DGC 120 Planning team meeting - Week 1

Planning team:

- Thyago Consort (thyago@cds)
- Adam Craig (craig@its)
- Jeremy Gillula (jeremy@its)
- Sue Ann Hong (sueh@its)
- Haomiao (H) Hong (haomiao@its)
- Alan Somers (somers@its)
- Mike Thielman (thielman@yahoo.com)
- Rocky Velez (rocky@its)

TA:

- Lars Cremean (lars@cds)

Other support:

- Kristo Kriechbaum (grad. student of Joel Burdick), 10+ hrs./wk.
- Luis Goncalves (Evolution Robotics, fmr. Grad student), 10 hrs./wk.
- Les White (JPL), 10 hrs./wk. (shared w/ embedded systems)
- ?? NGC, Evolution, JPL, Caltech

Meeting Goals and Agenda

Goals:

- ☒ Bring all up to date on current status of planning team
- ☒ Plan out the term in order to meet project objectives, using standardized tools for project engineering (GOTChA chart, timeline, stoplight chart, task lists)
- ☒ Subteam decomposition of planning objectives, goals
- ☒ Review available resources

Agenda:

8:00 Meeting goals, agenda
8:05 Team GOTChA chart
8:20 Team timeline
8:35 Team status, stoplight chart
8:50 Review of resources
9:00 Subteam composition and scope
9:20 Action items
9:30 Adjourn

Goals

- ☒ Design, document and build a system to compete in the 2004 DARPA Grand Challenge (DGC)
- ☒ Be the first team to complete the DGC course in 10 hours or less.

Objectives

- ☒ 10 mph on desert roads in good driving conditions (IGC)
- ☒ 5 mph on trails IGC
- ☒ 5 mph across open terrain IGC
- ☒ Ability to detect and avoid obstacles of height > 0.5 m, radius 0.25m at 10 mph
- ☒ Ability to suffer at least one computer failure and continue operating

DGC 120 Planning team GOTChA chart

Goals

- ☒ Effectively, quickly, safely and autonomously command the vehicle across ~210 mi. of DGC course
- ☒Guaranteed confinement to course corridor, defined by waypoints and in the time required
- ☒ " " through the QID course

Objectives

- ☒Average 21 mph autonomously over ten hours over { A, B, C} type of terrain (A,B,C TBD)
- ☒Similar objectives for different speeds, driving conditions (enumerated)
- ☒Ability to accurately detect obstacles under various driving conditions
- ☒10 mph on desert roads in good driving conditions (IGC)
- ☒5 mph on trails IGC
- ☒5 mph across open terrain IGC
- ☒Ability to detect and avoid obstacles of height > 0.5 m, radius 0.25m at 10 mph
- ☒Ability to suffer at least one computer failure and continue operating

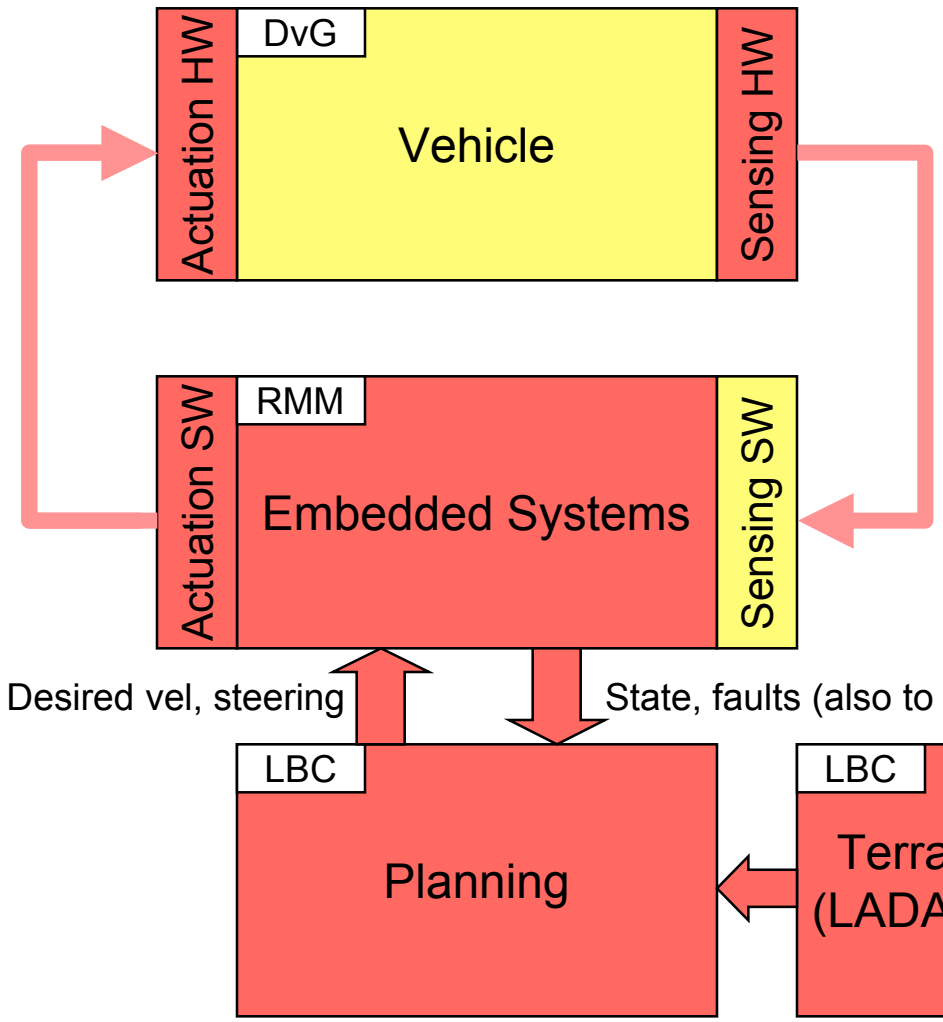
Technical Challenges

- ☒Not crashing
- ☒Avoiding other competitors
- ☒Properly navigating water
- ☒Terrain classification and proper response
- ☒Managing "dead end" scenarios
- ☒Effective response to fault information from emb. sys.
- ☒Robust software capability of running indefinitely without segfaults, runtime errors, memory leaks

Approach

- ☒Vision and LADAR based sensing
- ☒Arbiter-based driving framework to handle multiple sensory inputs
- ☒Integration of software with portable MTA-based embedded system design
- ☒Use of a priori known information (static maps) about course for navigation

Project Structure (Status Chart)

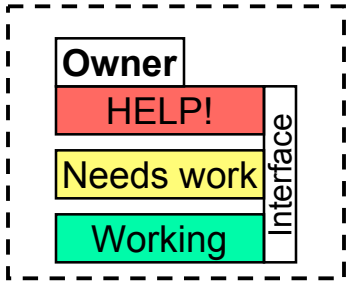


Divide work into 3 teams

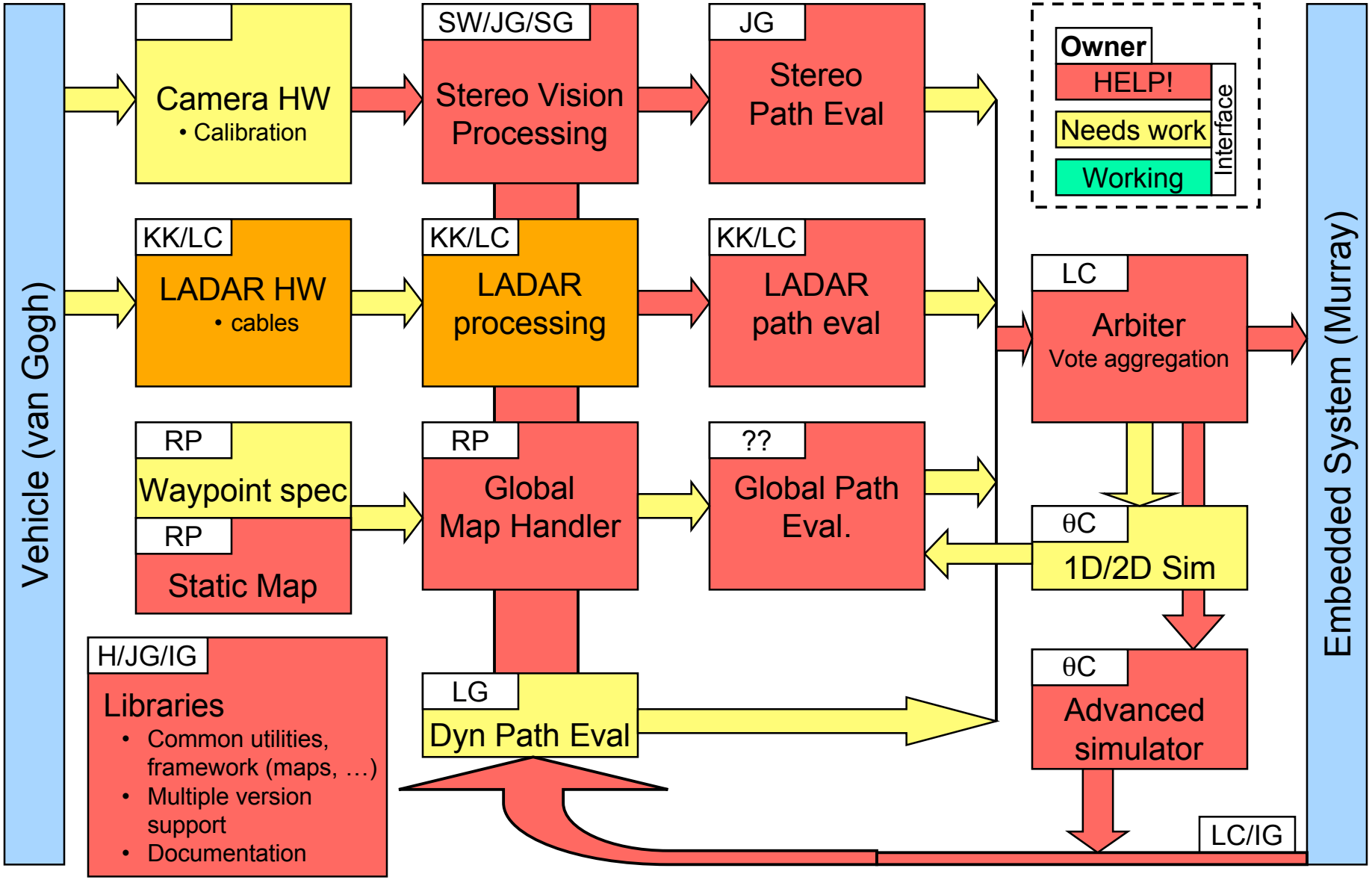
- ☒Vehicles
- ☒Embedded Systems
- ☒Planning (incl. terrain sensing)

Define interfaces between teams

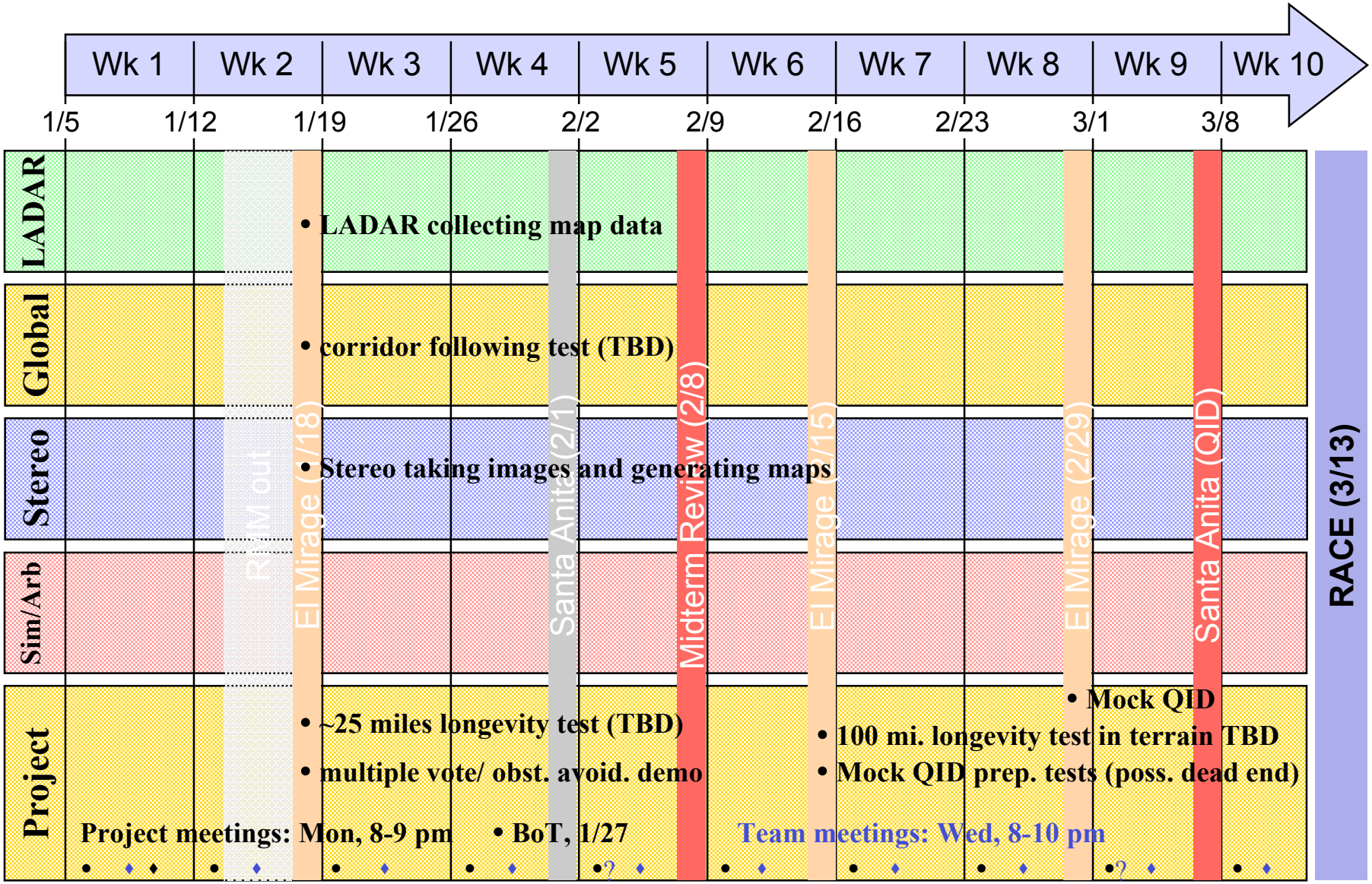
- ☒Make sure that nothing falls between the cracks



DGC 120 Planning team status chart



Planning Team Timeline



Planning: Subteam Composition

LADAR Team (MT, KK)

- ☒ Integration of LADAR hardware
- ☒ Robust terrain map generation
- ☒ Map path evaluation and vote generation

Stereovision Team (JG, HH)

- ☒ Integration and calibration of multiple sets of Firewire stereovision cameras
- ☒ Integration of purchased stereovision software from Videre systems
- ☒ Generation of terrain maps from range maps
- ☒ Map path evaluation and vote generation

Global Team (AS, RV, LW)

- ☒ Code for processing waypoint route data definition file (RDDF)
- ☒ Generation and processing of static (a priori) maps for use during race
- ☒ Efficient navigation of route corridor, with guarantee of staying in-bounds
- ☒ Map path evaluation and vote generation

Planning Systems Team (SAH, AC, ΘC)

- ☒ Development and documentation of reusable map classes, with data logging capability
- ☒ Development of simulation environment for testing and debugging code, as needed
- ☒ Testing and refining of arbiter algorithms for combining votes, guidelines for voters
- ☒ Testing and development of dynamic feasibility evaluator (DFE)
- ☒ Develop visualization tools for debugging, as needed

Comment and remarks

- ☒ Need to get people aligned with where the most work needs to be done

Project meetings M 8-9pm, 139 Moore

Team meetings W 8-9:30pm, 139 Moore

- ☒ Condensed subteam status updates
- ☒ Brief timeline review
- ☒ Issues to resolve
- ☒ Action items

Optional Sat. ~noon, pizza in shop (Guggenheim)

Planning Team Resources

Resources:

- ☒ CVS: concurrent versioning system, history of code development and effective way to manage code revisions
  - core code in team/ module
- ☒ Core test code:
  - team/tests/WaypointNav/ <-- new tests program, utilizes MTA, vstate, vdrive
  - team/tests/waypointnav/ <-- old but retains some functionality not yet ported
- ☒ Web resources: Toolkits, code standards, libraries, etc.
- ☒ CDS Wiki page, for creating and adding project documentation (historical and functional)
- ☒ Maybe: Bugzilla or Mantis - bug (and general task) tracking software, configurable, sortable
- ☒ Doxygen: Automatic documentation generator from code comments

Action items:

- Get account on grandchallenge, if you don't already have one
- Learn basic CVS usage
- Become familiar with compiling code within CVS framework

Best practices - documentation:

- Develop within CVS. 'cvs update' when you begin working and 'cvs commit' when you finish. Write informative commit messages.
- TEST your code before committing (for compile errors, runtime errors, bugs)
- Create README files in directories that indicate author, file structure and instructions for compiling and usage
- Comment the top of each file with author, date, functionality information

Planning Subteam Resources

LADAR Team (MT, KK)

- ☒ One new large LADAR (untested), one large broken(?) LADAR unit, one small unit (from Burdick lab)
- ☒ www.sick.de (*limited*) and associated documentation for our LADAR (in the shop)
- ☒ Driver code in team/Ladar/driver_klk and test code in team/Ladar/
- ☒ Developed of LADAR bumper code in team/tests/waypointnav/ladar.cc

Stereovision Team (JG, HH)

- ☒ One pair of mounted and calibrated(!) Firefly firewire cameras (four more on order)
- ☒Small Vision System (SVS, software) from Videre systems (www.videredesign.com)
- ☒ Code in team/stereovision/ (Steve Waydo, waydo@cds) to get pairs of rectified and synchronized images
- ☒ Code by Jeremy Gillula to generate goodness map from elevation data and perform (simple) path evaluation and vote generation

Global Team (AS, RV, LW)

- ☒ Preliminary waypoint specs and waypoint following code in team/WaypointNav/global.cc
- ☒ ArcView and Feature Analyst installed on computer (which?) in lab (07 Moore)
- ☒ Downloaded satellite images (where?)
- ☒ Potentially: altitude laser scan (ALS) data of course route
- ☒ Preliminary corridor following and D* code developed by Rich Petras (NOT in CVS, zip file of latest, minimally documented)

Planning Systems Team (SAH, AC, ΘC)

- ☒ Working arbiter framework in team/tests/WaypointNav/
- ☒ team/LocalMap/ class (fairly well documented)
- ☒ Planar simulation integrated into team/tests/waypointnav (not WaypointNav), written by Thyago Consort
- ☒ visualization-gui/ module in CVS, well documented and written by Dave Benson, built on GTK+ 2.0

Planning Subteam Action Items

ALL Subteams

• Create brief GOTChA chart and timeline consistent with team goals (email text OK) for subteam and send to Lars (lars@cds) - not necessary for HW1, but useful

LADAR Subteam (MT, KK)

☒ Test new LADAR unit, find effective minimum and maximum range, and approximate max. angle of incidence for scan returns

☒ Develop one page "whitepaper" outlining LADAR subsystem parameters (scan resolution, number of scanpoints, mount angle, range, …) and performance estimates (terrain map resolution)

Stereovision Subteam (JG, HH)

☒ Test out Steve Waydo's code with camera HW and iridium(?) to get images from camera pair

☒ Install and configure SVS on firewire computer, run test programs and get sample output

☒ Outline plan for integrating existing goodness map/ path evaluation code and generate preliminary schedule for integration

Global Subteam (AS, RV, LW)

☒ Review code for waypoint following (brief)

☒ Find ArcView and Feature Analyst, find out capabilities and evaluate whether they are useful

☒ Hunt down downloaded satellite images

☒ Send email to Lars to get tgz file of RP code (not in CVS), and spend a short amount of time trying to understand its functionality. Send email to Rich Petras (petras@helios.jpl.nasa.gov) requesting documentation

☒ Request ALS whitepaper and emails from Dave or Lars

Planning Systems Subteam (SAH, AC, ΘC)

☒ Outline plan for creating reusable map class

☒ Test waypointnav/WaypointNav in simulation and track down scaling bugs

☒ Demonstrate effective use of Dave Benson's visualization-gui

Next Project Meeting: Thurs., 8 Jan, 8:30pm