

TO UPGRADE A TELESCOPE?

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ABSTRACT. The effectiveness of existing telescopes can often be greatly enhanced through upgrading. Two important questions which should be answered in the planning stage are discussed, based on recent experience in upgrading two Lowell Observatory telescopes.

The scientific contributions that result from the use of small telescopes are well-documented in this symposium. With high quantum efficiency, solid-state detector arrays, small telescopes have become faint object instruments, in addition to their more classical regular, time-intensive usage.

Telescopes should operate with a degree of efficiency commensurate with the new instrumentation and demands. Present computer and integrated-circuit technology has made possible their inexpensive upgrading at a level of sophistication previously available only to the larger observatories. New mirror fabrication technology may have a similar effect. But, where does one start?

The first question is to decide whether to maintain, upgrade, or replace the existing telescope. If maintenance has become too expensive, or new capabilities are required, often the only consideration is replacement. However, excluding greater aperture as the primary requirement, upgrading the old telescope can be a viable alternative at a few percent of the replacement cost.

Upgrading may be concerned with any part of the telescope, i.e., optical, mechanical, electro-mechanical, electronics, and building or site. A decision to upgrade must be based on very careful scrutiny of what needs to be improved. If it can be clearly shown that only one or two categories need attention, upgrading may be a good choice.

As an example, a careless decision to upgrade a telescope's drives and control system can be a costly mistake when it is later found that no improvement was gained because the support structure, bearings, or gearing were faulty. It may have been wiser to maintain this telescope at its present capability while acquiring a new one.

If the decision is to upgrade, should the work be done within the organization, by contract with a commercial firm, or through some

combination of these? The recent upgrading of two Lowell telescopes was done within the Observatory because of available expertise. This allowed flexibility in choosing computer and interface electronics compatible with existing equipment; and, since the upgrading was of our design, long-term maintenance and future modifications can easily be managed. Eventual duplication of the improvements on other telescopes at the Observatory also provides a potential savings. Without sufficient in-house expertise, a commercial contract would have been the most satisfactory approach.

Thus, the two questions that should be answered are: Is the area of the proposed upgrading well defined? Is the work to be done commercially? The former question is the most important and is the most difficult to answer. It is often neglected in one's eagerness to cure some obvious problem.