates the world-famous Research Triangle Park. "New entrants into the research park market such as China are developing research parks on such a huge scale that they are changing the market dramatically. China has taken our model to the nth degree and has expanded dramatically on it."

Recently developed science parks in China are providing existing parks in the United States with an unprecedented challenge in economic development.

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Why Cessna Outsourced Manufacture Of Its 'SkyCatcher' To Chinese Fighter Jet Company

Textron Inc.'s Cessna Aircraft division of Wichita, Kan., has selected Shenyang Aircraft Corp., China's largest fighter jet manufacturer, to build its new "Skycatcher" entry-level aircraft. Shenyang, a subsidiary of China Aviation Industry Corp., a Chinese government-owned consortium of aircraft manufacturers, will build the Skycatcher for about $100,000.

In signing the deal with the Chinese, Cessna has received "a lot of comments praising our foresight and we have a lot of people accusing us of being in league with the devil," says Doug Oliver, Cessna's director of corporate communications. "But we think this is an extremely smart business move, otherwise we wouldn't have done it."

After spending more than a year conducting a global sourcing search, Cessna found no other company able to manufacture the new light sport aircraft for anything close to $100,000. "When you look at the requirements that we had, which include safety and reliability and the need to have a company willing to make a sizeable investment in order to keep costs competitive, selecting Shenyang was a no brainer," says Oliver.

Cessna signed its agreement with Shenyang at the Great Hall of the People in Beijing. It has already received 900 orders for the plane, which has a 100-horsepower engine, speeds up to 118 knots and a maximum range of 470 nautical miles. The retail price is $109,500.

Cessna could not build the aircraft in the United States for anything close to the price point in China, says Oliver. "We looked in every part of the United States. We looked in Eastern Europe, Central America, South America. We've gotten a lot of comments saying Cessna was the last bastion of America. But we already source parts from all around the world. Nothing is American any more. Nothing is German any more. Nothing is Japanese any more. Harley-Davidson sources parts from all around the world. Let's face it, we're in a global economy."

Cessna picked the $100,000 price point for its entry-level aircraft and chose Shenyang in the hopes of making flying more affordable. "How do you appeal to pilots who got married and had kids and got out of flying?" Oliver asks. "If you had something that was half the price of a Cessna 172, then it's half the cost to get a pilot's license. With this new airplane, we really designed it for the training market to try to attract more people into the field. Once they learn to fly a little bit and get their feet wet they want to move up, they want more power."

If Cessna is successful in getting more people to take up flying, "we're going to help the aerospace industry here," says Oliver. Moreover, he points out, the U.S. aerospace industry will post a $56 billion trade surplus in 2007. It's not exactly being killed by foreign competition.

Placing production in China also provides Cessna with the opportunity to serve the potentially large Chinese market. Currently, China's entire airspace is controlled by the military, so there is no general aviation. But the United States government and all the commercial airplane manufacturers are working hard to change that. "In a huge country with roads that aren't so great, and once the airspace opens there, who is in a better position to tap into that market than Cessna who builds these new training aircraft and light support aircraft that are easy to get into?" Oliver asks.

Shenyang will stamp aluminum, produce the fuselage, assemble the aircraft, including engines, avionics, brakes, hydraulics and flight controls that are sourced primarily from U.S. companies. Shenyang will then do an initial flight test, take the aircraft apart, put it on a container and ship it to a Cessna location in the United States that has yet to be determined. Cessna will re-assemble the aircraft and do another flight test. Cessna expects to build 700 aircraft per year at full production.

Shenyang has been in the aircraft business since 1951. The company does work for Boeing, Airbus and Bombardier. It is building China's indigenous fighter aircraft and is working on China's regional jet.

Is Cessna creating a competitor in its own market-space, Oliver is asked.

"Is that bad?" he quickly responds. "Is competition bad? I don't know that it matters. There is not a huge transfer of technology. All the systems engineering is being done in Wichita. It's really aluminum work — stamping out parts and putting them together," he says. "We needed somebody to invest. It's not something you can find just anywhere."

There was no way the craft could be built in the United States. In Wichita, Cessna will build 380 business jets this year. Next year, the company plans on delivering 470 jets. "We are maxed out," says Oliver. "We are hiring 1,500 people over the next year — that's 10 percent of the workforce. In Wichita, we are bursting at the seams."

The company has just announced plans for a "huge" expansion of its subassembly facility in Columbus, Ga., enabling the company "to concentrate on more complex work," says Oliver. More repetitive work, wire harnesses and aluminum production are being moved to the company's plant in Chihuahua, Mexico.

Cessna's facility in Indepen-

(Continued on page five)

Contractor Gets Stonewalled While Trying To Research Military Weapon Supply Chains

The Department of Defense and its prime contractors are not responsive in providing information about the source of parts in its major weapons systems, according to a study commissioned by the United States-China Economic and Security Review Commission (USCC).

In an analysis of three weapons systems in various stages of development and use in the field, USCC contractor Synthesis Partners contacted individuals in more than 50 organizations that might have information on sources of parts and components. The idea was to identify data that is "required to develop a clear picture of the complete supply chain for military platforms" and provide policymakers with an accurate portrayal of the source of parts that are in major weapons systems, says the company. It was unable to do so.

Synthesis made repeated attempts to contact key personnel who might have product sourcing information for the three weapons systems: the UH-60 Blackhawk helicopter; the F-22 Raptor fighter; and the DDG 1000 Destroyer. It was provided with no information worthy of reporting.

The DOD program executive office (PEO) for the Blackhawk helicopter along with prime contractor Sikorsky "concluded that there is no 'simple' [Blackhawk] subsystem for which they can or are willing to provide supplier data to the USCC," says the study. The Blackhawk was produced in five different countries — Japan, UK, Australia, South Korea and Poland." The simplest subsystem they could identify in their discussions was the [helicopter's] gearbox," according to the Synthesis Partners report. There are 700 manufactured parts in the gearbox alone, "and they claim it would be overly burdensome to their staff to provide the kind of supplier data we're looking for," says the study. "They indicated that their databases are not organized to provide the types of information we discussed (supplier locations.)"

DOD's program executive office for the Blackhawk said it would provide the USCC with both the number of parts manufactured overseas and in the United States along with the number of suppliers from overseas and in the United States, but that it would provide the information not for the entire gearbox but only for one aspect of it: the bellcrank, which has between three and six suppliers.

"Their condition to providing this information was another, more specific letter of request from the USCC," says the report. On October 30, the Army Materiel Command (AMC) told the U.S.-China Commission that the letter requesting AMC's help in identifying the sources of parts would have to be approved by AMC's legislative liaison. The legislative liaison told Synthesis Partners that it would get involved " 'if it was directed to do so by proper officials.' " However, "subsequent attempts to contact the POCs [points of contact] have not ascertained if the original offer remains valid," according to the report.

Synthesis Partners received similar run-arounds with the two other weapons systems it was researching for the U.S.-China Commission. For the F-22 fighter, the points of contact "have not been responsive to date," says the report. DOD's program executive office for the F-22 told Synthesis Partners that it had information on 5,000 systems, sub-systems, components and material suppliers for the F-22, but that access to the information was limited. "The POC indicated that he would have the legal team review our request," says the study. "Since that time, he has been unresponsive."

For the DDG-1000 destroyer still under development, Synthesis contacted prime contractors General Dynamics (Bath) and Northrop Grumman. GD said it wouldn't provide any information until it was told to do so by the Defense Department's program executive office. Northrop Grumman "did not respond to repeated phone calls."

DOD's program executive officer said "he is addressing our request," according to the report. "However, we've received no feedback to date."

Synthesis Partners found that the Defense Contract Management Agency conducted a sourcing study on the Blackhawk for DOD's Office of Industrial Policy. It didn't find any parts for the aircraft sourced from China, but its investigation did not penetrate much beyond the second-tier supplier level. "DCMA's methodology may indicate, and as our work to date shows, that a single authoritative source covering the complete supply chain to the third tier supplier level does not exist," says the study. Other than this one report from DCMA "our efforts did not identify other organizations addressing the issue," says the Synthesis Partners report to the China Commission. The Intelligence Community's Acquisition Risk Center "has not conducted studies addressing the issue of the identification of foreign parts, components and material suppliers to U.S. weapons systems."

Synthesis Partners says it will be difficult to get information about foreign suppliers from those involved in weapons systems. "Information holders may in fact perceive a downside to cooperating with the USCC, as they risk revealing something in their programs of which they had no foreknowledge," says the study. "Research did not reveal other U.S. government organizations that are currently assessing the potential risks associated with the foreign manufacture of weapons systems parts and subsystems."

A Big Lump Of Coal For Science & Technology...(Continued from one)

Promote Excellence in Technology, Education and Science (COMPETES) Act, an "authorization" bill signed by President Bush on August 7, 2007, means nothing.

Almost all increases in funding for the agencies carrying out the national charter for advancing research into the physical sciences, came in the form of pork projects that have nothing to do with the sciences. In the entire 3,565-page omnibus bill, there were more than 11,900 congressional pork barrel projects totaling billions of dollars.

The National Science Foundation's budget for next year will increase by a lowly 2.5 percent, to $5.9 billion, far below the expected level of inflation and substantially less than the $6.6 billion "authorized" in the America COMPETES Act of 2007. The final appropriation for 2008 is far short of the $6.43 billion proposed by President Bush in January (an 8.7 percent increase), or the $6.55 billion approved by the Senate (up 10.8 percent) or the $6.5 billion approved by the House.

NIST's final budget number of $756 million has $51 million in earmarks for construction projects in Alabama and Mississippi, home states of two Senate members (Richard Shelby, R-Ala., and Thad Cochran, R-Miss.) who sit on the NIST appropriations committee. Among those earmarks is $30 million for "a laboratory and research space at the South Alabama Engineering and Science Center." Another $30 million is directed toward "competitive grants for research science buildings....as they relate to the Department of Commerce," according to wording in the bill. "These grants shall be awarded to colleges, universities and other non-profit science research organizations on a competitive basis." None of this has anything to do with NIST, and yet, there it is stuffed into its budget.

Other NIST programs get hammered. The Manufacturing Extension Partnership's budget plunges by 14.4 percent from $104.7 million in 2007 to $89.6 million in 2008. In the America COMPETES Act, the budget for MEP was directed to increase to $110 million in 2008. (By comparison, the agricultural extension program run by the Department of Agriculture receives an appropriation of $456 million).

The Technology Innovation Program, which is replacing the Advanced Technology Program, will receive $65 million, down from $79 million last year and down from the $100 million authorized in the America COMPETES Act. An "explanatory statement" provided with the omnibus appropriations bill says that the 2008 amount "will address mortgage obligations relating to projects created under the Advanced Technology Program."

NIST's laboratory program receives $440 million, an increase of $6 million over 2007's budget of $434 million, or a 1.4 percent increase. This is far lower than the $500 million President Bush requested, and the amounts approved by the House and Senate appropriations bills, which were in line with the Bush request, representing a 15 percent increase in NIST's laboratory budget.

The Department of Energy's Office of Science sees its budget increase 2.6 percent next year to $4.02 billion, far less than the $4.5 billion approved by the House Appropriations Committee and $4.49 billion approved by the Senate Appropriations Committee. But subtract out earmarks and the Science Office budget goes down by another $124 million to $3.89 billion, an increase of $97.8 million over last year and $504 million lower than the Bush administration's original request.

Health research at the NIH is also stagnant, rising just 1 percent to $29.2 billion.

Other programs in the $516 billion omnibus bill receive substantial boosts in funding, including $5 billion to combat AIDS around the world, $544 million more than Bush sought; and $3.7 billion more than Bush's request for veterans programs.

Not a word was said by any politician lamenting the shortfall of support for the research infrastructure that supports wealth generation of the American society. Among politicians, R&D is among the lowest of all government funding priorities. As of press time on Dec. 19, even the House Science Committee had not issued a press release about the loss of funding for its beloved programs.

In reading through dozens of press releases issued by members of Congress, there are great proclamations about the keen work done to secure earmarks for local congressional districts. Rep. John Boozman (D-Ark.) issued a press release listing 150 pork barrel projects he helped secure for his state totaling hundreds of millions of dollars, including $2.9 million for the Dale Bumpers Small Farms Research Center in Boonsville.

Rep. Pete Visclosky (D-Ind.) pronounced victory in securing $4.6 million for northwest Indiana crime prevention initiatives. "This funding is in addition to the over $58 million in energy and water infrastructure projects announced by Visclosky yesterday," his press release boasts.

Sen. Lamar Alexander (R-Tenn.), who has spoken eloquently at press conferences about the need for a vibrant research enterprise, said in his press release that the omnibus bill "includes funding for the military and its veterans, border security, drought relief, dam infrastructure repair, national park improvements and other projects vital to Tennessee." He then observes that the bill has "too many earmarks and gimmicks." Five paragraphs later he starts listing the earmarks in the bill headed to Tennessee including $34.6 million "to continue design, land acquisition and construction of the new Chikamauga Lock."

Sen. Carl Levin (D-Mich.) proclaimed in his press release: "The bill contains millions of dollars for projects across Michigan." He, too, then lists hundreds of earmarks headed into Michigan, including tens of thousand of dollars for a program at Wayne State University "to support exchanges between the U.S. and China, Detroit."

North Carolina Labor Department Studies Plight Of Pillowtex Workers

About 40 percent of the laid off workers from bankrupt Pillowtex Co. had not yet found work three years after they lost their jobs, and for those who have, take-home pay isn't as much as they were making at Pillowtex. The North Carolina Employment Security Commission's Labor Market Information Division is following the employment prospects of 4,820 laid off workers from Pillowtex, the largest mass layoff in North Carolina history.

By the end of 2006, the average annual wage of an ex-Pillowtex worker in a new job was $24,488, not including benefits, compared to $27,040 while at Pillowtex prior to its closure in 2003.

Twenty-three percent of the workers finding jobs went into the trade, transportation and utility industry; 22 percent went into education and health services; and 15 percent went into professional and business services.

"During our analysis of Pillowtex workers, we have been noticing a trend within our professional and business services industries," says Betty McGrath of the North Carolina Employment Security Commission. "What on the surface appeared to be a positive outcome for these workers, upon further analysis revealed...a large number of workers who are finding employment within [this category] are on the payrolls of temporary health firms. A substantial amount of growth that is occurring in professional business services is actually due to the growth of temporary health services."

North Carolina has been the most impacted state in the nation by layoffs due to trade. Between 2004 and 2006, almost 39,000 North Carolina workers have been certified by the Trade Adjustment Assistance program as having lost jobs to trade, more than 10 percent of the U.S. total of 387,755. North Carolina's job losses due to trade between 2004 and 2006 far surpassed the next closest state, California, which lost of 30,717 jobs, followed by Pennsylvania with 21,373, Michigan with 20,574, Ohio with 18,306 and South Carolina with 17,697.

"North Carolina's economy is undergoing a major transformation," McGrath told a recent field hearing of the United States-China Economic and Security Review Commission. "Our economy continues to shed jobs in our manufacturing industries, but at the same time is experiencing tremendous growth within our service providing industries."

The state has found that many laid off manufacturing workers have a difficult time leaving their communities to look for work. "The manufacturing plant was more than just the place of work," said McGrath. "It was the core and center of that community — many generations." Hundreds of small towns throughout North Carolina impacted by plant closures are dying. "There is a sense of community inherent in the people of North Carolina," said McGrath. "It's easy to say go take advantage of training and go get a new job. It's a complete overhaul of their perspective on what their relationship to work is."

Young people are moving out of the impacted towns, but older family members stay, a point that brought the following observation from U.S-China Commission chairman Carolyn Bartholomey: "When we were in Ohio a couple of years ago, we were told that Ohio's biggest export was its young people because there was no future for them there."

Cessna's Chinese Aircraft...(From page two)

dence, Mo., is also running full steam, making single engines and Mustangs, of which it expects to produce 100 more next year than this year. "We are desperately looking for people as are the other manufacturers in Wichita," says Oliver.

The company is also planning the new Citation CJ jet and XLS, plus a new business jet, "and we don't have the space," he adds. "We're studying launching a large cabin concept that could be introduced next year that will require engineering support. That might be hard to find in the United States because so few students are studying aerospace engineering."

Moving production of the Skycatcher "is more than just dollars and cents," says Oliver. "It's more than just saying we want it cheap so we're moving it to China. Our due diligence was exhaustive and it was global. It really was a clear choice to go this route."

Also driving Cessna was its obligation to shareholders. As a publicly traded company, Cessna's mission "is to make money for the people who own stock," says Oliver. "That is capitalism. That is the world we live in. We realize our social responsibility to the U.S. aerospace industry and the communities in which we live and we see this as strengthening that position — strengthening the American aerospace position. What better way to help change the social environment of China than to do work with the industry there?"

The plane will have a maximum gross weight of 1,320 pounds, a service ceiling of 15,500 feet, a useful load of 490 pounds and a fuel load of 24 gallons. Cessna sold 1,239 aircraft in 2006 and had sales of $4.2 billion. It currently has a backlog of $11.9 billion.

Economic Development...

(Continued from page one)

Research Triangle Park, which was created in 1959, is 5,000 acres, twice the size of the next largest research park in the United States. With 157 tenants, it is small in comparison to many of the new Chinese parks.

"The scale of China's development is such that following the RTP model, they have over 70 percent of their parks larger than 250 acres, many larger than RTP in and of itself," said Weddle. "RTP and the U.S. research parks have much to learn from the Chinese and what it will take to compete in the future: scale, nimbleness, speed-to-market and flexibility to attract talent and recruit expatriates to return," said Weddle. "Just as the manufacturing sector has to rethink and retool how it works because of the emergence of China and globalization, the R&D sector is also being impacted and must respond accordingly."

Since 1970, there has been a 17-fold increase in the number of research parks in the world. There are about 700 research parks worldwide, with 400 outside of the United States. The average size of a research park in the United States is 500 acres. Research Triangle Park was created to integrate the research capabilities of Duke University, University of North Carolina at Chapel Hill and North Carolina State University. It has helped propel North Carolina from being one of the poorest states in the nation to one of the richest.

The strong research university system in the United States may no longer win the battle for industrial and technological development and future prosperity. "It would be advantageous if we had more tools in our toolbox to be able to compete" with China, Weddle told a recent meeting of the United States-China Economic and Security Review Commission. "All of us at the local and regional and state level need all the help we can get from the federal government."

China's high-tech industrial zones employ a variety of incentives to entice industry to locate their R&D and production. Data compiled by IBM's Global Investment Location Database show that those incentives are working, with China and India leading the world in 2004 with inward investment for major R&D projects.

The Chinese "are making huge strides in that area," says Weddle. "We have to compete and I think it is one area where we enjoy limited time but significant current advantages [because] much of the R&D that's moving to China and India today is not the higher order R&D, but rather R&D that supports manufacturing and sales offices. We still have a niche there, but it's going to be very tough. It will be a lot more difficult 10 years from now if we don't have U.S. federal support for these kinds of things."

The primary area of federal support needed is robust funding for university research and development, which has been in steady decline. There should also be the rapid implementation of substantial investment tax credits that encourage companies to build new production capacity; a robust R&D tax credit to encourage research; and tax holidays similar to those that are "fundamentally provided to U.S. firms entering into" China and India, said Patrick Conway, professor of economics at the University of North Carolina, Chapel Hill.

Investment in U.S. university research infrastructure is "peanuts" compared to what is taking place in China,

(Continued on next page)

Comparison of Res. Triangle Park and Select Chinese Science Parks

Science Park	Location	Year Established	Area (acres)	No. of Tenants
Zhongguanoun Science Park	Beijing	1988	24,710	4,400
Zhengzhou High And New Technology Industries Development Zone	Zhengzhou	1988	16,010	1,003
Research Triangle Park	North Carolina	1959	7,000	157
Shanghai Zhangjiang Hi-Tech Park	Shanghai	1992	6,178	1,000
Nanjing New & High Tech. Development Zone	Nanjiing	1988	4,077	2,000
Shanghai Hi-Tech Park United Development Co. Ltd.	Shanghai	n/a	3,534	1,200
Shenzhen High-Tech Industrial Park	Shenzhen	1996	2,842	2,350
Tsinghua University Science Park	Beijing	1993	1,704	40
Shanghai Hongqiao Linkong Economic Zone	Shanghai	n/a	692	2,000
Beijing Zhong-Guancun Life Science Park	Beijing	2002	628	19
SDPIM- Macao Industrial Parks Development Co.	Macao	2003	67	11

Economic Development...

(Continued from page six)

said Conway. Funding research "is a costly enterprise. If we wish to compete in that area, our government needs to be invested as well. [North Carolina] is a state competing with a state's resources. China is a national government and that is inherently going to be unequal."

The current model of economic development in the United States is states competing with each other for new industry and jobs. "I don't think we've enjoined the debate or discussion in the U.S. today about the role of the federal government helping to nurture or meet or address" the challenges raised by states competing with countries, said Weddle. "We can get to the specifics of legislation once we reach agreement that the federal government is going to play some role in [global economic development], and I don't think we are anywhere near that."

In the United States, policymakers at the national level can't get beyond the "industrial policy" debate. But at the regional and local level, there is a hearty embrace of industrial policy. Research Triangle Park "is an example of industrial policy in the 1950s — picking high technology, back then it was chemistry," said Weddle. "We thought that was pretty much where it was going to be — picking a sector and investing heavily. In 1984, we picked the biotech center and made strategic investments and saw huge benefits and dividends come from that. Today, we're the fifth largest concentration of life science activity in the U.S."

What China is doing today — investing in its higher education system, training workers, investing in infrastructure and recruiting expatriates back to high-end technology isn't so much industrial policy as it is "economic policy," said Weddle. "Do we have one? Not at that scale or at that level of pro-activity."

In China today, the Central Party has two fundamental objectives: one is staying in power and the other is economic growth. "That is their policy and there is no other policy than that," said Weddle. "All of their tactical actions stem from how they facilitate economic growth. They are making massive investments in improving their university excellence opportunities. They are making massive public infrastructure investments to create [industrial and R&D] zones. They're providing massive tax holidays, but then, not to be outdone by themselves, they're now moving quickly and making very structured investments to bring Chinese intellectuals home, to recruit home their expatriates, to recruit the talent back that the United States has so well trained in our schools and universities over these years. They are actually providing direct financial incentives to those individuals to come home and start new businesses."

Chinese public officials at the regional and local level are evaluated on 22 different criteria — "and 17 or 18 of these have to deal with economic growth," said Weddle. The country might be centrally controlled, but "it's pretty wide open when it comes to making deals and doing business."

The United States hasn't realized what it is up against. "We're still kind of myopic in the United States in thinking we're the center of the universe and we're just one place in the universe of economies," said Weddle. "We have to learn how to function in a globally integrated environment better than we have before." There is a sense that "we have many big U.S.-based companies," but they are now global firms with large global supply chains and foreign employees and hold little allegiance to the United States.

In the area of science and technology parks, China is "leapfrogging" the United States, Weddle added. "What we've done in 50 years at RTP, they're doing in 15 years and replicating that now and even shortening these time horizons in five to seven to eight years in some of their smaller things," he told the China Commission. "They are global almost to a fault in their thinking in many ways. We toured a research park there in Suzhou that is a joint venture between the Chinese government and Singapore. We wouldn't even think about that. They partner up in ways that we wouldn't even think about or we might have issues or get all caught up in our knickers worrying about how it works out in this, that and the other."

Inward Investment Of Top 15 Countries *(2005)*	**Outward Investment Of Top 15 Countries** *(2005)*
1. India	1. United States
2. United States	2. Japan
3. China	3. Germany
4. Poland	4. Korea
5. Vietnam	5. United Kingdom
6. United Kingdom	6. France
7. Philippines	7. Italy
8. Malaysia	8. Canada
9. France	9. Singapore
10. Slovakia	10. Finland
11. Canada	11. Switzerland
12. Czech Republic	12. Netherlands
13. Brazil	13. India
14. Thailand	14. Russia
15. Germany	15. China

Top 10 Regions For Inward Investments 2004

1. Shanghai, China
2. Guangdon, China
3. Kamataka, India
4. Tamilnadu, India
5. California, USA
6. Jiangsu, China
7. Adhra Pradesh, India
8. North Carolina, USA
9. New South Wales, Australia
10. Zheijang, China

(Source of charts: IBM's Global Investment Locations Database as cited in the IBM Global Business Services publication "Corporate Location Strategies in Response to Global Business Environment Dynamics," June 18, 2007.)

DARPA Makes Five Awards Under 'Disruptive' Manufacturing Tech. Program

The Defense Advanced Research Projects Agency has finished making awards under its recently created "Disruptive Manufacturing Technologies" program. The agency is funding technologies that should result in "pervasive cost savings for multiple" weapons platforms, says the Arlington, Va.-based agency.

DARPA selected five bids to pursue manufacturing technologies in three product areas: integrated circuits, software and advanced materials. The new military environment "places a premium on fast and affordable manufacturing processes," says DARPA. "Furthermore, when the cost of manufacturing spare parts is taken into consideration, it becomes clear that new approaches to defense manufacturing are critically needed to guarantee the future success of the military."

DARPA selected contractors that will apply manufacturing principles to existing products. "Each project has one or more 'challenge parts' — components currently manufactured for a defense system that provide the benchmarks for cost and cycle-time improvements," says DARPA.

Here are the winning contractors and their projects:

• BAE Systems won a $4.85-million contract to work with Rohm & Haas and the University of Colorado at Boulder to reduce the cost of traveling wave tube amplifiers by a factor of 10. The project aims to create a "new paradigm for millimeter wave circuits," says DARPA. Rohm & Haas has a DARPA contract under the Three-Dimension Micro Electromagnetic Radio Frequency program.

• BAE Systems won a $3.4-million contract to improve the ability to adapt software code into weapons systems. "Current software engineering tools do not adequately support the rapid addition of new capabilities to existing models and code," says DARPA. "The reality that perfect software and hardware are unlikely to be delivered causes concern that operational degradation can result from accidental system faults."

BAE is teaming with MIT and Vanderbilt University's Institute for Software Integration Systems in the "Producible Adaptive Model-Based Software" project that will develop tools that can be "uniformly applied to software adaptation across multiple timescales," says DARPA. "The effectiveness of program results will be demonstrated and measured in two key DOD application areas: flight control/vehicle management systems and software-defined radios. These substantially different domains will provide compelling evidence that this technology is broadly applicable and can have a significant impact on a large cross section of critical DOD systems. A 90 percent cost reduction over the use of current, best-of-breed software engineering tools is expected through the adoption of this technology."

• Boeing has won a $2.64-millioncontract to develop a non-autoclave manufacturing technology for polymer matrix prepreg composite structures. "The technology development will focus on establishing robust materials and out-of-autoclave processes for fabrication of full-size aerospace structural components with the same performance as autoclave-process materials," says DARPA. "The developments in this program will enable the use of the same materials and processes for both development and production, mitigating risks frequently realized in program life cycles at maturation to production. Polymer composite parts can be manufactured in low volume production at 75 percent of the cost of the autoclaved components."

• The University of Michigan has won a $3.33-million contract to develop a system for the direct digital manufacture of airfoils that "disrupts the state-of-the-art investment casting process for manufacturing super-alloy airfoils, the high-strength blades that power aircraft turbine engines," says DARPA. Direct digital manufacturing "will eliminate nearly all the tooling, handling and associated causes for scrap in airfoil investment casting. It will enable production of new designs that are impossible using current processing and more efficient on-demand manufacturing. Direct digital manufacturing's underlying technology involves layer-by-layer patterning of photo-curable ceramic resins through large area mask-less lithography."

• PPG Industries has received a $986,000 contract to work on pressureless sintering of plasma-synthesized boron carbide nano-sized powders "that will disrupt the current methods for manufacturing body armor," says DARPA. "Boron carbide armor is lightweight and has excellent ballistic properties, but current batch processes for its manufacture are slow and costly." DARPA hopes to reduce the cost of armor-grade powder through plasma synthesis in a continuous process "and use pressureless sintering to densify the powder into ceramic armor without the need for high-cost hot pressing. Together these developments will reduce the cost of armor inserts by two-thirds."

The Disruptive Manufacturing Technology Web sites:

Integrated Circuits:
http://www.darpa.mil/MTO/Programs/dmt/index.html

Software Producibility:
http://www.darpa.mil/ipto/programs/dmt/dmt.asp

Advanced Materials:
http://www.darpa.mil/dso/thrusts/materials/novelmat/disman/index.htm

The Disruptive Manufacturing Technology solicitation is located at
http://www.fob.gov/servlet/Solicitation/R/ODA/DARPA/CMO/BAA06-34

The Top 19 Technology Trends For 2008

BY DAVID SMITH

1. Green, Green, Green: During 2008, everything turns green. The greening of information technology started in 2007, but will pick up speed and spread to all parts of both the corporate and consumer domains. This includes efforts at conserving power, more efficient procedures, less travel and many other activities to save resources. Look for major shifts in R&D budgets and collaborative partnerships to reflect this trend.

2. "Peer-to-peer" re-brands itself and becomes an ad-supported connection between consumers, business and content producers. This connection is an extension to the pace of adoption of Reed's Law — the law of increasing global enterprises arising from group-group connections. Video and collaborative applications will be the driver. The drive toward ad hoc, multi-party collaboration will increase because of the peer-to-peer nature and its impact on trust.

3. The IT industry's key players dramatically increase the migration of core offerings. Applications, business intelligence, storage, imaging, CRM, etc. will migrate to online delivery models as a key method for profitably serving high-growth markets, particularly small- and medium-sized businesses. Web "mashups" that combine data from more than one source into one integrated tool will be the dominant model for the creation of composite enterprise applications and will peak around 2012. Mashup technologies will evolve significantly over the next five years, and application leaders must take this evolution into account when evaluating the impact of mashups and in formulating an enterprise mashup strategy.

4. The fabric of the enterprise computing and data center begins to change considerably. New definitions of what a server is, new definitions of bladed workstations and even a massive change in storage will occur. As server virtualization use continues to expand to a wider range of users and industries, a growing number of companies will opt to use iSCSI as the supporting SAN fabric for the servers being consolidated.

5. Flash memory hits the mainstream in a big way. In 2007, flash entered the mainstream with several fabs being put into production, and the vast majority of these fabs are producing flash chips. We saw major technology companies introducing computers without disk drives, with flash being considerably faster and more durable than current disk drives. Sixty-four gigabyte disks that are affordable, smaller and solid-state will be hitting the mainstream in a big way, leading to more crash-resistant and faster laptops. Flash-based storage makes a move toward the datacenter both as a green and a faster access option. Flash-based storage, whose cost per gigabyte is rapidly approaching magnetic disks, offers the additional benefits of 10 times the performance, higher storage densities and much lower power consumption. Flash also makes handheld devices more competitive to laptop PCs.

6. Voice no longer drives communications. It is more than just voice. The march toward digital convergence and unified communications picks up steam. In the business enterprise, IP telephony has reached about 25 percent of the global market, with most organizations testing the waters for wider deployment. The movement of Microsoft and others into this space will enhance its uptake.

7. Significant growth driven by WiFi is apparent across communications hardware providers and carriers. 2008 will be the year to watch for significant growth across communication hardware providers and carriers in the number of users with WiFi-enabled cell phones, and even the takeoff of WiFi on airplanes. Carriers that embrace WiFi will deliver significant value-added to their subscribers through a full browsing experience and easy access to Web services and other communications options. One-to-one cell conferencing appears and new location-centric collaboration emerges.

8. A new paradigm arrives in the wireless markets. As the precursor appeared in 2007, 2008 will see increased transformation as mobile network operators open up their networks. Look for a new paradigm in pricing, equipment and services. This change is based on mounting pressure from Web gadgets and open development efforts such as Google's Android and the Open Handset Alliance. Mobile network operators will have to begrudgingly open up their networks to any device and any application. Mobile networks will not only open up to outside handsets, devices and applications, but media content, search, social networks, conferencing, shopping and a variety of services will all be standard parts of the mobile network experience.

9. WiMAX continues its consolidation and makes many changes during the year. The market will consolidate around both device makers and chip companies, but the industry will grow especially in fixed access and sensor applications. M-Taiwan will become the showplace for future applications.

10. Internet video of all types increases. From flash-centric social media to enterprise video application to IP HD video these will all be taking market share away from satellite and will begin to impact cable.

11. Digital convergence enters a new stage of growth, finally beginning to exploit the benefits of horizontal digital convergence. The need for higher profits, value partnering and time compression forces traditional companies to look for solutions and capabilities outside of their traditional vertical industries. An example is the health industry looking at the new Nintendo Wii game console, with its motion sensitive controllers, as a way to motivate exercise and physical therapy.

12. Advertising revenue increases as new applications emerge and as tens of millions of users use immersive worlds and play massively multiplayer online games (MMOGs). With broadband penetration well up the curve globally (wireline and wireless), the movement of advertising will increase as new applications emerge and as huge numbers of users increasingly use immersive worlds and MMOGs. These new worlds and game sites are some of the stickiest on the Web, resulting in some of the highest levels of time spent per month online. This

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indicates they are becoming a primary form of online communication for some users. Look for the launch of asynchronous multiplayer games. The income from advertising will justify free market sustainable residential broadband. The net neutrality issue will be resolved in 2009 - 2011.

13. Outsourcing transitions to smart sourcing. Horizontal convergence will further build upon the transitioning of outsourcing to smart sourcing. Smart sourcing is when organizations utilize the Reed's law approach of self forming groups to help identify, jointly design and jointly produce products that are not in the organization's core competencies. This is particularly important as the design and product life-cycles continue to compress, and new convergence products reach beyond traditional product lines. With the growth of broadband Internet, smart phones and devices, and various always-on products and tools, the timing is right to exploit these new capabilities.

14. The corporate and governmental business models move toward ones more dominated by Reed's law of self-forming groups. Innovation, collaboration and transformation will be at the top of every leader's list during 2008. Companies are demanding new tools and methods to execute that change within their existing organizations, as well as for the kind of design thinking that transforms cultures. The next change is to stop competing against your competitors. Traditional rivals aren't the biggest worry. Disruptive innovation is hitting corporations from outside their businesses and from outside their traditional industries. The impacts of horizontal digital convergence will bring new white space industries that will be disruptors to traditional industries.

15. Global warming and the energy crisis continue to have major impacts. Even with the data centers going green, these impacts will be increasingly felt. With oil production peaking in the next five years and new sources coming online slowly, look for many point solutions that will have little impact. China and India will become leaders in solar power, and the movement to biofuels will create ecological and food challenges for many. 2008 will be the year where LEDs become common for lighting, and new forms of energy storage will leave the labs. Look for new players to emerge, from Brazil with their new oil fields to Google, which is pouring tens of millions of dollars into funding wind, solar and geothermal power.

16. Global stability continues to become even more high risk. China will continue to have its way with other nation's critical information. In 2007, we learned that electronic attacks emanating from the Chinese military had penetrated the German Chancellery, England's Whitehall and the Pentagon. 2008 will see a continuance of such attacks by China on Western governments and industry. More penetrations of government agencies and labs will be uncovered and publicized. The likelihood of superpower conflict with China, Russia or both increases, which will make the war on terrorism seem like it's not such a big deal. The likelihood of a regional nuclear exchange increases considerably during the next 10 years.

17. The worldwide economy will be volatile during the next few years. Water will become a driver much like oil was in the 20th century. The movement to a cashless society will increase, as digital imaging will progress to the point it will defeat most anti-counterfeiting systems. China will exchange its U.S. currencies for Euros and other currencies, which will cause the dollar to decrease in value and adversely impact the stock market. The U.S. consumer economy will slow, maybe into recession, with a resulting impact on the world's economy. Specifically, this will weaken the business models based on consumer and Internet advertising. Advertisers, entrepreneurs and investors will switch their attention to B2B business.

18. The age of bio continues to grow in importance. New products from the industry consolidations of 2006/2007 begin coming to market in 2008/2009. Digital convergence also impacts the age of bio with evidence-based medicine being enabled by the horizontal convergence of multiple industries.

19. Social applications come into prominence built around the growth of pervasive communications and computing. The growth of all the elements above will make 2008 the toughest year ever for CIOs. The same elements that are driving consumers to the social networking and social media sites will enter the enterprise marketplace and CIOs will lose control because of their business impact.

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