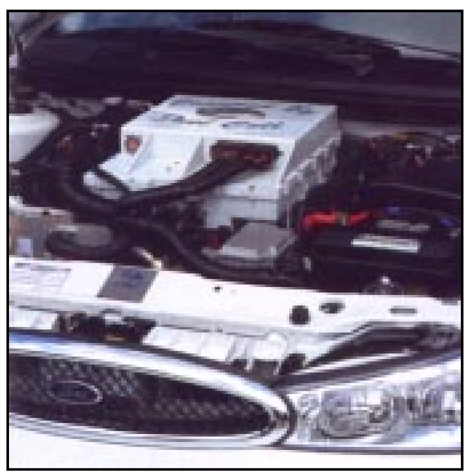
Computers in cars have become increasingly more sophisticated. As Powers has said, "In 1969, the Apollo space program used only a little over 150 kilobytes of on-board computer memory to help pilot a manned spacecraft from the earth to the moon and back. Thirty short years later, your car might use as much as 500 kilobytes just to keep the CD player from skipping."

Technology developed by the automotive industry has drawn the interest of several Defense agencies that wanted to know, for example, how to make a robust micro-controller at such low cost.

"That's the magic," Powers said with professional pride, "of the auto industry."



Ford fuel cell technology: on the road to achieving zero emissions

Ford and the NAC

Asked whether the industry is comfortable working directly with TACOM and the National Automotive Center, Powers replied with a quick, "Sure. Especially in diesel engines, simulation techniques, and simulators as well. Our simulator people have talked with them. Through the years,

Powers giving Secretary Richardson the keys to the P2000 in October 1999

sometimes it'll be simulators, sometimes simulation. And right now the hot topics are diesels and hybrids"

In this era of joint ventures, Powers is non-discriminating. If somebody has the technology that his company is interested in working on, that's the person Powers wants to speak with, regardless of agency or position.

"I think we'll have the ideal state," he said, "when you walk into a room and you have no idea what the position of the person is. It's just, 'How good is that person technically? Have they brought quality data to the discussion? What do we need to solve at that point in time?'"

That approach—one that sent humans safely into space and back—is now being used to send American soldiers safely into battle and back and American consumers safely to the grocery store and back. That indeed is a reasonable marriage.

Photo Credits:
P1: Ford; NAC
P2: TACOM HistOfc
P3: Ford
P4: Ford; Detroit News

Bill Powers

Title

Vice-President of Research, Ford Motor Company.

Personal

Powers joined Ford in 1979 from the University of Michigan, where he served as professor of aerospace engineering, computer information and control engineering since 1968.

As an undergraduate, he was a co-op student for the U.S. Army Ballistic Missile Agency, which became NASA-Huntsville. He helped develop the Saturn Booster guidance system and Apollo mission analysis during the mid-1960's, and later served as a consultant on the Space Shuttle program from 1970 to 1979.

In the mid-1970's he started exploring biomedical and automotive engineering. "I had students from auto companies," said Powers. "In fact, one did a Ph.D. thesis on the control of automotive engines. Then, he and I taught a short course in the summer at the U-M on the control of automotive engines, which was new to a lot of automotive engineers but the principles were very similar to rockets."

Powers and his wife, Linda, live in Ann Arbor.

Education

Powers received a bachelor of science in aerospace engineering from the University of Florida in 1963. He received his Ph.D. in engineering mechanics from the University of Texas at Austin in 1968.

Quotation

On alternative powerplants for cars: "We don't know what the winner will be and that's why it's an R&D problem."

NATIONAL AUTOMOTIVE CENTER

Inside History

July 2000

This document is available at www.tacom.army.mil/tardec/nac.

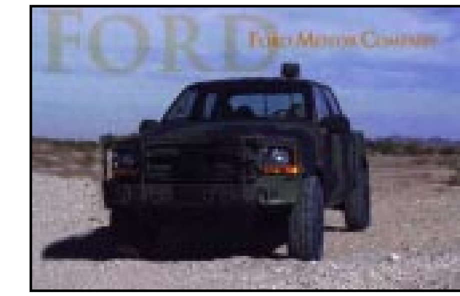
NAC HISTORY

Powers on Partnership

"I think it's a reasonable marriage," said Bill Powers, Ford Motor Company's vice-president of research. Powers referred to a decade-old marriage of research and development efforts between public and private automotive agencies.

Bill Powers, Vice President of Research, Ford Motor Company

These joint ventures grew out of pressing needs in the industry, military, and government to drive down vehicle costs, increase technical sophistication, improve fuel efficiency, and increase safety. Seen not so long ago as radical and anti-competitive, the marriage is now accepted by experts like Powers as not only efficient but also reasonable.



A Ford F-250 Superduty crew cab retrofitted for military purposes

With over 20 years of experience in the aerospace industry, Powers is in a unique position to make an evaluation. Powers contrasted aerospace, which has a long history of collaboration and teamwork, with automotive, which has been more fully privatized and fiercely competitive. He noted that researchers at the Big Three face greater challenges when it comes to collaboration, not only due to their competitiveness but also their funding. "I'd say the marriage is working as well as it could when you have much more private participation than, say, in the aerospace industry, where almost all the money's coming from the same source."

Collaboration Surrounded by Competition

Powers made the point that collaboration is still relatively new to the industry in comparison to the aerospace industry. "I come from aerospace," he said, "where you didn't really know where the technologists you were working with worked most of the time. You thought about what they knew." In contrast, he recalls his first day at Ford. "The first day I walked into Ford (and if I'd have walked into GM or Chrysler it would have been the same way), I signed an agreement about anti-trust."

That was the case in late 1979, but five years later the laws would change to encourage companies to collaborate with each other in some pre-competitive areas. In 1984, Congress passed the Cooperative Research Act. A few years later, automakers decided to work with each other and their suppliers on composites. The Automotive Composites Consortium (ACC) was formed in 1988. Its success helped stimulate other consortia to address other technical issues. USCAR was created to manage and run all of these consortia.

Relations were also changing between the automotive industry and the federal government. In the early 1990's, USCAR and the federal government formed the Partnership for a New Generation of Vehicles (PNGV) and the U.S. Army formed the National Automotive Center (NAC).

Both were created to improve the cost and efficiency of vehicles and to develop a new class of vehicles without sacrificing key elements such as utility and safety.

Still Growing

This is still a new movement. In contrast to the aerospace industry, as Powers points out, "it's been just a little over 10 years that we've been formally collaborating."

"But I'd say everyone has to come to the party – federal government, the companies – looking to contribute as much as we can in areas where we don't compete."

Edsel Ford (center) studies a cutaway of the tank transmission at the Detroit Arsenal during World War II

Those areas include finding new materials for fuel cells and new materials for after-treatment devices that will help in emerging powerplant technologies.

As Powers pointed out, "We have so many candidate technologies that it's crazy for us not to collaborate across both the federal government agencies as well as the other companies."

Communication Across the Lines

Good communication is key. According to Powers, this has not been a problem. "Larry Burns, Bernard Robertson and I have an ease of communication," he said, referring to his counterparts at GM and DaimlerChrysler. "We have a USCAR council meeting each month. We go to Washington to meet with colleagues in the government. We know how to shoot straight with each other. Getting three competitors to work together is not trivial, but we have no problem laying it out on the table."

For all three, diesel is an ongoing concern. According to Powers, many Americans view diesel as a dirty word, but the Department of Defense (which consumes three-quarters of the total energy used by the federal government) runs on diesel.

Industry and the government each gain when they can put their heads together on the thorny problem of diesel and emissions.

Local emissions (smog) tend to be generated by hydrocarbons, oxides of nitrogen (NO_x). On the other hand, global warming results from $C0_2$. Diesels are good for $C0_2$ but not as good for NO_x. "There's this classical balance," Powers explained, "as you try to decrease CO_2 you tend to increase NO_x. Together, we need to figure out... can we beat that balance? We haven't been able to beat it yet."

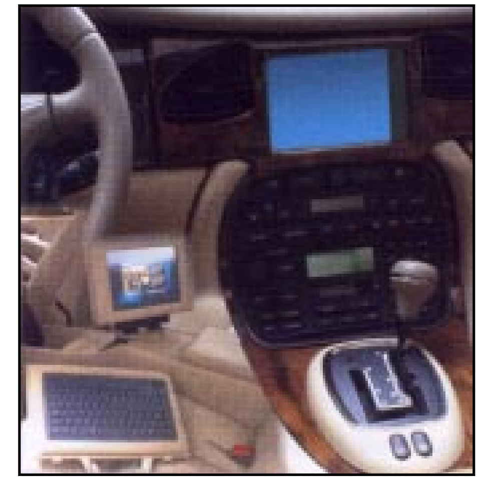
The Big 4 Platform

Powers identifies a platform of four goals for collaboration. They include decreasing the weight of vehicles while preserving package and functionality such as safety.

A second area is new devices for powerplants, whether it's spark ignition, direct injection compression ignition, the diesel, fuel cells, or hybrids.

Another area is power electronics. In the 1950's, American cars moved from 6-volt batteries to 12-volt batteries. Powers said that within the next decade consumers will see a change to 36-volt batteries. This will be an especially useful change for the military with its vehicles' "power-hogs" such as advanced telecommunication and smart weapon systems.

The fourth area is what Powers terms "low power" electronics – digital controllers and wireless. This was Powers' entry into the automotive field. "It's been in existence for over 25 years," Powers noted, "and it will continue for another 25 because the learning curve is still moving so fast."



The next generation electrical power system

Uniting with Universities

Ford has had a long relationship with the U-M (from where Powers himself was recruited) and has a major strategic relationship with MIT. "We promised [MIT] $20 million over five years, not just to collaborate on research but to look for more general ways of interacting because we know that MIT sets the agenda for the world of engineering schools," said Powers.

"We look at universities as a total-system solution," said Powers. "This involves research, recruiting, and the development of relationships with professors."

Ford also has a formal program called the University Research Program to which it gives $4 million a year toward path-breaking work.

Going Global

Powers sees the future of collaboration between Ford, other automakers, the Department of Energy (DOE) and the Department of Defense (DOD) as becoming ever more global. General Motors, DaimlerChrysler and Ford are already global companies. They are not only members of USCAR but also EUCAR. Several issues tie them together: global warming, decreasing local emissions, and improving fuel economy and vehicle safety.

Ford's lightweight hybrid, the P2000

Powers served as Program Manager for the Mark III

According to Powers, one of the ways that world governments can help is to become more uniform in their regulatory requirements. "Every time we, the companies, have to spend money to deal with different regulations," he said, "that's money we're not spending on something else."

Computers and Consumers

Powers came into the automotive field just as the wave of computerization was beginning to swell. Automotive engineers and consumers alike have ridden this wave over the past few decades.

"In the automotive industry, you do something neat and you can see it in production."

Engineers faced huge challenges in this area, only to create solutions that consumers and government agencies have come to appreciate. One of the things that Powers liked about the automotive field was being able to see his direct contribution in production. "In the automotive industry," he said, "you do something neat and you can see it in production. I think that's the way we're getting a lot of good engineers in the automotive industry. They're seeing some pretty high-tech stuff going into production. That's a turn-on. A good engineer likes to see that."

Powers pointed out that industry developed computers to be used in cars at relatively low cost and to be robust. In the late 1970's, the auto industry started putting computers on cars, computers that would work in climates as varied as Houston and Anchorage, under any humidity, any temperature, and yet be low-cost.