

A collection of military medals and a pair of glasses on a wooden surface. The medals include a red ribbon with a circular emblem, a blue ribbon with a circular emblem, and two silver Maltese crosses with central emblems. A pair of gold-rimmed glasses with a thin wire bridge and a small red-tipped antenna-like object are also visible. A circular compass is partially visible in the bottom left corner.

# JG-PP Lead-Free Electronics Soldering Project

Dallas, Texas  
20 June 2001

# Agenda

- ◆ Introductions 8:30 – 9:00
- ◆ Welcome 9:00 – 9:30
- ◆ Logistics 9:30 – 9:45
- ◆ Break 9:45 – 10:00
- ◆ TI Commercial View of Pb-Free Components/Future 10:00 – 10:30
- ◆ JG-PP Process Overview 10:30 – 11:00
- ◆ Objectives of the Meeting 11:00 – 12:00
- ◆ Lunch 12:00 – 12:30
- ◆ Objectives of Meeting 12:30 – 2:30
- ◆ Break 2:30 – 2:45
- ◆ Objectives of Meeting 2:45 – 4:00
- ◆ Review Deliverables 4:00 – 5:00

# Introductions

- ◆ Who
- ◆ Affiliation
- ◆ Background
- ◆ Interest in this project

A collection of military medals and a pair of glasses on a wooden surface. The medals include a red ribbon with a circular emblem, a blue ribbon with a circular emblem, and two large silver Maltese crosses with central emblems. A pair of gold-rimmed glasses with thin temples is also visible. The items are arranged on a wooden surface with a blue border.

Welcome

Jim Marischen

Director, ES Texas Engineering  
Raytheon Company

# Logistics

- ◆ Scheduled length of meeting
- ◆ Facilities issues
- ◆ Lunch

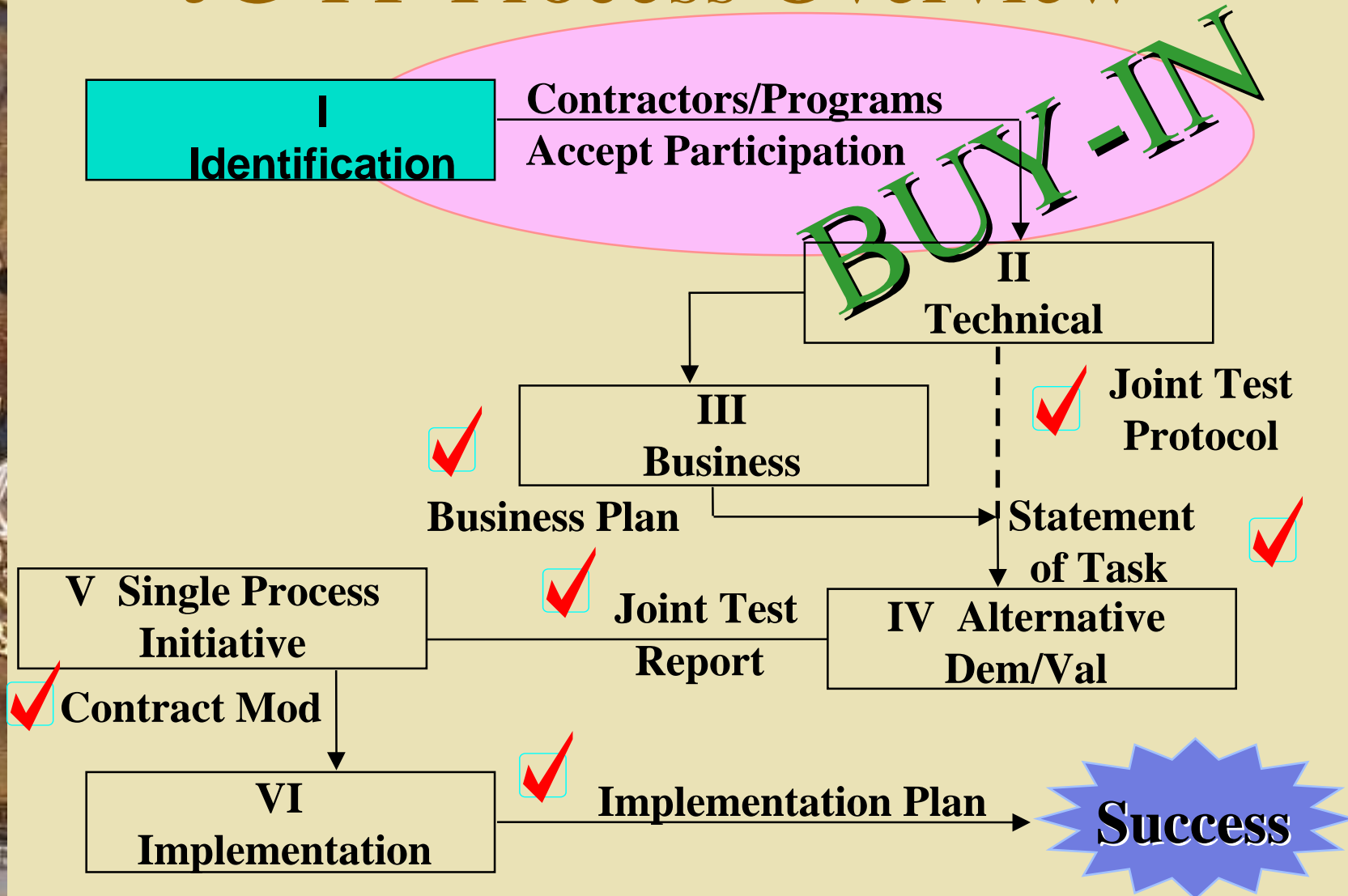


# TI Commercial View of Pb-Free Components/Future

Doug Romm

SLL Packaging  
Process & Materials Development  
Semiconductor Group  
Texas Instruments

# JG-PP Process Overview





# JG-PP Methodology

The validated methodology involves six phases:

- ◆ **Phase I - Identification**
  - Identify participants
  - Identify target hazardous material(s)/process(es)
- ◆ **Phase II - Technical (occurs concurrently with Phase III - Business)**
  - Define performance requirements for specific applications
  - Identify potential alternatives
  - Create the necessary technical products (PAR, JTP) to validate alternatives that are more environmentally acceptable
- ◆ **Phase III - Business (occurs concurrently with Phase II - Technical)**
  - Define funding requirements
  - Identify funding sources
  - Develop business strategy as appropriate



# JG-PP Methodology

- ◆ **Phase IV - Alternative Demonstration/Validation**
  - Perform the required tests
  - Compare test results to performance requirements
  - Determine a technically acceptable alternative and document it in the JTR
- ◆ **Phase V - Single Process Initiative**
  - Initiate a block change to authorize the use of validated alternatives at OEM facilities
- ◆ **Phase VI - Implementation**
  - Implement alternatives in manufacturing and maintenance operations
  - Share technology as widely as possible



# Objectives of Meeting

- ◆ Boundaries
- ◆ Deliverables for EOD 20 June 2001
- ◆ JG-PP Lead-Free Electronics Soldering Project Plan
- ◆ Gather information for Potential Alternatives Report (PAR)
  - Baseline process flow, EHS and economic data on current Sn/Pb electronics soldering both commercial and military
  - Identify potential lead-free solders and test vehicles; compare & contrast
  - Determine ROM cost savings (if any) for each alternative
  - Assign actions and dates to gather information for PAR; their specific performance requirements in terms of tests & acceptance criteria to submit by 13 July.
  - Date to submit PAR to overall stakeholders meeting (Florida meeting)
- ◆ Gather information for Joint Test Protocol (JTP)
  - Decide factors most important in selecting a lead-free solder and test vehicle
  - Determine level of evaluation/tests/results needed to satisfy participants/customers and sell change
- ◆ Discuss major JTP issues



# Boundaries

- ◆ Define/set boundaries
- ◆ Don't try to solve the nuts and bolts problems today
- ◆ This should be a "strategic" meeting, not a tactical meeting
  - Need to identify the level of effort (evaluation/tests/results) needed to satisfy participants/customers
  - Keep in mind "What's Required to Sell the Change" as JTP developed



# Deliverables for EOD 20 June 2001

- ◆ Develop draft "project management plan"
- ◆ Generate PAR format/outline
- ◆ Develop strawman JTP to be distributed to participants by 20 July
- ◆ Date for next meeting/teleconference around 01 August



# JG-PP Lead-Free Electronics Soldering Project Plan

- ◆ Objectives
- ◆ Scope
- ◆ Phases
- ◆ Project Schedule
- ◆ ROM Cost
- ◆ JG-PP Lead-Free Solder Team



# Objective of JG-PP Lead-Free Electronics Soldering Project


## ◆ **Project Objective:**

- Demonstrate/validate capability of alternative lead-free electronics solder alloys and processes to meet performance standards required by affected defense system programs.



# Scope of JG-PP Lead-Free Electronics Soldering Project

- ◆ Demonstration/Validation of Lead-Free Solder Alloys
- ◆ Bulk solder characterization (done by others)?
- ◆ Include depot rework/CRM?
- ◆ Functional board performance?
- ◆ System level performance under power?



# Scope of JG-PP Lead-Free Electronics Soldering Project

## **New Build/New Design (Pb-Free):**

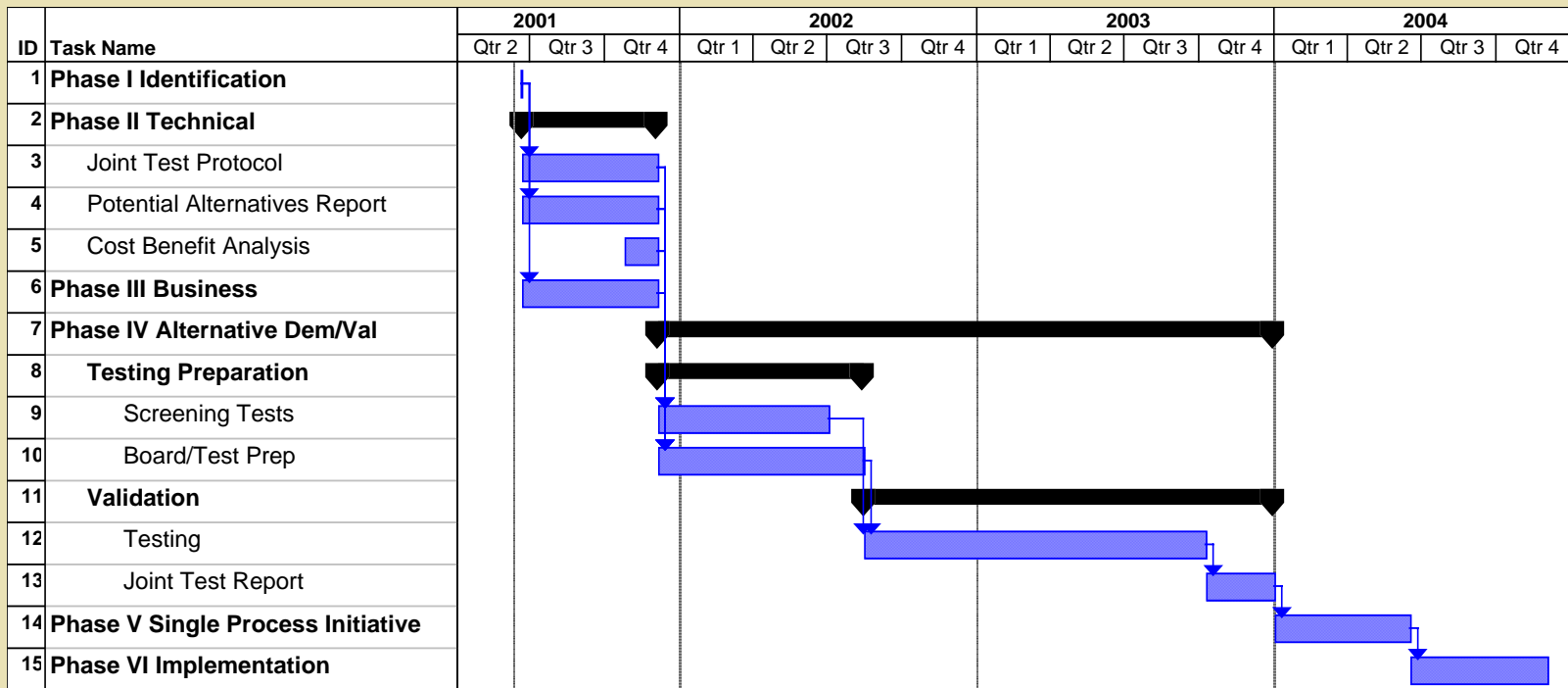
- ◆ {220 +/- 10 C liquidus}-temperature lead-free solders (Bi, Cu?)
- ◆ with {supplier furnished} fluxes
- ◆ applied by {wave, reflow, manual & heat shrink} methods
- ◆ under {manufacturing} conditions
- ◆ to {SMT, TH, Mixed & Interconnects} components
- ◆ with {plastic, ceramic, size} packaging
- ◆ with {lead-free} surface finishes
- ◆ and {150C minimum laminate/Tg} board types
- ◆ with {multi-layer} construction



# Phases of JG-PP Lead-Free Electronics Soldering Project

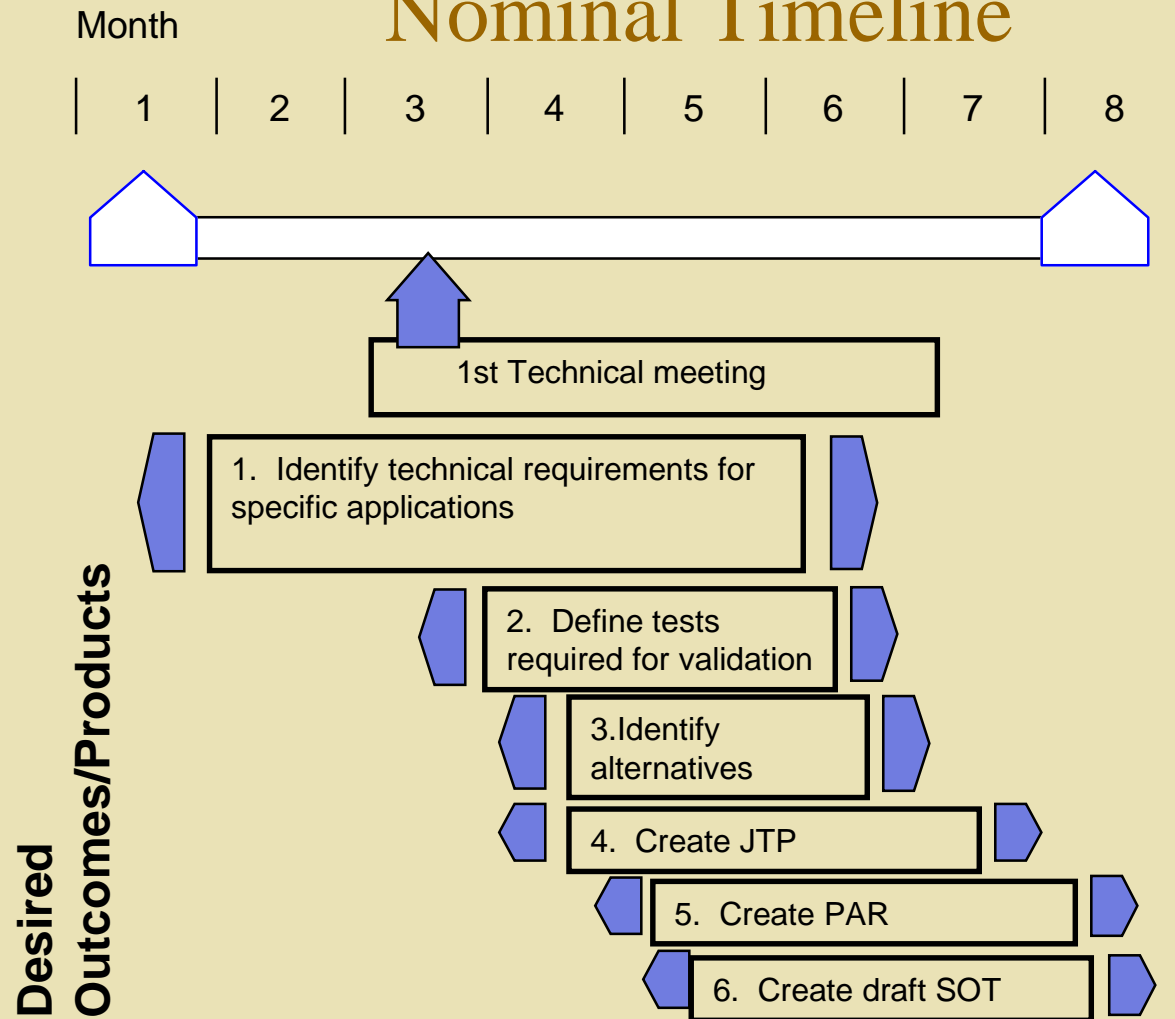
- ◆ Phase I – Identification
- ◆ Phase II – Technical
- ◆ Phase III – Business
- ◆ Phase IV – Alternative Dem/Val
- ◆ Phase V – Single Process Initiative
- ◆ Phase VI – Implementation

# Proposed Project Schedule



# II - Technical Phase

## Nominal Timeline





# Project ROM Cost

- ◆ Alternative Dem/Val \$1.49M
- ◆ JG-PP Oversight/Support \$0.20M
- ◆ Total Funding \$1.69M



# JG-PP Lead-Free Solder Team

- ◆ Identify weapon system customers and their technical expert representatives
  - Invite to next meeting
  - Participation necessary to reach consensus on JTP
- ◆ Identify capabilities/level of participation by project participants
- ◆ Assign actions to gather contact information




# Gather Information for Potential Alternatives Report (PAR)

- ◆ Identify potential lead-free solders and test vehicles; compare & contrast
  - Solder Alloys (Sn/Pb benchmark)
  - Other alternative conductive interconnect media
- ◆ Test Vehicle surface finish
- ◆ Component surface finish(es)
- ◆ Baseline process flow, EHS and economic data on current Sn/Pb electronics soldering both commercial and military
- ◆ Determine ROM cost savings (if any) for each alternative
- ◆ Assign actions and dates to gather information for PAR to submit by 13 July.
- ◆ Goal - Submit PAR at next overall stakeholders meeting



# Gather Information for the Joint Test Protocol (JTP)

- ◆ Decide factors most important in selecting a lead-free solder and test vehicle
- ◆ Determine level of evaluation/tests/results needed to satisfy participants/customers and sell change
- ◆ Identify **TRULY NECESSARY** performance requirements for electronics soldering
- ◆ Agreement/consensus on Specifications/use conditions
  - Discuss each program's performance requirements
  - Delineate common requirements and unique requirements
- ◆ Assign actions and dates to gather their specific performance requirements in terms of tests & acceptance criteria to submit by 13 July



# Major Issues for the Lead-Free Electronics Soldering Project

- ◆ Identify scope/approach of other projects (NEMI, CALC, ITRI, Sandia, NIST, NCMS, etc.)
  - minimize duplication
- ◆ ROM cost savings/benefit analysis
- ◆ Test vehicle
  - new design
  - modified existing design
  - etc.
- ◆ Testing
  - Functional
  - Continuity
  - etc.
- ◆ Test Environments
  - Temp shock
  - Temp cycle
  - Vibration
  - Combination environments
  - Mechanical shock
- ◆ Test equipment/availability
- ◆ Test component types (TH, SMT, etc.)
- ◆ Number and types of alloys to be tested
- ◆ Pass/Fail criteria for each test/evaluation
- ◆ etc.



# Review Deliverables

- ◆ Develop draft “project management plan”
  - Define Scope/Objectives of JG-PP Lead-Free Electronics Soldering Project
  - Identify weapon system customers and their technical expert representatives
  - Top-level project schedule
  - ROM cost for testing phase of project by 20 July
- ◆ Develop strawman JTP to be distributed to participants by 20 July
  - Assign actions and dates to gather their specific performance requirements in terms of tests & acceptance criteria to submit by 13 July.
- ◆ Generate PAR format/outline
  - Baseline process flow, EHS and economic data on current Sn/Pb electronics soldering both commercial and military
  - Identify potential lead-free solders and test vehicles; compare & contrast
  - Determine ROM cost savings (if any) for each alternative
  - Assign actions and dates to gather information for PAR; their specific performance requirements in terms of tests & acceptance criteria to submit by 13 July.
  - Date to submit PAR to overall stakeholders meeting (Florida meeting)
- ◆ Date for next meeting/teleconference around 01 August

# Actions

WHAT	WHO	WHEN	COMMENTS
Establish Boundaries	Team	20 June '01	
Define project objective	Team	20 June '01	
Define project scope	Team	20 June '01	
Update project schedule	Team	20 June '01	
Update project ROM	Team	20 June '01	
Identify weapon system customers and their technical expert representatives	Team	13 July '01	
Identify capabilities/level of participation by project participants	Team	13 July '01	
Identify potential lead-free solders for PAR		13 July '01	
Identify potential test vehicles for PAR		13 July '01	
Research test vehicle surface finishes for PAR		13 July '01	
Research component surface finishes for PAR		13 July '01	
Determine ROM cost savings (if any) for each alternative for PAR		13 July '01	
Decide factors most important in selecting a lead-free solder and test vehicle for JTP		20 July '01	
Determine level of evaluation/tests/results needed to satisfy participants/customers and sell change for JTP		20 July '01	
Identify TRULY NECESSARY performance requirements for JTP		20 July '01	
Provide each program's performance requirements for JTP		20 July '01	
Delineate common requirements and unique requirements for JTP		20 July '01	
Identify scope/approach of other projects (NEMI, CALC, ITRI, Sandia, NIST, NCMS, etc.) for JTP		20 July '01	
ROM cost savings/benefit analysis for PAR		13 July '01	
Establish date for next meeting/teleconference around 01 August			

7/5/01

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Dallas - 20 June 2001

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# BACKUP

7/5/01

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# Rules for Brainstorming:

- ◆ Each team member will participate in turn, with one idea per person. If a member does not have an idea, he or she will say, “Pass.”
- ◆ Continue generating ideas until all members say, “Pass.”
- ◆ Accept all ideas at face value. Do not edit, discuss, evaluate, reinforce, criticize, put down, ridicule, or belittle any ideas during initial idea-generating step.
- ◆ Record all ideas.
- ◆ Encourage quantity of ideas; encourage “wild” ideas.
- ◆ Brainstorming should be FUN! Humor is okay!



# Code of Conduct

- ◆ Criticize ideas, not people.
- ◆ LCS
  - **What I like ....**
  - **My concern ....**
  - **I suggest .....**
- ◆ The only stupid question is the one that is not asked.
- ◆ Everyone in the group is responsible for group progress.
- ◆ Be open to the ideas of others