Letters to the Editor

Re: The Lunar Albedo

Dear Sir:

The September, 1965, issue of this *Journal* contains a fascinating description by Leon J. Kosofsky and G. Calvin Broome of the NASA-planned photographic satellite called the Lunar Orbiter. There is, however, a statement near the bottom of the second column on page 777 that has caused this reader some concern. It is stated that "the moon is a very poor reflector, whose normal albedo averages about 7%." The normal albedo is defined by these authors as the ratio of the measured luminance of the moon to that of an ideal white surface when the angles of incidence and emittance are zero. Presumably this means the reflectance toward earth by a surface near the center of the lunar disc when the moon is as close to being full as it can be without being eclipsed. Many astronomical texts and my Fourteenth Edition of the *Encyclopaedia Britannica* state that the albedo of the moon is 7%.

Several years ago, I had occasion to examine Russell's famous discussion[1] "On the Albedo of the Planets and Their Satellites." He adopted Bond's definition[2] and quoted Bond as follows:

> "Let a sphere S be exposed to parallel light. Then its albedo A is the ratio of the whole amount of light reflected from this to the whole amount incident on it."

On the basis of this definition, Russell calculated the albedo of the moon to be 7.3%. Needless to say, anyone who attempts to photograph the moon is not interested in "the whole amount of light reflected" by the moon but only in the amount that is reflected in the direction of the lens of his camera.

Not too long ago, I calculated the normal albedo of the moon in an amateurish sort of way. Using the solar constant and the luminous efficiency of solar radiation outside the earth's atmosphere, I concluded that something like 13.5 lumens of solar radiation impinge on each square centimeter of the lunar surface near the center of the lunar disc when the moon is full (or nearly full). Were this radiation to fall normally on an ideal white surface obeying Lambert's law, the surface would have a luminance of 13.5 lamberts. Now, Sytinskaya[3] averaged 36 determinations of the lunar constant by different authors and reported that the illuminance produced at the top of the earth's atmosphere by the full moon is 3.42×10^{-6} lumens/cm^2. Assuming the moon to subtend a solid angle of 5.74×10^{-5} steradians, it is easily calculated that the average luminance of the full moon is 1.88 lamberts. Inasmuch as it has been observed since the time of Galileo that the full moon is remarkably uniform in luminance from center to limb, the average luminance just calculated can represent the luminance of an area near the center of the lunar disc. The ratio of 1.88 lamberts for the actual moon to the 13.5 lamberts for the assumed white surface leads to a normal albedo of 13.9%.

In a paper by Gehrels et al.,[4] abstracted in *Science Abstracts*, Section A, for April, 1965, the geometric albedo of the moon at 5,400 angstroms was found to be 21%. The authors are reported as stating that the lunar surface was 10–20% brighter in the 1956/59 period than in the period of 1963 November/1964 January. They surmise that the variation is caused by luminescence, which could be expected to vary with the solar cycle.

The principal purpose of this letter is to alert fellow-members of this Society to the fact that the term *albedo* has been defined in many different ways in the astronomical literature and is frequently used without precise specification.

References

1. *Astrophys. J.*, p. 173, April 1916.
2. *Proc. Am. Acad. Arts Sci. 8:* 232, 1861.
3. *Russ. A. J., 34:* 899, 1957.
4. *Astron. J. (USA), 69:* No. 10, 826, Dec. 1964.

October 20, 1965

ARTHUR C. HARDY
15 Kenilworth Rd.
Wellesley, Mass. 02181

Re: Demand for Television Standards

Dear Sir,

Recent developments in the color TV field have pointed up a lack of standardization, which the Society might perhaps take the lead in correcting. I am referring to the various pulse and subcarrier feeds required by such items as live and film cameras, color bar generators, encoders and the like.

For many years now, monochrome equipment has used four standard feeds of Line Drive, Field Drive, Blanking and Sync. Recent equipment has tended to drop the requirement for Drives, but Sync Generators must necessarily produce these pulses for use with existing equipment. In the case of color, subcarrier is additionally required, and sometimes so is an additional gating pulse called Burst Flag. Realizing that this now involves six cables to each piece of equipment in addition to the purely video circuits, efforts have been made to reduce this number. Manufacturer A now does not use Drives, but does use Burst Flag; manufacturer B has eliminated Burst Flag but still uses Drives, and manufacturer C goes along merrily with all six. It would seem that if one company can afford to add the extra circuitry to eliminate some of these pulses, all should be able to. However, there is very much of a "chicken and egg" situation developing, with neither the customers nor suppliers willing to take a firm line.

If both Drives and Burst Flag are discounted, there are still three feeds left: Syncs, Blanking and Subcarrier. The latter, being a pure sine wave, cannot be handled by limiting or regenerating pulse amplifiers, and is usually distributed by video amplifiers. This usually requires that the subcarrier amplitude be restricted to 2 volts peak to peak, in contrast to the 1 or 1.4 volts of composite video and the 4 volts of pulses. The complete installation is therefore somewhat complicated by requiring two types of amplifiers and three different operating levels. Even with only three feeds instead of six, there is a considerable capital investment involved in the selection, routing, switching and distribution of these pulses. Could the number of feeds be further reduced? It should be quite possible to mix Burst with Sync; Blanking might be added also to give a true "color black" signal, but the complexity of the separation circuits might be such that it would be more economical to stick with two feeds: Blanking, and Sync-plus-Burst. An interesting point is that these two signals, mixed to form "color black," are also required as inputs to any vision switcher requiring to fade from color to black. Alternatively, completely new signals might be preferred, such as Sync-plus-continuous subcarrier.

Present subminiature and microcircuits are available to do the necessary sorting out of signals and regeneration of Subcarrier when required. Monochrome units, if affected by the presence of the Burst on the Sync signal, could have a simple tuned circuit trap added at their inputs, or at the inputs to their pulse distribution amplifiers. The use of microcircuits

also tends to answer the question of level to be used for our preferred one or two signals. Since it is somewhat of a problem to handle 4-volt signals with such circuits, it would be advisable to reduce them to 2 volts (similar to present 625-line standards) or perhaps better still to 1 volt for compatibility with video signals.

It might also be pointed out that the reduction of pulse distribution systems to handle at the most two signals means that there is no unnecessary capital investment in equipment that may not be useful in a few years time should one logical development occur, that of having each camera fitted with its own sync generator and only distributing a genlocking signal.

Finally, it has been brought to my attention that a subcommittee of the EIA is in the process of drafting proposed standards for American equipment. Unfortunately these standards will be too late for the current crop of color equipment, but it is to be hoped that both American and International suppliers will take note of any such recommendations and act on them promptly to reduce the confusion outlined above. Perhaps the EIA would also let us all know what it is they are proposing, rather than wait until their Standard is formally issued.

September 24, 1965

Michael W. Barlow
5052 Chestnut Avenue
Pierrefonds
Montreal, Can.

Errata

There have been errors in these *Journals;* March 1965, paper by Arch D. Smith; May 1965 Progress Report; and the June 1965 Education Industry News column.

MARCH

Arch D. Smith, "Engineering photography methods for the Titan II research and development flight program"

On p. 248, the top two pictures are in order but a correction is to be made in titles,

For: **Fig. 11. Break-up of inter-stage portion at top of first stage.**
Fig. 12. Camera in recoverable pod on the outside of the second stage.

Read: **Fig. 11. Camera in recoverable pod on the outside of the second stage.**
Fig. 12. Break-up of inter-stage portion at top of first stage.

On p. 248, col. 1, line 16,

For: "Figure 11 illustrates the 'fire in the hole' technique which caused considerable break-up of the inter-stage portion at the top of the first stage. Engineers could not tell from films of this nature just what the exact repercussions were.

"A camera was mounted in a recoverable pod on the outside of the second stage (Fig. 12). The technique, despite the break-up, was successful, but the engineers were not satisfied. . ."

Read: "The 'fire in the hole' technique caused considerable break-up of the inter-stage portion at the top of the first stage. Engineers could not tell from films of this nature just what the exact repercussions were.

"A camera was mounted in a recoverable pod on the outside of the second stage (Fig. 11). The technique, despite the break-up, was successful, but the engineers were not satisfied (Fig. 12). . . ."

MAY

Putnam, "Progress committee report for 1964"

On p. 387, col. 2, line 14,

For: ". . . Possibly 50,000 to 60,000 8mm sound projectors are being used, primarily in schools and business.[7]"

Read: ". . . Possibly 50,000 to 60,000 8mm sound and silent projectors are being used, primarily in schools and business.[7]"

JUNE

Education, Industry News, "Video International Productions"

On p. 556, col. 3, line 49,

For: ". . . (His address is 6, Minnie Mansions, Hamilton St., Pretoria, South Africa)."

Read: ". . . (His address is 205 Ella Court, 296 Smit Street, Hillbrow, Johannesburg)."

standards and recommended practices

Approved American Standard

Published here for your information is one American Standard approved on August 9, 1965, by the American Standards Association. PH22.106-1965, Dimensions of 35mm Motion-Picture Anamorphic Projected Image Area, 2.35:1 Aspect Ratio, is a revision of the existing standard differing from it's previous version only in an editorial manner.

Inasmuch as compliance with American Standards is purely voluntary, the standards will become truly effective if very broad publicity is given to their existence. The ASA and the SMPTE would appreciate any personal influence to promote the use of standards where such action is appropriate and proper. Copies of the standard may be obtained for a nominal fee from the American Standards Association, 10 East 40th Street, New York City, 10016.—*A.E.A.*