



First Lecture
January 3, 2005



Agenda

- Introducing the Staff
- Logistics—website, wiki, rooms, calendar
- Course Policies and Philosophy
- Contest Preview
 - The Game
 - The Kit
- Today's Objectives
 - ORC API preview
 - Assembling the ORC Pad
 - Pegbot



The MASLab Staff

- Undergrads and grads like you!
 - Program Finale
 - Technical Yuran
 - Software Tim
 - Mechanical Aaron
 - Hardware Dany
 - ORC Ed
- Staff mailing list: maslab-core05
- Student mailing list: maslab-2005



Mentors and Check-offs

- Everyone on the staff is here to help
- Everyone can witness a check-off
- Mentors keep a closer watch:
 - Teams 1-4 -- Finale
 - Teams 5-8 -- Yuran
 - Teams 9-12 -- Aaron
 - Teams 13-15 -- Tim



Sponsors

- MIT Course 6
- Cypress
- Advance Circuits
- Globtek
- iRobot
- Analog Devices
- Hanksraft Motors
- Acroname
- Digikey



Logistics

- Website: maslab.lcs.mit.edu/2005/
 - 2005 section links to the wiki
- Lab Access
 - 34-501 (24 hours) – 47519, 72962*
 - 38-500 staffed 12-8 (but opens at 10 am)
- Storage Options
 - Take it with you—tubs provided
 - Locker or storage closet (we're working on it)
 - Unattended valuables = loss of sensor points



Lab and Lecture Schedule

- Lectures Jan. 3-7, Jan. 10 and Jan. 12
- Enrichment Lectures to be scheduled
- This week: lab after lecture until 6:30 pm
- Starting next week:
 - lab from 12 – 8+ pm weekdays,
 - 12 – 5 pm weekends
- Java Tutorial: tomorrow night!!
 - 34-501, 7-9pm



Key Dates

- Checkpoint One Jan. 7
- Design Review Jan. 12
- Checkpoint Two Jan. 14
- Mock Contest One Jan. 20
- Mock Contest Two Jan. 25
- Impounding Jan. 27
- Final Contest Jan. 28
- Clean-up day Jan. 29



Course Philosophy

- Maslab should be fun!
- You will learn a lot!
- Why all the rules?
 - Keep you on track.
 - Respect your volunteer staff.



Course Policies

- 6 Units Pass/Fail
- 6 EDPs

Passing Grade

- ↔ Keep kit (except computer)
- ↔ Meet course requirements



Course Policy: Requirements

- Adequate effort and time invested in MASLab
- Attend mandatory meetings/events
- Majority of work in lab
- Completion of “checkpoints”
- Make daily lab entries (few sentences minimum)
- Submit final report (5-10 pages per team)
- Help tidy workshop on your team’s turn
- Help final cleanup on lab cleanup day



Course Policies: Disasters

- You are responsible for the working condition of your hardware
- If hardware breaks:
 - You're responsible for a replacement.
 - In most cases of accidental damage, MASLab will split the cost of a replacement.
 - Costs: Eden \$250, Orc \$150, OrcPad \$40
 - Let's avoid this situation! Be careful!

Contest Preview: The Basics

- You'll build and program a robot
- Robots use **vision**, range finders, other sensors to locate and transport "target" objects.
- The playing field is **unknown**
 - Where are obstacles?
 - Where are targets?
 - What is the shape of the playing field?
- The robot functions **autonomously**





Contest Preview: The Rules

- 3 minute scoring round
- Optional 3 minute exploring pre-round
- Targets are red wooden balls
- Score by:
 - 5 pts – field goal over mouse hole
 - 3 pts – through mouse hole
 - 1 pt – porch in front of mouse hole
 - 1 pt – possession



Contest Preview: The Field

- Blue line on top of white walls with pseudo-randomly spaced tick marks
- Yellow border around mouse holes
- 4-bit vertical green and black bar codes on walls
- Red balls



Contest Preview: Prizes!

- More of an ***exhibition*** than a ***competition***
 - It's a hard problem. Work together!
 - You'll do better if you work with other teams.
- Awards
 - 1st place
 - *MASLab Engineering Award* and other staff picks for cool ideas or clever implementations
 - *At least* one award for cosmetics



The Kit

- We supply basic parts
 - Enough to build a complete robot.
 - Motors, wheels, computer, sensors...
- You supply “extras”
 - Better motors, custom-made widgets, unique/unusual sensors
 - Subject to spending limit (\$100 per team) and non-passive components to staff thumbs-up



Sensor Budget

- ~30 pts, subject to staff approval and availability

Item	Value
Extra drive motor	9
Ultrasound	7
IR (long range)	6
Servo	5
Gyro	5
Optical Encoder	4
IR (short range)	4
Whisker switch	2
Solenoid	2
Moment buttons	1
Photodiodes, etc.	1

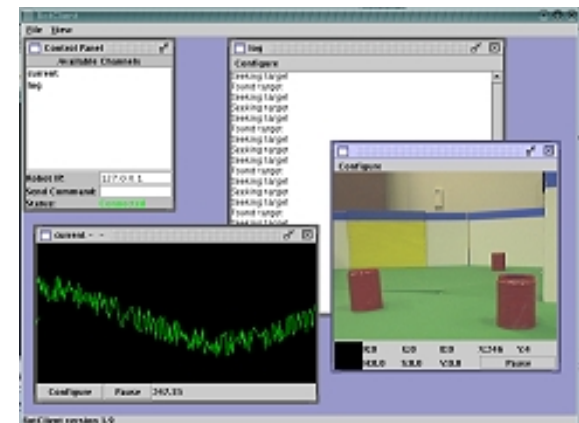


Building Tips

- Mechanical: machine shop access is *very* useful!
 - MASLab tools limited, imprecise
- Software
 - Many conceptual parts
 - Outputs hard to observe without care, so...

Building Tips

- Write modular code
- Focus on behaviors (go straight, turn, etc.)
- Design for test:
 - iterate between coding, compiling, and tests
 - automate tasks (calibration)
 - test on static images
 - use the debug clients





Updates, bugs, advice

- maslab.jar updates at boot
- firmware updates as needed
- Problems? Suggestions? Let us know!
 - Don't stew bitterly
 - Your advice is very welcome

Kit details: Hardware Overview

- Orc Board (the larger board)
 - provides hardware resources—interface between compute and sensors, motors
- Orc Pad (the smaller board)
 - joystick and lcd
 - draw images on to it
 - log text messages
 - start robot without wireless





Kit details: batteries

- One 12 V lead-acid battery
 - may trade or borrow a different size (and different amp-hours: 2, 5, or 7)
 - ALWAYS fused
- 13.8 V DC regulator
 - if both battery and regulator are plugged in, the battery is recharged



Kit details: Software

- Java documentation at Sun's website
- Maslab goodies on maslab website
- All documentation linked from maslab.lcs.mit.edu/2005/wiki



Kit details: orcd

- Persistent service on the eden that
 - implements low-level usb port handling
 - Arbitrates between client applications
 - Provides shell capability (Eden's IP address, run/execute arbitrary programs)
- We provide the binary. You never need to compile/write anything
 - Except maybe `/etc/orcd.conf`



Kit Details: Maslab APIs

- Maslab.camera—get frames from camera
- Maslab.orc—implements Orc API
 - analog digital orcpad
 - lcd motor lcd console
 - servo soar
- Maslab.telemetry—data logging, visualization, debugging
- Maslab.util—helper classes



Example

```
import maslab.orc.*;
import maslab.util.*;

import java.io.*;

public class hello
{

    public static void main(String[] args)
    {
        Orc o;
        try {
            o=new Orc();
        } catch (IOException ex) {
            System.out.println("Could not create orc!");
            return;
        }

        o.lcdConsoleHome();
        o.lcdConsoleWrite("Hello, world\n\n");
        o.lcdConsoleWrite("Press a key...");
        o.padButtonsGet();
    }
}
```



Today's Objectives: OrcPad

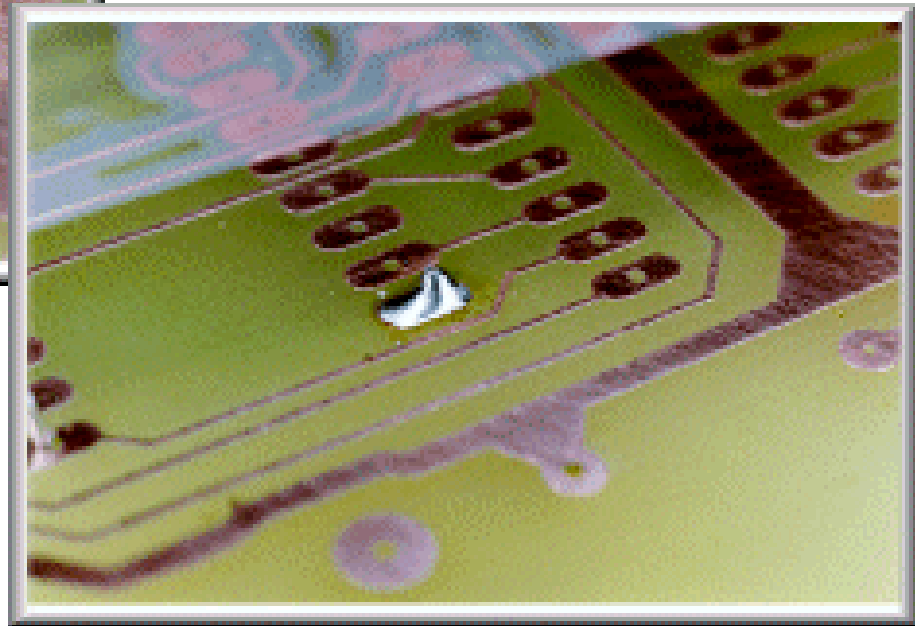
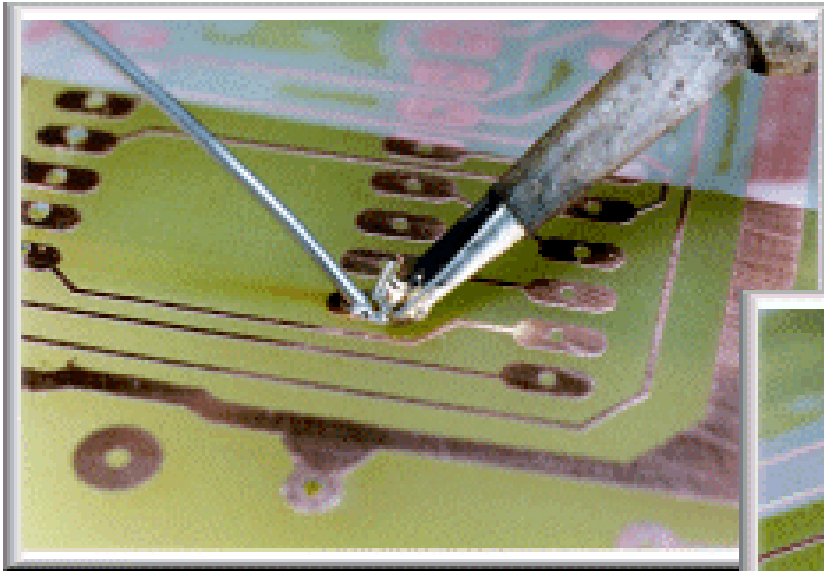
- Assemble OrcPad
- Step-by-step instructions included
- After soldering kit, check with a staffer:
 - Make sure it's right—get LCD, chip to finish
 - Get suggestions on your soldering technique (this is a class, after all :)



Today's Objectives: Soldering

- Soldering is non-trivial, especially surface mount components
- Goals: good physical connection; electrical and thermal connectivity
- Technique: heat both parts of joint first. (Don't paint with solder!) Avoid oxidation – the joint should be shiny.

Diagrams



<http://www.epemag.wimborne.co.uk/solderpix.htm>



More on Soldering:

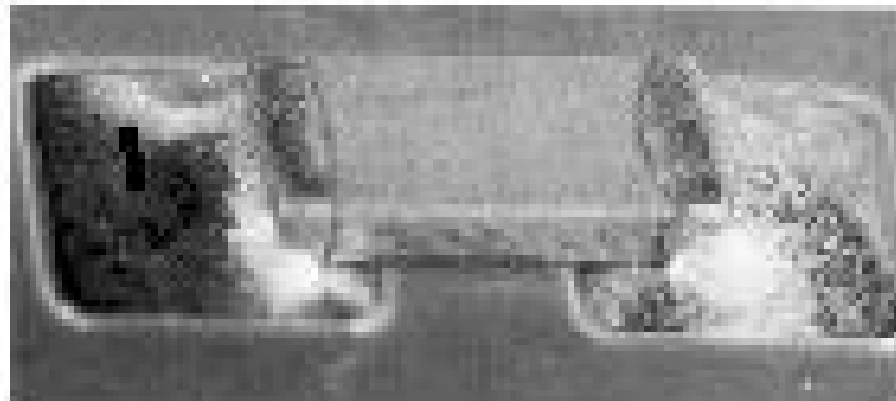
- Use the lowest heat that will work (about 650 F)
- Keep iron tip clean and shiny. Store with solder on it. Never “sharpen” tip.
- Minimize heating time (avoids oxidation, damaging sensitive components)
 - Contact shouldn’t be more than 2-3 seconds
 - Let components cool for a few seconds



Tips for Surface Mount

- Put a dab of solder on one of the pads
- Slide the device right next to the solder. Remelt the solder and slide the component in place.
- Solder second pad.
- Use all left pads/right pads for the dabs when components are next to each other.

Surface Mount



<http://www.geocities.com/vk3em/smtguide/websmt.html>



Today's Objectives

- Gyro sensor – solder the board
- Orcboard – add 3x2 header for gyro
- Software
 - Write a hello world for your Eden
 - Print a hello world to the orc pad
- Pegbot
 - Slap it together!
 - Get something moving!



More objectives

- Staff and equipment are limited, so please be patient! Everyone will get a turn.
- Other things to do:
 - make your battery cable
 - inspect orc board for missing/poor joints
 - play with the playing field
 - take pictures of the playing field
 - extend tutorial code
 - brainstorm contest strategies