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FINAL REPORT

STUDY OF SKY NOISE

Submitted by

Polaroid Corporation
730 Main Street
Cambridge, Massachusetts

Navy Department, Bureau of Ships

Contract NObsr 63175--Index Number HE-050724--27 June 1957

Report Prepared by

SIGNED R. CLARK JONES

R. Clark Jones

(Polaroid Project RC-47)

Approved for Distribution

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SIGNED E.R. BLOUT

E.R. Blout
Associate Director of Research

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[redacted]

STUDY OF SKY NOISE

Final Report

R. Clark Jones

June 27, 1957

Beginning about 1950, the writer began to develop the theory of a method for the statistical description of the irregularities in the radiance distribution of the sky. The basic elements of this method were complete in 1951, having been worked out under Contract NObsr 53179, The method makes use of a two-dimensional form of Wiener's generalized harmonic analysis.

The new method of description is here called the Wiener spectrum method, and was first described in a 30-page report dated October 2, 1952, entitled "Sky Noise -- Its Nature and Analysis". This report was actually written during the hiatus between Contracts NObsr 53179 and 63175.

Under the present contract (NObsr 63175) the writer amplified the theory, and applied it to a number of different problems. Nineteen reports were written during the period 1953 through 1955 as a result of this work. These reports were attached as enclosures to the eight Quarterly Reports written under this contract. A list of the 19 "SN" reports written under this contract is given on page 3.

In 1952, not under this contract, the writer began to apply this same theory to the description of the granularity of photographic images. A 60-page manuscript on this subject was offered to the Journal of the Optical Society in 1953, but was rejected for excessive length. A condensation of this manuscript appeared in 1955: J. Opt. Soc. Am. 45, 799-808 (1955).

In 1955 and 1956, most of the writer's activity under this contract has been as a member of the Working Group on Infrared Backgrounds. The writer feels that the association with the WGIRB was very fruitful, and that he now has a better balanced view of the usefulness of the Wiener spectrum method. During this period, as Editor for the WGIRB, the writer prepared five successive drafts of the Group's report "Concepts and Units for the Presentation of Infrared Background Information", and seven drafts of "Aims, Conclusions and Recommendations of the WGIRB".

Several members of the WGIRB reported that they had difficulty in obtaining and using the various reports written under this contract, and recommended that the material in these reports be combined in a single report written with a uniform terminology and notation.

Such a report is considerably more than half written, 125 rough draft pages being completed. The writer had hoped to finish the report under this contract, but this has proved impossible. It is contemplated at the time of this writing (27 June 1957) that the report will be finished under a contract to be negotiated with the Thermal Radiation Laboratory, Geophysical Research Directorate, Air Force Cambridge Research Center, Hanscom Field, Bedford, Massachusetts.

The Table of Contents of the report now being written is shown on pages 4 and 5. At this moment, the first thirteen chapters are written, and Chapter XIV is nearly finished.

A complete list of the reports written on this contract is on pages 6 and 7.

Sky Noise Reports

by

R. Clark Jones

SN-1	"Sky Noise: Its Nature and Analysis" October 2, 1952	#380
SN-2	"Emendation to: Sky Noise: Its Nature and Analysis" February 13, 1953	#390
SN-3	"Sky Noise: The Threshold Value of B for a Sequential Scanning System" April 2, 1953	#430
SN-4	"Sky Noise: Its Nature and Analysis" 2nd Edition September 15, 1953	#480
SN-5	"On the Analysis of Horizon Noise" September 22, 1953	#489
SN-6	"Sky Noise: Overall Calibration of Equipment Used in 1951 Tests" September 24, 1953	#488
SN-7	"Two Dimensional Noise Spectra that are Periodic in One or Both Dimensions" November 10, 1953	#497
SN-8	"Sky Noise: Noise Spectra of the Form C^2/k^p" November 12, 1953	#499
SN-9	"Sky Noise: Analysis of Circular Scanning" November 17, 1953	#506
SN-10	"Sky Noise Distinguished from Sky Background" December 30, 1953	#509
SN-11	"Sky Noise on a Spherical Surface" December 27, 1953	#513
SN-12	"Detection of Targets against the Sky Background" April 12, 1954	#535
SN-13	"Sky Noise: Results of the 1951 Measurements" January 11, 1954	#536
SN-14	"A Solution of the Scanning Equation" April 10, 1954	#537
SN-15	"Sky Noise on a Spherical Surface, II" May 23, 1954	#541
SN-16	"On the Theory of Scanning Reticles (Episcotisters)" May 25, 1954	#542
SN-17	"An Improved Scanning Reticle" August 8, 1954	#543
SN-18	"Summary of Sky Noise Activities" September 17, 1954	#561
SN-19	"Sky Noise: Optimum Shape of the Scanning Aperture" January 10, 1955	#572

Table of Contents

List of Reports Submitted under this Contract

Quarterly Report No. 1, dated September 22, 1953, No. 486

1. "Sky Noise: Its Nature and Analysis," second edition, dated September 15, 1953, No. 480.

2. "Sky Noise: Threshold Value of B for a Sequential Scanning System," dated April 2, 1953, No. 430.

3. "Discussion on March 5, 1953, of Future Activities under Contract RC-47," dated March 6, 1953, No. 485.

Quarterly Report No. 2, dated September 24, 1953, No. 487

Quarterly Report No. 3, dated February 22, 1954, No. 526

1. "Sky Noise: Overall Calibration of Equipment Used in the 1951 Tests," dated September 24, 1953, No. 488.

2. "On the Analysis of Horizon Noise," dated September 22, 1953, No. 489.

Quarterly Report No. 4, dated March 31, 1954, No. 530.

1. "Two Dimensional Noise Spectra that are Periodic in One or Both Dimensions," dated November 10, 1953, No. 497.

2. "Sky Noise: Noise Spectra of the Form: C^2/k^p," dated November 12, 1953, No. 499.

3. "Sky Noise: Analysis of Circular Scanning," dated November 17, 1953, No. 506.

4. "Questions about Spherical Harmonics," dated January 8, 1954, No. 514.

5. "Sky Noise Distinguished from Sky Backgrounds," dated December30, 1953, No. 509.

Quarterly Report No. 5, dated May 17, 1954, No. 538.

1. "A Solution of the Scanning Equation," dated April 10, 1954, No. 537.

2. "Sky Noise: Results of the 1951 Measurements," dated January 11, 1954, No. 536.

3. "Detection of Targets against the Sky Background," dated April 12, 1954, No. 535.

4. "Sky Noise on a Spherical Surface," dated December 27, 1953, No. 513.

Quarterly Report No. 6, dated August 11, 1954, No. 558.

1. "Sky Noise on a Spherical Surface II," dated May 23, 1954, No. 541.

2. "On the Theory of Scanning Reticles (Episcotisters)," dated May 25, 1954, No. 542.

Quarterly Report No. 7, dated August 1, 1954, No. 559.

1. "An Improved Scanning Reticle," August 8, 1954, No. 547.

2. "Summary of Sky Noise Activities," dated September 17, 1954, No. 561.

3. "Chart for Evaluating Detectivity," dated August 8, 1954, No. 544.

4. "Review of the Detectivity of Infrared Detectors," dated August 4, 1954, No. 546.

5. "Detectivity of Photoconductive Cells," dated August 27, 1954, No. 549.

Quarterly Report No. 8, dated February 28, 1955, No. 584.

1. "Sky Noise: Optimum Shape of the Scanning Aperture," dated January 10, 1955, No. 572.

2. "Belometer Number Translation," dated January 7, 1955, No. 571.