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# WORLD CHESS CHAMPION GARRY KASPAROV TO MATCH WITS AGAINST IBM'S DEEP BLUE* AT THE ASSOCIATION FOR COMPUTING (ACM) CHESS CHALLENGE

Philadelphia, Feb. 9, 1996 . . . Sports and science will enter a historic venture tomorrow as Garry Kasparov, the reigning World Chess Champion, matches his genius against the brute force of IBM's Deep Blue*, the ACM International Computer Chess Champion, for $500,000 in prize money.

The ACM Chess Challenge is the first traditional six-game chess match of its kind, where humans and computers use strategy as well as speed. Previously, humans and computers only played chess in speed matches. What will also be different about this traditional match is that Deep Blue's moves will be transmitted via the Internet to the live, open-to-the-public event at the Pennsylvania Convention Center. The match, which starts tomorrow and ends on February 17th, is ACM's kick-off event to the organization's year-long celebration of the 50th anniversary of computing, culminating with ACM '97.

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"The meeting of Deep Blue and Kasparov is the pinnacle of IBM Research's efforts to asses how computers can solve complex computational problems -- chess is the perfect test situation for determining how computers solve difficult problems," said Monty Newborn, Computer Chess Committee Chair for ACM.

Deep Blue possesses a brute force computing speed capable of examining 200 million positions per second or 50 billion positions in three minutes. The performance of this chess computer, considered the most powerful in existence, is great enough to be considered comparable to Kasparov's level.

Past computer designs that attempted to approximate human thinking often ended with poor results. Deep Blue plays with a computer's strengths -- computational speeds and pattern analysis -- instead of attempting to mimic the human mind, which employs an extremely complex evaluation function of experience and intuition.

Scientists at IBM Research hope that Deep Blue will be a stepping stone to developing similar computers that will benefit industrial and commercial arenas. By joining special purpose hardware and software with general purpose parallel computing systems, the IBM Deep Blue development team has generated large advances in computer technology. Through both the development of Deep Blue and the results of its match with Kasparov, IBM's engineers will apply the acquired knowledge to other intricate disciplines and problems such as data mining applications in financial markets research, traffic, and cargo scheduling at the world's largest international airports and molecular dynamic simulations in the pharmaceutical industry.

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Scientists on the IBM research team who have spent six years developing Deep Blue will have an active role in the match as well. As Kasparov makes a move on the chess board, they will transmit it back via the Internet to the 32-node supercomputer (IBM RISC System/6000 Scalable POWERparallel System*) at IBM's T.J. Watson Research Center in Yorktown Heights, N.Y.

In conjunction with the match, IBM will donate $20,000 to Philadelphia public schools under the auspices of the Philadelphia Inquirer and $10,000 to the Raging Rooks high school chess team of Harlem in New York City.

## The Association for Computing (ACM)

The Association for Computing (ACM), founded in 1947, is an 85,000 member international scientific and educational organization dedicated to advancing the art, science, engineering and application of information technology. ACM serves both professional and public interests by fostering the open interchange of information and by promoting the highest professional and ethical standards. This mission is accomplished through its many publications, conferences, special interest groups, chapters, and network communications.

## IBM Research Division

IBM Research operates in seven locations worldwide: the Thomas J. Watson Research Center in Yorktown Heights, N.Y.; the Almaden Research Center in San Jose, Calif.; the Zurich Research Laboratory in Ruschlikon, Switzerland; the Tokyo

Research Laboratory in Yamato, Japan; the Haifa Research Laboratory in Haifa, Israel; the China Research Laboratory in Beijing, China; and the Austin Research Laboratory in Austin, Texas. The major areas of research are computer systems, computer applications and solutions, systems technology, physical sciences, mathematical sciences, data storage, and communications.

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# So What Does a Chess-Playing Computer Have to do with Making Sure My Plane is On Time?

## IBM's Deep Blue: Specialized Computing For Commercial Applications

Without the benefit of human intuition or instinct, chess computers rely upon the ability to quickly mine through billions of calculations to look ahead at all the possible moves and choose the best one. With the creation of Deep Blue, a parallel processing, high performance information system, IBM Research has designed a computer that, for the first time in history, claims enough pure processing power to actually pose a serious challenge to Garry Kasparov, the World Chess Champion. But why build a system that plays chess? Other than Kasparov, who would be interested in such a computer?

The computer that is playing against Kasparov this week in Philadelphia is quite proficient in quickly solving complex but common business problems which, historically, have been very costly to solve in terms of both time and money. The technology underneath Deep Blue is a unique combination of customized processor chips, designed by IBM Research, used in conjunction with the IBM RS/6000 SP system. Adding to the enormous processing power of a typical SP system, Deep Blue's specialized chips are particularly adept a solving the problem of how to win a game of chess. This new paradigm in computing combines both specialized software *and* hardware to more effectively tackle problems. In much the same way, similar systems can be designed to specifically address the challenge of many different industries.

From express shipping and air transportation to health insurance, financial investment, cosmetics manufacturing and retail distribution, a broad number of industries can benefit from this combination of specialized processors integrated into powerful parallel processing systems to tackle entirely new classes of business applications. Here are a few examples of how industries can use this customized computing power to answer common and complex mainstream business questions:

**Pharmaceutical Engineering** - By creating a processing chip that can specifically address the complexities of molecular dynamics, a system can be designed and built which efficiently analyzes the interaction between particular atoms in a molecule pertinent to the design of drugs. The typical time necessary to bring a drug to market is 12 years. A system designed to specifically target this problem could cut that time in half.

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**Air Transportation** - By tracking many dynamically changing variables relevant to scheduling aircraft and crews, monitoring current situational and weather conditions, a specialized system for airline operations management can deal with changing conditions much more efficiently and cost efficientiy. Such a system could dramatically reduce disruptions to travelers, while at the same time reduce airline costs.

**Health Maintenance** - A health maintenance organization could use a specialized system employing datamining techniques to discover meaningful patterns of information contained in the massive amounts of individual patient data it stores. The system could analyze data dealing with the drugs that have been prescribed for patients, their overall effectiveness and look for potential interactions.

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# Chung-Jen Tan

Chung-Jen Tan is the senior manager of the Parallel System Platforms Department at IBM T.J. Watson Research Center, Yorktown Heights, N.Y. In this capacity, his responsibilities include research programs in the areas of architecture development and machine design for highly parallel scalable systems. His department was responsible for the communication subsystem architecture definition and instrumental in the design of the IBM RISC System/6000 Scalable POWERparallel Systems SP. He is also the manager for the IBM Deep Blue computer chess project.

Mr. Tan is a member of the ACM, IEEE, and a member of the ACM Computer Chess Committee. He received a BSEE degree from Seattle University, in 1963, and a Ph.D. in Engineering Science from Columbia University in 1969. He joined IBM T. J. Watson Research Center in 1969 as a Research Staff Member, and has been involved in technical and managerial activities in the areas of design automation, optimizing compilers, and parallel processing.

Jerry Brody
IBM Research Scientist

Jerry Brody has been working on the Deep Blue hardware design project for almost 6 years at the IBM T.J. Watson Research Center in Yorktown Heights, NY. He joined IBM Research in 1978. Since joining IBM he has worked on the Research Parallel Processor Prototype (RP3); YSE hardware, a Logic Simulation machine; and 801 machine hardware replication, IBM's first RISC processor. He also worked on VS-4 hardware, a vector scan system that etched patterns directly on silicone wafers for sub-micron integrated circuits in 1978.

Jerry graduated in 1959 from the RCA Institutes, New York City, NY with an AS Degree in Television and RF Theory. He also took many undergraduate courses at different schools and colleges.

# Murray Campbell

Murray Campbell is a research scientist at the IBM TJ Watson Research Center in Yorktown Heights. Murray has been working on the Deep Blue computer chess project since joining IBM in 1989.

Murray received his Ph.D. in 1987 from the Carnegie Mellon University School of Computer Science for work on chunking as an abstraction mechanism in solving complex problems. He received an M.Sc. in Computing Science in 1981 from the University of Alberta for his research in parallel game tree search. He also received his B.Sc. in Computing Science from the University of Alberta in 1979.

## Joseph Hoane, Jr.

Joseph Hoane, Jr. has been working on Deep Blue's software for five years at IBM Research in Yorktown Heights, N.Y. Previous efforts at IBM Research include work on RP3, a research parallel processor; and network simulation for parallel processors to understand the communications overhead. He has also designed a custom embedded compiler for a database system. From 1984 to 1987, he worked at IBM in East Fishkill, N.Y., on a custom wiring program for Multilayer Ceramic Modules.

Joe graduated in 1984 from the University of Illinois with a B.S. in Computer Science. He received an M.S. in Computer Science from Columbia University in 1994.

# Feng-hsiung Hsu

Feng-hsiung Hsu joined IBM in 1989 as a research staff member at IBM T. J. Watson Research Center, and is currently the architect and the principal designer of the Deep Blue chess machine.

He received a Ph.D. in Computer Science from Carnegie Mellon University in 1989 for architectural work on chess machines and for research on parallel alpha-beta search algorithms. He is best known for his work on the chess machine Deep Thought which won the Fredkin Intermediate Prize in 1988 for being the first computer to achieve a Grandmaster level rating, as well as the Omni Challenge Prize in 1990 by defeating International Master David Levy with the perfect score of 4-0. Mr. Hsu is also the recipient of the 1990 Mephisto Award for his doctoral dissertation and the 1991 ACM Grace Murray Hopper Award for his contributions in architecture and algorithms for chess machines.

Mr. Hsu's current research interests, beside "building the ultimate chess machine," include algorithm design, parallel software design, high performance system architectures, VLSI design, and special purpose computing.