

CAE Ltd.

For many years, Montreal-based Canadian Aviation Electronics Ltd. (known by its acronym, CAE) has been one of the world's top war-related industries. Widely-known as a "global leader" in simulation technology, its products are highly coveted for training military personnel in the use of many of the world's most-deadly weapons delivery systems.

In October 2002, CAE announced that it was collaborating with Boeing, the world's leading "missile defense" prime contractor. This was a breakthrough for the Canadian company because Boeing wanted CAE's cutting-edge products not just to train soldiers how to use "missile defense" weapons systems, but for the very creation, design, testing, evaluation and development of these systems. CAE's most significant contribution to Boeing's "missile defense" work revolves around three simulation products, known as STRIVE, ITEMS and RAVE.

A secondary avenue of support from CAE for "missile defense" was the use of its president and CEO, Derek H. Burney, between 1999 and 2004. He actively promoted the U.S.-led weapons program in speeches to influential business associations. (See sidebar on "Derek H. Burney," pages 38-39.)

CAE was the obvious Canadian company of choice for Boeing. With annual revenues of over \$1 billion and with "manufacturing operations and training facilities in 17 countries," including major subsidiaries in Europe and the U.S. (Dallas, Texas and Tampa, Florida), CAE is

"a global leader in providing advanced simulation and controls equipment and integrated training solutions."¹

With the U.S. military as its largest customer, CAE has proudly trained thousands of warriors in the intricacies of using many of the world's deadliest weapons technologies. Among the U.S. weapons systems supported by CAE are bombers, fighter jets, attack helicopters, aerial gunships, unmanned aerial vehicles, main battle tanks, warships and submarines equipped with nuclear weapons.²



CAE is at the cutting edge of a global revolution in how weapons systems are created. Called "computational prototyping" or "simulation-based design," this process flowered in the 1990s, thanks to advances in computer-aided design and digital imaging systems. Boeing, the world's No. 1 prime contractor for "missile defense" weapons development will use CAE's products to create, design, test, evaluate and develop "missile defense" weapons systems.

STRIVE

When CAE and Boeing announced their "missile defense" partnership, they described it as a "technical assistance agreement" that was being established "as an open framework for long-term cooperation." Boeing explained that it chose CAE for its "suite of modeling and simulation software tools." Among these tools is an extremely complex, computer program called STRIVE. Contrary to CAE's usual role of designing high-tech training devices for *existing* weapons systems, Boeing will use STRIVE to create synthetic, computer environments for use in the creative process of designing, evaluating and developing *new* "missile defense" weapons systems.

As Boeing and CAE stated in their media announcement, STRIVE will be used by Boeing to:

"evaluate and develop systems related to air and missile threats, sensors, interceptors, and battle management/command, control and communications systems. ... Strive is a modeling and simulation framework that gives software developers the

ability to easily design complex, interoperable systems. STRIVE will give software developers, *designing a range of ballistic missile defense technology, the ability to model systems and [learn] how these systems interact and interoperate.*"³ (Emphasis added)

STRIVE's central role as a tool to develop new "missile defense" systems, is conveyed in a CAE product brochure. It explains that STRIVE is a "development framework" that will:

"enable Boeing to *build and test scenarios using proposed terrain, weather, missile threat and defense platforms, launch detection and tracking sensors. These scenarios can then be changed and manipulated with different parameters as Boeing verifies and validates BMD designs.*"⁴ (Emphasis added)

CAE's STRIVE technology will therefore play a pivotal role in allowing Boeing to actually create its new "missile defense" weapons systems. Essential to the creation of new weapons, sensors, tracking devices and their various platforms, is the ability to test and evaluate emerging product designs. With such assessment methods integrated into the design process, weapons developers can repeatedly return to the



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drawing board with new modifications and improvements until they are finally ready for production.

This revolutionary, product-development process called “computational prototyping,” “multidisciplinary design and optimization” and “simulation-based design.” It flowered in the 1990s, thanks to simultaneous advances in computer-aided design and the digital imaging systems used to create artificial or synthetic environments.

Throughout history, the institutions of war have been able to afford the very best facilities, equipment and scientists that money can buy. Not surprisingly, the Pentagon, being the wealthiest war institution in world history, is at the forefront of this whole new technological frontier in human/machine creativity and design. Many, however, would be surprised to learn that Canada’s CAE is at the very cutting edge of this brave new world in “missile defense” weapons design.

In a paper called “Computation-Based Design,” Ilan Kroo, Professor of Aeronautics and Astronautics at Stanford University, sums it up by saying “the basic idea involves a combination of simulation, modeling and design tools that are required for the design of complex systems.”⁵

Derek Burney, then CAE president and CEO, hinted briefly at this concept in early 2003, when he tried to impress CAE investors by saying that “our *STRIVE* simulation and modeling technology will be used by Boeing to assess ballistic missile defense systems.”⁶

Thanks to CAE’s advanced simulation technology, Canada is at the frontier of a revolution in computer-aided design that is being used by Boeing to create and improve various weapons systems under the banner of “missile defense.” This is what Donald W. Campbell, CAE’s “Military Simulation and Training” group president hinted at when he said:

“This agreement [with Boeing] is also representative of our strategy to use CAE’s modeling and simulation expertise *throughout the development cycle of large defense programs.*”⁷ (Emphasis added)

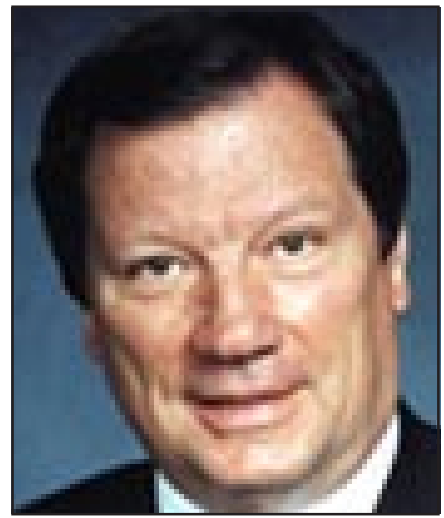
For years, CAE’s products have been used for training purposes, i.e.,

“From R&D initiatives to analysis and acquisition..., modeling and simulation significantly enhances the effectiveness and readiness of warfighters.”

Donald W. Campbell
President, CAE’s Military Simulation & Training Group

He joined CAE after a 36-year career in Canada’s Department of Foreign Affairs and International

Trade. Most recently, he was Deputy Foreign Minister. He was Chretien’s representative for G-8 Summits (1997-2000), Ambassador to Korea (1984-1985) and Japan (1993-1997) and Deputy Minister for International Trade (1989-1993).



Donald W. Campbell

after a weapons system has already rolled off the assembly line. Boeing’s decision to use CAE technology to design, assess and develop *new* systems for America’s “missile defense” weapons program, was understandably considered a breakthrough by CAE. As such, the “missile defense” deal was a welcome break from CAE’s

“long history of creating synthetic training environments that accurately model and realistically recreate a virtual world.”⁸

In a CAE newsletter on military simulation and training, Donald Campbell elaborated on this departure from their usual markets:

“Our modeling and simulation expertise has been applied primarily to the training niche. However, the use of modeling and simulation extends far beyond traditional military training and has application throughout the military community. *From research and development initiatives to analysis and acquisition activities,* modeling and simulation significantly enhances the effectiveness and readiness of warfighters. Now, CAE is applying its modeling and simulation capabilities in new ways so our customers can *analyze, design and procure assets* more efficiently and economically....

A good example of CAE’s initiative to expand the use of our modeling and simulation expertise is our participation in the Boeing-led Ballistic Missile Defense program. We will be providing our STRIVE devel-

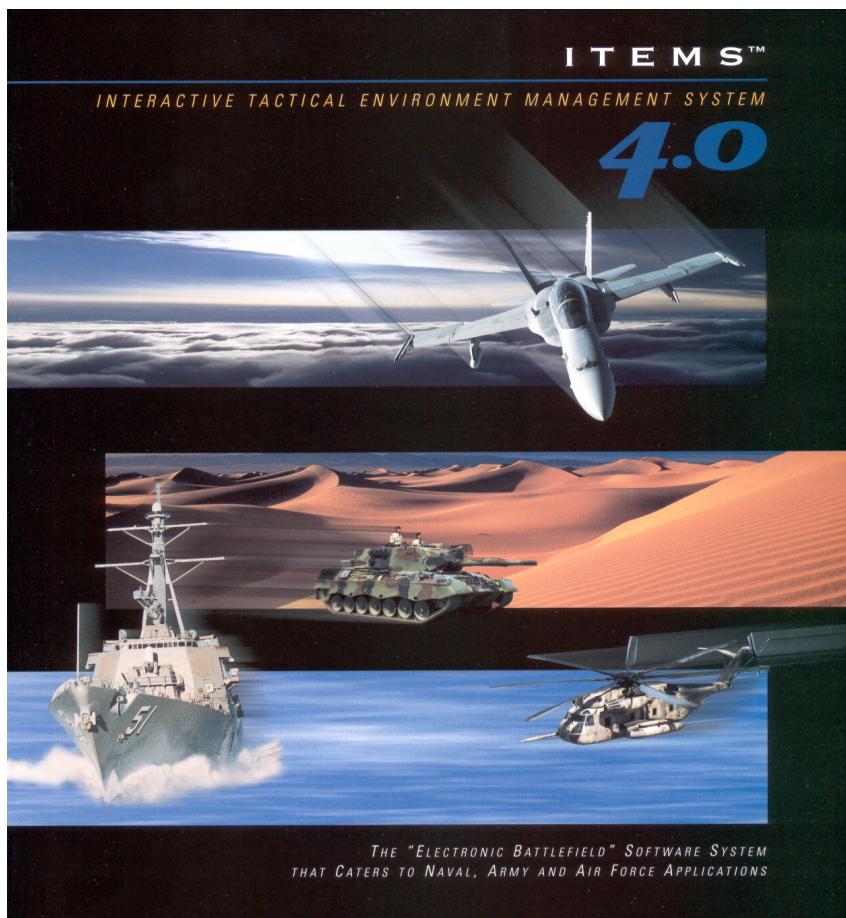
opment framework and engineering expertise in designing complex synthetic environments.”⁹ (Emphasis added)

For years, the U.S. military has recognized the importance of this phenomenon. The U.S. Army created “Planning Guidelines for Simulation and Modeling for Acquisition Requirements and Training” (SMART) to exploit this revolution in computer-aided design and simulation technology. As stated in the document’s “executive summary,” gone are the days of having:

“separate communities working independently to identify requirements, engineer solutions, develop hardware prototypes, test the prototypes, manufacture the systems, support the systems and then finally train on and operate the systems....

A virtual design in a collaborative environment allows the proposed [weapon] system to be evaluated for combat effectiveness, man-print [Manpower and Personnel Integration], supportability and customer needs before building a hardware prototype.”¹⁰

CAE understands that the use of their products to design, test and develop new “missile defense” weapons systems is at the very forefront of efforts to expand their business and profits. Similarly, the field of simulation-aided design is leading the way in the whole business of war. It is through this process that the most advanced, most expensive and most deadly, new weapons systems are now being created.



ITEMS

CAE's Interactive Tactical Environment Management System (ITEMS) is another CAE product used by Boeing for "missile defense" applications. The initial announcement of the CAE-Boeing partnership, described ITEMS as

"a software development tool used to create and represent computer-generated weapons, sensors and other systems in a synthetic environment."¹¹

ITEMS has long been used for a many U.S. military applications. It received high praise in the above-mentioned, SMART "Guidelines." Published by the U.S. Army's Battle Command, Simulation and Experimentation Directorate (formerly known as the Army Model and Simulation Office), this reference guide glowingly describes CAE's ITEMS technology as an:

"off the shelf integrated software system that configures and runs a synthetic tactical environment, including programmable interactive players and support for command and control authority structures. The user can generate a target rich tactical scenario without hardcoded data limitations.... Scenarios created within the framework of ITEMS can

range from simple engagements to complex interactive warfighting simulations. The system includes 2-D terrain maps and 3-D views."¹²

The U.S. military is using CAE's ITEMS technology for:

- ◆ Anti-submarine warfare training
- ◆ Anti-surface warfare training
- ◆ Tactical and attack helicopter training and mission rehearsal
- ◆ Air-air and air-ground combat training with intelligent interactive air targets and synthetic wingmen
- ◆ Maritime & air surveillance training
- ◆ Reconnaissance vehicle and tank crew training
- ◆ Officer cadet education & training

As the CAE's web page on ITEMS explains, the reason this product is useful for so many military training purposes is because it can create:

"sophisticated and complex tactical environments for air, land and sea applications. The product has been used extensively to provide high-fidelity computer-generated forces and electronic warfare environments. With its physics-based engineering-level models, ITEMS provides unparalleled realism in its rep-

resentation of weapons, sensors and platforms."¹³

However, as useful as it has been for so many *training* purposes, ITEMS is not limited to such use. As with CAE's STRIVE product, the value of ITEMS goes far beyond mere training applications.

The CAE's webpage on ITEMS mentions that this product

"excels in real-time, human-in-the-loop simulation such as those required for...*crew station research and development.*" (Emphasis added).

It also lists the following non-training roles played by ITEMS:

- ◆ Anti-submarine warfare...*doctrine development*
- ◆ Survivability *experiments*
- ◆ Digitization of battlefield *experiments*
- ◆ UAV *studies.*¹⁴ (Emphasis added)

However, CAE reveals little more about the non-training functions of ITEMS, other these oblique references to "experiments," "studies" and "doctrine development." (This latter term refers to tactical "if/then rules" used in operating ITEMS programs).¹⁵

However, when Boeing and CAE announced their partnership on "missile defense," they clearly stated that CAE's ITEMS "software tool" would be used by Boeing "in *developing* ballistic missile defense systems."¹⁶ (Emphasis added)

For an understanding of how ITEMS is used in weapons design, and therefore how it could be used in what both Boeing and CAE describe as "*developing* ballistic missile defense systems," it is instructive to read an academic paper written by Lieutenant Colonel Craig Hanford during his stint at the U.S. Army War College. In this essay, submitted for an advanced course called "Military Applications of Artificial Intelligence," Hanford focused on what he identified as the central importance of simulation, and specifically CAE's ITEMS product, in the design and development of new weapons systems. His summary notes that:

"Virtual simulations utilizing expert systems such as ITEMS will be key to compressing the materiel acquisition cycle, isolating key man/machine performance needs and ensuring that

smart graphics for real-time simulation & control

RAVE

RAVE

new technologies are capable of supporting the soldier in evolving missions and unit tactics. Interactively using these types of simulations on a consistent high fidelity synthetic battlefield... will allow warriors and developers to better conceptualize, experiment and examine alternative doctrinal, training and materiel development concepts. The results of this work will conserve resources and compress the time needed to integrate advanced technology with warfighting concepts and force structure design. *Designing systems in the virtual world proves that early virtual testing and experimentation, and virtual manufacturing will conserve resources.*¹⁷ (Emphasis added)

The Real-time Advanced Visualization Environment (RAVE), is yet another CAE simulation product that Boeing will use to actually develop "missile defense" weapons systems. This CAE product has, in the past, often been used to create three-dimension, interactive instrument panels, such as those in warplanes. RAVE has also been used to create accurate room-sized banks of complex instruments used in nuclear power plants.¹⁸

For an idea of how incredibly realistic RAVE instrument simulations

are, read these descriptions:

"All control panels are created using a stereolithography process that produces plastic, high-fidelity, molded replications of actual aircraft instruments. The panels are populated with the necessary operational aircraft components. The result is a fully functional, three-dimensional, physically correct representation of the actual aircraft panel. This offers a significant fidelity improvement over previous generation two-dimensional silk-screen panels. Instruments, displays and selected indicators are animated projections using CAE's...RAVE. Animated instruments include articulated parts and color textures designed to create a realistic and fully functional instrument simulation."¹⁹

"RAVE graphics give...enhanced flexibility...allowing a user to define realistic instruments by scanning photographs, and placing these instruments on large virtual panels, complete with dents, scratches, paint discolorations and other real-world imperfections."²⁰

A Boeing media release of October 2002, stated that RAVE is

"used to create, modify and test sophisticated real-time graphical displays." Boeing stated at that time that it "intends to use...RAVE software tools in developing ballistic missile defense systems."²¹

So, as with CAE's STRIVE and ITEMS products, Boeing is *not* using RAVE simply to train military personnel on how to use the "missile defense" hardware that they create. Rather, both companies make it clear that these three CAE products, which have put Canada at the leading edge of a global revolution in industrial-design, will be used to actually create, assess and develop new "missile defense" systems. This is obviously a crucial, concrete, Canadian contribution to "missile defense" weapons development and should not be downplayed in any way.

Some, however, have expressed

NDP Critiques Government Support for CAE

Alexa McDonough (MP, Halifax, NDP): To make it easier to convince Canada to support their views, the Americans are contacting Canadian businesses, such as Canadian Aviation Electronics [CAE], to ask them to join in the program. My question is for the Minister of National Defence. Does this government support the U.S. missile defence shield project, yes or no?

John O'Reilly (MP, Haliburton-Victoria-Brock, Liberal; Parliamentary Secretary to the Minister of National Defence): Canada has made no decision but is keeping an open mind about the U.S. ballistic missile defence project. With respect to CAE, I would like to remind the honourable member that it is a private company that does not act on behalf of the Canadian government.

McDonough: The government is participating *de facto* in the American missile defence project. CAE has already received \$72 million in federal funds in partnership with Boeing. This

company is involved in the [National Missile Defense] and the Canadian government is funding it. The government says that it has not made up its

mind and it turns around and subsidizes a corporation that is running simulations for the project. Why does the government not simply admit it is supporting the missile defence program? What kind of policy hijacking is this?

O'Reilly: May I remind the honourable member again that CAE is a private company. It does not act on behalf of the Canadian government. No decision has been made on national missile defence system.

There are three items here. One is our commitment to NATO, one is our commitment to NORAD and one is

our commitment to interoperability with the Americans. I remind the member that CAE is a private company.

Source: House of Commons Debates, *Hansard*, November 1, 2002. www.parl.gc.ca/PDF/37/2/parlbus/chambus/house/debates/Han020-E.PDF



Alexa McDonough and the New Democratic Party have been on the forefront of Canada's movement to expose and oppose the U.S.-led "missile defense" weapons development program.

the opinion that CAE has made even more significant contributions to “missile defense.” For example, Steve Staples, the Polaris Institute’s “defence analyst” (who did not mention CAE’s role in *designing*, developing and evaluating “missile defense” weapons systems), went so far as to claim that “CAE’s technological contribution is *insignificant* compared to its political

contribution.”²² (Emphasis added)

While it is doubtful that CAE’s important role in aiding and abetting the design of “missile defense” weapons for Boeing (the “Lead Systems Integrator” for the whole program), can in any way be called “insignificant,” it is true that key CAE executives have tried to influence Canadian political decisions on so-called “missile defense.”

Meddling in Politics

When CAE and Boeing’s Integrated Defense Systems made media announcements about their partnering agreement on the development of “missile defense,” they noted that there had already been

“similar agreements...signed this past summer [2002] at the Farnborough Air Show [a UK weapons ba-

Pork Barrelling 101: How the Scam Works

Over the centuries, governments and businesses have evolved elaborate schemes for scratching each others’ backs by furthering their intertwined goals of profit and power. America’s “missile defense” scheme is, of course, not the first such weapons development program to use corporate contracts and partnering relationships as a means of enlisting political support from allied governments. It is, however, the most gargantuan example of this phenomena in world history and represents a brilliant culmination of the countless Machiavellian schemes that preceded it.

A recent success story in this genre of partnering programs, in which the U.S. government uses lucrative, war contracts as the bait to rally support from foreign governments) is the so-called “Joint Strike Fighter” program. Project Ploughshares notes that this campaign, to build the world’s most advanced warplane, is “the Pentagon’s model for obtaining foreign corporate and government commitment to BMD [Ballistic Missile Defense].”²⁷

Here’s how such schemes work: First, the U.S. declares its intent to develop a major new weapons system. Then, it invites selected, allied governments to collaborate by contributing large sums of money from their public coffers. Although this wealth should be spent on socially-useful public programs, participating governments present the idea as if it were an opportunity to save money, create jobs and build the domestic economy. Of course, nothing could be further from the truth.

In reality, America’s political allies collaborate on such programs because they benefit the bottom lines of domestic corporations. Military firms in Canada and Europe are eager to promote America’s new weapons programs because they

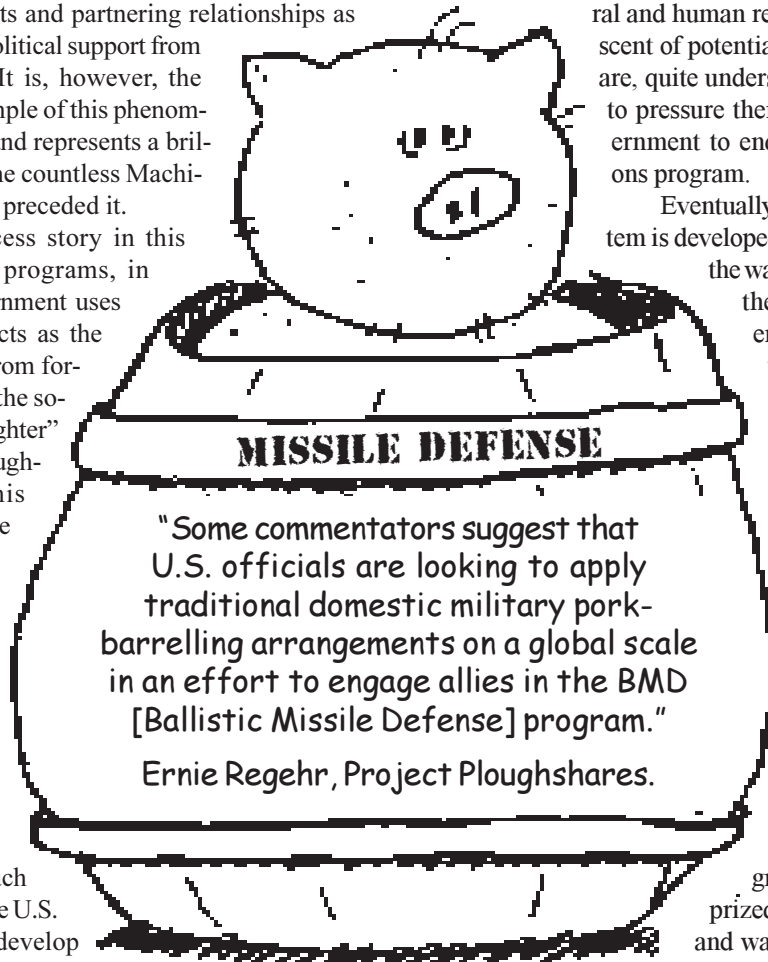
anticipate benefiting from a boom in lucrative contracts.

Many large, non-military firms also see profits on the horizon because the regime changes that are engineered, using the latest U.S. military hardware, are always friendly to foreign corporations that want to exploit the regime’s natural and human resources. Thus driven by the scent of potential profit, many corporations are, quite understandably, highly motivated to pressure their close friends within government to endorse the latest U.S. weapons program.

Eventually, when the new weapon system is developed and, in the case of the JSF, the warplanes are finally rolling off the assembly line, those governments that have contributed are lined up to join the exclusive club whose members are allowed to own a few of the weapons systems.

Meanwhile, the Pentagon is pleased because the scheme has cleverly assured greater military cooperation among allies. This is really one of the main functions of such plans. The U.S. and its allies, once using the same weapons systems, can fight their wars with greater efficiency. This highly-prized dream of U.S. warfighters and war planners is what they call “interoperability.” Essentially, it

means that America’s institutions of war are moving closer to their goal of commanding and controlling a larger, more fully-integrated, multinational force of interlinked warriors and weapons systems. Together, these closely-knit military forces compose a single, war-fighting entity, in essence, a giant interconnected, war machine.



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1. “Canadian Company Joins BMD Program,” *Ploughshares Monitor*, Winter 2002. www.ploughshares.ca/CONTENT/MONITOR/mond02j.html

zaar] between Boeing and Alenia Spazio (a Finmeccanica Company of Italy), European Aeronautics and Defense Systems (EADS) and BAE Systems of the United Kingdom.”²³

Here’s how Project Ploughshares described the importance of CAE-Boeing partnership:

“CAE is the latest of a global who’s who of military contractors to partner with Boeing in missile defence systems development. Earlier this year, Boeing announced similar agreements with Finmeccanica of Italy, BAE Systems of the UK, and European Aeronautic Defence and Space Company (EADS). Boeing and its four partner corporations all appear in the latest Stockholm International Peace Research Institute ranking of the world’s largest 100 arms-producing companies.

The recent partnership announcements coincide with a U.S. government diplomatic offensive to enlist NATO governments in the BMD program. In July, Pentagon and U.S. State Department officials visited counterparts in 12 European NATO capitals to argue the political and economic benefits of missile defence. Some commentators suggest that U.S. officials are looking to apply traditional domestic military pork-barrelling arrangements on a global scale in an effort to engage allies in the BMD program (Berrigan and Hartung, 2002). Others go further to suggest that because it “shows so much promise for transatlantic industrial cooperation,” missile defence may be the “glue” to hold NATO together (*Jane’s Defence Weekly* 2002, p. 2).²⁴

If one is still wondering how Boeing’s decisions to partner with several of the world’s largest war-related industries can have such a powerful effect upon the *political* decision-making processes of foreign governments, it is worth knowing the extent to which Boeing is integral to the whole “missile defense” weapons program. Boeing has received more contracts for this new weapons development program than any other corporation. As its media release regarding partnership with CAE made clear:

“Boeing is responsible for the de-

velopment and integration of the ground-based mid-course defense elements, including the ground-based interceptor, early warning radars and interfaces to the space-based infrared system satellites.”²⁵

Besides being “the primary systems integrator for U.S. missile defense,” Boeing is also a top, war industry in many other ways. This “[U.S.]\$23-billion business” is:

“one of the world’s largest space and defense businesses.... It is a leading provider of intelligence, surveillance and reconnaissance; the

world’s largest military aircraft manufacturer; the world’s largest satellite manufacturer and a leading provider of space-based communications;... NASA’s largest contractor; and a global leader in satellite launch services. In terms of sales, Boeing is also the largest U.S. exporter.”²⁶

It is, therefore, not difficult to imagine that when companies like Boeing speak, governments listen.

And, Boeing’s choice to partner with CAE speaks highly of this Canadian corporation’s value in supporting “missile defense” weapons design.

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