NSA Pioneers New Diamond-Based Technology

pen research often leads to the creation of new technology. The NSA Scientific Advisory Board recognized this when, in the late 1950's, it recommended that NSA create the Laboratory for Physical Sciences as an unclassified research organization associated with a major research institution. It would provide an opportunity for the academic and industrial research world to come together.

The Agency now conducts unclassified research in engineering and the physical sciences jointly with the University of Maryland at the Laboratory for Physical Sciences.

NSA's Involvement in Research and Development

Physicists at the Laboratory for Physical Sciences (LPS), a division in the Directorate of Technology, saw opportunities to use inexpensive industrial—grade diamond and aerosol spray cooling to solve problems encountered in high—performance computing engines and other systems that could overheat in field environments.

The solutions to these thermal problems did not require costly, high-quality single-crystal diamond

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found in expensive jewelry, but the use of relatively inexpensive polycrystalline diamond produced by commercial plasma methods. These polycrystalline diamond plates have a thermal conductivity many times greater than that of copper and are very good electrical insulators.

In 1989, LPS scientists began a comprehensive research program to exploit synthetic diamond and aerosol spray cooling. It involved many divergent groups investigating applications which addressed heat and reliability issues. As a result, greatly improved thermal management properties were demonstrated. They were applied to reduce the size and weight of present-day supercomputers.

Smaller is Better

One of the first demonstration projects was to shrink a supercomputer to fit in a small suitcase. The original machine was approximately the size of a home refrigerator-freezer combination.

In 1998, this machine was successfully demonstrated at SGI Cray Research. It ran about 10 percent faster than the standard commercial version and was substantially smaller. Only the central processor elements and main memory were incorporated in this demonstration version.

In 1999, a joint NSA and Defense Applied Research Projects Agency program successfully demonstrated that portions of a supercomputer could be engineered to fit into a cube 6 inches on a side. It was made of diamond-based multi-chip modules and aerosol spray cooled to remove the 2,500 watts of heat from the system.

Diamond Details

Diamond is the world's hardest substance. It brings to mind a rare, beautifully faceted, very expensive, and large single-crystal gemstone.

Because of its fire and durability, diamond is unique among the natural mineral elements. Today, many of diamond's physical properties can be explained, such as why it is so different from the other allotropic forms of carbon. The extremely strong bonds between the carbon atoms in the diamond structure not only make it the hardest known material, but also the best conductor of heat.

Unlike other effective heat conductors, such as copper or silver, diamond is also an exceptional electrical insulator. The ability to move heat easily from one place to another is an attribute that is beneficial in high-performance microelectronic systems because heat is their mortal enemy.

Heat degrades the overall reliability of electronic systems. Its properties make diamond an ideal material for advanced semiconductor packaging applications. Moving heat is only half of the problem-ultimately it must be discarded into the environment.

Aerosol Spray Cooling Technique

An efficient way to extract heat and place it into the environment is to evaporate a liquid. The human body uses sweat to do this. A technique called aerosol spray cooling is a type of "high-tech sweat." Small droplets of liquid are sprayed onto a hot surface where they evaporate. Just as a perfume atomizer sprays a cloud of tiny liquid droplets onto a surface to evaporate, an aerosol spray nozzle does the same thing to a hot micro-

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electronic package in a computing system. The hot gas is recovered and recycled for reuse in a closed cycle system, just as in a home refrigerator or freezer. This evaporation process, or phase change from a liquid to a gas, removes the heat to a suitable place for dumping to the atmosphere.

The combination of diamonds to move heat, and aerosol spray cooling to extract heat from electronic devices, has played a pivotal role in the design of high-performance computing systems at NSA.

The new computer, diamond-based technology, aerosol spray cooled systems, and advanced microelectronics thermal management techniques are on display in the NSA/CSS Demonstration Center in OPS 2B.

For more information on diamond research and aerosol spray cooling, contact Paul Boudreaux, Technical Director, Laboratory for Physical Sciences at 301–935–6547.—mdh

Survey Update

Thank you for letting the NSA/CSS Internal Communications Cell (NICC) know what you think of the NSA Newsletter. The NICC heard from hundreds of military assignees, civilian employees, and retirees, and we appreciate each response. The feedback is being tabulated and analyzed. Look for the results in upcoming editions!

Retirements

51 Years James R. Child

43 Years Kenneth A. Williams

37 Years
Catherine R. Allen
Shirley A. Barton
Dale F. Brigman
Laurence P. Coghlan III

36 Years

Harry Timmons

James R. Gunning Glenn F. Wheeler

35 Years

Helen J. Collins John L. Davies Albert J. Fichter George O. Kent, Jr. Thomas Sandusky

34 Years

Vicki N. Meiser Kenneth F. Pearce Alan H. Roth Linda C. Weibe 33 Years

Mary K. Bjorklund Nikki G. Erdman Jonathan A. Gerbracht Jack R. Grimm Alice Freeman Harris George O. Little, Jr. Mary J. Loyd

32 Years

Robert J. Liberatore Gerald D. O'Connor Cheryl J. Wheeler

30 Years

John M. McClean Richard J. Rolfe Sally L. Thomas

29 Years Deborah J. Willis

28 Years Frank C. Wirth 27 Years

Katherine G. Gray Frederick E. Pross

26 Years

Diane L. Bowen John E. Burroughs

25 Years

Susan A. Cook Susan A. Feibel Barbara L. Gates Andrew Slusar, Jr.

24 Years

James Cooper

23 Years Lenore I. Bredthauer

> 21 Years Susan J. Hyland

20 Years John J. Bradish Rebecca J. Glase Carol E. D. Hart

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Schedule of Events

November 4, Storyteller Penny Gamble Williams, Tribal Chief of the Chappaquidick Tribe of the Wampanoag Indian Nation, 9:00–11:00 a.m., Canine Suite

November 12, Film, "Smoke Signals,"10:00 a.m.-noon, R & E Symposium Center

November 17, Flag Raising, 8:00 a.m., OPS 2A

American Indian/Alaskan Native Luncheon, 11:00 a.m.-12:30 p.m., Canine Suite

Registration is available on the EEO HomePage at http://www.s.nsa/ERS/EEO/events.html.

Health Benefits

The Health Benefits Open Season is ongoing through Monday. December 13. Individual plan brochures and the 2000 Comparison Guides are available in the Integrated Personnel Activities (IPAs), NSA Customer Service Centers, and the Health Benefits Office (SAB 1, Room S1CN03).

Even employees who do not plan on making an Open Season change should review the new 2000 brochure for their current plan because premiums and coverage may change. Electronic versions of most brochures are available on the Agency's Retirement and Insurance HomePage and on the Office of Personnel Management's INTERNET Webpage at www.opm. gov/insure.

New enrollments and changes will be effective January 2, 2000. Questions may be referred to the Health Benefits Office at 963-4524(s) or 410-854-6063.

Awards

MERITORIOUS CIVILIAN SERVICE AWARD







Richard S. Berardino

Cynthia S. Dearfield

Robert W. Jackson

DIRECTOR'S DISTINGUISHED SERVICE MEDAL







Alice Freeman Harris

EXCEPTIONAL CIVILIAN SERVICE AWARD



Maria N. O'Connor

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Club Notes

Celtic Forum meets the last Tuesday of every month. Anyone interested in the culture, art, languages, or heritage of the Celtic lands (Brittany, Comwall, Ireland, Man. Scotland, and Wales) or peoples is welcome to attend. For further information, contact Karen Davis (kmdavis@nsa), 301-688-7884.

Comic Book/Science—Fiction Memorabilia Collectors Club meets the first Friday of every month. The club provides a forum for people interested in comic books, science fiction, games, and other fandom. A second meeting for family members to attend is held on the third Saturday of each month at the Provinces Library. For more information, contact Ann White (abwhit1@nsa).

Deep Sixers SCUBA Diving Club will hold its monthly meeting on Thursday, November 18 at 7:00 p.m. Possible fall trips include a heated lake in West Virginia and fossil hunting at Calvert Cliffs. A December road trip for Florida diving is in the planning. There is quarry diving at Bainbridge most weekends. There is an on-line Deep Sixers Dive Club through home INTERNET that offers a chat room, message board, on-line calendar, and photo gallery. For more club information, contact Mark at 301-688-7681.

Hispanic Forum meets every month and offers a wide array of activities throughout the year. For more information about the forum's goals, activities, and how to join, subscribe to ESS 1252 or contact Ivette Collazo (imcolla@nsa). The Hispanic Forum's activities are open to all employees.

Parkway Coin and Stamp Club will hold its monthly stamp meeting Thursday, November 4 at noon. The monthly coin meeting will be Thursday, November 18 at noon. Meeting locations will be displayed in the showcase opposite the OPS 1 Cafeteria entrance during the week of each meeting. Anyone interested is invited to attend. For stamp club information, contact Grover Hinds at 301–688–4598. For coin club information, contact Mitch Ross at 301–688–8428.

Socially Oriented Bikers Motorcycle Club will meet Wednesday. November 3 and December 1 at 5:00 p.m. at Perry's in Odenton. Meetings are scheduled for the first Wednesday of each month. For more exciting news on the club, subscribe to Electronic Subscription Service (ESS) 111 or visit the club's Web site via INTERNET. Future rides include Lancaster, PA: Eastern Shore; and Laconia Bike Rally, NH. Lunch rides are held the third Wednesday of each month at 11:30 a.m. Membership costs \$12 per year. For further information, contact Ron at 301-688-1051, Kent at 301-688-0905, or Brenda at 301-688-4292.

Single People in Activities Recreational and Cultural (SPARC) events for November include dining out at Elkridge Furnace Inn, the Sugarloaf Craft Fair, the Ellicott City Ghost Tour, a game and card event, a singles dance, a monthly activities planning meeting, and weekly happy hours and trivia at Hurricanes. For more information, subscribe to ESS 1444 or contact Sally Biggerstaff at 972–2270(s) or 301–688–0146.

Women and Men in NSA (WIN) is now accepting nominations for the 1999 Dorothy T. Blum Award for Excellence in the employee personal and professional development arena.

The award recognizes Agency employees who have helped other individuals (not necessarily those they have worked with) to attain their personal or professional goals.

The award is named in memory of Dorothy T. Blum, who believed that people are NSA's most valuable resource and provided opportunities, guidance, and encouragement to many Agency employees. The awardee, whose name will be announced at a WIN luncheon in late February 2000, will receive \$250 and a small inscribed plaque. Last year's recipient was Deborah Shocmaker.

Nominations should include the name, organization, and telephone number of both the submitter and the nominee; a summary paragraph explaining why the person deserves to be recognized; one or two paragraphs with specific details; and any information relevant to the nomination.

Three copies of the nomination should be sent to the Dorothy T. Blum Award Committee of WIN, in care of CWF, VCC, OPS 2A, Room 210, by February 5, 2000. The point of contact is Barbara Clark, 301–688, 2958, OPS 2B, Room 5118.

CWF Holiday Party

The Civilian Welfare Fund presents "Kohl and Company," December 4, 9:00 a.m., 11:00 a.m., and 1:00 p.m., OPS 2A/2B Cafeteria. For more information, contact the CWF at 301–688–7337.

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Paul Derthick's Headline Puzzleby Larry Gray

The following are headlines from recent daily newspapers. Each of the five is a different letter-for-letter substitution. All five are derived from the same mixed alphabet at different settings against itself. For Paul Derthick's explanation of how to do the Headline Puzzle, visit Website http://nicc.fanx.s.nsa/newsletter/news/puzzle.html.

- GWEEHJFCT RZKXA'Q RZKKAQ QVEFCA GWCAETAQ HC CKEVG JFEKZHCF
- AOVPSQQV, QSOSEAH VQUOVU MSGQMJEQJMVRZ DOUR URZSMG VRPSGQAMG
- 3. EGKJU EUZXRDTJ GD HKUXWG XRAG'J HGSRWRAZS JWZWKJ JGKTEW
- 4. BLEQ MENFUC QLBGXXC LC FBVFLBC CUHI KXXG-MHBE CGFV
- 5. GJZB BPLUH DUBGHZ SJAA IUH PMCGXGMCGMSG IHUL PMCUMGZPJ

 Answer will appear next month.

Answer to October Puzzle:

- 1. DEMOCRATS HOPING TO CLOSE GAP IN REPUBLICAN-CONTROLLED SENATE
- 2. SYBASE BOARD APPROVES BUYBACK OF OUTSTANDING STOCK
- 3. SLOW--GROWTH ACTIVISTS UPSET OVER HIGH-TECH PUSH FOR ROADS
- 4. KAFELNIKOV VICTOR OVER KIEFER AT LEGG MASON TENNIS CLASSIC
- 5. RUSSIAN ECONOMY BEING CRIPPLED BY MASSIVE FLIGHT OF CAPITAL Setting: ESKER Key: MORAINE Hat: DRUMLIN

Paradise Island

Hidden below are 25 words associated with the word island. The words read in any direction and any letter may be used more than once.



In Memoriam

Mark F. Abernathy, a security sup-

port specialist in the Support Services Organization, died August 7. He was 46.

A native and resident of Baltimore, MD, Mr.

Abernathy joined the

Agency in 1986.

Mr. Abernathy is survived by his wife, Patricia.

Virginia H. Davis, a former analyst in the Operations Organization, died June 4. She was 74.

Ms. Davis began her Agency career at Arlington Hall. She retired in 1973 with 24 years of Federal service. Ms. Davis most recently resided in Dayton, VA. She enjoyed travel.

Gerald A. Deckert, a manager in the

Operations Organization, died July 28 of a heart attack. He was 46.

Mr. Deckert
earned a degree in
engineering from
Washington State
University. He

joined the Agency in 1975. Mr. Deckert resided in Elkridge, MD. He was a cycling enthusiast, a philatelist, and active in the Boy Scouts.

Mr. Deckert is survived by his wife, Barbara; a son, Brian; and a daughter, Claire.

Douglas A. Fletcher, a logistics officer in the Support Services Organization, died August 25 of ventricular fibrillation. He was 52.

Mr. Fletcher joined the Agency in 1965. He earned an Associates of Arts Degree in Business Administration

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