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TO JOHN GREENEWALD JR.	FROM 88 CG/SCCIADF 2275 D STREET ROOM 0047 WRIGHT-PATTERSON AFB OH 45433-7220

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2 Attachments
1. Your request, 23 Aug 99
2. Requested records

Point of contact for this request is Sheila M. Washington, (937) 255-3016 ext 2132, Fax (937) 656-4295, or e-mail: sheila.washington@wpafb.af.mil.

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106 2 3 1999

John Greenwald Jr

Defense Technical Information Center
Attn: DTIC-RSM [Kelly D. Akers, FOIA Manager]
8725 John J. Kingman Road, Suite 0944
Fort Belvoir, VA 22060-6128 USA

O. P. R. AFMC/HO
CONTROL # 0002365W
DUE DATE 7 Feb 00

Dear Sir,

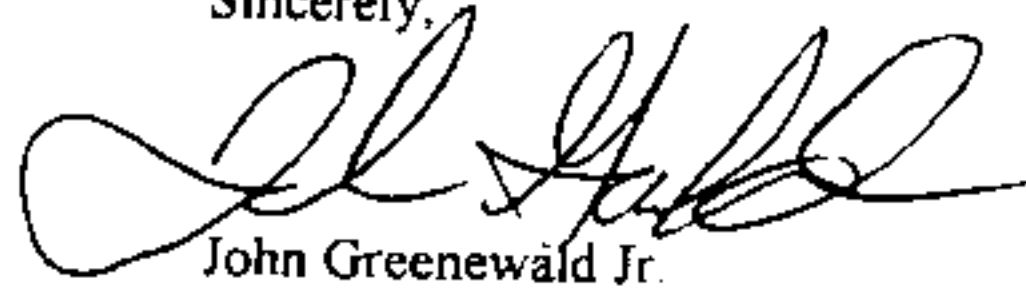
This is a non-commercial request under the provisions of the Freedom of Information Act, 5 U.S.C. § 552. My fee status category is academic, and I agree to pay up to fifteen dollars for the requested material.

I respectfully request a copy of the following document:

AD Number: B217522
Title: The Need For Basic Sky Studies
Authors: Hynek, J. A.
Pagination: 10
Report Date: June 1951
Report Number:

This document title, AD Number, etc. was obtained from an official DTIC bibliography. They told me to contact you for obtaining it. Thank you very much for your time. and I look forward to your response.

Sincerely,



John Greenwald Jr.

Enclosures:
None

The Need for Basic Sky Studies.

OHIO STATE UNIV RESEARCH FOUNDATION COLUMBUS

JUN 1951

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Technical Paper No. 143

THE NEED FOR BASIC SKY STUDIES

Project No. 378

Contract No. AF33(038)-3729

E. O. 683-144

G. H. Harding, Laboratory Director

12 June 1951



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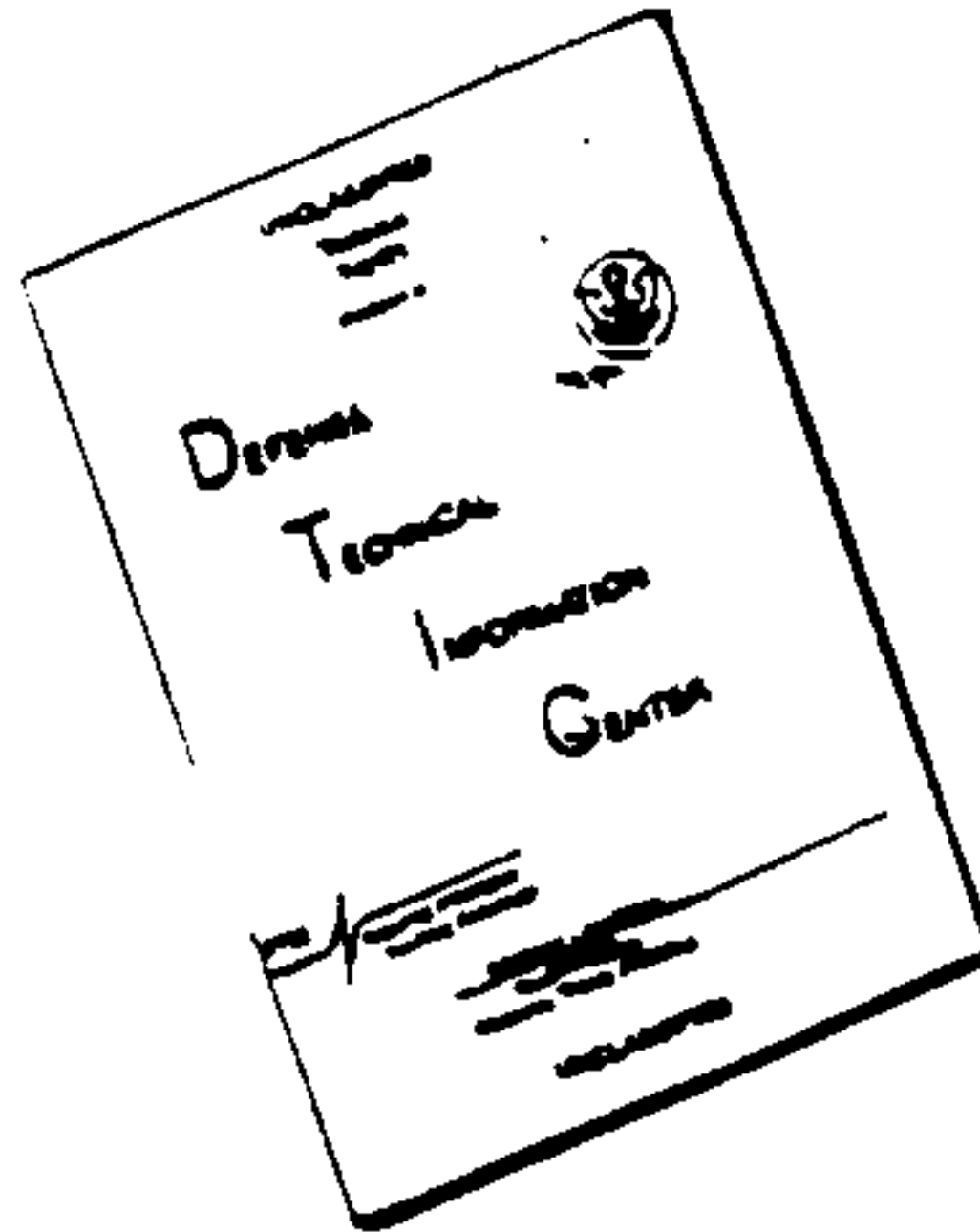
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AUG 8 / 1951

MAPPING AND CHARTING RESEARCH LABORATORY

Technical Paper No. 143

THE NEED FOR BASIC SKY STUDIES

Prepared by
Dr. J. Allen Hynek
Consultant, Mapping and Charting Research Laboratory
Assistant Dean, Graduate School, Ohio State University
Director, McMillin Observatory

The Ohio State University Research Foundation
Project 378

for the
U. S. Air Force Air Materiel Command
Wright-Patterson Air Force Base, Dayton, Ohio
Contract No. AF33(038)-3729
E. O. 683-144

Columbus, Ohio
12 June 1951

Copy No. 16

FOREWORD

This report was prepared by the Mapping and Charting Research Laboratory of the Ohio State University Research Foundation, under USAF Contract No. AF33(038)-3729. The contract was administered under the direction of the Mapping and Charting Branch, Photographic Laboratory, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, with Mr. James J. Deeg, Chief of the Mapping and Charting Branch, as Project Officer.

ABSTRACT

This paper, one of thirteen papers concerning various aspects of mapping and charting, was presented by the author at the Eighth Meeting of the Panel on Cartography and Geodesy, Committee on Geophysics and Geography, National Research and Development Board, held November 3, 1950, at the Mapping and Charting Research Laboratory, Ohio State University Research Foundation, Columbus, Ohio.

Attention is called to atmospheric phenomena long familiar to the astronomer but which he has regarded almost entirely in a negative sense. It appears possible today with advanced techniques of photo-electric photometry to turn these phenomena of "seeing" and "twinkling" to good use in the study of the physical conditions of the upper atmosphere. Several approaches to the study of these phenomena in a positive way are suggested. In military terms these have been termed for quick reference "Operation Twinkle" and "Operation Sky Star" and refer to the problems of astronomical seeing and of sky noise respectively.

THE NEED FOR BASIC SKY STUDIES

I speak not as one who presumes to be conversant with your highly specialized field, but as an astronomer who merely wishes to call your attention to certain phenomena long familiar to astronomers. These phenomena, because of the availability today of infinitely more precise means of measurement than when these matters first were pointed out, may now be utilized to give us basic information about the structure of the atmosphere.

Recent advances in photoelectric techniques, notably the photomultiplier cell which raises sensitivity levels essentially to the theoretical limit, the lead sulfide and lead telluride photoconductive cells, which allow photoelectric investigation to be carried into the infrared, and the development to new levels of precision of both DC and AC amplifiers, as well as the introduction of pulse counting techniques in photoelectric work, which allow a higher order of discrimination of the received signals-- all these offer opportunity for quantitative measures of these phenomena long familiar to the astronomer as a by-product of his work, but which now are assuming an importance all their own.

Their importance has two aspects: that relating to basic studies of the earth's atmosphere, and that relating to military purposes involving mapping and charting, navigation, signaling, and very possibly meteorology. Because of the military aspects of the importance of these new proposed studies, I am not aware, as a civilian astronomer, how much classified work may be in progress in these areas. None the less it may be well to call attention to several avenues of investigation which

might be undertaken with profit both from the standpoint of military applications and of advancing our knowledge of the earth's atmosphere.

The astronomer is beset by two great obstacles in his investigations of the universe: daytime, which is simply the result of the action of the earth's atmosphere on light coming from the sun, and "poor seeing," which is the result of the action of the earth's atmosphere on light coming from the stars at night (and, of course, in the daytime too). Both effects would not exist if the earth had no atmosphere; stars would shine in the "daytime" and at night, which would differ from day only in that an especially bright star among the thousands, the sun, would be absent.

The new photoelectric advances offer an opportunity for analyzing these two phenomena - daytime, that is, the daylight sky, and "poor seeing" - with the definite promise that such studies will advance our basic knowledge of the atmosphere.

Let us consider "poor seeing" first. I should like to outline a series of experiments and measures, and because of the manifest military aspects of such information, we might suitably term, "operation twinkle."

The twinkling of the stars arises from thermal disturbances in the atmosphere - inversion layers and general turbulence - anywhere from a few feet in front of the telescope out to the upper reaches of the atmosphere. Twinkling is synonymous with "bad seeing", for when the atmosphere is unsteady, astronomical images are likewise unsteady and "dance" about, making certain kinds of astronomical work difficult if not impossible.

The "dance" of the image is not always the same. The most frequent is a rapid change in form of the image. Without an atmosphere, a star image would approximate a point. To be exact, every star image would be the familiar diffraction pattern of a point source. The earth's atmosphere rarely allows a true diffraction pattern to be seen. The image looks more like a highly agitated, luminous amoeba. The fluctuations in form of the image are rapid, and may range from one or two to several hundred fluctuations a second.

The atmosphere also causes the image as a whole to oscillate over several seconds of arc and in a period often of several seconds. This has been termed "dancing" by some observers and the terms "scintillation" and "pulsation" have been applied to the change of intensity and size, respectively. Regardless of terminology, a star image, because of the action of the atmosphere, does change in size, intensity, and position.

Until recently it has not been possible to make truly quantitative measures of these changes, changes which are indices of atmospheric conditions such as the existence of temperature inversion layers and their approximate height, and of layers of atmospheric turbulence. The frequency spectrum of "seeing" should be investigated in detail, and the relative strength of the low frequency changes (a few per second) and those of high frequency (more than one hundred cycles per second) correlated with meteorological conditions in the upper atmosphere.

Stars can be observed telescopically in the daytime. Generally, "seeing" is very much worse in the daytime. A quantitative intercomparison

of night and day seeing conditions is almost certain to be of value in the study of atmospheric conditions. Since so very little truly quantitative work has yet been done (to the best of my knowledge) little can be said of the ultimate value of these suggested investigations other than that they hold considerable promise. Little more can ever be said of basic research. If we know the answer before we start, it wouldn't be research.

There is another aspect to this problem which is related to the above and yet is basically different. This is the problem of "sky noise." In "seeing," a point source of light (starlight) passes through the atmosphere and one can study the distortions; the essentially flat wave-front suffers because of this passage. By focal adjustment of the telescope, even some isolation of the layers most effective in producing this distortion can be made.

If, however, we isolate a tiny portion of the daylight sky, no larger in size than the average apparent diameter of a star, how will its fluctuations in brightness compare with that of a star? Since the size is constant, "dancing" and pulsation will not enter. To what extent will our "sky-star" twinkle, or with what frequencies will it pulsate? How are the amplitudes at the various frequencies related? How do the above parameters vary with wavelength, i.e., with position in the spectrum, of the sky? How will the variations differ within a strong absorption band, say, of water? And finally, how are all these variables related to angular distance from the sun and from the zenith, and how do they vary seasonally and with altitude above sea level. Perhaps there may even be a variation with the solar cycle!

The purpose of this paper, let us repeat, in conclusion, is not to formulate a specific program but to call attention to the physical information that might become available for both basic and military needs if "operation twinkle" and "operation sky-star" are set up to build upon previous work done in these fields, but utilizing the recent, striking advances in photoelectric techniques.

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IN REPLY
REFER TO

DTIC-RS (FOIA 2000-34)

DEC 17 1999

Mr. John Greenewald, Jr.

Dear Mr. Greenewald:

This is in reply to your letter dated December 4, 1999, which was received in this office December 10, 1999, requesting information under the Freedom of Information Act (FOIA). Under Department of Defense rules implementing the FOIA, published at 32 CFR 286, your request was categorized as "other."

Release of the documents listed on the enclosure may only be performed by the appropriate Air Force releasing activity. Therefore, your request has been forwarded to the office below for processing and direct response back to you.

Commander
OL-P, 11 CS/SCSR (FOIA)
1000 Air Force Pentagon
Washington, DC 20330-1000

Please direct all future correspondence concerning the documents listed on the enclosure to the above organization.

Please understand that other members of the public may submit a FOIA request for copies of FOIA requests received by this office, or the names of those who have submitted requests. Should such occur, your name, and, if asked for, a copy of your request will be released; however, your home address and home telephone number will not be released. You may be contacted by other private citizens who have obtained your name by using such a request. Be advised, however, correspondence from the Defense Department about your request will be on official letterhead.

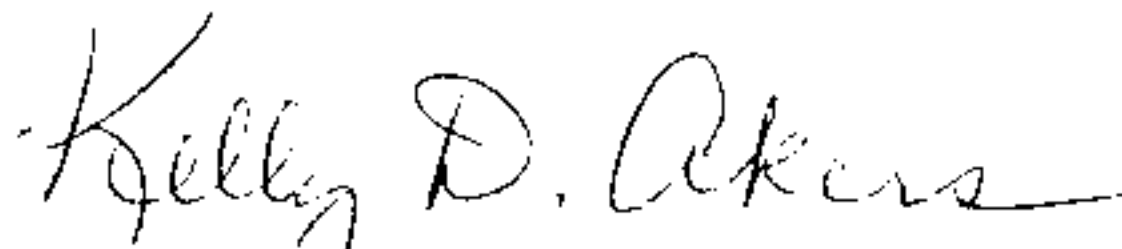
DTIC-RS (FOIA 2000-34)
Mr. John Greenewald, Jr.

PAGE 2

DEC 17 1999

To date, no assessable fees have been incurred for services from the Defense Technical Information Center related to the processing of this request. If you have any questions, please call me at (703) 767-9194.

Sincerely,

A handwritten signature in cursive script that reads "Kelly D. Akers". The signature is written in dark ink and is positioned above the typed name.

KELLY D. AKERS
FOIA Program Manager

Encl

AIR FORCE DOCUMENTS

1. Document Number: AD B812021
Unclassified Title: Daylight Photography of Stars - and
Appendix 1
Report Date: 24 June 1949
Classification: UNCLASSIFIED
Contract Number: W-33-038-AC-16704
Corporate Author: Mapping and Charting Research Lab, Ohio
State University Research Foundation,
Columbus, OH

2. Document Number: AD B217522
Unclassified Title: The Need for Basic Sky Studies
Report Date: June 1951
Classification: UNCLASSIFIED
Contract Number: AF33(038)3729
Corporate Author: Mapping and Charting Research Lab, Ohio
State University Research Foundation,
Columbus, OH

3. Document Number: AD 232833
Unclassified Title: On the Effects of Image Motion on the
Accuracy of Measurement of a Flashing
Satellite
Report Date: 1 Feb 1960
Classification: UNCLASSIFIED
Contract Number: AF19(604)41
Corporate Author: Smithsonian Astrophysical Observatory,
Cambridge, MA



DEPARTMENT OF THE AIR FORCE
11TH WING

12 January 2000

11 CS/SCSR (FOIA)
1000 Air Force Pentagon
Washington DC 20330-1000

Mr. John Greenewald Jr.

Dear Mr. Greenewald

This is in response to your 4 December 1999, Freedom of Information Act request. We received it from the Defense Technical Information Center.

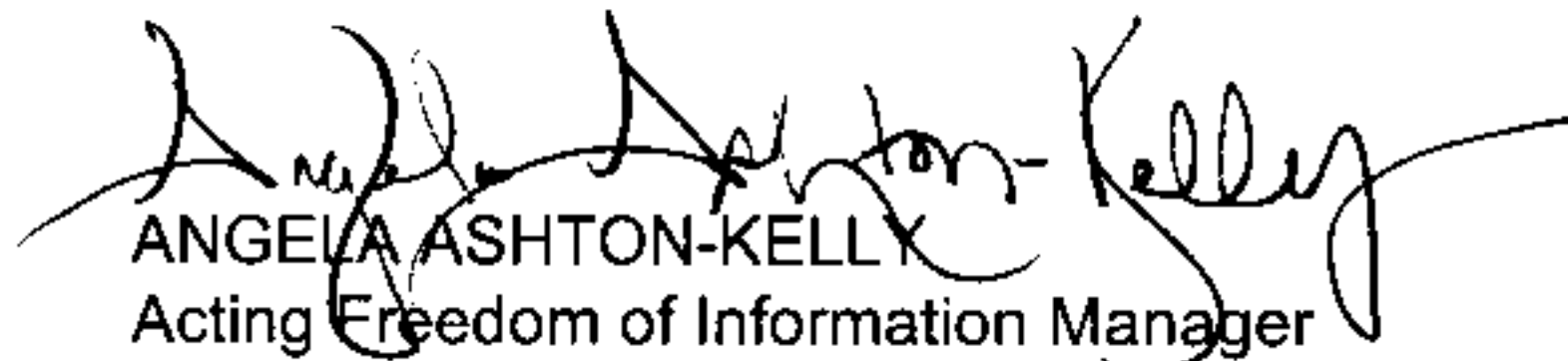
The document you are requesting does not fall under our purview; therefore, we are referring your request to the following agency for action.

66 ABW/SCSF (FOIA)
63 Grenier Street
Hanscom AFB MA 01731-2301

Inasmuch as this completes our work on your request, we are closing your file in this office. Any future inquiries regarding this referral should be directed to Hanscom.

Our action officer is Mr. John Espinal at (703) 696-7269. When inquiring, please reference Case #00-0418. There are no assessable fees for processing your FOIA request in this instance.

Sincerely


ANGELA ASHTON-KELLY
Acting Freedom of Information Manager