Minutes: High-Contrast Performance Budget Kickoff Meeting(s) 28 Nov 2006

Present: Rich Dekany, Mike Liu, Bruce Macintosh 21 Nov 2006

Rich gave an introduction to the performance budget development process being used for NGAO. Described two specific goals: 1) a technical report identifying the key drivers and parametric relationships governing high-contrast performance, and 2) a numerical tool for use in subsequent design work, up to and including NGAO commissioning phase.

A discussion of available tools ensued. Bruce pointed out that there are two distinct classes of numerical tools available:

A) Run full AO simulation for detectable point source at a given radius. This captures the important properties of the AO PSF. Requires extrapolation of a short (1 sec) exposure – many be a problem in modeling static and quasi-static effects.

B) Spreadsheet tool allows breakdown of limiting terms (may be overkill for NGAO, not GPI).

After some thoughtful discussion, we adopted a strategy of developing a new, 'clean' version of the GPI spreadsheet tool for use in NGAO. This will contain fewer error terms than need be tracked for GPI, but may include additional LGS-specific terms (see below). **Action item: Bruce will distribute initial version of new tool by mid-January, to allow feedback/interpretation before Team Meeting #4 on January 22, 2007.**

Specific areas for concern with NGAO high-contrast includes:

How does residual telescope error scale with NGAO number of subapertures and number of control actuators? **Action: None. There is a separate WBS element to look into this.**

Bruce spoke convincingly that some work is needed to understand the best kind of coronagraph/back-end instrument for use with NGAO. Leakage through the coronagraph is one class of error where Bruce is unsure we really understand. Overall, understanding our calibration approach will have a large impact on controlling the high-contrast error budget. **Action: Rich will include this in the work scope template for this activity.**

Spatial power spectra of tomography errors are an important output of simulations for high-contrast. (see below).

LGS aberrations (ala Richard Clare) for semi-static errors is important.

In response to Rich's concern that high-contrast wasn't getting visibility in Claire's science requirements process, Mike commented that it was time to refine the science case upward from the 'cartoon' level and establish a more specific set of science requirements.

Action: Mike will review SRD Release 1
Action: Mike will contact Claire directly to ensure HC into properly represented in the process.

In terms of responsibilities for this IPT, **Bruce agreed to develop the spreadsheet tool and draft an outline of the technical report; Rich agreed to continue chairing these IPT meetings and running down action items.**

The issue of funding individuals at LLNL was raised. **Action: Rich will discuss with the EC.**

Action: Rich will bring Chris and Ralf up to speed [Done.]

Action: Bruce will be at CARA Dec 8 – 10 – will talk to Chris and Ralf if possible.

We agreed to hold the next High-contrast team meeting on 12/12/06 at 1pm PST.
Action: Rich to announce.

Follow-up telecon 28 Nov 2006 (for IPT members unable to attend 21 Nov)

Present: Chris Neyman, Ralf Flicker, Rich Dekany

We discussed a number of items, several of which relate to corollary WBS work packages.

There was general agreement that the parametric relationship on residual static errors, as a function of correction order, was reasonably well understood. There was similar agreement that the dynamical information on residuals errors was not well understood. The basic problem seems to be that AO telemetry and PCS fast-capture mode data did not particularly agree. (Some of this is due to accelerometers on M2 and M3 not being attached to the optics, but to mechanical supports). Compound this with changes made by the KI vibration reduction effort and potential structural changes wrought by the earthquake and there was little confidence in the telescope dynamical behavior.

A number of resources were identified:

> NGWFS telemetry stream at high-speed may provide best-yet measurement of residual telescope errors.
>
> For global tip/tilt, STRAP has good telemetry. Clare was going to look at the closed-loop PSDs, what Marcos called 'synthetic open loop PSD' – what the input disturbance would have been before tip/tilt correction (uses the closed-loop feedback of the new FSM control?) **Action: Chris will touch base w/ Richard & Marcos to gauge their plans for mining the new telemetry database for various diagnostic purposes.** Note, there is 120 hr under 3.1.1.1.2 for dynamic

telescope performance data. This will probably consist of fast data capture from ACS. What is the potential role of new NGWFS telemetry for local segment tip/tilt information?

We also discussed ways of better interpreting/calibrating the telemetry stream:

Peter Tuthill has described a technique based on non-redundant aperture closure phases to calibrate AO telemetry**. Action: Rich will revisit calibration issue re: PHARO. – is this a possible SURF project?** Could this be useful for dynamical studies of M1?

In response to issue of residual tomography error power spectrum (raised by Bruce):

Ralf says it may be possible to extract the power spectrum of residual wavefront errors (up to the DM cutoff limit – a constraint of his fast simulation approach).

Chris points out that Tokovinin and Viard describe the filter function by which Kolmogorov gets colored (spatially) in the formation of Tomography error. This is done for NGS; they also show that the filter functions become very complication.

Action: Ralf & Chris will rev up their Tokovinin codes to investigate the spatial power spectrum of residual tomography error. It may not be a strong function of the specific asterism; we'll try this for asterism 8a (could be quincunx).

Input from the static and dynamic telescope error study should be formatted for input to Bruce's spreadsheet. (Some early indication of the spatial frequency bins that Bruce uses.) **Action: Rich will ask Bruce for a heads-up on the interface.**

Additional discussion was had on the issue of laser-specific AO issues, such as the calibration drift as the LGS varies in the HO WFS subaperture. Calibration will be a big issue for NGAO HC observations. Some open questions:

Are there differences in the impact of scintillation in an LGS HO WFS than in an NGS HO WFS?

How important is the difference in measuring the wavefront tip/tilt in LGS mode? What about spatial filtering – the NGS assumption is always to use a tight filter; is this workable/useful with LGS?

Action: Chris will contact Lisa Poyneer (or Bruce) to identify which are the key LGS-specific issues that may be ignored by GPI.

Next meeting on 12/12 at 1pm was endorsed.