AUTOMATED TELESCOPE BALANCE WEIGHTS

The telescope now has a semiautomatic balancing system. Its purpose is to relieve the mechanical crew of the drudgery of the old manual balancing techniques and to make the telescope a little bit easier to use. The project was coordinated by John Kerr with contributions from Bill Cruise, Charlie Pomaski, Bob Song, and Peter Sydserff.

Once before, during the late 1970's, an attempt was made to automate part of the balancing task, but a faulty electronic circuit, paired with a power failure, could have created a potentially abnormal situation by accidentally driving the vertical weights of the telescope all the way up, making it top-heavy. Luckily, this was discovered during acceptance tests. Because of that incident, all of the computerized balancing of the telescope was postponed and most of the electronic control of the weights was disabled.

The telescope is held in balance by eleven counterweights distributed throughout the structure - four vertical and four horizontal weights above the Cassegrain environment to trim out movement in the declination axis and three weights in the horseshoe to trim out the right ascension axis. The old manual method of balancing involved manually slewing the telescope, one axis at a time, reading the current meters to try and determine the unbalanced torque, and then going up on the telescope to run individual balance weight drive motors for an estimated time period that hopefully positioned the weights to counteract the unbalanced torque. This process was repeated iteratively until the telescope was considered balanced.

With the new balance system, the telescope control computer automates much of the old manual method. Upon issuance of a command at the telescope operator's console, the computer automatically slews the telescope in a given axis, plots the unbalanced torque and prints the suggested position of the weights in kilogram-meters. The operator can then enter a command to move the weights, as a group or individually, to the desired position and monitor their progress on a video screen. The process is still done iteratively, but much time can be saved by allowing so much control from the operator's console. When the user is finished, a hardcopy of the plots and configuration can be obtained to be placed into a binder for future reference.

A new feature of the balance system is on-line storage of the various instrument configurations. Some of the information contained for a specific configuration include balance weight positions and slewing limits. This enhancement will allow the user to preset the balance weights before the slewing and will make the telescope easier to operate because of the automatic slewing limits.

Perhaps in the future, the telescope can be completely balanced by a single command. Most of the pieces are in place already; only the problem of accidentally misplacing the weights remains to be overcome. In the meantime, the improvements in the balancing process have already had an effect by making the telescope quicker to balance and easier to operate.

J. Kerr

TELESCOPE ENCODER SYSTEM IMPROVEMENTS

The encoder subsystems of the Telescope Control System (TCS) are critical to all facets of successful observations. The absolute encoders provide the position reference for pointing the telescope at its target. The incremental encoders provide the feedback element in the tracking servo loop. Over the history of the telescope, the encoders have been one of the major sources of TCS problems. While encoder-related problems have been reduced, they have continued to be a negative factor in TCS reliability. A major effort has been mounted to minimize the problems by increasing encoder reliability and performance.

The microcomputer absolute encoder system was carefully studied to determine the cause of position jumps, or glitches. An error was found in the encoder turns counting algorithm, and has been corrected. New electronic circuit cards have been built by Adtech, an electronics firm in Honolulu, and these correct a few design errors in the original system. At present, the encoder system is providing reliable, glitch-free position information.

The encoders used for the absolute encoder subsystem have 16 bits of resolution. However, to be compatible with the original absolute encoder subsystem, only 15 bits were used. We are currently upgrading encoder electronics cards built by Adtech to take advantage of the additional bit of resolution. When installed, along with some software changes, the pointing resolution of the telescope will be improved by a factor of two. This will provide a resolution of 0.494 arcsecond for HA, and 0.659 for DEC. This increase in resolution should yield some improvements in the pointing model, and should provide better telescope performance for the average user.

The incremental encoders originally supplied with the telescope have been a major source of problems. Over the last two years, a program of scheduled