

## New Facility Opens For Circuit Boards

The Circuit Board Fabrication department has added a new facility, sporting new paint and hundreds of thousands of dollars worth of new equipment. This new (Plated-Through-Hole) facility, located in Building 7 adds more flexibility and capacity by providing high density, double-sided boards. These boards are made by plating circuitry not only on both sides of the boards, but also on the side surfaces of the holes through the board--hence, the name Plated-Through-Hole. The new technique, will permit production of much more complex circuits. Initially, gold plating will be used for the complete two-sided circuits.

The facility is under George Wood, who is now heading all circuit board production including the Silk Screen Department. The new department which includes circuit design and photography has complete facilities for production of the circuits. Equipment in the new department includes a series of chemical solution vats, a \$30,000 water filtration system to remove chemicals from water before it is disposed into the town sewage system, a photographic exposure room, a camera room, and a design and drafting room.

The process was developed by: Dick Clemente-Chemical Development, Walter Bonin-Photo Resist Development, Dick Mullarkey-Process Engineering, Ron Boudreau and Dick Krauchune-Technicians and production will be run by John Viscogliosi-Supervisor, Bernie Cote-Chemical Analyst, and Norm Perryman-Circuit Layout Supervisor.



Staff of new Plated-Through-Hole Facility

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## Flood Threat Averted



Digital employees moved into action quickly and helped avert flooding of DEC facilities when the rain-swelled Assabet River overflowed its banks. Ken Olsen gives an account of the flood on Pages 5 and 6.

## K. Olsen Speaks At ARD Meeting

The intricacies and costs of manufacturing computers were outlined by President Ken Olsen in a speech given at the American Research and Development's annual stockholders' meeting held in March at the John Hancock Building, Boston.

Mr. Olsen's speech in part:

"Next week, we are delivering our first model of our PDP-8/I which is the latest step in our family of PDP-8 computers. This family now has some 2,000 computers in the field which makes it one of the three or four computers in history that has gotten to this kind of production. Because we are just getting the PDP-8/I into production, the steps and costs involved are very fresh in my mind, so I will review them with you.

... 'We now use some 80 million components a year, and the selection decides the reliability and cost of the equipment. We use several million integrated circuits. For the PDP-8/I, we built a PDP-7 computer-operated integrated circuit tester. This cost about \$100,000 but tests 2,000 circuits an hour and is a part of production.

'We then designed a facility for generating printed circuit boards. This is costing us about \$500,000 for a very elaborate plating and chemical processing system consisting of 75 different process steps. It also includes \$30,000 for equipment so that, as good citizens, we can purify water before we dispose of it.

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## K. Olsen's Speech

(Cont'd. from P. 1)

'We have a highly-tooled and automated module assembly facility that, with only two hundred skilled girls, turns out between one and two million modules a year.

'We also have three computer-controlled module testers. The latest of these is driven by a PDP-7 and is used for testing integrated circuit modules and costs about \$100,000. It performs 30 tests in three seconds. These would take 15 minutes to two hours by hand.

'The next step is to make a frame in which we plug the modules. The basic part of this is the socket. The tooling for the part is well over \$100,000. In a PDP-8/1, there are 44 of these sockets with 11,500 gold-plated contacts in which we have to put wires. To do this, we use our PDP-6 automatic drafting system which makes the drawings and generates a punched card for each wire. These cards then go to an automatic wiring machine which puts on one wire for each punched card. These machines cost another \$200,000 each.

'We then take the completed frame and put it to a PDP-8 driven tester. This tester looks at all of the 11,500 contacts and tests each one to make sure each wire is in the right place. Only a computer could make all these tests in one minute. This machine is an investment of \$75,000 and a number of months work of very competent engineers.

'We then assemble the computers in our production line, where there are semiautomatic test stations along the way to test each completed computer in an oven to make sure it will tolerate temperatures way beyond what a human being can tolerate.

'Then, to be really sure that the PDP-8/1, which is a brand new product, is truly sound, we take the first 25 units and use them ourselves or test them before we ship one to a customer.

'All of these steps are expensive, but are relatively easy because they can be visualized and readily planned, budgeted, and checked. The part of building a computer which gets most people in trouble is the programming. This is an area in which we feel very proud. We have 85 programmers on our staff in whom we are very proud. Programming is difficult because you can't visualize the process of work. However, we can brag about the work our programmers have done because we now, I believe, are the only computer manufacturer who can claim to have complete software for all our computers. . . ."

## Four Marketing Changes Made

Several appointments have been announced in marketing assignments, with new marketing managers in the PDP-9, PDP-10 and module areas, and the creation of a new marketing position for the Clinical Lab System.



Dave Cotton



Bob McInnis



Bill McNamara



Ray Lindsay

Dave Cotton replaces Bob Lane as PDP-10 Marketing Manager. He came to DEC in 1964 as an applications engineer and has been PDP-9 Marketing Manager for the past three years.

Replacing Dave in the PDP-9 marketing position is Bob McInnis, who comes to DEC from Electronics Associates, Inc., where he served as District Sales Manager for New England and Eastern Canada. Previously, he had held a position as Product Marketing Manager for large-scale computers at EAI.

Bill McNamara has been promoted to Module Marketing Manager. He was formerly in charge of Physics Applications for the PDP-9. Bill came to DEC last year from Bettis Atomic where he was an instrumentation engineer.

Ray Lindsay, who has been District Manager in DEC's Pittsburgh Office, has been appointed to the newly-created position of Marketing Manager for DEC's clinical laboratory system (blood analysis). Ray joined Digital in 1963 as an applications engineer in the Pittsburgh District.

## We Now Rank Fifth

Some interesting statistics were provided by President Ken Olsen at the recently-held annual stockholders meeting of American Research and Development. The statistics included:

Digital now has 2,541 computers in the field, making it the world's fifth largest computer manufacturer in total computer installations.

Digital has made more computers than RCA, General Electric, Burroughs, Control Data, and 2 times as many as Scientific Data Systems.

Digital is one of the few computer manufacturers who can provide complete software for all its computers.

### Bob Lane Named Product Manager



Bob Lane, formerly PDP-10 Marketing Manager, has been named to the newly created position of Product Line Manager for PDP-1, 4, 5, 6, and 7 products. He will be responsible for the continuing sales of PDP-1 through 7 computer systems. His group will report to Vice President Stan Olsen.

The new product line will enable DEC to continue to provide quality service to users of computers which are no longer being marketed. It will also allow us to make available new options to users of PDP-1 through PDP-7 computers. Bob Reed will be in charge of manufacturing. Judy Edwards will be the departmental secretary which will serve as communications center for field inquiries.

Bob joined DEC in 1963 as a sales engineer and later became PDP-6 and PDP-10 Marketing Manager. Before coming to Digital, he held engineering management positions with Western Electric and ITT. He is a native of Havana, Illinois, and a graduate of the University of Illinois. He and his wife, Jo, now make their home in Sudbury.

## Canadian Identity To Be Maintained



Engineer John Hughes, Toronto, explains the Computer Lab at a seminar in Maynard.

As far back as the 1860's when Alexander Graham Bell left Canada to pursue his research in the United States, Canada has suffered from an idea drain. Many products designed or conceived in Canada end up with a "Made in U.S.A." label.

Digital recently took a significant step to help reverse the trend when it announced that the Canadian identity of the DEC Computer Lab would be preserved. The Computer Lab, a device for teaching basic computer logic, was conceived and designed by Digital employees in Canada. It will be manufactured at DEC's Carleton Place plant and will proudly bear a "Made in Canada" label.

The basic idea for the Computer Lab was conceived by Canada Manager, Denny Doyle. He turned over product responsibility to DEC applications engineer, John Hughes, Toronto, who coordinated the project, including supplying design information, writing the workbook which accompanies the Computer Lab, and developing a marketing plan in Canada.

The Computer Lab was first announced by Digital to a group of Canadian school teachers at a special seminar held in Toronto. Compact in size and moderately priced (\$445), the Computer Lab has very promising sales potential. It could become a standard high school teaching aid.

### New U.K. Manager

Geoff Shingles has been named Sales Manager for the United Kingdom, replacing Tom Dalzell who recently left the Company. He joined the DEC, UK staff three years ago, having previously served as a design engineer with Elliott Brothers, London. Geoff is an electrical engineering graduate of the University of Leeds and also attended the Philips International Institute for Technological Studies in Holland.

# Assabet River Flood Threat Averted (Cont'd. from P. 1)

When the normally-placid Assabet River, transformed into an angry torrent by heavy March rains, overflowed its banks and threatened to flood our buildings, DEC employees rose to the occasion magnificently. Their enthusiastic response, devotion, and resourcefulness--some of them fought the waters all through the day and through most of the night--helped avert serious damage.

The names of those who donned rubber boots, filled sandbags, rounded up pumps or equipment, and contributed brawn and ingenuity are too numerous to list. Because everyone was so absorbed with the task at hand, a list was never compiled. President Ken Olsen, as ardent a floodfighter as any, wrote the following article to personally express his thanks to the many participants and to provide an accurate record of their exploits.

By Ken Olsen

I would like to thank everyone who played a part in protecting Digital during the flood on March 19th. It was a magnificent display of cooperation and effort on the part of many people. There was strenuous filling and carrying of sandbags, long tedious wiping up of water, and many special jobs involved in the effort with which we are so proud. In addition, I want to express appreciation to all those who stayed with their regular jobs so that we lost very little production during this dangerous time.

On Sunday afternoon, March 17th, there was just enough water in the Assabet River for a comfortable canoe ride. By Monday evening, we had received about six inches of rain, and the water was within a foot of the bank. By Tuesday morning, it was lapping over the edge, and a few hours later was well over the bank, completely flooding P.A.C.E. Plastics, and was 18 inches higher than the floor of Building 11.

We then had two doors to dam. We built a dam across the first one with 2" x 10" planks and plywood. We couldn't nail to the second door, so we put plywood on each side of the doorway and filled it with ready-mixed concrete just as the water was reaching the door. This seemed to harden just in time to keep the door tight.



DEC employees fill sandbags to help stem the Assabet flood waters.



The Assabet River rose several feet above its normal level and flooded

We were told that in the 1955 hurricane, Raytheon had sandbagged the openings into Building 11, but the water came up through the many drains inside the Building so that it was flooded anyway. We were told that it was hopeless to protect Building 11 and that we shouldn't bother trying. Building 11 is where the first step in our production of modules is done, and we were not going to lose that facility without a good fight.

First, we bought all the wax toilet seals in Maynard and used them to close the drains in the Building with a sheet of plywood and three layers of sandbags. I don't think a drop of water came through these drains.

Meanwhile, we rounded up several thousand sandbags and 60 pair of boots. All through the day and well into the night, we filled sandbags. We made a stem across the



One of the steps in the flood battle was building a sandbag barrier.



several knots faster than usual as it passed the Maynard Mills.

courtyard with sandbags and called in six tremendous pumps to pump out the water in this courtyard to protect the buildings that contain our new plated-through-hole facility, our sheet metal and machine shops, and our Gardner-Denver wire-wrap machines.

This dam and pumping was so effective that the paving in the courtyard started to burst. There is a sluiceway underneath that opens right to the River, and the pressure of the River on the paving started to push it up.

We uncovered the sluiceway, which, of course, immediately flooded the courtyard. We then had every able-bodied man we could get hold of carry sandbags to the opening of the sluiceway. At first it seemed like the sluiceway was a bottomless pit, but, finally, after several hundred bags, the sluiceway was filled up and we were able to pump out the courtyard.

Our dam was so good and the pumps were so big, that there wasn't enough leakage through the dam to keep the pumps busy. The River reached its peak about 4:00 Wednesday morning, and then started to drop. By Wednesday night it was just a few inches over the bank, but Building 11 was cleaned and production was running smoothly.

I feel we should all be proud of the cooperation, enthusiasm (and physical strength), and competence of our people. We should also be pleased and express our appreciation to the Town, and to the local contractors, for the help we received during this emergency.

Ken Olsen

## Many New Uses For Our Computers

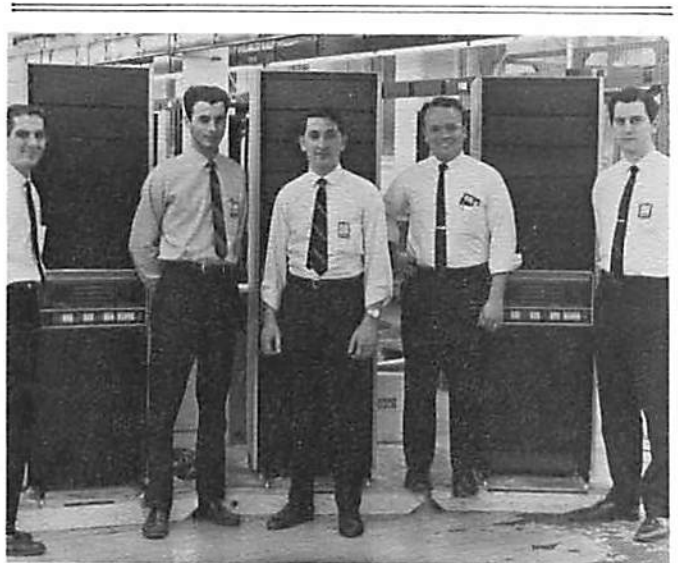
Barely a week goes by without a Digital computer being put to a new and novel use. Some of the latest uses of DEC computers include:

Use of a PDP-8 to speed the preparation of daily battle orders is being evaluated by the U.S. Air Force. The computer will help simplify the "horrendous clerical task" of specifying what types and numbers of aircraft are to be assigned to a mission and what kinds of weapons they are to carry against what targets.

A PDP-8/I used by the Ethyl Corporation to help evaluate and control the octane quality of gasoline produced from automatic, continuous blending systems. According to Ethyl Corporation, the new approach can result in greater versatility of operation and a reduction of overall system cost for blending installations.

The British Natural Environment Research Council's Hydrological Research Unit is using a PDP-8 to study flooding. Although the study is confined to Great Britain, it is expected that the results may be extended to cover world-wide areas.

A LINC-8 is being used at the Manitoba Cancer Treatment and Research Foundation in Winnipeg as part of a new radio isotope scanning system. The system can indicate the size, shape, and position of an organ and can aid in detecting abnormalities.



FIRST 8/I COMPUTERS - Shown with the first 8/I's to be completed last month are (left to right) Manufacturing Technician, Al Czajkowski; Group Leaders, Joe Catalano and Bob Hesseltine; and Production Engineer, Bill Val-laincourt. They were responsible for organizing the product line and meeting the schedule for the first deliveries.

# 48 Complete DEC Tech Courses

Some 48 technicians recently completed DEC TECH training courses given by Digital's training department. Most of the graduates will be assigned to Digital field offices as field service technicians.



PDP-8/S Class: (left to right) Alfred Hudson, David Neff, Richard Miller, Dale Nutter, Paul Bezeredi, Joseph Chiridon, Russell Koleski, Wali Rose, Ronald Blough, Michael Ricciardello, Leo McDowell, Daniel Mutnansky, Dennis Markferding, Richard Brown, John Snodgrass, (front kneeling) Charles Sweeney, and Regis Cook.



PDP-8 Class: (left to right) Paul Karatzas, Alvin Dorsett, Groff Davis, Joseph Cloutier, Richard Langer, Charles Kapper, John Crabtree, Joseph Delcourt, David Burdine, Thomas McCabe, and Dennis Giles.



PDP-8/I Class: (left to right) Chris Packard, Richard Seik, Ken Stupak, David Stacey, Dean Johnson, Ronald Meyers, Douglas Behr, David Fountain, Dennis Brown, Henry Opacki, David Dyer, William Koppleman, Gregory Master, and Gary Gaums.

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## New Facility

(Cont'd. from P. 1)

Steps in the production of a circuit board via the new method include:

1. Drilling
2. Wet-honing - Cleaning out the holes so they are smoother.
3. Plating - Copper plating the entire surface.
4. Cleaning
5. Applying and curing resist (photo-sensitive material)
6. Exposing surface in an exposure machine where an intense light is flashed through a negative, selectively breaking down the resist polymer.
7. Treating in a chemical to remove the exposed resist.
8. Pattern Plating, which involves adding copper to all the exposed areas.
9. Gold or Solder Plating the exposed circuitry.
10. Removing resist
11. Etching the copper--only that protected by gold remains.
12. Beveling and notching
13. Inspecting

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Future editions of ON LINE will explain the various steps in greater detail.

## Many Employees Enroll in Tuition Refund Program

Human Relations, Marketing, Algebra, Statistics, English Composition, Energy Conversion, Accounting, Stress Analysis . . . and the list goes on. This is just a sampling of the many, many courses DEC employees are taking through the Company's Tuition Refund Program. The complete list is as varied as it is long.

Digital, which is anxious to promote and encourage continued education for all employees, established the program several years ago. It feels the funds it is spending for tuition refunds are an extremely worthwhile and valuable investment.

Some employees, such as Accounting Manager Bob Dill, have already received degrees through DEC's Tuition Refund Program. He obtained a Master's Degree in Accounting from Boston College after taking courses through the DEC plan.

At present, one of the most ambitious participants is Dick Gruen, a systems analyst in the San Francisco Regional Office. He is now taking four courses simultaneously: Linear Equations, Iteration, Interpolation and Approximation, Ordinary Differential Equations and Integral Equations, and Partial Differential Equations. This means 9:15 a.m. to 4:00 p.m. classes on both Saturday and Sunday at the University of California at Berkeley, plus one weekday evening of classes and many hours of homework and study.

Another DEC employee, technician Roger Gagne, is pursuing a full-time five-course schedule at Lowell Technical Institute. He has another year of study before obtaining his Bachelor's Degree.

Dennis O'Connor, PDP-9 Engineering, who came to DEC with an Associates Degree in Electronics, has been working for five and one-half years toward his BS completely through the Tuition Refund Program. He says he's averaged eight hours of classroom work per week and sixteen hours of study per week. He figures he will have driven over 40,000 miles in getting this degree.

A number of full-time employees are taking four courses simultaneously. For some, it means three or four evenings a week of classroom work and hours of additional study. It's hard, especially for the married man with children, but not impossible. Few of life's good things come easily, least of all an education.

Among the colleges at which DEC employees are enrolled are Northeastern University, Boston University, Suffolk University, Mount Wachusett Community College, C.W. Post College, Lowell Commercial College, Lowell Tech, Clark University, and Merrimack College.

Probably the most frequently attended school, as far as DEC employees are concerned, is Northeastern, which offers the convenience of a suburban campus on Route 128 in Burlington--with an extensive curriculum. The average cost of a course at NU is approximately \$25 per quarter hour credit.



Technician Roger Gagne is benefiting from DEC's Tuition Refund Program. He expects to receive a bachelor's degree from Lowell Tech next year.

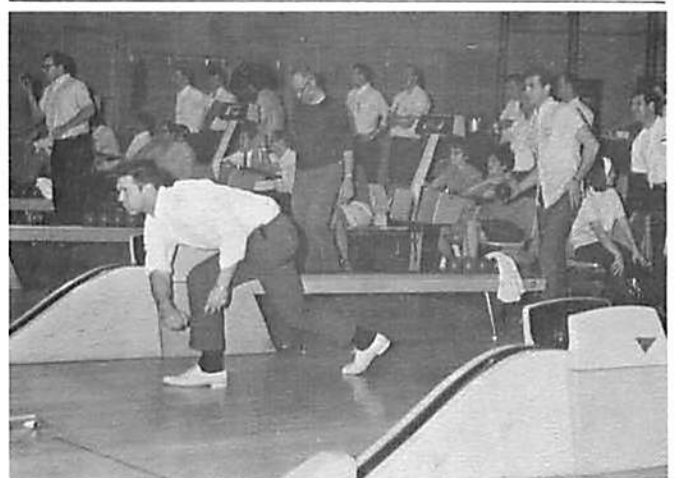
DEC's Tuition Refund Program provides up to \$450 per year as follows:

|                        |  |
|------------------------|--|
| Graduate Courses:      | "B" grade or better must be achieved   |
| Undergraduate Courses: | "B" grade or better receive full tuition reimbursement; "C" grade receives half tuition reimbursement. |

Recently, the plan was liberalized to allow tuition reimbursement regardless of G.I. Bill tuition benefits received.

The program is administered by the Personnel Department. A person wishing to take a course must fill out a special form which must first be approved by his supervisor and then submitted to Personnel for approval. Reimbursement is made after the course is completed and a transcript showing the grades is given to Personnel.

At present, approximately 100 employees are enrolled in the program, and total refunds will amount to about \$14,000 for the 1967-1968 school year.



DEC's bowling league is concluding another successful season. The league's annual banquet will be held at the Beacon Terrace, Route 9.

## Record Turnout For Softball

A record 183 players have signed up to participate in the DEC-sponsored summer softball league, according to league president, Paul DiMouro. As soon as the ground cleared in late March, the avid participants were already out practicing.

League games will be played at Maynard's Crowe Park and Sudbury's Haynes School on Monday and Thursday nights. The players for the first time will sport jerseys with DIGITAL written across the chest and hats with a letter "D". Each team will have a different color combination.

The teams will be:

1. Production Control/DEC Tape
2. Personnel/Module Test
3. Special Systems
4. PDP-9
5. PDP-10
6. Drafting/Machine Shop
7. PDP-8 Systems
8. PDP-8/I
9. Programming/Model Shop



The Softball Committee consists of P. DiMouro, president; R. Melanson, vice president; R. LeBlanc, treasurer; and B. Doucette, L. Gaviglia, R. Dooley, S. Koziol, G. Nickerson, R. Chestna, B. Anessi, R. Grzyb, T. Chalada, J. Maria, B. Williams, M. Dunahue, P. Coyne, C. McComas, and D. Digirglano.

## Employee Count

A recent survey indicated that more than a quarter of the 1,900 employees employed by Digital at its Maynard plant and headquarters were Maynard residents. An exact count showed that 425 DEC employees are Maynard residents. Other local towns from which Digital draws heavily are Hudson, 192; Acton, 131; Marlboro, 94; Stow, 59; Sudbury, 54; Lowell, 53; and Littleton, 74.

# April Anniversaries

### 2 Years

John Andrade  
Kenneth Brabitz  
Stewart Campbell  
Wilma Carter  
Richard Devno  
Dieter Hansen  
Richard Heald  
Kathryn Hebert  
James Hoover  
Benjamin Jedrey  
Robert Jones

William Landeteiner  
David Lazuka  
John Majeran  
George Nickerson  
John Pinder  
Reginald Rea  
Richard Sorensen  
Carolyn Stacey  
Richard Swanson  
Thelma Williams  
Joseph Wise

### 3 Years

Richard Abel  
Andrew Allison  
Mary Bakum  
Joseph Ballou  
John Caulfield  
John French  
Raymond Jones

Gertrude Rasmussen  
Michael Parry  
Viola Priest  
Alan Pyke  
Godfrey Shingles  
Bradstreet Vachon

### 4 Years

Robert Brooks  
Jean Dwinells  
Helga Herla

David Packer  
Ilse Peters  
Rose Pittsley

### 5 Years

I. Ferne Halley  
William Long  
Paul McGaunn

Joseph Monahan, Jr.  
John Rodenhiser  
Anne Wojcik

### 6 Years

Viola Clement  
Rita Daigneau  
Harold Godfrey  
Stephen Gradie  
Wiley Henton

Dominic Inferrera  
Carol Pitz  
Helga Starr  
Peter Waldron

### 7 Years

Arthur Brazee  
Charles Newell

Robert Savell  
Joseph Scalia

### 8 Years

Eva Robblee

### 9 Years

Robert Graham  
Roger Melanson