

Project: Investigate the applicability and practicality of training and utilizing distributed cross-disciplinary student teams to provide assurance services* on systems engineering projects

*Systems Assurance practice based on NASA JPL's Product and Process Assurance group (project mentor)

Primary tasks:

- Rapidly educate students on value of SA (SMU, UH)
- Develop SA training modules for use within senior MIS course (UH)
- Pilot using distributed assurance team (UH) on SMU systems engineering projects

What is systems assurance?

Systems Assurance provides independent credentialed information to reduce uncertainty for decisions based on system quality.

Independent: an unbiased perspective (e.g. not the developer or customer)

Credentialed: (1) based on tangible evidence or process, (2) performed by credible/accredited personnel, (3) direct relation to quality uncertainty

Why is assurance needed?

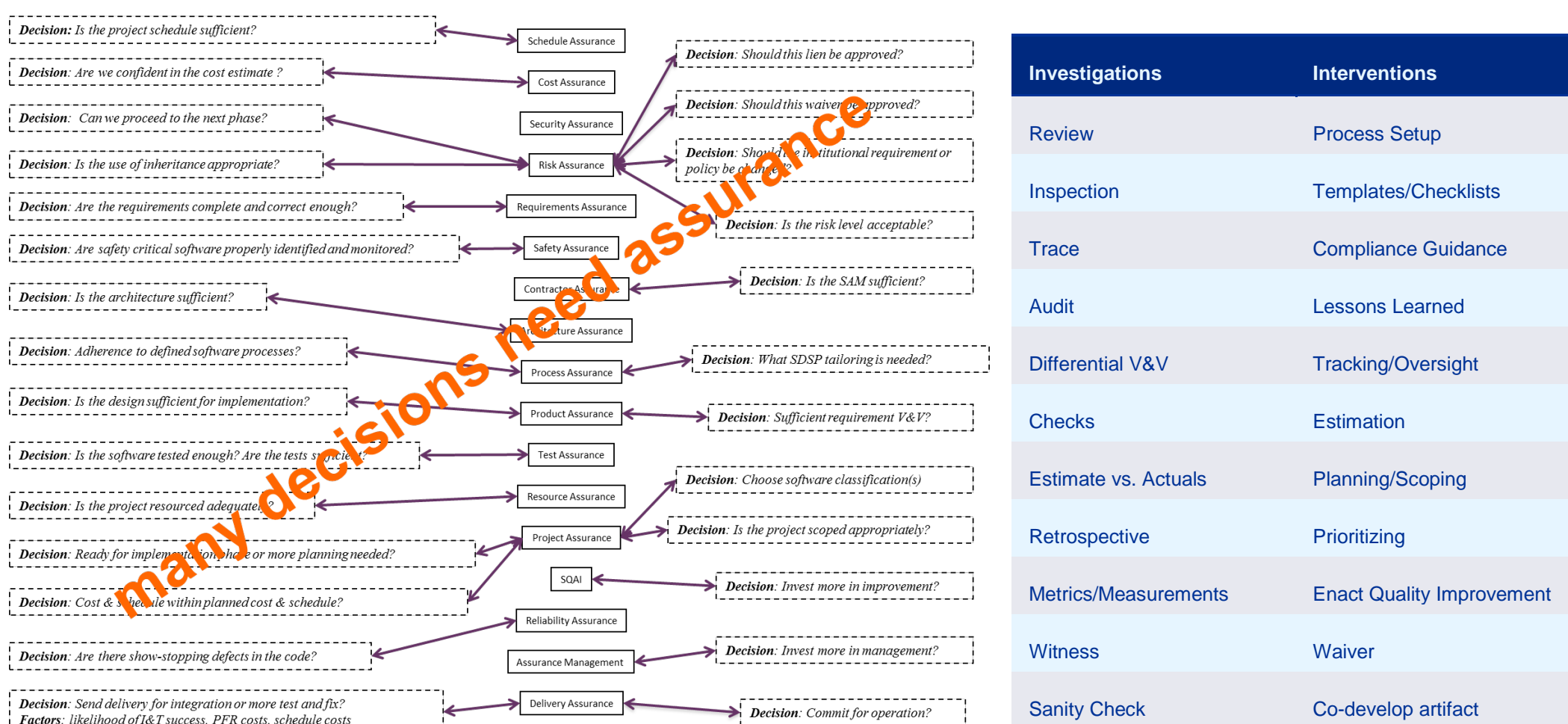
There is always uncertainty about system qualities:

1. people make mistakes
2. no process is perfect
3. budget/schedule/resource constraints and pressures create quality uncertainties

Value of SA comes from reducing the risk of bad decisions due to uncertainty about quality NOT from reducing risk from defects

Assurance risk example: decision to deliver untested/insufficiently tested areas have potential losses due to late rework, unplanned work, and unexpected malfunctions

SA investigations and interventions identify, reduce, and help manage uncertainty in the qualities decisions depend on.



Investigations	Interventions
Review	Process Setup
Inspection	Templates/Checklists
Trace	Compliance Guidance
Audit	Lessons Learned
Differential V&V	Tracking/Oversight
Checks	Estimation
Estimate vs. Actuals	Planning/Scoping
Retrospective	Prioritizing
Metrics/Measurements	Enact Quality Improvement
Witness	Waiver
Sanity Check	Co-develop artifact

Example assurance activities & artifacts

Based on interviews with the SMU developers, DoD customer, and document reviews students selected assurance activities like these ...

Resource Assurance	Requirements Assurance	Process Assurance	Product Assurance	Reliability Assurance
WBS allocation review	Requirements inspection	Assist task manager prepare for reviews	Facilitate code walkthroughs/reviews	Software reliability analysis (complexity, design verification, FMECA, static analysis, model checking, etc.)
resource sufficiency review	Requirements gap/completeness analysis	Review and assess readiness of review documents	PPQA audit	Reliability analysis verification
	Requirements trace verification	PPQA audit	Assess artifacts for rework (build reviews, insufficient Ass, bad code, etc.)	
Schedule Assurance	Requirements verification	provide consulting/experiences while processes are being planned and defined	Independent code or hardware review	Delivery Assurance
WBS scheduling completeness	Requirements review	Writing templates	Product review	Problem report evaluation
schedule risk assessment	Process evaluation	Process evaluation	Running code coverage tools and assessing results	System Delivery Package Evaluation
	Safety Assurance	provide process tailoring suggestions	Product evaluations (RTM, review of other documents like SMPs, RDOs, STPs, STRs, user's guide, OPSCON)	Participate in delivery reviews
Cost Assurance	reliability modeling	writing process documents	Product gap analysis	
Project cost model review	software safety risk analysis	Promoting (sometimes enforcing) institutional requirements		Project Assurance
	SW Safety/ Hazard Analysis Support	provide assistance in writing waivers	Test Assurance	Review/approve SMPs
		requirements compliance verification	Making sure that unit test plans, designs and cases are properly and timely addressed.	Gap Analysis of SMPs
Risk Assurance	system and safety compliance assessment	requirements compliance verification	Ensuring testers are involved throughout the life cycle phases	member of the review board
problem report closure monitoring	Perform system safety analysis	process tailoring review	SW testing plan review	Metrics & trend analysis
risk definition/sufficiency analysis	Review system safety mitigation plans	involvement in process document writing	SW requirements vs. test traceability completeness	System classification assessment
risk management planning and reporting	Verify software safety mitigations	Process gap analysis	SW test plan procedures review	Change review and impact analysis
review assurance plan	Architecture Assurance	system certification	Test plan completeness review	participate in peer reviews
Independent review of risk assessment	Consistency review with respect to system design	process compliance check	Test plan correctness review	Coordinate implementation of peer reviews
Risk assessment (independent)	Component dictionary	SMP/PMSP compliance assessment	test artifact verification	Participate in project milestone reviews
Critical risk gathering		management plan compliance assessment		
Risk monitoring and tracking		Local procedures compliance assessment		
		Problem reporting process assessment		
		CM audits		

Systems Assurance Plan: Micro Expression Facial Motion Recognition
 UH Manoa Systems Assurance Team

Deliverable	Activities	What We Need	Plan to Deliver	Why?	
System Requirements Report	<ul style="list-style-type: none"> Requirements completeness of functional requirements assessment Requirements consistency inspection Requirements ambiguity analysis 	Project Requirements (General & Gesture)	Jan 1-14	Jan 15	To support requirements milestone. Prevent ambiguous requirements from being propagated down the SDLC.
Level of Design Risk Review	<ul style="list-style-type: none"> Design costs analysis Ability to support requirements inspection Design quality analysis 	Design decision, list of costs, List of additional needed equipment	Jan 1-14	Jan 15	Provide confidence in expenditure and under quality design.
Design Feasibility Review	<ul style="list-style-type: none"> Design alternatives analysis Design decision assessment Requirements consistency assessment 	Design decision, alternatives considered	Jan 15-24	Jan 25	To support feasibility of design. Ensure confidence in selected design.
Acceptance Test Plan Report	<ul style="list-style-type: none"> Acceptance Testing analysis Gather possible overlooked tests in accordance of requirements 	Complete list of Tests within the Acceptance Test Plan	Jan 15-24	Jan 25	To ensure all specifications are tested adequately in all possible and important situations.
"Xbox Kinect" Product Risk Assessment	<ul style="list-style-type: none"> Xbox Kinect quality assessment Xbox Kinect ability to meet requirements inspection 	Results, expected results and goals of Tests 3, 4, and 5 and 6 as listed in Design Document.	Jan 26-29	Jan 30	Provide confidence in usage of Xbox Kinect. Verify that Xbox Kinect was the best obvious choice.
Facial Detection Assessment	<ul style="list-style-type: none"> Detection with distance assessment Detection in lighting assessment Unforeseen elements inspections 	Results, expected results and goals of Test 3 and 4 as listed in Design Document	Jan 30- Feb 5	Feb 6	Express confidence levels in facial detection in a variety of different distance and lighting scenarios.
Facial Expression Recognition Assessment	<ul style="list-style-type: none"> Expression Recognition with distance assessment Expression Recognition with lighting assessment Unforeseen elements inspection 	Results, expected results, and goals of Test 5 and 6 as listed in the Design Document	Feb 6- Feb 12	Feb 13	Express confidence levels in the ability to recognize facial expressions according to requirements. Analyze any unforeseen problems.
VBS2 Integration Process Assessment	<ul style="list-style-type: none"> VBS and Xbox Kinect integration assessment Product test inspection 	Results, expected results and goals of Test 8 as listed in Design Document	March 15-24	March 25	To deliver a tested and functional product. Verify integration is as initially required.
User-Installation and Portability Process Assessment	<ul style="list-style-type: none"> VBS integration with VBS process analysis VBS alternatives analysis Xbox Kinect installation process compliance check Portability check 	Results, expected results and goals of Test 1 and 2 as listed in Design Document	April 1-6	April 7	To specify areas of concern. Verify installation process is as initially required. Portability is to the required set-up and take-down time

... to develop assurance plans like these ...

Kinect Design Decision Risk Assurance

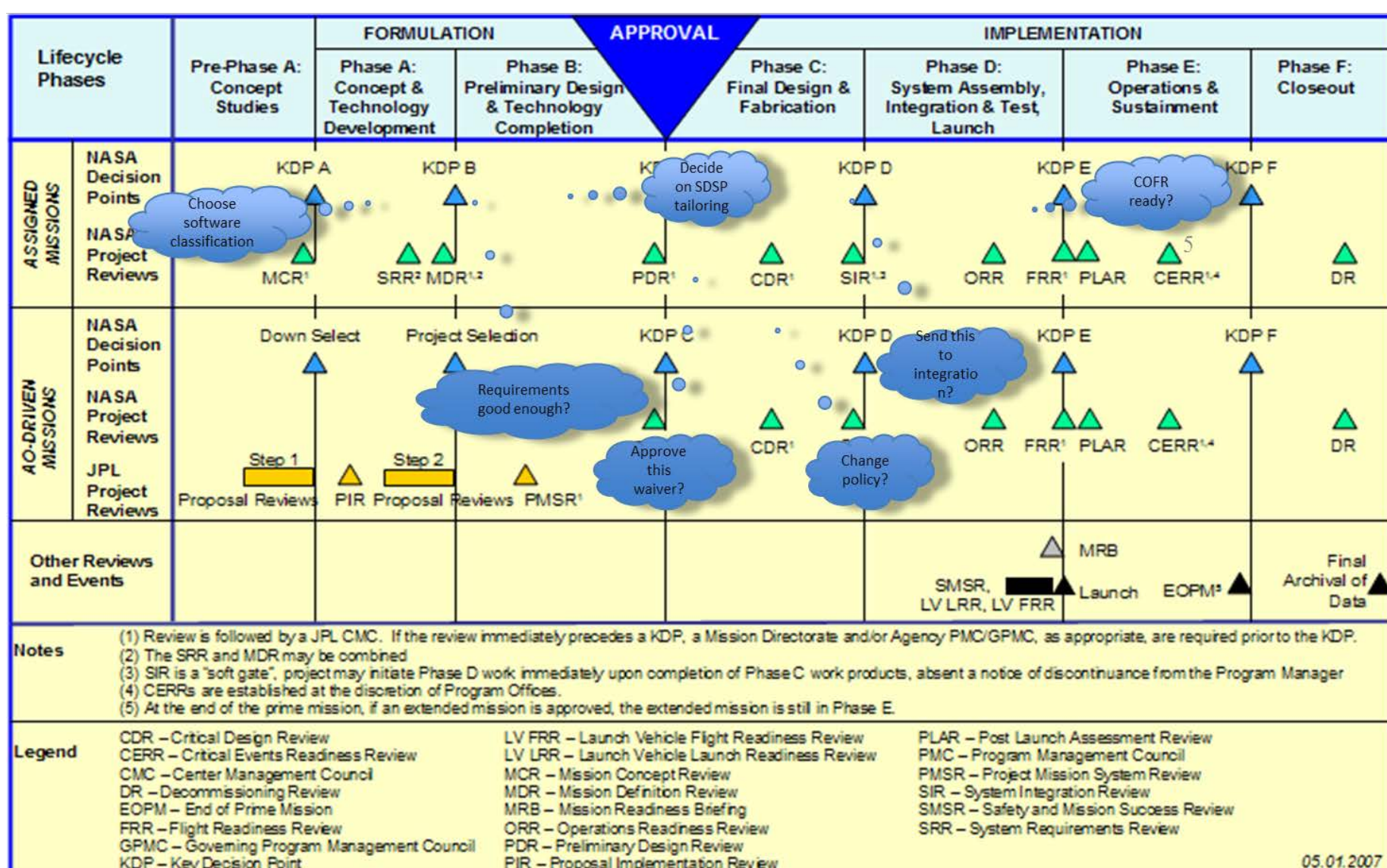
Body Positioning and National Movement of Avatars
Risk Kinect Design Decision: risk assessment seems to be oriented around the decision of using Kinect and does not really account for the alternatives nor give us a good basis to the design decision of using Kinect.

- Risk assessment of Kinect hardware capabilities fulfilling requirements:
 - Focused more on natural hand and arm signals for Kinect avatars
 - **Requirement:** pick up natural motion recognition for one squad leader and display on avatars
 - Addressed in 6.3 and p13
 - Good
 - Addressed in 6.4 and p14
 - The client has confirmed that they received the VBS2 Fusion system, and we need **verification of receipt** so we can remove this from the risk list.
 - **Evolutionary Requirement:** design needs to support multiple person motion capture in the future
 - **Level of Service Requirement:**
 - Interfacing between the Kinect API and VBS2 API
 - Addressed in 6.1 paragraph 1 and 10 of document
 - Identified interfacing components in VBS2 API is good (finding of DLL)
 - Unclear on whether DLL is a Kinect-specific
 - Will scripting language be used for the DLL to program? This is confusing.
 - Interfacing DLL with Kinect appears to be an issue for consideration
 - High uncertainty regarding the actual interfacing of Kinect through this DLL or VBS2 Fusion system
 - How much time would it take for learning curve of VBS2 ASI?
 - What is an alternative if this does not "prove viable"?
 - How will they demonstrate that it is a viable solution or not? What activities will be taken to understand the viability of this?
 - There are tasks scheduled such as Test IDE Gesture Recognition that seem to address this but they are not clearly traced to the particular risk concerns.
 - Addressed in Risk management plan item 10
 - Good that they defined a contingency plan if they do not find a solution
 - In tasks schedule, it is unclear how the tasks map to the risk management items. Map these out.

... and deliver assurance artifacts ("credentials") like these to:

- Help identify critical project decisions and decision points
- Help prepare developers for reviews (e.g. preliminary design)
- Inspect artifacts and documents (e.g. test plan)
- Perform process/product compliance audits
- Perform trace verifications (e.g. requirements coverage to test)
- Evaluate and prioritize problem/defect reports
- Participate in delivery certification
- Monitor problem closure
- Perform independent risk assessments
- Other duties that pertain to reducing uncertainty for critical decisions

Some Important Decisions Within the NASA Systems Engineering Lifecycle



Shilder MIS students were given three 75min training sessions on the above NASA JPL based assurance approach within a systems Applications Programming course