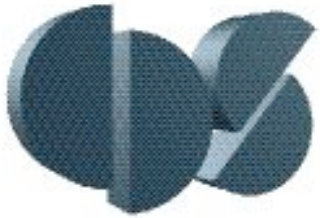
CS/EE/ME 75a
Design Reviews



Richard M. Murray

30 October 2006

Goals

- Review the schedule for the remainder of the term (projects)
- Provide guidelines for design reviews and upcoming presentations

Agenda

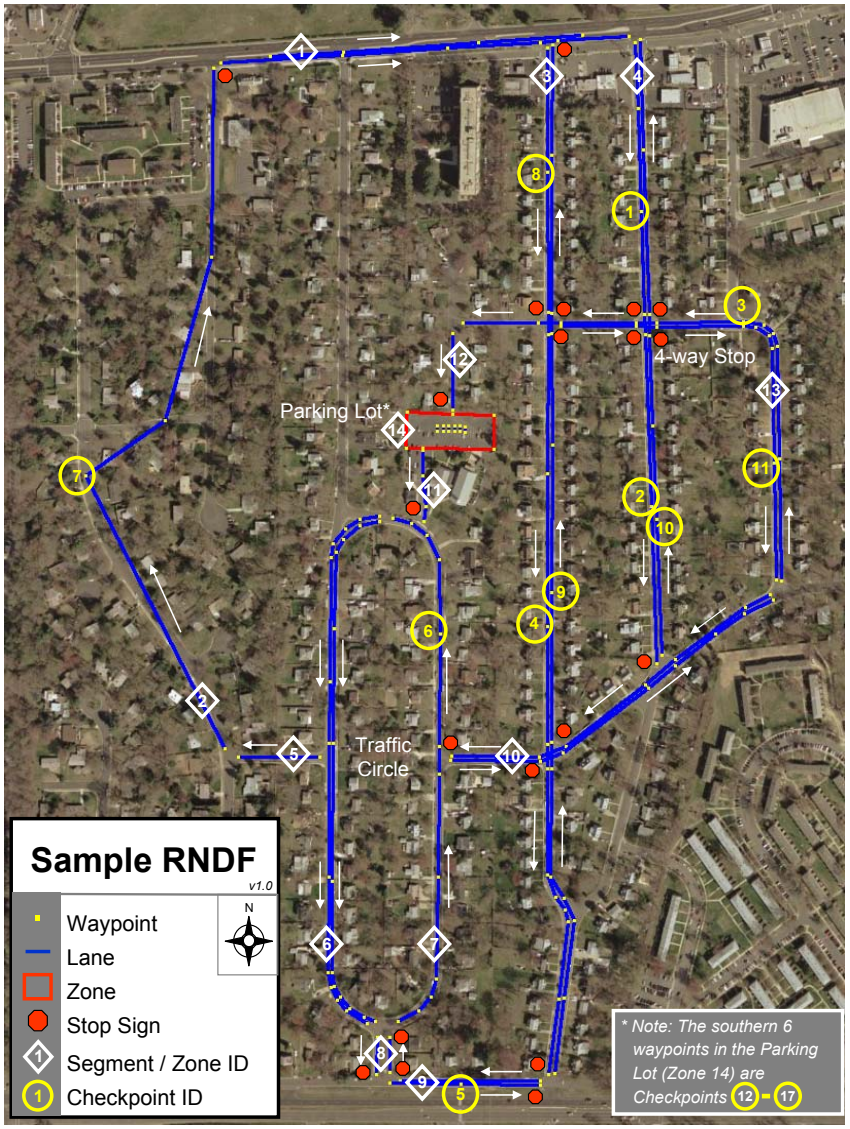
12:00 Goals, agenda and notetaker
12:05 Project (and course) schedule
12:15 Review guidelines
12:30 Schedule for the remainder of the term
12:55 Adjourn

HW #4 due at 5 pm

2007 DARPA Grand Challenge (Urban Challenge)

Autonomous Urban Driving

- 60 mile course, less than 6 hours
- City streets, obeying traffic rules
- Follow cars, maintain safe distance
- Pull around stopped, moving vehicles
- Stop and go through intersections
- Navigate in parking lots (w/ other cars)
- U turns, traffic merges, replanning
- ~~Prizes: $2M, $500K, $250K~~



Team Caltech, 2006-07

Goal: design, build and document an autonomous ground vehicle that can win the 2007 Urban Challenge

2006 | 2007

Summer | Fall | Winter | Spring | Summer | Fall

Conceive | **Design** | **Implement** | **Optimize**

Autonomous Vehicles SURF (15)

Conceptual Design & Technology Analysis

CS 11

CDS 110a

EE/CS 148

CDS 110b

ME/CS 132

CS/EE/ ME 75 (3-9-6)

Senior Thesis Projects

DGC SURF (24)

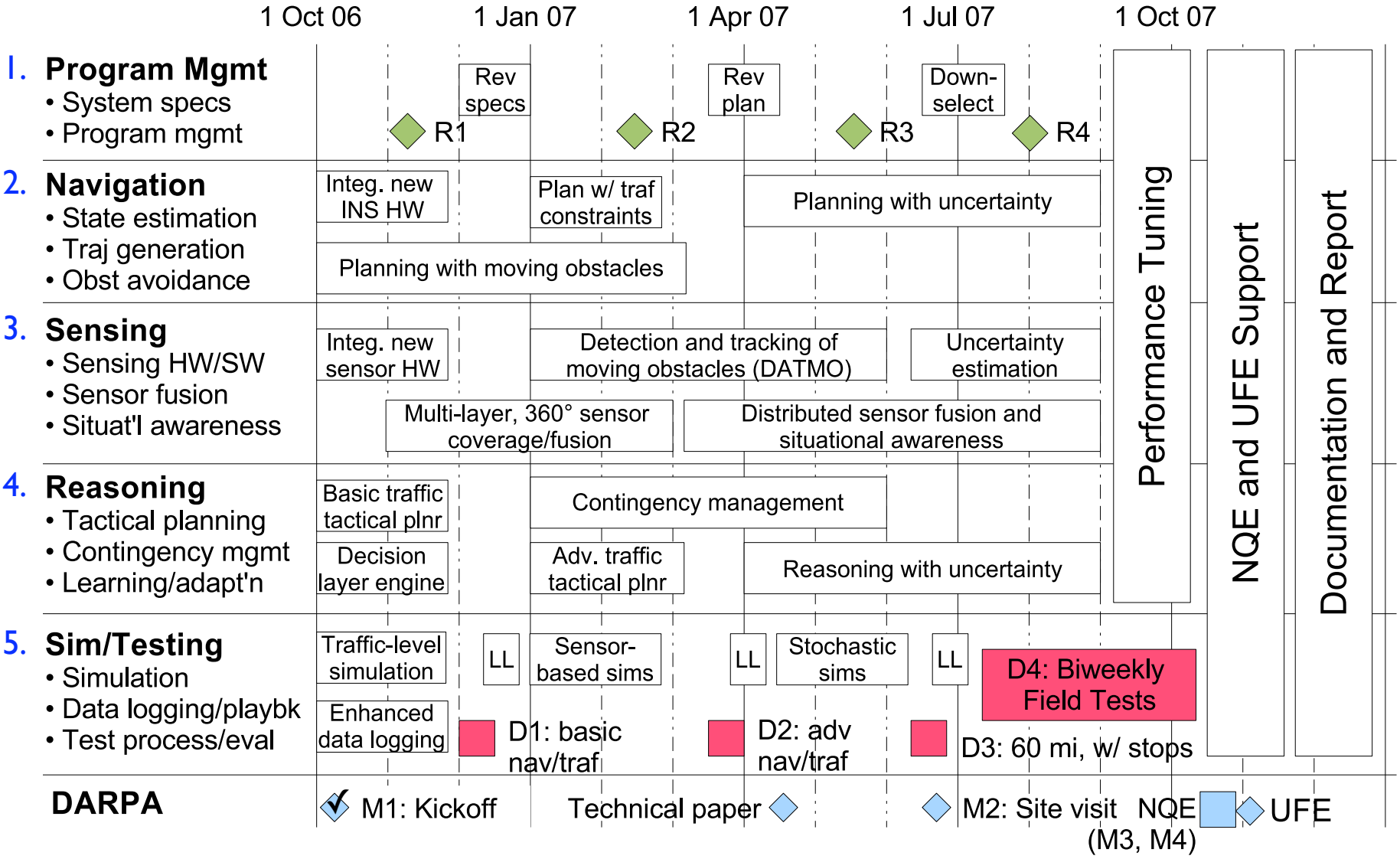
RACE (3 NOV 07)

Sr Theses

Graduate Research

JPL/NGC + additional partners

Project Timeline



Technology Readiness Levels

TRL	Description	Entry Criteria
1	**Technology concept** - Review of literature shows technology concept is available & potentially useful	Documented on wiki or bugzilla
2	**GOTChA chart** has been developed for the project indicating how a given technology might be applied	GOTChA chart posted on wiki
3	**Desktop demo** - demonstration of the key ideas is available via a hardware mockup or MATLAB demo	Preliminary design and demo posted on wiki
4	**Prototype implementation** - documented initial demo of the technology that verifies key objectives	Documented design with external review
5	**Alice demonstration** - demo of the technology on Alice (or using logged data); not yet baseline code	Demonstration on Alice
6	**Reviewed design** - successfully pass design review, including implementation in standard code/hardware base on Alice documention on wiki and doxygen	Pass formal design review
7	**Integrated module** - integrated into standard code/ hardware base; tracked w/ config mgmt process	Build manager/imple-mentation team signoff
8	**Flight tested** - demonstrated in an Integrated Test Team (ITT) sponsored test	Documented performance in ITT test
9	**Race ready** - tested for 100+ hours of operations in a race-like environment.	Documented operation for 100+ hours

- SURF06
- CEM 75ab
- CDS 110+
- EE 148+
- ME 131+
- ...

- CEM 75c
- Indep proj

- Implement ation team
- SURF07

Design Reviews

Purpose

- Provide a mechanism for getting *external feedback* on system/component design
- Provide the team (and project manager) an opportunity to get a view of the entire project

Types of reviews

- Preliminary design review (PDR)
  - Verify that the system under design can proceed to detailed design stage
  - Assess design against system performance specifications
- Critical design review (CDR)
  - Verify that the system can proceed to implementation stage
  - Review of final design for each item in the system, verifying performance against specs
- Peer review/design walkthrough
  - Detailed technical review with small group of technical experts
  - Usually go through details of the design using code/hardware (rather than powerpoint)

- DGC: Implementation review (IR)
  - Use for systems that are being implemented in a *spiral design* cycle (multiple iterations of working systems)
  - Review occurs 4 weeks before field test; review design plans

Review Feedback Mechanisms

Requests for Action (RFAs)

- Allow reviewers to provide specific requests for action by team
- RFAs will be entered into Bugzilla and reported on at the next review
- (Note: this means we have to report out on the ones from last time)

Review Assessments

- Allow reviewers to assess each component of team presentations
- Forms will be provided to team at end of the review
- Will be used to determine team grade; see Wiki for example

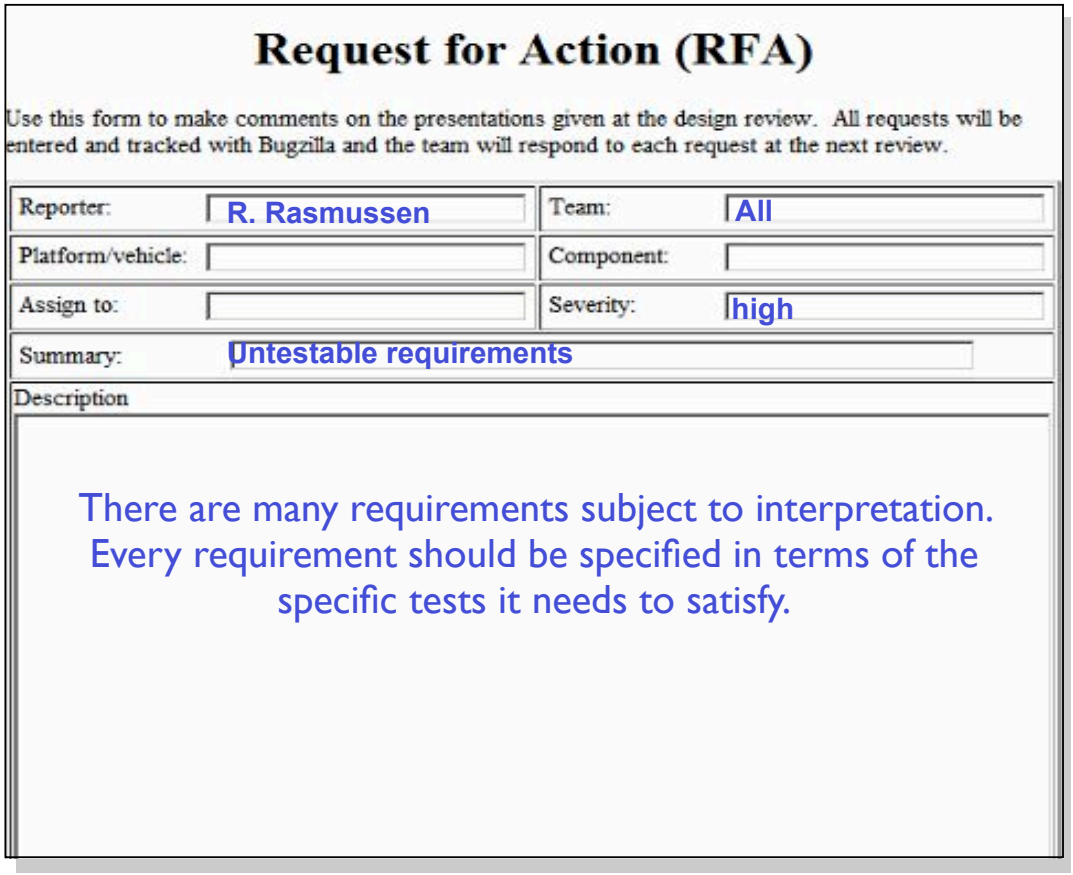
Questions and discussion during review

- One of the most useful forms of feedback and interaction
- Need to be careful to schedule time for questions and discussion during the review
- General rule: schedule presentations for 2/3 of the time alloted to allow for Q&A

Review team caucus and feedback

- Review team to collect thoughts and provide overall guidance/feedback

Request for Action (RFA)



Request for Action (RFA)

Use this form to make comments on the presentations given at the design review. All requests will be entered and tracked with Bugzilla and the team will respond to each request at the next review.

Reporter:	R. Rasmussen	Team:	All
Platform/vehicle:		Component:	
Assign to:		Severity:	high
Summary:	Untestable requirements		

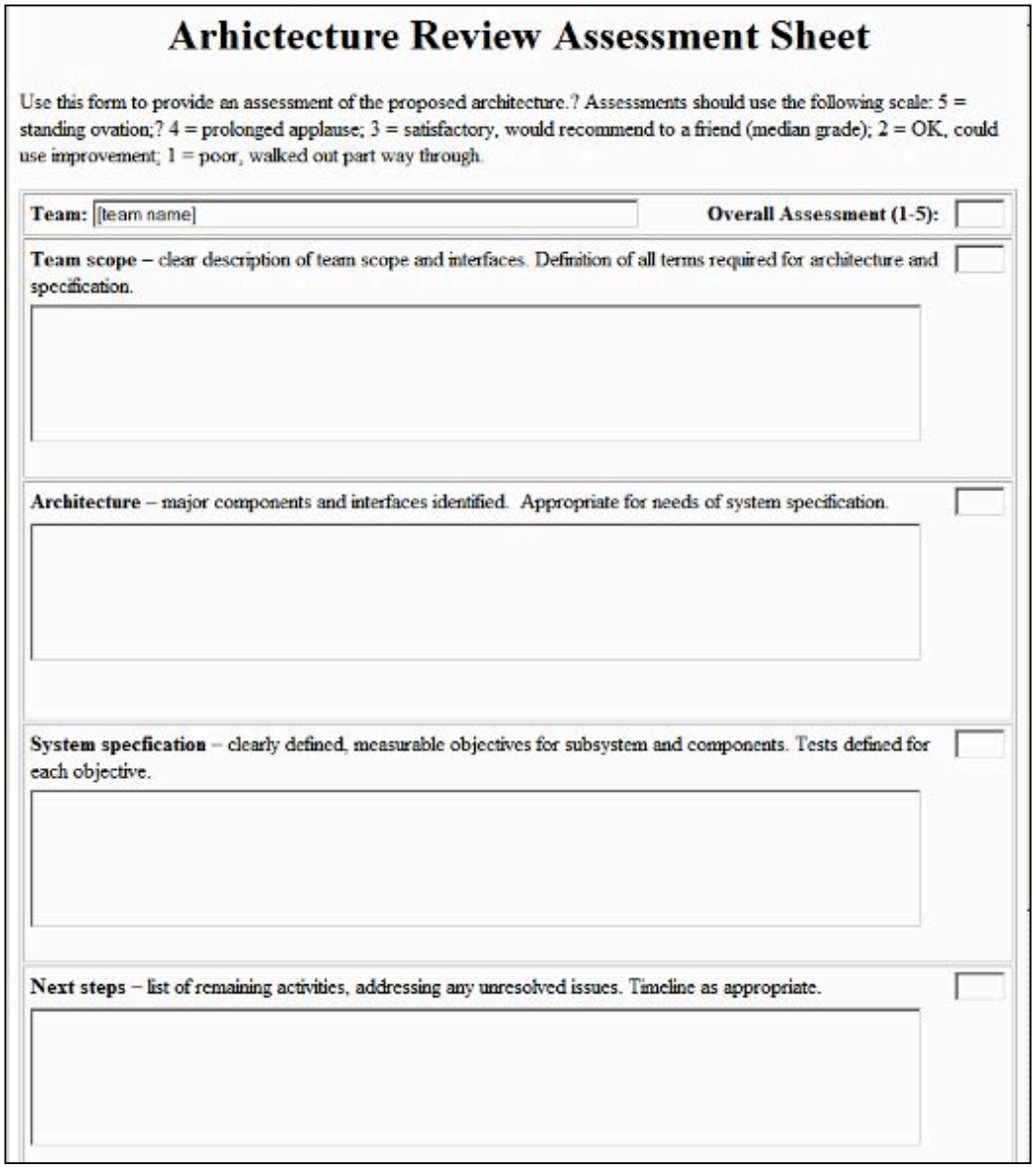
Description

There are many requirements subject to interpretation. Every requirement should be specified in terms of the specific tests it needs to satisfy.

Usage

- Allow reviewers to provide specific requests for action by team
- RFAs will be entered into Bugzilla and reported on at the next review
- Entry is responsibility of the team making the presenta-tion (will form part of the 'documentation' score for the course grade).

Review Assessment Sheet



Arhictecture Review Assessment Sheet

Use this form to provide an assessment of the proposed architecture.? Assessments should use the following scale: 5 = standing ovation;? 4 = prolonged applause; 3 = satisfactory, would recommend to a friend (median grade); 2 = OK, could use improvement; 1 = poor, walked out part way through.

Team: [team name] **Overall Assessment (1-5):**

Team scope – clear description of team scope and interfaces. Definition of all terms required for architecture and specification.

Architecture – major components and interfaces identified. Appropriate for needs of system specification.

System specfication – clearly defined, measurable objectives for subsystem and components. Tests defined for each objective.

Next steps – list of remaining activities, addressing any unresolved issues. Timeline as appropriate.

Usage

- Allow reviewers to assess each component of team presentations
- Forms will be provided to team at end of the review
- Will be used to determine team grade for review

Team Caltech Review Schedule

Implementation Review: 15 Nov 06

- Presentation by implementation team, focused on 11-12 Dec field test
- CS/EE/ME 75 students invited to attend any part; will provide review of project

Fall 2006: Team presentations

- Week 7-10: presentations by teams on current activities
  - 8 Nov: operations
  - 15 Nov: navigation
  - 22 Nov: sensing
  - 29 Nov: mission
- Will serve as a quasi-PDR for fall term; plan to use RFAs plus review assessment sheets
- Will serve as mechanism for team presentation grade (20%)

Winter 2007 PDR + Implementation Review: Feb 07

- Presentation by individual project teams working on TRL 4 (prototype implementation)
- Implementation team will also present review in preparation for Mar 07 field test

Winter 2007 CDR: Mar 07

- Presentation by individual project teams working on TRL 6 (reviewed design)