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Reply to Attn of: 925

May 13, 1993

TO: Ed Masuoka
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FROM: John Barker
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SUBJECT: **Computer Sizing for MODIS Calibration-Related Level-1 Processing** from special executive meeting of the MCST Steering Committee on Friday, May 7, 1993 in Bill Barnes Office, Building 22, GSFC

This memo is intended to summarize the conclusions on the computer sizing requirements for the calibration-related parts of the MODIS Level-1 processing which were agreed upon in our MCST Executive Steering Committee Meeting on Friday, May 7th. Those in attendance were: Bill Barnes (Chair), John Barker, Al Fleig, Joann Harnden and Ed Masuoka.

The ROM (rough- order of magnitude) sizing estimate for the Level-1 MODIS Calibration Product is 3 GFLOPS. This includes creation of the Level-2 MODIS Utility Mask Product, which is required for the calibration algorithm. This sizing estimate covers the operational EOSDIS/PGS computer processing requirements for the required at-launch MODIS Products for which MCST is responsible. It does not include either the raw 12-bit Level-0 reformatting to 16-bit uncalibrated unresampled Level-1A Product, or the computer processing necessary to obtain the required pixel-by-pixel geolocation prior to calibration processing. SDST is responsible for those two parts of the Level-1 processing. The estimate also does not include whatever extra processing may be necessary during the two to six month Activation and Evaluation (A & E) Phase of each EOS launch.

The 3 GFLOPS sizing estimate was arrived at with success-based assumptions, and some exception planning for currently expected corrections, for both the instrument performance and the required ground processing algorithm implementations. The instrument-based processing of the on-board calibrator data with other processing will be about 20 MFLOPS. The standard GOES and LANDSAT methods for destriping are assumed to be minimally necessary and will require about 100 MFLOPS on 12-bit MODIS imagery, without masking. The major historical error in the Histogram Equalization Destriping techniques of the 1980-era satellite imagers was due to low-end or high-end saturation which led to

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bias errors in the linear calibration coefficients. A more accurate destriping calibration, which will involve a linear implementation of the masking algorithm will require about 1.5 GFLOPS. A proposed calibration correction that would be new in this generation of imagers is to invert the optical MTF (Modulation Transfer Function) of each instrument in order to reduce the radiometric error of up to 30 % over heterogeneous scenes in order to provide the potential for accurate quantitative at-surface reflectance estimates, rather than quantitative at-satellite radiance. A linear implementation of this MTF inversion will also be about 1.5 GFLOPS for MODIS. If linear approximations were not available for either of these two processes, then the estimate would probably have to be increased by an order of magnitude. However, linear approximations appear to be possible. Once one has committed to an inversion processing step, then the major potential instrument correction for "ghost" imaging can probably be handled, again with a linear approximation, within the 3 GFLOPS estimate.

MCST provided the required "Alpha" delivery of the conceptual design of the MODIS Calibration Algorithm to SDST on February 5th. The "Beta" delivery is scheduled for January, 1994. It will contain specific algorithms on which to base a more accurate sizing estimate. The current ROM estimate represents a collective judgment. It is probably as accurate a sizing estimate as is likely to be worth generating in the absence of specific formulations, which will be available in January, 1994.

John Barker

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