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TARGET SIGNATURE ANALYSIS CENTER: DATA COMPILATION

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Infrared and Optical Sensor Laboratory Willow Run Laboratories Institute of Science and Technology The University of Michigan Ann Arbor, Michigan



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> Air Force Avionics Laboratory Research and Technology Division Air Force Systems Command Wright-Patterson Air Force Base, Ohio



NOTICES

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NOTE TO USERS

<u>Target Signature Analysis Center:</u> Data Compilation is a periodically updated publication of the optical and microwave targei and background data stored on magnetic tape at the Target Signature Analysis Center established at The University of Michigan and sponsored by the Air Force Avionics Laboratory. Separate volumes are maintained for classified and unclassified data. The compilation is distributed in loose-leaf form so that supplemental publications can be readily integrated in accordance with the established indexing system. The complete publication history of the <u>Target Signature Analysis Center: Data Compilation</u> is summarized in the foreword to the enclosed document.

This present document is the fourth publication of unclassified data and the eighth publication in the overall compilation. It consists of optical data, revised explanatory text, and composite cross indexes, and is meant to be integrated with the previous unclassified publications. The following suggestions are made for revising the existing unclassified <u>Data Compilation</u> and adding the enclosed material.

(1) Remove and destroy previously published cover, Notices, and all front matter (dated August 1968). Insert corresponding new pages, supplied herewith.

(2) Remove and destroy all numbered text pages and Distribution List (dated August 1968 or earlier) from the previously integrated compilation (pp. 1 through 72).

(3) Insert new section 1 (Introduction, pp. 1-1 through 1-11).

(4) Insert new section 2 (Cumulative Subject Cross Index, pp. 2-1 through 2-9).

(5) Insert new text for section 3 (Optical Spectral Data, pp. 3-1 through 3-46). Following p. 3-46, insert optical data sheets and dividers AA through CJ from previous compilations.

(6) Following p. CJ-14, insert new text for section 4 (Optical Reflectance Distribution Function Data, pp. 4-1 through 4-17), followed by the enclosed reflectance distribution data sheets.

(7) Following p. (f)CJA 25, insert new text for section 5 (Radar (Active Microwave) Data, pp. 5-1 through 5-10). Following p. 5-10, insert radar data sheets and dividers from preious compilations.

(8) Insert new text for section 6 (Passive Microwave Data, pp. 6-1 through 6-3). Following p. 6-3, insert passive microwave data sheets from previous compilations.

(9) Insert new distribution list.

(10) Remove and destroy DD Form 1473, and replace it with the new page supplied herewith.

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TARGET SIGNATURE ANALYSIS CENTER: DATA COMPILATION

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Seventh Supplement

Dwayne Carmer

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January 1969

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FOREWORD

This is the eighth publication overall and the fourth <u>unclassified publication</u> of the <u>Target Signature Analysis Center</u>: Data Compilation (July 1966). It was prepared at the Willow Run Laboratories, a unit of The University of Michigan's Institute of Science and Technology. The preparation was begun under Air Force Contract AF 33(657)-10974 and continued under Contracts AF 33(615)-3654 and F33615-67-C-1293. The originator's report number is 8492-35-B. The work was administered under the direction of the Air Force Avionics Laboratory, Research and Technology Division, Air Force Systems Command, Wright-Patterson Air Force Base, Ohio, with Mr. Bruno K. Wernicke as the project engineer.

Dwayne Carmer is author of this supplement, under the direction of Howard Courtney, Principal Investigator. The author gratefully acknowledges the assistance of Glenn Curtis, who was responsible for processing the data included with the present in this revision. Contributors to previous supplements include Dianne Earing, Dr. I. W. Ginsberg, Elmer Haag, and Jerry Beard.

Report	Author	Date	WRL Report No.	AD Number (DDC)
Unclassified Publications Original Compilation	Dianne Earing James A. Smith	July 1966	7850 -2- В	AD 489 968
Second Supplement	Dianne Earing	July 1967	8492-5 3	AD 819 712
Fifth Supplement	Dianne Earing	August 1968	8492-15-B	AD 840 091
Seventh Supplement	Dwayne Carmer	January 1969	8492-35-B	-
Classified Publications First Supplement	Dianne Earing	December 196	6 7850-9-B	AD 379 650
Third Supplement	Dianne Earing	October 1967	8492-12-B	AD 384 874
Fourth Supplemen':	Dianne Earing Elmer Haag	December 196	7 8492-14-B	AD 391 239
Sixth Supplement	Dianne Earing	November 196	8 8492-25-B	AD 394 783
Eighth Supplemen'.	Dwayne Carmer	January 1969	8492-43-B	-

PUBLICATION HISTORY OF THE TARGET SIGNATURE ANALYSIS CENTER: DATA COMPILATION

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ABSTRACT

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This supplement to the <u>Target Signature Analysis Center</u>: Data Compilation augments an ordered, indexed compilation of reflectances, radar cross sections, and apparent temperatures of target and background materials. The Data Compilation includes spectral reflectances and transmittances in the optical region from 0.3 to 15 μ and normalized radar cross sections (active) and apparent temperatures (passive), plotted as functions of aspect or depression angle, at millimeter wavelengths. When available, the experimental parameters associated with each curve are listed to provide the user with a description of the important experimental conditions.

This supplement contains the initial addition of reflectance distribution function data to the unclassified compilation. The data are presented in tabular form as a function of reflection angle for fixed incidence angles and discrete wavelengths in the visible and near-infrared spectral regions. These data were obtained from the Laboratory Measurements Phase of the Target Signature Measurements Program conducted at The University of Michigan and sponsored by the Air Force Avionics Laboratory. The unclassified compilation, including these data, consists of about 4300 curves and 112 tables (in general, each table is the equivalent of four unique curves).

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TARGET SIGNATURE ANALYSIS CENTER: DATA COMPILATION Seventh Supplement

1 INTRODUCTION

The Target Signature Analysis Center established at the Willow Run Laboratories of The University of Michigan's Institute of Science and Technology and sponsored by the Air Force Avionics Laboratory comprises a document collection, a data library, and a staff of analysts. It provides a centralized source of data and analysis techniques useful for improving remote sensors. The routine functions of the Center include collecting, evaluating, and categorizing data on the properties of various target and background objects. In the optical portion of the electromagnetic spectrum from 0.3 to 15 μ , the data are primarily on reflectance and transmittance; at microwave frequencies, they consist of normalized radar cross sections (active) and apparent temperatures (passive). The primary source of data is reports published by laboratories making such measurements. In some instances, unpublished data have also been acquired directly from an experimenter.

Each document received by the Analysis Center is examined for data to be added to the library. Selected data are then manually digitized using an established format. Coded descriptors are assigned to each curve for retrieval purposes, and the conditions of each experiment are recorded. Data points and the descriptive and parametric information are also stored on magnetic tape. Since the parameters required to define radar measurements differ in many respects from those required for optical measurements, separate formats were designed to handle the different types of information. However, a general format has recently been devised and will eventually be used for all data. This new format is discussed in section 6 and has been used for processing the passive microwave data.

Optical $(0.3 < \lambda < 1000 \ \mu)$ and microwave $(\lambda > 1000 \ \mu)$ instruments were used to obtain the data reported here; the experiments were conducted Ling the last three decades. Three types of measurements are represented:

- (1) Laboratory measurements of materials such as leaves, soil, and paints
- (2) Ground-based field measurements of objects such as plants, soil plots, and vehicles
- (3) Airborne measurements of scones

In the optical portion of the spectrum, laboratory measurement programs are far more abundant than either ground-based field measurements or airborne measurement programs. In the microwave region, field and airborne instrument measurements predominate. There

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is a much larger amount of data on background materials (e.g., leaves, crops, and soils) than on man-made materials. The reason is that most of the past measurements were performed by scientists in the fields of botany, agronomy, and natural science, and, therefore, the primary motivation for these measurements was an interest in natural objects.

This data compilation is the product of a survey of existing data on target and background materials and is intended to present the results of such a survey in a single source. The picture it presents of natural and man-made objects in the real world and their interaction with electromagnetic radiation is in no way complete. Although many data have been gathered on some materials and at a few wavelengths, data are completely lacking for other materials and other wavelengths. Moreover, even the existing data are not accompanied with all the parametric and support information required for their adequate interpretation. The extensive Target Signature Measurements Program currently sponsored by the Air Force Avionics Laboratory is planned to fill existing data gaps. This program provides for laboratory and field measurements of target and background materials and objects at both optical and microwave frequencies. In the optical region, bidirectional and directional reflectances are under investigation. In the microwave region, optical simulation studies are being conducted, and existing radiometric (passive) data are being collected. Some of the data from this program, specifically reflectance data in the 0.3- to $2.5-\mu$ spectral interval and reflectance distribution data at laser wavelengths are included in this compilation.

Only unclassified data from the Target Signature Analysis Center's collection are included in this supplement. The classified data have been published separately and are referenced in the foreword to this publication. Each data curve or data table has been assigned alphabetic descriptor codes to describe the object measured, the instrumentation used, the optical property measured, and the spectral interval employed. An alphabetically arranged list of these codes is given in table 1-1. The data curves in this publication have been grouped according to the coded descriptor that best describes the object measured. This prime descriptor, a page number, and the common name(s) of the objects are arranged as a cross index in section 2, which will be revised as future supplements are published, thus making it cumulative.

Section 3 contains optical spectral data as well as (a) a theoretical treatment of reflectance, (b) a description of some of the instruments used to collect these data, and (c) a summary of experiments yielding optical spectral data. The data sources in the TSAC collection are listed with the experiments included in the summary; the additional references also noted there are listed in section 3.6, which cites the literature sources for all of section 3. Section 3 is thus self-contained, to facilitate future additions to the compilation.

Section 4 contains optical data of the bidirectional reflectance or reflectance distribution function type. Although covered conceptually in section 3, a definition of the reflectance distribution function is given in section 4 along with some equations for the application of such data and a description of the instruments used for data collection. Section 4.5 lists the literature sources for this material.

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Section 5 contains active microwave data of two types: averaged normalized radar cross sections as a function of aspect angle, with frequency as a parameter, and cumulative probability distribution vs. radar cross section. The curves are grouped according to the type of object measured. Instrumentation and TSAC literature sources comprise section 5.3; again, section 5 is thus self-contained.

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Section 6 contains passive microwave data and a generalized parameter list that is part of an expanded version developed from the parameter system used in sections 3 and 4. Later data compilations will make use of this generalized list.

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TABLE 1-1. TARGET SIGNATURE SUBJECT-CODE LIST

A	TARGETS	AE	Materials
ÀA	Ground	AEA [‡]	Aluminum
AAA	Buildings	AEB	Asphalt
AAAA	Steel	AEC	Brick
AAAB	Brick, Stone, Concrete	AED	Burlap
AAAC	Wood Frame	AEE	Canvas
AAAD	Stick Huts	AEF	Cinder
AAAE	Mud Huts	AEG	Concrete
AAB	Guns	AEH	Dirt
AABA	Artillery	AEI [*]	Galvanized Steel
AABB	Rifles	AEJ	Glass
AAC	Industrial Facilities	AEK	Gravel
AACA	Power Stations	AEL	Metal
AACB	Shipyards	AELA	Aluminum
AAD	Military Facilities	AELB	Brass
AADA	Communication Centers	AELC	Bronze
AADB	Fortifications	AELD	Copper
AADC	Launching Sites	AELE	Steel
AADCA	Antiaircraft	AELEA	Galvanized
AADD	Marshalling Yards	AELEB	Stainless
AADE	Supply Depots	AEM	Paint
AAE	Airfields	AEMA	White Pigments
AAF	Railroad	AEMAA	Zinc Oxide (Zinc White)
AAFA	Tracks	AEMAB	Lead Basic Carbonate
AAFB	Yards		(White Lead)
AAG	Reads	AEMAC	Titanium Dioxide
AAH	Bridges	AEMB	Green Pigments
AAI	Dams	AEMBA	Chromic Oxide (Chrome
AAJ	Locks		Green)
AAK	Personnel	AEMC	Red Pigments
AAKA	Clothing	AEMCA	Ferric Oxide (Hematite)
AAKAA	Cotton Fibers (Cellulose)	AEMCB	Trilead Tetroxide (Red
AAKAB	Synthetic Fibers		Lead)
AAKAC	Wool Fibers	AEMD	Metallic Pigments
AAKAD	Nonc Joth Items	AEMDA	Aluminum Powder
AAKB	'i roop Concentrations	AEME	Other Pigments (Color
AAKC	Skin		Unknown)
AAKCA	Asiatic	AEMEA	Mica
AAKCB	Caucasian	AEMEB	Aluminum Silicate
AAKCC	Negro	AEMF	Mediums, Thinners, Driers
AAL	Vehicles	AEMFA	Resin
AALA	Aircraft	AEMFAA	Oleo
AÁLB	Armored	AEMFAB	Alkyd
AALC	Convoys	AEMFB	Ester
AALD	Earth-Moving	AFMFC	Xylene
AALE	Tanks	AEMG	Primer
AALF	Trucks	AEN	Paper/Cardboard
AB	Marine	AEO	Plastic
ABA	Submarine	AEP	Rubber
ABB	Surface Vessels	AEQ	Tar
ABBA	Barges	AER	Tile
ABBB	Landing Craft	AES	Varnish
AC	Camouflage	AET	Wood
AD	Decoys .	AF	Radiation Control
+		AFA	Antireflection Coating

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*Not being used in the present system.

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TABLE 1-1. TARGET SIGNATURE SUBJECT-CODE LIST (Continued)

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AFB	Shielding	BCF	Overcast
AFC	Temperature Control	BD	Season
AG	Signatures	BDA	Summer
AH	Geometric Shapes	BDB	Fall
AHA	Flat Plates	BDC	Winter
AHB	Dihedrals (Concave)	BDD	Spring
AHC	Trihedrals (Concave)	BE	Terrain Uniformity
AHD	Spheres and Spheroids	BEA	Flat
AHE	Cylindrical Shapes	BEB	Rolling
AHF	Conical Shapes	BEC	Hilly
AHG	Wedges	BED	Mountainous
AHH	Dipoles	BEE*	Rural
AHI	Ravleigh Scatters	BEF*	Urban
AHJ	Other	BF	Soil
AI	Contaminants	BFA*	Cultivated
AIA	Corrosion	BFB*	Uncultivated
AIB	Dew	BFC	Coarse Textured
AIC	Dirt	BFCA	Sand
AID	Dust	BFCB	Loamy Sand
AIE	Oxide	BFD	Moderately Coarse Textured
AIF	Rust	BFDA	Sandy Loam
AIG	None Visible	BFDB	Fine Sandy Loam
	•	BFE	Medium Textured
		BFEA	Loam
В	BACKGROUNDS	BFEB	Silt Loam
BA	Atmosphere	BFEC	Silt
BAA	Constituents	BFF	Moderately Fine Textured
BAAA	Aerosols	DEEA	Clay Loom
BAAB	Dust	DITA	Sandy Clay Loam
BAAC	Fog	DIID	Silty Clay Loam
BAAD	Gases	DFFC	Fine Textured
BAAE	Haze	DFG	Sandy Clay
BAAF	Rain	DFCD	Silty Clay
BAAG	Smog	Brud	Clay
BAAH	Smoke	DFUC	Other Constituents
BAAI	Snow	DFUA	Organia Matanial
BAAJ	Spray	DFIA	Organic Material
BAAK	Water Vapor	Brnd	Diamoton)
BAB	Sky .	DERC	Cobbles (2 to 10 in
BB	Clouds	EFHC	Diameter)
BBA	Cumulonimbus	DEND	Diameter)
BBB	Cirrus	, BrnD	Stolles (Greater Illali 10 in Diamatan)
BBC	Cirrocumulus	DEHE	Deducel
BBD	Cirrostratus	BFRE	Bearock
BBE	Altocumulus	Brnr	Sait
BBF	Altostratus	Bri	Series
BBG	Cumulus	BFIA	Aguan
BBH	Nimbostratus	BFIB	Aiken
BBI	Stratocumulus	BFIC	Akron-
BC	Light Conditions	BFID	Alamance
BCA	Day	BFIE	Albion
BCB	Sunrise or Sunset	BFIF	Alonso
BCC	Twilight	BFIG	Barnes
BCD	Night	BFIH	Blakely
BCE	Clear	BFII	Clareville

*Not being used in the present system.

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BFIJ	Clarion	BGBAA	Sphagnum Moss
BFIK	Collington	BGC	Vascular
BFIL	Colts Neck	BGCA	Banana Family
BFIM	Decatur	BGCAA	Banana
BFIN	Dublin	BGCB	Bromeliaceae Family
BFIO	Gooch	BGCBA	Bunch Grass
BFIP	Grady	BGCC	Buckwheat Family
BFIQ	Greenville	BGCCA	Buckwheat
BFIR	Guthrie	BGCD	Composite Family
BFIS	Hainamanu		(cf. Ligneous)
BFIT	Hall	BGCDA	Daisy
BFIU	Hamakua	BGCDB	Goldenrod
BFIV	Herradura	BGCDC	Ragweed
BFIW	Joplin	BGCDD	Sunflower
BEIX	Marias	BGCE	Convolvulus Family
BFIY	Marshall	BGCEA	Sweet Potato
BFIZ	Matanzas	BGCF	Crowfoot Family
BEI	Series (Continued)	EGCEA	Crowfoot
BEJA	Manry	BGCG	Duckweed Family
BEIB	Moaula	BGCGA	Duckweed
BEIC	Ngglehu	BCCH	Evening-Primrose Family
BEID	Onomea	BGCHA	Willow Herb
BRIF	Ookala	Ducitta	(cf Willow Family)
DETE	Orangehurg	BGCI	Forn Family
BEIG	Oriente	BGCIA	Bracken Fern
BETH	Orman	BGCJ	Flax Family
Brit	Dallman	BGCIA	Flay
BELL	Penn	BGCK	Goosefoot Family
BEIV	Dierre	BGCKA	Pigweed
BEIL	Putnam	BOCKB	Sugar Beet
DETM	Quibdo	BGCL	Gourd Family
BEIN	Bubicon	BGCLA	Saush
DEIA	Buston	BGCM	Grass Family
DFID	Santa Barbara	BGCMA	Barley
DFJF	Torse Duna	BGCMB	Bermuda Grass
DEID	Tifton	BGCMC	Corn
DFIG	Tillman	BGCMD	Creeping Grass
Drob Drift	Tiloit	BGCME	Fescue
DFUI	Vernon	BGCMF	Foxtail
Druu '9FIV	Weld	BGCMG	Ilvas
Druv	Windthorst	BGCMH	Millet
Dru v Dru v	Volo	BGCMI	Oats
DFIN	Zanogvillo	BGCMJ	Reeds
DIGI	Minerals	BGCMK	Rice
BFI.	Chemicals	BGCML	Rve
BFM	Moisture Content	BGCMM	Selin
DFM	Noista e Contein Dru	BGCMN	Timothy
BEMB	Damn	BGCMO	Vetch
BEMC	Saturated	BGCMP	Wheat
DF MC RC	Variation	BGCN	Heath Family (see also
BGA	Herbaceous Alose Funci		Ligneous)
BGAA	Cladoniaceae Family	BGCNA	European Blueberry
	Reinder Mass	BGCNR	Heather
BCB	Moge_I iverwort	BGCO	Mallow Family
RCRA	Snhagmum Ramily	BGCOA	Cotton
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BGCP	Mustard Family	BGDLC	Hazelnut
BGCPA	Cabbage	BGDLD	Hornbeam
BGCPB	Mustard	BGDLE	Ironwood (cf. Ebony
BGCQ	Nightshade Family		Family)
BGCQA	Potatoes	BGDM	Heath Family (cf. Herba-
BGCQB	Tomatoes		ceous)
BGCR	Pea (or Pulse) Family	BGDMA	Mountain Laurel
	(see also Ligneous)	BGDN	Holly Family
BGCRA	Alfalfa	BGDNA	Holly
BGCRB	Clover	BGDO	Honeysuckle Family
BGCRC	Coffee Plant	BDGOA	Viburnum
BGCRD	Lentil	BGDP	Laurel Family
BGCRE	Lima Bean	BGDPA	Laurel
BGCRF	Pea	BGDPB	Sassafrass
BGCRG	Feanut	BCDO	Lily Family
BGCRH	Sovhean	BCDQ	Vucca
BCCBI	String Bean	DODAN	Lindon Family
BGCN	Diantain Femily	DGDR	Decewood
DGCS	Plantain Family	BGDRA	DabSw00u Lindon
DGCBA	Fiantain Sodro Fomily	BGDRB	Linden Longrig Fermilie
BGCI	Sedge Failing	BGDS	Logania Family
BGCTA	Cotton Grass	BGDSA	Privet (Ligustrum)
BGCTB	Sedge	BGDT	Magnolia Family
BGD	Ligneous	BGDTA	Magnolia
BGDA	Arecaceae Family	BGDTB	Tulip
BGDAA	Areca Palm	BGDTC	Tulip Poplar
BGDB	Beech Family	BGDU	Maple Family
BGDBA	Beech	BGDUA	Maple
BGDBB	Chestnut	BGDV	Mulberry Family
BGDBC	Oak	BGDVA	Rubber
BGDC	Bignonia Family	BGDW	Olive Family
BGDCA	Catalpa	BGDWA	Ash
BGDD	Calycanthaceae Family	BGDX	Pine Family
BGDDA	Meratia Praecox	BGDXA	Cedar
BGDE	Carduacea Family	BGDXB	Fir
BGDEA	Rabbit Brush	BGDXC	Juniper
BCDF	Cashew Family	BGDXD	Larch
BGDFA	Chinese Pistachio	BGDXE	Pine
BGDFB	Sumach	BGDXF	Spruce
BGDG	Composite Family	BGDY	Plane-Tree Family
2020	(cf. Berbaceous)	BGDYA	Sycamore
BGDGA	Sagebrush	BGDZ	Pea Family (cf. Herbaceous)
BGDGB	Wormwood	BGDZA	Locust
BODOD	Dogwood Family	PGF	Ligneous (Continued)
BODIA	Dogwood	DOL	Doco Family
BODIA	Ebony Family	DOLA	Blockbonwy
BGDI	EDDity Faintly	BGEAA	Charme
BGDIA	Towalta)	BGEAB	Cherry
	Family)	BGEAC	Hawthorn
BGDIB	Persimmon	BGEAD	Juneberry
BGDJ	Elm Family	BGEAE	Peach
BGDJA	Eim	BGEAF	Pin Cherry
BGDK	Figwort Family	BGEAG	Plum
BGDKA	Paulowina	BGEB	Sour Gum Family
BGDL	Hazel Family	BGEBA	Gum
BGDLA	Alder	BGEC	Trumpet-Creeper Family
BGDLB	Birch	BGECA	Calabash

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	Mine The soliter		Destune on Grain
BGED	vine Family	BJCD	Pasture or Gram
BGEDA	Virginia Creeper	BJCE	Rice Pauly
BGEE	Walnut Family		
BGEEA	Ніскогу	C	EQUIPMENT
BGEF	Willow Family	CA	Radar
BGEFA	Aspen	CAA	Coherent
BGEFB	Poplar	CAB	Nonconerent
BGEFC	Willow (cf. Evening	CAC	Pulse
	Primrose Family)	CAD	CW
BGEFCA	Dwarf	CAE	MTI
BGEFCB	Ground	CAF	Resolution Limited by Antenna
BGEG	Witch Hazel Family	CAG	Synthetic Aperture
BGEGA	Sweet Gum	CB	Radiometer
BGF	Leaf	CBA	Optical (Wavelength Less
BGFA	Narrow		Than 1000 μ)
BGFB	Broad	CBB	Microwave (Wavelength
BGFBA	Coriaceous (Leathery)		Greater Than or Equal
BGFBB	Membranous		to 1000 μ)
BGFBC	Lower Leaf Surface	CBBA	Unmodulated
BGFBD	Upper Leaf Surface	CBBB	Post-Detection Modulated
BGFC	Young (Spring)	CBBC	Signal Modulated
BGED	Mature (Summer)	CBBD	Cross Correlated
BGFF	Old (Fall)	CBBE	Two-Channel Subtraction
DOFE	Drv		Spectrograph
BCC	Bark		Eastman Kodak
DCU			Spectrometer
BGR	I wig Woton	CD	Beelman
BR	Formations	CDA	Deckinan Madal DII
BHA	Formacions	CDAA	Model DU
BHAA	Lake	CDAB	Model DK-1
BHAB	Puddle	CDAC	Model DK-2
BHAC	River	CDAD	Microspec
BHAD	Sea	CDB	General Electric
BHB	State	CDC	Perkin-Limer
BHBA		CDCA	Model 12
BHBB	Ice and Liquid	CDCB	Model 21
BHBC	Liquid	CDD	Interference
BHBD	Snow	CDE	Cary
BI	Climate	CDEA	Model 14
BJ	Composite Backgrounds	CDEB	Model 90
BJA	Urban	CE	Platform
BJAA	Villages	CEA	Aircraft
BJAB	Towns	CEB	Balloon
PJAC	Cities	CEC	Ground
БЈВ	Rural-Uncultivated	CED	Laboratory
BJBA	Jungle	CEE	Shipborne
BJBB	Forest	CF	Optical
BJBC 4	Grassplains	CFA	Ultraviolet
BJBD	Marsh	CFB	Visible
BJBE	Tundra	CFC	Infrared
BJBF	Desert	CFD	Active
BJC	Rural-Cultivated	CFE	Passive
BJCA	Orchard	CG	Detectors
BJCB	Bushes and Shrubs	CH	Filters
BJCC	Plowed Fields	CI	Image Tubes
1000		CI	Materials
		00	

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	TABLE 1-1. TARGET SIGNATURE SU	BJECT-CODE	LIST (Continued)
CJA	Reflectance Standards (Optical)	DDBB	Elliptic
CJAA	Magnesium Oxide	DDBBA	Right
CJAAA	Smoked	DDBBB	Left
CIAAB	Droccod	DDBC	Linear
CIAR	Magnagium Carbonoio	DDBCA	Pernendicular
CIAC	Sulphus	DDBCB	Parallel
CIAC	Alimatica	DDBD	Random
CJAD	Alummuni	DE	Refraction
CJADA	Mil'FOF	DF	Reflectance
CJADB	Sandolasted	DFA	Directional
CJAE	Sapphire Felt	DFAA	Sneeular Included
CJAF	Other Specular Standards	DFAB	Specular Not Included
CJAG	Other Diffuse Standards	DFR	Specular Specular
CJB	Reflectance Standards (Microwave)	DFC	Standard
CJBA	Metailic Sphere	DFC	Barreta
CJBB	Luneberg Reflector	DFCA	Baryle Blancas of Colfer
CJBC	Corner Reflector	DRCB	Flowers of Sullur
СК	Evaluation	DFCC	Gypsum
СКА	Noise	DFCD	Magnesium Carbonate
CL	Reflectometer (Bidirectional)	DFCE	Magnesium Oxide
CLA	EGR	DFCF	Paper
CLB	PGR	DFCG	Rhodium Mirror
CM	Polarimeter	DFCH	Aluminum Mirror
		DFD	Bidirectional
		DFE	Total (Albedo)
ס	RADIATION	DFF	Absolute
DA DA	Pattern	DG	Scintillation
	Asnect Dependence	DH	Solar Influence
	Aspect Dependence	DI	Transmittance
	Badan Cross Section (a)	DIA	Directional
DAC	Normalized (z.)	DIB	Bidirectional
DACA	Normanzed (0 ₀)	DJ	Emission
	Alternation	DÍA	Atmosphere
DBA	Absorption	DIB	Emissivity
DBB	Scatter	DIC	Emittance
DBBA	Backscatter Coefficient (ρ)	DID	Blackbody
DC	Modulation	DIE	Greybody
DD	Polarization	DIF	Fluorescence
DDA	Radar	DIG	Thermal
DDAA	Circular	DK	Artificial Sources
DDAAA	Right		
DDAAB	Left	DKB	Baaan
DDAB	Elliptic		Flomo
DDABA	Right	DEC	Flame
DDABB	Left	DED	r lare
DDAC	Linear	DKE	
DDACA	Horizontal or Perpen-	DKF	Gas Discharge
	dicular	DKG	Globar
DDACB	Vertical or Parallel	DKH	Incandescent Lamp
DDACC	Oblique	DKI	Maser, Laser, Iraser, Uvaser
DDACCA	Cross-Polarized	DKJ	Mantle
DDACCB	Darallal_Dalarizad	DKK	Nernst Glower
מאמת	Pondom	DKL	Nuclear Explosion
2010		DKM	Oscillator
מתם 100	Optical Optical	DKN	Shock Tube
	UITCUIAT	DKO	Spark
NUBAA	HIGH	DKP	Vapor Lamp
DURAR	Leit	DKQ	Monochromator

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DL	Natural Sources	ECCI	1.9-u hand
DLA	Aurora	ECCK	$2.2-\mu$ band
DLB	Airglow	FCCI	$2.2 - \mu$ band
DLC	Lightning	ECCH	$A_{3-\mu}$ band
DLD	Lunar	ECCM	$6.2 \dots$ band
DLE	Planetary	ECCN	$0.5 - \mu$ band
DLF	Solar	ECCO	9.0-µ band
DLG	Stellar	ECCP	Other
DLH	Zodiacal Light	ECD	Line
DLI	Sky	ED	Radio Frequency
DM	Flux	EDA	EHF (30 to 300 GHZ)
DN	Radiance	EDAN	V Band (46 to 56 GHz)
DO	Coherence	EDAQ	Q Band (36 to 46 GHz)
	Diffraction	EDAT	Upper K _a Band (30 to
DP	Apparent Temperature		36 GHz)
DQ	Apparent Temperature	EDB	SHF (3 to 30 GHz)
DWA	Antenna	EDBF	Lower K _a Band (20.9 to
LAB	Target		30 GHz)
DQC	Contrast	EDBJ	K_{u} Band (10.9 to 20.9 GHz)
-		EDBM	X Band (5.2 to 10.9 CHz)
<u>E</u>	SPECTRA	EDBP	Upper S Band (3.0 to
EA	Gamma Rays		5.2 GHz)
EB	X-Rays	EDC	UHF (0.3 to 3 GHz)
EC	Optical	EDCE	Lower S Band (1.55 to
ECA	Ultraviolet		3.0 GHz)
ECAA	Less than 0.1 μ	EDCH	L Band (0.39 to 1.55 GHz)
ECAB	0.1 to 0.2 μ	EDCK	P Band (2.25 to 3.90 GHz)
ECAC	0.2 to 0.3 μ	EDD	VHF (30 to 300 MHz)
ECAD	0.3 to 0.4 μ	EDE	HF (3 to 30 MHz)
ECB	Visible (0.4 to 0.7 μ)	EDF	MF(0.3 to 3 MHz)
ECBA	Chromaticity	EDG	LF(30 to 300 kHz)
ECBB	Color	EDH	VI.F (3 to 30 kHz)
ECBBA	Blue	2011	V III (0 10 00 MIZ)
ECBBB	Green	P	ODEDATIONS
ECBBC	Yellow	F FA	Detection
ECBBD	Orange	ra FD	Detection
ECBBE	Red	FB TO	Discrimination
ECBBF	Brown	FC	Reconnaissance
ECBBG	Field Drab	FD	Surveillance
ECBBH	Khaki	FE DDA	Imaging
ECBBI	Olive Drab	FEA	Photography
ECBBJ	White	FEB	Scann ag
ECBBK	Grev	FEC	Contrast
ECBBL	Black	FED	Resolution
ECC	Infrared	FEE	Display
ECCA	07 to 15 "	FF	Filtering
ECCB	15 to 3.0 "	FFA	Spatial
ECCC	3 to 5 "	FFB	Spectral
FCCD	5 to 8	FG	Measurement
FCCF	9 to 15	FGA	Temperature
FCCF	15 to 50 μ	FGB	Time
FCÓC	10 το συ μ 50 to 100	FGC	Position
ECCU	ου το του μ 100 to 1000 μ	FGD	Range
ECCI FCCI	1 A band	FGE	Angle
rui	1.7- µ. Odiku	FGF	Velocity

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TABLE 1-1. TARGET SIGNATURE SUBJECT-CODE LIST (Concluded)

FCC	Accolonation	~~	
FUU		GE	One-Dimensional
FA	Calibration	GF	Two-Dimensional
FI	Homing	GG	Linear
FJ	Pattern Recognition		
~	A 314 T Trova	Н	ACOUSTICS
G	ANALYSIS	HA	Attenuation
GA	Mathematical	HAA	Absorption
GAA	Model	HAR	Scatter
GB	Statistical	UADA	Dealtraatton Coofficient
GBA	Distribution	IIADA UD	Backscatter Coefficient
GBAA	Gaussian	HB	Modulation
GBB	Process	HC	Refraction
GBBA	Frandia	HD	Reflectance
GBBB	Stationary	HE	Transmission
GBBC	Nonstationary	HF	Emission
GC	Information Drogogging	HG	Artificial Sources
GCA	Digital	HH	Natural Sources
GCA CD	Digital	HI	Flux
GD	Correlation	HJ	Diffraction
GDA	Auto-	uv	Execution Shoatmum
GDB	Cross-	111	Frequency spectrum
		нL	Correlation

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Airfields	AAE 1	Blackberry	BGD 226
	AEA 7 (f)AEL 9,	Blacktop	See Asphalt
	10	Bracken Fern	BGC 3
Alder	BGD 46	Bramble Briar	BGD 225
Alfalfa	BGC 106-111	Brass	AEL 6
	3133: 45, 52, 53,	Brick	AEC 1. 2
	57. 62. 65. 67. 77	Bridges	AAH 1
	3135: 1	Bromegrass	BGC 12
Allevel	AEM 52, 53, 76	Bronze	AET. 50-52
	77. 91	Buckeye	BGD 303
Allovg	See Motals	Building	
	ATA 5 G (Alan		(Aleo cos enenif.
	ABA 0, 0 (ABO		in building
	sec alummum		ne building
A 1		Pundoal	materiais)
	ADA 1, 0, 4, 1-9		BGC 140
A1	(IJAEL 7, 8	$Burlap \dots \dots \dots \dots \dots \dots \dots \dots \dots \dots$	AED 1-5
Aluminum Alciad	AEA ?		AEM 15
	(I)AEL 9, 10		
Aluminum Bronze	AEL 21, 22	Cabbage	BGC 103, 104
Aluminum Mirror	CJ 9	Calabash	BGD 232
Aluminum Oxide	AEA 2	Calcium Carbonate	BFK 1
	CJ 10	Calcium Oxide	CJ 11
	(f)AEM 1-3	Calcium Sulfate	BFK 1
Aluminum Paint	AEM 37, 39, 82-	Camouflage	AAKA 2
•	85, 101		AED 1-5
Aluminum Silicate Paint	AEM 50, 51,		AEE 1.2
	102, 104	Canvas	AEE 1. 2
Apple	BG 7, 8		AEM 70
	BGD 225, 374	Carbon (Carbon Black)	AEL 20
Ash	BGD 107, 121	Carbon (Carbon Diack,	BEL 1 (Also see
	3134: 7		Granhita)
Aspen	BGD 258, 261,	Cardboard	AEN 1-17
	376, 382	Catalna	BGD 30-32 336
Asphalt	AAE 1	Caucagian Skin	AAK 1 2 4 5
	AAG 5		7
	AEB 1, 2	Cedar	BGD 122 123
	AEK 1	Ccual	358 404
	3290: 7, 29	Coment	AF 1
Pakalita	AFO 3		AFG 1_A
Darente	ALC J	Commin	AFD 2
Danisani Popiar	DOD 203	Conomia Inculating Falt	COTA 9.95
Darlum Sumue	DCD 0 19 51	Ceramic mischaring rett	(Algo goo fibor
Вагк	<i>DGD</i> 9, 12, 01,		(Also see inder-
· ·	71, 190, 220,	Champy	11'4X) DCD 916 997
,	227, 229, 231,	Cherry	DU1 240, 441,
	233	Chart	
	BGC 31, 35		DF ffU 3, 9, 7, 8
	BFHD 3, 8		DCID 320
Basswood	BGD 56, 68, 345		DCD 33
Beech	HGD 2, 8, 317,		BGD 328, 329,
	320	M 	300
Bermuda Grass	BGC -5	Chrome Oxide Paint	1 Y 10 00
	3133: 13	(Unrome Green)	AEM 18-20
Birch	BGD 47, 51, 342	Chromium (Plating)	AEL 6, 39, 40
	3134: 7		(1)AEL 1-6
Birdsfoot Trefoil	BGC 106	Chromium (Pere)	AEL 1

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Cinder	AEF 1	Crow Foot	BGC 2
	3290: 48-50,	Daisies	BGC 1
	52, 53	Desert	3137: 1-12 (Al-
Cinder Block	AEF 1		so see Sand)
$Clay \ldots \ldots$	See Soll	Dieffenbachia	BGD 315
Clay Loam	DFFA 1-10	Diorite	BFHD 3, 9, 10
Burlan	AED 1-5	Dirt	AAG I-J
	AEM 15		AEN 2 AFM 54 67
Canvas	AEE 1, 2		(Also see Soil)
	AEM 70	Domwood	BGD 36-43
Cotton	AAKA 1, 6, 14-	Dolerite	BFHD 3, 10
	28, 33, 35	Dracaena	BGC 145
Nylon \ldots \ldots \ldots \ldots	AAKA 6, 28-31,	Duckweed	BGC 2
	31-31 (1) A A K A 1B		BH 2
Orlon	AAKA 31	Flm	BG 8
Bayon	AAKA 32. 34. 36		BGD 45, 46,
	AE 2		337-340
Vinvl	ААКА б	Enamel	See Paint
	AEO 2-5	Factories	3201: 1-4
Wool	AAKA 1, 2, 6-		BG 4
	14, 33, 36	Farmland	3135: 1-8 (Also
Clothing	AAKA 1-57		see Crops and
Clcver	119		Rural Terrain)
Cabal	AEL 23	Felsite	BFHD 5, 11
	AAG 3. 5	Fern.	AFM 26-37 82
Cocklebur	BGC 145	Ferric Oxide Faint	BGC 56
Coconut Palm	BGD 316, 317	Fiberirax	CJ 10, 11
Coffee	BGC 112		(f)CJA 8-25
Coleus	BGD 304-314	Field	AAA 1
Concrete	AE 1		BE 3, 4, 11-14
	AEG 1-4 2200. 20 30 51		BG 3, 4
Connon	AEL 6. 24. 46.		BGC 2, 13, 10-
Copper.	47		20,00,00-10 113 1 <i>4</i> 3
	(f)AEL 11-22		3133. 1-82
Coral	BFHD 6, 11, 12	Fine Sandy Loam	BFDB 1-6
Corn	BGC 35-55, 148,	Fir.	BGD 123-125
	149, 181-183		3134: 6
	3133: 62-64	Fir Board	AET 3
Catton	BGC 99-102	Flags (Weeds)	3133: 11, 12, 26,
	159-179	<u> </u>	27
	CJ 12	Flagstone	BGC 3 4
	3133: 56, 57	Flax	BFK 3
Cotton (Cloth)	AAKA 1, 6, 14-	Foliage	See Vegetation
	28, 33, 35	Foxtail.	BGC 56, 57
Cottonwood	BGD 235-258,	Cubbro	BEHD 8
	ang		AEM 38
Crangeta	AET 1	Galvanized Iron	AEL 19
	AAA 1	Geranium	BGD 303, 304,
oroko	BE 14		312, 313
	3133: 1-82	Ginkgo Biloba	BGD 303
	3135: 1-8 (Also	Glass	AEJ 1, 2
	see specific	G_1	CJ 13 Apt 17 A1 AA
	crops, e.g.,	Gold Daint	AEL (, 21-22 AEM 37 100
	corn, wnear,	Goldenrod	BGD 34
	c		202 -1

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Granite	AE 2 BFHD 2, 4, 5,	Lava	BFHD 2
Que el Ma	7, 10	(White Lead)	AEM 9-12, 19-
Graphite	BFK 2 BC A	T_ntil	BGC 113
Grass	BGC 9 12-31	Lichens	BG 9
	35, 55, 56, 58-		BGD 356, 357
	60, 143, 146-	Lima Beans	BGC 113, 114
	148	Limestone	BFHA 1
	3133: 1-11, 13-		BFHD 4, 7
	24, 29-34, 38-	Linden	BGD 69
	44, 46-49, 52,		AEM 52, 69
	00, 01-01, 00, 66 77	Loamy Sand	BECB 1
Gravel	AEK 1	Locust	GGD 223, 224
014Ver	BFHD 1-12	Loess	3131: 53-58
	3290: 1, 6, 26,	Log	AAA 2
	29, 40, 43, 48,	Lucite	AEO 2
	51	Madrone	BGD 342, 343
Current Managha	(I)BGCM I-0 See individual	Magnesium	AEL 9, 29
Ground Largets	targete e g	Magnesium Carbonate	CJ 8, 9
	Buildings, Air-	Magnesium Citrate	CJ 12
	fields, Person-	Magnesium Oxide	CJ 7, 14 (f)/71A 1_8
	nel, Roads,	Magnolia	BGD 70. 345
	Bridges, Vehi-	Manzanita	BGC 156, 157
	Cies, industrial	Maple	BGD 72-106,
	Facilities, eu.		345-353, 400,
Haloxylon	BG 8	March	402,403
	AEL 3, 31, 32	Marah Groee	3136.2.3
Hav	BG 9 (Also see	Meadow	See Field
	Straw)	Merion Blue Grass	(f)BGCM 1-6
Hazelnut	BGD 51, 52	Mesquite	BGD 223
Heather	BGC 99	Metals	A 17 A 17
	3134:7 , DCC 158 150	Alciad	(f)AEL 9, 10
Hickory	BGD 232, 234	Aluminum	AEA 1. 3. 4. 7-9
Holly.	BGD 54		(f)AEL 7.8
Hornbean	BGD 53	Aluminum Bronze	AEL 21, 22
Ice	3122: 1-9	Brass	AEL 6
Ilyas	BGC 58, 59	Chromium (Plating)	AEL 50-52 AEL 6 39 40
Inconel	AEL 2, 3, 8, 45	All	(f)AEL 1-6
Indian Mallow	BGC 158	Chromium (Pure)	AEL 1
Insulating Felt.	(I)CJA 8-20 ATT 1 25	Cobalt	AEL 23
	BGD 44	Copper	AEL 6, 24, 46,
Tunchennu	DCD 229		• (f)AFL 11-22
Juneperry	BGD 125. 126	Galvanized Iron	AEL 19
otanper	358, 359	Gold	AEL 7, 41-44
Vaalin	AFM RA	Hastelloy	AEL 3, 31, 32
Khaki	AAKA 1		AEL 2, 3, 8, 45
Kovar	AEL 8		ABL 1, 20 AFT 2
Tooguan	ATM 80	Magnesium	AEL 9. 29
Lacquer	See Water	Molybdenum	AEL 2, 8, 29.
Larch	BGD 126, 127	······································	30, 49, 50
Laurel	AEM 15	Nickel	AEL 9, 10, 30,
			31, 52. 53

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Palladium	AEL 12, 32, 41 AEL 10, 11	Uniform (Cloth)	AAKA 2, 6, 28- 30
	AEM 105	Vehicle	AE 2
Rhodium	AEL 11 12 46	Onal	CJ 13
Silver	AEL 12 13 37.	Oriental Skin	A A K 3
	40	Orlen	AAKA 91
Stainlage Stual	AFT 1 13 15	Orion	AAVA 91
Dramieso deer	20 25 28 AA	Paint	
	20, 23, 20, 44, 15	Alkydi	AEM 52, 53,
Stool (Mild)	TU ATT 5 25 20	•	76, 77, 91
	AEL 0, 00-09	Aluminum	AEM 37, 39, 82-
Idiliaiuni	ADL 41-47		85, 101
	AEA 0	Aluminum Silicate	AEM 50, 51,
	AEL 3-3, 10-19,		102, 104
Tine	JZ-30, 40	Black	AEM 1, 4, 54,
	ALL 19		63, 65, 71, 91-
	DIN J		93
	AEM 49, 30, 00		(f)AEM 1-9
	BGC 144	Blue	AEM 3, 4, 54.
	BGC 01		55
	BFK 1-3	Brown	AEM 1. 58. 59
	BGC 144	Clear Finishes	AEM 3, 87-90
	BGD 233	Chrome Oxide (Chrome	,
Molybaenum	AEL 2, 8, 29, 30,	Green)	AEM 18-25
Masa	49,00	Dirt Covered	AEM 54, 67
M088		Driers, Thinners,	
	DG 2, 4 DC A 1	Mediums	AEM 52, 87-90
	DCD 1-3		(Also see
Mountain Taural	BGD 53_55		Alkyd, Resin)
Mountaine	See Terrein	Ferric Oxide	AEM 26-37, 82
		Foreign	AALF 1
	DE 13 14		AEM 86, 87
Mulhorry	BGD 353	Gold	AEM 37, 100
	(f)BGDV 1-6	Green	AALF 1
Mullein	BGD 341		AEM 12-25
Nustard	BGC 104	Gray	AEM 2, 4, 63,
Mular	AFO 3		64,66,70,93,
	MLO V		94
Negro Skin	AAK 1, 3-7	Lead Basic Carbonate	
Nickel	AEL 9, 10, 30,	(White Lead)	AEM 9-12, 19-
	31, 52, 53		21
Nylon	AAKA 6, 28-31	Metallic	AEM 37-39, 82-
	37-57		86
	(1)AAKA 1-6	Mica	AEM 49, 50, 66
		Olive Drab	AEM 13, 14, 16,
Oak	BGC 7-29, 320-		17, 78-82, 95-
	336, 384-400,		100
	402	<u>^</u>	(f)AEM 20-39
	3134: 4	Orange	AEM 2
Oate	BGC 62-65	Plastic Laminate	AEM 104, 105
	3133: 56, 71,	Platinum	AEM 100, 101
	75, 82	Primer	AEM 26, 37
Olive Drab		кеа	AAA 1
Burlap	AED 3-5	Deele	AEM 25-37, 81
Casvas	AEE 1	Resin	AEM 68, 76, 77,
Patat	AEM 13, 14, 16,	011	85, 86, 90, 91
	17, 78-82, 95-		AEM 101
	100		AEM 4
	(f)AEM 20-39		ALM 4
Plastic	AEO 4. 5	verver (om) Diack	(1)AEM 10-19

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Velvet (31	VI)	W	/h	ltε	9						(f)AEM 4-9
White			•	•							AEM 5-12, 71-
							-	-	-	-	78, 94, 95
											(f)AEM 10-19
Yellow .											AEM 60, 61
Zinc (Gal	va	ni	te)					Ì		AEM 38
Zinc Oxid	e	(7	in	c							
White				•							AEM 6-9 18
	•	•	•	•	•	•	•	•	•	•	19
Dalladium											AEL 12 32 41
Palmetto	•	•	•	•	•	:	•	•	•	•	BGD 317
Paner		•	•	•	•		•		•	•	AEN 1-17
Parachutes		:		•	•	•	•	•	•	•	AAKA 37-57
	•	•	•	•	•	•	•	•	•	•	(f)AAKA 1-6
Pararubber											BGD 355, 356
Paulowina .		Ì	Ī	Ī							BGD 46
Pavement .	Ì		Ì		Ì		Ī				3290: 1-53 (Al-
				-	-		•		•		so see Roads)
Pea											BGC 114
Peach				•	•		•				BGD 228, 229
Peanuts											BGC 114-116
Pear								,			BGD 226
Pebbles		•	•					•	•		AEB 1
											AEG 1
											BFCA 6
Persimmon	•		•	٠	•		•	•	•	•	BGD 44
Personnel .					•			•		•	See Cloth and
											Skin
Philodendron	1			•	•	•				•	BGD 316
Pigweed	•	•	•	•	•	•	•	•	•	•	BGC 5
Pine		•	•	•	•	•	•	•	•	•	BE 8
											BGD 127-195,
											359, 360, 403-
											406
											3132: 1
											3134: 4, 6, 7
Pinyon	٠	•	٠	•	٠	٠	٠	٠	٠	٠	BGD 121, 122
Pitch	٠	•	•	•	٠	٠	•	•	•	٠	AEQ 1
Plantain	٠	٠	٠	•	٠	٠	٠	٠	•	•	BGC 142
Plastic	•		•		:	:	٠	٠	•	•	AEO 1-5
Plastic Lam	m	at	е.	F 3	un	ιt	•	•	•	•	AEM 104, 105
Platinum.	٠	٠	٠	٠	٠	•	٠	٠	٠	٠	AEL 10, 11
Dietienen De	1										AEM 100 101
Platinum Pa	IN	C	•	•	٠	٠	٠	٠	٠	•	AEM 100, 101
Plum	٠	٠	•	٠	•	•	٠	٠	٠	٠	BG 1 DCD 997 990
											DGD 221, 230,
Dodgol											AAC 9
Pousoi	٠	٠	٠	•	٠	٠	٠	•	•	•	DFA 1_5
Dond											Soo Water
Ponlar	•	•	•	•	•	•	•	•	•	•	BGD 262-288
ropar	•	•	•	٠	٠	•	٠	•	•	•	382, 383
Pornhytic									_		BFHD 9
Potassium N	Jjt	r2	te	•	•	•	Ĵ	•		•	BFK 2
Potato	-			•	•	•	•	•	•	•	BGC 1, 104.
	•	•	•	•	•	•	•	•	•	•	179, 180
Potterv	_	¢					_				AER 2
Primer	•	•	•			•					AEM 26. 37
Purite	•	•	•	•	•	•	•	•	•	•	BFK 3

Quartz	BFK 3 BFHD 6, 11, 12
Ragweed	BGC 1 3135: 7
Rayon	AAKA 32, 34, 36 BGD 373
Reeds	BGC 65
	010
Aluminum Mirror	
Fiberfrax	CJ 10, 11 (f)CJA 8-25
Magnesium Oxide	CJ 7, 14 (f)CJA 1-6
Velvet Paint (3M)	
White	(f)AEL 4-9
Deindeen Mong	
Reindeer Moss	BGA I
Residential Area	3202: 1, 2
Resin Paint	AEM 68, 76, 77,
	85 86 90 91
Rhodium	AEL 11, 12, 40
Rice	BGC 66
River	See Water
Doode	
noads	
	AAG 1-5
	(Also see Pave-
	ment and
	specific road
	specific road
	materials, e.g.,
	A 1 1 AL (11-14)
	Asphalt, Cinder,
	Asphalt, Cinder,
	Asphait, Cinder, Concrete,
	Asphait, Cinder, Concrete, Gravel, Dirt,
	Asphait, Cinder, Concrete, Gravel, Dirt, etc.)
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.)
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 DE 11
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BE 11 BE 11
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BE 11 BFHD 1
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BE 11 BFHD 1 AAA 1, 2
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BE 11 BFHD 1 AAA 1, 2 AER 1
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BE 11 BFHD 1 AAA 1, 2 AER 1 AFR 1
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BE 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BE 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353-
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BE 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355
Rock . . . Roofing Materials . . Rubber . . . Rubber Leaf . . Runway . . .	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BE 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355 AAE 1
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BF 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355 AAE 1 AE 1 AE 2
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BF 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355 AAE 1 AE 2 AFL 5
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BF 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355 AAE 1 AE 2 AEL 5 DCC 22, 27
Rock Roofing Materials Rubber Rubber Leaf Runway Rust 	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BE 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355 AAE 1 AE 2 AEL 5 BGC 66, 67
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BE 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355 AAE 1 AE 2 AEL 5 BGC 66, 67 3133: 24, 25
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BF 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355 AAE 1 AE 2 AEL 5 BGC 66, 67 3133: 24, 25
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BF 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355 AAE 1 AE 2 AEL 5 BGC 66, 67 3133: 24, 25 BGD 35
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BF 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355 AAE 1 AE 2 AEL 5 BGC 66, 67 3133: 24, 25 BGD 35 BE 7, 15
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BF 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355 AAE 1 AE 2 AEL 5 BGC 66, 67 3133: 24, 25 BGD 35 BE 7, 15 BF 17
Rock .	Aspnait, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BF 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355 AAE 1 AE 2 AEL 5 BGC 66, 67 3133: 24, 25 BGD 35 BE 7, 15 BF 17 BFK 2
Rock Roofing Materials . . . Rubber Rubber Leaf Runway Rust Rye Rye Grass Salt 	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BF 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355 AAE 1 AE 2 AEL 5 BGC 66, 67 3133: 24, 25 BGD 35 BE 7, 15 BF 17 BFK 2 3131: 59
Rock . Roofing Materials . Rubber . Rubber Leaf . Runway . Rust . Rye . Rye Grass . Salt .	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BF 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355 AAE 1 AE 2 AEL 5 BGC 66, 67 3133: 24, 25 BGD 35 BF 7, 15 BF 17 BFK 2 3131: 58
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BF 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355 AAE 1 AE 2 AEL 5 BGC 66, 67 3133: 24, 25 BGD 35 BE 7, 15 BF 17 BFK 2 3131: 58 See Soil
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BF 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355 AAE 1 AE 2 AEL 5 BGC 66, 67 3133: 24, 25 BGD 35 BE 7, 15 BF 17 BFK 2 3131: 58 See Soil BFHD 5
Rock . Roofing Materials . Rubber . Rubber Leaf . Runway . Rust . Rye . Rye Grass . Salt . Sandstone . Sandy Loam .	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BF 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355 AAE 1 AE 2 AEL 5 BGC 66, 67 3133: 24, 25 BGD 35 BE 7, 15 BF 17 BFK 2 3131: 58 See Soil BFHD 5 See Soil
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BF 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355 AAE 1 AE 2 AEL 5 BGC 66, 67 3133: 24, 25 BGD 35 BE 7, 15 BF 17 BFK 2 3131: 58 See Soil BFHD 5 See Soil CL 10, 11
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BF 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355 AAE 1 AE 2 AEL 5 BGC 66, 67 3133: 24, 25 BGD 35 BF 17 BFK 2 3131: 58 See Soil BFHD 5 See Soil CJ 10, 11 AER 52
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BF 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355 AAE 1 AE 2 AEL 5 BGC 66, 67 3133: 24, 25 BGD 35 BE 7, 15 BF 17 BFK 2 3131: 58 See Soil BFHD 5 See Soil CJ 10, 11 AEM 52
Rock	Asphalt, Cinder, Concrete, Gravel, Dirt, etc.) AEK 1 BF 11 BFHD 1 AAA 1, 2 AER 1 AEP 1, 2 BGD 106, 353- 355 AAE 1 AE 2 AEL 5 BGC 66, 67 3133: 24, 25 BGD 35 BE 7, 15 BF 17 BFK 2 3131: 58 See Soil BFHD 5 See Soil CJ 10, 11 AEM 52 BGD 55, 344

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Sawdust AE 2 Sea............ BH 6 3123: 1-15 BH 2, 3 Sedge BGC 143 BGC 68 Selin Shale. **BF 17 AEM 90** AAA 1 Silt..... BF EC 1 Siltstone BFHD 6, 8, 11 **BFEB 1-11** BFFC 1 AEL 12, 13, 37-40 Silver Paint . . . **AEM 101** Skin Caucasian AAK 1, 2, 4, 5, Negro AAK 1, 3-7 Oriental AAK 3 (P)BAB BH 7-14 3133: 28, 34, 38, 47, 51 3290: 37-39 Sod (f)BGCM 1-6 Sodium Carbonate BFK 1 Sodium Chloride. BFK 2 Sodium Nitrate BFK 1 Sodium Silicate AEH 2 BFK 2, 3 BFL 1, 2 Soil Clay BFGC 1-5 3131: 31-43 Clay Loam **BFFA 1-10** . . . Cultivated BFA 1-7 BFDA 6-8 3131: 44-52 Dirt.... AAG 1-3 AEH 2 AEM 54, 67 3290: 52, 53 Fine Sandy Loam.... BFDB 1-6 Lava **BFHD 2** Loam **BFEA 1-9** Loamy Sand BFCB 1 3131: 53-58 Loess..... Miscellaneous BF 1-18 Rock AEK 1 BE 11 **BFHD 1** Sand . . . **AEM 67** BE 1-3, 5, 6, 9-11 **BFCA 1-14**

Sandy Loam	i .	•	•	•	•	•	•	•	AAG 1
									BFDA 1-8
									3133: 29-39,
-									42-46
Shale	• •	•	•	٠	٠	٠	٠	٠	BF 17
Silt	•••	•	٠	•	•	•	٠	•	BFEC 1
Silt Loam.	• •	•	•'	•	•	•	٠	•	BFEB 1-11
Silty Clay L	<i>i</i> oan	n	•	•	٠	٠	٠	٠	BFFC 1
Sorghum	• •	•	•	•	•	•	•	•	BGC 9-12
Soybeans			•		•				BGC 116-141
									3133: 52, 54,
									55, 59, 60, 77-
									79
Sphagnum Mos	s .	•	•	•	•	•	•	•	BGB 1, 2
Spruce		•	•		•	•			BGD 195, 196,
									361, 406, 407
Squash			•						BGC 8
Stainless Steel					•	•			AEL 1, 13, 15,
									20, 25, 28, 44,
									45
Stee' (Mild) .									AEL 5, 35-39
Stones				•	•	•			BFHD 1
									3290: 44-47
Straw									AAA 1, 2
									BG 1
									BGC 65, 67, 99.
									113
Stream									See Water
String Beans.		Ì						÷	BGC 141, 142
Sudan Grass .		÷		Ì					3133: 8-11
Sugar Beet		Ì		Ì	Ĩ				BGC 6-8
Sulphur		Ż		Ì	Ì		÷	÷	BFL 1
		•	•	Ť.		-	-	•	CJ 9
									(f)CJA 7
Sumach			_			-			BGD 33, 34
Sunflower			Ì			·	Ì	:	BGC 1
Swamns	•••	,	•	•	•	•	•	•	See Marsh
Sweetenm	•••	Ċ	•	•	Ċ	•	•	•	BG 5
	•••	•	•	•	•	•	•	•	BGD 291-302
									374
Sweet Potato									BGC 1
Sycamore	•••			•	•		•		BGD 196-223
	•••	•	•	•	•	•	•	•	361-372 407
									408
Tantalum	• •	•	٠	•	٠	٠	٠	•	AEL 47-49
Tape (Cloth).	• •	•	•	٠	•	٠	•	•	AE 2
Tar	•••	•	•	•	•	٠	•	•	AEQ 1, 2
Targets		•	•	•	•	•	•	•	See Ground
									Targets and
									specific types
									of targets
Tar Paper	• •	٠	٠	•	•	÷	•	•	AEQ 2
Tarpaulin	•••	•	•	•	•	•	•	•	(f)AEE 1, 2
Target Materia	ls	٠	•	•	•	•	•	•	See specific
									materials such
									as Asphalt,
									Brick, etc.
Target Materia	als ((M	lis	IC.)	•	•	•	AE 1-3
Terra Cotta .			•			•	•	•	AE 1

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3131: 1-30 (Also see Desert)

Terrain	BE 1-14	Bermuda Grass	BGC 35
	BF 10-13		3133: 13
Flat	BE 2-7	Birch	BGD 47, 51, 342
Hilly	BE 7, 8		3134: 7
Ice, Water, and Land	3154: 1-3	Birdsfoot Tufoil	BGC 106
Mountains	BE 9-11	Blackberry	BGD 226
Dunal	3137: 2, 7-11 DF 12-14	Bracken Fern	BGC 3 DCD 995
Water and Land	3152.1	Bromegrass	BGD 225 BGC 12
Water, Ice, Land, and		Buckeye	BGD 303
Small Buildings	3303: 1	Burdock	BGC 146
Wooded	BE 1, 8	Cabbage	BGC 103, 104
	BH 9	Calabash	BGD 232
	3132: 1	Catalpa	BGD 30-32, 336
	3134: 1-7	Cedar	BGD 122, 123,
Tilo	3130; 3 AFD 1_3	Chamm	308, 404 DCD 996 997
Timothy	BGC 68-70	Cherry	230
Titanium.	AEA 6	Chestnut	BGD 320
	AEL 3-5, 16-	Chinese Pistachio	BGD 33
	19, 32-35. 45	Clover	BGC 68-70, 111,
Titanium Dioxide	CJ 11		112
Tomato	BGC 104, 105	Cocklebur.	BGC 145
Tourmaline	AEM 67	Coconut Palm	BGD 316, 317
Tree	BE 4 DCD 1 2 6		BGC 112 BGD 304.314
	22 23 196 259	Corn	BGC 35-55, 148.
	BG 1. 5		149. 181-183
	BGD 2, 106		3133: 62-64
Truck	AALF 1		3135: 1
Tuff	AE 1	Cotton	BGC 99-102,
Tulip	BGD 70, 71		159-179
Tulip Poplar.	BGD 71, 72		CJ IZ 2192, 56 57
	BGD 231 ATM 52 90	Cottonwood	3133: 00, 07 DCD 985-958
101pentine	ALMI 02, 03	Cottonwood	375, 376, 408,
Uniforms	AAKA 1-57		409
Vegetation		Crow Foot	BGC 2
Alder	BGD 46	Daisies	BGC 1
Alfalfa	BGC 106-111	Dieffenbachia	BGD 315
	3133: 45, 52, 53,	Dogwood	BGD 36-43
	57, 62, 65, 57,	Dracaena	BGC 145
	3135: 1	TURMEER	BH 2
Apple	BG 7. 8	Elm.	BG 8
	BGD 225, 374		BGD 45, 46,
Ash	BGD 107, 121		337-340
	3134: 7		3134: 7
Aspen?	BGD 258-261,	Fallow	BG 4
Polgom Doplo-	370-382 DCD 262	Fern	BGC 181
Baisam Popiar	BGD 203 BGD 0 12 51		
LMAIR	71, 196, 225.	Flem	BE 3. 4. 11-14
	227, 229, 231,		BG 3, 4
	233		BGC 2, 13, 15-
Barley	BGC 31-35		28, 65, 68-70,
Basswood.	BGD 56, 68, 345		113, 143
Beech	BGD 2, 6, 317, 320		3133: 1-82

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、1997年には、1994年代は1998年代に、学校的などの研究には、現在的学校の時期であるとは最高級になった。1994年代は1997年代に、1994年代に、1994年代に、1994年代に、1994年代

Fir	BGD 123-125	Mountain Laurel	BGD 53-55
	3134: 6	Mulberry	BGD 353
Flax	BGC 3, 4		(f)BGDV 1-6
Foxtail	BGC 56, 57	Mullein	BGD 341
Geranium	BGD 303, 304,	Mustard	BGC 104
	312, 313	Oak	AET 1
Ginkgo Biloba	BGD 303		BGD 7-29, 320-
Goldenrod	BGD 34		336, 384-400,
Grass	BG 4		402
	BGC 9, 12-31,		3134: 4
	35, 55, 56, 58-	Oats	BGC 62-65
	60, 143, 146-		3133 56 71
	148		75. 82
	3133: 1-11, 13-	Pea	BGC 114
	24. 29-34. 38-	Peach	BGD 228 229
	44. 46-49. 52.	Peanuts	BGC 114-116
	53, 57-61, 63,	Pear	BGD 226
	66. 77	Persimmon	BGD 44
Haloxylon	BG 8	Philodendron	BGD 316
Hawthorne	BGD 227	Pigweed	BGC 5
Hay	BG 9 (Also see	Pine	BE 8
•	Straw)		BGD 127-195.
Hazelnut	BGD 51, 52		359, 360, 403-
Heather	BGC 99		406
Hemlock	3134: 7		3132: 1
Hibiscus	BGC 158, 159		3134: 4, 6, 7
Hickory	BGD 232, 234	Pinyon	BGD 121, 122
Holly	BGD 54	Plantain	BGC 142
Hornbean	BGD 53	Plum	BG 7
Nyas	BGC 58, 59		BGD 227, 230,
Indian Mallow	BGC 158		231, 374
	BGD 44	Poplar	BGD 262-288,
	BGD 228		382, 383
5 uniper	DGD 120, 120, 259, 259, 250	Potato	BGD 1, 104,
Larch	BCD 126 127	Dogwood	179, 180
Lentil.	BGC 113	Ragweeu	DGC 1 DCD 272
Lichens	BG 9	Reade	
Lilac	BGD 356, 357	Reindeer Mogg	BGC 0J
Lima Beans	BGC 113, 114	Rico	BCC 66
Linden	BGD 69	Rubber Leaf	BGD 106 353-
Locust	BGD 223, 224		355
Madrone	BGD 342, 343	Rve	BGC 66, 67
Magnolia	BGD 70, 345	Rve Grass	3133: 24, 25
Manzanita	BGC 156, 157	Sagebrush	BGD 35
Maple	BGD 72-106,	Sassafras	BGD 55, 344
	345-353, 400,	Sedge	BGC 143
	402,405	-	BH 2, 3
Marsh Grass	3136: 2, 3	Selin	BGC 68
Merion Blue Grass	(f)BGCM 1-6	Sorghum	BGC 9-12
Mesquite	BGD 223	Soybeans	BGC 116-141
Milkweed	BGC 144		3133: 52, 54,
M111et	BGC 61		55, 59, 60, 77-
	BGC 144		79
Mockernut	BGD 233	Sphagnum Moss	BGB 1, 2
MOSS	BFILL Z	Spruce	BGD 195, 196,
	DU 4, 4 DCA 1	Course at	301, 400, 407
	BGB 1-3	squasn	BGC 8

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Straw	V	AAA 1, 2	Yucca	BGD 20
		BG 1	Vehicles	AALF 1
		BGC 65, 67, 99,	Velvet Paint (3M) Black	(f)AEM 10-19
		113	Velvet Paint (3M) White	(f)AEM 4-9
Strin	o Beans	BGC 141, 142	Vetch	BGC 70
Suda	Grage	3133: 8-11	Viburnum	BGD 33
Sugar	n Boot	BGC 8-8	Vinvl	AAKA 6
Sugar		PCD 33 34	·	AEO 2-5
Gund		DOD 00, 04	Virginia Creener	BGD 232 375
Sunn			Auguna creeper	Dub lou, ere
Swee	tgum	DC 0 DCD 901 909	Walnut	BGD 232
		BGD 291-302,	Water	BF 13
		314		BG 2 , 🗧
Swee	t Potato	BGC 1	4	BGC 65
Syca	more	BGD 196-223,		BH 1-14
		361-372, 407,		3123: 1-15
		408		3136: 2, 3
Time	othy	BGC 68-70	Woods	BG 3
Tom	ato	BGC 104, 105	Weeds	BGC 1
Tree		BE 4		2001
		EGD 1, 2, 6 ,		2122, 11 12
		22, 23, 196, 259		02 07 00 44
Tron	vical Vegetation	BG 1. 5		20, 21, 30, 44
1.01	iour regeneren r.r.r	BGD 2. 106	Wheat	BGC 70-99,
75,16	~	BGD 70 71	1	150-156,
	$\begin{array}{c} \mathbf{p} \\ $	BGD 71 72		3133: 68-70,
Tuni	lo Cum	BGD 231		80-82
Tupi		BCC 70		3135: 1
Vetc	n		Willow	BGD 289, 290
Vibu	rnum	BGD 33	Wood	AAA 2
Virg	inia Creeper	BGD 232, 313		AAG 5
Walr	nut	BGD 232		AAH 1
Wee	ds	BG 3		AET 1-3
		BGC 1	Wood Stain	AEM 4
	۰.	BH 2, 3	Wool	AAKA 1-2.6-
		3133: 11, 12,		14. 33. 36
		26, 27, 38, 44	Wormwood	BGD 35 36
Whe	at	BGC 70-99,		<i>Dan</i> 00, 00
		150-156	Yantak	BG 4
		3133: 68-70.	Yucca	BGD 56
		80-83		A ET 10
		3135-1		AEL 19
337(1).	~	BCD 280 200	Zinc (Galvanite) Paint	AEM 38
W 1110	uw	BCD 35 38	Zinc Oxide (Zinc White)	AEM 0-9, 18,
WOR				19
Yant	ак	DU 4		

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3 OPTICAL SPECTRAL DATA

3.1. THEORY OF REFLECTANCE

The purpose of this discussion is to enable the user of this data compilation to consider the data in a proper perspective. The "reflectance" alone, for example, does not sufficiently describe the results of an experiment to allow the results to be used indiscriminately. One must have knowledge of the measuring instrument's characteristics, since they have measurable effect on interpretation of the output. Some important instrument parameters include spectral esolution, the solid angle of effective viewing, and characteristics of the radiation sc rre.

Our present understanding of radiation theory does not permit an analytical description, in closed form, of the exact relationship between the radiation emitted by a source (whether natural or artificial) and the radiation received by a remote sensor after this radiation has been reflected by an object under surveillance. There are well known laws to describe the simple case of an electromagnetic wave incident upon a perfectly planar interface between two media. In this case, the reflected wave depends upon the radiation wavelength, the angle of incidence, and the physical properties (permittivity, permeability, and conductivity) of the two adjoining media. The laws governing such a case are sufficiently understood so that the refractive index and extinction coefficient of materials involved may be found by determining the reflection coefficients of the materials. For the more complicated case involving a surface with periodic or random surface irregularities, an analytic determination of the properties of the reflected electromagnetic field may only be approximated.

In the past ten years many papers have been published on scattering, or reflection from rough surfaces. Many theories have been developed, but none is both general and rigorous at the same time. To perform reasonably simple numerical calculations on the basis of these theories, certain simplifying assumptions are introduced, usually including one or more of the following:

- (1) The dimensions of scattering elements of the rough surface are either much smaller or much greater than the wavelength of the incident radiation.
- (2) The radii of curvature of the scattering elements are much greater than the wavelength of the incident radiation.
- (3) Shadowing or obscuration effects occurring at the surface may be neglected.
- (4) Only the far field is to be considered.
- (5) Multiple reflections may be neglected.
- (6) Consideration is restricted to a particular model of surface roughness (e.g., sawtooth, sinusoidal protrusions of definite shape and in random position, with random variations in height given by their statistical distribution and correlation function).

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Electromagnetic scattering theory has been used in the past to compute radiation backscatter from targets in the microwave region of the spectrum, where the radiation wavelength is much greater than the minute irregularities of the target surface and where the conductivity of the target material is infinite. In the optical region, where materials have finite conductivity and the surface irregularities have a wide range in size relative to the radiation wavelength, present electromagnetic scattering theory is applicable to only a few special cases, so the only way to determine reflectance in this region for target and background objects is by experimentation.

One can arrive at the most general definition of reflectance ρ' (called bidirectional reflectance [3-1] by considering an infinitesimal element of surface, dA, upon which radiation of infinitesimal solid angle $d\omega_i$ and radiance L_i is incident. Taking a coordinate system fixed with respect to dA, with polar angle θ' measured from the normal and azimuth angle ϕ' measured from a fixed line (see fig. 3-1), the contribution to the reflected radiance, $dL_r(\theta'_r, \phi'_r)$, in the reflected pencil for the direction (θ'_r, ϕ'_r) is

$$dL_{\mathbf{r}}(\theta_{\mathbf{r}}^{\prime}, \phi_{\mathbf{r}}^{\prime}) = \rho^{\prime}L_{\mathbf{i}}(\theta_{\mathbf{i}}^{\prime}, \phi_{\mathbf{i}}^{\prime})\cos \theta_{\mathbf{i}}^{\prime}d\omega_{\mathbf{i}}^{\prime}$$
(3-1)

T.

Generally, ρ' is a function of the incident and reflected directions $(\theta'_i, \phi'_i \text{ and } \theta'_r, \phi'_r \text{ respectively})$, the polarization (P), the wavelength (λ) , and the optical parameters of the material on either side of the surface. Total radiance in a given reflected direction is obtained by integrating



FIGURE 3-1. LOCAL COORDINATE SYSTEM FOR DETERMINING BIDIRECTIONAL REFLECTANCE

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equation 1 over all incident directions, which yields

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$$\mathbf{L}_{\mathbf{r}}(\theta_{\mathbf{r}}^{\prime}, \phi_{\mathbf{r}}^{\prime}) = \int \rho^{\prime} \mathbf{L}_{\mathbf{i}}(\theta_{\mathbf{i}}^{\prime}, \phi_{\mathbf{i}}^{\prime}) \cos \theta_{\mathbf{i}}^{\prime} d\omega_{\mathbf{i}}^{\prime}$$
(3-2)

Also, by Helmholtz's reciprocity theorem, if the directions of the incident and reflected pencils are interchanged, the bidirectional reflectance is unchanged, i.e.,

$$\rho'(\theta_1', \phi_1'; \theta_2', \phi_2'; \mathbf{P}; \lambda) = \rho'(\theta_2', \phi_2'; \theta_1', \phi_1'; \mathbf{P}; \lambda)$$
(3-3)

Since the optical constants of materials may change from point to point, bidirectional reflectance becomes a function of the location of dA. If it is then assumed that the surface can be described by z' = f(x', y'), the correct functional dependence for reflectance is

$$\rho'(\theta_{i}^{\dagger}, \phi_{i}^{\dagger}; \theta_{i}^{\dagger}, \phi_{i}^{\dagger}; \mathbf{P}; \lambda; \mathbf{x}^{\dagger}, \mathbf{y}^{\dagger}, \mathbf{z}^{\dagger})_{\mathbf{z}^{\dagger}=\mathbf{f}(\mathbf{x}^{\dagger}, \mathbf{y}^{\dagger})}$$

Generally, the direction of the normal to dA is also a function of the location of dA on the surface of the object. Hence, even if the incident and reflected radiation have a constant direction with respect to the (x', y', z') coordinates, the angles (θ_i', ϕ_i') and (θ_r', ϕ_r') (taken with respect to the local normal) would be a function of location of the surface element dA. For convenience, a second, absolute coordinate system is usually introduced, viz., (x, y, z). The x-y plane of this system is coincident with the average value of z' = f(x', y') along the surface A, and is, therefore, the "average" plane of the reflector. The normal to this average plane is parallel to the z axis. Instead of referring the incident and reflected radiation to the local coordinates, they are then referred to the absolute system, with θ as the polar angle and ϕ as the azimuthal angle. The bidirectional reflectance with respect to this system is

Another type of reflectance commonly considered is the directional reflectance ρ_{d} which is a function of only one direction, either the incident or reflected direction. In the case where reflected power is integrated over a hemisphere and incident power is from a specific direction, directional reflectance is denoted by ρ_{di} . The incident power $d\Phi_{i}$ is

$$d\Phi_{i} = dL_{i}(\theta_{i}, \phi_{i}) \cos \theta_{i} d\omega_{i} dA \qquad (3-4)$$

and using equation 3-2,

$$\mathbb{L}_{\mathbf{r}} = \rho' \frac{\mathrm{d}\Phi_{\mathbf{i}}}{\mathrm{d}\mathbf{A}}$$
(3-5)

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Since the reflected power $d\Phi_r$ is given by

$$d\Phi_{\mathbf{r}} = dA \int_{2\pi} d\mathbf{L}_{\mathbf{r}} \cos \theta_{\mathbf{r}} d\omega_{\mathbf{r}} = d\Phi_{\mathbf{i}} \int_{2\pi} \rho' \cos \theta_{\mathbf{r}} d\omega_{\mathbf{r}}$$
(3-6)

therefore,

$$\rho_{di}(\theta_i, \phi_i; \mathbf{P}; \lambda; \mathbf{x}, \mathbf{y}) = \int_{2\pi} \rho' \cos \theta_r \, d\omega_r$$
(3-7)

When dA is uniformly illuminated from all directions ($L_i = constant$), the corresponding directional reflectance, ρ_{dr} , is defined as the ratio of the radiance reflected in a given direction to the incident radiance. To proceed as previously,

$$\mathbf{L}_{\mathbf{r}} = \int_{2\pi} \rho' \mathbf{L}_{\mathbf{i}} \cos \theta_{\mathbf{i}} d\omega_{\mathbf{i}} = \mathbf{L}_{\mathbf{i}} \int_{2\pi} \rho' \cos \theta_{\mathbf{i}} d\omega_{\mathbf{i}}$$

and, thus,

$$\rho_{dr}(\theta_{r}, \phi_{r}; \mathbf{P}; \lambda; \mathbf{x}, \mathbf{y}) = \int_{2\pi} \rho' \cos \theta_{i} d\omega_{i}$$
(3-8)

From comparison of equations 3-7 and 3-d,

$$\rho_{di}(\theta, \phi; \mathbf{P}; \lambda; \mathbf{x}, \mathbf{y}) = \rho_{dr}(\theta, \phi; \mathbf{P}; \lambda; \mathbf{x}, \mathbf{y}) = \rho_{d}$$
(3-9)

 p_d is called directional reflectance.

3.2. INSTRUMENTATION

This section describes several types of instruments used to generate the optical data included in this compilation. An expression is derived for the "reflected quantity" measured by each type.

3.2.1. GENERAL ELECTRIC SPECTROPHOTOMETER [3-2]. A schematic diagram of this measurement apparatus is presented in figure 3-2. Monochromatic radiation from the source passes through a Nicol prism (N_1) and then through a Wollaston prism (W_1) oriented to N_1 at an azimuth angle α . The prism W_1 converts the radiation into two linearly polarized beams, the polarization of one of which is perpendicular to that of the other. The beams then pass through a rapidly rotating Nicol prism (N_2) and into the integrating sphere where, with the same angle of incidence, one impinges on a reference and the other on the sample materials. A detector looks into the sphere in a direction perpendicular to the plane of the two incident beams. The integrating sphere is coated with a diffuse reflector (MgO), the reflectance of which is assumed independent of polarization.

If f is used to denote the frequency of rotation of N_2 and t the time, the subscripts 1 and 2 to distinguish the beams incident on reference and sample respectively, the symbols | and |

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FIGURE 3-2. SCHEMATIC OF THE GENERAL ELECTRIC SPECTROFHOTOMETER

to represent the polarizations perpendicular to each other, and the superscripts i and r to represent incident and reflected radiation respectively, then the p; wer at the detector (except for a factor dependent on the reflectance of the sphere) is

$$\Phi = \Phi_1^r + \Phi_2^r \tag{3-10}$$

The beams emerging from W_1 are linearly polarized and their powers given by

Ł,

 $\Phi_{2}^{\prime} = \Psi_{0} \sin^{2} \alpha$ $\Phi_{2}^{\prime} = \Phi_{0} \cos^{2} \alpha$ (3-11)

where Φ_0 is the power from N₁. The prism N₂ passes that portion of the power polarized in a fixed direction, so that

$$\Phi_{1}^{i} = \Phi_{1}^{i} \sin^{2} (2\pi i t) = \Phi_{0} \sin^{2} \alpha \sin^{2} (2\pi i t)$$

$$\Phi_{2}^{i} = \Phi_{2}^{i} \cos^{2} (2\pi i t) = \Phi_{0} \cos^{2} \alpha \cos^{2} (2\pi i t)$$
(3-12)

It it is assumed that the directional reflectance of the reference, $\rho_{d,1}(\lambda)$, is independent of polarization,

$$\Phi_1^r = \rho_{d,1}(\lambda) \Phi_1^i = \rho_{d,1}(\lambda) \Phi_0 \sin^2 \alpha \sin^2 (2\pi ft)$$
(3-13)

If the polarization symbols || and || are taken to refer to the polarization parallel to the directions in which beam 2 emerging from N₂ is maximum and minimum, respectively, then the power reflected from the sample is

$$\Phi_2^{\mathbf{r}} = \Phi_0 \cos^2 \alpha \cos^2 (2\pi ft) \left[\rho_{\mathbf{d},2}(||, \lambda) \cos^2 (2\pi ft) + \rho_{\mathbf{d},2}(\underline{\mid}, \lambda) \sin^2 (2\pi ft) \right]$$
(3-14)

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The power at the detector is then*

 $\Phi = \Phi_0 \left\{ \rho_1 \sin^2 \alpha \sin^2 (2\pi ft) + \cos^2 \alpha \cos^2 (2\pi ft) \left[\rho_2(||, \lambda) \cos^2 (2\pi ft) + \rho_2(||, \lambda) \sin^2 (2\pi ft) \right] \right\} (3-15)$

Rearranging terms gives

$$\Phi = 1/2 \left\{ \rho_1(\lambda) \sin^2 \alpha + \cos^2 \alpha \left[\frac{3}{2} \rho^2(||, \lambda) + \frac{1}{2} \rho_2(\underline{|}, \lambda) \right] \right\}$$

- $1/2 \left[\rho_1(\lambda) \sin^2 \alpha - \rho_2(||, \lambda) \cos^2 \alpha \right] \cos (4\pi ft)$
+ $1/8 \left[\rho_2(||, \lambda) - \rho_2(\underline{|}, \lambda) \right] \cos (3\pi ft) \cos^2 \alpha$ (3-16)

The a-c portion of the output from the detector, having a frequency of 2f, is fed to a motor which rotates N_1 so that it takes that position for which

$$\rho_1(\lambda) \sin^2 \alpha = \rho_2(||, \lambda) \cos^2 \alpha \qquad (3-17)$$

Ω.

A simple measurement of α allows $\rho_2(||, \lambda)$ to be computed from

$$\rho_2(||, \lambda) = \rho_1 \tan^2 \alpha \qquad (3-18)$$

when the reflectance of the reference, $\rho_1(\lambda)$, is known. The directional reflectance ρ_2 is, of course, a function of the direction of incidence, and, therefore, the calculated value is correct only for that particular direction.

Since the incident beam is not infinitesimally narrow, it illuminates a finite, albeit small, area of the sample. Therefore, the computed directional reflectance of the sample is really the true reflectonce averaged over the illuminated area,

$$\overline{\rho}_{2}(||, \lambda) = \frac{1}{A} \int_{A} \rho_{2}(||; \lambda; \mathbf{x}, \mathbf{y}) \, d\mathbf{x} \, d\mathbf{y} \qquad (3-19)$$

where A is the illuminated area of the sample, and similarly for ρ_1 . Hence, in terms of the reference $\overline{\rho}_1$, the reflectance of the sample is

$$\frac{\overline{\rho}_{\Sigma}(||, \lambda)}{\overline{\rho}_{1}(\lambda)} = \tan^{2} \alpha$$

3.2.2. BECKMAN DK-2 SPECTROPHOTOMETER WITH REFLECTANCE ATTACHMENT. Figure 3-3 is an illustration of this measuring device. Monochromatic light is reflected from an oscillating plane mirror (M_1) alternately to one of two spherical mirrors $(M_2 \text{ and } M_3)$. M_1 is

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^{*}The subscript d has been dropped.



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FIGURE 3-3. SCHEMATIC OF THE BECKMAN SPECTROPHOTOMETER WITH REFLECTANCE ATTACHMENT

positioned in the focal planes of M_2 and M_3 . Thus, the radiation is reflected alternately, with little divergence, onto the reference and the sample at normal incidence. The detector compares the reflected power from the reference and sample and gives the ratio of the two.

Because the monochromator is a prism instrument, the radiation incident on M_1 is slightly polarized. More polarization results from reflection from the plane and spherical mirrors. Radiation entering the integrating sphere is probably elliptically polarized. If the subscripts 1 and 2 are used for quantities referring to the reference and sample respectively, and $\rho_d(P, \lambda, n)$ is taken to represent the directional reflectance at normal incidence, wavelength λ , and polarization P, the reflected powers are

$$\Phi_1^{\mathbf{r}} = \rho_{\mathbf{d},1}(\lambda, \mathbf{n})\Phi_0$$

$$\Phi_2^{\mathbf{r}} = \rho_{\mathbf{d},2}(\mathbf{P}, \lambda, \mathbf{n})\Phi_0$$
(3-20)

where Φ_0 is the incident power of wavelength λ and polarization P. It is assumed that the reflectance of the reference is not polarization dependent.

Because the radiation is incident normal to the reflectors, that portion of the power which is specularly reflected will exit through the entrance ports undetected. If $\rho_g(P, \lambda, n)$ is taken as the specular reflectance for normal incidence, wavelength λ , and polarization P, then the specularly reflected powers are $\rho_{s,1}(\lambda, n)\Phi_0$ and $\rho_{s,2}(P, \lambda, n)\Phi_0$ for the reference and sample respectively. If the incident radiation had no divergence and filled the whole entrance port,

none of the specularly reflected radiation would be detected. However, because of the divergence of the incident beam and the configuration of the equipment, only a fraction k of this radiation would be undetected. Therefore, the detected powers are

$$\Phi_{1}^{\mathbf{r}} = [\rho_{\mathbf{d},1}(\lambda, \mathbf{n}) - \mathbf{k}\rho_{\mathbf{s},1}(\lambda, \mathbf{n})]\Phi_{0}$$

$$\Phi_{2}^{\mathbf{r}} = [\rho_{\mathbf{d},2}(\mathbf{P}, \lambda, \mathbf{n}) - \mathbf{k}\rho_{\mathbf{s},2}(\mathbf{P}, \lambda, \mathbf{n})]\Phi_{0}$$
(3-21)

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The same value of k is used for both reference and sample because of symmetry. The value reported by the detector represents the ratio

$$\frac{\rho_{\mathbf{d},2}(\mathbf{P},\lambda,\mathbf{n})-\kappa\rho_{\mathbf{s},2}(\mathbf{P},\lambda,\mathbf{n})}{\rho_{\mathbf{d},1}(\lambda,\mathbf{n})-\kappa\rho_{\mathbf{s},1}(\lambda,\mathbf{n})}=\frac{\Phi_{1}^{\mathbf{r}}}{\Phi_{\mathbf{n}}^{\mathbf{r}}}$$

Again, the indicated reflectances are averages over the illuminated areas.

3.2.3. COBLENTZ HEMISPHERE USED BY NEW YORK UNIVERSITY. This measurement apparatus uses a hemispherical specular reflector (see fig. 3-4) with the sample and detector located a small distance from and diametrically opposite to the center of the sphere. Through an entrance port, well collimated, monochromatic radiation becomes incident on the sample at a fixed angle. Because of imaging problems associated with the off-center location of the sample, the aperture of the detector should be larger than the sample to guarantee that most of the radiation reflected from the hemisphere is detected. With $L_i(\lambda; P_i; \theta_i, \phi_i)$ representing the radiance with wavelength λ and polarization P_i incident on the sample in the direction (θ_i, ϕ_i), the radiance reflected by the sample, L_r , is

$$\mathbf{L}_{\mathbf{r}}(\lambda; \mathbf{P}_{\mathbf{r}}; \theta_{\mathbf{r}}, \phi_{\mathbf{r}}) = \rho'(\lambda; \mathbf{P}_{\mathbf{i}}; \theta_{\mathbf{r}}, \phi_{\mathbf{r}}; \theta_{\mathbf{i}}, \phi_{\mathbf{i}}) \mathbf{L}_{\mathbf{i}} \cos \theta_{\mathbf{i}} d\omega_{\mathbf{r}}$$
(3-22)



Top View

FIGURE 3-4. SCHEMATIC OF THE COBLENTZ HEMISPHERICAL REFLEC-TANCE ATTACHMENT USED BY NEW YORK UNIVERSITY

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where the subscript r designates reflected radiation and ρ' is the bidirectional reflectance for incident polarization P_i . Given the directions of incidence and reflection, P_i , and λ , P_r may be determined.

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If it can be assumed that the distance from the sample to the center of the sphere is very small compared to the radius of the sphere and that the area being illuminated is small, then the reflected radiance is approximately normally incident on the sphere. For normal incidence, the reflectance of the sphere, $\rho_{\rm g}$, is independent of polarization of the incident radiation and depends only on its wavelength. The power Φ at the detector is, thus,

$$\Phi = \rho_{\mathbf{s}}(\lambda) \mathbf{L}_{\mathbf{i}} \cos \theta_{\mathbf{i}} d\omega_{\mathbf{i}} \mathbf{A} \int_{\omega_{\mathbf{r}}=2\pi} \rho'(\lambda; \mathbf{P}_{\mathbf{i}}; \theta_{\mathbf{r}}, \phi_{\mathbf{r}}; \theta_{\mathbf{i}}, \phi_{\mathbf{i}}) \cos \theta_{\mathbf{r}} d\omega_{\mathbf{r}}$$
(3-23)

where N_i is taken as uniform across the illuminated area A, ω_r as the solid angle for reflection from the sample, and ρ' as the bidirectional reflectance averaged over A. From the definition for ρ_d ,

$$\Phi = L_{i} \cos \theta_{i} d\omega_{i} A \rho_{s}(\lambda) \rho_{d}(\lambda; P_{i}; \theta_{i}, \phi_{i})$$
(3-24)

By making two measurements, one with the sample and one with a reference having a directional reflectance $\rho_{d,1}$ which is known,

$$\frac{\rho_{\mathbf{d}}^{(\lambda; \mathbf{P}_{i}; \theta_{i}, \phi_{i})}}{\rho_{\mathbf{d},1}^{(\lambda; \mathbf{P}_{i}; \theta_{i}, \phi_{i})} = \frac{\Phi}{\Phi_{1}}}$$
(3-25)

is obtained, where the power reflected from the reft. ence and the reflectances are averaged over the illuminated areas.

Equation 3-24 represents the power incident in the plane of the detector. In reality, however, the acceptance angle of the detector, ω_d , is less than 2π , so the power received by the detector, Φ_{rec} , is given by

$$\Phi_{\mathbf{rec}} = (\omega_d/\hat{r}_d) \backsim$$

At angles of grazing incidence in the plane of the detector, radiation is reflected by the detector and is strongly polarized. This radiation is reflected off the hemisphere and onto the sample. Therefore, there will be some error caused by multiple reflections, and these reflections will be more strongly polarized than the initial radiation from the monochromator.

3.2.4. PORTABLE SPECTROPHOTOMETER USED BY USAERDL. This instrument is shown in figure 3-5. White, unpolarized radiation from the source is reflected from a plane mirror (M_1) onto the sample. Radiation reflected from the sample is focused onto the detector aperture by a spherical mirror (M_2) . The detector is located in the focal plane of M_2 and thus



FIGURE 3-5. SCHEMATIC OF THE USAERDL PORTABLE SPECTROPHOTOMETER

receives only the radiation reflected normally from the sample. In practice, the detector is a monochromator, so only radiation at a particular wavelength λ is sensed. The source and M_1 can be moved about to give different angles of incidence on the sample. As a result of reflection from M_1 the radiance incident on the sample is probably partially polarized.

The spectral radiance incident on an area dA of the sample located at (x, y) is $L_i(\lambda; P; \theta_i, \phi_i; x, y)$, where P is the polarization for the incident direction (θ_i, ϕ_i) . For this particular configuration, (θ_i, ϕ_i) is determined by (x, y). The spectral power reflected normally $(\theta_r = 0^\circ)$ by each dA is $d\Phi$:

$$d\Phi = dAL_{i}(\lambda, P) \left[\int_{\Delta \omega_{i}} \rho'(\lambda; P; \theta_{i}, \phi_{i}; n; x, y) \cos \theta_{i} d\omega_{i} \right] d\omega_{r}$$
(3-26)

where ρ' is the spectral bidirectional reflectance for radiation of polarization P which is incident from (∂_i, ϕ_i) on the area at (x, y) and reflected normally (indicated by the symbol n); $\Delta \omega_i$ is the solid angle of the source as seen from the sample, and it is assumed that L_i is constant^{*} in each $\Delta \omega_i$. The total power Φ reflected normally by the sample (of area A) is

$$\Phi = \mathbf{L}_{i}(\lambda, \mathbf{P}) \left[\int_{\mathbf{A}} \int_{\Delta \omega_{i}} \rho'(\lambda; \mathbf{P}; \theta_{i}, \phi_{i}; n; \mathbf{x}, \mathbf{y}) \cos \theta_{i} d\omega_{i} d\mathbf{A} \right] d\omega_{\mathbf{r}}$$
(3-27)

*It has been assumed that $\Delta \omega_i$ is small enough so that a constant, meaningful polarization can be associated with the pencil of radiation.

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For a reference with bidirectional reflectance ρ'_r that is independent of position and polarization, the detected power Φ is

$$\Phi' = \mathbf{L}_{i}(\lambda, \mathbf{P}) \mathbf{A} \left[\int_{\Delta \omega_{i}} \rho_{\mathbf{r}}'(\lambda; \theta_{i}, \phi_{i}; \mathbf{n}) \cos \theta_{i} d\omega_{i} \right] d\omega_{\mathbf{r}}$$
(3-28)

The ratio of the power detected from the sample to that from the reference is

$$\frac{\Phi}{\Phi^{\dagger}} = \frac{\int_{\Delta\omega_{i}} \overline{\rho}'(\lambda; \mathbf{P}; \theta_{i}, \phi_{i}; \mathbf{n}) \cos \theta_{i} d\omega_{i}}{\int_{\Delta\omega_{i}} \rho_{\mathbf{r}}'(\lambda; \theta_{i}, \phi_{i}; \mathbf{n}) \cos \theta_{i} d\omega_{i}}$$
(3-29)

where $\overline{\rho}$ is the average of ρ' over the area A, i.e.,

$$\overline{\rho}' = \frac{1}{A} \int_{A} \rho' \, dA \tag{3-30}$$

With $\Delta \omega_i$ so small that quantities may be considered constant throughout it, equation 3-29 becomes

$$\frac{\overline{\rho}'(\lambda; \mathbf{P}; \theta_{\mathbf{i}}, \phi_{\mathbf{i}}; \mathbf{n})}{\rho_{\mathbf{r}}'(\lambda; \theta_{\mathbf{i}}, \phi_{\mathbf{i}}; \mathbf{n})} = \frac{\Phi}{\Phi'}$$
(3-31)

In practice, the beam incident on the sample in this case is divergent. Since reflectance for most objects exhibits angular dependence, and since a divergent beam represents a range of incidence angles, it intuitively appears that the divergence angle will affect the final reflectance value.

3.2.5. KRINOV'S FIELD MEASUREMENTS [3-3]. The methods described in this section were used for field measurements with the sun and a clear sky as the radiation source. The measurement procedure varied depending upon whether the surface measured was horizontal or vertical. For horizontal surfaces, the detector was oriented in one of two positions: looking directly downward or looking downward at 45° to the vertical. To establish a reference system for further discussion, all azimuth values are relative to the sun which is defined to be at an azimuth of 180° ; angles — considered positive when measured clockwise from the zero-azimuth line. When looking downward, the detector was either moved back and forth along the $90^{\circ}-270^{\circ}$ line over a large area (cf. fig. 3-6a) or rotated 5° to 10° about a vertical axis coincident with its viewing direction (cf. fig. 3-6b). In the first case, when the detector was moved back and forth over a large area of the ground being observed, the instrument was always criented normal to the ground. In effect, the measurement was bidirectional if it can be assumed that all the incident radiation emanates from the sun. Under this assumption, $\rho'(3_i, \phi_i; 3_r, \phi_r) = \rho! (\theta_{sun}, 180; 0, 0)$. This measurement is integrated over the area of the ground observed. In the second case, the





(a) Horizontal surfaces: man walks over area A to be measured with the spectrograph; spectrograph is oriented normal to ground and looking downward for as much as 30 min.



FIGURE 3-6. SCHEMATIC OF MEASUREMENT CONFIGURATION USED BY KRINOV

spectrograph was mounted on a tripod and directed at the sample at an angle of 45° from the normal and an azimuth of 270° . The spectrograph was then rotated on the tripod through an azimuth of 10° to 20° . When measuring vertical surfaces, i.e., trees, cliffs, or walls, the spectrograph was directed horizontally or slightly upward at the surface and at azimuths of 45° or 315° , and the ir strument was then also rotated through a small azimuth.

Because the incident radiation comes from the sum and clear sky, the incident spectral radiance is very dependent on angle and not quite unpolarized (particularly in the blue region of the spectrum): $L_i(\lambda; P_i; \theta_i, \phi_i)$, with (θ_i, ϕ_i) the direction of incidence and P_i the polarization. Also, the time of day, season, and atmospheric condition act as variables. $d\Phi_g$ is the spectral power reflected by a surface element dA and into the rather large solid angle ω_D which subtends the detector:

$$d\Phi_{\mathbf{s}}(\lambda) = dA \int_{\omega_{\mathbf{D}}} d\omega_{\mathbf{D}} \int_{\omega_{\mathbf{i}}=2\pi} \rho'(\lambda; \mathbf{P}_{\mathbf{i}}; \theta_{\mathbf{i}}, \phi_{\mathbf{i}}; \theta_{\mathbf{r}}, \phi_{\mathbf{r}}) \mathbf{L}_{\mathbf{i}}(\lambda; \mathbf{P}_{\mathbf{i}}; \theta_{\mathbf{i}}, \phi_{\mathbf{i}}) \cos \theta_{\mathbf{i}} d\omega_{\mathbf{i}}$$
(3-32)

where $\langle \theta_{\mathbf{r}}, \phi_{\mathbf{r}} \rangle$ is the direction of reflectance, $\omega_{\mathbf{i}}$ the solid angle of incidence, and ρ' the bidirectional reflectance. The recorder for this system is photographic film, hence the system records energy. Assuming the detector views an area A at any time and scans at a constant rate over a time T, and that $\mathbf{L}_{\mathbf{i}}$ is independent of time, then the spectral energy reflected by the sample, $\mathbf{Q}_{\mathbf{g}}(\lambda)$, is

$$\mathbf{Q}_{\mathbf{g}}(\lambda) = \mathbf{T}\mathbf{A} \int_{\boldsymbol{\omega}_{\mathbf{D}}} d\boldsymbol{\omega}_{\mathbf{D}} \int_{\boldsymbol{\omega}_{\mathbf{i}}=2\pi} \overline{\rho}(\lambda; \mathbf{P}_{\mathbf{i}}; \boldsymbol{\theta}_{\mathbf{i}}, \boldsymbol{\phi}_{\mathbf{i}}; \boldsymbol{\theta}_{\mathbf{r}}, \boldsymbol{\phi}_{\mathbf{r}}) \mathbf{L}_{\mathbf{i}}(\lambda; \mathbf{P}_{\mathbf{i}}; \boldsymbol{\theta}_{\mathbf{i}}, \boldsymbol{\phi}_{\mathbf{i}}) \cos \boldsymbol{\theta}_{\mathbf{i}} d\boldsymbol{\omega}_{\mathbf{i}}$$
(3-33)

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where $\overline{\rho}$ ' is ρ ' averaged over the scanned area A_s , i.e.,

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$$\overline{\rho}' = \frac{1}{A_s} \int_A \rho' \, dA$$

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The sample can be replaced by a reference the reflectance of which, ρ'_r does not vary with position, and the film exposed for a time T without scanning. The reflected spectral energy $Q_R(\lambda)$ is then

$$Q_{R}(\lambda) = TA \int_{\omega_{D}} d\omega_{D} \int_{\omega_{i}=2\pi} \rho_{r}^{*}(\lambda; P_{i}; \theta_{i}, \phi_{i}; \theta_{r}, \phi_{r}) L_{i} \cos \theta_{i} d\omega_{i}$$
(3-34)

A comparison of $Q_g(\lambda)$ and $Q_R(\lambda)$ may then be made.

For a second case referred to above, the results are the same if A_g is set equal to A, since it may be assumed that A is imaged onto a small area of the film and the average of $Q_g(\lambda)$ over this small area is taken. With the detector pointed downwards at 45° to the vertical and at an azimuth of 90° or 225° the results are obtained as shown with appropriate changes in θ_r and ϕ_r . Similar equations may be derived for vertical surfaces.

3.2.6. HOHLRAUM REFLECTANCE ATTACHMENT. This interesting apparatus for determining spectral reflectance is shown in figure 3-7. It consists of a blackbody cavity with a





viewing port. The viewing port is small enough so that the radiation in the ravity closely approximates the blackbody case, and the portions of the inner wall visible through the port occupy only a small solid angle. The sample is water cooled and is oriented with its normal at an angle of 13° to the viewing direction. If dA is again taken to represent the area of the sample viewed and ρ' to represent the bidirectional reflectance, the spectral power Φ_r reflected by the sample through the viewing port is

$$\Phi_{\mathbf{r}}(\lambda) = dAL_{\mathbf{r}}(\lambda) \cos(13^{\circ}) d\omega_{\mathbf{r}} = d\Sigma d\omega_{\mathbf{s}}L_{\mathbf{r}}(\lambda)$$
(3-35)

where $L_r(\lambda)$ is the reflected spectral radiance, $d\omega_r$ the solid angle subtended by the viewing port at the sample, $d\Sigma$ the area of the detector (considered small), and $d\omega_s$ the solid angle subtended by the sample at the detector ($d\omega_s$ is considered normal to $d\Sigma$).

$$\mathbf{L}_{\mathbf{r}}(\lambda) = \int_{\omega_{\mathbf{i}}} \rho^{\dagger}(\lambda; \mathbf{P}_{\mathbf{i}}; \theta_{\mathbf{i}}, \phi_{\mathbf{i}}; \theta_{\mathbf{r}}, \phi_{\mathbf{r}}) \mathbf{L}_{\mathbf{i}}(\lambda) \cos \theta_{\mathbf{i}} d\omega_{\mathbf{i}}$$
(3-36)

where $L_i(\lambda)$ is the incident spectral radiance, (θ_i, ϕ_i) the incident direction, ω_i the angle subtended at the sample by the entrance to the sample holder, and P_i the polarization of the incident radiation. The incident radiation is blackbody type and hence <u>unpolarized</u>; furthermore, the incident spectral radiance is a constant. Therefore,

$$\Phi_{\mathbf{r}}(\lambda) = d\Sigma d\omega_{\mathbf{g}} \mathbf{L}_{\mathbf{i}}(\lambda) \int_{\omega_{\mathbf{i}}} \rho'(\lambda; \mathbf{P}_{\mathbf{i}}; \theta_{\mathbf{i}}, \phi_{\mathbf{i}}; 13^{\mathbf{0}}, \phi_{\mathbf{r}}) \cos \theta_{\mathbf{i}} d\omega_{\mathbf{i}}$$
(3-37)

Next, the detector is moved to view a flat area dA of the cavity wall far from the sample holder. The resulting spectral power, Φ_w , there is

$$\Phi_{\mathbf{w}}(\lambda) = d\mathbf{A} d\omega_{\mathbf{w}} \mathbf{L}_{\mathbf{i}}(\lambda) \cos \theta_{\mathbf{w}} = d\Sigma d\omega_{\mathbf{s}} \mathbf{L}_{\mathbf{i}}(\lambda)$$
(3-38)

where θ_{W} is the angle between the viewing direction and the normal to the wall, and $d\omega_{W}$ is the solid angle subtended by the viewing port at the area dA on the wall. The ratio of the spectral powers detected is

$$\frac{\Phi_{\mathbf{w}}^{(\lambda)}}{\Phi_{\mathbf{g}}^{(\lambda)}} = \int_{\omega_{\mathbf{i}}} \rho'(\lambda; \mathbf{P}_{\mathbf{i}}; \theta_{\mathbf{i}}, \phi_{\mathbf{i}}; 13^{0}, \phi_{\mathbf{r}}) \cos \theta_{\mathbf{i}} d\omega_{\mathbf{i}}$$
(3-39)

Hence, the detector can be interpreted as giving the spectral bidirectional reflectance for unpolarized light, integrated over the projected solid angle of the source (as seen by the sample). Since it was assumed that the detector viewed only a very small area, dA, of the sample, the

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bidirectional reflectance appearing under the integral applies only to that area. In some instances, the sample has been placed at the wall of the Hohlraum cavity instead of further into the sample holder. The ratio of powers detected is then

$$\frac{\Phi_{\mathbf{w}}^{(\lambda)}}{\Phi_{\mathbf{s}}^{(\lambda)}} = \int_{\omega_{i}=2\pi} \rho^{\dagger}(\lambda; \mathbf{P}_{i}; \theta_{i}, \phi_{i}; \mathbf{13^{0}}, \phi_{r}) \cos \theta_{i} d\omega_{i} = \rho_{d}(\lambda; \mathbf{P}_{i}; \mathbf{13^{0}}, \phi_{r})$$

Once again, the reflectance measured .s an average over the illuminate a area.

3.2.7. DETROIT ARSENAL REFLECTANCE MEASUREMENTS [3-4]

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The measurements reported herein from the Detroit Arsenal were made with a Perkin-Elmer Recording Spectrometer and a Coblentz hemispherical reflectance attachment. Figure 3-8 is a schematic diagram of the measurement apparatus. Basically, the incident radiation, which is very nearly monochromatic, is focused on the sample through a small hole in the hemisphere. The sample is located at a small distance from the sphere's center. Energy reflected by the sample in any direction is re-reflected by the gold-coated hemisphere (a specular reflector)





and focused at a spot in the sample plane diametrically opposite the sample. By a system of mirrors the collected energy is focused on the detector.

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The instrument was calibrated separately for specular reflectors and for diffuse reflectors. For specular reflectors, an evaporated aluminum standard of known reflectance was placed in the sample location, and the lister then slit widths were adjusted until the reading coincided with the predetermined value. The slit width was recorded for that wavelength and the procedure repeated at 1 0- μ intervals between 1 and 12 μ . The first wavelength read was 1 μ . The resulting set of slit widths was used for all samples considered specular, and the reading was recorded as reflectance. In the case of a diffuse reflector, the same procedure was followed using 4 smoked MgO standard.

3.2.8. NOTS POLARIZATION MEASUREMENTS [3-5]

The data obtained at the Naval Ordnance Test Station (NOTS), China Lake, Calif., consist of measurements of the degree of linear polarization of light reflected from target and background objects. The data result from a joint laboratory and field study and are reported in three forms:

(1) P_{L} vs. λ

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- (2) Γ_L vs. θ
- (3) P_{L}^{-} vs. ϕ

where $P_{T_{i}}$ = degree of linear polarization

 λ = wavelength

- θ = zenith angle of observation
- ϕ = azimuth angle of observation

Field measurements were mather using a specially designed polarimeter consisting of a Polaroid HN-22 high extinction linear polarization filter, an f/4 250-mm telephoto lens, an eyepiece to observe the field of view, and an RCA 200-4-25-2.0 silicon photodetector (fig. 3-9). The wavelength was monitored by inserting any one of a series of $20-m\mu$ optical bandpass filters behind the polarization analyzer. The filters were centered at the following peak wavelengths: 486, 520, 546, 579, 589, 656, and 706 m μ . The detector field of view was 2° .

The polarimeter was mounted on a tripod for measuring terrain. The positions of the sun and polarimeter with respect to the observed ground were recorded using the notation shown in figure 3-3. The polarization analyzer was then rotated and currents corresponding to the maximum and minimum transmitted fluxes $(I_1 \text{ and } I_2)$ were recorded. The degree of linear polarization was calculated from the following equation:

$$P_{L} = \frac{I_1 - I_2}{I_1 + I_2}$$

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Laboratory measurements were conducted in much the same way as the field studies. The instrument (fig. 3-11) differed basically from the field instrument in two respects: (1) an artificial source was used rather than the natural illumination, and (2) the source and the detector were coplanar; for the field measurements, the detector could be situated at any desired azimuth in relation to the sun. The source was fixed, while the sample could be tilted to allow various incidence angles. The detector could also be mered independent of the sample holder to permit several viewing angles.



FIGURE 3-11. LABORATORY POLARIMETER AND INSTRUMENTATION

The illumination angles used in this study were 30° , 60° , and 80° , and the observation angle varied from 5° to 85° .

The polarizer was inserted in the incident beam in first the perpendicular and then the parallel orientation. Light reflected from the sample, V_{\perp} and V_{\parallel} respectively, was recorded.

Here the degree of linear polarization, P_L , is given by

$$\mathbf{P}_{\mathbf{L}} = \frac{\mathbf{V}_{\perp} - \mathbf{C}\mathbf{V}_{||}}{\mathbf{V}_{\perp} + \mathbf{C}\mathbf{V}_{||}}$$

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where $V_{\perp i,r}$ = voltage observed upon reflection in the direction θ_r of perpendicularly polarized light at an incidence angle θ_i

 V_{ii} = voltage observed upon reflection in the direction θ_r of parallel polarized light i,r at an incidence angle θ_i

3.2.9. CARY 14R REFLECTOMETER. This instrument is shown schematically in figure 3-12. Sample illumination was achieved by placing a high intensity source at a small port in the bottom of the integrating sphere. The sample is thus illuminated by a broad spectral band, hemispherical source. A double prism grating monochromator then alternately looks at a MgCO₃ reference and the sample. This instrument may be operated over the 0.2- to $2.2-\mu$ range.



FIG' RE 3-12. CARY 14R REFLECTOMETER [3-6]

3.2.10. PERKIN-ELMER NORMAL INCIDENCE REFLECTOMETER. This instrument is shown schematically infigure 3-13. In operation, broad spectral band light is collected and focused on the sample at the reflectance unit (fig. 3-14). Light reflected from the sample is collected and focused onto the entrance slit of a Perkin-Elmer Model 99 monochromator where it is analyzed spectrally from 0.2 to 0.4 μ . The measurements were made using a MgCO₃ reflectance standard.

3.3. ABSOLUTE REFLECTANCE

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As is apparent from the earlier discussion, the measurement of reflectance is usually made relative to an arbitrary standard, and it is presented in that manner in many cases in this com-

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pilation. To convert such data to absolute values requires knowledge of the absolute reflectance of the standard used. An absolute measurement is of the following form:

$$\rho_{d}\left(\theta_{i}, \phi_{j}\right)_{abs} = \frac{p_{r,x}}{p_{i}}$$
(3-40)

where p_i is the power incident on the sample in the direction (θ_i, ϕ_i) , and $p_{r,x}$ is the power reflected into a hemisphere by the sample. On the other hand, a relative measurement has the form

$$\rho_{d}\left(\theta_{i}, \phi_{i}\right)_{rel} = \frac{p_{r,x}}{p_{r,st}}$$
(3-41)

where, again, $p_{r,x}$ is the power reflected into a hemisphere by the sample, while $p_{r,st}$ is the power reflected into a hemisphere by some reflectance standard.

If the absolute directional reflectance of the standard, $p_{d,st} \begin{pmatrix} \theta_i, \phi_i \\ abs \end{pmatrix}$ is known, the absolute reflectance of the sample can be calculated:

$$\rho_{d}\left(\theta_{i}, \phi_{i}\right)_{abs} = \frac{p_{r,st}}{p_{i}}$$

$$p_{r,st} = \rho_{d,st}\left(\theta_{i}, \phi_{i}\right)_{abs} p_{i} \qquad (3-42)$$

Substituting equation 42 into equation 41 yields

$$\rho_{d}\left(\theta_{i}, \phi_{i}\right)_{rel} = \frac{p_{r,x}}{\rho_{d,st}\left(\theta_{i}, \phi_{i}\right)_{abs}}$$
$$\rho_{d}\left(\theta_{i}, \phi_{i}\right)_{rel} = \frac{\rho_{d}\left(\theta_{i}, \phi_{i}\right)_{abs}}{\rho_{d,st}\left(\theta_{i}, \phi_{i}\right)_{abs}}$$

and, therefore,

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or

$$\rho_{d}(\theta_{i}, \phi_{i})_{abs} = \rho_{d}(\theta_{i}, \phi_{i})_{rel} \rho_{d,st}(\theta_{i}, \phi_{i})_{abs}$$

Thus, to obtain absolute values of the reflectance of a sample, it is necessary to multiply the relative reflectance of the sample by the absolute reflectance of the standard as measured at the same wavelength, incidence angle, etc.

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To facilitate these computations, recommended values for the absolute reflectance of three commonly used reflectance standards, MgO, $BaSO_4$, and $MgCO_3$, are presented in figures 3-15 through 3-17. The reader is cautioned that although these curves are considered to represent the best data currently available, they are nevertheless subject to the errors inherent in the instrumentation used. If highly accurate results are necessary, the references cited should be consulted for a description of the measurement techniques and error analyses associated with the data. Section 3.4 indicates which of the optical data are reported as absolute and which as relative. For the relative data, the reflectance standard has also been designated.

It should also be noted that even after corrections for the standard are applied to data in this compilation, the curves may or may not more truly represent absolute reflectance. This is because the reflectance of such standards may vary within a few percent on the basis of preparation techniques, thickness and age of the samples, their exposure to ultraviolet radiation, etc. Since very few of the experiments considered have indicated in their reports the absolute reflectance of the standard used or completely described its preparation, it is impossible to say that the absolute reflectance shown in figures 3-15 through 3-17 is identical to that of the standard used in a given experiment.



FIGURE 3-15. ABSOLUTE REFLECTANCE OF SMOKED MgO [3-7, 3-8, 3-9]

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3.4. SUMMARY OF EXPERIMENTS YIELDING OPTICAL DATA

The documents from which the unclassified optical data have been extracted are briefly summarized on the following pages. These summaries are included to facilitate use of the data presented in section 3.7. Information on the experimental platform, instrumentation, reflectance standards (for relative data) and other related matters has been included, and additional references describing some of the instrumentation in greater detail are cited. As already indicated, the code consisting of the letter B and five digits at the beginning of each entry is the accessions number assigned to the document by the Target Signature Analysis Center. All curves extracted from the document carry this accessions number plus a number from 001 to 999, which is an arbitrary designation assigned to specific curves. The two numbers together constitute a curve's identification number. Bibliographical information on each of the documents is stated; the user is referred to the original source if more detailed information is required. ()

B-00829. Hopkins: Reflectance Curves of Various Leaves, unpub., USAERDL, Ft. Belvoir, Va., 1955 (est.).

Platform: laboratory

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Instrument: USAERDL spectrophotometer (original design)

Quantity measured: ρ_d Wavelength range: 0.9 to 2.7 μ

Reflectance attachment: integrating sphere

Reflectance standard: MgO

Comments: This instrument is no longer in operation. Basically, it consisted of a Ga. Her monochromator coupled with an integrating sphere.

B-00830. Hopkins: Reflectance Curves of Various Soils, unpub., USAERDL, Ft. Belvoir, Va., 1955 (est.).

Platform: laboratory

Instrument 1: Beckman DU spectrophotometer Quantity measured: ρ_d Wavelength range: 0.4 to 1.2 μ Reflectance attachment: ellipsoidal mirror that collects radiation diffusely reflected from the sample Reflectance standard: MgO Additional reference: 3-10

Instrument 2: USAERDL spectrophotometer (original design) Quantity measured: ρ_d Wavelength range: 0.9 to 2.7 μ **Reflectance attachment: integrating sphere** Reflectance standard: MgO Comments: This instrument is no longer in operation. Basically, it consisted of a

Gaertner monochromator coupled with an integrating sphere.

B-01035. Sigler: Airborne Rapid Scan Spectrometer and Earth Reflectance Measurements as a Function of Altitude (Final Report), Inst. Div., Radiation, Inc., Orlando, Fla., July 1957.

Platform: airborne

Instrument: Perkin-Elmer 108 rapid-scan spectrometer Quantity measured: α (albedo) Wavelength range: 0.4 to 3.0 μ Reflectance standard: data are absolute Comments: These data were obtained by rotating a periscope (installed through a hole in the side of the aircraft) 180° to alternately view the sky radiation and that reflected by

the earth.

B-01049. Billings: Reflection of Visible and Infrared Radiation from Leaves of Different Ecological Groups, Am. J. Bot., Vol. 38, 1951.

Platform: laboratory

Instrument: Beckman DU spectrophotometer Quantity measured: ρ_d Wavelength range: 0.4 to 1.1 μ Reflectance attachment: ellipsoidal mirror that collects radiation diffusely reflect. d from the sample Reflectance standard: MgCO3 Additional reference: 3-10

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B-01175. Derksen. Monahan: A Reflectometer for Measuring Diffuse Reflectance in the Visible id Infrared Regions, J. Opt. Soc. Am., Vol. 42, No. 4, 1952. Platform: la' itory

Instrument 1: General Electric spectrophotometer Quantity measured: ρ_d Wavelength range: 0.4 to 1.0 μ Reflectance attachment: integrating sphere Reflectance standard: MgO Additional references. 3-2, 3-11, 3-12 Comments: See section 3.2.1.

Instrument 2: Perkin-Elmer 12-B spectrometer Quantity measured: ρ_d Wavelength range: 1.0 to 2.7 μ Reflectance attachment: Coblentz hemisphere Reflectance standard: MgO Additional references: 3-13, 3-14 Comments: See section 3.2.3.

B-01176. Wright: Spectral Reflectance Characteristics of Camouflage Greens Versus Camouflage Detection, IRMA III Report No. 1281, USAERDL, Ft. Belvoir, Va., March 1953.

Platform: laboratory

Instrument: General Electric spectrophotometer Quantity measured: ρ_d Wavelength range: 0.4 to 1.08 μ Reflectance attachment: integrating sphere Reflectance standard: MgO Additional references: 3-2, 3-11, 3-12 Comments: See section 3.2.1.

B-01337. Dyrornik, Orr, Young: Reflectance Curves of Soil, Rocks, Vegetation, and Pavement, Report Mr. 1746R, USAERDL, Ft. Belvoir, Va., April 1963.

Platform: $g \in$ ind-based field

Instrument: USAERDL portable spectrophotometer Quantity measured: ρ' Wavelength range: 0.25 to 2.5 μ Reflectance attachment: collecting mirror Reflectance standard: measured relative to thermoglass and values converted to MgO Additional reference: 3-15 Comments: See section 3.2.4.

B-01339. Haas et al.: Spectrophotometric and Colorimetric Study of Color Transparencies of Some Natural Objects, Report No. 4794, NBS, Washington, D. C., March 1957.

Platform: laboratory

Instrument: General Electric spectrophotometer Quantity measured: ρ_d Wavelength range: 0.4 to 1.08 μ Reflectance attachment: integrating sphere Reflectance standard: MgO Additional references: 3-2, 3-11, 3-12 Comments: See section 3.2.1.

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B-01352. Haas, et al.: Spectrophotometric and Colorimetric Study of Diseased and Rust Resisting Cereal Crops, Report No. 4591, NBS, Washington, D. C., July 1956.

Platform: laboratory

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Instrument: General Electric spectrophotometer Quantity measured: $\rho_{\rm d}$ Wavelength range: 0.4 to 1.08 μ Reflectance attachment: integrating sphere Reflectance standard: MgO Additional references: 3-2, 3-11, 3-12 Comments: See section 3.2.2.

B-01353. Hall, Keegan, Schleter: Spectrophotometric and Colorimetric Change in the Leaf of a White Oak Tree under Conditions of Natural Drying and Excessive Moisture, Report No. 4322, NBS, Washington, D. C., September 1955.

Platform: laboratory

Instrument: General Electric spectrophotometer Quantity measured: $\rho_{\rm d}$ Wavelength range: 0.4 to 1.08 μ Reflectance attachment: integrating sphere Reflectance standard: MgO Additional references: 3-2, 3-11, 3-12 Comments: See section 3.2.1.

B-01367. Haas et al.: Spectrophotometric and Colorimetric Study of Foliage Stored in Covered Metal Containers, Report No. 4370, NBS, Washington, D. C., M_vember 1955.

Platform: laboratory

Instrument: General Electric spectrophotometer Quantity measured: $\rho_{\rm d}$ Wavelength range: 0.4 to 1.08 μ Reflectance attachment: integrating sphere Reflectance standard: MgO Additional references: 3-2, 3-11, 3-12 Comments: See section 5.2.1.

B-01368. Haas et al.: Spectrophotometric and Colorimetric Record of Some Leaves of Trees, Vegetation and Soils, Report No. 4528, NBS, Washington, D. C., April 1956.

Platform: laboratory

Instrument: General Electric spectrophotometer Quantity measured: ρ_{\perp} Wavelength range: 0.4 to 1.08 μ Reflectance attachment: integrating sphere Reflectance standard: MgO Additional references: 3-2, 3-11, 3-12 Comments: See section 3.2.1.

B-01370. Duntley: Reflectance of Natural Terrains, Report No. OSRD 6554, Louis Comfort Tiffany Foundation, Oyster Bay, N. Y., September 1945.

Platform: airborne

Instrument: Eastman Kodak spectrogeograph

Quantity measured: α (albedo)

Wavelength range: 0.43 to 0.73 μ

Reflectance standard: data are absolute

Comments: The data were obtained by rotating a periscope (installed through a hole in the side of the aircraft) 180° to alternately view the sky radiation and that reflected by the earth. The spectrophotometric curves obtained were derived from densitometer readings of spectrograms.

B-01643. Reflectance Data on Crops (unpub.), Mine Detection Branch, USAERDL, Ft. Belvoir, Va., 1962 (est.).

Platform: ground-based field

Instrument: USAERDL portable spectrophotometer Quantity measured: ρ Wavelength range: 0.25 to 2.5 μ Reflectance attachment: collecting mirror Reflectance standard: measured relative to thermoglass and values converted to MgO Additional reference: 3-15 Comments: See section 3.2.4.

B-01761. Shull: A Spectrophotometric Study of Reflection of Light from Leaf Surfaces, Botan. Gaz., Vol. 87, 1929.

Platform: laboratory

Instrument: spectrophotometer (original design) Quantity measured: ρ_d Wavelength range: 0.43 to 0.70 μ Reflectance attachment: integrating sphere Reflectance standard: MgCO₃

B-01815. Kronstein: Research, Studies, and Investigations on Spectral Reflectances and Absorption Characteristics of Camouflage Paint Materials and Natural Objects, Final Report, Contract DA-44-009 ENG-1447, New York Univ., New York, March 1955.

Platform: laboratory

Instrument 1: Beckman DK-2 spectrorholometer Quantity measured: ρ_d Wavelength range: 0.4 to 2.5 μ **Reflectance attachment: integrating sphere** Reflectance standard: data obtained relative to MgCO3, but values converted to absolute Comments: See section 3.2.2.

Instrument 2: Perkin-Elmer Model 12 and Model 112 spectrophotometers

Quantity measured: ρ_d Wavelength range: 2.5 to 15 μ

Reflectance attachment: Coblentz hemisphere

Reflectance standard: Specular samples were measured relative to a rhodium mirror and diffuse samples relative to flowers of sulphur. Data have been converted to absolute values.

Comments: See section 3.2.3.

B-01948. Dinger: The Absorption of Radiant Energy in Plants, Ph.D thesis, Iowa State Univ., Iowa City, 1941.

Platform: laboratory

Instrument: photometric goniometer (original design) Quantity measured: ρ' , τ' (bidirectional transmittance) Wavelength range: 0.35 to 0.75 μ

Reflectance standard: bond paper

Comments: Reflectance data were obtained by focusing monochromatic light on the sample at normal incidence, then examining the reflected component at 10° off normal. Bond paper, believed by the experimenter to have scattering properties similar to those of foliage, was measured in the same way, and the ratio of the two quantities is the reported reflectance. Transmittance measurements relative to bond paper were also made.

B-02250. Haas et al.: Spectrophotometric and Colorimetric Study of Color Transparencies of Some Man-Made Objects, Report No. 4953, NBS, Washington, D. C., November 1957.

Platform: laboratory

Instrument: General Electric spectrophotometer

Quantity measured: ρ_d , τ_d Wavelength range: 0.4 to 1.08 μ

Reflectance attachment: integrating sphere

Reflectance standard: MgO

Additional references: 3-2, 3-11, 3-12

Comments: For transmittance measurements, the sample was placed at one of the entrance ports of the sphere, and MgO covered both the sample and reference ports. See section 3.2.1 also.

B-02418. Spectral Reflectance of Several Crops (unpub.), Purdue Univ., Lafayette, Ind., 1964.

Platform: laboratory

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Instrument: Beckman DK-2 spectrophotometer Quantity measured: ρ_d Wavelength range: 0.28 to 2.6 μ Reflectance attachment: integrating sphere Reflectance standard: MgO Comments: See section 3.2.2.

B-03070. Gates et al.: Spectral Properties of Plants, Appl. Opt., Vol. 4, No. 1, 1965.

Platform: laboratory

Instrument 1: General Electric spectrophotometer

Quantity measured: ρ_d , τ_d Wavelength range: 0.4 to 1.08 μ

Reflectance attachment: integrating sphere

Reflectance standard: MgO

Additional references: 3-2, 3-11, 3-12

Comments: See section 3.2.1. For transmittance measurements, the sample was placed at one of the entrance ports of the sphere, and MgO covered both the sample and reference ports.

Instrument 2: Cary 14 spectrophotometer Quantity measured: ρ_d Wavelength range: 0.385 to 2.2 μ Reflectance attachment: integrating sphere (Cary 1411) Reflectance standard: MgO Additional reference: 3-16 Comments: Operation is similar to that of the integrating sphere discussed in section

3.2.2. However, in this experiment the sample was illuminated with white light, and the radiation was spectrally dispersed <u>after</u> reflection. Also, the sample was viewed at 60° off normal.

B-03117. Turner: Reflectance Properties of Thin Films and Multilayers, Presented at Conf. on Radiative Transfer from Solid Materials, Boston, Mass., December 1960.

No descriptive information on these data was available.

B-03231. Dunkle, Gier: Spectral Reflectivity of Certain Minerals and Similar Inorganic Materials, Inst. Eng. Res., Univ. of Calif., Berkeley, January 1954, AD 26 394.

Platform: laboratory

Instrument: Perkin-Elmer spectrophotometer Quantity measured: ρ_d Wavelength range: 1.0 to 15.0 μ Reflectance attachment: Hohlraum Reflectance standard: data are absolute Comments: See section 3.2.6.

B-03256. Clark, Hardy, Vinegar: Goniometric Spectrometer for the Measurement of Diffuse Reflectance and Transmittance of Skin in the Infrared Region, J. Opt. Soc. Am., Vol. 43, No. 11, 1953.

Platform: laboratory

Instrument: goniometer coupled with a Wadsworth-Littrow spectrometer Quantity measured: ρ_d Wavelength range: 0.55 to 2.5 μ Reflectance attachment: see comments below Reflectance standard: data are absolute Comments: Measurement of diffuse reflectance was obtained by illuminating the sample with monochromatic light and automatically scanning the detector about the sample. T

with monochromatic light and automatically scanning the detector about the sample. The detector thus recorded the reflectance integrated over 180°. This process was repeated at several discrete wavelengths.

B-03258. Ashburn, Wilson: Spectral Diffuse Reflectance of Desert Surfaces, J. Opt. Soc. Am., Vol. 46, No. 8, 1956.

Platform: ground-based field and airborne

Instrument: albedometer (original design) Quantity measured: α (albedo) Wavelength range: 0.4 to 0.65 μ Reflectance attachment: integrating sphere Reflectance standard: unspecified, if any Additional reference: 3-17 Comments: No information on whether the data are absolute or relative was available.

B-03303. Jacquez, Kuppenheim: Spectral Reflectance of Human Skin in the Region 235-1000 Millimicrons, J. Appl. Physiol., Vol. 7, March 1955.

Platform: laboratory

Instrument 1: Beckman DU spectrophotometer Quantity measured: ρ_d Wavelength range: 0.235 to 0.70 μ Reflectance attachment: ellipsoidal mirror that collects radiation diffusely reflected from the sample Reflectance standard: MgO Additional reference: 3-10

Instrument 2: General Electric spectrophotometer Quantity measured: ρ_d Wavelength range: 0.4 to 1.0 μ Reflectance attachment: integrating sphere Reflectance standard: MgO Additional references: 3-2, 3-11, 3-12 Comments: See section 3.2.1.

B-03304. Dimmitroff et al.: Spectral Reflectance of Human Skin in the Region 0.7-2.6 Microns, J. Appl. Physiol., Vol. 8, November 1955.

Platform: laboratory

Instrument 1: General Electric spectrophotometer Quantity measured: $\rho_{\rm d}$ Wavelength range: 0.4 to 0.7 μ Reflectance attachment: integrating sphere Reflectance standard: MgO Additional references: 3-2, 3-11, 3-12 Comments: See section 3.2.1

Instrument 2: Perkin-Elmer infrared spectrometer
Quantity measured: ρ_d
Wavelength range: 0.7 to 2.6 μ
Reflectance attachment: integrating sphere
Reflectance standard: MgO
Additional references: 3-13, 3-18
Comments: This instrument is similar in operation to the Beckman DK-2 spectrophotometer discussed in section 3.2.2.

B-03305. Heer, Kuppenheim: Spectral Reflectance of White and Negro Skin between 440 and 1000 Millimicrons, J. Appl. Physiol., Vol. 4, April 1952.

Flatform: laboratory

Instrument: General Electric spectrophotometer Quantity measured: ρ_d Wavelength range: 0.431 to 1.0 μ Reflectance attachment: integrating sphere Reflectance standard: MgO Additional references: 3-2, 3-11, 3-12 Comments: See section 3.2.1.

B-03333. Infrared Optical Measurements, Report No. 8626, NBS, Washington, D. C., December 1964.

Platform: laboratory

Instrument 1: General Electric spectrophotometer Quantity mersured: ρ_d Wavelength range: 0.4 to 1.08 μ Reflectance attachment: integrating sphere Reflectance standard: MgO Additional references: 3-2, 3-11, 3-12 Comments: See section 3.2.1.

Instrument 2: Cary 14 spectrophotometer Quantity measured: $\rho_{\rm C}$ Wavelength range: 0.26 to 2.2 μ Reflectance attachment: integrating sphere (C

Reflectance attachment: integrating sphere (Cary 1411)

Reflectance standard: MgO

Additional reference: 3-16

Comments: Operation is similar to that of the integrating sphere discussed in section 3.2.2. However, in this experiment the sample was illuminated with white light, and the radiation was spectrally dispersed <u>after</u> reflection. Also, the sample was viewed at 60° off normal.

Instrument 3: Cary 90 spectrophotometer Quantity measured: ρ_d Wavelength range: 2.5 to 15 μ Reflectance attachment: white hemisphere Reflectance standard: data are absolute Additional reference: 3-19

Comments: The White attachment is basically a Coblentz-type hemisphere (see sec. 3.2.3). The sample was hemispherically illuminated with white light, and the reflected radiation was viewed slightly off normal.

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B-00355. Miscellaneous data from several sources including N. Y. Univ., Syracuse Univ., and Detroit Arsenal, Warren, Mich. (unpub.), 1950 (est.).

Platform: laboratory

Instrument: see comments below

Quantity measured: ρ_d , τ

Wavelength range: 0.4 to 15.0 μ

Reflectance attachment: see comments below

Reflectance standard: see comments below Comments: Several unpublished, miscellaneous curves from various sources are collected here. Curves B-03355-001 through B-03355-006 are transmission data on optical materials, and no descriptive information on the instrumentation for them was available. Curves B-03355-007 through B-03355-009 are the reflectance of water from 1 to 15 μ , for angles of incidence of 0°, 60°, and 80°. Again, no descriptive information on this experiment was available. Curves B-03355-010 through B-03355-037 are reflectance data on foliage species for the visible and near-infrared regions and appear to be standard spectrophotometric curves (μ d). Curves B-03355-039 through B-03355-046 are the reflectance (ρ d) of paints in the 0.4 to 2.6- μ interval and are believed to have been obtained, relative to MgO, on the Beckman DK-2 spectrophotometer (see sec. 3.2.2). Curves B-03355-047

B-03374. Olson et al.: An Analysis of Measurements of Light Reflectance from Tree Foliage Made during 1960 and 1961, Report on Contract NR-387-025, Agricultural Expt. Sta., University of Illinois, Urbana, June 1964, AD 608-114.

through B-03355-053 were obtained on the Bausch and Lomb spectrophotometer (see under

Platform: laboratory

B-04642).

Instrument: General Electric spec ophotometer Quantity measured: $\rho_{\rm d}$ Wavelength range: 0.4 to 0.7 μ Reflectance attachment: integrating sphere Reflectance standard: MgO Additional references: 3-2, 3-11, 3-12 Comments: See section 3.2.1.

B-03463. Specular Spectral Reflectance of Paints from 0.4 to 40.0 Microns, Report No. 31, U. S. Dept. of Commerce, Washington, D. C., April 1964.

Platform: laboratory

Instrument 1: Cary 14 spectrophotometer Quantity measured: ρ' Wavelength range: 0.4 to 2.5 μ Reflectance attachment: Cary Model 1413 specular-reflectance attachment Reflectance standard: aluminum mirror Comments: Angle of incidence was 8^o off normal. Instrument 2: Beckman IR-7 spectrophotometer

Quantity measured: ρ' Wavelength range: 2.5 to 15 μ Reflectance attachment: Cary Model 24425 specular-reflectance attachment Reflectance standard: aluminum mirror Comments: Angle of incidence was 30° off normal.

B-03559. Bartrow: Calibration on the Spectral Directional Reflectance of Six Samples of Red Pine Needles (unpub.), NBS, Test No. G-35201-1, Agr. Res. Serv., Beltsville, Md., November 1964.

Platform: laboratory

Instrument 1: General Electric spectrophotometer Quantity measured: ρ_d Wavelength range: 0.4 to 1.08 μ Reflectance attachment: integrating sphere Relectance standard: MgO Additional references: 3-2, 3-11, 3-12 Comments: See section 3.2.1.

Instrument 2: Cary 14 spectrophotometer Quantity measured: ρ_d Wavelength range: 0.26 to 2.2 μ

Reflectance attachment: integrating sphere (Cary 1411)

Reflectance standard: MgO Additional reference: 3-16

Comments: Operation is similar to that of the integrating sphere discussed in section 3.2.2. However, in this experiment, the sample was illuminated with white light, and the radiation was spectrally dispersed after reirection. Also, the sample was viewed at 60^J off normal.

Instrument 3: Cary 90 spectrophoto.neter Quantity measured: ρ_d Wavelength range: 2.5 to 15 μ

Reflectance attachment: White hemisphere

Reflectance standard: data are absolute

Additional reference: 3-19

Comments: The White attachment is basically a Coblentz-type hemisphere (see sec. 3.2.3). The sample was hemispherically illuminated with white light, and the reflected radiation was viewed slightly off normal.

B-03804. Morris, Olson: Determination of Emissivity and Reflectivity Data on Aircraft Structural Materials, Part II, Supplement I, Report No. 56-222, Armour Res. Foundation, Chicago, Ill., October 1958, AD 202 494.

Platform: labcsatory

Instrument 1: original design using a Perkin-Elmer monochromator

Quantity measured: ρ_d

Wavelength range: 0.3 to 0.4 μ and 0.7 to 2.7 μ

Reflectance attachment: integrating sphere

Reflectance standard: data obtained relative to MgCO3, but values converted to absolute Comments: The instrumert is similar in operation to the Beckman DK-2 spectrophotometer discussed in section 3.2.2, except that it is operated in the single-beam mode. Ratio recording is achieved by the substitution method.

Instrument 2: General Electric spectrophotometer Quantity measured: ρ_d Wavelength range: 0.4 to 0.7 μ **Reflectance attachment:** integrating sphere Reflectance standard: data obtained relative to NigCO3, but values converted to absolute Additional references: 3-2, 3-11, 3-12 Comments: See section 3.2.1.

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B-03856. Betz et al.: Techniques for Measurements of Total Normal Emissivity, Solar Absorptivity and Presentation of Results, Armour Res. Foundation, Chicago, Ill., October 1958.

Platform: laboratory

Instrument 1: General Electric spectrophotometer Quantity measured: ρ_d Wavelength range: 0.4 to 0.7 μ Reflectance attachment: integrating sphere Reflectance standard: data obtained relative to MgCO₃, but values converted to absolute Additional references: 3-2, 3-11, 3-12 Comments: See section 3.2.1.

Instrument 2: Original design using a Perkin-Elmer monochromator

Quantity measured: ρ_d Wavelength range: 0.3 to 0.4 μ and 0.7 to 2.7 μ

Reflectance attachment. integrating sphere

Reflectance standard: data obtained relative to MgCO3, but values converted to absolute Comments: This instrument is similar to the integrating sphere device described in section 3.2.. The sample and reference are alternately illuminated with monochromatic energy at 9° off normal.

B-03959. Edwards, Hall: Far Infrared Reflectance of Spacecraft Coatings, presented at the AIAA Thermophysics Specialist Conference, Monterey, Calif., September 1965.

Platform: laboratory

Instrument 1: Perkin-Elmer 98 monochromator coupled with an integrating sphere (original design)

Quantity measured: ρ_d Wavelength range: 0.33 to 2.5 μ Reflectance attachment: integrating sphere Reflectance standard: data are absolute Additional reference: 3-20 Comments: This instrument operates in the single-beam mode.

Instrument 2: Perkin-Elmer 98 monochromator with Hohlraum attachment Quantity measured: $\rho_{\rm d}$ Wavelength range: 1.5 to 15 μ Reflectance attachment: Hohlraum Reflectance standard: data are absolute Additional references: 3-21 through 3-25

B-03960. Albright et al.: Solar Absorptance and Thermal Emittance of Aluminum Coated with Surface Films of Evaporated Aluminum Oxide, presented at the AIAA Thermophysics Specialist Conference, Monterey, Calif., September 1965.

Platform: laboratory

Comments: See section 3.2.6.

instrument: Perkin-Elmer Model 13 and Model 20 spectrophotometers Quantity measured: ρ' Wavelength range: 5 to 15 μ Reflectance attachment: specular-reflectance attachment Reflectance standard: not specified

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B-03995. Krinov: Spectral Reflectance Properties of Natural Formations (trans. by Belkov), Technical Translation No. 439, Nat. Res. Council of Canada, Ottawa, 1953.

Platform: Ground-based field and airborne

Instrument: several spectrographs Quantity measured: ρ' Wavelength range: 0.4 to 0.9 μ **Reflectance attachment:** none Reflectance standard: barite paper, gypsum Comments: See section 3.2.5.

B-04424. Hall: Measurement on the Optical Properties of Snow, unpub., Willow Run Laboratories of the Institute of Science and Technology, The University of Michigan, Ann Arbor, 1965 (est.).

Platform: laboratory

Instrument: interferometric device Quantity measured: ρ' Wavelength range: 0.95 to 2.7 μ Reflectance standard: flowers of sulphur

3-04616. Myers, Thomas: Reflectance of Cotton Leaves Under Various Conditions of Drying (unpub. data), U. S. Dept. of Agr., Agr. Res. Serv., Weslaco, Texas, June 1966.

Platform: laboratory

Instrument: Beckinan DK-2 spectrophotometer

Quantity measured: ρ_d , τ_d Wavelength range: 0.5 to 2.5 μ

Reflectance attachment: integ. ating sphere

Reflectance standard: MgO for ρ_d , but values of τ_d are absolute

Comments: For transmittance measurements, the sample was positioned at one of the entrance ports of the integrating sphere, and MgO was placed at both the sample and reference ports (cf. fig. 3-3). Thus, energy transmitted into a hemisphere was seen by the detector. (See section 3.2.2.)

B-04642. Wilburn: Spectra Notebook, Vol. I; Material, Target and Background Data, Tech. Report No. 8863, Components Research and Development Laboratories, U. S. Army Tank Automotive Center, Warren, Mich., May 1965.

Platform: laboratory

Instrument: Bausch and Lomb 808 spectrophotometer Quantity measured: ρ_d Wavelength range: 0.4 to 0.7 μ Reflectance attachment: integrating sphere Reflectance standard: MgO

B-04802. Korbel: Thermal and Optical Characteristics of Eniwetok Sand (Final Report), Materials Lab., New York Naval Shipyard, Brooklyn, N. Y., November 1952.

Platform: laboratory

Instrument: General Electric spectrophotometer Quantity measured: ρ_d Wavelength range: 0.4 to 1.08 μ Reflectance attachment: integrating sphere Reflectance standard: MgO Additional references: 3-2, 3-11, 3-12 Comments: See section 3.2.1.

B-04803. Cooper, Derksen: Spectral Reflectance and Transmittance of Forest Fuel Materials (Final Report), Material Lab., New York Naval Shipyard, Brooklyn, N. Y., March 1952.

Platform: laboratory

Instrument 1: General Electric spectrophotometer Quantity measured: ρ_d , τ_d Wavelength range: 0.4 to 1.0 μ Reflectance attachment: integrating sphere Reflectance standard: pd data obtained relative to MgO, but values converted to absolute; values of τ_d are absolute Additional references: 3-2, 3-11, 3-12 Comments: For transmittance measurements, the sample was placed at one of the entrance ports of the integrating sphere, and MgO covered both the sample and reference ports. See section 3.2.1 also. Instrument 2: Perkin-Elmer infrared spectrometer Quantity measured: ρ_d , τ_d Wavelength range: 1.0 to 2.7 μ Reflectance attachment: Coblentz hemisphere Reflectance standard: pd data obtained relative to MgO, but converted to absolute; values of $\tau_{\rm d}$ are abso'ite Additional references: 3-13, 3-14

Comments: See section 3.2.3.

B-04804. Hovis: Infrared Reflectivity of Some Common Minerals, Appl. Opt., Vol. 5, No. 2 (1966).

Platform: laboratory

Instrument 1: Beckman DK-2 spectrophotometer Quantity measured: ρ_d Wavelength range: 0.5 to 2.5 μ Reflectance attachment: integrating sphere Reflectance standard: unspecified Comments: See section 3.2.2.

Instrument 2: Cary 90 spectrophotometer Quantity measured: ρ_d Wavelength range: 2.5 to 6.0 μ

Reflectance attachment: White hemisphere

Reflectance standard: data are absolute

Additional reference: 3-19

Comments: The White attachment is basically a Coblentz type hemisphere (see sec. 3.2.3). The sample was hemispherically illuminated with white light, and the reflected radiation was viewed slightly off normal.

als (Final Report), Materials Lab., New York Naval Shipyard, Brooklyn, N. Y., March 1954. Platform: laboratory Instrument 1: Beckman DU spectrophotometer Quantity measured: ρ_d , τ_d Wavelength range: 0.22 to 0.4 μ Reflectance attachment: ellipsoidal mirror that collects radiation diffusely reflected from the sample Reflectance standard: pd data obtained relative to MgO, but values converted to absolute: values of τ_d are absolute Additional reference: 3-10 Instrument 2: General Electric spectrophotometer Quantity measured: ρ_d , τ_d Wavelength range: 0.4 to 1.0 μ Reflectance attachment: integrating sphere Reflectance standard: ρ_d data obtained relative to MgO, but values converted to absolute; values of τ_d are absolute Additional references: 3-2, 3-11, 3-12 Comments: For transmittance measurements, the sample vas placed at one of the entrance ports of the integrating sphere, and MgO covered both the sample and reference ports. See section 3.2.1 also. Instrument 3: Porkin-Elmer infrared spectrometer Quantity measured: ρ_d , τ_d Wavelength range: 1.0 to 2.7 μ Reflectance attachment: Coblentz hemisphere

B-04805. Byrne, Mancinelli: Optical Transmittance, Reflectance, and Absorptance of Materi-

Wavelength range: 1.0 to 2.7 μ Reflectance attachment: Cohlentz hemisphere Reflectance standard: ρ_d data obtained relative to MgO, but converted to absolute; values of τ_d are absolute Additional references: 3-13, 3-14

Comments: See section 3.2.3.

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B-04806. Byrne, Schilling: Spectral Reflectance and Transmittance of Interior Fuel Materials (Final Report), Materials Lab., New York Naval Shipyard, Brooklyn, N. Y., November 1953.

Platform: laboratory

Instrument 1: Beckman DU spectrophotometer Quantity measured: ρ_d , τ_d Wavelength range: 0.22 to 0.4 μ Reflectance attachment: ellipsoidal mirror that collects radiation diffusely reflected from the sample Reflectance standard: ρ_d data obtained relative to MgO, but values converted to absolute; values of τ_{d} are absolute Additional reference: 3-10 Instrument 2: General Electric spectrophotometer Quantity measured: ρ_d , τ_d Wavelength range: 0.4 to 1.0 μ Reflectance attachment: integrating sphere Reflectance standard: Ad data obtained relative to MgO, but values converted to absolute; values of τ_d are absolute Additional references: 3-2, 3-11, 3-12 Comments: For transmittance measurements, the sample was placed at one of the entrance ports of the integrating sphere, and MgO covered both the sample and reference ports. See section 3.2.1 also. Instrument 3: Perkin-Elmer infrared spectrometer Quantity measured: ρ_d , τ_d Wavelength range: 1.0 to 2.7 μ Reflectance attachment: Coblentz hemisphere Reflectance standard: pd data obtained relative to MgO, but converted to absolute; values of τ_d are absolute Additional references: 3-13, 3-14 Comments: See section 3.2.3. B-04179. Edwards et al.: Basic Studies on the Use and Control of Solar Energy (Annual Report, Aug. 1959 to Aug. 1960), Univ. of California, Los Angeles, October 1960. **Platform:** laboratory Instrument 1: Beckman DK-2 spectrophotometer Quantity measured: ρ_d Wavelength range: 0.25 to 2.5 μ Reflectance attachment: integrating sphere Reflectance standard: data obtained relative to MgO, but values converted to absolute Comments: See section 3.2.2. Instrument 2: General Electric spectrophotometer Quantity measured: ρ_d Wavelength range: 0.4 to 1.0 μ Reflectance attachment: integrating sphere Reflectance standard: data obtained relative to MgCO₃, but values converted to absolute Additional references: 3-2, 3-11, 3-12 Comments: See section 3.2.1. Instrument 3: Perkin-Elmer spectrophotometer Quantity measured: ρ_d Wavelength range: 1.25 to 15 μ **Reflectance attachment:** Hohlraum Reflectance standard: data are absolute Comments: See section 3.2.6.

January 1969

B-05289. Ohlsen, Etemad: Spectral and Total Radiation Data of Various Aircraft Materials, North American Aviation, Inc., Los Angeles Div., Eng. Dept., Los Angeles, Calif., 23 July 1957.

Platform: laboratory

Instrument 1: General Electric spectrophotometer
Quantity measured: ρ_d
Wavelength range: 0.4 to 1.0 μ
Reflectance attachment: integrating sphere
Reflectance standard: data obtained relative to MgCO₃, but values converted to absolute
Comments: See section 3.2.1.
Instrument 2: Original design using a Perkin-Elmer 83 monochromator

Quantity measured: ρ_d Wavelength range: 1 to 25 μ Reflectance attachment: Hohlraum Reflectance standard: Data are absolute Comments: A Hohlraum device is discussed in section 3.2.6.

B-05370. Betz et al.: Determination of Emissivity and Reflectivity Data on Aircraft Structural Materials, Part I: Techniques for Measurements of Total Normal Emissivity and Reflectivity with Some Data on Copper and Nickel, Document Service Center, Knott Bldg., Dayton, Ohio, October 1956.

Platform: laboratory

Instrument: General Electric spectrophotometer Quantity measured: ρ_d Wavelength range: 0.38 to 0.7 μ Reflectance attachment: integrating sphere Reflectance standard: MgO Additional references: 3-2, 3-11, 3-12 Comments: See section 3.2.1.

B-013522. Funai, Starr, Streed: Principles of Infrared Camouflage for Low Temperature Targets, Navai Civil Engineering Lab., Port Hueneme, Calif., July 1953, AD 139 720.

Platform: laboratory

Instrument: Beckman IR-3 spectrophotometer Quantity measured: ρ_d Wavelength range: 1.8 to 13 μ Reflectance attachment: Hohlraum Reflectance standard: data are absolute Comments: See section 3.2.6.

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B-19999, B-20000, B-20001, B-20002. Reflectance of Target and Background Materials, unpublished data from the Air Force Target Signature Measurement Program, Willow Run Laboratories, Institute of Science and Technology, The University of Michigan, Ann Arbor, 1967.

Platform: laboratory

Instrument: Beckman DK-2 spectrophotometer

Quantity measured: ρ_d , τ_d Wavelength range: 0.28 to 2.6 μ

Wavelength range: 0.26 to 2.6 μ Reflectance attachment: integrating sphere Reflectance standard: MgO for ρ_d , but values of τ_d are absolute Comments: For transmittance measurements, the sa uple was positioned at one of the en-trance ports of the integrating sphere, and MgO was placed at both the sample and refer-ence ports (cf. fig. 3-3). Thus, energy transmitted into a hemisphere was seen by the detector. See section 3.2.2 also.
3.5. DATA FORMAT

In order to transfer a data curve from a source document to the Target Signature Library, the curve is first semi-automatically digitized and keypunched on IBM cards. Creat care is exercised to preserve all significant details of the original curve except those attributable to instrument noise. Data points are taken in such a way that the new curve formed by connecting the data points with straight lines will duplicate the original curve. In essence, this amounts to taking data points at all significant inflection points on the original curve, so that relatively few data points are required to describe a smooth curve, although many points may be required to describe a highly erratic curve. The keypunched cards are the mechanism for transferring the data to magnetic tape in the Target Signature Library and for printing out data curves in a standard format on a plotting machine.

The header information above each of the data curves includes the curve's identification number, the curve's title, subject codes, and parameter information. The identification number consists of the internal control letter B and eight digits. The first five digits identify the document from which the data were taken. (Section 3.4 lists the documents by control letter and these five digits.) The last three digits of the identification number have been arbitrarily assigned by the Target Signature Analysis Center for retrieval and to identify a particular curve within a given source document. The subject code is a group of letters assigned to each curve to permit retrieval by subject. Each letter represents a specific descriptor, and each curve is assigned as many letters and as many codes as are required to describe it adequately. The Target Signature Subject-Code List (table 1-1) explains these codes. As an example, a curve may be described as follows:

Object measured: loam (BFEA)
Instrumentation: General Electric spectrophotometer (CDB)
Experimental platform: Laboratory (CED)
Quantity measured: Directional reflectance with the specular component included in the measurement (DFAA)
Reflectance standard: MgO (DFCE)
Spectral interval: 0.4 to 0.7 μ (ECB) and 0.7 to 1.5 μ (ECCA)

The conditions of the experiment, called parameter information, are also listed on the printed header in abbreviated form. This information is derived from the original source when possible. For many of the data, very few parameter entries appear either because the source did not document all of the experimental parameters or because some parameters are not applicable to all measurements, e.g., altitude and range are not parameters for laboratory measurements. Table 3-1 is the key for interpreting this parameter information. Figure 3-18 illustrates the angle parameters pertinent to some measurements.

The optical data in this section are arranged according to the subject code most descriptive of the object or sample measured. Since the Target Signature Subject-Code List contains a large number of specific types of target and background categories, it was necessary in some cases to group the data into somewhat broader categories. These are cross-indexed by subject in section 2.

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FIGURE 3-18. GEOMETRY FOR SOME SPECIFIED OPTICAL DATA PARAMETERS

TABLE 3-1. OPTICAL DATA PARAMETERS

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DATE	Date of measurement (day, month, and year)						
TIME	Time of measurement (24-hour clock)						
LAT	Latitude of measurement (field measurement) or of location at which specimen was collected (laboratory measurement)						
LONG	Longitude of measurement or of location at which specimen was collected, as with LAT						
ALT	Altitude of experimental platform (thousand, of feet)						
RANGE	Slant range (thousands of feet)						
DAYS RE	Number of days sample had been removed from its natural environment						
IN*	Incidence angle (degrees from normal)						
IAZ*	Azimuth of incident radiation (degrees)						
CN**	Collection angle (degrees from normal)						
CAZ**	Azimuth of collection angle (degrees)						
IRR	Type of target irradiation coded as follows:						
	 A Sun B Moon C Skylight (extended source) D Laser E Other artificial point sources 						
OBST	Obstructions in the air that prevent a clear view of the target, coded as follows:						
	ASmokeBHazeCDustDSandEFogFDrizzleGRainHSnowIHail						
TTEMP	Temperature of target or measured object (^O K)						
WIND SP	Average wind speed (mph)						
WIND DI	Wind direction						
CLD	Total cloud cover coded as follows:						
	A 0 to 0.1 B 0.2 to 0.5 C 0.6 to 0.8 D 0.9 to 1.0						
VIS	Visibility (miles)						
TEMP	Temperature of environment (°F)						
DEW PT	Dew point temperature (⁰ F)						
N AVE	Number of curves or measurements averaged to make up this curve						

*These angles are defined only if the major portion of radiation incident on the target comes from a point source, e.g., the sun (see fig. 3-18).

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**These angles are defined when the target is observed from one direction (see fig. 3-18).

فلفاط معاقدهم تعريره وإرفادهم متراغير وروار والملافلات

COLUMN TRADES

3.6. REFERENCES FOR SECTION 3

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- 3-3. E. L. Krinov, Spectral Reflectance Properties of Natural Formations, trans. by G. Belkov, Natl. Res. Council, Canada, Technical Translation No. 439, Ottawa, Ontario, 1953.
- 3-4. D. K. Wilburn and O. Renius, The Spectral Reflectance of Ordnance Materials at Wavelengths of 1 to 12 Microns (U), Detroit Arsenal, Centerline, Mich., 8 February 1965, AD 087 246 (CONFIDENTIAL).
- 3-5. V. W. McIntire, Light Polarizing Properties of Terrestrial Backgrounds and Painted Surfaces (U), Naval Ordnance Test Station, China Lake, Calif., September 1964, AD 354 613 (CONFIDENTIAL).
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- 3-8. D. G. Goebel, B. P. Caldwell, and H. K. Hammond, III. "Use of an Auxiliary Sphere with a Spectroreflectometer to Obtain Absolute Reflectance," J. Opt. Soc. Am., Vol. 56, 1966, pp. 783-788.
- .3-9. W. E. K. Middleton and C. L. Sanders, "The Absolute Spectral Diffuse Reflectance of Magnesium Oxide," J. Opt. Soc. Am., Vol. 41, 1951, pp. 419-424.
- 3-10. H. H. Car and A. O. Beckman, "A Quartz Photoelectric Spectrophotometer," J. Opt. Soc. Am., Vol. 31, 1941, pp. 682-689.
- 3-11. A. C. Hardy, "History of the Design of the Recording Spectrophotometer," J. Opt. Soc. Am., Vol. 28, 1938, pp. 360-371.
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- 3-17. E. V. Ashburn et al., "Narrow Pass Band Albedometer," Rev. Sci. Instr., Vol. 27, 1956, pp. 90-91.
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- 3-25. D. K. Edwards, and N. Bayard de Volo, "Useful Approximation for the Spectral and Total Emissivity of Smooth Bare Metals," Advances in Thermophysical Properties at Extreme Temperature and Pressure, American Society of Mechanical Engineers, New York, 1965, pp. 174-188.

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OPTICAL REFLECTANCE DISTRIBUTION FUNCTION DATA

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The data treated in this section were obtained through a reflectance measurement of a different type than that used for the data of section 3. As pointed out in section 3.1, the term "reflectance" by itself is vague and should not be used unless the exact type of reflectance is indicated. The common concept for reflectance employs a dimensionless quantity, perhaps as a function of wavelength and always between the values 0 and 1 (or 0% and 100%). Further, it is assumed that the total power reflected by a surface is collected and the ratio of this to the total incident power is the reflectance of that surface; however, situations where total powers are involved seldom occur naturally. Laboratory instruments have been built to approximate or simulate the conditions for such a total reflectance measurement, but each type of instrument (sec. 3.2) really measures only its particular type of reflectance.

Section 3.1 contains a derivation of a "general reflectance" ρ' , called bidirectional reflectance, which is based on a directional source and a point receiver; thus the problems of collecting all reflected power or illuminating the surface from all directions are avoided. However, ρ' is not really a reflectance. Since the initial publication of that derivation, the symbol ρ' has been changed to f_r and the name from "bidirectional reflectance" to "quadravariate reflectance distribution function" (4RDF) [4-1] (this notation is used in this section). This was necessary because f_r is not simply a ratio of reflected to incident powers but is a measure of power per unit projected solid angle reflected in a given direction to power incident from a given source direction. Thus, f_r with units of reciprocal steradianc (sr⁻¹), is not bounded by 0 and 1, and can vary with the cource and receiver angles. This is the type of reflectance that occurs naturally and is of most value to the analysis of remote sensory systems.

A formal definition of the reflectance distribution function and some mathematical manipuiations of 4RDF are given in section 4.1; section 4.2 contains equations illustrating how the 4RDF data can be applied to sensor systems. A description of the instrument used for collection of 4RDF data is given in section 4.3. The format used for presenting the data in this compilation is explained in section 4.4.

4.1. DEFINITION OF THE REFLECTANCE DISTRIBUTION FUNCTION 4RDF

The definition given here is based on the treatment of reflectance and emissivity in the Handbook of Military Infrared Technology [4-1]. However, the symbols and terminology are those used in reference 4-2.

Consider radiant power incident on an element of surface area δA from direction θ_i , ϕ_i and contained within the a beam of solid angle $d\omega_i$, where θ_i is the polar and ϕ_i the azimuth angle relative to a coordinate system fixed to area δA , as shown in figure 4-1. If the radiant power source has a radiance $\delta_i L_i(\theta_i, \phi_i)$ in direction θ_i , ϕ_i , then the power incident on the surface from this source is

$$\delta \mathbf{P}_{i} = \mathbf{L}_{i}(\theta_{i}, \phi_{i}) \cos \theta_{i} \delta \mathbf{A} d\omega_{i}$$
$$= \delta \mathbf{E}(\theta_{i}, \phi_{i}) \delta \mathbf{A}$$

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(4-1)

where

$$d\omega_i = \sin \theta_i d\theta_i d\phi_i$$

and

$$\delta \mathbf{E} = \mathbf{L}_{i} d\boldsymbol{\omega}_{i} \cos \theta_{i}$$



FIGURE 4-1. LOCAL COORDINATE SYSTEM FOR DETER-MINING BIDIRECTIONAL REFLECTANCE

Now considering only the incident power δP_i from direction θ_i , ϕ_i , the radiant intensity $\delta I_r(\theta_r, \phi_r)$ of the area δA in direction θ_r , ϕ_r due to reflection or scattering is

$$\delta I_{\mathbf{r}}(\theta_{\mathbf{r}}, \phi_{\mathbf{r}}) = \delta P_{\mathbf{i}}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}}) f_{\mathbf{r}}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}}; \theta_{\mathbf{r}}, \phi_{\mathbf{r}}) \cos \theta_{\mathbf{r}}$$
(4-2)

and since

$$\frac{\delta I_{r}}{\cos \theta_{r} \delta A} = \delta L_{r}$$

and

$$\frac{\delta \mathbf{P}_i}{\delta \mathbf{A}} = \delta \mathbf{E}$$

we have the reflected radiance relation

$$\delta \mathbf{L}_{\mathbf{r}}(\theta_{\mathbf{r}}, \phi_{\mathbf{r}}) = \delta \mathbf{E}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}}) \mathbf{f}_{\mathbf{r}}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}}; \theta_{\mathbf{r}}, \phi_{\mathbf{r}})$$
(4-3)

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In equations 4-2 and 4-3, f_r is defined as the operator that acts on incident power or irradiance to give the reflected radiant intensity or reflected radiance, respectively, of an element δA that is a reflector or scatterer. Explicitly,

$$f_{\mathbf{r}}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}}; \theta_{\mathbf{r}}, \phi_{\mathbf{r}}) = \frac{\delta \mathbf{L}_{\mathbf{r}}(\theta_{\mathbf{r}}, \phi_{\mathbf{r}})}{\delta \mathbf{E}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}})} = \frac{\delta \mathbf{L}_{\mathbf{r}}(\theta_{\mathbf{r}}, \phi_{\mathbf{r}})}{\mathbf{L}_{\mathbf{i}}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}})\cos\theta_{\mathbf{i}}d\omega_{\mathbf{i}}}$$
(4-4)

(The geometrical factor $\cos \theta_i$ in equation 4-2 does not appear in equation 4-3 because radiance is defined as watts per square centimeter per projected unit solid angle in the direction of propagation.) The reflectance distribution function, f_r , is thus the ratio of reflected radiance to irradiance, each quantity having a direction associated with it. If certain conditions are met, one may apply a theorem of reciprocity [4-3], generally attributed to Helmholtz, which states that the respective directions may be interchanged; i.e.,

$$\mathbf{f_r}(\theta_1, \phi_1; \theta_2, \phi_2) = \mathbf{f_r}(\theta_2, \phi_2; \theta_1, \phi_1)$$

From equation 4-4:

$$\delta \mathbf{L}_{\mathbf{r}}(\boldsymbol{\theta}_{\mathbf{r}}, \boldsymbol{\phi}_{\mathbf{r}}) = \mathbf{f}_{\mathbf{r}} \, \delta \mathbf{E}(\boldsymbol{\theta}_{\mathbf{i}}, \boldsymbol{\phi}_{\mathbf{i}}) = \mathbf{f}_{\mathbf{r}} \frac{\delta \mathbf{P}_{\mathbf{i}}(\boldsymbol{\theta}_{\mathbf{i}}, \boldsymbol{\phi}_{\mathbf{i}})}{\delta \mathbf{A}}$$

But, the total power reflected by δA due to δE is

$$P_{r} = \delta A \int_{h} \delta L_{r}(\theta_{r}, \phi_{r}) \cos \theta_{r} d\omega_{r}$$
$$= \delta A \int_{h} f_{r} \frac{\delta P_{i}(\theta_{i}, \phi_{i})}{\delta A} \cos \theta_{r} d\omega_{r}$$

where the integral is over the hemisphere above δA .

Now, if $\delta P_i(\theta_i, \phi_i)$ is the only source power considered and all its rays are contained within a small solid angle $d\omega_i$, then

$$\mathbf{P}_{\mathbf{r}} = \mathbf{P}_{\mathbf{i}}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}}) \int_{\mathbf{h}} \mathbf{f}_{\mathbf{r}}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}}; \theta_{\mathbf{r}}, \phi_{\mathbf{r}}) \cos \theta_{\mathbf{r}} d\omega_{\mathbf{r}}$$
$$\frac{\mathbf{P}_{\mathbf{r}}}{\mathbf{P}_{\mathbf{i}}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}})} = \int_{\mathbf{h}} \mathbf{f}_{\mathbf{r}}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}}; \theta_{\mathbf{r}}, \phi_{\mathbf{r}}) \cos \theta_{\mathbf{r}} d\omega_{\mathbf{r}}$$

Now, it is recognized that

$$\frac{\mathbf{P_r}}{\mathbf{P_i}(\theta_i, \phi_i)} = \rho_{di}$$

where ρ_{di} is the quantity obtained when a detector is at one port of an integrating sphere and a sample at another port of the sphere is illuminated by a small beam of light from direction θ_i , ϕ_i . Thus,

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$$f_{\mathbf{r}}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}}; \theta_{\mathbf{r}}, \phi_{\mathbf{r}}) \cos \theta_{\mathbf{r}} d\omega_{\mathbf{r}} = \rho_{d\mathbf{i}}$$

(4-5)

But,

 $\int_{\mathbf{h}} \cos \theta_{\mathbf{r}} \, \mathrm{d} \omega_{\mathbf{r}} = \pi$

therefore,

$$\frac{\int_{\mathbf{h}} \mathbf{f}_{\mathbf{r}}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}}; \theta_{\mathbf{r}}, \phi_{\mathbf{r}}) \cos \theta_{\mathbf{r}} d\omega_{\mathbf{r}}}{\int_{\mathbf{h}} \cos \theta_{\mathbf{r}} d\omega_{\mathbf{r}}} = \frac{\rho_{d\mathbf{i}}}{\pi}$$

Now, the notation \overline{f}_{r} is defined as

$$\overline{f}_{\mathbf{r}}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}}) = \frac{\int_{\mathbf{h}} \mathbf{f}_{\mathbf{r}}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}}; \theta_{\mathbf{r}}, \phi_{\mathbf{r}}) \cos \theta_{\mathbf{r}} d\omega_{\mathbf{r}}}{\int_{\mathbf{h}} \cos \theta_{\mathbf{r}} d\omega_{\mathbf{r}}}$$
(4-6)

where $\overline{f_{r}}$ is a weighted average of f_{r} over the hemisphere. Because of the reciprocity theorem,

$$\overline{\mathbf{f}}_{\mathbf{r}}(\boldsymbol{\theta}_{\mathbf{i}}, \boldsymbol{\phi}_{\mathbf{i}}) = \overline{\mathbf{f}}_{\mathbf{r}}(\boldsymbol{\theta}_{\mathbf{r}}, \boldsymbol{\phi}_{\mathbf{r}}) = \overline{\mathbf{f}}_{\mathbf{r}}(\boldsymbol{\theta}, \boldsymbol{\phi})$$

or, in the former notation

$$\rho_{di} = \rho_{dr} = \rho_{d}$$

 $\rho_{\rm d} \neq \overline{\rm f}_{\rm r}(\theta,\,\phi)$

Note, however that

but rather,

$$\rho_{\rm d} = \pi \overline{f}_{\rm r}(\theta, \phi)$$

The terms $f_r(\theta_i, \phi_i; \theta_r, \phi_r)$ and $\overline{f}_r(\theta, \phi)$ also have the names "quadravariant reflectance distribution function" and "bivariant reflectance distribution function," which are shortened to the acronyms 4RDF and 2RDF, respectively. For a further discussion of f_r and different types of \overline{f}_r derived from it, i.e., f_r averaged over other angles, see reference 4-2, where f_r is termed f_4 .

4.2. SOME EQUATIONS FOR THE APPLICATION OF 4RDF DATA

Reflection characteristics of targets and backgrounds are generally used with appropriate equations to predict the operational capabilities of active or semi-active detection or mapping systems. In the past, most of the reflectance data has necessarily been of the ρ_d type, i.e., reflectance, without consideration of how the reflected power is distributed throughout the hemi-

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sphere. It should be obvious that generally much better predictions could be and for the operation of such systems if reflectance distribution function data were used. Erable to be a diffuse reflector, i.e., taking ρ_d and dividing by π , when in a dality it is a forward scatter or a backscatter, would be completely eliminated.

The price one pays to obtain these better predictions, in addition to the data acquisition costs, is the necessity of working with large amounts of data since $f_r(\theta_i, \phi_i; \theta_r, \phi_r)$ or 4RDF varies with both source and receiver directions.* The manner in which 4RDF varies depends on the particular surface considered and the polarization states of the source and receiver, as shown by the data in section 4.5. Much of the variation in 4RDF as a function of receiver angle (θ_r) is unimportant when application is made to active detection or mapping systems where the source and receiver are typically colinear or separated by only a small bistatic angle. For such a system, only those data points where the receiver angle is close, or equal, to the incidence angle would be needed. On the other hand, all the 4RDF data is necessary when application is made to semi-active systems where a flare or the sun is the source and the receiver can be almost anywhere.

The determination of relative contrast in a proposed strip map or other scene could be made very accurately by ranking the $f_r(\theta_r, \phi_r; \theta_i, \phi_i)$ values for all targets and backgrounds that are to be included. An important assumption here is that 4RDF data are available for the targets and backgrounds considered or that mathematical models for these have been formulated from data collected for the basic materials. A similar ranking of ρ_d (or $\overline{f_r}$ or 2RDF in the new notation) values for the same targets and backgrounds could not be depended upon to predict relative contrast unless the angular reflection properties of everything in the scene were the same. This is certainly possible but not very probable.

An important advantage to using 4RDF data lies in the polarization parameters that can be exploited to enhance contrast. Since all four polarization components ** usually have different values, there are many combinations — sums, differences, and ratios — that could be used with appropriate instrumentation to change the contrast between specified targets or target classes and their backgrounds. A simple illustration of this is the blinking effect one observes when a polaroid filter is rotated between one's eye and a sun-lighted automobile. Extensive analysis is needed to determine the optimum source polarization plane or planes, receiver analyzer orientations, and/or signal processing; but the effort would pay off, especially when new detection or mapping systems are designed.

^{*}The reflectance distribution function also varies with wavelength just as ρ_d does; in fact, it may be possible (for certain targets and certain angles) to determine the λ -dependence of f_r data through ρ_d versus λ measurements. Such a procedure would certainly not apply for incidence angles near grazing, for targets with surface textures whose dimensions are comparable to the wavelengths employed, or in spectral regions where absorption bands occur.

^{**}See discussion of polarization at the beginning of section 4.4.

For a given system design, the received power for calculation of signal-to-noise ratios can be computed with 4RDF data in the following manner. By definition from equation 4-4,

 $\mathbf{f}_{\mathbf{r}}(\boldsymbol{\theta}_{\mathbf{i}}, \boldsymbol{\phi}_{\mathbf{i}}; \boldsymbol{\theta}_{\mathbf{r}}, \boldsymbol{\phi}_{\mathbf{r}}) = \frac{\delta \mathbf{L}_{\mathbf{r}}(\boldsymbol{\theta}_{\mathbf{r}}, \boldsymbol{\phi}_{\mathbf{r}})}{\mathbf{L}_{\mathbf{i}}(\boldsymbol{\theta}_{\mathbf{i}}, \boldsymbol{\phi}_{\mathbf{i}}) \mathbf{d} \boldsymbol{\Omega}_{\mathbf{i}}}$ (4-4a)

or

$$\delta \mathbf{L}_{\mathbf{r}}(\boldsymbol{\theta}_{\mathbf{r}}, \boldsymbol{\phi}_{\mathbf{r}}) = \mathbf{f}_{\mathbf{r}}(\boldsymbol{\theta}_{\mathbf{i}}, \boldsymbol{\phi}_{\mathbf{i}}; \boldsymbol{\theta}_{\mathbf{r}}, \boldsymbol{\phi}_{\mathbf{r}}) \mathbf{L}_{\mathbf{i}}(\boldsymbol{\theta}_{\mathbf{i}}, \boldsymbol{\phi}_{\mathbf{i}}) \mathrm{d}\boldsymbol{\Omega}_{\mathbf{i}}$$

where subscripts r and i refer to reflected and incident, respectively

- $d\Omega_i = d\omega_i \cos \theta_i$ is the projected solid angle through which the source illuminates the tar
 - get surface
 - L is radiance

A specified λ and $\Delta\lambda$ are assumed. The radiant power P passing through a remote aperture and coming from a surface with a radiance L is

$$\mathbf{P} = \mathbf{L}\mathbf{A}\mathbf{\Omega}$$

where A is the area of the radiating (or reflecting) surface

 $\boldsymbol{\Omega}$ is the projected solid angle subtended by the receiving aperture

 $\Omega = \omega \cos \theta$, where θ is the angle between the surface normal and the receiving aperture normal and ω is the total solid angle. It is assumed here that ω is small and that the receiver is pointed directly toward the area A. Thus, in general, these equations give

$$\mathbf{P}(\theta_{\mathbf{r}}, \phi_{\mathbf{r}}) = \left[\int_{\omega_{\mathbf{i}}} \mathbf{f}_{\mathbf{r}}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}}; \theta_{\mathbf{r}}, \phi_{\mathbf{r}}) \mathbf{L}_{\mathbf{i}}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}}) d\Omega_{\mathbf{i}}\right] \mathbf{A}\Omega_{\mathbf{r}}$$

where the integral is over the input solid angle. The term in brackets is the target radiance L_r due to reflection of a source that subtends a solid angle ω_i and has a radiance L_i . A is the area within the field of view subject to L_i , and Ω_r is the projected solid angle of the receiver.

This general equation can be simplified when certain conditions exist: if f_r does not vary over the range of incidence angles considered, it can be moved outside the integral; the remaining integral is the irradiance on the target E. Thus, under these conditions,

 $\mathbf{P}(\boldsymbol{\theta}_{\mathbf{r}}, \boldsymbol{\phi}_{\mathbf{r}}) = \mathbf{f}_{\mathbf{r}}(\boldsymbol{\theta}_{\mathbf{i}}, \boldsymbol{\phi}_{\mathbf{i}}; \boldsymbol{\theta}_{\mathbf{r}}, \boldsymbol{\phi}_{\mathbf{r}}) \mathbf{E}(\boldsymbol{\theta}_{\mathbf{i}}, \boldsymbol{\phi}_{\mathbf{i}}) \mathbf{A} \boldsymbol{\Omega}_{\mathbf{r}}$

At least five different equations can be derived for received power depending on the illumination source and/or the receiver field of view.

Case I. Solar or other source for which irradiance is known

In a selected wavelength band and assuming the field of view to be always fully illuminated,

$$\mathbf{P} = \mathbf{f}_{\mathbf{r}}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}}; \theta_{\mathbf{r}}, \phi_{\mathbf{r}}) \mathbf{E}_{\mathbf{g}} \cos \theta_{\mathbf{i}} \mathbf{A}_{\mathbf{r}} \frac{\pi}{4} \alpha^2 \mathbf{S}_{\mathbf{a}}$$
(4-7)

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where $f_r(\theta_i, \phi_i; \theta_r, \phi_r)$ is the reflectance distribution function of the surface and is a function of source and receiver directions relative to the surface under study

 E_{S} is the irradiance on a surface normal to the source

 θ_i is the incident polar angle (E_g cos θ_i is thus the target irradiance E)

A_r is the receiver aperture area

 α is the total angle field of view

S_a is the loss term to account for atmospheric scattering or absorption

Note that equation 4-7 is independent of range since, when range is decreased, the target area decreases and the receiver solid angle increases.

Case II. Laser or other source with small beam properties arranged coaxially with a receiver

In a selected wavelength band and assuming the illuminated area to be larger than field of view,

$$\mathbf{P} = f_{\mathbf{r}}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}}; \theta_{\mathbf{r}}, \phi_{\mathbf{r}}) \mathbf{P}_{\mathbf{t}} \frac{\alpha^2}{\gamma^2} \frac{\mathbf{A}_{\mathbf{r}}}{\mathbf{R}^2} \cos \theta \mathbf{S}_{\mathbf{a}}^2$$
(4-8)

where Pt is the total transmitted power

R is the range to the target

 θ is the polar angle of incidence and reflection

 γ is the half-power beam divergence angle of the transmitter and other terms are as in equation 4-7

The loss term is now squared since there is two-way propagation. When the receiver field of view α is smaller than the transmitter beam divergence γ , their ratio correctly weights the P_t term to account for powerⁱ transmitted but not useful. When α is larger than γ , the ratio term drops out; i.e., for a field of view larger than the beam divergence

$$\mathbf{P} = f_r(\theta_i, \phi_i; \theta_r, \phi_r) \mathbf{P}_t \frac{\mathbf{A}_r}{\mathbf{R}^2} \cos \theta \mathbf{S}_a^2$$
(4-9)

Case III. Laser or other source with small beam properties not arranged coaxially with a receiver

In a selected wavelength band and assuming the illuminated area to be larger than the field of view,

$$\mathbf{P} = \mathbf{f}_{\mathbf{r}}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}}; \theta_{\mathbf{r}}, \phi_{\mathbf{r}}) \mathbf{P}_{\mathbf{t}} \frac{\alpha^2}{\gamma^2} \mathbf{A}_{\mathbf{r}} \cos \theta_{\mathbf{i}} \frac{1}{\mathbf{R}_{\mathbf{t}}^2} \mathbf{S}_{\mathbf{a}} \mathbf{S}_{\mathbf{a}}$$

where

 θ_i is the polar angle of incidence

Rt is the range of the target from the transmitter

 S_{a_t} and S_{a_r} are loss terms for the paths to the target from the transmitter and to the receiver from the target, respectively

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Just as in equation 4-9 when α is larger than γ , their ratio drops out; i.e.,

$$\mathbf{P} = \mathbf{f}_{\mathbf{r}}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}}; \theta_{\mathbf{r}}, \phi_{\mathbf{r}}) \mathbf{P}_{\mathbf{t}} \mathbf{A}_{\mathbf{r}} \cos \theta_{\mathbf{i}} \frac{\mathbf{I}}{\mathbf{R}_{\mathbf{t}}^2} \mathbf{S}_{\mathbf{a}} \mathbf{S}_{\mathbf{t}} \mathbf{S}_{\mathbf{r}}$$
(4-10)

In all of these equations one must be careful that the $f_r(\theta_i, \phi_i; \theta_r, \phi_r)$ used applies to the entire target area. If this is not possible, an averaged value should be used based on the relative areas of the several materials or objects comprising the target or filling the field of view.

4.3. DESCRIPTION OF INSTRUMENTATION

The instrument used in the Target Signature Measurements Program (laboratory phase) at The University of Michigan to collect the data presented in this section is called the breadboard gonioreflectometer or "BGR" [4-2]. It is a table-top instrument comprising two radiation sources, a receiver, a sample mount, signal-processing electronics, and chart recorder. One source is a plane-polarized He-Ne laser (Spectra-Physics Model 130B) operating at a wavelength of 0.6328 μ m. The other source is a tungsten-quartz iodine lamp with a 250-mm grating monochromator (Bausch and Lomb with slits set for $\Delta \lambda = \pm 50$ Å bandwic(h) for operation from 0.3 to 1.4 μ . However, the spectral interval is restricted by the detector in the receiver and the power available from the lamp. The receiver uses an S-1 response photomultiplier (RCA-7102) and has a two-element optical system and field stop that defines a field of view of 7.5 cm at a range of 53 cm and focuses the entrance aperture onto the photocathode. An adjustable iris at the entrance sets the aperture to about 3-cm diameter so that a solid angle of 0.0025 sr is defined for collection of reflected radiation.

Samples are mounted vertically on a hand-operated rotary table set in the path of the source beam to achieve the desired incidence angle. The receiver is mounted on a stand so that the source beam, the sample normal, and the receiver viewing direction all lie in a common plane parallel to the table top. The coordinate system used for a typical measurement is shown in figure 4-2. The choice of the $\phi = 0$ reference line on the sample is arbitrary.

The laser beam is diverged with a negative lens to yield an illuminated spot on the sample, about 2.5-cm diameter at normal incidence; the beam divergence angle (total) is less than 32 mrad. At the exit slits of the monochromator, a two-element optical system and an iris are used to focus a round spot on the sample. The maximum convergence of these rays forming the illuminated spot is less than 40 mrad total angle. The iris is used to reduce the spot size when necessary so that the illuminated area (an ellipse for large incidence angles) is not larger than the field of view of the receiver.

Polaroid filters, HN22 for the visible and HR for the near-IR spectral region, are used to polarize the beam from the monochromator, rotate the polarized beam from the laser, and serve as analyzers in front of the receiver entrance aperture. Inherent sensitivity of the receiver to the polarization of the input beam was checked by .otating the photomultiplier and then the optics about the longitudinal axis of the beam and was found to be negligible in both cases.



FIGURE 4-2. SAMPLE COORDINATE SYSTEM. Typical for measurements in the $\phi = 0^{\circ}$ and $\phi = 180^{\circ}$ planes.

The beams from the sources are chopped mechanically at a 90-Hz rate to allow use of narrowband filtering and a homodyne detector system. Precision electrical attenuators are used in the signal line between the receiver and the filter-homodyne detector so that only a small dynamic range is required for these systems. The attenuators are used over a range of 3 decades, and a test of system linearity over this range with calibrated neutral-density filters gave results of $\pm 3\%$, which is comparable to the linearity of the photomultiplier alone. The dc output signal from the homodyne detector is recorded on a strip chart, signal vs. time, and the noise can be averaged out for seconds or minutes when necessary.

Calibration of the entire instrument is accomplished in the following manner. A calibrated neutral-density filter of sufficient density is placed between the source and receiver, and a signal proportional to the incident power is obtained. Such calibrations are repeated at half-hour intervals or before and after each run to insure good calibration values. Since the source power is usually constant, as shown by a monitor detector, calibration values are also constant.

The measured values of $f_r(\theta_i, \phi_i; \theta_r, \phi_r)$ are obtained for a given set of polarization conditions by use of the equation

$$\mathbf{f}_{\mathbf{r}}(\theta_{\mathbf{i}}, \phi_{\mathbf{i}}; \theta_{\mathbf{r}}, \phi_{\mathbf{r}}) = \frac{\mathbf{V}_{\mathbf{r}}(\theta_{\mathbf{r}}, \phi_{\mathbf{r}})\mathbf{K}_{\mathbf{r}}}{\mathbf{V}_{\mathbf{c}}\mathbf{K}_{\mathbf{c}}\mathbf{K}_{\mathbf{NDF}}\boldsymbol{\omega}_{\mathbf{r}}\cos\theta_{\mathbf{r}}}$$

where

 V_r is the voltage from the receiver due to reflected power

- K_r is precision attenuator setting for voltage V_r
- V_{C} is the calibration voltage (as measured or a linear interpolation if successive values differ)
- K_c is the precision attenuator setting for voltage V_c

K_{NDF} is the attenuation of the calibrated neutral density filter used during the calibration measurement $w_r \cos \theta_r$ is the projected solid angle of the receiver as seen from the sample surface

An error analysis considering all factors of the measurement to have normally distributed errors within measured or factory-specified limits resulted in a 50% probable error of $\pm 5\%$ on a stated value of f_r . Most of this error is due to uncertainties in the calibration of the neutral-density filter.

Since spatial coherence of the incident radiation beam may be a significant parameter of the reflection process, a Young's double-slit interference experiment was performed with the laser beam to determine its partial coherence factor. According to coherence theory [4-4] the real part of the complex partial coherence factor $|\gamma_{12}|$ can be obtained under certain conditions by measuring the visibility of fringes produced by a pair of illuminated slits. Visibility is defined here as

$$V = \frac{I_{\max} - I_{\min}}{I_{\max} + I_{\min}}$$

where I_{max} is the light intensity at a bright part of the interference pattern and I_{min} is the light intensity at the darker part. The required conditions for such a measurement are (a) that the slit widths be small relative to the distance from slit plane to the fringe observation plane, and (b) that monochromatic radiation be used.

In the experiment, slits of about 0.25-mm width separated by about 0.25 mm were illuminated by the laser beam after passing through the negative diverging lens. The visibility of the fringe pattern was measured at a distance of about 0.75 m with a photomultiplier having a small (0.2 mm) aperture. In moving the slit pair across the width of the laser beam, visibilities or $|\gamma_{12}|$ values between 0.83 to 0.98 were obtained. It was observed that dust particles on the lens caused the lower values of $|\gamma_{12}|$.

4.4. DATA FORMAT

The data are presented in a tabular format with certain parameters listed in a header. The f_r values in the table are those measured as well as one computed value. During the measurement, the source may be linearily polarized or unpolarized and the receiver may or may not employ a linear polarization analyzer. These possible conditions on the source and receiver result in nine different values of f_r if the planes of linear polarization take on orthogonal values relative to a reference plane. The reference plane is usually that formed by the normal to the sample surface (or average surface if it has some contour) and the illuminating beam direction. The nine values of f_r are identified by the letters $\ell \ell$, ℓp , $p\ell$, pp, ℓt , pt, $o\ell$, op, and ot, where ℓ = parallel, p = perpendicular, t = no analyzer on the receiver (total signal received). and o = source not polarized (or strictly speaking, randomly polarized). The first letter of each pair refers to the source polarization and the second to that of the receiver. The first four values

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of f_r , namely, $f_r(\ell\ell)$, $f_r(\ell p)$, $f_r(p\ell)$, and $f_r(pp)^*$ are the basic ones, and the others can be derived from them. The computed value given in the tarts is $f_r(ot)$, obtained by the equation:

$$f_{r}(ot) = \frac{f_{r}(\ell\ell) + f_{r}(\ell p)}{2} + \frac{f_{r}(pp) + f_{r}(p\ell)}{2}$$

The other values can be computed by the following equations:

()

$$f_{r}(\ell t) = f_{r}(\ell \ell) + f_{r}(\ell p)$$

$$f_{r}(pt) = f_{r}(pp) + f_{r}(p\ell)$$

$$f_{r}(o\ell) = \frac{f_{r}(\ell \ell) + f_{r}(p\ell)}{2}$$

$$f_{r}(op) = \frac{f_{r}(pp) + f_{r}(\ell p)}{2}$$

Each of the four basic components has an ideal value of $1/2\pi = 0.159 \text{ sr}^{-1}$, which would apply for a perfectly diffuse reflector with 100% efficiency (no absorption or transmission). This value would also be independent of angle, that is, constant, for such an ideal diffuse reflector.

Because subscripts and lower case letters are not available in the computer printouts used for the data in this section, the notation RDF(LL), RDF(LP), RDF(PL), RDF(PP), and RDF(OT)are used instead of $f_r(\ell\ell)$, etc. The notation 1/SR used in the printout with RDF(LL), etc., refers to the units of RDF, in reciprocal steradians.

The data are arranged according to the prime subject code for each sample derived from the Target Signature Subject-Code List (table 1-1). These codes are prefixed with the letter f, and the filing divider sheets are labeled (f)AEM, etc., to distinguish between these data and those of section 3. The various parts of a typical page of tabular data and header information are shown and identified in table 4-1. Several pages are required to present all the data for a given sample.

Each page of data contains:

(a) Sample number and area/condition number

- (b) Title and short description
- (c) Subject codes
- (d) Data set numbers included on that page
- (e) Parameter information: the type of source, the coherence factor, if it applies, and the instrumentation used, the accuracy of the data, the number of data sets averaged, the angles θ_i , ϕ_i , θ_r , ϕ_r , $\beta = |\theta_i \theta_r|$ if β is fixed, and the wavelength of the source (a fixed quantity)

^{*}The complete notation for the reflectance distribution function with all angles and polarization parameters included is $f_r(\theta_i, \phi_i, \ell; \theta_r, \phi_r, \ell)$, $f_r(\theta_i, \phi_i, \ell; \theta_r, \phi_r, p)$, etc., where items to the left of the semicolon within the parentheses refer to the source and those to the right to the receiver.

- (f) Data set numbers for each measured quantity
- (g) A table of measured RDF values, one computed RDF value, and the variable angle

(h) Repeat of (f) and (g) when one of fixed angles changes value

Identification is provided by a letter (see table 4-2) to designate the agency that supplied the measurement data, followed by a 5-digit number that is assigned by the TSAC library to each sample, material, or object that has been measured. These six characters are followed by a dash and 3 digits designating a particular numbered area on the sample or designating (by an arbitrary number) a changed condition of the sample; that is, a new area/condition number would be assigned if the sample had been clean and was allowed to become dirty. The letter, the sample number, and the area/condition number comprise the ID number for that sample. Note the parts of this number identified in table 4-1. Data set numbers are assigned to a group of data points that has in common one variable, all other parameters including polarization being fixed. For example, one data set might contain RDF(LL) data where θ_i, ϕ_i, ϕ_r and the polarization parameters are fixed and θ_r is variable; when ϕ_r is changed to some other value a new data set number is assigned, etc. If the angle parameters are the same but the wavelength or the source type is changed, a new data set number is again assigned. Note the assignment of data set numbers in table 4-1. A similar rule is followed in assigning data set numbers for data when the bistatic angle $\beta = |\theta_i - \theta_r|$ is fixed during the measurement, although is this case two angles are varying at once.

Since the f_r data (see sec. 2 for a cross index) are given in a tabular format, several graphs of f_r versus θ_r are included here to help the reader visualize the spatial variation of f_r for various incidence angles. Four different types of materials were chosen, and for reasons of clarity the function plotted is $f_r(ot)$ rather than the four basic components; i.e., for these data the source is unpolarized and no analyzer is used on the receiver. A polar coordinate system was chosen as the graphic: format because the resulting figure is symbolic of the reflection or scattering process. Figures 4-3a and b show the somewhat diffuse reflection distribution function of 3M white velvet paint, and figure 4-4 shows data for an orange-colored nylon cloth which exhibits both forward scatter and backscatter. Logarithmic scales are used in figures 4-5 and 4-3a and b to accommodate the large dynamic range of the forward-scatter values of an olive drab paint and a mulberry leaf, respectively.

4-12

TABLE 4-1. IDENTIFICATION OF ITEMS ON TYPICAL DATA PAGE

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Sample No.	Area/Con	dition No.				
A01027-0	~~ 03					
	ID No.					
Prefix Letter for	D.D. PAINT	USED ON M	AZ-290 7 1	AN TRUCK.		LIED
Measuring Agency	ON 2 COATS	OF ZINC CH	ROMATE PR	THER ON AN	DDIZED ALU	MINUM.
(Table 4-2) SUB	SAMPLE PREF	PARED AT U	OF N.			
(·····································	AEMB ECBE	31	-			
See table 1—1 DAT.	A SET NUMBER	is s s	See table 1	11	.	
	AMETER INFO	MATION	o Source	ce Conercad	e See tab	
	SOURCE DI	T GAMM	10190	INSTRUMEN	TATION= CL	A .
	THETA(I)=	G PH	NI NUMBEI [(I)≈ (R UF RUNS / D WAYELEI	AVERAGED= NGTH= _63	1 3
		-				-
DATA SET	NUMBER THETA(R)	1 RDE(11)	2 RDE/RL1	3	4 805/881	CUMPUTED
/= 0	(DEG)	(1/SR)	(1/SR)	(1/58)	(1/SR)	(1/SR)
	0.00					Hair of PDE
	10.00	.1127	.0050	.0042	.1149	118
Change of 🕈 r	20.00	.0384	.0043	.0039	.0411	•044
1	30.00	.0170	.0041	•0039	.0189	.022
	50.00	.0107	+0041	.9039	.0119	+015
\	60.00	-0077	-0043	-0036	-0074	.012
1	70.00	.0078	.0045	.0037	-0080	.012
	80.00	.0072	-0041	.0035	.0081	.011
	Ne	w Data Sat	No.	¢,		
		* Daia 301		_	_	
DATA SET	NUMBER	5	6	7	8	COMPUTED
=180_0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
						11,000
	0.00	1174	0050			• • •
	20.00	•1124	-0052	-0042	•11/5	.120
	30.00	.0170	.0035	.0039	-0184	-021
	40.00	.0107	.0039	.0039	.0116	.015
	50.00	•0086	.0042	.0038	.0097	.013
	60.00	.0077	.0042	.0036	.0085	.012
	70.00	.0078	-0045	.0037	.0082	.012
	80.00	-0072	+0044	•0035	•0085	.012
	TABLE 4-2.	CODE LIS	r for mea	SURING AG	ency	
Pref	ix Letters		,- <u>-</u>	Organizati	on	-
	A		The Univ Target Si	ersity of Mi ignature Mea	chigan asurements	
	В		The Univ Target Si Documen	ersity of Mi Ignature Ana t Library Re	chigan Uysis Cente eports	r
、	С		The Univ C. Olson	ersity of Mi	chigan	
	D		National	Bureau of Si	andards	
	E		Texas In	struments In	IC.	
		Jai	wary 1989			
			••			4-1

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. 1800 = 00 n o 10⁰ 10⁰ With Leaf Backing Without Leaf Backing 300 300 600 **60**0 f_(0, t) 0.2 900 0.3 0.2 0.3 900

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FIGURE 4-4. REFLECTANCE DISTRIBUTION FUNCTION $f_r(o, t)$ VS. RECEIVER ANGLE θ_r FOR ORANGE-COLORED NYLON CLOTH. $\lambda = 0.6328 \ \mu m$. Sample ID No. A01059-14 and -15. Arrowheads indicate value of θ_i , incidence angle of source.



FIGURE 4-5. REFLECTANCE DISTRIBUTION FUNCTION $f_r(o, t)$ VS. RECEIVER ANGLE θ_r FOR AN OLIVE DRAB PAINT. $\lambda = 0.6328 \ \mu m$. Sample ID No. A01027-003. Arrowheads indicate value of θ_i , incidence angle of source.

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4.5. REFERENCES FOR SECTION 4

- 4-1. W. L. Wolfe (ed.), Handbook of Military Infrared Technology, Office of Naval Research, Washington, D. C., 1965, Chapter 2, p. 25.
- 4-2. Target Signature Measurements (U), Final Report, Rept. 8047-28-F, AFAL-TR-68-198, Willow Run Laboratories of the Institute of Science and Technology, The University of Michigan, Ann Arbor, September 1968 (CONFIDENTIAL). AD 932 735
- 4-3. A. T. DeHoop, A Reciprocity Theorem for the Electromagnetic Field Scattered by an Obstacle, Appl. Sci. Res., Sec. B, Vol. 8, p. 135, 1960.

4-4. M. Born and E. Wolf, Principles of Optics, Macmillan, 1964, Chapter 10.

AC1C57-C14 TITLE NYLON CLOTH USED FOR PERSONNEL PARACHUTES, PLAIN WEAVE WITH RIB STCP PATTERN, 1.1 CZ MAX WT/SQ YD, SHRUNK, MIL-C-7C2O(ASG), TYPE I, UNCYEC, (] LAYER). SUBJECT CODES AAKAB ECBBJ CATA SET NUPBERS 6. 7. 2, 3, 4, 5, 8 1. PARAMETER INFORMATION SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(I)= 30.CO PHI(I)=180.00 **WAVELENGTH=** .633 DATA SET NUMBER 2 CCMPUTEC 3 1 4 RCF(LL) RCF(PL) RDF(LP) KOF(PP) PHI(R) THETA(R) RCF(OT) Ω (CEG) (1/SR)(1/SR) (1/SR) (1/SR) (1/SR) .C141 C.CO .1053 .0139 .1308 .132 .0913 10.00 .C142 .0145 .1156 .118 .1182 .0942 .0172 .123 20.00 .C168 .1055 .C228 .1326 .141 30.00 .0220 .1210 •C3C2 .1539 .167 40.00 .0285 50.00 .C433 .0386 .2046 .220 .1528 .2035 .C656 60.00 .0571 .3020 .314 70.00 .2634 .0928 .0826 .4390 .439 .4049 80.00 .1969 .C785 .0635 .372 CCMPUTED DATA SET NUMBER 5 7 6 8 RCF(PP) RCF(OT) RCF(PL) RDF(LP) PHI(R) THETA(R) RCF(LL) (1/SR) (1/SR)=180.0 (CEG) (1/SR)(1/SP)(1/SR).132 .1053 .C141 .0139 .1308 C.CO 10.00 .C143 .1657 .166 .1382 .0144 20.00 .C145 .0144 .1474 .144 .1125 30.00 .0163 .1542 40.00 .1067 .0182 .148 .0168 .1411 .133 50.00 .0897 .C194 .0882 .1300 .129 60.00 .0217 .0174 .1009 .C25C .0196 .1437 70.00 .145 80.00 .0985 .C261 .0209 .1246 .135

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(<u>f)AAK 2</u>

AC1C58-C1	4					
T T T I	F					
	NYLCN CLCTH	USEC FCR	PERSONNEL	PARACHUTES	- PLAIN W	EAVE WITH
	RIB STOP PA	TTERN. 1.1	CZ MAX hT	ISC YC. SH	RUNK.	
	¥IL-C-7C200	ASG), TYPE	I. CLIVE	GREEN LARM	Y 106), (1	LAYER).
SUB	ECT CODES			۲.		
	AAKAB ECBE	I				
CATA	SET NUMBER	S				
	1, 2, 3	4, 5,	5, 7, 8	1		
PARA	VPETER INFOR	MATIEN				
	SOURCE= DK	LI GAPPA	(0)=.90	INSTRUMENT	ATICN= CL	Α
	ACCURACY= F	IVE PERCEN	T NUMBER	CF RUNS A	VERAGEC=	1
	$THETA(\mathbf{I})=3$	BC.CC PFI	$(I) = 18C \cdot CC$	WAVELEN	GTF= .63	3
DATA SET	NUMBER	1	2	3	4	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PI)	RDF(LP)	RCF(PP)	RCF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
-		s de server s				
	C.CC	.0549	•C048	0050	.0624	•064
	10.00	.0467	.0053	.0053	.0597	.059
	2C.CO	.0468	.0059	.0058	.0656	.062
	30.00	•0483	•C075	.0071	.0753	.069
	40.00	•0496	.089	•C089	•0866	.077
	50.00	.0535	.0116	.0110	.1065	.091
	60.00	•C€26	.0178	.0164	.1570	.127
	70.00	•C613	•C208	.0168	.1915	.145
	80.00	•0516	.0166	•0133	•1933	•137
DATA SET	NUMBER	5	6	7	8	CCMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(CT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C CC	0549	C049	0050	0624	064
	10 00	•0347	•0046 C046	.0048	-0532	-056
		· · · · · · · · · · · · · · · · · · ·	4403	.0045	.0424	.047
	30.00	• • • 2]	• U V 7 U		OV767	• • • • •
	46.00	-0405	-051	.0047	.0403	.045
	50.00	.0369	.056	.0050	.0390	.043
	60.00	.0351	.063	.0052	.0395	.043
	70.00	.0373	.0069	.0053	.0424	.046
	80.00	.0368	.087	.0057	.0452	.048

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AC1C55-C14 TITLE NYLON CLOTH USED FOR PERSONNEL PARACHUTES, PLAIN WEAVE WITH RIB STOP PATTERN, 1.1 CZ MAX WT/SQ YC, SHRUNK, MIL-C-7C20(ASG), TYPE I, CRANGE (FED 12197) (1 LAYER). SUBJECT CCDES AAKAE ECBBD CATA SET NUPBERS 1. 2, 3, 4, 5. 7. 8 PARAMETER INFORMATICN INSTRUMENTATION= CLA SCURCE= DKI GAMMA(0)=.90 ACCURACY= FIVE PERCENT NLPBER CF RUNS AVERAGEC= 1 THETA(I)= 30.00 PHI(I)=18C.00 WAVELENGTH= .633 CCMPUTEC DATA SET NUMBER 2 3 4 1 THETA(R) RCF(LL) RCF(PL) RDF(LP) RCF(PP) RDF(OT) PHI(R) (1/SR) (1/SR) (1/SR)(1/SR) (1/SR) 0 (CEG) .130 0.00 .1000 .0159 .0179 .1253 .115 10.00 .0837 .0173 .0184 .1115 .0206 .120 .1135 20.00 .0866 .0199 .138 .0262 .1271 .C26C 30.00 .0967 .175 .0358 .1566 .1209 .0364 40.00 .0509 .0487 .2001 .223 .1454 50.00 .0786 .1885 .0710 .3087 .323 60.00 .2094 .364 ·C852 .3615 70.00 .0719 .3774 80.00 .1791 .0739 .0564 .343 CCMPUTEC DATA SET NUMBER 5 7 8 6 RDF(LP) RDF(PP) RDF(OT) RCF(LL) RCF(PL) FHI(R) THETA(R) (1/SR)(1/SR)(1/SR)=180.0 (CEG) (1/SR) (1/SR).130 C.CO .1000 .0159 .0179 .1253 10.00 .1040 .C149 .0174 .1339 .135 20.00 .0909 .1198 .C148 .0161 .121 30.00 .0915 .1278 .C18C .0183 .128 40.00 .0819 .0202 .1264 .0197 .124 50.00 .0204 .0813 .0228 .1204 66.00 .122 70.00 .0932 .0259 .0225 .1351 .138 .1373 .139 80.00 .0935 .C261 .0218

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AC1C59-C	15					
TITI	E					
	NYLCN CLCTH	USEC FOR	PERSCANEL	PARACHUTES	5, PLAIN W	EAVE WITH
	RIB STOP PA	TTERN, 1.1	CZ MAX NT	ISQ YE, SH	RUNK, MIL	-C-7020
	(ASG), TYPE	I.CRANGE(F	EC 1219) (ON 4 LAYER	S CF SYCA	MORE LEAV.
SUB	JECT CODES					
	AAKAB ECBE	D				
CAT	A SET NUPBER	RS				
	1, 2, 3	3, 4, 5,	6, 7, 8			
PAR	AFETER INFOR	RMATICN			_	
	SOURCE= DP	(I GAMMA	(0) = .90	INSTRUMENT	TATION= CL	Δ
	ACCURACY= F	IVE PERCEN	T NUMBER	CF RUNS /	AVERAGED=	1
	THETA(I) = 3	30.0C PHI	(I) = 180.00	HAVELE	•63 ••••	3
DATA SET	NUMBER	1	2	3	4	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(CEG)	(1/ŚR)	(1/58)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.1198	.C2C7	.0216	.1352	.151
	10.00	.0582	.0226	.0229	.1191	.131
	20.00	.0585	.0260	.0262	.1214	.136
	30.00	.1087	. C324	.0319	.1357	.154
	40.00	.1272	.0424	~04C2	.1627	.186
	50.00	.1544	.0581	.0538	.2145	.240
	66.00	.2038	.0881	.0760	.3229	.345
	76.00	.2029	. C844	.0683	.3342	.345
	86.00	.1639	.0678	•0492	.3225	.302
DATA SET	NUMBER	5	6	7	8	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.1198	.0207	.0216	.1392	.151
	10.00	.1173	.0195	.0200	.1446	.151
	20.00	.1032	.0166	.0196	.1179	.129
	30.00					
	40.00	.1045	.0214	.0216	.1271	.137
	50.00	.0546	.0235	•0228	.1280	.134
	60.00	.0937	·C259	.0236	.1200	.132
	76.00	.1058	.0281	.0245	.1340	.146
	80.00	.1114	. C291	.0233	.1464	.155

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111	LE AVICA CIGTI		DEDCONSE	DADACHUTE		EANE UTTO
	DIE CTOD D	ATTEDN . 1	TERSUNNEL	TICO VC C	JI PLAIN W	CAVE WITS
	NIC 310F P	ATTERNY I.	1 62 FFA W	1/36 TL9 31 1 /1 1 AVED		
CLIE	FIL-C-7C20	LAJUIS JAN	U TAP IGUS	J LI LATER	/•	
306	AAVAD CODES	D.C.				
5 A 7	A CET NENDE					
U M I	.1. 2.	3. 4. 5.	6.7	0		
DAG	AVETSO TAEO	54 74 54 54 77 54		C		1
r mr	SUBCE: D	XT CANN	A(0)+ 60	TNCTOLMER	TATION- CI	•
		RIVE DEDCE	NT NINGE	D CE DHRC	AVEDACED=	.
	THETA(1)=	30.00 00	T/T)=19C A	n er nung i n – laveigi	NCTU- AD	2
		JUILU FI	1117-100+0	U WAVELED	-916- +03	
DATA SET	NUMBER	1	2	3	4	COMPUTED
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	•C836	. C073	.0074	.0946	.096
	10.00	•C6C5	•C072	.0075	.0698	.072
	20.00	. C6C4	. C087	.0090	•0692	.074
	3C • CC	.Qććć	•C124	.0123	.0816	.086
	40.00	•C713	. C171	.0158	.0987	.101
	5C.OC	.C884	•C2E3	.0236	.1352	.137
	60.00	.1272	•C493	.0429	•2252	•222
	70.00	.1392	. C528	•0449	•2759	• 256
	80.00	•1058	.C341	.0251	•2390	•204
DATA 661		E	,	-	•	CONDUTED
CLIIDI	THETACON	2 0 re (11)	0	(005/10)	0	
-190 0	INCIALAJ INCOS	<i>KUTILLJ</i>	KLP1PLJ	KUF(LP) /1/601	KUP1PP7	KUF(UIJ
+10U+V	ILEO!	(1/2K)	(1/5#)	(1/2k)	(1/2#)	(1/2K)
	0.00	.0836	-0073	-0074	.0946	.096
	10.00	.0844	-0070	.0070	.1044	.101
	20.00	.0687	8303	-0068	.0818	
	30.00					
	40.00	.0644	.077	.0078	.0812	.081
	50.00	.0528	.C074	.0073	.0741	.071
	60.00	.0511	-C081	.0074	.0625	.065
	70.00	.0599	.0091	.0075	.0706	.074
	80.00	-0612	.0095	.0064	.0734	-075

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AC1C61-C14					
TITLE					
NYLCN GLCT	H USEC FCR	CARGE PARA	CHUTES, DO	CORY WEAVE	•
2.25 DZ MA	X WT/SQ YD,	UNSHRUNK,	FIL-C-73	50(ASG), T	YPE I.
CLIVE GREE	N (ARPY 1C	5) (1 LAYER			-
SUBJECT CCCES					
AAKAB ECB	6 I				
CATA SET NUPBE	RS				
1, 2,	3, 4, 5,	6, 7, 8	•		
PARAMETER INFO	RMATICN				
SOURCE= D	KI GAMMA	1(0)=.90	INSTRUMENT	TATICN= CL	A
ACCURACY=	FIVE PERCEN	T NUMBER	CF RUNS /	AVERAGED=	1
THETA(I)=	30.CO PH1	((1) = 180.00	WAVELE!	\GTH≠ .63	3
DATA SET NUMBER	1	2	3	4	CCMPUTED
PHI(R) THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RCF(OT)
= C (CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
ų.					
*1 ¹ C' • O O	.0395	.C057	.0059	•0423	.047
10.00	. 04C1	.070	.0072	•0455	.050
20.00	-0448	•C094	.0097	.0541	•059
30.00	-0507	.0138	•C139	•C696	.074
40.00	•C424	•C15C	.0143	.0662	•069
50.00	•0368	.0165	.0154	•0704	.071
60.00	•0396	.0185	.0166	-0809	•078
70.00	.0405	.0191	.0169	•0933	•085
. 80.00	•C479	·C174	.0145	•1040	•092
DATA SET NUMBER	5	6	7	8	CCMPUTED
PHI(R) THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RCF(OT)
=180.0 (CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
C.CC	.0395	. C057	.0059	.0423	.047
10.00	.0409	.051	.0054	~0461	•049
20.00	.0428	•0049	.0048	.0452	•049
36.00					
46-00	•C314	•C045	.0043	.0317	.036
50.00	•0240	•CO43	.0039	•0253	•029
60-00	.0215	•0044	•0038	.0203	•025
76.60	•C223	•C046	.0037	.0210	.026
80.00	•C261	.049	.0037	«C244	.030

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AC151C-CO1 TITLE C.D. CANVAS TARPAULIN, 24 IN. X 20-1/2 IN., TAKEN FRCH A L.S. 18 TON M4A FIGH SPEED TRACTCR. SUBJECT CCCES AEE **ECBBI** CATA SET NUMBERS 1, 2, 3, 4, Parameter information 4, 5, 6, 7. 8 SOURCE= DXH GAMMA(C)= INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(I)= C PHI(I)= O WAVELENGTH= .633 2 DATA SET NUMBER 1 3 CCMPUTEC RCF(PL) PHI(R) THETA(R) RCF(LL) RDF(LP) RCF(PP) RDF(CT) 0 (CEG) (1/SR) (1/SR)(1/SR) (1/SR) (1/SR)ł C.CC .016 .007 .006 10.00 .016 .023 .006 20.00 .014 .006 .015 .021 .013 .00é .006 .014 30.00 .019 .C12 .006 .006 .014 40.00 .019 .006 5C.CO .012 .006 .015 .020 .007 .006 .020 60.00 .011 ÷916 .007 70.00 .C11 .007 .015 .022 .007 80.00 .C11 .007 .019 .022 5 CCMPUTED DATA SET NUMBER 7 6 8 THETA(R) PHI(R) RDF(LL) RDF(LP) RDF(PP) RCF(OT) RCF(PL) (DEG) (1/58)(1/SR)(1/SR)(1/SR)(1/SR) =180.0 C.CC .016 10.00 °C17 .007 .007 .024 20.00 -C15 .006 .006 .015 .021 .0Cć .106 .021 30.00 .C14 .015 .013 .006 .020 40.00 .006 .015 .021 50.00 .012 .007 .007 .016 -022 60.00 .C12 .007 .007 .017 -023 70.00 .C12 800. .007 .019 80.00 .C13 .008 .008 .023 .026

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0. AC151C-C01 TITLE C.D. CANVAS TARPAULIN, 24 IN. X 20-1/2 IN., TAKEN FRCM A L.S. 18 TON M4A HIGH SPEED TRACTCR. SUBJECT CCCES AEE ECBBI CATA SET NUMBERS 9, 10, 11, 12, 13, 14, 15, 16 PARAMETER INFURMATICN INSTRUMENTATION= CLA GA/MA(C)= SOURCE= DKH ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 **WAVELENGTH=** •633 THETA(I) = 45.CCPHI(I)=18C.00 CCMPUTEC DATA SET NUMBER ς 10 11 12 RCF(LP) RCF(PP) RCF(OT) PFI(R) THETA(R) RCF(LL) RCF(PL) (1/SR) (CEG) (1/SR)(1/SR)(1/SR) (1/SR)C 3 .011 .018 .006 .014 5.00 .006 .019 .006 .015 15.CC .010 .006 .019 .006 .016 25.CC .C1C .006 .006 .C20 -006 .018 35.00 .C1C .006 .021 .022 .007 45.00 .C1C JOC7 .007 .025 .025 55.00 .C11 .007 .030 .028 .008 65.CC .C12 .037 .008 .035 .009 75.00 .016 .049 .011 .010 .053 85.00 .C23 DATA SET NUMBER CCMPUTED 13 14 15 16 RUF(OT) RCF(LL) RCF(PL) RCF(LP) RCF(PP) PHI(R) THETA(R) (1/SR) (1/SR)(1/SR)(1/SF)(1/SR) =180.0 (DEG) .018 .006 .013 .C12 .006 5.00 .014 .019 .006 15.00 .C13 .006 .015 .022 .007 .007 25.00 .C15 .C24 .007 .017 35.00 .C18 .007 45.00 .029 .009 .009 .020 .C21 55.OC .009 .009 .019 .028 .019 65.CO .020 .009 .028 .009 75.OC .019 .009 .022 .030 85.CO .019 .010

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TITLE CLD CONCRETE (20 YEARS) FROM WILLOW RUN AIRPORT APRON. SUBJECT CCCES AEG CATA SET NUMBERS 4,, 1, 5. 2, 3, 6, 7, 9 PARAMETER INFORMATION GAMPA(C)=.9C SOURCE= DKI INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(I)= C PHI(I) =0 **WAVELENGTH**# .633 DATA SET NUMBER 1 2 3 CCMPUTEC ROF(LP) PHILR) THETA(R) ROF(LL) RCF(PL) RDF(PP) RDF(OT) (CEG) (1/SR) (1/SR) (1/SR)(1/SR)(1/SR)Ĉ 0.00 .0439 10.00 .C654 .C491 .0704 .114 .C479 .0658 20.00 .0603 .0425 .108 °C420 .0438 30.00 .0582 .0605 .104 .C424 40.00 .0551 .C442 .0602 .101 .097 50.00 .C435 .0359 .0601 .0497 60.00 .0502 .0590 .096 JC424 .0412 70.00 00469 .0399 .0600 .094 .0418 86.00 .0458 .0412 .0399 .0608 .094 CATA SET NUMBER 5 6 7 8 COMPUTED RCF(PL) PHI(R) THETA(S) RCF(LL) RDF(LP) RCF(PP) RDF(OT) =180.0 (1/SR) (1/SR) $(1/S_{R})$ (1/SR) (CEG) {1/SR} C.CC .0430 .0626 .107 10.00 .0640 .0449 .0427 .105 20.00 -0609 .0446 .0612 .C556 .096 3C.CO .0552 .C4C8 .0400 .0400 .0562 .096 40.00 .0530 .C419 50.00 .0509 .0413 .0394 .0564 .094 60.00 .0593 .094 .0482 .6422 .0390 70.00 .0396 .0370 .0567 .089 .0442 .0558 80.00 .0351 .0330 .083 .C372

(f)AEG 1

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AC1325-CG1

January 1969

(f)AEG 2

AC1325-CO1					
TITLE					
CID CENCRE	TE (20 VEAD	SS FREN L			PCN.
SUBJECT CODES				STRUCKI HI	nun•
AFG					
FATA SET NUNRE	29				
0, 10, 1	NJ 1. 12. 12.	14. 15. 14	2		
DADANETED INCOL	LY 169 139 DMATICN	144 134 10			
SOUDCE- D	KI CANNI	NIC1- CC	TACTOL MENT	TATION- CL	•
	ETVE BEDCEI	410/-070 T NIMOEC	INSTRUMEN	IATILN- UL Avedacer-	. р
146 TA/TI-	TIVE FERGER	\ \ FCER \ _\00 0/	N LF KUNS /	DVERAGEL=	1
IDC (#\1/*	EVALU PF	111)=106+66	S NAVELE	NGIF= .03	
DATA SET NUMBER	ς	10	11	12	COMPLITED
PHI(R) THETA(R)	REFILLS	RCF(P1)	RCF(LP)	RCF(PP)	RCF(OT)
= 0 (CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
C ~ CO	.CE12	.0481	.0433	.0648	.109
10.00	.0583	.0443	.0434	-0605	.103
26.00	-0544	.6432	-0420	.0594	.100
30.00	.0493	.0430	.0393	-0605	.096
40.00	.0499	.0418	.0415	-0600	.097
50-00	.6473	.0418	.0393	-0602	.094
00-00	-0460	.0403	-0406	.0626	.095
76.00	.0488	.0417	.0405	4940.	.100
86.00	.6461	-0300	.0384	.0703	.067
	•••••	••••	•••••		•••
DATA SET NUMBER	12	14	15	16	CCMPUTED
PHI(R) THETA(R)	REF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
=180.0 (DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
C.CO	.0612	.0481	.0433	.C648	.109
10.00	.0671	<u>.</u> C497	.0447	.0703	÷116
20.00					
30.00	sG663	.0463	.0434	. C655	.111
46.00	·C633	.C462	.0442	.0631	.108
50.00	.0576	.C427	.0412	.0572	.099
60.00	.0541	.0423	.0414	.0567	.097
76.00	-05C2	.0417	.0393	.0541	.093
80.00	•C45G	.C384	.0355	.0526	.086

January 1969

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AC1329-	-co	1											
T	ITL	E											
		CLD CCNC	RETE	(20	YE	ARS) I	FRCM	WIL	LOW RU	IN AI	RPCRT	APR	2N •
Si	UBJ	ECT CCDE	S										
		AEG											
C /	ATA	SET NUP	BERS										
		17, 18,	19,	20,	21	, 22,	23,	24					
PJ	ARA	NETER IN	FORM	ATIC	N								
		SOURCE=	DKI	ł	GAM	FA (0):	=.9C	1	INSTRUM	IENTA	TICN=	CLA	
		ACCURACY	= FI\	VE P	ERC	ENT	NLM	BER	CF RUN	IS AV	ERAGED	= 1	
		THETA(I)	= 40.	.00	P	HI(I):	=18C	-00	WAVE	LENG	iTH= .	633	
CATA SI	ET	NUMBER		17			18		19		20	C	
PHILR)	THETA(R	1) F	RDF(LL)	RD	FIPL)	RDFILP)	RCF(PP)	RDF(O
= (٥	(DEG)	ł	(1/5	R)	(1)	/SR)		(1/SR)		(1/SR)		(1/SR
		C.CO		.05	56	•1	C440		.0427	,	.0600)	.10
		10.00		•C4	98	•1	C44C		.0400)	.0611		.09
		20.00		.05	07		C419		.0416	1	.0603		- 191
		30.00		•C4	79		C423		.0408	1	.0631		r J9'
		40.00		.04	81	. (C410		.0410)	.0655	;	.09
		50.00		.04	92	•f	C434		.0398	}	.0726)	.10
		60.00		.04	78	• 1	C411		.0396)	.0742	2	-10
		76.00		.04	52		C387		.0355	i	.0774	ł	.09
		80.00		.04	71	•	C 35.7		-0347	7	.C837)	.10
	CT	AINGED		21					22		34		COMPLIT
Dutio	r	THETAIS		DDE/		·	22 7 Bi	\$	63 DDE/10		575/00		DOCIO
= 180.0	í.	(rfc)	• # • •	11/5	D 1	11	/ 4 F L / 5 p 1		11/501		11/581		11/52
-10040		10207		14/3	n /	14	/ 36 /		(1/30/		11/30/		12730
		C.CC		.C5	56	•	C44C		.0427	7	.0600	1	.10
		10.00		.05	94	•	0462		.0441	L	.0618	•	-10
		20.00		.06	46	•	C495		.0455	i	.0698	3	.11
		36.00		.07	26	•(0503		.0479)	.0748	}	.12
		40.00											
		50.00		.07	41	•1	C 5 C 6		.0486	b	.0711		•12
		6C.OC		.07	17	•(0502		.0489)	.0703		.12
		70.00		~ /	36	,	 .		0446	5	AEDO		10
		14444		•UC	32	•	53P			,	- +V277		044

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(f)AEG 4

AC1325-CO1						
TITLE					•	
CLD	CONCRET	E (2C YEAR	S) FRCM WI	LLCH RUN A	IRPCRT AP	RCN.
SUBJECT	CCDES					
AEG	i					
CATA SE	T NUMBER	S				
25	, 26, 27	, 28, 29,	30, 31, 32			
PARAMET	ER INFOR	MATICN				
SOU	RCE= DK	I GAMMA	(C)=.9C	INSTRUMENT	ATICN= CL	۵
ACC	URACY= F	IVE PERCEN	T NUMBER	CF RUNS A	VERAGEC=	1
THE	TA(I) = 5	D.CC PHI	$(1) = 18C \cdot CC$	HAVELEN	GTH= .63	3
DATA SET NUM	IBER	25	26	27	28	CCMPUTED
PHI(R) TH	ETA(R)	RCF(LL)	RCF(PL)	RCF(LP)	RCF(PP)	RCF(OT)
= 0 (CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CC	.0505	. C442	•04C3	.0610	•098
1	C.CC	.0508	.C427	.0426	.0600	.098
2	C-00	.0480	.0419	.0405	.0625	.096
3	00.00	.0466	•C4C9	•C4C9	.0649	.097
4	C-00	.0493	•C427	.0416	.0705	.102
5	C.CO	•C492	.C411	.0352	. C782	.104
6	0.00	.0459	•C351	.0356	.0836	.102
7	°C-C0	.0484	. C374	•0349	.0914	.106
8	0.00	.0513	.0350	•0329	.0997	.109
DATA SET NUM	BER	29	30	31	32	CCMPUTED
PHI(R) TH	EIACE	RDF(LL)	RCF(9L)	RDF(LP)	RCF(PP)	RCF(OT)
=150.0 (UEG)	(1/SR)	(1/58)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.0305	.0442	•04C3	.0610	•098
1	C • 00	.0566	.C455	.0435	.C621	.104
2	C.CO	•C62C	.0472	.0458	.0647	.110
3	02.00	.0678	•0527	.0473	.0741	.121
4	C.0C	.0776	.0573	.0513	.0814	.134
5	C.CC					
6	0.00	•CE32	.0547	•0538	.0818	•137
7	·C.00	.0750	.0560	•0535	•0757	.132
. 8	UU	.0668	•0495	.0473	•0633	.113

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AC1325-CO1 TITLE CLD CONCRETE (2C YEARS) FROM WILLOW RUN AIRPORT APRON. SUBJECT CODES AEG CATA SET NUPBERS 33, 34, 35, 36, 37, 38, 39, 40 PARAMETER INFORMATICN SOURCE= DKI GAMPA(C)=.90 INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(1)= 60.0C PHI(I)=18C.CO WAVELENGTH= .633 DATA SET NUMBER 33 34 35 COMPUTED 36 PHI(R) THETA(R) RCF(LL) RCF(PL) RDF(LP) RDF(PP) RDF(OT) (CEG) (1/SR) (1/SR) 0 (1/SR) (1/SR)(1/SR).0477 .0418 .0393 .0599 C.CO .094 .0443 .0399 .0372 10.00 .0614 .091 .C4C1 .0372 20.00 .0444 .0618 .092 30.00 .0467 .C432 .0408 .0715 .101 40.00 .0467 .0413 .0382 .0759 .101 50.00 •C386 .0449 .0352 .0835 .101 60.00 .0376 .0941 .C5C4 .0356 .109 70.00 .0547 .0330 .C328 .1065 .113 80.00 .0609 .0310 .1234 .0301 .123 DATA SET NUMBER 37 38 39 40 CCMPUTED PHICRY THETA(R) RDF(LL) RCF(PL) RDF(LP) RDF(PP) RCF(OT)

30.00 .C49C .0467 .0667 40.00 .0723 -C568 .0506 .0778 50.00 .0872 .C625 .0561 .0886. 60.00 70.00 .0969 .0648 .0622 .0937 80.00 .0833 .C618 .0571 .0842

(1/SR)

10418

.0440

.C454

(1/SR)

.0393

.0399

.0438

(1/SR)

.094

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.103

.113

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=180.0

(DEG)

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Statistic Statistics Statistics
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CHIP	LED CONCRET	IC LZG TEAM	COLERCE MI	LLLM KUN A	AINPLKI AP	KLN.
308.	AEC LUDES					
CAT.	PEU A cet Number					
LAI	A JEI NUPDER A1 A2 A2		44 47 40			
240	414 429 43 Aneteo ineos); 44; 42; MATIC:	409 419 40	1		
FAR	CONDER INFUR	("AILLN /1 - ^ ANN/		TACTOUNEN!		•
	ACCIDACV- C	TVE DEDCEN	T NINDEO	TRAINCREN	IAIICN- UL Avedacer	д 1
	THETALTY - 7	TAC PENGER	11 NCPEER 1/11-196 66	LF RUNS /	-VERAUEL- 10tl- 22	2
				NAVELCI	101703	3
CATA SET	NUMBER	41	42	43	44	CCMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RCF(LP)	REF(PP)	RDF(OT)
= C	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CC	. C458	. C4C1	.0385	.0589	.092
	10.00	.0460	·C378	•0396	•0593	.091
	20.00	.0471	.0400	.0402	.0671	.097
	30.00	. C459	.0385	.0381	.0721	.097
	40.00	•0458	•C248	.0365	.0779	.093
	50.00	.0492	·C353	.0348	.0903	.105
	60.00	. C528	.C34C	.0320	.1060	.112
	70.00	•C667	•C313	.0316	.1348	.132
	20. 3 8	.0997	.C3C6	.0308	.1889	.175
DATA SET	NUMBER	45	46	47	48	CCMPUTEC
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C 00	0469	C / C)	0305	0500	003
		•0430	-6461	•0303	•0269	•092
		+0504	+0414	.0417	.0572	•075
	26.00	* 6516	•6442	+0464	-0609	•098
	56.00	•0393	•1468	•0430	.0025	• 10 1-
	46.00	•UC/2	+U478 6499	•U470 0ee4	•0073	• 110
	JC.00	-0202	•L025	•0330	.084/	•141
	0L.UU 70 00	•1019	•U/10	•0048	• 1025	.1/0
	86.00	.1203	.0792	-0761	.1134	. 195
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TITLE CHRCME-PLATED GLASS BEACS, 3 MM CIA. BEACS IN REGULAR ARRAY, CN 4 IN. SQ. ALLMINLM SLESTRATE. SUBJECT CODES CJAG AEL CATA SET NUPBERS 2, 3, 1, PARAMETER INFORMATION SOURCE= DKH GAMMA(C)= INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(I) =0 PHI(I) =C WAYELENGTH= .633 DATA SET NUMBER 1 2 3 CCMPUTED RDF(LP) PHI(R) RCF(LL) RCF(PL) THETA(R) RCF(PP) RDF(OT) (CEG) (1/SR) (1/SR)(1/SR) (1/SR) 0 (1/SR)-C.CO .0962 .0039 .0035 .0984 10.00 .101 20.00 .0482 .0036 .0033 .051 .0464 .0321 .C035 .0036 30.00 .0339 .037 40.00 .0322 .0036 .0037 .0365 .038 50.00 .C326 .0038 .CO41 .0439 .042 60.00 .0039 .0044 .0344 .047 .0517 70.00 .0415 .C032 .0046 .0698 .060

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TITLE CHRCPE-PLATED GLASS BEACS, 3 MM CIA. BEACS IN REGULAR ARRAY, CN 4 IN. SQ. ALLMINUM SUBSTRATE. SUBJECT CCDES AEL CJAG CATA SET NUMBERS 5, 6, 7, 8, 9, 1C, 11, 12 PARAMETER INFORMATICN SCURCE= DKH GATACUTACY= FIVE PERCENT NLPBER CF RUNS AVERAGED= 1 THETA(I)= 40.CO PHI(R) THETA(R) RCF(LL) RCF(PL) RCM COMPUTEC PHI(R) THETA(R) RCF(LL) RCF(PL) RCG C333 C.CC C332 C.CC C333 C.CC C334 C.CC C340 C.CC C340 C.CC C340 C.CC C340 C.CC C340 C.CC C347	AC11	94-C	01					
CHRCME-PLATED GLASS BEACS, 3 MM CIA. BEACS IN REGULAR ARRAY, CN 4 IN. SQ. ALLMINUM SUBSTRATE. SUBJECT CCDES AEL CJAG CATA SET NUMBERS 5, 6, 7, 8, 9, 1C, 11, 12 PARAMETER INFORMATICN SCURCE= DKH GAMMA(0)= INSTRUMENTATICN= CLA ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1 THETA(I)= 40.CO PHI(I)= 18C.O WAVELENGIM= .633 DATA SET NUMBER 5 6 7 8 CCMPUTEC PHI(R) THETA(R) RCF(LL) RCF(PL) RDF(LP) RCF(PP) RCF(OT) = 0 (CEG) (1/SR) (1/SR) (1/SR) (1/SR) (1/SR) C.CC .C333 .CU44 .CO37 .C358 .O39 1C.OC .C334 .CU44 .CO37 .C358 .O39 1C.OC .C332 .CU52 .O040 .O467 .O45 3C.OC .C332 .CU52 .O040 .O467 .O45 3C.OC .C340 .CO57 .O045 .O559 .O50 4C.OC .C387 .CO67 .O057 .O725 .O61 5C.OC .C387 .CO76 .CO97 .1492 .O33 BC.CC .C387 .CO76 .CO97 .1492 .O33 BC.CC .C387 .CO76 .CO97 .2055 .O74		TIT	E					
CN 4 IN. SQ. ALLWINUM SUBSTRATE. SUBJECT CCDES AEL CJAG CATA SET NUMBERS 5, 6, 7, 8, 9, 1C, 11, 12 PARAMETER INFORMATION SCURCE= DKH GAMMA(0)= INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1 THETA(I)= 40.CC PHI(I)= 18C.0 %AVELENGIH= .633 DATA SET NUMBER 5 6 7 8 CCMPUTEC PHI(R) THETA(R) RCF(LL) RCF(PL) RCF(LP) RCF(PP) RCF(OT) = 0 (CEG) (1/SR) (1/SR) (1/SR) (1/SR) (1/SR) C.CC .C333 .C044 .C037 .C358 .039 1C.00 .C334 .C046 .0039 .C413 .042 2C.CC .0332 .C052 .0040 .0467 .045 3C.0C .C3340 .C057 .0045 .0559 .050 4C.00 .C37C .C067 .0057 .0725 .061 5C.00 .0714 .0111 .0097 .1571 .125 6C.CO .C387 .C076 .C097 .1492 .103 BC.CC .C387 .C076 .C097 .1492 .103			CHRCME-PLA	TED GLASS	BEACS. 3 MM	CIA. BEAL	CS IN REGU	LAR ARRAY.
SUBJECT CCDES AEL CJAG CATA SET NUMBERS 5, 6, 7, 8, 9, 1C, 11, 12 PARAMETER INFORMATICN SCURCE= DKH GAMMA(0)= INSTRUMENTATICN= CLA ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1 THETA(I)= 40.CC PHI(I)= 18C.0 WAVELENGTH= .633 DATA SET NUMBER 5 6 7 8 CCMPUTED PHI(R) THETA(R) RCF(LL) RCF(PL) RDF(LP) RDF(PP) RDF(0T) = 0 (CEG) (1/SR) (1/SR) (1/SR) (1/SR) * 0 (CEG) (1/SR) (1/SR) (1/SR) (1/SR) (1/SR) * 0 (CEG) C332 .C044 .C037 .C358 .039 1C.00 .C333 .C044 .C037 .C358 .039 1C.00 .0340 .C057 .0045 .0559 .050 4C.00 .037C .C067 .0057 .0725 .061 5C.00 .071			CN 4 IN. S	Q. ALLMINU	SLESTRATE			
AEL CJAG CATA SET NUMBERS 5, 6, 7, 8, 9, 1C, 11, 12 PARAMETER INFORMATION SCURCE= DKH GATA SET NUMBER GAMMA(0)= INSTRUMENTATION SCURCE= DKH GATA SET NUMBER FIVE PERCENT NUMBER 5 ACCURACY= FILL REF(PL) RDF(LP) RDF(PP) RDF(OT) = 0 CCC C333 CCC C333 CCC C333 CCC C333 CCC C333 CCC C332 CCC C332 CCC C333 CCC C332 <tr< th=""><th></th><th>SUB.</th><th>JECT CCDES</th><th></th><th></th><th></th><th></th><th></th></tr<>		SUB.	JECT CCDES					
CATA SET NUMBERS 5, 6, 7, 8, 9, 1C, 11, 12 PARAMETER INFORMATION SCURCE= DKH GAMMA(0)= INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1 THETA(1)= 40.CO PHI(1)= 18C.0 WAVELENGTH= .633 DATA SET NUMBER 5 6 7 8 COMPUTED PHI(R) THETA(R) RCF(LL) RCF(PL) RCF(LP) RCF(PP) RCF(0T) = 0 (CEG) (1/SR) (1/SR) (1/SR) (1/SR) (1/SR) C.CC .C333 .CU44 .CO37 .C358 .O39 1C.00 .C334 .CU44 .CO37 .C358 .O39 1C.00 .C332 .CO52 .O040 .O467 .O45 3C.0C .O340 .CO57 .O045 .O559 .O50 4C.00 .O37C .CO67 .O057 .O725 .O61 5C.00 .O714 .O111 .O097 .1571 .125 6C.CO .C387 .CO67 .O073 .1059 .O79 7C.CO .C387 .CO76 .CO97 .1492 .103 8C.CC .C387 .CO76 .O077 .1492 .103		•••	AEL CJA	G				
5, 6, 7, 8, 9, 1C, 11, 12 PARAMETER INFORMATICN SCURCE= DKH GAMMA(0)= INSTRLMENTATICN= CLA ACCLRACY= FIVE PERCENT NLMEER CF RUNS AVERAGED= 1 THETA(I)= 40.CC PHI(I)= 18C.0 WAVELENGTH= .633 DATA SET NUMER 5 6 7 8 CCMPUTEC PHI(R) THETA(R) RCF(LL) RCF(PL) RCF(LP) RCF(PP) RCF(0T) = 0 (CEG) (1/SR) (1/SR) (1/SR) (1/SR) (1/SR) (1/SR) C.CC .C333 .CU44 .CO37 .C358 .O39 1C.00 .C334 .CU44 .CO37 .C358 .O39 .C057 .O045 .O559 .O50 4C.00 .C387 .CO67 .O073 .I059 .O79 .CC0 .C387 .CO76 .CO97 .I492 .I03 8CC0 .C087 .CO76 .CO97 .I492 .I03		CAT	SET NUMBE	RS				
PARAMETER INFORMATION SCURCE= DKH GAMMA(0)= INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1 THETA(1)= 40.CC PHI(1)= 18C.0 WAVELENGTH= .633 DATA SET NUMBER 5 6 7 8 CCMPUTEC PHI(R) THETA(R) RCF(LL) RCF(PL) RDF(LP) RDF(PP) RDF(OT) = 0 (CEG) (1/SR) (1/SR) (1/SR) (1/SR) (1/SR) * 0 CCC .0332 .C044 .C037 .C358 .039 1C.00 .C234 .C046 .0039 .C413 .042 2C.CC .0332 .C052 .0040 .0467 .045 3C.0C .0340 .C057 .0045 .0559 .050 4C.00 .027C .C067 .0057 .0725 .061 5C.00 .0714 .0111 .0097 .1571 .125 6C.CO .C287 .C0		•••••	5. 6.	7. 8. 9.	10. 11. 12	2		
SCURCE= DKH GAPMA(0)= INSTRUPENTATION= CLA ACCURACY= FIVE PER'ENT NUPBER CF RUNS AVERAGEC= 1 THETA(I)= 40.CC PHI(I)= 18C.0 WAVELENGTH= .633 DATA SET NUMBER 5 6 7 8 CCMPUTEC PHI(R) THETA(R) RDF(LL) RCF(PL) RDF(LP) RDF(PP) RDF(OT) = 0 (CEG) (1/SR) (1/SR) (1/SR) (1/SR) (1/SR) = 0 (CEG) .0333 .CU44 .C037 .C358 .039 1C.00 .C334 .CU44 .C037 .C358 .039 1C.00 .C332 .C052 .0040 .0467 .045 3C.0C .0342 .C057 .0045 .0559 .050 4C.00 .037C .C067 .0057 .0725 .061 5C.00 .0714 .0111 .0097 .1571 .125 6C.00 .0387 .C067 .0073 .1039 .079		PAR	AMETER INFO	RMATICN		-		
ACCLRACY= FIVE PER'ENT NUPBER CF RUNS AVERAGED= 1 THETA(I)= 40.CO PHI(I)= 18C.O WAVELENGTH= .633 DATA SET NUMBER 5 6 7 8 CCMPUTEC PHI(R) THETA(R) RCF(LL) RCF(PL) RDF(LP) RDF(PP) RDF(OT) = 0 (CEG) (1/SR) (1/SR) (1/SR) (1/SR) = 0 (CEG) (1/SR) (1/SR) (1/SR) (1/SR) * 0 (CEG) (1/SR) (1/SR) (1/SR) (1/SR) * 0 (CEG) (1/SR) (1/SR) (1/SR) (1/SR) * 0 (CEG) 0.332 .C044 .C037 .C358 .039 * 0 (CEG) .0332 .C052 .0040 .0467 .042 * 0 .0332 .C057 .0045 .0559 .050 4C.00 .037C .C067 .0057 .0725 .061 5C.00 .0714 .0111 .0097 .1571 .125 6C.00 .C387 .C067 .0073 .1059 .079 7C.00 .C387 .C076 .C097 .1492 <td></td> <td></td> <td>SCURCE= D</td> <td>KH GAPP</td> <td>(() =</td> <td>INSTRUMEN</td> <td>TATION= CL</td> <td>Δ</td>			SCURCE= D	KH GAPP	(() =	INSTRUMEN	TATION= CL	Δ
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$			ACCLRACY=	FIVE PERCE	T NUMBER	CF RUNS	AVERAGEC=	1
DATA SET NUMBER 5 6 7 8 CCMPUTEC PHI(R) THETA(R) RCF(LL) RCF(PL) RDF(LP) RCF(PP) RCF(OT) ± 0 (CEG) (1/SR) (1/SR) (1/SR) (1/SR) (1/SR) C.CC .C333 .C044 .C037 .C358 .039 1C.0Q .C334 .C046 .0039 .C413 .042 2C.CC .0332 .C052 .0040 .0467 .045 3C.0C .0340 .C057 .0725 .061 5C.CO .0374 .C067 .0057 .0725 .061 5C.0O .0714 .0111 .0097 .1571 .125 6C.CO .C387 .C067 .0073 .1059 .079 7C.CO .C387 .C076 .C097 .1492 .103			THETA(I)=	40.00 PH	(1) = 180.0	hAVELE	NGIH= .63	3
DATA SET NUMBER 5 6 7 8 CCMPUTEC PHI(R) THETA(R) RCF(LL) RCF(PL) RDF(LP) RDF(PP) RDF(OT) = 0 (CEG) (1/SR) (1/SR) (1/SR) (1/SR) (1/SR) = 0 (CEG) (1/SR) (1/SR) (1/SR) (1/SR) (1/SR) = 0 (CCG .0333 .CU44 .C037 .C358 .039 = 1C.00 .C334 .C046 .0039 .C413 .042 = 2C.6C .0332 .C052 .0040 .0467 .045 = 3C.0C .0340 .C057 .0045 .0559 .050 = 4C.00 .037C .C067 .0057 .0725 .061 = 5C.00 .0714 .0111 .0097 .1571 .125 = 6C.CO .C387 .C067 .0073 .1059 .079 = .C06								-
PHI(R) THETA(R) RCF(LL) RCF(PL) RCF(LP) RCF(PP) RCF(OT) ± 0 (CEG) (1/SR) (1/SR) (1/SR) (1/SR) (1/SR) ± 0 C.CC .C333 .C044 .C037 .C358 .039 1C.00 .C334 .C046 .0039 .C413 .042 2C.CC .0332 .C052 .0040 .0467 .045 3C.0C .0340 .C057 .0045 .0559 .050 4C.00 .C37C .C067 .0057 .0725 .061 5C.00 .0714 .0111 .0097 .1571 .125 6C.CO .C387 .C067 .0073 .1059 .079 7C.CO .C387 .C076 .C097 .1492 .103 &C.CO .C387 .C076 .C097 .1492 .103	DATA	SET	NUMBER	5	6	7	8	CCMPUTED
$\begin{array}{c ccccc} * & 0 & (CEG) & (1/SR) \\ \hline & C.CG & .C333 & .C044 & .C037 & .C358 & .039 \\ 1C.00 & .C334 & .C046 & .0039 & .C413 & .042 \\ 2C.CC & .0332 & .C052 & .0040 & .0467 & .045 \\ 3C.0C & .C340 & .C057 & .0045 & .0559 & .050 \\ 4C.C0 & .C37C & .C067 & .0057 & .0725 & .061 \\ 5C.00 & .0714 & .0111 & .0097 & .1571 & .125 \\ 6C.C0 & .C387 & .C067 & .0073 & .1059 & .079 \\ 7C.C0 & .C387 & .C076 & .C097 & .1492 & .103 \\ 8C.C0 & .C466 & .C022 & .0027 & .2975 & .175 \\ \hline \end{array}$	PHI	(R)	THETA(R)	RCF(LL)	RCF(PL)	RCF(LP)	RCF(PP)	RCF(OT)
$\begin{array}{ccccccc} C.CC & .C333 & .CU44 & .CO37 & .C358 & .O39 \\ 1C.00 & .C334 & .CO46 & .O039 & .C413 & .O42 \\ 2C.CC & .O332 & .CO52 & .O040 & .O467 & .O45 \\ 3C.0C & .C340 & .C057 & .O045 & .O559 & .O50 \\ 4C.CO & .C37C & .CO67 & .O057 & .O725 & .O61 \\ 5C.CO & .O714 & .O111 & .O097 & .1571 & .125 \\ 6C.CO & .C387 & .CO67 & .O073 & .1059 & .O79 \\ 7C.CO & .C387 & .CO76 & .CO97 & .1492 & .103 \\ 8C.CC & .C466 & .CO22 & .O027 & .2975 & .175 \end{array}$	1	0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
$\begin{array}{cccccc}2333 &.C044 &.C037 &.C358 &.039 \\ 1C.00 &.C334 &.C046 &.0039 &.C413 &.042 \\ 2C.CC &.0332 &.C052 &.0040 &.0467 &.045 \\ 3C.0C &.C340 &.C057 &.0045 &.0559 &.050 \\ 4C.C0 &.C37C &.C067 &.9057 &.0725 &.061 \\ 5C.C0 &.0714 &.0111 &.0097 &.1571 &.125 \\ 6C.C0 &.C387 &.C067 &.0073 &.1059 &.079 \\ 7C.C0 &.C387 &.C076 &.C097 &.1492 &.103 \\ 8C.C0 &.C466 &.C022 &.0027 &.2975 &.175 \end{array}$								
$\begin{array}{cccccccccccccccccccccccccccccccccccc$			C.CC	•C333	•CÚ44	•0037	•C358	.039
2C.CC .0332 .C052 .0040 .0467 .045 3C.0C .0340 .C057 .0045 .0559 .050 4C.0O .C37C .C067 .0057 .0725 .061 5C.0O .0714 .0111 .0097 .1571 .125 6C.CO .C387 .C067 .0073 .1059 .079 7C.CO .C387 .C076 .C097 .1492 .103 6C.CC .C466 .C022 .0027 .2975 .175			10.00	•C334	.CO46	.0039	·C413	.042
3C.0C .C340 .C057 .0045 .0559 .050 4C.0O .C37C .C067 .9057 .0725 .061 5C.0O .0714 .0111 .0097 .1571 .125 6C.CO .C387 .C067 .0073 .1059 .079 7C.CO .C387 .C076 .C097 .1492 .103 8C.CC .C466 .C022 .0027 .2975 .175			20.00	.0332	•C052	.0040	.0467	.045
40.00 .037C .0067 .0057 .0725 .061 50.00 .0714 .0111 .0097 .1571 .125 60.00 .0387 .0067 .0073 .1059 .079 70.00 .0387 .0076 .0097 .1492 .103 80.00 .0466 .0022 .0027 .2975 .175			30.00	+0340	.0057	.0045	.0559	.050
5C.00 .0714 .0111 .0097 .1571 .125 6C.00 .C387 .C067 .0073 .1059 .079 7C.C0 .C387 .C076 .C097 .1492 .103 8C.00 .C466 .C022 .0027 .2975 .175			40.00	.0370	.C067	.0057	.0725	.061
6C.CO .C387 .C067 .0073 .1059 .079 7C.CO .C387 .C076 .C097 .1492 .103 8C.CC .C466 .C022 .0027 .2975 .175			50.00	.0714	.0111	.0097	.1571	.125
7C.CO .C387 .C076 .C097 .1492 .103 8C.CC .C466 .C022 .0027 .2975 .175			60.00	•C367	.0067	.0073	.1059	.079
86-66 -6466 -6022 -6027 -2975 -175			70.00	.0387	.0076	.0097	.1492	.103
			8C.CC	.0466	.C022	.0027	.2975	.175
	DATA	CET	NUMBED	c	10	11	10	CONDUTED
A DETIDI THETAIDI DECILI DECLEU DECLEDI DECLEDI DECLEU		361	THETAIDY	2005 (111)	205/01/	11	12	
* FILLEJ RUFLEJ RUFLEJ RUFLEF) RUFLFF RUFLFF RUFLUFJ *190.0 (FEC) (1/CD) (1/CD) (1/CD) (1/CD)	× 701 ±19	0.0	IDETAINT (DEC)	(1/50)	()/()	KUF(EF)	11/501	KUF(UI) (1/00)
-100+0 (0E0) (1/3K) (1/3K) (1/3K) (1/3K) (1/3K)	-10	0.0	10207	(1/38)	(1)241	(1/28)	(1/28)	(1/2K)
C-CC -0333 -C044 -0037 -0358 -039			C . CC	.0333	.0044	.0037	-0358	- 039
			10.00	.0320	.0044	.0036	-0356	.038
			20.00	-0360	.046	-0038	.0353	.040
36.00 .0461 .0050 .0055 .0383 .047			30.00	-0461	.050	.055	.0383	.047
40.00			40.00					
50.00 .0592 .050 .0043 .0502 .059			50.00	.0592	.050	.0043	.0502	.059
66.00 .0749 .0038 .0036 .0625 .072			60.00	.0749	.038	.0036	.0625	.072
76.60 .0324 .6628 .6027 .6307 .034			70.00	.0324	.CC28	.0027	.0307	.034
8C.00 .012C .0015 .0017 .0099 .013			80.00	•C12C	.C015	.0017	.0099	.013

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TIT	.E					
	LHKLFE-PLA	IED GLASS	BEAUS, 3 P	F LIA. UEA	L IN REGU	LAK AKKAT
	LN 5 1N. U.	IA. ALUFIN	CH SUBSIRA	IE USEC PS	FIELD SIA	NUAKU BY
CUD	IEXAS INSI	RUFENIS.				
200.	JECT CUDES	C 14C				
CAT	ALL ANU	5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5				
LAII	A SEI NUFDEI 1 2	N J – K – K – K – K – K – K – K – K – K –	4 7	0		
DAD	LY ZY . ANETED INEC	39 4 9 39 DMATICA	0, 1,	C		
PARI	SCHOCES DI	KMAILUN Vu cann.	A/01-	TACTORMEN	TATION- CI	•
	ACCIDACY+	NTI GAFFI	PIUJ- Nt Nemoci	D CE DINC	IAIILN- UL Avedaced-	, P 1
	THETALT -	A DU	NI NUFCE T/11-	N LF NUNG A	PVERAUEL# Notla 1 00	1
	14214111	U PR		U RAVELE	NOIN- 1.00	
DATA SET	NUMBER	1	2	3	4	COMPUTED
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RDF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
¢.						
	C.00					
	10.00	.2014	.0021	.0023	.1969	.201
	20.00	.1656	.0019	.0021	.1615	.166
	30.00	.1319	.020	.0021	.1290	.132
	40.00	.1428	.0019	.0019	.1462	.146
	50.00	.1772	.0019	-0021	.1948	.188
	60.00	.2257	.0024	•C023	.2625	.246
	70.00	.2128	.0025	.0025	.2748	-246
	80.00	.1961	.0027	.0025	•2836	•242
•			;		·	
DATA SET	NUMBER	5	6	7	8	CCMPUTED
PHI(R)	THETA(R)	RDF(11)	REF(PL)	RDF(LP)	RCF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0 0					
	10.00	.1000	.0022	.0020	1755	. 180
	20.00	1520	-0017	.0018	.1504	.153
	36.00	.1310	-0018	.0018	.1361	.135
	40.00	.1354	.021	.0022	.1476	.144
	50.00	.1689	.0018	.0020	.1919	.182
	60.00	.1833	.0019	.0020	.2246	-206
	76.00	.1572	.0019	.0019	.2107	.186
	86.00	1274	0019	.0017	1019	. 161

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د مانده میکاند. به بازم الدومه آود ماند و من مارک کرم کراهه که معهد در مانده میکاند.

AC1272-CC	1					
TITL	E					
	CHRCME-PLAT	ED GLASS B	EACS, 3 MM	CIA. BEAD	S IN REGU	LAR ARRAY
	CN S IN. DI	A. ALUMINU	M SUBSTRAT	E USEC AS	FIELD STA	NDARD BY
	TEXAS INSTR	UMENTS.				
SUBJ	ECT CCDES					
	AEL AHD	CJAG				
CATA	SET NUMBER	S				
	9, 10, 11	, 12, 13,	14, 15, 16	b		
PARA	METER INFOR	MATICN				
	SOURCE= DK	(H GAPPA	(0)=	INSTRUMENT	TATION= CL	Δ
	ACCURACY= F	IVE PERCEN	T NUMBER	R CF RUNS /	VERAGEC=	1
	$THETA(\mathbf{I}) = \mathbf{B}$	30.CC PF1	(I) = 18C.0	C HAVELE	Gif= 1.06	C
DATA SET	NUMBER	\$	10	11	12	CCMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RCF(LP)	RCF(PP)	RDF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	00	.1305	•C017	-0020	.1307	.132
	10.00	.1576	.0049	.0056	.1707	.169
	20.00	.2139	.C143	.0153	.2579	.251
	30.00	.2370	•C252	.0270	.3391	.314
	40.00	.2663	.0267	.0291	.3782	.350
	50.00	.26CC	.0252	.0282	.3781	• 346
	60.00	.2211	.C256	.0286	.3580	.317
	70.00	.2760	.C167	.0189	.4859	.399
	80.00	2868	.C076	.0082	.5693	.436
DATA SET	NUMBER	13	14	15	16	COMPUTED
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00	.1305	-0017	.0020	.1307	.132
	10.00	.1300	.0014	.0016	.1271	.130
	20.00	.1427	.015	.0018	.1351	.143
	30.00	¥ ~ 1¥ 1				
	40.00	.0915	.016	.0016	.0911	.093
	50.00	.0578	.C012	.0013	.0560	.058
	60.00	.0078	.C011	.0010	.0080	.009
	76.06	.0039	.0011	.0010	.0039	.005
	80.00	.0037	.013	.0011	.C032	.005

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AC1272-CC)1					
TITL	.e					
-	CHRCME-PLAT	ED GLASS I	BEACS, 3 MM	CIA. BEA	CS IN REGU	ILAR ARRA
	CN 9 IN. DI	A. ALLMIN	N SLBSTRAT	F USEC AS	FIELD STA	NDARC BY
	TEXAS INSTR	RUMENTS.				
SUB.	IECT CODES					
	AEL AHD	CJAG				
CATA	SET NUMBER	RS				
	17. 18. 19	3. 20. 21.	22. 23. 24			
PARA	WETER INFOR	RMATICN				
1	SOURCE= DI		A(C)=	TASTRUMEN	TATION= CI	٨
	ACCLRACY= 1	EIVE PERCE	AT NEWBER	CE RUNS	AVERAGED=	1
	THE $A(I) = A$	50.00 PH	1(1) = 180.0	LAVELE	NGTH: 1.06	

DATA SET	NUMBER	17	18	19	20	COMPUTE
9HI(R)	THETA(R)	RCE(11)	REFEREN	RDE(IP)	RELADI	REFIOT
= 0	(DEG)	(1/58)	11/58)	(1/58)	(1/59)	(1/58)
- 0	(020)		12/30/	(1) 507	(1) 307	(2) 307
	C.00	.1723	.0021	.0025	-2092	.193
	10.00	.2000	.0056	.0057	-2682	-240
	20.00	.1837	.088	.0091	.2731	.237
	30.00	.2052	.0222	.0253	-3389	-296
	40.00	.2670	.0372	-0422	-5231	.435
	50.00	.3580	.0491	.0561	-8129	.639
	60.00	.4040	.0571	.0667	1.081	.804
	70.00	-4245	-0479	-0579	1.418	.974
	80.00	4144	.0319	-0440	2.073	1.282
•						
DATA SET	NUMBER	21	22	23	24	CCMPUTE
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCFLOT
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SP)	(1/SR)	(1/SR)
	C.CO	.1723	.0021	.0025	.2092	.193
	10.00	.1148	-C015	.0018	.1360	.127
	20.00	.0759	.0012	.0015	.0838	.081
	30.00	.0126	.0010	.0012	.0128	.014
	40.00	.0053	.C011	.0013	.0047	.006
	50.00	.0039	.C012	.0013	.0031	.005
	60.00					
	34 44		0016	001/		885
	10.00	•0035		.0014	•UUZ8	.002

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AC1272-CC1						
TITLE						
Сн	RCME-PLAT	ED GLASS B	EACS. 3 MM	CIA. BEAD	S IN REGU	LAR ARRAY
CN	S IN. DI	A. ALLMINU	M SLBSTRAT	E USEC AS	FIELD STA	NDARE BY
TE	XAS INSTR	UMENTS.				
SUBJEC	T CCCES					
AE	L AHD	CJAG				
CATA S	ET NUMBER	S				
2	5, 26 . 27	28, 29,	30, 31, 32			
PARAME	TER INCOM	HATICN				
SO	URCE= DK	H GAPPA	(C)=	INSTRUMENT	ATICN= CL	٨
AC:	CL?#:Y= F	IVE PERCEN	T NUMBER	CF RUNS A	VERAGEC=	1
	ETA(I)= 8	0.CC PHI	(I) = 180.0	WAVELEN	GTH= 1.06	G
DATA SET NU	MBER	25	26	27	28	CCMPUTED
PHI(R) T	HETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RUF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(L/SR)	(1/SR)	(1/SR)
	C.OC	. 16C2	.0019	.0021	.2549	.210
	10.00	.1998	.CO3C	.0029	.3510	.278
	20.00	.198C	•C036	•C038	.3828	.294
	30.00	.1810	.0047	.C044	.4129	.302
	40.00	.1686	.C058	.0057	.4654	•323
	5C.CC	.2285	.C129	₀0131	.8310	.543
	60.00	.3117	•C232	.0250	1.710	1.035
	70.00	.3338	•C269	.0269	2.275	1.331
	86.60	.5125	•C301	.0228	3.155	3.860
DATA SET NU	MEER	29	30	31	32	CCMPUTED
PHI(R) T	HETA(R)	RCF(LL)	RCF(PL)	RCF(LP)	RCF(PP)	RCF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
•	0.00	-1602	.0019	-0021	.2549	-210
	10.00	.0279	.010	.0016	.0393	.035
	20.00	.0074	.0007	.0014	.0078	200
	30.00	.0C4C	* 300 0 .	.0014	.030	.005
	40.00	.0033	.0008	.0013	.0023	.004
	50.00	.0029	.009	-0014	.0019	.004
	60.00	.0030	.0009	.0014	-020	.004
	70.00	.0039	.0003	.0016	-0023	-004
	80.00					

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AC1197-CO1

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TITLE SANCELASTED ST ALLFINUF (FINE). SUBJECT CCDES AELA CJADB CATA SET NUPBERS 1, 2, 3, 4 PARAMETER INFORMATION SOURCE= DKH GAMMA(0) =INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 HETA(I) = 10.00-PFI(I)= 18C.0 hAVELENGTH= .54C CCMPLTED DATA SET NUMBER 2 1 PHI(R) THETA(R) RCF(LT) RCF(PT) RCF(OT) 0 (CEG) (1/SR)(1/SR) (1/SR) .3188 .3197 C.CC .319 .3541 .353 10.00 .3524 20.00 .3221 .3288 .325 30.00 .2842 .2913 .288 46.00 .2476 .2558 .252 50.00 .2135 .2311 .222 60.00 .1937 .2118 .203 70.00 .1770 .1941 .186 80.00 .1354 .1729 .156 DATA SET NUMBER CCMPUTED 3 4 PHI(R) THETA(R) REF LT) RCF(PT) RDF(OT) (1/SR) =160.0 (CEG) (1/SR)(1/SR) 0.00 .3188 .3197 .319 10.00 20.00 .2336 .2382 .236 .2044 .202 30.00 -2004 40.00 .1686 .1815 .175 .1569 .1682 .163 50.00 60.003 .1453 .1574 .151 70.00 .1298 .1386 .134

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AC1197-CC2 TITLE SANCELASTED ST ALUMINUM (FINE). SUBJECT CODES AELA CJADB CATA SET NUPBERS 1, 2, 3, 4, 5, 7, 8 6, PARAMETER INFORMATICN GAMMA(C) =SOURCE= DKH INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(I) = 10.CCP+I(I) = 180.0WAVELENGTH= 1.080 DATA SET NUMBER 2 3 4 CCMPUTED 1 RCF(PL) RCF(LP) RCF(PP) PHI(R) THEYA(R) RDF(LL) RDF(OT) C (DEG) (1/SR) (1/SR) (1/SR)(1/SR)(1/SR).368 C.CO .3359 .0432 .0398 .3121 .3722 .425 10.00 .3899 .C468 .0412 .0437 .0380 .371 20.00 ·335C .3260 .312 .0345 .2730 30.00 .2767 .0400 .224C .0332 .2286 40.00 .0372 .261 .2010 50.00 .1924 .0315 .230 .0348 .1**é**82 .C335 .1800 .207 6C.CC .0310 .1507 .C307 .1642 .186 70.00 .0274 .171 .0238 .1525 00.08 .1392 -C267 5 COMPUTED DATA SET NUMBER 6 7 8 RCF(LL) RCF(PL) RDF(LP) RCF(PP) RCF(OT) PHI(R·) THETA(R) =180.0 (DEG) (1/SR) (1/SR) (1/SR)(1/SR) (1/SR) C.CC .3399 .0432 .0398 .3121 .368 10.00 .0357 .2027 .253 20.00 .2341 .0335 .1892 .0341 30.00 .0312 .1672 .211 40.00 .1531 .0304 .0295 .1450 .179 50.00 .1342 .0263 .0275 .1248 .156 .146 6C.CO .1228 .C265 .0263 .1158 .1050 .134 70.00 .1157 .C224 .0253 .0866 .118 80.00 .1031 .0226 .0227

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AC1336-C	01				
111	LE				
	ALUMINUM A	LCLAC PANE	L USED AS	LABCRATCRY	STANDARD B
_	TEXAS INST	RUPENTS			
SUB	JECT CCDES				
	AELA CJA	D			
CAT	A SET NUMBE	RS			
	1, 2,	3, 4			
PAR	APETER INFO	RMATICN			
	SOURCE= D	KH GAPP	A(C)=	INSTRUMENT	ATICN= CLA
	ACCURACY=	FIVE PERCE	NT NUMBE	R CF RUNS A	VERAGED= 1
	THETA(I)=	0 PH	I(I)=	0 LAVELEN	GTH= 1-060
				•	
DATA SET	NUMBER	1	2	COMPLETED	
PHI(R)	THETA(R)	RCF(LT)	REFIPT	RDF(OT)	
= 0	(CEG)	(1/58)	(1/SR)	(1/58)	
•		127 2117		117 36 2	
	0.00				
	10.00	. 7, 98	. 2249	227	
	20.00	-04/8	. 6434	• 2 2 7	
	30.00	.0184	0178	•077	
	40.00	.0111	6161	.010	
	50.00	00111		•011	
	60.00		•6067	•008	
		•0075	•6047	.000	
		•0075	•0038	.006	
		00017	•6031	•000	
					•
DATA SET	NUMBER	3	4	CCPPUTED	
PHI(R)	THE (A(R)	RCF(LT)	REF(PT)	RDF(OT)	
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	
	0.0				
8	10.00	.2263	.2217	.224	
	20.00	.0434	-0427	.043	
	30.00	.0186	.0181	.018	
	40.00	.0116	.0104	.011	
	50.00	.0088	.070	000	
	60.00	06.00	.0050	.004	
	70.00	.00000	.0030	000 004	
	86.00	ACAE	•0030	•000	
		• • • • • • • •	•4423	•000	

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AC1336-C01 TITLE ALUPINUP ALCLAD PANEL USED AS LABORATORY STANDARD BY TEXAS INSTRUMENTS SUBJECT CCCES AELA CJAD CATA SET NUPBERS 5, 6. 7, 8 PARAMETER INFORMATION SOURCE≠ DKH INSTRUMENTATION= CLA GAMMA(0) =ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 PHI(I)=18C.00 THETA(I) = 60.CCWAVELENGTH= 1.060 DATA SET NUMBER 5 **CC**#PUTED 6 RCF(PT) PHI(R) THETA(R) RCF(LT) RCF(OT) (1/SR) (CEG) (1/SR) 0 (1/SR) C.CO .0071 .C042 .006 .0097 .0062 .008 10.00 .0104 20.00 .0148 .013 30.00 .C278 °C55C .025 40.00 .0762 .0683. .072 50.00 .4055 .4151 .410 60.00 134.61 149.51 142.060 70.00 .8373 .843 .8487 80.00 .2393 .1624 .201 DATA SET NUMBER CCMPLTED 7 8 PHI(R) RCF(PT) THETA(R) RDF(LT) RDF(OT) =180.0 (CEG) (1/SR)(1/SR) (1/SR)C.CO .0071 .CO42 .006 .0058 .C032 .004 10.00 .0050 20.00 .C025 .004 30.00 .0047 .C023 .003 .0040 .C021 40.00 .003 50.00 .0050 .C022 .004 60.00 70.00 .CG74 .0029 .005 80.00 .0145 **.**CO62 .010

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AC1296-CC1 TITLE COPPER PLATED, SANDBLASTED STAINLESS STEEL USED AS LABCRATCRY STANCARD BY TEXAS INSTRUMENTS, 4 INCHES SQUARE. (SAMPLE 1196 REPLATED) SUBJECT CCDES AELC AHA CJAG CATA SET NUMBERS 3. 5, 7. 8 1, 2. 4. 6, PARAPETER INFORMATION SOURCE= DKH INSTRUMENTATION= CLA GAPPA(C) =ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 WAVELENGTH= 1.060 C PHI(I)= HETA(I) =0 DATA SET NUHBER 3 CCMPUTEC 1 2 RCF(PL) RDF(LP) RCF(PP) PHI(R) THETA(R) RCF(LL) RDF(OT) (1/SR)(1/SR) (1/SR)(1/SR)(1/SR)0 (DEG) z C.0C .0669 .261 .1919 .0648 10.00 .1978 ·C645 .0649 20.00 .2026 .1968 .264 .2144 .0638 .2050 30.00 .0649 .274 40.00 .2203 .0597 .0623 .2065 .274 .286 50.00 .2347 .0567 .0603 .2212 .2327 .293 6C.CC .2450 ·C523 .0556 .2402 .296 70.00 .0492 .257C .C457 .298 80.00 .2685 .C357 .0384 .2532 CCMPUTED DATA SET NUMBER 5 6 7 8 PHI(R) RDF(LP) THETA(R) RDF(LL) RCF(PL) RCF(PP) REF(OT) =180.0 (CEG) (1/SR)(1/SR) (1/SR)(1/SR)(1/SR) C.GO .C641 .1514 .0643 .1894 10.00 .255 .1925 .0635 .0625 20.00 .1915 .255 .0610 .1959 30.00 .1945 .0600 .256 40.00 .2069 .0580 .0589 .2037 .264 00.JC .2172 **.**C556 .0557 .2139 .271 60.00 .2263 .0512 .0511 .2258 .277 .2382 70.00 .0457 .282 .2355 .0453 .2596 80.00 .2543 .C375 .0366 .294

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والمالحا ماطلا مرعداة وتحدير المؤاملا متكاكستما الاستخدادي ومكرك وأرأ

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بمقتلا المركز أينويك أوروا ومتعامية والمتكري والمسترين

AC1296-C	01					
TIT	LE					
	COPPER PLAT	ED. SANDEL	ASTED STAL	NLESS STEE	L USEC AS	
	LABCRATCRY	STANCARD B	Y TEXAS IN	STRUMENTS	4 INCHES	SCUARE.
	(SAMPLE 119	6 REPLATED)			
SUB.	JECT CODES		•			
••••	AELC AHA	CJAG				
CAT	A SET NUMBER	s				
••••	9.10.11	. 12. 13.	14. 15. 16			
PAR	AMETER INFOR	MATICN				
	SOURCE= DI		(C)=	INSTRUMENT	ATICN= CL	٨
	ACCURACY= 1	IVE PERCEN	T NUMBER	CF RUNS A	VERAGEC=	1
	THETA(I)=	20.CC PHI	(I) = 180.00	WAVELEN	GTH= 1.06	Ō
DATA SET	NUMBER	S	10	11	12	CCMPUTED
PHI(R)	THE TA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(QT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.1971	•C4C2	.0639	.1187	.210
	10.00	.2021	•C4C2	.0672	.1208	.215
	20.00	. 2C12	.0390	.0648	.1219	.213
	30.00	.2140	.0358	.0643	.1315	.225
	40.00	.2285	. C382	.0623	.1399	.234
-*	50.00	.2526	.0367	.0604	.1544	"252
	60.00	.2773	.0325	.0580	.1683	.268
	70.00	.3220	.0297	.0518	.1977	.301
	80.00	.3755	·C257	.0451	.2365	.341
DATA SET	NUMBER	13	14	15	16	CCMPUTED
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RCF(LP)	RCF(PP)	RDF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C - CO	-1971	.0402	.0639	-1187	- 210
	10.00	.2007	64.2	-0648	.1231	.214
	22.00				••••	••••
	30.00	-2083	.0350	-0646	1273	. 220
	40.00	-2060	.0373	.0607	.1267	.215
	50.00	.2027	.0354	.0570	.1229	209
	60.00	.2017	.0326	.0529	.1222	-205
	70.00	.2007	.0284	-0466	.1194	.198
	80.00	.1675	.0230	.0375	.1172	.188
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		ISAN	PIF	11	96 8	FP			· ·	- /	. – .	,		ne	1 67 8		31	¥۲	4.14	UNES	JUUMAE	•
S	UB.	JECT	COD	ES					•										× .			
-		AFLD		AH/		C	٨G															
C	AT/	SET	NL	MBE	RS		- V															
-		17.	18		19. 2	0.	2		22.	2	23.	24	4									
P	AR	VETE	RI	NFC	RMAT	10	N	•		-		_	-									
		SOUR	CE=	. 0	KH	(GAI	ANN	(0)	z			IN	ST	RL	JME	NT	AT 1		= CLA		
		ACCU	RAC	Y =	FIVE	P	ER	EN	T	N	L F	'BEF	RC	F	RL	NS	A	VER	AG	EC = 1		
		THET	V (Í) =	30.0	C	1	PHI	(1)	=]	80		0	h	A\	/EL	EN	GTH	* 2	1.060	l	
DATA S	ΕT	ALMB	FR			17				16	1			1	9				20		COMPLIT	Fr
PHILR)	THE	TA (R)	RD	Ē	LL)	RC	FI	PI)	9		ú	P)		RE	FI	PP)	RDFIO	TI
=	Ċ	([EG)	•	(1	15	R)	,	(1	15	5R)	1	(1/	SF	2)		(1	/5	R)	(1/SR)
		_				• -																
		C	• C0		•	15	69		٠	Ce	6ČZ			•0	61	10		•	20	54	•26	5
		10	• 00		•	20	14		٠	Cé	29	į		•0	62	21		•	20	10	•26	4
		20	.00		•	20	10 E 3		•	Ce	23	ļ		• C	63	34		•	20	94	.27	1
		30	.00		٠	21	21		•	C C	32			•0	63	91		٠	21	73	•27	9
		40	-00		٠	25	32 83		•		21	•		•0	01	1		•	23	10	•29	7
		50	- 00		٠	23	22		•	5	203 241	I		• 0	20	55		•	20	20	. 51	0
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		80	-00		٠	37) 43)	2 J 8 Z		•	() ()	40			•0	21	16		•	20' 47'	41	• 40	4
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DATA SI	ET	NUMB	ER			21				22	?			2	3				24		CCMPUT	EC
PHICR)	THE	TA (R)	RC	F ()	LL)	RC	F (PL)	R	DF	11	P)		RC	FL	PP)	RDF(0	T)
=180.	0	(C	EG)		(1	1:	`)		(1	15	R)		(1/	SF)		(1	/51	R)	(1/SR)
		С	.00		•	19	Ę.		•	06	62	1		.0	61	0			201	54	.26	5
		10	.00			20	Cr.			<u> </u>	38			.0	60	13			20	1)	.26	3
		20	.00			26	- J			Č6	44	ŀ		.0	62	20			21		.27	õ
		30	.00		•	··· • ·			5		, ,					-		•				-
		40	.00		•	19	75		è	C 6	28	ļ		.0	59	9			20	59	.26	3
		50	.00		•	15	12		•	C 5	72	1		.0	54	5			19	49	.24	9
		60	.CO		•	18	28		•	C 5	26			.0	49	8			18	55	.23	5
		7¢	.00		•	17	36		•	C4	57	,		.0	43	4			17	71	.22	0
		80	.00		•	17(29		- (C 3	77			. 0	33	5			170	9	20	-

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AC1296-CO	1					
TITL	E					
	COPPER PLAT	EC, SANDBL	ASTED STAL	NLESS SIEE	L USEL AS	COUADE
	LABORATORY	STANCARD B	Y TEXAS IN	STRUPENTS,	4 INCHES	SUUARES
	(SAMPLE 119	6 REPLATED)			
SUBJ	ECT CODES					•
	AELC AHA	CJAG				
CATA	SET NUMBER	S				
	25, 26, 27	, 28, 29,	30, 31, 32			
PARA	WETER INFOR	MATICN			ATTCH- CI	•
	SOURCE= DK	H GAMMA	(C)=	INSTRUMENT	ATTUNE CL	д 1
	ACCLRACY= F	IVE PERCEN	IT NUMBER	CF RUNS A	VERAGEU=	1
	THETA(I) = 4	0.CG PH1	$(I) = 18C \cdot 00$	NAVELEN	GTH= 1.06	U
DATA SET	NUMBER	25	26	27	28	CCMPUTED
UPIA 351 OUT/P1	TUETA(R)	RDF(LL)	RCF(PL)	RCF(LP)	RDF(PP)	RCF(OT)
PD1(6)	(056)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
= 0	(010)				,	
	0.0	-2038	.0600	.0582	.2034	.263
	10.00	.2118	.0600	.0601	.2093	.271
	20.00	.2156	.0599	.0590	.2140	.274
	36.00	.2252	•C228	.0602	.2263	.286
	46.00	.2397	.0588	.0589	.2426	.300
	50.00	.2678	.0578	.0577	.2749	.329
	00.00	.3029	. C546	.0535	.3194	.365
	76.00	.3718	.C494	.0521	.3990	.436
	80.00	.4988	.C463	.0495	•5429	.569
	ŶŨ					
		20	٥¢	31	32	CCMPUTED
DATA SET	NUMBER	25	UC (191379	RCE(LP)	RCF(PP)	RDF(OT)
PHI(R)	THEIALRS	KUFILL/	11/001	(1/SR)	(1/SR)	(1/SR)
=180.O	(CEG)	11/281	(1)361	(1) 507		
	C 00	.2038	.000.	.0582	.2034	.263
	10.00	2047	.0603	.0597	.2037	.264
	20.00	.1995	.0595	.0578	.1982	.257
	20.00	1984	.0594	.0599	.2012	.259
	00.00					
	50.00	.1968	.0578	.0550	.1912	•250
	60-00	.1855	•C521	.0523	.1762	.233
	70.00	.1747	.C452	.0447	.1630	.214
	80-00	.1644	.C365	.0357	.1527	.195

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AC1296-CO1 TITLE COPPER PLATED, SANDBLASTED STAINLESS STEEL USED AS LABCRATCRY STANDARD BY TEXAS INSTRUMENTS, 4 INCHES SQUARE. (SAMPLE 1196 REPLATED) SUBJECT CODES AELC AHA CJAG CATA SET NUMBERS 33, 34, 35, 36, 37, 38, 39, 40 PARAMETER INFORMATION SOURCE= DKH GAMMA(0) =INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(I) = 60.CCP+I(I)=18C.CO WAVELENGTH= 1.060 DATA SET NUMBER 33 34 35 36 CCMPUTED PHI(R) THETA(R) RCF(LL) RCF(PL) RDF(LP) RCF(PP) RCF(OT) 0 (CEG) (1/SR)(1/SR)(1/SR) $\left(\frac{1}{SR}\right)$ (1/SR)C.CO .2332 .0520 .0526 .2248 .281 10.00 .2410 .0531 .0521 .2441 .295 20.00 .2557 .0549 .0517 .2663 .314 30.00 .2751 ·C543 .0535 .2904 .339 40.00 .2991 .0537 .0528 .3156 .361 50.00 .3231 .0539 .0534 .3527 .392 60.00 .3712 .0536 .0505 .4168 .446 70.00 .4540 .C496 .0503 .5326 .543 80.00 .6281 .C512 .0537 .7913 DATA SET NUMBER 37 38 39 40 CCMPUTED PHI(R) THETA(R) RCF(LL) RCF(PL) RDF(LP) RCF(PP) RDF(OT) =180.0 (DEG) (1/SR)(1/SR)(1/SR) (1/SR)(1/SR)C.CC .2332 .0520 .0526 .2248 .281 10.00 .2162 .0522 .0525 .2087 -265 20.00 .1966 .0504 .0516 .1910 .245 30.00 .1895 .C514 .0522 .1805-.237 40.00 .1751 .0495 .0509 .1679 .224 50.00 .1880 .0516 .0528 .1778 .235 60.00 70.00 .1943 .C481 .0482 .1809 .236 20.38 .1801 ·C4C9 .0390 .1620 .211

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AC1296-C(01					
TITI	E					
	COPPER PLAT	ED. SANDEL	ASTED STAT	NLESS STEE	USEC AS	
	LABCRATCRY	STANDARD P	Y TEXAS IN	STRUMENTS.	4 INCHES	SCUARE.
	(SAMPLE 119	6 REPLATED				
SUB.	ECT CODES					
••••	AELC AHA	CJAG				
EATA	SET NUMBER	s				
	41, 42, 43	. 44. 45.	46. 47. 48			
PAR	METER INFOR	MATICN				
	SOURCE= DK		(C)=	INSTRUMENT	ATICN= CL	۵
	ACCURACY= F	IVE PERCEN	NI NUMBER	CF RUNS A	VERAGEC=	1
	THETA(I) = 7	10.CO PHI	(I) = 18C.00	WAVELEN	GTH= 1.06	0
						•
DATA SET	NUMBER	41	42	43	44	CCMPLTED
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(CT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	•					
	C.CO	.2204	·C426	·C445	.2157	.262
	10.00	.2580	.C469	.0474	.2532	.303
	20.00	.2885	•C491	.0497	.2880	.338
	30.00	.3167	.0479	.0489	•3221	.368
	40.00	.3481	.0510	.0483	.3621	.405
	50.00	.3780	.0508	.0462	.4303	.453
	60.00	.4237	.0510	•0494	•5659	.545
	76.00	•5658	.0497	.0521	.9073	.787
	?].CO	.8204	.0583	. C648	1.251	1.097
DATA SET	NUMBER	45	46	47	48	CCMPUTED
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RDF(OT)
=180.C	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.2204	.0426	.0445	.2157	•262
	10.00	.1958	.0415	.0429	.1891	.235
	20.00	.1775	•C416	.0435	.1714	.217
	30.00	.1612	.0406	.0421	.1539	. 199
	40.00	.1567	.C4C6	.0429	.1481	.194
	50.00	.1515	.C352	.0402	.1421	.186
	60.00	.1767	•C436	.0460	.1664	.216
	76.60					
	00.08	.2192	. C449	•0456	•2228	.266

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AC1332-CC1 TITLE 1 COPPER-PLATED, SANDBLASTED STAINLESS STEEL, 3 INCHES SQUARE. SUBJECT CODES AELC AHA CJAG CATA SET NUPBERS 1, 2, з, 4. 5, 7. 6, 8 PARAMETER INFORMATICS SOURCE= DKH GAMMA(C)= INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUPBER OF RUNS AVERAGED= 1 THETA(I)= 0 P+1(1)= WAVELENGTH= 1.060 C DATA SET NUMBER 1 2 3 CCMPUTED 4 PHI(R) THETA(R) RDF(LL) RCF(PL) RDF(LP) RCF(PP) RDF(OT) 0 (CEG) (1/SR)(1/SR) (1/SR) (1/SP) (1/SR)C.CO 10.00 .2122 .C797 .0820 .2061 .290 20.00 .2128 .C774 .0783 .2071 .288 3C.Or .2212 .0737 .0751 .2150 .292 40.00 -2271 .0688 .0816 .2197 .293 50.00 .2367 .C64C .0654 .2321 .299 60.00 .2375 .0568 .0584 .2350 .294 70.00 -2413 .C478 .0484 .2391 -288 80.00 .2526 .0356 .0367 .2565 .291 DATA SET NUMBER 5 6 7 8 COMPUTED PHICRÍ THETA(R) RCF(LL) RDF(PL) RDF(LP) RCF(PP) RDF(OT) =180.0 (CEG) (1/SR) (1/SR) (1/SR) (1/SR) (1/SR) C.CC 10.00 .2076 .0768 .0815 .280 .1940 20.00 .2139 .0723 .0783 .1974 .281 30.07 .2213 .0690 .0736 -2059 .285 40.00 .2296 ·C648 .0705 .2134 -289 50.00 .2381 .0593 .0639 .2216 -291 60.00 .2491 .C522 .0569 .2327 .295 70.00 .2557 .C447 .0477 •294 .2395 86.00 .2681 -0318 .0363 .2528 .295

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AC1332-C	01					
TIT	LE					
	COPPER-PLAT	ED. SANDEL	ASTED STAI	NLESS STEE	L, 3 INCH	ES SCUARE.
SLE.	JECT CCDES	•				
•••	AELC AHA	CJAG				
EAT	A SET NUMBER	S				
•••••	9.10.11	. 12. 13.	14. 15. 16			
PAR	AMETER INFOR	MATIEN				
•••••	SOURCE= DK	H GAMMA	(C)=	INSTRUMENT	ATICN= CL	۵
	ACCURACY= F	IVE PERCEN	T NUMBER	CF RUNS A	VERAGEC=	1
	THETA(I) = 2	0.CC PF1	(I)=18C.CO	NAVELEN	GTH= 1.06	C
0474 651	A 1.MD C 0	c	10	3 \$	12	CONDUTED
UATA SET	NUMBER	5		11	12	
PHICK	INCIALS	KUPILLI (1)(D)	KUF(PL)	KUF(LP)	KUF1FFJ	(1/50)
= U	(LEG)	(1758)	(1)2k)	(1/2k)	(1)24)	(1/38/
	C.CO	.2103	·C745	.0751	.2036	.282
	10.00	.2031	·C747	.0755	-2022	.278
	20.00	.2016	.0719	.0726	.1982	.272
	30.00	.2122	.0703	.0713	.2097	.282
	40.00	.2256	.0654	.0676	.2263	•292
	50.00	.2465	.0580	.0622	.2480	.307
	60.00	.2714	.0497	.0578	.2725	.326
	70.00	.3095	.C416	.0516	.3071	•355
	80.00	.3438	.0282	.0381	.3420	.376
DATA SET	NUMBER	13	14	15	16	CCMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RCF(LP)	RCF(PP)	RCF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	00.0	.2103	.0745	.0751	.2036	.282
	10.00	.2237	.0757	.0762	.2189	.297
	20.00					
	36.00	.2312	.0716	.0728	.2227	.299
	40.00	.2290	.0649	.0681	.2206	.291
	50.00	.2193	.0581	.0614	.2116	.275
	60.00	.2175	.0519	.0537	.2087	.266
	76.00	.2089	•C431	.0451	.2025	.250
	80.00	.2130	.0309	.0337	.2015	.240

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TITLE COPPER-PLATED, SANDBLASTED STAINLESS STEEL, 3 INCHES SQUARE. SUBJECT CCDES AHA CJAG AELC CATA SET NUMBERS 17, 18, 19, 20, 21, 22, 23, 24 PARAMETER INFORMATICN GAMMA(0) =SOURCE= DKH INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1 THETA(1)= 30.00 PHI(I)=18C.00 WAVELENGTH= 1.060 DATA SET NUMBER CCMPUTED 17 18 19 20 PHI(R) THETA(R) RCF(LL) RCF(PL) RDF(LP) RDF(PP) RDF(07) 0 (CEG) (1/SR) (1/SR)(1/SR)(1/SR)(1/SR) C-CO .2212 .C724 .0750 .2152 .292 .2062 10.00 .0718 .0726 -2062 .278 .2054 .0711 .0712 .277 20.00 .2067 .C694 .2101 30.00 .2067 .0683 .277 .2206 .289 .2253 40.00 .0667 .0655 .2435 .0613 50.00 .0639 .310 .2517 60.00 .2844 °C222 .0597 .2876 .345 .385 70.00 .3302 .0503 .0527 .3367 86.00 .4115 .C432 .0460 .4195 .460 DATA SET NUMBER COMPUTED 23 24 21 22 RDF(PL) PHI(R) RCF(LL) RCF(LP) RCF(PP) RDF(OT) THETA(R) (1/SR) (1/SR) =180.0 (CEG) (1/SR) (1/SR) (1/SR) .0724 0.00 .2212 .0750 .2152 .292 10.00 .2232 .0710 .0725 .2123 .289 20.00 .2315 .0711 .0724 .2238 .299 30.00 .290 .0659 .2189 46.00 .2294 •C663 .270 .2136 .0606 .2061 50.00 .0590 .251 5C.CO .2039 .0514 .0517 .1945 .234 70.00 .1970 .C423 .0430 .186C .0305 .209 ,1751 80.00 .1826 .0307

AC1332-C	C 1					
TIT	LE					
•••	COPPER-FLAT	ED. SANDEL	ASTED STAT	INIESS STE	EL. 3 INCH	ES SOUARE.
SUB.	JECT CODES					CO DECKAL
000		C.14G				
CAT	A SET NUPBER	S				
	25. 26. 27	. 28. 29.	30. 31. 32	2		
PAR	AMETER INFOR	MATICN		-		
,	SOURCE= DK	H GAPPA	(C)=	INSTRUMENT	TATION= CL	۵
	ACCURACY= F	IVE PERCEN		CE BUNS	VERAGEC=	1
	THETA(I) = 4	O.CC PHI	(I)=180.00	WAVELE	GTH= 1.06	C
		·				
DATA SET	NUMBER	25	26	27	28	CCMPUTEC
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
= C	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C CO	2221	6443	6700	9119	200
		•2331	• • • • • • •	• • • • • • •	•2115	• 290
		02290	+0040	•0077	•2101	• 28 1
	20.00	+22UU 2105	•0040	•0038	•2100	• 282
	50.00 40.00	+2177	+0032	+0038	•2124	•281
	40.00 50 00	• 2 2 2 8	•6373	+0010	• 2 2 0 3	• 288
		• 2 9 9 0	+6961	•0507	•2488	• 307
	30.00	•200U	aU 204	•6530	• 2894	• 3 3 9
		• 3490	•0444 ···	•0488	• 3552	• 359
	86.00	•4494	•6348	i •0395	•4685	•496
		4				
DATA SET	NUMBER	29	30	31	32	CCMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RCF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	•2331	.0642	.0709	.2113	.290
	10.00	.2374	.C646	.0720	.2152	.295
	20.00	.2276	·C644	.0691	.2114	.286
	30.00	.2317	.0629	.0688	.2125	.288
	40.00					· — •
	50.00	.2126	.0565	.0585	.2027	.265
	60.00	.2023	•C498	.0521	.1893	.247
	70.00	.1856	.C394	•0420	.1736	.220
	80.00	.1786	•C315	.0312	.1645	.203

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T	ITL	E																	
		COP	PER-	PL	ATEC		SAN	CBL	AST	ED	STAI	NLE	SS :	STEE	L, 3	INC	HES	SCUA	RE.
S	U8 J	ECT	CCC	ES		•									•				
		AELI	2	AH	4	C.	JAG												
2	ATA	SET	T NU	.MBI	ERS														
		33	. 34		35.	36	. 3	7,	38.	39	• 4C								
P	ARA	METE	RI	ŇFI	DRMA	TI	ČN –	-	-		-								
		SOUR	RCE=	: 1	DKH		GA	MMA	(0)	z		INS	TRU	MENT	ATIC	N= C	LA		
		ACCI	RAC	; Y =	FIV	/E	PER	CEN	T	NU	MEER	CF	RU	NS A	VERA	GEC=	i		
		THE	T A (1	() =	60.	CO		PH I	(1)	= 1 8	IC-CO	1	WAV	ELEN	GTH=	1.0	60		
DATA S	ET	NUM	BER			3	3			34			35		3	6	CC	MPUT	EC
PHILR)	TH	ETAC	R)	R	CF	(LL)	RC	F(P	۲ L)	RD	F(L	P)	RCF	(PP)	F	CFIO	T)
I	0	((CEGI)	(1/:	SR)		(1	/SR	:)	(1	/SR)	(1/	SR)	(1/SR)
		(•2	375		•	C 5 7	C	•	057	2	•2	371		•29	4
		1(0.00	3		•2	56C		•	C57	15	•	057	7	.2	488		.31	0
		2(C.CC)		.20	64C		•	C57	14		058	3	•2	585		.31	9
		3(0.00)		•2	772		•	C56	7		057	L	•2	742		• 33	3
		4(0.00)		.2	845		•	C 56	1	•	055	9	•2	833		• 34	0
		5	0.00)		•2	558		٠	C 5 3	1	•	053	7	•3	019		.35	2
		6	C.CC			• 32	294		•	C49	13		050	2	• 3	430		•38	6
		7	0.00)		•3	826		•	C43	96	•	046	2	- • 4	095		.44	1
		8()		•52	219		٠	C 3 5	2	•	043	7	•5	773		•58	9
DATA C	F T	N. 4 1 N. 4 1				3	~			20			30					MOUT	c ~
DUTIO	5 J 1	TU	CER Ctai	101	c	300	f / 1 1	•	70	30 6/0		00	37 E/(-	51	۳ ۵.۵۵	(U :/00\	- UL		51 T 1
-140	, ^		C 1 M 1 7 E C 1		г 4	50F	1 L L 6 D 1		11	737		- 21	Γίι: /CD	r / \	11/	(1/00	17
-160+	U			,			341		(1	/ 31		41	/ 38	,	(1/	3K	. 1	1/34	1
		(C.CC)		.2	375		•	C 5 7	1C		057	2	•2	2371		•29	4
		1(0.00)		.2	258		•	C 5 5	i 4	ابه	056	5	•2	202		.27	9
		20	Ű.OC)		.2	C 9 7	ł.	•	C 5 2	23		054	5	•2	028		•26	0
		3(0.00)		.2	C72	ŀ	•	052	23	•	054	4	•1	978		•25	6
		4(C.CC	2		.2	CCC		•	C49	;4		051	5	•1	882		•24	5
		5(0.00)		.2	[49			C 4 9	8	•	C 5 2	4	•]	983		.25	3
		6	C . GC)															
		7(C.CC	3		•2	134		٠	C42	25	•	C43	7	• 2	2050		•25	2
		8	C.CC			.1	633			C31	4		032	3	- 1	764		•21	2

AC1332~CO	1					
TITL Sugj	E Copper-plati Ect codes	ED, SANDELA	ASTEC STAIN	LESS Side	L, 3 INCHE	S SCUARE.
	ACLU ANA	C C C C C C C C C C C C C C C C C C C				
LATA	SEI NUPUEN	. 44. 45. 4	46. 47, 48	•		
	410 429 73	NATIEN				
PAKA	PEIER INFOR	H GAMMA	(0)=	INSTRUMENT	ATICN= CL	
	ACCHRACY= F	IVE PERCEN	T NUMBER	CF RUNS A	VERAGEC=	
	THETAILS 7	0.CO PHI	(1) = 180.00	WAVELEN	GTH= 1.060	
	THE FEAT					COMPLITED
DATA SET	NUMBER	41	42	43	99 005/00)	PEFIOT)
DUTIP)	THETAIR)	RDF(LL)	RCF(PL)	RCF(LP)	KUP(PP)	(1/52)
- 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1126)	11/307
• •	•				2264	.288
	C.00	.24CC	.0504	.0462	-2377	.303
	10.00	.2515	.0483	.0449	-2017	.325
	20.00	.2742	.C484	.0403	• 2000	.340
	30.00	.2893	·C479	.0470	2227	.362
	40.00	.3066	.0479	.0400	2240	.367
	50.00	.3148	.0424	.0420	- 3540	.388
	60.00	.3335	.0402	.0404	• 3012	439
	70.00	.3745	.0347	•0370	6977	.576
	80.00	.4886	.0329	•0555	• 2 7 1 1	•••
					4.9	COMPUTED
DATA SET	NUMBER	45	46	47	40	RDF(OT)
DHIR)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	(1/59)	(1/SR)
*180-0	(CEG)	(1/SR)	(1/SR)	(1/2k)	(1/36/	
- 200 - 0				0443	2364	.288
	C.OC	.2400	.0504	.0402	2155	.264
	10.00	.2213	.0448	.0400	2066	.253
	20.00	.2079	.C458	.0420	1024	.236
	30.00	.1930	.0439	.0430	1811	.230
	40.00	.1929	.0415	.U437 0200	.1670	.211
	50.00	.1815	.0363	.0000	.2039	.252
	60.00	,2151	.0410	•1443		
	76.00		674F	0272	2081	.255
	80.00	.2298	.0347	+U313		

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AC1187-CO1 TITLE ELACK PAINT (AF3621-73-0C0C-8730) THINNED 1 TO 1 WITH AMYL ACETATE, 2 CCATS APPLIEC 5 MIN. APART, SPRAYEC CN 120 GAUGE STEEL. SUBJECT CODES AEM ECBBL CATA SET NUMBERS 1, 2, 3, 4 PARAMETER INFORMATICN SOURCE= DKI GAMPA(0)=.90 INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 HETA(I) =С PEI(1)= 0 **WAVELENGTH=** .633 DATA SET NUMBER 3 1 2 CCMPUTED 4 PHI(R) THETA(R) RCF(LL) RCF(PL) RDF(LP) RDF(PP) RDF(OT) C (DEG) (1/SR)(1/SR) (1/SR) (1/SR) Ŧ (1/SR)C.CC .1176 .0000 .0000 .1795 10.00 .149 15.CQ ·C369 .0000 .0000 .0544 .046 20.00 .0142 .0000 .0001 .0199 .017 30.00 .COC1 .CC34 .0001 .0047 .004 45.CC .0001 .002 .0011 .CO01 .018 60.00 .0007 .0001 .CO01 .001 .CO13 70.00 .001 .0006 .0001 .0001 .0013 80.00 .0002 •0001 .001 .0006 .0013

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AC1187-C	01					
111	1 6					
	ALAER DATN'	T 1463621-	73-0000-87			17TL
	ANAL VUE VUE	TE. 2 CCAT	C ADDITER (5 NTA ADAI	DI. CDDAVE	14 1 F F C N:
	120 CANCE	CTEEL	J MFFLILU .	A LTU® HLH	VII SPRAIC	
CLIR	IFOT CODES	SIECE				
300		R I				
C A 7	A SET NEWDER					
CAT	5. A.	7. 8. 9.	10. 11. 15	5		
DAR	ANETER THEO	DMATICE	TOA TTA PU	F.		
	SCURCE= DI	KT CAMM	10)=.90	TASTOUMENT	TATION- CI	٨
	ACCURACY=	FIVE PERCEI	T NINAFI	R CF QLAS	AVERAGER=	
	THEYA(T) = 0	45.00 PH	(())= 18C_(N LAVELEI	-VERMOLD- NGTH= -63	13
DATA SET	NUMBER	5	6	7	8	CCMPLTED
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	2% (PP)	RCF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	1/SR)	(1/SR)
	C.CO	.0006	.0000	.0000	.0007	.001
	15.00	.0013	-COOC	.0000	-0022	.002
	35.00	.0297	.0009	.0006	.1370	•084
	45.00	.4146	.0000	•0138	3.975	2,202
	55.00	.0259	.CCCC	.0031	.7923	.413
	65.00	.0010	.COCC	.0005	.0916	.047
	80.00	.0C10	.0000	.0000	.0198	.010
DATA SET	NUMBED	c	10	11	12	CONDUTED
DHILDI	THETAIRY	805/11)	PRE(D)	505/10) TT	905(80) 12	PRETATI
=180.0	([[[]]]	(1/(0))	(1)/50)	11/501	11/501	11/501
-1000	(0207	141 GN /	VI/ JN/	(1/3//	(1)341	(1/38)
	C.00	.0006	.0000	.0000	.0007	.001
	15.00	.0006	.0000	.0000	.C005	.001
	35.00	.0006	.COCC	.0000	.0004	.001
	45.00					
	55.00	.0005	.0000	.0000	.C004	.000
	76.00	.0005	.0000	.0005	.0004	.000
	80.00	.0005	.COC¢	.0000	.C004	.000

January 1969

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AC1187-CO1 TITLE PLACK PAINT (AF3621-73-CCOC-8730) THINNED 1 TO 1 WITH AMYL ACETATE, 2 COATS APPLIED 5 MIN. APART, SPRAYED CN 120 GAUGE STEEL. SUBJECT CODES AEM ECBBL CATA SET NUPBERS 13, 14, 15, 16, 17, 18, 19, 20 PARAMETER INFORMATION SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT + NUMBER OF RUNS AVERAGED= 1 $THETA(I) = 70 \circ CC$ PHI(I) = 180.0WAVELENGTH= .633 DATA SET NUMBER CCMPUTED 13 14 15 16 PHI(R) THETA(R) RDF(LL) RCF(PL) ROF(LP) RDF(PP) RDF(OT) (1/SR) 0 (CEG) (1/SR) (1/SR) (1/SR) (1/SR) -.C000 .0005 .000 .0004 .0000 5.00 .0000 .0010 20.00 .CCC4 .0000 .001 40.00 .0000 .006 .CCC5 .0001 .0107 .cocc 50.00 .0824 .Cć14 s611 60.00 .0000 .0050 1.155 .0000 65.00 .8031 .0371 9.368 5.104 70.00 8.340 .0000 .2453 64.830 36.708 75.00 5.446 .0000 .1297 34.154 19.865 80.00 1.256 .0000. .0193 5.953 3.614 DATA SET NUMBER 20 CCMPUTED 17 18 19 PHI(R) ROF(PP) RDF(LL) RCF(PL) RDF(OT) THETA(R) RDF(LP) =180.0 (1/SR) (1/SR) (1/SR) (1/SR)(CEG) (1/SR) .000 C.CC .0004 .cocc .0005 .0000 .0004 .0000 20.00 .0000 .0004 .000 .COCC .000 40.00 .0005 .0000 .0004 60.00 .0004 .0000 .0001 .0005 .001 70.00 80.00 .0006 .0000 .0009 .001 .0001

AC1337-001

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TIT	LË				
	3 CCATS 3M	BLACK VELV	ET PAINT	COVERING 30 P	ERCENT CF
	ALUPINUM AL	CLAD PANEL	IN PELKA-	-DCTTEC PATTE	RN USED AS
	LABCRATCRY	STANCARC B	Y TEXAS I	NSTRUMENTS.	
SUB	JECT CODES	•••••••••••••••••••••••••••••••••••••••			
			C.1AG		
FAT	A CET NUMBER				
641	$1 \cdot 2 \cdot 3$. 4			
DAD	ANETED INCOM				
E AN	CUIDLE* UN		10)-	TACTOUNEATAT	TEN= CLA
	ACCIDACY= B	TVE DEDCEN	T NIVAEI	D CE DINS AVE	104- 00A DAGEC= 1
	TUETAITI-	- 1 VE FERUER	(T)- (N LP NUNS MVL	L+ 1 040
	1021A(1)-	U PF1	(1)-	y RAVELENGI	r- 1.000
DATA SET	NUMBER	1	2	CCMPUTED	
PHI(R)	THETA(R)	RDF(LT)	RCF(PT)	RCF(OT)	
= Ŭ	(CEG)	(1/SR)	(1/SR)	(1/SR)	
	C.CO				
	10.00	.1873	.1701	.179	
	20.00	.C4C4	.C37C	· . 039	
	30.00	.0175	.0164	.017	
	40.00	.0106	.0102	.010	
	50.00	.0084	.0082	.008	
	60.00	.0074	.C074	.007	
	70.00	.0070	.C071	.007	
	86.00	.0097	.025	.009	
DATA SET	NUMBER	3	4	CCMPUTED	
PHI(R)	THETA(R)	RDF(LT)	RCF(PT)	RDF(OT)	
=180.0	(CÉG)	(1/SR)	(1/SR)	(1/SR)	
	C-CO				
	10.00	.1884	.1706	.179	
	20.00	. 04C2	.C368	•039	
	30.00	.0172	.C165	.017	
	40-00	.0110	.0107	.011	
	50.00	.0C84	.0085	.008	
	60.00	.0075	.0076	.008	
	70.00	.0072	.C074	.007	
	80.38	.0073	-0056	.008	

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AC1337-CO1 TITLE 3 CCATS 3M BLACK VELVET PAINT COVERING 30 PERCENT CF ALUMINUM ALCLAD PANEL IN PELKA-DETTED PATTERN USED AS LABCRATCRY STANDARD BY TEXAS INSTRUMENTS. SUBJECT CCDES CJAG AEM ECBBL AELA CATA SET NUMBERS 5, 6, 7, 8 PARAMETER INFORMATICN GAMMA(C) =SOURCE= DKH INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(I) = 60.0C PHI(I)=18C.CO WAVELENGTH= 1.060 DATA SET NUMBER 5 CCMPUTEC 6 THETA(R) PHI(R) RCF(LT) RCF(PT) RCF(OT) (DEG) 0 (1/SR) (1/SR)(1/SR)-.007 C.CO .0073 .C071 .0093 10.00 .0096 .009 20.00 .0133 .C142 .014 ·C245 .C261 30.00 .025 .C644 40.00 .066 .C678 .3065 .314 50.00 .3216 60.00 76.047 84.581 80.314 .8295 .797 70.00 .7653 80.00 .2339 .2416 .238 DATA SET NUMBER CCMPUTED 7 8 PHI(R) THETA(R) RCF(LT) RCF(PT) RDF(OT) (1/SR)(1/SR)=180.0 (CEG) (1/SR) .0073 .C071 .007 C.CC .CC65 10.00 .C06C .006 .0052 20.00 .CC61 .006 30.00 .0060 .0049 .005 40.00 .0053 .CO41 .005 50.00 .0068 .0051 .006 60.00 .0096 .0072 .008 70.00 80.08 .0177 .C161 .017

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January 1969

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AC1338-C	01				
TIT	LE				
	3 CCATS 3M	BLACK VELV	ET PAINT (COVERING 64.4 PERC	ENT CF
	ALUMINUM AL	CLAD PANEL	IN PELKA	DCTTEC PATTERN US	ED AS
	LABCRAVCRY	STANDARD E	Y TEXAS I	STRUMENTS.	
SUB.	JECT CODES				
•••	AEM ECBE	L AELA	DALAG		
CAT	A SET NUMBER	S			
	1. 2. 2	. 4			
DAR	AVETER INFOR	MATICN			
r an	CONDUCES ON	N CANNA	101+	TA CTRUMENTATION.	C1 A
	ACCI 0ACV+ 5	THE DEDCED	T NINDES	TROTRUPENTATION-	"- 1
	THETALTS	A DL1	(NGP 22) (///	N LF KUNG AVERAGEL	·= 1
	THE FACT /-	U PPI	(11)- (J WAVELENGIP= 10	,000
DATA SET	NUMBER	1	2	COMPUTED	
PHI(R)	THETA(R)	RDF(LT)	RCF(PT)	RDF(OT)	
* 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	
	C.00				
	10.00	-1324	-2195	.126	
	20.00	.0409	•C374	•039	
	30.00	.0219	•C2C3	.021	
	40.00	.0152	•C144	.015	
	50.00	. C12C	.0119	-012	
	60.00	.0105	•C113	.011	
	70.00	sCC96	•C114	.011	
	80.00	.0088	•C133	.011	
DATA CET	NIKASD	3	L.	CONDUTED	
CUT/DA	THETATON		7 905(07)		
-140 0	1051A(8)	NUF (217	AUT (T ()	RUF(UI) (1/68)	
-160.0	1660	(1/3K)	(1/38)	11/241	
	C.CC				
	10.00	.1427	1266	.135	
	20.00	. 6469	-C368	.039	
	30.00	.0220	1226	.021	
	40.00	-0149	.0147	.015	
	50.00	.0116	.0123	.012	
	60.00	.0105	.0114	.011	
	70.00	2210.	.0120	.031	
	80.00	.0002	0120	.012	
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AC1338-CC1 TITLE 3 CCATS 3M BLACK VELVET PAINT COVERING 64.4 PERCENT CF ALUMINUM ALCLAD PANEL IN PELKA-DETTED PATTERN USED AS LABCRATCRY STANCARD BY TEXAS INSTRUMENTS. SUBJECT CCDES ECBBL AEM AELA CJAG CATA SET NUMBERS 5, 6, 7, 8 PARAMETER INFORMATION SOURCE= DKH GAPPA(C) =INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETAIL)= 60.CC P+I(I)=18C.CC WAVELENGTH= 1.06C DATA SET NUMBER 5 CCMPUTED Ô PHI(R) THETA(R) RCF(LT) RCF(PT) RCF(OT) 0 (CEG) (1/SR)(1/SR) (1/SR)C.CC .0099 .0106 .010 10.00 .C123 .C142 .013 20.00 .0167 .019 .0203 30.00 .0279 .C347 .031 .C76C 4C.CG .0631 .070 .2567 50.00 .289C .273 60.00 38.542 46.418 42.480 .418 .3650 70.00 .4703 80.00 .1271 .2016 .164 DATA SET NUMBER 7 8 CCMPUTEC PHI(R) RCF(LT) THETA(R) RCF(PT) RDF(OT) =180.0 (CEG) (1/SR)(1/SR) (1/SR)C.CC .0099 .010 .C1C6 10.00 .0090. .0090 .009 20.00 .008 .0084 .C076 30.00 .0084 .C072 .008 40.00 .CC76 .C061 .007 50.00 .0096 .077 .009 60.00 70.00 .0123 .0099 .011 80.00 .0176 .0178 .018

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AC1335-CC	01				
TITI	.E			<u>.</u> .	
	3 CCATS CF	3M BLACK	VELVET PAI	NT CN ALLPIN	LM ALCLAC
	PANEL SUBST	TRATE USED	AS LABERA	TCRY STANDAR	C BY
	TEXAS INSTR	RUMENTS.			
SUB	JECT CCDES				
	AEM ECBE	BL CJAG			
CATA	SET NUMBER	RS			
	1, 2, 3	3, 4			
PAR	APETER INFOR	RMATICN			
	SOURCE= DI	KH GAMMI	*(C)=	INSTRUMENTA'	TICN= CLA
	ACCURACY= 1	FIVE PERCE	NT NUMBER	R CF RUNS AVI	ERAGEC= 1
	THETA(I)=	0 PH	I(I)= (O WAVELENG	Th= 1.080
DATA SET	NUMBER	1	2	CCPPUTED	
PHI(R)	THETA(R)	RDF(LT)	RCF(PT)	RDF(OT)	
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	
	C.00				
	10.00	.0076	.C07C	.007	
	20.00	.0072	.C072	•007	
	36.00	.0669	-0077	.007	
	40.00	.CC65	.084	•007	
	50.00	.0061	.0095	•008	
	60.00	.0C57	.0109	•008	
	70.00	•CC53	•C133	.009	
	80.00	-0049	.C173	.011	
CATA SET	NUMBER	3	4	CCPPUTEC	
PHI(R)	THETA(R)	RCF(LT)	RCF(PT)	RDF(OT)	
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	
	C.CO				
	10.00	.0076	£063	-007	
	20.00	.0072	.071	.007	
	30.00	.0069	.075	.007	
	40.00	.0066	.0084	.008	
	50.00	.0662	.093	.008	
	60.00	.0058	.0109	.008	
	76.00	.0055	.0133	.009	
	80.00	.0C55	.0178	.012	

January 1969

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AC1339-CO1

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TITLE 3 CCATS OF 3M BLACK VELVET PAINT ON ALUMINUM ALCLAC PANEL SUBSTRATE USED AS LABORATORY STANDARD BY TEXAS INSTRUMENTS. SUBJECT CODES ECBBL CJAG AEM CATA SET NUMBERS 5, 6, 7, 8 PARAPETER INFORMATICN SOURCE= DKH GAMFA(0) =INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(I)= 60.CC PHI(I)=18C.CO WAVELENGTH= 1.060 DATA SET NUMBER 5 6 CCMPUTED PHI(R) THETA(R) RDF(LT) RCF(PT) RDF(OT) Ŧ 0 (CEG) (1/SR) (1/SR) (1/SR)C.CC .0056 .0101 .008 10.00 .0048 .C12C .008 20.00 .CC41 .C143 .009 30.00 .C182 .0032 .011 40.00 .0025 •C238 .013 50.00 .0330 .CC23 .018 60.00 .0037 .0493 .026 70.00 .0102 .0819 .046 80.00 .0322 .1519 .092 DATA SET NUMBER 7 8 COMPUTED PHI(R) THETA(R) RDF(LT) RCF(PT) RDF(OT) ≈180.0 (CEG) (1/SR) (1/SR) (1/SR) C.GC .0056 .0101 .008 10.00 .0062 .0093 .008 20.00 .0069 .085 .008 30.00 .0077 ·C083 .008 40.00 .0074 .C071 .007 50.00 .01CC .C092 .010 60.00 70.00 .0128 .0119 .012 80.00 .0070 .0191 .013

AC129C-C	01					
111	LE					
	3M WHITE VE	LVET PAINT	(THE CEAT	S) CN CNE	CCAT ZINC	CHRCMATE
	PRIMER CN A	NOCIZED AL	UMINUM SUB	STRATE (6	IN. SC.).	
SUB	JECT CODES					
L V L	ACMA EUDD A Set Newrer	J LJAG C				
CA II	$1 \cdot 2 \cdot 3$. 4. 5.	6. 7. 8			
PAR	APETER INFOR	MATICN	-, ., .			
	SOURCE= DK	H GAMMA	(C)=	INSTRUMENT	ATICN= CL	٨
	ACCURACY= F	IVE PERCEN	T NUMBER	CF RUNS A	VERAGEC=	1
	THE TA $(Y) =$	C PHI	(I) = 0	WAVELEN	GTH= 1.06	0
DATA SET	NUMBER	1	2	3	4	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
± 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	c					
	10.00	1559	1220	1207	1610	205
	20.00	-1529	-1323	•1277	•1519	•200
	30.00	.1516	.1317	.1314	.1471	.281
	40.00	-1482	.1288	.1309	.1433	.276
	50.00	.1521	-1304	₀1332	.1447	.280
	60.00	.1510	•1293	.1329	.1450	.279
	70.00	.1487	.1275	.1319	.1461	.277
	80.00	•1443	•1226	•1246	.1438	•268
		_		_		
DATA SET	NUMBER	5	6	7	8	CCMPUTED
2180.0	INCIALN)	KUF(LL) /1/(D)	KUF(PL)	KCF(LP)	RUF(PP)	REF(OI)
-20010	(220)	11/34/	(1/3#)	(1/38)	(1/2K)	(1/2K)
	C.CO					
	10.00	.1580	.1324	.1303	.1489	.285
	20.00	.1551	.1346	•1333	.1483	-286
	30.00	.1515	.1326	•1329	-1471	.282
	40.00	•1502	.1347	.1308	.1504	•283
	50.00	• 1937 - 1697	•1222	+1207 1261	• 1490	•219 274
	76.00	+1363	•1301	+1201	•1973 .1479	• 2 1 0
	86.00	.1283	.1237	.1107	.1454	.254

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(Î)ÂEM 11 . () AC129C-CO1 TITLE 3M WHITE VELVET PAINT (THE CEATS) ON CHE CEAT ZING CHROMATE PRIMER ON ANCOIZED ALUMINUM SUBSTRATE (6 IN. SC.). SUBJECT CCDES AEMA ECBBJ CJAG CATA SET NUMBERS 9, 10, 11, 12, 13, 14, 15, 16 PARAMETER INFORMATICN SOURCE= DKH GAMMA(C)= INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(1)= 20.00 PHI(1)= 180.0 hAVELENGTH= 1.060 DATA SET NUMBER 9 10 11 12 COMPUTED PHI(R) THETA(R) RDF(LL) RCF(PL) RDF(LP) RDF(PP) RDF(OT) z 0 (CEG) (1/SR) (1/SR)(1/SR)(1/SR)(1/SR) C.CC .159C .1286 .1349 .1416 .282 10.00 .1568 .1259 .1376 -1422 .281 20.00 .1513 .1264 .1341 .1405 .276 30.00 .1509 .1275 .1361 .1430 .279 40.00 .148C .1311 .1348 .1464 ().280 50.00 .1458 .1345 .1331 .1496 .281 60.00 .1414 .1331 .1285 .278 .1540 70.00 .1394 .1351 .1262 .1638 .282 80.00 .1354 .1325 .1194 .1699 .279 DATA SET NUMBER 13 14 15 16 COMPUTED PHI(R) THETA(R) RDF(LL) RDF(PL) RDF(LP) RDF(PP) RCF(OT) =180.0 (CEG) (1/SR)(1/SR) (1/SR)(1/SR)(1/SR)C.OC ·159C .1286 .1349 .1416 .282 10.00 .1648 .1292 .1363 .1478 .289 20.00 30.00 .1253 .1676 ,1387 .1457 .289 40.00 .1638 .1282 .1390 .1433 .287 50.00 .1605 .1294 .1372 .1445 .286 00.38 .1584 .1338 .1357 .1493 .289 70.00 .1552 .1318 .1325 .1486 .284 80.00 .1501 .1275 .1259 .1439 .274

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AC129C-C01

TITLE			AT O CONTO	IN THE THE C	CAT ZINC	CHRCMATE
	3M WHITE VEL	VET PAINT	LINE CLAIS	TPATE 16	N. SC.).	
i	PRIMER CN AN	IODIZED ALL	WINDE 2003	STRATE TO A		
SUB.I	ECT CODES					
	AEMA ECBB.	J CJAG				
ATAT	SET NUPBERS	5				
D ATE	33. 34. 35	, 36, 37, 3	38, 35, 40			
DADA	WETER INFORM	MATIEN			ATION- CL	
rane.	SOURCE= DKI	H GAMMA	(())=	INSTRUPENT	ATICH- CEP	•
	ACCLRACY= F	IVE PERCEN	T NUMBER	CF RUNS A	VERAUEL- 1 CTU- 1 060	• •
	THETA(T)= 6	0.00 PHI	(I) = 180.0	WAVELEN	GIM# 1.000	•
				_	24	CONDUTED
	LING CO	33	34	35	30	Pre(OT)
DATA SET	TUCTAID	RDF(LL)	RCF(PL)	RCF(LP)	RUFIPPI	(1/59)
PHICK	INCIALS/	(1/58)	(1/SR)	(1/SR)	(1/58)	(1) 261
= 0	(DEG)					279
	0.00	1556	.1210	.1400	.1389	.210
	C.UU	1658	.1205	.1428	.1410	.200
	10.00	1505	.1225	.1404	.1474	.280
	20.00	1400	.1243	.1404	.1530	.283
	30.00	• 1 7 7 0	1252	.1359	.1617	.284
	40.00	• 1 4 4 4	1271	.1339	.1732	.289
	50.00	.1440	1224	.1326	.1911	-298
	60.00	.1485	1237	1295	.2278	.318
	70.00	.1578	1212	1286	.3287	.385
	80.00	.1907	•1223			
			20	20	40	CCMPUTED
DATA SET	NUMBER	37	30 000(R1)	DEC (IP)	RCF(PP)	RDF(OT)
PHI(R)	THETA(R)	RDF(LL)	RUPIPLI	(1/00)	(1/SR)	(1/SR)
=180.0	(CEG)	(1/SR)	(1/2k)	(1) 201		
				1400	.1389	.278
	C.CO	.1556	.1210	1400	.1451	.288
	10.00	.1613	.1269	• 1431	1444	.289
	20.00	.1641	.1267	• 1432	1001	.300
	30.00	.1748	.1311	.1400	+1771	.293
	40-00	.1766	.1243	-1428	1412	.326
	50.00	.2025	.1337	.1543	.1013	
	60.00				1014	365
	70.00	.2314	.1493	.1675	.1014	. 255
		.2231	.1484	.1645	.1740	د د د ه

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AC129C-C	01					
TIT	LE					
	3M WHITE VE	ELVET PAINT	I (THE CEAT	IS) CN CNE	CCAT ZINC	CHROMATE
	PRIMER CN /	NODIZED A	LUMINUM SUE	STRATE (6	IN. SC.).	
SUB	JECT CODES					
	AEMA ECBE	BJ CJAG				
CAT	A SET NUPBER	S				
	41, 42, 43	3, 44, 45,	46, 47, 48	3		
PAR	AMETER INFOR	RMATICN	· -			
	SOURCE= DI	KH GAMP/	b (C) =	INSTRUMEN	TATICN= CL	, 🔺
	ACCURACY= 1	IVE PERCE	NT NUPBER	R CF RUNS	AVERAGEC=	1
	THETA(I) = 7	70.00 PH	I(I) = 180.0	D WAVELEI	NGTH= 1.06	0
DATA SET	NUMBER	41	42	43	44	COMPUTED
PHI(R)	THETA(R)	RCF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C - 00	. 1458	. 1174	. 1322	1384	. 267
	10.00	-1360	.1165	1255	-1405	.260
	20.00	.1395	.1173	.1293	-1472	.267
	30.00	.1368	.1165	.1262	.1532	.266
	40.00	.1401	.1174	.1302	.1657	.277
	50.00	.1431	.1151	.1298	.1822	.285
	60.00	.1536	.1138	.1292	.2159	.306
	76.00	.1877	.1171	.1296	.2990	.367
	80.00	.3114	.1161	.1363	.5540	• 559
					•	
DATA SÉT	NUMBER	45	46	- 47	48	CCMPUTEC
PHI(B)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
≠180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.0C	.1458	.1174	.1322	.1394	.267
	10.00	.1464	.1164	.1305	.1353	.264
	20.00	.1574	.1220	.1376	.1397	.278
	30.00	.1631	.1220	.1388	.1403	.242
	40.00	.1709	.1295	.1416	.1504	.296
	50.00	.1645	.1234	.1300	.1432	.281
	60.00	.2103	.1457	.1539	.1796	°342
	70.00					
	80.00	.2668	.1745	.1779	-2226	.421
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Sec. Participation

AC1292-C	01					
TIT	LF					
	2M AFITE VE	IVET PAINT	THE CEAT	S) EN ENE	CEAT 71NC	CHREMATE
	PRIMER CN A	NGDIZED AL	UNTAUN SUR	STRATE (11	IN. 50.)	-
SUB.	JECT CODES					•
	AEMA ECBB	J CJAG				
CAT	A SET NUMBER	S				
	1. 2. 3	4. 5.	6. 7. 8			
PAR	AMETER INFOR	MATICN	••••••			
	SOURCE= DK	H GAMPA	(C)=	INSTRUMENT	ATICN= CL	۵
	ACCURACY= F	IVE PERCEN	T NUMBER	CF RUNS A	VERAGEC=	1
	THETA(I)=	0 PHI	(1)= 0	HAVELEN	GTH= 1.06	Ū.
						•
DATA SET	NUMBER	1	2	3	4	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C - CC					
	10.00	.1730	.1508	.1432	.1698	.318
	20.00	.1665	.1502	.1417	.1645	.311
	30.00	.1639	.1528	.1433	.1694	.315
	40.00	.1593	.1475	.1400	.1653	•306
	50.00	.1567	.1478	.1385	.1636	• 30 3
	60.00	.1526	.1457	.1353	.1629	•298
	76.00	.1464	.1397	.1291	.1594	.287
	· 8C-CO	.1351	.1269	.1160	.1488	•263
DATA SET	NUMBER	5	6	7	8	CCMPUTED
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RCF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO					
	10.00	.1689	.1491	.1416	.1701	.315
	20.00	.1643	.1489	.1418	.1664	.311
	3C.GC	.1589	.1462	.1399	.1624	• 304
	40.00	,1592	.1467	.1409	.1629	• 305
	50.00	.1551	.1452	.1377	.1619	• 300
	6C ~ 00	.1504	.1427	.1340	.1601	•294
	76.00	.1436	.1384	.1281	.1589	•285
	86.00	.1357	.1298	.1176	°1530	.268

January 1969

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AC1292-CC2

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TITLE 3M WHITE VELVET PAINT (THE CEATS) ON ONE CEAT ZING CHREMATE PRIMER CN ANODIZED ALUPINUP SUBSTRATE (11 IN. SC.). SUBJECT CODES AEMA ECBBJ CJAG CATA SET NUPBERS 3, 2, 1. 4. 5, 6, 7. 8 PARAMETER INFORMATION SOURCE= DK1 GAMPA(C)=.90 INSTRUMENTATION= GLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(I) =0 PHI(I) =0 WAVELENGTH# 1.060 DATA SET NUMBER 3 CCMPUTED 1 2 ROF(PL) RDF(LP) PHI(R) THETA(R) RDF(LL) RCF(PP) RDF(OT) (1/SR) 0 (CEG) (1/58)(1/3R) (1/SR)(1/SR) C.00 .1798 10.00 .1507 .1503 .1698 .325 .1748 .319 20.00 .1502 .1479 - 3645 .1524 30.36 .1742 .1528 .1694 .324 .315 40.00 .1485 .1474 .1487 .1653 50.00 .1673 .1477 .1463 .312 .1636 .1629 .367 60.00 -1620 .1457 .1442 -297 70.00 .1571 .1397 .1373 .1594 80.00 .1473 .1269 .1278 .1488 .275 DATA SET NUMBER 5 7 8 CCMPUTED 6 PHI(R) RDF(LL) RCF(PL) THETA(R) RDF(LP) RCF(PP) REF(OT) =180.0 (CEG) (1/SR) (1/SR) (1/SR) (1/SR)(1/SR)C.CC 10.00 .1805 .1414 .1510 .1613 .317 .1517 .1590 .315 20.00 .1770 .1423 .1564 .311 .1408 .1513 30.00 .1739 .311 .1708 .1581 40.00 .142? .1511 .1483 56.00 .1675 .1420 .1583 .308 .1626 .1439 .1577 .302 60.00 .1405 .1358 .292 70.00 .1538 .1373 .1577 9C.00 .1375 .1293 .1184 .1530 .269

January 1989

AC1292-CO3					
9 T T I E					
ILILE De llite ve				CCAT TINC	CLOCHATE
SH WELLE VE Dotned Fin A	NCOITED A	I LING GERI IINTRIM CIG	SI UN UNE	THE SC 1	UFRUMATE
FRIFER UN A	INCLILED PI	LUPINUE JUD	STRATE ILL	110 3601	•
ACNA EFRO					•
PEMA EGDE Cata cet shimped	NG LUPO				
LM3M JE3 NUPDEN	1. 4. 5.	6. 7. 2)		
	NATICK				
CONDERS OF	T CANNA	101=.90	TASTRUMENT	ATTONE CL	A
ACCUGACV= E	TVE SEDCEN	T NI-NRED	PE DINC A	WEDACEC=	1
THETA/ILE	C DH	lills C	LI KURS P	GTH= 1.06	<u>.</u>
	• • • •				U .
DATA SET NUMBER	1	2	3	4	COMPUTED
PHI(R) THETA(R)	RDFILLS	REFIPL	REFILPS	RDF(PP)	RDF(OT)
= 0 (£EG)	(1/SR)	(1/SR)	(1/SR)	(1/58)	(1/SR)
• • • • • • • • • •					
00.3					
16.00	.1860	.1485	.1556	.1679	.329
26.00	.1770	.1476	.1492	.1626	.318
30.00	.1736	.15CC	.1529	.1663	.321
40.00	.1681	.1468	.1478	.1623	.313
50.00	.1656	.1467	.1458	.1623	.310
66.00	.1625	.1452	.1433	.1623	.307
76.00	.1559	.1425	.1382	.1607	.299
80.00	.1484	.1356	.1279	.1578	.285
DATA SET NUMBER	5	6	7	8	CCMPUTED
PHI(R) THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
=180.0 (CEG)	(1/SR)	(1/SR)	(1/SR)	(<u>1</u> /SR)	(1/SR)
C.00					
16.00	.1822	.1500	•1525	•1693	•327
20.00	.1776	.1503	•1524	.1666	•323
30.00	.1732	•1482	.1517	•1635	.318
46.00	+1721	.1490	.1514	.1640	.318
50.00	.1624	-1459	.1497	.1614	. 51 5
65.00	• 1637	5471.	•14/5	-1630	• 310
76.00	•1577	.1383	,1410	.1503	• 29 /
86.00	•143C	•1222	.1240	-1463	.209

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AC1292-CO3

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TIT	L£					
	3H WHITE VE	LVET PAINT	(THC CCAT	S) CN ONE	CCAT ZINC	CHRCMATE
	PRIMER CN A	NOCIZED AL	UPINUP SUB	STRATE (11	IN. SC.)	•
SUB	JECT CODES					
	AEMA ECBE	J CJAG				
EAT	A SET NUMBER	S				
	9.10.11	. 12. 13.	14, 15, 16			
PAR	AMETER INFOR	MATICN				
••••	SOURCE= DE	I GAMMA	(C) = .90	INSTRUMENT	ATICN= CL	A
	ACCURACY= F	IVE PERCEN	T NUMBER	CF RUNS A	VERAGEC=	1
	THETA(T) = C	O.CC PET	$(1) = 18C_{-}C_{-}$	WAVELEN	GTH= 1.06	Ō
						-
DATA SET	NUMBER	S	10	11	12	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RCF(LP)	RCF(PP)	RDF(OT)
= 0	(CFG)	(1/SR)	(1/58)	(1/SR)	(1/SR)	(1/SR)
- •			• • • • • •			
	C - CO	.1603	-1412	. 1451	-1602	.303
	10.00	.1553	.1381	.1423	.1576	297
	26.00	.1517	.1372	-1401	.1607	.295
	30.00	.1508	.1368	.1407	.1667	.298
	AC .00	.1478	.1349	.1384	.1708	.296
	50.00	1492	1200	1367	1861	. 298
	50.00 60 00	1403	1245	1321	1075	- 304
		• 1 4 7 2	1260	1205	2366	. 224
		1404	1225	+1273	2402	260
	86.00	+7524	+1240	•1203	• 376 3	• 370
DATA SET	NUMBER	13	14	15	16	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RCF(LP)	kCF{PP}	RDF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/_2)	(1/ <u>S</u> R)	(1/SR)
	C-CO	.1603	.1412	.1451	.1602	.303
	10.00	.1653	.1425	•1478	.1598	.308
	20.00	.1720	.1454	.1516	.1626	.316
	36.00	. 183C	.1500	.1546	.1696	•329
	40.00	.1713	.1352	.1398	.1541	.300
	56.00	.2152	.1596	.1655	.1878	.364
	66.00					
	70.00	.242?	.1736	.1779	.2076	.401
	80.00	.2280	.1679	.1731	.1922	.381

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AC1027~0	03					
. TIT	LE					
• •	C.D. PAINT	USED CN M	Z-200 7 T	EN TRUCK.		LIED
	ON 2 COATS	OF ZINC CH	RCMATE PR	IMER ON AND	DIZED ALU	MINUr.
	SAMPLE PRE	PARED AT U	CF M.			
SUB	JECT CODES					
	AEMB ECBI	BI	<u>.</u>			
DAT	A SET NUMBER	२ऽ				
	1, 2,	3, 4, 5,	6, 7, 1	8		
PAR	AMETER INFO	RMATICN				
	SOURCE= DI	KI GAMM/	(0)=.90	INSTRUMENT	FATION= CL	. A
	ACCURACY= 1	FIVE PERCE	NT NUMBEI	R CF RUNS /	AVERAGED=	1
	THETA(I)=	C PH	[(I)= (D WAVELEI	NGTH= .63	3
DATA SET	NUMBER	1	2	3	4	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(IP)	RDF(PP)	RDF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/58)
	C.00					
	10.00	.1127	.0050	.0042	.1149	.118
	20.00	.0384	.CO43	.0039	.0411	.044
	30.00	.0170	.CO41	.0039	.0189	.022
	40.00	.0107	.0041	.0039	.0119	.015
	50.00	-0C8 (.CO43	.0038	.0094	.013
	6C.00	.0077	.0042	.0036	.0084	.012
	70.00	-0078	.0045	.0037	08000	.012
	80.00	•0072	.0041	.0035	•0081	.011
DATA SET	NUMBER	5	6	7	8	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RCF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00		,			
	10.00	1934	0052	0043	1176	120
	20.00	-1127	-0052	•0072,	•11()	.120
	20.00	•0307	••••= 0025	•0039	•U411 0104	• 444
-	46.00	-0107	.0039	.0039	0114	-021
	50.00	-0101 A800-	.0042	.0039	.0007	.013
	60.00	.0077	.0042	-0036	.0091	_012
	76.00	-0078	.0045	-0037	-0082	.012
	80.00	.0072	.0044	.0035	.0085	.012

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International Contraction

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AC1027-003 TITLE C.D. PAINT USED CN MAZ-200 7 TCN TRUCK, 1 CCAT APPLIED CN 2 COATS OF ZINC CHRCMATE PRIMER ON ANODIZED ALUMINUM. SAMPLE PREPARED AT U. CF M. SUBJECT CODES AEMB ECBBI CATA SET NUPBERS 9, 10, 11, 12, 23, 14, 15, 16 PARAMETER INFORMATICN SOURCE= DKI GAMMA(0) = .90INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(I) = 20.00PHI(I)=180.00 WAVELENGTH= .633 DATA SET NUMBER ç 10 11 12 CCMPUTER PHI(R) THETA(R) RDF(LL) RCF(PL) RDF(LP) RCF(PP) RDF(OT) 0 (DEG) (1/SR) (1/SR) (1/SR)(1/SR)(1/SR)0.00 .0421 .CO41 .CO41 .0448 .048 10.00 .1140 .C051 .0041 .1401 .132 20.00 .1936 * ÷ 0054 .0047 .2750 .239 30.00 .1109 :0053 .0042 .1946 .158 .0364 40.00 .0005 .0040 .0778 .059 .0149 50.00 .C049 .0041 .0352 .030 .0094 60.00 .0049 .0040 .0213 .020 70.00 .0049 .0077 .0036 .017 .0177 80.00 .0072 .0045 .0037 .0192 .017 DATA SET NUMBER 13 14 15 16 COMPUTED PHI(R) THETA(R) RDF(LL) RDF(PL) RDF(LP) RDF(PP) RDF(OT) =180.0 (C2G) (1/SR)(1/SR)(1/SR) (1/SR) (1/SR)C.00 .0421 .CO41 .0041 .0448 .048 10.00 .0184 .C046 .0041 .0197 .023 20.00 30.00 .0039 .01C4 .0047 .0105 .015 40.00 .0091 .CO46 .0040 .0091 .013 •CO46, 50.00 .0085 .0038 .0083 .013 66.00 .CC82 .CO47 .0037 .0078 .012 70.00 .0080 .0046 .0034 .0074 .012 80.00 .0074 .CO45 .0033 .0070 .011

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AC1027-003 TITLE C.D. PAINT USED ON MAZ-200 7 TON TRUCK, 1 CC+ F APPLIED CN 2 COATS OF ZINC CHRCPATE PRIMER ON ANODIZED ALUMINUP. SAMPLE PREPARED AT U. CF M. SUBJECT CODES EC881 AEMB CATA SET NUMBERS 17, 18, 19, 20, 21, 22, 23, 24 PARAMETER INFORMATION GAMPA(0)=.90 INSTRUMENTATION= CLA SOURCE= DKI ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1 THETA(I) = 40.00PHI(I)=180.00 WAVELENGTH= .633 DATA SET NUMBER COMPUTED 17 18 19 20 RCF(PL) RDF(LP) RDF(PP) RDF(OT) PHI(R) THETA(R) RDF(LL) (1/SR) (1/SR)(1/SR) (1/SR)* 0 (CEG) (1/SR).0039 .0042 .0110 .0119 .015 C.00 .0041 10.00 .0044 .0233 .024 .0169 20.00 .0367 .0046 .0043 .0719 .059 .0062 30.00 .0956 .0049 .2748 .191 .0079 40.00 .1400 .0050 .6384 .396 .C076 50.00 .0651 .0051 .5414 .310 .C063 60.00 .C174 .0049 .2621 .145 .1378 70.00 .0C83 .C059 .0045 .078 80.00 .0100 .C057 .0042 .1217 .071 CCMPUTED DATA SET NUMBER 21 22 23 24 RCF(PL) RCF(LP) RCF(PP) RDF(LL) RDF(OT) PHI(R) THE TA(R) (1/SR)(1/SR) (1/SR)(1/SR) (1/SR)=180.0 (CEG) .0039 .0042 C.CO .0110 .0119 .015 .0043 .0093 .014 10.00 .0095 .CO41 .0041 .0085 .013 20.00 .0092 .CO41 30.00 .0099 .0044 .0089 .014 .C044 40.00 .C105 .0045 .0089 .014 50.00 .0048 60.00 **.**C1CC .0048 .0042 .0080 .014 .0040 .0073 76.00 .0094 **.CO4**8 .013 80.00 .0086 .C046 .0034 .0067 .012

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AC1C27-CO3

TITLE C.D. PAINT USED ON #AZ-200 7 TON TRUCK, 1 COAT APPLIED CN 2 COATS OF ZINC CHRCMATE PRIMER CN ANCDIZED ALUMINUM. SAMPLE PREPARED AT L. CF M. SUBJECT CODES AEMB **ECBBI** CATA SET NUMBERS 25, 26, 27, 28, 29, 30, 31, 32 PARAMETER INFORMATION SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(I) = 50.00PFI(I)=18C.00 **WAVELENGTH**= .633 DATA SET NUMBER 25 26 27 28 CCMPUTED RCF(LL) PHI(R) THETA(R) RCF(PL) RDF(LP) RCF(PP) RDF(OT) 0 (CEG) (1/SR)(1/SR) (1/SR)(1/SR) (1/SR)C.CO .0081 .0037 .0038 .0096 .013 .0038 10.00 .0097 .0039 .0147 .016 20.00 .0144 .C04C .0041 .0340 .028 .0269 .0057 36.00 .CO47 .1173 .077 40.00 .0513 **.0068** .0047 .4726 .268 1.189 50.00 .0474 .0094 .0052 .626 60.00 .0108 .0091 .0051 1.141 .583 .0086 .0045 76.00 .0117 .6697 .347 80.00 .0322 .0083 .0042 .5032 .274 DATA SET NUMBER 29 30 31 32 COMPUTED PHI(R) THETA(R) RCF(LL) RCF(PL) RDF(LP) RCF(PP) RDF(OT) =180.0 (CEG) (1/SR), (1/SR) (1/SR)(1/SR)(1/SR)C.CO .0081 .013 .C037 .0038 .0096 10.00 .C076 .039 .0037 .0083 .012 20.00 .0081 -CO4C .0039 .0080 .012 36.60 .0084 .CO38 .C042 .0078 .012 40.00 .0096 .CO45 .0042 .0086 .013 50.00 66.00 .0102 .CO47 .0040 .0085 .014 -CO48 70.00 .0095 .0036 .0075 .013 .0090 .0036 80.00 .0048 .C073 .012

MANUTAL SPECIAL SPECIA

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AC1C27-C	03					
TIT	LE					
	C.D. PAINT	USED ON ZA	Z-2C0 7 TC	N TRUCK.	CCAT APP	I TEC
	CN 2 COATS	OF ZINC CH	RCMATE PRI	MER CN AND	CIZED ALU	MINUM.
	SAMPLE PRE	PAREC AT L.	CF M.			
SUB.	JECT CCDES					
	AEMB ECB	BI				
CAT	A SET NUMBE	RS				
	33, 34, 3	5, 36, 37,	38, 35, 40			
PAR	AMETER INFO	RMATICN				
	SOURCE= D	KI GAMMA	(0) = .90	INSTRUMENT	TATICN= CL	A
	ACCLRACY=	FIVE PERCEN	T NUMBER	CF RUNS A	AVERAGEC=	1
	THETA(I)=	60.CC PH1	(1) = 18C.00	HAVELEN	GTH= .63	3
DATA SET	NUMBER	33	34	35	36	CCMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RCF(LP)	RCF(PP)	RCF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C 00	0070	6030	0040	6001	012
		• 46 79	•030	•6042	-0091	.015
		•0665	•6039	•0045	.0123	.015
		•6693	•0041	+6045	•0222	.020
	36.66	•0118	.043	.0048	•0599	.040
	46.00	.0147	.048	.0050	.2300	•127
	56.00	.0107	.0078	.0057	1.020	•522
		•0281	•0100	.0074	2.919	1.482
		•1685	.0102	.0069	3.324	1.755
	80.00	• 3510	•COSC	•0001	2.578	1.472
				• •		
UATA SET	NUMBER	31	38	39	40	CCMPUTED
FFILK)	IHEIA(K)	RUF(LL)	RCF(PL)	RUF(LP)	RCF(PP)	RCF(OT)
=150.0	(66)	(1/2K)	(1/2%)	(1/58)	(1/SR)	(1/SR)
	c.co	.0079	.038	.0042	.0091	.013
	10.00	.0077	.038	.0042	.0075	.012
- *	20.00	.CC79	.035	.0042	.0070	.011
·	30.00	.0085	•C038	.0043	.C071	.012
	40.00	.0091	.CO4C	.0043	.0075	.012
	50.00	.0107	-C045	.0045	.085	.014
	60.00		_			
	70.00	.0119	•C048	.0045	.088	.015
-	80.00	.0111	•C047	.0041	.0092	.015

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AC1C27-003 TITLE C.D. PAINT USED ON MAZ-200 7 TON TRUCK, 1 COAT APPLIED CN 2 CCATS OF ZINC CHRCPATE PRIMER ON ANODIZED ALUPINUM. SAMPLE PREPARED AT U. CF M. SUBJECT CCDES AEMB **ECBBI** CATA SET NUPBERS 41, 42, 43, 44, 45, 46, 47, 48 PARAMETER INFORMATION SOURCE= DKI GAMMA(0)=.90 INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1 THETA(I) = 70.0CPHI(I) = 18C.COhAVELENGTH= .633 DATA SET NUMBER 41 42 43 44 COMPUTED RCF (LL) RCF(PL) PHI(R) THETA(R) RDF(LP) RCF(PP) RDF(OT) 0 (CEG) (1/SR)(1/SR) (1/SR)(1/SR)(1/SR).0085 .0073 .C035 .0042 .012 C.CO .0071 .0042 .013 10.00 .C034 .0106 .0073 20.00 .C036 .0043 .0175 .016 .CC76 .0045 .0404 30.00 .C039 .028 .0073 .0045 40.00 .C047 .1371 .077 50.00 .0126 .0077 .0048 .6026 .314 60.00 .1489 .C193 .0060 2.864 1.519 ,0096 70.00 1.253 .C468 9.211 5.260 3.601 80.00 .0532 .0177 13.430 8.551 DATA SET NUMBER COMPUTED 45 46 47 48 RDF(1P) RDF(OT) PHI(R) THEIA(R) RCF(LL) RCF(PL) RDF(PP) =180.0 (CEG) (1/SR)(1/SR) (1/SR) (1/SR) (1/SR) .0042 .0085 .CC73 .0035 C.GO .012 .0072 .0033 10.00 .0040 .0066 .011 .0076 .0034 20.00 .0042 .0068 .011 .0035 30.00 .0080. .0041 .0061 .011 40.00 .0090 .0037 .0043 .0069 .012 50.00 .0101 .0040 .0045 .0074 .013 60.00 .CO45 .0121 .0046 .0093 .015 70.00 86.00 .0058 .0050 .021 .0159 .0161

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AC1044-0	03					
TIT						
	LOUS PAINI	DE TINC CL	ACTICO / 18	LN IRUCK, AND	2 CUAIS AF	
	SAMPLE PRE	DARED AT 15	CF N.	IPER UN PIN	LUIZED ALL	FINUP.
SUB	JECT CODES					
••••	AEMB ECB	BI				
CAT	A SET NUMBER	RS				
	1, 2,	3, 4, 5,	6, 7,	8		
PAR	AMETER INFO	RMATICN				
		KI GAMP/	A(C)=.9C	INSTRUMEN	TATION= CL	.A
	ALGUKAGT= Theta/ti-	FIVE PERCER	NI NUMBE	R LF KUNS A	AVEKAGEU≠ Notu= 47	1
	INCIALL/=	U PF		U NAVELEI	NGIF= .03	2
DATA SET	NUMBER	1	2	3	4	COMPUTED
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RDF(OT)
× 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CC					
	10.00	.1156	•C044	•0042	.1159	.120
	20.00	.0405	.CO4C	•0039	.0417	•045
	30.00	-C186	.0039	.0038	•0196	•023
	40.00	.0113	•0039	.0039	.0123	.016
	56.60	•UL89 0079	+6043	•0030	-0099	•015
	70.00	.0070	.0042	•0034	.0090	•012
	80.00	-0072	.0043	-0035	0000	.012
						••••
DATA SET	NUMBER	5	6	7	8	CCMPUTED
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C-00					
	10.00	.1139	•C042	.0041	.1151	•119
	20.00	.0442	•CO41	.0039	•0476	-050
	30.00	.0185	.0042	•0039	.0210	-024
	40.00	.0113	.0043	.0038	-0129	•016
	20.00	.0090	.0043	.0037	•0102	.014
	70 00	+UUUI 0074	•UU43 CO45	.0037	•0092	.013
	80.00	-0017	.0045	.0037	-UU00 0000	•012
			AUV7U	****		•V12

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AC1C44-C03

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TITIF C.D. PAINT USED ON MAZ-200 7 TON TRUCK, 2 COATS APPLIED ON 2 COATS OF ZINC CHROMATE PRIMER ON ANODIZED ALUMINUM. SAMPLE PREPARED AT U. CF M. SUBJECT CODES AEMB ECBBI CATA SET NUMBERS 9, 10, 11, 12, 13, 14, 15, 16 PARAMETER INFORMATION SOURCE= DKI GAMMA(0) = .90INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(I) = 20.0CPHI(I)=180.00 WAVELENGTH= .633 DATA SET NUMBER ς 10 11 12 COMPUTED THETA(R) RDF(LL) RDF(PL) RDF(LP) RDF(PP) PHI(R) RDF(OT) (CEG) (1/SR)(1/SR) (1/SR)(1/SR)z 0 (1/SR) .0039 C.CO .C447 .C04C .0483 .050 .1091 .0042 .1276 10.00 .CO41 .122 2C.CO .2076 .1565 .0043 .0041 .186 30.00 .0987 .C043 .0040 .1559 .131 40.00 .0366 .CO44 .0041 .0732 .059 50.00 .0155 .C046 .0041 .0354 .030 60.00 .0096 .C044 .0039 .0215 .C20 70.00 .CC77 .0046 .0037 .0179 .017 80.00 .CC70 .CO44 .0034 .0192. .017 DATA SET NUMBER 13 14 COMPUTED 15 16 RCF(PL) PHI(R) RDF(LL) THETA(R) RDF(LP) RDF(PP) RDF(OT) =180.0 (CEG) (1/SR)(1/SR)(1/SR) (1/SR)(1/SR).0039 C.CO .0447 .CO40 .0483 .050 10.00 .0190 .CO44 .0042 .0186 .023 20.00 30.00 .0105 .0041 .0041 .0098 .014 46.00 .C042 .0092 .0040 .0085 .013 50.00 .0083 .0043 .0037 .0079 .012 60.00 .CC82 .0044 .0037 .0074 .012 70.00 .0079 .0044 .0070 .0033 .011 80.00 .0077 .0039 .0033

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AC1C44-C03					
TITLE					
C.D. PAINT	USED CN M	Z-200 7 TO	IN TRUCK, 2	2 CUATS AP	PLIEC
CN 2 COATS	OF ZINC CI	RCMATE PR	IMER ON ANG	CIZED ALU	MINUM.
SAMPLE PRE	PARED AT U.	. CF M.			
SUBJECT CODES					
AEMB ECB	B I				
CATA SET NURBE	RS			,	
17, 18, 1	9, 20, 21,	22, 23, 24	•		
PARAPETER INFO	RMATICN				
SOURCE= D	KI GAMM	A(O)=_9C	INSTRUMEN	TATICN= CL	Α
ACCURACY=	FIVE PERCEN	NT NUMBER	R CF RUNS /	VERAGEC=	1
THETA(I)=	40.CC PH	[(])=180.00	WAVELEI	GTh= .63	3
NATA CET NHMAED	13	19	10	20	CONDUTED
BUT/D) TUETA/D)	PUE (11)	10	57 575(10)	20 005/001	
+ 0 (PEC)	(1/CD)	(1/CD)	NUF(LF) /1/00)	11/501	()/(D)
- 0 (228)	(1/28)	(1/38)	(1/38/	(1/36)	(1/38/
C - 09	•C111	.0039	.0041	.0123	.016
10.00	. C169	.0041	.0040	.0249	.025
20.00	.0370	. CO41	.0042	.0771	.061
30.00	.0857	·C045	.0045	.2630	.179
46.00	.1084	.0049	.0048	•5032	.311
50.00	.0531	.049	0005ء	.4465	.252
60.00	. C159	•C049	.0046	.2407	.133
76.00	.0079	.0049	.0044	.1298	.074
80.00	.0C91	.0049	.0044	.1170	•068
DATA SET NUMBER	21	22	23	24	CCMPUTED
PHI(R) THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
=180.0 (CEG)	(1/3R)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
c . ca	•••••	6036	6041		A1 (
	•0111	•0039	.0041	+0123	+010
	.0693	•0039	•0041	•0090	•015
20.00	+0692	•0040	•0040	+0084	•015
	•UIUI	•6043	•0044	+00AT	•014
70.00	0000	C	0040	0093	012
26 • UU	•UUYY 6004	+UU94 0047	3U42	•0005	•013
	-0099	+6047	5CUU.	•0071	+012
10+00 80 AA	•ULC/	+0070	+4033	500/I	•012
Gų s UU		•••••	•4233	•0005	• • • • • •

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AC1C44-C03

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TITLE C.D. PAINT USED ON PAZ-200 7 TON TRUCK, 2 COATS APPLIED CN 2 COATS OF ZINC CHRCHATE PRIMER ON ANCOIZED ALUPINUP. SAMPLE PREPARED AT U. CF M. SURJECT CODES AENB · ECBBI CATA SET NUPBERS 25, 26, 27, 28, 29, 30, 31, 32 PARAMETER INFORMATICN SOURCE= DKI GAMPA(C) = .SCINSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGED= 1 THETA(I) = 50.00PHI(I)=180.00 WAVELENGTH= .633 DATA SET NUMBER 25 26 27 28 COMPUTED RDF(LP) RDF(PP) PHI(R) THETA(R) RCF(LL) RCF(PL) RDF(OT) (1/5R) (1/SR) (1/SR)0 (DEG) (1/SR)(1/SR). .0040 .0100 C.00 .0085 .0041 .013 10.00 .0102 .0039 .0042 .0150 .017 20.00 .C135 .0044 .0356 .029 .0041 30.00 , .1286 .0301 .0046 .0045 .084 .0536 40.00 .0049 :C05C .4691 .266 50.00 .0442 .0060 .0053 1.005 .530 .9560 66.00 .0073 .0118 .0054 .490 70.00 .0050 .6029 .0123 .0067 .313 .0041 80.00 .0333 .0056 .4739 .258 DATA SET NUMBER COMPUTED 29 30 31 32 RDF(PL) RDF(LP) PHI(R) RDF(PP) THETA(R) RCF(LL) RDF(OT) =180.0 (1/SR)(1/SR)(1/SR)(1/SR)(CEG) (1/SR).0085 .040 .013 C.GC .0041 .0100 10.00 .0085 .0038 .0082 .012 .0041 .0038 .0043 20.00 .0087 .0078 .012 .0089 .0042 30.00 .0039 .0077 .012 .0103 .0045 40.00 .C044 .0086 .014 50.00 .0047 .0084 .0106 .0042 .014 60.00 70.00 .0096 .0045 .0038 .0073 .013 .0034 80.00 .0090 .0047 .0066 .012

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A01C44-00	33					
TITI	_E					
	C.D. PAINT	USED CN MA	Z-2C0 7 TC	N TRUCK, 2	CGATS AP	PLIEC
	CN 2 COATS	OF ZINC CH	RCMATE PRI	MER ON AND	CIZED ALU	MINUM
	SAMPLE PRE	PAREC AT L.	CF M.			
SUB.	JECT CODES					
	AEMB ECBI	81				
EAT	A SET NUMBER	RS				
	33, 34, 3	5, 36, 37,	38, 35, 40			
PAR	APETER INFU	KMAIILN Ai oamma	$(\alpha) = \alpha \alpha$	1. CT01 MCA		•
	SUURCE= U	CI GAMPA Etve Dedeel	(U)=.9C	INSIRUMENI	ATILN= LL	А 1
	AUCIKALIS I	FIVE PERLEN	I NUPDER	LE KUNS A	VEKAGEL= .ctl=	1
	INCIALI/# ((1)=100+00	WAVELER	61F= •03	2
DATA SET	NUMBER	22	34	25	36	COMPUTED
PHI(R)	THETA(R)	REFUL	REFIPIN	RDELLP	ROF(PP)	ROF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
•						!
	C.CO	•CC78	.0038	.0041	.0088	.012
	10.00	.0083	.0038	.0043	.0119	.014
	20.00	.0095	.040	.C045	•C214	•020
``	-30.00	.0118	•C042	•0046	.0593	.040
N .	46.00	•C154	.0046	•0049	.2503	.138
	5C.CO	.0112	.0060	.0058	1.029	•526
	60.00	.0244	. C084	.0067	2.526	1.283
	76.00	.1501	-C1CC	.0071	2.913	1.540
	80.00	•3329	.C085	•0060	2.412	1.380
DATA SET	NUMBER ;	37	38	39	40	CCMPUTED
PHI(R)	THETALRY	RCF(LL)	RCF(PL)	RCF(LP)	RCF(PP)	RDF(OT)
=180.0	(DES)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	c_00'	-0078	-0038	.0041	-0088	-012
	10.00 /	.0078	.037	.0041	.079	.012
ţ	26.00	.0082	.036	.0043	.0072	.012
	30.00	.0088	.037	.0043	.0071	.012
*	40.00	.0093	.0039	.0044	.0075	.013
	50.00	.0111	.CO44	.0047	.0085	.014
	60.00					
	76.00	.0116	.047	:0044	.0086	.015
	80.00	.0113	.0051	•C044	.0087	.015

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AC1C44-C0	03					
TITI	LE					
	C.D. PAINT	USED CN M	Z-200 7 TC	N TRUCK .	2 CCATS AP	PLIEC
	CN 2 COATS	OF ZINC C	HRCMATE PRI	MER ON AN	CDIZED ALU	p Inup.
·	SAMPLE PREI	PAREC AT L	. CF 7.			
SUB	SECT CCDES					
	AEMB ECBI	31				
CAT	A SET NUMBER	RS				
	41, 42, 43	3, 44, 45,	46, 47, 48			
PAR	APETER INFO	RMATICN				
	SOURCE= DI	CI GAMM	A(O)=.9C	INSTRUMEN	TATICN= CL	A
	ACCURACY= 1	FIVE PERCE	NT NUMBER	CF RUNS	AVERAGED=	1
	THETA(I)=	70.CC PH	I(I)=18C.CO	WAVELE	NGTH= .62	2
DATA SET	NUMBER	41	42	43	44	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(DEG)	{1/SR}	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	c.co	.CC71	•C036	.0042	.0084	.012
	10.00	.0073	.0035	.0042	.0107	.013
	20.00	.0075	.C037	.0044	.0168	.016
	30.00	.0078	·C037	.0046	.0374	.027
	40.00	.0078	.C042	.0049	.1309	.074
	5C.00	.0129	-C053	.0053	.6307	.327
	60.00	.1618	.0098	.0073	3.233	1.706
	76.00	1.198	.C182	.0110	9.175	5.201
	8C.Q0	3.475	.C249	.0147	12.929	8.222
Data set		45	4.4	47	49	CONDUTED
DUTA SET	THETAIDY	27 27	0F 6 (D1)	205/101	90	
-180 D	10618(8/	(1/09)	KUF(FL) (1/59)	NUTILT/ (1/CD)	11/501	(1/20)
-100.00	10007	11/38/	11/34/	(1/36)	(1/5K)	(1) 3K)
	C.CO	.0071	.036	.0042	-C084	.012
	10.00	•UG72	•C034	.0041	.0072	.011
	20.00	.0076	•C035	.0041	.0068	.011
	30.00	.0083	.0036	.0043	.0066	.011
	40.00	.0091	.0036	.0044	.0068	-012
	50.00	.0098	.039	•0045	.0072	.013
	60.00	.0120	-0047	•0050	.0087	.015
	70.00				_	-
	80.00	.0124	.0057	.0037	.0144	.018

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AC1047-0	03					
TIT	F					
• • •	2 CCATS 529	A C.C. PAT	NT CN 2 CC	ATS ZINC C	HRCMATE.	WET CECKED
	CN ANODIZED	ALLPINUN	SAPPLE PR	EPAREC AT	L. CF M.	
SUB	JECT CODES		#**** Uu ••		•••••	
	AEMB ECBB	T				
CAT	A SET NUMBER	S		*		
	1, 2, 3	, 4, 5,	6, 7, 8	!		
·PAR	APETER INFOR	MATICN				
	SOURCE= DK	I GAMMA	(0) = .90	INSTRUMENT	ATICN= CL	2
	ACCURACY= F	IVE PERCEN	T NUMBER	CF RUNS A	VERAGED=	1
	THETA(I)=	C PHI	(I)= 0) WAVELEN	GTH= .63	3
DATA CET	AUNOES	1	2	2		,
DATA SET	THETAIDY	4	2 005(01)	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	4	
= 0	(CEC)	(1/50)	(1/50)	(1/50)	11/501	(1/50)
- 0	106	11/38/	111941	121341	11/36/	(1/30)
	C.CO					
	10.00	.0447	.C025	.0024	.0480	.049
	20.00	.0312	.0023	.0022	.0352	.036
	30.00	-0216	.0021	.0022	.0272	.027
	40.00	.0142	.0025	.0021	.0201	.019
	50.00	.0106	. C025	.0023	.0155	.015
·	60.00	.0081	.0026	•C021	.0131	.013
	70.00	.0067	.0029	.0020	.0122	.012
	80.00	.0065	· C026	.0026	.0132	.012
	NUMBER	K,	6	7	8	COMPLITED
PHI(R)	THETA(R)	REFILL	RCF(PL)	RDF(1P)	RCF(PP)	RCF(CT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	•					
	C.GG					
	10.00	•C445	. C025	.0024	•0473	.048
	20.00	.0337	•C024	.0022	•0373	•038
	30.00	.0232	.C024	.0024	·C275	•028
	40.00	-C156	•CC25	-0022	•C2C2	.020
	50.00	.011C	.CC25	.0023	.0152	.015
	50.00	8830.	.0026	.0023	-0129	.013
	70.00	.0072	.027	.0026	<u>0119</u>	.012
	8C.CO	.CC69	.CC26	.0016	.0137	-012

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AC1047-003

TITLE 2 CCATS 529A G.C. PAINT ON 2 CCATS ZINC CHRCHAVE, WET DECKED CN ANODIZED ALUPINUP, SAPPLE PREPARED AT U. CF M. SUBJECT CODES ECBBI A EMB CATA SET NUPBERS 9, 10, 11, 12, 13, 14, 15, 16 PARAPETER INFORMATION SOURCE= OKI GAMMA(0)=.SC INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(I)= 20.GC.633 PHI(I)=180.00 WAVELENGTH= DATA SET NUMBER 10 S 11 COMPUTED 12 RDF(LL) PHI(R) THETA(R) RCF(PL) RDF(LP) ROF(PP) RDF(OT) 0 (CEG) (1/SR)(1/SR) (1/SR)(1/SR) (1/SR).C023 .0321 .0022 .036 C.00 .0356 .04C3 .C026 10.00 .0021 .0548 .050 .0021 20.00 .0422 .0023 .0654 .056 .0022 .0693 30.00 .0392 .C024 .057 40.00 .0275 .0024 .0023 .0626 .047 50.00 .0181 .0027 .0532 .0023 .038 60.00 .0115 .C027 .0024 .0445 .031 .0080 .0030 .0023 70.00 .0420 .028 80.00 .0057 .0025 .0024 .0469 .029 DATA SET NUMBER 13 14 15 16 COMPUTED RDF(LL) PHI(R) THETA(R) RCF(PL) RDF(LP) RDF(PP) RCF(OT) =180.0 (CEG) (1/SR)(1/SR) (1/SR)(1/SR)(1/SR)C.CO .CC23 .036 .C321 .0022 .0356 10.00 -C242 .C025 .0023 .0240 .026 20.00 30.00 .0127 .0027 .0025 .0126 .015 .0096 40.00 .C026 .0098 .0024 .012 50.00 .0024 .0082 .0026 .0081 .011 60.00 .0072 .0024 .0026 .0073 .010 76.00 .0067 .0025 .0020 .0068 .009 80.00 .0065 .0023 .0024 .0070 .009

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TITLE 2 CCATS 529A C.C. PAINT EN 2 CCATS ZINC CHREMATE, WET CECKED IN ANCOIZED ALUPINUP, SAMPLE PREPARED AT U. CF M. SUBJECT CCDES AEMB ECBBI CATA SET NUPBERS 17, 18, 19, 20, 21, 22, 23, 24 PARAMETER INFORMATION INSTRUMENTATION= CLA GAMMA(0) = .9CSOURCE= DKI NUMBER OF RUNS AVERAGED= 1 ACCURACY= FIVE PERCENT WAVELENGTH= PHI(I)=18C.00 .633 THETA(I) = 40.CC19 20 CCMPUTED 18 DATA SET NUMBER 17 RCF(PP) RCF(OT) RCF(PL) RDF(LP) RDF(LL) THETA(R) PHI(R) (1/SR)(1/SR)(1/SR) (1/SR) (1/SR)(CEG) = 0 .019 .0023 .0020 .0188 C.CO .0140 .029 .CC24 .0022 .0328 10.00 .C2C2 .0023 .0592 .045 .C267 .C025 20.00 .1043 .0320 .0025 .071 .022 30.00 .0030 .1585 .098 .0310 .0025 40.00 .C031 .2078 .118 .0026 50.00 .0225 .121 .0031 .C026 .2249 .0114 66.00 .125 .0028 .2384 70.00 **.**CC58 .C034 .144 86.00 .0031 .2734 .0087 .C032 CCMPUTED 24 23 21 22 DATA SET NUMBER RDF(LP) RCF(PP) RCF(OT) RCF(LL) RCF(PL) PHI(R) THETA(R) (1/SR)(1/SR)(1/SR) (1/SR) (1/SR) =180.0 (CEG) .019 .C188 C.CC .0140 .CC23 .0020 .014 .0126 10.00 .0112 .0024 .0022 .0096 .012 .0093 .C024 .0022 20.00 .0086 .011 .0024 .0092 .CC27 30.00 40.00 .C077 .011 .0085 .0026 .0028 50.00 .010 .0067 .0025 .0081 .0026 60.00 .0064 .010 .C025 .0075 70.00 .CC29 .009 .0061 .0018 80.00 .0070 .0031

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AC1C47-C03 TITLE 2 CEATS 529A C.C. PAINT CN 2 CEATS ZINC CHREPATE, WET DECKED CN ANODIZED ALUPINUP, SAPPLE PREPARED AT U. CF P. SUBJECT CODES EC881 AEMB CATA SET NUPBERS 25, 26, 27, 28, 29, 30, 31, 32 PARAMETER INFORMATION SOURCE= DKI GAMPA(0)=.9C INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(I) = 50.CCPHI(I)=180.00 WAVELENGTH* .633 DATA SET NUMBER 25 26 27 28 CCMPUTED PHI(R) RDF(PP) THETA(R) RCF(LL) RCF(PL) RDF(LP) RDF(OT) 0 (CEG) (1/SR) (1/SR) (1/SR) (1/SR)(1/SR) C.CO .0105 3C024 .0021 .015 .0146 10.00 .C131 .0024 .0022 .0253 .022 20.00 .0177 .C026 .0024 .036 .0497 .0024 30.00 .0202 .0027 .0991 .062 40.00 .0216 .C032 .0028 .1960 .112 .0141 .0029 50.00 .0034 .3319 .176 .0037 60.00 .0061 .0030 .249 .4854 70.00 .0111 .0043 .0034 .6132 .316 80.00 .397 .0422 .CO4C .0032 .7442 DATA SET NUMBER 30 COMPUTED 29 31 32 PHI(R) THETA(R) RDF(LL) ROF(PL) RDF(LP) RDF(PP) RDF(OT) =180.0 (CEG) (1/SR)(1/SR) (1/SR)(1/SR)(1/SR) C.CC .0105 .0024 .0021 .0146 .015 10.00 .098 .011 .0085 .0021 .0022 20.00 .0081 .0078 .023 .0023 .010 30.00 .010 .0077 .C025 .0024 .0074 40.00 .0086 .0027 .0026 .0077 .011 50.00 60.00 .0076 .011 .0090 .003C .0026 70.00 .0084 .C028 .0027 .010 .0069 80.00 .0080 .0031 .0024 .0072 .010

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AC1C47-0	203					×
TI	ILE					
	2 CCATS 52	9A C.C. PAI	INT EN 2 CO	ATS ZINC C	CHRCMATE,	WET DECKED
	CN ANODIZE	D ALLVINUM	SAMPLE PR	REPARED AT	U. CF M.	
SUE	BJECT CODES		-			
	AEMB ECB	81				
CAT	TA SET NUPBE	RS				
	33, 34, 3	5, 36, 37,	38, 35, 40			
PAF	RAPETER INFO	RMATICN				
	SOURCE= D	KI GAPP/	(0)=.90	INSTRUMENT	TATION= CL	_ A
	ACCURACY=	FIVE PERCEN	NT NUMBER	R CF RUNS A	VERAGEC=	1
	THETA(I)=	60.CC PH	$((I) = 18C \cdot C($) WAVELE	GTH= .63	33
DATA SET	I NUMBER	33	34	35	36	CCMPUTEC
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= C	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	c.co	.0079	•C023	• ũ 022	.0124	.012
	16.00	. CC98	.0023	•C024	.0214	.018
	20.00	.C111	.0026	.0025	.0431	.030
	30.00	-0124	•C028	.0027	.0931	.056
	46.00	. C1C3	.0030	.0030	.2038	.110
	50.00	.0064	.0036	.0031	.4579	.236
	60.CC	.0140	•C044	.0034	.9055	.464
	°C.00	.0747	•C048	.0038	1.484	.784
	80.00	.2572	•0056	•0043	2.102	1.185
DATA SE	T NUMBER	37	38	39	40	CCMPUTED
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
=180.0	(CEG)	(1/SR)	(1/57)	(1/SR)	(1/SR)	(1/SR)
	C • CC	.0079	•C023	.C022	.0124	.012
	10.00	.0C74	·C023	.0023	.0087	.010
	20.00	.0069	•C023	.0023	.0072	•009
	30.00	. C070	•C024	.0024	.0066	•009
	40.00	.0076	.0025	.0025	.0065	.010
	50.00	•CC90	•CC3C	.0029	•0080	.011
	60.00					
	70.00	.0101	.C034	•C032	•0085	.013
	80.00	.0103	.C035	.0033	.0085	.013

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	AC1C47-CO3					
	TITLE 2 CCATS CN ANOD SUBJECT COD AEMB CATA SET NU 41, 42 PARAMETER I SOURCE=	529A C.C. IZED ALUFIN ES ECBBI PBERS 43, 44, 4 NFORMATION DKI GA	PAINT EN 2 C UP, SAMPLE F 5, 46, 47, 4	CATS ZINC Prepared At	CHRCHATE, U. CF M.	WET CECKED
	ACCURAC	Y= FIVE PERC	ENT NUMBE	R CF RUNS	AVERAGED=	1
	IHE IA (I)= 70.CC	PHI(I)=18C.0	O HAVELE	NGTH= .6	33
	DATA SET NUMBER PHI(R) THETA(= 0 (CEG)	41 R) RDF(LL) (1/SR)	42 RCF(PL) (1/SR)	43 RCF(LP) (1/SR)	44 RCF(PP) (1/SR)	COMPUTED RDF(0Y) (1/SR)
ŗ	C.CO 1C.OO 2C.OO	.0C67 .0C73 .0075	•0022 •0024 •0026	•0023 •0024 •0025	.0118	.012 .016
Ο	3C.00 4C.00 5C.CO	.0066 .0C52 .0117	•C025 •C031 •C036	•0025 •0029 •0031	.0357 .2163 .5459	.020 .049 .114 .282
	80.00 70.00 80.00	.0713 .4014 1.414	.C048 .C071 .C095	•0036 •0054 •0072	1.364 3.265 6.211	•722 1•839 3•821
	DATA SÉT NUMBER	45	46	47	48	COMPUTED
	=180.0 (CEG)	() RCF(LL) (1/SR)	RDF(PL) (1/SR)	RDF(LP) (1/SR)	RCF(PP) (1/SR)	RDF(OT) (1/SR)
	C.CO 1C.CC	.CC67	• • • • • • • • • • • • • • • • • • • •	•0023	.0118	-012
	2C.00 3C.00	•0C64	•C022 •C023	•0024 •0025	•0084 •0068 •0061	-010 -009
	4C.00 5C.00 6C.00	-0073 -0C82 -01C0	•0024 •0030 •0032	•0025 •0029	.0062	•009 •011
	7C.00 8C.00	-0148	•0046	.0038	.0137	•013 •018

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TIT	LE					
	C.D. PAINT	ED STEEL PA	ATE, 7-3/4	IN. SC.,	TAKEN FRO	MAL.S.
	18 TCN M 4A	HIGH SPEED	TRACTCR.			
SUB	JECT CODES					
	AEMB ECBI	BI				
CAT	A SET NUPBE	RS				
	1, 2,	3, 4, 5,	6, 7, 8	3		
PAR	AMETER INFO	RMATICN				
	SOURCE= D	KH GAPP/	×(0)=	INSTRUMENT	TATICN= CL	A
	ACCURACY=	FIVE PERCE	NT NUMBER	R CF RUNS /	VERAGEC=	1
	THETA(I)=	C PH	[(I)= () WAVELEN	GTH= .63	3
		٩				
DATA SET	NUMBER	1	2	3	4	COMPUTED
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RE-(LP)	RCF(PP)	RCF(OT)
≖ C	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	0.00					
	10.00	.025	.008	.008	.025	.033
	20.00	. 6 2 2	.008	.007	.024	.031
	30.00	.021	.008	.008	.024	.031
	40.00	-020	.009	.008	.024	.031
	50.00	.019	.009	.009	.026	.032
	60.00	.018	-010	.010	-028	.033
	70.00	.618	.011	-011	-030	.035
	80.00	-010	.012	.012	.033	.038
DATA SET	NUMBER	5	6	7	8	CCMPUTEC
PHI(R)	THETA(R)	RCF(11)	RDF(PL)	RCF(LP)	RCF(PP)	RCF(OT)
=100.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.00					
	10.00	•C26	830.	.008	.026	.034
	20.00	•C24	.008	.008	.025	.033
	30.00	•C22	800.	.008	.025	.032
	40.00	•C21	.009	.009	.025	.032
	50.00	.019	.009	.009	.026	.032
	60.00.	.019	.010	.010	.029	.034
	70.00	.019	.011	.011	.031	.036
	80.00	.019	.012	.012	.033	.038

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یر ۱۹ ۱۹۹۹ میل ۱۹۹۹ میل ۱۹۹۹ میلوند ا AC1509-CO1 TITLE C.D. PAINTED STEEL PLATE, 7-3/4 IN. SQ., TAKEN FROM A U.S. 18 TCN M4A HIGH SPEED TRACTCR. SUBJECT CCDES AEMB **ECBBI** CATA SET NUPBERS 9, 10, 11, 12, 13, 14, 15, 16 PARAMETER INFORMATICN INSTRUMENTATION= CLA SOURCE= DKH GAMMA(C) =ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(I) = 45.CCPHI(I)=18C.CO hAVELENGTH= .633 DATA SET NUMBER S 10 CCMPUTEC 11 12 PHI(R) THETA(R) RCF(LL) RCF(PL) RDF(LP) RCF(PP) RDF(OT) (1/SR) 0 (DEG) (1/SR) (1/SR) (1/SR) (1/\$R) = .009 .009 .026 5.00 .C19 .032 .010 .030 15.00 .019 .009 .034 .010 .010 25.00 .C18 .036 .037 35.00 .C18 .011 .011 .044 .042 45.00 .019 .013 .012 .055 .050 55.00 .C22 .013 .013 .068 .058 65.00 °C27 .015 .015 .084 .071 75.00 .038 .016 .017 .108 .090 85.00 .C58 .019 .019 .141 .119 DATA SET NUMBER 13 15 COMPUTED 14 16 RCF(PL) PHI(R) THETA(R) RDF(LL) RDF(LP) RDF(PP) RDF(OT) (1/SR) =180.0 (1/SR)(1/SR)(1/SR) (1/SR) (DEG) .009 .024 . 5.00 .C20 .008 .031 15.00 .022 .009 .008 .023 .031 25.00 .C23 .009 .008 .024 .032 35.00 .C27 .010 .009 .026 .036 45.GC 55.00 .C30 .011 .011 .029 .041 .011 65.00 .C29 .011 .029 .040 .013 .013 75.00 .030 .030 .043 85.00 .C29 .014 .014 .029 .043

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TIT	LE		1			
-	MERICN BLUE	E GRASS SCD	FRESHLY	CBTAINED, 3	B IN. GRAS	S BLADES.
	SANCY LCAM	SOIL NOT V	ISIBLE	•		-
SUB	JECT CODES					
	egc⊭					
CAT.	A SET NUPBER	RS				
	1, 2,	3, 4, 5.	6, 7,	8		
PAR	AMETER INFOR	RMATICN				
	SOURCE= D	CI GAMMA	(0)=.90	INSTRUMENT	TATION= CL	A 1
	ACCURACY= 1	FIVE PERCEN	IT NUPBE	R CF RUNS /	VERAGED=	1 *
	THETA(I)=	C PHI	(1)=	Ó WAVELEN	iGTH= .63	3
	۲					
DATA SET	NUMBER	1	2	3	4	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
≖ 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	,					
	C.00					
	10.00	.0068	.004/	.0038	-500-	.012
	20.00	.0050	-0052	.0035	.0089	-012
	30.00	.6033	.0052	.0035	.0090	.011
	40.00	.0050	.0000	.0035	-0085	.011
	>0.00	.0046	•0051	.0034	.0090	.011
	6C.CU 70.00	.0042	.0047	.0031	-6034	010
	70.00	.0039	.0042	.0031	.0071	-009
	BLaUU ,	*0632	+6027	+0045	-0097	•013
DATA SET	NUMBER	5	6	7	*	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LF)	ROF(PP)	RDF(OT)
=180_0	(CEG)	(1/SR)	i1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CC					
	10.00	.0071	.0043	.0042	.0075	.012
	20.00	.0661	.0037	.0037	.0065	.010
	30.00	.0051	.003C	.0034	.0052	.008
	40.90	.0048	.0023	.0033	.0039	.007
	50.00	.OC51	.0024	.0035	.0043	.008
	60.00	.0045	.0027	.0033	.0043	.007
	70.00	.0647	.C025	.0036	.0042	, .007
	80-00	.0050	.0028	-0039	.0051	.000

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AC1327-CO	1					
TITL	.6			_		
	MERICN BLUE	GRASS SCD	FRESHLY C	BTAINEC, 3	IN. GRAS	S ELAUES,
	SANCY LCAM	SCIL NCT Y	ISIELE			
SUBJ	IECT CODES					
	BGCM					
CATS	SET NUPBER	S				
	9, 10, 11	, 12, 13,	14, 15, 16)		
PARA	WETER INFOR	MATICN				
	SOURCE= DK	I GAPPA	(0) = .90	INSTRUMENT	ATICN= CL	A
	ACCURACY= F	IVE PERCEN	T NUMBER	CF RUNS A	VERAGEC=	1
	THETA(I) = 2	0.00 PHI	(I) = 180.00) WAVELEN	GTH= .63	3
DATA SET	NUMBER	ς	10	11	12	CCMPUTEC
DU1/91	THETA(R)	RDF(LL)	RDF(PL)	RCF(LP)	RCF(PP)	RCF(OT)
= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	c 00	. 6657	-048	.0035	.0083	.011
		.0041	.0045	.0028	.0075	.009
	20.00	.6632	.0041	.0024	.0068	•008
	20.00	-0028	.039	-0022	.0065	.008
	40.00	.0025	-0036	.0019	.0059	.007
	40.00 50 00	-0638	-0025	.031	.C036	.006
	50.00 40 00	-0039	.0024	.0030	.0035	.006
		-0036	.024	.0027	.0036	.006
		-0048	.027	.0034	.0040	.007
	64.00		••••			
DATA SET	AUMRER	13	14	15	16	CCMPUTED
	THEIA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
=180.G	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
		0057	6049	0035	-0083	.011
	C.C0	.0057	0040	0030	.0092	.013
	10.00	.0072	*****	.0037		
	20.00	0000	5057	0050	.0107	.015
	30.00	.0092	00071 0050	0058	.0092	.015
	40.00	.0102	-0090 CARE	.0064	.0104	.017
	50.00	•0112	-0055 CO47	.0071	-0132	.020
	60.00	.0120	• UVC F	.0080	.0164	.023
	76.00	.0133	•UUIC	0100	.0282	.035
	86.00	•U1//	•4753	60407		

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TITL	.6		•			
	FERICN ELU	E GRASS SCD	FRESHLY C	BTAINED, 3	IN. GRAS	S BLADES,
	SANDY LCAM	SOIL NCT V	ISIBLE	-		
SUB.	JECT CODES					
	BGCM					
CAT	A SET NUPBE	RS				
	17, 18, 1	9, 20, 21,	22, 23, 24			
PAR	AMETER INFO	RMATICN				
	SOURCE= D	KI GAPPA	(0)=.90	INSTRUMENT	ATICN= CL	A
	ACCURACY=	FIVE PERCEN	T NUFBER	CF RUNS	VERAGED#	1
	THETA(I)=	40.CC PH1	(I)=18C.CO	HAVELEI	iGTH= .63	3
				ŧ.		
DATA SET	NUMBER	17	18	19	20	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
			*			
	C•00	.0046	.0032	.0033	.0055	.008
	10.00	.0036	•C026	.0027	.0042	.007
	20.00	•CC25	.C021	.0021	.0033	.005
	30.00	-0019	.0025	.0016	.0035	.005
	40.00	.0017	•C022	.0014	.0031	.004
	50.00	.0017	•C023	.0014	.0031	.004
	60.00	.0021	•C026	.0016	.0039	.005
	70.00	.0023	.0028	.0017	.0044	.005
	86.00	.0029	.0029	°0050	.0045	.000
DATA SET	NUMBER	21	22	23	24	COMPUTED
PHICRS	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C-00	.0046	.032	.0033	.0055	.008
	10.00	°0C28	. C036	.0036	-0066	-010
	20.00	.0074	•CO41	.0044	.0073	.012
	30.00	.0101	•0049	.0051	.0094	.015
	40.00					
	50.00	.0141	-0082	.0068	.0176	•023
	60.00	.0139	.0075	.0068	<u> </u>	.022
	70.00	.0130	•0083	.0067	.0179	.023
	80.00	.0126	.0094	.0069	.0200	.024

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AC1327-CO	1					
TITL	.£					
	MERICN BLUE	GRASS SCD	FRESHLY C	BTAINED, 3	IN. GRAS	S ELACES,
	SANDY LEAM	SULL NOT V	ISIELE			
SUBJ	IECT CODES					
	EGCM					
CATA	SET NUPBER	S				
	25, 26, 27	, 28, 29,	30, 31, 32			
PARA	WETER INFOR	MATICN				
	SOURCE= DK	I GAMPA	(0) = .90	INSTRUMENT	ATIEN= CL	A
	ACCURACY= F	IVE PERCEN	T NUMBER	CF RUNS A	VERAGEC=	1
	THETA(1)= 5	i0.CC PHI	(I) = 18C.CC	HAVELEN	GT+= .63	3
					20	CONDUTES
DATA SET	NUMBER	25	26	27	28	
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	KUT(PP)	KUP (UT)
= O	(DEG)	(1/SR)	(1/SR)	(1/28)	(1/24)	(1/28)
			0005	0027	C042	066
	C.CC	.0036	.025	•0021	.0042	.005
	10.00	.0029	.0020	.0022	•0036	005
	20.00	.0021	.0025	.0017	.0037	.004
	30.00	-0016	.0018	.0014	°0024	.004
	40.00	.0017	.0010	0013		.003
	50.00	.0015	.0017	.0011	•9927	.004
	60.00	.0015	.020	.0010	-0030	-005
	70.00	.0023	•0022	-0010	2260	.011
	80.00	•0054	°CU45	.0052	•6673	~VII
DATA SET		26	30	31	32	CCMPUTED
DATA SET	THETAIRS	REF(11)	RCF(PL)	RCF(LP)	RCF(PP)	RDF(OT)
-190 0	16661	(1/58)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
-100.0	(0107					
	0.00	.0036	.C025	.0027	•C042	.006
	10.00	.C042	.0028	.0028	.0046	.007
	20.00	.0057	.036	.0037	.0059	.009
	30.00	.0026	.C046	.0047	.0081	°013
	40.00	.0101	.0058	.0052	.C114	.016
	50.00					
	66.00	.0128	•C079	.0064	.0162	.022
	76.00	.0145	. C08C	.0078	.0155	-023
	80.00	.0193	. C086	.0109	.0157	•027

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AC1327-CO1 TITLE PERICN BLUE GRASS SCC FRESHLY CBTAINED, 3 IN. GRASS BLADES, SANCY LCAM SOIL NOT VISIBLE SUBJECT CODES RGCN CATA SET NUPBERS 33, 34, 35, 36, 37, 38, 39, 40 PARAPETER INFORMATICA SOURCE= DKI GAMPA(0)=.90 INSTRUMENTATION= CLA ACCLEACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(1)= 60.00 PHI(I)=180.00 WAVELENGTH= .633 DATA SET NUMBER 35 CCMPUTED 33 34 36 RDF(OT) PHI(R) THETA(R) RCF(LL) RDF(PL) 9DF(LP) RDF(PP) 0 (DEG) (1/SR)(1/SR) (1/SR) (1/SR) (1/SR) C.CC .0016 .C021 .0012 .0030 .004 .0013 .0029 10.00 .0C18 .C020 .004 .0020 20.00 .0C17 .0014 .0012 .003 .0012 .0009 30 - 00 .0012 .0018 .003 .0011 .0008 .002 40.00 .0011 .0018 .0010 50.00 .C011 .0008 .0017 .002 60.00 .0010 .0015 .0007 .0022 .003 70.00 .0C4C .0039 .0024 .0070 .009 80.00 .0046 «C045 .0026 .0092 .010 DATA SET NUMBER 40 COMPUTED 37 38 39 PHIERS THETA(R) ROF(LL) RCF(PL) RDF(LP) ROF(PP) RDF(OT) =180.0 (026) (1/SR) (1/SR) (1/SR)(1/SR) (1/SR) C.00 .CC16 .021 .0012 .0030 .004 10.00 .CC26 .C023 .0019 .0035 .005 20.00 .0034 .0028 .0023 .0046 .007 36.00 .0064 .0038 .0045 .011 .0077 40.00 .0059 .0047 .015 .0088 .0106 50.00 .0121 .0069 .0058 .0129 .019 60.00 .03C2 .0126 .0230 70.00 e0124 .039 .0207 .0323 80.00 .0173 .0471 .059

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AC1327-C	01					
111	LE					
	FERICN BLU	E GRASS SCI	C FRESHL'S C	BTAINED.	3 IN. GRAS	S BLACES.
	SANCY LCAM	SOIL NCT	VISIELE			• •••••
SUB.	JECT CODES					
	BGCM					
CAT	A SET NUFBER	RS				
	41, 42, 43	3, 44, 45,	46, 47, 48	1		
PAR	AMETER INFO	RMATICN				
	SOURCE= DI	KI GAMMI	A(C)=.9C	INSTRUMENT	TATION= CL	٨
	ACCURACY= I	FIVE PERCE	NT NUMBER	CF RUNS	AVERAGEC=	1
	THETA(I) = 1	70.CC PH	I(I)=18C.00	WAVELE	NGTH= .63	3
DAYA SET	NUMBER	41	42	43	44	CCMPUTED
PH1(R)	IHEIA(K)	REFILLS	RCF(PL)	RCF(LP)	RCF(PP)	RCF(OT)
= U	IUE6)	(1)2K)	(1128)	{ 1 / SR }	(1/SR)	(1/SR)
	C 00	0013	0015	0010	0024	000
	10.00	.0012	0012	0000	-0024	\$003 003
	20.00	.0012	-0011	-0007	.0018	•003
	30.00	P330.	-0010	.0006	.0016	.002
	40.00	-0008	.0010	.0006	.0022	.002
	50.00	2000-	.0011	.0006	-0017	-002
	66.00	.0037	.C024	.0020	.0046	.006
	70.00	.0C41	.C021	.0020	.0041	.006
	80.00	.CC24	.0019	.0014	.0036	.005
DATA SET	NUMBER	45	40	47	48	CCMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(LEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.0013	.C015	.0010	.0024	.003
	10.00	.OC16	.CC13	.0012	.0021	.003
	20.00	. 0C26	.CC2C	.0017	.0036	.005
	30.00	.0C38	.028	.0024	.0152	.007
	40.00	.0099	.0053	.0050	.0103	.015
	50.00	.0159	.0081	.0075	.0152	-023
	60.00	.0130	.0087	.0080	.0175	.027
	76.60					
	86.60	.0517	.C287	•0237	.0688	.086

Sec. Sec.

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AC1324-CO1 TITLE MATURE MULBERRY LEAF, 2 HOURS CLC, PICKED FROM THE SOUTHEAST SIDE CF THE BUSH, IN AUGUST 1967 SUBJECT CODES BGDV CATA SET NUMBERS 1, 2, 3, 49 5, 6, 7. 8 PARAMETER INFORMATICN SOURCE DKI GAMMA(0)=.90 INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 С .633 THETA(1) = P⊢I(I)= 0 WAVELENGTH= DATA SET NUMBER COMPUTED 2 3 1 4 RCF(PL) RCF(PP) PHI(R) THETA(R) RDF(LL) RCF(LP) PPF(OT) (1/SR) ± 0 (CEG) (1/SR)(1/SR) (1/SR) 1 41) C.CO .0625 .CO43 .0042 10.00 .0817 .076 .0039 .0038 20.00 .0308 .C337 -036 30.00 .0172 .C040 .0040 .0169 .021 .CO42 .0040 40.00 .01C4 .0106 .015 .0079 .041 .0039 50.00 °C033 .013 .0071 .C046 .0032 60.00 .0087 .012 .0071 .0038 70.00 .CO42 .0089 .012 80.00 .0059 .Cú56 .0034 .0093 .012 DATA SET NUMBER 5 6 7 8 COMPUTED THETA(R) RCF(PP) PHI(R) RCF(LL) RCF(PL) RCF(LP) RCF(OT) =180.0 (CEG) (1/SR)(1/SR)(1/SR)(1/SR)(1/SR) C.CC 10.00 .C04C .0039 .0773 .0644 .075 .0038 .0348 20.00 °C348 .C041 .039 .0038 .0157 30.00 .0166 .0035 .020 46.00 .0093 .0040 .0105 .0040 .014 50.00 .0092 .013 .0083 **.**CO4C .0038 60.00 .0072 .C043 .0041 .0087 .012 70.00 .0070 .0045 .0038 .0084 .012 80.00 .0052 .0037 .0091 .CO4C .011

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TITLE MATURE MULBERRY LEAF, 2 FOURS OLD, PICKED FROM THE SOUTHEAST SIDE OF THE BUSF, IN AUGUST 1967 SUBJECT CODES BGDV CATA SET NUMBERS 9, 10, 11, 12, 13, 14, 15, 16
PATLRE PULBERRY LEAF, 2 FCLRS CLC, PICKEC FRCM THE SCUTHEASTSIDE OF THE BUSF, IN AUGUST 1967SUBJECT CODES2GDVCATA SET NUMBERS9, 10, 11, 12, 13, 14, 15, 16
SIDE OF THE BLSH, IN ALGUST 1967 SUBJECT CODES BODV CATA SET NUMBERS 9, 10, 11, 12, 13, 14, 15, 16
SUBJECT CODES 2GDV CATA SET NUMBERS 9, 10, 11, 12, 13, 14, 15, 16
EGDV CATA SET NUMBERS 9, 10, 11, 12, 13, 14, 15, 16
CATA SET NUMBERS 9, 10, 11, 12, 13, 14, 15, 16
9, 10, 11, 12, 13, 14, 15, 16
PARAMETER INFORMATION
SOURCE= DKI GAPPA(0)=.90 INSTRUMENTATION= CLA
ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1
THETA(I)= 20.00 PHI(I)=18C.CO WAVELENGTH= .633
DATA SET NUMBER S IU II IZ CUMPUTED
PHILE INCIDENT (1/CD) (1/CD) (1/CD) (1/CD) (1/CD)
± () (LEG) (1/SK) (1/SK) (1/SK) (1/SK) (1/SK)
C.CO .C333 .C036 .0038 .0347 .038
16.00 .0536 .0040 .0040 .0822 .072
20.00 .0610 .0041 .0043 .1315 .100
36.06 .0474 .0042 .0041 .1121 .084
46.00 .0269 .0041 .0040 .0645 .050
56.00 .6154 .6045 .0045 .0323 .028
66.00 .0054 .0047 .0043 .0208 .020
76.60 .0102 .0055 .0041 .0141 .017
86.00 .067 .0051 .0042 .0211 .019
DATA SET NUMBER 13 14 15 16 COMPUTED
PHI(R) THETA(R) RCF(LL) RCF(PL) RDF(LP) RCF(PP) RCF(OT)
=180.0 (DEG) (1/SR) (1/SR) (1/SR) (1/SR) (1/SR)
C 00 C 222 C 026 . 0038 . 0347 . 038
30.00 .0089 .0041 .0038 .0083 .013
86.00 .0050 .0035 .0029 .0061 .009

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	AC1324-C	D1					
	TITI Sub Cata Para	LE MATURE PUL SIDE OF TH JECT CCDES UGDV A SET NUPBE 17, 18, 1 APETER INFO SOURCE= D ACCURACY= THETA(I)=	BERRY LEAF E BLSF, IN RS 9, 20, 21, RMATICN KI GAMM FIVE PERCE 40.C0 PH	2 4CURS C AUGUST 196 22, 23, 24 A(0)=.9C NT NLMBER I(I)=180.00	LC, PICKE 7 Instrumen CF Runs Havele	C FRCM THE Tation= CL Averagec= NgTH= .63	SCUTHEAST A 1 3
	DATA SET	NUMBER	17 REF(11)	18 RCF(PL)	19 RDE (1 P)	20 RDF(RP)	COMPUTED RDF(OT)
	= 0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
		C.00	.0104	.034	.0042	.0105	.014
		10.00	.0161	.0036	.0039	.0207	•C22
		20.00	.0278	.0042	.0042	.0603	-048
		30.00	.0416	.0050	•0047	.1683	.110
\frown		40.00	.0357	.0052	.0049	.2990	.174
\cup		50.00	•0266	.0057	.0051	• 300 /	.202
			•0132	•VU37 0043	•0052	•2010	•173 .082
		80.00	.0135	. 062	•0059	.1050	.065
	DATA SET Phi(r)	NUMBER THETA(R)	21 RDF(LL)	22 RDF(PL)	23 RDF(LP)	24 RDF(PP)	COMPUTED RDF(OT)
	=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1)2K)
		0.00	-0104		-0042	.0105	.014
		10.00	-0081		.0038	.0082	.012
		20.00	.0075	.0037	.0038	.0071	.011
		30.00	.0076	.C042	.0041	.0073	.012
		40.00					
		50.00	.0074	.C045	.0041	.0068	.011
		60.00	.0074	.CO41	.0037	-0060	.011
		70.00	.0073	.0047	.0035	-0061	.011
		86.00	.0C65	.0041	.0035	.0065	-010

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AC1324-CC	1					
TIT	F					
	NATURE NULL	SERRY LEAF.	2 FCLRS C	LC. PICKED	FRCM THE	SCUTHEAST
	SIDE OF THE	BLSH. IN	ALGUST 196	57	_	
SHR.	IECT CODES			•		
2001	RGDV					
FAT	A SET NUMBER	25				
6417	25. 26. 21	. 28. 29.	30. 31. 32			
PAR	AVETER INFO	MATICN				
• • • • • •	SOURCE= DI		(C) = .5C	INSTRUMENT	ATICN= CL	A
	ACCLRACY* 1	IVE PERCEN	T NUMBER	CF RUNS A	VERAGED=	1
	THETA(I)=	50.CO PH1	(1)=180.00	hAVELEN	GTH= -63	3
DATA SET	NUMBER	25	26	27	28	CCMPUTED
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	PDF(LP)	RCF(PP)	RCF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	41/SR)	(1/SR)
	C.CO	.3076	.0035	.0038	. C091	.012
	10.00	•CC39	·C035	.0042	.0135	.016
	20.00	•0158	. CO44	•0046	.0312	.028
	30.00	.022C	•C044	•0043	.1014	.066
	46.00	.0264	.059	•0052	.3399	.189
	50.00	.0193	.070	.0064	.6731	• 353
	00.33	.0112	.0065	•0067	.7692	.397
	76.00	•0227	.0075	.0068	.6634	.350
	86.00	.0623	.060	.0059	.5051	.290
						COMPLETER
DATA SET	NUMBER	25	30	31	32	
PHI(R)	THETA(R)	RDF(LL)	REF(PL)	KDF(LP)	RUFLPPJ	KUPLUIJ
=180.0	(CEG)	(1/SR)	(1/58)	(1/5k)	(1/5K)	(1/58)
	0.00	.0076	.0035	.0038	.0091	.012
	10.00	.0068	.038	.0038	.0072	.011
	20.00	.0066	.0038	.0038	.0069	.011
	30.00	.0072	.037	.0038	.066	.011
	40.00	.0077	.C043	.0042	.0069	.012
	50.00		-			
	60.00	.0082	.0043	.0042	.0072	.012
	76.00	.0077	. C040	•0048	.0066	.012
	80.00	.0068	.CO46	.0040	.070	.011

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AC1324-CO1 TITLE MATURE FULBERRY LEAF, 2 HOURS CLD, PICKED FROM THE SOUTHEAST SIDE OF THE BUSH. IN AUGUST 1967 SUBJECT CODES 8 GD V CATA SET NUMBERS 33, 34, 35, 36, 37, 38, 39, 40 PARAMETER INFORMATICN SOURCE* DKI GAMMA(0)=.90 INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(1)= 60.00 PHI(1)=180.00 WAVELENGTH= .033 DATA SET NUMBER 33 34 35 CCMPUTED 36 THETA(R) RDF(LP) RDF(LL) RCF(PL) PHI(R) RDF(PP) RDF(OT) (1/SR)(1/SR) 0 (CEG) (1/SR) (1/SR) (1/SR) .0065 .C036 .0041 .0081 .011 C.00 .0073 .0038 10.00 .0047 .0116 .014 20.00 .0094 .CO46 .0045 .0200 .019 .C119 .0593 30.00 .C05C .0050 .041 40.00 .0131 .0053 .0056 .2020 .113 .0110 50.00 .C065 .0064 .6920 .358 60.00 °C288 .C083 .0077 1.581 .813 70.00 .0052 .1369 .0081 2.411 1.283 80.00 .4272 .0113 .0105 2.788 1.618 DATA SET NUMBER 39 COMPUTED 37 38 40 RCF(PL) RDF(OT) PHI(R) RDF(LL) THETA(R) RDF(LP) RCF(PP) =180.0 (CEG) (1/SR) (1/SR)(1/SR) (1/SR) (1/SR)C.00 .0041 .0081 .011 .0065 .0036 10.00 .0036 .0039 .011 .0064 .0071 20.00 .0068 .0034 .0040 .CO68 .010 .0067 30.00 .C037 .010 .0038 .0064 5.00 .0071 .CO41 .0042 .0066 .011 50.00 .0080 .0047 .0041 .0072 .012 60.00 70.00 .0097 .C050 .0040 .0079 .013 80.00 .0090 .0035 .0027 .0065 .011

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AC1324-C	01					
TIT	LE					
	MATURE MULE	BERRY LEAF	2 FCLRS C	LC, PICKED	FRCM THE	SCUTHEAST
	SIDE OF THE	E BUSH, IN	ALGUST 190	57		
SUB.	JECT CODES	-				
	EGDV					
CAT	A SET NUFBER	25				
	41, 42, 43	3, 44, 45,	46, 47, 48	3		
PAR	AMETER INFO	RMATICN				
	SOURCE= DI	CI GAMPI	A(O)=.9C	INSTRUMENT	ATICN= CL	Δ
	ACCURACY= 1	FIVE PERCE	T NUMBER	R CF RUNS A	VERAGED=	1
	THETA(I)= 1	70.00 Ph	I(I)=180.CO	WAVELER	GTH= .63	3
DATA SET	NUMBER	41	42	43	44	CCMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.0062	·CJ36	.0041	.0082	.011
	10~00	.0065	.038	.0042	.0108	.013
	20.00	.0072	•C048	.0044	.0191	.018
	30.00	.0081	.0046	.0051	.0367	.027
	40.00	.0093	+0050	.0058	.1258	.073
	50.00	-0202	.097	.0068	.5335	•285
	60.00	.1146	-0089	.0031	2.031	1.084
	76.00	•5554	.0122	, .0107	5.514	3.065
	86.00	2.287	°C18C	•0147	11.151	0.125
DATA SET	NUMBER	45	46	47	48	CCMPUTED
SHI(R)	THETA(R)	REFILL	RCF(PL)	RDF(LP)	RDF(PP)	RCF(OT)
*180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
						• • • • • • • •
	C.CC	.0062	.036	.0041	.0082	.011
	10.00	.0058	.0036	.0038	.0070	.010
	20.00	.0061	.037	.0036	.0065	.010
	30.00	.0066	.038	.0039	.0064	.010
	40.00	.0070	.CO41	.0044	.0065	.011
	50.00	-0082	.0041	,0045	.068	.912
	60.00	.0099	.0038	.0053	.0069	.013
	70.00					
	80.00	.0136	.0052	.0050	-0128	.018

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AC119C-CO1						
TITLE						
SM	OKED MAGN		E CR ALLAT	NEW PLATE		
1 8	PPRGXIMAT	ELV 1.75 T	O 2 NN FED	rsit).		
SHRUES	T CODES		ber 6a 1 1 1,4 ca.1			
000000 L.)	688					
rata S	FT NEHAFR	ç				
	1, 2 , 3	. 4. 5.	6. 7. 8			
PARANE	TER INFOR	KA1%CN	37 ,, 0			
SO	URCE= DX	I GANNA	(0) = .90	TASTRUMENT	ATTONS OF	Δ
AC	CURACY= F	IVE DERCEN	T NEWRER	CE DUNC A	VEPACED=	1
TH	FTA(I) =	C PHT	(1)= 0	LAVELEN	CTHE .63	2
•••		• • • • •	(1/- V	*******		•
DATA SET NU	MACR	1	2	3	4	COMPLITED
PHI(R) T	HETAIR)	RDF(11)	REFEREN	RDECEPT	REFIDE	PDF(OT)
= 0	(CFG)	(1/SR)	(1/58)	(1/SR)	11/581	(1/SR)
					3 27 31. 2	
	C.CO					
	10.00	.1751	.1310	.1352	. 1663	. 304
	20.00	.1746	.1307	.1402	.1636	.305
	30.00	.1750	.132C	.1409	.1659	- 307
	40.00	.1691	.1272	.1389	.1594	.297
	50.00	.1625	.1246	.1365	.1600	.292
	6C.0C	.1526	.1187	.1298	.1612	.281
	70.00	.1425	.1082	.1270	.1484	-263
	80.00	.1280	.1023	.1120	.1561	.249
DATA CET AN	NDCD	E		-		CCN011750
DUTION T	TIDER Vetain	2	0	1	8 0021200	LEMPUIEL
-190 0	121A(8)	KUP (LL1	KUP (PL)	RUP(LY)	KLIFIPP)	KUPIUIJ
-150.0	(LEG)	(1)2K	(1/58)	(1/2k)	(1/2K)	(1/2K)
	0.00					
•	10.00	1740	1434	1280	1954	210
	20.00	1727	91737	1297	• 4000 1721	•217
	30.00	.1666	.1366	. 1345	.1728	. 378
	40.00	.1654	-1330	.1349	-1661	. 200
	50.00	.1560	.1277	.1299	. 1645	**** , 780
	60.00	1472	.1236	.1247	.]:: 42	, 280
	70.00	1322	1089	.1168	. 1497	262
	80.00	.1165	.1024	.1019	.1552	.238

AC119C-C	01					
TITI	LE					
	SMOKED MAGN	NESIUP CXI	DE CN ALUMI	INUM PLATE		
	(APPRCXIMA)	ELY 1.75	TC 2 MM CEP	POSIT).		
SUB.	JECT CODES					
••••	CJAAA					
CAY	A SET NUMBER	25				
	9.10.11	1. 12. 13.	14. 15. 16	5		
PAR	APETER INFOR	MATIEN				
	SOURCE= DI	CI GAMP	A(Q)=_9C	INSTRUMENT	TATION= CL	Α
	ACCURACY= 1	TVE PERCE	NT NUPBER	R CF RUNS	VERAGEC=	1
	THETA(I)=	20.CC PH	I(I)= 18C.(WAVELEI	NGTH≂ ₀63	33
DATA SET	NUMBER	9	10	11	12	COMPUTED
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.1538	-1514	.1222	.1844	.306
	10.00	.1540	.1531	.1232	.1885	.309
	20.00	.1493	.1491	.1237	.1850	.304
	30.00	.1458	.1474	.1236	.1872	• 302
	40.00	.1387	.1450	.1207	.1839	.294
	50.00	.1346	.143C	.1177	.1880	.292
	60.00	.1281	.1341	.1135	.1928	.284
	70.00	.1182	.1230	.1042	.1935	.269
	80.00	.1132	.1072	.0965	.1932	.255
DATA SET	NUMBER	13	14	15	16	CCMPUTED
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RCF(OT)
=180.0	(DEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	c.00	.1538	.1514	.1222	.1844	.306
	16.00	.1 6 25	.1499	.1247	.1838	.310
	20.00					
	30.00	.1693	.1485	.1270	.1867	.316
	40.00	.1699	.1462	.1264	.1870	.315
	59-90	.1681	.1432	.1242	.1850	.310
	60.00	.1581	.1373	.1192	.1847	• 300
	70.00	.1406	•1277	.1090	.1752	"276
	80.00	.1345	.1186	.1041	.1689	.263

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. () AC119C-CO1 TITLE SMOKED MAGNESILM CXIDE EN ALUMINUM PLATE (APPROXIMATELY 1.75 TC 2 MM CEPOSI ... SUBJECT CCOES CJAAA CATA SET NUMBERS 17, 18, 19, 20, 21, 22, 23, 24 PARAMETER INFORMATION SOURCE= DKI GAMMA(0)=.9C INSTRUMENTATION= CL4 ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(I)= 40.00 PHI(I)= 180.0 WAVELENGTH= .633 DATA SET NUMBER 17 18 19 20 CCMPUTED PHI(R) THETA(R) RCF(LL) RCF(PL) RDF(LP) RCF(PP) RDF(OT) (1/SR) 0 (CEG) (1/SR) (1/SR) (1/SR)(1/SR)C - 00 .1625 .1276 .1331 .1600 .292 .1342 .1679 10.00 .1566 .1300 .294 .1338 .1285 20.00 .1504 .1700 .291 .1297 .1314 .1516 .294 30.00 .1760 .1596 .1294 .298 4C.Cü .1522 .1865 .1268 50.00 .1463 .1233 .1977 .297 .1457 .1217 .1173 .296 60.00 .2073 .2019 70.00 .1511 .1121 .1112 .288 80.00 .1586 .1030 .0999 .2400 .301 DATA SET NUMBER 21 22 CCMPUTED 23 24 PHI(R) THETA(R) RDF(LL) RDF(PL) ROF(LP) RCF(PP) RDF(OT) =180.0 (DEG) (1/SR) (1/SR) (1/SR)(1/SR)(1/SR) C.OC .1625 .1264 .1331 .1587 .290 .1680 .1649 .1333 10.00 .1295 .298 20.00 ,1709 .1297 .1291 .1633 -296 30.00 .1263 .1226 .292 .1741 .1607 40.00 .1846 .1233 .1207 .1715 .300 50.00 .1777 .1210 .1140 .1690 60.00 .291 .1113 70.00 .1716 .1116 .1568 .276 80.00 .1567 .1054 .0991 .1571 .259

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AC119C-CC	01					
TITI	.E					
	SMOKEC MAGN	ESILM CXIC	E CN ALLMI	NUP PLATE		
CHD	LAPPREXIMAL	ELY 1.75 1	C 2 MM CEN	US11),		
SOR.	JELI LUUES					
CAT/	- СЈРАА А сет Мемрео	c				
LMII	- 361 NOPDER 25, 36 27		30. 31. 32)		
PAR	AVETER INFOR	MATICN	241 214 25	•		
1 600	SOURCE= DK	I GAMMA	(C) = .9C	INSTRUMENT	ATICN= CL	۵
	ACCLRACY= F	IVE PERCEN	T NUMBER	CF RUNS	VERAGEC=	1
	THETA(I)= 6	0.CC PHI	$(I) = 18C_{*}(I)$	hAVELEN	GT+= .63	3
DATA SET	NUMBER	23	26	27	28	CCMPUTED
PHI(R)	THETA(R)	RD7(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.1479	-1229	.1272	.1633	.281
	10.00	.1452	.1248	.1289	.1706	.285
	20.00	.1387	.1268	.1251	.1797	285 ،
	30.00	.1443	·1246	.1232	.1929	.292
	40.00	.1531	.1237	.1230	.2095	.305
	5C.CC	.1770	.1212	.1200	.2438	- 331
	60.00	.2251	.1201	.1176	.3078	•385
	.70.00	.2600	.1137	.1123	.3349	.410
	80.00	.3352	.1077	.1038	.4152	.481
DATA SET	NUMBER	29	00	31	32	CCMPUTEC
PHI(R)	THETA(R)	RGF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(OT)
=160.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C • 00	.1479	.1229	.1272	.1633	.281
	10.00	.1555	.1149	.1257	.1586	.277
	20.00	.1630	.1135	.1222	.1533	.276
	30.00	.1751	.1123	.1216	.1534	.281
	40.00	.1822	.1085	.1173	.1510	•279
	50.00	1922	.1059	-1134	.1533	.282
	60.00					201
	70.00	.2077	.0965	.1029	• 1643	-366
	80.00	.1938	•C862	.0907	•1218	.201

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TITLE PAGNESILP OXICE, PRESSED AT 4200 PSI, AGAINST INK **ELOTTER PAPER.** SUBJECT CODES CJAAE CATA SET NUMBERS 1, 2, 3, 4 PARAMETER INFORMATICN SOURCE= DKI GAMPA(0)=.90 INSTRUMENTATION= CLA ACCLRACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 HETA(I) =C PHI(I)= C WAVELENGTH= .633 DATA SET NUMBER 3 CCMPUTED 1 2 4 RDF(LL) RCF(PL) PHI(R) THETA(R) RDF(LP) RCF(PP) RDF(OT) (CEG) (1/SR) = 0 (1/SR)(1/SR)(1/SR) (1/SR)C.CC 10.00 .1908 .1437 .1385 .1822 .728 .1421 20.00 .1794 .1361 .1799 .319 .1764 .1400 30.00 .1407 .1733 .315 .1754 40.00 .1696 .1416 .1366 .312 .1123 .1359 .1763 .306 50.00 .1342 .1558 60.00 .1743 .1378 .1316 .300 .1376 .237 70.00 .1525 .1722 .1317 .1451 80.00 .1361 .1279 .1744 .252

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AC1317-CU1					
TITLE					
MAGNE	SILP OXICE. PRES	SEC AT 420	O PST. AGA	INST INK	
PLOTT	ER PAPER.				
SUBJECT C	CDES				
CJAAB					
CATA SET	NUMBERS				
5,	6, 7, 8, 9,	10, 11, 12			
PARAPETER	INFORMATICN				
SOURC	E= DKI GAMMA	(())=.90	INSTRUMENT	ATICN= CL	۵
ACCUR	ACY= FIVE PERCEN	T NUMBER	CF RUNS A	VERAGEC=	1
THETA	(1)= 40.CO PHI	(I) = 180.0	WAVELEN	GTH= .63	3
DATA SET NUMBE	R 5	6	7	8	CCMPUTED
PHI(R) THET	A(R) RCF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RCF(OT)
≠ 0 (DE	G) (1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
с.	00 .1763	.1454	.1424	.1813	• 323
10.	00 .1701	. 142C	.1432	.1827	.319
20.	CC _16C4	.1424	.1384	.1827	.312
30.	60 .16C3	.1391	.1425	.1812	•312
40.	CO .1519	.1410	•1398	.1928	•313
50.	co . 1515	.1386	<u> </u>	.1938	• 309
60.	CC .1491	.1338	.1335	.1920	• 304
70.	60 .1472	.1302	.1268	.1958	• 300
SC.	CO •1565	.132C	.1220	•2147	.313
DATA SET NUMBE	R S	10	11	12	CCMPUTED
PHI(R) THET	A(R) RDF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	REF(OT)
=180.0 (CE	G) (1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
С.	.1763	.1454	.1424	.1813	.323
10.	.1813	.1453	.1468	.1827	.328
20.	CC .1923	.1458	.1435	.1861	.334
30.	00 .1985	.1460	.1374	.1913	.337
4C.	00				
47.	GG .2157	.1544	.1407	.2108	.361
50.	.2081	.1501	.1415	.2031	.351
60.	.2014	.1531	.1379	.1995	.346
· 7C.	CO .1924	.1524	.1385	.1943	.339
80.	.1785	.1459	.1307	.1883	. 322

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AC1192-CC1 TITLE FLOWERS OF SULPHUR, MANUALLY PRESSED INTO PLASTIC CONTAINER APPREXIMATELY 2.5 X 2.5 X .25 IN. SUBJECT CODES CJAC CATA SET NUMBERS 1, 2, 3, 4 PARAMETER INFORMATION SOURCE= DKI GAPPA(0)=.90 INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(I) =P⊢I(I)= 0 C WAVELENGTH= .633 CATA SET NUMBER 1 2 3 CCMPUTED 4 PHI(R) THETA(R) RCF(LL) RCF(PL) RDF(LP) RCF(PP) RDF(OT) 0 (CEG) (1/SR) (1/SR) (1/SR) x (1/SR) (1/SR) C.CC 10.00 ,1498 .1390 .1345 .1453 .284 .1357 20.00 .1487 .1352 .1457 .285 30.00 .1467 .1398 .1350 .1460 .284 40.00 .1346 .1415 .1290 .1409 .273 50.00 .1386 .132C .268 .1261 .1391 60.00 .1290 .1252 .1202 .1313 .253 70.00 .1194 .1105 .1267 .237 .1184 80.00 .1031 .1006 .0918 .1109 .203

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AC1191-CO1 TITLE FIBERFRAX, TYPE 970 JH CERAPIC INSULATING FELT, (CARBORUNDUM CC.), CN 1/4 IN. PLYNCCC BACKING. SUBJECT CCDES CJAE CATA SET NUMBERS 1, 2 PARAMETER INFORMATION SOURCE= DKH GAMMA(0) =INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(I)= G PHI(I)= 0 WAVELENGTH= .425 DATA SET NUMBER 1 2 CC*PUTED REF(PT) THETA(R) RDF(LT) RDF(OT) PHI(R) (1/SR) (1/SR) \$ 0 (CEG) (1/SR)C.CO 7.00 .3296 .3296 .330 .3264 .3264 10.00 .326 .3268 .327 15.00 .3268

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AC1191-CO1

TITLE FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT, (CARBORLNDUM CC.), CN 1/4 IN. PLYWCCC BACKING. SUBJECT CODES CJAE CATA SET NUMBERS 3, 4, 5, 6 PARAMETER INFORMATION INSTRUMENTATION= CLA SOURCE= DKH GAMPA(C)= ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THE: A(I) = 80.00 PHI(I)= 18C.0 HAVELENGTH= .425 DATA SET NUMBER 3 4 CCMPUTED PHI(R) THETA(R) ROF(LT) RCF(PT) RDF(OT) Ŧ 0 (CEG) (1/SR) (1/SR) (1/SR) C.CO .2646 .3699 .317 20.00 .3357 **397C** .365 40.00 .5775 .6817 .630 60.00 1.791 .3680 1.079 80.00 DATA SET NUMBER CCMPUTED 5 δ PHI(R) RCF(LT) RCF(PT) THE TA(R) ROF(OT) ≠180.0 (DEG) (1/SR) (1/SR)(1/SR)C.GO. .2646 -3699 .317 20.00 .2346 .3937 .314 40.00 .2533 .3541 .304 60.00 .2822 .4933 .388 70.00 .3352 .5769 .456 80.00

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AC1191~CO	1				
TITL	E FIBERFRAX,	TYPE 570 JH	CERAFIC I	INSULATING FELT. LYWCCC BACKING.	
	ILAKCURLINU				
20RJ	ECT CODES				
	CJAE				
CATA	SET NUMBE	KS			
	7, 8,	90 16 DAILSICA			
PARA	NETER INFO	RMAILLN	(0)-	INSTRUMENTATION= CLA	
	SOURCE= D	KH GAPPA	10]= • NI 6050	CE DUNS AVERAGEC= 1	
	ACCURACY=	FIVE PERCEN	I NUFEER	LAVELENGTH= .550	
	THETA(I)=	80.CC PFI	([)= 180.0	RAVELLIGTIC	
			-	CCHORTEC	
DATA SET	NUMBER	7	8		
PHI(R)	THETA(R)	RGF(LT)	REFIPIS		
= 0	(CEG)	(1/SR)	(1/SR)	(1/SK)	
•			_		
	00200	.0739	.2362	.155	
	20.00	.2673	.2962	.282	
	40.00	.4372	.4955	.466	
	60.00	1.051	1.271	1.161	
	80.00				
DATA SET	NUMBER	5	10	CCMPUTED	
011/01	THETA(R)	RCF(LT)	RCF(PT)	RDF(OT)	
-190 0	(CFG)	(1/SR)	(1/SR)	(1/SR)	
-100.0	(020)				
	00.0	.0739	.2362	.155	
	20.00	.1319	.2334	.182	
		2186	.235C	.227	
		- 3842	.2362	.310	
		6764	.3120	• 469	
	76.60				
	86.60				

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AC1191-C01 TITLE FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT. (CARBORLNDUM CC.), CN 1/4 IN. PLYNCCE BACKING. SUBJECT CCDES CJAE CATA SET NUPBERS 11, 12, 13, 14 PARAMETER INFORMATION GAMMA(C)= INSTRUMENTATION= CLA SOURCE= DKH NUMBER OF RUNS AVERAGED= 1 ACCURACY- FIVE PERCENT .750 PHI(I) = 180.0WAVELENGTH= THETA(I)= 00.00 COMPUTED DATA SET NUMBER 11 12 RCF(PT) RCF(LT) RCF(OT) THETA(R) PHI(R) (1/SR) (1/SR)(1/SR) (CEG) = 0 .215 .2137 C.CC .2173 .2709 .2592 .265 20.00 .4480 .433 40.00 .4181 1.148 60.00 1.082 1.017 4.321 5.447 5.134 80.00 14 CCMPUTED DATA SET NUMBER 13 RCF(PT) RDF(OT) PHI(R) THETA(R) RCF(LT) (1/SR)=180.0 (CEG) (1/SR)(1/SR).2173 .2137 .215 C.CC .203 20.00 .204. .2008 40.00 .1965 .2069 .202 .2199 .218 60.00 .2160 .2227 .235 .2480 70.00 . 80.00

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AC1191-CO1 TITLE FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT, (CARBORUNDUM CO.), CN 1/4 IN. PLYNCCC BACKING. SUBJECT CCCES CJAE CATA SET NUPBERS 15, 16, 17, 18 PARAMETER INFORMATION SOURCE= DKH GAMMA(0)= INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER CF RUNS AVERAGEC= 1 THETA(I) = 80.COP⊢I(I)= 18C.0 **WAVELENGTH= 1.100** DATA SET NUMBER 15 16 CCMPUTED PHI(R) THETA(R) RDF(LT) RCF(PT) REF(OT) × 0 (CEG) (1/SR)(1/SR) (1/SR) .2166 0.00 .2281 .222 20.00 .2677 .2829 .275 40.00 .4239 .43 .4628 1.224 60.00 1.087 1.155 80.00 3.000 6.269 4.634 DATA SET NUMBER 17 18 CCMPUTED PHI(R) THETA(R) RDF(LT) REF(PT) RCF(OT) ≠180.0 (CEG) (1/SR) (1/SR) (1/SR)C.CO .222 .2166 .2281 20.00 .2039 .2081 .206 46.00 .2033 .2102 .207 66.00 .2014 .2242 .213 70.00 .2069 .249C .228 80.00

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AC1191-CC2 TITLE FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT, (CARBORUNDUM CO.), EN 1/4 IN. PLYNCOD BACKING. SUBJECT CODES CJAE CATA SET NUPBERS 1, 2, 3, 4 Parameter information SOURCE= DKH GAMMA(U)= INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 **HAVELENGTH= .550** THETA(I)= 0 PHI(1)= G DATA SET NUMBER 1 2 3 COMPUTED 4 PHI(R) RCF(LL) THETA(R) RDF(PL) RDF(LP) RCF(PP) RCF(OT) 0 (CEG) (1/SR) ÷ (1/SR) (1/SR) (1/SR) (1/SR) C.00 7.00 .2142 .2063 .1474 .1404 .354 .2031 10.00 .1486 .2045 .1415 .349 .2025 15.00 .1515 .1443 .2059 .352

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AC1191-C	02					
TIT	LE					
	FIBERFRAX,	TYPE 570 .	JH CERAMIC	INSULATING	G FELT,	
	(CARBORLND)	u∺ cc.), cr	1/4 IN. 1	PLYNCCD BAG	CKING.	
SUB.	JECT CODES					
	CJAE					
CAT	A SET NUMBER	₹S.				
•••••	5. 6.	7.8				
PAR	AVETER INFOR	RMATICN				
• • • • •	SOURCE= D	CH GAMP	(C)=	INSTRUMEN	FATION= CL	A
	ACCL'RACY= I	FIVE PERCE	NT NUMBEI	R CF RUNS	AVERAGEC=	1
	THETA(I)=	O PH	[(])= (G HAVELE	NGTH= .75	0
DATA SET	NUMBER	5	6	7	8	CCMPUTED
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	ROF(PP)	RDF(CT)
≭ 0	(CEG)	(1/\$R)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C = C O					
	7.00	.1990	.1455	.1400	. 1931	.339
	10.00	.1951	.1429	.1394	.1908	.334
	15.00	.1951	.1466	.1422	.1945	.339

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AC1191-CC2 TITLE FIBERFRAX, TYPE 970 JH CERAPIC INSULATING FELT. (CAREORUNDUM CC.), CN 1/4 IN. PLYNECD BACKING. SUBJECT CODES CJÁE CATA SET NUMBERS 9, 10, 11, 12 PARAMETER INFORMATICN SOURCE= DKH GAMMA(C) =INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 PFI(I)= THETA(I)= G 0 WAVELENGTH= 1.100 DATA SET NUMBER G 12 COMPUTED 10 11 THETA(R) RCF(LL) RCF(PL) RCF(LP) RCF(PF) PHI(R) RDF(OT) (1/SR) (1/SR) (1/SR) = 0 (CEG) (1/SP) (1/SR) 0.00 7.00 .1390 .1952 .339 .1952 .1469 10.00 .1905 .1443 .1395 .1910 .533 15.00 .1914 .1484 .1417 .1904 .336

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AC1191-CC2

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TIT	LE					
	FIBERFRAX,	TYPE STO	JH CERAMIC	INSULATING	G FELT.	
	(CARBORLND)	UM CC.), C	N 1/4 IN. (PLYNCCC BAG	CKING.	
SUB.	JECT CODES	•				
	CJAE					
CAT	A SET NUMBER	RS				
-	13, 14, 19	5, 16				
PAR	APETER INFO	RMATICN				
	SOURCE= DI	KH GAMM	A(C)=	INSTRUMEN'	TATICN= CL	A
	ACCURACY= 1	FIVE PERCE	NT NUMBER	R CF RUNS	AVERAGEC=	1
	THETA(I)=	C PH	I(I)=	C WAVELE	NGT⊢= 1.10	0
DATA SET	NUMBER	13	14	15	16	CCMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RDF(OT)
= 90.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	c.cc					
	7.00	.1578	.1416	.1408	.1919	.336
	10.00	.1571	.1385	.1402	.1856	.331
	15.00	.1580	.1409	.1429	.1846	333

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AC1191-CC2

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TITLE FIBERFRAX, TYPE S70 JH CERAPIC INSULATING FELT, (CARBORUNDUM CO.), CN 1/4 IN. PLYNCCC BACKING. SUBJECT CODES CJAE CATA SET NUPBERS 17, 18, 19, 20, 21, 22, 23, 24 PARAMETER INFORMATICN SOURCE= DKH GAMMA(0)= INSTRUMENTATION= CLA NLPBER OF RUNS AVERAGED= 1 ACCURACY= FIVE PERCENT THETA(I)= C PHI(I) =C **hAVELENGTH=** .633 DATA SET NUMBER 17 18 19 20 COMPUTED RCF(PL) PHI(R) THETA(R) RDF(LL) RDF(LP) RCF(PP) RCF(OT) (1/SR)(1/SR)0 (CEG) (1/SR)(1/SR)(1/SR)C.CC .308 10.00 .1270 .1851 .1234 .18C3 .1757 .298 20.00 .1245 .1252 .1709 .1671 .1249 30.00 .1245 .1584 .287 40.00 .1561 .1201 .1193 .1505 .273 50.00 .1456 .1180 .1107 .1476 .261 .1389 .1084 60.00 .1037 .1375 .244 .1323 .1001 .230 70.00 .0953 .1326 .0848 80.00 .1181 .0799 .1185 .201 DATA SET NUMBER 21 22 23 24 CCMPUTED PHI(R) RDF(LL) RCF(PL) RCF(PP) RCF(OT) THETA(R) RDF(LP) =180.0 (1/SR) (CEG) (1/SR)(1/SR) (1/SR)(1/SR)C.CO .1932 .1326 .1316 .1902 10.00 .324 .1817 .1333 .1301 20.00 .1792 .312 .1694 30.00 .1276 .1266 .1655 .295 .1596 .1263 .1585 .283 40.00 .1218 59.00 .1463 .1217 .1121 .1505 .265 .1410 60.00 .1132 .1054 .1461 .253 .1319 .1313 70.00 .0982 .0949 .228 80.00 .1194 .0840 .C817 .1183 .202

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AC1191-CO	2					
TIT	E					
	FIBERFRAX.	TYPE 970 .	H CERAFIC	INSULATING	G FELT.	
•	CARBORLNDL	IM CC.). CN	1/4 IN. F	LYWCCC BAG	CKING.	
SUB.	JECT CODES					
	CJAE					
CATA	A SET NUMBER	s				
••••	25. 26. 27	. 28. 29.	30. 31. 32	2		
PAR	AMETER INFOR	MATICN		-		
• • • • •	SOURCE= DI		(0)=	INSTRUMENT	TATICN= CL	Δ
	ACCURACY= F	IVE PERCEN	T NUMBER	R CF RUNS	VERAGED=	1
	THETA(I)= 4	O.CC PET	(I) = 180.0	WAVELE	GTH= .63	3
						-
DATA SET	NUMBER	25	26	27	28	CCMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RCF(PP)	RCF(QT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
-						
	C.OC	.1543	.1180	.1198	.1532	.273
	10.00	.1610	.1234	•1236	.1600	.284
	20.00	.1687	.1243	.1275	.1576	.294
	30.00	.1817	.1312	.1309	.1855	.315
	40.00	.1549	.1356	•1324	•2056	.334
	50.00	.2162	.1317	.1298	.2286	.353
	60.00	.2405	.1287	.1204	.2556	.373
	76.00	.2775	.1177	.1150	.2907	.400
	00.38		.1051		.3344	
						
DATA SET	NUMBER	25	30	31	32	CCMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	/(1/SR)	(1/SR)	(1/SR)
	C.CO	.1543	.118C	.1198	.1532	.273
	10.00	.1536	.1186	.1197	.1520	.272
	20.00	.1532	.1147	.1141	.1480	.265
	30.00	.1494	.1109	.1101	.1493	.260
	40.00					
	50.00	.138C	.1031	.1021	.1427	.243
	60.00	.1327	.0987	.0955	.1332	•230
	70.00	.1200	.0896	•0862	.1210	.20 8
	80.00	.1007		.0712		

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AC1293-CO1 TITLE FIBERFRAX, TYPE 970 JH CERAPIC INSULATING FELT CN 1/4 IN. PLYWCCD BACKING. SUBJECT CODES CJAE ECBBJ CATA SET NUMBERS 2. 3, 7. 8 1. 4, 5. 6, PARAPETER INFORMATICN SOURCE= DKH GAMMA(0)= INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUPBER OF RUNS AVERAGED= 1 PHI(I)= 0 hAVELENGTH= 1.060 THETA(I) =G 3 CCMPUTED DATA SET NUMBER 2 1 RCF(PL) ROF(LP) RCF(PP) THETA(R) RDF(LL) RDF(OT) PHI(R) (1/SR) (1/SR)(DEG) (1/SR)(1/SR) (1/SR)0 C.CO .1386 .1497 .1939 .344 10.00 .2068 .1369 20.00 .1983 .1460 .1780 .330 .1467 .324 30.00 .1918 .1376 .1721 .1263 .1421 .306 40.00 .1811 .1615 .1369 .1542 .295 50.00 .1775 .1222 .1293 .281 66.00 .1703 .1154 .1472 .1399 70.00 .1615 .1044 .1170 .261 80.00 .1432 .0897 .1010 .1263 .230 DATA SET NUMBER 5 7 COMPUTED 6 8 RDF(LP) RCF(PP) PHI(R) THETA(R) RDF(LL) RCF(PL) RDF(OT) =180.0 (CEG) (1/SR) (1/SR)(1/SR)(1/SR)(1/SR)C.00 .2090 .1365 .1488 .1917 .343 10.00 .1785 .331 20.00 .1997 .1353 .1480 .321 .1458 30.00 .1921 .1334 .1717 .311 40.00 .1847 .1320 .1412 .1641 .299 50.00 .1772 .1254 .1341 .1605 .286 60.00 .1700 .1202 .1266 .1547 .1084 .1133 .1455 .263 70.00 .1582 .0918 .1305 .230 80.00 .1411 .0962

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AC1293-CO1 TITLE FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT CN 1/4 IN. PLYWCCD BACKING. SUBJECT CCDES CJAE ECBBJ CATA SET NUMBERS 9, 10, 11, 12, 13, 14, 15, 16 PARAMETER INFORMATICN GAMMA(0) =SOURCE= DKH INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 PHI(I)=18C.CO THETA(I) = 20.00WAVELENGTH= 1.06C DATA SET NUMBER S 10 11 CCMPUTEC 12 RDF(LL) PHI(R) THETA(R) RCF(PL) RDF(LP) RCF(PP) RCF(OT) 0 (DEG) (1/SR)(1/SR)(1/SR) (1/SR) (1/SR)C.CO .1434 .1549 .1291 .1664 .317 10.00 .1946 .1390 .1470 .1763 .328 20.00 .1891 .1370 .1442 .1756 .323 30.00 .1898 .1398 .1463 .1787 .327 40.00 .1864 .1324 .1437 .1716 .317 50.00 .1876 .1406 .1283 .1730 .315 60.00 .306 .1885 .1213 .1307 .1725 .1908 70.00 .1144 .1759 .1229 .302 80.00 .1868 .1002 .1092 .1739 .285 DATA SET NUMBER 13 15 CCMPUTED 14 16 PHI(R) THETA(R) RDF(LL) RCF(PL) RDF(LP) RCF(PP) RCF(OT) =180.0 (CEG) (1/SR)(1/SR) (1/SR)(1/SR)(1/SR).317 C.CO .1949 .1291 .1434 .1664 10.00 .1900 .1305 .1423 .1735 .318 20.00 30.00 .1814 .1248 .1379 .1654 .305 .1555 40.00 .1734 .1223 .1324 .292 50.00 .1637 .1154 .1258 .1441 .274 .1079 60.00 .1552 .1179 .1369 .259 70.00 .1412 .0984 .236 .1064 1266 80.00 .1252 .G853 .0912 .208 ,1140

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AC1293-0	01					
TIT	LE					
	FIBERFRAX,	TYPE 970 .	JH CERAMIC	INSULATING	G FELT CN	
	1/4 IN. PL	WCCD BACK	ING.			
SUB	JECT CODES					
	CJAE ECBE	3J				
CAT	A SET NUMBER	RS				
	17, 18, 19	3, 20, 21,	22, 23, 24	1		
PAK	AFEIEK INFUR	CARILK		TACTORIACEA		•
	SUURLES DI	M GAFFI	t(U)≠ \7 bit.NOC0	INSIKUPEN	IAIILNª LL	. A
	AUDUNAUT= /	TVE PERCET	\I NUFEEX [/1_100 00	LF KUNG /	VERAGEUT	1
	INCIALI-		1117-180-00	WAYELE	1011- 1.00	U .
DATA SET	NUMBER	17	18	19	20	CCMPUTED
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RDF(LP)	RDF(PP)	RDF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO	.1668	.1313	.1296	.1663	•297
	10.00	.1700	.1367	.1325	.1737	• 306
	20.00	.1744	1428	.1355	.1811	.317
	30.00	,1819	.1445	.1407	.1880	• 328
	40.00	.1848	.1443	.1386	.1954	•332
	50.00	.1513	.1411	.1350	.2024	.335
	60.00	.2016	.1378	.1321	.2147	•343
	70.00	.2116	.1273	.1226	•2260	.344
	80.00	.2220	.1132	.1116	.2336	.340
DATA SET	NUMBER	21	22	23	24	CCMPUTEC
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RDF(LP)	ROF(PP)	RCF(OT)
=180+0	(CEG)	(1/SR)	{1/SR}	(1/SR)	(1/SR)	(1/SR)
	C.00	.1668	.1313	.1296	.1663	.297
	10.00	.1638	.1269	.1241	.1607	.288
	20.00	.1599	.1258	.1224	.1660	•287
	30.00					
	40.00	.1529	. 1212	.1155	.1627	•276
	50.00	.1487	.1191	.1129	.1527	.267
	6C.OC	.1408	.1132	.1075	-1430	•252
	70.00	.1321	.1048	.0996	.1345	-235
	8C.QQ	.1176	•0942	.0876	.1232	•211

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AC1293-CO1 TITLE FIBERFRAX, TYPE 970 JH CERAMIC INSULATING FELT CN 174 IN. PLYWOOD BACKING. SUBJECT CCDES ÇJAE ECBBJ CATA SET NUMBERS 25, 26, 27, 28, 29, 30, 31, 32 PARAMETER INFORMATION INSTRUMENTATION= CLA GAMMA(C)= SOUR" E= DKH NUMBER OF RUKS EVERAGED= 1 ACCUPACY= FIVE PERCENT WAVELER GTH= 1.060 PHI(I)=18C.00 THETA(1)= 40.00 3 CCMPUTED 26 27 25 DATA SET NUMBER REF(PP) RCF(OT) RDF(LP) R.F(PL) THETA(R) RDF(LL) PHI(R) (1/SR) (1/SR) (1/SR) (1/SR) (1/SR)(DEG) 0 .294 .1284 .1655 .1325 .1620 C.CO .305 .1307 .1758 .1370 10.00 .1671 .326 .1828 .1340 20.00 .14C2 .1751 .334 .1978 .1389 .1432 30.00 .1873 .2117 .347 .1435 .1394 40.00 .1996 .369 .2332 .1442 .1390 50.00 .2211 .389 .2591 .1400 .1333 .2456 60.00 .2917 .416 .1333 .1264 .2804 70.00 .3221 .439 .1134 .1197 .3220 80.00 COMPUTED 32 31 30 29 DATA SET NUMBER RDF(PP) RDF(OT) RCF(PL) RDF(LP) RCF(LL) THETA(R) PHI(R) (1/SR)(1/SR) (1/SR) (1/SR)(CEG) (1/SR)=180.0 .294 .1655 .1325 .1284 .1620 C.00 .1631 .290 .1305 .1262 .1607 10.00 .1570 .279 .1205 .1236 .1567 20.00 .278 .1621 .1173 .1524 .1235 36.00 40.00 .264 .1091 .1568 .1449 .1169 50.00 .251 .1030 .1475 .1356 .1124 66.00 .230 .0936 .1026 .1357 .1274 76.00 .207 .1245 .0817 .0926 80.00 .1148

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AC1293-00	21					
TIT	E					
	FIBERFRAX,	TYPE 970	JH CERAMIC	INSULATIN	G FELT CN	
	1/4 IN. PL	YWEED BACK	ING.			
SUB.	JECT CODES					
·	CJAE ECBI	BJ				
CAT	A SET NUMBER					
0.4.0	33, 39, 3 Neteo treo	0, 30, 31, NATIO	38g 35g 40			
PAK	APETER INFU	KMATILN XII CANN	A/01-		TATION- CI	•
	SUUKLE= DI	NN GART Rive Derce	A(()= NT NK NDEA	INSTRUMEN	IAIILN= LL Averanced-	.# 1
	AUGUNAUT=	LYC PERCE	NI NUFEEK 1/11-190 00	LF KURS S	RVENAGEU = Noti= 1 04	1
	INCIALI/=	Partu PP	1113-100.00	MAYELE	NG18= 1.00	
DATA SET	NUMBER	33	34	35	36	COMPUTED
PHI(R)	THETA(R)	RDF(LL)	RCF(PL)	RUF(LP)	RDF(PP)	RDF(OT)
= 0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CO.	.1632	.1239	.1296	.1589	.288
-	10.00	.1728	.1268	.1352	.1671	.301
	20.00	.1863	.1323	.1407	.1834	.321
	30.00	.2015	.1372	.1438	.2047	.344
	40.00	.2291	.1435	.1456	.2417	.380
	5C.CO	.2678	.1464	.1548	.2912	.430
	60.00	.3356	.1466	-1491	.3545	.493
	76.00	.4C43	.1406	.1396	.4426	.564
	86.00	•5176	.1315	.1305	•5596	.670
DATA SET	NUMBER	37	38	39	40	
PHI(R)	THETA(R)	RCF(11)	REF(PL)	ROF(IP)	RDFIPPI	RDF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	C.CC	.1632	.1239	.1296	.1589	.288
	10.00	.1544	.1194	.1237	.1506	.274
	20.00	.1540	.1179	.1217	.1486	.271
	30.00	.15C1	.1141	.1153	.1461	.263
	40.00	.1480	.1108	.1122	.1489	.260
	50.00					
	60.00	.1431	.104C	.1050	.1475	-250
	70.00	.1374	.Ĉ\$74	.0973	.1357	.234
	80.00	.1258	.0853	.0862	.1235	-210

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AC1293-CC	01					
TITL	E					
	FIBERFRAX,	TYPE 970 J	H CERAFIC	INSULATING	FELT CN	
	1/4 IN. PLY	WCCD BACKI	NG.			
SUB.	JECT CCDES					
	CJAE ECBB	J				
CATA	A SET NUMBER	S		• _		
	41, 42, 43	, 44, 45,	46, 47, 48			
PAR	AMETER INFOR	MATICN				
	SOURCE± DK	H GAMMA	(())=	INSTRUMENT	TATION= CL	Δ
	ACCURACY= F	IVE PERCEN	T NUPBER	CF PUNS A	VERAGEC=	1
	THETA(I) = 6	0.CC PHI	$(I) = 18C \cdot CC$	WAVELEN	GTF = 1.06	C
DATA SET	NUMBER	41	42	43	44	
PHI(R)	THETA(R)	RCF(LL)	RCF(PL)	RCF(LP)	RCF(PP)	REF(OT)
= 0	(EEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
-			••••			
	C.CC	.1455	.1115	.1139	.1447	.258
	10.00	.1569	.1192	.1184	.1619	.278
	20.00	.1734	.1231	.1245	.1815	.301
	36.00	.1989	.1302	.1297	.2140	•336
	40.00	.2402	.1372	.1344	.2671	•389
	50.00	.3C81	.1442	.1389	.3503	.471
	60.00	.422C	.1488	•1414	.4806	•596
	76.00	•5859	.1475	.1413	.6731	.774
	9 C • C C	.8577	•1414	.1370	.9745	1.055
DATA SET	NUMBER	45	46	47	48	CCMPUTED
PHI(R)	THETA(R)	RDF(LL)	RDF(PL)	RDF(LP)	RDF(PP)	RCF(OT)
=180.0	(CEG)	(1/SR)	(1/SR)	(1/SR)	(1/SR)	(1/SR)
	c.co	.1455	.1115	.1139	.1447	•258
	10.00	.1407	.1092	.1121	.1404	.251
	20.00	.1371	.1058	.1072	.1331	.242
	30.00	.1361	.1045	.1056	.1331	.240
	40.00	.1341	.1031	•0999	.1337	.235
	50.00	.1342	.1024	•0986	.1452	.240
	66.00					
	76.00	.1315	.0958	.0900	.1489	•233
	86.00	.1305	-C888	•0835	.1408	•222

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AC1293-CO1 TITLE FIBERFRAX, TYPE STO JH CERAPIC INSULATING FELT CN 1/4 IN. PLYWOOD BACKING. SUBJECT CODES CJAE **ECBBJ** CATA SET NUMBERS 49, 50, 51, 52, 53, 54, 55, 56 PARAPETER INFORMATICN GAMMA(0)= SOURCE= DKH INSTRUMENTATION= CLA ACCURACY= FIVE PERCENT NUMBER OF RUNS AVERAGED= 1 THETA(I) = 70.CCPFI(I)=18C.CO WAVELENGTH= 1.060 51 DATA SET NUMBER 49 50 52 COMPUTED PHI(R) THETA(R) RCF(LL) RCF(PL) RDF(LP) RCF(PP) RCF(OT) 0 (CEG) (1/SR)(1/SR) (1/SR)(1/SR)(1/SR)C.CC .1366 .1035 .1033 .1399 .242 .1046 10.00 .1455 .1061 .1508 .253 .1133 2C.CC .1691 .1121 .1766 .286 .1182 .2180 30.00 .2028 .1180 .328 40.00 .2605 .1262 .1249 .399 .2872 50.00 .3686 .1338 .1351 .4070 .522 60.00 ,5592 .1423 .1406 .6247 .733 70.00 .8992 .1445 .1468 1.023 1.107 86.00 1.529 .1460 .1439 1.695 1.757 DATA SET NUMBER 53 54 55 56 CCMPUTED PHI(R) THETA(R) RCF(LL) RCF(PL) RDF(LP) RCF(PP) RDF(OT) (1/SR) (1/SR) (1/SR)(1/SR) =180.0 (CEG) (1/SR)C.CO .242 .1366 .1035 .1033 .1399 .1276 .1000 .0986 .1293 .228 10.00 .1273 .0997 .1002 .1281 .228 20.00 .1249 .221 30.00 .0965 .0966 .1242 .1290 .0980. .225 40.00 .1273 .0959 50.00 .1209 .0878 .0870 .1217 .209 66.00 .1338 .C942 .0922 .1448 .232 70.00

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.0952

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RADAR (ACTIVE MICROWAVE) DATA

The active microwave data in the TSAC compilation consists of averaged radar cross sections as a function of aspect angle with frequency as a parameter, and cumulative probability distribution vs. radar cross section. The latter data appear only in the classified supplement.

Each radar data curve has been digitized by the same technique as used for the optical data, and the curves are reproduced on uniform grids. Normalized radar cross section σ_0 in decibels is plotted along the ordinate, and the abscissa represents the angle measured from the normal (aspect angle) in degrees. The header information for each curve, which includes the curve's identification number, title, a coded designation for the type of terrain covered, and parameter information, is also supplied by computer.

5.1. DATA FORMAT

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A numerical code is used to identify the radar curves. The number of digits in the code is variable, depending on the number of descriptors required for a particular target or background. Table 5-1 contains the key for interpreting this code. The first digit, always a 3, identifies the curve as being radar data. The second digit, either a 1, 2, or 3, indicates that the curve is for a background, target, or combination of terrain and target, respectively. Third, fourth, and fifth digits, when used, represent successively finer subdivisions of the material class involved. Thus, 31312 represents clay, a subset of soil (3131), which in turn is a subset of terrain (313), which is a background material (31) being measured by radar (3). Table 5-1 also indicates which material classes require still additional descriptors. These are designated by the letters A, B, C, C_1 , C_2 , C_3 , etc., as defined in table 5-2. Table 5-3 explains the parameter information appearing in the curve header. In section 5.3 the radar data are grouped according to the first four digits of the curve identification number.

TABLE 5-1. RADAR DATA NUMERICAL CODE

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n

31	BACKGROUND AND TERRAIN
311	Sky
312	Hov States
3122 🗆 *C, C, C, C, C,	Ice
3123 🗆 AB	Water
313	Terrain
3131	Soil
31311C ₁ C ₂ C ₃ C ₄	Sand
31312C1C2C3C4	Clay
31313C ₁ C ₂ C ₃ C ₄	Loam, cultivated
31314C ₁ C ₂ C ₃ C ₄	Loam, uncultivated
31315C ₁ C ₂ C ₃ C ₄	Rock
31316C1C2C3C4	Salt
3132	Trees
31321C ₁ C ₂ C ₃ C ₄	Leaves, laboratory sample
$31322C_{1}C_{2}C_{3}C_{4}$	Bark, laboratory sample
$31323C_1C_2C_3C_4$	Broad-leaf trees
31324C ₁ C ₂ C ₃ C ₄	Narrow-leaf trees
31325C ₁ C ₂ C ₃ C ₄	Broad-leaf shrubs
31326C ₁ C ₂ C ₃ C ₄	Narrow-leaf shrubs
3133	Crops
31331C ₁ C ₂ C ₃ C ₄	Grain
$31332C_{1}C_{2}C_{3}C_{4}$	Broad-leaf crops
31333C ₁ C ₂ C ₃ C ₄	Grass
31334C ₁ C ₂ C ₃ C ₄	Mosses, ferns, and fungi
3134XC ₁ C ₂ C ₃ C ₄	Forest, where X is the percentage of cover
3135 D C ₁ C ₂ C ₃ C ₄	Farmland (including farm buildings, etc.)
$3136 \square C_1 C_2 C_3 C_4$	Marsh
$3137 \square C_1 C_2 C_3 C_4$	Desert
314	Space
315	Combinations of Ice, H ₂ O, and Land
3151AC ₁ C ₂ C ₃ C ₄	Ice and H ₂ C
3152AC ₁ C ₂ C ₃ C ₄	H ₂ O and land
$\mathbf{^{3153}\squareC_1C_2C_3C_4C_2}_{\mathbf{I}}$	Ice and land
3154AC ₁ C ₂ C ₃ C ₄ C ₂	Ice, H ₂ O, and land

*The symbol 🗆 indicates a blank space.

TABLE 5-1. RADAR DATA NUMERICAL CODE (Continued)

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32	TARGET	
320	Composite areas	
$3201 \square C_1 C_2 C_3 C_4$	Industrial area	
$3202 \square C_1 C_2 C_3 C_4$	Residential area	
$3203 \square C_1 C_2 C_3 C_4$	Rural town area	
321	Buildings and building materials	
3211	Materials	
32111C ₁ C ₂ C ₃ C ₄	Painted lumber	
$32112C_{1}C_{2}C_{3}C_{4}$	Brick and tile	
$32113C_{1}C_{2}C_{3}C_{4}$	Asphalt	
$32114C_{1}C_{2}C_{3}C_{4}$	Glass	
$3212\squareC_1C_2C_3C_4$	Concrete buildings	
$3213\squareC_1C_2C_3C_4$	Frame buildings	
3214 □ C ₁ C ₂ C ₃ C ₄	Camouflage, decoys, and temporary structures	
$3215 \square C_1 C_2 C_3 C_4$	Steel buildings	
322 0 0 C ₁ 0 0 C ₄	Personnel	
$323 \square \square C_1 \square \square C_4$	Surface vehicles	
3231 D C ₁ D D C ₄	Trucks, armor, and painted vehicles	
324 🗆 🗆 C ₁ 🗆 🗆 C ₄	Aircraft	
$325 \square \square C_1 \square \square C_4$	Missiles	
$328 \square \square C_1 C_2 C_3 C_4$	Airfields	
3290DC1C2C3C4	Pavement, where D is	
	 Asphalt (4) Concrete (7) Cinder and gravel Srick (5) Gravel (8) Concrete and gravel Cinder (6) Stone (9) Cinder and dirt 	
33	COMBINATIONS OF TERRAIN AND TARGETS	
3301 □ C ₁ C ₂ C ₃ C ₄	Orchard with paved highway	

 $\begin{array}{c} 3301 \square C_1 C_2 C_3 C_4 \\ 3302 \square C_1 C_2 C_3 C_4 \\ 3303 A C_1 C_2 C_3 C_4 C_2 \\ L C_3 C_4 C_2 C_4 C_2 \\ L C_4 C_4 C_2 \\ L C_4 C_4 C_4 \\ L C_$

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Desert, highway, and bridges

Water, ice, land, and small buildings

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TABLE 5-2. SCALES OF ADDITIONAL DESCRIPTORS FOR RADAR DATA

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Scale A: Douglas Sea Scale

Code No.	Description	Wave Height (ft)	Wind Speed (knots)
0	Calm	0	0
1	Smooth	<1	<6.5
2	Slight	1 to 3	6.5 to 12
3	Moderate	3 to 5	12 to 14.5
4	Rough	5 to 8	14.5 to 18
5	Very rough	8 to 12	18 to 23
6	High	12 to 20	23 to 30
7	Very high	20 to 40	30 to 40
8	Mountainous	>40	>40
9	Confused		

Scale B: Wind-Direction Scale



1 indicates antenna direction.

Scale C_1 : Season When Measurements Taken

1	Summer: June, July, August
2	Fall: September, October, November

Winter: December, January, February 3

Spring: March, April, May 4

Scale C2: Small-Scale Roughness

1	Roughness = $<0.01\lambda$
2	Roughness = 0.01λ to 0.05λ
3	Roughness = 0.05λ to 0.10λ
4	Roughness = 0.10λ to 0.50λ
5	Roughness = 0.50λ to 1.00λ
6	Roughness = 1.00λ to 5.00λ
7	Roughness = 5.00λ to 10.00λ
8	Roughness = 10.00λ to 50.00λ
9	Roughness = $> 50.00\lambda$

Scale C3: Large-Scale Roughness

Flat

1

3

4

4

Rolling Hilly

Mountainous

Scale C4: Wetness or Snow

1 Dry ground 2

- Wet ground (rain) Partially flooded or swampy 3
- Snow, $< 3\lambda$ deep Snow, 3 to 10λ deep 5
- Snow, 10 to 20λ deep Snow, 20 to 50λ deep Snow, 50 to 100λ deep Snow, >100λ deep 6
- 7
- 8 9

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TABLE 5-3. RADAR DATA PARAMETERS

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BAND	Frequency interval of measurement coded as follows:		
	B Low frequency P 0.225 to 0.390 GHz L 0.390 to 1.55 S 1.55 to 3.90 C 3.90 to 6.20 X 6.20 to 10.9 KU 10.9 to 20.9 KA 20.9 to 36.0 Q 36.0 to 46.0 V 46.0 to 56.0		
FREQ	Exact frequency of measurement (gigshertz)		
POL	Polarization of transmitted signal and polarization of received signal, coded as follows:		
	VVVertical × verticalHVHorizontal × verticalRLRight circular × left circularRRRight circular × right circularAVAverageHHHorizontal × horizontalVHVertical × horizontalLRLeft circular × right circularLLLeft circular × left circular		
LAT	Latitude of measurement		
LONG	Longitude of measurement		
DATE	Date of measurement (day, month, and year)		
RADAR TYPE	Coded as follows:		
	ACCAirborne cw, coherentACNAirborne cw, noncoherentAPCAirborne pulse, coherentAPNAirborne pulse, noncoherentGCCGround cw, coherentGCNGround cw, noncoherentGPCGround pulse, coherentGPNGround pulse, noncoherent		
BEAMWIDTH	Beamwidth between half-power points (degrees)		
RANGE	Range in thousands of feet followed by an R for slant range or an H for altitude.		
AREA	Total sampling area per average point (square feet)		
AVERAGING	Degree of averaging, scaled from 1 (instantaneous) to 9 (very heavily averaged)		
VARIANCE	Variance about curves (decibels)		

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5.2. SUMMARY OF EXPERIMENTS YIELDING RADAR DATA

The documents from which the radar data have been extracted are briefly summarized below. These summaries are included to facilitate use of the data presented in section 5.3. Information on the experimental platform, instrumentation, reflectance standards, and other related matters has been included. The code consisting of the letter B and five digits at the beginning of each entry is the accessions number assigned to the document by the Target Signature Analysis Center. All curves extracted from the document carry this accessions number plus a number from 001 to 999 which is an arbitrary designation assigned to specific curves. The two numbers together constitute a curve's identification number. Bibliographical information on each of the documents is included, and the user is referred to the original source if more detailed information is required.

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B-03337. Campbell: Backscattering Characteristics of Land and Sea at X-Band, General Precision Laboratory, Inc., Pleasantville, N. Y., May 1958.

Instrumentation

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System 1: airborne pulsed radar Antenna: 18-in.-diameter paraboloid Polarization: horizontal Frequency: X-band ($\lambda = 3.4$ cm) Antenna beamwidth: unspecified Pulse-repetition frequency: 20 kHz Pulse duration: 1/4 μ sec

System 2: airborne pulsed radar Antenna: a pair of paraboloids, 18-in. diameter Polarization: vertical, horizontal, cross Frequency: X-bard ($\lambda = 3.4$ cm) Antenna becamwidth (both azimuth and elevation): 5

Antenna beamwidth (both azimuth and elevation): $5 1/2^{\circ}$

Pulse-repetition frequency: 50 kHz

Pulse duration: 1 µsec Comments: One antenna was arranged to transmit vertically polarized radiation, and the other was arranged to transmit horizontally polarized radiation. For the crosspolarization measurements, the horizontally polarized antenna was used for transmission and the vertically polarized antenna for reception. The antennas were mounted on a servo-controlled platform within a radome on the underside of the C-46 test aircraft. Platform azimuth was adjusted during each run so that the direction of propagation (excent for normal incidence) was forward, approximately along the

ground track of the aircraft. The platform tilt angle, which determined the radiation incidence angle, was stabilized against aircraft motion about the tilt axis by means of a vertical gyroscope mounted on the platform.

Targets and Backgrounds Observed: wooded land (Connecticut), cultivated land (Virginia), Atlantic Ocean, dry pine forests and grasslands (northern Arizona), irrigated farm land (Chandler, Ariz.), desert and dry lake bed (Amboy, Calif.)

Test Procedure (Property Measured): scattering cross section per unit area

Data

Output form: curves of scattering cross section, 10 log σ_0 vs. incidence angle; curves are averages of several measurements

B-03539. Measurements of Terrain Backscattering with Airborne X-Band Radar (Final Report), Goodyear Aerospace Corp., Litchfield Park, Ariz., 30 September 1959, AD 229 104. Instrumentation System: airborne side-looking pulsed radar Antenna: designed to provide uniform ground illumination angles of incidence from 10° to 70⁰ **Polarization:** horizontal Frequency: 9375 MHz (X-band) Antenna beamwidths: 4º azimuth, 9.2º elevation Pulse-repetition frequency: 800 pps Pulse duration: 0.78 µsec Transmitter output power: 50 kw Targets and Backgrounds Observed: wooded land (New Jersey, Connecticut), cultivated land (Virginia), wooded land with occasional residential and cleared areas (Long Island, N. Y.), water (Long Island Sound, N. Y.) Test Procedure (Property Measured): ratio of received-to-transmitted rf power levels at X-band **Experimental Parameters Specified** Aspect angle: $10^{\circ} < \theta < 70^{\circ}$ Others: altitude, terrain clearance, slant range Data Output form: tables and curves of backscattering coefficient σ_0 vs. aspect angle Data processing: averages, data spread, probability density function for σ_0 Errors: σ_0 accurate to 1 dB B-03553. Hagn: An Investigation of the Direct Backscatter of High-Frequency Radio Waves from Land, Sea Water, and Ice Surfaces (Final Report II), Stanford Research Institute, Menlo Park, Calif., May 1962, AD 278 138. Instrumentation System: airborne high-frequency pulsed radar (a cw mode was also available) Antenna: a crossed Yagi array was secured to the nose of the aircraft and a dipole under the tail; the two antennas were matched to have a VSWR of les- than 1.4:1 when airborne Polarization: horizontal, vertical, cross Frequency: 32.8 MHz Antenna beamwidth Nose antenna vertical: 140° azimuth, 20° elevation Nose antenna horizontal: 50° azimuth, 10° elevation Tail antenna horizontal: 40° azimuth, 5° elevation Pulse-repetition frequency: variable from 10 to 10,000 pps Pulse duration: variable from 1 μ sec to 10 msec Transmitter output power: variable from 4 w to 4 kw Targets and Backgrounds Observed: ocean, polar sea ice, selected land surfaces Test Procedure (Property Measured): backscatter reflection coefficient as a function of incidence angle Data Output form: plots of backscatter reflection coefficient ρ vs. angle of incidence

Data processing: averages, data spread computed

B-04333. Grant, Yaplee: Backscattering from Water and Land at Centimeter and Millimeter Wavelengths, Naval Research Laboratory, Washington, D. C., 20 March 1957.

Instrumentation System: 2-antenna, zero-intermediate frequency superheterodyne cw Doppler Antenna: spun aluminum parabolas

Polarization: vertical

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Frequency: 3.2 cm at X-band, 1.25 cm at K-band, 8.6 mm at Q-band

Antenna beamwidth (both azimuth and elevation): 3.1° for X-band; 3.4° for K-band, 2.4° for Q-band

Transmitter: low-power klystron transmitting tubes: 2K25 at X-band. 2K50 at K-band, QK-291 at Q-band

Comments in the water-surface measurements, the difference in frequency between the transmitted and received signals was provided by the Doppler shift due to the motion of the water. The frequency response of the audio amplifier was linear down to 20 Hz. A radial velocity of about 0.6 knot on the X-band system and less than 0.2 knot on the Q-band system was necessary to give a 20-Hz Doppler frequency. Only in the case of extremely calm water were velocities lower than this encountered. For calm water and all the land-terrain measurements the difference in frequency between transmitted and received signals was provided by frequency modulating the klystron transmitter.

Targets and Backgrounds Observed: water surfaces, tree-covered terrain, tall dry weeds, wet terrain covered with tall green weeds or flags, short dry grass, green grass, nonhomogeneous terrain

Comments: Water-surface data were taken on the Potomac River Bridge, Newburg, Md., where a catwalk 150 ft high provided an unobstructed view of the water at all angles from normal incidence to the horizon. Terrain data were taken from bridges that had approaches at least 100 ft above relatively flat land. The bridges used were the Neches River Bridge, Port Arthur, Tex., the Huey P. Long Bridge, New Orleans, La., and the Eugene Talmadge Bridge, Savannah, Ga.

Test Procedure (Property Measured): readings of the ratio of received power were made every 5° from 0° to 40° and every 10° from 40° to 80°

Experimental Parameters Specified Wind velocity: 0-25 knots

Data

Output form: curves of average radar cross section of water or land echo per unit area of surface σ_0 vs. angle of incidence

B-04434. MacDonald, Ament, Ringwait: Terrain Clutter Measurements, Naval Research Laboratory, Washington, D. C., 21 January 1958, AD 156 184.

Instrumentation System: airborne pulsed radar Antenna: unspecified Polarization: horizontal, cross Frequency: X-band, S-band, L-band Antenna beamwidth: unspecified Pulse-repetition frequency: 175 Hz Pulse duration: 1/2 μsec

Targets and Backgrounds Observed: rural terrain, urban terrain

Test Procedure (Property Measured): radar ground clutter

Experimental Parameters Specified Altitude: .2000, 3000, 6000 ft Depression angle: $1.5^{\circ} \le \theta \le 90^{\circ}$ Aircraft ground speed: 140 knots Date: February 1956 Location: Annapolis, Baltimore (Md.)

Data

Output form: charts of normalized radar cross section (dB), 10 log σ_0 vs. depression angle

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B-04435. Peake, Taylor: Radar Back-Scattering Measurements from "Moon-Like" Surfaces, Antenna Laboratory, Ohio State University Research Foundation, Columbus, 1 May 1963.

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Instru::entation System: single-antenna cw Doppler

Antenna: high-gain pyramidal horns and zoned dielectric lenses designed to give an optimum pattern at operating range of 20 ft

Polarization: horizontal, vertical

Frequency: 10 GHz at X-band, 15.5 GHz at K_u -band, 35 GHz at K_a -band Transmitter: low-power klystrons, X-12 at X-band and K_u -band, QK-291 at K_a -band Detector: 1N23 crystals at X-band, 1N26 crystals at K_u -band, 1N53 crystals at K_a -band

Targets and Backgrounds Observed: sand, gravel, stone

Test Procedure (Property Measured): radar backscatter (dB)

Data

Output form: curves of radar backscatter vs. grazing angles of 20° to 80° Data processing: curves of radar return, 10 log γ vs. normalized roughness

B-04436. Cosgriff, Peake, Taylor: Terrain Scattering Properties for Sensor System Design: Terrain Handbook No. 2, sponsored by contracts between U. S. Air Force (ARDC) and U. S. Army Signal Corps and Ohio State University Research Foundation, Columbus, May 1960.

Instrumentation System: single-antenna cw Doppler

Antenna: high-gain pyramidal horns with zoned dielectric lenses designed to give an optimum pattern at operating range of 20 ft

Pelarization: horizontal, vertical

Frequency: 10 GHz at X-band, 15.5 GHz at Ku-band, 35 GHz at Ka-band

Transmitter: low-power klystrons, X-13 at X-band, X-12 at K_u -band, QK-291 at K_a -band Detector: 1N23 crystals at X-band, 1N26 crystals at K_u -band, 1N23 crystals at K_a -band

Targets and Backgrounds Observed: smooth terrain, vegetation, snow- and rain-covered terrain, sea

Test Procedure (Property Measured): radar cross section per unit area of terrain (normalized echo area)

Experimental Parameters Specified

Incidence angle: measurements made at 5° or 10° intervals for incidence angles from 10^c to 80^o (±1^c)

Slant range: 20 ft

Effective illuminated area (normal to line of sight): 2.41 ft² at X-band, 2.36 ft² at K_n -band, 0.67 f^2 at K_n -band

Data

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Output form: curves of radar cross section per unit area of terrain vs. angle of incidence and frequency

Error: measurements accurate to ±1 dB

Insert Radar Data Sheets Here

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6 PASSIVE MICROWAVE DATA

The passive microwave data in this compilation are apparent temperatures (antenna .r target) as a function of aspect or depression angle. These data are processed in a manner similar to that used for the optical data in section 3, i.e., each curve is digitized and assigned subject codes (table 1-1), and the parameter information describing the experimental conditions (see table 6-1) is listed. However, the system used to process the microwave data is actually an expanded version of that used with the optical data. It has been designed to handle not only passive microwave data, but also, eventually, both directional and bidirectional reflectance data. Thus, many of the parameters defined in table 6-1 do not apply to the data now in this section, but were included for future data accessions.

There is also a major difference in printed-out format between the curve headers for the optical data and those for the microwave data in this section. For the optical data, all the parameter designations are printed as part of each header whether cr not there is specific information on the parameter. For the microwave data, only those parameters for which there are specific entries will appear; parameters that are not applicable or not specified are not included. The data are arranged by subject codes and alphabetically cross-indexed in section 2.

TABLE 6-1. GENERALIZED PARAMETERS FOR PASSIVE MICROWAVE DATA

TIME

MONTH	Month of measurement
DAY	Day of measurement
YEAR	Year of measurement
FIME	Time of measurement (24-hour clock), Greenwich Standard Time (GMT)

TARGET

LAT	Latitude (degrees) of measurement (fie'd measurement) or of location at which specimen was collected (laboratory measurement)
LATNS	Latitude, North (N) or South (S)
LONG	Longitude (degrees) of measurement or of location at which specimen was collected, as with LAT
LONG EW	Longitude, East (E) or West (W)
TARALT	Altitude of target above ground (kilometers)
TARZEN	Zenith angle (degrees) of target normal with respect to vertical
TARAZ	Azimuth angle (degrees) of target normal with respect to a $\phi = 0$ reference line defined for a given target
TARUNF	Surface uniformity coded as UNIFRM (uniform) or NONUNF (nonuniform) in radar applications, use subject codes from table 1-1 or the Douglas Sea Scale codes (table 5-2).
TAROPQ	Target opaqueness coded as OPAQUE (opaque), TRANSP (transparent), or TRANSL (translucent)
TARTEM	Target temperature (degrees Ketvin)
TH2OES	Qualitative estimate of free water content coded as DRY, DAMP, WET or PTFL (partially flooded). Indicate snow under TARCS1 or TARCS2.

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TABLE 6-1. GENERALIZED (PASSIVE MICROWAVE) DATA PARAMETERS (Continued) Quantitative measure (percent) of free water content; W indicates per-TH2OME centage by weight, V percentage by volume Number of hours sample has been removed from its natural environment HRSREM Target coating or substrate 1 coded using up to a five-letter code from the Target Signature Subject-Code List (table 1-1) preceded by a C TARCS1 (coating) or S (substrate); snow coatings are indicated using the following letter code at the end of subject code BHBD: A Incomplete cover B Depth 0 to 5 cm С Depth 5 to 20 cm D Depth over 20 cm Target coating or substrate 2 (see TARSC1) TARCS2 Target contaminant coded using up to a six-letter subject code from TARCON table 1-1 TARSRD Availability of data on the target's surface roughness, coded by AVAIL Availability of the target's dielectric constant, coded by DC; its index of TARDCN refraction, coded by N; or both, coded by BOTH TARINF Availability of other descriptive information about the target, coded by AVAIL. BACKGROUND Predominant background type coded using up to a six-letter subject code **BKGTYP** from table 1-1 BKGUNF Background uniformity (see TARUNF) BKGOPQ Background opaqueness (see TAROPQ) BKGTEM Background temperature (see TARTEM) BH2OES Qualitative estimate of free water content (see TH2OES) Quantitative measure of free water content (see TH2OME) BH2OME BKGCS1 Background coating or substrate 1 (see TARCS1) Background coating or substrate 2 (see TARCS2) BKGCS2 Background contaminant (see TARCON) BKGCON Availability of data on the background's surface roughness (see TARSRD) BKGSRD Availability of the backgrounds dielectric constant, index of reiraction, BKGDCN or both (see TARDCN) BKGINF Availability of other descriptive information about the background (see TARINF) METEOROLOGY Note: These parameters are applicable to field experiments only. Ambient or air temperature (^OK) AIRTEM BARPRS **Barometric pressure (millibars) Relative humidity** RELHUM Visibility (kilometers) VISBIL Wind speed (miles per hour) WINDSP Wind direction (N, NNE, NE, ENE, etc.); for radar, indicate relative WINDIR bearing with 0° being from target to receiver and angle measured counterclockwise

OBST Obstructions in the air preventing a clear view of the target, coded as NONE, FOG, DRIZZL, RAIN, SNOW, HAZE, SMOKE, DUST, or OTHER PRAMT Ground accumulation of precipitation in the preceding 24-hour period (centimeters) CLDCOV Total cloud cover (percent)

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TABLE 6-1. GENERALIZED (PASSIVE MICROWAVE) DATA PARAMETERS (Concluded)

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SOURCE

Note: These parameters are not applicable to passive-microwave measurement systems.

SORTYP	Type of source coded using table 1-1
SGAMMA	The real part of the coherence function of the source, i.e., the visibility
	function or $ \gamma_0 $; for radar, 1.0 = coherent, 0.0 = noncoherent
SORPOL	Type of source polarization coded using table 1-1
SORDP	Degree of polarization at the source (percent)
ZENINC	Zenith angle of incidence (degrees)
AZINC	Azimuth angle of incidence (degrees)
SRANGE	Range (distance) from source to target (kilometers)
SORINF	Availability of other descriptive information about the source, coded by AVATL.

RECEIVER

MINST	Measuring instrument coded using table 1-1
ROMEGA	Mean reflected solid angle (steradians)
RRANGE	Range from target to receiver (kilometers)
ZENOBS	Zenith angle of observation (degrees)
AZOBS	Azimuth angle of observation (degrees)
RECPOL	Type of receiver polarization coded using table 1-1
LAMDA	Operating center wavelength λ_{α} (centimeters)
IFBAND	Intermediate frequency bandwidth or spectral resolution expressed as $\Delta\lambda/\lambda_c$
TIMEC	Time constant for integration time of the receiver (seconds)
INSENS	Availability of data on instrument sensitivity, coded by AVAIL
SYSACC	System accuracy expressed in units of the dependent variable
ANT3DB	3-db antenna beamwidth (degrees)
AVESLL	Average side-lobe level of the antenna (decibels)
RECINF	Availability of other descriptive information about the receiver, coded by AVAIL

GENERAL

PLATE	Experimental platform coded using table 1-1
RELABS*	Dependent variable is indicated as relative (REL) or absolute (ABS)
STAND	Standard used coded using table 1-1
NAVE	Number of curves or measurements averaged to make up this curve
VARNCE	Variance about curves in units of ordinate dimensions

*If ABS (absolute) appears along with an entry for STAND (standard), the measurement was originally done on a relative basis using the indicated standard and later converted to absolute values.

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