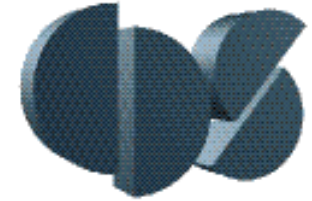


# CS/EE/ME 75a Winter Term Kickoff



**Richard Murray**

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**Ben Brantley**

**Joel Burdick**

**Lars Cremean**

**Kristo Kriechbaum**

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**Engineering and Applied Science  
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Team Caltech, 3 Jan 05



Richard Murray, Caltech CDS

# Meeting Goals and Agenda

## Goals

- Discuss course structure for the term
- Summary field test results and status against first term goals
- Discuss project goals and timeline for the next term

## Agenda

- 7:30 Goals, Agenda, Notetaker
- 7:35 CS/EE/ME 75b overview
- 8:10 Winter term project plan
- 8:25 Team breakouts: weekly meeting time
- 8:30 Done

**Notetaker:** \_\_\_\_\_

- Record notes and action items from meeting; post on wiki

# Course Administration

**Class homepage:** <http://www.cds.caltech.edu/~murray/dgc75>

## Course meetings

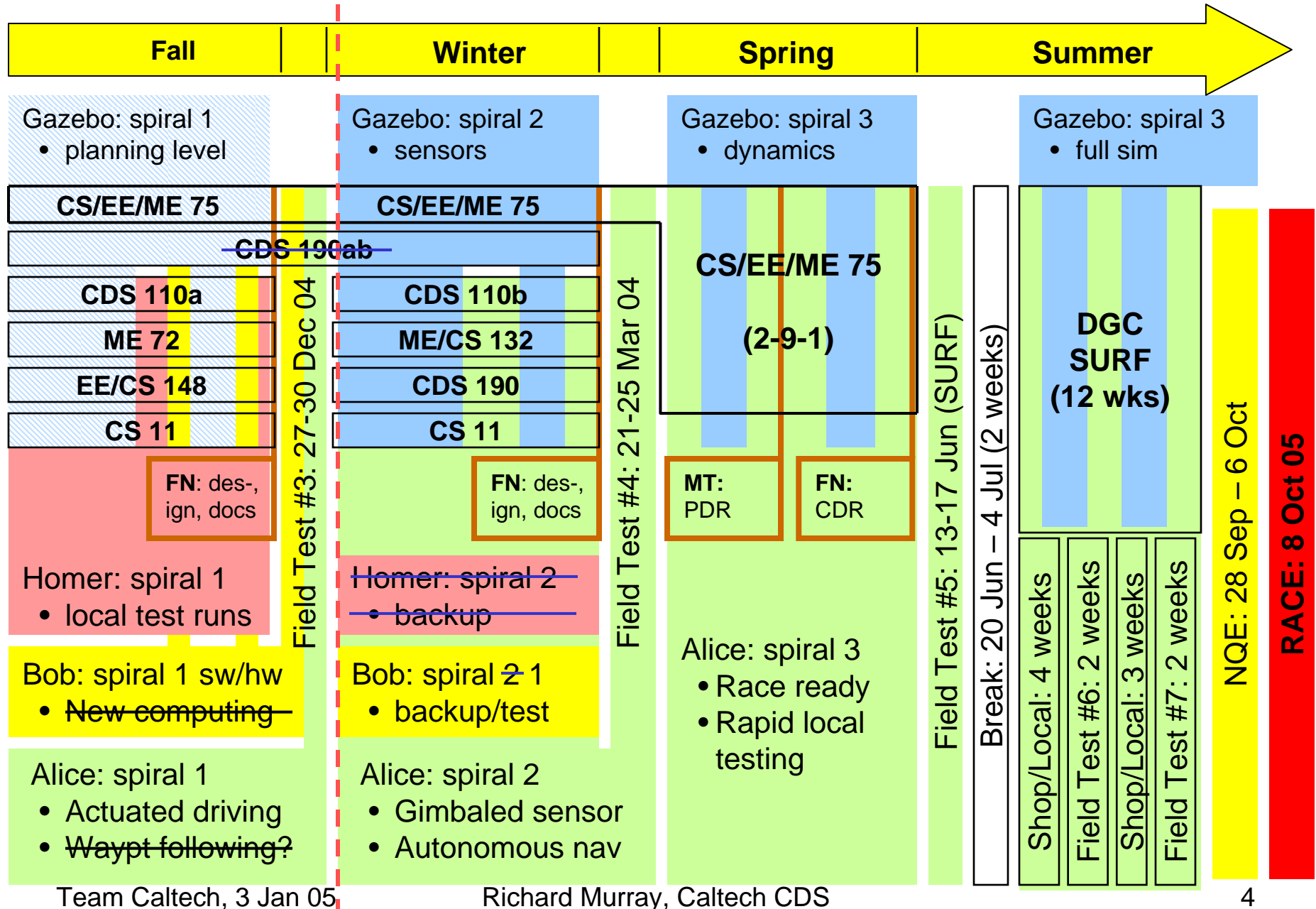
- Project meetings: Monday, 7:30 pm, 101 Guggenheim
- Team meetings: TBD. Weekly **between Wed noon and Fri 5 pm**

## Grading

- 20% Homework (weeks 1-4 only) – HW #1 available on course web page
- 20% Participation
- 20% Team project review (final)
- 40% Documentation of work for the term (based on quality of technical work and quality of documentation)

**Collaboration policy:** full collaboration encouraged. Write up your own work.

# CS/EE/ME 75 Timeline



# CS/EE/ME 75 Supporting Courses

## CDS 110b – Control Design

- Instructor: MacMynowski
- Optimal control, Kalman filters, and  $H_\infty$  based design
- MacMynowski has agreed to allow independent projects for CS/EE/ME 75 participants
- Possibilities: Kalman filtering of IMU/GPS, sensor fusion, high performance path following

## ME/CS 132 – Robotics

- Instructor: Burdick
- Sensor-based navigation
- Course projects can be aligned with Team Caltech project needs

## CDS 190 – Modeling and Simulation

- Instructor: Murray
- Modeling and simulation using Gazebo
- Course project will be to build a simulation of the 2004 DGC course and test new algorithms

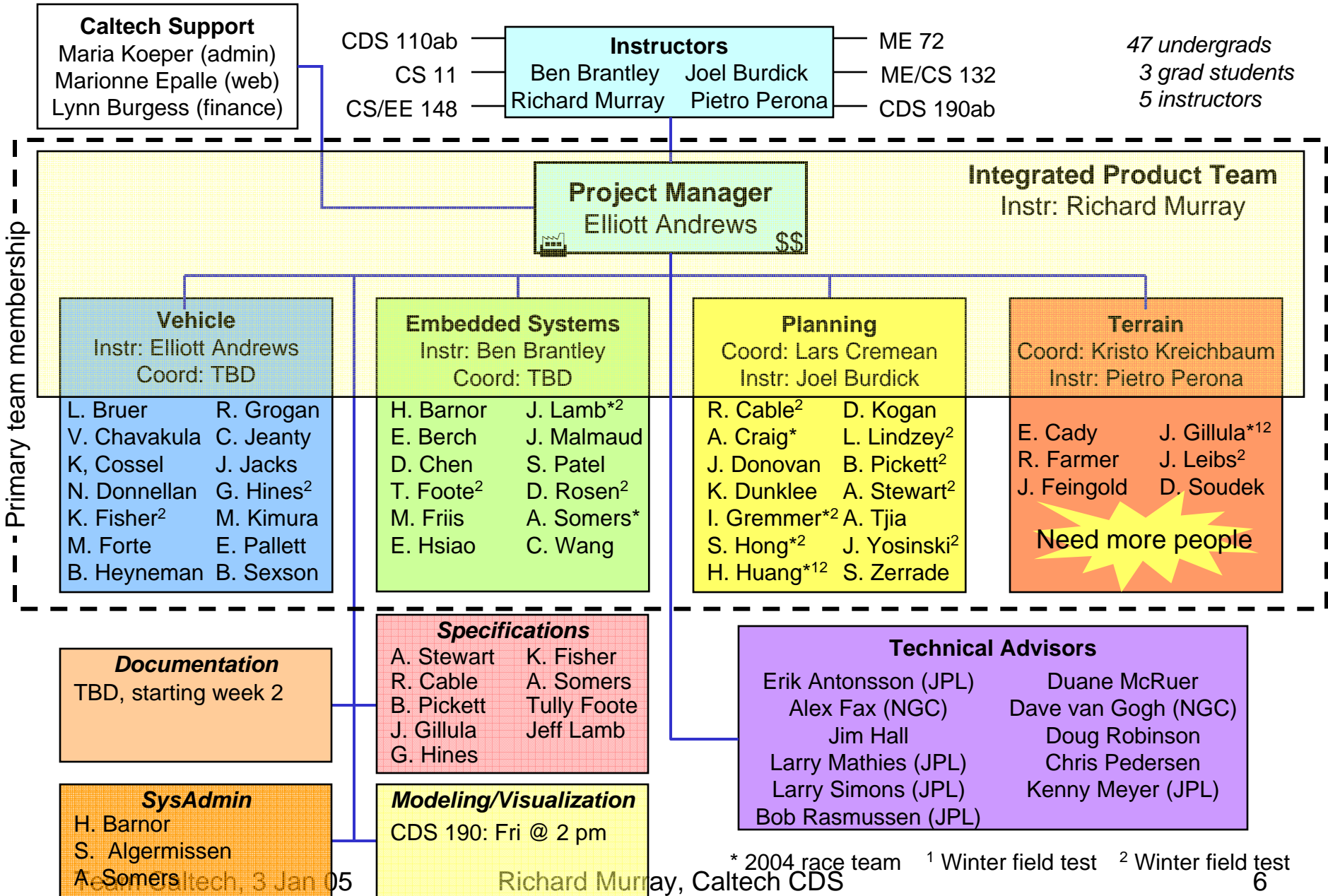
## CS 11 – Computer Programming Shop

- Special section for DGC participants

## CS/EE/ME 75 – increased units

- Putting through request to allow up to 6 units of credit in second term
- Students who are spending more than 3 hours per week should consider increasing units before add day

# Team Caltech Organizational Chart



# Meeting Goals and Agenda

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**Notetaker:** \_\_\_\_\_

- Record notes and action items from meeting; post on wiki

# Project GOTChA Chart (Fall 2004)

## Goals

- Establish teams and skills required for multi-disciplinary, large-scale project
- Develop capability in key technical areas, aligned with DGC needs
- Finalize and test new system architecture, starting with summer results + review team feedback

## Objectives

- • All students using GOTChA charts, bugzilla, wiki, svn as common tools
- • Field tests of spiral 1 technologies on preliminary system architecture
  - ▫ 5 m/sec autonomous ops w/ Bob on calibrated course w/ new modules
  - ▫ Remote control of Alice
- • System design review by team of outside experts

## Technical Challenges

- Systems integration, especially SW
- Perception: high speed, unstructured
- Decision-making: robust planning
- Technical driving: accurate path following
- New teams, with mixed set of skills

## Approach








- CS/EE/ME 75: team-based design
- CS 11: structure real-time programming
- ME 72: gimbaled sensor platform (GSP)
- CDS 110: tight waypoint following + GSP analysis
- CS/EE 148: imaging architecture and algorithms
- Partnerships/vendors: contract out vehicle components (& integration?)
- Exploit volunteer collaborations

# Field Test #3 GOTChA Chart

## Goals

- Demonstrate spiral 1 results
- Provide test time for class projects
- Train new students on field operations

## Objectives

-  Test RDDF path generation: El Mirage QID RDDF course
-  Test deliberative planner on Bob: ~~El Mirage QID RDDF course with chosen obstacles~~
-  Test mode management on Bob: (1) mode + virtual E-stop signal sent through Sparrow interface
-  Autonomous driving (deliberative planner) of Bob ~~on trails~~ with terrain sensors feeding map
-  Road following (ID?) algorithms
-  Remote control of Alice + ~~preliminary offroad characterization~~
-  Improved operations: checklists, meals, network/computing, go/no-go tests

## Summary of Accomplishments

- Computing and networking installed in Alice; excellent testing platform
- Preliminary actuation of Alice: throttle, steering, brake
- LN200 working using new linux interface
- Demonstrated 2004 functionality after improvements to Bob's configuration
- Bridged ethernet for streamlined operations

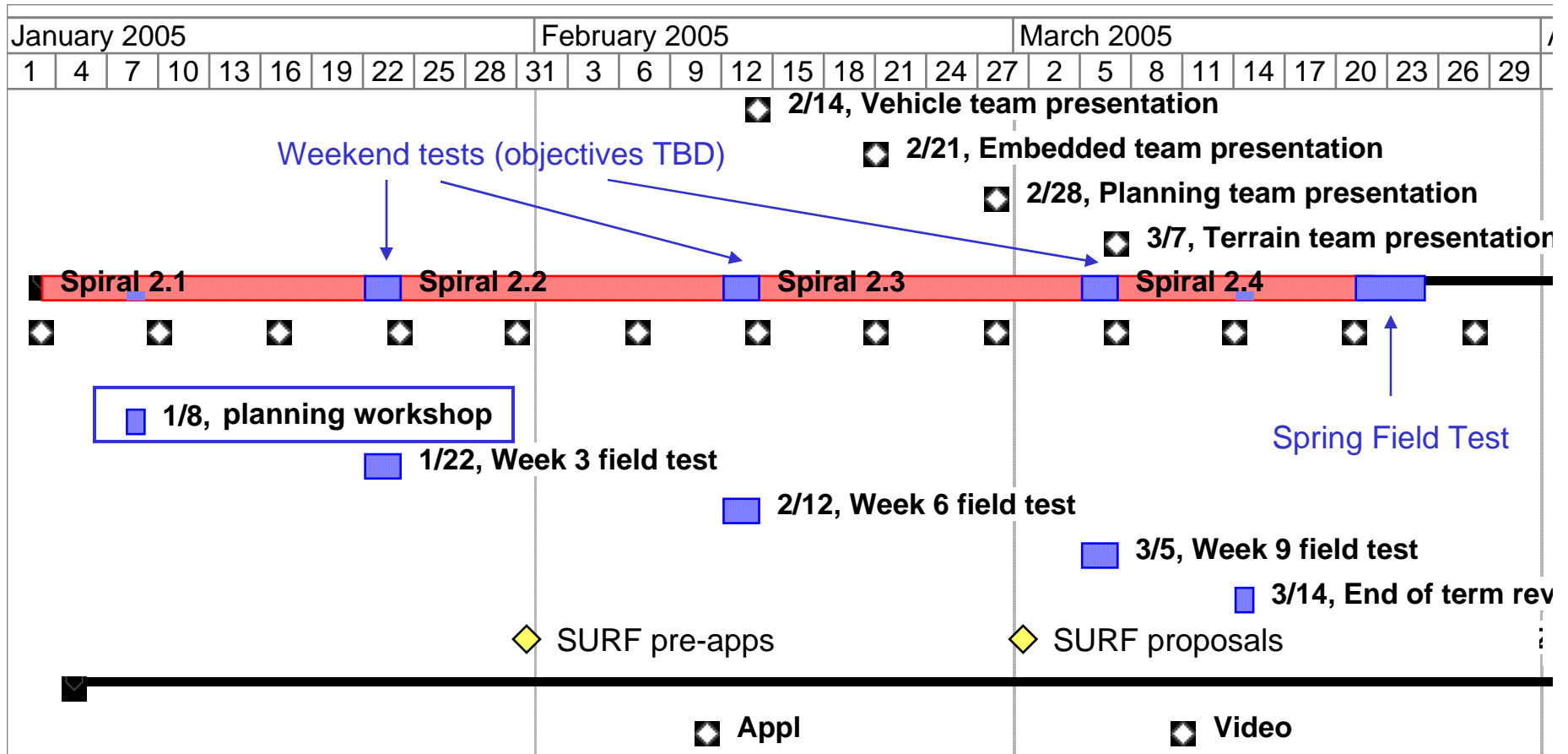
## Issues

- Bob's steering badly in need of repair
- vdrive not accepting commands from integrated planner

## Lessons Learned

- Don't leave the shop without fully testing the code that will run in the field
- Always have a go/no go meeting before leaving for the field

# Winter Term Timeline (DRAFT)



## Test-based schedule

- Three weekend test windows: W3, W6, W9
- GOTChA workshop on 8 Jan (Sat) to plan out details of tests and project GOTChA
- End of term field test: 10 miles @ 10 mph over representative terrain (TBD)

## Team presentations and review

- Weeks 6-9: presentations by each team
  - Specs, architecture, test plan, status
  - Plan for field test + remainder of term
- 14 Mar 05: end of term review

## Team Breakouts

### Breakout by team and meet for 5 minutes

- Determine what day/time you will have your weekly group meeting
- All team meetings should be between Wed at noon and Fri at 5 pm
- Please determine **three** times in that range when the team can meet

### Richard will come by and get meeting times from you

- Final team meeting times will be sent out to mailing list by Tuesday pm
- OK to attend meetings for other teams if you are interested
- Location: team coordinator will set this up and send out e-mail

### Week 1 team meeting

- All teams should meeting *this* week at designated time
- Agenda: review feedback from fall 04 review (on wiki) + GOTChA charts

<b>Vehicle: Shop</b>	<b>Embedded: Foyer</b>
<b>Planning: front of 101 Gug</b>	<b>Terrain: rear of 101 Gug</b>