Responses to many of Jim Lyke's comments.
SMA 4/19/10

A few of the comments on zero points and the like were address by the papers on background and sensitivity posted on the review page.

There is not a satisfactory explanation on why neither NIRC2 nor OSIRIS can be reused for NGAO.

Although this topic is not within the scope of this review, it is an issue that was resolved some time ago.

The NGAO project did carefully consider the possibility of reusing one of the existing instruments.

At the build to cost review the project presented its cost related decisions. One of these was to not spend the money to upgrade OSIRIS. The NGAO project concluded that since OSIRIS was being moved to Keck I, and that LGS facility would continue to operate through the commissioning of NGAO and beyond, OSIRIS was the right instrument to leave on that facility. This is even truer if we can accomplish the grating upgrade, and perhaps a detector upgrade.

The NGAO design constraints included feeding more than one fixed instrument and other considerations that required a long distance to the output focal plane, necessitating an AO relay with a slower f-number than f/15. OSIRIS and NIRC2 are designed for f/15 focal planes.

With regards to reuse of NIRC2, this was also considered, but the extent of the modifications required would essentially make it a new instrument. In 2009 dollars the cost of building NIRC2 was estimated to be at least $8M. The age of NIRC2 and the obsolescence of key systems make it unlikely that it can provide another 10+ years of reliable operation. Experience indicates that there will be significant risks to reliability if extensive modifications are made to NIRC2 without a more general refurbishment. The needed modifications would include replacing the camera optics to eliminate the problems with distortion, replacing its detector and most of the electronics, and other modifications to make it suitable for use with NGAO. This does not include to problem of adapting it to the new plate scale. Very little of the original NIRC2 would remain, particularly because some features are simply not required for NGAO.

Figure 1 seriously understates the performance of K2 LGSAO.

The curve shown in the figure is based on a wavefront error of 400 nm. KAON-461 states that LGS mode on the Keck II AO system has a measured performance of 378 nm with a 10 magnitude NGS, and 557 nm with an 18^{th} magnitude NGS.

What assurances do we have that optics can be made to these exacting conditions?

See section 6.4.4.1 in the report. Information on optical manufacturing tolerances has been obtained from vendors.

If optics are made to such high tolerance, why would we add a field flattener that increases distortion (pg 33)?

There is a trade off to be given further consideration in this regard.

It seems that (as stated) we will need a method for measuring distortion. If that is available (as on NIRC2), why have such high tolerances on the optics?

It is a question of balancing sources of error and having margin. While the methods applied to NIRC2 do work, they have limitations, partly because the distortion found in the NIRC2 optics is not well behaved.

If we are going to add distortion anyway that will need to be measured and removed, couldn't we have lower tolerance on the optics?

See the previous answer.

What makes a pupil mask rotator unique to DAVINCI as NIRC2 also has one?

This text has been modified in version 1.1 of the report. The statement that it was "unique" refers to the need to have this rotating mask interchange with circular masks of various sizes for the coronagraph mode. The design for this mask system will not be a simple reuse of existing designs.

Grating stability also vital for transforming 2D spectra into 3D datacubes

Yes.

Need to think out high precision encoding--concerns about noise pickup from LVDT and stray light from optical sensors

If optical sensors were to be used the issue of light leakage would have to be addressed. This is part of the baseline requirements for all WMKO instruments.

LVDTs are fine with proper shielding of their drive signals. This does not present an unusual design or implementation risk.

How will DAVINCI interface to KCSF and the NGAO MultiSystem Command Sequencer (MSCS)?

Via the Keck Task Library keyword interface.

What is the concept for the IFS DRP?

It depends on which IFS slicer design is adopted. The hybrid slicer may use an adaptation of the DRP being developed for MOSFIRE. The lenslet slicer will require a DRP based on the heritage of the OSIRIS DRP.

What is the reason for two relays? This seems overly complex. OSIRIS handles its scale changing with a single relay and covers the same range of magnifications.

The hybrid slicer concept requires a larger aperture for the relay output and it was decided that these larger optics should be stationary, so the magnification was divided into two cascaded relays.

Also, there are two sets of three first relays because DAVINCI covers a large wavelength range than OSIRIS.

The optical system is not entirely reflective as there are transmissive filters in the beam. Some refocusing when switching filters may be necessary.

All filters will be the same thickness. There may be a focus shift when going to coronagraph mode if the occulting spots are on a glass substrate.

If the field flattener is introduced, will it not add a color term to focus?

The field flattener may have some wavelength related effects that represent another trade off to be considered when trying to optimize spot size over the field.

Why introduce the field flattener?

The reasons for considering it are stated in the text, it increases the radius over which the images are diffraction limited to the short wavelength cut-off (700 nm) at the expense of increased the barrel distortion.

Figure 15 does not show the "as-built" image quality.

If you mean that the text uses the term “as-built” when the instrument is not built that is true. It was intended to mean the “as currently designed without field flattening” image quality.

Please cite a source for 0.8" median seeing. Morning twilight image quality tests give 0.56" median seeing (see S. Panteleev report)

This will be discussed.