DDC/BIB-77/04

SOLAR CELLS AND SOLAR PANELS

A DDC BIBLIOGRAPHY

DDC-TAS
Cameron Station
Alexandria, Va. 22314

APRIL 1977

DEFENSE DOCUMENTATION CENTER
DEFENSE LOGISTICS AGENCY
Cameron Station
Alexandria, Va. 22314

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

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*Solar Cells	Manufacturing
*Solar Panels	Sun
Power Supplies	Solar Collectors
Power Levels	Orientation (Direction)

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This bibliography is a selection of unclassified and unlimited distribution references on Solar Cells and Solar Panels. These citations of reports present information on performance characteristics, fabrication, development of power levels, degradation studies of solar cells, and systems for orienting solar panels continuously toward the sun. Corporate Author-Monitoring Agency, Subject, Title and Personal Author are provided.

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SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

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F O R E W O R D

This unclassified and unlimited bibliography contains 213 selected citations of reports on *Solar Cells and Solar Panels*. These references were selected from entries processed into the Defense Documentation Center's AD data bank during the period of January 1953 through December 1976.

This bibliography supersedes *Solar Cells and Solar Panels*, AD-768 400, DDC-TAS-73-51, dated October 1973.

Entries are sequenced by AD number. Computer-generated indexes of Corporate Author-Monitoring Agency, Subject, Title and Personal Author are provided.

BY ORDER OF THE DIRECTOR, DEFENSE LOGISTICS AGENCY

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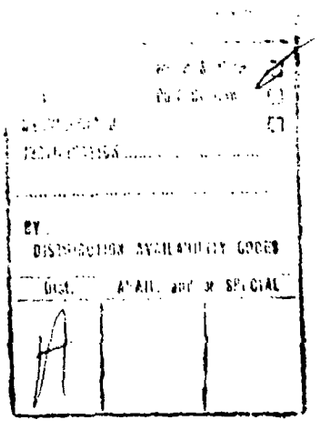
Defense Documentation Center



C O N T E N T S

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 257 494
TRANS WORLD AIRLINES INC KANSAS CITY MO

HIGH EFFICIENCY SILICON SOLAR CELLS (U)

DEC 60 IV LAMOND,PIERRE;BERMAN,PAUL;
CONTRACT: DA36 039SC85250
MONITOR: ARPA 80 59

UNCLASSIFIED REPORT

DESCRIPTORS: *POWER SUPPLIES, *SOLAR CELLS, CALIBRATION, COATINGS, CRYSTALS, DESIGN, DIFFUSION, EFFECTIVENESS, ELECTRON IRRADIATION, MATERIALS, PHOTOSENSITIVITY, DAMAGE, RADIATION EFFECTS, REFLECTION, SEMICONDUCTORS, SILICON, TESTS (U)

A SUMMARY IS PRESENTED OF THE PROCESS USED AT TRANSITRON FOR THE P ON N SOLAR CELLS. THESE HAVE BEEN SUPERSEDED BY THE MORE RADIATION RESISTANT N ON P TYPE CELLS. PROBLEMS IN OPTIMIZING THE JUNCTION DEPTH OF SOLAR CELLS ARE DISCUSSED. THE RESULTS OF DIFFUSION EXPERIMENTS ARE PRESENTED. THE CALIBRATION OF SOLAR CELL STAND-ARDS AND ARTIFICIAL LIGHT SYSTEMS FOR THE TESTING OF SOLAR CELLS IS DISCUSSED. SPECIAL ATTENTION IS GIVEN TO THE PROBLEMS ENCOUNTERED IN USING A TUNGSTEN ARTIFICIAL LIGHT SOURCE TO DETERMINE THE EFFICIENCY OF SOLAR CELLS. EXPERIMENTAL RESULTS ARE PRESENTED WHICH VALIDATE THE THEORETICAL DISCUSSION. RESULTS OF ELECTRON BOMBARDMENT EXPERIMENTS ON P ON N AND N ON P SOLAR CELLS ARE GIVEN WHICH SHOW THE N ON P CELL STRUCTURE TO BE APPROXIMATELY FIVE TIMES MORE RESISTANT TO DAMAGE BY 2 MEV AND 700 KEV ELECTRONS. ELECTRON BOMBARDMENT EXPERIMENTS ON N ON P CELLS FABRICATED AT TRANSITRON ARE PRESENTED WHICH AGREE WITH THE RESULTS OBTAINED WITH THE SIGNAL CORPS N ON P CELLS. THE FABRICATION OF TRANSITRON RADIATION RESISTANT N ON P SOLAR CELLS IS DISCUSSED AND THE PROCESS AS DEVELOPED SO FAR IS GIVEN. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 257 495
TECHNICAL OPERATIONS INC BURLINGTON MASS

RESEARCH DETECTED TOWARD THE IMPROVEMENT OF THE EFFICIENCY OF SILICON BATTERIES BY UTILIZATION OF UNABSORBED PHOTONS (U)

MAY 61 IV
REPT. NO. 861 24
CONTRACT: AF19 604 7306
MONITOR: AFCRL 475

UNCLASSIFIED REPORT

DESCRIPTORS: *POWER SUPPLIES, *SILICON, *SOLAR CELLS, ABSORPTION, COATINGS, DYES, EFFECTIVENESS, INFRARED RADIATION, INSTRUMENTATION, PHOSPHORESCENT MATERIALS, PHOTOGRAPHIC CHEMICALS, PHOTONS, REFLECTION, SENSITIVITY, SOLAR RADIATION, SURFACES, TEST METHODS, ULTRAVIOLET RADIATION (U)

ATTEMPTS WERE MADE TO INCREASE THE POWER OUTPUT OF SI SOLAR CELLS BY SENSITIZING THE CELLS TO THOSE REGIONS IN WHICH THEY DO NOT RESPOND, (UV AND IR) AND BY INCREASING THE ABSORPTION AND EFFICIENCY OF THE CELLS IN THE SPECTRAL REGIONS IN WHICH THEY DO RESPOND. THREE METHODS WERE STUDIED: (1) COATING THE CELL SURFACE WITH PHOSPHORS WHICH ABSORB IN THE UV AND BLUE REGION AND FLUORESED IN THE REGION OF RESPONSE OF THE SOLAR CELL (0.45 TO 1.0 MICRONS) AND WITH DYE ENERGY-TRANSFER AGENTS; (2) APPLYING ANTIREFLECTION COATINGS TO THE CELL SURFACE FOR THE REGION OF RESPONSE; AND ( ) APPLYING DYE SENSITIZERS FOR THE IR REGION. ADSORPTION AND RESPONSE OF SI SOLAR CELLS WAS OPTIMIZED BY INDUSTRY IN THE REGION 0.45 TO 1.0 ANGSTROMS. SENSITIZATION OF THE CELLS BY PHOSPHORS IN THE UV REGION IS FEASIBLE BUT THE INTENSITY OF FLUORESCENCE REQUIRED TO DRIVE THE CELL APPEARS TO BE GREATER THAN THAT EASILY ACHIEVED BY SURFACE COATING. NEITHER SENSITIZATION BY CHEMICAL SENSITIZERS IN THE UV REGION NOR BY DYE SENSITIZATION IN THE IR REGION APPEARS TO BE POSSIBLE. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 258 660
HOFFMAN ELECTRONICS CORP SANTA BARBARA CALIF

COATINGS FOR SOLAR CELLS (U)

FEB 61 1V WITUCKI,ROBERT M.;LEWIS,ARTHUR E.;

UNCLASSIFIED REPORT

DESCRIPTORS: *COATINGS, *INFRARED RADIATION, *OPTICAL COATINGS, *SOLAR CELLS, *THIN FILMS (STORAGE DEVICES), *ULTRAVIOLET RADIATION, ABSORPTION, BLACKBODY RADIATION, DIELECTRICS, INFRARED OPTICAL MATERIALS, MATERIALS, PLASTICS, POLYMERS, REFLECTION, REFLECTOMETERS, SEMICONDUCTORS, SILICONES, SPECTROPHOTOMETERS (U)

THE THECRETICAL BASIS FOR THE REFLECTANCE OF DIELECTRIC MATERIALS IN THE ULTRAVIOLET AND THE NEAR INFRARED WAS REVIEWED, AS WELL AS THE PROPERTIES REQUIRED FOR HIGH EMISSIVITY. IT WAS CONCLUDED THAT SINGLE THIN FILM COATINGS ALONE, OF 1 MICRON OR LESS IN THICKNESS, CAN NOT PROVIDE EITHER ADEQUATE EMISSIVITY OR HIGH SELECTIVE REFLECTIVITY OF THE WAVELENGTHS REQUIRED AND STILL SHOW HIGH TRANSMISSION FROM 0.45 TO 1.1 MICRON. A HIGH EMISSIVITY WAS FOUND TO BE THE MOST IMPORTANT SINGLE METHOD OF REJECTING ENERGY IN SPACE. THEREFORE ATTENTION WAS DIRECTED PRIMARILY TOWARD ACHIEVING MAXIMUM EMISSIVITY. EMISSIVITIES OF THE ORDER OF 0.9 CAN ONLY BE OBTAINED USING COATINGS OF SEVERAL MILS THICKNESS. SILICONE COATINGS WERE FOUND TO BE VERY SIMPLE AND INEXPENSIVE TO APPLY, AND WITHIN THE ACCURACY OF AVAILALE DATA TO SHOW A PREDICTED PERFORMANCE IN SPACE EQUIVALENT TO THE PRESENTLY USED ULTRAVIOLET REFLECTING COATED COVER GLASSES. NUMEROUS LABORATORY TESTS OF LIMITED TIME DURATION HAVE SHOWN THE SELECTED SILICONE COATING TO BE STABLE TO THE EXPECTED ENVIRONMENTAL CONDITIONS DURING STORAGE AS WELL AS IN SPACE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 260 068
TRW INC CLEVELAND OHIO

DESIGN STUDY FOR ADVANCED SOLAR THERMIONIC POWER SYSTEMS ITEM III. ELECTRICAL CHARACTERISTICS STUDY (U)

DEC 60 IV
REPT. NO. ER 4262
CONTRACT: AF33 616 7411

UNCLASSIFIED REPORT

DESCRIPTORS: *PLASMAS(PHYSICS), *POWER SUPPLIES, *SOLAR CELLS, *THERMIONIC EMISSION, CESIUM, DESIGN, DIODES, DIRECT CURRENT, EFFECTIVENESS, ELECTRICAL PROPERTIES, ELECTRON IRRADIATION, GENERATORS, SOLAR RADIATION, SPACE ENVIRONMENTS, TESTS, THEORY, VACUUM APPARATUS, VAPORS, VOLTAGE REGULATORS (U)

RESULTS OF A THEORETICAL AND EXPERIMENTAL STUDY OF ELECTRICAL CHARACTERISTICS OF CESIUM-VAPOR AND VACUUM THERMIONIC GENERATORS ARE PRESENTED. THE RESULTS INDICATE THAT A NON-OPTIMIZED CESIUM CONVERTER CAN GIVE THE PREDICTED PERFORMANCE. A WIRE SPACER TECHNIQUE FOR VACUUM DIODES WAS INVESTIGATED AND PROVEN ENTIRELY SUCCESSFUL. THIS TECHNIQUE OFFERS SUBSTANTIAL ADVANTAGES OVER SAPPHIRE SPACERS AND SIMPLIFIES CONSIDERABLY THE DESIGN FOR THE 250-WATT VACUUM GENERATOR. THE RESPONSE OF BOTH CESIUM AND VACUUM GENERATORS TO SUDDEN CHANGES IN LOAD APPEARS TO BE INSTANTANEOUS FOR ALL PRACTICAL PURPOSES, THEREBY PERMITTING THE USE OF SWITCHING TYPE VOLTAGE REGULATORS WHICH OFFER PARTICULAR ADVANTAGES IN SPACE APPLICATIONS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 262 005
MOUNT VERNON RESEARCH CO ALEXANDRIA VA

SOLAR SPECTRUM SIMULATOR, SPACE ENVIRONMENT SIMULATOR FOR TESTING SOLAR CELLS (U)

NOV 60 IV STICKNEY,WILLIAM W.;
CONTRACT: AF33 616 6935

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *SOLAR SPECTRUM, *SPACE ENVIRONMENTS, ARGON, OPTICS, PLASMA JETS, PLASMAS(PHYSICS), PRESSURE, QUARTZ, SIMULATION, TEST METHODS, TESTS, THERMAL RADIATION, VACUUM APPARATUS (U)

A DEVICE IS TO BE DEVELOPED WHICH WILL SIMULATE THE SPACE ENVIRONMENT SO THAT THE PERFORMANCE IN SPACE OF SOLAR CELLS AND ARRAYS OF THEM CAN BE REALISTICALLY EVALUATED IN THE LABORATORY. THE ENVIRONMENT INCLUDES THREE BASIC PARAMETERS: SOLAR RADIATION, PRESSURE, AND THERMAL CONDITIONS. AN ARGON STABILIZED, DC, PLASMA ARC WAS DEVELOPED AS A LIGHT SOURCE TO SIMULATE THE SOLAR RADIATION IN BOTH COLOR DISTRIBUTION AND INTENSITY FROM 0.2 TO 2.0 MICRONS WAVELENGTH. A VACUUM CHAMBER WITH LIQUID NITROGEN COOLED WALLS WAS BUILT TO SIMULATE THE EFFECTS ON SOLAR CELLS OF PRESSURE AND THERMAL CONDITIONS IN SPACE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 263 861
IIT RESEARCH INST CHICAGO ILL

INVESTIGATION OF SINGLE ENERGY GAP SOLAR CELL MATERIAL (U)

JUN 61 IV ROBINSON,ROBERT J.;
REPT. NO. 1175 10
CONTRACT: DA36 039SC87381
MONITOR: ARPA 80 61

UNCLASSIFIED REPORT

DESCRIPTORS: *MANUFACTURING, *POWER SUPPLIES, *SOLAR CELLS, CADMIUM COMPOUNDS, CONTROLLED ATMOSPHERES, CRYSTALS, DESIGN, DIFFUSION, ELECTRICAL PROPERTIES, HIGH TEMPERATURE, INTERMETALLIC COMPOUNDS, MATERIALS, OPTICS, PROCESSING, PRODUCTION, SEMICONDUCTORS, SINGLE CRYSTALS, TELLURIDES, TESTS, THERMAL STRESSES (U)

EMPHASIS WAS PLACED ON FORMING P-TYPE LAYERS ON N-TYPE ZONE LEVELED CDTE BY VAPOR DIFFUSION IN THE RECENTLY ACQUIRED MULTIPLE ZONE FABRICATION FURNACE. LOW TEMPERATURE DIFFUSION FABRICATION STUDIES WERE EMPHASIZED AND IT IS SHOWN THAT SHALLOW AND DEEP JUNCTIONS CAN BE FORMED AT 500 C. ELECTRICAL, THERMAL AND OPTICAL STUDIES OF THE N-TYPE BASE MATERIAL, AND SPECTRAL RESPONSE CURVES OF THE COMPLETED SOLAR CELLS ARE INCLUDED. COMBINED OPTICAL TRANSMISSION AND SPECTRAL RESPONSE CURVES SHOW THAT THE ABSORPTION COEFFICIENT VERSUS WAVELENGTH HAS A SLOPE SIMILAR TO SILICON RATHER THAN TO GAAS OR INP WHICH IS FAVORABLE. LOW TEMPERATURE FABRICATION IS SHOWN TO BE POSSIBLE AND IS ADVANCED AS AN ARGUMENT FOR CDTE SINCE LESS FABRICATION DISORDER IS EXPECTED COMPARED TO HIGH TEMPERATURE FABRICATION. HOWEVER, THE ROOM TEMPERATURE CONVERSION EFFICIENCIES OF CURRENT CDTE SOLAR CELLS ARE STILL LOW COMPARED TO SILICON, BUT THE STILL EARLY STATE OF THE ART OF CDTE IS STRESSED. PRELIMINARY HIGH TEMPERATURE PHOTOVOLTAIC EXPERIMENTS TEND TO CONFIRM THE USE OF CDTE COMPARED TO SILICON. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 265 213
LOCKHEED MISSILES AND SPACE CO SUNNYVALE CALIF

PROTON DAMAGE TO SOLAR CELLS (U)

AUG 61 1V CHOW,K.T.;LODI,E.A.;
REPT. NO. LMSD 703735 1
CONTRACT: AF04 647 564

UNCLASSIFIED REPORT

DESCRIPTORS: *DAMAGE, *RADIATION EFFECTS, *SOLAR CELLS, *SPACE ENVIRONMENTS, INSTRUMENTATION, POWER SUPPLIES, PROTON BEAMS, PROTONS, RADIOACTIVATION ANALYSIS, SILICON, SIMULATION (U)

THE PERFORMANCE WAS EVALUATED OF COMMERCIALLY AVAILABLE SILICON SOLAR CELLS WHICH ARE TO BE USED AS A POWER SOURCE IN THE SPACE RADIATION FIELD SURROUNDING THE EARTH. THE EXPERIMENT WAS SPECIFICALLY DESIGNED TO PROVIDE INFORMATION ON THE PROTON RADIATION ENCOUNTERED BY SOLAR CELLS OPERATING IN SPACE. THE RESULTS INDICATED THAT A 25% REDUCTION IN MAXIMUM POWER OUTPUT OF THE CELL OCCURRED AT INTEGRATED FLUXES OF APPROXIMATELY 5 X 10 TO THE 9TH AND 10TH POWER PROTONS/SQ CM FOR 3-MEV AND 13-MEV PROTONS, RESPECTIVELY. THE CELLS WERE FURTHER IRRADIATED TO OBTAIN A REDUCTION IN MAXIMUM POWER OUTPUT OF ABOUT 40 TO 50%. ROOM-TEMPERATURE ANNEALING OF THE CELLS WAS OBSERVED FOR A PERIOD OF FOUR WEEKS WITH NO SIGNIFICANT CHANGES OCCURRING. THE PROTON SOURCE, THE APPARATUS FOR MEASURING THE ELECTRICAL OUTPUT OF THE SOLAR CELL, AND THE RESULTS OF THE EXPERIMENT ARE PRESENTED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 269 508
ELECTRO-OPTICAL SYSTEMS INC PASADENA CALIF

CHEMICAL REACTIONS TO CONVERT SOLAR ENERGY INTO POWER SOURCES (U)

SEP 61 1V ROWLETTE,J.J.;
CONTRACT: AF33 616 6546
MONITOR: ARL 60

UNCLASSIFIED REPORT

DESCRIPTORS: *OXIDES, *POWER SUPPLIES, *SOLAR CELLS, *SOLAR RADIATION, *SULFUR COMPOUNDS, CADMIUM COMPOUNDS, CATALYSTS, CHEMICAL REACTIONS, DECOMPOSITION, ELECTROLYTIC CELLS, GASES, HYDROGEN, LABORATORY EQUIPMENT, LIQUIDS, PEROXIDES, PHOTOCHEMICAL REACTIONS, REGENERATION, SYNTHESIS, TELLURIDES, TEMPERATURE, THERMOCHEMISTRY, ZINC COMPOUNDS (U)

PHOTOCHEMICAL SYNTHESIS OF H2O2 AND THE COMBINED THERMAL-PHOTOCHEMICAL DECOMPOSITION WERE STUDIED FOR THE ULTIMATE POSSIBILITY OF USING SUNLIGHT FOR REGENERATIVE ELECTROLYTIC CELLS, OR FOR THE PURPOSE OF MAKING H2O2 FOR OTHER HIGH ENERGY APPLICATIONS. THEORETICAL ANALYSIS OF THE PHOTOLYSIS AND THERMAL DECOMPOSITION OF SO3 STRONGLY INDICATED THAT A COMBINATION OF A PHOTOCHEMICAL AND THERMAL DECOMPOSITION WOULD NOT YIELD A DECOMPOSITION GREATER THAN THE 2 PROCESSES USED SEPARATELY. H2O2 SYNTHESIS WAS ACCOMPLISHED IN BOTH LIQUID AND GASEOUS STATES USING CADMIUM TELLURIDE AND ZINC OXIDE AS PHOTOCATALYST. WITHOUT ORGANIC ADDITIVES IN THE LIQUID PHASE, NEITHER CATALYST SHOWS ANY PROMISE. IN THE PRESENCE OF THE ADDITIVES, THE REACTIONS ARE ALWAYS EXOTHERMIC AND CONSEQUENTLY OF NO VALUE FOR ENERGY CONVERSION. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 270 131
RADIO CORP OF AMERICA PRINCETON N J DEFENSE ELECTRONIC PRODUCTS

SOLAR CELL ARRAY OPTIMIZATION (U)

NOV 61 1V ADDISS,R.R.;ANCHUTIN,A.;
CONTRACT: AF33 616 7415
MONITOR: ASD TR61 11

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, ADHESIVES, AIRBORNE, CADMIUM COMPOUNDS, COATINGS, MATERIALS, PHOTOELECTRIC CELLS (SEMICONDUCTOR), PHOTOTUBES, PLASTICS, POWER SUPPLIES, RELIABILITY, SINGLE CRYSTALS, SULFIDES (U)

PRELIMINARY SPECIFICATIONS ARE GIVEN FOR TWO OPTIMIZED SOLAR-CELL-ARRAY SYSTEMS. THE PRIMARY OPTIMIZATION CRITERION APPLIED WAS TO OBTAIN THE MAXIMUM ELECTRICAL POWER CONVERSION OF SOLAR ENERGY IN SPACE PER UNIT OF SYSTEM WEIGHT, CONSISTENT WITH REQUIRED MINIMUM RELIABILITY AND MAXIMUM PERMISSIBLE PACKAGED VOLUME. SPECIFICAREAS CONSIDERED ARE, PHOTOVOLTAIC MATERIALS, CRYSTAL CONVERSION, SOLAR CELL CIRCUIT SIMULATION, ARRAY INTERCONNECTION OPTIMIZATION, ADHESIVES, ARRAY STRUCTURES, FOAM INFLATION, THERMAL DESIGN, TEMPERATURE AND INTENSITY EFFECTS, AND LAUNCH ENVIRONMENT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 271 358
SPECTROLAB SYLMAR CALIF

INVESTIGATION OF OPTICAL COATINGS FOR SOLAR CELLS (U)

DEC 60 1V MANN,A.E.;

UNCLASSIFIED REPORT

DESCRIPTORS: *INFRARED FILTERS, *OPTICAL COATINGS, *RARE EARTH COMPOUNDS, *SOLAR CELLS, ADHESIVES, BETA PARTICLES, BLACKBODY RADIATION, BONDING, COATINGS, FLUORIDES, INFRARED RADIATION, OXYFLUORIDES, POWER SUPPLIES, RADIATION EFFECTS, RARE EARTH ELEMENTS, REFLECTION, SATELLITES (ARTIFICIAL), SILICON, SPACE ENVIRONMENTS, STABILITY, TESTS, THEORY, THERMODYNAMICS, VAPOR PLATING, WAVE PROPAGATION (U)

THE USE OF SPECTRALLY SELECTIVE COATINGS AS FILTERS FOR SI SOLAR CELLS IS UNDER INVESTIGATION WITH PRIMARY EMPHASIS ON AUXILIARY POWER SYSTEMS FOR SPACE VEHICLES. A GENERAL STUDY OF THE THERMAL BALANCE OF A SOLAR PANEL IN SPACE AND THE RESULTANT EFFECT ON ARRAY EFFICIENCY WERE EXAMINED. THE DIFFUSE SPECTRAL REFLECTANCES AND SPECTRAL SENSITIVITIES OF TYPICAL SI CELLS ARE BEING REDETERMINED. THE PHYSICAL PROPERTIES AND ENVIRONMENTAL CHARACTERISTICS OF STATE-OF-THEART COATINGS ARE BEING STUDIED AND MEASUREMENTS OF THE SPECTRAL TRANSMITTANCE, REFLECTANCE AND EMITTANCE FOR CELL COATINGS ARE BEING OBTAINED. ENVIRONMENTAL TESTS INCLUDED HUMIDITY, HIGH- AND LOW-TEMPERATURE STORAGE, TEMPERATURE SHOCK, VACUUM STORAGE AND UV AND BETA IRRADIATION. ADAPTATION OF THE SPECTROLAB IR WINDOW COATING TO SI SOLAR CELLS IS BEING STUDIED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 271 599
SPECTROLAB SYLMAR CALIF

INVESTIGATION OF OPTICAL COATINGS FOR SOLAR CELLS (U)

JUN 60 IV MANN,A.E.;
CONTRACT: DA36 039SC85284
MONITOR: ARPA 80 59

UNCLASSIFIED REPORT

DESCRIPTORS: *OPTICAL COATINGS, *SOLAR CELLS, GLASS, POWER SUPPLIES, PROTECTIVE COVERINGS, SEMICONDUCTORS, SOLAR RADIATION, TESTS (U)

THE USE OF SPECTRALLY SELECTIVE COATINGS AS FILTERS FOR SILICON SOLAR CELLS WAS STUDIED. THE THERMAL BALANCE OF A SOLAR PANEL IN SPACE AND THE RESULTANT EFFECT ON ARRAY EFFICIENCY WAS EXAMINED; A SPECIFIC EXAMPLE IS STUDIED. THE PHYSICAL PROPERTIES AND ENVIRONMENTAL CHARACTERISTICS OF STATE-OF-THE-ART COATINGS WERE STUDIED. MEASUREMENTS OF THE SPECTRAL TRANSMITTANCE, REFLECTANCE AND EMITTANCE FOR COATED CELLS WERE OBTAINED. ENVIRONMENTAL TESTS INCLUDED HUMIDITY, HIGH AND LOW TEMPERATURE STORAGE, TEMPERATURE SHOCK, VACUUM STORAGE, AND ULTRAVIOLET AND BETA IRRADIATION. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 273 55)
GOODYEAR AEROSPACE CORP AKRON OHIO

SOLAR ORIENTING DEVICE FOR EXPANDABLE FLAT-PANEL ARRAY (U)

JAN 62 1V MCKEEL,G.J.;

UNCLASSIFIED REPORT

DESCRIPTORS: *ELECTRIC POWER PRODUCTION, *SOLAR CELLS, DESIGN, DETECTION, ENERGY CONVERSION, FEASIBILITY STUDIES, FOCUSING, POWER SUPPLIES, ROTATING STRUCTURES, SENSITIVITY, SOLAR RADIATION, SUN, TESTS, THERMAL RADIATION, TRACKING (U)
IDENTIFIERS: ROTATING STRUCTURES (M)

THE EFFECTS OF SOLAR DECLINATION CHANGE ON THE TOTAL ANGULAR ERROR OF THE ARRAY AND THE POSITION FOR MOUNTING THE SUN SENSOR ARE TREATED. CURVES OF TOTAL ANGULAR ERROR VERSUS DECLINATION CHANGE FOR VARIOUS VALUES OF THE TRACKING DRIVE ERROR ARE PRESENTED. AN EXAMPLE IS OUTLINED FOR CALCULATING THE POSSIBLE PERIOD OF UNATTENDED OPERATION OF THE SOLAR ORIENTING DEVICE AND ITS ARRAY FOR A PARTICULAR SET OF INITIAL CONDITIONS WHICH CONTAIN A CONSTANT DECLINATION VALUE. THE TRACKING RATE FOR THE ARRAY IS EXAMINED TO OBTAIN AN INSIGHT INTO SOME OF THE IMPORTANT PARAMETERS AFFECTING ITS OPERATION. THE REQUIREMENTS FOR AUTOMATIC DECLINATION CONTROL APPLICABLE TO THE SOLAR ORIENTING DEVICE WERE EXAMINED, AND A FEASIBLE APPROACH TO THE SENSOR IS PRESENTED. A CIRCUIT DIAGRAM ILLUSTRATES THE ADDITIONAL HARDWARE NEEDED FOR TWO-AXIS AUTOMATIC CONTROL. SENSOR MODIFICATION IS DISCUSSED FOR THE PURPOSE OF REMOVING THE DEAD ZONE WHICH, UNDER CERTAIN TRACKING CONDITIONS, CAN OCCUR. EXPERIMENTAL RESULTS GAINED FROM THE BREADBOARD MODEL OF THE MOUNT AND DRIVE UNIT ARE GIVEN, AND THE SUN SENSOR ACCURACY IS ALSO OBTAINED. PHOTOGRAPHS OF THE BREADBOARD MOUNT AND SUN SENSOR ARE INCLUDED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 274 481
LOCKHEED MISSILES AND SPACE CO SUNNYVALE CALIF

SOLAR REGENERATIVE CHEMICAL SYSTEM (U)

DEC 61 1V GANDEL,M.G.;
REPT. NO. 2 52 61 2
CONTRACT: DA36 039SC85245

UNCLASSIFIED REPORT

DESCRIPTORS: *CADMIUM COMPOUNDS, *FUEL CELLS, *IODIDES, *POWER SUPPLIES, *SOLAR CELLS, *TIN COMPOUNDS, BROMIDES, COPPER COMPOUNDS, DISSOCIATION, DYES, ELECTROCHEMISTRY, ENERGY CONVERSION, LEAD COMPOUNDS, PHOTOCHEMICAL REACTIONS, PHOTOSENSITIVITY, SOLAR RADIATION, TEMPERATURE, THERMOCHEMISTRY, THERMODYNAMICS (U)

A REGENERATIVE-TYPE FUEL CELL, WITH REGENERATION BASED ON THE THERMAL DISSOCIATION OF CDI2 OR SNI2, WAS SHOWN TO BE UNFEASIBLE. THE THEORETICAL EVALUATION OF THE THERMODYNAMICS AND HIGH-TEMPER-ATURE KINETICS OF BOTH SYSTEMS SUPPORTS THE NEGATIVE EXPERIMENTAL FINDINGS. THE METAL-MOLTEN SALT THERMOCELL WAS BASED ON A LARGE THERMAL GRADIENT ACROSS THE ELECTROLYTE WHICH GENERATES A POTENTIAL BETWEEN HOT AND COLD METAL TO ELECTROLYTE JUNCTIONS. THE VALUES OF DE/DT (IN MICRO V/DEG), THE CHANGE OF POTENTIAL WITH TEMPERATURE DIFFERENTIAL, WERE EXPERIMENTALLY DETERMINED AND RANGED FROM -30 TO -100. A SYSTEM IS SOUGHT WHERE DE/DT IS ON THE ORDER OF SEVERAL HUNDRED MICRO V/DEG. THE DOUBLE THERMOGALVANIC CELL UTILIZES AN ELECTROLYTIC CELL OPERATING AT ELEVATED TEMPERATURE, TO REGENERATE THE REACTION PRODUCTS OF A FUEL CELL. ELECTROLYSIS OF CDI2 WAS PERFORMED WITH APPROXIMATELY 40-% CURRENT EFFICIENCY; THE LOW CURRENT EFFICIENCY WAS ATTRIBUTED TO THE SOLUBILITY OF MOLTEN CD IN THE FUSED SALT. PHOTOCHEMICALLY REGENERATIVE SYSTEMS BASED ON THE REVERSIBLE PHOTOCHEMICAL BLEACHING OF WATER-SOLUBLE DYES WERE STUDIED. THE PROFLAVINE-ASCORBIC ACID SYSTEM WAS FOUND TO BE THE MOST SUCCESSFUL. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 274 841
RADIO CORP OF AMERICA PRINCETON N J DEFENSE ELECTRONIC PRODUCTS

SOLAR CELL ARRAY OPTIMIZATION, VOLUME II (U)

FEB 62 IV
REPT. NO. TR61 11 V2
CONTRACT: AF33 616 7415
MONITOR: ASD TR61 11 V2

UNCLASSIFIED REPORT

DESCRIPTORS: *ELECTRIC POWER PRODUCTION, *SOLAR CELLS, ADHESIVES, AIRBORNE, CADMIUM COMPOUNDS, COATINGS, ENERGY CONVERSION, MATERIALS, PHOTOELECTRIC CELLS (SEMICONDUCTOR), PHOTOTUBES, PLASTICS, POWER SUPPLIES, DAMAGE, RADIATION EFFECTS, RELIABILITY, SINGLE CRYSTALS, SULFIDES, THIN FILMS (STORAGE DEVICES) (U)
IDENTIFIERS: THIN FILMS, THIN FILM ELECTRONICS (U)

THE ANALYSIS COVERS THE FABRICATION AND TEST OF PHOTOVOLTAIC MATERIALS AND DESIGN OF SOLAR-CELL ARRAYS FOR MAXIMUM CONVERSION OF SOLAR ENERGY WITH MINIMUM WEIGHT. EVAPORATED LAYER CELLS WITH AN EFFICIENCY OF UP TO 4.5 PERCENT OVER ANAREA OF 1.6 SQ CM WERE FABRICATED. RESEARCH ON CRYSTAL LAYER CONVERSION REDUCED THE TEMPERATURE FOR RECRYSTALLIZATION FROM 500 C TO 300 C. TWO MODELS OF SOLAR-CELL ARRAYS TO SIMULATE A 100 SQ FT SYSTEM WERE FABRICATED: THE TELE COPING SAIL WITH A DENSITY OF 0.075 LB SQ FT., AND THE INFLATABLE TORUS SAIL WITH A DENSITY OF 0.04 LB SQ FT. THE MAXIMUM AREA OF INDIVIDUAL CELLS WAS INCREASED BY A FACTOR OF 27, THICKNESS OF SUBSTRATE REDUCED BY FACTOR OF 6, AND WEIGHT REDUCED BY FACTOR OF 7. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 281 829
HOFFMAN ELECTRONICS CORP EL MONTE CALIF

DESIGN STUDY OF SOLAR ENERGY MEASUREMENT TECHNIQUES. (U)

DESCRIPTIVE NOTE: INTERIM REPT., MAR 61-15 JAN 62,
JUN 62 63P ROSS ,BERND ;BICKLER,D. B.
;
REPT. NO. TN61 156
CONTRACT: AF33 616 7946
PROJ: 3145
MONITOR: ASD TN61 156

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, CALIBRATION, COMPUTERS, INSTRUMENTATION, LIGHT, TESTS (U)
IDENTIFIERS: SPECTRA (M)

A NEW PRIMARY STANDARD SOLAR CELL CALIBRATION PROCEDURE HAS BEEN DEFINED WHICH IS EXPECTED TO PROVIDE A MORE NEARLY ABSOLUTE BASIS FOR DETERMINING SOLAR CELL PERFORMANCE. A PRELIMINARY DESIGN FOR A PORTABLE TESTER IS SET FORTH, THE PURPOSE OF WHICH IS TO MEASURE THE OUTPUT OF SOLAR CONVERTER POWER SUPPLIES UNDER A WIDE RANGE OF RADIATION CONDITIONS AND EXTRAPOLATE TO SPACE SOLAR RADIATION CONDITIONS. DATA ON SOLAR CELL PERFORMANCE PARAMETERS, CURRENTS, VOLTAGES, ETC., AS A FUNCTION OF RADIANT ENERGY INTENSITY AND TEMPERATURE ARE PRESENTED. SPECTRAL RESPONSE DATA ARE PRESENTED. (AUTHOR) (M)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 282 219
RADIO CORP OF AMERICA PRINCETON N J DEFENSE ELECTRONIC PRODUCTS

APPLIED RESEARCH PROGRAM ON HIGH-TEMPERATURE RADIATION-RESISTANT SOLAR-CELL ARRAY. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO. 1, MAY-JUL 62.
AUG 62 14P
REPT. NO. AED-1558
CONTRACT: AF 33(657)-8490

UNCLASSIFIED REPORT

DESCRIPTORS: (•SOLAR CELLS), GALLIUM COMPOUNDS, ARSENIDES, HEAT RESISTANT ALLOYS, HIGH TEMPERATURE RESEARCH, DAMAGE, RADIATION EFFECTS, MEASUREMENT, TESTS, ABSORPTION, SATELLITES(ARTIFICIAL), MANUFACTURING, PROCESSING (U)

EFFORT WAS MADE TO DETERMINE THE TECHNOLOGY NECESSARY FOR THE APPLICATION OF A HIGH-TEMPERATURE, RADIATION-RESISTANT ARRAY OF SOLAR CELLS IN A CONFIGURATION SUITABLE TO AEROSPACE VEHICLES. TOWARD THIS END, GALLIUM ARSENIDE SOLAR CELLS ARE BEING FABRICATED FOR TEMPERATURE AND RADIATION TESTS, AND EXPERIMENTAL STUDIES ARE BEING CONDUCTED TO DETERMINE TECHNIQUES FOR FABRICATING MODULES AND ARRAYS. THE CHOICE OF GALLIUM ARSENIDE SOLAR CELLS FOR THIS PROGRAM WAS DICTATED BY THE SUPERIOR HIGH-TEMPERATURE AND RADIATION-RESISTANCE CHARACTERISTICS OF GALLIUM ARSENIDE AS COMPARED WITH SILICON. THESE TWO MATERIALS ARE THE ONLY ONES WHICH HAVE BEEN EXTENSIVELY DEVELOPED FOR SOLAR CELL USE. THE BASIC PROPERTIES OF SILICON AND GALLIUM ARSENIDE ARE SHOWN. IT SHOULD BE NOTED THAT GALLIUM ARSENIDE HAS A LARGER BAND GAP, HIGHER ELECTRON AND HOLE MOBILITY, AND A HIGHER ATOMIC MASS THAN SILICON. THE HIGHER BAND GAP ACCOUNTS FOR THE BETTER HIGH-TEMPERATURE PERFORMANCE OF GALLIUM ARSENIDE CELLS. THE HIGHER MOBILITIES RESULT IN LOWER INTERNAL ELECTRICAL RESISTANCE AND THE HIGHER MASS CONTRIBUTES TO A BETTER RADIATION RESISTANCE. GALLIUM ARSENIDE CELLS HAVE A POTENTIALLY HIGHER CONVERSION EFFICIENCY, BASED ON THEORETICAL CONSIDERATIONS. BECAUSE OF THEIR EARLIER DEVELOPMENT, SILICON CELLS PRESENTLY HAVE A SOMEWHAT HIGHER EFFICIENCY. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 284 032
HARSHAW CHEMICAL CO CLEVELAND OHIO

RESEARCH ON SOLAR-ENERGY CONVERSION EMPLOYING CADMIUM SULFIDE (U)

APR 62 IV SHIRLAND,FRED A.;WOLFF,G.A.;NIXON, JOHN D.;
REPT. NO. 4
CONTRACT: DA36 039SC87289
MONITOR: ASD TDR-62-69

UNCLASSIFIED REPORT

DESCRIPTORS: *CADMIUM COMPOUNDS, *SOLAR CELLS, *SOLAR RADIATION, FILMS, MANUFACTURING, SEMICONDUCTORS, SINGLE CRYSTALS, SULFIDES (U)

RESEARCH ON SOLAR ENERGY CONVERSION EMPLOYING CDS GROWTH, ANNEALING, ETCHING AND ORIENTATION OF CDS SINGLE CRYSTALS AND FILMS.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 285 315
WESTINGHOUSE ELECTRIC CORP DAYTON OHIO

GALLIUM ARSENIDE DENDRITE SINGLE CRYSTAL PROGRAM (U)

AUG 62 1V
CONTRACT: AF33 657 8162

UNCLASSIFIED REPORT

DESCRIPTORS: *ARSENIDES, *GALLIUM COMPOUNDS, *LABORATORY FURNACES, *SOLAR CELLS, CRUCIBLES, DESIGN, DIFFUSION, EXPLOSIONS, INTERMETALLIC COMPOUNDS, MATERIALS, PHOSPHORUS, SINGLE CRYSTALS, TEMPERATURE CONTROL, ZINC (U)

A 7 IN. EXPLORATORY DENDRITE PULLING FURNACE WAS PUT INTO OPERATION. CONSTRUCTION OF A 24 IN. PULLER CONTINUES. GAAS SOLAR CELLS WERE MADE BY AN OPEN TUBE DIFFUSION PROCESS. PRELIMINARY RESULTS HAVE BEEN OBTAINED IN AN INVESTIGATION OF THE FEASIILITY OF PRODUCING A GRADED BAND GAP BY OPEN TUBE DIFFUSION OF P INTO GAAS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOMO7

AD- 286 578
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

SOLAR BATTERIES OF THE FUTURE (U)

SEP 62 1V KOLTUN,M.;
REPT. NO. TT 62 972

UNCLASSIFIED REPORT

DESCRIPTORS: *FUEL CELLS, *POWER SUPPLIES, *SOLAR CELLS, *SOLAR RADIATION, INTERMETALLIC COMPOUNDS, PHOTOELECTRIC CELLS (SEMICONDUCTOR), PHOTOTUBES, SILICON (U)

THE CONVERSION OF HELIOENERGETICS INTO AN INDEPENDENT AND IMPORTANT TECHNOLOGICAL FIELD IS DISCUSSED. OUTSTANDING SCIENTISTS OF THE WORLD, INCLUDING FREDERIC JOLIOT-CURIE, FEEL THAT HELIOENERGETICS WILL BE PUT ON AN EQUAL FOOTING WITH THE STUDY OF ATOMIC ENERGY. IN THIS CONNECTION SCIENTISTS AWAIT FURTHER RESEARCH. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 287 570
RADIO CORP OF AMERICA PRINCETON N J DEFENSE ELECTRONIC PRODUCTS

APPLIED RESEARCH PROGRAM ON HIGH-TEMPERATURE RADIATION-RESISTANT SOLAR-CELL ARRAY (U)

OCT 62 IV

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, ARSENIDES, DESIGN, ELECTRIC CONNECTORS, ELECTRIC CURRENTS, GALLIUM COMPOUNDS, MEASUREMENT, MECHANICAL PROPERTIES, RADIATION EFFECTS, SILICON, SOLDERED JOINTS, TESTS (U)

PRODUCTION AND TESTING OF GAAS SOLAR CELLS.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 292 709
WESTINGHOUSE ELECTRIC CORP DAYTON OHIO

GALLIUM ARSENIDE DENDRITE SINGLE CRYSTAL PROGRAM (U)

NOV 62 IV

UNCLASSIFIED REPORT

DESCRIPTORS: *ARSENIDES, *GALLIUM COMPOUNDS, *SINGLE CRYSTALS, *SOLAR CELLS, CRYSTAL OVENS, CRYSTALS, EPITAXIAL GROWTH, INTERMETALLIC COMPOUNDS (U)
IDENTIFIERS: DENDRITES(CRYSTALLOGRAPHY) (U)

DENDRITIC GAAS MATERIAL HAS BEEN OBTAINED FROM A 7-IN. EXPLORATORY PULLING FURNACE. THE TECHNIQUES LEARNED FOR STOICHIOMETRY AND TEMPERATURE CONTROL ARE BEING APPLIED IN THE CONSTRUCTION OF A 14- AND A 24-IN. PULLING FURNACE REPRODUCIBILITY OF RESULTS HAS BEEN IMPROVED IN THE OPENTUBE DIFFUSION PROCESS. DETECTION OF PARTIAL SURFACE CONVERSION OF GAAS TO GAP BY A REFLECTION METHOD HAS BEEN EXPLORED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 293 831
RADIO CORP OF AMERICA SOMERVILLE N J

GALLIUM ARSENIDE SOLAR CELL PRODUCTION PROCESSES AND TECHNIQUES (U)

DEC 62 1V BERTRAM,H.;GIBBONS,L.H.;
CONTRACT: AF 33(657)-8921

UNCLASSIFIED REPORT

DESCRIPTORS: *ARSENIDES, *GALLIUM COMPOUNDS, *POWER SUPPLIES, *SOLAR CELLS, COATINGS, COPPER, CRYSTALS, DIFFUSION, ELECTRIC POTENTIAL, GOLD, GROWTH(PHYSIOLOGY), MANUFACTURING, MONOXIDES, NICKEL, PLATING, REFLECTION, RUPTURE, SILICON COMPOUNDS, SIMULATION, SINGLE CRYSTALS, SOLAR RADIATION, SOLDERING ALLOYS (U)

EFFORTS TO IMPROVE THE YIEL OF LARGE AREA SINGLE CRYSTAL GALLIUM ARSENIDE AS WELL AS SUPPLYING CRYSTAL FOR SOLAR CELL FABRICATION C NTINUED. SEVERAL STEPS IN THE SOLAR CELL FABRICATION PROCESS, CURRENTLY IN USE, WERE EXAMINED CAREFULLY IN AN ATTEMPT TO IMPROVE CELL EFFICIENCE OR INCREASE THE POTENTIAL PRODUCTION RATE. CON IDERABLE ATTENTION WAS DEVOTE TO THE MEANS FOR APPLYING SOLDER CONTACTS TO THE SOLAR CELL. STUDIE ERE MADE OF VARIOUS WAFER POLISHING TECHNIQUES AND THEIR EFFECT ON CELL EFFICIENCY; THE DEPOSITION OF A SILICON MONOXIDE ANTIREFLECTION COATING ON WAVERS; THE EVALUATION OF SOLAR CELL P-N JUNCTION CHARACTERISTICS USING PILOT LINE CELLS; AND SOLAR SIMULATION. (AUT OR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 294 016
HARSHAW CHEMICAL CO CLEVELAND OHIO

LARGE AREA THIN FILM CADMIUM SULFIDE SOLAR CELL ARRAY INVESTIGATION (U)

JAN 63 IV SHIRLAND,F.A.;SCHAEFER,J.C.;
CONTRACT: AF33 657 9975

UNCLASSIFIED REPORT

DESCRIPTORS: *AUXILIARY POWER PLANTS, *POWER SUPPLIES, *SOLAR CELLS, ACCELERATION, CADMIUM COMPOUNDS, DESIGN, LAMINATES, PHOTOELECTRIC CELLS (SEMICONDUCTOR), PHOTOTUBES, PLASTICS, SHEETS, SHOCK RESISTANCE, SINGLE CRYSTALS, SULFIDES, TEMPERATURE, TESTS, THIN FILMS (STORAGE DEVICES) (U)

THE MAJOR FACTOR OW PREVENTI G CC PTA CE OF E C S FILM SOLAR CELL AS P OTOVOL IC CONVER ER FOR P C U ILLI RY POWER SYS EMS IS THAT IT IS UN ES UNPROVEN IN THE SPACE ENVIRO . T TI G OF HE C S FIL CELL UNDER THE CONDITIONS OF SPACE AND THE CONDITIONS THA WOUL B NCOUNTER D IN GETTING ARRAYS INTO SP CE IS E PRINCIPAL OBJEC IV ECO RY OBJECTIVES AR TO IMPROVE THE P RFOR A CE OF TH CDS FILM CELL AN TO OB I B R UNDERS NDI G OF E FU DAM NTAL GOV RNING T E OPERATION OF T IS C LL. F ULL C LE EFFORTS WERE EXERTED ON THE D SIGN OF CDS FILM CELL ARRAYS ON TABILI Y S U IE AND ENVIRONMENTAL AND PERFORMANCE T STING AND ON T E CONS RUC IO OF C LL A ARRAYS FOR HE ORBITAL EVALUATION PANELS. A FINAL DESIGN OF C DS FILM CELL RR YS FOR HE ORBI AL TEST WAS EVOLVED, AND ARR YS OF THIS DESIG SUCCE SFULLY MET REQUIRE ENTS FOR S OCK ACC LERATION AND T MPERATURE CYCLING WITH NO DISC R IBLE ILL FFECT . A STOCK PILE OF LARGE ARE CDS FILM CELLS OF GR ATER TH % CO V R IO EFFICIENCY WAS BUIL UP. AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 295 056
TEXTRON ELECTRONICS INC SYLMAR CALIF HELIOTEK DIV

HIGH EFFICIENCY SILICON SOLAR CELLS (U)

SEP 62 1V BERMAN,PAUL A.;HANDY,ROLAND J.;
PERRY,G.;
CONTRACT: DA36 039SC90777

UNCLASSIFIED REPORT

DESCRIPTORS: *POWER SUPPLIES, *SILICON, CIRCUITS, CONFIGURATION, CRYSTALS, DESIGN, DIFFUSION, ELECTRICAL PROPERTIES, INTENSITY, LIGHT, MANUFACTURING, MIRRORS, PHOTOELECTRIC CELLS (SEMICONDUCTOR), PHOTOTUBES, RESISTANCE (ELECTRICAL), SOLAR CELLS, SOLAR RADIATION (U)

PRELIMINARY EXPERIMENTS WERE PERFORMED ON N/P AND P/N CELLS HAVING VARIOUS JUNCTION DEPTHS TO DETERMINE THE EFFECTS OF LIGHT INTENSITY ON CELL PERFORMANCE FOR VARIOUS CELL CONFIGURATIONS. PRELIMINARY RESULTS INDICATED THAT CELLS DIFFUSED TWICE AS LONG AS STANDARD PRODUCTION-TYPE CELLS OPERATE MORE EFFICIENTLY AT THE HIGHER SOLAR INTENSITIES. THE SHALLOW DIFFUSED CELLS HAD HIGHER SHORT CIRCUIT CURRENTS INDICATING HIGHER POTENTIAL EFFICIENCIES WITH THE USE OF OPTIMIZED GRID DESIGNS TO FURTHER REDUCE SERIES RESISTANCE. THEORETICAL CALCULATIONS WERE CARRIED OUT TO DETERMINE THE OPTIMUM GRID CONFIGURATION FOR SHALLOW-DIFFUSED CELLS. RESULTS INDICATED THAT THE OPTIMUM GRID SPACING IS VERY INSENSITIVE TO CHANGES IN LIGHT LEVEL IF ALL OTHER VARIABLES ARE HELD CONSTANT. THE GRID SPACING DOES, HOWEVER, CHANGE SIGNIFICANTLY WITH VARIOUS A-FACTOR VALUES. POSSIBLY THROUGH THIS MECHANISM THE OPTIMIZED GRID SPACING CHANGES AS A FUNCTION OF LIGHT LEVEL. A DETAILED SOLAR CELL EQUIVALENT SERIES RESISTANCE CIRCUIT IS PRESENTED. STUDIES WERE MADE TO DETERMINE WHERE THE CELL SERIES RESISTANCE IS LOCATED AND WHICH LOCATIONS ARE MORE IMPORTANT WITH RESPECT TO THE REDUCTION OF THE TOTAL SERIES RESISTANCE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 295 558
RADIO CORP OF AMERICA PRINCETON N J DEFENSE ELECTRONIC PRODUCTS

SOLAR CELL ARRAY OPTIMIZATION (U)

DEC 62 IV

UNCLASSIFIED REPORT

DESCRIPTORS: *CRYSTALS, *POWER SUPPLIES, CADMIUM COMPOUNDS, DESIGN, ELECTRICAL PROPERTIES, ELECTRONS, FILMS, MANUFACTURING, PHOTOELECTRIC CELLS (SEMICONDUCTOR), PHOTOELECTRIC MATERIALS, PHOTOTUBES, PLASTICS, PROTONS, DAMAGE, RADIATION EFFECTS, RESISTANCE (ELECTRICAL), SEMICONDUCTORS, SOLAR CELLS, SULFIDES, THIN FILMS (STORAGE DEVICES) (U)
IDENTIFIERS: THIN FILM ELECTRONICS, THIN FILMS (M)

SOLAR CELL ARRAY OPTIMIZATION. RESEARCH AND FABRICATION PHASES OF THIS WORK WERE DIRECTED TOWARDS DEMONSTRATING THE POTENTIAL OF LARGE AREA, THIN-FILM CADMIUM SULFIDE PHOTOVOLTAIC MATERIALS. POWER-TO-WEIGHT RATIO FOR FOUR-INCH SQUARE CELLS APPROACHES 20 WATTS/LB.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 296 367
RADIO CORP OF AMERICA PRINCETON N J DEFENSE ELECTRONIC PRODUCTS

APPLIED RESEARCH PROGRAM ON HIGH-TEMPERATURE RADIATION-RESISTANT SOLAR-CELL ARRAY (U)

JAN 63 IV

UNCLASSIFIED REPORT

DESCRIPTORS: *ELECTRIC POWER PRODUCTION, *SOLAR CELLS, ARSENIDES, COATINGS, EFFECTIVENESS, ELASTIC PROPERTIES, ELECTRON IRRADIATION, FAILURE (MECHANICS), GALLIUM COMPOUNDS, HEAT, INFRARED SPECTROSCOPY, INHIBITION, LEAD(METAL), LOW TEMPERATURE BATTERIES, OPERATION, OXIDES, POWER SUPPLIES, DAMAGE, RADIATION EFFECTS, REFLECTION, SILICON, SILICON COMPOUNDS, SILICONE PLASTICS, SOLDERED JOINTS, STORAGE, TEMPERATURE, TEST METHODS (U)

DEVELOPMENT OF HIGH-TEMPERATURE RADIATIONRESISTANT SOLAR-CELL ARRAY: GALLIUM ARSENIDE AND SILICON CELLS USED: SILICON MONOXIDE COATINGS WERE TESTED FOR ANTI-REFLECTION EFFECT: SHELF LIFE OF CELLS AT 200 C WAS TESTED.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 297 026
SPECTROLAB SYLMAR CALIF

INVESTIGATION OF OPTICAL COATINGS FOR SOLAR CELLS (U)

DEC 61 IV FULLER,F.E.;

UNCLASSIFIED REPORT

DESCRIPTORS: *PHOTOELASTICITY, *SOLAR CELLS, DESIGN, OPTICAL COATINGS, OPTICAL FILTERS, POWER SUPPLIES, RADIATION EFFECTS, SILICON (U)

PERFORMANCE ANALYSES OF SILICON CELL SOLAR POWER SYSTEMS USING RADI TION CONCENTRATION AND FILTERING HAVE BEEN OBTAINED. PERFORMANCE CHARACTERISTICS OF SILICON PHOTOVOLTAIC CELLS AND FILTERS HAVE BEEN STUDIED WITH RESPECT TO THE RELATION OF THEIR CHARACTERISTICS TO THE POWER SYSTEM DESIGN AND PERFORMANCE. ELEMENTARY CONDITIONS OF SYSTEM DESIGN FOR OPTIMUM PERFORMANCE HAVE BEEN ESTABLISHED. THE ELEMENTS OF PLAN HAVE BEEN OUTLINED FOR THE DEVELOPMENT OF ADEQUATE METHODS FOR THE DESIGN AND PERFORMANCE ANALYSIS OF PHOTOVOLTAIC CELL SOLAR POWER SYSTEMS USING RADIATION CONCENTRATION AND FILTERING. ALSO, A BASIC PLAN FOR THE CONSTRUCTION OF A PROTOTYPE SOLAR POWER SYSTEM WITH CONCENTRATION AND FILTERING HAS BEEN OUTLINED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 297 389
LIBRARY OF CONGRESS WASHINGTON D C AEROSPACE TECHNOLOGY DIV

DIRECT ENERGY CONVERSION IN THE USSR. SOLAR CELL RESEARCH (U)

FEB 63 IV
REPT. NO. P 63 20

UNCLASSIFIED REPORT

DESCRIPTORS: *PHOTOELECTRIC MATERIALS, *RESEARCH MANAGEMENT, CADMIUM COMPOUNDS, COOLING, CRYSTAL DEFECTS, DIFFUSION, EFFECTIVENESS, ELECTRICAL CONDUCTIVITY, HALL EFFECT, IMPURITIES, MANUFACTURING, NUCLEAR PARTICLES, PHOSPHORUS, PHOTOCONDUCTIVITY, SEMICONDUCTING FILMS, SEMICONDUCTOR DEVICES, SEMICONDUCTORS, SILICON, SOLAR CELLS, SOLID STATE PHYSICS, SULFIDES, SURFACE PROPERTIES, TELLURIDES, TEMPERATURE, THEORY (U)

SOLAR CELL RESEARCH AND DIRECT ENERGY CONVERSION IN THE USSR.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 298 681
ION PHYSICS CORP BURLINGTON MASS

P-N JUNCTION FORMATION TECHNIQUES (U)

FEB 63 IV KING,WILLIAM J.;BURRILL,JAMES T.;
BUMILLER,DONALD;
CONTRACT: AF33 657 10505

UNCLASSIFIED REPORT

DESCRIPTORS: *ENERGY CONVERSION, *PHOTOELECTRIC CELLS (SEMICONDUCTOR), CONFIGURATION, COSTS, DIFFUSION, EFFECTIVENESS, ELECTRIC POTENTIAL, ELECTRON TRANSITIONS, ION BEAMS, ION BOMBARDMENT, IONS, LIFE EXPECTANCY, MANUFACTURING, PHOTOELECTRIC EFFECT, PROCESSING, PRODUCTION, DAMAGE, RADIATION EFFECTS, RELIABILITY, RESISTANCE (ELECTRICAL), SEMICONDUCTOR DEVICES, SILICON, SOLAR CELLS, TEMPERATURE (U)
IDENTIFIERS: ION IMPLANTATION (M)

FABRICATING SILICON SOLAR CELLS BY ION IMPLANTATION TECHNIQUES.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 298 759
GENERAL ELECTRIC CO PHILADELPHIA PA MISSILE AND SPACE DIV

CONFIGURATION STRUCTURE AND SUBSYSTEM ENGINEERING ANALYSIS REPORT. SECTION 7: ELECTRICAL POWER AND DISTRIBUTION SUBSYSTEM ENGINEERING ANALYSIS (U)

OCT 62 1V
REPT. NO. 62SD4300 V13
CONTRACT: AF04 647 476

UNCLASSIFIED REPORT

DESCRIPTORS: *POWER EQUIPMENT, *SOLAR CELLS, COMMUNUCATION SATELLITES (ACTIVE), DISTRIBUTION, POWER SUPPLIES, DAMAGE, RADIATION EFFECTS, SELECTION, SOLAR FLARES, TEST VEHICLES, TESTS (U)

ELECTRICAL POWER AND DISTRIBUTION SUBSYSTEMS FOR THE ADVENT COMMUNICATION SATELLITE. RADIATION EFFECTS ON SOLAR CELLS. TEST RESULTS AND SELECTION CRITERIA FOR SOLAR CELLS. PADDLE DEPLOY AND SEPARATION BOLT SQUIB FIRING TEST.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 400 559
HOFFMAN ELECTRONICS CORP EL MONTE CALIF

SOLAR ENERGY MEASUREMENT TECHNIQUES (U)

JAN 63 IV ROSS,BERND;BICKLER,D.B.;
CONTRACT: AF33 616 7946
MONITOR: ASD TDR62 882

UNCLASSIFIED REPORT

DESCRIPTORS: *POWER SUPPLIES, *SOLAR CELLS, *SOLAR RADIATION, CALIBRATION, INSTRUMENTATION, LIGHT, MANUFACTURING, MEASUREMENT, PYRHELIOMETERS, SILICON, SPECTRUM ANALYZERS, STABILITY, SUN, TEST EQUIPMENT, TEST METHODS (U)
IDENTIFIERS: COLOR TEMPERATURE (M)

PORTABLE TEST UNIT TO DETERMINE THE OUTPUT OF A SOLAR CELL POWER SUPPLY IN SPACE BY ANALYZING OUTPUT UNDER LABORATORY OR FIELD CONDITIONS.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 400 707
WESTINGHOUSE ELECTRIC CORP DAYTON OHIO

GALLIUM ARSENIDE DENDRITE SINGLE CRYSTAL PROGRAM (U)

FEB 63 IV
CONTRACT: AF33 657 8162

UNCLASSIFIED REPORT

DESCRIPTORS: *GALLIUM COMPOUNDS, *SINGLE CRYSTALS, *SOLAR CELLS, ARSENIDES, CRYSTAL GROWTH, LABORATORY FURNACES, MATERIALS, PREPARATION, SHEETS (U)
IDENTIFIERS: DENDRITES(CRYSTALLOGRAPHY) (U)

GROWTH OF GALLIUM ARSENIDE SINGLE CRYSTAL DENDRITES: SOLAR CELL PREPARATION.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 401 699
HARSHAW CHEMICAL CO CLEVELAND OHIO

LARGE AREA THIN FILM CADMIUM SULFIDE SOLAR CELL ARRAY INVESTIGATION (U)

MAR 63 IV SCHAEFER,J.C.;WOLFF,G.A.;HILL,E.R.;
CONTRACT: AF33 657 9975

UNCLASSIFIED REPORT

DESCRIPTORS: *CADMIUM COMPOUNDS, *SOLAR CELLS, *THIN FILMS (STORAGE DEVICES), ACCELERATION, ACRYLIC RESINS, COATINGS, COPPER, CRYSTAL GROWTH, CRYSTALS, ELECTRODEPOSITION, EXPERIMENTAL DATA, FILMS, GLASS, GOLD, LOADING (MECHANICS), MANUFACTURING, MOLYBDENUM, NICKEL, PLASTICS, SHOCK RESISTANCE, SILVER, SOLAR PANELS, SONAR SOUND ANALYZERS, SULFIDES, TESTS (U)
IDENTIFIERS: THIN FILMS (M)

LARGE-AREA, THIN-FILM, CADMIUM SULFIDE SOLAR CELL ARRAY INVESTIGATION.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 401 872
SPECTROLAB SYLMAR CALIF

INVESTIGATION OF OPTICAL COATINGS FOR SOLAR CELLS (U)

SEP 62 IV ROMAGNOLI,R.J.;

UNCLASSIFIED REPORT

DESCRIPTORS: *OPTICAL COATINGS, *SOLAR CELLS, *SOLAR RADIATION, FOCUSING, OPTICAL FILTERS, PHOTOELECTRIC CELLS (SEMICONDUCTOR), SILICON, SPECTRA (VISIBLE + ULTRAVIOLET) (U)

THE CONCENTRATION AND FILTERING OF SOLAR RADIATION WAS INVESTIGATED IN CONNECTION WITH SILICON PHOTOVOLTAIC CELLS.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 402 838
TEXTRON ELECTRONICS INC SYLMAR CALIF HELIOTEK DIV

HIGH EFFICIENCY SILICON SOLAR CELLS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. NO. 2, 15 SEP-15 DEC 62,
DEC 62 1V BERMAN ,PAUL A. ;HANDY , RELAND J. ;RELIK,GEZA P. ;
CONTRACT: DA36 039SC90777
PROJ: DA-3A99-09-002

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: REPORT ON INVESTIGATION FOR THE IMPROVEMENT OF HIGH EFFICIENCY SILICON SOLAR CELLS FOR TERRESTRIAL APPLICATIONS.

DESCRIPTORS: *SOLAR CELLS, *SOLAR RADIATION, SOLAR PANELS, RESISTANCE (ELECTRICAL), COSTS, NITROGEN, PHOSPHOROUS, IONS, MIRRORS, CIR, SEMICONDUCTOR DEVICES, EQUATIONS, MATHEMATICAL ANALYSIS, SILICON, MEASUREMENT. (U)

THE PURPOSE OF THIS RESEARCH IS THE DEVELOPMENT OF HIGH EFFICIENCY, LOW COST SILICON SOLAR CELLS. THE OBJECTIVE IS HIGH YIELDS, IN THE ORDER OF 70% OF THE CELLS HAVING EFFICIENCIES IN THE RANGE OF 12 TO 14% LEADING TO A CELL COST OF $2.00 TO $3.00 FOR A CELL HAVING DIMENSIONS OF 1 CM BY 2 CM. BOTH N ON P AND P ON N CELL STRUCTURES ARE TO BE STUDIED AND THE CELLS OPTIMIZED FOR USE IN TERRESTRIAL ENVIRONMENT WITH AND WITHOUT UTILIZATION OF SOLAR CONCENTRATORS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 406 353
WESTINGHOUSE ELECTRIC CORP PITTSBURGH PA

WEBBED DENDRITIC SILICON SOLAR CELL RADIATION EFFECTS INVESTIGATION. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT., 15 JAN-15 APR 63,
APR 63 36P TARNEJA,K.S.;BABCOCK,R.V.;
LAMB,R.D.;
REPT. NO. 63 927 534R1
CONTRACT: AF33 657 10527

UNCLASSIFIED REPORT

DESCRIPTORS: *SCELLS, RESISTANCE (ELEC, SILICON, DAMAGE, RADIATION EFFECTS, CRYSTAL, BORON, DIFFUSION, PHOTOENGRAVING, SPECTROPHOTOMETERS, ELECTRON BEAMS, RADIATION (U)

INITIAL WORK TOWARD MAXIMIZING THE RADIATION RESISTANCE OF SILICON WEBBED DENDRITIC SOLAR CELLS IS DISCUSSED. DESIGN CONSIDERATIONS, TECHNIQUES FOR FABRICATING CELLS OF 1 OHM CM RESISTIVITY, AND STEPS PREPARATORY TO RADIATION DAMAGE STUDY ARE PRESENTED. EFFICIENCIES AS HIGH AS 12.4% WERE ACHIEVED ON SOLAR CELLS MADE FROM 1 OHM-CM N-TYPE SILICON WEBBED DENDRITES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 407 489
GENERAL INSTRUMENT CORP NEWARK N J

SOLAR FLAT PLATE THERMOELECTRIC GENERATOR RESEARCH. (U)

DESCRIPTIVE NOTE: QUARTERLY REPT. NO. 1, 1 MAR-1 JUNE 63.
JUN 63 14P
CONTRACT: AF33 657 10335
PROJ: 8173
TASK: 817302

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR PANELS, *THERMOELECTRICITY, *GENERATORS, TEST EQUIPMENT (ELECTRONICS), TESTS, OPTICAL COATING, ELECTRIC POWER PRODUC, SOLAR RADIATION, SPACECRAFT, FIXED CON, PLASTICS, ALUMINUM, DESIGN, STRUCTURAL, OPTICAL PROPERTIES, THERMAL RADIATION, SEMICONDUCTOR, TELLURIUM ALLOYS, BISMUTH ALLOYS, LEAD ALLOYS, PROCESSING, NICKEL, GOLD, ALUMINUM, REFLECTORS, HONEYCOMB CORES, SANDWICH CONSTRUC, BONDING, TEMPERATURE. (U)

RESEARCH CONCERNS THE DEVELOPMENT OF SOLAR FLAT PLATE THERMOELECTRIC GENERATORS FOR SPACECRAFT. A SOLAR FLAT PLATE THERMOELECTRIC GENERATOR CON SISTS OF A COLLECTOR PLATE WITH AN OPTICALLY SE LECTIVE COATING, SMALL SIZE SEMICONDUCTOR THERMO ELEMENTS, A RADIATOR PLATE AND A SUPPORT STRUC TURE. THREE MONTHS OF RESEARCH AND DEVELOPMENT WORK ON THIS SPACE AUXILIARY POWER SYSTEM IS DESCRIBED. THE TECHNICAL PROBLEM AREAS INVESTI GATED INCLUDE: COLLECTOR COATINGS, THERMOELECTRIC MATERIALS AND CONTACTS AND SUPPORT STRUCTURES. COLLECTOR COATING SAMPLES SUITABLE FOR EVALUATION WERE OBTAINED. TEST EQUIPMENT FOR THERMAL CY CLING TESTS OF SOLAR THERMOELECTRIC PANELS WAS FABRICATED. PANELS USING A PLASTIC FO-UPPORT STRUCTURE AND ON ALUMINUM HONEYCOMB SUPPORT STRUCTURE WERE FABRICATED AND TESTED. A NUMBER OF DIFFERENT THERMOELECTRIC MATERIALS WERE TESTED FOR EFFICIENCY AT VARIOUS OPERATING TEMPERATURES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 407 525
HARSHAW CHEMICAL CO CLEVELAND OHIO

LARGE AREA THIN FILM CADMIUM SULFIDE SOLAR CELL ARRAY INVESTIGATION. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO. 3, 15 MAR-15 JUNE 63,
JUN 63 25P SCHAEFER,J.C.;HUMRICK,R.J.;
HILL,E.R.;
CONTRACT: AF33 657 9975
PROJ: 8173
TASK: 817301

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *X-RAY DIFFRACTION, CRYSTALS, CADMIUM, SULFIDES, PHOTO, X RAY PHOTOGRAPHY, PURIFI, DISTILLATION, SEMICONDUCTING FILMS, SULFUR, DIODES (SEMICONDUCTOR), LUMINESCENCE, CADMIUM COMPOUNDS, MICROSCOPY. (U)
IDENTIFIERS: THIN FILM ELECTRONICS, THIN FILMS (U)

A 5.18 THIN-FILM CELL WAS PRODUCED ON A 1 IN. X 1 IN. SUBSTRATE. THIS RESULT COMPARES FAVORABLY WITH THE MAXIMUM EFFICIENCY OF 5.48 REPORTED FOR A SINGLE CRYSTAL CDS CELL. A PROCEDURE FOR UP GRADING LOW EFFICIENCY CELLS TO THE AVERAGE EFFICIENCY LEEVEL WAS ALSO DEVELOPED. A NON DESTRUCTIVE X-RAY TECHNIQUE WAS USED SUCCESS FULLY TO PHOTOGRAPH DISLOCATIONS IN SINGLE CRYSTAL CDS. THIS PROCEDURE PROMISES TO YIELD A FUND OF INFORMATION. EFFORTS TO PRODUCE AN ULTRAPURE CDS BY DISTILLATION OF THE ELEMENTS AND SUBSEQUENT REACTION IS UNDERWAY. WORK WAS CARRIED ON IN THE ANALYSIS OF THE I-V DATA AND SPECTRAL RESPONSE IN AN EFFORT TO CATALOG THIS DATA IN THE FORM OF A. THE PRESENT DATA CAN BE IN AN EFFORT TO CATALOG THIS DATA IN THE FORM OF A MODEL. THE PRESENT DATA CAN BE MADE TO FIT A P-N JUNCTION WITH PHOTOCONDUCTIVE SERIES AND SHUNT RESISTANCES. SOME REJECT 'SHORTED' CELLS WERE STUDIED AT LOW TEMPERATURES WHERE THE I-V CURVE BEGINS TO RESEMBLE A BACK WARD DIODE. INJECTION LUMINESCENCE WITH VERY LOW CONVERSION EFFICIENCY WAS OBSERVED WITH THE RADIATION LYING IN THE BAND BETWEEN 1 AND 1.5 EV. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 409 001
TEXTRON ELECTRONICS INC SYLMAR CALIF HELIOTEK DIV

HIGH EFFICIENCY SILICON SOLAR CELLS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. NO. 3, 15 DEC 62 15 MAR 63,
APR 63 IV BERMAN,PAUL A.;HANDY, ROLAND J.;ROLIK,GEZA P.;
CONTRACT: DA36 039SC90777
PROJ: 3A99 09 002

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, ELECTRICAL PROP), (*SOLAR RADIATION, INTENSITY), RESIST, SILICON, DESIGN, THEORY, MEASUREMENT, ELECTRIC CURRENTS, MIRRORS, ELEC, MATHEMATICAL PREDICTION, EQUATIONS. (U)

AN ADDITIONAL MIRROR WAS ADDED TO THE SOLAR CON CENTRATOR EQUIPMENT SO THAT IS IS POSSIBLE TO MAKE SOLAR CELL MEASUREMENTS AT APPROXIMATELY 5 GM-CALORIES/SQ CM/MIN SOLAR INTENSITY. THE CONCENTRATOR WAS USED TO VERIFY THE SUNLIGHT POWER PREDICTIONS MADE FROM TUNGSTEN POWER MEAS UREMENTS DURING THE P()/N BIVARIABLE EXPERIMENT. A GENERAL EQUATION WAS DEVELOPED FOR THE THEO RETICAL DETERMINATION OF THE TOTAL CELL SERIES RESISTANCE FROM A KNOWLEDGE OF THE VALUES OF THE COMPONENT RESISTANCES. THE EQUATIONS WERE UTI LIZED TO PREDICT THE SERIES RESISTANCE OF PRODUC TION TYPE N()/P AND N()/N CELLS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /Z0M07

AD- 411 257
RADIO CORP OF AMERICA PRINCETON N J DEFENSE ELECTRONIC PRODUCTS

APPLIED RESEARCH PROGRAM ON HIGH TEMPERATURE RADIATION RESISTANT SOLAR CELL ARRAY, VOLUME I. (U)

DESCRIPTIVE NOTE: ANNUAL REPT., 15 APR 62-14 APR 63. JUN 63 94P
CONTRACT: AF33 657 8490
PROJ: 8173
TASK: TASK 817301 16
MONITOR: ASD TDR63 516, VI

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: REPORT ON STATIC ENERGY CONVERSION TECHNOLOGY.

DESCRIPTORS: (*SOLAR CELLS, HIGH-TEMPERATURE), GALLIUM COMPOUNDS, ARSENIDES, GAL, ARSENIC ALLOYS, AEROSPACE CRAFT, DESIGN, SINGLE CRYSTALS, MANUFACTURING, FILMS, TESTS, RADIATION DAMAGE. (U)
IDENTIFIERS: THIN FILMS (U)

A TOTAL OF 780 CELLS WAS PRODUCED WITH EFFICIEN CIES OF UP TO 10% AND WITH A MODE EFFECIENCY OF EIGHT PERCENT FOR THE LATER UNITS. TESTS OF THE CELLS MADE AT ELEVATED TEMPERATURES AND IN HIGH RADIATION ENVIRONMENTS HAVE ESTABLISHED THE CHARACTERISTICS OF THE CELLS. THE CRITICAL FLUX FOR THE GALLIUM ARSENIDE CELLS EQUALLED OR EX CEEDED THAT OF SILICON CELLS. TESTS OF CADMIUM SULFIDE CELLS WERE NOT JUDGED SUFFICIENTLY CON CLUSIVE TO ESTABLISH THE LEVEL OF CRITICAL FLUX. SOLDERING TECHNIQUES WERE DEVELOPED AND EVALUATED IN TERMS OF THE EFFECTS UPON FINISHED CELLS. THERMAL CHARACTERISTICS OF THE CELLS AND PANELS WERE APPRAISED IN TERMS OF ORBITAL EVALUATION. PANEL ASSEMBLY TECHNIQUES WERE DEVELOPED AND EVALUATED IN TERMS OF THE ELECTRICAL AND MECHANI CAL CONSIDERATIONS INVOLVED IN INTEGRATING CELLS INTO PANELS. INVESTIGATION AND FABRICATION OF SINGLE-CRYSTAL, THIN-FILM GALLIUM ARSENIDE CELLS WERE MADE. EVALUATION OF METHODS FOR DEPOSITING EPITAXIAL FILMS, TECHNIQUES FOR PRODUCING THE DESIRED **DOPING** STRUCTURE, AND STUDIES OF THE RESULTANT PHOTOVOLTAIC AND SURFACE-CONTACTING PROPERTIES WERE MADE FOR THIN-FILM GAAS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 412 654
RADIO CORP OF AMERICA PRINCETON N J DEFENSE ELECTRONIC PRODUCTS

APPLIED RESEARCH PROGRAM ON HIGH-TEMPERATURE RADIATION-RESISTANT SOLAR-CELL ARRAY. (U)

DESCRIPTIVE NOTE: QQUARTERLY TECHNICAL PROGRESS REPT. NO. 4, MAY JUL 63.
JUL 63 23P
REPT. NO. AED R2043
CONTRACT: AF33 657 8490
TASK: TASK 817301 16

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, MANUFACTURING), (*ADHESIVES, SOLAR CELLS), GALLIUM, ARSENIC ALLOYS, HONEYCOMB CORES, ALUMI, TESTS, TEMPERATURE, VACUUM, MECHANICAL, THICKNESS, SEMICONDUCTING FILMS, DIFFUSION, EPITAXIAL GROWTH, IMPURITIES, ZINC, CHEMICAL MILLING, TABLES(DATA), EQUATIONS, MEASURE, METAL COATINGS, RADIATION DAMAGE. (U)
IDENTIFIERS: *THIN FILMS (U)

CONTENTS: GALLIUM ARSENIDE CELL DEVELOPMENT AND FABRICATION; ARRAY DESIGN AND TESTING; SUMMARY, ARRAY DESIGN, MODULE DESIGN, FIXTURE DESIGN, MATERIALS TEST AND SELECTION, PROTOTYPE PANEL, RADIATION TESTING; THIN-FILM GALLIUM ARSENIDE INVESTIGATION, THIN FILM DIFFUSED-JUNCTION SOLAR CELLS, THIN-FILM GROWN-JUNCTION SOLAR CELLS, PROPERTIES OF EVAPORA TED METALLIC CONTACTS ON GAAS, ANALYSIS, MEASUREMENTS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 418 154
HAMILTON STANDARD WINDSOR LOCKS CONN

MODULAR DESIGN OF IMPROVED SOLAR CONVERTERS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. NO. 7, 1 DEC 62 28 FEB 63,
FEB 63 1V MORIARTY,WILLIAM J.;
REPT. NO. HSER2667
CONTRACT: DA36 039SC87461
PROJ: DA PROJ. 1G622001A053 03

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR PANELS, MODULES (ELEC), (*SOLAR CELLS, MANUFACTURING), SILICON, MOLDINGS, BONDING, ELECTRIC CURRENTS, ELECTRIC POTENTIAL, PLASTICS, ACRYLIC RESINS. (U)

THREE IMPORTANT TESTS WERE CONDUCTED DURING THIS PERIOD: (1) A TEMPERATURE GRADIENT TEST OF THE PROTOTYPE MODULE; (2) A MOLDED SHINGLE ASSEMBLY SHEAR TEST; AND (3) A CURRENT VERSUS VOLTAGE OUT PUT OF THE ACTIVE MODULE. RELATIVE TO THE SPECIAL WARFARE CONCEPTUAL DESIGN, DRAWINGS OF A MARKEDLY DIFFERENT MORE ADVANCED ARRAY WERE COMPLETED. USAELRDL SUGGESTED THAT DETAILED SKETCHES OF THIS CONCEPT BE DEVELOPED FOR FURTHER EVALUATION. A WIRING LAYOUT AND CALCULATIONS FOR THE ELECTRICAL DESIGN OF THE ACTIVE 5-WATT MODULE WERE DEVELOPED WHICH INDICATE THE NUMBER OF CELLS PER SERIES STRING, TOTAL NUMBER OF CELLS, ELECTRICAL OUTPUT, AND PHYSICAL SIZE. LIGHT TRANSMISSION TESTS WERE PERFORMED ON THE MATERIALS LISTED IN THE PREVIOUS REPORT WHICH WERE SUBJECTED TO ULTRA-VIOLET AND SUNLIGHT EXPOSURE. AN EVALUATION OF THE ADDI TIONAL COVER MATERIALS ALSO LISTED IN THE SAME REPORT HAS BEEN MADE BASED ON LIGHT TRANSMISSION LOSSESS AND LITERATURE ANALYSIS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 418 322
GENERAL INSTRUMENT CORP NEWARK N J

SOLAR FLAT PLATE THERMOELECTRIC GENERATOR RESEARCH. (U)

DESCRIPTIVE NOTE: QUARTERLY REPT. NO. 2, 1 JUNE-1 SEP 63.
SEP 63 24P
CONTRACT: AF33 657 10335
PROJ: 8173
TASK: 817302

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR PANELS, THERMOELECTRIC), (*AUXILIARY POWER PLANTS, SPACECRAFT), DESIGN, OPTICAL COATINGS, TEMPERATURE, STRUC, THERMOCOUPLES, ENERGY CONVERSION, SOLAR RADIATION, METAL PLATES, PIPES, ALUMINUM, NICKEL, THICKNESS, WEIGHT, SOLDERED JOINTS, TESTS. (U)

A SOLAR FLAT PLATE THERMOELECTRIC GENERATOR CONSISTS OF A COLLECTOR PLATE WITH AN OPTICALLY SELECTIVE COATING, SMALL SIZE SEMICONDUCTOR THERMOELEMENTS, A RADIATOR PLATE AND A SUPPORT STRUCTURE. EMPHASIS HAS BEEN PLACED ON A SUPPORT STRUCTURE CONCEPT DESIGNATED AS THE INTEGRAL REINFORCED PLATE IN WHICH RADIATOR AND COLLECTOR PLATES ARE FOLDED INTO SELF-SUPPORTING STRUCTURES. A NUMBER OF THERMAL CYCLING TESTS HAVE BEEN CONDUCTED UP TO A MAXIMUM OF 2000 CYCLES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 421 700
GENERAL ELECTRIC CO AUBURN N Y

RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO. 4, 1 JULY-30 SEP 63.
SEP 63 31P
CONTRACT: AF33 657 10601
TASK: 817301 33

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, SEMICONDUCTING FILMS), (*SEMICONDUCTING FILMS, SOLAR CELLS), CADMIUM ALLOYS, TELLURIUM ALLOYS, CRYSTAL GROWTH, FEASIBILITY STUDIES, SURFACES, SOLDERING, MAINTENANCE, COPPER ALLOYS (U)
IDENTIFIERS: THIN FILMS (U)

THE EMPHASIS OF THE THIN FILM SOLAR CELL WORK WAS ON (1) GROWING ACCEPTABLE CADMIUM TELLURIDE FILMS IN VERTICAL SUBSTRATES TO YIELD MORE USABLE AREA, (2) FABRICATING CELLS THAT HAVE JUNCTION AREAS OF 40 TO 50 SQ CM, (3) EXPERIMENTING WITH DIFFERENT SURFACE TREATMENTS TO YIELD MORE UNIFORM CELLS, (4) INVESTIGATING METHODS OF ATTACHING LEADS TO THE CELLS (INDIUM SOLDERING SEEMS SATISFACTORY), (5) TAKING DATA ON FOUR-MONTH OLD CELLS TO SEE HOW THE CELLS PARAMETER CHANGE WITH TIME, AND (6) PERFORMING BASIC STUDIES OF THE PROPERTIES OF JUNCTIONS BETWEEN CDTE AND OTHER MATERIALS.
(AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 422 396
GOODYEAR AEROSPACE CORP AKRON OHIO

SOLAR ORIENTING DEVICE FOR EXPANDABLE FLAT-PANEL ARRAY. (U)

DESCRIPTIVE NOTE: FINAL REPT. FOR 1 JULY 61-30 JUNE 63,
JUL 63 100P MCKEEL,G. J. ;
REPT. NO. GER-11184
CONTRACT: DA-36-039-SC-88913
PROJ: DA-1-G-622001-A-053
TASK: 1-G-622001-A-053-03

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, POSITIONING DEVICES), (*SOLAR PANELS, POSITIONING DEVICES), SOLAR RADIATION, CIRCUITS, EXPERIMENTAL DATA, PHOTOELECTRIC CELLS, WIND, SUN, ELECTRIC, ELECTRIC POTENTIAL (U)

THIS REPORT SUMMARIZES THE RESULTS OF TWO YEARS OF ANALYTICAL STUDIES AND EXPERIMENTAL TESTING OF SYSTEMS FOR AUTOMATICALLY ORIENTING VARIOUS SIZED SOLAR CELL PANELS CONTINUOUSLY TO THE SUN. ANALYSIS OF THE APPARENT MOTION OF THE SUN, WIND EFFECTS, PANEL ORIENTATION, SUN SENSING, AND BASIC SYSTEM CONFIGURATIONS ARE INCLUDED IN THE SECTION ON GENERAL STUDIES. A SECTION IS PRESENTED ON THE OPERATION, DESIGN, AND FABRICATION OF THE SINGLE-AND TWO-AXIS SUN SENSORS. SYSTEM CIRCUIT DIAGRAMS ARE INCLUDED FOR BOTH THE SINGLEAXIS AND TWO-AXIS AUTOMATIC DRIVE SYSTEMS. DESCRIPTIONS OF THE MOUNT AND DRIVE HEAD ASSEMBLIES ARE INCLUDED, AND THE GENERAL SETUP CONSIDERATION FOR EACH SYSTEM IS GIVEN. ADVANTAGE OF THE TWOAXIS AUTOMATIC SYSTEM OVER THE SINGLE-AXIS AUTOMATIC SYSTEM IS ALSO PRESENTED. EXPERIMENTAL RESULTS ON THE SINGLE-AXIS SUN SENSOR AND ITS ASSOCIATED DRIVE SYSTEM ARE GIVEN. THE EXPERIMENTAL TESTING ON THE TWO-AXIS SUN SENSOR AND THE COMPLETE TWO-AXIS SYSTEM IS INCLUDED. EXPERIMENTAL RESULTS SHOW THE EVOLUTION FROM THE SIMPLE AUTOMATIC SINGLE-AXIS SENSOR WITH AN ACCURACY OF 10 DEGREES TO THE COMPLETELY AUTOMATIC TWO-AXIS SYSTEM WITHPOINTING ERROR OF LESS THAN 1 DEGREE. CONCLUSIONS AND RECOMMENDATIONS ARE PROVIDED TO INDICATE THE ADVANTAGES AND POSSIBLE DIRECTION THESE ORIENTING SYSTEMS MAY TAKE IN THEIR APPLICATION TO GROUND POWER DEVICES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 422 529
TEXTRON ELECTRONICS INC SYLMAR CALIF HELIOTEK DIV

HIGH EFFICIENCY SILICON SOLAR CELLS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. NO. 4, 15 MAR-15 JUNE 63,
JUL 63 1V BERMAN,PAUL A. ;
CONTRACT: DA36 039SC90777
PROJ: 1GC22001A053 03

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, SILICON), (*SILICON, SOLAR CELLS), MANUFACTURING, COSTS, PRODUCTION, PERFORMANCE (ENGINEERING), ELECTRIC POTENTIAL (U)

FIVE HUNDRED P(+)/N AND FIVE HUNDRED N(+)/P CELLS HAVE BEEN FABRICATED ON A PILOT LINE BASIS. THERE WAS A 70% YIELD OF P(+)/N CELLS HAVING A 100 MW/SQ CM SUNLIGHT EFFICIENCY OF 11.4% OR GREATER. THERE WAS A 70% YIELD OF N(+)/P CELLS HAVING A 100 MW/SQ CM SUNLIGHT EFFICIENCY OF 10.1% OR GREATER. PRELIMINARY MEASUREMENTS INDICATE A SUBSTANTIAL INCREASE IN EFFICIENCY FOR BOTH CELL TYPES AT SOLAR INTENSITIES OF APPROXIMATELY 300 MW/SQ CM, DUE TO THE SPECIFIC DESIGN OF THESE CELLS FOR OPERATION AT THESE INTENSITIES, THUS SHOWING GOOD PERFORMANCE FOR OPERATION IN SYSTEMS UTILIZING SOLAR CONCENTRATORS. COMPARISONS ARE MADE BETWEEN THE PILOT LINE N(+)/P AND P(+)/N CELLS; AND BETWEEN THESE CELLS AND COMMERCIALLY AVAILABLE PRODUCTION CELLS OF BOTH POLARITIES. COST ESTIMATES ARE GIVEN ON THE BASIS OF THE YIELDS OBTAINED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 423 684
HARSHAW CHEMICAL CO CLEVELAND OHIO

INVESTIGATION OF THIN FILM CADMIUM SULFIDE SOLAR CELLS. (U)

DESCRIPTIVE NOTE: REPT. FOR SEP 62-NOV 63,
NOV 63 60P SCHAEFER,J. C. ;HUMRICK,R. J.
;HILL,E. R. ;BELT,R. F. ;
CONTRACT: AF33 657 9975
PROJ: 8173
TASK: 817301 32
MONITOR: ASD TDR63 743

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, CADMIUM COMPOUNDS), (*SEMICONDUCTING FILMS, CADMIUM COMPOUNDS), (*CADMIUM COMPOUNDS, SULFIDES), PHOTOELECTRIC CELLS (SEMICONDUCTOR), DESIGN, MATERIALS, ELECTRODES, LIFE EXPECTANCY, DAMAGE, RADIATION EFFECTS, ELECTRONS, CRYSTAL DEFECTS, STABILITY, MANUFACTURING, CRYSTAL GROWTH, ENCAPSULATION, SANDWICH CONSTRUCTION, PLASTICS, PHOTONS, ENERGY, ELECTRICAL PROPERTIES, SPACECRAFT (U)
IDENTIFIERS: QUANTUM YIELD, THIN FILMS (U)

RESEARCH AND DEVELOPMENT OF A LARGE AREA CDS, VACUUM EVAPORATED, THIN FILM, FLEXIBLE, LIGHTWEIGHT, FRONT WALL SOLAR CELL WAS CONTINUED IN AN EFFORT TO IMPROVE THE PERFORMANCE CHARACTERISTICS. EFFICIENCIES WERE INCREASED TO A MAXIMUM OF 5.1%. POWER TO WEIGHT RATIOS OF 15 WATTS PER POUND ARE NORMAL WITH 30 AS A MAXIMUM. AN UPGRADING PROCEDURE FOR LOW EFFICIENCY CELLS WAS DEVELOPED. TEST PANELS WERE SUBMITTED FOR A 30 DAY ORBITAL SPACE FLIGHT EVALUATION. ELECTRON DAMAGE EXPERIMENTS INDICATE LITTLE EFFECT ON THE CDS SOLAR CELLS. X-RAY TECHNIQUES HAVE BEEN USED TO PHOTOGRAPH DISLOCATIONS IN SINGLE CRYSTAL CDS. CURRENT-VOLTAGE CURVES AND SPECTRAL RESPONSE DATA ANALYSES RESULTED IN A ONE-TRAP MODEL OF THE CDS PHOTOVOLTAIC CELL. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 427 070
MALLORY (P R) AND CO INC BURLINGTON MASS

CELL EQUALIZATION TECHNIQUES. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
DEC 63 28P WHORISKEY,PETER J. ;
CONTRACT: AF33 657 8749
PROJ: 8173
TASK: 817304 18
MONITOR: RTD TDR63 4187

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, STORAGE BATTERIES), (*STORAGE BATTERIES, SOLAR CELLS), (*ALKALINE BATTERIES, SOLAR CELLS), NICKEL, CADMIUM, DIODES (SEMICONDUCTOR), GERMANIUM, LIFE EXPECTANCY, SILICON, SILVER, ZINC, ELECTRIC DISCHARGES, BATTERIES AND COMPONENTS (U)

A SPACE VEHICLE POWER SUPPLY CONSISTS OF CERTAIN TYPES OF HERMETICALLY SEALED ALKALINE BATTERY CELLS COUPLED WITH SOLAR CELLS. DURING USAGE THESE ALKALINE BATTERY CELLS, SERIES CONNECTED, ARE REPEATEDLY SUBJECTED TO CHARGE-DISCHARGE CYCLES THAT CAN PRODUCE CELL FAILURE. THESE FAILURES ARE, IN TURN, ATTRIBUTABLE TO INHERENT CELL DIFFERENCES INTENSIFIED BY CYCLING RATE, OVERALL CYCLING TIME AND DEPTH OF DISCHARGE. THE PRIME FAILURE MODES CONSIST OF: (A) UNEQUAL CELL CHARGE WHICH CAUSES THE EVOLUTION OF GAS IN SUFFICIENT QUANTITIES TO DESTROY THE CELL, AND (B) CELL REVERSAL ON DISCHARGE THAT EFFECTIVELY CANCELS THE CELL FROM THE CIRCUIT AND ULTIMATELY RESULTS IN CELL FAILURE. THE OBJECTIVES OF THIS PROGRAM WERE, ACCORDINGLY, TO INVESTIGATE: (1) METHODS OF EQUALIZING THE TERMINAL VOLTAGE OF THE INDIVIDUAL CELLS ON CHARGE, AND (2) METHODS OF PREVENTING CELL REVERSAL UPON DISCHARGE. TO ACHIEVE CELL EQUALIZATION, THE LOGARITHMIC FORWARD VOLT-AMPERE CHARACTERISTIC OF SEMICONDUCTOR P-N JUNCTIONS WAS INVESTIGATED IN DEPTH. SEMICONDUCTOR DIODES WERE DESIGNED AND TESTED FOR SPECIFIC V-I SLOPES AND CURRENT HANDLING CAPABILITY. SIMILARLY, THE ANTI-REVERSAL APPROACH CONSISTED OF UTILIZING THE LOW FORWARD DROP OF ESPECIALLY FABRICATED GE DIODES WHICH WERE PLACED ACROSS THE CELL TERMINALS, IN PARALLEL TO, BUT IN POLARITY OPPOSING THE EQUALIZER DIODES. THESE DIODE ASSEMBLIES MATERIALLY INCREASED THE CYCLE LIFE OF NI-CD CELLS.
(AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 427 608
GENERAL ELECTRIC CO AUBURN N Y

RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO. 5, 1 OCT-31 DEC 63.
DEC 63 35P
CONTRACT: AF33 657 10601
TASK: 817301 33

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, VAPOR PLATING), (*CADMIUM ALLOYS, TELLURIUM ALLOYS), (*CRYSTAL STRUCTURE, SOLAR CELLS), MOLYBDENUM, COPPER, TELLURIUM, CADMIUM, NICKEL, GOLD, IMPURITIES, GALLIUM, ELECTRODES, ALUMINUM, SILVER, CHROMIUM, BERYLLIUM, BISMUTH, ANTIMONY, LEAD(METAL), DIODES, ELECTRICAL CONDUCTIVITY, ELECTRIC POTENTIAL, EFFECTIVENESS, REFLECTORS, INDIUM COMPOUNDS, OXIDES (U)
IDENTIFIERS: HETEROJUNCTIONS, INDIUM(III) OXIDE, THIN FILMS (U)

STUDIES OF FACTORS AFFECTING THE PROPERTIES OF POLYCRYSTALLINE CDTE FILM GROWN BY THE VAPOR REACTION PROCESS ARE DISCUSSED AND A VARIETY OF MOLYBDENUM SUBSTRATES ARE COMPARED. NO REAL DIFFERENCES ARE FOUND. ROUGH MEASURES OF TEMPERATURE EFFECTS AND TELLURIUM FLOW RATE ON FILM GROWTH RATE ARE REPORTED. THE TAILORING PROCESS WAS CHANGED IN TWO RUNS WITH EFFICIENCY MARKEDLY IMPROVED. THE PRINCIPAL CONCLUSION OF A STUDY OF EVAPORATED METAL CONTACTS IS THAT GOLD IS THE BEST ELECTRODE MATERIAL OF THE TEN EXAMINED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 428 424
ION PHYSICS CORP BURLINGTON MASS

P-N JUNCTION FORMATION TECHNIQUES. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO. 1, 2 OCT 63-2 JAN 64.
JAN 64 66P
CONTRACT: AF33 615 1097

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, SILICON), (*SEMICONDUCTING FILMS, VAPOR PLATING), SINGLE CRYSTALS, VACUUM APPARATUS, PLASMA MEDIUM, TANTALUM, GLASS, PHOSPHORUS, IONS, RESISTANCE (ELECTRICAL), PRODUCTION, MANUFACTURING, TRACER STUDIES (U)
IDENTIFIERS: PN JUNCTIONS, PYREX (U)

AN APPLIED RESEARCH PROGRAM HAS BEEN INITIATED TO INCREASE THE STATE-OF-THE-ART EFFICIENCY OF SOLAR CELLS PRODUCED BY ION IMPLANTATION TECHNIQUES AND TO DEMONSTRATE FEASIBILITY FOR PRODUCING THIN FILM SOLAR CELLS BY PLASMA DEPOSITION. DURING THIS QUARTER, EFFORTS IN THE ION IMPLANTATION AREA PRIMARILY HAVE INVOLVED FOUNDATION INVESTIGATIONS AND EQUIPMENT MODIFICATIONS. PREVIOUS INVESTIGATIONS HAD POINTED OUT THREE MAJOR PROBLEM AREAS IN ION IMPLANTATION CELLS; MATERIAL PROBLEMS, RESISTIVITY PROBLEMS, AND OTHER PROBLEMS RESULTING FROM IMPLANTATION TECHNIQUES. THE LATTER, IN PARTICULAR, INVOLVED FORWARD LEAKAGE EFFECTS WHICH WERE MASKING THE EFFECTS ON CELL PERFORMANCE OF OTHER VARIABLES SUCH AS JUNCTION PROFILE VARIATIONS. A MAJOR EFFORT WAS MADE TO DETERMINE THE REASONS FOR THIS LEAKAGE AND RESULTS UNEQUIVOCABLY INDICATE THE SOURCE TO BE PIPES CAUSED BY DIRT-SHADOWING DURING IMPLANTATION. AN EXTENSIVE INVESTIGATION WAS INITIATED INTO AN EXACT MEASUREMENT OF THE ACTUAL JUNCTION PROFILES PRESENT AS A FUNCTION OF IMPLANTATION PARAMETERS AND ANNEALING PROCEDURES. THIS INVOLVES A DETERMINATION OF THE RATIO OF ELECTRICALLY ACTIVE TO PHYSICALLY PRESENT PHOSPHOROUS BY RESISTIVITY AND TRACER TECHNIQUES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 428 634
RADIO CORP OF AMERICA PRINCETON N J DEFENSE ELECTRONIC PRODUCTS

APPLIED RESEARCH PROGRAM ON HIGH TEMPERATURE RADIATION RESISTANT SOLAR CELL ARRAY, VOLUME II. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT., 15 APR-15 OCT 63.
DEC 63 57P
CONTRACT: AF33 657 8490
PROJ: 8173
TASK: 817301 16
MONITOR: ASD TDR63 516, VOL. 2

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, HIGH TEMPERATURE), (*HIGH TEMPERATURE, DAMAGE), (*DAMAGE, SOLAR CELLS), CONFIGURATION, AEROSPACE CRAFT, GALLIUM COMPOUNDS, ARSENIDES, CADMIUM COMPOUNDS, SULFIDES, THIN FILMS (STORAGE DEVICES), (U)THIN FILMS (STORAGE DEVICES) (U)
IDENTIFIERS: THIN FILM ELECTRONICS, THIN FILMS (U)

RESEARCH FOR DEVELOPMENT OF A HIGH-TEMPERATURE, RADIATION RESISTANT, SOLAR CELL ARRAY FOR AEROSPACE VEHICLE.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 428 999
TEXTRON ELECTRONICS INC SYLMAR CALIF HELIOTEK DIV

HIGH EFFICIENCY SILICON SOLAR CELLS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. NO. 5, 15 JUNE-15 SEP 63,
OCT 63 IV BERMAN,PAUL A. ;
CONTRACT: DA36 039SC90777
PROJ: 1GC22001A053 03

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, SILICON), (*SILICON, SOLAR CELLS), (*ENERGY CONVERSION, SOLAR CELLS), CRYSTALS, DIFFUSION, DESIGN, COATINGS, SILICON COMPOUNDS, OXIDES, RESISTANCE (ELECTRICAL), COSTS, STATISTICAL ANALYSIS (U)

SOME ODITIONAL STATISTICAL ANALYSES OF THE FIRST N(+)P BIVARIABLE EXPERIMENT WERE MADE. THE VARIANCE ON THIS EXPERIMENT WAS GREATER FROM RUN TO RUN THAN WITHIN A RUN, AT ANY GIVEN DESIGN POINT. A PRELIMINARY STATISTICAL EXPERIMENT WAS PERFORMED ON N(+)P CELLS HAVING BETWEEN 5 AND 27 GRID LINES WITH DIFFUSION TIMES OF 20 AND 80 MINUTES. HALF THE CELLS WERE COATED WITH SIO WHILE HALF WERE NOT. EXPERIMENTAL RESULTS SHOWED A FLAT OPTIMUM BETWEEN 9 AND 18 GRID LINES, AND BETWEEN THE DIFFUSION TIMES OF 20 AND 80 MIN. WITH REGARD TO THE LATTER VARIABLE, THE RELATIVE INSENSITIVITY OF N(+)P CELL EFFICIENCIES, AS COMPARED TO P(+)N CELL EFFICIENCIES, WITH VARIATION OF JUNCTION DEPTH WAS AGAIN OBSERVED, AND THIS INSENSITIVITY CAUSED SOME DIFFICULTY IN DETERMINING A CLEAR SUPERIORITY OF ONE DIFFUSION TIME OVER THE OTHER DUE TO THE MASKING EFFECTS OF OTHER VARIABLES. CELLS HAVING TOTAL CELL SERIES RESISTANCES OF LESS THAN 0.20 OHMS WERE FABRICATED. POLYCRYSTALLINE CELLS SHOWED SUNLIGHT CONVERSION EFFICIENCIES OF AS HIGH AS 11%. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 429 136
WESTINGHOUSE ELECTRIC CORP DAYTON OHIO

DENDRITIC SILICON SOLAR CELL PANEL. (U)

DESCRIPTIVE NOTE: FINAL REPT., AUG 62-AUG 63,
OCT 63 80P TARNEJA,K. S. ;ROSSI,V. A. ;
CONTRACT: AF33 657 9820
PROJ: 8173
TASK: 817301 29
MONITOR: RTD TDR63 40 30

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, MANUFACTURING), (*SOLAR PANELS, SILICON), (*SILICON, SOLAR CELLS), THERMAL EXPANSION, ACCELERATION, VIBRATION, SHOCK (MECHANICS), PHYSICAL PROPERTIES, ENERGY CONVERSION, DIFFUSION, OPTICAL PROPERTIES, LIFE EXPECTANCY, DESIGN, TESTS, TEST EQUIPMENT (U)
IDENTIFIERS: DENDRITES(CRYSTALLOGRAPHY) (U)

STUDIES DIRECTED TOWARD THE FABRICATION OF HIGH EFFICIENCY SOLAR CELLS ON SILICON WEBBED DENDRITES AND THE SOLAR CELL PANELS WERE UNDERTAKEN. SOME OF THE BASIC DESIGN CONSIDERATIONS AND FAB RICATION TECHNIQUES ARE PRESENTED. PREPARATION OF P(+)N AND N(+)P SOLAR CELL STRUCTURE IS DISCUSSED. CELL EFFICIENCIES WERE MEASURED USING TWO TUNGSTEN PHOTOFLOOD LAMPS AS THE LIGHT SOURCE. EFFICIENCIES AS HIGH AS 13% WERE ACHIEVED ON 2CM X LCM X 0.05CM, AS HIGH AS 12% WERE ACHIEVED ON 15CM X 1CM X 0.05CM, AND AS HIGH AS 10% WERE ACHIEVED ON 30CM X 1CM X 0.05CM SOLAR CELLS PREPARED FROM SILICON WEBBED DENDRITES. SPECTRAL RESPONSE MEASUREMENTS WERE MADE ON SILICON WEB SOLAR CELLS AND TYPICAL CURVES ARE PRESENTED. ONE MECHANICAL SAMPLE, FOUR OPERATIONAL SOLAR CELL PANELS, AND TWO SPECIAL OPERATIONAL PANELS WERE FABRICATED, TESTED AND SUBMITTED IN PART FULFILLMENT OF THE SUBJECT CONTRACT. COMPLETE RESULTS ON THESE PANELS ARE DISCUSSED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 432 192
HARSHAW CHEMICAL CO CLEVELAND OHIO

INVESTIGATION OF THIN FILM CADMIUM SULFIDE SOLAR CELLS. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO. 1, 25 NOV 63-25 FEB 64,
MAR 64 55P SCHAEFER,J. C. ;HUMRICK,R. J. ;BELT,R. F. ;
CONTRACT: AF33 615 1248
TASK: 817301 32

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, FILMS), (*CADMIUM COMPOUNDS, SULFIDES), VAPOR PLATING, VACUUM APPARATUS, QUARTZ, TANTALUM, SILICON, FLUORIDES, COPPER COMPOUNDS, CALCIUM COMPOUNDS, TITANIUM, NICKEL ALLOYS, IRON ALLOYS, ELECTROPLATING, PH FACTOR, COPPER, SULFUR, ZIRCONIUM, MOLYBDENUM, TUNGSTEN, HEAT TREATMENT, OPTICAL PROPERTIES, ELECTROPLATING, SOLUTIONS(MIXTURES) (U)
IDENTIFIERS: COPPER(I) SULFIDE (U)

THE PURPOSE OF THIS PROGRAM IS TO CONTINUE THE RESEARCH AND DEVELOPMENT ON LARGE AREA, THIN FILM FLEXIBLE, LIGHT WEIGHT CADMIUM SULFIDE SOLAR CELLS. HIGHER EFFICIENCY STABLE CELLS WITH A HIGH POWER TO WEIGHT RATIO ARE GOALS OF THIS PROGRAM. HIGHER EFFICIENCY CELLS APPEAR PROBABLE WHEN THE BARRIER IS FORMED CHEMICALLY. CELLS HAVE BEEN FABRICATED FOR EXPOSURE TO GAMMA RADIATION AT NRL. NEW CONTACTING TECHNIQUES ARE BEING INVESTIGATED FOR APPLICATION ON THE ONE SQUARE FOOT AND ONE-HALF SQUARE FOOT ARRAYS. A REAR WALL THIN FILM CDS PHOTOVOLTAIC CELL CAN BE PRODUCED. A CONSIDERABLE EFFORT WOULD BE NEEDED TO PERFECT THIS INTO AN EFFICIENT AND USABLE ITEM, FURTHER WORK HAS BEEN ABANDONED. THE PRINCIPAL VACUUM EVAPORATION PARAMETERS OF SUBSTRATE TEMPERATURE AND SURFACE PERFECTION HAVE BEEN STUDIED FOR CDS DEPOSITIONS. THIN FILMS OF CDS WERE PREPARED ON MO, TA, TI, INVAR 36, QUARTZ, SI AND CAF2. SUBSTRATE TEMPERATURES RANGED FROM 200 TO 650 C. TI SHOWS EXCELLENT PROMISE FOR REDUCING THE TOTAL CELL WEIGHT. ANNEALING, DOPING AND CHEMICAL REACTIONS WERE STUDIED TO INCREASE OUTPUT EFFICIENCIES OF PRODUCTION CELLS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 434 706
AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB OHIO

WEBBED DENDRITIC SILICON SOLAR CELL RADIATION EFFECTS INVESTIGATION. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT., 1 JAN 63-1 JAN 64,
JAN 64 96P BABCOCK,R. V. ;SUN,K. H. ;
CONTRACT: AF33 657 10527
PROJ: 8173
TASK: 817301
MONITOR: APL TDR64 20

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, DAMAGE), (*DAMAGE, SOLAR CELLS), (*SILICON, SOLAR CELLS), OPTIMIZATION, ELECTRON BEAMS, MANUFACTURING, STRUCTURAL PROPERTIES, METAL PLATES, ENERGY CONVERSION, SEMICONDUCTORS, OXYGEN, VACUUM APPARATUS, VACUUM FURNACES, PERFORMANCE (ENGINEERING), (U)PERFORMANCE (ENGINEERING) (U)
IDENTIFIERS: DENDRITES(CRYSTALLOGRAPHY), PN JUNCTIONS (U)

AN INVESTIGATION WAS CONDUCTED TO DETERMINE THE OPTIMUM STRUCTURE FOR SILICON SOLAR CELLS, WITH REGARD TO RESISTANCE TO DAMAGE BY 2 MEV ELECTRONS. THE PARAMETERS CONSIDERED WERE CELL TYPE, I.E. P/N OR N/P, JUNCTION DEPTH, AND BASE RESISTIVITY. OF ALL THE PARAMETERS AFFECTING CELL RADIATION RESISTANCE, THE INITIAL EFFICIENCY WAS FOUND TO HAVE THE LARGEST EFFECT. A COMPARISON WAS MADE TO ASSESS THE SUPERIORTY OF THE OPTIMUM N/P STRUCTURE, FOR 2 MEV ELECTRON FLUX DENSITIES IN THE RANGE 10 TO THE 13TH 10 TO THE 15TH POWER ELECTRONS/SQ CM. THE DEGRADATION RATE PER DECADE OF FLUX FOR THE P/N STRUCTURE WAS ABOUT 25% VS 21% FOR THE N/P CELLS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 437 942
TEXTRON ELECTRONICS INC SYLMAR CALIF HELIOTEK DIV

HIGH EFFICIENCY SILICON SOLAR CELLS REPORT NUMBER VI. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. NO. 6, 15 SEP-15 DEC 63,
JAN 64 64P BERMAN,PAUL A. ;
CONTRACT: DA-36-039-SC-90777
PROJ: DA-1G622001A053
TASK: 1G622001A05303

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, MANUFACTURING), ENERGY CONVERSION, DESIGN, COSTS, SILICON (U)

ANALYSIS OF THE PERFORMANCE OF THE PILOT LINE CELLS FABRICATED DURING THE FOURTH QUARTER INDICATE THAT THE BASIC CELL DESIGN REMAINS HIGHLY EFFICIENT AT INTENSITIES UP TO 2000 MW/SQ CM, SHOWING A SIGNIFICANT IMPROVEMENT IN THE STATE OF THE ART. ATTEMPTS TO SIGNIFICANTLY REDUCE CELL COSTS BY REPLACING THE RATHER LENGTHY JUNCTION CLEAN-UP ETCH BY A SIMPLE EDGE SANDING OPERATION HAVE SHOWN THAT WHILE SOME MODIFIED TECHNIQUES MAY HAVE VALUE IN THIS AREA, THE SPECIFIC TECHNIQUE USE IN THE EXPERIMENT RESULTED IN TOO GREAT A POWER LOSS TO BE OF VALUE IN REDUCING THE COST PER WATT RATIO. SOME ALTERNATE TECHNIQUES ARE PROPOSED. RESULTS ARE PRESENTED OF AN EXPERIMENTS TO DETERMINE THE EFFECT OF VIRGIN AND SCRAP POLYCRYSTALLINE MATERIAL ON THE EFFICIENCY OF POLYCRYSTALLINE CELLS. THE RESULTS WERE SOMEWHAT MASKED BY THE FACT THAT FIVE OF THE EIGHT INGOTS PURCHASED AS POLYCRYSTALLINE MATERIAL WERE ACTUALLY PARTIALLY SINGLE CRYSTALLINE IN NATURE. AN APPENDIX IS INCLUDED DESCRIBING A RADIATION EXPERIMENT ON N+/P POLYCRYSTALLINE CELLS AND THE RESULTS ARE COMPARED TO THOSE OBTAINED ON SINGLE CRYSTALLINE CELLS IN VARIOUS LIGHT SOURCES. THE RESULTS INDICATE THAT THE N/P POLYCRYSTALLINE AND SINGLE CRYSTALLINE CELLS DEGRADE TO THE SAME POWER VALUE AT A FLUX OF ABOUT 10 TO THE 14TH POWER ELECTRONS/SQ CM IN A SUNLIGHT SOURCE, WITH THE PER CENT DEGRADATION BEING CONSIDERABLY SMALLER FOR THE FORMER CELL TYPE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 438 526
GENERAL ELECTRIC CO AUBURN N Y

RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO. 6, 1 JAN31 MAR 64,
MAR 64 43P LAWLER,J. L. ;KILLAM,C. H. ; CUSANO,D. A. ;LUBOWSKI,S. J. ;
CONTRACT: AF33 657 10601
TASK: 817301 33

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, FILMS), (*CADMIUM COMPOUNDS, TELLURIDES), (*TELLURIDES, SOLAR CELLS), VAPOR PLATING, MANUFACTURING, IMPURITIES, CADMIUM, TELLURIUM, IODIDES, SEMICONDUCTORS, MOLYBDENUM, DIODES, VOLTAGE, ELECTRIC CURRENTS, SELENIDES, HEAT TREATMENT, SINGLE CRYSTALS, METAL CRYSTALS, SOLAR PANELS, ELECTRIC CONNECTORS, GOLD, ELECTRODES (U)
IDENTIFIERS: CADMIUM SELENIDE, CADMIUM IODIDE, SUBSTRATES(ELECTRONIC), SUBSTRATES(ELECTRONICS), THIN FILM ELECTRONICS, THIN FILMS (U)

THIS REPORT DISCUSSES RESEARCH ON THIN FILM CDTE SOLAR CELLS CARRIED ON DURING THE FIRST QUARTER OF 1964. CHANGES IN THE DESIGN OF THE VAPOR REACTION APPARATUS ARE DESCRIBED AND EVALUATED. THE EFFECTS OF CHANGES IN THE GROWTH CONDITIONS ARE DESCRIBED. FILM ADHERENCE WAS FOUND TO IMPROVE GREATLY CONCURRENTLY WITH THE USE OF GENERAL ELECTRIC CO. MOLYBDENUM SUBSTRATES. STUDIES OF THE EVAPORATED ELECTRODES WERE CONTINUED AND SOME WORK WAS DONE ON PLATED AND SILK-SCREENED ELECTRODES. BOTH SOLDERED AND EPOXY-BONDED CONNECTIONS TO THE EVAPORATED GRID WERE EXAMINED, WITH THE LATTER BELIEVED TO BE THE SUPERIOR TECHNIQUE. STUDIES OF THE EFFECTS OF CRYSTAL ORIENTATION ON CELL CHARACTERISTICS ARE REPORTED. AN IMPROVED CDSE CELL IS DESCRIBED AND FURTHER WORK ON A N-ON-P CELL IS REPORTED. A LIST OF REPRESENTATIVE CELLS FABRICATED DURING THE QUARTER IS INCLUDED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 451 543
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA

DENDRITIC SOLAR CELL AND ARRAY INVESTIGATION. (U)

DESCRIPTIVE NOTE: INTERIM PROGRESS REPT. NO. 4, 1 JUNE-1 SEP 64,
SEP 64 106P TARNEJA,K. S. ;
CONTRACT: AF33 615 1049
PROJ: 8173

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, MANUFACTURING), SILICON, SOLAR PANELS, DESIGN, CRYSTAL STRUCTURES, RESISTANCE (ELECTRICAL), VOLTAGE, PROTON BOMBARDMENT, ELECTRON, ELECTRON DENSITY, AIR, VACUUM, TARGETS, ALUMINUM, EPITAXIAL GROWTH, STRUCTURAL PROPERTIES, MECHANICAL PROPERTIES (U)
IDENTIFIERS: DENDRITES(CRYSTALLOGRAPHY) (U)

THE ONE-YEAR EFFORT IS DISCUSSED FOR MAXIMIZING THE RADIATION RESISTANCE OF SILICON WEBBED DENDRITES USING NOVEL APPROACHES SUCH AS INTRODUCTION OF DRIFT FIELDS. DESIGN CONSIDERATIONS AND FABRICATION TECHNIQUES FOR SOLAR CELLS USING DRIFT-FIELD STRUCTURES ARE PRESENTED. THREE DIFFERENT APPROACHES FOR ACHIEVING GRADED BASE STRUCTURES ARE DISCUSSED. RESULTS ON SOLAR CELLS FABRICATED USING THESE APPROACHES ARE PRESENTED. DESIGN CONSIDERATIONS AND ANALYSIS OF VARIOUS SUBSTRUCTURES FOR SOLAR CELL PANEL ASSEMBLY ARE DISCUSSED. EFFORTS WERE DEVOTED TO THE DESIGN OF SOLAR CELL PANELS FOR THE PURPOSES OF IMPROVING WATTS/LB. ANTIREFLECTIVE COATINGS WERE APPLIED ON SOLAR CELLS FABRICATED FROM SILICON WEBBED DENDRITES. IRRADIATION STUDIES USING 1 MEV ELECTRON ENERGY ON THE VARIOUS DRIFT FIELD STRUCTURES ARE PRESENTED. IRRADIATION EXPERIMENTS ON P/N AND N/P SOLAR CELLS IN VACUUM AND IN AIR WERE CARRIED ON AND THE RESULTS DISCUSSED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 454 009
TEXTRON ELECTRONICS INC SYLMAR CALIF HELIOTEK DIV

HIGH EFFICIENCY SILICON SOLAR CELLS. (U)

DESCRIPTIVE NOTE: REPT. NO. 8 (FINAL), 15 JUN 62-15 JUL 64,
AUG 64 IV BERMAN,PAUL A. ;
CONTRACT: DA36 039SC90777
PROJ: 1G6 22001A053 03

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (•SOLAR CELLS, MANUFACTURING), SILICON, COSTS, ENERGY CONVERSION, DESIGN, EFFECTIVENESS, ELECTRICAL PROPERTIES, VOLTAGE (U)

EXPERIMENTS LEADING TO AN OPTIMIZED DESIGN FOR N+/P AND P+/N SOLAR CELLS WHICH ARE TO BE UTILIZED IN A TERRESTRIAL ENVIRONMENT AT A SOLAR INTENSITY OF ABOUT 350 MW/SQ CM ARE DESCRIBED. THE SAME CELL DESIGN IS SHOWN TO BE OPTIMIZED FOR 100 MW/SQ CM EARTH•S SURFACE SOLAR INTENSITIES AS WELL. IT IS FOUND THAT THE RESULTS OF THE EXPERIMENTS CAN BE PREDICTED FROM THEORY TO A GOOD APPROXIMATION. PILOT LINE PRODUCTION OF CELLS UTILIZING THE OPTIMIZED DESIGN IS DESCRIBED AND YIELD DISTRIBUTIONS ARE PRESENTED. GOOD EFFICIENCY YIELDS ARE FOUND TO OCCUR FOR BOTH POLARITIES, HOWEVER THE YIELD DISTRIBUTION OF THE P+/N CELLS IS SUPERIOR TO THAT OF THE N+/P CELLS. THE P+/N DISTRIBUTION PEAKS IN THE 13.5-14.0% EFFICIENCY RANGE WITH A YIELD OF 70% OF THE CELLS HAVING AN EFFICIENCY OF 12.9% OR GREATER. THE YIELD DISTRIBUTIONS ARE DISCUSSED IN THE LIGHT OF FURTHER ANALYSIS OF THE ELECTRICAL CHARACTERISTICS OF THE CELLS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 462 346
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

THE EFFECT OF 4 MEV ELECTRONS ON COVERED BRITISH SILICON SOLAR CELLS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
FEB 65 23P TREBLE,F. C. ;
REPT. NO. TR-65026

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (•SOLAR CELLS, RADIATION EFFECTS), (•SILICON, ELECTRON IRRADIATION), ELECTRONS, LIGHT, SOLAR RADIATION, CALIBRATION, DISTRIBUTION, MEASUREMENT, INTENSITY, DEGRADATION, ELECTRICAL PROPERTIES (U)

AN EXPERIMENTAL STUDY HAS BEEN MADE OF THE EFFECTS OF 4 MEV ELECTRON BOMBARDMENT ON THE SPECTRAL RESPONSE AND ORBITAL PERFORMANCE OF TWO BRITISH MAKES OF 10 OHM CM N/P SILICON SOLAR CELLS WITH CEMENTED-ON 0.006-IN. GLASS COVER SLIPS. A SUBSIDIARY PURPOSE OF THE STUDY WAS TO COMPARE THE LATEST MEASUREMENT TECHNIQUES EMPLOYING SHORT CIRCUIT CURRENT CALIBRATIONS IN THE LABORATORY WITH THOSE IN MALTA SUNLIGHT. THE TWO METHODS WERE FOUND TO GIVE RESULTS IN CLOSE AGREEMENT. A FACTOR RELATING THE MEAN MALTA CALIBRATION TO THE AIR MASS ZERO SHORT-CIRCUIT CURRENT WAS ESTABLISHED AND FOUND TO BE REMARKABLY INSENSITIVE TO SHIFTS IN SPECTRAL RESPONSE OF THE CELLS. THE RESULTS OF THE STUDY ARE PRESENTED AS A SERIES OF MEAN SPECTRAL RESPONSE AND VOLTAGECURRENT CURVES SHOWING THE EFFECT OF VARIOUS RADIATION FLUXES. THE PERFORMANCE PARAMETERS OF INTEREST ARE ALSO PLOTTED AS A FUNCTION OF ELECTRON FLUX. THE PROBABLE FALL IN SOLAR CELL OUTPUT DURING THE LIFE OF THE UK.3 SATELLITE IS PREDICTED FROM THE DATA. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 476 696 10/2
RCA LABS DIV RADIO CORP OF AMERICA PRINCETON N J

IMPROVED THIN-FILM SOLAR CELLS. (U)

DESCRIPTIVE NOTE: FINAL REPT. 16 NOV 64-15 NOV 65,
JAN 66 65P PERKINS ,DAVID M. ;HUI ,
WILLIAM L. ;NOEL ,GERALD ;PASIERB,EDWARD F. ;

CONTRACT: AF33(615)-2259
PROJ: AF-8173
TASK: 817301-34
MONITOR: AFAPL TR-65-123

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, FILMS), COSTS, WEIGHT, MANUFACTURING, ABSORPTION, GALLIUM COMPOUNDS, ARSENIC COMPOUNDS, OXIDES, SINGLE CRYSTALS, CRYSTAL GROWTH, THICKNESS, DOPING, GRAIN BOUNDARIES, PLATINUM, SILICON COATINGS, ETCHING, ANNEALING, DEGRADATION, HUMIDITY, TEMPERATURE, STABILITY (U)
IDENTIFIERS: ANTIREFLECTION COATINGS, THIN FILMS (U)

DURING THIS CONTRACT THIN-FILM GAAS SOLAR CELLS USING SEMITRANSPARENT PT LAYERS AS THE BARRIER CONTACT HAVE BEEN MADE AND INVESTIGATED TO IMPROVE THEIR PHOTOVOLTAIC CHARACTERISTICS. STUDIES OF THE GAAS FILM, GROWN BY THE CLOSE-SPACED OXIDE TRANSPORT PROCESS, AND THE BARRIER CONTACT STRUCTURE, CONSISTING OF THE PT FILM, GRIDDING AND ANTIREFLECTION COATING, LED TO THE FABRICATION OF CELLS WITH THE FOLLOWING MAXIMUM EFFICIENCIES: 5.1% FOR 0.2 CC, 4.5% FOR 2.0 CC AND 3% FOR 4.0 CC. IT WAS SHOWN THAT DEGRADATION OF THESE CELLS IN ROOM AMBIENT IS DUE TO THE POST-EVAPORATION ETCHING USED DURING THE FABRICATION PROCESS. STABLE CELLS WERE MADE WITH EFFICIENCIES OF 2.8% FOR AREAS OF 2.0 CC. TESTS WERE MADE TO EVALUATE THE EFFECTS OF TEMPERATURE, VACUUM, MOISTURE, ULTRAVIOLET LIGHT, AND PROTON RADIATION ON THE PT-GAAS STRUCTURE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 477 447 10/2 13/8
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR DIV

MANUFACTURING METHODS FOR SILICON DENDRITE SOLAR CELLS. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 MAY 63-31 JUL 65, DEC 65 117P ICHIKAWA ,Y. ;KISINKO ,P. M. ;MANDALAKAS ,J. N. ;MERRITTS ,T. D. ; STONEBRAKER,E. R. ;
CONTRACT: AF33(657)-11274
PROJ: MM-8-130
MONITOR: AFML TR-65-413

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, PRODUCTION), SILICON, CRYSTAL GROWTH, DIFFUSION, TEST METHODS, SIMULATION, INDUSTRIAL EQUIPMENT, MANUFACTURING, POWER SUPPLIES (U)

TECHNIQUES FOR PRODUCING LOW-COST, HIGH EFFICIENCY, SILICON WEB DENDRITE SOLAR CELLS ON AN UNBALANCED PILOT LINE ARE REPORTED. SILICON DENDRITIC WEB (0.5 X 12 IN.) HAVING THICKNESS, RESISTIVITY, AND CRYSTAL PROPERTIES FOR DEVICE OBJECTIVES WAS PRODUCED. SILICON DENDRITIC WEB N-ON-P SOLAR CELLS (1.27 X 30.5 CM) WERE FABRICATED DURING THE PILOT RUN. PROCESSES WERE DESIGNED TO ASSURE A YIELD OF 75% OF 9% MINIMUM EFFICIENT CELLS. THE DISTRIBUTION OF YIELD BASED ON SOLAR CELL EFFICIENCY WAS > OR = 9%, 100%; > OR = 10%, 68%; AND > OR = 11%, 18%. THE OVERALL PHYSICAL YIELD WAS 78% DURING THE OPERATION OF THE UNBALANCED PILOT LINE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 477 592 10/2 18/8
LOCKHEED MISSILES AND SPACE CO PALO ALTO CALIF

GAMMA RADIATION EFFECTS IN SILICON SOLAR CELLS, (U)

OCT 58 37P ENSLOW ,G. ;JUNGA ,F. ;
HAPP,W. W. ;
REPT. NO. LMSD-5137
CONTRACT: AF04(647)-97

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *DAMAGE), SILICON, GAMMA RAYS, ELECTRICAL PROPERTIES, POWER SUPPLIES, (U)POWER SUPPLIES (U)

TEN SILICON SOLAR CELLS WERE IRRADIATED BY 100-CURIE CO 60 GAMMA RAY SOURCE TO A DOSE OF 10 TO THE 7TH POWER R. IN-SITU MEASUREMENTS OF THE OPEN-CIRCUIT VOLTAGE AND SHORT-CIRCUIT CURRENT WERE OBTAINED. CALCULATIONS TO PREDICT THE PERFORMANCE OF SILICON SOLAR CELLS UNDER IRRADIATION WERE MADE ON THE BASIS OF KNOWN PROPERTIES OF SILICON AND ON THE BASIS OF MODELS OF RADIATION DAMAGE IN SOLIDS. CALCULATED AND EXPERIMENTAL RESULTS WERE COMPARED. THE ELECTRICAL CHARACTERISTICS OF THE SOLAR CELLS WERE MEASURED AS A FUNCTION OF TEMPERATURE BEFORE AND AFTER IRRADIATION. THE PERFORMANCE OF A SILICON SOLAR CELL POWER SUPPLY IN RADIATION FIELDS IS DISCUSSED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 486 792 10/2
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR DIV

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT. (U)

DESCRIPTIVE NOTE: INTERIM PROGRESS REPT. NO. 2, 1 APR-1 JUL 66,
JUL 66 29P HARDING,W. R. ,JR.|
CONTRACT: AF 33(615)-3462

UNCLASSIFIED REPORT

DESCRIPTORS: (•SOLAR CELLS, FEASIBILITY STUDIES), SILICON, ELECTRICAL RESISTANCE, VOLTAGE, PHOTOENGRAVING, BORON, COATINGS, PHOSPHORUS, DIFFUSION, EPITAXIAL GROWTH, ARSENIC, ELECTRICAL CONDUCTIVITY, VAPOR PLATING, TITANIUM, SILVER, INDIUM, DOPING, REDUCTION, ALIGNMENT, SEMICONDUCTOR DIODES, CIRCUITS, LEAKAGE(ELECTRICAL), OSCILLATORS, FREQUENCY CONVERTERS (U)
IDENTIFIERS: PHOTO-RESIST (U)

THIS REPORT COVERS THE PROGRESS ON THE HIGH VOLAGE SOLAR CELL ARRAY SEGMENT FOR THE PERIOD 1 APR TO 1 JULY, 1966. SUITABLE PHOTORESIST TECHNIQUES FOR WEB SILICON WERE DEVELOPED DURING THIS PERIOD AND CRITICAL ALIGNMENT AND COATING TECHNIQUES WERE DESIGNED. THE UTILIZATION OF SUBCOLLECTORS FOR THE HIGH VOLTAGE CELL IS DISCUSSED. A MODEL FOR THE HIGH VOLTAGE CELL WAS SET UP AND ANALYZED. THE POWER LOSSES IN HERENT IN THE STRUCTURE AND THE APPROACHES NEEDED TO SOLVE THEM WERE INVESTIGATED AND REPORTED. DEVELOPMENT OF THE OSCILLATOR AND MULTIPLIER CIRCUITS WAS CONTINUED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /Z0M07

AD- 487 633 10/2
LOCKHEED MISSILES AND SPACE CO PALO ALTO CALIF RESEARCH LABS

PROTON AND ELECTRON IRRADIATION OF N/P SILICON SOLAR CELLS, (U)

APR 65 64P REYNARD, D. L. ;
REPT. NO. LMSC-3-56-65-4
CONTRACT: AF 04(647)-787

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, SILICON), RADIATION EFFECTS, PROTONS, ELECTRONS, DEGRADATION, DAMAGE, RADIATION EFFECTS, ELECTRICAL PROPERTIES, MEASUREMENT, CALIBRATION (U)

THE RADIATION DEGRADATION DATA FOR TEN OHM-CM N/P SILICON SOLAR CELLS WHICH EXISTED AT THE INITIATION OF THIS TEST PROGRAM WAS IN NEED OF FURTHER SUBSTANTIATION AND IMPROVEMENT. A TEST PROGRAM WAS THUS COMMENCED WHICH WOULD PROVIDE COMPLETE AND RELIABLE PERFORMANCE DATA FOR THE SUPPORT OF THE POWER SYSTEM DESIGN AND THE ASSURANCE OF THE SYSTEM'S RELIABILITY. SOLAR CELLS WERE IRRADIATED WITH ELECTRONS WITH FOUR ENERGIES AND PROTONS WITH THREE ENERGIES. COMPARABLE CELLS PRODUCED BY FOUR DIFFERENT MANUFACTURERS WERE INCLUDED. SOLAR CELL/COVER/ADHESIVE COMPOSITE SAMPLES WERE ELECTRON-IRRADIATED. I-V CHARACTERISTICS WERE OBTAINED AT INTERMEDIATE, AS WELL AS FINAL, TOTAL FLUX LEVELS. THE DESIRED TEST DATA WERE OBTAINED WITH A HIGH DEGREE OF ACCURACY. THE CELLS OF THE FOUR MANUFACTURERS WERE SUBSTANTIALLY EQUAL IN RADIATION TOLERANCE. LITTLE DIFFERENCE WAS NOTED BETWEEN THE PERFORMANCE OF 1 AND 10 OHM-CM CELLS. IT WAS CONCLUDED THAT ONLY POWER MEASUREMENTS ARE VALID AS CRITERIA FOR RELATIVE POWER SYSTEM DEGRADATION. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 487 634 10/2
LOCKHEED MISSILES AND SPACE CO PALO ALTO CALIF

IRRADIATION OF SOLAR CELL SUB-PANELS WITH 0.8 MEV ELECTRONS. (U)

NOV 64 22P REYNARD,D. L. ;
REPT. NO. LMSC-3-56-64-8
CONTRACT: AF 04(647)-787

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, SILICON), ELECTRONS, DAMAGE, RADIATION EFFECTS, SENSITIVITY, PERFORMANCE(ENGINEERING), TEMPERATURE, DEGRADATION (U)

THE SILICON SOLAR CELL HAS RADIATION DEGRADATION CHARACTERISTICS WHICH HAVE BEEN THOROUGHLY INVESTIGATED, AND, AS A RESULT, ARE WELL-ESTABLISHED. THE RADIATION SENSITIVITY OF GROUPS OF THESE CELLS ASSEMBLED INTO MODULES, HOWEVER, HAD NOT BEEN INVESTIGATED PRIOR TO THE PERFORMANCE OF THIS EXPERIMENT. THE OBJECTIVE OF THE EXPERIMENT WAS TO OBSERVE THE SENSITIVITY OF THE LMSC SOLAR CELL SUB-PANEL (A TEN-CELL IN PARALLEL MODULE) AS COMPARED TO SINGLE SOLAR CELLS. ANY VARIATION OF THIS SENSITIVITY AMONG VARIOUS MANUFACTURING BATCHES WAS TO BE ESTABLISHED. AS A RESULT OF THE EXPERIMENT IT WAS FOUND THAT THE MANUFACTURING PROCESSES CURRENTLY USED DO NOT AFFECT THE RADIATION PROPERTIES OF THE MODULE. THE MODULE SUFFERS RADIATION DEGRADATION AT THE SAME RATE AS DO SINGLE SOLAR CELLS. NO BATCH-TO-BATCH DIFFERENCES OF THESE PROPERTIES WERE FOUND. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 601 459
HARSHAW CHEMICAL CO CLEVELAND OHIO

INVESTIGATION OF THIN FILM CADMIUM SULFIDE SOLAR CELLS. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO. 2, 25 FEB-25 MAY 64
MAY 64 46P SCHAEFER,J. C. ;HUMRICK,R. J. ;BELT,R. F. ;
CONTRACT: AF33 615 1248
PROJ: 8173
TASK: 81301, 817332

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, FILMS), (*CADMIUM COMPOUNDS, SULFIDES), VAPOR PLATING, VACUUM APPARATUS, SINGLE CRYSTALS, TITANIUM, COPPER COMPOUNDS, CHLORIDES, INDIUM, MOLYBDENUM, SILICON COMPOUNDS, MONOXIDES, SURFACE PROPERTIES, ENERGY CONVERSION, EFFECTIVENESS (U)
IDENTIFIERS: THIN FILMS (U)

CONSIDERABLE EMPHASIS HAS BEEN PLACED ON THE DEVELOPMENT OF THE CHEMIPLATED OR IMMERSION TECHNIQUE FOR THE BARRIER FORMATION. GAINS OF ABOUT 40% IN CONVERSION EFFICIENCY HAVE BEEN REALIZED OVER THE STANDARD EFFICIENCY OF 2.5%. LIGHTER WEIGHT SOLAR CELLS HAVE BEEN FABRICATED ON TITANIUM SUBSTRATES WITH HIGH POWER TO WEIGHT RATIOS. SOLAR CELLS USING H-FILM AS THE SUBSTRATE MATERIAL HAVE BEEN MADE WITH EFFICIENCIES OF OVER 4% AND POWER TO WEIGHT RATIOS GREATER THAN 40. THE VACUUM DEPOSITION OF CDS ON SINGLE CRYSTAL CDS HAS BEEN PERFORMED TO STUDY EFFECTS OF SUBSTRATE PERFECTION ON THE QUALITY OF THE FILM. SOLID STATE REACTIONS OF CUCI AND CDS WERE INVESTIGATED IN ORDER TO PREPARE MORE EFFECTIVE BARRIERS. INDIUM PLATED MO SUBSTRATES WERE UTILIZED TO PROVIDE OHMIC CONTACTS AT THE CDS SUBSTRATE INTERFACE. SPECTRAL RESPONSE OF ELECTROPLATED AND CHEMIPLATED CELLS AS A FUNCTION OF TIME SHOWS THAT THE LATTER APPEAR TO BE MORE STABLE IN ORDINARY AMBIENTS. THE USE OF SIO THIN FILMS ON THE TOP SURFACE OF THE CELLS HAS LED TO A MORE STABLE CELL IN THE PRESENCE OF WATER VAPOR. OPTICAL STUDIES ON THE CHEMIPLATED BARRIER LAYER HAVE CONFIRMED A CU2-XS COMPOUND OF A THICKNESS OF ABOUT 1800A AND EXHIBITING FREE CARRIER ABSORPTION.

(U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /Z0M07

AD- 602 759
TEXTRON ELECTRONICS INC SYLMAR CALIF HELIOTEK DIV

HIGH EFFICIENCY SILICON SOLAR CELLS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. NO. 7, 15 DEC 63-15 MAR 64,
APR 64 53P BERMAN,PAUL A. ;
CONTRACT: DA36 039SC90777
PROJ: 1G6 22001 A053 03

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, SILICON), (*SILICON, SOLAR CELLS), (*ENERGY CONVERSION, SOLAR RADIATION), DESIGN, MANUFACTURING, COSTS, SINTERING, EVAPORATION, DIFFUSION, CRYSTALS, SEMICONDUCTORS, RESISTANCE (ELECTRICAL), OPTIMIZATION, MATRICES(MATHEMATICS) (U)

A POLYVARIABLE EXPERIMENT WAS PERFORMED ON P(+)/N SOLAR CELLS TO DETERMINE THE OPTIMUM DESIGN FOR PERFORMANCE AT SOLAR INTENSITIES OF ABOUT 350 MW/SQ CM. THE REGION OF MAXIMUM RESPONSE WAS DETERMINED AND INDICATED THAT A 13 LINE GRID PATTERN COMBINED WITH A 12 MINUTE DIFFUSION TIME WOULD GIVE THE MAXIMUM PERFORMANCE FOR P(+)/N CELLS OPERATED AT SOLAR INTENSITIES UP TO 350 MW/SQ CM. A BIVARIABLE EXPERIMENT PERFORMED ON P(+)/N POLYCRYSTALLINE CELLS HAS SHOWN THAT POLYCRYSTALLINE CELLS CAN BE OPTIMIZED AND DESIGNED FOR USE IN CONCENTRATED LIGHT SYSTEMS. IT WAS FOUND THAT CELL DESIGNS NEAR THE REGION OF MAXIMUM RESPONSE ACTUALLY SHOWED INCREASED EFFICIENCIES AT 316 MW/SQ CM EQUIVALENT SOLAR INTENSITIES. THE FABRICATION OF CELLS HAVING FROM 4 TO 8 TIMES THE ACTIVE AREA OF THE NORMAL 1 X 2 CM CELL INDICATES THAT LARGE AREA CELLS CAN BE MADE WITH SHORT CIRCUIT CURRENT DENSITIES AND OPEN CIRCUIT VOLTAGES THAT COMPARE QUITE CLOSELY WITH THOSE OBTAINED FROM 1 X 2 CM. INVESTIGATIONS HAVE BEEN MADE TO DETERMINE METHODS OF ELIMINATING THE TIME CONSUMING AND RELATIVELY EXPENSIVE JUNCTION CLEAN UP ETCH WITH A MORE RAPID, LESS COSTLY PROCESS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 605 425
HARSHAW CHEMICAL CO CLEVELAND OHIO

INVESTIGATION OF THIN FILM CADMIUM SULFIDE SOLAR CELLS. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO. 3, 26 MAY-25 AUG 64,
AUG 64 8P SCHAEFER,J. C. ;HUMRICK,R. J. ; BELT,R. F. ;
CONTRACT: AF33 615 1248
PROJ: 8173
TASK: 817301,817332

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-601 459.

DESCRIPTORS: (*SOLAR CELLS, FILMS), (*CADMIUM COMPOUNDS, SULFIDES), ENERGY CONVERSION, BATTERIES AND COMPONENTS, ELECTROPLATING, VAPOR PLATING, DEGRADATION, CHEMICAL MILLING, COPPER COMPOUNDS, CHLORIDES, SILICON COMPOUNDS, MONOXIDES, SURFACE PROPERTIES, EFFECTIVENESS (U)
IDENTIFIERS: THIN FILMS (U)

THE DEGRADATION OF ELECTROPLATED CELLS HAS BEEN CLOSELY OBSERVED AND IT HAS BEEN FOUND THAT RECOVERY CAN BE ACCOMPLISHED UNDER PROPER CONDITIONS. CHEMICAL MILLING OF THE SUBSTRATE IS AN EXCELLENT METHOD FOR PRODUCING HIGH POWER TO WEIGHT RATIO CELLS. FABRICATION OF THE ONE-HALF AND ONE SQUARE FOOT MECHANICAL SAMPLE ARRAYS INDICATE IMPROVED TOTAL AREA UTILIZATION FACTORS. PHOTOVOLTAIC CELLS AND DIODES HAVE BEEN PREPARED BY FIRST DEPOSITING A THIN FILM OF CUCL ON CDS. THE CUCL WAS SUBSEQUENTLY CONVERTED TO CU9,5S5 BY MEANS OF H2S. OPTICAL STUDIES ON ELECTROPLATED AND CHEMIPLATED BARRIERS HAVE SERVED TO CONFIRM THE PRESENCE OF CU2S ALONE OR MIXED WITH CUS. THIN LAYERS OF SIO HAVE BEEN UTILIZED AS A WATER VAPOR BARRIER TO SIGNIFICANTLY DECREASE DEGRADATION OF CELLS. ADDITIONAL THEORETICAL WORK HAS BEEN PERFORMED ON A HETEROJUNCTION MODEL OF THE CELL OPERATION. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 605 931
GENERAL INSTRUMENT CORP NEWARK N J

SOLAR FLAT PLATE THERMOELECTRIC GENERATOR RESEARCH, (U)

SEP 64 98P RUSH,ROBERT E. I

CONTRACT: AF 33(657)-10335
PROJ: AF-8173
TASK: 817302
MONITOR: AFAPL TDR-64-87

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR PANELS, THERMOELECTRICITY), (*THERMOELECTRICITY, SOLAR PANELS), GENERATORS, ENERGY CONVERSION, SOLAR RADIATION, OPTICAL COATINGS, ELECTRICAL POWER PRODUCTION, STRUCTURAL MEMBERS, ALUMINUM, ENVIRONMENTAL TESTS, BISMUTH ALLOYS, TELLURIUM ALLOYS, SPACECRAFT, POWER SUPPLIES, EXPANDED PLASTICS, HONEYCOMB CORES, METAL PLATES, JOINING, PERFORMANCE (ENGINEERING), CORROSION, LITHIUM, LIQUID METALS, SUBLIMATION, DESIGN, STORAGE, SEMICONDUCTORS, THERMOCOUPLES (U)

A SOLAR FLAT PLATE THERMOELECTRIC CONVERTER CONSISTS OF A COLLECTOR PLATE WITH AN OPTICALLY SELECTIVE COATING, SMALL SIZE THERMOELEMENTS, A RADIATOR PLATE AND A SUPPORT. THE COLLECTOR AND RADIATOR PLATES WERE FOLDED INTO SELFSUPPORTING STRUCTURES WHICH, COMBINED WITH ALUMINUM TUBULAR MEMBERS, COMPRISED THE PANEL SUPPORT CONFIGURATION. THIS DESIGN RESULTED IN A VERY LOW CONVERTER WEIGHT, ONLY 53 GRAMS PER SQUARE FOOT. A NUMBER OF PROTOTYPE PANELS, WERE FABRICATED AND TESTED. THE PANELS PASSED SPECIFIED ENVIRONMENTAL TEST WITHOUT PHYSICAL OR ELECTRICAL CHANGES. EVALUATION OF THE OPTICALLY SELECTIVE COATING DISCLOSED THAT THE COATING EFFICIENCY ACTUALLY OBTAINED IN THE PILOT PRODUCTION RUNS WAS ONLY 80% OF THE LITERATURE VALUE. THE PROCESSING OF THE BISMUTH TELLURIDE THERMOELECTRIC MATERIAL INTO THE SHAPE AND SIZE REQUIRED FOR THE SOLAR PANELS CAUSED A DECREASE IN PERFORMANCE RELATIVE TO LARGE SIZE THERMOELEMENTS. THIS DECREASE, COMBINED WITH BASIC MATERIAL PROPERTIES INFERIOR TO LITERATURE VALUES, RESULTED IN A THERMOELECTRIC EFFICIENCY ONLY 50% OF THAT INITIALLY EXPECTED.

(U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 605 957
TRW SPACE TECHNOLOGY LABS LOS ANGELES CALIF

DESIGN CRITERIA FOR SILICON SOLAR CELL POWER SUPPLIES, (U)

FEB 59 8P ROBISON,P. C. ;
REPT. NO. STL/TN-59-0000-00234

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, SILICON), (*SPACECRAFT, POWER SUPPLIES), (*POWER SUPPLIES, SOLAR CELLS), DESIGN, COATINGS, GEOMETRIC FORMS, ELECTRICAL PROPERTIES, TEMPERATURE, TEMPERATURE CONTROL, SOLAR RADIATION, GLASS, SOLAR PANELS, EMISSIVITY, ELECTRIC CURRENTS, ENERGY CONVERSION, MATHEMATICAL ANALYSIS, PERFORMANCE (ENGINEERING), SPACE PROBES (U)

GENERAL PRINCIPLES OF DESIGN ARE OUTLINED FOR THE USE OF SILICON SOLAR CELLS FOR POWER IN SPACE PROBES. SEVERAL ELECTRICAL CHARACTERISTICS IMPORTANT TO DESIGN ARE CONSIDERED. ANALYSIS OF POSSIBLE GEOMETRIC CONFIGURATIONS OF SOLAR CELLS IS GIVEN ALONG WITH A SEMI-EMPIRICAL METHOD. MENTION IS MADE OF TEMPERATURES AND TEMPERATURE CONTROL. THE RESULTS ARE USED TO INDICATE A DESIGN APPROACH. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 603 213
NAVAL RESEARCH LAB WASHINGTON D C

ELECTRON-BOMBARDMENT DAMAGE IN SILICON SOLAR CELLS. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
OCT 64 62P STATLER,R. L. ;
REPT. NO. NRL-6091
PROJ: SF013 12 04 4533 ,SR007 11 01 0549

UNCLASSIFIED REPORT

DESCRIPTORS: (•SOLAR CELLS, DAMAGE), (•SILICON, ELECTRON IRRADIATION), SEMICONDUCTOR DEVICES, ELECTRICAL PROPERTIES, PHOTOELECTRIC EFFECT, SATELLITES (ARTIFICIAL), POWER SUPPLIES, (U)POWER SUPPLIES (U)

A STUDY WAS MADE OF THE RADIATION DAMAGE IN 11 TYPES OF SILICON SOLAR CELLS AS A RESULT OF 1-MEV ELECTRON BOMBARDMENT. INCLUDED IN THE STUDY ARE P/N CELLS, N/P CELLS OF DIFFERENT BULK RESISTIVITIES, PLANAR CELLS, AND DRIFT-FIELD CELLS. A COMPARATIVE ANALYSIS WAS MADE OF THE RADIATIONINDUCED DEGRADATION IN THESE CELLS AS A FUNCTION OF SHORTCIRCUIT CURRENT, MAXIMUM POWER OUTPUT, MINORITY-CARRIER DIFFUSION LENGTH, AND PHOTOVOLTAIC SPECTRAL RESPONSE. THE P/N CELLS WERE FOUND TO BE MUCH MORE SENSITIVE TO RADIATION DAMAGE THAN ANY TYPE OF N/P CELLS IN THIS INVESTIGATION. IN TH N/P CELLS, THERE IS A DEFINITE INDICATION OF INCREASING RADIATION RESISTANCE ACCOMPANYING INCREASING VALUES OF BULK RESISTIVITY, UP TO 10 OHM-CM. THE DRIFT-FIELD SOLAR CELLS EXHIBIT A FURTHER IMPROVEMENT IN RADIATION RESISTANCE BEYOND THAT OF THE OTHER TYPES OF N/P CELLS. (AUTHOR) (U)

ODC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 609 204
NATIONAL CASH REGISTER CO DAYTON OHIO

INVESTIGATION OF CHEMICALLY SPRAYED THINFILM PHOTOVOLTAIC CELLS. (U)

DESCRIPTIVE NOTE: QUARTERLY REPT. NO. 2, 15 AUG-14 NOV 64,
NOV 64 36P CHAMBERLIN,R. R. ;SKARMAN,J. S.
;
CONTRACT: AF33 615 1578
PROJ: 8173
TASK: 817301

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: LEGIBILITY OF THIS DOCUMENT IS IN PART UNSATISFACTORY. REPRODUCTION HAS BEEN MADE FROM THE BEST AVAILABLE COPY.

DESCRIPTORS: (*SOLAR CELLS, MANUFACTURING), (*PHOTOELECTRIC CELLS (SEMICONDUCTOR), MANUFACTURING), (*SEMICONDUCTING FILMS, SULFIDES), COPPER COMPOUNDS, CADMIUM COMPOUNDS, SPRAYS, BRONZE, STEEL, TEST FACILITIES, COMPLEX COMPOUNDS (U)
IDENTIFIERS: CADMIUM SULFIDES, COPPER SULFIDES, THIN FILMS (U)

THE REPORT DISCUSSES THE DETAILS OF THE CHEMICAL SPRAY DEPOSITION TECHNIQUE THAT WAS USED FOR THE DEPOSITION OF THE CDS AND CU SUB X S SUB Y SEMICONDUCTOR FILMS. TOPICS INCLUDE FILM DEPOSITION TECHNIQUES, FILM STUDIES, CELL FABRICATION, AND TEST INSTALLATION. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 609 424
TRW SPACE TECHNOLOGY LABS LOS ANGELES CALIF

ELECTRON BOMBARDMENT OF SILICON SOLAR CELLS. (U)

FEB 60 52P DOWNING,R. G. ;
REPT. NO. STL/TR-60-0000-04057 ,STL/EM-10-5

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, ELECTRON IRRADIATION), (*DAMAGE, SOLAR CELLS), SILICON, PHOTOELECTRIC CELLS (SEMICONDUCTOR), SEMICONDUCTORS, QUARTZ, GLASS, SHIELDING, CRYSTAL DEFECTS, HEAT TREATMENT, SEMICONDUCTOR DEVICES, SATELLITES (ARTIFICIAL), SPACECRAFT, GRAPHICS, (U)GRAPHICS (U)

SILICON SOLAR CELLS WERE IRRADIATED WITH 500 KEV ELECTRONS TO DETERMINE THE EFFECT OF ELECTRON RADIATION SIMILAR TO THAT ENCOUNTERED IN SATELLITES ON THE EFFICIENCY OF SOLAR CELLS. THE EXPERIMENTS SHOW THAT AN INTEGRATED FLUX OF ABOUT 5 X 10 TO THE 13TH POWER E/SQ CM REDUCES SILICON SOLAR CELL EFFICIENCY BY ABOUT 25 PERCENT. ADDITIONAL EXPERIMENTS USING QUARTZ AND GLASS SHIELDING FOR RADIATION PROTECTION SHOW THE SUITABILITY OF REDUCING THE RADIATION DAMAGE BY THIS TECHNIQUE. COMBINING THE EXPERIMENTAL RESULTS WITH THE SIMPLE THEORY, 0.065 IN. OF QUARTZ OR GLASS ARE INDICATED AS NECESSARY TO PROVIDE PROTECTION FROM 800 KEV ELECTRONS IN THE TRAPPED RADIATION BANDS. ADDITIONAL PROTECTION OF SHIELDED SILICON SOLAR CELLS WILL RESULT FROM ANNEALING OF RADIATION INDUCED DEFECTS AT A LOW RATE NEAR ROOM TEMPERATURES. NO QUANTITATIVE DATA ON ANNEALING WAS OBTAINED FROM THESE EXPERIMENTS, BUT THIS EFFECT SHOULD BE REGARDED AS A SUBJECT FOR FURTHER INVESTIGATION IN ADDITION TO DETAILED INVESTIGATION OF RADIATION DAMAGE IN SILICON SOLAR CELLS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 610 356
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

ELECTRIC POWER STATION IN THE COSMOS, (U)

JAN 65 6P MARININ,YURII ;
REPT. NO. FTD-TT-64-633
MONITOR: TT , 65 61029

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: UNEDITED ROUGH DRAFT TRANS. FROM SOVETSKAYA BELORUSSIYA (USSR) 1963, 9 JUL, P. 3.

DESCRIPTORS: (*ELECTRIC POWER PRODUCTION, SPACE FLIGHT), (*SOLAR CELLS, SPACE FLIGHT), (*SOLAR PANELS, SPACE FLIGHT), (*SPACE FLIGHT, ELECTRIC POWER PRODUCTION), USSR, RADIOACTIVE ISOTOPES, NUCLEAR REACTORS, RADIOACTIVE CONTAMINATION, MOON, POWER SUPPLIES (U)
IDENTIFIERS: MARINER, TRANSIT (U)

AN ACCOUNT IS GIVEN OF GENERATION OF ELECTRIC POWER FOR TRAVEL BY ROCKETS, SATELLITES, AND SPACE SHIPS. THE POWER IS GENERATED BY SOLAR MEANS, RADIOACTIVE ISOTOPES, OR NUCLEAR REACTORS. BRIEF MENTION IS MADE OF THE FLIGHT OF 'MARINER II' TOWARD VENUS AND OF THE USE OF RADIOISOTOPES FOR THE AMERICAN NAVIGATIONAL SATELLITES 'TRANSIT IV A' AND 'TRANSIT IV B'. RADIOACTIVE CONTAMINATION OF THE MOON OR OF ANY OTHER PLANET ON WHICH LANDINGS MIGHT BE MADE IS ALSO DISCUSSED. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOMO7

AD- 611 535
GENERAL ELECTRIC CO AUBURN N Y

RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 SEP 62 - 31 DEC 64, FEB 65 193P ALDRICH,RICHARD W. ;CUSANO, DOMINIC A. ;
CONTRACT: AF 33(657)-10601
PROJ: AF-8173
TASK: 817301
MONITOR: AFAPL TR-65-8

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-438 526

DESCRIPTORS: (*SOLAR CELLS, FILMS), (*CADMIUM COMPOUNDS, TELLURIDES), SEMICONDUCTORS, SINGLE CRYSTALS, VAPOR PLATING, MOLYBDENUM, MANUFACTURING, IMPURITIES, POWDERS, DIODES (SEMICONDUCTOR), GOLD, ELECTRIC CONNECTORS, ENCAPSULATION, SILICON COATINGS, METAL COATINGS, PLASTIC COATINGS, OXIDES, HEAT TREATMENT, VOLTAGE, INDIUM COMPOUNDS, COPPER COMPOUNDS, SELENIDES, STORAGE, ENVIRONMENTAL TESTS (U)
IDENTIFIERS: CADMIUM TELLURIDE, COPPER TELLURIDE, INDIUM(III) OXIDE (U)

LARGE-AREA (56 SQ CM) CELLS THAT WERE 4.6% EFFICIENT AND A SOLAR PANEL - 1/2 SQ FT IN AREA - WERE FABRICATED. ON THE AVERAGE, THE EFFICIENCY, THE POWER OUTPUT PER UNIT WEIGHT, AND THE YIELD OF LARGE AREA SOLAR CELLS MADE FROM CADMIUM TELLURIDE FILMS ALL INCREASED MONOTONICALLY DURING THE CONTRACT PERIOD (1 SEPTEMBER 1962 TO 31 DECEMBER 1964). THE COMPOSITE OBJECTIVE FOR THE RUN OF THE CONTRACT WAS THE DEVELOPMENT OF LIGHTWEIGHT, FLEXIBLE, SOLAR CELLS OF APPROXIMATELY 5% MAXIMUM EFFICIENCY. THE SEMICONDUCTOR MATERIAL WAS TO BE POLYCRYSTALLINE CADMIUM TELLURIDE. THE CELLS WERE TO WITHSTAND, OR SHOW PROMISE OF WITHSTANDING, WITHOUT DETERIORATION A NORMAL LABORATORY ENVIRONMENT, PARTICLE AND ULTRA-VIOLET RADIATION, HIGH AND LOW TEMPERATURES, AND VACUUM. THE VARIOUS INVESTIGATIONS THAT WERE UNDERTAKEN TO ACHIEVE SUCH LARGE AREA CELLS ARE DISCUSSED IN DETAIL IN THIS REPORT. THE INVESTIGATIONS INCLUDE STUDIES OF PHOTOVOLTAIC JUNCTIONS, FILM GROWTH TECHNIQUES, COLLECTOR ELECTRODES, COLLECTOR BUSBARS, AND CAPSULATION TECHNIQUES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 612 485
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR DIV

DENDRITIC SOLAR CELL AND ARRAY INVESTIGATION. (U)

DESCRIPTIVE NOTE: INTERIM PROGRESS REPT. NO. 6, 1 DEC 64-1 MAR 65,
MAR 65 36P TARNEJA,K. S. ;
CONTRACT: AF33 615 1049
PROJ: 8173

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, MANUFACTURING), (*SEMICONDUCTING FILMS, SOLAR CELLS), (*EPITAXIAL GROWTH, SEMICONDUCTING FILMS), SILICON COMPOUNDS, OXIDES, SINGLE CRYSTALS, SILICON, SEMICONDUCTOR DEVICES, FILMS, DAMAGE, RADIATION EFFECTS, ALUMINUM, CERAMIC COATINGS, DRIFT, STRUCTURE, DESIGN, IMPURITIES, BORON(U)
IDENTIFIERS: STRUCTURE (M)

THE REPORT DISCUSSES THE CONTINUED DEVELOPMENT OF DRIFT FIELD SOLAR CELLS USING EPITAXIAL GROWTH TECHNIQUES AND SOLAR CELL PANEL FABRICATION AND ARRAY DESIGN STUDIES. MODIFICATIONS IN THE GRAPHITE RESISTANCE EPITAXIAL SYSTEM ARE DISCUSSED. ATTEMPTS TO GROW SIO2 FILMS DIRECTLY ON THE DIFFUSED CELL SURFACE WERE MADE. RESULTS OF THE IRRADIATION SERIES OF 1 MEV ELECTRONS ON Al-DOPED SOLAR CELLS ARE PRESENTED. THE MODULE AND THE PANEL SIZE USING THE 'SLOTTED ANGLE' DESIGN HAS BEEN FINALIZED. DESIGN STUDIES OF ARRAYS UP TO 20 SQUARE FEET ARE PRESENTED AND DISCUSSED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 613 187
HARSHAW CHEMICAL CO CLEVELAND OHIO

INVESTIGATION OF CDS THIN-FILM SOLAR CELLS. (U)

DESCRIPTIVE NOTE: REPT. FOR NOV 63-DEC 64.
FEB 65 122P
CONTRACT: AF 33(615)-1248
PROJ: AF-8173
TASK: 817301
MONITOR: AFAPL TR-65-1

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-605 425.

DESCRIPTORS: (*SEMICONDUCTING FILMS, SOLAR CELLS), (*SOLAR CELLS, FILMS), (*CADMIUM COMPOUNDS, SULFIDES), ENERGY CONVERSION, PLATING, COPPER COMPOUNDS, CHLORIDES, VAPOR PLATING, VACUUM APPARATUS, SILICON COMPOUNDS, MONOXIDES, DEGRADATION, SURFACE PROPERTIES, DAMAGE, RADIATION EFFECTS, EFFECTIVENESS, ENVIRONMENTAL TESTS, MOLYBDENUM, QUARTZ, TANTALUM, SILICON, CALCIUM COMPOUNDS, FLUORIDES, TITANIUM, NICKEL ALLOYS, IRON ALLOYS, SINGLE CRYSTALS (U)
IDENTIFIERS: CADMIUM SULFIDES, THIN FILMS (U)

RESEARCH AND DEVELOPMENT OF FRONT WALL, THIN FILM, FLEXIBLE, LIGHT WEIGHT CDS SOLAR CELLS WAS CONTINUED AND DECIDED IMPROVEMENTS HAVE BEEN ACCOMPLISHED. A ONE SQUARE FOOT ARRAY SHOWS A POWER TO WEIGHT RATIO OF ABOUT 35.0 WATTS/LB. WITH AN OVERALL AREA UTILIZATION FACTOR OF OVER 0.80. A NEW CHEMICAL BARRIER FORMATION PROCESS WAS DEVELOPED PROVIDING HIGHER CELL EFFICIENCES. EXPOSURE OF CELLS TO ELECTRON, PROTON AND COBALT 60 RADIATION SHOW LITTLE OR NO DAMAGE. STUDIES ON THE FORMATION OF THE CDS LAYER INDICATE A HIGHER DEGREE OF PREFERRED ORIENTATION AND CRYSTALLITE SIZE AS THE SUBSTRATE TEMPERATURE INCREASES. CRYSTALLITES OF 100 MICRON DIMENSION WERE OBSERVED. OPTICAL MEASUREMENTS ON THE P-LAYER CONFIRM THE CONCLUSION THAT THE BARRIER LAYER IS A HIGHLY CONDUCTING COPPER SULFIDE. OVERLAYERS OF SIO DEPOSITED ON THE CELL DECREASE THE RATE OF WATER VAPOR DEGRADATION, BUT MECHANICAL IMPERFECTIONS RESTRICT THE THICKNESS OF THE DEPOSITED LAYER. THEORETICAL ANALYSIS OF THE EXPERIMENTAL DATA SHOW SERIOUS AND PROBABLY INSURMOUNTABLE PROBLEMS WITH APPLICATION OF EITHER A SURFACE STATE OR TRAP MODEL FOR THE CDS SOLAR CELL. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 622 483
JOHNS HOPKINS UNIV SILVER SPRING MD APPLIED PHYSICS LAB

EFFECTS OF PASSIVE ATTITUDE CONTROL ON SOLAR POWER SYSTEMS, (U)

MAY 64 17P FISCHELL,ROBERT E. ;
REPT. NO. CF-3077
CONTRACT: NOW62 0604C

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, ATTITUDE CONTROL SYSTEMS), (*ATTITUDE CONTROL SYSTEMS, SOLAR CELLS), SPACECRAFT, SATELLITES(ARTIFICIAL), POWER SUPPLIES, STABILIZATION, ORBITS, SOLAR RADIATION, SPINNING(MOTION), GEOMAGNETISM, GRAVITY (U)

THERE IS A STRONG RELATIONSHIP BETWEEN A SPACECRAFT'S ATTITUDE CONTROL SYSTEM AND ITS CAPACILITY FOR GENERATING ELECTRICAL POWER FROM SOLAR CELLS. THE EFFECTS OF FOUR PARTICULARLY INTERESTING PASSIVE ATTITUDE CONTROL TECHNIQUES ON THE SPACECRAFT'S SOLAR POWER SYSTEM ARE DISCUSSED. THESE FOUR TECHNIQUES ARE: SOLAR STABILIZATION, SPIN STABILIZATION, MAGNETIC STABILIZATION, GRAVITY GRADIENT STABILIZATION. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 625 440 10/2 18/8
NAVAL RESEARCH LAB WASHINGTON D C

RADIATION DAMAGE IN SILICON SOLAR CELLS FROM 4.6-MEV PROTON BOMBARDMENT. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
NOV 65 45P STATLER,R. L. ;
REPT. NO. NRL-6333
PROJ: SF-013-12-04-4533 ,SR-007-11-01-0549

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-608 213.

DESCRIPTORS: (*SOLAR CELLS, SILICON), (*PROTON BOMBARDMENT, SOLAR CELLS), (*DAMAGE, SOLAR CELLS), ELECTRICAL PROPERTIES, PHOTOELECTRIC EFFECT, SATELLITES(ARTIFICIAL), POWER SUPPLIES, DEGRADATION, (U)DEGRADATION (U)

A STUDY WAS MADE OF THE RADIATION DAMAGE IN TEN TYPES OF SILICON SOLAR CELLS AS A RESULT OF 4.6-MEV PROTON BOMBARDMENT. THE CELLS COMPRISED SUCH TYPES AS P/N CELLS, N/P CELLS WITH DIFFERENT BULK-RESISTIVITIES, PLANAR CELLS, AND DRIFT-FIELD CELLS. A COMPARATIVE ANALYSIS WAS MADE OF THE RADIATION-INDUCED DEGRADATION IN THESE CELLS AS A FUNCTION OF SHORT-CIRCUIT CURRENT, MAXIMUM POWER OUTPUT, MINORITY-CARRIER DIFFUSION LENGTH, AND PHOTOVOLTAIC SPECTRAL RESPONSE. THE P/N CELLS WERE FOUND TO BE MORE SENSITIVE TO RADIATION DAMAGE THAN ANY TYPE OF N/P CELL IN THIS STUDY. IN THE N/P CELLS, THERE IS A DEFINITE TREND TOWARD INCREASING RADIATION RESISTANCE ACCOMPANYING INCREASING VALUES OF BULK RESISTIVITY, UP TO 10 OHM-CM. THE DRIFT-FIELD SOLAR CELLS EXHIBIT A FURTHER IMPROVEMENT IN RADIATION RESISTANCE BEYOND THAT OF THE OTHER TYPES OF N/P CELLS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOMO7

AD- 634 810 10/2
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

SILICON SOLAR BATTERIES, (U)

JAN 66 84P GLIBERMAN, A. YA. ;ZAYTSEVA,A. K. ;
REPT. NO. FTD-MT-64-204,
MONITOR: TT 66-61584

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF MONO. KREMNIIEVYE SOLNECHNYYE BATAREI, MOSCOW/LENINGRAD, 1961, 72P. MASSOVAYA RADIO BIBLIOTEKA (USSR), V396 72P 1961.

DESCRIPTORS: (•SOLAR CELLS, SILICON), USSR, ENERGY CONVERSION, PHOTOELECTRIC CELLS(SEMICONDUCTOR), PHOTOELECTRIC EFFECT, ABSORPTION, EFFECTIVENESS, IMPURITIES, ELECTRICAL CONDUCTIVITY (U)
IDENTIFIERS: ELECTRICAL CONDUCTIVITY (U)

THE PAMPHLET PRESENTS PHYSICAL PRINCIPLES OF WORK OF SILICON SOLAR ENERGY PHOTOELECTRIC CONVERTERS. CONSIDERED ARE ELECTRICAL AND SPECTRAL CHARACTERISTICS OF INSTRUMENTS AND FACTORS AFFECTING MAGNITUDE OF CONVERTER EFFICIENCY. PECULIARITIES OF USE OF SOLAR BATTERIES ARE CHARACTERIZED. A NUMBER OF CONSTRUCTIONS OF BATTERIES ARE DESCRIBED AND EXAMPLES ARE GIVEN OF THEIR APPLICATION IN DIFFERNENT AREAS OF SCIENCE AND TECHNOLOGY. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOMO7

AD- 634 882 10/2
AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB OHIO

DENDRITIC SILICON SOLAR CELLS AND UTILIZATION EXPERIENCE, (U)

66 26P WISE, JOSEPH ;
REPT. NO. AFAPL-CONF-66-7,
PROJ: AF-8173,
TASK: 817301,

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PRESENTED AT THE IEEE AEROSPACE CONFERENCE, SEATTLE, WASH. JUL 11-15, 1966.

DESCRIPTORS: (*SOLAR CELLS, SILICON), EPITAXIAL GROWTH, PHOSPHORUS, DIFFUSION, COATINGS, QUARTZ, PERFORMANCE(ENGINEERING), SOLAR PANELS, ELECTRIC POWER PRODUCTION (U)

THE METHOD OF FABRICATION FOR DENDRITIC SILICON SOLAR CELLS OF 30 SQ CENTIMETERS IS DESCRIBED; BOTH CONVENTIONAL N ON P AND N ON P DRIFT-FIELD CELLS ARE INCLUDED. THE N ON P CELLS ARE FORMED THROUGH DIFFUSION OF PHOSPHORUS ON THE TOP SURFACE; THE DRIFT-FIELD CELLS, THROUGH EPITAXIAL GROWTH OF A 40-MICRON LAYER ON A SEGMENT OF DENDRITIC SILICON WEB MATERIAL FOLLOWED BY PHOSPHOROUS DIFFUSION, ANTI-REFLECTION COATINGS, AND INTEGRAL QUARTZ COATINGS. EXPERIENCE IN FABRICATING THESE CELLS AND IN UTILIZING THEM ON A FLEXIBLE ARRAY IS SUMMARIZED AND THEIR POTENTIALS FOR LOWER WEIGHT, LONGER LIFE, AND LOWER COST ARE ASSESSED; SPACE PERFORMANCE ESTIMATES ALSO ARE INCLUDED. THE USE OF THE ION IMPLANTATION JUNCTION FORMATION IN THE FABRICATION OF HIGHLY EFFICIENT, THIN DENDRITIC SILICON SOLAR CELLS ALSO IS OUTLINED. MEASUREMENTS ACCOMPLISHED AT THE AIR FORCE AERO PROPULSION LABORATORY ON THE VARIOUS CELL TYPES ARE INCLUDED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 635 851 10/2
AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB OHIO

MEASUREMENT TECHNIQUES FOR SILICON SOLAR CELLS. (U)

MAY 66 18P PRYSTALOSKI, D. F. ;
REPT. NO. AFAPL-CONF-66-4,
PROJ: AF-817301,
TASK: 817301-19,

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PREPARED FOR PRESENTATION AT THE ANNUAL POWER SOURCES CONFERENCE (20TH), ATLANTIC CITY, NEW JERSEY, 24-26 MAY 1966.

DESCRIPTORS: (*SOLAR CELLS, MEASUREMENT), SILICON, EFFECTIVENESS, ELECTRIC POWER PRODUCTION, SIMULATORS, SOLAR RADIATION, CORRELATION TECHNIQUES, CARBON, XENON, TUNGSTEN, FILAMENTS, LIGHTING EQUIPMENT, ENERGY, INTENSITY (U)

THE PROBLEM OF CORRELATING THE MEASURED RADIATION ENERGY INTENSITY OF SEVERAL FLUX DETECTORS UNDER THE CARBON-ARC, XENON, AND TUNGSTEN-FILAMENT LAMPS AS SOLAR SIMULATORS IS COMPLEX. ASSOCIATED FACTORS OF BASIC IMPORTANCE IN UNDERSTANDING THIS CORRELATION ARE SPECTRAL CONTINUITY, STABILITY, SPECTRAL DISTRIBUTION, AND UNIFORMITY OF INTENSITY OF THE ARTIFICIAL LIGHT SOURCES. A PROCEDURE FOR ESTABLISHING ACCURATE, INCIDENT RADIATION FLUX OR INPUT ENERGY UNDER THE MENTIONED LIGHT SOURCES IS ESSENTIAL TO INSURE AGREEMENT IN SOLAR-CELL EFFICIENCY MEASUREMENTS. THE USE OF THIS CORRELATION IS ILLUSTRATED IN THE REPORTING OF THE PERFORMANCE CHARACTERISTICS OF THE WESTINGHOUSE DENDRITIC, SILICON, STANDARD, AND DRIFT-FIELD, SOLAR-CELL ARRAYS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 649 672 10/2 18/8
LOCKHEED MISSILES AND SPACE CO PALO ALTO CALIF

AN ANALYSIS OF NON-UNIFORM PROTON IRRADIATION DAMAGE IN SILICON SOLAR CELLS, (U)

MAR 66 10P CROWTHER,D. L. ;LODI,E. A. ;DEPANGHER,J. ;ANDREW,A. ;

UNCLASSIFIED REPORT
AVAILABILITY: PUBLISHED IN IEEE TRANSACTIONS ON NUCLEAR SCIENCE P37-46 OCT 1966.
SUPPLEMENTARY NOTE: REPT. ON IRRADIATION DAMAGE IN SOLAR CELLS.

DESCRIPTORS: (*SOLAR CELLS, *DAMAGE), SILICON, PROTONS, MATHEMATICAL MODELS, EXPERIMENTAL DATA, (U)EXPERIMENTAL DATA (U)

EXPERIMENTAL DATA OBTAINED ON THE DEGRADATION OF THE SHORT-CIRCUIT CURRENT IN 1-OHM-CM N/P SILICON SOLAR CELLS IRRADIATED BY LOW-ENERGY, 0.1-3.0 MEV, PROTONS WERE ANALYZED WITH THE AID OF AN N-LAYER SOLAR-CELL MODEL. THE RESULTS SHOW THAT THE DAMAGE CONSTANT, K(E SUB P), RISES LESS RAPIDLY WITH DECREASING PROTON ENERGY, E SUB P, THAN IT DOES AT HIGHER PROTON ENERGIES. THE DERIVED DAMAGE LAW WAS ANALYTICALLY DESCRIBED. THE REPRESENTATION WAS FOUND ADEQUATE FOR INCIDENT PROTON ENERGIES OF 0.5, 1, AND 3 MEV AND DEFINITIVE E SUB P > OR = 0.1 MEV. THE VALUE OF K SUB 0 LISTED SHOULD BE CONSIDERED AS REPRESENTATIVE ONLY OF THE PARTICULAR SOLAR CELLS ANALYZED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 650 114 10/2 11/3
AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB OHIO

INTEGRAL COVERS FOR SOLAR CELLS, (U)

MAR 67 24P WISE,J. F. ;MCCLELLAND, J. A. ;STATLER,R. L. ;
REPT. NO. AFAPL-CONF-67-8
PROJ: AF-8173

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PREPARED IN COOPERATION WITH NAVAL RESEARCH LAB., WASHINGTON, D. C. PRESENTED AT THE IEEE PHOTOVOLTAIC SPECIALISTS CONFERENCE (6TH), COCOA BEACH, FLA., 28-30 MAR 67.

DESCRIPTORS: (•SOLAR CELLS, COATINGS), PERFORMANCE(ENGINEERING), GLASS, QUARTZ, SPACE ENVIRONMENTS, DAMAGE, RADIATION EFFECTS, CERAMIC COATINGS (U)

PRESENT INTEGRAL COVER CONFIGURATIONS IN THE 1 TO 2 MIL THICKNESS RANGE CAN OPERATE SATISFACTORILY IN SPACE FOR EXTENDED TIME PERIODS. PANEL WEIGHT REDUCTIONS OF 40 PERCENT ARE POSSIBLE FOR ONE-YEAR OPERATION IN SPACE WITH A DOSE EQUIVALENT TO 10 TO THE 13TH POWER ELECTRONS PER SQUARE CENTIMETER PER DAY BY THE USE OF 4-MIL INTEGRAL COVERS ON THIN, DRIFT-FIELD SOLAR CELLS. A THOROUGH COST-EFFECTIVENESS ANALYSIS OF THIS APPROACH HAS NOT BEEN CONDUCTED TO-DATE, HOWEVER. PROPER DESIGN OF THESE COATINGS CAN IMPROVE THE EFFICIENCY OF THE CELLS THROUGH OPTIMUM SPECTRAL MATCH AND THUS ELIMINATES THE REQUIREMENTS FOR ADHESIVES, COVER-SLIP LAYERS, AND THE ASSOCIATED INTERFERENCE COATINGS REQUIRED TO REDUCE ULTRAVIOLET-DARKENING EFFECTS ON THE ADHESIVES. THE INTEGRAL COVERS EXHIBIT ABOUT THE SAME DEGRADATION RATE AS THE FUSED-SILICA COVER SLIPS. THESE COATINGS ALSO PERMIT HIGHER TEMPERATURE OPERATION OF SOLAR CELLS FOR HANDLING AND ANNEALING PURPOSES AS WELL AS NEAR-SUN MISSION APPLICATIONS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 651 013 10/2
JOHNS HOPKINS UNIV SILVER SPRING MD APPLIED PHYSICS LAB

SOME EFFECTS OF ELECTRON IRRADIATION AND TEMPERATURE ON SOLAR CELL PERFORMANCE, (U)

MAY 63 21P MARTIN,J. H. ;TEENER,J. W. ;RALPH,E. L. ;
REPT. NO. CF-3028
CONTRACT: NOW-62-0604

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PREPARED IN COOPERATION WITH HELIOTEK DIV., TEXTRON ELECTRONICS, INC.

DESCRIPTORS: (*SOLAR CELLS, ELECTRON IRRADIATION), SILICON, SEMICONDUCTORS, CARRIERS(SEMICONDUCTORS), PERFORMANCE(ENGINEERING), TEMPERATURE, DEGRADATION, SPACE ENVIRONMENTS (U)

THE ANNA 1B GEODETIC SATELLITE WAS LAUNCHED INTO A 600 NAUTICAL MILE, 50 DEGREE INCLINATION ORBIT ON OCTOBER 31, 1962. PORTIONS OF VI CURVES OF THE FLASHING LIGHT CIRCUIT WERE SUBSEQUENTLY DETERMINED FROM TELEMETRY RECORDS. THESE DATA ARE PRESENTED AS THE SOLID LINE PORTIONS OF FIGURE 1 FOR TWO DAYS AND FOR 29 DAYS AFTER LAUNCH. EXAMINATION OF THESE CURVES INDICATES THE CHANGE IN BOTH VOLTAGE AND CURRENT WHICH OCCUR AFTER IRRADIATION. THE EFFECT OF TEMPERATURE IS ALSO INDICATED. THEREFORE, A STUDY OF SOLAR CELL PERFORMANCE AFTER IRRADIATION AND AS A FUNCTION OF CELL TEMPERATURE WAS UNDERTAKEN. A QUANTITATIVE ANALYSIS OF THESE EFFECTS IS PRESENTED, COMPARED WITH EXPERIMENTAL RESULTS AND THE DESIGN CAPABILITIES OF THESE TECHNIQUES EVALUATED. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 654 285 10/2 22/2
AEROSPACE CORP EL SEGUNDO CALIF LABS DIV

SOLAR CELL POWER SYSTEMS FOR AIR FORCE SATELLITES, (U)

MAY 67 34P STOFEL,EDWIN J. ;
REPT. NO. TR-1001(2250-20)-7
CONTRACT: AF 04(695)-1001
MONITOR: SSD TR-67-89

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *POWER), (*SATELLITES(ARTIFICIAL), *SOLAR PANELS), POWER SUPPLIES, SPACEBORNE, QUALITY CONTROL, TESTS, DESIGN (U)

THE U.S. AIR FORCE HAS USED SOLAR CELL POWER SYSTEMS ON VARIOUS TYPES OF SATELLITES. THE CURRENT METHODS USED FOR CHOOSING THE ARRAY, THE NUMBER OF CELLS, THEIR PLACEMENT ON THE SOLAR PANELS, AND THE QUALITY ASSURANCE TESTS CONDUCTED ON THE PANELS ARE DISCUSSED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 657 155 10/2 9/1 18/8
JOHNS HOPKINS UNIV SILVER SPRING MD APPLIED PHYSICS LAB

RADIATION DAMAGE TO ORBITING SOLAR CELLS AND TRANSISTORS. (U)

DESCRIPTIVE NOTE: TECHNICAL MEMO.,
MAR 67 33P FISCHELL,R. E. ;MARTIN,J. H. ;RADFORD,W. E. ;ALLEN,W. E. ;
REPT. NO. TG-886
CONTRACT: NOW-62-0604

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, DAMAGE), (*TRANSISTORS, DAMAGE), SPACE ENVIRONMENTS, EXPERIMENTAL DATA, SCIENTIFIC SATELLITES, PERFORMANCE(ENGINEERING), (U)PERFORMANCE(ENGINEERING) (U)

IN-FLIGHT SOLAR CELL DEGRADATION STUDIES BEGAN WITH THE LAUNCHING OF THE 1961-01 SATELLITE ON JUNE 29, 1961. SIMILAR EXPERIMENTS WERE FLOWN ON THE 1961-ALPHA ETA AND 1961-ALPHA ETA 2 SATELLITES. DATA OBTAINED FROM THESE SATELLITES COVER A TIME PERIOD BOTH BEFORE AND AFTER OPERATION STARFISH ON JULY 9, 1962. SUBSEQUENTLY SOLAR CELL AND ELECTRONIC EXPERIMENTS WERE FLOWN ON SATELLITES 1962-BETA ETA, ANNA I-B, 1963-38C, AND 1964-83C. THE DATA INDICATE THAT THE DAMAGE TO SOLAR CELLS IN A 1000 KM ORBIT DURING THE EARLY MONTHS AFTER OPERATION STARFISH MAY NOT HAVE BEEN MOSTLY A RESULT OF FISSION SPECTRUM ELECTRONS. ALTHOUGH MANY ENERGETIC ELECTRONS WERE INTRODUCED INTO THE INNER BELT, IT IS INDICATED THAT SOME HIGH ENERGY (> 4.5 MEV) PROTONS WERE REDISTRIBUTED TO ALTITUDES INCLUDING 1000 KM. THE RESULTS OF FLIGHT EXPERIMENTS INDICATE THAT OPTIMUM POWER-TO-WEIGHT RATIO SOLAR ARRAYS WILL BE OBTAINED BY USE OF N-ON-P SOLAR CELLS WITH 6 MIL GLASS COVERS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOMO7

AD- 658 453 22/2 10/2
AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB OHIO

AN ANALYSIS OF LOW ORBITAL DRAG CONSTRAINTS OF ORBIT- AND SUN-ORIENTED SOLAR-CELL ARRAYS. (U)

AUG 67 31P LAUDERBACK,PAUL W. ;
REPT. NO. AFAPL-CONF-68-2
PROJ: AF-3145

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PRESENTED AT THE INTERSOCIETY ENERGY CONVERSION ENGINEERING CONFERENCE (1967), MIAMI BEACH, FLA., 13-17 AUG 67.

DESCRIPTORS: (*SOLAR PANELS, AERODYNAMIC CHARACTERISTICS), DRAG, ORBITS, SOLAR CELLS, WEIGHT, ALIGNMENT (U)

A COMPARISON OF ORBIT- AND SUN-ORIENTED SOLAR-CELL-ARRAY CONCEPTS TO PRODUCE SPACE POWER IN LOW-EARTH ORBITS HAS BEEN CONDUCTED. RESULTS OBTAINED SHOW THAT AERODYNAMIC DRAG PENALTIES AS LARGE AS 9100 POUNDS/KILOWATT FOR A ONE-YEAR MISSION MAY BE ENCOUNTERED. THE CONTRIBUTION OF A DRAG MAKEUP SYSTEM TO THE TOTAL SYSTEM SPECIFIC WEIGHT FOR AN ORBIT- OR SUN-ORIENTED ARRAY IS NEGLIGIBLE ABOVE 250 AND 375 NAUTICAL MILES RESPECTIVELY. BELOW 185 NAUTICAL MILES AND FOR A MISSION DURATION OF ONE YEAR, THE ORBIT-ORIENTED ARRAY CONCEPT IS MORE DESIRABLE FROM A WEIGHT STANDPOINT. THE STUDY HAS INCLUDED ONLY THE EFFECTS OF AERODYNAMIC DRAG. THE DRAG MAKEUP SYSTEM CONSISTS OF PROPULSIVE DEVICES AND STORAGE TANKS. FOR EACH CONCEPT THE TOTAL SYSTEM INCLUDES DRAG MAKEUP, BATTERIES, AND SOLAR-CELL ARRAY. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 661 557 20/12 10/2 20/3
CLEVITE CORP CLEVELAND OHIO

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS. (U)

DESCRIPTIVE NOTE: INTERIM REPT. 1 JUN 66-31 MAY 67, SEP 67 94P SHIOZAWA,L. R. ;SULLIVAN, GEORGE A. ;AUGUSTINE,FRANK ;
CONTRACT: AF 33(615)-5224
PROJ: AF-7885
MONITOR: ARL 67-0190

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, CADMIUM SULFIDES), (*CADMIUM SULFIDES, FILMS), TRANSPORT PROPERTIES, CARRIERS(SEMICONDUCTORS), SULFIDES, COPPER COMPOUNDS, PHOTOCONDUCTIVITY, SEMICONDUCTORS, OPTICAL PROPERTIES, BAND THEORY OF SOLIDS, MODELS(SIMULATIONS), SINGLE CRYSTALS, ELECTRICAL PROPERTIES (U)
IDENTIFIERS: PHOTOVOLTAIC EFFECT (U)

DURING THE FIRST YEAR OF THIS PROJECT 'MODEL 1066,' AN EXPLANATION OF THE MECHANISM RESPONSIBLE FOR THE PHOTOVOLTAIC EFFECT IN THIN-FILM CDS SOLAR CELLS WAS DEVELOPED. EMPHASIS HAS SINCE BEEN PLACED ON CRITICAL EXPERIMENTS DESIGNED TO TEST THIS MODEL, AND TO ESTABLISH CELL PARAMETERS ESSENTIAL TO FURTHER REFINEMENT OF THE MODEL. EXPERIMENTS WHICH HAVE BEEN CARRIED OUT INCLUDE MEASUREMENTS OF THE THICKNESS OF THE CU2S LAYER, EXAMINATION OF THE GRAIN STRUCTURE OF THE CDS LAYER, MEASUREMENTS OF OPTICAL ABSORPTION IN AND EXAMINATION OF THE CRYSTALLOGRAPHY AND STOICHIOMETRY OF THE CU2S LAYER, DIFFUSION AND SOLUBILITY MEASUREMENTS FOR CU IN CDS, AND MEASUREMENTS OF JUNCTION CAPACITANCE, CURRENT-VOLTAGE CHARACTERISTICS AND SPECTRAL RESPONSE OF CDS SOLAR CELLS. IN ADDITION, A UNIQUE EVAPORATION SYSTEM HAS BEEN DEVELOPED AND IS BEING USED SUCCESSFULLY. FINDINGS OF THESE INVESTIGATIONS HAVE ALL BEEN IN GENERAL AGREEMENT WITH 'MODEL 1066,' WHICH INVOLVES LIGHT ABSORPTION BY HOLE-ELECTRON PAIR GENERATION IN THE P-TYPE CU2S LAYER, FOLLOWED BY DIFFUSION OF THE MINORITY ELECTRONS INTO A COPPER-COMPENSATED DARK-INSULATING CDS LAYER, AND COLLECTION OF THESE AT AN I-N CDS HOMOJUNCTION. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 666 439 10/2 20/12
CLEVITE CORP CLEVELAND OHIO ELECTRONIC RESEARCH DIV

FABRICATION OF CADMIUM SULFIDE THIN FILM SOLAR CELLS FOR SPACE VEHICLE TESTING. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 SEP 65-15 AUG 67, DEC 67 48P NASTELIN,H. E. ;HIETANEN, J. R. ;SHIRLAND,F. A. ;
REPT. NO. 303280
CONTRACT: AF 33(615)-3253
PROJ: AF-7885
MONITOR: ARL 67-0282

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, PERFORMANCE(ENGINEERING)), (*SEMICONDUCTING FILMS, CADMIUM SULFIDES), (*SPACECRAFT COMPONENTS, SOLAR CELLS), FLIGHT TESTING, EFFICIENCY, STABILITY, DOPING, LIGHT TRANSMISSION, BALLOONS, BAND THEORY OF SOLIDS, MANUFACTURING, COPPER COMPOUNDS, SULFIDES (U)

FIVE SERIES OF FLIGHT PANELS FOR SATELLITE AND BALLOON FLIGHT TESTING WERE PREPARED. PANELS AR-1 THROUGH 6 WERE DELIVERED TO APL IN SEPTEMBER OF 1965. PANELS AR-8 THROUGH 10, OF SIMILAR FABRICATION, WERE DELIVERED IN MARCH OF 1966. PANELS ARX-701-1 THROUGH 4 WERE DELIVERED IN APRIL OF 1967 FOR INCLUSION IN THE OV1-13 SATELLITE EXPERIMENT. THREE BALLOON FLIGHT MODULES, AFAPL-CDS-1, -2, AND -3, WERE DELIVERED TO APL IN MAY OF 1966, AND THREE ADDITIONAL BALLOON FLIGHT MODULES, AFAPL-CDS-005, 006, 007, WERE DELIVERED IN MAY OF 1967, BOTH FOR JPL BALLOON FLIGHT EXPERIMENTS. WORK WAS PERFORMED ON INCREASING THE EFFICIENCY AND STABILITY OF CDS THIN FILM SOLAR CELLS. MOST OF THE WORK WAS CONCERNED WITH IMPROVEMENTS IN THE FORMATION OF THE BARRIER LAYER AND INCLUDED TREATMENTS OF THE CDS FILM PRIOR TO THE FORMATION OF THE BARRIER LAYER, VARIATIONS IN THE BARRIER FORMATION PROCESS, AND TREATMENTS OF THE FILM AND BARRIER AFTER FORMATION OF THE BARRIER. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 667 519 10/2
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

PRESENT STATUS OF CADMIUM SULFIDE THIN FILM SOLAR CELLS. (U)

DESCRIPTIVE NOTE: TECHNICAL NOTE,
DEC 67 40P STANLEY,A. G. ;
REPT. NO. TN-1967-52
CONTRACT: AF 19(628)-5167
PROJ: AF-649L
MONITOR: ESD TR-67-574

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, CADMIUM SULFIDES), FILMS, ELECTRICAL PROPERTIES, DEGRADATION, THERMAL PROPERTIES, INFRARED SPECTROSCOPY, STRESSES, FAILURE(MECHANICS), CHARGED PARTICLES, ULTRAVIOLET SPECTRA, VISIBLE SPECTRA, CONDUCTIVITY, TENSILE PROPERTIES, MEASUREMENT (U)
IDENTIFIERS: THIN FILMS (U)

CADMIUM SULFIDE THIN FILM SOLAR CELLS, ESPECIALLY SELECTED FOR STABILITY UNDER AMBIENT CONDITIONS, EXPERIENCED SEVERE DEGRADATION IN THEIR I-V CHARACTERISTICS WHEN SUBJECTED TO THERMAL CYCLING IN VACUUM. A NUMBER OF DIAGNOSTIC TECHNIQUES WERE APPLIED TO DETERMINE THE FAILURE MECHANISM. THESE INCLUDED CROSS-SECTIONING, INFRARED MEASUREMENTS, MECHANICAL STRESS TESTS AND THE MEASUREMENT OF SERIES AND SHUNT RESISTANCE. DIFFERENT TYPES OF FAILURE MODES ARE DISCUSSED. THE RESULTS OF RADIATION EXPERIMENTS ARE SUMMARIZED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 668 144 10/2 22/2 18/5
JOHNS HOPKINS UNIV SILVER SPRING MD APPLIED PHYSICS LAB

SOLAR CELL POWER SYSTEMS FOR APL SATELLITES. (U)

DESCRIPTIVE NOTE: TECHNICAL MEMO.,
FEB 68 33P FISCHELL,ROBERT E. ;
REPT. NO. APL-TG-950
CONTRACT: NOW-62-0604

UNCLASSIFIED REPORT

DESCRIPTORS: (*SATELLITES(ARTIFICIAL), *SOLAR CELLS), (*ELECTRIC POWER PRODUCTION, SATELLITES(ARTIFICIAL)), POWER SUPPLIES, PERFORMANCE(ENGINEERING), RELIABILITY(ELECTRONICS), BATTERY COMPONENTS, ELECTRIC BATTERIES, TEMPERATURE, VOLTAGE, NUCLEAR POWER PLANTS, THERMOELECTRICITY, AUXILIARY POWER PLANTS, PLUTONIUM, SEMICONDUCTOR DIODES, ATTITUDE CONTROL SYSTEMS, DC TO DC CONVERTERS, DIAGRAMS, SOLDERING (U)
IDENTIFIERS: SNAP 3 (U)

SINCE 1959, THE APPLIED PHYSICS LABORATORY HAS DESIGNED AND LAUNCHED 31 EARTH SATELLITES. FROM VERY SIMPLE, LOW-POWER DESIGN IN 1959, THERE HAVE DEVELOPED MUCH MORE SOPHISTICATED SOLAR CELL POWER SYSTEMS THAT GENERATE HIGHER POWER LEVELS. THIS PAPER DESCRIBES THE DEVELOPMENT OF VARIOUS POWER SYSTEMS AND THE APPLICATION OF SEVERAL CONTROL TECHNIQUES FOR IMPROVING SATELLITE OPERATING PERFORMANCE AND RELIABILITY. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 676 976 10/2
AEROSPACE CORP EL SEGUNDO CALIF LAB OPERATIONS

NEUTRON DAMAGE TO SILICON SOLAR CELLS, (U)

JUN 68 51P STOFEL,EDWIN J. ;STEWART, THOMAS B. ;ORNELAS,JOSEPH R. ;

REPT. NO. TR-0158(3250-20)-5
CONTRACT: F04695-67-C-0158
MONITOR: SAMSO TR-68-368

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *DAMAGE), NEUTRON REACTIONS, SILICON, CARRIERS(SEMICONDUCTORS), DIFFUSION, ELECTRICAL PROPERTIES, (U)ELECTRICAL PROPERTIES (U)

SILICON SOLAR CELLS OF THE N/P 5 TO 10 OHM-CM TYPE WERE IRRADIATED WITH NEUTRON FLUENCES FROM 5.2 X 10 TO THE NINTH POWER TO 1.5 X 10 TO THE 13TH POWER N/(SQ CM) USING A TRIGA REACTOR. CURRENT-VOLTAGE CHARACTERISTICS, SPECTRAL RESPONSE, AND DIFFUSION LENGTH MEASUREMENTS WERE MADE AND THE RESULTS INTERRELATED. AGREEMENT WITH THEORY IS GOOD. DIFFUSION LENGTH DEPENDS UPON INJECTION LEVEL IN A MANNER SIMILAR TO THAT FOR PROTON IRRADIATION. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 678 540 20/12 10/2 20/3
CLEVITE CORP CLEVELAND OHIO ELECTRONIC RESEARCH DIV

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. NO. 1, 1 JUN-31 AUG 66,
SEP 66 25P SHIOZAWA,L. R. ;SULLIVAN, GEORGE A. ;AUGUSTINE,F. ;JOST,J. M. ;
CONTRACT: AF 33(615)-5224
PROJ: AF-3033
TASK: 303330

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO QUARTERLY PROGRESS REPORT NO. 2, AD-678 542.

DESCRIPTORS: (*CADMIUM SULFIDES, *SEMICONDUCTING FILMS), (*SOLAR CELLS, CADMIUM SULFIDES), DIFFUSION, COPPER, COPPER COMPOUNDS, VACUUM APPARATUS, FILMS, LABORATORY EQUIPMENT, VOLTAGE (U)
IDENTIFIERS: COPPER SULFIDE, PHOTOVOLTAIC EFFECT (U)

EMPHASIS IN THIS REPORT WAS PLACED ON THE PLANNING AND INITIATION OF SEVERAL EXPERIMENTS DESIGNED TO LEAD TO AN UNDERSTANDING OF THE PHOTOVOLTAIC MECHANISM OPERATIVE IN CDS SOLAR CELLS WHICH HAVE BEEN DEVELOPED IN THIS LABORATORY. EXPERIMENTS INCLUDE MEASUREMENTS OF THE DIFFUSION AND SOLUBILITY OF COPPER IN CDS CRYSTALS, AND A MEASUREMENT OF THE THICKNESS OF THE CU2S LAYER IN TYPICAL SOLAR CELLS. ALSO MENTIONED IS WORK ON THE CONSTRUCTION OF A VACUUM EVAPORATION SYSTEM AND THE DEVELOPMENT OF OHMIC CONTACTS TO CDS CRYSTALS, BOTH OF WHICH ARE ESSENTIAL TO THIS RESEARCH PROGRAM. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 678 541 20/12 10/2 20/3
CLEVITE CORP CLEVELAND OHIO ELECTRONIC RESEARCH DIV

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. NO. 3, 1 DEC 66-28 FEB 67,
MAR 67 30P SHIOZAWA,L. R. ;SULLIVAN, GEORGE A. ;AUGUSTINE,FRANK ;
CONTRACT: AF 33(615)-5224
PROJ: AF-3033
TASK: 303330

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-678 542.

DESCRIPTORS: (*SOLAR CELLS, CADMIUM SULFIDES), (*CADMIUM SULFIDES, SEMICONDUCTING FILMS), VACUUM APPARATUS, REFRACTIVE INDEX, ABSORPTION SPECTRA, COPPER COMPOUNDS, SULFIDES, DIFFUSION, VAPOR PLATING (U)
IDENTIFIERS: COPPER SULFIDES, *PHOTOVOLTAIC EFFECT (U)

THE EMPHASIS DURING THE THIRD QUARTER WAS PLACED ON A CONTINUATION OF EXPERIMENTS NECESSARY TO THE UNDERSTANDING OF THE THIN FILM CDS SOLAR CELL. INCLUDED WERE DIFFUSION AND SOLUBILITY MEASUREMENTS OF COPPER IN CDS, PERFECTION OF A NEW VACUUM EVAPORATION SYSTEM, AND MEASUREMENTS OF THE INDEX OF REFRACTION AND ABSORPTION COEFFICIENTS OF EVAPORATED THIN CU2S FILMS AS A FUNCTION OF WAVELENGTH. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOMO7

AD- 678 542 20/12 10/2 20/3
CLEVITE CORP CLEVELAND OHIO ELECTRONIC RESEARCH DIV

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. NO. 2, 1 SEP-30 NOV 66,
DEC 66 37P SHIOZAWA,L. R. ;SULLIVAN, GEORGE A. ;AUGUSTINE,F. ;JOST,J. M. ;
CONTRACT: AF 33(615)-5224
PROJ: AF-3033
TASK: 303330

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO QUARTERLY PROGRESS REPORT NO. 1, AD-678 540.

DESCRIPTORS: (*CADMIUM SULFIDES, *SEMICONDUCTING FILMS), (*SOLAR CELLS, CADMIUM SULFIDES), CARRIERS(SEMICONDUCTORS), DIFFUSION, COPPER, COPPER COMPOUNDS, SULFIDES, VACUUM APPARATUS, FILMS, VOLTAGE, EFFICIENCY (U)
IDENTIFIERS: COPPER SULFIDE, PHOTOVOLTAIC EFFECT, QUANTUM EFFICIENCY (U)

THIS REPORT GIVES A TENTATIVE EXPLANATION OF THE MECHANISM RESPONSIBLE FOR THE PHOTOVOLTAIC EFFECT IN THE THIN-FILM CDS CELLS, AND A DISCUSSION OF CRITICAL EXPERIMENTS WHICH MIGHT BE PERFORMED TO TEST THIS MODEL. ALSO REPORTED IS THE CONTINUATION OF THE WORK ON THE DIFFUSION OF COPPER INTO CDS SINGLE CRYSTALS, AND THIS HAS BEEN EXTENDED TO INCLUDE DIFFUSION OF CU IN THE CDS SOLAR CELLS. A NEW VACUUM EVAPORATION SYSTEM FOR THE PROJECT HAS BEEN INSTALLED AND IS NOW OPERATIONAL. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 682 888 22/2 21/3 10/2
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

THE ION ENGINE AND LARGE SOLAR ARRAY FOR THE X5 SPACECRAFT. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
AUG 68 28P DAY,B. P. ;TREBLE,F. C.

REPT. NO. RAE-TR-68191

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PRESENTED AT THE ANNUAL MEETING OF THE BRITISH INTERPLANETARY SOCIETY (NO. 1), SOUTHAMPTON UNIV., 24-25 APR 68.

DESCRIPTORS: (*SOLAR PANELS, DESIGN), (*SPACECRAFT COMPONENTS, RELIABILITY(ELECTRONICS)), (*ION ENGINES, DESIGN), ION ENGINES, SPACE PROPULSION, SOLAR PANELS, DESIGN, SOLAR CELLS, SUBSTRATES, GREAT BRITAIN, SYNCHRONOUS SATELLITES (U)
IDENTIFIERS: BLACK ARROW LAUNCH VEHICLES (U)

A DESCRIPTION IS GIVEN OF THE ION ENGINE AND THE 550 W DEPLOYABLE SOLAR ARRAY PROPOSED FOR THE BLACK ARROW X5 SPACECRAFT. PROBLEM AREAS ARE DISCUSSED AND AN INDICATION IS GIVEN OF THE PRESENT STATE OF DEVELOPMENT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOMO7

AD- 684 560 10/2
CLEVITE CORP CLEVELAND OHIO ELECTRONIC RESEARCH DIV

IMPROVEMENTS IN CDS THIN FILM SOLAR CELLS. (U)

DESCRIPTIVE NOTE: INTERIM TECHNICAL REPT. 1 NOV 67-1 NOV 68,
DEC 68 45P NASTELIN,H. E. ;
CONTRACT: F33615-68-C-1182
PROJ: AF-7885
MONITOR: ARL 68-0217

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, CADMIUM COMPOUNDS), FILMS, SOLAR PANELS, BARRIER COATINGS, CIRCUIT INTERCONNECTIONS, MANUFACTURING, EFFICIENCY, ARSENIDE(U)
IDENTIFIERS: THIN FILMS (U)

THE PERFORMANCE OF TWO CDS THIN FILM SOLAR CELL FLIGHT PANELS, WHICH WERE INCLUDED IN A SATELLITE EXPERIMENT IN A HIGH RADIATION ORBIT, SHOWED NO SERIOUS DEGRADATION AFTER A PERIOD OF 130 DAYS. THE RESULTS OF BALLOON FLIGHT CALIBRATION TESTS INDICATE THAT AMO PERFORMANCE OF CDS THIN FILM SOLAR CELLS AT 80,000 FEET VERY CLOSELY PARALLELS SIMULATED AMO MEASUREMENTS. THE EVALUATION OF A NUMBER OF MATERIALS AS CONTACTS TO THE BARRIER LAYER OF THE CDS CELL INDICATES THAT GOLD, EITHER EVAPORATED OR AS THE FILLER IN A CONDUCTIVE EPOXY SUCH AS IS PRESENTLY USED IN THE FABRICATION PROCESS OF CDS CELLS, PROVIDES THE LOWEST RESISTANT OHMIC CONTACT. A STUDY IN THE OPTIMIZATION OF THE BARRIER FORMATION PROCESS SHOWS THAT A FAIRLY WIDE LATITUDE EXISTS IN THE VARIOUS PROCESS PARAMETERS, ESPECIALLY AS REGARDS LOW LIGHT LEVEL PERFORMANCE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 686 496 10/2 20/12
GENERAL DYNAMICS/ASTRONAUTICS SAN DIEGO CALIF

PHOTOVOLTAIC AND THERMOELECTRIC SOLAR ENERGY CONVERSION USING THIN FILMS, (U)

DEC 61 65P ZIMMERMAN,W. B. ;EVANS,J. C. , JR;
REPT. NO. GDA-ERR-AN-103

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, FILMS), PHOTOELECTRIC EFFECT, SEEBECK EFFECT, SILICON, SEMICONDUCTORS, BAND THEORY OF SOLIDS, CADMIUM SULFIDES, DEPOSITION (U)
IDENTIFIERS: THIN FILMS (U)

SOLAR ENERGY CONVERSION BY THE USE OF THIN FILMS IN PHOTOVOLTAIC AND THERMOELECTRIC DEVICES IS DISCUSSED. EXPERIMENTAL WORK IS PRESENTED ON THE FABRICATION OF A THIN FILM CADMIUM SULFIDE CELL WHICH UTILIZES THE PHOTOVOLTAIC EFFECT. A THEORETICAL INVESTIGATION IS MADE OF THE TEMPERATURE DIFFERENCES OBTAINABLE IN SPACE BY USING THIN, LIGHT-WEIGHT PLASTIC SHEETS, AND THE USE OF SUCH PLASTICS FOR THERMOELECTRIC GENERATORS IS DISCUSSED. TEMPERATURE DIFFERENCES OF SEVERAL HUNDRED CENTRIGRADE DEGREES CAN BE OBTAINED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 691 506 10/2 22/2
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

ENVIRONMENTAL ASSESSMENT OF THIN SILICON SOLAR CELLS FROM PILOT PRODUCTION. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
JAN 69 42P CRABB,R. L. ;
REPT. NO. RAE-TR-69006

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR PANELS, SOLAR CELLS), (*SOLAR CELLS, RELIABILITY(ELECTRONICS)), SILICON, SPACE ENVIRONMENTS, DAMAGE, RADIATION EFFECTS, ELECTRONS, PROTONS, MANUFACTURING, PROTECTIVE TREATMENTS, METAL COATINGS, ELECTRIC TERMINALS, CORROSION INHIBITION, PERFORMANCE(ENGINEERING), STORAGE, HUMIDITY, THERMAL STABILITY, LIQUID IMMERSION TESTS, FAILURE(ELECTRONICS), GREAT BRITAIN (U)
IDENTIFIERS: EVALUATION (U)

FOLLOWING THE EARLIER DEMONSTRATION OF THE PERFORMANCE CAPABILITIES OF 4 MIL SILICON SOLAR CELLS AND THE FEASIBILITY OF USING THESE CELLS ON LARGE FLEXIBLE ARRAYS OF SPACE VEHICLES, MORE THAN A THOUSAND 4 MIL CELLS HAVE BEEN FABRICATED IN PILOT PRODUCTION BY FOUR ROUTES. THE VARIOUS TYPES OF CELLS WHICH HAVE BEEN EVALUATED HAD SOLDERLESS EVAPORATED TITANIUM-SILVER CONTACTS IN BOTH A CONVENTIONAL AND WRAP-ROUND CONFIGURATION, SOLDERLESS EVAPORATED TITANIUM-SILVER CONTACTS 'OVER-PLATED' WITH A LAYER OF COPPER-GOLD, AND SOLDERLESS PLATED NICKEL-COPPER-GOLD CONTACTS IN A CONVENTIONAL AND WRAP-ROUND CONFIGURATION. BOTH 1 X 2 AND 2 X 2 CM, N ON P CELLS HAVE BEEN MANUFACTURED FROM 1 AND 10 OHM CM BORON DOPED SILICON. IN EVERY CASE, SATISFACTORY PRODUCTION YIELDS HAVE BEEN ACHIEVED. THE ABOVE CELLS HAVE BEEN SUBJECTED TO ENVIRONMENTAL CONDITIONS AIMED AT STUDYING THE EFFECTS OF HIGH AMBIENT HUMIDITY ON THE CELL CONTACTS DURING 'SHELF-LIFE' PRIOR TO LAUNCH AND THE DEGRADATION IN PERFORMANCE FROM ELECTRON AND PROTON IRRADIATION ENCOUNTERED DURING LONG TERM SPIRAL TRANSFER ORBITS TO SYNCHRONOUS ALTITUDE. SPECIFICALLY THE PROBLEM OF LOW ENERGY 'SYNCHRONOUS ALTITUDE' PROTON IRRADIATION OF EXPOSED BAR AND BACK CONTACTS AND THE PROTECTION AFFORDED BY VARIOUS FORMS OF COATINGS HAS BEEN INVESTIGATED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 691 587 10/2
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

LARGE SOLAR ARRAY DEVELOPMENT IN U. K. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
JAN 69 26P TREBLE,F. C. ;
REPT. NO. RAE-TR-69007

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PRESENTED AT THE IEEE PHOTOVOLTAIC SPECIALISTS' CONFERENCE (7TH), PASADENA, CALIF. 19-21 NOV 68.

DESCRIPTORS: (*EXTENDABLE STRUCTURES, SOLAR PANELS), (*SOLAR PANELS, DESIGN), SOLAR CELLS, SILICON, FLEXIBLE STRUCTURES, THERMOPLASTIC RESINS, FILMS, SUBSTRATES, SUPPORTS, STORAGE, OPERATION, PNEUMATIC DEVICES, PYROTECHNICS, IMPACT SHOCK, VIBRATION ISOLATORS, CIRCUIT INTERCONNECTIONS, THERMAL EXPANSION, WEIGHT, GREAT BRITAIN (U)
IDENTIFIERS: MOUNTINGS, POLYIMIDE RESINS (U)

ASPECTS OF LARGE SOLAR ARRAY TECHNOLOGY ARE REVIEWED, WITH PARTICULAR REFERENCE TO THE DEVELOPMENT OF AN EXPERIMENTAL 560 W DEPLOYABLE ARRAY, WHICH HAS SOME NOVEL FEATURES. THE ARRAY CONSISTS OF VERY THIN SILICON SOLAR CELLS MOUNTED ON KAPTON POLYIMIDE FILM. IT IS STOWED BY FOLDING THE KAPTON CONCERTINA FASHION INTO RECTANGULAR COMPARTMENTS AND DEPLOYED BY PNEUMATICALLY-ACTUATED TELESCOPIC MASTS. DEPLOYMENT IS INITIATED BY DUPLICATED PYROTECHNIC ACTUATORS AND TAKES ABOUT TWO MINUTES TO COMPLETE. THE ESTIMATED ALL-UP WEIGHT OF THE 78 SQ FT ARRAY, INCLUDING STOWAGE COMPARTMENTS, CUSHIONING AND DEPLOYMENT MECHANISM IS 25.2 LB, GIVING A POWER-WEIGHT RATIO OF 22.3 W/LB AT 55C. THE MAIN PROBLEM AREAS ARE DISCUSSED IN SOME DETAIL, WITH AN INDICATION OF THE PROGRESS MADE TO DATE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 691 631 10/2 18/6 20/12
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

A STUDY OF AMERICAN RADIATION RESISTANT 'LITHIUM' SOLAR CELLS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
MAR 69 17P CRABB,R. L. ;
REPT. NO. RAE-TR-69044

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *DAMAGE), LITHIUM, DOPING, SILICON, GREAT BRITAIN, (U)GREAT BRITAIN (U)

THE PERFORMANCE CHARACTERISTICS OF TWENTY-FIVE AMERICAN LITHIUM-DOPED P ON N SILICON SOLAR CELLS HAVE BEEN EVALUATED FOLLOWING SEQUENTIAL 1 MEV ELECTRON IRRADIATION FOR FLUENCES UP TO 10 TO THE 16TH POWER/E.SQ.CM. ALTHOUGH THE 'SELF HEALING' PERFORMANCE RECOVERY EXHIBITED BY THESE CELLS AT ROOM TEMPERATURE FOLLOWING ELECTRON IRRADIATION WAS IMPRESSIVE, THEIR N-TYPE BASE SILICON SUSTAINED MUCH GREATER DAMAGE THAN THE P-TYPE BASE SILICON OF THE N ON P, 10 OHM-CM CONTROL CELLS. THUS THE END-OF-LIFE PERFORMANCE WAS, AT BEST, WORSE THAN THAT OF CONVENTIONAL N ON P, 10 OHM-CM CELLS. THE POST-IRRADIATION PERFORMANCE OF THE LITHIUM CELLS HAS REMAINED UNCHANGED FOR THREE THOUSAND HOURS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 694 117 10/2 20/12
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

CALCULATED EFFICIENCIES OF PRACTICAL GAAS AND SI SOLAR CELLS INCLUDING THE EFFECT OF BUILD-IN ELECTRIC FIELDS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
NOV 68 48P ELLIS,B. ;MOSS,T. S. ;
REPT. NO. RAE-TR-68268

UNCLASSIFIED REPORT

DESCRIPTORS: (*SEMICONDUCTOR DEVICES, SOLAR CELLS), (*SOLAR CELLS, PERFORMANCE(ENGINEERING)), GALLIUM ARSENIDES, SILICON, RELIABILITY(ELECTRONICS), DOPING, ELECTRIC FIELDS, DAMAGE, RADIATION EFFECTS, RECOMBINATION REACTIONS, CARRIERS(SEMICONDUCTORS), DEPOSITION, MANUFACTURING, EFFICIENCY, GREAT BRITAIN (U)
IDENTIFIERS: *SEMICONDUCTOR JUNCTIONS (U)

THE PERFORMANCE OF GAAS SOLAR CELLS HAS BEEN CALCULATED AS A FUNCTION OF THE DOPING LEVELS, USING PRACTICAL VALUES FOR THE TRANSPORT PARAMETERS. CALCULATIONS SHOW THAT SURFACE RECOMBINATION IS A MORE PROBABLE CAUSE OF THE POOR EFFICIENCIES OBTAINED IN PRACTICE THAN RECOMBINATION IN THE JUNCTION REGION. ELECTRIC FIELDS BUILT INTO THE CELL BY DOPING GRADATIONS MAY BE USED TO REDUCE SURFACE LOSSES AND PRODUCE AN EFFICIENCY EXCEEDING 20% FOR A SURFACE RECOMBINATION VELOCITY OF 10 TO THE 6TH POWER CM/SEC. THIS FIGURE ALLOWS FOR THE FINITE RESISTANCE OF THE SURFACE LAYER, THE EFFECT OF WHICH IS CONSIDERED IN DETAIL FOR SEVERAL CASES. RESULTS FOR SI CELLS ARE ALSO PRESENTED. THESE ARE WELL IN ACCORD WITH THE VALUES OBTAINED IN PRACTICE. FOR BOTH MATERIALS CONSIDERATION IS GIVEN TO THE DEGRADATION BROUGHT ABOUT BY PARTICLE BOMBARDMENT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 694 893 10/2 22/2
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

PERFORMANCE OF CADMIUM SULFIDE THIN FILM SOLAR CELLS IN A SPACE ENVIRONMENT. (U)

DESCRIPTIVE NOTE: JOURNAL ARTICLE,
DEC 68 4P STANLEY,ALAN G. ;
REPT. NO. JA-3359
CONTRACT: AF 19(628)-5167
MONITOR: ESD TR-69-196

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN PROCEEDINGS OF THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, V57 N4 P692-694 APR 69.
SUPPLEMENTARY NOTE: REVISION OF REPORT DATED 30 OCT 68.

DESCRIPTORS: (*SATELLITES(ARTIFICIAL), SOLAR PANELS), (*CADMIUM SULFIDES, SOLAR CELLS), (*SOLAR CELLS, RELIABILITY(ELECTRONICS)), FILMS, SPACE ENVIRONMENTS, THERMAL STABILITY, ELECTRICAL PROPERTIES, DEGRADATION(U)
IDENTIFIERS: EVALUATION, THIN FILMS (U)

CADMIUM SULFIDE THIN FILM SOLAR CELLS HAVE BEEN SUBJECTED TO EXTENDED THERMAL CYCLING TESTS IN VACUUM TO SIMULATE THE CONDITIONS OF AN EARTH ORBITING SATELLITE. WHEN CYCLED UNDER LOAD, THE SOLAR CELLS EXHIBIT A SLOW LOSS OF OUTPUT. SEVERAL POSSIBLE CAUSES OF THIS LOSS ARE SUGGESTED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 696 850 10/2 20/6
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

ON THE INFRA-RED RESPONSE OF SILICON SOLAR CELLS AS A FUNCTION OF THICKNESS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
JUN 69 32P JENKINS,R. M. ;
REPT. NO. RAE-TR-69126, RAE-TR-SPACE-319

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, SILICON), (*INFRARED SPECTRA, RESPONSE), SUBSTRATES, SOLAR RADIATION, ABSORPTION, PROBABILITY, MATHEMATICAL MODELS, GREAT BRITAIN (U)
IDENTIFIERS: SPECTRA (U)

THE PERFORMANCE OF THIN SOLAR CELLS IS COMPARED WITH THAT OF CONVENTIONAL THICK CELLS AND THE FACTORS AFFECTING THE RESPONSE AS A FUNCTION OF THICKNESS DISCUSSED. BY USING A SIMPLE ONE-DIMENSIONAL MODEL, EQUATIONS ARE DERIVED FOR THE CONTRIBUTION TO THE RESPONSE OF A SOLAR CELL FROM THE BASE REGION. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 697 902 10/2 22/2
JOHNS HOPKINS UNIV SILVER SPRING MD APPLIED PHYSICS LAB

DESIGN AND ANALYSIS OF SOLAR CELL ARRAY CONFIGURATIONS FOR VERTICALLY STABILIZED SATELLITES IN NEAR-EARTH ORBITS. (U)

DESCRIPTIVE NOTE: TECHNICAL MEMO.,
AUG 69 156P ALLEN,WALTER E. ;
REPT. NO. APL-TG-1066
CONTRACT: NOW-62-0604

UNCLASSIFIED REPORT

DESCRIPTORS: (*SATELLITES(ARTIFICIAL), POWER EQUIPMENT), (*SOLAR PANELS, CONFIGURATION), SOLAR CELLS, DESIGN, SATELLITE ATTITUDE, LOW ORBIT TRAJECTORIES, STORAGE BATTERIES, RELIABILITY(ELECTRONICS), SPACE ENVIRONMENTS, DAMAGE, RADIATION EFFECTS, SOLAR RADIATION, ILLUMINATION, STABILIZATION SYSTEMS, CELESTIAL MECHANICS, ALBEDO, PERFORMANCE(ENGINEERING), SPACECRAFT (U)
IDENTIFIERS: EVALUATION, NICKEL CADMIUM BATTERIES, SHADOWS, *ARRAYS, *SOLAR CELLS, *SPACECRAFT ELECTRIC POWER UNITS, VERTICALLY STABILIZED SATELLITES (U)

SOLAR ARRAY CONFIGURATION DESIGN AND ANALYSIS TECHNIQUES ARE DEVELOPED FROM BASIC SOLAR CELL PERFORMANCE CHARACTERISTICS. THE RELATIONSHIP BETWEEN THE ARRAY AND OTHER ELEMENTS IN THE POWER SYSTEM IS PRESENTED WITH EMPHASIS ON NICKEL-CADMIUM BATTERY CHARACTERISTICS AS THEY RELATE TO THE DESIGN OF THE ARRAY. THE PREDICTABLE SOLAR ORIENTATION PATTERNS FOR TWO AND THREE AXIS VERTICALLY STABILIZED SPACECRAFT ARE EXAMINED IN DETAIL. THE INFLUENCE OF THE ORBIT UPON THE DESIGN OF THE ARRAY AND METHODS FOR PREDICTING SUNLIGHT EXPOSURE TIME AND INTEGRATED AVERAGE ARRAY POWER ARE INTRODUCED. THE EFFECTS OF THE ORBIT ENVIRONMENT UPON ARRAY PERFORMANCE INCLUDING VARIATIONS IN SOLAR ILLUMINATION INTENSITY, DEGRADATION CAUSED BY PARTICLE IRRADIATION, AND THE POTENTIAL INFLUENCE OF EARTH ALBEDO ARE DISCUSSED. FINALLY, A SPECIFIC ARRAY DESIGN IS UNDERTAKEN FOR A VERTICALLY STABILIZED SPACECRAFT WITH A CONSTANT 20-WATT ELECTRICAL LOAD. THE DESIGN, ALTHOUGH SPECIFIC, DEMONSTRATES SOLAR-ARRAY DESIGN PRINCIPLES AND TECHNIQUES THAT ARE UNIVERSALLY APPLICABLE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 698 927 10/2 22/2
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

TYPE APPROVAL TEST REPORT ON FERRANTI SOLAR CELLS FOR THE BLACK ARROW X3 SPACECRAFT. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
MAR 69 22P DOLLERY,A. A. ;
REPT. NO. RAE-TR-69046

UNCLASSIFIED REPORT

DESCRIPTORS: (*SCIENTIFIC SATELLITES, SOLAR CELLS), (*SOLAR CELLS, RELIABILITY(ELECTRONICS)), PHOTODIODES, ACCEPTABILITY, ELECTRICAL PROPERTIES, OPTICAL PROPERTIES, RESPONSE, DAMAGE, RADIATION EFFECTS, THERMAL STABILITY, VISUAL INSPECTION, ELECTRIC TERMINALS, SOLDERING, OPTICAL COATINGS, GREAT BRITAIN (U)
IDENTIFIERS: BLACK ARROW X3 SATELLITES (U)

THE REPORT PRESENTS THE RESULTS OF TYPE APPROVAL TESTS PERFORMED ON SOLAR CELLS INTENDED FOR USE IN THE BLACK ARROW X3 SPACECRAFT. (U)

DDC EPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 702 095 20/12 20/3 10/2
CLEVITE CORP CLEVELAND OHIO ELECTRONIC RESEARCH DIV

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH EFFICIENCY CDS THIN-FILM SOLAR CELLS. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. 1 JUN 66-31 MAY 69,
OCT 69 217P SHIOZAWA,L. R. ;AUGUSTINE, F. ;SULLIVAN,G. A. ;SMITH,J. M. , III.; COOK,W. R. , JR;
CONTRACT: AF 33(615)-5224
PROJ: AF-7885, CLEVITE-303330
MONITOR: ARL 69-0155

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, PERFORMANCE(ENGINEERING)), (*SEMICONDUCTING FILMS, BAND THEORY OF SOLIDS), CADMIUM SULFIDES, COPPER COMPOUNDS, SULFIDES, PHOTOCONDUCTIVITY, EPITAXIAL GROWTH, SINGLE CRYSTALS, PHASE STUDIES, MICROSTRUCTURE (U)
IDENTIFIERS: *PHOTOVOLTAIC EFFECT, HETEROJUNCTIONS, COPPER SULFIDES (U)

THREE YEARS OF RESEARCH ON THE OPERATING MECHANISMS OF THE CDS THIN-FILM SOLAR CELL ARE DESCRIBED IN THIS REPORT. THE ESSENTIAL INFORMATION CONTAINED IN ALL REPORTS PREVIOUSLY ISSUED UNDER THIS CONTRACT HAS BEEN REASSEMBLED. NEW INFORMATION, NOT PREVIOUSLY REPORTED INCLUDE DATA ON THE ANTIMONOCHROMATIC SPECTRAL RESPONSE OF DIFFERENT TYPES OF CELLS, MEASUREMENTS OF THE THRESHOLD VOLTAGE FOR ELECTROLYTIC DEPOSITION OF COPPER FROM CU2S, OBSERVATIONS ON THE FORMATION OF COPPER WHISKERS ON CU2S BY HEATING, X-RAY CRYSTALLOGRAPHIC DATA ON LOW-TEMPERATURE PHASE TRANSFORMATIONS OF CUPROUS SULFIDE, MEASUREMENTS OF OPTICAL TRANSMISSION OF CU-SATURATED CDS SINGLE CRYSTALS, DATA ON THE PHOTOCONDUCTIVE RISE AND DECAY TIMES OF CU-COMPENSATED CDS, DISCUSSION OF THE BENEFICIAL ROLE OF OXYGEN IN PROMOTING THE PHOTOVOLTAIC EFFECT DURING CELL FABRICATION, AND THE SUBSEQUENT DEGRADING EFFECTS OF OXYGEN DURING HIGH TEMPERATURE EXPOSURE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 707 134 10/2 4/2
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

BALLOON-FLIGHT INSTRUMENTATION FOR SOLAR-CELL MEASUREMENTS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
JAN 70 22P SARLES,FREDERICK W. , JR.;
HAASE,WAYNE C. ;MCKENZIE,PAUL F. ;
REPT. NO. TR-476
CONTRACT: AF 19(628)-5167
PROJ: AF-649L
MONITOR: ESD TR-70-3

UNCLASSIFIED REPORT

DESCRIPTORS: (•METEOROLOGICAL BALLOONS, SOLAR CELLS), (•SOLAR CELLS, DEGRADATION), CALIBRATION, SOLAR PANELS, INSTRUMENTATION, DC TO DC CONVERTERS, TELEMETER SYSTEMS, FIELD EFFECT TRANSISTORS, DATA TRANSMISSION SYSTEMS, STATISTICAL DATA (U)
IDENTIFIERS: LES(LINCOLN EXPERIMENTAL SATELLITES), LES-6 SATELLITE, LINCOLN EXPERIMENTAL SATELLITES (U)

INSTRUMENTATION WAS DEVELOPED WHICH AUTOMATICALLY MEASURES THE V-I CHARACTERISTICS OF A NUMBER OF SOLAR CELLS, AND TRANSMITS THE RESULTANT SERIALIZED DATA STREAM OVER AN RF TELEMETRY LINK. THE PARTICULAR SYSTEM WAS DESIGNED FOR 64 CELLS WHOSE SELECTION IS ACCOMPLISHED ENTIRELY BY SEMICONDUCTOR SWITCHING. TWO-HUNDRED-AND-FIFTY-TWO POINTS ARE TAKEN ON THE V-I CHARACTERISTIC, GIVING DETAILED INFORMATION ON SLOPES AS WELL AS ACTUAL VALUES. MEASUREMENT ACCURACIES ARE 0.03 PERCENT OF FULL SCALE FOR VOLTAGE, AND 0.1 PERCENT FOR CURRENT; THESE DO NOT REPRESENT ATTAINABLE LIMITS, BUT ARE SIMPLY REASONABLE LIMITS FOR THIS SPECIFIC APPLICATION. THE SYSTEM DESCRIBED WAS BUILT TO CALIBRATE SOLAR CELLS ON A HIGH-ALTITUDE BALLOON FLIGHT, BUT THE TECHNIQUES CAN BE USED EQUALLY WELL FOR GROUND OR SATELLITE APPLICATIONS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 707 345 14/2 10/2
JOHNS HOPKINS UNIV SILVER SPRING MD APPLIED PHYSICS LAB

SOLAR PANEL TEST SET. (U)

DESCRIPTIVE NOTE: TECHNICAL MEMO.,
FEB 70 29P RAY,WILLIAM E. :
REPT. NO. APL-TG-1103
CONTRACT: NOW-62-0604
MONITOR: IDEP 556.45.00.00-56-01

UNCLASSIFIED REPORT

DESCRIPTORS: (•SOLAR PANELS, TEST EQUIPMENT), SUN, SIMULATION, POWER SUPPLIES, CONTROL PANELS, ILLUMINATION, REFLECTIVITY, CALIBRATION, TEST METHODS(U)

THE REPORT DESCRIBES THE SOLAR PANEL TEST SET DEVELOPED FOR TESTING SOLAR CELL PANELS IN ARTIFICIAL SUNLIGHT AT AN EQUIVALENT SUNLIGHT INTENSITY OF 140 MW/SQ.CM. THE TEST SET USES IODINE-QUARTZ (TUNGSTEN) LAMPS AS THE RADIANT-ENERGY SOURCE, AND THE EMERGING RADIATION IS UNIFORMLY REFLECTED AND TOTALLY DIFFUSED. AN AIR CONDITIONER, WHICH IS PART OF THE TEST SET, PROVIDES THE COOLING AIR NECESSARY TO CONTROL THE TEMPERATURE OF THE SOLAR PANEL UNDER TEST. THE METHODS OF CALIBRATING THE TEST SET ARE DESCRIBED, AND THE ACCURACY OF THE MEASUREMENTS OBTAINED WHEN USING ARTIFICIAL LIGHT AS THE RADIATION SOURCE IS DISCUSSED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /20M07

AD- 707 483 10/2 22/2
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

PRELIMINARY RESULTS FROM THE LES-6 SOLAR CELL EXPERIMENT. (U)

DESCRIPTIVE NOTE: MEETING SPEECH,
70 6P SARLES,FREDERICK W. ;
REPT. NO. MS-28108
CONTRACT: AF 19(628)-5167
MONITOR: ESD TR-70-119

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN AIAA PAPER NO. 70-600 P1-4
N.D.

DESCRIPTORS: (•SCIENTIFIC SATELLITES, SOLAR CELLS), (•SOLAR CELLS, RELIABILITY), FEEDBACK AMPLIFIERS, SOLAR PANELS, SOLAR RADIATION, PROTON BOMBARDMENT, DEGRADATION, PERIODIC VARIATIONS, STATISTICAL DATA (U)
IDENTIFIERS: LES-6 SATELLITE (U)

IN ORDER TO STUDY SOLAR CELL DEGRADATION IN SYNCHRONOUS ORBIT, A SOLAR CELL EXPERIMENT WAS FLOWN ON THE LINCOLN LABORATORY LES-6 SATELLITE. THE EXPERIMENT CONSISTS OF THIRTY CELLS OF VARIOUS TYPES. PRELIMINARY RESULTS HAVE BEEN OBTAINED FROM THE FIRST YEAR OF OBSERVATION. MAXIMUM POWER DEGRADATIONS RANGE FROM 10 PER CENT FOR A CELL COMPARABLE TO THAT IN A PROPERLY CONSTRUCTED SOLAR ARRAY TO 35 PER CENT FOR A CELL WHICH EXPERIENCES LOW ENERGY PROTON DAMAGE. LITHIUM DOPED P/N CELLS FAIRED POORLY, DEGRADATIONS AS HIGH AS 42 PER CENT BEING NOTED IN ONE UNIT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 707 869 10/2 20/12
CLEVITE CORP CLEVELAND OHIO ELECTRONIC RESEARCH DIV

IMPROVEMENTS IN CDS THIN FILM SOLAR CELLS. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. 1 NOV 67-1 NOV 69.
MAR 70 82P DUNN,W. F. ;NASTELIN,H. E. ;
CONTRACT: F33615-68-C-1182
PROJ: AF-7885
MONITOR: ARL 70-0036

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, PERFORMANCE(ENGINEERING)), (*SEMICONDUCTING FILMS, ELECTRIC TERMINALS), CADMIUM SULFIDES, SCIENTIFIC SATELLITES, BALLOONS, WORK FUNCTIONS, COPPER COMPOUNDS, SULFIDES (U)
IDENTIFIERS: OHMIC CONTACTS, OV1-13 SATELLITE, OV1-17 SATELLITE, COPPER SULFIDES, ELECTRIC CONTACTS (U)

THE REPORT IS CONCERNED WITH TWO AREAS IN THE CADMIUM SULFIDE SOLAR CELL DEVELOPMENT PROGRAM: (1) A PROGRAM OF FLIGHT PANEL CONSTRUCTION FOR SATELLITE AND BALLOON TESTING OF CDS SOLAR CELLS AND (2) A DEVELOPMENTAL EFFORT FOR IMPROVING THE STABILITY AND EFFICIENCY OF THE CDS SOLAR CELL. EXPERIMENTAL CDS SOLAR CELLS PANELS ARE BEING TESTED ON THE OV1-13 AND OV1-17 SATELLITE EXPERIMENTS. THE DEVELOPMENTAL EFFORT WAS CONCENTRATED INTO THE FOLLOWING AREAS: (1) CONTACT RESISTANCE MEASUREMENTS MADE ON THE CDS CURRENT COLLECTOR GRID ADHESIVE, (2) AN OPTIMIZATION OF THE CDS CELL FOR GOOD LOW LIGHT LEVEL PERFORMANCE, (3) AN OPTIMIZATION OF THE CU2S BARRIER FORMATION PROCESS AND (4) AN INVESTIGATION OF COPPER NODULES FOUND ON CDS CELLS THAT HAD BEEN DEGRADED IN THE OPEN CIRCUIT VOLTAGE MODE. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 708 598 10/2 22/2
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

SOLAR CELL CALIBRATION EXPERIMENTS ON LES-6. (U)

DESCRIPTIVE NOTE: MEETING SPEECH,
68 8P SARLES,FREDERICK W. ;
STANLEY,ALAN G. ;BURROWES,CURTIS ;
REPT. NO. MS-2428
CONTRACT: AF 19(628)-5167
MONITOR: ESD TR-70-163

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN IEEE PHOTOVOLTAIC SPECIALISTS CONFERENCE (7TH), PASADENA, CALIF., P262-266 1968.

DESCRIPTORS: (*COMMUNICATION SATELLITES(ACTIVE), SOLAR CELLS), (*SOLAR CELLS, CALIBRATION), SPACE COMMUNICATIONS (U)
IDENTIFIERS: LES 6 SATELLITE (U)

THE SIXTH LINCOLN LABORATORY EXPERIMENTAL SATELLITE (LES-6) WAS PLACED IN A SYNCHRONOUS ORBIT ON 26 SEPTEMBER 1968. AMONG INSTRUMENTATION ON BOARD IS A SOLAR CELL CALIBRATION EXPERIMENT TO MEASURE THE V-I CHARACTERISTICS AT VARIOUS ANGLES OF SOLAR INCIDENCE OF 30 SOLAR CELLS INCLUDING STANDARD N/P SILICON (SI) CELLS WITH 6-MIL COVER SLIDES, SI N/P CELLS WITH 1-MIL SPUTTERED SILICA COVERINGS, P/N LITHIUM DRIFTED CELLS WITH INTEGRAL COVERS, DENDRITIC N/P SI CELLS WITH 6-MIL COVER SLIDES AND WITH 2-MIL INTEGRAL COVERS, ION IMPLANT SI CELLS WITH 1-MIL INTEGRAL COVERS; CDS THIN FILM CELLS, AND CDTE THIN FILM CELLS. CALIBRATION OF THE EXPERIMENTAL CELLS WAS CARRIED OUT AT KITT'S PEAK NEAR TUSCON, ARIZONA. INITIAL ORBITAL RESULTS HAVE AGREED CLOSELY WITH THOSE EXPECTED FROM THE CALIBRATION. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 708 603 10/2 22/2
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

SOLAR CELL DEGRADATION EXPERIMENTS ON LES-4 AND -5. (U)

DESCRIPTIVE NOTE: MEETING SPEECH,
68 6P SARLES,FREDERICK W. ;COX, LAWRENCE P. ;
REPT. NO. MS-2427
CONTRACT: AF 19(628)-5167
MONITOR: ESD TR-70-162

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN IEEE PHOTOVOLTAIC SPECIALISTS CONFERENCE (7TH), PASADENA, CALIF., P269-273 1968.

DESCRIPTORS: (*COMMUNICATION SATELLITES(ACTIVE), SOLAR CELLS), (*SOLAR CELLS, DEGRADATION), SPACE COMMUNICATIONS (U)
IDENTIFIERS: LES 5 SATELLITE, LES-4 SATELLITE (U)

LINCOLN LABORATORY SATELLITES LES-4 AND -5 EACH CARRY SOLAR CELL EXPERIMENTS: MEASUREMENT OF 10 OHM CM SILICON CELL WITH 30-MIL COVER SLIDE; MEASUREMENT OF 10 OHM CM SILICON CELL WITH 30-MIL COVER SLIDE; MEASUREMENT OF 10 OHM CM SILICON CELL WITH 6-MIL COVER SLIDE; MEASUREMENT OF TWO CDTE THIN FILM CELLS (LES-4 ONLY); MEASUREMENT OF TWO CDS THIN FILM CELLS (LES-5 ONLY). RESULTS ARE DISCUSSED. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 710 081 7/5 6/11 10/1
FRANKLIN INST RESEARCH LABS PHILADELPHIA PA

DESIGN AND DEVELOP SOLAR CELLS. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 APR 67-31 MAR 70,
MAY 70 70P SIMPSON,WILLIAM H. ;
REUCROFT,PHILIP J. ;
REPT. NO. FIRL-F-C2022
CONTRACT: F19628-67-C-0273
PROJ: AF-8659
TASK: 865903
MONITOR: AFCRL 70-0264

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: ALSO INCLUDES PHOTOELECTRONIC EFFECTS IN ORGANIC MATERIALS. I. CHLOROPHYLL-CHLORANIL LAMELLAR SYSTEMS, AD-707 521, AND PHOTOELECTRONIC EFFECTS IN ORGANIC MATERIALS. II. VARIATION OF PHOTOVOLTAGE WITH PH IN CHLOROPHYLL-QUINONE SOLUTIONS, AD-709 837.

DESCRIPTORS: (*CHLOROPHYLLS, *PHOTOELECTRIC EFFECT), (*SOLAR CELLS, CHLOROPHYLLS), QUINONES, SOLUTIONS(MIXTURES), OXYGEN, ORGANIC SOLVENTS, EXCITONS (U)
IDENTIFIERS: MATRIX ISOLATION TECHNIQUES, CHLOROPHYLL A, *PHOTOVOLTAIC CELLS, DISSOLVED GASES (U)

THE PHOTOVOLTAGES OF SOLUTIONS OF CHLOROPHYLL AND A DONOR OR ACCEPTOR WERE MEASURED FOR SEVERAL SYSTEMS. THE EFFECT OF OXYGEN DISSOLVED IN THE SOLVENT WAS ALSO INVESTIGATED. THE PHOTOVOLTAGES WERE USUALLY ON THE ORDER OF A FEW MILLIVOLTS. IN SOLID-LAMELLAR SYSTEMS CONSISTING OF CHLOROPHYLL AND ORGANIC SUBSTRATES THE PHOTOVOLTAGES WERE GENERALLY HIGHER. AN 'ACTION' SPECTRUM INDICATED THAT THE PEAK VOLTAGE OCCURRED AT THE PEAK ABSORPTION IN THE RED BAND. PHOTOVOLTAGE PRODUCTION IN THE SOLID SYSTEMS WAS ATTRIBUTED TO A BI-EXCITONIC MECHANISM. QUANTUM MECHANICAL TUNNELING AND OTHER CONDUCTION MECHANISMS WERE INVESTIGATED IN THIN FILMS OF CHLOROPHYLL A. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 710 636 10/2
CLEVITE CORP CLEVELAND OHIO ELECTRONIC RESEARCH DIV

THIN FILM CDS SOLAR CELL FABRICATION PARAMETER STUDY. (U)

DESCRIPTIVE NOTE: INTERIM TECHNICAL REPT.,
JUN 70 17P DEUCHER,T. F. ;
CONTRACT: F33615-68-C-1182
PROJ: AF-7885
TASK: 788500
MONITOR: ARL 70-0099

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, MANUFACTURING), CADMIUM SULFIDES, METAL FILMS, SEMICONDUCTING FILMS, PLASTIC COATINGS, VAPOR PLATING, VACUUM APPARATUS, BARRIER COATINGS (U)
IDENTIFIERS: THIN FILMS (U)

THE STUDY IS, ESSENTIALLY, A BRIEF DESCRIPTION OF THE PROCESSES, CURRENTLY USED AND ALTERNATIVES, NECESSARY TO THE MANUFACTURE OF THIN FILM CDS SOLAR CELLS. THESE PROCESSES RELATE TO THE APPLICATION OF THE CONDUCTIVE LAYER TO THE PLASTIC FILM, PLATING ON OF A SUITABLE METALLIC INTERLAYER, DEPOSITION OF THE CDS LAYER, FORMATION OF THE BARRIER, ATTACHMENT OF THE CONDUCTIVE GRID AND COVER PLASTIC AND IN PROCESS AND FINAL TESTING. MATERIAL COSTS AND PRODUCTIVITY OF EACH OF THE PRESENT MANUFACTURING PROCESSES ARE LISTED, AND AS A COMPARISON, MATERIAL COSTS AND PRODUCTIVITY BASED ON HIGH PRODUCTION METHODS ARE ESTIMATED WHEREVER POSSIBLE. THOSE PROCESSES OR OPERATIONS WHICH LEND THEMSELVES PRESENTLY TO LARGE VOLUME PRODUCTION HAVE BEEN INCORPORATED INTO SUGGESTED MECHANISMS THAT ARE BRIEFLY DESCRIBED. A FEW, OF WHICH GRIDDING IS AN EXAMPLE, ARE IN NEED OF FURTHER STUDY, AS TO PROCESSES WHICH ARE MORE ADAPTABLE TO MECHANIZATION THAN AT PRESENT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 712 936 20/12 13/8 10/2
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

PROPERTIES OF P-N JUNCTIONS IN CADMIUM SULFIDE AND CONSTRUCTION OF PHOTOELECTRIC TRANSDUCERS, (U)

JUN 70 8P KNEV,STEFAN ;STOYANOV,VASIL ;STEFANOV,RODOSLAV ;

REPT. NO. FTD-HC-23-133-70
PROJ: FTD-7230178

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: EDITED TRANS. OF BULGARSKA AKADEMIYA NA NAUKITE, SOFIA. FIZICHESKI INSTITUT. IZVESTIYA, V17 P13-20 1968.

DESCRIPTORS: (*SEMICONDUCTORS, INTERFACES), (*CADMIUM SULFIDES, PHOTOELECTRIC EFFECT), (*SOLAR CELLS, MANUFACTURING), PERFORMANCE(ENGINEERING), USSR (U)
IDENTIFIERS: *SEMICONDUCTOR JUNCTIONS, TRANSLATIONS (U)

THE DEVELOPMENT OF EFFICIENT PHOTOELECTRIC CONVERTERS BASED ON CDS IS DESCRIBED. THE PHOTOELECTRIC P-N JUNCTIONS WERE MADE AS FOLLOWS: CADMIUM SULFIDE POWDER WAS PRESSED INTO SMALL TABLETS UNDER A PRESSURE OF SEVERAL HUNDRED KILOGRAMS PER CM(SUPERSCRIPT 2). THE TABLETS WERE BAKED FOR 15 MIN UNDER CLOSELY CONTROLLED CONDITIONS TO FORM PURE MONOCRYSTALS (SIZE, UP TO 50 MU) ON ONE SIDE OF THE TABLET, I.E., TO FORM THE WORKING SURFACE OF THE CONVERTER. THIS WORKING SURFACE WAS THEN IMMERSED FOR SEVERAL SECONDS IN A BOILING, SATURATED WATER SOLUTION OF COPPER SULFATE TO COVER IT WITH A THIN COATING WHICH CONTAINED P-TYPE CARRIERS AND WAS PRESUMED TO BE FORMED BY THE CHEMICAL REACTION GIVEN. THE COATED TABLET WAS THEN HEATED AT A TEMPERATURE OF 350 DEGREES CENTIGRADE FOR ABOUT 20 SEC. THE CONVERTER WAS COMPLETED BY DEPOSITING ELECTRODES ON BOTH SIDES OF THE TABLET. EFFICIENCIES OF THE ORDER OF 8 PERCENT WERE OBTAINED WITH THE DESCRIBED PHOTOELECTRIC CONVERTERS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 715 261 10/2 18/8
AEROSPACE CORP EL SEGUNDO CALIF LAB OPERATIONS

LOW - ENERGY PROTON DAMAGE TO SILICON/ SOLAR CELLS. (U)

DESCRIPTIVE NOTE: REPT. FOR JAN 69-JAN 70, OCT 70 37P STOFEL,EDWIN J. ;JOSLIN, DAVID E. ;
REPT. NO. TR-0059(6250-20)-8
CONTRACT: F04701-70-C-0059
MONITOR: SAMSO TR-70-407

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *DAMAGE), PROTONS, RELIABILITY(ELECTRONICS), CRYSTAL DEFECTS, SILICON, (U)SILICON (U)
IDENTIFIERS: ATS 1 SATELLITE (U)

THE EFFECT OF LOW-ENERGY (<2 MEV) PROTON IRRADIATION UPON THE JUNCTION PROPERTIES OF SILICON SOLAR CELLS HAS BEEN MEASURED. THESE MEASUREMENTS ARE USED TO EXPLAIN THE LARGE POWER LOSS OBSERVED ON THE ATS-1 AND INTELSAT II-4 SATELLITES.
(AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 715 285 10/2
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

DEGRADATION OF CDS THIN FILM SOLAR CELLS IN DIFFERENT ENVIRONMENTS. (U)

DESCRIPTIVE NOTE: TECHNICAL NOTE,
NOV 70 26P STANLEY,ALAN G. ;
REPT. NO. TN-1970-33
CONTRACT: F19628-70-C-0230
PROJ: AF-649L
MONITOR: ESD TR-70-341

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, DEGRADATION), TEST METHODS, THERMAL STRESSES, SPACE ENVIRONMENTS, CADMIUM SULFIDES, FAILURE(ELECTRONICS), SEMICONDUCTOR DEVICES, RELIABILITY(ELECTRONICS) (U)
IDENTIFIERS: PHOTOVOLTAIC EFFECT (U)

CADMIUM SULFIDE THIN FILM CELLS WERE OPERATED UNDER DIFFERENT BIAS CONDITIONS FOR PERIODS OF SIX MONTHS IN THE FOLLOWING ENVIRONMENTS: VACUUM THERMAL CYCLING BETWEEN -160 AND 60C, CONSTANT ILLUMINATION IN VACUUM AND IN DRY OXYGEN AT 60C. THE RESULTS WERE COMPARED TO THE DEGRADATION OF TEST CELLS IN SYNCHRONOUS ORBIT. IT WAS CONCLUDED FROM THE OBSERVED CHANGES IN THE I-V CHARACTERISTICS THAT THE DEGRADATION IS CAUSED PRIMARILY BY A COMBINATION OF LIGHT AND TEMPERATURE AND NOT BY PURELY THERMAL STRESSES. THE PRESENCE OF A VACUUM DOES NOT APPEAR TO BE A SIGNIFICANT CONTRIBUTORY FACTOR TO THE ULTIMATE DEGRADATION OF THE CELLS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 721 888 9/1 10/2
ARMY ELECTRONICS COMMAND FORT MONMOUTH N J

SPECTRAL RESPONSE INVESTIGATION OF SILICON PHOTOVOLTAIC CELLS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT. 1 JAN-1 DEC 69,
MAR 71 91P KITTL,EMIL ;
REPT. NO. ECOM-3401
PROJ: DA-1-T-061102-A-34-A
TASK: 1-T-061102-A-34-A-02

UNCLASSIFIED REPORT

DESCRIPTORS: (*PHOTOELECTRIC CELLS(SEMICONDUCTOR), DESIGN), (*SOLAR CELLS, TEST METHODS), SILICON, THERMOCOUPLES, SPECTRUM ANALYZERS, OPTICAL FILTERS, SOLAR RADIATION (U)
IDENTIFIERS: *PHOTOVOLTAIC CELLS, *THERMOPHOTOVOLTAIC CONVERTERS (U)

RESULTS OF AN EXPERIMENTAL ANALYSIS ARE PRESENTED WHICH ENCOMPASS MEASURMENTS OF THE ABSOLUTE VALUE OF THE SPECTRAL RESPONSE OF SILICON PHOTOVOLTAIC CELLS OVER A WIDE RANGE OF INCIDENT MONOCHROMATIC RADIATION INTENSITY. THE CELLS, A DIFFUSED-JUNCTION, SINGLE-CRYSTAL TYPE, CONTAINED A DENSE CONTACT GRID PATTERN. THIS DESIGN PROVIDED HIGH POWER DENSITY OUTPUT AT HIGH INTENSITY RADIATION LEVELS. THREE EXPERIMENTAL APPROACHES WERE USED RANGING IN INCIDENT PHOTON CURRENT FROM 0.1 MICRO ANGSTROM/SQ CM TO 1 ANGSTROM/SQ. CM. FOR THE LOW-INTENSITY RADIATION LEVELS, THE BEAM FROM A PRISM-MONOCHROMATOR ILLUMINATED THE SILICON CELL. AT MEDIUM RADIATION LEVELS, A TUNGSTEN-IODINE STANDARD LAMP WAS COMBINED WITH TWENTY-NINE NARROW-BAND INTERFERENCE FILTERS TO PROVIDE QUASI-MONOCHROMATIC RADIATION. AT HIGH RADIATION LEVELS, A PULSED XENON DISCHARGE LAMP WAS USED WITH THE SAME SET OF INTERFERENCE FILTERS. A BROADBAND, THERMOCOUPLE RADIATION DETECTOR PROVIDED FOR THE SIMULTANEOUS MEASUREMENT OF THE INCIDENT RADIATION AND THE SILICON-CELL OUTPUT CURRENT. MEASUREMENT OF EFFECTIVE CARRIER LIFETIME SERVED AS A MEANS FOR EXPLAINING DIFFERENCES IN THE SPECTRAL RESPONSE BEHAVIOR BETWEEN THE P+/N AND N+/P CELL TYPES. RESULTS FROM EXPERIMENTS WITH HIGH-INTENSITY CHROMATIC LIGHT SOURCES ARE ALSO REPORTED WHICH INDICATE THE HIGH OUTPUT POWER POTENTIAL OF THE SILICON CELL. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 722 112 10/2 20/12
CLEVITE CORP CLEVELAND OHIO

RESEARCH ON THE OPERATING AND FAILURE MECHANISMS IN CDS SOLAR CELLS. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. 1 JUN 69-31 MAY 70,
SEP 70 147P SHIOZAWA,L. R. ;AUGUSTINE, F. ;COOK,W. R. , JR;
CONTRACT: F33615-69-C-1732
PROJ: AF-7885, AF-916080/7885
MONITOR: ARL 70-0169

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, FAILURE(ELECTRONICS)), (*SEMICONDUCTING FILMS, ELECTRICAL PROPERTIES), CADMIUM SULFIDES, COPPER COMPOUNDS, ELECTRIC CURRENTS, MANUFACTURING, VAPOR PLATING, PHASE STUDIES, PHASE DIAGRAMS (U)
IDENTIFIERS: THIN FILMS, COPPER SULFIDES (U)

THE OPERATING AND FAILURE MECHANISMS OF CU2S: CDS THIN FILM SOLAR CELLS WERE EXAMINED FURTHER DURING THE PAST YEAR. THE SHORT CIRCUIT CURRENT OF PILOT PRODUCTION CELLS WAS FOUND TO BE SENSITIVE TO THE UNIFORMITY OF ZN PLATING AND TO THE TEXTURE OF THE METALLIZED PLASTIC SUBSTRATE. EXTENSIVE LITERATURE AND EXPERIMENTAL STUDIES ON THE VARIOUS FORMS OF CUPROUS SULFIDE WERE CARRIED OUT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 723 315 10/2
CLEVITE CORP CLEVELAND OHIO ELECTRONIC RESEARCH DIV

IMPROVEMENTS IN CDS THIN FILM SOLAR CELLS. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. 1 NOV 69-31 OCT 70,
JAN 71 81P DUNN,WILLIAM F. ;
CONTRACT: F33615-68-C-1162
PROJ: AF-7885
MONITOR: ARL 71-0015

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, PERFORMANCE(ENGINEERING)), SEMICONDUCTOR DEVICES, CADMIUM SULFIDES, FLIGHT TESTING, SCIENTIFIC SATELLITES (U)
IDENTIFIERS: OV1-13 SATELLITE, OV1-17 SATELLITE, THIN FILMS (U)

THE REPORT IS CONCERNED WITH TWO AREAS IN THE CADMIUM SULFIDE THIN FILM SOLAR CELL DEVELOPMENT PROGRAM: (1) A REPORT ON SPACE FLIGHT TESTING OF CDS CELLS AND (2) RESULTS OF A DEVELOPMENT PROGRAM FOR IMPROVING THE STABILITY AND EFFICIENCY OF THE STANDARD CDS CELL. TWO SPACE FLIGHT TESTS OF CDS CELLS ARE REPORTED. THE FIRST TEST, ARX-701, CONTAINED TWO CDS PANELS ON THE OV1-13 SATELLITE. THE SECOND SPACE FLIGHT TEST CONTAINED ONE CDS PANEL, ARX-901, AND WAS FLOWN ON THE OV1-17 SATELLITE. A DEVELOPMENT PROGRAM FOR OBTAINING ENGINEERING MEASUREMENTS FROM THE CDS CELL WAS CARRIED OUT. A STUDY WAS MADE OF HEATING EFFECTS ON THE CADMIUM SULFIDE THIN FILM CELL AFTER FORMATION OF THE BARRIER LAYER. ADDITIONAL INVESTIGATIONS WERE MADE OF LOW PRESSURE LAMINATIONS, A SILVER COATED GLASS POWDER FOR METALLIZED SUBSTRATE USE AND VARIATIONS IN GRIDDING ATTACHMENT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 726 114 10/2 20/12
NORTHEASTERN UNIV BOSTON MASS

RESEARCH IN SOLAR ENERGY CONVERSION. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 OCT 66-30 SEP 70,
JAN 71 163P NOWAK,WELVILLE B. ;
CONTRACT: F19628-67-C-0119
PROJ: AF-8659
TASK: 865901
MONITOR: AFCRL 71-0163

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, RELIABILITY(ELECTRONICS)), (*PHOTOELECTRIC CELLS(SEMICONDUCTOR), MANUFACTURING), SEMICONDUCTING FILMS, VAPOR PLATING, CARRIERS(SEMICONDUCTORS), SILICON, EPITAXIAL GROWTH, COMPUTER PROGRAMS, ABSORPTION SPECTRA, ELECTRICAL PROPERTIES, GALLIUM COMPOUNDS, PHOSPHIDES, GALLIUM ARSENIDES, GERMANIUM, ZINC COMPOUNDS, SELENIDES (U)
IDENTIFIERS: ZINC SELENIDES, GALLIUM PHOSPHIDES, HETEROJUNCTIONS (U)

THE FOLLOWING TOPICS RELATED TO PHOTOVOLTAIC SOLAR-ENERGY CONVERSION WERE INVESTIGATED: TRANSIENT RESPONSE OF MOMENTARILY REVERSE-BIASED SOLAR CELLS, ELECTRODIFUSSION EFFECTS IN SEMICONDUCTORS, EFFECT OF ELECTRIC FIELDS AND CHARGED PARTICLE IMPINGEMENT ON PLANAR-EDGE-GROWTH OF SINGLE CRYSTAL SILICON FILMS ON AMORPHOUS QUARTZ, AND HETEROJUNCTION PHOTOVOLTAIC SOLAR CELLS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 728 186 10/2 18/8
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

COMPARISON OF LOW-ENERGY PROTON DAMAGE IN ION-IMPLANTED AND DIFFUSED SILICON SOLAR CELLS. (U)

DESCRIPTIVE NOTE: JOURNAL ARTICLE,
SEP 70 3P STANLEY,ALAN G. ;
REPT. NO. JA-3779
CONTRACT: AF 19(628)-5167
MONITOR: ESD TR-71-129

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN PROCEEDINGS OF THE IEEE, V59 N2 P321-322 FEB 71.

DESCRIPTORS: (*SOLAR CELLS, *RADIATION DAMAGE), PROTON BOMBARDMENT, SILICON (U)
IDENTIFIERS: ION IMPLANTATION (U)

A COMPARISON IS MADE OF LOW-ENERGY PROTON DAMAGE IN ION-IMPLANTED AND DIFFUSED SILICON SOLAR CELLS. IT IS SHOWN THAT ION-IMPLANTED CELLS ARE MORE RADIATION RESISTANT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 731 940 10/2 22/2
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

SOLAR CELL DEGRADATION EXPERIMENTS ON THE LINCOLN LABORATORY LES-4 AND LES-5 SATELLITES. (U)

DESCRIPTIVE NOTE: JOURNAL ARTICLE,
OCT 69 6P SARLES,F. WILLIAM , JR.;
COX,LARRY P. ;
REPT. NO. JA-3895
CONTRACT: AF 19(628)-5167
MONITOR: ESD TR-71-260

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN IEEE TRANSACTIONS ON ELECTRON DEVICES, VED-18 N8 P507-511 AUG 71.
SUPPLEMENTARY NOTE: PRESENTED AT EHE IEEE PHOTOVOLTAIC SPECIALISTS CONFERENCE (7TH) HELD IN PASADENA, CALIF. 19-21 NOV 68.

DESCRIPTORS: (*SOLAR CELLS, DEGRADATION), (*SCIENTIFIC SATELLITES, SOLAR CELLS), APOGEE, PERIGEE, ELLIPTICAL ORBIT TRAJECTORIES, SILICON COATINGS, FILMS, CADMIUM SULFIDES, TELLURIUM COMPOUNDS, SOLAR RADIATION (U)
IDENTIFIERS: LES-5 SATELLITE, LES-4 SATELLITE (U)

LES-4 WAS ORBITED IN DECEMBER 1965 IN A HIGHLY ELLIPTICAL ORBIT WITH AN 18,000-MI APOGEE AND A 100-MI PERIGEE; LES-5 WAS INJECTED INTO A QUASI-SYNCHRONOUS ORBIT IN JULY 1967. IN THE LES-5 EXPERIMENT, THE SI CELLS EXHIBIT AN I(SC) DEGRADATION OF EIGHT PERCENT PER YEAR PLUS AN INITIAL SHORT TERM DEGRADATION OF FOUR PERCENT; V(AC) IS RELATIVELY UNAFFECTED. THE CDS CELLS HAVE AN I(SC) DEGRADATION OF 20 PERCENT PER YEAR PLUS AN INITIAL DEGRADATION OF FIVE PERCENT. IN THE LES-4 EXPERIMENT, THE SI CELL WITH THE 6-MIL COVER SLIDE SHOWS TWO RATES OF DEGRADATION, WITH THE BREAK POINT OCCURRING AT ABOUT 100 DAYS; THE CELL WITH THE 30-MIL COVER SLIDE SHOWS SUBSTANTIALLY LESS DEGRADATION. AFTER 700 DAYS, THE SHORT-CIRCUIT CURRENTS OF THESE TWO CELLS ARE 60 PERCENT AND 78 PERCENT OF THEIR INITIAL AMO VALUES. ONE CDTE CELL HAS DECAYED TO 38 PERCENT OF ITS INITIAL AMO VALUE AFTER 700 DAYS; THE SECOND SAMPLE GIVES ANOMALOUS RESULTS. IN EACH EXPERIMENT AMO TO AM2 SHORTOCIRCUIT CURRENT RATIOS OF APPROXIMATELY 1.09 WERE NOTED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 734 536 20/12 10/2
HUGHES AIRCRAFT CO CULVER CITY CALIF ELECTRONIC PROPERTIES INFORMATION CENTER

CUPROUS SULFIDE AND CUPROUS SULFIDE-CADMIUM SULFIDE HETEROJUNCTIONS. (U)

DESCRIPTIVE NOTE: INTERIM REPT.,
SEP 71 62P NEUBERGER,M. ;
REPT. NO. EPIC-IR-69-REV
CONTRACT: DSA900-72-C-1182

UNCLASSIFIED REPORT

DESCRIPTORS: (*SEMICONDUCTORS, PHYSICAL PROPERTIES), (*SOLAR CELLS, SULFIDES), COPPER COMPOUNDS, CADMIUM SULFIDES, SEMICONDUCTING FILMS, ELECTRICAL PROPERTIES, THERMAL PROPERTIES, OPTICAL PROPERTIES, PHOTOELECTRIC EFFECT, BAND THEORY OF SOLIDS (U)
IDENTIFIERS: PHOTOVOLTAIC EFFECT, SEMICONDUCTOR JUNCTIONS, HETEROJUNCTIONS, COPPER SULFIDES (U)

56 EXTRACTS OF DOCUMENTS WHICH PROVIDE INFORMATION ON CUPROUS SULFIDE AND CUPROUS SULFIDE-CADMIUM SULFIDE FROM THE ELECTRONIC PROPERTIES INFORMATION CENTER STORAGE AND RETRIEVAL SYSTEM ARE PROVIDED. CONSIDERABLE MINERALOGICAL INFORMATION AS WELL AS PHASE DIAGRAMS, PHYSICAL PROPERTIES AND PHOTOVOLTAIC PROPERTIES ARE INCLUDED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 737 161 10/2
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

STRUCTURAL FAILURES IN LIGHTWEIGHT SOLAR CELL ARRAYS UNDER THERMAL CYCLING. (U)

DESCRIPTIVE NOTE: JOURNAL ARTICLE,
NOV 70 8P STANLEY,ALAN G. ;
REPT. NO. JA-3835
CONTRACT: F19628-70-C-0230
MONITOR: ESD TR-71-331

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN IEEE TRANSACTIONS ON AEROSPACE AND ELECTRONIC SYSTEMS, VAES-7 N4 P606-612 JUL 71.

DESCRIPTORS: (*SOLAR CELLS, THERMAL STRESSES), TEST METHODS, SILICON, HONEYCOMB CORES, FLEXIBLE STRUCTURES, FAILURE(MECHANICS), CRYOGENICS, VIBRATION (U)
IDENTIFIERS: *THERMAL CYCLING TESTS, FAILURE ANALYSIS (U)

SEVERAL DIFFERENT TYPES OF SMALL SILICON SOLAR CELL ARRAYS MOUNTED ON LIGHTWEIGHT HONEYCOMB PANELS AND ON FLEXIBLE SUBSTRATES WERE SUBJECTED TO LONG-TERM THERMAL CYCLING TESTS BETWEEN -160 AND 60C IN DRY NITROGEN. OTHER TESTS INCLUDED IMMERSION IN LIQUID NITROGEN AND VIBRATION FATIGUE TESTS IN EXCESS OF ONE MILLION CYCLES. THE ARRAYS EXPERIENCED A REDUCTION IN OUTPUT CAUSED BY CONTACT FAILURE, FRACTURE IN THE SILICON AND COVER SLIDE, AND DISINTEGRATION OF THE HONEYCOMB. FAILURE MODES CAUSED BY DIFFERENT CELL AND INTERCONNECT CONSTRUCTIONS ARE COMPARED. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 740 577 10/2 18/8
AIR FORCE CAMBRIDGE RESEARCH LABS L G HANSCOM FIELD MASS

SOLAR CELL RADATION RESPONSE NEAR THE INTERFACE OF DIFFERENT ATOMIC NUMBER MATERIALS. (U)

DESCRIPTIVE NOTE: PHYSICAL SCIENCES RESEARCH PAPERS,
NOV 71 23P BURKE,E. A. ;CAPPELLI,J. R. ;LOWE,J. F. ;WALL,J. A. ;
REPT. NO. AFCRL-72-0045, AFCRL-PSRP-472
PROJ: AF-5621
TASK: 562109

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *DAMAGE), COBALT, GAMMA RAYS, INTERFACES, ALUMINUM, GOLD, COPPER, MOLYBDENUM, SILICON, (U)SILICON (U)
IDENTIFIERS: COBALT 60, THIN FILMS (U)

THE RESPONSE OF CO-60 IRRADIATED N/P SILICON SOLAR CELLS WAS MEASURED AS A FUNCTION OF THE ATOMIC NUMBER OF THE MEDIUM ADJACENT TO THE CELL AND THE DIRECTION OF THE GAMMA RAY BEAM. THE INTERPOSITIONING OF VARIOUS THICKNESSES OF ALUMINUM BETWEEN THE ADJACENT MATERIAL AND THE CELL HAD THE EFFECT OF MOVING THE CELL TO VARIOUS LOCATIONS IN AN APPROXIMATE MONOATOMIC NUMBERED MEDIUM. WITH THIS TECHNIQUE, THE SOLAR CELL RESPONSE WAS DETERMINED AT VARIOUS DISTANCES FROM THE INTERFACE FOR GOLD AND BERYLLIUM. IONIZATION CHAMBER DATA WERE USED TO ESTIMATE THE INFLUENCE OF VARIOUS BASE CONTACT MATERIALS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /Z0M07

AD- 741 524 10/2 22/2
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE VA

SPACE ELECTRIC POWER PLANTS. PART I
(LITSOM K SOLNTSU), (U)

72 7P LIDORENKO,N. ;
REPT. NO. FSTC-HT-23-923-72
PROJ: FSTC-T7023012301

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. FROM PRAVDA, MOSCOW (USSR) N160 P3, 9 JUN 71, BY DONALD E. CHAMBERLIN.

DESCRIPTORS: (*SOLAR CELLS, SPACECRAFT COMPONENTS), ENERGY CONVERSION, SEMICONDUCTOR DEVICES, USSR (U)
IDENTIFIERS: SOLAR GENERATORS, TRANSLATIONS (U)

THE THEORETICAL ASPECT OF SOLAR POWER PLANTS OF SOVIET SPACECRAFT IS EXPLAINED BY LIDORENKO, AN EXPERT IN THE FIELD OF RECHARGEABLE POWER SOURCES. DEVELOPMENT OF SOLAR BATTERIES FOR LUNOKHOD-1 SOLVES NEW PROBLEMS. THE TYPE OF SEMICONDUCTOR CHOSEN PERFORMS WELL IN THE 100-150C AND WITHSTANDS VIGOROUS COOLING. THE SEMICONDUCTOR PASSED THROUGH A LUNAR ECLIPSE INTACT WHEN THE COVER OF THE LUNOKHOD WAS LEFT OPEN. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 745 364 10/2
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE VA

A STUDY OF 'PHOTOVOLT' GENERATOR AT HIGH RADIATION INTENSITY (ISSLEDOVANIE ELEKTRICHESKIKH KHARAKTERISTIK GENERATOROV 'FOTOVOLT' PRI POVYSHENNOI MOSHCHNOSTI IZLUCHENIYA), (U)

JUN 72 5P LANDSMAN,A. P. ;STREBKOV, D. S. ;
REPT. NO. FSTC-HT-23-1014-72

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. FROM GELIOTEKHNIKA (USSR) N3 P3-6 1970, BY ALBERT L. PEABODY.

DESCRIPTORS: (*SOLAR CELLS, DESIGN), PHOTOELECTRIC CELLS(SEMICONDUCTOR), PHOTOSENSITIVITY, ELECTRICAL PROPERTIES, USSR (U)
IDENTIFIERS: PHOTOVOLTAIC CELLS, SOLAR GENERATORS, TRANSLATIONS (U)

THE NEW HIGH VOLTAGE PHOTOELECTRIC GENERATOR 'PHOTOVOLT' IS DESCRIBED. THE SPECTRAL SENSITIVITY AND CURRENT-VOLTAGE CHARACTERISTICS ARE GIVEN. THE GENERATOR EFFICIENCY RISES FROM 7% TO 10% WHILE THE LIGHT POWER INCREASES FROM NORMAL VALUE UP TO 4 KW/SQ M. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 748 694 10/2
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE VA

SOLAR BATTERY-PHOTOVOLTAIC CELL POWER SUPPLY FOR EQUIPMENT (USTROISTVO DLYA PITANIYA POTREBITELEI OT SOLNECHNOI BATAREI S FOTOPREOBRAZO VATELYAMI). (U)

JUN 72 2P GRIGORYAN,R. S. ;
REPT. NO. FSTC-HT-23-750-72

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF PATENT (USSR) 271 619.

DESCRIPTORS: (*POWER SUPPLIES, *SOLAR CELLS), (*SWITCHING CIRCUITS, POWER SUPPLIES), ELECTRIC RELAYS, DETECTORS, PATENTS, USSR (U)
IDENTIFIERS: TRANSLATIONS (U)

A DEVICE IS DESCRIBED FOR THE POWER SUPPLY OF CONSUMERS BY A SOLAR BATTERY WITH PHOTOCONVERTORS CONTAINING A COMMUTATOR TO CONNECT THE LOADS TO THE BATTERY. TO INCREASE RELIABILITY, THE COMMUTATOR HAS RELAYS AND POWER SENSORS, THE CONTACTS OF WHICH ARE INCLUDED IN THE CIRCUIT OF THE COIL OF A RELAY SEPARATING THE SOLAR BATTERY INTO SEVERAL SECTIONS, EACH OF WHICH IS CONNECTED TO AN INDIVIDUAL CONSUMER THROUGH THE CONTACT OF THIS RELAY. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 749 477 10/2 18/8
BOEING CO SEATTLE WASH

REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS). (U)

DESCRIPTIVE NOTE: INTERIM TECHNICAL REPT. 17 MAY 71-17 MAY 72,
AUG 72 88P HORNE,WILLIAM E. ;MADARAS, BARBARA K. ;
CONTRACT: F33615-71-C-1583
PROJ: AF-3145
MONITOR: AFAPL TR-72-69

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *DAMAGE), (*SEMICONDUCTORS, DAMAGE), (*SILICON, DAMAGE), DOPING, LITHIUM, ELECTRON IRRADIATION, PROTON BOMBARDMENT, NUCLEAR EXPLOSIONS, TEST METHODS, CRYSTAL DEFECTS, GAMMA RAYS, REAL TIME, (U)REAL TIME (U)
IDENTIFIERS: ACCELERATED TESTS, RADIATION HARDENING, *HARDENING(SYSTEMS) (U)

A TECHNIQUE IS BEING DEVELOPED FOR THE ACCELERATED EVALUATION OF SILICON SOLAR CELLS TO BE USED IN EXTENDED SPACE MISSIONS DURING WHICH WEAPONS ENVIRONMENTS MAY ALSO BE ENCOUNTERED. STANDARD N/P SILICON CELLS, AS WELL AS LITHIUM DOPED SILICON CELLS, ARE BEING USED AS TEST SAMPLES DURING THE DEVELOPMENT AND VERIFICATION OF THE EVALUATION METHOD. THE REPORT DISCUSSES AN ANALYSIS OF EXISTING LITERATURE AND THE PHILOSOPHY OF APPROACH TO THE PROBLEM RESULTING FROM THE ANALYSIS. AN EXPLORATORY TEST PROGRAM DESIGNED TO AUGMENT EXISTING DATA AND TO FURTHER DEVELOP THE METHOD OF APPROACH IS DESCRIBED. ALSO, A REAL-TIME TEST CURRENTLY UNDERWAY WHICH INVOLVES N/P AND LITHIUM DOPED SOLAR CELLS EXPOSED SIMULTANEOUSLY TO LOW-FLUX ELECTRON AND PROTON RADIATION PLUS ILLUMINATION IS DESCRIBED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOMO7

AD- 754 901 10/2
AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB OHIO

THEORETICAL TREATMENT OF THE VERTICAL MULTIJUNCTION SOLAR CELL. (U)

DESCRIPTIVE NOTE: REPT. FOR 1 JUL 71-1 MAR 72,
DEC 72 42P RAHILLY,W. PATRICK ;
REPT. NO. AFAPL-TR-72-77
PROJ: AF-3145

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, EFFICIENCY), CARRIERS(SEMICONDUCTORS), ELECTRIC CURRENTS, VOLTAGE, DESIGN, DAMAGE, RADIATION EFFECTS (U)
IDENTIFIERS: SEMICONDUCTOR JUNCTIONS (U)

A BRIEF THEORETICAL TREATMENT OF THE VERTICAL MULTIJUNCTION SOLAR CELL IS PRESENTED. THE CELL GEOMETRY CONSIDERED WAS 2 CM X 2 CM X 250 MICRONS. SOLUTIONS FOR THE MINORITY CARRIER DIFFUSION EQUATIONS WERE OBTAINED SO AS TO DERIVE THE LIGHT GENERATED CURRENT PER UNIT WAVELENGTH (SPECTRAL RESPONSE) AND TOTAL LIGHT GENERATED CURRENT. THE SPECTRAL RESPONSE CALCULATIONS REVEALED THAT ENHANCED CARRIER COLLECTION IS PREDICTED IN THE 'RED' PORTION OF THE SUNLIGHT SPECTRUM. THE TOTAL LIGHT GENERATED CURRENT WAS FOUND TO INCREASE ASYMPTOTICALLY TO A LIMIT OF NOMINALLY 190 MILLIAMPERES FOR INCREASING NUMBERS OF JUNCTIONS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 755 743 10/2 22/2
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

STATUS REPORT ON RAE ADVANCED SOLAR ARRAY DEVELOPMENT. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
JUL 72 31P TREBLE,F. C. ;
REPT. NO. RAE-TR-72109
MONITOR: DRIC BR-29829

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PRESENTED AT THE IEEE PHOTOVOLTAIC SPECIALISTS' CONFERENCE, (9TH) SILVER SPRING, MD., 2-4 MAY 72.

DESCRIPTORS: (*SOLAR CELLS, PERFORMANCE(ENGINEERING)), (*SPACECRAFT COMPONENTS, SOLAR CELLS), DESIGN, GREAT BRITAIN, DAMAGE, RADIATION EFFECTS, SPACE ENVIRONMENTS, PROTON BOMBARDMENT (U)

RECENT PROGRESS IN ADVANCED LIGHTWEIGHT SOLAR ARRAY TECHNOLOGY IS REVIEWED. SOLAR CELL PERFORMANCE WAS IMPROVED. PANEL ASSEMBLIES EMBODYING THE CEMENTLESS MOUNTING TECHNIQUE HAVE SUCCESSFULLY WITHSTOOD PROLONGED DEEP THERMAL CYCLING AND OTHER ENVIRONMENTAL TESTS. SOME ARE CURRENLTY BEING FLOWN EXPERIMENTALLY ON THE PROSPERO TECHNOLOGICAL SATELLITE. A STOWED ARRAY HAS SURVIVED SEVERE VIBRATION WITH NEGLIGIBLE DAMAGE. A SOLUTION HAS BEEN FOUND TO THE PROBLEM OF PROTECTING THE BACKS OF THE CELLS FROM LOW ENERGY PROTONS. USEFUL EXPERIENCE HAS BEEN GAINED IN ALL ASPECTS OF THE MANUFACTURE, HANDLING AND TESTING OF FLEXIBLE FOLDING ARRAYS. DESIGN QUALIFICATION TESTS HAVE BEGUN ON A 280W PROTOTYPE. THE ADVANTAGES AND DISADVANTAGES OF THE DESIGN IN RELATION TO THE ALTERNATIVE ROLL-UP TYPE ARE DISCUSSED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 756 039 10/2 22/2
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE VA

SPACE ELECTRIC POWER PLANTS. PART 2, (U)

FEB 73 6P KOROLEV,M. ;
REPT. NO. FSTC-HT-23-921-72

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF PRAVDA, MOSCOW (USSR) N161 P3, 10 JUN 71. SEE ALSO PART 1, AD-741 524.

DESCRIPTORS: (•SOLAR PANELS, SPACECRAFT COMPONENTS), SOLAR CELLS, LIFE EXPECTANCY, PHOTOELECTRIC CELLS(SEMICONDUCTOR), SILICON, INTEGRATED CIRCUITS, ELECTRIC POWER PRODUCTION, USSR (U)
IDENTIFIERS: •SOLAR GENERATORS, TRANSLATIONS (U)

SOLAR BATTERIES AND POWER CELLS ARE DISCUSSED. 7, 500 PHOTOCELLS COMPRISING A PANEL 1 METER SQUARE GENERATE MORE THAN 100 WATTS OF ELECTRICAL ENERGY. SPACE SERVICE LIFE OF CERTAIN SEMICONDUCTORS IS GIVEN AS TWO TO THREE YEARS. GLASS COATINGS PROTECT PANELS FROM HEAVY PROTONS. REFERENCE IS MADE TO THE BOEING CO. PROJECT OF UNFOLDING GLASS FABRIC PANELS FOR SPACE USE. KOROLEV ALSO STATES THAT SOVIET SCIENTISTS CONFIRM THE FEASIBILITY OF SUCH A PROJECT BUT CLAIM THAT IT WILL BE SURPASSED. THIN FILM HIGHLY EFFICIENT PHOTOCELL PANELS HAVE BEEN DEVELOPED IN THE USSR. REFERENCE IS MADE TO AN UNSPECIFIED PLANT/FACTORY WHICH MANUFACTURES NOT ONLY SPACE POWER UNITS (USING SOLAR ENERGY) BUT GROUND SOLAR POWER PLANTS AS WELL. A 600 WATT PILOT INSTALLATION HAS BEEN IN OPERATION IN THE KARAKUM DESERT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 756 228 10/2
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE VA

INVESTIGATION OF PHOTOELECTRIC CHARACTERISTICS OF GALLIUM ARSENIDE SOLAR CELLS OVER A WIDE RANGE OF CHANGE IN LIGHT FLUX, (U)

JAN 73 13P KAGAN,M. B. ;ILYUBASHEVSKAYA, T. L. ;
REPT. NO. FSTC-HT-23-2027-72

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF GELIOTEKHNIKA (USSR) N2 P12-21 1971.

DESCRIPTORS: (*SOLAR CELLS, *GALLIUM ARSENIDES), PHOTOELECTRIC CELLS(SEMICONDUCTOR), SILICON, RELIABILITY(ELECTRONICS), USSR (U)
IDENTIFIERS: COMPARISON, TRANSLATIONS (U)

THE CHARACTERISTICS OF GALLIUM ARSENIDE AS SOLAR CELLS IN THE 4 WATT/SQ M-72000 WATT/SQ M ILLUMINATION RANGE ARE ANALYZED IN THIS RUSSIAN REPORT. THE CONNECTION OF THE OBSERVED RELATIONSHIPS WITH THE ELECTRO-PHYSICAL PARAMETERS OF P-N JUNCTIONS ARE DETERMINED, AND COMPARED WITH SILICON. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 756 594 20/12 10/2
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE VA

HETEROGENEOUS SOLAR CONVERTORS BASED ON POLYCRYSTALLINE CADMIUM SULFIDE AND CADMIUM SELENIDE (GETEROGENNE SOLNECHNE PREOBRAZOVATELI NA OSNOVE POLIKRISTALLICHESKOGO SULFIDA I SELENIDA KADMIYA), ? (U)

SEP 72 10P KOMASHCHENKO,V. N. ;
MARCHENKO,A. I. ;FEDORUS,G. A. ;
REPT. NO. FSTC-HT-23-113-72

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF POLUPROVODNIKOVAYA TEKHNIKA I MIKROELEKTRONIKA (USSR) N4 P112-121 N.D., BY A. PEABODY.

DESCRIPTORS: (*SEMICONDUCTING FILMS, *SOLAR CELLS), CADMIUM SULFIDES, CADMIUM SELENIDES, PHOTOSENSITIVITY, ELECTRICAL PROPERTIES, USSR (U)
IDENTIFIERS: THIN FILMS, TRANSLATIONS (U)

THE AUTHORS PRESENT DATA ON THE DEVELOPMENT AND INVESTIGATION OF PHOTOELECTRIC CONVERTORS BASED ON PRESSED SINTERED TABLETS OF CDS AND CDSE, PLUS SOMEWHAT MORE DETAILED DATA ON PHOTOELECTRIC CONVERTORS BASED ON CDSE FILMS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 756 602 10/2 20/12
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE VA

EFFECTIVENESS OF SOLAR CELLS BASED ON CDS-CUZ-XS HETEROJUNCTIONS, (U)

DEC 72 9P PAVELETS,S. YU. ;
REPT. NO. FSTC-HT-23-2032-72

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF GELIOTEKHNIKA (USSR) N3 P3-8 1971.

DESCRIPTORS: (*PHOTOELECTRIC CELLS(SEMICONDUCTOR), EFFICIENCY), (*SOLAR CELLS, EFFICIENCY), COPPER COMPOUNDS, SURFACES, BAND THEORY OF SOLIDS, USSR, CADMIUM SULFIDES (U)
IDENTIFIERS: HETEROJUNCTIONS, TRANSLATIONS, COPPER SULFIDES (U)

ANALYSIS OF LOSS AND CHANCES OF EFFICIENCY INCREASE IN CDS-CU(2-X)S PHOTOCONVERTERS WITH IMPURITY LIGHT ABSORPTION SHOWS THAT EFFECTIVE PHOTOCELLS CAN BE PRODUCED ONLY WITH USE OF THE DRIFT FIELD AND C RACTERISTICS OF THE FLOW OF THE CHEMICAL REACTION WHICH FORMS CU(2-X)S ON THE CDS SURFACE. THE RUSSIAN REPORT DISCUSSES THE FACT THAT FURTHER PROGRESS IS POSSIBLE IN THE PRODUCTION OF SOLAR BATTERIES BASED ON CDS-CU(2-X)S HETEROJUNCTIONS AS A RESULT OF SELECTION OF THE OPTIMUM MODE OF CHEMICAL TREATMENT, IN THE PRESENCE OF THE OPTIMUM POLYCRYSTALLINE STRUCTURE OF CDS LAYERS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 759 290 21/3 22/2 22/1
TECHNION INC MONROVIA CALIF.

ADVANCED ELECTRIC THRUSTER (A SPACE ELECTRIC RAMJET). (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT.,
APR 73 117P CANN,GORDON L. ;
CONTRACT: F04611-73-C-0020
PROJ: AF-10-003
MONITOR: AFRPL TR-73-12

UNCLASSIFIED REPORT

DESCRIPTORS: (*ELECTRIC ENGINES, PERFORMANCE(ENGINEERING)), (*SPACE PROPULSION, ASTRONAUTICS), DESIGN, ARC JET ENGINES, ION ENGINES, PLASMA ENGINES, MAGNETIC FIELDS, DRAG, SOLAR CELLS (U)
IDENTIFIERS: STATIONKEEPING, THRUSTERS (U)

LABORATORY EXPERIMENTS HAVE ESTABLISHED THAT AXISYMMETRIC PLASMA ACCELERATORS USING A SOLENOIDAL MAGNETIC FIELD CAN PRODUCE THRUST BY RECYCLING THE AMBIENT MATERIAL OF THE VACUUM TANK IN WHICH THEY WERE OPERATED, INDICATING THAT AN ELECTROMAGNETIC ACCELERATOR ON A SATELLITE AT LOW ALTITUDE SHOULD BE ABLE TO IONIZE AND ACCELERATE AIR STREAMING BY IT AND PRODUCE THRUST FOR DRAG MAKE UP. THIS PRINCIPLE IS THE BASIS OF THE SPACE ELECTRIC RAMJET. USE OF SOLAR CELL ARRAYS TO SUPPLY POWER GIVES THE SYSTEM A THEORETICAL UNLIMITED TOTAL IMPULSE, OTHERWISE LIMITED BY ENGINE CATHODE AND ANODE LIFETIMES. MINIMUM SYSTEM PERFORMANCE REQUIREMENTS FOR DRAG MAKE UP IN THE 100-300 MILES ALTITUDE RANGE ARE COMPUTED. BASIC DESIGN PARAMETERS FOR SYSTEM COMPONENTS (ANODE, CATHODE, MAGNET COIL, INSULATORS) AND POWER REQUIREMENTS ARE CALCULATED. (AUTHOR MODIFIED ABSTRACT) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 759 812 10/2
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE VA

CALCULATION AND COST OPTIMIZATION OF CERTAIN SOLAR GENERATOR THERMOBATTERY PARAMETERS (K RASCHETU I OPTIMIZATSII PO STOIMOSTI NEKOTORYKH PARAMETROV TERMOBATAREI SOLNECHNYKH GENERATOROV), (U)

JAN 73 11P DRABKIN,L. M. ;
REPT. NO. FSTC-HT-23-1433-72

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF GELIOTEKHNIKA (USSR) NI P9-15 1971.

DESCRIPTORS: (*THERMOELECTRICITY, COSTS), (*SOLAR CELLS, COSTS), PRODUCTION, BATTERY COMPONENTS, ELECTRIC BATTERIES, MATHEMATICAL MODELS, USSR, DESIGN (U)
IDENTIFIERS: TRANSLATIONS (U)

A METHOD FOR ECONOMIC ANALYSIS OF THERMOELECTRIC GENERATORS IS DISCUSSED IN THE RUSSIAN REPORT. A FORMULA IS PRESENTED WHICH PERMITS CALCULATION OF THE COST OF MANUFACTURE OF A THERMOELECTRIC GENERATOR THERMOBATTERY (IF MATERIAL OUTLAY ON IT IS KNOWN). FROM THE FORMULA PROPOSED, IT FOLLOWS IN PARTICULAR THAT, WITH A DECREASE IN THE WEIGHT OF MATERIALS, THE COST OF A BATTERY DECREASES LINEARLY. HOWEVER, WITH A DECREASE IN THE WEIGHT OF MATERIALS (THICKNESS OF THERMOELEMENTS), THE NUMBER OF THERMOELEMENTS PER WATT GENERATED GROWS, APPROACHING INFINITY. WAGE EXPENDITURES ALSO INCREASE CONSIDERABLY HERE. THE FORMULA DOES NOT TAKE ALL FACTORS INTO ACCOUNT, AND IT IS IMPOSSIBLE TO BUILD UP A METHOD FOR OPTIMIZING THERMOBATTERY CONSTRUCTION PARAMETER DESIGN, ESPECIALLY FOR THE SOLAR THERMOELECTRIC GENERATOR. (AUTHOR MODIFIED ABSTRACT) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 759 946 9/1 20/12 18/8
NORTHROP RESEARCH AND TECHNOLOGY CENTER HAWTHORNE CALIF

RADIATION EFFECTS ON SEMICONDUCTOR MATERIALS AND DEVICES. (U)

DESCRIPTIVE NOTE: FINAL REPT. 8 FEB-8 DEC 72,
MAR 73 210P SROUR,JOSEPH R. ;OTHMER, SIEGFRIED ;CURTIS,ORLIE L. , JR;
REPT. NO. NRTC-72-16R
CONTRACT: DAAG39-69-C-0039, DAAG39-73-C-0019
PROJ: HDL-235227
MONITOR: HDL 039-3

UNCLASSIFIED REPORT

DESCRIPTORS: (*SEMICONDUCTOR DEVICES, DAMAGE), (*SEMICONDUCTORS, *DAMAGE), RECOMBINATION REACTIONS, CARRIERS(SEMICONDUCTORS), CRYSTAL DEFECTS, SILICON, NEUTRON REACTIONS, ANNEALING, SOLAR CELLS, GALLIUM ARSENIDES, GAMMA RAYS, PHOTOCONDUCTIVITY, (U)PHOTOCONDUCTIVITY (U)

TECHNIQUES ARE DESCRIBED FOR OBTAINING RECOMBINATION-CENTER PARAMETERS FROM CARRIER LIFETIME STUDIES. STUDIES OF RECOMBINATION AT DISORDERED REGIONS INCLUDE DAMAGE COMPARISONS FOR FUSION- AND FISSION-NEUTRON-IRRADIATED BULK SILICON AND SILICON SOLAR CELLS, AND DIFFUSION LENGTH MEASUREMENTS IN NEUTRON-IRRADIATED SILICON AND GALLIUM ARSENIDE. SHORT-TERM ANNEALING INVESTIGATIONS INCLUDE THE DEVELOPMENT OF EXPRESSIONS FOR EVALUATING EARLY-TIME DAMAGE RATIOS AND STUDIES OF TRANSIENT RECOVERY IN BULK SILICON, SILICON SOLAR CELLS, AND BIPOLAR TRANSISTORS FOLLOWING BURSTS OF BOTH 14-MEV AND REACTOR NEUTRONS. MEASUREMENT TECHNIQUES ARE DESCRIBED FOR DETERMINING DRIFT MOBILITY IN HEAVILY IRRADIATED SILICON AND FOR DETERMINING THE INJECTION-LEVEL DEPENDENCE OF LIFETIME IN SEMICONDUCTORS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 760 172 10/2
HELIOTEK SYLMAR CALIF

VERTICAL MULTIJUNCTION SOLAR CELLS. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. 15 NOV 71-15 DEC 72,
FEB 73 145P STELLA,PAUL M. ;
REPT. NO. 380-4654
CONTRACT: F33615-72-C-1310
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-73-3

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, DESIGN), CARRIERS(SEMICONDUCTORS), EFFICIENCY, PHOTOCONDUCTIVITY, DAMAGE, RADIATION EFFECTS, ELECTRON IRRADIATION, NEUTRON REACTIONS, RELIABILITY(ELECTRONICS), SILICON, SPACECRAFT COMPONENTS, SPACE ENVIRONMENTS (U)
IDENTIFIERS: CARRIER LIFETIME, SEMICONDUCTOR JUNCTIONS (U)

A THEORETICAL ANALYSIS OF THE VERTICAL MULTIJUNCTION (VMJ) SOLAR CELL WAS PERFORMED WHICH INDICATED THAT USING SILICON CERTAIN CONFIGURATIONS COULD BE FABRICATED TO SATISFY THE PROGRAM OBJECTIVES. RESULTS INDICATE THAT INITIAL AMO EFFICIENCIES OF 15% CAN BE ACHIEVED, AND THAT AT LEAST 12% EFFICIENCY CAN BE EXPECTED AFTER SEVEN YEARS OPERATION AT SYNCHRONOUS ORBIT IN A NUCLEAR WEAPONS ENVIRONMENT. EXPERIMENTAL DEVICES FABRICATED DURING THE PROGRAM EXHIBITED RELATIVELY HIGH LONG WAVELENGTH RESPONSE AS PREDICTED BY THEORY. THESE OVERSIZE DEVICES (WIDTHS APPROXIMATELY 100 MICROMETERS) EXHIBITED LOW EFFICIENCIES (6-8%) AND POOR SHORT WAVELENGTH RESPONSE DUE TO SLOW SURFACE STATES WHICH DRASTICALLY REDUCED SHORT WAVELENGTH COLLECTION EFFICIENCY AND DEVICE VOLTAGE AS WELL AS CAUSING INSTABILITY IN THE DEVICE I-V CHARACTERISTIC. THESE SURFACE STATES MUST BE ELIMINATED IF HIGH EFFICIENCY VMJ DEVICES ARE TO BECOME A REALITY. (MODIFIED AUTHOR ABSTRACT) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 762 941 10/2
ION PHYSICS CORP BURLINGTON MASS

LONG LIFE HARDENED LITHIUM DOPED SILICON SOLAR CELL INVESTIGATION. (U)

DESCRIPTIVE NOTE: FINAL REPT. MAY 70-DEC 72, JUN 73 124P BARTELS,F. T. C. ;
CONTRACT: F33615-70-C-1491
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-73-47

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, DAMAGE), SILICON, LITHIUM, DOPING, LIFE EXPECTANCY, MANUFACTURING, ULTRASONIC WELDING, MODULES(ELECTRONICS), (U)
(U)MODULES(ELECTRONICS) (U)
IDENTIFIERS: RADIATION HARDENING (U)

A REPORT IS MADE ON A PROGRAM TO DEVELOP LITHIUM-DOPED SILICON SOLAR CELLS WITH IMPROVED STABILITY, EFFICIENCY, AND RADIATION RESISTANCE. A NOVEL CELL STRUCTURE WITH AN ION-EMPLANTED BARRIER LAYER IMMEDIATELY BELOW THE P-N JUNCTION WAS DEVELOPED AND EVALUATED. THE MANUFACTURING PROCESS IS DESCRIBED IN DETAIL. ACTUAL RESULTS FOR LITHIUM DISTRIBUTION, ANNEALING CHARACTERISTICS AND CELL STABILITY ARE COMPARED TO THEORETICAL PREDICTIONS FOR BOTH BARRIER AND NON-BARRIER CELLS. MODULE FABRICATION INCLUDING ALUMINUM WELDED INTERCONNECTS AND INTEGRAL COVER GLASS IS DISCUSSED. PERFORMANCE OF THE EXPERIMENTAL CELLS AFTER ELECTRON AND NEUTRON IRRADIATION IS COMPARED TO THAT OF NON-BARRIER CELLS. (MODIFIED AUTHOR ABSTRACT) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 764 357 10/2
AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB
OHIO

LITHIUM-DOPED SILICON SOLAR CELLS STATE-
OF-THE-ART. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT. APR-OCT 72,
JUN 73 42P GREEN,JOHN M. ;
REPT. NO. AFAPL-TR-73-4
PROJ: AF-3145
TASK: 314519

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, STATE-OF-THE-ART REVIEWS),
SILICON, LITHIUM, DOPING, ENERGY CONVERSION, DAMAGE,
RADIATION EFFECTS, INHIBITION, SPACECRAFT COMPONENTS,
SPACE ENVIRONMENTS (U)

THE PRESENT STATUS OF LITHIUM-DOPED SOLAR CELLS WAS INVESTIGATED. IMPROVEMENTS IN FABRICATION TECHNIQUES HAVE MADE POSSIBLE LITHIUM-DOPED CELLS WHICH ARE 11.9% EFFICIENT AT AMO CONDITIONS AND 28 C. CELL AREAS OF 12 SQUARE CENTIMETERS ARE NOW FEASIBLE. ANNEALING CHARACTERISTICS ARE HIGHLY TEMPERATURE DEPENDENT WITH 60 C BEING THE MINIMUM ARRAY TEMPERATURE FOR GOOD PERFORMANCE. IF THE RECOVERED POWER LEVELS FOR N/P CELLS AND P/N LITHIUM-DOPED CELLS ARE COMPARED FOR AN ARRAY TEMPERATURE OF 80 C, IT IS FOUND THAT THE P/N LITHIUM-DOPED CELLS ARE 15% HIGHER AFTER 10 TO THE 15TH POWER/SQ CM 1 MEV EQUIVALENT ELECTRONS AND 85% HIGHER AFTER 10 TO THE 13TH POWER/SQ CM FISSION SPECTRUM NEUTRONS. BASED ON THIS SURVEY THE USE OF LITHIUM-DOPED CELLS IS RECOMMENDED FOR MISSIONS WHICH REQUIRE SOLAR ARRAYS TO OPERATE AT TEMPERATURES ABOVE 60 C, ESPECIALLY IF THE SATELLITE MUST SURVIVE A NUCLEAR WEAPON ENVIRONMENT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 764 816 10/2 9/1
GLOBE-UNION INC EL MONTE CALIF CENTRALAB SEMICONDUCTOR DIV

ELECTROFORMED ALUMINUM SOLAR CELL CONTRACTS. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. 1 FEB 72-30 MAR 73,
MAR 73 44P ILES,PETER A. ;
CONTRACT: F33615-72-C-1427
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-73-29

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, ELECTRIC CONNECTORS), (*ELECTRIC CONNECTORS, *ELECTROFORMING), ALUMINUM, SILICON, FEASIBILITY STUDIES, COST EFFECTIVENESS (U)
IDENTIFIERS: ELECTRIC CONTACTS (U)

INVESTIGATIONS WERE CONDUCTED TO EVALUATE THE FEASIBILITY OF ACHIEVING IMPROVED ALUMINUM SOLAR CELL CONTACTS AND INTERCONNECTS WHICH COULD REDUCE OVERALL SOLAR ARRAY COST AND WEIGHT WITHOUT SACRIFICE OF PERFORMANCE AND RELIABILITY. PROBLEMS OF POOR ADHERENCE AND THICKNESS CONTROL OF THE CONTACT METALLIZATION WERE ENCOUNTERED DURING THE COURSE OF THE PROGRAM. EFFORTS TO RESOLVE THESE PROBLEMS WERE UNSUCCESSFUL. BECAUSE OF THE SERIOUS CONTACT METALLIZATION PROBLEMS, NO EFFORT WAS EXPENDED IN ATTEMPTING TO ACHIEVE ADVANCED WRAP-AROUND CONTACT CONFIGURATIONS OR INTERCONNECTION OF CELLS USING THE ELECTROFORMING TECHNIQUE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 771 426 10/2 22/2 18/8
BOEING AEROSPACE CO SEATTLE WASH

BAR GAP RADIATION TEST. (U)

DESCRIPTIVE NOTE: FINAL REPT. OCT-DEC 73,
DEC 73 70P RUSSELL,DENNIS A. ;
REPT. NO. D180-17847-1
CONTRACT: N00014-74-C-0064

UNCLASSIFIED REPORT

DESCRIPTORS: *SPACECRAFT COMPONENTS, *SOLAR PANELS, *RADIATION EFFECTS, PROTONS, ULTRAVIOLET RADIATION, THERMAL CYCLING TESTS, SOLAR CELLS, SATELLITES(ARTIFICIAL), PERFORMANCE(ENGINEERING) (U)

A TEST PROGRAM WAS CONDUCTED INVESTIGATING THE EFFECTS OF PROTON AND ULTRAVIOLET RADIATION AND THERMAL CYCLING ON U.S. NAVY SATELLITE SOLAR PANELS. GOVERNMENT-SUPPLIED TEST PANELS WERE PLACED IN A VACUUM CHAMBER AND EXPOSED ALTERNATELY TO 200-KEV PROTONS TO A FLUENCE OF 10 TO THE 15TH POWER P/SQ CM, TO 270 HOURS OF ULTRAVIOLET RADIATION AT A ONE SUN RATE, AND TO 21 THERMAL CYCLES. THE PERFORMANCE OF THE TEST PANELS IN THE FORM OF I-V CURVES WAS MEASURED IN SITU BEFORE THE START OF TESTING AND PERIODICALLY THROUGHOUT THE TEST. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 772 817 10/2
KSW ELECTRONICS INC BURLINGTON MASS

LITHIUM IMPLANTED SOLAR CELLS, DATA. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 JUN-31 JUL 73,
JUL 73 23P SMITH,DONALD A. ;HARTKE,
JEROME L. ;
CONTRACT: F19628-73-C-0214
PROJ: AF-8659
TASK: 865906
MONITOR: AFCRL TR-73-0493

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, SILICON, LITHIUM, ION IMPLANTATION, DIFFUSION, PHOSPHORUS (U)

THE REPORT CONTAINS THE IDENTIFICATION AND PROCESSING DESCRIPTION OF ALL SAMPLES PROCESSED AND THE TABULATED MEASUREMENT DATA OBTAINED ON PHOSPHORUS DIFFUSED, LITHIUM IMPLANTED, P-TYPE SILICON SOLAR CELL BLANKS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 773 237 10/2 22/2
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

OPTIMIZATION OF SOLAR CELL SHIELDING FOR GEOSTATIONARY MISSIONS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
AUG 73 41P WALKDEN,M. W. ;
REPT. NO. RAE-TR-73105
MONITOR: DRIC BR-36625

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *RADIATION SHIELDING, SHIELDING, SYNCHRONOUS SATELLITES, THICKNESS, OPTIMIZATION, GREAT BRITAIN (U)

EQUIVALENT ONE MEV ELECTRON FLUENCES, END OF LIFE OUTPUT POWERS AND POWER TO WEIGHT RATIOS ARE ESTIMATED FOR SOLAR CELLS IN A FIVE YEAR GEOSTATIONARY MISSION BEGINNING IN 1975. THE STUDY COVERS CELL THICKNESSES FROM 125 MICROMETERS TO 300 MICROMETERS, COVERSLIP THICKNESSES FROM 25 MICROMETERS TO 300 MICROMETERS, AND REAR SHIELDING TYPICAL OF RIGID AND LIGHTWEIGHT FLEXIBLE ARRAYS. IT IS CONCLUDED THAT THE THINNEST CELLS AND SHIELDING GIVE THE BEST POWER TO WEIGHT RATIO, ALTHOUGH THE CHOICE FOR A PARTICULAR SPACECRAFT WILL BE INFLUENCED BY CONSIDERATIONS OF AVAILABILITY, COST, FRAGILITY AND ARRAY AREA. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 774 592 10/2 18/8
BOEING CO SEATTLE WASH

REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS). (U)

DESCRIPTIVE NOTE: INTERIM TECHNICAL REPT. NO. 2, 17 MAY 72-17 MAY 73,
OCT 73 113P HORNE,WILLIAM E. ;MADARAS, BARBARA K. ;
REPT. NO. D180-10491-3
CONTRACT: F33615-71-C-1583
PROJ: AF-3145
MONITOR: AFAPL TR-72-69-VOL-2

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AV-749 477.

DESCRIPTORS: *SOLAR CELLS, *RADIATION EFFECTS, SILICON, LITHIUM, DOPING, DAMAGE, ANNEALING, ELECTRON IRRADIATION, PROTON BOMBARDMENT, ACCELERATED TESTING, MATHEMATICAL MODELS (U)

THE REPORT DISCUSSES EXPLORATORY TESTING AND DATA ANALYSES. A PROPOSED MODEL FOR THE ANNEALING OF LITHIUM SOLAR CELLS IS PRESENTED. IN ADDITION, NEW DATA SHOWING THE ENERGY DEPENDENCE OF PROTON AND ELECTRON DAMAGE IN LITHIUM-DOPED SILICON AND THE ANNEALING OF SUCH DAMAGE ARE PRESENTED. NEW DATA ALSO INDICATE THAT SIMULTANEOUS IRRADIATIONS WITH PROTONS AND ELECTRONS PRODUCE SYNERGISTIC EFFECTS. THESE EFFECTS MAY PRODUCT EITHER MORE OR LESS DAMAGE THAN THE SUM OF THE SEPARATE ENVIRONMENT DEPENDING ON THE RELATIVE ELECTRON-TO-PROTON FLUENCES. (MODIFIED AUTHOR ABSTRACT) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 776 171 10/2 20/12
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE VA

SOLAR ELEMENTS BASED ON EPITAXIAL GAAS FILMS. (U)

JAN 74 6P KARGIN,M. B. ;KAROLEVA,N. S. ;NULLER,T. P. ;
REPT. NO. FSTC-HT-23-1802-72

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF GELIOTEKHNIKA (USSR) N2 P28-31 1970.

DESCRIPTORS: *SOLAR CELLS, *SEMICONDUCTING FILMS, *GALLIUM ARSENIDES, THIN FILMS, ELECTRICAL PROPERTIES, PHOTOELECTRIC EFFECT, TRANSLATIONS, USSR (U)

IN RECENT YEARS, THE EFFORTS OF MANY INVESTIGATORS HAVE BEEN DIRECTED AT THE DEVELOPMENT OF THIN-FILM POLYCRYSTALLINE SOLAR CELLS (S.C.), WHICH, IN COMPARISON WITH MONOCRYSTALLINE S.C. HAVE A BETTER RATIO OF OUTPUT TO POWER-WEIGHT PV(W/KG) AND A MUCH LOWER COST. THE AUTHORS OBTAINED AND INVESTIGATED THE PRINCIPAL CHARACTERISTICS OF S.C. BASED ON EPITAXIAL FILMS OF GALLIUM ARSENIDE, WHICH POSSESS THE MAXIMUM VALUE FOR LIMITING EFFICIENCY FOR THE SOLAR SPECTRUM AND ALSO ARE CHARACTERIZED BY THE BEST (IN COMPARISON WITH OTHER MATERIALS) TEMPERATURE RELATIONSHIPS OF ITS PARAMETERS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 776 551 10/2
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE VA

HETEROGENEOUS SOLAR CONVERTERS BASED ON POLYCRYSTALLINE CADMIUM SULFIDE AND SELENIDE, (U)

NOV 73 11P KOMASHCHENKO,V. N. ; MARCHENKO,A. I. ;FEDORUS,G. A. ;
REPT. NO. FSTC-HT-23-1083-72

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF POLUPROVODNIKOVAYA TEKHNIKA I MIKROELEKTRONIKA (USSR) N4 P112-121.

DESCRIPTORS: *SOLAR CELLS, *SEMICONDUCTOR DEVICES, CADMIUM SULFIDES, CADMIUM SELENIDES, MANUFACTURING, PHOTOCONDUCTIVITY, ELECTRICAL PROPERTIES, TRANSLATIONS, USSR (U)

HETEROGENEOUS SOLAR CONVERTERS BASED ON POLYCRYSTALLINE CADMIUM SULFIDE AND SELENIDE-- TRANSLATION.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 777 139 20/12 7/4 10/2
NATIONAL CENTER FOR ENERGY MANAGEMENT AND POWER
PHILADELPHIA PA

REVIEW AND EVALUATION OF WORK PERFORMED ON
ORGANIC SEMICONDUCTOR SOLAR CELLS. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 JUL 72-30 JUN 73,
JUL 73 69P NOEL,GERALD T. ;
CONTRACT: F19628-72-C-0270
PROJ: AF-8659
TASK: 865901
MONITOR: AFCRL TR-73-0699

UNCLASSIFIED REPORT

DESCRIPTORS: *PHOTOVOLTAIC EFFECT, *SEMICONDUCTORS, *SOLAR CELLS, ORGANIC COMPOUNDS, ELECTRON TRANSITIONS, EXCITONS, IONIZATION, BAND THEORY OF SOLIDS, ABSORPTION(PHYSICAL), PHOTONS, CRYSTALS (U)
IDENTIFIERS: *ORGANIC SEMICONDUCTORS (U)

THE REPORT REVIEWS EXPERIMENTAL AND THEORETICAL STUDIES RELATED TO THE PHOTOVOLTAIC EFFECT IN ORGANIC SEMICONDUCTORS. PROCESSES RELEVANT TO THE OPERATION AND PERFORMANCE OF ORGANIC SOLAR CELLS ARE OUTLINED AND DISCUSSED IN THE CONTEXT OF A BLOCK DIAGRAM TYPE MODEL OF AN ORGANIC PHOTOVOLTAIC DEVICE. A DETAILED DISCUSSION OF THE IMPACT OF PHOTON ABSORPTION AND CARRIER GENERATION PROCESSES ON THE ULTIMATE PERFORMANCE OF SOLAR CELLS USING ORGANIC SEMICONDUCTOR MATERIALS IS PRESENTED.
(AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /Z0M07

AD- 777 473 10/2 22/2
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

THE RAE LIGHTWEIGHT SOLAR ARRAY. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
FEB 74 17P TREBLE,F. C. ;
REPT. NO. RAE-TR-73172
MONITOR: DRIC BR-39317

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PRESENTED AT THE INTERNATIONAL CONGRESS 'THE SUN IN THE SERVICE OF MANKIND', PARIS, 2-6 JUL 73.

DESCRIPTORS: *SOLAR CELLS, *SPACECRAFT COMPONENTS, ARRAYS, SILICON, LIGHTWEIGHT, FOLDING, FLEXIBLE STRUCTURES, GREAT BRITAIN (U)
IDENTIFIERS: SOLAR ARRAYS (U)

THE PAPER TRACES THE DEVELOPMENT OF THE RAE LIGHTWEIGHT FLEXIBLE FOLD-UP SOLAR ARRAY, CULMINATING IN THE RECENT SUCCESSFUL TESTS ON A 280W PROTOTYPE WHICH HAVE QUALIFIED THE DESIGN FOR 6 YEARS IN GEOSTATIONARY ORBIT. THE ARRAY EMBODIES A NUMBER OF UNIQUE FEATURES, INCLUDING 125 MICROMETERS SILICON SOLAR CELLS WITH WRAPAROUND CONTACTS, 100 MICROMETERS CERIA-STABILIZED GLASS COVERSLIPS, CEMENTLESS MOUNTING OF CELLS ON THE FLEXIBLE SUBSTRATE AND DEPLOYMENT BY A PNEUMATICALLY ACTUATED TELESCOPIC MAST. A SMALL VERSION OF THE ARRAY IS TO BE FLOWN ON THE BRITISH X4 SATELLITE IN 1974. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 781 926 10/2
BOSTON COLL CHESTNUT HILL MASS DEPT OF PHYSICS

INVESTIGATION OF ORGANIC SEMICONDUCTOR FOR PHOTOVOLTAIC APPLICATION. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 JUL 70-31 DEC 73,
APR 74 44P FANG,PAO-HSEIN ;
CONTRACT: F19628-71-C-0093
PROJ: AF-8659
TASK: 865901
MONITOR: AFCRL TR-74-0192

UNCLASSIFIED REPORT

DESCRIPTORS: *SEMICONDUCTORS, *ORGANIC COMPOUNDS, *PHOTOVOLTAIC EFFECT, *SOLAR CELLS, MEASUREMENT, AGING(MATERIALS), TRANSPORT PROPERTIES, MATHEMATICAL MODELS, ELECTRODES, METALS (U)
IDENTIFIERS: *NAPHTHACENES, *ORGANIC SEMICONDUCTORS (U)

THE WORK IS ORIENTED TOWARD FIVE AREAS: (1) MEASUREMENT OF THE PHOTOVOLTAIC CONVERSION EFFICIENCY AS A SOLAR CELL, (2) ANALYSIS OF THE SPECTRAL RESPONSE OF THE QUANTUM YIELD, (3) ANALYSIS OF THE TRANSIENT RESPONSE WITH A PULSED LIGHT SOURCE, (4) MODEL ANALYSIS OF THE CONFIGURATION OF THE ORGANIC SEMICONDUCTOR SOLAR CELL AND (5) THE AGING PHENOMENON OF TETRACENE SOLAR CELLS. THE WORK IN AREAS (1) TO (4) IS COMPLETED TOGETHER WITH PHYSICAL INTERPRETATIONS. AREA (5), WHICH REQUIRES MEASUREMENTS OVER AN EXTENDED PERIOD OF TIME, BUT IS OF FUNDAMENTAL IMPORTANCE FROM THE POINT OF VIEW OF PRACTICAL APPLICATION, HAS NOT BEEN ABLE TO BE COMPLETED BEFORE THE TERMINATION OF THE PRESENT CONTRACT, AND A STAGE OF PHYSICAL INTERPRETATION HAS NOT BEEN REACHED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 801 717 10/2
LOCKHEED MISSILES AND SPACE CO PALO ALTO CALIF

RADIATION EFFECTS IN SILICON SOLAR CELLS. PART II, (U)

DEC 58 28P JUNGA,FRANK A. ;ENSLOW, GEORGE M. ;
REPT. NO. LMSD-48351
CONTRACT: AF 04(647)-97

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO PART I REPT. NO. LMSD-5137 DATED 15 OCT 58, AD-477 592.

DESCRIPTORS: (*SOLAR CELLS, *DAMAGE), (*SILICON, SOLAR CELLS), GAMMA RAYS, NEUTRONS, SATELLITES(ARTIFICIAL), THERMAL RADIATION, PHOTOELECTRIC EFFECT, COMPTON SCATTERING, ANNEALING, X RAYS, SPECIAL FUNCTIONS(MATHEMATICAL), ABSORPTION, DENSITY, (U)DENSITY (U)

CALCULATIONS HAVE BEEN PERFORMED TO ESTIMATE THE NUMBER OF ATOMS DISPLACED FROM NORMAL SITES BY COMPTON ELECTRONS FROM CO(60) GAMMA RAYS AND BY SLOW AND FAST NEUTRONS. THE RESULTANT CHANGE IN CARRIER LIFETIMES AND MOBILITIES ARE USED TO PREDICT THE PERFORMANCE OF A SILICON SOLAR CELL UNDER GAMMA AND NEUTRON IRRADIATION. THE EFFECT OF ANNEALING OF DEFECTS IS CONSIDERED, AND FROM THESE COMPUTATIONS AN ESTIMATE IS MADE TO SHOW THE MINIMUM FLUX NECESSARY TO PRODUCE NOTICEABLE DAMAGE. DATA ARE PRESENTED SHOWING THE EFFECTS OF CO(60) GAMMA RAYS ON 10 SILICON SOLAR CELLS AND COMPARISON IS MADE WITH THE THEORY. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 804 977 10/2
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR DIV

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT. (U)

DESCRIPTIVE NOTE: INTERIM PROGRESS REPT. NO. 3, 1 JUL-1 OCT 66,
OCT 66 17P HARDING,W. R. , JR;
CONTRACT: AF 33(615)-3462

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, DESIGN), CIRCUIT INTERCONNECTIONS, INTERRUPTERS, FREQUENCY MULTIPLIERS, SILICON, INTEGRATED CIRCUITS (U)

AN INTEGRATED CELL WAS FABRICATED WITH SERIES INTERCONNECTION. THE PROBLEMS INHERENT IN THIS STRUCTURE ARE DISCUSSED. THESE PROBLEMS WERE LATERAL RESISTANCE AND ISOLATION JUNCTION LEAKAGE UNDER ILLUMINATION. TECHNIQUES OF JUNCTION FABRICATION ARE DISCUSSED. A WORKING CIRCUIT FOR CHOPPING A MULTIPLYING SOLAR CELL OUTPUT TO 1000 VOLTS IS DISCUSSED. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 805 407 10/2
ION PHYSICS CORP BURLINGTON MASS

ION IMPLANTATION JUNCTION TECHNIQUES. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO. 3, 1 AUG-31 OCT 66,
OCT 66 42P KING,Q. J. ;BURRILL,J. T. ;SMITH,D. ;HARRISON,S. ;SOLOMON,S. J. ;

CONTRACT: AF 33(615)-3636

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, SILICON), MANUFACTURING, POWER, WEIGHT, COSTS, FILMS, THICKNESS (U)
IDENTIFIERS: ION IMPLANTATION, THIN FILMS (U)

THE PROGRAM IS PRIMARILY DIRECTED AT THE FABRICATION OF HIGH POWER-TO-WEIGHT RATIO CELLS WITH INTEGRAL COVERSLIPS. DURING THIS QUARTER INVESTIGATIONS WERE CONCENTRATED ON CONVENTIONAL SILICON MATERIAL CELLS. AT A NOMINAL THICKNESS OF 8 MILS (WITHOUT COVERSLIP), EFFICIENCIES AS HIGH AS 10.38 (AMO) AND P/W RATIOS OF 121 WATTS/LB HAVE BEEN ACHIEVED. AT 5 MILS, THE RESPECTIVE NUMBERS ARE 9.58 AND 181 WATTS/LB. EIGHT MIL CELLS WITH 1.5 INTEGRAL COVERSLIPS WERE MADE WITH EFFICIENCIES OF 12.38 (TUNGSTEN - 2800 K) AND P/W RATIOS OF 130 WATTS/LB (TUNGSTEN). (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 807 711 10/2 11/6
RCA LABS PRINCETON N J

ADVANCED THIN-FILM SOLAR CELLS. (U)

DESCRIPTIVE NOTE: FINAL REPT. 16 NOV 65-15 NOV 66,
JAN 67 53P CROSSLEY,PETER A. ;NOEL,
GERALD T. ;PERKINS,DAVID M. ;HUI,WILLIAM L.
C. ;BRODTMAN,KARL ;
CONTRACT: AF 33(615)-3486
PROJ: AF-8173
TASK: 817301
MONITOR: AFAPL TR-67-4

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *SEMICONDUCTING FILMS), GALLIUM ARSENIDES, TRANSPORT PROPERTIES, SUBSTRATES, MASS SPECTROSCOPY, CAPACITANCE, PREPARATION, PROCESSING, LABORATORY FURNACES, IMPURITIES, STABILITY, OXIDES (U)
IDENTIFIERS: ANTIREFLECTION COATINGS, THIN FILMS, THIN FILM ELECTRONICS (U)

DURING THIS CONTRACT THIN-FILM GAAS SOLAR CELLS USING SEMITRANSPARENT PT LAYERS AS THE BARRIER CONTACT HAVE BEEN MADE AND INVESTIGATED TO IMPROVE THEIR PHOTOVOLTAIC CHARACTERISTICS. STUDIES OF THE GAAS FILM, GROWN BY THE OXIDE TRANSPORT PROCESS, AND THE BARRIER CONTACT STRUCTURE, CONSISTING OF THE PT FILM, GRIDDING, AND ANTIREFLECTION COATING, LED TO THE FABRICATION OF A CELL OF 2-SQ CM ACTIVE AREA WITH AN EFFICIENCY OF 3.77 PERCENT UNDER TUNGSTEN LIGHT GIVING AN I(SC) VALUE EQUIVALENT TO THAT OF 1/100 MW SQ CM AIR MASS 1 SUNLIGHT. THE CELL FABRICATION METHODS WHICH WERE DEVELOPED RESULTED IN CELLS THAT EXHIBITED NO DEGRADATION UNDER ROOM AMBIENT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 809 143 10/2
HUGHES AIRCRAFT CO EL SEGUNDO CALIF SPACE SYSTEMS DIV

FLEXIBLE INTEGRATED SOLAR CELL ARRAY. (U)

DESCRIPTIVE NOTE: QUARTERLY REPT. NO. 7, 1 DEC 66-1 MAR 67,
MAR 67 33P DUPONT,PRESTON S. ;
SUENAGA,EIJI L. ;BURNELL,P. ;
REPT. NO. SSD-70123R
CONTRACT: AF 33(615)-2750
PROJ: AF-8173
TASK: 81730-007

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, CONFIGURATION), ENVIRONMENTAL TESTS, TEST METHODS, ACOUSTICS, VIBRATION, SOLAR PANELS, TEMPERATURE, TUNGSTEN, FRACTURE(MECHANICS), GLASS, ALUMINUM, SHOCK(MECHANICS), NOISE (U)
IDENTIFIERS: TITAN 3 (U)

THE SEVENTH QUARTER ACTIVITY DESCRIBED IN THIS REPORT CONSISTS OF THE UPGRADING OF THE MECHANICAL MODEL IN PREPARATION FOR THE TITAN III VIBRATION AND ACOUSTIC NOISE TESTS. SP8B, AN ADVANCED (SOLDERLESS) SOLAR CELL ARRAY, COMPLETE WITH COVERGLASSES, HAS BEEN ASSEMBLED, SUNLIGHT TESTED AT TABLE MOUNTAIN, AND INTEGRATED INTO THE MECHANICAL MODEL DUMMY SOLAR PANEL. SP8A, AN EARLIER SOLAR ARRAY, HAS ALSO BEEN PATCHED INTO THE DUMMY SOLAR PANEL. EFFICIENCY TESTS AT TABLE MOUNTAIN WERE CONDUCTED ON DRIFT-FIELD SOLAR CELLS. SPECTRAL RESPONSE TESTS HAVE BEEN RUN ON THE VARIOUS TYPES OF SOLAR CELLS USED IN THE FISCA PROGRAM. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 813 447 10/2 9/5
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR DIV

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT. (U)

DESCRIPTIVE NOTE: INTERIM PROGRESS REPT. NO. 5, 1 JAN-31 MAR 67,
MAR 67 32P HARDING,W. R. , JR;
CONTRACT: AF 33(615)-3462

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, INTEGRATED CIRCUITS), (*SEMICONDUCTING FILMS, MANUFACTURING), CRYSTALLIZATION, MASKING, ION ENGINES, SILICON, EVAPORATION, DEPOSITION, IMPURITIES, DOPING, SURFACE PROPERTIES, FEASIBILITY STUDIES, OXIDES, PHOSPHORUS, LEAKAGE(ELECTRICAL), INFRARED SPECTROSCOPY, ETCHING, ELECTRICAL RESISTANCE, DIFFUSION (U)
IDENTIFIERS: FABRICATION, METALLIZATION, NEAR INFRARED REGION (U)

A SOLUTION TO THE PROBLEM OF LATERAL ISOLATION OF A SERIES STRING MONOLITHIC SOLAR CELL IS PRESENTED. THE STRUCTURE PRODUCED CELLS WITH OUTPUT VOLTAGES OF 2 VOLTS V MAX AND 7.38 CONVERSION EFFICIENCY UNDER AM=0, 140 MW/SQ CM ILLUMINATION. GOOD CURVE FACTORS AND OUTPUTS WERE DEMONSTATED INDICATING THE FEASIBILITY OF INTERNAL, MONOLITHIC ISOLATION AND INTERCONNECTION. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /Z0MC7

AD- 815 664 10/2
HUGHES AIRCRAFT CO EL SEGUNDO CALIF SPACE SYSTEMS DIV

FLEXIBLE INTEGRATED SOLAR CELL ARRAY. (U)

DESCRIPTIVE NOTE: QUARTERLY REPT. NO. 8, 2 MAR-1 JUN 67,
JUN 67 84P DUPONT,PRESTON S. ;BALLEW, L. ;SUENAGA,EIJI L. ;THOMAS,H. ;TERKUN,V. ;

REPT. NO. SSD-70268R
CONTRACT: AF 33(615)-2750
PROJ: AF-8173
TASK: 81730

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR PANELS, ENVIRONMENTAL TESTS), MODEL TESTS, HUMIDITY, CONFIGURATION, VIBRATION, VISUAL INSPECTION, NOISE, INTENSITY, TEMPERATURE, STORAGE, WEIGHT, REDUCTION (U)
IDENTIFIERS: ARRAYS, SOLAR CELLS, SUNLIGHT (U)

THE EIGHTH QUARTER ACTIVITY DESCRIBED IN THIS REPORT INCLUDED THE COMPLETION OF ENVIRONMENTAL TESTS ON THE FISCA MECHANICAL MODEL, PRELIMINARY QUALIFICATION TESTS ON CONVENTIONAL 2 X 2 CM CELL ARRAY SEGMENTS, HUMIDITY TESTS ON THE SP-1E DENDRITIC CELL ARRAY SEGMENT, AND EFFICIENCY MEASUREMENTS FOR A SAMPLE OF DRIFT-FIELD DENDRITIC CELLS. THREE CANDIDATE DESIGNS WERE ALSO COMPLETED FOR FISCA FLIGHT UNITS. THE MECHANICAL MODEL SUCCESSFULLY PASSED BOTH A VIBRATION AND AN ACOUSTIC NOISE TEST AT TITAN IIIC QUALIFICATION LEVELS. SAMPLE ARRAY SEGMENTS, FABRICATED USING 4 AND 8 MIL THICK, 2 X 2 CM CELLS, ALSO PASSED A TITAN IIIC VIBRATION TEST. A VISUAL INSPECTION AFTER 408 HOURS OF HIGH HUMIDITY EXPOSURE AT ELEVATED TEMPERATURES REVEALED NO DAMAGE TO THE SP-1E ARRAY. ELECTRICAL PERFORMANCE TEST RESULTS ARE NOT YET AVAILABLE. SUNLIGHT PERFORMANCE MEASUREMENTS WERE CONDUCTED AT TABLE MOUNTAIN FOR A SAMPLE OF DENDRITIC DRIFT-FIELD CELLS. A DRIFT-FIELD PRIMARY STANDARD WAS USED AS A REFERENCE. CONVERSION EFFICIENCIES AS HIGH AS 11 PERCENT (AMO, 140 MW/SQ CM, 25 C, 90 PERCENT ACTIVE AREA FACTOR) WERE MEASURED. BASED ON THE CONVENTION OF NOT EXCLUDING COLLECTOR GRIDS FROM THE ACTIVE AREA, THE PEAK EFFICIENCY MEASURED WAS 10.6 PERCENT (I.E., 93 PERCENT ACTIVE AREA FACTOR, AMO, 140 MW/SQ CM, 25 C). (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 817 614 10/2
ION PHYSICS CORP BURLINGTON MASS

THIN SILICON SOLAR CELLS BY ION IMPLANTATION. (U)

DESCRIPTIVE NOTE: FINAL REPT. 25 JAN 66-27 JUN 67,
JUL 67 70P BURRILL,J. T. ;STIRRUP,K.
;
CONTRACT: AF 33(615)-3636
MONITOR: AFAPL TR-67-83

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, SILICON), DENDRITIC STRUCTURE, INFRARED SPECTRA, ACCELERATION, DAMAGE, RADIATION EFFECTS, HANDLING, CERAMIC COATINGS, SURFACE PROPERTIES, CRYSTAL STRUCTURE (U)
IDENTIFIERS: SEMICONDUCTOR JUNCTIONS (U)

THE REPORT DESCRIBES INVESTIGATIONS PERFORMED OVER A 17 MONTH PERIOD ON THE FABRICATION OF THIN N-ON-P SILICON CELLS USING THE ION IMPLANTATION TECHNIQUE. INVESTIGATIONS CONDUCTED UNDER THIS PROGRAM REPRESENT AN EXTENSION OF INVESTIGATIONS CONDUCTED ON CONTRACT AF33(615)-2292 AND PRECEDING CONTRACTS. WORK ON DENDRITIC MATERIAL DEMONSTRATED THAT CELL QUALITY IS ALMOST COMPLETELY DETERMINED BY THE STARTING MATERIAL. ALTHOUGH MATERIAL OF THE HIGHEST QUALITY WAS NOT AVAILABLE FOR USE ON THIS CONTRACT, CELLS WITH AMO EFFICIENCIES OF GREATER THAN 9.4% AND POWER-TO-WEIGHT RATIOS OF GREATER THAN 100 WATTS/LB WERE FABRICATED. THESE VALUES WERE ACHIEVED ON CELLS WHICH HAD THE DENDRITES LEFT ON TO PROVIDE STRUCTURAL RIGIDITY AND FORM PART OF THE ACTIVE AREA. WORK ON CONVENTIONAL MATERIAL HAS DEMONSTRATED THE FEASIBILITY OF FABRICATING SILICON SOLAR CELLS USING A REFLECTING BACK CONFIGURATION. THE USE OF THIS CONTACT WILL ALLOW THINNER, MORE RADIATION RESISTANT CELLS TO BE FABRICATED WITH HIGHER EFFICIENCIES DUE TO THE SECOND PASS OF THE INCIDENT RADIATION THROUGH THE CELL AND THUS AN INCREASED ABSORPTION PATH NEARER THE JUNCTIONS. CELLS DOWN TO 0.004 INCH HAVE BEEN FABRICATED, USING THIS TECHNIQUE, WHICH SHOWED IMPROVED EFFICIENCIES UNDER BOTH TUNGSTEN AND AMO CONDITIONS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /Z0M07

AD- 818 310 10/2
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR DIV

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT. (U)

DESCRIPTIVE NOTE: INTERIM PROGRESS REPT. NO. 6, 1 APR-30 JUN 67,
JUN 67 21P NOWALK,T. P. ;
CONTRACT: AF 33(615)-3462

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, MANUFACTURING), SILICON COATINGS, FREQUENCY MULTIPLIERS, DESIGN, INTERRUPTERS, TUNGSTEN, VOLTAGE CONTROLLED OSCILLATORS (U)

THIS REPORT COVERS THE PROGRESS ON THE HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT. THE INTERNAL INTEGRATED ISOLATION AND INTERCONNECTION DESIGN WAS USED IN FABRICATION OF HVSC ON SILICON WEB. A SERIES CONNECTED ARRAY OF FOUR UNCOATED UNITS, NOT NECESSARILY ADJOINING ONE WITH THE OTHER, YIELDED AN INTEGRATED OUTPUT OF VOC = 2.0 VOLTS AND 5.5 EFFICIENCY UNDER 100 MW/CM SQUARED INCIDENT TUNGSTEN LAMP RADIATION. THE CURVE FACTOR WAS 0.76. PROBLEMS ENCOUNTERED WERE SIMILAR TO THOSE EXPERIENCED ON EQUIVALENT ARRAYS FABRICATED ON SILICON WAFERS. THUS, FEASIBILITY OF THE DESIGN CONCEPT HAS BEEN DEMONSTRATED ON SILICON WEB. SIZE AND WEIGHT OF THE MULTIPLIER PORTION OF THE CONVERTER WERE REDUCED BY A FACTOR OF FIVE BY USING SUBMINIATURE COMPONENTS. CHOPPER OPERATION HAS BEEN DEMONSTRATED AT A FREQUENCY OF 1 MHZ. FINALLY, THE DEVELOPMENT OF A VOLTAGE CONTROLLED OSCILLATOR FOR VOLTAGE REGULATION HAS BEEN INITIATED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 819 491 10/2
HUGHES AIRCRAFT CO EL SEGUNDO CALIF SPACE SYSTEMS DIV

FLEXIBLE INTEGRATED SOLAR CELL ARRAY. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 JUN 65-31 MAY 67,
AUG 67 153P BERRY,L. B. ;BROWN,W. D.
;DAWSON,W. P. ;SUENAGA,E. L. ;
REPT. NO. SSD-70378R
CONTRACT: AF 33(615)-2750
PROJ: AF-8173
TASK: 81730-007
MONITOR: AFAPL TR-67-100

UNCLASSIFIED REPORT

DESCRIPTORS: (•SOLAR PANELS, FLEXIBLE STRUCTURES), (•SOLAR CELLS, AEROSPACE CRAFT), LAUNCHING, PACKAGING, TEST METHODS, AERODYNAMICS, VIBRATION, STRESSES, HALOCARBON PLASTICS, GLASS TEXTILES, GRAVITY, DEFLECTION, CONFIGURATION, MANUFACTURING (U)
IDENTIFIERS: ATLAS, CENTAUR, TITAN 3 (U)

A 2-YEAR RESEARCH AND DEVELOPMENT PROGRAM FOR THE AIR FORCE WAS CONDUCTED TO ACQUIRE THE TECHNOLOGY TO DESIGN AND FABRICATE FLEXIBLE DEPLOYABLE SOLAR CELL ARRAYS THAT ADVANCED THE POWER-TO-WEIGHT RATIO OF PRESENT ARRAYS BY A FACTOR OF THREE. LARGE AREA FLEXIBLE INTEGRATED SOLAR CELL ARRAYS (FISCA) ARE CAPABLE OF COMPACT STOWAGE AND POSITIVE DEPLOYMENT AND RETRACTION. THIS REPORT PRESENTS THE FISCA DEVELOPMENT PROGRAM INCLUDING THE SUBSYSTEM DESIGN AND MECHANICAL SYSTEM TEST CERTIFICATION TO THE ATLAS/CENTAUR AND TITAN III-C LAUNCH ENVIRONMENT. THE FISCA DESIGN WAS EXTENDED TO INCLUDE LARGE AREA SOLAR ARRAYS. A 50-SQUARE-FOOT DEMONSTRATION MODEL CAPABLE OF PRODUCING 500 WATTS IN A NEAR-EARTH ORBIT WAS FABRICATED AND TESTED. TECHNIQUES FOR FABRICATING AND TESTING FLEXIBLE ARRAYS UTILIZING STANDARD 2 BY 2 CM N/P 10-OHM CM SILICON CELLS AS WELL AS 1 BY 30 CM DENDRITIC SILICON CELLS WERE EXAMINED. ALTHOUGH EITHER CELL COULD HAVE BEEN UTILIZED, THE PRIMARY EFFORT WAS FOCUSED ON INCORPORATION OF A GFP 1 BY 30 CM DENDRITIC CELL INTO THE FISCA DEMONSTRATION MODEL. PROOF OF PRINCIPLE HAS BEEN ESTABLISHED AND INDICATES THAT ARRAYS UP TO 20 KILOWATTS IN SIZE ARE ENTIRELY FEASIBLE. FUTURE EFFORT WOULD BE CENTERED AROUND DESIGN, DEVELOPMENT, AND FABRICATION OF A FLIGHT-QUALIFIED 5-KW SYSTEM HAVING A SPECIFIC MASS OF 40 LB/KW OR BETTER. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 820 279 10/2 13/8
GENERAL ELECTRIC CO LYNCHBURG VA POLYCRYSTALLINE SEMICONDUCTOR PRODUCTS BUSINESS SECTION

IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL EFFECTS INVESTIGATION. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL REPT. NO. 2, 1 JUN-31 AUG 67,
AUG 67 50P SCHLOTTERBECK,RICHARD S. ;
CONTRACT: F33615-67-C-1485

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, DESIGN), POWER EQUIPMENT, MANUFACTURING, CADMIUM ALLOYS, TELLURIDES, SUBSTRATES, MOLYBDENUM, WEIGHT, LEAKAGE(ELECTRICAL), HEAT TREATMENT, FILMS, EFFICIENCY, DOPING, ETCHING, COPPER ALLOYS, SOLUBILITY, PLATINUM, SINGLE CRYSTALS (U)
IDENTIFIERS: PROTOTYPE EQUIPMENT, ARRAYS, SOLAR CELLS (U)

SEVERAL ONE SQUARE INCH CELLS HAVE BEEN MADE FROM LIGHT WEIGHT MATERIAL AND 2-12 MICRON CDTE FILMS. THESE CELLS HAD A WEIGHT-TO-AREA RATIO OF 0.022 POUNDS PER SQUARE FOOT AND A POWER-TO-WEIGHT RATIO OF 140 WATTS PER POUND. A GENERALLY NEGATIVE EXPONENTIAL DEPENDENCE OF CELL LEAKAGE CONDUCTANCE ON FILM THICKNESS HAS BEEN OBSERVED. INTERESTING RESULTS HAVE BEEN NOTED ON FILMS GROWN ON MOLY SUBSTRATES TREATED IN A WIDE VARIETY OF DIFFERENT ETCHANTS. ONE PARTICULAR NEW SOLUTION RESULTED IN FILMS WITH ONE-HALF TO ONE-THIRD THE LEAKAGE CONDUCTANCE OF FILMS GROWN ON SUBSTRATES ETCHED BY THE STANDARD SULFATE SOLUTION. SEVERAL PROTOTYPE DESIGNS OF A SINGLE-FEED BOILER ARE BEING EVALUATED. FURTHER STUDIES OF SINGLE VS. DOUBLE TREATMENT, INTERMEDIATE HEAT TREATMENT, DIP TIME AND SOLUTION CONCENTRATION HAVE RESULTED IN REFINEMENTS OF THE CU(+) BARRIER FORMATION PROCESS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOMO7

AD- 822 426 10/2
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR DIV

DENDRITIC SILICON SOLAR CELL OPTIMIZATION AND FABRICATION. (U)

DESCRIPTIVE NOTE: FINAL REPT. 2 AUG 65-14 APR 67,
OCT 67 42P MERRITTS,T. D. ;ERNICK,N.
;ICHIKAWA,Y. ;
CONTRACT: AF 33(615)-3223
PROJ: AF-8173
TASK: 817301
MONITOR: AFAPL TR-67-101

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *SILICON), (*DENDRITIC STRUCTURE, SOLAR CELLS), WEIGHT, REDUCTION, TUNGSTEN, SPECIFICATIONS, THICKNESS, INTENSITY, TEMPERATURE, DIFFUSION, EPITAXIAL GROWTH, SUBSTRATES, DAMAGE, RADIATION EFFECTS, SPECTROPHOTOMETERS, SPUTTERING, OPTIMIZATION, COATINGS, QUARTZ, SILVER COMPOUNDS, TITANIUM (U)

THIS REPORT DESCRIBES THE RESEARCH AND DEVELOPMENT WORK TO OPTIMIZE AND FABRICATE DENDRITIC SILICON SOLAR CELLS IN THE AREAS RELATED TO WEIGHT REDUCTION, PHYSICAL AND ELECTRICAL CHARACTERISTICS, AND RADIATION RESISTANCE. A TOTAL OF 970 DIFFUSED STANDARD CELLS AND 901 EPITAXIAL DRIFT FIELD CELLS OF 1 BY 30.5 CM SIZE WERE FABRICATED. THE EFFICIENCY RANGE OF THE STANDARD CELLS WAS 9.0 TO 13.3 PERCENT WITH A MEAN OF 10.5 PERCENT, AND THE RANGE OF THE DRIFT FIELD CELLS WAS 9.0 TO 12.7 PERCENT WITH A MEAN OF 10.6 PERCENT. THE CELL EFFICIENCIES ARE BASED ON TUNGSTEN 100 MW/SQ CM. PHYSICAL AND ELECTRICAL PROPERTIES BASED ON TYPICAL CELL CHARACTERISTICS RELATED TO ILLUMINATION INTENSITY, SPECTRAL RESPONSE, TEMPERATURE, AND RADIATION RESISTANCE ARE GIVEN. PROCESS SPECIFICATIONS FOR CELL FABRICATION ARE INCLUDED. INTEGRAL QUARTZ COATINGS OF AT LEAST .001 INCH THICKNESS WERE EVALUATED AND ARE DISCUSSED BRIEFLY. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /Z0M07

AD- 822 428 10/2
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR DIV

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT. (U)

DESCRIPTIVE NOTE: INTERIM PROGRESS REPT. NO. 7, 1 JUL-30 SEP 67,
SEP 67 32P NOWALK,T. P. ;
CONTRACT: AF 33(615)-3462

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR PANELS, SILICON), (*SOLAR CELLS, SILICON), VOLTAGE REGULATORS, PROCESSING, MASKING, DIFFUSION, VOLTAGE, EPITAXIAL GROWTH, DOPING, DENDRITIC STRUCTURE, OXIDATION, POWER AMPLIFIERS, PULSE AMPLIFI(U)
IDENTIFIERS: ISOLATORS(ELECTRONICS), MULTIVIBRATORS, PHOTORESIST TECHNIQUES, VOLTAGE MULTIPLIERS (U)

THIS REPORT COVERS THE PROGRESS ON THE HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT. PROCESSING OF TWELVE INCH LONG SILICON WEB WAS PERFORMED. A NUMBER OF MODIFICATIONS RELATED TO THE PHOTOMASKING AND ISOLATION DIFFUSION STEPS WERE INTRODUCED WHICH MADE THIS POSSIBLE. THE LONGEST CELL TESTED CONSISTED OF A 43-UNIT CONTIGUOUS ARRAY WHICH YIELDED VOC = 19.7 VOLTS, ISC = 5.5 MA AND PM = 71.4 MW UNDER 100 SQ CM TUNGSTEN LIGHTS. EFFICIENCY IN THE UNCOATED STATE WAS 3.9% -- EQUIVALENT TO AN ESTIMATED >5% COATED CELL. THUS THE PROGRAM CONCEPT OF THE HIGH VOLTAGE SOLAR CELL HAS BEEN EXTENDED TO PHYSICAL LENGTHS UP TO TWELVE INCHES, AND DEVICES HAVE BEEN TESTED IN ARRAYS WHICH EXCEED SEVEN INCHES IN LENGTH. A POWER CONDITIONING NETWORK CAPABLE OF CONVERTING 50 VDC TO 1000 VDC WITH A 10 WATT POWER CAPABILITY HAS BEEN DEVELOPED USING VOLTAGE MULTIPLIER TECHNIQUES. SYSTEM EFFICIENCY AT FULL LOAD IS APPROXIMATELY 75%. BETTER THAN 5% VOLTAGE REGULATION IS OBTAINED FOR LOADS RANGING FROM 10% OF FULL LOAD TO FULL LOAD. A RATING OF 46 WATTS/LB IS OBTAINED WITH PROTOTYPE BREADBOARD CIRCUIT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 825 455 10/2
GENERAL ELECTRIC CO LYNCHBURG VA POLYCRYSTALLINE
SEMICONDUCTOR PRODUCTS BUSINESS SECTION

IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL
EFFECTS INVESTIGATION. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL REPT. NO. 3, 1
SEP-30 NOV 67,
DEC 67 80P SCHLOTTERBECK,RICHARD S. ;
CONTRACT: F33615-67-C-1485

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, EFFICIENCY), CADMIUM,
TELLURIUM, SILVER, COPPER, SCIENTIFIC RESEARCH,
PLATINUM, PROCESSING, PHOSPHORUS, STABILITY,
PREPARATION, PERFORMANCE(ENGINEERING), ENVIRONMENTAL
TESTS (U)

A SIMPLE AND QUICK PROCEDURE FOR PREPARING AND
TESTING CDTE: CU2TE SOLAR CELLS MADE FROM
SINGLE CRYSTALLINE CDTE IS DESCRIBED. THIS NEW
TECHNIQUE WILL REDUCE THE OVERALL TIME FACTOR FOR
DEVICE PREPARATION AND TEST AND THEREBY INCREASE THE
EFFICIENCY OF RESEARCH INVESTIGATIONS. THE APPLIED
RESEARCH PROGRAM WAS DIRECTED TO STUDIES OF THE
EFFECTS OF SUBSTRATE ETCHING AND PHOSPHORUS DOPING ON
CELL PERFORMANCE. IT HAS BEEN SHOWN THAT THE
FERRICYANIDE ETCH OF THE MOLY SUBSTRATE RESULTS IN
HIGH QUALITY CDTE FILM, WHICH, ON THE AVERAGE,
PRODUCES HIGHER EFFICIENCY (E.G. 4.5% VS. 4.1%)
AND LESS 'LEAKY' CELLS THAN FILM GROWN ON ACID
TREATED SUBSTRATES. A COMPARISON BETWEEN
PHOSPHORUS AND COPPER AS ACCEPTOR DOPANTS IN THE
CDTE FILM SHOWED THAT THE LATTER ELEMENT WAS
SUPERIOR IN TERMS OF CELL ISC AND EFFICIENCY.
EFFICIENCIES IN THE RANGE OF 4.5% TO 5.5% HAVE
BECOME FAIRLY COMMON FOR 1 SQ. IN. CELLS. WITH
LARGER AREAS (1 IN. X 4 IN.), THE VALUES ARE
SOMEWHAT LOWER, NAMELY 3.5% TO 5.0%. SCANNING
OF THE LARGER AREAS IN 1 CM2 'CELL UNITS' HAS CLEARLY
SHOWN THAT MANY PORTIONS OF THE LARGER AREA ARE OVER
5.0% EFFICIENCY. IT IS BELIEVED THAT FURTHER
REFINEMENTS IN THE FILM GROWING PROCESS, RATHER THAN
THE CHOICE OF DOPANTS, IS THE KEY TO ACHIEVING CELL
EFFICIENCIES GREATER THAN THE 5% LEVEL THAT HAS
BEEN DEMONSTRATED IN THE WORK OF THIS QUARTER.
(AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /Z0M07

AD- 828 769 10/2
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT. (U)

DESCRIPTIVE NOTE: FINAL REPT. 3 JAN 66-15 NOV 67,
NOV 67 110P NOWALK,T. F. ;HAJEK,G.
D. ;
CONTRACT: AF 33(615)-3462
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-68-1

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR PANELS, FEASIBILITY STUDIES), MANUFACTURING, MICROELECTRONICS, PERFORMANCE(ENGINEERING), INTEGRATED CIRCUITS, ELECTRICAL PROPERTIES, SILICON, SOLAR CELLS, DC TO DC CONVERTERS (U)
IDENTIFIERS: ELECTRICAL LOADING, ION PROPULSION, SEMICONDUCTOR JUNCTIONS (U)

THE FINAL REPORT SUMMARIZES THE ENTIRE DEVELOPMENT PROGRAM CONDUCTED BY THE WESTINGHOUSE ELECTRIC CORPORATION IN WHICH FEASIBILITY OF FABRICATING HIGH VOLTAGE SOLAR CELL ARRAYS ON 1 CM X 30 CM SILICON WEB WAS DEMONSTRATED, AND A POWER CONDITIONING NETWORK FOR CONVERSION OF 50 VDC TO 1000 VDC WITH A 10 WATT POWER CAPABILITY WAS DEVELOPED USING VOLTAGE MULTIPLIER TECHNIQUES. THE HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT WAS DESIGNED ABOUT A DIFFUSED ISOLATION AND INTERCONNECT STRUCTURE, THE ANALOGUE OF A SERIES ARRAY OF MORE THAN SIXTY INDIVIDUAL CELLS IN THE WELL-KNOWN SHINGLED CONFIGURATION. FABRICATION OF THE MONOLITHIC STRUCTURE REQUIRED DEVELOPMENT OF NEW TECHNIQUES FOR HANDLING TWELVE-INCH PIECES OF SILICON, NOTABLY IN DIFFUSION AND PHOTOMASKING OPERATIONS. THE RESULTANT HIGH VOLTAGE CELLS WERE CHARACTERIZED BY OPEN CIRCUIT VOLTAGES OF 30 VOLTS, SHORT CIRCUIT CURRENTS OF 7 TO 8 MA AND EFFICIENCIES UP TO 7.3% UNDER 100 MA/SQ CM, AMI, TUNGSTEN RADIATION. THUS, THE FINAL SAMPLES DELIVERED TO THE AIR FORCE DEMONSTRATE THE FEASIBILITY OF BUILDING HIGH VOLTAGE SOLAR CELL ARRAY SEGMENTS IN MONOLITHIC STRUCTURES AS PER CONTRACT EXPECTATIONS. THE CELL DESIGN, FABRICATION PROCESS AND TEST RESULTS ARE REVIEWED IN THIS REPORT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 831 536 10/2
GENERAL ELECTRIC CO LYNCHBURG VA

IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL EFFECTS INVESTIGATION. (U)

DESCRIPTIVE NOTE: QUARTERLY REPT. NO. 4, 1 DEC 67-29 FEB 68,
MAR 68 55P SCHLOTTERBECK,RICHARD S. ;
CONTRACT: F33615-67-C-1485

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, CADMIUM COMPOUNDS), (*SOLAR PANELS, CADMIUM COMPOUNDS), TELLURIDES, FILMS, SUBSTRATES, MOLYBDENUM, COPPER, CADMIUM SULFIDES, ADHESION, ELECTRON DIFFRACTION, MICROSCOPY, TRACER STUDIES, EFFICIENCY, GOLD, ENVIRONMENTAL TESTS (U)
IDENTIFIERS: *CADMIUM TELLURIDE, THIN FILMS (U)

BASIC MATERIALS RESEARCH HAS BEEN CONDUCTED IN FOUR GENERAL AREAS AS FOLLOWS: ELECTRON DIFFRACTION AND OPTICAL MICROSCOPY STUDIES, QUANTUM EFFICIENCY MEASUREMENTS VERSUS WAVELENGTH UNDER OPERATING CONDITIONS, DEGRADATION TESTS UNDER CONTROLLED AMBIENT CONDITIONS AND DIFFUSION AND SOLUBILITY MEASUREMENTS USING RADIOACTIVE COPPER. A MAXIMUM EFFICIENCY OF 5.5% (SUNLIGHT INTO ELECTRIC POWER, AMI) WAS CALCULATED ON THE BASIS OF THE SPECTRAL RESPONSE AND I-V CHARACTERISTIC OF A FRESH, 'BARE' SINGLE CRYSTAL CELL. EFFICIENCIES GREATER THAN 6.5% WOULD BE EXPECTED AFTER ALLOWANCES FOR CELL AREA COVERED BY THE CONTACT AND THE USE OF LACQUER AS AN ANTI-REFLECTANCE COATING. A FUNDAMENTAL STUDY OF THE REACTIONS WHICH MAY BE TAKING PLACE ON THE SUBSTRATE HAS BEEN STARTED. RESULTS ARE REPORTED ON THE BEHAVIOR OF BOTH PLATINUM BARRIER AND COPPER BARRIER CELLS IN A VARIETY OF ENVIRONMENTS. EFFICIENCIES OF 5.5% ON ONE SQUARE INCH CELLS HAVE BEEN OBSERVED WITH NO MEASURABLE DETERIORATION AT ROOM TEMPERATURE/DRY AIR OR, IN AIR AT 79% R. H. AREA SCANNING TECHNIQUES ON 60 SQUARE INCHES OF GROWN FILM HAVE DISCLOSED APPROXIMATELY ONE SQUARE INCH AREAS WITH EFFICIENCIES AS HIGH AS 5.8%. MODIFICATIONS IN THE GOLD GRIDDING TECHNIQUE AND EVAPORATION CYCLE HAVE RESULTED IN SIGNIFICANTLY HIGHER CELL EFFICIENCY DISTRIBUTIONS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 831 824 10/2 13/8
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR DIV

INVESTIGATION OF LARGE AREA DENDRITIC WEB TYPE GERMANIUM PHOTOVOLTAIC CELLS. (U)

DESCRIPTIVE NOTE: FINAL REPT. 15 JUL 66-29 DEC 67,
APR 68 72P ERNICK,N. ;MERRITTS,T. D.
;WEHRLI,H. A. ;
CONTRACT: DA-28-043-AMC-02350(E)
PROJ: DA-1T0-14501-A34A
MONITOR: ECOM 02350-F

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, DESIGN), MANUFACTURING, GERMANIUM, CRYSTAL GROWTH, ELECTRICAL RESISTANCE, DIFFUSION, GALLIUM, SOLAR PANELS, FEASIBILITY STUDIES, PERFORMANCE(ENGINEERING), EFFICIENCY, VOLTAGE, ELECTRIC CURRENTS (U)

THIS FINAL REPORT DESCRIBES THE DEVELOPMENT OF A LARGE-AREA THERMOPHOTOVOLTAIC CELL MADE ON GERMANIUM WEB. THE WEB GROWTH PROCESS IS DISCUSSED, INCLUDING THE MODIFICATIONS NECESSARY FOR GROWTH OF N-TYPE WEB OF RESISTIVITY AS LOW AS 0.004 OHM-CM. DEVICES UTILIZING EITHER FRONT OR BACK JUNCTIONS, AND PREPARED EITHER BY ALLOYING OR BY DIFFUSION, WERE PREPARED. OF THESE DEVICES, THE GALLIUM-DIFFUSED FRONT JUNCTION TYPE SHOWED MOST PROMISE AS A THERMOPHOTOVOLTAIC POWER GENERATOR. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 836 612 10/2 13/8
GENERAL ELECTRIC CO LYNCHBURG VA POLYCRYSTALLINE SEMICONDUCTOR PRODUCTS BUSINESS SECTION

IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL EFFECTS INVESTIGATION. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL REPT. NO. 5, 1 MAR-31 MAY 68,
MAY 68 106P SCHLOTTERBECK,RICHARD S. ;
CONTRACT: F33615-67-C-1485

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO QUARTERLY TECHNICAL REPT. NO. 3, AD-825 455.

DESCRIPTORS: (*SOLAR CELLS, MANUFACTURING), CADMIUM COMPOUNDS, TELLURIDES, ENVIRONMENTAL TESTS, EFFICIENCY, STABILITY, TEST METHODS, MATHEMATICAL MODELS, CORRELATION TECHNIQUES, METALLOGRAPHY, SPACE SIMULATION CHAMBERS (U)
IDENTIFIERS: CADMIUM TELLURIDE, GRAPHS(CHARTS) (U)

WORK ON THE BASIC PHYSICS AND CHEMISTRY OF THE CU2TE-CDTE SYSTEM AS WELL AS MEANS FOR DEFINING THE PROPER MEASURING AND EVALUATION PROCEDURES OF ACTUAL CELLS ARE PRESENTED IN DETAIL. SIGNIFICANT CONTRIBUTIONS TOWARDS IMPROVEMENT IN UNDERSTANDING THE MORE FUNDAMENTAL ASPECTS OF THE CDTE SOLAR CELL WERE MADE IN THE FOLLOWING AREAS: USE OF OPTICAL MICROSCOPIC TEC QUES IN ASCERTAINING THE 'METALLOGRAPHY' OF T FILM CELLS; ELECTRON DIFFRACTION STUDIES, MAINTENANCE TESTS, AND DIFFUSION AND SOLUBILITY MEASUREMENTS OF COPPER IN CDTE; AND, SOLAR CELL SPECTRAL RESPONSE MEASUREMENTS. EXTENSIVE STUDIES HAVE ALSO BEEN MADE ON THE EFFECTS ON FILM AND SOLAR CELL CHARACTERISTICS OF THREE MAJOR VARIABLES IN THE FILM GROWTH PROCESS: CONTINUAL CUCL FEED; EFFECT ON NET DONOR CONCENTRATION OF CUCL FEED RATE; AND, EFFECT ON NET DONOR CONCENTRATIONS OF VARIATIONS IN PUMPING SPEED. THE COMBINED EFFECTS OF THE CUCL POWDER FLOW RATE AND THE MEASURED REACTOR PRESSURES HAVE ESTABLISHED AN EMPIRICAL RELATIONSHIP BETWEEN THOSE VARIABLES AND THE NET IMPURITY DENSITY (ND-NA). A NUMBER OF CELL CHARACTERISTICS HAVE BEEN SUCCESSFULLY CORRELATED WITH (ND-NA), AND THE CORRELATION QUALITATIVELY ACCOUNTED FOR BY A PROPOSED THEORETICAL DEVICE MODEL. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 836 663 22/2
HUGHES AIRCRAFT CO EL SEGUNDO CALIF SPACE SYSTEMS DIV

ORIENTATION LINKAGE FOR A SOLAR CELL ARRAY: OL SCA. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 JUL 67-30 JUN 68,
JUL 68 283P TURNER,WILLIAM N. ;OLSON,
MERLE C. ;
REPT. NO. SSD-80221R
CONTRACT: F33615-67-C-1785
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-68-76

UNCLASSIFIED REPORT

DESCRIPTORS: (*SATELLITES(ARTIFICIAL), ATTITUDE CONTROL SYSTEMS), (*ATTITUDE CONTROL SYSTEMS, *SOLAR CELLS), LUBRICATION, MOMENTUM, SUN, DETECTORS, LIFE EXPECTANCY, FEASIBILITY STUDIES, DESIGN (U)

A 12-MONTH PROGRAM WAS CONDUCTED TO DEVELOP THE TECHNOLOGY FOR ACTIVELY ORIENTING 1/2- TO 20-KW SOLAR-CELL ARRAYS ON ACTIVELY AND PASSIVELY STABILIZED EARTH-ORIENTED SATELLITES WITH MISSION LIFETIMES OF 3 TO 5 YEARS. A DETAILED DESIGN FOR LINKAGE CAPABLE OF CARRYING A 5-KW ARRAY WAS DEVELOPED. CONSIDERATION OF THE GENERAL DESIGN REQUIREMENTS LED TO SPECIFICATION OF A TWO-DEGREE-OF-FREEDOM GEARLESS MECHANISM INCORPORATING SUN SENSING, DIRECT SHAFT TORQUING, AND POWER TRANSFER BY SLIPRING/BRUSH ASSEMBLIES. LOAD CONDITIONS AND LIFE REQUIREMENTS ALLOWED INCORPORATION OF DRY-LUBRICATION TECHNIQUES THROUGHOUT. IT IS SHOWN THAT SPECIFICATION OF RELATIVELY SHORT SUN-ACQUISITION TIMES FOR THIS TYPE OF SYSTEM PENALIZES THE DESIGN UNNECESSARILY. IN THE GENERAL CASE, THE MISSION VEHICLE'S CONTROL SYSTEM SHOULD INCLUDE AN ADEQUATE ANGULAR-MOMENTUM STORAGE DEVICE AS WELL AS REACTION-JET ATTITUDE CONTROLS. THE RESIDUAL ATMOSPHERE PRECLUDES OPERATING FOR ANY APPRECIABLE PERIOD IN ORBITS BELOW 400 N. MI. ALTITUDE. SATISFACTORY PERFORMANCE OF DRY, SELF-LUBRICATING COMPOSITES WAS DEMONSTRATED FOR BEARING LUBRICATION AND FOR MOTOR, POWER, AND SIGNAL TRANSFER BRUSHES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /Z0M07

AD- 847 127 10/2 13/8
GENERAL ELECTRIC CO SYRACUSE N Y SPECIAL INFORMATION PRODUCTS DEPT

IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL EFFECTS INVESTIGATION. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO. 6, 1 JUN-31 AUG 68,
SEP 68 28P ALDRICH,R. W. ;MARPLE,D. T. F. ;
CONTRACT: F33615-67-C-1485

UNCLASSIFIED REPORT

DESCRIPTORS: (*CADMIUM COMPOUNDS, SOLAR CELLS), (*SOLAR CELLS, MANUFACTURING), TELLURIDES, COPPER COMPOUNDS, CRYSTAL GROWTH, ULTRAVIOLET SPECTRA, VISIBLE SPECTRA, RESPONSE(BIOLOGY), CALIBRATION, DEPOSITION, EVAPORATION, GOLD, PHOSPHORUS, CRYSTAL DEFECTS, SEMICONDUCTING FILMS, SOLAR PANELS (U)
IDENTIFIERS: CADMIUM TELLURIDES, HETEROJUNCTIONS, SEMICONDUCTOR JUNCTIONS (U)

THE OUTPUT VOLTAGE OF CU2TE:CDTE HETEROJUNCTION CELLS MIGHT BE IMPROVED BY USING INSTEAD A PN HOMOJUNCTION, A METAL:SEMICONDUCTOR BARRIER, OR SOME OTHER TYPE OF HETEROJUNCTION. DURING THE PRESENT QUARTER PHOSPHORUS DIFFUSION HAS BEEN USED TO FORM SHALLOW PN HOMOJUNCTIONS. SOME PHOTORESPONSE WAS NOTED, BUT SEVERE CURRENT LIMITING WAS EXPERIENCED DUE TO HIGH P-REGION SHEET RESISTIVITY. ALSO RE-EXAMINED WAS GOLD:CDTE BARRIERS, FORMED BY BOTH EVAPORATION AND ELECTROLESS DEPOSITION. ONE EVAPORATED GOLD CELL YIELDED UNUSUALLY HIGH OPEN-CIRCUIT VOLTAGE (680 MV), BUT CURRENT (AND EFFICIENCY) WERE RELATIVELY LOW. WORK ON SHORT-CIRCUIT CURRENT IMPROVEMENT CHIEFLY INVOLVED IMPROVING THE AREA UTILIZATION FACTOR FROM ABOUT 89% TO 95%, USING BETTER EVAPORATION MASKS AND HOLD-DOWN TECHNIQUES. AN ATTEMPT WAS MADE TO GAIN EXTRINSIC ABSORPTION OF LIGHT BY GROWING CDSE(X)TE(1-X) MIXED CRYSTAL FILMS, BUT NO INCREASE IN CURRENT WAS NOTED. TWO METHODS FOR CALCULATING SHORT-CIRCUIT CURRENTS AND EFFICIENCIES FROM SPECTRAL RESPONSE DATA ARE GIVEN. A NON-LINEAR RELATIONSHIP BETWEEN OUTPUT CURRENT AND ILLUMINATION INTENSITY IN THIN FILM CELLS WAS NOTED AND A METHOD FOR TAKING THIS INTO ACCOUNT IN EFFICIENCY CALCULATIONS IS GIVEN. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /Z0M07

AD- 850 354 10/2 13/13
HUGHES AIRCRAFT CO EL SEGUNDO CALIF SPACE SYSTEMS DIV

LARGE RETRACTABLE SOLAR CELL ARRAY. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL REPT. NO. 3, 27 DEC 68-23 MAR 69,
APR 69 68P WOLFF,GEORGE ;FELKEL,EDWARD O. ;
REPT. NO. SSD-90112R
CONTRACT: F33615-68-C-1676

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO QUARTERLY TECHNICAL REPT. NO. 2, AD-845 768.

DESCRIPTORS: (*SOLAR PANELS, *EXTENDABLE STRUCTURES), SOLAR CELLS, POWER SUPPLIES, BOOMS(EQUIPMENT), EXPERIMENTAL DESIGN, FLIGHT TESTING, ENVIRONMENTAL TESTS, RELIABILITY (U)
IDENTIFIERS: *LRSCA(LARGE RETRACTABLE SOLAR CELL ARRAY) (U)

THE MAIN ACTIVITY ON THE LARGE RETRACTABLE SOLAR CELL ARRAY (LRSCA) PROGRAM DURING THE THIRD QUARTERLY REPORTING PERIOD CONSISTED OF THE COMPLETION OF THE ANALYSIS OF A MAJORITY OF THE MAJOR SUBSYSTEM COMPONENTS, START OF DETAILED DRAWINGS, COMPLETION OF THE PRELIMINARY QUALIFICATION MODEL DESIGN AND TEST SPECIFICATION, EMC GUIDELINES, FAILURE MODES AND EFFECTS ANALYSIS, MAINTAINABILITY AND RELIABILITY ANALYSIS, AS WELL AS COMPLETION OF THE SOLAR ARRAY TEST BED. DETAILED DESIGN REVIEWS WERE ALSO HELD DURING THIS PERIOD ON THE SOLAR ARRAY, SOLAR ARRAY STORAGE DRUM AND MECHANISM, AND THE ORIENTATION LINKAGE MECHANISM AND CONTROL ELECTRONICS. TEST AND DEVELOPMENT ACTIVITY CONSISTED OF TEST VERIFICATION OF SUBSYSTEM ELEMENTS, SUCH AS THE BOOM LENGTH COMPENSATOR MECHANISM, CELL AND SUBSTRATE MATERIAL PROCESSES, AS WELL AS THE PERFORMANCE OF PANEL TENSION TESTS AT ROOM TEMPERATURE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 852 760 10/2
GENERAL ELECTRIC CO SYRACUSE N Y SEMICONDUCTOR PRODUCTS DEPT

IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL EFFECTS INVESTIGATION. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 MAR 67-1 MAY 69, MAY 69 125P DENEVE,R. J. ;ALDRICH,R. W. ;BLAKE,F. A. ;KRAPF,R. N. ;MARPLE,D. T. F. ;
CONTRACT: F33615-67-C-1485
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-69-32

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *CADMIUM COMPOUNDS), (*SEMICONDUCTING FILMS, *VAPOR PLATING), (*SOLAR PANELS, ENVIRONMENTAL TESTS), TELLURIDES, COPPER, DEGRADATION, HUMIDITY, CADMIUM SULFIDES, INFLATABLE STRUCTURES, EXPANDED PLASTICS, ISOCYANATE PLASTICS, WORK FUNCTIONS, EPITAXIAL GROWTH, SUBSTRATES, ADHESION, INTERFACES (U)
IDENTIFIERS: CADMIUM TELLURIDES (U)

WORK ON VAPOR-REACTED THIN-FILM CDTE SOLAR CELLS IS REPORTED. DEVELOPMENT OF THE BASIC FILM GROWTH PROCESSING AND CELL FABRICATION IS SUMMARIZED. A GENERAL DESCRIPTION OF THE VAPOR REACTION PROCESS FOR GROWING THIN CDTE FILM ON A MOLYBDENUM SUBSTRATE, AS IT WAS USED AT THE BEGINNING OF 1967, IS GIVEN. AMONG THE MAJOR PROBLEMS WORKED ON WERE WEIGHT REDUCTION, ADHERENCE OF FILM TO SUBSTRATE, ELECTRICAL CONTACTS, STABILITY, AND EFFICIENCY. THE RESULTS OF STABILITY TESTS ARE REPORTED, AND MEASUREMENT OF EFFICIENCY AND FACTORS AFFECTING IT ARE DISCUSSED. A RE-EXAMINATION OF METAL: SEMICONDUCTOR BARRIERS RESULTED IN A SUCCESSFUL EFFORT TO BUILD GOLD SCHOTTKY BARRIER CELLS DURING THE FINAL FOUR MONTHS OF THE CONTRACT. FILM GROWTH PARAMETERS AND PROCESSING METHODS WERE EXAMINED, AND EFFICIENCY RESULTS OBTAINED WITH GOLD BARRIER CELLS ARE REPORTED. TECHNIQUES FOR PRODUCING AN INFLATABLE ARRAY OF THIN-FILM SOLAR CELLS WERE STUDIED. METHODS FOR CALCULATING SHORT CIRCUIT CURRENT FROM SPECTRAL RESPONSE DATA AND FOR DETERMINING AM-1 AND AM-0 SOLAR CELL EFFICIENCIES FROM MEASUREMENTS UNDER TUNGSTEN RADIATION ARE GIVEN(U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 854 941 10/2 13/13
HUGHES AIRCRAFT CO EL SEGUNDO CALIF SPACE SYSTEMS DIV

LARGE RETRACTABLE SOLAR CELL ARRAY. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL REPT. NO. 4, 24 MAR-29 JUN 69,
JUL 69 60P FELKEL,EDWARD O. ;WOLFF, GEORGE ;
REPT. NO. SSD-90240R
CONTRACT: F33615-68-C-1676
PROJ: AF-682J

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO QUARTERLY TECHNICAL REPT. NO. 3, AD-850 354.

DESCRIPTORS: (*SOLAR PANELS, *EXTENDABLE STRUCTURES), SOLAR CELLS, POWER SUPPLIES, BOOMS(EQUIPMENT), EXPERIMENTAL DESIGN, FLIGHT TESTING, ENVIRONMENTAL TESTS, RELIABILITY (U)
IDENTIFIERS: *LRSCA(LARGE RETRACTABLE SOLAR CELL ARRAY) (U)

PRESENTED ARE DETAILED DRAWINGS OF THE ORIENTATION MECHANISM IN CORPORATION OF REFERENCE SOLAR CELL AND SOLAR CELL MODULES OF 8 AND 12-MIL CELLS IN THE SOLAR PANEL DESIGN, DETAIL DRAWINGS OF THE DRUM MECHANISM AND SOLAR ARRAY, AND ALL ELECTRONIC CIRCUIT DETAIL DESIGN. BREADBOARDS OF THE SOLAR PANEL SWITCH AND CHARGE CURRENT CONTROLLER WERE BUILT AND TESTED OVER ANTICIPATED ORBITAL TEMPERATURE EXTREMES. (U)
(AUTHOR)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 860 179 10/2 22/2
HUGHES AIRCRAFT CO EL SEGUNDO CALIF SPACE SYSTEMS DIV

LARGE RETRACTABLE SOLAR CELL ARRAY. (U)

DESCRIPTIVE NOTE: QUARTERLY REPT. NO. 5, 30 JUN-28 SEP 69,
OCT 69 62P FELKEL,EDWARD O. ;WOLFF, GEORGE ;OLSON,M. C. ;TURNER,W. N. ;DANIEL, R. E. ;
REPT. NO. SSD-90364R
CONTRACT: F33615-68-C-1676
PROJ: AF-682J

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO QUARTERLY TECHNICAL REPT. NO. 4, AD-854-941.

DESCRIPTORS: (*SOLAR PANELS, EXTENDABLE STRUCTURES), SOLAR CELLS, POWER SUPPLIES, BOOMS(EQUIPMENT), CONTROL SYSTEMS, CIRCUITS, INVERTERS, TELEMETER SYSTEMS, ENVIRONMENTAL TESTS, ELECTRIC MOTORS, DESIGN, RELIABILITY, SPECIFICATIONS, LAUNCH VEHICLES, INTERFA(U)
IDENTIFIERS: AGENA, LARGE RETRACTABLE SOLAR CELL ARRAYS (U)

THE MAIN ACTIVITIES ON THE LARGE RETRACTABLE SOLAR CELL ARRAY(LRSCA) PROGRAM DURING THE FIFTH QUARTERLY REPORTING PERIOD CONSISTED OF COMPLETION OF THE DETAILED DRAWINGS OF THE SOLAR ARRAY, DRUM MECHANISM, AND CONTROL ELECTRONICS UNIT (CEU). CIRCUIT DESIGN OF THE TWO-PHASE, 400 HZ POWER SUPPLY FOR THE EXTENSION/RETRACTION MOTOR HAS BEEN COMPLETED. BREADBOARDS OF THE BOOST/ADD INVERTER, THE 10 KHZ INVERTER, AND THE INSTRUMENTATION CONDITIONING UNIT (ICU) HAVE BEEN BUILT AND FUNCTIONALLY TESTED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 867 390 9/1 10/2 20/12
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

GALLIUM-ARSENIDE PHOTOELECTRIC RECEIVING DEVICES, (U)

FEB 70 21P KORWIN-PAWLOWSKI,MICHAL :
REPT. NO. FTD-HT-23-658-69
PROJ: FTD-6040102

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: EDITED TRANS. OF PRZEGLAD ELEKTRONIKI (POLAND) V10 N3 P105-11^ 1969, BY L. MAROKUS.

DESCRIPTORS: (*PHOTODIODES, GALLIUM ARSENIDES), (*SOLAR CELLS, GALLIUM ARSENIDES), (*VARIABLE RESISTORS, GALLIUM ARSENIDES), PHOTOELECTRIC CELLS(SEMICONDUCTOR), PHOTOCONDUCTIVITY, DAMAGE, RADIATION EFFECTS, SPACE ENVIRONMENTS, ALPHA PARTICLE DETECTORS, POLAND (U)
IDENTIFIERS: *PHOTORESISTORS, TRANSLATIONS (U)

A REVIEW OF THE STATE OF THE ART IN GALIUM ARSENIDE PHOTOELECTRIC DEVICES FOR RADIATION DETECTION AND ENERGY CONVERSION IS MADE, BASED ON RECENT FOREIGN PUBLICATIONS. THE CONSTRUCTION, FABRICATION TECHNIQUES AND PRO PERTIES OF VARIOUS KINDS OF PHOTORESISTORS, PHOTODIODES AND SOLAR CELLS MADE OF GAAS ARE DESCRIBED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /Z0M07

AD- 867 832 11/2 10/2
TEM-PRES RESEARCH/CARBORUNDUM STATE COLLEGE PA

HYDROGEN-IMPREGNATED GLASS COVERS FOR HARDENED SOLAR CELLS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT. 15 NOV 68-15 JAN 70, MAR 70 59P FAILE,SAMUEL P. ;HARDING, WILLIAM R. ;
CONTRACT: F33615-69-C-1221
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-70-12

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, GLASS), (*GLASS, DAMAGE), HARDENING, IMPREGNATION, HYDROGEN, PROTECTION, COLORS, COLOR CENTERS, (U)COLOR CENTERS (U)
IDENTIFIERS: RADIATION HARDENING (U)

THE REPORT SUMMARIZES THE ENTIRE DEVELOPMENT PROGRAM CONDUCTED BY TEM-PRES RESEARCH/ CARBORUNDUM WHICH EXPERIMENTALLY DEMONSTRATED THAT HYDROGEN IMPREGNATION WILL SIGNIFICANTLY REDUCE DARKENING OF SOLAR CELL GLASS COVERS UNDER SOLAR, NUCLEAR, AND VAN ALLEN BELT RADIATION CONDITIONS, AND THAT THIS TECHNIQUE CAN BE PRACTICALLY APPLIED TO HARDENED SOLAR CELL ARRAYS ON FUTURE ORBITAL VEHICLES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 869 460 10/2 18/8
WESTINGHOUSE RESEARCH LABS PITTSBURGH PA

SOLAR CELL NEUTRON DAMAGE INVESTIGATION. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 OCT 68-6 FEB 70, MAY 70 146P HICKS,JOHN M. ;
CONTRACT: F33615-68-C-1616
PROJ: AF-3145
MONITOR: AFAPL TR-70-24

UNCLASSIFIED REPORT

DESCRIPTORS: (•SOLAR CELLS, •DAMAGE), SILICON, EPITAXIAL GROWTH, FAST NEUTRONS, EFFICIENCY, DEGRADATION, (U)DEGRADATION (U)

MULTI-LAYER SILICON SOLAR CELLS OFFER THE POSSIBILITY OF NUCLEAR RADIATION RESISTANCE GREATER THAN THAT OF CONVENTIONAL STATE-OF-ART SINGLE JUNCTION SILICON SOLAR CELLS. EPITAXIALLY-FABRICATED SPECIMENS WERE PREPARED AND STUDIED FOR THEIR PERFORMANCE UNDER FAST NEUTRON IRRADIATION. SEVERAL MULTILAYER SPECIMENS PLUS CONVENTIONAL STATE-OF-ART N/P SPECIMENS WERE EXPOSED TO NEAR-FISSION SPECTRUM NEUTRONS. THE AIR MASS ZERO POWER CONVERSION CHARACTERISTICS WERE EVALUATED DURING INTERRUPTIONS IN THE BOMBARDMENT. EFFICIENCIES OF PRE-PROTOTYPE UNCOATED SPECIMENS WERE AS HIGH AS 6%, AND MONOTONICALLY DECREASED WITH INCREASES IN FLUENCE. SIMILAR DEGRADATION WAS OBSERVED IN THE SHORT-CIRCUIT CURRENT OF THE SPECIMENS. THE EFFICIENCIES AND SHORT CIRCUIT CURRENTS AT ALL FLUENCE VALUES WERE LESS THAN EXPECTED ON THE BASIS OF COMPUTER MODELING STUDIES. AT THE PRESENT TIME, THE PREMATURE DEGRADATION IS ATTRIBUTED TO ARTIFACTS IN THE DEVELOPMENTAL CELLS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 875 751 10/2
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR DIV

SILICON CELL LIFETIME AND EFFICIENCY IMPROVEMENT. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. 15 DEC 68-15 FEB 70,
SEP 70 288P JOHNSON,JOSEPH E. , JR.;
DAVIS,JOHN RANSFORD ;RAI-CHOUDBURY,P. ;
BARRETT,DONALD L. ;
CONTRACT: F33615-68-C-1189
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-70-30

UNCLASSIFIED REPORT

DESCRIPTORS: (•SOLAR CELLS, LIFE EXPECTANCY), PERFORMANCE(ENGINEERING), SEMICONDUCTOR DEVICES, SILICON, TEST METHODS, EPITAXIAL GROWTH, MANUFACTURING, DAMAGE, RADIATION EFFECTS, ELECTRON IRRADIATION, SIMULATION (U)
IDENTIFIERS: ANALOG SIMULATION, CARRIER RECOMBINATION, COMPUTER AIDED DESIGN, COMPUTERIZED SIMULATION, MINORITY CARRIERS, RADIATION HARDENING (U)

THE LOSS THROUGH RECOMBINATION OF MINORITY CARRIERS GENERATED DEEP WITHIN A SILICON SOLAR CELL IS A LIMITATION ON THE EFFICIENCY AND RADIATION RESISTANCE OF PRESENT DEVICES. IN THIS WORK THE AUTHORS HAVE EXPLORED THE POTENTIAL OF MULTIJUNCTION SILICON SOLAR CELLS PREPARED BY DIFFUSION AND EPITAXIAL TECHNIQUES FOR IMPROVED EFFICIENCY AND RADIATION RESISTANCE. TWO-JUNCTION DIFFUSED CELL STRUCTURES WERE FOUND TO OFFER IMPROVED PERFORMANCE FOR VERY THIN WAFERS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 913 278 10/2 18/8
AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB OHIO

NEUTRON IRRADIATION TEST OF EXPERIMENTAL SOLAR CELLS. (U)

DESCRIPTIVE NOTE: PROGRESS REPT.,
JUL 73 48P GRIFFEN,NEIL C. ;WALLIS, ALBERT E. ;
REPT. NO. AFAPL-TR-73-58
PROJ: AF-3145
TASK: 314519

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, DAMAGE), (*SILICON, SOLAR CELLS), NEUTRONS, NUCLEAR EXPLOSION DAMAGE, MILITARY SATELLITES, NUCLEAR RADIATION, HARDENING, DEGRADATION, LITHIUM, DOPING, ANNEALING, TEMPERATURE, NEUTRON FLUX, STABILITY, EFFICIENCY, TABLES(DATA), GRAPHICS, (U)GRAPHICS (U)

NINETY-SEVEN SILICON SOLAR CELLS OF 3 DIFFERENT TYPES WERE EXPOSED TO 5 DIFFERENT NEUTRON FLUENCE LEVELS BETWEEN 1.72 X 10 TO THE 11TH POWER AND 2.47 X 10 TO THE 13TH POWER NEUTRONS/SQ CM (1 MEV EQUIVALENT) IN THE WHITE SANDS MISSILE RANGE EAST BURST REACTOR AND THEN ALLOWED TO ANNEAL AT TEMPERATURES OF 25, 60 AND 80 C FOR APPROXIMATELY 1000 HOURS. PRE AND POST-EXPOSURE MEASUREMENTS WERE TAKEN TO DETERMINE THE AMOUNT OF DEGRADATION DUE TO NEUTRON EXPOSURE AND THE RATE AND EXTENT TO WHICH THE DAMAGE ANNEALED. THE THREE TYPES OF SPECIMENS INCLUDED THE EXPERIMENTAL, SUPER-VIOLET, SILICON CELLS RECENTLY DEVELOPED BY THE COMSAT LABORATORIES, STATE-OF-THE-ART LITHIUM-DOPED SILICON CELLS, AND EXPERIMENTAL BARRIER-LAYER, LITHIUM-DOPED SILICON CELLS. THIS REPORT DOCUMENTS THE TEST PROCEDURES AND RESULTS OF THE EXPERIMENT. THE COMSAT CELLS HAD THE HIGHEST PRE-EXPOSURE EFFICIENCIES BUT AFTER EXPOSURE THE LITHIUM-DOPED CELLS ANNEALED TO SIGNIFICANTLY HIGHER EFFICIENCIES. THE BARRIER-LAYER CELLS HAD LOW INITIAL EFFICIENCIES AND WERE UNSTABLE. EXTENSIVE DATA TAKEN ON THE CELLS IS ON FILE AND MAY BE MADE AVAILABLE FOR FURTHER STUDIES AND ANALYSES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 919 085 10/2 18/6 22/2
AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB OHIO

AN EVALUATION OF A SPACE FLIGHT TEST OF HARDENED SOLAR ARRAY TECHNOLOGY. (U)

DESCRIPTIVE NOTE: FINAL PROJECT REPT. 15 JAN 72-15 APR 73,
MAR 74 79P GREEN,JOHN M. ;
REPT. NO. AFAPL-TR-73-106
PROJ: AF-3145
TASK: 314519

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR PANELS, *RADIATION HARDENING), (*SOLAR CELLS, ARRAYS), NAVIGATION SATELLITES, FLIGHT TESTING, TEST METHODS, TELEMETERING DATA, TEMPERATURE, INTENSITY, VOLTAGE, DIRECT CURRENT, ULTRASONIC WELDING, HONEYCOMB CORES, BONDING, ALUMINUM, LITHIUM, DOPING, COORDINATES, TRANSFORMATIONS, TITANIUM, SILVER (U)
IDENTIFIERS: TRANSIT (U)

ON 2 SEPTEMBER 1972, THE NAVY LAUNCHED A NAVIGATIONAL SATELLITE OF THE TRANSIT SERIES. THIS SATELLITE, WHICH WAS CALLED TRIAD DURING ITS DEVELOPMENT, HAS A RADIOISOTOPE THERMAL GENERATOR (RTG) FOR ITS MAIN POWER SOURCE; HOWEVER, IT HAS AN AUXILIARY POWER SOURCE CONSISTING OF FOUR EXPERIMENTAL HARDENED SOLAR PANEL SEGMENTS. ANOTHER ONE OF THE EXPERIMENTS ON BOARD THE SPACECRAFT IS A SET OF SIX SOLAR CELL MODULES DESIGNATED THE ENVIRONMENTAL SURVEY PANEL (ESP). THIS REPORT WILL DESCRIBE THE PRE-FLIGHT TESTS THAT WERE CONDUCTED ON THE SOLAR POWER EXPERIMENTS, THE RESULTS OF THOSE TESTS, AND THE FLIGHT DATA THAT ARE AVAILABLE. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A000 451 10/2 18/8 22/2
PHILCO-FORD CORP PALO ALTO CALIF WESTERN DEVELOPMENT LABS DIV

REAL TIME ASSESSMENT OF IMPROVED LITHIUM-DOPED SOLAR CELLS. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
JUL 74 228P BRIGGS,DONALD C. ;POLLARD, HOWARD E. ;PETERSON,DARRYL G. ;
CONTRACT: F33615-73-C-2016
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-74-55

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: *SOLAR CELLS, *RADIATION EFFECTS, SILICON, LITHIUM, DOPING, ELECTRON IRRADIATION, NEUTRONS, STRONTIUM, ISOTOPES, NUCLEAR EXPLOSIONS, SPACECRAFT COMPONENTS, REAL TIME (U)

LITHIUM-DOPED SILICON SOLAR CELLS WERE IRRADIATED AT AN ACCELERATED REAL-TIME RATE, WITH A STRONTIUM-90 RADIOISOTOPE SIMULATING THE TRAPPED ELECTRON ENVIRONMENT. THE IRRADIATION WAS PERFORMED FOR A ONE-YEAR PERIOD IN A SIMULATED SPACE ENVIRONMENT. THREE ADVANCED TYPES OF LITHIUM CELLS AND TWO TYPES OF CONVENTIONAL N/P CELLS WERE CONTROLLED TO TEMPERATURES TYPICAL OF NORMAL ORIENTED SOLAR ARRAY SATELLITE OPERATIONAL CONDITIONS. AT THE SIX-MONTH POINT, THE CELLS WERE EXPOSED TO A PULSED NEUTRON ENVIRONMENT SIMULATING A NUCLEAR WEAPON DETONATION. THE EXPERIMENT WAS SUCCESSFUL IN PROVIDING HIGH QUALITY DATA CHARACTERIZING THE COMPARATIVE PERFORMANCE OF SEVERAL SOLAR CELL TYPES. THE EXPERIMENTAL PROGRAM DEMONSTRATED THE ADVANTAGES OBTAINED BY USING RECENT PRODUCTION LITHIUM-DOPED SOLAR CELLS FOR SPACECRAFT MISSIONS REQUIRING NUCLEAR HARDENING. THE FEASIBILITY OF DESIGNING AND PRODUCING SOLAR ARRAYS USING ALUMINUM CONTACT LITHIUM-DOPED SOLAR CELLS HAS BEEN SHOWN TO HAVE DEFINITE ADVANTAGES FOR ARRAYS SUBJECTED TO NEUTRON ENVIRONMENTS. (MODIFIED AUTHOR ABSTRACT) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A001 084 10/2 22/2
TEXAS INSTRUMENTS INC DALLAS SEMICONDUCTOR GROUP

DEVELOPMENT OF VERTICAL MULTIJUNCTION SOLAR CELLS FOR SPACECRAFT PRIMARY POWER. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT. 1 JAN 73-31 MAR 74,
JUN 74 71P SMELTZER,RONALD K. ;HOTZ,
ROD F. ;SHAH,PRADEEP ;
REPT. NO. TI-03-74-15
CONTRACT: F33615-73-C-2019
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-74-45

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: *SOLAR CELLS, *SPACECRAFT COMPONENTS, SILICON, RADIATION RESISTANCE, EPITAXIAL GROWTH, ELECTRON BEAMS, ORIENTATION(DIRECTION), DIFFUSION (U)
IDENTIFIERS: DESIGN, SOLAR ARRAYS (U)

DURING THE FIRST HALF OF THIS PROGRAM TO DEVELOP THE VERTICAL MULTIJUNCTION SOLAR CELL, NEW SILICON TECHNOLOGIES WERE DEVELOPED SO THAT THREE TYPES OF 2000 JUNCTION PER CM PACKING DENSITY, VERTICAL MULTIJUNCTION SOLAR CELLS CAN BE MADE. THE NEW TECHNOLOGIES INCLUDE: (1) LARGE AREA ELECTRON BEAM PATTERN GENERATION, (2) ORIENTATION DEPENDENT ETCHING, (3) EPITAXIAL SILICON REFILL OF DEEP GROOVES, AND (4) DIFFUSION IN DEEP GROOVES. BASED UPON THE TECHNOLOGY DEVELOPMENT ACHIEVED AND THE PROPOSED VMJ CELL DESIGNS, TWO TYPES OF CELLS WERE SELECTED FOR CONTINUING DEVELOPMENT. A FEW PRELIMINARY, LOW EFFICIENCY CELLS WERE FABRICATED. A SMALL MODELING EFFORT WAS ALSO UNDERTAKEN TO ANSWER SPECIFIC QUESTIONS RELEVANT TO CELL FABRICATION. BASED UPON THE RESULTS OBTAINED DURING THIS HALF OF THE PROGRAM, THE VMJ SOLAR CELL, ALTHOUGH REQUIRING VERY ADVANCED FABRICATION TECHNIQUES, IS A VIABLE DEVICE FOR SPACECRAFT POWER IN THE FUTURE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /Z0M07

AD-A002 339 22/2 10/2 18/8
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

THE PROSPERO SOLAR CELL EXPERIMENTS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
JUN 74 20P TREBLE,F. C. ;
REPT. NO. RAE-TR-74061
MONITOR: DRIC BR-41995

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: *SPACECRAFT COMPONENTS, *SOLAR CELLS, *RADIATION EFFECTS, SILICON, CERIUM COMPOUNDS, OXIDES, COATINGS, GREAT BRITAIN (U)
IDENTIFIERS: PHOTOVOLTAIC CELLS, PROSPERO SATELLITE (U)

THE EXPERIMENTS HAVE DEMONSTRATED THE SPACE WORTHINESS AND RADIATION RESISTANCE OF VERY THIN FLEXIBLY-MOUNTED SILICON CELLS AND THE SUPERIORITY OF CERIA-STABILIZED GLASS OVER FUSED SILICON AS A COVERSLIP MATERIAL. THE ACCURACY OF PERFORMANCE AND RADIATION DAMAGE PREDICTIONS BASED ON TERRESTRIAL MEASUREMENTS HAS BEEN ESTABLISHED. THE BEHAVIOR OF THE HEAVILY PRE-IRRADIATED CELLS IN THE COVERSLIP EXPERIMENT APPEARS TO CONFIRM THE RECENTLY DISCOVERED PHOTON DEGRADATION EFFECT IN FLOAT ZONE SILICON OF HIGH DISLOCATION DENSITY. BUT THE EFFECT IS NOT YET EVIDENT IN THE THIN CELLS WHICH WERE NOT PRE-IRRADIATED. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A002 846 10/2 11/2
GENERAL ELECTRIC CO PHILADELPHIA PA SPACE DIV

INTEGRAL GLASS COVERS FOR SILICON SOLAR CELLS. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. 19 MAY 71-31 OCT 74,
OCT 74 70P RAUCH,HARRY W. , SR.;
ULRICH,DONALD R. ;
CONTRACT: F33615-71-C-1656
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-74-14

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: *SOLAR CELLS, *PROTECTIVE COATINGS, *GLASS, RADIATION RESISTANCE, THERMAL EXPANSION, LIGHT TRANSMISSION, FUSION(MELTING), SILICON (U)

A PROGRAM OF INORGANIC GLASS DEVELOPMENT RESULTING IN THE FORMULATION OF NUMEROUS COMPOSITIONS FOR DIRECT FUSION TO SILICON SOLAR CELLS WAS CONDUCTED. THE GLASSES WERE SEDIMENTED AS -200 MESH PARTICLES ONTO THE FRONT SURFACE OF THE SOLAR CELLS, THEN FUSED, TO FORM AN INTEGRAL COVER, AT TEMPERATURES RANGING FROM 510C TO 600C DEPENDING ON SOLAR CELL TYPE AND GLASS COMPOSITION. COATINGS, AT LEAST 50 MICRONS THICK, WERE APPLIED TO BOTH N/P ALUMINUM -CONTACTED AND SILVER/TITANIUM-CONTACTED CELLS. ELECTRICAL CHARACTERIZATION OF THE BARE AND COATED CELLS, BEFORE AND AFTER ELECTRON IRRADIATION, SHOWS THAT SOME CELLS CAN BE INTEGRALLY COVERED BY THIS TECHNIQUE WITHOUT DEGRADING THEIR CONVERSION EFFICIENCY BELOW AN ACCEPTABLE LEVEL. GLASS PREPARATION, COMPOSITIONAL MODIFICATIONS, AND THE EFFECT OF THESE CHANGES ON FUSION TEMPERATURE, RADIATION RESISTANCE, TRANSMISSION, AND THERMAL EXPANSION ARE DISCUSSED. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A003 509 10/2
BOEING CO SEATTLE WASH

REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS), VOLUME III. (U)

DESCRIPTIVE NOTE: FINAL REPT. MAY 71-JUL 74, JUL 74 275P HORNE,W. E. ;GREEGOR,R. B. ;WILKINSON,M. C. ;MADARAS,B. K. ;
REPT. NO. D180-10491-4
CONTRACT: F33615-71-C-1583
MONITOR: AFAPL TR-72-69-VOL-3

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO REPORT DATED OCT 73, AD-774 592.

DESCRIPTORS: *SOLAR CELLS, SILICON, LITHIUM, DOPING, ACCELERATED TESTING, MODELS, DAMAGE, SPACEBORNE, RADIATION EFFECTS, ANNEALING (U)

A TECHNIQUE WAS DEVELOPED FOR THE ACCELERATED EVALUATION OF SILICON SOLAR CELLS TO BE USED IN EXTENDED SPACE MISSIONS DURING WHICH WEAPONS ENVIRONMENTS MAY ALSO BE ENCOUNTERED. STANDARD N/P SILICON CELLS, AS WELL AS LITHIUM-DOPED SILICON CELLS, WERE USED AS TEST SAMPLES DURING THE DEVELOPMENT AND VERIFICATION OF THE EVALUATION METHOD. THE SOLAR CELL DAMAGE MODEL DEVELOPED REPRESENTS A SIGNIFICANT ADVANCEMENT FOR PREDICTING SPACE PERFORMANCE OF SOLAR CELLS. THE MODEL IS CAPABLE OF (1) ACCOUNTING FOR THE SHIELDING OF SOLAR ARRAYS, (2) INTEGRATING OVER THE SPACE ENVIRONMENT FOR BOTH PROTONS AND ELECTRONS, (3) CALCULATING DEFECT DENSITIES AS A FUNCTION OF POSITION INSIDE THE SOLAR CELL, (4) CALCULATING THE OUTPUT I-V CHARACTERISTICS OF SOLAR CELLS UNDER A SOLAR ILLUMINATION SPECTRUM, AND (5) ACCOUNTING FOR ANNEALING IN LITHIUM DOPED P/N SOLAR CELLS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A003 752 22/1 17/7 10/2
AEROSPACE CORP EL SEGUNDO CALIF ENGINEERING SCIENCE OPERATIONS

SHADED SUN SENSOR MODELING FOR SPACECRAFT ACQUISITION PERFORMANCE ANALYSIS, (U)

NOV 74 25P WONG,K. K. ;MANKE,G. M. ;UYEMINAMI,R. T. ;
REPT. NO. TR-0075(5624-02)-1
CONTRACT: F04701-74-C-0075
MONITOR: SAMSO TR-74-261

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: *SATELLITE ATTITUDE, *SOLAR CELLS, *SPACECRAFT COMPONENTS, MATHEMATICAL MODELS, POSITION FINDING (U)
IDENTIFIERS: *SOLAR SENSORS, SPACECRAFT CONTROL, *SATELLITE ATTITUDE CONTROL, SPACECRAFT POSITION INDICATIONS, SOLAR POSITION (U)

THE SUN SENSOR USED IN THE 3-AXIS CONTROL OF A SPACECRAFT IS MODELED, AND ITS EFFECTS ON SUN ACQUISITION PERFORMANCE ARE DEMONSTRATED. THE SENSOR IS MADE UP OF THE COMBINED OUTPUTS OF FOUR DISCRETE SOLAR CELLS ELECTRICALLY CONNECTED IN A MANNER TO ACHIEVE THE CONTROL ERROR SIGNALS. TO PROTECT THESE CELLS FROM INTERFERING REFLECTIONS FROM THE SPACECRAFT BODY, A SHADE SURROUNDING EACH CELL IS ADDED. THE SHADES PRODUCE SIGNIFICANT VARIATIONS IN SENSOR OUTPUTS FROM THE UNSHADED OUTPUTS. ACQUISITION CONTROL STABILITY IS INFLUENCED BY THE INTRODUCTION OF THE SHADE. A SET THEORETIC APPROACH IS USED TO OBTAIN A MODEL OF THE SHADED SENSOR OUTPUT. THIS MODEL IS INCORPORATED IN A RIGID BODY SPACECRAFT SIMULATION, AND SUN ACQUISITION PERFORMANCE IS PRESENTED. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /Z0M07

AD-A004 544 22/2 10/2
AEROSPACE CORP EL SEGUNDO CALIF

SOLAR CELL AND ARRAY STANDARDIZATION FOR AIR FORCE SPACECRAFT, (U)

JUL 74 8P KILLIAN,H. J. ;WADE,E. ; WISE,J. F. ;SAMPSON,H. T. ;
REPT. NO. TR-0075(5901-02)-2
CONTRACT: F04701-74-C-0075
MONITOR: SAMSO TR-74-273

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *SPACECRAFT COMPONENTS, WEIGHT, STANDARDS, MILITARY REQUIREMENTS, COSTS (U)
IDENTIFIERS: SOLAR CELL ARRAYS (U)

EFFORTS HAVE BEEN IN PROGRESS TO EVALUATE AND TO ACCOMPLISH SOLAR CELL AND ARRAY STANDARDIZATION FOR AIR FORCE SPACECRAFT. ANALYSIS RESULTS INDICATE THAT THE ARRAY AREA AND WEIGHT PENALTIES THAT TYPICALLY WOULD BE INVOLVED IN THE USE OF A STANDARD SOLAR CELL MODULE WOULD BE LESS THAN 10%. THE POTENTIAL PAYOFF OF STANDARDIZATION IS COST SAVINGS TO THE AIR FORCE AND IMPROVED SOLAR ARRAY RELIABILITY. COST EXPERIENCE DATA FROM NASA ARE USED TO SHOW THAT LARGE SAVINGS OVER A 12-YEAR PERIOD MIGHT BE POSSIBLE. AN ATTEMPT IS BEING MADE TO STANDARDIZE PROCUREMENT PRACTICES AT THE POWER SYSTEM AND SOLAR ARRAY LEVELS AND TO STANDARDIZE HARDWARE AT THE SOLAR CELL LEVEL. THREE DOCUMENTS HAVE BEEN PREPARED AS PART OF THIS EFFORT: A MILITARY STANDARD FOR THE DESIGN OF SPACE VEHICLES DC POWER SYSTEMS (MIL-STD-1539), A MILITARY SPECIFICATION FOR SOLAR ARRAYS (MIL-S-XXXXX), AND A MILITARY SPECIFICATION FOR SOLAR CELLS (MIL-C-83443). (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /Z0M07

AD-A005 265 10/2 22/2
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

MATHEMATICAL MODELLING OF THE ROYAL AIRCRAFT ESTABLISHMENT (RAE) LIGHTWEIGHT FLEXIBLE SOLAR ARRAY. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
OCT 74 22P PLIMMER,R. N. A. ;
REPT. NO. RAE-TR-74112
MONITOR: DRIC BR-43578

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, ARRAYS, PANELS, ATTITUDE(INCLINATION), SPACECRAFT COMPONENTS, FLEXIBLE STRUCTURES, VIBRATION, MATHEMATICAL MODELS, SATELLITE ATTITUDE, GREAT BRITAIN (U)
IDENTIFIERS: *SOLAR CELL ARRAYS, SPACECRAFT CONTROL, CONTROL SIMULATION (U)

THE PAPER DESCRIBES THE DEVELOPMENT OF A MATHEMATICAL MODEL FOR THE ATTITUDE DYNAMICS OF A SPACECRAFT EQUIPPED WITH A LIGHTWEIGHT FLEXIBLE SOLAR ARRAY. THE THEORY HAS BEEN DEVELOPED USING A CONTINUOUS MECHANICS APPROACH AND A COMPUTER PROGRAM PREPARED TO GENERATE THE LATERAL BENDING MODES OF A SPACECRAFT COMPRISING A RIGID CENTRAL STRUCTURE CARRYING A PAIR OF SOLAR ARRAYS SYMMETRICALLY SITUATED ABOUT THE CENTRAL BODY. FURTHERMORE, THE PROGRAM WILL GENERATE THE EFFECTIVE INERTIA AND MASS AS A FUNCTION OF THE FORCING FREQUENCY. THESE ARE THEN FORMULATED IN THE FORM OF TRANSFER FUNCTIONS WHICH ARE MORE CONVENIENT FOR CONTROL PROBLEM ANALYSIS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A005 918 10/2 20/12
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE VA

LONG WAVE SENSITIVITY OF SOLAR CONVERTERS N-CDS-CU(2-X)S. (U)

NOV 74 8P MARCHENKO,A. I. ;PAVELETS, S. YU. ;FEDORUS,G. A. ;
REPT. NO. FSTC-HT-23-1574-71

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF UKRAINSKII FIZICHESKII ZHURNAL (USSR) V15 N9 P1530-1534 1970.

DESCRIPTORS: *SOLAR CELLS, *CADMIUM SULFIDES, *PHOTOVOLTAIC EFFECT, COPPER COMPOUNDS, SULFIDES, IMPURITIES, SEMICONDUCTOR JUNCTIONS, INFRARED SPECTRA, NEAR INFRARED RADIATION, TRANSLATIONS, USSR (U)
IDENTIFIERS: *COPPER SULFIDES, PHOTOVOLTAIC CONVERSION, HETEROJUNCTIONS (U)

LONG WAVE SENSITIVITY OF SOLAR CONVERTERS N-CDS-CU(2-X)S--TRANSLATION.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /Z0M07

AD-A009 719 1976
ARMY ELECTRONICS COMMAND FORT MONMOUTH N J

LOW COST INJECTION LASER ENGAGEMENT SIMULATOR. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT.,
APR 75 15P GAMMARINO,R. R. ;SCHIEL,E.
J. ;
REPT. NO. ECOM-4308
PROJ: DA-1-S-762703-DH-93

UNCLASSIFIED REPORT

DESCRIPTORS: *GUNFIRE, *SIMULATORS, *INJECTION LASERS, SIMULATION, OPTICAL DETECTORS, TRAINING DEVICES, SOLAR CELLS (U)
IDENTIFIERS: *HIT INDICATORS (U)

A LOW-COST MAN-TO-MAN ENGAGEMENT SIMULATOR IS DESCRIBED IN THIS REPORT. RIFLE FIRE IS SIMULATED BY AN INJECTION LASER TRANSMITTER EMITTING 100 NS PULSES. THE ESSENTIAL COMPONENTS IN THE TRANSMITTER ARE A TRIPLE GAALAS INJECTION LASER STACK WITH A 10 W OUTPUT AT 810 NM, AN SCR DRIVING CIRCUIT, A BATTERY AND A SINGLE LENS (FOCAL LENGTH = 7.5 CM, F/2) FOR BEAM COLLIMATION TO 2 MRAD. THE IL TRANSMITTER IS MOUNTED ON A M-16 RIFLE AND BORESIGHTED WITH THE RIFLE SIGHT. 'HITS' ARE DETECTED BY FOUR SOLAR CELLS MOUNTED ON A HELMET, COVERING A LARGER THAN HEMISPHERICAL FIELD-OF-VIEW. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A010 487 17/9
AEROSPACE CORP EL SEGUNDO CALIF

93 - GHZ RADAR CROSS-SECTION MEASUREMENTS OF SATELLITE ELEMENTAL SCATTERERS, (U)

APR 75 37P DYBDAL,ROBERT B. ;KING, HOWARD E. ;

REPT. NO. TR-0075(5230-40)-4
CONTRACT: F04701-74-C-0075
MONITOR: SAMSO TR-75-127

UNCLASSIFIED REPORT

DESCRIPTORS: *RADAR CROSS SECTIONS, MILLIMETER WAVES, ARTIFICIAL SATELLITES, SPACECRAFT COMPONENTS, SOLAR CELLS, THERMAL INSULATION, SATELLITE ANTENNAS, SCATTERING, EXTREMELY HIGH FREQUENCY (U)

THE RCS OF REPRESENTATIVE SPACECRAFT MATERIALS AND COMPONENTS WAS MEASURED AT 93 GHZ. MEASUREMENTS OF SOLAR CELLS, THERMAL BLANKET MATERIAL, STRUCTURAL COMPONENTS, AND SENSORS ARE INCLUDED. THESE MEASUREMENTS INDICATE THE HIGHLY SPECULAR NATURE OF SCATTERING AT MILLIMETER WAVELENGTHS. THE MEASUREMENTS GENERALLY AGREE WITH RESULTS PREDICTED ON THE BASIS OF COMMON ASYMPTOTIC FORMULATIONS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOMO7

AD-A011 084 22/2 10/2
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

WORK IN UK ON THE APPLICATIONS OF SOLAR CELLS IN SPACE. (U)

DEC 74 16P TREBLE,F. C. ;
REPT. NO. RAE-TR-74159
MONITOR: DRIC BR-44998

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *PHOTOVOLTAIC EFFECT, SCIENTIFIC SATELLITES, SPACECRAFT COMPONENTS, SILICON, CADMIUM SULFIDES, REVIEWS, GREAT BRITAIN (U)
IDENTIFIERS: ARIEL 3 SATELLITE (U)

BRITISH EFFORTS AND ACHIEVEMENTS IN THE FIELD OF PHOTOVOLTAIC SOLAR ENERGY CONVERSION IN SPACE OVER THE PAST 14 YEARS ARE REVIEWED. THE SATELLITES POWERED BY BRITISH SOLAR CELLS ARE LISTED AND THE ARIEL 3 ARRAY IS DESCRIBED IN DETAIL BY WAY OF AN INTRODUCTION TO THE SUBJECT. SILICON CELLS OF CONVENTIONAL THICKNESS HAVE BEEN DEVELOPED TO A CONVERSION EFFICIENCY EXCEEDING 11.5% AND THIN CELLS WITH A SUPERIOR POWER-TO-WEIGHT RATIO HAVE BEEN DEVELOPED AND MANUFACTURED IN PILOT PRODUCTION. OTHER ACHIEVEMENTS ARE A CHEAPER AND BETTER TYPE OF GLASS COVERSLIP, AN ULTRA-THIN INTEGRAL GLASS COATING AND LIGHTWEIGHT FLEXIBLE CADMIUM SULFIDE CELLS. IN ANTICIPATION OF FUTURE MULTIKILOWATT POWER REQUIREMENTS, A PROTOTYPE LIGHTWEIGHT DEPLOYABLE ARRAY EMBODYING ADVANCED CONCEPTS HAS BEEN BUILT AND QUALIFIED FOR PROLONGED OPERATION IN THE GEOSTATIONARY ORBIT. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A013 921 10/2 22/2
GLOBE-UNION INC EL MONTE CALIF CENTRALAB SEMICONDUCTOR DIV

HARDENED VIOLET RESPONSE SILICON SOLAR CELL FOR SATELLITE APPLICATION. (U)

DESCRIPTIVE NOTE: FINAL REPT. JUN 73-APR 75, MAY 75 50P ILES,P. A. ;
CONTRACT: F33615-73-C-2073
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-75-20

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *SILICON, SPACECRAFT COMPONENTS, RADIATION HARDENING, PERFORMANCE TESTS, RADIATION EFFECTS, ELECTRICAL RESISTIVITY, ALUMINUM (U)
IDENTIFIERS: *SPACECRAFT POWER SUPPLIES (U)

THIS CONTRACT INVOLVED DEVELOPMENT OF FURTHER HARDENED VERSIONS OF VIOLET RESPONSE SOLAR CELLS, BY ADDING ALUMINUM CONTACTS, AND BY TESTING THE EFFECTS OF HIGHER RESISTIVITY SILICON. THE CONVENTIONAL VIOLET CELLS IMPROVED STEADILY IN OUTPUT DURING THE CONTRACT (70-79 MW 2X2 CM) THERE WERE DIFFICULTIES IN APPLYING SUITABLE FINE LINE ALUMINUM CONTACTS TO THE SHALLOW DIFFUSED FRONT SURFACE OF THE CELL. THE BEST VIOLET CELLS WITH ALUMINUM CONTACTS WERE ABOUT 10% LOWER IN OUTPUT THAN THE USUAL VIOLET CELLS. RADIATION TESTS SHOWED THAT LOW RESISTIVITY (1-3 OHM-CM) SILICON STILL GAVE BEST OVERALL CELL PERFORMANCE. LIMITED ENVIRONMENTAL TESTS SHOWED THAT THE PERFORMANCE OF VIOLET CELLS WAS SATISFACTORY. MORE INTENSIVE STUDY OF THE OVERALL CONTACT PROPERTIES IS SUGGESTED. VIOLET CELLS WITH BOTH CONVENTIONAL AND ALUMINUM CONTACTS, AND COVERING A DECADE OF BULK RESISTIVITY VALUES, WERE DELIVERED FOR EVALUATION, AND FOR ASSOCIATED TESTS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD-A015 380 20/12 11/6 11/4 10/2
BROWN UNIV PROVIDENCE R I

ANNUAL TECHNICAL REPORT, MATERIALS RESEARCH LABORATORY, JULY 1, 1973-JUNE 30, 1974. (U)

JUN 74 127P

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SPONSORED IN PART BY NATIONAL SCIENCE FOUNDATION, WASHINGTON, D.C. SEE ALSO AD-783 648.

DESCRIPTORS: *SCIENTIFIC RESEARCH, *MATERIALS, PLASTIC DEFORMATION, DISLOCATIONS, LASERS, SOLAR CELLS, FRACTURE(MECHANICS), STRESS STRAIN RELATIONS, STRESS CORROSION, CREEP, METALS, CRACK PROPAGATION, FINITE ELEMENT ANALYSIS, COMPOSITE MATERIALS, SEMICONDUCTORS, GLASS, FLUORIDES, NUCLEAR MAGNETIC RESONANCE (U)

CONTENTS: MICROSCOPIC AND MACROSCOPIC DYNAMIC PLASTICITY; FRACTURE OF SOLIDS; INORGANIC GLASSES; CHEMISORPTION ON METALLIC SURFACES; CHALCOGENIDE MATERIALS; ALLOY DESIGN AND SYNTHESIS OF MICROSTRUCTURES FOR SPECIFIC PROPERTIES; PLASMAS IN SOLIDS; LOW TEMPERATURE PROPERTIES OF MATERIALS; PSEUDO-ONE-DIMENSIONAL CONDUCTORS; GENERAL STUDIES OF MECHANICAL PROPERTIES; MATERIALS FOR SOLAR CELLS; OPTICAL PROPERTIES; MAGNETIC PROPERTIES. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A015 840 10/2 11/2
SIMULATION PHYSICS INC BURLINGTON MASS

STRESS FREE APPLICATION OF GLASS COVERS FOR RADIATION HARDENED SOLAR CELLS AND ARRAYS. (U)

DESCRIPTIVE NOTE: INTERIM REPT. JAN 74-JUN 75,
JUN 75 42P KIRKPATRICK,ALLEN R. ;
MINNUCCI,JOHN A. ;
CONTRACT: F33615-74-C-2001
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-75-54

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *PROTECTIVE COATINGS, *GLASS, RADIATION EFFECTS, HUMIDITY, TEMPERATURE, THERMAL CYCLING TESTS, VACUUM ULTRAVIOLET RADIATION, PROTON BOMBARDMENT, ELECTRON IRRADIATION, RADIATION HARDENING, BONDING, SPACECRAFT COMPONENTS (U)
IDENTIFIERS: *SILICON SOLAR CELLS, BOROSILICATE GLASS (U)

THIS REPORT DESCRIBES THE FIRST SIXTEEN MONTHS OF A TWO AND ONE HALF YEAR PROGRAM TO DEVELOP A PRACTICAL INTEGRAL PROTECTIVE COVER FOR SILICON SOLAR CELLS. THE REPORT DISCUSSES SELECTION OF CORNING 7070 BOROSILICATE GLASS AS AN OPTIMUM COVER MATERIAL AND EXPLAINS THE MECHANICS OF THE ELECTROSTATIC FIELD-ASSISTED BONDING PROCESS USED FOR COVER APPLICATION. EXCELLENT RESULTS HAVE BEEN ACHIEVED FOR MOST SOLAR CELL TYPES. UNDER ENVIRONMENTAL EVALUATIONS AND ELECTRON AND PROTON IRRADIATION TESTS INTEGRALLY COVERED CELLS EXHIBIT PERFORMANCE STATISTICALLY AT LEAST EQUAL TO THAT OF CELLS WITH CONVENTIONAL GLUED COVERS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A015 880 10/2 9/1
HUGHES AIRCRAFT CO EL SEGUNDO CALIF SPACE AND COMMUNICATIONS GROUP

REVERSE CURRENT BLOCKING DIODES FOR FLEXIBLE SOLAR ARRAY PROTECTION. (U)

DESCRIPTIVE NOTE: FINAL REPT. 2 APR 73-14 MAR 75,
APR 75 247P LEVY,E. , JR.;MCGRATH,R.
J. ;
REPT. NO. SCG-50121R
CONTRACT: F33615-73-C-2060
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-75-23

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR PANELS, *SOLAR CELLS, *SEMICONDUCTOR DIODES, *PROTECTIVE EQUIPMENT, FLEXIBLE STRUCTURES, SEMICONDUCTORS, SILICON, VOLTAGE, DIRECT CURRENT, LEAKAGE(ELECTRICAL), MIRRORS, IONIZING RADIATION (U)
IDENTIFIERS: *BLOCKING DIODES, REVERSE CURRENT, MESA STRUCTURES (U)

A UNIQUE SOLAR CELL BLOCKING DIODE FOR USE ON SOLAR PANELS IS DESCRIBED. THE DEVICE HAS THE PHYSICAL CHARACTERISTICS OF A SOLAR CELL AND THE ELECTRICAL PROPERTIES OF CONVENTIONAL DIODES CURRENTLY USED FOR SOLAR ARRAY REVERSE CURRENT ISOLATION AND PROTECTION. THIS COMBINATION OF PHYSICAL CHARACTERISTICS AND ELECTRICAL PROPERTIES PERMITS MOUNTING OF THE DIODE ON THE PANEL SURFACE IN SERIES WITH SOLAR CELLS, AND IS PARTICULARLY USEFUL FOR FLEXIBLE ROLLUP SOLAR ARRAYS. THE DIODE JUNCTION IS DIFFUSED INTO A 1 X 2 CM, 8 MIL THICK, P-DOPED SILICON BLANK. NOMINAL INVERSE VOLTAGE STANDOFF CHARACTERISTICS OF 140 VOLTS AT 1 MA LEAKAGE HAVE BEEN ACHIEVED WITH 20 OHM-CM BASE RESISTIVITY, 6 MICROMETER DIFFUSED JUNCTIONS, AND HEAVY SILICON MONOXIDE LAYERS FOR SURFACE PASSIVATION. TYPICAL FORWARD VOLTAGE DROP AT 0.3/3.0 AMPERES ARE OF THE ORDER OF 0.8/1.2 VOLTS. CONVENTIONAL DIODES EXHIBIT NOMINAL INVERSE VOLTAGE STANDOFF CHARACTERISTICS OF 100 VOLTS AT 25 MICROAMPERES LEAKAGE, AND TYPICAL FORWARD VOLTAGE DROP OF 0.8/1.0 VOLT AT 0.3/3.0 AMPERES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A016 529 22/2 10/2 17/7
AEROSPACE CORP EL SEGUNDO CALIF GUIDANCE AND CONTROL DIV

A GENERAL APPROACH TO THE SHADED SUN SENSOR MODELING PROBLEM WITH AN APPLICATION TO THE FLTSATCOM SHADED SUN SENSORS. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
AUG 75 41P WONG,K. K. ;
REPT. NO. TR-0076(6724-02)-1
CONTRACT: F04701-75-C-0076
MONITOR: SAMSO TR-75-243

UNCLASSIFIED REPORT

DESCRIPTORS: *SATELLITE ATTITUDE, *SOLAR CELLS, SPACECRAFT COMPONENTS, POSITION FINDING, MATHEMATICAL MODELS, COMPUTERIZED SIMULATION (U)
IDENTIFIERS: SHADES, SOLAR SENSORS, SPACECRAFT CONTROL, SATELLITE ATTITUDE CONTROL, SPACECRAFT POSITION INDICATORS, SOLAR POSITION (U)

SUN SENSORS ARE WIDELY USED IN SPACE VEHICLES FOR SUN ACQUISITION OR DETERMINATION OF BODY ATTITUDE RELATIVE TO THE SUN. IN ORDER TO ALLEVIATE UNDESIRABLE REFLECTIONS FROM THE VARIOUS PARTS OF THE VEHICLE, SHADES ARE OFTEN INTRODUCED ABOUT THE SUN SENSITIVE DEVICE. THE ADDED NONLINEARITY IN THE ATTITUDE CONTROL SYSTEM DUE TO THE EFFECT OF SHADING ALTERS THE STABILITY MARGIN AND DEGRADES THE ANALYTICAL RESULTS OBTAINED FROM THE LINEARIZED APPROACH. A GENERAL APPROACH IS PRESENTED IN THIS PAPER ON THE MODELING OF SHADED SUN SENSORS. THE APPROACH APPLIES TO SHADING WALL GEOMETRY AND SOLAR CELLS WHOSE BOUNDARIES CAN BE DESCRIBED OR APPROXIMATED BY A PIECEWISE LINEAR RELATION. THE OUTPUT OF THE CELL, WHICH DEPENDS ON THE SUN ANGLE AND THE SHADE DIMENSIONS, IS A FUNCTION OF THE INTERSECTION OF THE SHADE PATTERN WITH THE CELL AREA. HAVING DEFINED THE SHADE STRUCTURE BY VECTORS FIXED IN THE SENSOR'S COORDINATE FRAME, THE SHADE CONTRIBUTION DUE TO EACH PARTITIONED SHADE STRUCTURE IS CALCULATED SEQUENTIALLY SO THAT IT IS NOT NECESSARY TO DEFINE AN INTEGRAL SHADE PATTERN AND VARIOUS BOUNDARY CONDITIONS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A021 424 10/3 7/5
NAVAL WEAPONS CENTER CHINA LAKE CALIF

EVALUATION OF SOME THIONINE REDOX SYSTEMS AS POTENTIAL REGENERATIVE PHOTOGALVANIC BATTERIES. (U)

FEB 76 25P FINE,DWIGHT A. ;FLETCHER, AARON N. ;

REPT. NO. NWC-TP-5813
PROJ: ZR011-07

UNCLASSIFIED REPORT

DESCRIPTORS: *ELECTROCHEMISTRY, *PHOTOELECTRICITY, *DYES, *SOLAR CELLS, *ETHYLENEDINITRILO TETRAACETATES, PERFORMANCE TESTS, SULFUR HETEROCYCLIC COMPOUNDS, NITROGEN HETEROCYCLIC COMPOUNDS, ENERGY CONVERSION, OXIDATION REDUCTION REACTIONS, ELECTRODES, COBALT COMPOUNDS, ELECTROLYTES, PH FACTOR, CONCENTRATION(CHEMISTRY) (U)
IDENTIFIERS: *PHENAZATHIONIUM/DIAMINO-SULFIDE, *PHOTOGALVANIC CELLS (U)

THIS REPORT SUMMARIZES PRELIMINARY INVESTIGATIONS ON PHOTOELECTRICAL SYSTEMS INVOLVING THIONINE DYE AND INORGANIC REDUCING AGENTS; THESE SYSTEMS OFFER POTENTIAL FOR USE AS PHOTOGALVANIC CELLS IN SOLAR ENERGY CONVERSION. THE REPORT STRESSES THE THIONINE-COBALT(II)ETHYLENE-DIAMINETETRAACETATE (EDTA) SYSTEM, WHICH HAS YIELDED VOLTAGES AND CURRENTS COMPARABLE TO AND IN SOME CASES EXCEEDING THOSE WHICH HAVE BEEN REPORTED FOR THE THIONINE-FE(2+) SYSTEM. MEASUREMENTS ON THE THIONINE-COEDTA(2-) SYSTEM HAVE BEEN CARRIED OUT USING TWO TYPES OF TRANSPARENT ELECTRODE, TIN DIOXIDE AND GOLD/PALLADIUM. EFFECTS OF CONCENTRATION AND AGING ON VOLTAGES ARE REPORTED HERE, AS WELL AS RESULTS OF CLOSED-CIRCUIT MEASUREMENTS UNDER LOAD. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A022 052 10/2
JOHNS HOPKINS UNIV LAUREL MD APPLIED PHYSICS LAB

SPUTTER ION MASS SPECTROMETER ANALYSIS OF COPPER SULFIDE/CADMIUM SULFIDE SOLAR CELL SAMPLES. (U)

DESCRIPTIVE NOTE: TECHNICAL MEMO.,
OCT 75 55P SATKIEWICZ,F. G. ;CHARLES, H. K. , JR
REPT. NO. APL/JHU-TG-1284
CONTRACT: N00017-72-C-4401

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *PHOTOVOLTAIC EFFECT, COPPER COMPOUNDS, CADMIUM SULFIDES, PERFORMANCE TESTS, MASS SPECTROMETRY, ATOMIC SPECTRA, CHEMICAL ANALYSIS, IONS, HETEROJUNCTIONS, SPUTTERING (U)
IDENTIFIERS: *CADMIUM SULFIDE SOLAR CELLS, *SPUTTER ION SOURCE MASS SPECTROMETRY, DESIGN CRITERIA, SIMS TECHNIQUE (U)

THE CAPABILITIES OF THE APPLIED PHYSICS LABORATORY INCLUDE SOLAR SIMULATORS AND CONTROL CELL STANDARDS FOR PROPER TESTING AND EVALUATION OF SOLAR CELL PERFORMANCE, CONTROLLED TEMPERATURE AND ATMOSPHERE FURNACES TO STUDY THE EFFECTS OF AMBIENT GASES (SURFACE EFFECTS) AND IMPURITY DIFFUSION (JUNCTION EFFECTS), AND A SPUTTER ION SOURCE MASS SPECTROMETER (SIMS) THAT CAN PROVIDE BOTH IONIC AND POLYATOMIC SPECIES VERSUS DEPTH PROFILES FOR THE CU2S/CDS SAMPLES. ANALYSIS OF SURFACE SPECIES BEFORE AND AFTER AMBIENT EXPOSURE MAY LEAD TO THE DEVELOPMENT OF EFFECTIVE SURFACE COATINGS. PROFILE DATA THROUGH THE JUNCTION REGION MAY AID IN THE STUDY OF IMPURITY DIFFUSION, WHICH IS BELIEVED TO BE A CHIEF SOURCE OF TEMPERATURE DEGRADATION IN THE CU2S/CDS SYSTEM. AN EXPLORATORY STUDY WAS CONDUCTED TO DETERMINE THE FEASIBILITY OF THE SIMS TECHNIQUE. THIS REPORT SUMMARIZES ITS RESULTS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-AL22 713 10/2 12/1 9/2
JOHNS HOPKINS UNIV LAUREL MD APPLIED PHYSICS LAB

SAS-C SOLAR ARRAY DEPLOYMENT DYNAMICS. (U)

DESCRIPTIVE NOTE: TECHNICAL MEMO.,
AUG 75 67P WILLIAMS,C. E. ;
REPT. NO. APL/JHU/TG-1281
CONTRACT: N00017-72-C-4401

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR PANELS, *EQUATIONS OF MOTION, *COMPUTERIZED SIMULATION, NONLINEAR SYSTEMS, DIGITAL COMPUTERS, DEPLOYMENT, CONFIGURATIONS, PLANAR STRUCTURE, VACUUM CHAMBERS, EXPERIMENTAL DATA, SPACECRAFT, SPINNING(MOTION), DIGITAL SIMULATION (U)
IDENTIFIERS: *SOLAR ARRAYS, UNFOLDING ARRAY, DEPLOYMENT DYNAMICS, SPACECRAFT DESPIN, DESPIN (U)

SAS-C HAS FOUR SEGMENTED SOLAR ARRAYS, EACH CONSISTING OF THREE CONTIGUOUS, SPRING-CONNECTED SOLAR PANELS. ARRAY DEPLOYMENT INVOLVES UNFOLDING FROM AN INVERTED 'N' CONFIGURATION TO AN EXTENDED PLANAR CONFIGURATION. THE DEPLOYMENT DYNAMICS OF THIS TYPE OF MECHANICAL SYSTEM ARE SUCH THAT THE POSSIBILITY OF DAMAGE TO ANY ONE OF THE FOUR SOLAR ARRAYS, BECAUSE OF UNDESIRABLE DEPLOYMENT DYNAMICS, IS QUITE SIGNIFICANT. MINIMIZING THIS POSSIBILITY HAS BEEN THE OBJECTIVE OF AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION. IN THE ANALYTICAL INVESTIGATION, DIGITAL COMPUTER SIMULATIONS WERE USED TO EXAMINE MANY ASPECTS OF THE DEPLOYMENT DYNAMICS. THE SIMULATIONS RESULTED IN A SET OF ARRAY SPRING AND MASS PARAMETERS THAT MINIMIZE DEPLOYMENT DAMAGE POTENTIAL. EXPERIMENTAL INVESTIGATIONS CONSISTED OF SPACECRAFT DESPIN AN ARRAY DEPLOYMENT IN A VACUUM CHAMBER. THE REPORT PRESENTS ANALYTIC AND EXPERIMENTAL RESULTS. ACCEPTABLE AGREEMENT WAS OBTAINED BETWEEN THE VACUUM TEST DATA AND THE DIGITAL SIMULATION. ALL OF THE RESULTS INDICATE THAT THE EXPECTED DEPLOYMENT DYNAMICS ARE ACCEPTABLE FOR FLIGHT. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A025 719 10/2 22/2
TEXAS INSTRUMENTS INC DALLAS SEMICONDUCTOR GROUP

DEVELOPMENT OF VERTICAL MULTIJUNCTION SOLAR CELLS FOR SPACECRAFT PRIMARY POWER. VOLUME II. (U)

DESCRIPTIVE NOTE: FINAL REPT. JUN 74-JUN 75,
NOV 75 54P LLOYD,W. W. ;YEAKLEY,
RICHARD ;FULLER,CLYDE ;MALONE,FARRIS ;
REPT. NO. TI-03-75-41
CONTRACT: F33615-73-C-2019
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-74-45-VOL-2

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO REPORT DATED JUN 74, AD-A001 084.

DESCRIPTORS: *SOLAR CELLS, SPACECRAFT, POWER SUPPLIES, SPACEBORNE, RADIATION HARDENING, LONG WAVELENGTHS, RESPONSE (U)
IDENTIFIERS: *VERTICAL MULTIJUNCTION SOLAR CELLS, SOLAR ARRAYS (U)

BASED ON THE TYPES OF VERTICAL MULTIJUNCTION CELLS DEVELOPED IN THE FIRST HALF OF THIS CONTRACT (REPORT NO. AFAPL-TR-74-45), THE OPEN-GROOVE TYPE CONFIGURATION WAS SELECTED SINCE EARLY CHARACTERIZATION RESULTS SHOWED THE PREDICTED IMPROVEMENTS IN LONG-WAVE RESPONSE AND TOLERANCE TO ELECTRON BOMBARDMENT. IN ADDITION, A PROCESS WAS DEVELOPED THAT CONVERTS THE SURFACE OF THIS CELL INTO AN EFFECTIVE BLACK BODY, WHICH ALSO HAS THE POTENTIAL OF REDUCING THE AREA OF THE COLLECTING JUNCTION. CELLS MADE USING THE BLACK-SURFACE, OPEN-GROOVE STRUCTURE HAVE DEMONSTRATED THAT THE SHORT CIRCUIT CURRENT HAS DROPPED ONLY 13% AFTER EXPOSURE TO 10 TO THE 16TH POWER, MEV ELECTRONS; THE BLUE RESPONSE IS NOT LIMITED BY THE DEEP GROOVES; THE LONG-WAVE RESPONSE CAN BE 30% HIGHER THAN FOR A CONVENTIONAL CELL; ACTUAL EFFICIENCIES OF 9% HAVE BEEN OBTAINED, WITH A CLEAR POTENTIAL OF REACHING 14%. TOGETHER WITH THE SIGNIFICANTLY SIMPLIFIED PROCESSES DEVELOPED FOR THE FABRICATION OF THE CELLS, THESE RESULTS SHOW THAT THE VERTICAL MULTIJUNCTION CELL IS A VIABLE DEVICE FOR SPACECRAFT POWER. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A025 922 10/3
SPECTROLAB INC SYLMAR CALIF

LOW REFLECTIVITY SOLAR CELLS. (U)

DESCRIPTIVE NOTE: FINAL REPT. 31 MAY 74-4 JAN 76,
JAN 76 83P STELLA,PAUL ;AVERY,JAMES ;
SCOTT-MONCK,JOHN ;
REPT. NO. 380-4686F
CONTRACT: F33615-74-C-2044
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-75-98

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *ANTIREFLECTION COATINGS, REFLECTIVITY, REFLECTION, REFLECTANCE, ETCHING, SILICON, QUARTZ, SODIUM, POTASSIUM COMPOUNDS, HYDROXIDES (U)
IDENTIFIERS: *SILICON SOLAR CELLS, SOLAR ENERGY CONVERSION, PHOTOVOLTAIC CONVERSION (U)

TECHNIQUES FOR BOTH REDUCING AND CHANGING SPECULAR REFLECTANCE FROM SILICON SOLAR CELL ASSEMBLIES (CELL AND COVER) WERE DEVELOPED. MECHANICAL AND CHEMICAL TREATMENTS OF QUARTZ CELL COVERS YIELDED SURFACES THAT ACTED LIKE NEARLY PERFECT DIFFUSERS OF INCOMING VISIBLE RADIATION. A FOUR ORDER OF MAGNITUDE REDUCTION IN SPECULAR REFLECTIVITY WAS ACHIEVED IN THIS MANNER. SELECTIVE ETCHES AND MULTIPLE ANTIREFLECTION (AR) COATINGS WERE USED TO REDUCE THE TOTAL REFLECTION FROM THE CELL. ETCHES SUCH AS SODIUM AND POTASSIUM HYDROXIDE REDUCED THE TOTAL REFLECTION OVER THE ENTIRE SILICON CELL SPECTRUM (350-1100 NM) TO BELOW ONE PERCENT, WITH A CORRESPONDING INCREASE IN OUTPUT CURRENT OF NEARLY EIGHT PERCENT OVER CONVENTIONALLY PREPARED SURFACES. SOME DEGRADATION IN FILL FACTOR WAS OBSERVED WITH THE ETCHED SURFACE SO THAT THE CURRENT INCREASE AT THE LOAD VOLTAGE WAS SOMEWHAT LESS THAN AT SHORT CIRCUIT. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A025 923 10/3
AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB OHIO

SOLAR CELL OBSERVABLES REDUCTION TECHNIQUES. (U)

DESCRIPTIVE NOTE: FINAL REPT. SEP 74-OCT 75, APR 76 45P GEIS,JACK W. ;
REPT. NO. AFAPL-TR-76-13
PROJ: AF-3145
TASK: 314519

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, ANTIREFLECTION COATINGS, REFLECTANCE, OPTICAL PROPERTIES, ELECTRICAL PROPERTIES, REFLECTION (U)

AN IN-HOUSE STUDY OF THE OPTICAL AND ELECTRICAL PROPERTIES OF SOLAR CELLS HAS REVEALED THAT IT IS POSSIBLE TO REDUCE THE SPECULAR COMPONENT OF REFLECTED LIGHT INTENSITY BY ABOUT THREE TO FOUR ORDERS OF MAGNITUDE THROUGH PROPER TREATMENT OF THE CELL SURFACE, ELECTRICAL CONTACTS, AND THE COVERGLASS. THE STUDY REVEALED THAT CELL COVERGLASSES MECHANICALLY AND CHEMICALLY TREATED TO PRODUCE A ROUGHENED SURFACE WILL MULTIPLY REFLECT AND DISPERSE INCIDENT LIGHT CAUSING A SIGNIFICANT REDUCTION IN REFLECTED LIGHT INTENSITY. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A025 978 17/2.1 10/2
YUMA PROVING GROUND ARIZ

REMOTE PORTABLE SOLAR POWERED MICROWAVE SYSTEM, (U)

76 10P BOTTONE,ANTHONY G. ;

UNCLASSIFIED REPORT

DESCRIPTORS: *DATA LINKS, *RADIO LINKS, *REMOTE TERMINALS, *SOLAR CELLS, PHOTOVOLTAIC EFFECT, DISCONE ANTENNAS, TELEVISION TRANSMITTERS, DATA RATE, RANGE(DISTANCE), VIDEO SIGNALS, VOICE COMMUNICATIONS, TELEMETERING DATA, RADIO TRANSMITTERS, TEST METHODS (U)

DURING THE PROCESS OF TESTING, DEVELOPMENT, AND EVALUATION OF ARMY MATERIAL, DATA IS OFTEN REQUIRED OR DESIRED TO BE TRANSMITTED FROM REMOTE, ISOLATED OR RUGGED LOCATIONS. PRESENT DAY METHODOLOGY REGARDING COMMUNICATIONS SUPPORT OF THESE REMOTE TESTS AND EVALUATION IS LIMITED IN FLEXIBILITY, MOBILITY, BANDWIDTH, AND APPLICATION. IN ADDITION, THIS PRESENT DAY METHODOLOGY INVOLVES RELIANCE ON FIRM-FIXED OR GENERATOR POWER AND PRESENTS A DRAWBACK OF NOT BEING ABLE TO OPERATE IN REAL-TIME MODES THAT ARE ESSENTIAL IN SUPPORT OF SOME MISSIONS OF THE DEPARTMENT OF THE ARMY. TO SOLVE THE PROBLEMS MENTIONED ABOVE, A COMPARATIVELY INEXPENSIVE, HIGHLY RELIABLE, SELF CONTAINED AND SIMPLE SOLUTION HAS BEEN DEVISED AND SUCCESSFULLY TESTED. A HIGHLY EFFICIENT MICROWAVE TRANSMITTER THAT OPERATES FROM LOW VOLTAGE D.C. POWER HAS BEEN COUPLED WITH A PHOTOVOLTAIC SOLAR ACTIVATED POWER SOURCE (ARRAY OF SOLAR CELLS). THIS COMBINATION, USING A MINIATURE 8 OZ. OMNIDIRECTIONAL DISCONE ANTENNA, TRANSMITTED A 525 LINE TELEVISION PRESENTATION OF A MISSION TEST IN REAL TIME, OVER A DISTANCE OF SEVERAL MILES. THE PORTABLE SOLAR POWERED TERMINAL TOOK APPROXIMATELY 15 MINUTES SET UP TIME, AND OPERATED SUCCESSFULLY FOR THE DURATION OF THE TEST. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A030 529 10/1
NAVAL RESEARCH LAB WASHINGTON D C

NAVY APPLICATIONS FOR TERRESTRIAL PHOTOVOLTAIC SOLAR POWER. (U)

DESCRIPTIVE NOTE: INTERIM REPT.,
SEP 76 39P STATLER,R. L. ;HUBLER,G. K. ;GUENZER,C. S. ;FARADAY,B. J. ;
REPT. NO. NRL-MR-3363
PROJ: NRL-H01-55, RR012-06
TASK: RR012-06-41

UNCLASSIFIED REPORT

DESCRIPTORS: *ENERGY CONVERSION, *PHOTOVOLTAIC EFFECT, *SOLAR ENERGY, *SOLAR CELLS, SOLAR RADIATION, ELECTRIC POWER, COST EFFECTIVENESS, NAVIGATIONAL AIDS, COMMUNICATION EQUIPMENT, SURVEILLANCE (U)

THE U.S. ARMY MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT CENTER (MERDC), FORT BELVOIR HAS BEEN TASKED BY THE ASSISTANT SECRETARY OF DEFENSE (INSTALLATIONS AND LOGISTICS) WITH ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION (ERDA) FUNDS TO PREPARE A DEPARTMENT OF DEFENSE PROPOSAL FOR INSTALLING TERRESTRIAL SOLAR PHOTOVOLTAIC POWER IN DOD OPERATIONAL SYSTEMS. THIS REPORT DESCRIBES A SURVEY MADE BY THE RADIATION EFFECTS BRANCH OF THE RADIATION TECHNOLOGY DIVISION TO IDENTIFY SPECIFIC TERRESTRIAL SOLAR PHOTOVOLTAIC POWER APPLICATIONS APPROPRIATE TO DOD OPERATIONAL SYSTEMS AND FACILITIES. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A030 532 10/2 22/2 20/6
AEROSPACE CORP EL SEGUNDO CALIF CHEMISTRY AND PHYSICS LAB

COMSAT NONREFLECTIVE SOLAR CELL EVALUATION. (U)

DESCRIPTIVE NOTE: INTERIM REPT.,
AUG 76 16P JOSLIN,DAVID E. ;
REPT. NO. TR-0076(6111)-7
CONTRACT: F04701-75-C-0076
MONITOR: SAMSO TR-76-189

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *COMMUNICATION SATELLITES, *RADIATION HARDENING, ANTIREFLECTION COATINGS, EFFICIENCY, SILICON, COLORS, ELECTRICAL RESISTANCE, SHORT CIRCUITS (U)
IDENTIFIERS: NONREFLECTIVE CELLS, SPECTRAL RESPONSE, CAPTURE EFFICIENCY, VIOLET, INTERFERENCE FILTERS (U)

THE NEW COMSAT NONREFLECTIVE CELL IS REPORTED TO HAVE A GREATER AIRMASS-ZERO EFFICIENCY THAN THE COMSAT VIOLET CELL. THE RESULTS OF AN EVALUATION OF SPECTRAL RESPONSE AND DIODE CHARACTERISTICS OF THE NEW SOLAR CELL ARE DESCRIBED IN THIS REPORT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A031 893 10/3 20/5
NAVAL POSTGRADUATE SCHOOL MONTEREY CALIF

EXAMINATION OF LASER-PRODUCED PRESSURE PULSES IN A GALLIUM ARSENIDE SOLAR CELL. (U)

DESCRIPTIVE NOTE: MASTER'S THESIS,
JUN 76 124P JACOBSON,JOHN FRANK I

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *PRESSURE MEASUREMENT, INFRARED PULSES, GALLIUM ARSENIDES, PRESSURE GAGES, CARBON DIOXIDE LASERS, TEA LASERS, IRRADIATION, QUARTZ, GOLD, ABSORPTION, THESES, GERMANIUM, THERMOPILES (U)
IDENTIFIERS: *LASER IRRADIATION (U)

PRESSURE PULSES CAUSED BY IRRADIATION OF A MODEL GALLIUM ARSENIDE SOLAR CELL WITH A CARBON DIOXIDE TEA LASER WERE EXAMINED USING POWER DENSITIES OF THE ORDER OF 10 TO THE 7TH POWER WATTS/SQ CM. THE PRESSURE PULSES WERE MONITORED WITH A SANDIA TYPE QUARTZ PRESSURE GAUGE. IT WAS DISCOVERED THAT THE RELATIVELY LOW POWER DENSITIES USED WERE CAPABLE OF REMOVING THE SILICON DIOXIDE ANTIREFLECTIVE AND GOLD CONTACT LAYERS OF THE SOLAR CELL AFTER ONLY A FEW SHOTS OF THE LASER. AN EXPONENTIAL RELATIONSHIP BETWEEN THE INITIAL THICKNESSES OF THESE LAYERS AND THE PRESSURE PULSE GENERATED IN THE GALLIUM ARSENIDE SUBSTRATE WAS INDICATED FOR GOLD CONTACT LAYERS OF LESS THAN 5000 A THICKNESS. EVIDENCE WAS FOUND THAT THE PRINCIPAL PRESSURE GENERATION MECHANISM IS THERMO-MECHANICAL. GOLD FILMS OF THICKNESS GREATER THAN 5000 A WERE FOUND TO BE ABLE TO ABSORB THE POWER DENSITIES USED WITH NO APPARENT DAMAGE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A034 987 10/2 17/7
COAST GUARD RESEARCH AND DEVELOPMENT CENTER GROTON CONN

LABORATORY EVALUATION OF SOLAR POWER UNITS FOR MARINE AIDS TO NAVIGATION. (U)

DESCRIPTIVE NOTE: INTERIM REPT.,
JUN 76 79P RYBA,JOHN S. INAUS,DAVID A.
REPT. NO. CGR/DC-5/76
MONITOR: USCG D-106-76

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR ENERGY, *POWER SUPPLIES, *NAVIGATIONAL AIDS, *SOLAR PANELS, *SOLAR CELLS, ELECTRIC BATTERIES, PERFORMANCE(ENGINEERING), COAST GUARD, MARKER LIGHTS, VOLTAGE REGULATORS, QUALITY CONTROL, TEMPERATURE, LABORATORY TESTS, PHOTOVOLTAIC EFFECT (U)
IDENTIFIERS: SOLAR ARRAYS, SPECTROLAB ARRAYS (U)

THIS REPORT DESCRIBES THE COAST GUARD EVALUATION OF SOLAR ENERGY AS A POWER SOURCE FOR LIGHTED AIDS TO NAVIGATION. FIFTY-THREE SOLAR POWERED AIDS, ON TEST IN A NATURAL ENVIRONMENT AT GROTON, CONNECTICUT, HAVE BEEN CONTINUOUSLY MONITORED FOR TWO YEARS. SOLAR ARRAYS FROM TWO MANUFACTURERS WERE TESTED WITH NEITHER BEING WHOLLY SATISFACTORY. ONE HAD MAJOR QUALITY CONTROL PROBLEMS WHILE THE OTHER SUFFERED FROM INADEQUATE SEALING. THREE TYPES OF LEAD-ACID BATTERIES USED FOR ENERGY STORAGE HAVE ALL BEEN SATISFACTORY TO DATE. THE TEST HAS INDICATED THE ADVANTAGES OF VOLTAGE REGULATION IN REDUCING WATER USE IN BATTERIES, BUT HAS NOT PROVED THAT REGULATION IS IN FACT REQUIRED FOR LONG BATTERY LIFE. THE INSOLATION MEASURED HAS SHOWN EXCELLENT AGREEMENT WITH THAT PREDICTED USING THE AVERAGES FROM A SURROGATE AREA. ALMOST ALL OF THE ORIGINAL ESTIMATES THAT WERE MADE TO PREDICT SYSTEM PERFORMANCE (BATTERY CAPACITY VS. TIME OF YEAR) PROVED TO BE VERY CONSERVATIVE AND MOST OF THE SYSTEMS PERFORMED BETTER THAN EXPECTED. (AUTHOR) (U)

CORPORATE AUTHOR - MONITORING AGENCY

*ADVANCED RESEARCH PROJECTS AGENCY ARLINGTON VA

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ARPA-80 59
HIGH EFFICIENCY SILICON SOLAR CELLS
AD- 257 454

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ARPA-80 59
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AD- 271 599

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INVESTIGATION OF SINGLE ENERGY GAP SOLAR CELL MATERIAL
AD- 263 861

*AERONAUTICAL SYSTEMS DIV WRIGHT-PATTERSON AFB OHIO

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RESEARCH ON SOLAR-ENERGY CONVERSION EMPLOYING CADMIUM SULFIDE
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APPLIED RESEARCH PROGRAM ON HIGH TEMPERATURE RADIATION RESISTANT SOLAR CELL ARRAY, VOLUME II.
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AD- 274 841

*AEROSPACE CORP EL SEGUNDO CALIF

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*AEROSPACE CORP EL SEGUNDO CALIF CHEMISTRY AND PHYSICS LAB

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AD-A030 532

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SHADED SUN SENSOR MODELING FOR SPACECRAFT ACQUISITION PERFORMANCE ANALYSIS.
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*AEROSPACE CORP EL SEGUNDO CALIF GUIDANCE AND CONTROL DIV

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(SAMSO-TR-75-243)
AD-A016 529

*AEROSPACE CORP EL SEGUNDO CALIF LAB OPERATIONS

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*AEROSPACE RESEARCH LABS WRIGHT-PATTERSON AFB OHIO

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AD- 723 315

*AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB OHIO

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INTEGRAL COVERS FOR SOLAR CELLS.
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AN ANALYSIS OF LOW ORBITAL DRAG CONSTRAINTS OF ORBIT- AND SUN-ORIENTED SOLAR-CELL ARRAYS.
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SOLAR FLAT PLATE THERMOELECTRIC GENERATOR RESEARCH.
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IMPROVED THIN-FILM SOLAR CELLS.
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AFAPL-TR-67-4
ADVANCED THIN-FILM SOLAR CELLS.
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THIN SILICON SOLAR CELLS BY ION IMPLANTATION.
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AFAPL-TR-67-108
FLEXIBLE INTEGRATED SOLAR CELL ARRAY.
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AFAPL-TR-67-101
DENDRITIC SILICON SOLAR CELL OPTIMIZATION AND FABRICATION.
AD- 822 426

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AFAPL-TR-69-32
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AD- 875 751

• • •

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REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS).
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• • •

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REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS).
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• • •

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REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS). VOLUME III.
AD-A003 509

• • •

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THEORETICAL TREATMENT OF THE VERTICAL MULTIJUNCTION SOLAR CELL.
AD- 754 901

• • •

AFAPL-TR-73-3
VERTICAL MULTIJUNCTION SOLAR CELLS.
AD- 760 172

• • •

AFAPL-TR-73-4
LITHIUM-DOPED SILICON SOLAR CELLS STATE-OF-THE-ART.
AD- 764 357

• • •

AFAPL-TR-73-29
ELECTROFORMED ALUMINUM SOLAR CELL CONTRACTS.
AD- 764 816

• • •

AFAPL-TR-73-47
LONG LIFE HARDENED LITHIUM DOPED SILICON SOLAR CELL INVESTIGATION.
AD- 762 941

• • •

AFAPL-TR-73-58
NEUTRON IRRADIATION TEST OF EXPERIMENTAL SOLAR CELLS.
AD- 913 278

• • •

AFAPL-TR-73-106
AN EVALUATION OF A SPACE FLIGHT TEST OF HARDENED SOLAR ARRAY TECHNOLOGY.
AD- 919 085

• • •

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INTEGRAL GLASS COVERS FOR SILICON SOLAR CELLS.
AD-A002 846

• • •

AFAPL-TR-74-45
DEVELOPMENT OF VERTICAL MULTIJUNCTION SOLAR CELLS FOR SPACECRAFT PRIMARY POWER.
AD-A001 084

• • •

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DEVELOPMENT OF VERTICAL MULTIJUNCTION SOLAR CELLS FOR SPACECRAFT PRIMARY POWER. VOLUME II.
AD-A025 719

• • •

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REAL TIME ASSESSMENT OF IMPROVED LITHIUM-DOPED SOLAR CELLS.
AD-A000 451

• • •

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HARDENED VIOLET RESPONSE SILICON SOLAR CELL FOR SATELLITE APPLICATION.
AD-A013 921

• • •

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REVERSE CURRENT BLOCKING DIODES FOR FLEXIBLE SOLAR ARRAY PROTECTION.
AD-A015 880

• • •

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STRESS FREE APPLICATION OF GLASS COVERS FOR RADIATION HARDENED SOLAR CELLS AND ARRAYS.
AD-A015 840

• • •

AFAPL-TR-75-98
LOW REFLECTIVITY SOLAR CELLS.
AD-A025 922

• • •

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SOLAR CELL OBSERVABLES REDUCTION TECHNIQUES.
AD-A025 923

•AIR FORCE CAMBRIDGE RESEARCH LABS HANSCOM AFB MASS

• • •

AFCRL-70-0264
DESIGN AND DEVELOP SOLAR CELLS.
AD- 710 081

• • •

AFCRL-71-0163
RESEARCH IN SOLAR ENERGY CONVERSION.
AD- 726 114

• • •

AFCRL-475
RESEARCH DETECTED TOWARD THE IMPROVEMENT OF THE EFFICIENCY OF SILICON BATTERIES BY UTILIZATION OF UNABSORBED PHOTONS
AD- 257 495

• • •

AFCRL-TR-73-0493
LITHIUM IMPLANTED SOLAR CELLS, DATA.
AD- 772 817

• • •

AFCRL-TR-73-0699
REVIEW AND EVALUATION OF WORK PERFORMED ON ORGANIC SEMICONDUCTOR SOLAR CELLS.
AD- 777 139

• • •

AFCRL-TR-74-0192
INVESTIGATION OF ORGANIC SEMICONDUCTOR FOR PHOTOVOLTAIC APPLICATION.
AD- 781 926

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• • •

AFCRL-72-0045
SOLAR CELL RADATION RESPONSE NEAR THE INTERFACE OF DIFFERENT ATOMIC NUMBER MATERIALS.
AD- 740 577

• • •

AFCRL-PSRP-472
SOLAR CELL RADATION RESPONSE NEAR THE INTERFACE OF DIFFERENT ATOMIC NUMBER MATERIALS.
AD- 740 577

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• • •

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MANUFACTURING METHODS FOR SILICON DENDRITE SOLAR CELLS.
AD- 477 447

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• • •

AFRPL-TR-73-12
ADVANCED ELECTRIC THRUSTER (A SPACE ELECTRIC RAMJET).
AD- 759 290

•ARMY ELECTRONICS COMMAND FORT MONMOUTH N J

• • •

ECOM-02350-F
INVESTIGATION OF LARGE AREA DENDRITIC WEB TYPE GERMANIUM PHOTOVOLTAIC CELLS.
AD- 831 824

• • •

ECOM-3401
SPECTRAL RESPONSE INVESTIGATION OF SILICON PHOTOVOLTAIC CELLS.
AD- 721 888

• • •

ECOM-4308
LOW COST INJECTION LASER ENGAGEMENT SIMULATOR.
AD-A009 719

•ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE VA

• • •

FSTC-HT-23-113-72
HETEROGENEOUS SOLAR CONVERTORS BASED ON POLYCRYSTALLINE CADMIUM SULFIDE AND CADMIUM SELENIDE (GETEROGENNE SOLNECHNE PREOBRAZOVATELI NA OSNOVE POLIKRISTALLICHESKOGO SULFIDA I SELENIDA KADMIYA), ?
AD- 756 594

• • •

FSTC-HT-23-750-72
SOLAR BATTERY-PHOTOVOLTAIC CELL POWER SUPPLY FOR EQUIPMENT (USTROISTVO DLYA PITANIYA POTREBITELEI OT SOLNECHNOI BATAREI S FOTOPREOBRAZOVATELYAMI),
AD- 748 694

• • •

FSTC-HT-23-921-72
SPACE ELECTRIC POWER PLANTS. PART 2,
AD- 756 039

• • •

FSTC-HT-23-923-72
SPACE ELECTRIC POWER PLANTS. PART I (LITSOV K SOLNTSU),
AD- 741 529

• • •

FSTC-HT-23-1014-72
A STUDY OF 'PHOTOVOLT' GENERATOR AT HIGH RADIATION INTENSITY (ISSLEDOVANIE ELEKTRICHESKIKH KHARAKTERISTIK GENERATOROV 'FOTOVOLT' PRI POVYSHENNOI MOSHCHNOSTI IZLUCHENIYA),
AD- 745 364

• • •

FSTC-HT-23-1083-72
HETEROGENEOUS SOLAR CONVERTERS BASED ON POLYCRYSTALLINE CADMIUM SULFIDE AND SELENIDE,
AD- 776 551

• • •

FSTC-HT-23-1433-72
CALCULATION AND COST OPTIMIZATION OF CERTAIN SOLAR GENERATOR THERMOBATTERY PARAMETERS (K RASCHETU I OPTIMIZATSII PO STOIMOSTI NEKOTORYKH PARAMETROV TERMOBATAREI SOLNECHNYKH GENERATOROV),
AD- 759 812

• • •

FSTC-HT-23-1574-71
LONG WAVE SENSITIVITY OF SOLAR CONVERTERS N-CDS-CU(2-X)S,
AD-A005 918

• • •

FSTC-HT-23-1802-72
SOLAR ELEMENTS BASED ON EPITAXIAL GAAS FILMS,
AD- 776 171

• • •

FSTC-HT-23-2027-72
INVESTIGATION OF PHOTOELECTRIC CHARACTERISTICS OF GALLIUM ARSENIDE SOLAR CELLS OVER A WIDE RANGE OF CHANGE IN LIGHT FLUX,
AD- 756 228

• • •

FSTC-HT-23-2032-72
EFFECTIVENESS OF SOLAR CELLS BASED ON CDS-CUZ-XS HETEROJUNCTIONS,
AD- 756 602

•BOEING AEROSPACE CO SEATTLE WASH

• • •

D180-17847-1

BAR GAP RADIATION TEST.
AD- 771 926

•BOEING CO SEATTLE WASH

• • •

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AD- 749 477

• • •

D180-10491-3
REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS). (AFAPL-TR-72-69-VOL-2)
AD- 774 592

• • •

D180-10491-4
REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS). VOLUME III. (AFAPL-TR-72-69-VOL-3)
AD-A003 509

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• • •

INVESTIGATION OF ORGANIC SEMICONDUCTOR FOR PHOTOVOLTAIC APPLICATION. (AFCRL-TR-74-0192)
AD- 781 926

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AD-A015 380

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RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS. (ARL-67-0190)
AD- 661 557

• • •

RESEARCH ON THE OPERATING AND

FAILURE MECHANISMS IN CDS SOLAR CELLS.
(ARL-70-0169)
AD- 722 112

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• • •

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS.
AD- 678 540

• • •

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS.
AD- 678 541

• • •

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS.
AD- 678 542

• • •

IMPROVEMENTS IN CDS THIN FILM SOLAR CELLS.
(ARL-68-0217)
AD- 684 560

• • •

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH EFFICIENCY CDS THIN-FILM SOLAR CELLS.
(ARL-69-0155)
AD- 702 095

• • •

IMPROVEMENTS IN CDS THIN FILM SOLAR CELLS.
(ARL-70-0036)
AD- 707 869

• • •

THIN FILM CDS SOLAR CELL FABRICATION PARAMETER STUDY.
(ARL-70-0099)
AD- 710 636

• • •

IMPROVE-ENTS IN CDS THIN FILM SOLAR CELLS.
(ARL-71-0015)
AD- 723 315

• • •

303280
FABRICATION OF CADMIUM SULFIDE THIN FILM SOLAR CELLS FOR SPACE VEHICLE TESTING.
(ARL-67-0282)
AD- 666 439

•COAST GUARD WASHINGTON D C

• • •

USCG-D-106-76
LABORATORY EVALUATION OF SOLAR POWER UNITS FOR MARINE AIDS TO NAVIGATION.
AD-A034 987

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CGR/DC-5/76
LABORATORY EVALUATION OF SOLAR POWER UNITS FOR MARINE AIDS TO NAVIGATION.
(USCG-D-106-76)
AD-A034 987

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• • •

DRIC-BR-29829
STATUS REPORT ON RAE ADVANCED SOLAR ARRAY DEVELOPMENT.
AD- 755 743

• • •

DRIC-BR-36625
OPTIMIZATION OF SOLAR CELL SHIELDING FOR GEOSTATIONARY MISSIONS.
AD- 773 237

• • •

DRIC-BR-39317
THE RAE LIGHTWEIGHT SOLAR ARRAY.
AD- 777 473

• • •

DRIC-BR-41995
THE PROSPERO SOLAR CELL EXPERIMENTS.
AD-A002 339

• • •

DRIC-BR-43578
MATHEMATICAL MODELLING OF THE ROYAL AIRCRAFT ESTABLISHMENT (RAE) LIGHTWEIGHT FLEXIBLE SOLAR ARRAY.
AD-A005 265

• • •

DRIC-BR-44998
WORK IN UK ON THE APPLICATIONS OF SOLAR CELLS IN SPACE.
AD-A011 084

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• • •

ESD-TR-67-574
PRESENT STATUS OF CADMIUM SULFIDE THIN FILM SOLAR CELLS.
AD- 667 519

• • •

ESD-TR-69-196
PERFORMANCE OF CADMIUM SULFIDE THIN FILM SOLAR CELLS IN A SPACE ENVIRONMENT.
AD- 694 893

• • •

ESD-TR-70-3
BALLOON-FLIGHT INSTRUMENTATION FOR SOLAR-CELL MEASUREMENTS.
AD- 707 134

• • •

ESD-TR-70-119
PRELIMINARY RESULTS FROM THE LES-6 SOLAR CELL EXPERIMENT.
AD- 707 483

• • •

ESD-TR-70-162
SOLAR CELL DEGRADATION EXPERIMENTS ON LES-4 AND -5.
AD- 708 603

• • •

ESD-TR-70-163
SOLAR CELL CALIBRATION EXPERIMENTS ON LES-6.
AD- 708 598

• • •

ESD-TR-70-341
DEGRADATION OF CDS THIN FILM SOLAR CELLS IN DIFFERENT ENVIRONMENTS.
AD- 715 285

• • •

ESD-TR-71-129
COMPARISON OF LOW-ENERGY PROTON DAMAGE IN ION-IMPLANTED AND DIFFUSED SILICON SOLAR CELLS.
AD- 728 186

• • •

ESD-TR-71-260
SOLAR CELL DEGRADATION EXPERIMENTS ON THE LINCOLN LABORATORY LES-6 AND LES-5 SATELLITES.
AD- 731 940

• • •

ESD-TR-71-331
STRUCTURAL FAILURES IN LIGHTWEIGHT SOLAR CELL ARRAYS UNDER THERMAL CYCLING.
AD- 737 161

•ELECTRO-OPTICAL SYSTEMS INC PASADENA CALIF

• • •

CHEMICAL REACTIONS TO CONVERT SOLAR ENERGY INTO POWER SOURCES (ARL-60)
AD- 269 508

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• • •

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PROPERTIES OF P-N JUNCTIONS IN CADMIUM SULFIDE AND CONSTRUCTION OF PHOTOELECTRIC TRANSDUCERS.
AD- 712 936

• • •

FTD-HT-23-658-69
GALLIUM-ARSENIDE PHOTOELECTRIC RECEIVING DEVICES.
AD- 867 390

• • •

FTD-MT-64-204
SILICON SOLAR BATTERIES.
(TT-66-61584)
AD- 634 810

• • •

FTD-TT-64-633
ELECTRIC POWER STATION IN THE COSMOS.
(TT-65 61029)
AD- 610 356

• • •

TT 62 972
SOLAR BATTERIES OF THE FUTURE
AD- 286 578

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DESIGN AND DEVELOP SOLAR CELLS.
(AFCRL-70-0264)
AD- 710 081

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PHOTOVOLTAIC AND THERMOELECTRIC SOLAR ENERGY CONVERSION USING THIN FILMS.
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• • •

RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS.
AD- 421 708

• • •

RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS.
AD- 427 608

• • •

RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS.
AD- 438 526

• • •

RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS.
(AFAPL-TR-65-8)
AD- 611 535

•GENERAL ELECTRIC CO LYNCHBURG VA

• • •

IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL EFFECTS INVESTIGATION.
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• • •

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• • •

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AD- 836 612

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CONFIGURATION STRUCTURE AND SUBSYSTEM ENGINEERING ANALYSIS REPORT. SECTION 7: ELECTRICAL POWER AND DISTRIBUTION SUBSYSTEM ENGINEERING ANALYSIS
AD- 298 759

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INTEGRAL GLASS COVERS FOR SILICON SOLAR CELLS.
(AFAPL-TR-74-14)
AD-A002 846

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• • •

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(AFAPL-TR-69-32)
AD- 852 760

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• • •

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AD- 418 322

• • •

SOLAR FLAT PLATE THERMOELECTRIC GENERATOR RESEARCH.
(AFAPL-TDR-64-87)
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AD- 764 816

• • •

HARDENED VIOLET RESPONSE SILICON SOLAR CELL FOR SATELLITE APPLICATION.
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SOLAR ORIENTING DEVICE FOR EXPANDABLE FLAT-PANEL ARRAY.
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MODULAR DESIGN OF IMPROVED SOLAR CONVERTERS.
AD- 418 154

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HDL-039-3
RADIATION EFFECTS ON SEMICONDUCTOR MATERIALS AND DEVICES.
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AD- 407 525

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INVESTIGATION OF THIN FILM CADMIUM SULFIDE SOLAR CELLS.
(ASD-TDR63 743)
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• • •

INVESTIGATION OF THIN FILM CADMIUM SULFIDE SOLAR CELLS.
AD- 432 192

• • •

INVESTIGATION OF THIN FILM CADMIUM SULFIDE SOLAR CELLS.
AD- 601 459

• • •

INVESTIGATION OF THIN FILM CADMIUM SULFIDE SOLAR CELLS.
AD- 605 425

• • •

INVESTIGATION OF CDS THIN-FILM SOLAR CELLS.
(AFAPL-TR-65-1)
AD- 613 187

• • •

4
RESEARCH ON SOLAR-ENERGY CONVERSION EMPLOYING CADMIUM SULFIDE
(ASD-TDR-62-69)
AD- 284 032

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380-4654
VERTICAL MULTIJUNCTION SOLAR CELLS.
(AFAPL-TR-73-3)
AD- 760 172

•HOFFMAN ELECTRONICS CORP EL MONTE CALIF

• • •

SOLAR ENERGY MEASUREMENT TECHNIQUES
(ASD-TDR62 882)
AD- 400 559

• • •

TN61 156
DESIGN STUDY OF SOLAR ENERGY MEASUREMENT TECHNIQUES.
(ASD-TN61 156)
AD- 281 829

•HOFFMAN ELECTRONICS CORP SANTA BARBARA CALIF

• • •

COATINGS FOR SOLAR CELLS
AD- 258 660

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ELECTRONIC PROPERTIES INFORMATION CENTER

• • •

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CUPROUS SULFIDE AND CUPROUS SULFIDE-CADMIUM SULFIDE HETEROJUNCTIONS.
AD- 734 536

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SPACE AND COMMUNICATIONS GROUP

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SCG-50121R
REVERSE CURRENT BLOCKING DIODES FOR FLEXIBLE SOLAR ARRAY PROTECTION.
(AFAPL-TR-75-23)
AD-A015 880

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SSD-70123R

FLEXIBLE INTEGRATED SOLAR CEI
ARRAY.
AD- 809 143

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SSD-70268R
FLEXIBLE INTEGRATED SOLAR CELL
ARRAY.
AD- 815 669

• • •

SSD-70378R
FLEXIBLE INTEGRATED SOLAR CELL
ARRAY.
(AFAPL-TR-67-100)
AD- 819 491

• • •

SSD-80221R
ORIENTATION LINKAGE FOR A SOLAR
CELL ARRAY: OL SCA.
(AFAPL-TR-68-76)
AD- 836 663

• • •

SSD-90112R
LARGE RETRACTABLE SOLAR CELL
ARRAY.
AD- 850 354

• • •

SSD-90240R
LARGE RETRACTABLE SOLAR CELL
ARRAY.
AD- 854 941

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SSD-90364R
LARGE RETRACTABLE SOLAR CELL
ARRAY.
AD- 860 179

•IIT RESEARCH INST CHICAGO ILL

• • •

1175 10
INVESTIGATION OF SINGLE ENERGY
GAP SOLAR CELL MATERIAL
(ARPA-80 61)
AD- 263 861

•INTERAGENCY DATA EXCHANGE PROGRAM

• • •

IDEP-556.45.00.00-S6-0.
SOLAR PANEL TEST SET.
AD- 707 345

•ION PHYSICS CORP BURLINGTON MASS

• • •

P-N JUNCTION FORMATION
TECHNIQUES
AD- 298 681

• • •

P-N JUNCTION FORMATION
TECHNIQUES.
AD- 428 424

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LONG LIFE HARDENED LITHIUM
DOPED SILICON SOLAR CELL
INVESTIGATION.
(AFAPL-TR-73-97)
AD- 762 941

• • •

ION IMPLANTATION JUNCTION
TECHNIQUES.
AD- 805 907

• • •

THIN SILICON SOLAR CELLS BY ION
IMPLANTATION.
(AFAPL-TR-67-83)
AD- 817 614

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APL/JHU/TG-1281
SAS-C SOLAR ARRAY DEPLOYMENT
DYNAMICS.
AD-A022 713

• • •

APL/JHU-TG-1284
SPUTTER ION MASS SPECTROMETER
ANALYSIS OF COPPER SULFIDE/CADMIUM
SULFIDE SOLAR CELL SAMPLES.
AD-A022 052

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• • •

APL-TG-950
SOLAR CELL POWER SYSTEMS FOR
APL SATELLITES.
AD- 668 149

• • •

APL-TG-1066
DESIGN AND ANALYSIS OF SOLAR
CELL ARRAY CONFIGURATIONS FOR
VERTICALLY STABILIZED SATELLITES IN
NEAR-EARTH ORBITS.

AD- 697 902

• • •

APL-TG-1103
SOLAR PANEL TEST SET.
(IDEP-556.45.00.00-S6-01)
AD- 707 345

• • •

CF-3028
SOME EFFECTS OF ELECTRON
IRRADIATION AND TEMPERATURE ON
SOLAR CELL PERFORMANCE.
AD- 651 013

• • •

CF-3077
EFFECTS OF PASSIVE ATTITUDE
CONTROL ON SOLAR POWER SYSTEMS.
AD- 622 483

• • •

TG-886
RADIATION DAMAGE TO ORBITING
SOLAR CELLS AND TRANSISTORS.
AD- 657 155

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• • •

LITHIUM IMPLANTED SOLAR CELLS,
DATA.
(AFCRL-TR-73-0493)
AD- 772 817

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P 63 20
DIRECT ENERGY CONVERSION IN THE
USSR. SOLAR CELL RESEARCH
AD- 297 389

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AN ANALYSIS OF NON-UNIFORM
PROTON IRRADIATION DAMAGE IN
SILICON SOLAR CELLS.
AD- 649 672

• • •

LMSC-3-54-69-8
IRRADIATION OF SOLAR CELL SUB-
PANELS WITH 0.8 MEV ELECTRONS.
AD- 467 694

• • •

LMSD-5137
GAMMA RADIATION EFFECTS IN SILICON SOLAR CELLS,
AD- 477 592

• • •

LMSD-48351
RADIATION EFFECTS IN SILICON SOLAR CELLS. PART II.
AD- 801 717

•LOCKHEED MISSILES AND SPACE CO PALO ALTO CALIF RESEARCH LABS

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LMSC-3-56-65-4
PROTON AND ELECTRON IRRADIATION OF N/P SILICON SOLAR CELLS,
AD- 487 633

•LOCKHEED MISSILES AND SPACE CO SUNNYVALE CALIF

• • •

2 52 61 2
SOLAR REGENERATIVE CHEMICAL SYSTEM
AD- 274 481

• • •

LMSD 703735 I
PROTON DAMAGE TO SOLAR CELLS
AD- 265 213

•MALLORY (P R) AND CO INC BURLINGTON MASS

• • •

CELL EQUALIZATION TECHNIQUES.
(RTD-TDR63 4187)
AD- 427 070

•MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

• • •

JA-3359
PERFORMANCE OF CADMIUM SULFIDE THIN FILM SOLAR CELLS IN A SPACE ENVIRONMENT.
(ESD-TR-69-196)
AD- 694 893

• • •

JA-3779
COMPARISON OF LOW-ENERGY PROTON DAMAGE IN ION-IMPLANTED AND DIFFUSED SILICON SOLAR CELLS.
(ESD-TR-71-129)
AD- 728 186

• • •

JA-3835
STRUCTURAL FAILURES IN LIGHTWEIGHT SOLAR CELL ARRAYS UNDER THERMAL CYCLING.
(ESD-TR-71-331)
AD- 737 161

• • •

JA-3895
SOLAR CELL DEGRADATION EXPERIMENTS ON THE LINCOLN LABORATORY LES-4 AND LES-5 SATELLITES.
(ESD-TR-71-260)
AD- 731 940

• • •

MS-2427
SOLAR CELL DEGRADATION EXPERIMENTS ON LES-4 AND -5.
(ESD-TR-70-162)
AD- 708 603

• • •

MS-2428
SOLAR CELL CALIBRATION EXPERIMENTS ON LES-6.
(ESD-TR-70-163)
AD- 708 598

• • •

MS-2810B
PRELIMINARY RESULTS FROM THE LES-6 SOLAR CELL EXPERIMENT.
(ESD-TR-70-119)
AD- 707 483

• • •

TN-1967-52
PRESENT STATUS OF CADMIUM SULFIDE THIN FILM SOLAR CELLS.
(ESD-TR-67-574)
AD- 667 519

• • •

TN-1970-33
DEGRADATION OF CDS THIN FILM SOLAR CELLS IN DIFFERENT ENVIRONMENTS.
(ESD-TR-70-341)
AD- 715 285

• • •

TR-476
BALLOON-FLIGHT INSTRUMENTATION FOR SOLAR-CELL MEASUREMENTS.
(ESD-TR-70-3)
AD- 707 134

•MOUNT VERNON RESEARCH CO ALEXANDRIA VA

• • •

SOLAR SPECTRUM SIMULATOR. SPACE ENVIRONMENT SIMULATOR FOR TESTING SOLAR CELLS
AD- 262 005

•NATIONAL CASH REGISTER CO DAYTON OHIO

• • •

INVESTIGATION OF CHEMICALLY SPRAYED THINFILM PHOTOVOLTAIC CELLS.
AD- 609 209

•NATIONAL CENTER FOR ENERGY MANAGEMENT AND POWER PHILADELPHIA PA

• • •

REVIEW AND EVALUATION OF WORK PERFORMED ON ORGANIC SEMICONDUCTOR SOLAR CELLS.
(AFCRL-TR-73-0699)
AD- 777 139

•NAVAL POSTGRADUATE SCHOOL MONTEREY CALIF

• • •

EXAMINATION OF LASER-PRODUCED PRESSURE PULSES IN A GALLIUM ARSENIDE SOLAR CELL.
AD-A031 893

•NAVAL RESEARCH LAB WASHINGTON D C

• • •

NRL-6091
ELECTRON-BOMBARDMENT DAMAGE IN SILICON SOLAR CELLS.
AD- 608 213

• • •

NRL-6333
RADIATION DAMAGE IN SILICON SOLAR CELLS FROM 4.6-MEV PROTON BOMBARDMENT.
AD- 623 440

• • •

NRL-MR-3363

NAVY APPLICATIONS FOR TERRESTRIAL PHOTOVOLTAIC SOLAR POWER.
AD-A030 529

•NAVAL WEAPONS CENTER CHINA LAKE CALIF

• • •

NWC-TP-5813
EVALUATION OF SOME THIONINE REDOX SYSTEMS AS POTENTIAL REGENERATIVE PHOTOGALVANIC BATTERIES.
AD-A021 429

•NORTHEASTERN UNIV BOSTON MASS

• • •

RESEARCH IN SOLAR ENERGY CONVERSION.
(AFCRL-71-0163)
AD- 726 114

•NORTHROP RESEARCH AND TECHNOLOGY CENTER HAWTHORNE CALIF

• • •

NRTC-72-16R
RADIATION EFFECTS ON SEMICONDUCTOR MATERIALS AND DEVICES.
(NDL-039-3)
AD- 759 946

•PHILCO-FORD CORP PALO ALTO CALIF WESTERN DEVELOPMENT LABS DIV

• • •

REAL TIME ASSESSMENT OF IMPROVED LITHIUM-DOPED SOLAR CELLS.
(AFAPL-TR-74-55)
AD-A000 451

•RADIO CORP OF AMERICA PRINCETON N J DEFENSE ELECTRONIC PRODUCTS

• • •

SOLAR CELL ARRAY OPTIMIZATION (ASD-TR61 11)
AD- 270 131

• • •

APPLIED RESEARCH PROGRAM ON HIGH-TEMPERATURE RADIATION-RESISYANT SOLAR-CELL ARRAY
AD- 287 570

• • •

SOLAR CELL ARRAY OPTIMIZATION
AD- 295 558

• • •

APPLIED RESEARCH PROGRAM ON HIGH-TEMPERATURE RADIATION-RESISTANT SOLAR-CELL ARRAY
AD- 296 367

• • •

APPLIED RESEARCH PROGRAM ON HIGH TEMPERATURE RADIATION RESISTANT SOLAR CELL ARRAY, VOLUME I.
(ASD-TDR63 516)
AD- 411 257

• • •

APPLIED RESEARCH PROGRAM ON HIGH TEMPERATURE RADIATION RESISTANT SOLAR CELL ARRAY, VOLUME II.
(ASD-TDR63 516)
AD- 428 634

• • •

AED-1556
APPLIED RESEARCH PROGRAM ON HIGH-TEMPERATURE RADIATION-RESISTANT SOLAR-CELL ARRAY.
AD- 282 219

• • •

AED R2043
APPLIED RESEARCH PROGRAM ON HIGH-TEMPERATURE RAD IATION-RESISTANT SOLAR-CELL ARRAY.
AD- 412 654

• • •

TR61 11 V2
SOLAR CELL ARRAY OPTIMIZATION, VOLUME II
(ASD-TR61 11 V2)
AD- 274 841

•RADIO CORP OF AMERICA SOMERVILLE N J

• • •

GALLIUM ARSENIDE SOLAR CELL PRODUCTION PROCESSES AND TECHNIQUES
AD- 293 831

•RCA LABS PRINCETON N J

• • •

ADVANCED THIN-FILM SOLAR CELLS.
(AFAPL-TR-67-4)
AD- 807 711

•RCA LABS DIV RADIO CORP OF AMERICA PRINCETON N J

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IMPROVED THIN-FILM SOLAR CELLS.
(AFAPL-TR-65-123)
AD- 476 696

•RESEARCH AND TECHNOLOGY DIV BOLLING AFB D C

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RTD-TDR63 40 30
DENDRITIC SILICON SOLAR CELL PANEL.
AD- 429 136

• • •

RTD-TDR63 4187
CELL EQUALIZATION TECHNIQUES.
AD- 427 070

•ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

• • •

RAE-TR-68191
THE ION ENGINE AND LARGE SOLAR ARRAY FOR THE X5 SPACECRAFT.
AD- 682 888

• • •

RAE-TR-68268
CALCULATED EFFICIENCIES OF PRACTICAL GAAS AND SI SOLAR CELLS INCLUDING THE EFFECT OF BUILD-IN ELECTRIC FIELDS.
AD- 694 117

• • •

RAE-TR-69006
ENVIRONMENTAL ASSESSMENT OF THIN SILICON SOLAR CELLS FROM PILOT PRODUCTION.
AD- 691 506

• • •

RAE-TR-69007
LARGE SOLAR ARRAY DEVELOPMENT IN U. K.
AD- 691 587

• • •

RAE-TR-69044
A STUDY OF AMERICAN RADIATION RESISTANT 'LITHIUM' SOLAR CELLS.
AD- 691 631

• • •

RAE-TR-69046
TYPE APPROVAL TEST REPORT ON FERRANTI SOLAR CELLS FOR THE BLACK ARROW X3 SPACECRAFT.
AD- 698 927

• • •

RAE-TR-69126
ON THE INFRA-RED RESPONSE OF SILICON SOLAR CELLS AS A FUNCTION OF THICKNESS.
AD- 696 850

• • •

RAE-TR-72109
STATUS REPORT ON RAE ADVANCED SOLAR ARRAY DEVELOPMENT.
(DRIC-BR-29829)
AD- 755 743

• • •

RAE-TR-73105
OPTIMIZATION OF SOLAR CELL SHIELDING FOR GEOSTATIONARY MISSIONS.
(DRIC-BR-36625)
AD- 773 237

• • •

RAE-TR-73172
THE RAE LIGHTWEIGHT SOLAR ARRAY.
(DRIC-BR-39317)
AD- 777 473

• • •

RAE-TR-74061
THE PROSPERO SOLAR CELL EXPERIMENTS.
(DRIC-BR-41995)
AD-A002 339

• • •

RAE-TR-74112
MATHEMATICAL MODELLING OF THE ROYAL AIRCRAFT ESTABLISHMENT (RAE) LIGHTWEIGHT FLEXIBLE SOLAR ARRAY.
(DRIC-BR-43578)
AD-A005 265

• • •

RAE-TR-74159
WORK IN UK ON THE APPLICATIONS OF SOLAR CELLS IN SPACE.
(DRIC-BR-44998)
AD-A011 084

• • •

RAE-TR-SPACE-319
ON THE INFRA-RED RESPONSE OF SILICON SOLAR CELLS AS A FUNCTION OF THICKNESS.
AD- 696 850

• • •

TR-65026
THE EFFECT OF 4 MEV ELECTRONS ON COVERED BRITISH SILICON SOLAR CELLS.
AD- 462 346

•SIMULATION PHYSICS INC BURLINGTON MASS

• • •

STRESS FREE APPLICATION OF GLASS COVERS FOR RADIATION HARDENED SOLAR CELLS AND ARRAYS.
(AFAPL-TR-75-54)
AD-A015 840

•SPACE AND MISSILE SYSTEMS ORGANIZATION LOS ANGELES CALIF

• • •

SAMSO-TR-68-368
NEUTRON DAMAGE TO SILICON SOLAR CELLS.
AD- 676 976

• • •

SAMSO-TR-70-407
LOW - ENERGY PROTON DAMAGE TO SILICON/ SOLAR CELLS.
AD- 715 261

• • •

SAMSO-TR-74-261
SHADED SUN SENSOR MODELING FOR SPACECRAFT ACQUISITION PERFORMANCE ANALYSIS.
AD-A003 752

• • •

SAMSO-TR-74-273
SOLAR CELL AND ARRAY STANDARDIZATION FOR AIR FORCE SPACECRAFT.
AD-A004 544

• • •

SAMSO-TR-75-127
93 - GHZ RADAR CROSS-SECTION MEASUREMENTS OF SATELLITE ELEMENTAL SCATTERERS.
AD-A010 487

• • •

SAMSO-TR-75-243
A GENERAL APPROACH TO THE SHADED SUN SENSOR MODELING PROBLEM WITH AN APPLICATION TO THE FLTSATCOM SHADED SUN SENSORS.
AD-A016 529

• • •

SAMSO-TR-76-189
COMSAT NONREFLECTIVE SOLAR CELL EVALUATION.
AD-A030 532

•SPACE SYSTEMS DIV LOS ANGELES AIR FORCE STATION CALIF

• • •

SSD-TR-67-89
SOLAR CELL POWER SYSTEMS FOR AIR FORCE SATELLITES.
AD- 654 285

•SPECTROLAB SYLMAR CALIF

• • •

INVESTIGATION OF OPTICAL COATINGS FOR SOLAR CELLS
AD- 271 358

• • •

INVESTIGATION OF OPTICAL COATINGS FOR SOLAR CELLS
(ARPA-80 59)
AD- 271 599

• • •

INVESTIGATION OF OPTICAL COATINGS FOR SOLAR CELLS
AD- 297 026

• • •

INVESTIGATION OF OPTICAL COATINGS FOR SOLAR CELLS
AD- 401 872

•SPECTROLAB INC SYLMAR CALIF

• • •

380-4686F
LOW REFLECTIVITY SOLAR CELLS.
(AFAPL-TR-75-98)
AD-A025 922

•TECHNICAL OPERATIONS INC BURLINGTON MASS

• • •

861 24

TEC-WES

RESEARCH DETECTED TOWARD THE IMPROVEMENT OF THE EFFICIENCY OF SILICON BATTERIES BY UTILIZATION OF UNABSORBED PHOTONS (AFCRL-475)
AD- 257 495

•TECHNION INC HONROVIA CALIF•

• • •

ADVANCED ELECTRIC THRUSTER (A SPACE ELECTRIC RAMJET)• (AFRPL-TR-73-12)
AD- 759 290

•TEM-PRES RESEARCH/CARBORUNDUM STATE COLLEGE PA

• • •

HYDROGEN-IMPREGNATED GLASS COVERS FOR HARDENED SOLAR CELLS• (AFAPL-TR-70-12)
AD- 867 832

•TEXAS INSTRUMENTS INC DALLAS SEMICONDUCTOR GROUP

• • •

TI-03-74-15
DEVELOPMENT OF VERTICAL MULTIJUNCTION SOLAR CELLS FOR SPACECRAFT PRIMARY POWER• (AFAPL-TR-74-45)
AD-A001 084

• • •

TI-03-75-41
DEVELOPMENT OF VERTICAL MULTIJUNCTION SOLAR CELLS FOR SPACECRAFT PRIMARY POWER. VOLUME II• (AFAPL-TR-74-45-VOL-2)
AD-A025 719

•TEXTRON ELECTRONICS INC SYLMAR CALIF MELIOTEK DIV

• • •

HIGH EFFICIENCY SILICON SOLAR CELLS
AD- 295 056

• • •

HIGH EFFICIENCY SILICON SOLAR CELLS•
AD- 402 838

• • •

HIGH EFFICIENCY SILICON SOLAR CELLS•
AD- 409 001

• • •

HIGH EFFICIENCY SILICON SOLAR CELLS•
AD- 422 529

• • •

HIGH EFFICIENCY SILICON SOLAR CELLS•
AD- 428 999

• • •

HIGH EFFICIENCY SILICON SOLAR CELLS REPORT NUMBER V:•
AD- 437 942

• • •

HIGH EFFICIENCY SILICON SOLAR CELLS•
AD- 454 009

• • •

HIGH EFFICIENCY SILICON SOLAR CELLS•
AD- 602 759

•TRANS WORLD AIRLINES INC KANSAS CITY MO

• • •

HIGH EFFICIENCY SILICON SOLAR CELLS (ARPA-80 69)
AD- 257 494

•TRW INC CLEVELAND OHIO

• • •

ER 4262
DESIGN STUDY FOR ADVANCED SOLAR THERMIONIC POWER SYSTEMS ITEM III• ELECTRICAL CHARACTERISTICS STUDY
AD- 260 068

•TRW SPACE TECHNOLOGY LABS LOS ANGELES CALIF

• • •

STL/EM-10-5
ELECTRON BOMBARDMENT OF SILICON SOLAR CELLS•
AD- 609 424

• • •

STL/TN-59-0000-00234
DESIGN CRITERIA FOR SILICON SOLAR CELL POWER SUPPLIES•

UNCLASSIFIED /ZOHO7

AD- 605 957

• • •

STL/TR-60-0000-04057
ELECTRON BOMBARDMENT OF SILICON SOLAR CELLS•
AD- 609 429

•WESTINGHOUSE ELECTRIC CORP DAYTON OHIO

• • •

GALLIUM ARSENIDE DENDRITE SINGLE CRYSTAL PROGRAM
AD- 285 315

• • •

GALLIUM ARSENIDE DENDRITE SINGLE CRYSTAL PROGRAM
AD- 292 709

• • •

GALLIUM ARSENIDE DENDRITE SINGLE CRYSTAL PROGRAM
AD- 400 707

• • •

DENDRITIC SILICON SOLAR CELL PANEL• (RTD-TDR63 40 30)
AD- 429 136

•WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA

• • •

DENDRITIC SOLAR CELL AND ARRAY INVESTIGATION•
AD- 451 543

• • •

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT• (AFAPL-TR-68-1)
AD- 828 769

•WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR DIV

• • •

MANUFACTURING METHODS FOR SILICON DENDRITE SOLAR CELLS• (AFML-TR-65-413)
AD- 477 447

• • •

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT•
AD- 486 792

• • •

DENDRITIC SOLAR CELL AND ARRAY INVESTIGATION.
AD- 612 485

• • •

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT.
AD- 804 977

• • •

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT.
AD- 813 447

• • •

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT.
AD- 818 310

• • •

DENDRITIC SILICON SOLAR CELL OPTIMIZATION AND FABRICATION.
(AFAPL-TR-67-101)
AD- 822 426

• • •

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT.
AD- 822 428

• • •

INVESTIGATION OF LARGE AREA DENDRITIC WEB TYPE GERMANIUM PHOTOVOLTAIC CELLS.
(ECOM-02350-F)
AD- 831 824

• • •

SILICON CELL LIFETIME AND EFFICIENCY IMPROVEMENT.
(AFAPL-TR-70-30)
AD- 875 751

*WESTINGHOUSE ELECTRIC CORP PITTSBURGH PA

• • •

63 927 534R1
WEBBED DENDRITIC SILICON SOLAR CELL RADIATION EFFECTS INVESTIGATION.
AD- 406 353

*WESTINGHOUSE RESEARCH LABS PITTSBURGH PA

• • •

SOLAR CELL NEUTRON DAMAGE INVESTIGATION.
(AFAPL-TR-70-24)
AD- 869 460

*YUMA PROVING GROUND ARIZ

• • •

REMOTE PORTABLE SOLAR POWERED MICROWAVE SYSTEM.
AD-A025 978

CELLS.•
AD- 678 542

SOLAR CELLS
REPRINT: PERFORMANCE OF CADMIUM SULFIDE THIN FILM SOLAR CELLS IN A SPACE ENVIRONMENT.
AD- 694 893

•CHLOROPHYLLS
PHOTOELECTRIC EFFECT
DESIGN AND DEVELOP SOLAR CELLS.•
AD- 710 081

•COATINGS
COATINGS FOR SOLAR CELLS•
AD- 258 660

•COMMUNICATION SATELLITES
COMSAT NONREFLECTIVE SOLAR CELL EVALUATION.•
AD-A030 532

•COMMUNICATION SATELLITES(ACTIVE)
SOLAR CELLS
REPRINT: SOLAR CELL CALIBRATION EXPERIMENTS ON LES-6.
AD- 708 598
REPRINT: SOLAR CELL DEGRADATION EXPERIMENTS ON LES-4 AND -5.
AD- 708 603

•COMPUTERIZED SIMULATION
SAS-C SOLAR ARRAY DEPLOYMENT DYNAMICS.•
AD-A022 713

•CRYSTAL STRUCTURE
SOLAR CELLS
VAPOR PLATING PROCESS FOR MAKING CADMIUM TELLURIUM SOLAR CELLS, (SING MOLYBDENUM SUBSTRATE.
AD- 427 608

•CRYSTALS
SOLAR CELL ARRAY OPTIMIZATION. RESEARCH AND FABRICATION PHASES OF THIS WORK WERE DIRECTED TOWARDS DEMONSTRATING THE POTENTIAL OF LARGE AREA, THIN-FILM CADMIUM SULFIDE PHOTOVOLTAIC MATERIALS.
POWER-TO-WEIGHT RATIO FOR FOUR-INCH SQUARE CELLS APPROACHES 20 WATTS/LB.•
AD- 295 558

•DAMAGE
PROTON DAMAGE TO SOLAR CELLS•
AD- 265 213

SEMICONDUCTORS
RADIATION EFFECTS ON SEMICONDUCTOR MATERIALS AND DEVICES.•
AD- 759 946

SOLAR CELLS
RESEARCH FOR DEVELOPMENT OF A HIGH-TEMPERATURE, RADIATION RESISTANT, SOLAR CELL ARRAY FOR AEROSPACE VEHICLE.
AD- 428 639
WEBBED DENDRITIC SILICON SOLAR CELL RADIATION EFFECTS INVESTIGATION.•
AD- 434 706
GAMMA RADIATION EFFECTS IN SILICON SOLAR CELLS.•
AD- 477 592
ELECTRON BOMBARDMENT OF SILICON SOLAR CELLS.•
AD- 609 424
SILICON SOLAR CELLS: RADIATION DAMAGE, FROM 4.6-MEV PROTON BOMBARDMENT.•
AD- 625 440
REPRINT: AN ANALYSIS OF NON-UNIFORM PROTON IRRADIATION DAMAGE IN SILICON SOLAR CELLS.
AD- 649 672
NEUTRON DAMAGE TO SILICON SOLAR CELLS.•
AD- 676 976
A STUDY OF AMERICAN RADIATION RESISTANT •LITHIUM• SOLAR CELLS.•
AD- 691 631
LOW - ENERGY PROTON DAMAGE TO SILICON/ SOLAR CELLS.•
AD- 715 261
SOLAR CELL RADATION RESPONSE NEAR THE INTERFACE OF DIFFERENT ATOMIC NUMBER MATERIALS.•
AD- 740 577
REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS).•
AD- 749 477
RADIATION EFFECTS IN SILICON SOLAR CELLS. PART II.•
AD- 801 717
SOLAR CELL NEUTRON DAMAGE INVESTIGATION.•
AD- 869 460

•DATA LINKS
REMOTE PORTABLE SOLAR POWERED MICROWAVE SYSTEM.•
AD-A025 978

•DENDRITIC STRUCTURE
SOLAR CELLS
DENDRITIC SILICON SOLAR CELL OPTIMIZATION AND FABRICATION.•
AD- 822 426

•DYES
EVALUATION OF SOME THIONINE REDOX SYSTEMS AS POTENTIAL REGENERATIVE PHOTOGALVANIC BATTERIES.•
AD-A021 429

•ELECTRIC CONNECTORS
ELECTROFORMING
ELECTROFORMED ALUMINUM SOLAR CELL CONTRACTS.•
AD- 769 816

•ELECTRIC ENGINES
PERFORMANCE(ENGINEERING)
ADVANCED ELECTRIC THRUSTER (A SPACE ELECTRIC RAMJET).•
AD- 759 490

•ELECTRIC POWER PRODUCTION
SOLAR ORIENTING DEVICE FOR EXPANDABLE FLAT-PANEL ARRAY•
AD- 273 551
SOLAR CELL ARRAY OPTIMIZATION, VOLUME II•
AD- 279 841
DEVELOPMENT OF HIGH-TEMPERATURE RADIATIONRESISTANT SOLAR-CELL

ARRAY; GALLIUM ARSENIDE AND SILICON CELLS USED; SILICON MONOXIDE COATINGS WERE TESTED FOR ANTI-REFLECTION EFFECT; SHELF LIFE OF CELLS AT 200 C WAS TESTED.
AD- 296 367

SATELLITES(ARTIFICIAL)
SOLAR CELL POWER SYSTEMS FOR APL SATELLITES.*
AD- 638 144

SPACE FLIGHT
TRANSLATION OF RUSSIAN ARTICLE ON GENERATION OF ELECTRIC POWER FOR SPACE TRAVEL.
AD- 610 356

*ELECTROCHEMISTRY
EVALUATION OF SOME THIONINE REDOX SYSTEMS AS POTENTIAL REGENERATIVE PHOTOGALVANIC BATTERIES.*
AD-A021 424

*ELECTROFORMING
ELECTRIC CONNECTORS
ELECTROFORMED ALUMINUM SOLAR CELL CONTRACTS.*
AD- 764 816

*ENERGY CONVERSION
FABRICATING SILICON SOLAR CELLS BY ION IMPLANTATION TECHNIQUES.
AD- 298 681
NAVY APPLICATIONS FOR TERRESTRIAL PHOTOVOLTAIC SOLAR POWER.*
AD-A030 529

SOLAR CELLS
HIGH EFFICIENCY, LOW COST SILICON SOLAR CELLS FOR TERRESTRIAL ENVIRONMENT WITH THE OBJECTIVE OF 70% OF THE CELLS, HAVING EFFICIENCIES IN THE RANGE OF 12-14% AND COSTING 2-3 DOLLARS PER CELL.
AD- 428 999

SOLAR RADIATION
HIGH EFFICIENCY SILICON SOLAR CELLS.
AD- 602 759

*EPITAXIAL GROWTH
SEMICONDUCTING FILMS
DENDRITIC SOLAR CELL AND ARRAY INVESTIGATION.
AD- 612 485

*EQUATIONS OF MOTION
SAS-C SOLAR ARRAY DEPLOYMENT DYNAMICS.*
AD-A022 713

*ETHYLENEDINITRILO TETRAACETATES
EVALUATION OF SOME THIONINE REDOX SYSTEMS AS POTENTIAL REGENERATIVE PHOTOGALVANIC BATTERIES,*
AD-A021 424

*EXTENDABLE STRUCTURES
SOLAR PANELS
LARGE SOLAR ARRAY DEVELOPMENT IN U. K.*
AD- 691 587
LARGE RETRACTABLE SOLAR CELL ARRAY.*
AD- 850 354
LARGE RETRACTABLE SOLAR CELL ARRAY.*
AD- 854 941

*FUEL CELLS
SOLAR REGENERATIVE CHEMICAL SYSTEM*
AD- 274 481
METHODS OF CONVERTING VARIOUS FORMS OF ENERGY, INCLUDING SOLAR ENERGY, INTO ELECTRICAL ENERGY.
AD- 286 578

*GALLIUM ARSENIDES
SOLAR ELEMENTS BASED ON EPITAXIAL GAAS FILMS--TRANSLATION.
AD- 776 171

SOLAR CELLS
INVESTIGATION OF PHOTOELECTRIC CHARACTERISTICS OF GALLIUM ARSENIDE SOLAR CELLS OVER A WIDE RANGE OF CHANGE IN LIGHT FLUX--TRANSLATION.
AD- 756 228

*GALLIUM COMPOUNDS
OPERATION OF EXPLORATORY DENDRITE PULLING FURNACE.
PREPARATION OF ZN AND ZN-P DIFFUSED SOLAR CELLS.
AD- 285 315
GROWTH OF GALLIUM ARSENIDE SINGLE CRYSTALS.
AD- 292 709
GALLIUM ARSENIDE SOLAR CELL PRODUCTION AND TECHNIQUES; SOLDERED CONTACTS; SIO ANTIREFLECTION COATINGS; EVALUATION OF SOLAR CELL P-N JUNCTION CHARACTERISTICS; SOLAR SIMULATION; DIFFUSION AND POLISHING TECHNIQUES.
AD- 293 831
GROWTH OF GALLIUM ARSENIDE SINGLE CRYSTAL DENDRITES; SOLAR CELL PREPARATION.
AD- 400 707

*GENERATORS
SOLAR FLAT PLATE THERMOELECTRIC GENERATORS FOR SPACECRAFT POWER SOURCES.
AD- 407 489

*GLASS
INTEGRAL GLASS COVERS FOR SILICON SOLAR CELLS.*
AD-A002 846
STRESS FREE APPLICATION OF GLASS COVERS FOR RADIATION HARDENED SOLAR CELLS AND ARRAYS.*
AD-A015 840

DAMAGE
HYDROGEN-IMPREGNATED GLASS COVERS FOR HARDENED SOLAR CELLS.*
AD- 807 832

*GUNFIRE
LOW COST INJECTION LASER ENGAGEMENT SIMULATOR.*
AD-A009 719

•HIGH TEMPERATURE
DAMAGE
RESEARCH FOR DEVELOPMENT OF A HIGH-TEMPERATURE, RADIATION RESISTANT, SOLAR CELL ARRAY FOR AEROSPACE VEHICLE.
AD- 428 634

•INFRARED FILTERS
INVESTIGATION OF OPTICAL COATINGS FOR SOLAR CELLS•
AD- 271 358

•INFRARED RADIATION
COATINGS FOR SOLAR CELLS•
AD- 258 660

•INFRARED SPECTRA
RESPONSE
ON THE INFRA-RED RESPONSE OF SILICON SOLAR CELLS AS A FUNCTION OF THICKNESS.•
AD- 696 850

•INJECTION LASERS
LOW COST INJECTION LASER ENGAGEMENT SIMULATOR.•
AD-A009 719

•IODIDES
SOLAR REGENERATIVE CHEMICAL SYSTEM•
AD- 274 481

•ION ENGINES
DESIGN
THE ION ENGINE AND LARGE SOLAR ARRAY FOR THE X5 SPACECRAFT.•
AD- 682 888

•LABORATORY FURNACES
OPERATION OF EXPLORATORY DENDRITE PULLING FURNACE. PREPARATION OF ZN AND ZN-P DIFFUSED SOLAR CELLS.
AD- 285 315

•MANUFACTURING
INVESTIGATION OF SINGLE ENERGY GAP SOLAR CELL MATERIAL•
AD- 263 861

•MATERIALS
ANNUAL TECHNICAL REPORT, MATERIALS RESEARCH LABORATORY, JULY 1, 1973-JUNE 30, 1974.•
AD-A015 380

•METEOROLOGICAL BALLOONS
SOLAR CELLS
BALLOON-FLIGHT INSTRUMENTATION FOR SOLAR-CELL MEASUREMENTS.•
AD- 707 134

•NAVIGATIONAL AIDS
LABORATORY EVALUATION OF SOLAR POWER UNITS FOR MARINE AIDS TO NAVIGATION.•
AD-A034 987

•OPTICAL COATINGS
COATINGS FOR SOLAR CELLS•
AD- 258 660
INVESTIGATION OF OPTICAL COATINGS FOR SOLAR CELLS•
AD- 271 358
INVESTIGATION OF OPTICAL COATINGS FOR SOLAR CELLS•
AD- 271 599
THE CONCENTRATION AND FILTERING OF SOLAR RADIATION WAS INVESTIGATED IN CONNECTION WITH SILICON PHOTOVOLTAIC CELLS.
AD- 401 872

•ORGANIC COMPOUNDS
INVESTIGATION OF ORGANIC SEMICONDUCTOR FOR PHOTOVOLTAIC APPLICATION.•
AD- 781 926

•OXIDES
CHEMICAL REACTIONS TO CONVERT SOLAR ENERGY INTO POWER SOURCES•
AD- 269 508

•PHOTODIODES
GALLIUM ARSENIDES
GALLIUM-ARSENIDE PHOTOELECTRIC RECEIVING DEVICES--TRANSLATION
AD- 867 390

•PHOTOELASTICITY
CONTINUING RESEARCH ON DEVELOPMENT OF OPTICAL COATINGS FOR SOLAR CELLS BY IMPROVEMENT OF DESIGN OF SILICON CELL POWER SYSTEMS.
AD- 297 026

•PHOTOELECTRIC CELLS (SEMICONDUCTOR)
FABRICATING SILICON SOLAR CELLS BY ION IMPLANTATION TECHNIQUES.
AD- 298 681

MANUFACTURING
INVESTIGATION OF CHEMICALLY SPRAYED THIN-FILM PHOTOVOLTAIC CELLS.
AD- 609 204

•PHOTOELECTRIC CELLS(SEMICONDUCTOR)
DESIGN
SPECTRAL RESPONSE INVESTIGATION OF SILICON PHOTOVOLTAIC CELLS.•
AD- 721 888

EFFICIENCY
EFFECTIVENESS OF SOLAR CELLS BASED ON CDS-CUZ-XS HETEROJUNCTIONS--TRANSLATION.
AD- 756 602

MANUFACTURING
RESEARCH IN SOLAR ENERGY CONVERSION.•
AD- 726 114

•PHOTOELECTRIC EFFECT
CHLOROPHYLLS
DESIGN AND DEVELOP SOLAR CELLS.•
AD- 710 081

•PHOTOELECTRIC MATERIALS
SOLAR CELL RESEARCH AND DIRECT ENERGY CONVERSION IN THE USSR.
AD- 297 389

•PHOTOELECTRICITY
EVALUATION OF SOME THIONINE REDOX SYSTEMS AS POTENTIAL REGENERATIVE PHOTOGALVANIC BATTERIES.•
AD-A021 424

*PHOTOVOLTAIC EFFECT
REVIEW AND EVALUATION OF WORK PERFORMED ON ORGANIC SEMICONDUCTOR SOLAR CELLS.*
AD- 777 139
INVESTIGATION OF ORGANIC SEMICONDUCTOR FOR PHOTOVOLTAIC APPLICATION.*
AD- 781 926
LONG WAVE SENSITIVITY OF SOLAR CONVERTERS N-CDS-CU(2-X)S--TRANSLATION.
AD-A005 918
WORK IN UK ON THE APPLICATIONS OF SOLAR CELLS IN SPACE.*
AD-A011 084
SPUTTER ION MASS SPECTROMETER ANALYSIS OF COPPER SULFIDE/CADMIUM SULFIDE SOLAR CELL SAMPLES.*
AD-A022 052
NAVY APPLICATIONS FOR TERRESTRIAL PHOTOVOLTAIC SOLAR POWER.*
AD-A030 529

*PLASMAS(PHYSICS)
DESIGN STUDY FOR ADVANCED SOLAR THERMIONIC POWER SYSTEMS ITEM III. ELECTRICAL CHARACTERISTICS STUDY*
AD- 260 068

*POWER
SOLAR CELLS
SOLAR CELL POWER SYSTEMS FOR AIR FORCE SATELLITES.*
AD- 654 285

*POWER EQUIPMENT
ELECTRICAL POWER AND DISTRIBUTION SUBSYSTEMS FOR THE ADVENT COMMUNICATION SATELLITE. RADIATION EFFECTS ON SOLAR CELLS. TEST RESULTS AND SELECTION CRITERIA FOR SOLAR CELLS. PADDLE DEPLOY AND SEPARATION BOLT SQUIB FIRING TEST.
AD- 298 759

*POWER SUPPLIES
HIGH EFFICIENCY SILICON SOLAR CELLS*
AD- 257 494
RESEARCH DETECTED TOWARD THE IMPROVEMENT OF THE EFFICIENCY OF SILICON BATTERIES BY UTILIZATION OF UNABSORBED PHOTONS*
AD- 257 495
DESIGN STUDY FOR ADVANCED SOLAR THERMIONIC POWER SYSTEMS ITEM III. ELECTRICAL CHARACTERISTICS STUDY*
AD- 260 068
INVESTIGATION OF SINGLE ENERGY GAP SOLAR CELL MATERIAL*
AD- 263 861
CHEMICAL REACTIONS TO CONVERT SOLAR ENERGY INTO POWER SOURCES*
AD- 269 508
SOLAR REGENERATIVE CHEMICAL SYSTEM*
AD- 274 481
METHODS OF CONVERTING VARIOUS FORMS OF ENERGY, INCLUDING SOLAR ENERGY, INTO ELECTRICAL ENERGY.
AD- 286 574
GALLIUM ARSENIDE SOLAR CELL PRODUCTION AND TECHNIQUES; SOLDERED CONTACTS; SIO ANTIREFLECTION COATINGS; EVALUATION OF SOLAR CELL P-N JUNCTION CHARACTERISTICS; SOLAR SIMULATION; DIFFUSION AND POLISHING TECHNIQUES.
AD- 293 831
LARGE AREA THIN FILM CDS SOLAR CELL ARRAY INVESTIGATION. DESIGN OF CDS FILM CELL ARRAYS FOR PERFORMANCE AND ORBITAL TESTING.
AD- 294 016
HIGH EFFICIENCY SILICON SOLAR CELLS*
AD- 295 056
SOLAR CELL ARRAY OPTIMIZATION. RESEARCH AND FABRICATION PHASES OF THIS WORK WERE DIRECTED TOWARDS DEMONSTRATING THE POTENTIAL OF LARGE AREA, THIN-FILM CADMIUM SULFIDE PHOTOVOLTAIC MATERIALS. POWER-TO-WEIGHT RATIO FOR FOUR-INCH SQUARE CELLS APPROACHES 20 WATTS/LB.
AD- 295 558
PORTABLE TEST UNIT TO DETERMINE THE OUTPUT OF A SOLAR CELL POWER SUPPLY IN SPACE BY ANALYZING OUTPUT UNDER LABORATORY OR FIELD CONDITIONS.
AD- 400 559
LABORATORY EVALUATION OF SOLAR POWER UNITS FOR MARINE AIDS TO NAVIGATION.*
AD-A034 987

SOLAR CELLS
DESIGN CRITERIA FOR SILICON SOLAR CELL POWER SUPPLIES.
AD- 605 957
SOLAR BATTERY-PHOTOVOLTAIC CELL POWER SUPPLY FOR EQUIPMENT--TRANSLATION.
AD- 748 694

*PRESSURE MEASUREMENT
EXAMINATION OF LASER-PRODUCED PRESSURE PULSES IN A GALLIUM ARSENIDE SOLAR CELL.*
AD-A031 893

*PROTECTIVE COATINGS
INTEGRAL GLASS COVERS FOR SILICON SOLAR CELLS.*
AD-A002 846
STRESS FREE APPLICATION OF GLASS COVERS FOR RADIATION HARDENED SOLAR CELLS AND ARRAYS.*
AD-A015 840

*PROTECTIVE EQUIPMENT
REVERSE CURRENT BLOCKING DIODES FOR FLEXIBLE SOLAR ARRAY PROTECTION.*
AD-A015 880

*PROTON BOMBARDMENT
SOLAR CELLS
SILICON SOLAR CELLS: RADIATION DAMAGE, FROM 4.6-MEV PROTON BOMBARDMENT.
AD- 625 440

*RADAR CROSS SECTIONS
93 - GHZ RADAR CROSS-SECTION MEASUREMENTS OF SATELLITE ELEMENTAL SCATTERERS.*
AD-A010 487

CELLS.•
AD- 678 540
RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS.•
AD- 678 542

ELECTRIC TERMINALS
IMPROVEMENTS IN CDS THIN FILM SOLAR CELLS.•
AD- 707 869

ELECTRICAL PROPERTIES
RESEARCH ON THE OPERATING AND FAILURE MECHANISMS IN CDS SOLAR CELLS.•
AD- 722 112

MANUFACTURING
HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT.•
AD- 813 447

SOLAR CELLS
RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS.•
AD- 421 700
DENDRITIC SOLAR CELL AND ARRAY INVESTIGATION.
AD- 612 485
CDS THIN-FILM SOLAR CELLS.
AD- 613 187
HETEROGENEOUS SOLAR CONVERTORS BASED ON POLYCRYSTALLINE CADMIUM SULFIDE AND CADMIUM SELENIDE--TRANSLATION.
AD- 756 594
ADVANCED THIN-FILM SOLAR CELLS.•
AD- 807 711

SULFIDES
INVESTIGATION OF CHEMICALLY SPRAYED THIN-FILM PHOTOVOLTAIC CELLS.
AD- 609 204

VAPOR PLATING
P-N JUNCTION FORMATION TECHNIQUES.
AD- 428 424

IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL EFFECTS INVESTIGATION.•
AD- 852 760

•SEMICONDUCTOR DEVICES
HETEROGENEOUS SOLAR CONVERTERS BASED ON POLYCRYSTALLINE CADMIUM SULFIDE AND SELENIDE--TRANSLATION.
AD- 776 551

DAMAGE
RADIATION EFFECTS ON SEMICONDUCTOR MATERIALS AND DEVICES.•
AD- 759 946

SOLAR CELLS
CALCULATED EFFICIENCIES OF PRACTICAL GAAS AND SI SOLAR CELLS INCLUDING THE EFFECT OF BUILD-IN ELECTRIC FIELDS.•
AD- 694 117

•SEMICONDUCTOR DIODES
REVERSE CURRENT BLOCKING DIODES FOR FLEXIBLE SOLAR ARRAY PROTECTION.•
AD-A015 880

•SEMICONDUCTORS
REVIEW AND EVALUATION OF WORK PERFORMED ON ORGANIC SEMICONDUCTOR SOLAR CELLS.•
AD- 777 139
INVESTIGATION OF ORGANIC SEMICONDUCTOR FOR PHOTOVOLTAIC APPLICATION.•
AD- 781 926

DAMAGE
REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS).•
AD- 749 477
RADIATION EFFECTS ON SEMICONDUCTOR MATERIALS AND DEVICES.•
AD- 759 946

INTERFACES
PROPERTIES OF P-N JUNCTIONS IN CADMIUM SULFIDE AND CONSTRUCTION OF PHOTOELECTRIC TRANSDUCERS--TRANSLATION.
AD- 712 936

PHYSICAL PROPERTIES
CUPROUS SULFIDE AND CUPROUS SULFIDE-CADMIUM SULFIDE HETEROJUNCTIONS.•
AD- 734 536

•SILICON
RESEARCH DETECTED TOWARD THE IMPROVEMENT OF THE EFFICIENCY OF SILICON BATTERIES BY UTILIZATION OF UNABSORBED PHOTONS.
AD- 257 495
HIGH EFFICIENCY SILICON SOLAR CELLS.
AD- 295 056
HARDENED VIOLET RESPONSE SILICON SOLAR CELL FOR SATELLITE APPLICATION.•
AD-A013 921

DAMAGE
REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS).•
AD- 749 477

ELECTRON IRRADIATION
THE EFFECT OF 4 MEV ELECTRONS ON COVERED BRITISH SILICON SOLAR CELLS.
AD- 462 346
ELECTRON-BOMBARDMENT DAMAGE IN SILICON SOLAR CELLS.
AD- 608 213

SOLAR CELLS
HIGH EFFICIENCY SILICON SOLAR CELLS.•
AD- 422 529
HIGH EFFICIENCY, LOW COST SILICON SOLAR CELLS FOR TERRESTRIAL ENVIRONMENT WITH THE OBJECTIVE OF 70% OF THE CELLS. HAVING EFFICIENCIES IN THE RANGE OF 12-14% AND COSTING 2-3 DOLLARS PER CELL.

AD- 428 999
DENDRITIC SILICON SOLAR CELL PANELS; CELL EFFICIENCIES; SPECTRAL RESPONSE; PHYSICAL CHARACTERISTICS.
AD- 429 136
WEBBED DENDRITIC SILICON SOLAR CELL RADIATION EFFECTS INVESTIGATION..
AD- 434 706
HIGH EFFICIENCY SILICON SOLAR CELLS.
AD- 602 759
RADIATION EFFECTS IN SILICON SOLAR CELLS. PART II.
AD- 801 717
DENDRITIC SILICON SOLAR CELL OPTIMIZATION AND FABRICATION.
AD- 822 426
NEUTRON IRRADIATION TEST OF EXPERIMENTAL SOLAR CELLS.
AD- 913 278

•SIMULATORS
LOW COST INJECTION LASER ENGAGEMENT SIMULATOR.
'AD-A009 719

•SINGLE CRYSTALS
GROWTH OF GALLIUM ARSENIDE SINGLE CRYSTALS.
AD- 292 709
GROWTH OF GALLIUM ARSENIDE SINGLE CRYSTAL DENDRITES; SOLAR CELL PREPARATION.
AD- 400 707

•SOLAR CELLS
HIGH EFFICIENCY SILICON SOLAR CELLS.
AD- 257 494
RESEARCH DETECTED TOWARD THE IMPROVEMENT OF THE EFFICIENCY OF SILICON BATTERIES BY UTILIZATION OF UNABSORBED PHOTONS.
AD- 257 495
COATINGS FOR SOLAR CELLS.
AD- 258 660
DESIGN STUDY FOR ADVANCED SOLAR THERMIONIC POWER SYSTEMS ITEM III. ELECTRICAL CHARACTERISTICS STUDY.
AD- 260 068
SOLAR SPECTRUM SIMULATOR. SPACE ENVIRONMENT SIMULATOR FOR TESTING SOLAR CELLS.
AD- 262 005
INVESTIGATION OF SINGLE ENERGY GAP SOLAR CELL MATERIAL.
AD- 263 861
PROTON DAMAGE TO SOLAR CELLS.
AD- 265 213
CHEMICAL REACTIONS TO CONVERT SOLAR ENERGY INTO POWER SOURCES.
AD- 269 508
SOLAR CELL ARRAY OPTIMIZATION.
AD- 270 131
INVESTIGATION OF OPTICAL COATINGS FOR SOLAR CELLS.
AD- 271 358
INVESTIGATION OF OPTICAL COATINGS FOR SOLAR CELLS.
AD- 271 599
SOLAR ORIENTING DEVICE FOR EXPANDABLE FLAT-PANEL ARRAY.
AD- 273 551
SOLAR REGENERATIVE CHEMICAL SYSTEM.
AD- 274 481
SOLAR CELL ARRAY OPTIMIZATION, VOLUME II.
AD- 274 84?
DESIGN STUDY OF SOLAR ENERGY MEASUREMENT TECHNIQUES.
AD- 281 829
APPLIED RESEARCH PROGRAM ON HIGH-TEMPERATURE RADIATION-RESISTANT SOLAR-CELL ARRAY..
AD- 282 219
RESEARCH ON SOLAR ENERGY CONVERSION EMPLOYING CDS GROWTH, ANNEALING, ETCHING AND ORIENTATION OF CDS SINGLE CRYSTALS AND FILMS.
AD- 284 032
OPERATION OF EXPLORATORY DENDRITE PULLING FURNACE. PREPARATION OF ZN AND ZN-P DIFFUSED SOLAR CELLS.
AD- 285 315
METHODS OF CONVERTING VARIOUS FORMS OF ENERGY, INCLUDING SOLAR ENERGY, INTO ELECTRICAL ENERGY.
AD- 286 578
PRODUCTION AND TESTING OF GAAS SOLAR CELLS.
AD- 287 570
GROWTH OF GALLIUM ARSENIDE SINGLE CRYSTALS.
AD- 292 709
GALLIUM ARSENIDE SOLAR CELL PRODUCTION AND TECHNIQUES: SOLDERED CONTACTS; SIO ANTIREFLECTION COATINGS; EVALUATION OF SOLAR CELL P-N JUNCTION CHARACTERISTICS; SOLAR SIMULATION; DIFFUSION AND POLISHING TECHNIQUES.
AD- 293 831
LARGE AREA THIN FILM CDS SOLAR CELL ARRAY INVESTIGATION. DESIGN OF CDS FILM CELL ARRAYS FOR PERFORMANCE AND ORBITAL TESTING.
AD- 294 016
DEVELOPMENT OF HIGH-TEMPERATURE RADIATIONRESISTANT SOLAR-CELL ARRAY; GALLIUM ARSENIDE AND SILICON CELLS USED; SILICON MONOXIDE COATINGS WERE TESTED FOR ANTI-REFLECTION EFFECT; SHELF LIFE OF CELLS AT 200 C WAS TESTED.
AD- 296 367
CONTINUING RESEARCH ON DEVELOPMENT OF OPTICAL COATINGS FOR SOLAR CELLS BY IMPROVEMENT OF DESIGN OF SILICON CELL POWER SYSTEMS.
AD- 297 026
ELECTRICAL POWER AND DISTRIBUTION SUBSYSTEMS FOR THE ADVENT COMMUNICATION SATELLITE. RADIATION EFFECTS ON SOLAR CELLS. TEST RESULTS AND SELECTION CRITERIA FOR SOLAR CELLS. PADDLE DEPLOY AND SEPARATION BOLT SQUIB FIRING TEST.
AD- 298 759
PORTABLE TEST UNIT TO DETERMINE THE OUTPUT OF A SOLAR CELL POWER SUPPLY IN SPACE BY ANALYZING OUTPUT UNDER LABORATORY OR FIELD CONDITIONS.
AD- 400 559
GROWTH OF GALLIUM ARSENIDE SINGLE CRYSTAL DENDRITES;

SOLAR CELL PREPARATION.
AD- 400 707
LARGE-AREA, THIN-FILM, CADMIUM SULFIDE SOLAR CELL ARRAY INVESTIGATION.
AD- 401 699
THE CONCENTRATION AND FILTERING OF SOLAR RADIATION WAS INVESTIGATED IN CONNECTION WITH SILICON PHOTOVOLTAIC CELLS.
AD- 401 872
HIGH EFFICIENCY SOLAR CELLS FOR TERRESTRIAL USE. CONCENTRATED SUNLIGHT MEASUREMENTS SERIES RESISTANCE EFFECTS AND GRID OPTIMIZATION. COST FACTORS.
AD- 402 830
LARGE-AREA, CADMIUM SULFIDE, THIN-FILM SOLAR CELL ARRAY INVESTIGATION: QUARTERLY TECHNICAL PROGRESS REPT. NO. 3.
AD- 407 525
LITHIUM IMPLANTED SOLAR CELLS, DATA.*
AD- 772 817
OPTIMIZATION OF SOLAR CELL SHIELDING FOR GEOSTATIONARY MISSIONS.*
AD- 773 237
REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS).*
AD- 774 592
SOLAR ELEMENTS BASED ON EPITAXIAL GAAS FILMS--TRANSLATION.
AD- 776 171
HETEROGENEOUS SOLAR CONVERTERS BASED ON POLYCRYSTALLINE CADMIUM SULFIDE AND SELENIDE--TRANSLATION.
AD- 776 551
REVIEW AND EVALUATION OF WORK PERFORMED ON ORGANIC SEMICONDUCTOR SOLAR CELLS.*
AD- 777 139
THE RAE LIGHTWEIGHT SOLAR ARRAY.*
AD- 777 473
INVESTIGATION OF ORGANIC SEMICONDUCTOR FOR PHOTOVOLTAIC APPLICATION.*
AD- 781 926
REAL TIME ASSESSMENT OF IMPROVED LITHIUM-DOPED SOLAR CELLS.*
AD-A000 451
DEVELOPMENT OF VERTICAL MULTIJUNCTION SOLAR CELLS FOR SPACECRAFT PRIMARY POWER.*
AD-A001 084
THE PROSPERO SOLAR CELL EXPERIMENTS.*
AD-A001 339
INTEGRAL GLASS COVERS FOR SILICON SOLAR CELLS.*
AD-A002 846
REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS), VOLUME III.*
AD-A003 509
SHADED SUN SENSOR MODELING FOR SPACECRAFT ACQUISITION PERFORMANCE ANALYSIS.*
AD-A003 752
SOLAR CELL AND ARRAY STANDARDIZATION FOR AIR FORCE SPACECRAFT.*
AD-A004 544
MATHEMATICAL MODELLING OF THE ROYAL AIRCRAFT ESTABLISHMENT (RAE) LIGHTWEIGHT FLEXIBLE SOLAR ARRAY.*
AD-A005 265
LONG WAVE SENSITIVITY OF SOLAR CONVERTERS N-CDS-CU(2-X)S--TRANSLATION.
AD-A005 918
WORK IN UK ON THE APPLICATIONS OF SOLAR CELLS IN SPACE.*
AD-A011 084
HARDENED VIOLET RESPONSE SILICON SOLAR CELL FOR SATELLITE APPLICATION.*
AD-A013 921
STRESS FREE APPLICATION OF GLASS COVERS FOR RADIATION HARDENED SOLAR CELLS AND ARRAYS.*
AD-A015 840
REVERSE CURRENT BLOCKING DIODES FOR FLEXIBLE SOLAR ARRAY PROTECTION.*
AD-A015 880
A GENERAL APPROACH TO THE SHADED SUN SENSOR MODELING PROBLEM WITH AN APPLICATION TO THE FLTSATCOM SHADED SUN SENSORS.*
AD-A016 529
EVALUATION OF SOME THIONINE REDOX SYSTEMS AS POTENTIAL REGENERATIVE PHOTOGALVANIC BATTERIES.*
AD-A021 424
SPUTTER ION MASS SPECTROMETER ANALYSIS OF COPPER SULFIDE/CADMIUM SULFIDE SOLAR CELL SAMPLES.*
AD-A022 052
DEVELOPMENT OF VERTICAL MULTIJUNCTION SOLAR CELLS FOR SPACECRAFT PRIMARY POWER. VOLUME II.*
AD-A025 719
LOW REFLECTIVITY SOLAR CELLS.*
AD-A025 922
SOLAR CELL OBSERVABLES REDUCTION TECHNIQUES.*
AD-A025 923
REMOTE PORTABLE SOLAR POWERED MICROWAVE SYSTEM.*
AD-A025 978
NAVY APPLICATIONS FOR TERRESTRIAL PHOTOVOLTAIC SOLAR POWER.*
AD-A030 529
COMSAT NONREFLECTIVE SOLAR CELL EVALUATION.*
AD-A030 532
EXAMINATION OF LASER-PRODUCED PRESSURE PULSES IN A GALLIUM ARSENIDE SOLAR CELL.*
AD-A031 893
LABORATORY EVALUATION OF SOLAR POWER UNITS FOR MARINE AIDS TO NAVIGATION.*
AD-A034 987

AEROSPACE CRAFT
FLEXIBLE INTEGRATED SOLAR CELL ARRAY.*
AD- 819 491

ARRAYS
AN EVALUATION OF A SPACE FLIGHT TEST OF HARDENED SOLAR ARRAY TECHNOLOGY.*
AD- 919 085

ATTITUDE CONTROL SYSTEMS
EFFECTS OF PASSIVE ATTITUDE CONTROL ON SOLAR POWER SYSTEMS.
AD- 622 483
ORIENTATION LINKAGE FOR A SOLAR CELL ARRAY: OL SCA.•
AD- 836 663

CADMIUM COMPOUNDS
INVESTIGATION OF THIN FILM CADMIUM SULFIDE SOLAR CELLS.•
AD- 423 684
IMPROVEMENTS IN CDS THIN FILM SOLAR CELLS.•
AD- 684 560
IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL EFFECTS INVESTIGATION.•
AD- 831 536
IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL EFFECTS INVESTIGATION.•
AD- 852 760

CADMIUM SULFIDES
RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS.•
AD- 661 557
PRESENT STATUS OF CADMIUM SULFIDE THIN FILM SOLAR CELLS.•
AD- 667 519
RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS.•
AD- 678 540
RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS.•
AD- 678 541
RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS.•
AD- 678 542

CALIBRATION
REPRINT: SOLAR CELL CALIBRATION EXPERIMENTS ON LES-6.
AD- 708 598

CHLOROPHYLLS
DESIGN AND DEVELOP SOLAR CELLS.•
AD- 710 081

COATINGS
INTEGRAL COVERS FOR SOLAR CELLS.•
AD- 650 114

CONFIGURATION
FLEXIBLE INTEGRATED SOLAR CELL ARRAY.•
AD- 809 143

COSTS
CALCULATION AND COST OPTIMIZATION OF CERTAIN SOLAR GENERATOR THERMOBATTERY PARAMETERS-- TRANSLATION.
AD- 759 812

DAMAGE
"EBBED DENDRITIC SILICON SOLAR CELL RADIATION EFFECTS INVESTIGATION.•
AD- 434 706
GAMMA RADIATION EFFECTS IN SILICON SOLAR CELLS.
AD- 477 592
ELECTRON-BOMBARDMENT DAMAGE IN SILICON SOLAR CELLS.
AD- 608 213
REPRINT: AN ANALYSIS OF NON-UNIFORM PROTON IRRADIATION DAMAGE IN SILICON SOLAR CELLS.
AD- 649 672
RADIATION DAMAGE TO ORBITING SOLAR CELLS AND TRANSISTORS.•
AD- 657 155
NEUTRON DAMAGE TO SILICON SOLAR CELLS.•
AD- 676 976
A STUDY OF AMERICAN RADIATION RESISTANT "LITHIUM" SOLAR CELLS.•
AD- 691 631
LOW - ENERGY PROTON DAMAGE TO SILICON; SOLAR CELLS.•
AD- 715 261
SOLAR CELL RADATION RESPONSE NEAR THE INTERFACE OF DIFFERENT ATOMIC NUMBER MATERIALS.•
AD- 740 577
REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS).•
AD- 749 477
LONG LIFE HARDENED LITHIUM DOPED SILICON SOLAR CELL INVESTIGATION.•
AD- 762 941
RADIATION EFFECTS IN SILICON SOLAR CELLS. PART II.•
AD- 801 717
SOLAR CELL NEUTRON DAMAGE INVESTIGATION.•
AD- 869 460
NEUTRON IRRADIATION TEST OF EXPERIMENTAL SOLAR CELLS.•
AD- 913 278

DEGRADATION
BALLOON-FLIGHT INSTRUMENTATION FOR SOLAR-CELL MEASUREMENTS.•
AD- 707 134
REPRINT: SOLAR CELL DEGRADATION EXPERIMENTS ON LES-9 AND -5.•
AD- 708 603
DEGRADATION OF CDS THIN FILM SOLAR CELLS IN DIFFERENT ENVIRONMENTS.•
AD- 715 285
REPRINT: SOLAR CELL DEGRADATION EXPERIMENTS ON THE LINCOLN LABORATORY LES-9 AND LES-5 SATELLITES.
AD- 731 940

DESIGN
A STUDY OF "PHOTOVOLT" GENERATOR AT HIGH RADIATION INTENSITY-- TRANSLATION.
AD- 745 364
VERTICAL MULTIJUNCTION SOLAR CELLS.•
AD- 760 172
HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT.•
AD- 804 977
IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL EFFECTS

AD- 818 310
IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL EFFECTS INVESTIGATION.*
AD- 836 612
IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL EFFECTS INVESTIGATION.*
AD- 847 127

MEASUREMENT
MEASUREMENT TECHNIQUES FOR SILICON SOLAR CELLS.*
AD- 635 851

PERFORMANCE(ENGINEERING)
FABRICATION OF CADMIUM SULFIDE THIN FILM SOLAR CELLS FOR SPACE VEHICLE TESTING.*
AD- 666 439
CALCULATED EFFICIENCIES OF PRACTICAL GAAS AND SI SOLAR CELLS INCLUDING THE EFFECT OF BUILD-IN ELECTRIC FIELDS.*
AD- 694 117
RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH EFFICIENCY CDS THIN-FILM SOLAR CELLS.*
AD- 702 095
IMPROVEMENTS IN CDS THIN FILM SOLAR CELLS.*
AD- 707 869
IMPROVEMENTS IN CDS THIN FILM SOLAR CELLS.*
AD- 723 315
STATUS REPORT ON RAE ADVANCED SOLAR ARRAY DEVELOPMENT.*
AD- 755 743

POSITIONING DEVICES
SOLAR ORIENTING DEVICE FOR EXPANDABLE FLAT-PANEL ARRAY.*
AD- 422 396

POWER
SOLAR CELL POWER SYSTEMS FOR AIR FORCE SATELLITES.*
AD- 654 285

POWER SUPPLIES
SOLAR BATTERY-PHOTOVOLTAIC CELL POWER SUPPLY FOR EQUIPMENT--TRANSLATION.*
AD- 748 694

PRODUCTION
SILICON DENDRITE SOLAR CELL MANUFACTURING METHODS.
AD- 477 447

RADIATION DAMAGE
REPRINT: COMPARISON OF LOW-ENERGY PROTON DAMAGE IN ION-IMPLANTED AND DIFFUSED SILICON SOLAR CELLS.
AD- 728 186

RADIATION EFFECTS
THE EFFECT OF 4 MEV ELECTRONS ON COVERED BRITISH SILICON SOLAR CELLS.
AD- 462 346

RELIABILITY
REPRINT: PRELIMINARY RESULTS FROM THE LES-6 SOLAR CELL EXPERIMENT.
AD- 707 483

RELIABILITY(ELECTRONICS)
ENVIRONMENTAL ASSESSMENT OF THIN SILICON SOLAR CELLS FROM PILOT PRODUCTION.*
AD- 691 506
REPRINT: PERFORMANCE OF CADMIUM SULFIDE THIN FILM SOLAR CELLS IN A SPACE ENVIRONMENT.
AD- 694 893
TYPE APPROVAL TEST REPORT ON FERRANTI SOLAR CELLS FOR THE BLACK ARROW X3 SPACECRAFT.*
AD- 698 927
RESEARCH IN SOLAR ENERGY CONVERSION.*
AD- 726 119

SATELLITES(ARTIFICIAL)
SOLAR CELL POWER SYSTEMS FOR APL SATELLITES.*
AD- 668 149

SEMICONDUCTING FILMS
RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS.*
AD- 421 700
HETEROGENEOUS SOLAR CONVERTORS BASED ON POLYCRYSTALLINE CADMIUM SULFIDE AND CADMIUM SELENIDE--TRANSLATION.*
AD- 756 594
ADVANCED THIN-FILM SOLAR CELLS.*
AD- 807 711

SILICON
HIGH EFFICIENCY SILICON SOLAR CELLS.*
AD- 422 529
P-N JUNCTION FORMATION TECHNIQUES.
AD- 428 424
HIGH EFFICIENCY, LOW COST SILICON SOLAR CELLS FOR TERRESTRIAL ENVIRONMENT WITH THE OBJECTIVE OF 70% OF THE CELLS, HAVING EFFICIENCIES IN THE RANGE OF 12-14% AND COSTING 2-3 DOLLARS PER CELL.
AD- 428 999
PROTON AND ELECTRON IRRADIATION OF N/P SILICON SOLAR CELLS.*
AD- 487 633
IRRADIATION OF SOLAR CELL SUB-PANELS WITH 0.8 MEV ELECTRONS.*
AD- 487 634
HIGH EFFICIENCY SILICON SOLAR CELLS.
AD- 602 759
DESIGN CRITERIA FOR SILICON SOLAR CELL POWER SUPPLIES.
AD- 605 957
SILICON SOLAR CELLS: RADIATION DAMAGE, FROM 4.6-MEV PROTON BOMBARDMENT.
AD- 625 440
TRANSLATION OF RUSSIAN RESEARCH. SILICON SOLAR BATTERIES.
AD- 634 810
DENDRITIC SILICON SOLAR CELLS AND UTILIZATION EXPERIENCE.
AD- 634 882
ON THE INFRA-RED RESPONSE OF SILICON SOLAR CELLS AS A FUNCTION OF THICKNESS.*

AN EVALUATION OF A SPACE FLIGHT TEST OF HARDENED SOLAR ARRAY TECHNOLOGY.•
AD- 919 085

SATELLITES(ARTIFICIAL)
SOLAR CELL POWER SYSTEMS FOR AIR FORCE SATELLITES.•
AD- 654 285

SILICON
DENDRITIC SILICON SOLAR CELL PANELS; CELL EFFICIENCIES; SPECTRAL RESPONSE; PHYSICAL CHARACTERISTICS.
AD- 429 136
HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT.•
AD- 822 428

SOLAR CELLS
ENVIRONMENTAL ASSESSMENT OF THIN SILICON SOLAR CELLS FROM PILOT PRODUCTION.•
AD- 691 506

SPACE FLIGHT
TRANSLATION OF RUSSIAN ARTICLE ON GENERATION OF ELECTRIC POWER FOR SPACE TRAVEL.
AD- 610 356

SPACECRAFT COMPONENTS
SPACE ELECTRIC POWER PLANTS. PART 2--TRANSLATION.
AD- 756 039

TEST EQUIPMENT
SOLAR PANEL TEST SET.•
AD- 707 345

THERMOELECTRIC
SOLAR FLAT PLATE THERMOELECTRIC GENERATOR RESEARCH.
AD- 418 322

THERMOELECTRICITY
SOLAR FLAT PLATE THERMOELECTRIC GENERATOR RESEARCH.
AD- 605 931

•SOLAR RADIATION
CHEMICAL REACTIONS TO CONVERT SOLAR ENERGY INTO POWER SOURCES.
AD- 269 508
RESEARCH ON SOLAR ENERGY CONVERSION EMPLOYING CDS GROWTH, ANNEALING, ETCHING AND ORIENTATION OF CDS SINGLE CRYSTALS AND FILMS.
AD- 284 032
METHODS OF CONVERTING VARIOUS FORMS OF ENERGY, INCLUDING SOLAR ENERGY, INTO ELECTRICAL ENERGY.
AD- 286 578
PORTABLE TEST UNIT TO DETERMINE THE OUTPUT OF A SOLAR CELL POWER SUPPLY IN SPACE BY ANALYZING OUTPUT UNDER LABORATORY OR FIELD CONDITIONS.
AD- 400 559
THE CONCENTRATION AND FILTERING OF SOLAR RADIATION WAS INVESTIGATED IN CONNECTION WITH SILICON PHOTOVOLTAIC CELLS.
AD- 401 872
HIGH EFFICIENCY SOLAR CELLS FOR TERRESTRIAL USE. CONCENTRATED SUNLIGHT MEASUREMENTS. SERIES RESISTANCE EFFECTS AND GRID OPTIMIZATION. COST FACTORS.
AD- 402 838

INTENSITY
DEVELOPMENT OF HIGH EFFICIENCY SILICON SOLAR CELLS FOR TERRESTRIAL APPLICATIONS.
AD- 409 001

•SOLAR SPECTRUM
SOLAR SPECTRUM SIMULATOR. SPACE ENVIRONMENT SIMULATOR FOR TESTING SOLAR CELLS.
AD- 262 005

•SPACE ENVIRONMENTS
SOLAR SPECTRUM SIMULATOR. SPACE ENVIRONMENT SIMULATOR FOR TESTING SOLAR CELLS.
AD- 262 005
PROTON DAMAGE TO SOLAR CELLS.
AD- 265 213

•SPACE FLIGHT
ELECTRIC POWER PRODUCTION
TRANSLATION OF RUSSIAN ARTICLE ON GENERATION OF ELECTRIC POWER FOR SPACE TRAVEL.
AD- 610 356

•SPACE PROPULSION
ASTRONAUTICS
ADVANCED ELECTRIC THRUSTER (A SPACE ELECTRIC RAMJET).•
AD- 759 290

•SPACECRAFT
POWER SUPPLIES
DESIGN CRITERIA FOR SILICON SOLAR CELL POWER SUPPLIES.
AD- 605 957

•SPACECRAFT COMPONENTS
BAR GAP RADIATION TEST.•
AD- 771 426
THE RAE LIGHTWEIGHT SOLAR ARRAY.•
AD- 777 473
DEVELOPMENT OF VERTICAL MULTIJUNCTION SOLAR CELLS FOR SPACECRAFT PRIMARY POWER.•
AD-A001 084
THE PROSPERO SOLAR CELL EXPERIMENTS.•
AD-A002 339
SHADED SUN SENSOR MODELING FOR SPACECRAFT ACQUISITION PERFORMANCE ANALYSIS.•
AD-A003 752
SOLAR CELL AND ARRAY STANDARDIZATION FOR AIR FORCE SPACECRAFT.•
AD-A004 549

RELIABILITY(ELECTRONICS)
THE ION ENGINE AND LARGE SOLAR ARRAY FOR THE X5 SPACECRAFT.•
AD- 682 888

SOLAR CELLS
FABRICATION OF CADMIUM SULFIDE THIN FILM SOLAR CELLS FOR SPACE VEHICLE TESTING.•
AD- 666 439

STATUS REPORT ON RAE ADVANCED SOLAR ARRAY DEVELOPMENT.*
AD- 755 793

*STORAGE BATTERIES
SOLAR CELLS
DIODE ASSEMBLIES WHICH MATERIALLY INCREASE CYCLE LIFE OF NICKEL-CADMIUM CELLS FOR USE IN STORAGE BATTERIES COUPLED WITH SOLAR CELLS.
AD- 427 070

*SULFUR COMPOUNDS
CHEMICAL REACTIONS TO CONVERT SOLAR ENERGY INTO POWER SOURCES*
AD- 269 508

*SWITCHING CIRCUITS
POWER SUPPLIES
SOLAR BATTERY-PHOTOVOLTAIC CELL POWER SUPPLY FOR EQUIPMENT--TRANSLATION.
AD- 748 694

*TELLURIDES
SOLAR CELLS
RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS.*
AD- 438 526

*THERMIONIC EMISSION
DESIGN STUDY FOR ADVANCED SOLAR THERMIONIC POWER SYSTEMS ITEM III. ELECTRICAL CHARACTERISTICS STUDY*
AD- 260 068

*THERMOELECTRICITY
SOLAR FLAT PLATE THERMOELECTRIC GENERATORS FOR SPACECRAFT POWER SOURCES.
AD- 407 489

COSTS
CALCULATION AND COST OPTIMIZATION OF CERTAIN SOLAR GENERATOR THERMOBATTERY PARAMETERS--TRANSLATION.
AD- 759 812

SOLAR PANELS
SOLAR FLAT PLATE THERMOELECTRIC GENERATOR RESEARCH.
AD- 605 931

*THIN FILMS (STORAGE DEVICES)
COATINGS FOR SOLAR CELLS*
AD- 258 660
LARGE-AREA, THIN-FILM, CADMIUM SULFIDE SOLAR CELL ARRAY INVESTIGATION.
AD- 401 699

*TIN COMPOUNDS
SOLAR REGENERATIVE CHEMICAL SYSTEM*
AD- 274 481

*TRANSISTORS
DAMAGE
RADIATION DAMAGE TO ORBITING SOLAR CELLS AND TRANSISTORS.*
AD- 657 155

*ULTRAVIOLET RADIATION
COATINGS FOR SOLAR CELLS*
AD- 258 660

*VAPOR PLATING
SEMICONDUCTING FILMS
IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL EFFECTS INVESTIGATION.*
AD- 852 760

*VARIABLE RESISTORS
GALLIUM ARSENIDES
GALLIUM-ARSENIDE PHOTOELECTRIC RECEIVING DEVICES--TRANSLATION
AD- 867 390

*X-RAY DIFFRACTION
LARGE-AREA, CADMIUM SULFIDE, THIN-FILM SOLAR CELL ARRAY INVESTIGATION: QUARTERLY TECHNICAL PROGRESS REPT. NO. 3.
AD- 407 525

TITLE INDEX

DESIGN AND ANALYSIS OF SOLAR CELL ARRAY CONFIGURATIONS FOR VERTICALLY STABILIZED SATELLITES IN NEAR-EARTH ORBITS.(U) AD= 697 902
•SATELLITES(ARTIFICIAL)

DESIGN AND DEVELOP SOLAR CELLS.(U) AD= 710 081
•CHLOROPHYLLS

DESIGN CRITERIA FOR SILICON SOLAR CELL POWER SUPPLIES.(U) AD= 605 957
•SOLAR CELLS

DESIGN STUDY FOR ADVANCED SOLAR THERMIONIC POWER SYSTEMS ITEM III, ELECTRICAL CHARACTERISTICS STUDY(U) AD= 260 068
•PLASMAS(PHYSICS)

DESIGN STUDY OF SOLAR ENERGY MEASUREMENT TECHNIQUES.(U) AD= 281 829
•SOLAR CELLS

DEVELOPMENT OF VERTICAL MULTIJUNCTION SOLAR CELLS FOR SPACECRAFT PRIMARY POWER.(U) AD-A001 084
•SOLAR CELLS

DEVELOPMENT OF VERTICAL MULTIJUNCTION SOLAR CELLS FOR SPACECRAFT PRIMARY POWER, VOLUME II.(U) AD-A025 719
•SOLAR CELLS

DIRECT ENERGY CONVERSION IN THE USSR. SOLAR CELL RESEARCH(U) AD= 297 389
•PHOTOELECTRIC MATERIALS

EFFECTIVENESS OF SOLAR CELLS BASED ON CDS-CUZ-XS HETEROJUNCTIONS.(U) AD= 756 602
•PHOTOELECTRIC CELLS(SEMICONDUCTOR)

THE EFFECT OF 4 MEV ELECTRONS ON COVERED BRITISH SILICON SOLAR CELLS.(U) AD= 462 346
•SOLAR CELLS

EFFECTS OF PASSIVE ATTITUDE CONTROL ON SOLAR POWER SYSTEMS.(U) AD= 622 483
•SOLAR CELLS

ELECTRIC POWER STATION IN THE COSMOS.(U) AD= 610 356
•ELECTRIC POWER PRODUCTION

ELECTROFORMED ALUMINUM SOLAR CELL CONTRACTS.(U) AD= 764 816
•SOLAR CELLS

ELECTRON-BOMBARDMENT DAMAGE IN SILICON SOLAR CELLS.(U) AD= 608 213
•SOLAR CELLS

ELECTRON BOMBARDMENT OF SILICON SOLAR CELLS.(U) AD= 609 424
•SOLAR CELLS

ENVIRONMENTAL ASSESSMENT OF THIN SILICON SOLAR CELLS FROM PILOT PRODUCTION.(U) AD= 691 506
•SOLAR PANELS

AN EVALUATION OF A SPACE FLIGHT TEST OF HARDENED SOLAR ARRAY TECHNOLOGY.(U) AD= 919 085
•SOLAR PANELS

EVALUATION OF SOME THIONINE REDOX SYSTEMS AS POTENTIAL REGENERATIVE PHOTOGALVANIC BATTERIES.(U) AD-A021 424
•ELECTROCHEMISTRY

EXAMINATION OF LASER-PRODUCED PRESSURE PULSES IN A GALLIUM ARSENIDE SOLAR CELL.(U) AD-A031 893
•SOLAR CELLS

FABRICATION OF CADMIUM SULFIDE THIN FILM SOLAR CELLS FOR SPACE VEHICLE TESTING.(U) AD= 666 439
•SOLAR CELLS

FLEXIBLE INTEGRATED SOLAR CELL ARRAY.(U) AD= 809 143
•SOLAR CELLS

FLEXIBLE INTEGRATED SOLAR CELL ARRAY.(U) AD= 815 669
•SOLAR PANELS

FLEXIBLE INTEGRATED SOLAR CELL ARRAY.(U) AD= 819 491
•SOLAR PANELS

GALLIUM ARSENIDE DENDRITE SINGLE CRYSTAL PROGRAM(U) AD= 285 315
•ARSENIDES

GALLIUM ARSENIDE DENDRITE SINGLE CRYSTAL PROGRAM(U) AD= 292 709
•ARSENIDES

GALLIUM ARSENIDE DENDRITE SINGLE CRYSTAL PROGRAM(U) AD= 400 707
•GALLIUM COMPOUNDS

GALLIUM-ARSENIDE PHOTOELECTRIC RECEIVING DEVICES.(U) AD= 867 390
•PHOTODIODES

GALLIUM ARSENIDE SOLAR CELL PRODUCTION PROCESSES AND TECHNIQUES(U) AD= 293 831
•ARSENIDES

GAMMA RADIATION EFFECTS IN SILICON SOLAR CELLS.(U) AD= 477 592
•SOLAR CELLS

A GENERAL APPROACH TO THE SHADED SUN SENSOR MODELING PROBLEM WITH AN APPLICATION TO THE FLTSATCOM SHADED SUN SENSORS.(U) AD-A016 529
•SATELLITE ATTITUDE

HARDENED VIOLET RESPONSE SILICON SOLAR CELL FOR SATELLITE APPLICATION.(U) AD-A013 921
•SOLAR CELLS

HETEROGENEOUS SOLAR CONVERTERS BASED ON POLYCRYSTALLINE CADMIUM SULFIDE AND SELENIDE.(U) AD= 776 881
•SOLAR CELLS

HETEROGENEOUS SOLAR CONVERTORS BASED ON POLYCRYSTALLINE AD= 756 894

RESPONSE OF SILICON SOLAR CELLS AS A FUNCTION OF THICKNESS.(U)
•SOLAR CELLS

OPTIMIZATION OF SOLAR CELL SHIELDING FOR GEOSTATIONARY MISSIONS.(U) AD- 773 237
•SOLAR CELLS

ORIENTATION LINKAGE FOR A SOLAR CELL ARRAY: OL SCA.(U) AD- 836 663
•SATELLITES(ARTIFICIAL)

P-N JUNCTION FORMATION TECHNIQUES(U) AD- 298 681
•ENERGY CONVERSION

P-N JUNCTION FORMATION TECHNIGUES. (U) AD- 428 424
•SOLAR CELLS

PERFORMANCE OF CADMIUM SULFIDE THIN FILM SOLAR CELLS IN A SPACE ENVIRONMENT.(U) AD- 694 893
•SATELLITES(ARTIFICIAL)

PHOTOVOLTAIC AND THERMOELECTRIC SOLAR ENERGY CONVERSION USING THIN FILMS.(U) AD- 686 496
•SOLAR CELLS

PRELIMINARY RESULTS FROM THE LES-6 SOLAR CELL EXPERIMENT.(U) AD- 707 463
•SCIENTIFIC SATELLITES

PRESENT STATUS OF CADMIUM SULFIDE THIN FILM SOLAR CELLS.(U) AD- 667 519
•SOLAR CELLS

PROPERTIES OF P-N JUNCTIONS IN CADMIUM SULFIDE AND CONSTRUCTION OF PHOTOELECTRIC TRANSDUCERS.(U) AD- 712 936
•SEMICONDUCTORS

THE PROSPERO SOLAR CELL EXPERIMENTS.(U) AD-A002 339
•SPACECRAFT COMPONENTS

PROTON AND ELECTRON IRRADIATION OF N/P SILICON SOLAR CELLS.(U) AD- 487 633
•SOLAR CELLS

PROTON DAMAGE TO SOLAR CELLS(U) AD- 265 213
•DAMAGE

RADIATION DAMAGE IN SILICON SOLAR CELLS FROM 4.6-MEV PROTON BOMBARDMENT.(U) AD- 625 440
•SOLAR CELLS

RADIATION DAMAGE TO ORBITING SOLAR CELLS AND TRANSISTORS.(U) AD- 657 155
•SOLAR CELLS

RADIATION EFFECTS IN SILICON SOLAR CELLS. PART II,(U) AD- 801 717
•SOLAR CELLS

RADIATION EFFECTS ON SEMICONDUCTOR MATERIALS AND DEVICES.(U) AD- 759 946
•SEMICONDUCTOR DEVICES

THE RAE LIGHTWEIGHT SOLAR ARRAY.(U) AD- 777 473
•SOLAR CELLS

REAL TIME ASSESSMENT OF IMPROVED LITHIUM-DOPED SOLAR CELLS.(U) AD-A000 451
•SOLAR CELLS

REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS).(U) AD- 749 477
•SOLAR CELLS

REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS).(U) AD- 774 592
•SOLAR CELLS

REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS), VOLUME III.(U) AD-A003 509
•SOLAR CELLS

REMOTE PORTABLE SOLAR POWERED MICROWAVE SYSTEM.(U) AD-A025 978
•DATA LINKS

RESEARCH DETECTED TOWARD THE IMPROVEMENT OF THE EFFICIENCY OF SILICON BATTERIES BY UTILIZATION OF UNABSORBED PHOTONS(U) AD- 257 495
•POWER SUPPLIES

RESEARCH IN SOLAR ENERGY CONVERSION.(U) AD- 726 114
•SOLAR CELLS

RESEARCH ON SOLAR- ENERGY CONVERSION EMPLOYING CADMIUM SULFIDE(U) AD- 284 032
•CADMIUM COMPOUNDS

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS.(U) AD- 661 557
•SOLAR CELLS

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS.(U) AD- 678 540
•CADMIUM SULFIDES

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS.(U) AD- 678 541
•SOLAR CELLS

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS.(U) AD- 678 542
•CADMIUM SULFIDES

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH EFFICIENCY CDS THIN- AD- 702 095

FILM SOLAR CELLS.(U)
•SOLAR CELLS

RESEARCH ON THE OPERATING AND FAILURE MECHANISMS IN CDS SOLAR CELLS.(U) AD• 722 112
•SOLAR CELLS

RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS.(U) AD- 421 700
•SOLAR CELLS

RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS.(U) AD- 427 608
•SOLAR CELLS

RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS.(U) AD- 438 526
•SOLAR CELLS

RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS.(U) AD• 611 535
•SOLAR CELLS

REVERSE CURRENT BLOCKING DIODES FOR FLEXIBLE SOLAR ARRAY PROTECTION.(U) AD•A015 880
•SOLAR PANELS

REVIEW AND EVALUATION OF WORK PERFORMED ON ORGANIC SEMICONDUCTOR SOLAR CELLS.(U) AD- 777 139
•PHOTOVOLTAIC EFFECT

SAS-C SOLAR ARRAY DEPLOYMENT DYNAMICS.(U) AD-A022 713
•SOLAR PANELS

SHADED SUN SENSOR MODELING FOR SPACECRAFT ACQUISITION PERFORMANCE ANALYSIS,(U) AD-A003 752
•SATELLITE ATTITUDE

SILICON CELL LIFETIME AND EFFICIENCY IMPROVEMENT.(U) AD- 875 751
•SOLAR CELLS

SILICON SOLAR BATTERIES.(U) AD- 634 810
•SOLAR CELLS

SOLAR BATTERIES OF THE FUTURE(U) AD- 286 578
•FUEL CELLS

SOLAR BATTERY- PHOTOVOLTAIC CELL POWER SUPPLY FOR EQUIPMENT (USTROISTVO DLYA PITANIYA POTREBITELEI OT SOLNECHNOI BATAREI S FOTOPREOBRAZO VATELYAMI),(U) AD- 748 694
•POWER SUPPLIES

SOLAR CELL AND ARRAY STANDARDIZATION FOR AIR FORCE SPACECRAFT,(U) AD-A004 544
•SOLAR CELLS

SOLAR CELL ARRAY OPTIMIZATION(U) AD- 270 131
•SOLAR CELLS

SOLAR CELL ARRAY OPTIMIZATION(U) AD- 295 558
•CRYSTALS

SOLAR CELL ARRAY OPTIMIZATION, VOLUME II(U) AD- 274 891
•ELECTRIC POWER PRODUCTION

SOLAR CELL CALIBRATION EXPERIMENTS ON LES-6.(U) AD- 708 598
•COMMUNICATION SATELLITES(ACTIVE)

SOLAR CELL DEGRADATION EXPERIMENTS ON LES-4 AND -5.(U) AD- 708 603
•COMMUNICATION SATELLITES(ACTIVE)

SOLAR CELL DEGRADATION EXPERIMENTS ON THE LINCOLN LABORATORY LES-4 AND LES-5 SATELLITES.(U) AD- 731 940
•SOLAR CELLS

SOLAR CELL NEUTRON DAMAGE INVESTIGATION.(U) AD- 869 460
•SOLAR CELLS

SOLAR CELL OBSERVABLES REDUCTION TECHNIQUES.(U) AD-A025 923
•SOLAR CELLS

SOLAR CELL POWER AD- 654 285
SYSTEMS FOR AIR FORCE SATELLITES,(U)
•SOLAR CELLS

SOLAR CELL POWER SYSTEMS FOR APL SATELLITES.(U) AD- 668 144
•SATELLITES(ARTIFICIAL)

SOLAR CELL RADATION RESPONSE NEAR THE INTERFACE OF DIFFERENT ATOMIC NUMBER MATERIALS.(U) AD- 740 577
•SOLAR CELLS

SOLAR ELEMENTS BASED ON EPITAXIAL GAAS FILMS,(U) AD- 776 171
•SOLAR CELLS

SOLAR ENERGY MEASUREMENT TECHNIQUES(U) AD• 400 559
•POWER SUPPLIES

SOLAR FLAT PLATE THERMOELECTRIC GENERATOR RESEARCH. (U) AD- 407 489
•SOLAR PANELS

SOLAR FLAT PLATE THERMOELECTRIC GENERATOR RESEARCH.(U) AD• 418 322
•SOLAR PANELS

SOLAR FLAT PLATE THERMOELECTRIC GENERATOR RESEARCH.(U) AD- 605 931
•SOLAR PANELS

SOLAR ORIENTING DEVICE FOR EXPANDABLE FLAT-PANEL ARRAY(U) AD- 273 851
•ELECTRIC POWER PRODUCTION

SOLAR ORIENTING DEVICE FOR EXPANDABLE FLAT-PANEL ARRAY.(U) AD• 422 396
•SOLAR CELLS

SOLAR PANEL TEST SET.(U) AD• 707 345
•SOLAR PANELS

SOLAR REGENERATIVE CHEMICAL SYSTEM(U) AD• 274 481

•CADMIUM COMPOUNDS

SOLAR SPECTRUM AD- 262 005
SIMULATOR. SPACE ENVIRONMENT SIMULATOR FOR TESTING SOLAR CELLS(U)
•SOLAR CELLS

SOME EFFECTS OF AD- 651 013
ELECTRON IRRADIATION AND TEMPERATURE ON SOLAR CELL PERFORMANCE.(U)
•SOLAR CELLS

SPACE ELECTRIC POWER AD- 756 039
PLANTS. PART 2.(U)
•SOLAR PANELS

SPACE ELECTRIC POWER AD- 741 524
PLANTS. PART I (LITSOM K SOLNTSU).(U)
•SOLAR CELLS

SPECTRAL RESPONSE AD- 721 888
INVESTIGATION OF SILICON PHOTOVOLTAIC CELLS.(U)
•PHOTOELECTRIC CELLS(SEMICONDUCTOR)

SPUTTER ION MASS AD-A022 052
SPECTROMETER ANALYSIS OF COPPER SULFIDE/CADMIUM SULFIDE SOLAR CELL SAMPLES.(U)
•SOLAR CELLS

STATUS REPORT ON RAE AD- 755 743
ADVANCED SOLAR ARRAY DEVELOPMENT.(U)
•SOLAR CELLS

STRESS FREE APPLICATION AD-A015 840
OF GLASS COVERS FOR RADIATION HARDENED SOLAR CELLS AND ARRAYS.(U)
•SOLAR CELLS

STRUCTURAL FAILURES IN AD- 737 161
LIGHTWEIGHT SOLAR CELL ARRAYS UNDER THERMAL CYCLING.(U)
•SOLAR CELLS

A STUDY OF AMERICAN AD- 691 631
RADIATION RESISTANT •LITHIUM• SOLAR CELLS.(U)
•SOLAR CELLS

A STUDY OF •PHOTOVOLT• AD- 745 364
GENERATOR AT HIGH RADIATION INTENSITY (ISSLEDOVANIE ELEKTRICHESKIKH KHARAKTERISTIK GENERATOROV •FOTOVOLT• PRI POVYSHENNOI MOSHCHNOSTI IZLUCHENIYA).(U)
•SOLAR CELLS

THEORETICAL TREATMENT AD- 754 901
OF THE VERTICAL MULTIJUNCTION SOLAR CELL.(U)
•SOLAR CELLS

THIN FILM CDS SOLAR AD- 710 636
CELL FABRICATION PARAMETER STUDY.(U)
•SOLAR CELLS

THIN SILICON SOLAR AD- 817 614
CELLS BY ION IMPLANTATION.(U)
•SOLAR CELLS

TYPE APPROVAL TEST AD- 698 927
REPORT ON FERRANTI SOLAR CELLS FOR THE BLACK ARROW X3 SPACECRAFT.(U)
•SCIENTIFIC SATELLITES

VERTICAL MULTIJUNCTION AD- 760 172
SOLAR CELLS.(U)
•SOLAR CELLS

WEBBED DENDRITIC AD- 406 353
SILICON SOLAR CELL RADIATION EFFECTS INVESTIGATION. (U)
•SCELLS

WEBBED DENDRITIC AD- 434 706
SILICON SOLAR CELL RADIATION EFFECTS INVESTIGATION.(U)
•SOLAR CELLS

WORK IN UK ON THE AD-A011 084
APPLICATIONS OF SOLAR CELLS IN SPACE.(U)
•SOLAR CELLS

• • •

HIGH EFFICIENCY SILICON SOLAR CELLS.
AD- 402 838

• • •

HIGH EFFICIENCY SILICON SOLAR CELLS.
AD- 422 529

• • •

HIGH EFFICIENCY SILICON SOLAR CELLS.
AD- 428 999

• • •

HIGH EFFICIENCY SILICON SOLAR CELLS REPORT NUMBER VI.
AD- 437 942

• • •

HIGH EFFICIENCY SILICON SOLAR CELLS.
AD- 454 009

• • •

HIGH EFFICIENCY SILICON SOLAR CELLS.
AD- 602 759

•BERRY, L. B.

• • •

FLEXIBLE INTEGRATED SOLAR CELL ARRAY.
AD- 819 491

•BERTRAN, H

• • •

GALLIUM ARSENIDE SOLAR CELL PRODUCTION PROCESSES AND TECHNIQUES
AD- 293 831

•BICKLER, D.B

• • •

SOLAR ENERGY MEASUREMENT TECHNIQUES
AD- 400 569

•BICKLER, D. B.

• • •

DESIGN STUDY OF SOLAR ENERGY MEASUREMENT TECHNIQUES.
AD- 261 829

•BLAKE, F. A.

• • •

IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL EFFECTS INVESTIGATION.
AD- 852 760

•BOTTONE, ANTHONY S.

• • •

REMOTE PORTABLE SOLAR POWERED MICROWAVE SYSTEM.
AD-A025 978

•BRIGGS, DONALD C.

• • •

REAL TIME ASSESSMENT OF IMPROVED LITHIUM-DOPED SOLAR CELLS.
AD-A000 451

•BRODTMAN, KARL

• • •

ADVANCED THIN-FILM SOLAR CELLS.
AD- 807 711

•BROWN, W. D.

• • •

FLEXIBLE INTEGRATED SOLAR CELL ARRAY.
AD- 819 491

•BUHILLER, DONALD

• • •

P-N JUNCTION FORMATION TECHNIQUES
AD- 298 681

•BURKE, E. A.

• • •

SOLAR CELL RADATION RESPONSE NEAR THE INTERFACE OF DIFFERENT ATOMIC NUMBER MATERIALS.
AD- 740 577

•BURNELL, P.

• • •

FLEXIBLE INTEGRATED SOLAR CELL ARRAY.
AD- 809 143

•BURRILL, J. T.

• • •

ION IMPLANTATION JUNCTION TECHNIQUES.
AD- 805 407

• • •

THIN SILICON SOLAR CELLS BY ION IMPLANTATION.
AD- 817 614

•BURRILL, JAMES T

• • •

P-N JUNCTION FORMATION TECHNIQUES
AD- 298 681

•BURROWES, CURTIS

• • •

SOLAR CELL CALIBRATION EXPERIMENTS ON LES-6.
AD- 708 598

•CANN, GORDON L.

• • •

ADVANCED ELECTRIC THRUSTER (A SPACE ELECTRIC RAMJET).
AD- 759 290

•CAPPELLI, J. R.

• • •

SOLAR CELL RADATION RESPONSE NEAR THE INTERFACE OF DIFFERENT ATOMIC NUMBER MATERIALS.
AD- 740 577

•CHAMBERLIN, R. R.

• • •

INVESTIGATION OF CHEMICALLY SPRAYED THINFILM PHOTOVOLTAIC CELLS.
AD- 809 204

•CHARLES, H. K., JR

• • •

SPUTTER ION MASS SPECTROMETER ANALYSIS OF COPPER SULFIDE/CADMIUM SULFIDE SOLAR CELL SAMPLES.
AD-A022 052

•CHON, K.T

• • •

PROTON DAMAGE TO SOLAR CELLS
AD- 245 213

•COOK, W. R., JR

• • •

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH EFFICIENCY CDS THIN-FILM SOLAR

CELLS.
AD- 702 095

• • •

RESEARCH ON THE OPERATING AND FAILURE MECHANISMS IN CDS SOLAR CELLS.
AD- 722 112

•COX, LARRY P.

• • •

SOLAR CELL DEGRADATION EXPERIMENTS ON THE LINCOLN LABORATORY LES-4 AND LES-5 SATELLITES.
AD- 731 940

•COX, LAWRENCE P.

• • •

SOLAR CELL DEGRADATION EXPERIMENTS ON LES-4 AND -5.
AD- 708 603

•CRABB, R. L.

• • •

ENVIRONMENTAL ASSESSMENT OF THIN SILICON SOLAR CELLS FROM PILOT PRODUCTION.
AD- 691 506

• • •

A STUDY OF AMERICAN RADIATION RESISTANT 'LITHIUM' SOLAR CELLS.
AD- 691 631

•CROSSLEY, PETER A.

• • •

ADVANCED THIN-FILM SOLAR CELLS.
AD- 807 711

•CROWTHER, D. L.

• • •

AN ANALYSIS OF NON-UNIFORM PROTON IRRADIATION DAMAGE IN SILICON SOLAR CELLS,
AD- 649 672

•CURTIS, ORLIE L., JR

• • •

RADIATION EFFECTS ON SEMICONDUCTOR MATERIALS AND DEVICES.
AD- 759 946

•CUSANO, D. A.

• • •

RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS.
AD- 438 526

•CUSANO, DOMINIC A.

• • •

RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS.
AD- 611 535

•DANIEL, R. E.

• • •

LARGE RETRACTABLE SOLAR CELL ARRAY.
AD- 860 179

•DAVIS, JOHN RAMSFORD

• • •

SILICON CELL LIFETIME AND EFFICIENCY IMPROVEMENT.
AD- 875 751

•DAWSON, W. P.

• • •

FLEXIBLE INTEGRATED SOLAR CELL ARRAY.
AD- 819 491

•DAY, B. P.

• • •

THE ION ENGINE AND LARGE SOLAR ARRAY FOR THE X5 SPACECRAFT.
AD- 682 888

•DENEVE, R. J.

• • •

IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL EFFECTS INVESTIGATION.
AD- 852 760

•DEPANGHER, J.

• • •

AN ANALYSIS OF NON-UNIFORM PROTON IRRADIATION DAMAGE IN SILICON SOLAR CELLS.
AD- 649 672

•DEUCHER, T. F.

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THIN FILM CDS SOLAR CELL FABRICATION PARAMETER STUDY.
AD- 710 636

•DOLLERY, A. A.

• • •

TYPE APPROVAL TEST REPORT ON FERRANTI SOLAR CELLS FOR THE BLACK ARROW X3 SPACECRAFT.
AD- 698 927

•DOWNING, R. G.

• • •

ELECTRON BOMBARDMENT OF SILICON SOLAR CELLS,
AD- 609 424

•DRASKIN, L. M.

• • •

CALCULATION AND COST OPTIMIZATION OF CERTAIN SOLAR GENERATOR THERMOBATTERY PARAMETERS (K RASCHETU I OPTIMIZATSII PO STOIMOSTI NEKOTORYKH PARAMETROV TERMOBATAREI SOLNECHNYKH GENERATOROV),
AD- 759 812

•DUNN, W. F.

• • •

IMPROVEMENTS IN CDS THIN FILM SOLAR CELLS.
AD- 707 869

•DUNN, WILLIAM F.

• • •

IMPROVEMENTS IN CDS THIN FILM SOLAR CELLS.
AD- 723 315

•DUPONT, PRESTON S.

• • •

FLEXIBLE INTEGRATED SOLAR CELL ARRAY.
AD- 809 143

• • •

FLEXIBLE INTEGRATED SOLAR CELL ARRAY.
AD- 815 669

•DYBDAL, ROBERT B.

• • •

93 - GHZ RADAR CROSS-SECTION MEASUREMENTS OF SATELLITE ELEMENTAL SCATTERERS.
AD-A010 487

•ELLIS, B.

• • •

CALCULATED EFFICIENCIES OF PRACTICAL GAAS AND SI SOLAR CELLS INCLUDING THE EFFECT OF BUILD-IN ELECTRIC FIELDS.
AD- 694 117

•ENSLOW, G.

• • •

GAMMA RADIATION EFFECTS IN SILICON SOLAR CELLS.
AD- 477 592

•ENSLOW, GEORGE H.

• • •

RADIATION EFFECTS IN SILICON SOLAR CELLS. PART II.
AD- 801 717

•ERNICK, M.

• • •

DENDRITIC SILICON SOLAR CELL OPTIMIZATION AND FABRICATION.
AD- 822 426

• • •

INVESTIGATION OF LARGE AREA DENDRITIC WEB TYPE GERMANIUM PHOTOVOLTAIC CELLS.
AD- 831 824

•EVANS, J. C., JR

• • •

PHOTOVOLTAIC AND THERMOELECTRIC SOLAR ENERGY CONVERSION USING THIN FILMS.
AD- 688 496

•FAILE, SAMUEL P.

• • •

HYDROGEN-IMPREGNATED GLASS COVERS FOR HARDENED SOLAR CELLS.
AD- 867 832

•FANG, PAO-HSIN

• • •

INVESTIGATION OF ORGANIC SEMICONDUCTOR FOR PHOTOVOLTAIC APPLICATION.
AD- 781 926

•FARADAY, B. J.

• • •

NAVY APPLICATIONS FOR TERRESTRIAL PHOTOVOLTAIC SOLAR POWER.
AD-A030 529

•FEDORUS, G. A.

• • •

HETEROGENEOUS SOLAR CONVERTORS BASED ON POLYCRYSTALLINE CADMIUM SULFIDE AND CADMIUM SELENIDE (GETEROGENNE SOLNECHNE PREOBRAZOVATELI NA OSNOVE POLIKRISTALLICHESKOGO SULFIDA I SELENIDA KADMIYA), T
AD- 756 594

• • •

HETEROGENEOUS SOLAR CONVERTERS BASED ON POLYCRYSTALLINE CADMIUM SULFIDE AND SELENIDE.
AD- 776 551

• • •

LONG WAVE SENSITIVITY OF SOLAR CONVERTERS N-CDS-CU(2-X)S.
AD-A005 918

•FELKEL, EDWARD O.

• • •

LARGE RETRACTABLE SOLAR CELL ARRAY.
AD- 850 354

• • •

LARGE RETRACTABLE SOLAR CELL ARRAY.
AD- 854 941

• • •

LARGE RETRACTABLE SOLAR CELL ARRAY.
AD- 860 179

•FINE, DWIGHT A.

• • •

EVALUATION OF SOME THIONINE REDOX SYSTEMS AS POTENTIAL REGENERATIVE PHOTOGALVANIC BATTERIES.
AD-A021 424

•FISCHELL, R. E.

• • •

RADIATION DAMAGE TO ORBITING SOLAR CELLS AND TRANSISTORS.
AD- 657 155

•FISCHELL, ROBERT E.

• • •

EFFECTS OF PASSIVE ATTITUDE CONTROL ON SOLAR POWER SYSTEMS.
AD- 622 483

• • •

SOLAR CELL POWER SYSTEMS FOR APL SATELLITES.
AD- 668 144

•FLETCHER, AARON N.

• • •

EVALUATION OF SOME THIONINE REDOX SYSTEMS AS POTENTIAL REGENERATIVE PHOTOGALVANIC BATTERIES.
AD-A021 424

•FULLER, CLYDE

• • •

DEVELOPMENT OF VERTICAL MULTIJUNCTION SOLAR CELLS FOR SPACECRAFT PRIMARY POWER. VOLUME II.
AD-A025 719

•FULLER, F.E

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INVESTIGATION OF OPTICAL COATINGS FOR SOLAR CELLS
AD- 297 026

•GAMMARINO, R. R.

• • •

LOW COST INJECTION LASER ENGAGEMENT SIMULATOR.
AD-A009 719

•GANDEL, A.G

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SOLAR REGENERATIVE CHEMICAL SYSTEM
AD- 274 481

•GEIB, JACK M.

• • •

SOLAR CELL OBSERVABLES REDUCTION TECHNIQUES.
AD-A025 923

•GIBBONS, L•H

GALLIUM ARSENIDE SOLAR CELL PRODUCTION PROCESSES AND TECHNIQUES
AD- 293 831

•GLIBERMAN, A• YA•

SILICON SOLAR BATTERIES,
AD- 634 810

•GREEGOR, R• B•

REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS), VOLUME III•
AD-A003 509

•GREEN, JOHN M•

LITHIUM-DOPED SILICON SOLAR CELLS STATE-OF-THE-ART•
AD- 764 357

AN EVALUATION OF A SPACE FLIGHT TEST OF HARDENED SOLAR ARRAY TECHNOLOGY•
AD- 919 085

•GRIFFEN, NEIL C•

NEUTRON IRRADIATION TEST OF EXPERIMENTAL SOLAR CELLS•
AD- 913 278

•GRIGORYAN, R• S•

SOLAR BATTERY-PHOTOVOLTAIC CELL POWER SUPPLY FOR EQUIPMENT (USTROISTVO DLYA PITANIYA POTREBITELEI OT SOLNECHNOI BATAREI S FOTOPREOBRAZO VATELYAMI)•
AD- 748 694

•GUENZER, C• S•

NAVY APPLICATIONS FOR TERRESTRIAL PHOTOVOLTAIC SOLAR POWER•
AD-A030 529

•HAASE, WAYNE C•

BALLOON-FLIGHT INSTRUMENTATION FOR SOLAR-CELL MEASUREMENTS•
AD- 707 134

•HAJEK, G• D•

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT•
AD- 828 769

•HANDY, RELAND J•

HIGH EFFICIENCY SILICON SOLAR CELLS•
AD- 402 838

•HANDY, ROLAND J

HIGH EFFICIENCY SILICON SOLAR CELLS
AD- 295 056

HIGH EFFICIENCY SILICON SOLAR CELLS•
AD- 409 001

•HAPP, W• W•

GAMMA RADIATION EFFECTS IN SILICON SOLAR CELLS•
AD- 477 592

•HARDING, W• R• , JR

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT•
AD- 486 792

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT•
AD- 804 977

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT•
AD- 813 447

•HARDING, WILLIAM R•

HYDROGEN-IMPREGNATED GLASS COVERS FOR HARDENED SOLAR CELLS•
AD- 867 832

•HARRISON, S•

ION IMPLANTATION JUNCTION TECHNIQUES•
AD- 805 407

•HARTKE, JEROME L•

LITHIUM IMPLANTED SOLAR CELLS• DATA•
AD- 772 817

•HICKS, JOHN M•

SOLAR CELL NEUTRON DAMAGE INVESTIGATION•
AD- 869 460

•HIETANEN, J• R•

FABRICATION OF CADMIUM SULFIDE THIN FILM SOLAR CELLS FOR SPACE VEHICLE TESTING•
AD- 666 439

•HILL, E•R

LARGE AREA THIN FILM CADMIUM SULFIDE SOLAR CELL ARRAY INVESTIGATION
AD- 401 699

•HILL, E•R•

LARGE AREA THIN FILM CADMIUM SULFIDE SOLAR CELL ARRAY INVESTIGATION•
AD- 407 525

INVESTIGATION OF THIN FILM CADMIUM SULFIDE SOLAR CELLS•
AD- 423 684

•HORNE, W• E•

REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS), VOLUME III•
AD-A003 509

•HORNE, WILLIAM E•

• • •

REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS).
AD- 749 477

• • •

REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS).
AD- 774 592

•HOTZ, ROD F.

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DEVELOPMENT OF VERTICAL MULTIJUNCTION SOLAR CELLS FOR SPACECRAFT PRIMARY POWER.
AD-A001 084

•HUBLER, G. K.

• • •

NAVY APPLICATIONS FOR TERRESTRIAL PHOTOVOLTAIC SOLAR POWER.
AD-A030 529

•HUI, WILLIAM L.

• • •

IMPROVED THIN-FILM SOLAR CELLS.
AD- 476 696

•HUI, WILLIAM L. C.

• • •

ADVANCED THIN-FILM SOLAR CELLS.
AD- 807 711

•HUMRICK, R.J.

• • •

LARGE AREA THIN FILM CADMIUM SULFIDE SOLAR CELL ARRAY INVESTIGATION.
AD- 407 525

• • •

INVESTIGATION OF THIN FILM CADMIUM SULFIDE SOLAR CELLS.
AD- 423 689

• • •

INVESTIGATION OF THIN FILM CADMIUM SULFIDE SOLAR CELLS.
AD- 432 192

• • •

INVESTIGATION OF THIN FILM CADMIUM SULFIDE SOLAR CELLS.
AD- 601 459

• • •

INVESTIGATION OF THIN FILM CADMIUM SULFIDE SOLAR CELLS.
AD- 605 425

•ICHIKAWA, Y.

• • •

MANUFACTURING METHODS FOR SILICON DENDRITE SOLAR CELLS.
AD- 477 447

• • •

DENDRITIC SILICON SOLAR CELL OPTIMIZATION AND FABRICATION.
AD- 822 426

•ILES, P. A.

• • •

HARDENED VIOLET RESPONSE SILICON SOLAR CELL FOR SATELLITE APPLICATION.
AD-A013 921

•ILES, PETER A.

• • •

ELECTROFORMED ALUMINUM SOLAR CELL CONTRACTS.
AD- 764 816

•JACOBSON, JOHN FRANK

• • •

EXAMINATION OF LASER-PRODUCED PRESSURE PULSES IN A GALLIUM ARSENIDE SOLAR CELL.
AD-A031 893

•JENKINS, R. M.

• • •

ON THE INFRA-RED RESPONSE OF SILICON SOLAR CELLS AS A FUNCTION OF THICKNESS.
AD- 696 850

•JOHNSON, JOSEPH E., JR

• • •

SILICON CELL LIFETIME AND EFFICIENCY IMPROVEMENT.
AD- 875 751

•JOSLIN, DAVID E.

• • •

LOW - ENERGY PROTON DAMAGE TO SILICON/ SOLAR CELLS.
AD- 715 261

• • •

COMSAT NONREFLECTIVE SOLAR CELL EVALUATION.
AD-A030 532

•JOST, J. M.

• • •

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS.
AD- 678 540

• • •

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS.
AD- 678 542

•JUNGA, F.

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GAMMA RADIATION EFFECTS IN SILICON SOLAR CELLS.
AD- 477 592

•JUNGA, FRANK A.

• • •

RADIATION EFFECTS IN SILICON SOLAR CELLS. PART II.
AD- 801 717

•KAGAN, M. B.

• • •

INVESTIGATION OF PHOTOELECTRIC CHARACTERISTICS OF GALLIUM ARSENIDE SOLAR CELLS OVER A WIDE RANGE OF CHANGE IN LIGHT FLUX.
AD- 756 228

•KARGIN, M. B.

• • •

SOLAR ELEMENTS BASED ON EPITAXIAL GAAS FILMS.
AD- 776 171

•KARPOVA, M. S.

• • •

SOLAR ELEMENTS BASED ON EPITAXIAL

GAAS FILMS,
AD- 776 171

*KILLAM, G. H.
• • •
RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS.
AD- 438 526

*KILLIAN, H. J.
• • •
SOLAR CELL AND ARRAY STANDARDIZATION FOR AIR FORCE SPACECRAFT,
AD-A004 544

*KING, HOWARD E.
• • •
93 - GHZ RADAR CROSS-SECTION MEASUREMENTS OF SATELLITE ELEMENTAL SCATTERERS,
AD-A010 487

*KING, Q. J.
• • •
ION IMPLANTATION JUNCTION TECHNIQUES.
AD- 805 407

*KING, WILLIAM J
• • •
P-N JUNCTION FORMATION TECHNIQUES
AD- 299 601

*KIRKPATRICK, ALLEN R.
• • •
STRESS FREE APPLICATION OF GLASS COVERS FOR RADIATION HARDENED SOLAR CELLS AND ARRAYS.
AD-A015 840

*KISINKO, P. M.
• • •
MANUFACTURING METHODS FOR SILICON DENDRITE SOLAR CELLS.
AD- 477 447

*KITTL, EMIL
• • •
SPECTRAL RESPONSE INVESTIGATION OF SILICON PHOTOVOLTAIC CELLS.
AD- 721 888

*KNEV, STEFAN
• • •
PROPERTIES OF P-N JUNCTIONS IN CADMIUM SULFIDE AND CONSTRUCTION OF PHOTOELECTRIC TRANSDUCERS,
AD- 712 936

*KOLTUN, M
• • •
SOLAR BATTERIES OF THE FUTURE
AD- 286 578

*KOMASHCHENKO, V. N.
• • •
HETEROGENEOUS SOLAR CONVERTORS BASED ON POLYCRYSTALLINE CADMIUM SULFIDE AND CADMIUM SELENIDE (GETEROGENNE SOLNECHNE PREOBRAZOVATELI NA OSNOVE POLIKRISTALLICHESKOGO SULFIDA I SELENIDA KADMIYA), ?
AD- 756 594

• • •
HETEROGENEOUS SOLAR CONVERTERS BASED ON POLYCRYSTALLINE CADMIUM SULFIDE AND SELENIDE,
AD- 776 551

*KOROLEV, M.
• • •
SPACE ELECTRIC POWER PLANTS. PART 2,
AD- 756 039

*KORWIN-PAWLOWSKI, MICHAL
• • •
GALLIUM-ARSENIDE PHOTOELECTRIC RECEIVING DEVICES,
AD- 867 390

*KRAPF, R. N.
• • •
IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL EFFECTS INVESTIGATION.
AD- 852 760

*LAMB, R.D.
• • •
WEBBED DENDRITIC SILICON SOLAR CELL RADIATION EFFECTS INVESTIGATION.
AD- 406 353

*LAMOND, PIERRE
• • •
HIGH EFFICIENCY SILICON SOLAR CELLS
AD- 257 494

*LANDSMAN, A. P.
• • •
A STUDY OF 'PHOTOVOLT' GENERATOR AT HIGH RADIATION INTENSITY (ISSLEDOVANIE ELEKTRICHESKIKH KHARAKTERISTIK GENERATOROV 'FOTOVOLT' PRI POVYSHENNOI MOSHCHNOSTI IZLUCHENIYA),
AD- 745 364

*LAUDERBACK, PAUL W.
• • •
AN ANALYSIS OF LOW ORBITAL DRAG CONSTRAINTS OF ORBIT- AND SUN-ORIENTED SOLAR-CELL ARRAYS.
AD- 658 453

*LAWLER, J. L.
• • •
RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS.
AD- 438 526

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• • •
REVERSE CURRENT BLOCKING DIODES FOR FLEXIBLE SOLAR ARRAY PROTECTION.
AD-A015 880

*LEWIS, ARTHUR E
• • •
COATINGS FOR SOLAR CELLS
AD- 258 660

*LIDORENKO, N.
• • •
SPACE ELECTRIC POWER PLANTS. PART I (LITSOM K SOLNTSU),
AD- 741 524

*LLOYD, W. W.
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DEVELOPMENT OF VERTICAL MULTIJUNCTION SOLAR CELLS FOR SPACECRAFT PRIMARY POWER. VOLUME II.
AD-A025 719

LODI, E.A

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PROTON DAMAGE TO SOLAR CELLS
AD- 265 213

*LODI, E. A.

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AN ANALYSIS OF NON-UNIFORM PROTON IRRADIATION DAMAGE IN SILICON SOLAR CELLS.
AD- 649 672

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SOLAR CELL RADATION RESPONSE NEAR THE INTERFACE OF DIFFERENT ATOMIC NUMBER MATERIALS.
AD- 740 577

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RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS.
AD- 938 526

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INVESTIGATION OF PHOTOELECTRIC CHARACTERISTICS OF GALLIUM ARSENIDE SOLAR CELLS OVER A WIDE RANGE OF CHANGE IN LIGHT FLUX,
AD- 756 228

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REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS), VOLUME III.
AD-A003 509

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REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS).
AD- 749 477

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REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS).
AD- 774 592

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DEVELOPMENT OF VERTICAL MULTIJUNCTION SOLAR CELLS FOR SPACECRAFT PRIMARY POWER. VOLUME II.
AD-A025 719

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MANUFACTURING METHODS FOR SILICON DENDRITE SOLAR CELLS.
AD- 477 447

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SHADED SUN SENSOR MODELING FOR SPACECRAFT ACQUISITION PERFORMANCE ANALYSIS.
AD-A003 752

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INVESTIGATION OF OPTICAL COATINGS FOR SOLAR CELLS
AD- 271 358

• • •

INVESTIGATION OF OPTICAL COATINGS FOR SOLAR CELLS
AD- 271 599

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LONG WAVE SENSITIVITY OF SOLAR CONVERTERS N-CDS-CU(2-X)S,
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ELECTRIC POWER STATION IN THE COSMOS.
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IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL EFFECTS INVESTIGATION.
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REVERSE CURRENT BLOCKING DIODES FOR FLEXIBLE SOLAR ARRAY PROTECTION.
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SOLAR ORIENTING DEVICE FOR EXPANDABLE FLAT-PANEL ARRAY

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INVESTIGATION OF LARGE AREA DENDRITIC WEB TYPE GERMANIUM PHOTOVOLTAIC CELLS.
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MODULAR DESIGN OF IMPROVED SOLAR CONVERTERS.
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CALCULATED EFFICIENCIES OF PRACTICAL GAAS AND SI SOLAR CELLS INCLUDING THE EFFECT OF BUILD-IN ELECTRIC FIELDS.
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FABRICATION OF CADMIUM SULFIDE THIN FILM SOLAR CELLS FOR SPACE VEHICLE TESTING.
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IMPROVEMENTS IN CDS THIN FILM SOLAR CELLS.
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RESEARCH IN SOLAR ENERGY CONVERSION.
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AD- 818 310

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AD- 822 428

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SOLAR ELEMENTS BASED ON EPITAXIAL GAAS FILMS.
AD- 776 171

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LARGE RETRACTABLE SOLAR CELL ARRAY.
AD- 860 179

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ORIENTATION LINKAGE FOR A SOLAR CELL ARRAY: OL SCA.
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NEUTRON DAMAGE TO SILICON SOLAR CELLS.
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RADIATION EFFECTS ON SEMICONDUCTOR MATERIALS AND DEVICES.
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LONG WAVE SENSITIVITY OF SOLAR CONVERTERS N-CDS-CU(2-X)S.
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HIGH EFFICIENCY SILICON SOLAR CELLS
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REAL TIME ASSESSMENT OF IMPROVED LITHIUM-DOPED SOLAR CELLS.
AD-A000 451

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INVESTIGATION OF SINGLE ENERGY GAP SOLAR CELL MATERIAL
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INVESTIGATION OF OPTICAL COATINGS FOR SOLAR CELLS
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AD- 269 508

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SOLAR CELL AND ARRAY STANDARDIZATION FOR AIR FORCE SPACECRAFT.
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IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL EFFECTS INVESTIGATION.
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DEVELOPMENT OF VERTICAL MULTIJUNCTION SOLAR CELLS FOR SPACECRAFT PRIMARY POWER.
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LARGE AREA THIN FILM CADMIUM SULFIDE SOLAR CELL ARRAY INVESTIGATION
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FABRICATION OF CADMIUM SULFIDE THIN FILM SOLAR CELLS FOR SPACE VEHICLE TESTING.
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RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH EFFICIENCY CDS THIN-FILM SOLAR CELLS.
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DEGRADATION OF CDS THIN FILM SOLAR CELLS IN DIFFERENT ENVIRONMENTS.
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COMPARISON OF LOW-ENERGY PROTON DAMAGE IN ION-IMPLANTED AND DIFFUSED SILICON SOLAR CELLS.
AD- 728 186

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STRUCTURAL FAILURES IN LIGHTWEIGHT SOLAR CELL ARRAYS UNDER THERMAL CYCLING.
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PROPERTIES OF P-N JUNCTIONS IN CADMIUM SULFIDE AND CONSTRUCTION OF PHOTOELECTRIC TRANSDUCERS.
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THIN SILICON SOLAR CELLS BY ION IMPLANTATION•
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SOLAR CELL POWER SYSTEMS FOR AIR FORCE SATELLITES,
AD- 654 285

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NEUTRON DAMAGE TO SILICON SOLAR CELLS,
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LOW - ENERGY PROTON DAMAGE TO SILICON/ SOLAR CELLS•
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AD- 809 143

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FLEXIBLE INTEGRATED SOLAR CELL ARRAY•
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RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS•
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WEBBED DENDRITIC SILICON SOLAR CELL RADIATION EFFECTS INVESTIGATION•
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DENDRITIC SILICON SOLAR CELL PANEL•
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DENDRITIC SOLAR CELL AND ARRAY INVESTIGATION•
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SOME EFFECTS OF ELECTRON IRRADIATION AND TEMPERATURE ON SOLAR CELL PERFORMANCE•
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TUR-YEA

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THE RAE LIGHTWEIGHT SOLAR ARRAY.
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AD- 913 278

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REAL-TIME SPACE AND NUCLEAR EFFECTS ON SOLAR CELLS (ACCELERATED EVALUATION METHODS), VOLUME III.
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AD- 634 810

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PHOTOVOLTAIC AND THERMOELECTRIC SOLAR ENERGY CONVERSION USING THIN FILMS,
AD- 686 496