Guest Editorial

Leo Beiser
Consulting Physicist
151-77 28th Avenue
Flushing, New York 11354

Laser Recording and Information Handling
A Special Report—For the Record

It was just a year ago that SPIE published its Proceedings, Volume 53, on Laser Recording and Information Handling, documenting a comprehensive seminar which we are proud to have organized and chaired. Now this special issue of *Optical Engineering*, highlighting the same subject, has inspired the creation of a new group of excellent papers to express substantial advances in our understanding and application of this growing technology. The series begins with a unique compilation of surveys and study data, representing the considerations of several of our prominent specialists in the field. It concludes with some new applications data, taking advantage of the spectral characteristics of laser radiation in direct color image recording and instrumentation. Two Short Communications – on the distinguishable gray level in high-resolution film, and on semiconductor injection lasers – complete our report.

With this special issue, as with others that preceded it, we inspire advancement to new levels of both understanding and activity in this growing field of images and data communications. Thus, we become an organic member of the growth pattern, both disseminating new information and nurturing its utilization. While the community continues to see the potential of lasers in information handling through its eyes and, in part, through our spectacles, we continue to instill a catalytic impetus for further growth. But just where is it heading? Are we creating solutions to problems yet undefined? Perhaps we are. But we belive we are *anticipating* their definition. If issues like these appear to provide only limited coverage of today's problems and provoke questions on the relationship to tomorrow's needs, we have done our job. Tomorrow's applications follow closely behind today's knowledge. We include, here, several knowledgeable viewpoints covering the major ingredients of today's and tomorrow's information transfer systems.

Laser Recording and Information Handling starts with a laser. Thus, we start our report with a pair of papers about the laser, particularly of the gaseous variety, providing a broad appraisal of this basic component. The first paper surveys our vast resources of cw lasers, quantifies them in terms of families of characteristics, and then identifies significant operational and functional parameters which will help one to select a particular laser for a particular task. In the companion paper we have, for the first time, consolidated an authoritative view of laser noise characteristics. This subject was, from the vantage point of this editor, one of the most neglected resources of information for the laser information community. It was, at the same time, the most difficult to have covered properly, for those who appreciated the significance of its requirements were reticent regarding their opportunity to express them adequately. This joint laser coverage is, we believe, to become valuable to the information system designer who is concerned not only with the selection of a light source, but with the ultimate dynamic range and error characteristics of his laser-driven instrument – as determined, first, by the laser itself.

The next paper is an extension of the one which appeared in our 1974 Laser Recording Symposium Proceedings, reviewing for us the critical factors which determine performance of the optical systems of laser scanners. Since lenses which appear before the scanner (in post-objective scan) are relatively easy to design, build, and test, this current paper concentrates on the special family of lenses which appear *after* the scanner (in pre-objective scan). Upon these lenses are delegated the critical job of transforming the angular scan to a flat and linear field, requiring valid operation over a wide-field angle. Several examples of actual designs are discussed and compared.

Continuing with basic operations in laser recording systems, the next subject, scanning, is so fundamental that we are now planning a special SPIE seminar in August, 1976, to cover this principally new technology. In this current special issue, however, we include one scanning discussion which is particularly timely, for it relates to the accuracy characteristics we can expect from galvanometer-type scanners. In view of the increasing demands now being made of this basically simple component, we show that deceptively complex requirements must be met for achieving the precision demanded by some "simple" systems.

Another milestone contribution to this issue organizes our vast resources of recording media, providing, for the first time, extensive tabulations of comparative characteristics of not only the silver halides, but of the photoresists, the photopolymers, the ablative thin films, the photochromics, the chalcogenides, the magneto-optics and the crystalline types. Extensive referencing is provided for this substantive in-house research project, yielding major media characteristics and parameters, all of value to the designer of laser recording and retrieval systems.

Our next paper was contributed by a pioneer member of our community who claims to be retiring from day-to-day involvement in information systems development. Those who know of his dedication to the advancement of this technology simply do not believe it. After your opportunity to read his comprehensive review of the processes and problems common to magnetic tape and optical recording, if you were not already introduced to this author's work, you will join those of us who wish him to continue. The theme of this paper is the need for us to benefit from the commonalty of problems shared between two digital recording technologies. Since magnetic tape recording often exhibits striking

similarities to optical data recording, much is to be gained from our appreciation of the joint problems and their similarity of solution. Here, their individual capabilities and limitations are placed in sharp perspective so that one can benefit from the other.

Expanding on the applications orientations, in the next paper we introduce the considerations of a significant member of the NASA-Goddard image recording team who express the virtues of direct color image recording on large-format color film. Currently, each of four spectral bands is recorded separately, and subsequently printed into a composite through time-consuming color separation processes. The prospect and virtues of direct laser color recording are expressed, anticipating the opportunity to test these characteristics at NASA-Goddard in mid-1976, utilizing a new instrument being specially developed for this task.

The final full-length paper in this series discusses the design and development requirements and characteristics of the particular instrument introduced above, for recording large-format color imagery directly on nine-inch color film. Although many of the problems are similar to those of monochrome recording, a sufficient number is so unique that special consideration needs to be given to their proper resolution in a practical on-line application.

Closing our special series of papers are two Short Communications. The first summarizes a recent research evaluation of the realizability of detecting 64 levels of density within one (10 μm dia.) pixel in high resolution aerial film. The negative conclusion is not only significant from a storage materials viewpoint, but it may lead some of us to reassess the utility of 64-level (or higher) detectivity "at the pixel level." Clearly, according to this report, it was never available heretofore within a single 10 μm pixel, even from our classic high-resolution reconnaissance photography. Can the improved radiometric accuracy of some of our new scanning sensors be driving this apparent need to record multilevel pixels beyond reasonable utility? Finally, we report a special summary on cw semiconductor injection lasers and their recent favorable consideration as the light source for image scanners and recorders. Although currently-available injection lasers might supply substantial coherent radiation at the more actinic (and higher resolution) shorter wavelengths.

This is by no means the last chapter—although it may appear that way in this issue. There will be many more in the future, discussing this fascinating, expanding subject of laser information handling. In summary, we are now at a stage when applications of an advanced technology are materializing and growing. We convey, in this series, authoritative research and development toward useful applications. I sincerely acknowledge the valued contributions of all the authors who extended their already busy schedules to consolidate this material, and convey special gratitude to all the institutions they and we represent for providing guidance and support for this special report—for the record. ⊙