

TECH TALK TECH TALK TECH TALK TECH TALK

MASSACHUSETTS INSTITUTE OF TECHNOLOGY May 6, 1970

WELL DONE

Some 50 persons at the Draper Lab put in long hours helping rescue the Apollo 13 astronauts last month. D-Lab designed the guidance systems for the command and lunar modules and programs the systems' computers for each moon mission. During flights the Lab supports NASA both with experts sent to Houston and experts on standby in Cambridge. They communicate via special telephones and teletypewriters.

The MIT team of a dozen or so in Houston for Apollo 13 was headed by Philip G. Felleman. David G. Hoag, D-Lab's Apollo director, also was in Houston. When Apollo 13 lost electrical power in the command module at about 10 p.m. Monday, April 13, the MIT communicator on duty in Houston was Steven L. Copps while the communicator on duty in Cambridge was William H. Woolsey.

Almost immediately, Copps instructed Woolsey to begin summoning engineers from their homes. Woolsey quickly reached key engineering leaders such as Dr. Richard Battin, in charge of software, and Norman Sears and Ain Laats, in charge of hardware. Ralph R. Ragan, D-Lab deputy director for NASA programs, also was reached at home and came in. Many heard of the emergency over radio or television and came in before they could be called.

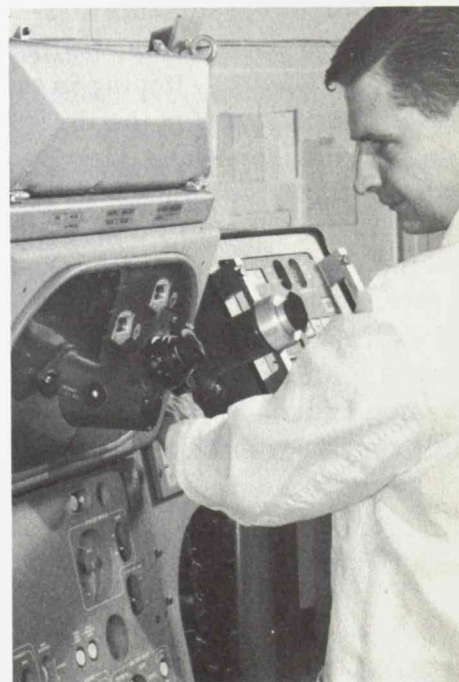
Within an hour, a team of some 40 experts had gathered in the Cambridge Lab and were beginning the computer simulations and equipment testing NASA needed to determine the best way to operate the crippled space ship and get the astronauts back to earth.

Donald W. Keene and later Peter Weissman, for example, worked on computer simulations of different auto pilot configurations, and with such people as Hugh Bliss and Steve Davis and Keith Glick, on how to control the spaceship from the lunar module and how to get the various modules separated before entry back into the earth atmosphere. Laats, Bob Lones, Ed Hall and his gyro group, Jerry Gilmore and his inertial components group, Charles Jurgelewicz who is expert on thermal design of the guidance system, and many others tackled the effects of temperature cycling.

Inside the stricken command module in space, heaters were off and the temperature was falling. How cold would the guidance system get? Would it work properly when started up again just before entry? The D-Lab designed the equipment to withstand such temperature cycling. To be sure, the engineers in Cambridge began chilling similar equipment, then starting it up and relaying the results to Houston.

Their conclusion, that the command module system would work when restarted, was borne out when Apollo 13, guided by its MIT system, splashed down in the Pacific just .4 nautical miles off its target. The journal "Aviation Week" called it "the most accurate landing in the history of U.S. manned space flight."

"Everyone in the Laboratory can take pride in the fact that they had a part in bringing the Apollo astronauts home safely," Dave Hoag said. "They were members of a nation-wide team of ground controllers and support personnel who demonstrated ingenuity, skill and extraordinary competence in the face of our first major space emergency."



Ain Laats in Systems Test Lab

BRAVE ENTERTAINMENTS

Opening tomorrow evening (May 7) in the Little Theatre at Kresge is the MIT Dramashop's production of Noel Coward's "Tonight at 8:30." Included in the program are "Red Peppers," "Fumed Oak," and "Still Life," three of nine plays Sir Noel wrote for himself and Gertrude Lawrence and first produced in London in 1936. Additional performances will be held May 8 and 9 and 15 and 16, with curtain time--naturally--at 8:30. Tickets (at \$2) may be reserved at the Kresge Box Office, Ext. 4720.

This production marks a change from Dramashop's traditional major presentations of single works in that the audience will see cast members playing two, or even three, different roles during the evening. Under the direction of Joseph D. Everingham, director of drama, the show features choreography by Mrs. Joan Blackmer and musical arrangements by Danny Lee, '73.

For its spring concert the MIT Choral Society has chosen Bach's monumental "Saint Matthew Passion," to be performed this Sunday evening (May 10) at 8:30 in Kresge. Unlike most university choruses, the Choral Society draws its members from the entire community--students and their wives, technicians, secretaries and faculty. Joining in the spring concert, under the direction of Professor Klaus Liepmann, will be the choir from St. Paul's Choir School in Cambridge and the Cambridge Festival Orchestra along with a number of soloists. Tickets are \$3 for reserved seats and \$2 general admission and may be bought at the Kresge Box Office.



CARS' minibus features comfortable seats and plenty of headroom.

MOVING ALONG WITH CARS

Though still quite young, Project CARS shares a traditional virtue with Mom and apple pie--everybody loves it. CARS stands for Computer Aided Routing System, a new concept in transportation also called Dial-a-Bus or Dial-a-Ride.

The CARS Project at MIT is a large, very interdisciplinary effort being carried out at the Urban Systems Laboratory involving personnel from six MIT departments, the Electronic Systems Laboratory and the Draper Lab. This project is sponsored by the Urban Mass Transportation Administration of the Department of Transportation.

Basically, the CARS concept combines the convenience and flexibility of the family car with the economy and lack of parking problems offered by public transportation. In CARS service, a fleet of minibuses are scheduled by a digital computer based upon customer requests received by telephone.

How it works is this: if you wanted to go from your apartment in Cambridge to MIT for instance, you would call the CARS service number and request a ride. The operator would tell you when a vehicle would be at your door to pick you up and approximately how long it would take you to get to your destination. You would board the minibus and after several stops along the way arrive at the Institute. Payment could be either by cash or by monthly billing.

This sounds rather simple, but it's actually an enormously involved project which calls forth the imaginations of urban planners, sociologists, political scientists, civil engineers, and communications and computer systems specialists. By now, most of the feasibility studies have been completed and all indications are that CARS will work. In fact, the minibus in the picture--on loan to CARS from the Ford Motor Company--is being used around Cambridge on simulated runs to check timing.

Both labor and management in the transit business view CARS with favor, a source of great encouragement to its staff, according to CARS project manager Ed Porter, as the concept offers the potential of reviving and expanding the public transit industry. Everything is ready now for an actual CARS demonstration which should be conducted in the near future.



Left to right are: Dennis Lane, Al Colucci, Dick Collis and Don Choate.

QUICKIES

With the thesis season in full bloom, the busiest area on campus may well be the Quick Copy Center in the basement of Building 3. The Center on the Sloan Campus is also working at full capacity. "Nearly all our jobs are rush," comments supervisor Dick Collis. But, with the headlong improvements in copying machines during the past ten years, there is small likelihood that anyone will be disappointed, barring a major mechanical failure, of course.

When Graphic Arts moved to its present location ten years ago, Room 3-003 was intended to be only a drop-off point for work moving between the central campus and Graphic Arts. Left on the main campus was one Xerox 914 copier for those rush jobs. The load back then was about 5-6,000 copies per month. The demand for these convenient, fast copies soon outstripped the copying capability of the machine.

Now two Xerox 2400s with automatic sorters are devoted to short runs, those on which ten or fewer copies are needed. Two large multilith presses, again with automatic sorters, look after the printings of up to 100 copies, so that all copies come out collated and ready for stapling. Helping still further is an automatic platemaker transforming typed copy into plates for the quick copy multiliths. What this amounts to is a growth from 6,000 copies per month to well over 600,000, with an expected peak load in May of more than 750,000.

You might keep in mind, as you head for Quick Copy, that you could brighten their days this month by asking for copies "tomorrow" instead of "Can I wait?"

BANG, BANG

The MIT Pistol and Rifle Club, Inc., would like to announce the beginning of another course in basic pistol marksmanship. This course will be offered for six consecutive Thursday evenings from 7 to 9 p.m., beginning May 14, in the Rifle Range in duPont Gymnasium. The course will be limited to 20 adult members of the MIT community. There is a fee of \$10 for the course, and pistols, ammunition and targets will be provided. Those interested should call Bill Westcott at Ext. 2471.

THE SQUEEZE IS ON

The rising cost of living commands a share of everyone's attention these days, and budget paring brings on grumbles from every quarter. Tech Talk, alas, is no exception. Because we have all been asked to trim our expenses, Tech Talk will be issued every three weeks during the summer, instead of following its regular bi-weekly schedule.

The next issue (May 20) will be the last bi-weekly publication until October. Publication dates during the summer will be: June 17, July 8 and 29, August 19 and September 9 and 30. Please jot these dates down if you think you may have some summertime news, and remember to call well ahead of the publication date.

Because the reduced number of issues will cause difficulties for those who are preparing to leave at the close of school, space for additional ads will be made available on page three of the May 20 issue. It would help a lot, too, if those of us who are staying in the community through the summer or longer would postpone advertising until a later issue. Please watch the bottom of page four for ad deadlines.

Here's a tip for departing students: the Matron's Student Furniture Exchange is eager to buy household items and furniture you may be trying to get rid of.

FOR SALE, ETC.

Columbia port stereo, 2 spkrs, \$20. Kathy Williams, X5792.
 Frostless 16 cu ft chest frzr, exc cond, best offer over \$80. X3432.
 Head Comp metal giant slalom 205cm skis, new, Dover bndgs, Nevada heel, were \$180, selling for \$95. Valerie, X1684.
 Boot for '60-'64 Corvaire, \$10. Harry, X215 Draper 7.
 Single bed, \$10. Peter, X2636.
 Crib & matt for infant, \$15. Kalil, X5789.
 Pedestal DR tbl, 42" dia, maple gr plastic top, burn resistant, etc, few mos old, \$30. Call 776-2089.
 Yashica Lynx-5000, 35mm viewfinder, case, flash, \$55. Linda, X5673.
 Bell & Howell super 8 movie cam, case, projector, etc; Regina elec broom; 2 stainless serving trays; consider swap latter items for 26" bicycle. Paul, X5641.
 Comp sgl bed, \$25; dresser, \$20, both exc cond. Marcia, X6641 or 492-4572 evgs.
 Flying club membership, 40% off. X4622.
 Frosted stretch wlg, \$20; exp babysitter w/10 sit in Eastgate. Mary, 868-4640.
 Girl's beige raincoat, 12, almost new, \$10, too long. Ava, X6214.
 Coldspot fl frzr, 62"x30"x36" dp, old but works well, reas offer accepted. X7444 Linc or 879-2376 Framingham.
 Air circulator, 3-spd, like new, \$20. X 7295 or 267-2019
 Child's bike w/train wh, \$5; carriage seat, \$2.50, both gd cond. Call 861-8070.
 Miranda Automex 3, 50 & 135 lenses, many access, \$175; Sears Big 2 motor shop vac w/access, \$60; Heath audio test gear, \$45 & \$25. Bob, X6607 or 491-4061.
 Stella Harmony beginning guitar w/canvas case, 7 mos old, \$20. Phyllis, X6743 morns.
 Pirelli Corvaire 1.85x13 tires balanced w/rims, yr old, 2 for \$45, 4 for \$65. X4939.
 Free: very cute kittens. Alan, X7001.
 Elec range, exc oven, alum top; wh formica K tbl, best offer. Helen, X4435.
 Garrard Lab 80 chgr w/wal base, cover, Picking cart, all like new. Ken, X7763.
 Hideabeed, like new, \$140; dresser, \$25, lg wd desk, \$30. Lynn, X6750 or 935-1832.
 Chery console piano, Ital prov, 7 yrs old, exc cond; Kenmore auto washer, reg & mod fabric cycles, \$25. Call 862-7750.
 Pr 15" wheels w/mtd casings, \$5. Paul, X1707.
 Sealpt Siamese kittens w/shots, v friendly, \$25 ea. Evelyn, X7652 Linc or 864-8945.
 Amana 14 cu ft frzr, exc cond, w/lock, int light, baskets & thermostat, \$100. Call 298-7785.
 Crib, matt & stroller. Ed, X5794 Linc.
 Robins & Meyers high cap 22" window fan, 2-spd, revers; dk br human hair fall; Great Books collection w/bkcase, mint cond. Dennis, X5770 Linc or 237-2192.
 Four-inch foam matt, 3'9"x6'8", \$25. Call 864-2087.
 Fenwick 9' fly rod, \$25; Orvis fbrgl's spin rod, 6'6", \$15. Dave, 868-1795.
 Gas stove, 36", rec mod, burner w/brain, wh, \$95; three fluffy kittens, box trained, free. Call 894-5253.
 Elec 80 gal ht wtr heater, stone lined, best offer. Donald Boucher, X5757 Linc.
 Kroydon barbll & dumbbell set, \$15. Mike, X6922.
 Med blond wiglet, never worn, \$12; wl do typing, 50¢/pg, 10¢/copy. Sue, X5748.
 Wright camper-trlr, slps 6, w/sink, ice box, storage bins. Bob, X7115 Linc.
 Sears iron, \$5; iron bd, \$3; elec hand mixer, \$8; pyrex dishes, \$1 or free w/above; fbrgl's 3-window curtains, \$9; designer maternity dresses, 12, \$4. Call 868-8733.
 Long hair pt angora kitten, raised w/animals & children. Call 864-7739.
 Matchless '54 motorcycle, 350cc, sgl cyl, exc cond, rec overhaul, \$550. X6548.
 Fieldcrest dbl bedspread, beige w/blue & green floral pat, exc cond, was \$40, now \$15. Mary, X5066.
 Girls bikes, gd cond, 24", \$13; 20", \$10. X7706 Linc.
 Zenith floor mod stereo, \$70. Jane Kosut, X3762.
 Copymate photocopier, 60-copy paper sets, \$20. Steve, 868-8723 5-8 pm.
 Free: 5 black kittens. X4152 or 523-6471.
 Telephoto lens 300mm f/5.2, screw mt, auto, immac cond, \$65 or best. Paul, X7232.
 Antique 2-drw dresser, \$7; green washable fiber mat, 9x12, \$10; fbrgl's drapes 54" length, 5 prs, \$2.50/pr. Anne, X6230.
 GE ironing mangler, reas price accepted. Larry, X6526.
 Zenith 15" b&w port TV, exc cond, reas price. Call 389-8164.
 Blithner 6' grand piano, recond & refinished, satin bl, \$800. Call 944-2138.
 Pr 12" spkrs in bass reflex encls, Lafayette SK-500 3-way, \$45 & Jensen exten range, \$30, both for \$65. George Cox, X545 Draper 7.
 Sunbeam lady's shaver, never used, pink, \$14. Janet, X653 Linc.
 Ferrograph 704 pa tape recdr, unused, \$450. Call 876-1229 evgs.
 Firestone 6.95x14 tire, br new, never used. Steve Tracton, X2181 or 868-7437.
 VW lthr seat covers, batt, gd cond, v reas. Alan Deniz, X2961.
 Stereo amp, \$50; spkrs, \$25; cart tape deck w/tape, \$50. Csaba, 491-1726.
 Honda CM 91, '67, 2.3K, exc cond, w/helmet & rack, \$225. X7160 Linc.
 Set Worldbook encyclopedias w/yr books, '67 ed, \$100. Bob, X3550.
 Three lovely, healthy b&w & grey kittens, 50¢ giftwrapped. Call 923-1794 evgs.
 BR set: dbl bed, bureau & mirror, vanity, side tbl, \$25, living, must sell. Call 337-4253.
 Scotts combined stamp catalogs, '68, \$5, '69, \$6.50. Arthur, X5834 Linc.
 Sofabed & 2 match chrs, lg lthr desk chr, \$50; 2 rugs, \$25 ea; port wash mach, yr old, ideal for apt, \$65. Neil, X5714 or 787-4263 evgs.
 Pr altered sealpt Siamese need affectionate home. Call 646-8784.
 Pr 8.50x14 tires on GM rims for price of rims alone. Nate, X7838 or 884-5611 evgs.
 FM radio converter for car R; reverb unit for car R. O'Callahan, X7393 Linc.
 Chrysler 209v air cond, 14,000 BTU w/mounting bracket. Mark Price, X2571.
 Pr studded shoes, 8.15x15, new Jan '70, exc cond. Carl, X2232.
 Alum 40' exten ladder, Sears best, perf cond, \$70. Jerry, X5525 or 494-2394.
 '58 Morris Minor convert, replace broken crank shaft or use for pts, \$60. C. O'Neal, X4301.
 '60 Ford, \$50. X1980.
 '63 Plymouth Spt Fury convert, V-8, 363hp, \$500 or best. X3335.
 '63 Alfa Romeo Spyder, '67 1600cc eng, Weber 5-spd trans, radials, 12K on eng, \$1000 or best. Carl Abrahamson, X2044.
 '63 Ramb Classic wgn, auto, gd ride, easy handling, best offer. X2415.
 '63 Dodge wgn air cond, fl pwr, \$300 or best. MacIntyre, X4831.
 '63 Ramb Amer, new br, batt & muff, \$100. Bruce, X2401.
 '64 Valiant 4-dr, V-200 sedan, auto. Allen, X2509 or 527-7292.
 '65 Dodge Polara wgn, 3-spd man, \$700. Call 648-0344 evgs.
 '65 Mustang, 8 cyl, std, 62K, v gd cond, \$800. Billericia 663-6886 evgs.
 '66 Peugeot wgn, eng nds wk, \$250. Angelo, X3495 or 535-2399 evgs.
 '66 Pontiac Tempest coupe, 6 cyl, std, 1 owner must sell, \$700. X7422 Linc.
 '66 VW sedan, \$750. Tom King, X3987.
 '66 VW, even tires are great, now \$675. Carl Dick, X3744.
 '66 Renault R-8, 36K, nds eng wk, \$150. Peter, X6568 or 354-5163.
 '67 Mercedes 250SE. Dick, X3835 or 254-1885.
 '67 Datsun convert, low mi, gd cond, fly equip, \$950. Mark, X4935.

'67 MGB/GT, immac cond, new avarth, br, 7 tires, 30K, yellow, \$1850 firm. Len Sherman, X7174 or 547-9267.
 '68 Ply Fury III convert, p st, R&H, ww, lt gr, bl top, \$2195. Call 935-4038 evgs.
 '68 Corvette coupe, 15K, immac cond. Bruce, X3725 or 935-1832.
 '69 Volvo 142S, 4-spd stick, AM-FM R, must sell. Jim, X2276.
 '69 Buick Stage I, high perf, p st & br, buckets, positrac, AM-FM R, stereo tape deck, extras, \$2995. Call 643-0507.
 '70 Karmann Ghia convert, living, must sell. Call 491-4132 evgs.
 Porsches, new & used, living, must sell. Call 663-6460 evgs.
 Arl, sublet w/opt, 2-BR of lg furn 3-BR apt, share K, fp etc, 2 mins to T, \$40/mo/person, avail 6/1. Hartmut, X7582.
 Ashburnham, Sunset Lake lot, v close to priv beaches, exc for building, reas. Sue, X7511 Linc.
 Billerica, 2-BR ranch, gd loc, w-w carp, util rm, sale. Call 667-3234.
 Boston, apt, 2-BR, 2B, dish, air cond, 5 mins from MIT, \$373/mo. X3663 or 742-4380.
 Boston, unfurn studio w/K&B, nr BU, avail 6/15 or earlier w/opt, \$110/mo, incl ht. Ben, X6865 or 266-6585 evgs.
 Bri, 2-BR, K, LR, d'ette, pking in 4-yr-old bldg, partly furn, avail 6/1-8/31, \$180/mo. Ed, X7935 MWF or 283 Woods Hole TTh.
 Bri, summer sublet, lg 2-BR unfurn apt, \$250/mo. Leslie, X2632.
 Brk, sublet Jul & Aug, lg BR, LR & K, conv loc. Stephanie, X5795.
 Camb, 3-rm apt, all util & pking. Call 864-8802 evgs.
 Camb, sublet 6/1-8/31, 2-BR apt nr Harv Sq, air cond, new bldg, \$335/mo. Alan, X5358 or 354-6366 evgs.
 Camb, mod furn apt for 2, avail 6/15-8/31, flexible, nr Cent Sq, dish, \$150/mo. X2925 or 868-2719.
 Camb, rm, bath & brkfst for student for summer, conv loc, in exchange for some afternoon work. X5746.
 Concord, 4 BR hse avail mid-June to mid-July. Dick, X2180.
 Eastgate, sublet fly furn 1-BR apt for summer. X6752 or 864-9099.
 Jam Pl, furn mod apt, 2-BR, LR, DR, air cond, disp, w-w carp, \$175/mo; parlor grand piano, \$240 or best; GE dishwasher, \$45. Steve, X4391.
 Kensington, England, lg hse, 7BR, furn avail 7/5-9/5, \$500/mo. Foster or Gayle, X7296.
 Lex, 7-rm col, 3 BR, eat-in K, DR, fam rm, 1 1/2 B, gar, nice lot, upper \$30's. Call 862-7904.
 Menemsha, Martha's Vineyard, cott on pond, slps 3, avail 6/15-6/26, \$75/wk. Alice, X3795.
 Ntn, 5-BR, lg col hse, 3 B, playrm, study & den, mod K, Auburndale area, \$400/mo, sum sublet, dates arranged. X6958 or 969-3834.
 Ntn, Jul & Aug sublet, unfurn 2-BR, 2-B apt, cent air cond, \$225/mo w/opt. X6892 or 244-5112.
 Ntn Highlands, sum sublet, 3 BR, lg yd, scr porch, nr T. X5623.
 Ntn, apt rent free for married cpl w/child in exchange for babysitting & housework, nr T. Call 527-2683.
 Ntn, 4-BR hse w/study, avail 6/15-8/30, \$350/mo. X2408 or 969-3439.
 NH land, 4 acre, Locke Lake dev, lake view, gd for 4-seas hse. Larry Schnee, X3494.
 NH, lake country cott, 2 BR, mod, fly equip, fpLR, priv beach & rowboat, \$110/wk. Mel, X6982.
 N Camb, sum sublet, 1 BR, 4-rm apt; 2 BR of 5 rm apt. Joe, X6179 or 625-0792 evgs.
 Sunrise Lake, NH, furn 3-BR vac home, priv beach, swim, etc, wkly rental. Call 729-8227 evgs.
 Switzerland, 3-BR chalet, sum & winter vac spot. Dorys, X5783.
 Wakefield, NH, cott, own beach, dock, mod K, avail 6/27-7/11. Donald, X5869 Linc.
 Westgate, effc, furn sublet 6/5-8/29, \$125/mo. Call 864-3874.
 Westgate, effc, furn, avail 5/29-6/28, v desirable. Ravi, X7080.
 Winnepesaukee, 3-BR cott, view, beach & dock. George Mayo, X6445.
WANTED & MISC.
 LOST: knurled silver Parker 75 pen in card punch rm Bldg 39, Apr 12, of sentimental value, generous reward. Alan, X1918.
 LOST: Lecture notes for 6.573 & 6.613 in 3-ring binder. Jim, X7719.
 FOUND: lovely calico cat, nds home desperately, young. Muriel Cooper, X1961 or 232-1919.
 Thesis typing done. X5751 or 864-0203 evgs.
 Parts for early 60's Alfa Romeo Spyder. Mike, X4387 or 354-5540.
 Transmission for 4-spd Saab. D. Kelland, X5559.
 Rmmate for sum for furn rm in lg 5-rm apt nr Inman Sq, avail 6/12-9/12, \$50/mo. Call 625-5016.
 Bicycle rack for VW. Call 536-0083 evgs.
 Exp 14-yr-old girl w/refs wl babysit for sum in Vt, NH or Me. X3646 or 625-0519.
 Wl do typing, theses or other papers. Hedy, X5957.
 Riders to Baltimore, 5/15/70. Mark Katz, X3539.
 Rmmate(s) to share Wat apt, \$70/mo ea. Gayle, X7296.
 Fem rmmate for 2-BR apt, 3 min to Harv Sq, 5 min to MIT, w-w carp, air cond, avail 6/1, \$100/mo, X5104 or 547-2674 evgs.
 Three-drw old filing cabinet, reas. Chris, X2375.
 Wl do typing, reas rate. Nancy Jones, 731-0210.
 Quality classical or acoustical guitar in prime cond by 6/1. X3146.
 Car to rent, 6/10-9/10, in gd working cond, pref not more than 3 yrs old, wl pay up to \$100/mo or according to mileage. Call 864-3914.
 Male rmmate wanted for furn apt, own rm, \$75/mo incl util. Call 787-4832 evgs.
 Fem rmmate for lg riverview apt on Beacon St. Jan, X5609 or 536-5686.
 Apt nr Porter Sq, unfurn, sunny, beg June or sublet w/opt, \$125-150 range. Sandy, X2048.
 People to sail, cruise in Greece in June. Bob Patterson, 492-6054.
 Cpl or sgl for own rm in 4-BR house, Inman Sq. Call 354-7221.
 Man's 10-spd bike. X5757 or 232-9725.
 TV, \$30. Claus, lv message X5571 or 5573.
 Hollywood sgl bed frame. Liz, X7115 or 261-1789.
 Exp sitter begin 6/1 in East or Westgate for gentle 8-mo-old child, MWF 9-4. Mrs. Evans, X1943 or 244-7331.
 Will do typing. X2003.
 K or DR chairs, end tables. Barbara, X7667.
 Drill press. Howard, X6588.
 ATTENTION: Sigma Xi members initiated last yr should pickup certificats in 3-453A or 3-439.