aLIGO SUS Acceptance Test Criteria
E1200844-v1

For a given type of suspension
- Design Document
  - Requirements document
  - Conceptual design documents
  - Final design documents
  - Control system design documents
- Full Mechanical Assembly Package
  - Drawings
  - As-built Solidworks assembly
  - As-built mechanical assembly procedure
  - Installation procedure
- Full electronics drawing package
  - As-built circuit schematics
  - Full signal chain electronics layout (wiring diagram)
  - Full signal chain description (block diagram)
  - Compensation vs. state description
  - Design description
  - Model of circuit which can predict
    - Transfer functions
    - Noise performance in terms of
      - Input and Output referred voltage noise
      - Current noise across coil
      - Force noise on optic
      - Displacement of optic
- Dynamical model, with fully cross-coupled DOFs (as necessary), and representative damping loops
  - Matlab / Mathematica models stored in SVN / DCC
- Dynamical model results package which contains
  - Commonly-asked-for Transfer functions (Matlab, Mathematica)
  - Mode shapes (Mathematica)
  - Predicted residual seismic motion (Matlab, Mathematica)
  - Predicted residual sensor noise (Matlab)
  - Predicted residual actuator noise (Matlab)
  - Predicted maximum range of motion (Matlab / Spreadsheet)
- Testing software package (as automated as possible)
  - Transfer functions
  - ASDs
  - Range
- User's manual

For a single suspension
All analog & digital systems complete as designed
- Full (control) signal chain for all stages in place and confirmed functional as designed
  - Sensor calibration understood/independently confirmed (at least for representative sensors on chain, independently calibrated by… VCO?)
  - Calibrated sensor channels stored in frames
  - range/signs understood (DC range test, compare against range document, signs check out with Sign Table)
  - ASD spectra understood (Spectra compared against sensor noise and

seismic into SUS point)
		- BIO completely functional (TEST/COIL out switch confirmed via ability to drive, frequency response switches confirmed with monitor chassis transfer functions)
		- All possible states of Frequency response of sensor chain and drive chain are confirmed
		- Electronics compensation filters have confirmed compensation to ~5% from DC to several kHz
		- Drive noise performance understood (matches expected noise level), matching expectations compared against requirements in Current, Force, and Displacement (ASDs of NoiseMon's turned "propagated" through models)
		- Undesired cross-coupling characterized / compensated / minimized
			- Technical
				- Sensors
				- Actuators
			- Fundamental / Mechanical
				- Longitudinal to Pitch
				- Others (?)
		- Control hierarchy defined as designed
	- Monitor Chassis
		- Monitor signals with MEDM (yes/no)
		- Noise performance confirmed functional (ASD of all OSEMs on all stage's NoiseMon channels)
		- Calibration understood
		- Calibrated channels in frames (yes/no)

Mechanical TFs (open loop "plant" for locking / damping loops) check out
		- As-installed (Phase 3b) TFs, compared against model and other SUS of same type / assembly level
		- Comparison of "Passed" TF all phases of testing show same results

Structural resonances are at acceptably high frequency
	- As-installed, driven (B&K Hammer & ISI) transfer function confirmation

Damping loops perform as best as possible, as expected from full production model
	- Closed loop gain
	- Open Loop Gain
	- ASDs and RMS motion match predictions given input in
		- L (with cavities if possible)
		- P and Y (with optical levers, if possible)
		- (others if possible)

As-installed Mechanics / Sensors / Actuators / Electronics inventoried
	- Fundamental properties measured
		- Mechanics
			- Optic S/N, associated mechanical properties (mass, radius, thickness)
			- Level of assembly vs. retrofits (flat flags, pitch adjusters, ECD magnets, etc)
			- Overall mass of each stage, as-installed
			- Trim mass distribution
			- Lowest stage characterization (violin mode frequencies; for fibers & ears: metrology)
		- Actuator / Driver
			- Serial numbers

- Coil Resistance / Inductance (of full chain, preferably, but at least once along the phases of testing)
- Driver noise level (as measured on the bench during phase 1a, and from noisemon circuits in situ)
- Frequency Response of Full Chain in all states
- Magnet characteristics

- Sensor
  - Serial numbers
  - Open light voltage / Calibration
  - Sensor noise level
  - Frequency Response of Full Chain
- Other associated Electronics (AA, AI, I/O Chassis, BIO Chassis, etc.)
  - Serial numbers
  - Associated during-assembly test results