Index to 1986 NASA Tech Briefs

Volume 11, Numbers 1-4 **JUNE 1987**


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INTRODUCTION

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This *Index to NASA Tech Briefs* contains abstracts and four indexes — subject, personal author, originating Center, and Tech Brief Number — for 1986 Tech Briefs.

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Originating Center Prefixes

ARC	Ames Research Center
GSC	Goddard Space Flight Center
HQN	NASA Headquarters
KSC	Kennedy Space Center
LAR	Langley Research Center
LEW	Lewis Research Center
MFS	Marshall Space Flight Center
MSC	Johnson Space Center (formerly Manned Spacecraft Center)
NPO	Jet Propulsion Laboratory/NASA Pasadena Office

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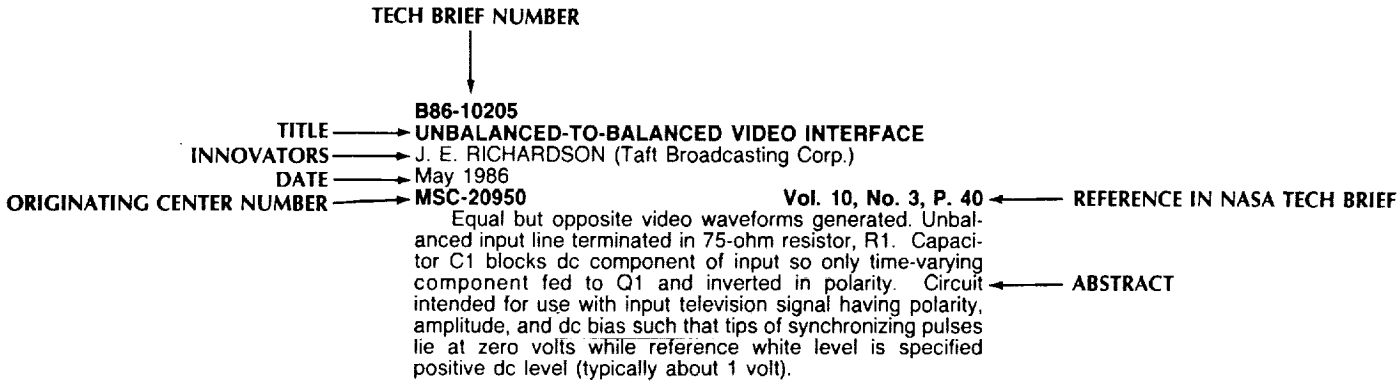

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JUNE 1987

Abstract Section

01 ELECTRONIC COMPONENTS AND CIRCUITS

B86-10001
MICROSTRIP ANTENNA GENERATES CIRCULARLY POLARIZED BEAM
J. HUANG (Caltech)
Jul. 1986
NPO-16460 **Vol. 10, No. 1, P. 32**

Circular microstrip antenna excited with higher order transverse magnetic (TM) modes generates circularly polarized, conical radiation patterns. Found both theoretically and experimentally that peak direction of radiation pattern is varied within wide angular range by combination of mode selection and loading substrate with materials of different dielectric constants.

B86-10002
IMPROVED HIGH/LOW JUNCTION SILICON SOLAR CELL
A. NEUGROSCHEL (University of Florida), S. C. PAO (University of Florida), F. A. LINDHOLM (University of Florida), and J. G. FOSSUM (University of Florida)
Jul. 1986
LEW-13618 **Vol. 10, No. 1, P. 34**

Method developed to raise value of open-circuit voltage in silicon solar cells by incorporating high/low junction in cell emitter. Power-conversion efficiency of low-resistivity silicon solar cell considerably less than maximum theoretical value mainly because open-circuit voltage is smaller than simple p/n junction theory predicts. With this method, air-mass-zero open-circuit voltage increased from 600 mV level to approximately 650 mV.

B86-10003
INCREASED SPECTRAL RESPONSE FOR CHARGE-COUPLED DEVICES
J. R. JANESICK (Caltech) and T. ELLIOTT (Caltech)
Jul. 1986
NPO-16150; NPO-16290 **Vol. 10, No. 1, P. 38**

Significant improvement in charge-coupled-device (CCD) spectral sensitivity is demonstrated over remarkable range. Improvement in quantum efficiency, in conjunction with CCD low-read-noise floor (less than 4e) opens up new scientific opportunities in fields of biology, nuclear science, laboratory plasma diagnostics, and host of other physical and astronomical applications in the UV, X-UV, and X-ray regimes.

B86-10004
SUBMICRON SILICON MOSFET
T. DAUD (Caltech)
Jul. 1986
NPO-16601 **Vol. 10, No. 1, P. 40**

Process for making metal-oxide/semiconductor field-effect transistors (MOSFET's) results in gate-channel lengths of only few hundred angstroms about 100 times as small as state-of-the-art devices. Gates must be shortened to develop faster MOSFET's; proposed fabrication process used to study effects of size reduction in MOS devices and eventually to build practical three-dimensional structures.

B86-10005
BURIED-DIELECTRIC-MICROSTRIP NETWORK
P. K. CHEO (United Technologies Corp.), R. A. WAGNER (United Technologies Corp.), and M. GILDEN (United Technologies Corp.)
Jul. 1986
LAR-13285 **Vol. 10, No. 1, P. 42**

Problem of obtaining very-broadband frequency response resolved with buried-dielectric-microstrip matching network incorporated into infrared-waveguide structure. Waveguide modulator structure represents state-of-the-art of integrated optical devices: Has three-dimensional shape to accommodate three quarter-wavelength-transformers for microwave impendance matching at both input and output terminals. Microwave network, along with microstrip line designed with aid of computer, integrated with optical waveguide and used to tune line-selectable CO2 laser that provides total tuning range of 30 GHz in two sidebands.

B86-10006
BRUSH-TYPE CONNECTORS FOR THERMOELECTRIC ELEMENTS
C. WOOD (Caltech)
Jun. 1986
NPO-16545 **Vol. 10, No. 1, P. 44**

Wire brushes used to connect positive and negative legs of semiconductor thermoelectric generators to power leads and heat sources and sinks. Brushes are flexible thermal and electrical conductors that readily accommodate expansion and contraction of legs with changing temperature. Thus, direct conductive coupling between heat source and sink allowed, in contrast to older and less efficient method of having to couple radiatively to accommodate thermal expansion.

B86-10007
PHASE-LOCKED LASER ARRAY WITH NONUNIFORM SPACING
D. E. ACKLEY (RCA Corp.)
Jun. 1986
LAR-13281 **Vol. 10, No. 1, P. 47**

To obtain phase-locked array that reliably produces single far-field lobe, configuration includes lasing stripes not placed on regular centers but located in regular way with

nonuniform centers (i.e., with spacing determined by some function). Alternatively, lasing stripes placed on set of periodic arrays with different stripe-to-stripe centers interlaced onto single chip or placed in structure in which stripe-to-stripe spacing is random or pseudorandom. Monolithic, phase-locked, semiconductor-laser array design produces output laser beam comprising substantially single lobe.

B86-10008
ULTRASONIC BONDING TO METALIZED PLASTIC
B. L. CONROY (Caltech) and C. T. CRUZAN (Caltech)
Jun. 1986
NPO-16087 **Vol. 10, No. 1, P. 48**
New technique makes it possible to bond wires ultrasonically to conductor patterns on such soft substrates as plain or ceramic-filled polytetrafluoroethylene. With ultrasonic bonding, unpackaged chips attached to soft circuit boards. Preferred because chips require substrate area and better matched electrically to circuit board at high frequencies.

B86-10009
MICROWAVE ANTENNA WITH REDUCED NOISE LEAKAGE
A. G. CHA (Caltech)
Jun. 1986
NPO-15785 **Vol. 10, No. 1, P. 48**
Gain or gain-to-temperature ratio of dual-shaped subreflector receiving antenna increased when illumination is tapered near aperture edge. Taper imposed in antenna feed reduces spillover in transmitting mode and reduces noise pickup in receiving mode.

B86-10010
PULSED-CORONA ELECTROSTATIC CHARGER
W. K. RHIM (Caltech), D. D. ELLEMAN (Caltech), B. MAKIN (Caltech), and W. T. SIMMS (Caltech)
Jun. 1986
NPO-16523 **Vol. 10, No. 1, P. 50**
Experimental charge-generating apparatus supplies nanocoulomb charges to small objects. Purpose of experiment to develop contactless charger for solid or liquid spheroids in contactless (levitation) processing. Circuit generates high-voltage RF Pulses, applied between two electrodes in each set. Also applies 60 Hz high accelerating voltage between two sets of electrodes. Two sets of electrodes made of conductive paint on acrylic sheets, placed diametrically opposite each other in supporting cylinder.

B86-10011
CALCULATING DIRECTIVITIES OF PLANAR-ARRAY ANTENNA FEEDS
Y. RAHMAT-SAMII (Caltech) and S. W. LEE (Caltech)
Jun. 1986
NPO-16505 **Vol. 10, No. 1, P. 51**
Design of planar-array antennas and antenna feeds aided by new approach to calculation of array directivity. Technique takes into account polarizations, asymmetries in element patterns, nonuniform element spacings, and arbitrary excitations. Gives numerical results faster than previous integration methods, and results agree with those obtained by older methods.

B86-10012
RELIABLE ONE-SHOT SEPARATION OF CONNECTORS
W. R. HOLMBERG (McDonnell Douglas Corp.)
Jun. 1986
MSC-20839 **Vol. 10, No. 1, P. 52**
Concept for separating electrical connectors by remote control simple and reliable. Suitable for one-time, irreversible separations, method uses weak explosion to destroy one member of the connector.

B86-10013
FLEX CIRCUITRY FOR CONFINED SPACES
J. B. FITZPATRICK (Simmonds Precision) and L. C. MAIER (Simmonds Precision)
Jun. 1986
MSC-20773 **Vol. 10, No. 1, P. 52**
To facilitate installation of electronic equipment in confined spaces, circuitry preassembled on flexible wiring. Mother boards, large bypass capacitors, and interface connectors mounted on flexible wiring and tested before installation. Flexible circuits eliminate need for in-place hardwiring and allow smaller enclosures to be used.

B86-10014
IMPROVED SOLAR-CELL TUNNEL JUNCTION
T. DAUD (Caltech) and A. KACHARE (Caltech)
Jun. 1986
NPO-16526 **Vol. 10, No. 1, P. 53**
Efficiency of multiple-junction silicon solar cells increased by inclusion of p+/n+ tunnel junctions of highly doped GaP between component cells. Relatively low recombination velocity at GaP junction principal reason for recommending this material. Relatively wide band gap also helps increase efficiency by reducing optical losses.

B86-10015
ADVANCED IPV NICKEL/HYDROGEN CELL
J. J. SMITHRICK, M. A. MANZO, O. GONZALEZ-SANABRIA, and D. G. SOLTIS
Jun. 1986 See Also (N84-23025)
LEW-13969 **Vol. 10, No. 1, P. 54**
Expansion and contraction of electrode stack accommodated to increase cycle life. Three features of advanced designs new and not incorporated but fully compatible in either contemporary cells: use of alternate methods of oxygen recombination, serrated-edge separators, and expandable stack. Designs also consider electrolyte volume requirements over life of cells and are fully compatible with state-of-the-art designs. Cells improve performance, life, and usable energy leading to lighter storage devices for low Earth-orbit applications for commercial or government applications.

B86-10097
ADJUSTABLE HEADBAND FOR EARPHONES
P. C. TOOLE, H. E. CHALSON, and S. BUSSEY
May 1986
KSC-11322 **Vol. 10, No. 2, P. 32**
New handband designed for comfort and convenience. New band consists of pair of steel head-clamping spring strips joined by tensioning screw. Cushioned side support mounted on end of one strip, and cushioned earphone and microphone mounted on end of second strip. Band reversible. Easily adjusted for head size and readily readjusted for greater comfort without removing.

B86-10098
LINEAR PHASE MODULATOR
R. H. HESSE (TRW, Inc.)
May 1986
MSC-20555 **Vol. 10, No. 2, P. 34**
Circuit suppresses AM component while providing matched input impedance. Phase modulation uses reflective properties of series resonant tank to reflect all of signal except for small amount in unloaded Q of coils and varactor diode. Circuit used in payload integrator of Space Shuttle S-band communications and tracking equipment, has applications in other communications and tracking equipment.

B86-10099
CROSS-ARRAY ANTENNA WITH SWITCHED STEERING
R. S. IWASAKI (Axiomatix)
May 1986
MSC-20889 **Vol. 10, No. 2, P. 38**
Selected phase shifting of feeds to antenna elements aims antenna beam. Antenna for Space Shuttle controlled in two dimensions by double-pole, double-throw switches

antenna feeds. Switches control phasing of antenna elements by transposing transmission-line delay elements between feeds to pairs of elements located on opposite sides of antenna. Same principles can be applied to antennas with additional elements along each axis.

B86-10100
POSITIVE-INDEX GUIDING IN CDH-LOC LASERS
D. BOTEZ (RCA Corp.)
May 1986
LAR-13312 **Vol. 10, No. 2, P. 40**

Nonabsorbing passive region has beam-guiding capability. Convex-lens-shaped layer has refractive index higher than surrounding material so serves as optical waveguide. Four times more power achieved for devices of this type not incorporating the passive region.

B86-10101
BIDIRECTIONAL DC-TO-DC POWER CONVERTER
C. R. GRIESBACH (Martin Marietta Corp.)
May 1986
MFS-28095 **Vol. 10, No. 2, P. 40**

Solid-state, series-resonant converter uses high-voltage thyristors. Converter used either to convert high-voltage, low-current dc power to low-voltage, high current power or reverse. Taking advantage of newly-available high-voltage thyristors to provide better reliability and efficiency than traditional converters that use vacuum tubes as power switches. New converter essentially maintenance free and provides greatly increased mean time between failures. Attractive in industrial applications whether or not bidirectional capability is required.

B86-10102
VIDEO PROCESSOR FOR TRANSPONDER PULSES
F. BYRNE
May 1986
KSC-11155 **Vol. 10, No. 2, P. 42**

Circuit detects interrogation signals from air-traffic-control station and determines whether transponder of airplane should respond. Circuit examines relative magnitudes of first two pulses in three-pulse sequence of interrogation signal. On basis of relative magnitudes, circuit decides whether main lobe of interrogating radar beam is received (response should be generated) or only side lobe received (and interrogation ignored). Circuit simple and inexpensive.

B86-10103
LITHIUM-COUNTERDOPED SOLAR CELLS
I. WEINBERG and H. BRANDHORST
May 1986
LEW-14177 **Vol. 10, No. 2, P. 43**

Resistance to damage by energetic electrons increased. Lithium-counterdoped cells produce more output power than presently-used, conventional n + p silicon cells, after irradiation by MeV electrons. In addition to possessing increased radiation resistance, lithium-counterdoped silicon solar cells show significant performance restoration when annealed at temperature of 100 degrees C. Performances compared after irradiation with 1-MeV electrons. Lithium-counter-doped solar cell offers potential for in situ annealing in space. Process increases electrical power available from solar-cell array during use in space missions subject to degrading particulate environment of space.

B86-10104
EJECTION MECHANISM FOR CIRCUIT BOARDS
T. L. HOUFF (Hughes Aircraft Co.) and D. SHINNO (Hughes Aircraft Co.)
May 1986
MSC-20763 **Vol. 10, No. 2, P. 46**

Damage to connectors reduced and special tools not needed. Clockwise rotation of screw tightens wedges against mounting body and right heat sink. Counterclockwise rotation of screw drives bottom wedge downward and jacking ring upward, pulling pins away from mating connector. Screw in mechanism turned to produce jacking force that disengages board from mating connector. Force parallel to connector pins do not bend or brake. When disengaged, board protrudes from assembly and readily grasped by operator.

B86-10105
BROADBAND ULTRASONIC TRANSDUCERS
R. C. HEYSER (Caltech)
May 1986
NPO-16590 **Vol. 10, No. 2, P. 47**

New geometry spreads out resonance region of piezoelectric crystal. In new transducer, crystal surfaces made nonparallel. One surface planar; other, concave. Geometry designed to produce nearly uniform response over a predetermined band of frequencies and to attenuate strongly frequencies outside band. Greater bandwidth improves accuracy of sonar and ultrasonic imaging equipment.

B86-10106
CORRECTING FOR NONLINEARITY IN A PHOTODETECTOR
R. A. SCHINDLER (Caltech)
May 1986
NPO-16055 **Vol. 10, No. 2, P. 47**

Simple positive-feedback circuit varies bias voltage as necessary. Ideal detector biased with constant voltage, detector current proportional to photon flux plus constant offset. Detector connected between inverting input and ground, and feedback from operational amplifier through feedback resistor Rf make voltage at inverting input equal to noninverting input. Bias voltage held constant. Principle applied to linearizing mercury cadmium telluride infrared detectors in Fourier-transform spectrometers and other spectral and imaging instruments.

B86-10107
IMPROVED HIGH/LOW JUNCTION SILICON SOLAR CELL
A. NEUGROSCHEL (University of Florida), S. C. PAO (University of Florida), F. A. LINDHOLM (University of Florida), and J. G. FOSSUM (University of Florida)
May 1986
LEW-13618 **Vol. 10, No. 2, P. 48**

Air-mass-zero open-circuit voltage increased to 650 mV. Oxide-charge-induced high/low emitter solar cell, electron accumulation layer induced by positive charge. High/low emitter suppresses dark emitter recombination current, resulting in power-conversion efficiencies significantly higher than previously achieved.

B86-10108
A 25-KW SERIES-RESONANT POWER CONVERTER
R. J. FRYE and R. R. ROBSON (Hughes Research Laboratories)
May 1986 See Also (N84-17481)
LEW-14197 **Vol. 10, No. 2, P. 49**

Prototype exhibited efficiency of 93.9 percent. 25-kW resonant dc/dc power converter designed, developed, fabricated, and tested, using Westinghouse D7ST transistors as high-power switches. D7ST transistor characterized for use as switch in series-resonant converters, and refined base-drive circuit developed. Technical base includes advanced switching magnetic, and filter components, mathematical circuit models, control philosophies, and switch-drive strategies. Power-system benefits such as lower losses when used for high-voltage distribution, and reduced magnetics and filter mass realized.

B86-10197
FABRICATION OF AN X-RAY IMAGING DETECTOR
G. E. ALCORN and A. S. BURGESS
May 1986
GSC-12956 **Vol. 10, No. 3, P. 30**

X-ray detector array yields mosaic image of object emitting 1- to 30-keV range fabricated from n-doped silicon

wafer. In proposed fabrication technique, thin walls of diffused n+ dopant divide wafer into pixels of rectangular cross section, each containing central electrode of thermally migrated p-type metal. This pnn+ arrangement reduces leakage current by preventing transistor action caused by pnp structure of earlier version.

B86-10198
SELF-ALINING ELECTRICAL CONNECTOR
A. SWANIC (Arbus, Inc.)
May 1986
MFS-26022 **Vol. 10, No. 3, P. 33**

Mating pair of insulators forces initial alinement of plug and socket. Male pins recessed behind one of alining insulators so they cannot touch female contacts alined. Contacts mate when coupling nut draws alined plug and socket together, depressing one of alining insulators against spring. Compressed spring provides tension on mated threads of assembly helping connector to resist loosening under vibration or shock. Arrangement prevents breakage or bending of male pins on conventional connectors when misalined contacts carelessly pressed together.

B86-10199
ROM-BASED PLAN-POSITION-INDICATOR SWEEP DRIVER
J. M. FRANKE and B. D. LEIGHTY
May 1986
LAR-13328 **Vol. 10, No. 3, P. 34**

Circuit produces PPI display on conventional X-Y oscilloscope. Circuit requires three inputs. First is once-per-scan pulse to synchronize display to north, relative heading, or another reference direction. Second is once-per-degree-of-rotation pulse to advance sweep rotation. Third input is normal sweep ramp. Duration of ramp corresponds to maximum displayed range. Changing ramp duration, while holding its peak amplitude constant, changes maximum displayed range. Conventional methods to accomplish this task use mechanically-driven deflection coils or mechanically-driven sine and cosine potentiometers, requiring mechanical preventive maintenance plus dedicated display indicator. New method displays radar sweep on any conventional storage oscilloscope.

B86-10200
VARIABLE SYNTHETIC CAPACITANCE
L. L. KLEINBERG
May 1986
GSC-12961 **Vol. 10, No. 3, P. 36**

Feedback amplifier circuit synthesizes electronically variable capacitance. Variable Synthetic Capacitor is amplifier circuit with follower/feedback configuration. Effective input capacitance depends on input set current. If synthetic capacitor is connected across resonant element of oscillator, oscillator frequency controlled via input set current. Circuit especially suitable for fine frequency adjustments of piezoelectric-crystal or inductor/capacitor resonant oscillators.

B86-10201
HIGH-RESOLUTION THERMAL X-RAY DETECTOR
S. H. MOSELEY
May 1986
GSC-12953 **Vol. 10, No. 3, P.37**

Thermal pulses from single photons measured. Detector, consists of X-ray absorber, temperature sensor in absorber, and thermal link from absorber to heat sink. X-ray photon detected by measuring temperature rise immediately following absorption of photon. Thermal X-ray detector, tested successfully in prototype, in theory operates as spectrometer that provides 100 times spectral resolution of conventional to detect trace constituents in materials by X-ray fluorescence. Also used for measuring energies of energetic electrons and weak pulses of light.

B86-10203
TEMPERATURE-SENSITIVE OSCILLATOR
L. L. KLEINBERG
May 1986
GSC-12958 **Vol. 10, No. 3, P. 39**

Ingestible thermometer consists of oscillator with temperature-dependent frequency. Device is quartz-crystal oscillator, frequency of which changes in proportion to change in temperature. Temperature-Sensitive Oscillator with nearly linear temperature coefficient of frequency obtained by using high-speed, high-gain, programable operational amplifier such as OP-32 to produce temperature-varying reflected capacitance across quartz crystal. New, small, inexpensive, low-power, temperature-sension circuit suitable for use as ingestible thermometer for measuring internal body temperature.

B86-10204
MULTIKILOWATT BIPOLAR NICKEL/HYDROGEN BATTERY
(Innovator Not Given Electrochemistry Branch) May 1986
See Also N82-24647/NSP
LEW-14244 **Vol. 10, No. 3, P. 39**

High energy densities appear feasible. Nickel/hydrogen battery utilizing bipolar construction in common pressure vessel, addressing needs for multikilowatt storage for low-Earth-orbit applications, designed and 10-cell prototype model tested. Modular-concept-design 35-kW battery projected energy densities of 20 to 24 Wh/b (160 to 190 kj/kg) and 700 to 900 Wh/ft3 (90 to 110 MJ/m3) and incorporated significant improvements over state-of-the-art storage systems.

B86-10205
UNBALANCED-TO-BALANCED VIDEO INTERFACE
J. E. RICHARDSON (Taft Broadcasting Corp.)
May 1986
MSC-20950 **Vol. 10, No. 3, P. 40**

Equal but opposite video waveforms generated. Unbalanced input line terminated in 75-ohm resistor, R1. Capacitor C1 blocks dc component of input so only time-varying component fed to Q1 and inverted in polarity. Circuit intended for use with input television signal having polarity, amplitude, and dc bias such that tips of synchronizing pulses lie at zero volts while reference white level is specified positive dc level (typically about 1 volt).

B86-10206
PASSIVE ELEMENT SHAPES ANTENNA RADIATION PATTERN
M. E. BONEBRIGHT (Cubic Corp.) and D. KILLION (Cubic Corp.)
May 1986
NPO-16632 **Vol. 10, No. 3, P. 41**

Parasitic waveguide element suppresses ground-reflected multipath radiation. Small section of waveguide placed in front of phased-array antenna operating at 850 MHz modifies radiation field by reducing power density parallel to and below ground plane without significantly affecting primary radiation at angles greater than 20 degrees above horizontal. Acts as parasitic radiator that shifts phase of portion of wavefront by approximately 180 degrees, causing partial cancellation in ground plane, thereby reducing radiation intensity in that direction by about 10 dB. Produces corresponding reduction in multipath radiation scattered from ground. Waveguide technique also used to decouple two nearby antennas.

B86-10207
RELIABILITY RESEARCH FOR PHOTOVOLTAIC MODULES
R. G. ROSS, JR. (Caltech)
May 1986
NPO-16595 **Vol. 10, No. 3, P. 42**

Report describes research approach used to improve reliability of photovoltaic modules. Aimed at raising useful

module lifetime to 20 to 30 years. Development of cost-effective solutions to module-lifetime problem requires compromises between degradation rates, failure rates, and lifetimes, on one hand, and costs of initial manufacture, maintenance, and lost energy, on other hand. Life-cycle costing integrates disparate economic terms, allowing cost effectiveness to be quantified, allowing comparison of different design alternatives.

B86-10208
GUIDELINES FOR SEU-RESISTANT INTEGRATED CIRCUITS
D. K. NICHOLS (Caltech)
May 1986
NPO-16596 **Vol. 10, No. 3, P. 42**

Paper presents recent results of continuing program for increasing resistance of integrated circuits to single-event upset (SEU). Results based on study of test data for heavy-ion SEU in more than 180 different types of devices. (Some devices perform identical functions but made by different processes.) Program also examines developments in mathematical models for SEU.

B86-10309
HYDRAULIC SHUTDOWN MONITOR
S. T. FLEMING (Rockwell International Corp.) and D. B. HARRINGTON (Rockwell International Corp.)
Jul. 1986
MSC-20796 **Vol. 10, No. 4, P. 30**

Adding switch allows inappropriate control actions to be overridden. Four-pole, double-throw switch added to front panel of controller to disable tracking-error and endpoint-error circuitry yet still retain overload-detection capability. Previously, it was necessary to use adjustable-voltage-level detection equipment connected with cables to hydraulic 'dump' or shutdown circuitry in controller.

B86-10310
CONTROLLING A FOUR-QUADRANT BRUSHLESS THREE-PHASE DC MOTOR
F. J. NOLA
Jul. 1986
MFS-28080 **Vol. 10, No. 4, P. 32**

Control circuit commutates windings of brushless, three-phase, permanent-magnet motor operating from power supply. With single analog command voltage, controller makes motor accelerate, drive steadily, or brake regeneratively, in clockwise or counterclockwise direction. Controller well suited for use with energy-storage flywheels, actuators for aircraft-control surfaces, cranes, industrial robots, and other electromechanical systems requiring bidirectional control or sudden stopping and reversal.

B86-10311
TAILORABLE INFRARED SENSING DEVICES
L. J. CHENG (Caltech)
Jul. 1986
NPO-16607 **Vol. 10, No. 4, P. 36**

Alternating layers of GexSi1.x and Si deposited by molecular-beam epitaxy. When electric field applied across stack, acts as detector for infrared photons. Device fabricated on silicon substrate together with sophisticated very-large-scale integrated circuitry. Useful for wide range of applications related to robotics, space exploration, and terrestrial surveillance.

B86-10312
ELECTROMETER AMPLIFIER WITH OVERLOAD PROTECTION
F. H. WOELLER and R. ALEXANDER (TRW, Inc.)
Jul. 1986
ARC-11457 **Vol. 10, No. 4, P. 36**

Circuit features low noise, input offset, and high linearity. Input preamplifier includes input-overload protection and nulling circuit to subtract dc offset from output. Prototype dc amplifier designed for use with ion detector has features desirable in general laboratory and field instrumentation.

B86-10313
SEMICONDUCTOR LASER WITH TWO-DIMENSIONAL BEAM STEERING
J. KATZ (Caltech)
Jul. 1986
NPO-16031 **Vol. 10, No. 4, P. 37**

Modification of monolithic semiconductor injection laser capable of one-dimensional electronic beam steering enables deflection of beam in second direction. Such laser chip provides beam pointing or raster scanning for applications in optical communications, data processing, image scanning, and optical ranging.

B86-10314
MOSFET POWER CONTROLLER
J. MITCHELL (Westinghouse Electric Corp.) and K. JONES (Westinghouse Electric Corp.)
Jul. 1986 See Also N83-21236/NSP
LEW-14112 **Vol. 10, No. 4, P. 38**

High current and voltage controlled remotely. Remote Power Controller includes two series-connected banks of parallel-connected MOSFET'S to withstand high current and voltage. Voltage sharing between switch banks, low-impedance, gate-drive circuits used. Provided controlled range for turn on. Individually trimmable to insure simultaneous switching within few nanoseconds during both turn on and turn off. Control circuit for each switch bank and over-current trip circuit float independently and supplied power via transformer T1 from inverter. Control of floating stages by optocouplers.

B86-10315
FAST REMOTE KILOVOLT-POWER CONTROLLER
P. HOWER (Westinghouse Electric Corp.)
Jul. 1986 See Also N83-21236/NSP
LEW-14111 **Vol. 10, No. 4, P. 42**

High power turned off rapidly in case of overload. Remote power controller (RPC) developed with power-handling capability of 25 A at 1,000 Vdc. RPC has programmable characteristic that trip open to clear fault within 3 microseconds.

B86-10316
LIST OF PREFERRED ELECTRONIC PARTS
R. E. COVEY (Caltech), W. R. SCOTT (Caltech), L. M. HESS (Caltech), G. STEFFY (Caltech), and F. R. STOTT (Caltech)
Jul. 1986 See Also N86-30889/NSP
NPO-16028 **Vol. 10, No. 4, P. 44**

Components passed stringent qualification tests tabulated and described. Destructive and nondestructive qualification testing confirmed parts capable of withstanding spacecraft environments without excessive degradation and have stable characteristics during operating lives. Testing assessed effects of electrical, environmental, and mechanical stresses in various levels and time durations.

B86-10410
FERRORESONANT FLUX-COUPLED BATTERY CHARGER
C. W. MCLYMAN (Caltech)
Sep. 1986
NPO-16530 **Vol. 10, No. 5, P.30**

Portable battery charger operates at about 20 kHz to take advantage of relatively low weight and low acoustical noise of ferroresonant circuits operating in this frequency range. Charger split into stationary unit connected to powerline and mobile unit connected to battery or other load. Power transferred to mobile unit by magnetic coupling between mating transformer halves. Advantage where sparking at electrical connection might pose explosion hazard or where operator disabled and cannot manipulate plug into wall outlet. Likely applications for charger include wheelchairs and robots.

B86-10411
GAAS SEMI-INSULATING LAYER FOR A GAAS DEVICE
G. SHERRILL (University of Virginia) and R. J. MATTAUCH (University of Virginia)
Sep. 1986
NPO-16394 **Vol. 10, No. 5, P. 32**
Improved design for GaAs electronic device or integrated circuit designed to operate at cryogenic temperatures, customary SiO_2 insulating layer replaced by semi-insulating layer of GaAs. Thermal expansions of device and covering layer therefore match closely, and thermal stresses caused by immersion in cryogenic chamber nearly eliminated.

B86-10412
VOLTAGE REGULATORS FOR PHOTOVOLTAIC SYSTEMS
R. DELOMBARD
Sep. 1986 See Also N84-25926/NSP
LEW-13288 **Vol. 10, No. 5, P. 34**
Two simple circuits developed to provide voltage regulation for high-voltage (i.e., is greater than 75 volts) and low-voltage (i.e., is less than 36 volts) photovoltaic/battery power systems. Use of these circuits results in voltage regulator small, low-cost, and reliable, with very low power dissipation. Simple oscillator circuit controls photovoltaic-array current to regulate system voltage and control battery charging. Circuit senses battery (and system) voltage and adjusts array current to keep battery voltage from exceeding maximum voltage.

B86-10413
PULLING-SPEED CONTROL FOR SILICON-WEB GROWTH
R. RICHTER (Caltech)
Sep. 1986
NPO-16685 **Vol. 10, No. 5, P. 35**
Proposed control system for dendritic-web growth of silicon ribbons varies ribbon speed according to melt temperature. System prevents too fast or too slow withdrawal of silicon web, which cause pullout of web or excessive web thickness, respectively. System also enables semiautomatic startup of web growth by automatically increasing web speed from zero to optimum value.

B86-10414
LONG-TERM ELECTRONIC TIMER
G. TEMPLE and T. KALASKEY
Sep. 1986
ARC-11590 **Vol. 10, No. 5, P. 36**
Timing circuit turns on power source on command, then turns it off again after preset interval. In comparison with prior devices, unit consumes little power and is smaller, lighter in weight, and less complicated. Timer includes oscillator and counter in integrated circuit. Timing interval equals oscillator period multiplied by number of cycles to be counted.

B86-10415
ELECTROABSORPTION INFRARED MODULATORS
D. L. ROBINSON (Caltech), W. K. MARSHALL (Caltech), and J. KATZ (Caltech)
Sep. 1986
NPO-16481 **Vol. 10, No. 5, P. 38**
Solid-state infrared modulator arrays fabricated and tested successfully. Arrays based on electro-absorption, and because of high speed inherent in small devices of this kind, expected to perform well at multigigahertz frequencies in such applications as multiplexing, demultiplexing, high-speed recording, and printing.

B86-10416
DUAL-SAMPLER PROCESSOR DIGITIZES CCD OUTPUT
P. M. SALOMON (Caltech)
Sep. 1986
NPO-16726 **Vol. 10, No. 5, P. 40**
Circuit for processing output of charge-coupled device (CCD) imager provides increased time for analog-to-digital conversion, thereby reducing bandwidth required for video processing. Instead of one sample-and-hold circuit of conventional processor, improved processor includes two sample-and-hold circuits alternated with each other. Dual-sampler processor operates with lower bandwidth and with timing requirements less stringent than those of single-sample processor.

B86-10417
PULSE-WIDTH PROPORTIONAL-CONTROLLER CIRCUIT
R. W. CLUKEY (Rockwell International Corp.)
Sep. 1986
MFS-29102 **Vol. 10, No. 5, P. 43**
Proportional controller for motor speed provides full 0- to 100-percent linear control of durations of motor-driving pulses. Controller uses commercially available LM3900 integrated circuit, which requires only single supply voltage of 4 to 30 V. Control voltage provided by adjustable potentiometer or by external source of feedback information such as motor-speed sensing circuit.

B86-10418
A COMBINED SCANNING CONFIGURATION FOR NEAR-FIELD ANTENNA MEASUREMENTS
Y. RAHMAT-SAMII (Caltech)
Sep. 1986
NPO-16644 **Vol. 10, No. 5, P. 44**
Scanning configuration for near-field antenna measurements uses cylindrical and plane-polar coordinate surfaces to guide motions of electromagnetic-field probes. Near-field measurements needed especially to enable determination of far fields of large, low-sidelobe, multiplebeam antennas, for which application of far-field measurements often not suitable. New cylindrical/plane-polar scanning configuration requires less space, yet expected to give complete measurements with fewer mechanical complications.

B86-10419
ANTENNA QUADRIPOD WITH REDUCED BLOCKAGE
J. J. CUCCHISSI (Caltech)
Sep. 1986
NPO-16704 **Vol. 10, No. 5, P. 45**
Design study for subreflector support of 64-m-diameter paraboloidal microwave antenna described in 19-page report. Objective of study to upgrade existing antenna quadripod, subject to mechanical and electromagnetic design requirements and optimization criteria. Principal effort directed toward reducing signal blockage by quadripod legs while minimizing structural weight.

B86-10453
ANALYZING MILLIMETER-WAVE MIXERS
P. SIEGEL, A. KERR, and W. HWANG (Columbia University)
Sep. 1986
GSC-12940 **Vol. 10, No. 5, P. 90**
Series of computer programs developed to serve as tool in understanding behavior and subsequent optimization of millimeter-wave mixers. Major program in collection is general mixer-analysis program that performs complete large- and small-signal analysis of mixer with known diode and mount characteristics. Primary objective behind programs to gain better understanding of factors that affect performance of room-temperature, single-ended Schottky-diode mixers operating above 100 GHz.

B86-10481
DESIGNING DC INDUCTORS WITH AIRGAPS
A. P. WAGNER (Caltech)
Nov. 1986
NPO-16739 **Vol. 10, No. 6, P. 28**
Optimal parameters obtained designing near saturation point. New iterative procedure aids design of dc inductors with airgaps in cores. For given core area and length, technique gives design having specified inductance and

peak flux density in core, using minimum required copper weight. Executed rapidly on programmable, hand-held calculator. Applications include lightweight inductors for aircraft electronics.

B86-10482
CIRCUIT FOR LIFETIME AND SURFACE-RECOMBINATION MEASUREMENTS
F. A. LINDHOLM (University of Florida), A. NEUGROSCHEL (University of Florida), and T. W. JUNG (University of Florida)
Nov. 1986
NPO-16752 **Vol. 10, No. 6, P. 30**

Test circuit for silicon solar cells suppresses spurious effects. New circuit increases accuracy of measurements of recombination lifetime and effective surface recombination velocity in silicon solar cell. Fast electronic switch, circuit grounds forward-biased cell so rapidly transient voltage to be measured not affected significantly.

B86-10483
FUEL-CELL STRUCTURE PREVENTS MEMBRANE DRYING
J. MCELROY (General Electric Co.)
Nov. 1986
MSC-21031 **Vol. 10, No. 6, P. 32**

Embossed plates direct flows of reactants and coolant. Membrane-type fuel-cell battery has improved reactant flow and heat removal. Compact, lightweight battery produces high current and power without drying of membranes.

B86-10484
SOLENOID-SIMULATION CIRCUIT
R. A. SIMON (Rockwell International Corp.)
Nov. 1986
MFS-29173 **Vol. 10, No. 6, P. 35**

Electrical properties of solenoids imitated for tests of control circuits. Simulation circuit imitates voltage and current responses of two engine-controlling solenoids. Used in tests of programs of digital engine-control circuits, also provides electronic interface with circuits imitating electrical properties of pressure sensors and linear variable-differential transformers. Produces voltages, currents, delays, and discrete turnon and turnoff signals representing operation of solenoid in engine-control relay. Many such circuits used simulating overall engine circuitry.

B86-10528
GRID-OPTIMIZATION PROGRAM FOR PHOTOVOLTAIC CELLS
R. E. DANIEL (Calfech) and T. S. LEE (Caltech)
Nov. 1986
NPO-16804 **Special Edition, P. 38**

CELLOPT program developed to assist in designing grid pattern of current-conducting material on photovoltaic cell. Analyzes parasitic resistance losses and shadow loss associated with metallized grid pattern on both round and rectangular solar cells. Though performs sensitivity studies, used primarily to optimize grid design in terms of bus bar and grid lines by minimizing power loss. CELLOPT written in APL.

02 ELECTRONIC SYSTEMS

B86-10016
IN-FLIGHT SIMULATOR FOR IFR TRAINING
L. C. PARKER
Jun. 1986
KSC-11218 **Vol. 10, No. 1, P. 56**

Computer-controlled unit feeds navigation signals to airplane instruments. Electronic training system allows students to learn to fly according to instrument flight rules (IFR) in uncrowded airspace. New system self-contained IFR simulator carried aboard training plane. Generates signals and commands for standard instruments on airplane, including navigational receiver, distance-measuring equipment, automatic direction finder, a marker-beacon receiver, altimeter, airspeed indicator, and heading indicator.

B86-10017
TIMED MULTIPLE-LASER ARRAY
J. B. LAUDENSLAGER (Caltech) and T. J. PACALA (Caltech)
Jun. 1986
NPO-16433 **Vol. 10, No. 1, P. 58**

Pulse power, frequency, and shape variable and combined to suit particular applications. Versatile laser system combines high power with high efficiency, long life, and low cost. System consists of array of excimer lasers fired under microcomputer control. When fired in unison, array produces high-power pulse at higher efficiency than otherwise possible. When fired in sequency, array produces pulses at a high rate without unduly stressing components and shortening their lives.

B86-10018
DETECTOR ARRAYS WITH IMAGE-PLANE PROCESSING
D. J. JOBSON
Jun. 1986 See Also (N84-25927)
LAR-13391 **Vol. 10, No. 1, P. 60**

Image detection and edge processing merged on same VLSI chip. Concept combines relatively large detector with small processor elements as VLSI chip features and has many specific embodiments. New device concept retains relatively large detector element sizes (perhaps 10 to 100 micrometers or larger in diameter) with processing-electronics components of much smaller size (2 micrometers or less), filling in gaps left between detectorelement active areas. Detector-array device helps to perform difference-ofGaussian operation for use in machine-vision edge enhancement and edge detection.

B86-10019
ECONOMICAL VIDEO MONITORING OF TRAFFIC
B. C. HOUSER (Caltech), G. PAINE (Caltech), L. D. RUBENSTEIN (Caltech), O. B. PARHAM, JR (Caltech), W. GRAVES (Dalmo Victor, Textron), and C. BRADLEY (MDOT)
Jun. 1986
NPO-16473 **Vol. 10, No. 1, P. 61**

Data compression allows video signals to be transmitted economically on telephone circuits. Telephone lines transmit television signals to remote traffic-control center. Lines also carry command signals from center to TV camera and compressor at highway site. Video system with television cameras positioned at critical points on highways allows traffic controllers to determine visually, almost immediately, exact cause of traffic-flow disruption; e.g., accidents, breakdowns, or spills, almost immediately. Controllers can then dispatch appropriate emergency services and alert motorists to minimize traffic backups.

B86-10020
INTEGRATED-CIRCUIT ACTIVE DIGITAL FILTER
R. NATHAN (Caltech)
Jun. 1986
NPO-16020 **Vol. 10, No. 1, P. 62**

Pipeline architecture with parallel multipliers and adders speeds calculation of weighted sums. Picture-element values and partial sums flow through delay-adder modules. After each cycle or time unit of calculation, each value in filter moves one position right. Digital integrated-circuit chips with pipeline architecture rapidly move 35 X 35 two-dimensional convolutions. Need for such circuits in image enhancement, data filtering, correlation, pattern extraction, and synthetic-

aperture-radar image processing: all require repeated calculations of weighted sums of values from images or two-dimensional arrays of data.

B86-10021
INTERMEDIATE-FREQUENCY-TO-VIDEO-BAND CONVERTER
N. C. HAM (Caltech), V. M. CHAVEZ (Caltech), V. S. CHEN (Caltech), and T. SATO (Caltech)
Jun. 1986
NPO-16214 **Vol. 10, No. 1, P. 64**

Analog and digital circuits combined to frequency-convert from intermediate frequencies directly to video-band frequencies to meet stringent requirements. IF-to-video-band converter operates on principle of signal-band cancellation in phase-quadrature circuits. Down-converts intermediate frequencies directly to video-band frequencies to near-zero frequency with good image-band rejection and low phase variation within passband.

B86-10022
HARDWARE/SOFTWARE EXPANSION OF DISPLAY TERMINAL AND CPU
B. R. ADAMS (Kentron International, Inc.)
Jun. 1986
LAR-13350 **Vol. 10, No. 1, P. 65**

IBM PC coupling used to expand capabilities of expensive special-purpose system. IBM PC was interfaced to Tektronix CP1151 computer through teletype port of Tektronix 4010-1 computer display terminal. Electronic interface built to provide isolation, level shifting, and signal inversion between IBM PC RS-232 port and 4010-1 terminal teletype port. Modifications to 4010-1 terminal made to increase teletype rate from 110 to 9,600 baud. Software for both computers developed to give control of DPO system to IBM PC and provide data/program file exchange between two computers. Coupling demonstrates utilization of low-cost microcomputer hardware and software to expand capabilities of expensive special-purpose computer systems.

B86-10023
PSEUDOLOG DIGITAL-TO-ANALOG CONVERTER
S. T. GOODER
Jun. 1986
LEW-14219 **Vol. 10, No. 1, P. 65**

Sensitivity decreases by 10 at beginning of each input decade. Method conceived to convert binary-coded data to suitable linear form for strip-chart recording. Strip-chart recordings obtained from typical pressure readings in a vacuum system during pumpdown. In reading curve, BCD digital vacuum-gage output processed by analog-to-digital converter in such way that only reading digits (but not range) appear in output. In range and reading, range also converted to analog and placed as most significant digit.

B86-10024
MICROWAVE SENSOR MEASURES TURBOPUMP SPEED
J. M. MARAM (Rockwell International Corp.) and L. WYETT (Rockwell Internatioal Corp.)
Jun. 1986
MFS-28083 **Vol. 10, No. 1, P. 67**

Sensor does not perturb flow and immune to cavitation. Reflected microwave signal is amplitude-modulated by passing reflective facets of nut on rotating shaft. Modulation frequency measured to find rotational speed. Device measures rotational speed of turbopump without obstructing flow.

B86-10025
SIMULATING SINGLE-EVENT UPSETS IN BIPOLAR RAM'S
J. A. ZOUTENDYK (Caltech)
Jun. 1986
NPO-16491 **Vol. 10, No. 1, P. 67**

Simulation technique saves testing. Uses interactive version of SPICE (Simulation Program with Integrated Circuit Emphasis). Device and subcircuit models available in software used to construct macromodel for an integrated bipolar transistor. Time-dependent current generators placed inside transistor macromodel to simulate charge collection from ion track. Significant finding of experiments is standard design practice of reducing power in unaddressed bipolar RAM cell increases sensitivity of cell to single-event upsets.

B86-10026
PLASMA SOURCE FOR CHARGE CONTROL
G. ASTON (Caltech), L. C. PLESS (Caltech), and W. D. DEININGER (Caltech)
Jun. 1986
NPO-16576 **Vol. 10, No. 1, P. 68**

Plasma source neutralizes electrical charge on spacecraft. When triggered by command from spacecraft potential monitor or from control system, plasma apparatus responds within about 1 s, generating charged plasma of required polarity. Discharging system to be tested on Air Force Geophysics Laboratory BERT-1 (Beam Emission Rocket Test) sounding rocket.

B86-10027
SINGLE-EVENT UPSETS CAUSED BY HIGH-ENERGY PROTONS
W. E. PRICE (Caltech), D. K. NICHOLS (Caltech), L. S. SMITH (Caltech), and G. A. SOLI (Caltech)
Jun. 1986
NPO-16504 **Vol. 10, No. 1, P. 68**

Heavy secondary ions do not significantly alter device responses. Conclusion that external reaction products cause no significant alteration of single-event-upset response based on comparison of data obtained from both lidded and unlidded devices and for proton beams impinging at angles ranging from 0 degrees to 180 degrees with respect to chip face. Study also found single-event-upset cross section increases only modestly as proton energy increased to 590 MeV, characteristic of maximum energies expected in belts of trapped protons surrounding Earth and Jupiter.

B86-10028
HYPERSPECTRAL INFRARED IMAGES OF TERRAIN
G. VANE (Caltech), A. F. H. GOETZ (Caltech), J. B. WELLMAN (Caltech), and C. C. LABAW (Caltech)
Jun. 1986
NPO-16295 **Vol. 10, No. 1, P. 69**

Images at 128 wavelengths allow direct identification of many earth surface materials. Two reports describe advanced airborne spectrometer that creates images of terrain at many wavelengths. Airborne imaging spectrometer (AIS) produces two-dimensional images in 128 spectral bands in 1.2-to-2.4-micrometer wavelength region. Images created by 32-by-32 array of mercury cadmium telluride detector elements. Array views swath of Earth below moving aircraft. Used for agricultural, geological, and other surveys.

B86-10109
DIGITAL SIGNAL COMBINING FOR CONFERENCE CALLING
F. BYRNE
May 1986
KSC-11285 **Vol. 10, No. 2, P. 50**

Signals combined with minimal noise by use of sums in read-only memories. Signals from subscribers A and B digitized, transmitted, and combined by addressing ROM. Combining operation electronic equivalent of looking up value of function of two variables in mathematical table. Combined digitized signal transmitted, converted to analog form, and delivered to subscriber C. System intended especially for combining number of separate audio signals into one signal for retransmission, as in telephone conference calling.

B86-10110
FAST INITIALIZATION OF BUBBLE-MEMORY SYSTEMS

K. T. LOONEY, C. D. NICHOLS, and P. J. HAYES
May 1986 See Also (N84-27977)
LAR-13357 **Vol. 10, No. 2, P. 52**

Improved scheme several orders of magnitude faster than normal initialization scheme. State-of-the-art commercial bubble-memory device used. Hardware interface designed connects controlling microprocessor to bubble-memory circuitry. System software written to exercise various functions of bubble-memory system in comparison made between normal and fast techniques. Future implementations of approach utilize E1PROM (electrically-erasable programable read-only memory) to provide greater system flexibility. Fast-initialization technique applicable to all bubble-memory devices.

B86-10111
BLENDING GYRO SIGNALS TO IMPROVE CONTROL STABILITY
J. F. L. LEE (Honeywell, Inc.)
May 1986
MSC-20370 **Vol. 10, No. 2, P. 55**

Interference by structural vibrations reduced by adding signals from spatially separated gyros. Technique involves blending signals from rate gyroscopes located at different parts of structure to obtain composite signal that more nearly represents rotation of entire structure. Aircraft vibrations perpendicular to pitch axis contribute to rotations sensed by pitch-rate gyros. Proper blending of signals from gyros suppress contribution of dominant vibrational mode. Most likely applications of concept are flight-control systems for aircraft.

B86-10112
SYNCHRONIZATION OF DATA RECORDED ON DIFFERENT RECORDERS
J. H. WISE (Caltech) and J. W. MCGREGOR (Caltech)
May 1986
NPO-16555 **Vol. 10, No. 2, P. 56**

Electrical and mechanical timing errors corrected. Electronic timing system enables time correlation of analog and digital signals recorded on different magnetic tapes or on different tracks of same tape. Recorded simultaneously on different magnetic-tape tracks along with data signals to enable subsequent time correlation of data. Concept improves analysis of Space Shuttle flight-data tapes containing signals with frequency components up to 50 Hz, used for higher frequencies, in kilohertz region. Useful in other applications requiring synchronization of data on different data tracks.

B86-10113
WIND-TUNNEL-MODEL LEAK-CHECKING SYSTEM
W. E. LARSON
May 1986 See Also (N85-17936)
LAR-13449 **Vol. 10, No. 2, P. 58**

Voice-actuated system allows one operator to do work of three. System uses voice-recognition-and-response unit and graphics terminal to interact with technician and to provide technician visual feedback. Computer-based Leak-check system allows computer to do more of total work in checking model for leaks to reduce time and manpower required to perform task.

B86-10114
LASER RANGING SYSTEM
J. K. RUSSELL (Lockheed Corp.)
May 1986
MSC-20870 **Vol. 10, No. 2, P. 59**

Laser system points and focuses TV camera. Ranger is modified stock distance-measuring unit mounted on and electrically connected to television camera. Effective over target range of 3 to 500 ft. (approximately 1 to 150m). Developed for television monitoring of nearby objects from Space Shuttle. Super-imposes range and range-rate (speed of approach or recession) data on television image of target. Principle adaptable to applications such as proximity warning and robot control.

B86-10115
SWITCHED-MULTIBEAM ANTENNA SYSTEM
R. S. IWASAKI (Axiomatix)
May 1986
MSC-20873 **Vol. 10, No. 2, P. 60**

Various time delays introduced at intermediate frequency aim antenna in different directions. System includes spherical reflector with feed horn containing two five-element cross arrays. Each element in cross array connected to different set of switched delay lines. Antenna has low and moderate gains and wide coverage.

B86-10116
TV VIDEO-LEVEL CONTROLLER
M. KRAVITZ (RCA Corp.), L. A. FREEDMAN (RCA Corp.), E. H. FREDD (RCA Corp.), and D. E. DENEF (RCA Corp.)
May 1986
MSC-18578 **Vol. 10, No. 2, P. 62**

Constant output maintained, though luminance varies by 5 million to 1. Three means of normalizing video output utilized in video-level controller: iris adjustment, tube voltage adjustment, and automatic gain control. With aid of automatic light control and gain control, television camera accommodates maximum light level 5 million times greater than lowest light level, while outputting constant 3-V peak signal to processing circuitry.

B86-10117
SIMULATION OF PCM DATA
G. G. BERNSTROM (IBM Corp.)
May 1986
KSC-11239 **Vol. 10, No. 2, P. 63**

Program for communications and control computer simulates pulse-code-modulated data. Software for simulation pulse-code-modulated (PCM) data from Space Shuttle during launch preparations developed for use with checkout, control, and monitor subsystem (CCMS). Facilitates testing of CCMS with data expected from main engines, external fuel tanks, operational instrumentation, general-purpose computer, backup flight system, and payload. Simulator program executes in standard CCMS hardware, requiring no new hardware.

B86-10209
ADJUSTABLE WORK STATION FOR VIDEO DISPLAYS AND KEYBOARDS
F. ROE, N. SHIELDS, JR. (Essex Corp.), M. F. FAGG (Essex Corp.), and D. HENDERSON (Essex Corp.)
May 1986
MFS-26009 **Vol. 10, No. 3, P. 44**

Work station for video displays and keyboards adaptable to operational and anthropometric requirements of individual operators. Visual displays placed beyond keyboard and in line with inclination of keyboard to minimize operator's head movement. In addition, station arranged so operator's eyes and hands focus onto three primary control and display areas. Quickens operating response and decreases chance of error, since input devices and feedback to operator are collocated.

B86-10210
ANALOG VIDEO IMAGE-ENHANCING DEVICE
L. M. WEINSTEIN
May 1986
LAR-13336 **Vol. 10, No. 3, P.46**

Inexpensive system yields pseudo-three-dimensional effect. Includes video camera with lens, connected to video monitor for analog video enhancement. Video signal obtained from monitor at point beyond where synchronization signals are detected, eliminating need to regenerate composite video signal. Analog video image-enhancing device improves appearance of technical photographs by

selectively compressing overall dynamic ranges while accentuating edges or small details of greatest interest.

B86-10211
AUTOMATED SIGNAL-TO-NOISE RATIO MEASUREMENT
J. E. PINEDA (Lockheed Engineering and Management Services Co., Inc.)
May 1986
MSC-21021 **Vol. 10, No. 3, P. 48**

Computer-controlled spectrum analysis gives rapid results for communication systems. Locates carrier signal in intermediate-frequency band and measures both carrier amplitude and amplitude of noise in several channels near carrier frequency. Computer then computes ratio of signal to average noise. Because measurements and calculations are rapid, system used in fading communication channels.

B86-10212
PHASE-MEASURING SYSTEM
W. T. DAVIS
May 1986
LAR-13439 **Vol. 10, No. 3, P. 49**

System developed and used at Langley Research Center measures phase between two signals of same frequency or between two signals, one of which is harmonic multiple of other. Simple and inexpensive device combines digital and analog components to give accurate phase measurements. One signal at frequency f fed to pulse shaper, produces negative pulse at time t4. Pulse applied to control input of sample-and-hold module 1. Second signal, at frequency nf, fed to zero-crossover amplifier, producing square wave at time t. Signal drives first one-shot producing narrow negative pulse at t1. Signal then drives second one-shot producing narrow positive pulse at time t2. This pulse used to turn on solid-state switch and reset integrator circuit to zero.

B86-10213
WIRELESS 'JUMP' STARTS FOR PARTLY DISABLED EQUIPMENT
K. D. CASTLE
May 1986
MSC-21010 **Vol. 10, No. 3, P.49**

Equipment activated when normal remote starting does not work Beam from nearby station first carries raw energy and then subsystem-activating signals to equipment crippled by discharged storage batteries. Operators start up equipment without approaching it under hazardous conditions. Potential terrestrial applications for scheme include starting of robots on such remotely-controlled hazardous tasks as handling of explosives or retrieval or deposition of objects in hostile environments.

B86-10214
RADIATION HARDENING OF COMPUTERS
D. K. NICHOLS, L. S. SMITH, J. A. ZOUTENDYK, A. E. GIDDINGS (Sandia National Laboratories), F. W. HEWLETT (Sandia National Laboratories), and R. K. TREECE (Sandia National Laboratories)
May 1986
NPO-16767 **Vol. 10, No. 3, P. 50**

Single-event upsets reduced by use of oversize transistors. Computers made less susceptible to ionizing radiation by replacing bipolar integrated circuits with properly designed, complementary metal-oxide-semiconductor (CMOS) circuits. CMOS circuit chips made highly resistant to single-event upset (SEU), especially when certain feedback resistors are incorporated. Redesigned chips also consume less power than original chips.

B86-10215
LASER INERTIAL NAVIGATION SYSTEM
R. J. HRUBY, G. XENAKIS, R. A. CARESTIA (University of Southern Colorado), W. S. BJORKMAN (Analytical Mechanics Associates, Inc.), S. F. SCHMIT (Analytical Mechanics Associates, Inc.), and L. D. CORLISS (U.S. Army Aeromechanics Laboratory)
May 1986
ARC-11473 **Vol. 10, No. 3, P. 53**

Acceptable accuracy obtained with short alignment time. Report describes successful helicopter tests of laser inertial navigational equipment. Tests conducted over 3-year period, both in laboratory and flight. Inertial system used as position/velocity/attitude indicator and later also served as part of automatic flight-control system.

B86-10233
ECONOMIC-ANALYSIS PROGRAM FOR A COMMUNICATION SYSTEM
R. G. CHAMBERLAIN
May 1986
NPO-16606 **Vol. 10, No. 3, P. 74**

Prices and profits of alternative designs compared. Objective of Land Mobile Satellite Service Finance Report (LMSS) program is to provide means for comparing alternative designs of LMSS systems. Program is Multiplan worksheet program. Labels used in worksheet chosen for satellite-based cellular communication service, but analysis not restricted to such cases. LMSS written for interactive execution with Multiplan (version 1.2) and implemented on IBM PC series computer operating under DOS (version 2.11).

B86-10317
PILOT-TONE SYSTEM FOR MOBILE COMMUNICATIONS
F. DAVARIAN (Caltech)
Jul. 1986
NPO-16414 **Vol. 10, No. 4, P. 46**

In mobile communication system called tone-calibrated technique, pilot tone provides phase- and amplitude-calibration reference to enable coherent demodulation of signal at receiver despite fading. Signal received by or from mobile terminal faded due to motion of terminal and propagation of signal along multiple paths. Fading introduces random amplitude modulation and phase modulation with bandwidth of twice Doppler frequency shift. Degrading effects of multipath fading reduced. Tonecalibrated technique for use with phase-modulated data or telephony systems using Manchester digital pulse-code modulation.

B86-10318
REDUCED-BANDWIDTH CODING FOR MOBILE COMMUNICATION
F. DAVARIAN (Caltech)
Jul. 1986
NPO-16447 **Vol. 10, No. 4, P. 48**

Fade-resistant mobile systems use power and spectrum efficiently. Transmission system employs tone-calibrated technique (TCT). Residual carrier used in technique to reduce fading-induced effects and coherently demodulate received signal. TCT potentially efficient in use of power and of frequency spectrum. Coding technique, intended for residual-carrier transmission system, alleviates fading and spectrum crowding that hamper mobile communications.

B86-10319
FRAME-SYNCHRONIZATION-ASSISTING MODULE
C. DESILVEIRA (Caltech)
Jul. 1986
NPO-16564 **Vol. 10, No. 4, P. 51**

Auxiliary data processor does computations related to synchronization of frames of telemetry data, relieving main processor of task. Called frame-synchronization-assisting module (FSAM), sorts through large amounts of data to determine whether valid and how configured. Module connected to main processor of computer through direct-memory-access (interface) module. Examines data in computer memory to find frame-synchronizing codes.

B86-10320
MOTOR SERVOLOOP WITH OPTICAL SHAFT ENCODER
S. P. MARASCALCO (Sperry Rand Corp.)

Jul. 1986
ARC-11582 **Vol. 10, No. 4, P. 52**

Position and rate feedback signals derived from single transducer. Servoloop generates digital and analog shaft-position and analog shaft-speed signals from output of incremental optical encoder. Signals used in feedback control of motor.

B86-10321
DIGITAL PSEUDONOISE GENERATOR
A. KNOEBEL (Caltech)
Jul. 1986
NPO-16627 **Vol. 10, No. 4, P. 53**

Architecture developed for noise generator based on pseudorandom number sequence. Concept involves no additions or multiplications; outputs of set of feedback shift registers combined, bit-by-bit, in accordance with desired probability distribution. Digital, pseudorandom number output fed to digital-to-analog converter to generate pseudonoise signal suitable for testing broadband amplifiers.

B86-10322
COMPENSATING FUNCTION FOR ANTENNA POINTING
D. L. MINGORI (University of California, Los Angeles) and J. S. GIBSON (University of California, Los Angeles)
Jul. 1986
NPO-16616 **Vol. 10, No. 4, P. 54**

Mean-square errors of antenna surface reduced. Compensating function helps point deformable antenna without inducing excessive pointing oscillations or deformations of reflecting surface. When implemented on computer in real time, function enables calculation of control signals in response to several sensor inputs: Function devised so signals control torque actuator of antenna-pointing mechanism in way to reduce or minimize squares of errors of antenna surface over long time.

B86-10323
AIRBORNE INSTRUMENTATION COMPUTER SYSTEM
G. A. BEVER
Jul. 1986 See Also N84-20521/NSP
ARC-11602 **Vol. 10, No. 4, P. 56**

Modular microcomputer provides real-time data processing and telemetryinterface functions. Programmable instrumentation system links pulsecode-modulation (PCM) telemetry to digital systems on test aircraft. Called AICS for airborne instrumentation computer system, also analyzes flight-test data during flight. Synthesized voice output available.

B86-10324
VLSI ARCHITECTURES FOR COMPUTING DFT'S
T. K. TRUONG (Caltech), J. J. CHANG (Caltech), I. S. HSU (Caltech), I. S. REED (Caltech), and D. Y. PEI (Caltech)
Jul. 1986
NPO-16656 **Vol. 10, No. 4, P. 58**

Simplifications result from use of residue Fermat number systems. System of finite arithmetic over residue Fermat number systems enables calculation of discrete Fourier transform (DFT) of series of complex numbers with reduced number of multiplications. Computer architectures based on approach suitable for design of very-large-scale integrated (VLSI) circuits for computing DFT's. General approach not limited to DFT's; Applicable to decoding of error-correcting codes and other transform calculations. System readily implemented in VLSI.

B86-10335
COMPUTER PROGRAM FOR SPACE-SHUTTLE TESTING
M. D. HYMAN (Abacus Programming Corp.), G. H. FINE (Abacus Programming Corp.), and G. J. HOLLOMBE (Abacus Programming Corp.)
Jul. 1986
MSC-20779 **Vol. 10, No. 4, P. 70**

Demand on Space Shuttle general-purpose computers reduced. Simulations Testbed and Scenario Pre-processor (STB&SPP) system reduces need for use of GPC's in hardware and software development and testing. System consists of computer program, SPP, and set of utility subroutines, STB, which incorporates Interface Simulator (ISIM). STB&SPP system written in FORTRAN V and Assembler.

B86-10420
SWITCHING SYSTEM FOR REDUNDANT POWER SUPPLIES
M. BRADFORD (United Technologies), R. GRANT (United Technologies), and G. PARKINSON (United Technologies)
Sep. 1986
ARC-11545 **Vol. 10, No. 5, P. 46**

Load-transfer unit connects airborne computer to standby power supply in case primary supply fails. Concept adaptable to systems in which power interruptions cannot be tolerated; for example, computers with volatile memories, safety equipment, and precise timers. Load-transfer unit monitors voltages and load current. Microprocessor controls transistor switches that connect load to whichever power supply has highest priority and correct voltage.

B86-10421
FADE-FREE MOBILE COMMUNICATION
C. R. STEVENSON (Caltech)
Sep. 1986
NPO-16441 **Vol. 10, No. 5, P. 48**

Scheme for mobile communication reduces multipath fading and interference between adjacent channels. Proposed communication system lends itself to almost completely digital implementation, eliminating costly and bulky crystal filters. Scheme suitable for satellite-aided or terrestrial mobile communication, including cellular mobile telephony, at frequencies in 150-to-900-MHz range.

B86-10422
MONOLITHIC 20-GHZ TRANSMITTING MODULE
T. KASCAK, G. KAELIN (Rockwell International Corp.), and A. GUPTA (Rockwell International Corp.)
Sep. 1986 See Also N84-13399/NSP
LEW-14285 **Vol. 10, No. 5, P. 51**

20-GHz monolithic microwave/millimeter-wave integrated circuit (MMIC) with amplification and phase-shift (time-delay) capabilities developed. Use of MMIC module technology promises to make feasible development of weight- and cost-effective phased-array antenna systems, identified as major factor in achieving minimum cost and efficient use of frequency and orbital resources of future generations of communication satellite systems. Use of MMIC transmitting modules provides for relatively simple method for phase-shift control of many separate radio-frequency (RF) signals required for phased-array antenna systems.

B86-10423
SIMULATOR TESTS CONTROLLER PERFORMANCE
M. F. LEMBECK (Caltech) and R. D. RASMUSSEN (Caltech)
Sep. 1986
NPO-15744 **Vol. 10, No. 5, P. 52**

Compact servosystem applies simulated dynamic loads, enabling realistic appraisal of motor and its control system without inconvenience of attaching real load. System simulates moments of inertia, rotational vibrations, changing load torques, and other characteristics of large or complex loads, without loads themselves and without awkwardness (and inaccuracy) of gravity-compensating devices used with such loads.

B86-10424
TRANSPONDER SYSTEM FOR HIGH-FREQUENCY RANGING
C. L. LICHTENBERG, P. W. SHORES, and H. S. KOBAYASHI
Sep. 1986
MSC-20912 **Vol. 10, No. 5, P. 54**

Transponder system uses phase difference between

transmitted and reflected high-frequency radio waves to measure distance to target. To suppress spurious measurements of reflections from objects near target at transmitted frequency and its harmonics, transponder at target generates return signal at half transmitted frequency. System useful in such applications as surveying, docking of ships, and short-range navigation.

B86-10425
A PRIORITY PROTOCOL FOR TOKEN-RING NETWORKS
H. T. LIU (Caltech)
Sep. 1986
NPO-16683 **Vol. 10, No. 5, P. 54**

New priority protocol controls access to token-ring local-area network (LAN) of digital-communication stations over widely ranging mix of low- and high-priority traffic. Protocol, called round-robin priority scheme (RRPS), introduces only small overhead and therefore degrades system performance only minimally. Key messages guaranteed access to local-area network during peak loads.

B86-10426
GLOBAL TIMING WITH LOW- AND HIGH-ORBITING SATELLITES
S. C. WU (Caltech) and V. J. ONDRASIK (Caltech)
Sep. 1986
NPO-16407 **Vol. 10, No. 5, P. 57**

Report summarizes method for synchronizing clocks at intercontinental distances employing satellites of Global Positioning System (GPS) in high Earth orbit and transit satellite in orbit at relatively low altitude of about 1,300 km. When fully implemented, method expected to supply precise time measurements for world-wide communication and navigation.

B86-10427
ADVANCED TRANSCEIVERS FOR FIREFIGHTERS
B. D. BLOOD (REMIC Corp.), O. P. GANDHI (REMIC Corp.), and R. E. RADKE (REMIC Corp.)
Sep. 1986
MFS-27040 **Vol. 10, No. 5, P. 59**

Report presents concept of improved portable radio transceiver for firefighters. Based in part on study of propagation of radio waves in such environments as high-rise buildings, ships, and tunnels. Study takes into account possible health hazard posed by personal tranceivers and needs and wishes expressed by firefighters in interviews. Conceptual radio attaches to clothing to allow hands-free use; voice-actuated with microphone worn at throat. Speaker placed near wearer's shoulder. Flexible antenna placed either horizontally across shoulders, vertically at one shoulder, or on transceiver itself.

B86-10428
DIGITAL CONTROL OF DURABILITY-TESTING BURNER RIGS
D. L. DEADMORE
Sep. 1986 See Also N85-21321/NSP
LEW-14362 **Vol. 10, No. 5, P. 60**

Report describes hardware and software that implement hybrid digital control of two Jet A-1 fueled, mach-0.3 burners from startup to completion of preset number of hot-corrosion/flame-durability cycle tests of materials at 1,652 degree F (900 degree C). Surface temperatures controlled more precisely than before.

B86-10429
LOW-CONCENTRATION-RATIO SOLAR-CELL ARRAYS
M. S. BISS (Rockwell International Corp.) and J. REED, DAVIDA. (Rockwell International Corp.)
Sep. 1986
MFS-28022 **Vol. 10, No. 5, P. 61**

Paper presents design concept for mass-producible arrays of solar electric batteries and concentrators tailored to individual requirements. Arrays intended primarily for space stations needing about 100 kW of power. However, modular, lightweight, compact, and relatively low-cost design also fulfill requirements of some terrestrial applications. Arrays built with currently available materials. Pultrusions, injection-molded parts, and composite materials used extensively to keep weight low. For added flexibility in design and construction, silicon and gallium arsenide solar-cell panels interchangeable.

B86-10454
INTERFACE PROGRAM FOR RELIABILITY PREDICTIONS
S. J. BAVUSO, J. L. PIERCE (Research Triangle Institute), P. L. PETERSEN (Kentron International, Inc.), and A. ROBERTS (Tesserract Systems)
Sep. 1986
LAR-13514 **Vol. 10, No. 5, P. 92**

CARE3MENU generates input file for CARE III program. Used to predict reliabilities of complex, redundant, fault-tolerant systems, including digital computers, aircraft, and nuclear and chemical control systems. CARE III input file often becomes complicated and not easily formatted with text editor. Provides easy interactive method of creating input file by automatically formatting set of user-supplied inputs for CARE III system. CARE3MENU provides detailed online help for most of its screen formats.

B86-10485
IMPROVED SPECTROMETER FOR FIELD USE
A. F. H. GOETZ (Caltech)
Nov. 1986
NPO-15732 **Vol. 10, No. 6, P. 36**

Proposed portable spectrometer for analyzing minerals in field generates spectral images like camera and process spectral data for real-time identification of materials. To identify unknown mineral, user locates significant peaks in displayed spectrum and matches them to spectrum in portfolio of reference spectra. Alternatively, user calls up display of prerecorded spectra in same wavelength region for comparison or allows spectrometer to determine best match automatically. New instrument makes it unnecessary to return data to laboratory or equipment trailer for processing.

B86-10486
THREE-FREQUENCY WATER-VAPOR RADIOMETER
M. A. JANSSEN (Caltech) and N. I. YAMANE (Caltech)
Nov. 1986
NPO-16531 **Vol. 10, No. 6, P. 37**

Measurements increase accuracies of delay predictions. Three-frequency microwave radiometer measures quantity of water vapor in atmosphere, part of effort to determine microwave-signal delays due to water vapor. Delay estimates necessary for accurate determination of distances in geodesy and related applications as very-long-baseline interferometry. Water-vapor data directly useful in weather research.

B86-10487
LASER-PULSE/FIBER-OPTIC LIQUID-LEAK DETECTOR
M. E. PADGETT
(Innovator Not Given (Opto-Electronics, Inc.) Nov. 1986
KSC-11331 **Vol. 10, No. 6, P. 38**

Several potential leak sites monitored using single sensing fiber. Fluid systems monitored quickly for leaks in remote, hazardous, or inaccessible locations by system of compact, lightweight fiber-optic leak sensors presently undergoing development. Sensors installed at potential leak sites as joints, couplings, and fittings. Sensor read by sending laser pulse along fiber, then noting presence or relative amplitude of return pulse. Leak-monitoring technique applicable to wide range of fluid systems and minimizes human exposure to toxic or dangerous fluids.

B86-10488
UNDERSTANDING MICROWAVE RADIOMETERS
J. M. STACEY (Caltech)

Nov. 1986
NPO-16586 **Vol. 10, No. 6, P. 41**

Report presents principles of microwave receivers for observing planetary surfaces from space. Report is tutorial and explains operation of receivers in detail to enable reader to specify and qualify them for spaceborne operation. Gives many examples to illustrate practical design procedures.

03 PHYSICAL SCIENCES

B86-10029
SEEBECK COEFFICIENT MEASURED WITH DIFFERENTIAL HEAT PULSES
L. ZOLTAN (Caltech), C. WOOD (Caltech), and G. STAPFER (Caltech)
Jun. 1986
NPO-16506 **Vol. 10, No. 1, P. 70**

Common experimental errors reduced because pulse technique suppresses drifts in thermoelectric measurements. Differential-heat-pulse apparatus measures Seebeck coefficient in semiconductors at temperatures up to 1,900 K. Sample heated to measuring temperature in furnace. Ends of sample then differentially heated a few degrees more by lamps. Differential temperature rise and consequent Seebeck voltage measured via thermocouple leads. Because pulse technique used, errors that often arise from long-term drifts in thermoelectric measurements suppressed. Apparatus works with temperature differences of only few degrees, further increasing accuracy of coefficients obtained.

B86-10030
BREWSTER-PLATE SPOILER FOR LASER SPECTROMETER
C. R. WEBSTER (Caltech)
Jun. 1986
NPO-16567 **Vol. 10, No. 1, P. 72**

Oscillating Brewster plate reduces effects of unwanted interference fringes on absorption-spectroscopic measurements obtained with tuned diode lasers. Plate modulates optical-path length past several resonance peaks causing interference fringes to pass by rapidly and become blurred. Thus, fringe effects averaged out over time. Technique used at other wavelengths from ultraviolet to infrared and in spectrometers with short or long optical paths, including those with retroreflectors or multipass cells.

B86-10031
TEST METHOD FOR X-RAY TELESCOPES
D. KORSCH (Korsch Optics, Inc.)
Jun. 1986
MFS-26020 **Vol. 10, No. 1, P. 75**

Telescopes and X-ray telescopes in particular, tested with nearby point sources of radiation. When point-source rays enter telescope through annular entrance pupil (and under conditions of spherical aberration), ring image produced. Deviation of ring image from perfect circular shape reveals misalinements and surface inaccuracies in telescope. Although particularly suited for grazing-incidence types of systems, this test method applied to other types of optical systems.

B86-10032
MICROWAVE POWER FROM NATURAL EMITTERS
J. M. STACEY (Caltech)
Jun. 1986
NPO-16581 **Vol. 10, No. 1, P. 77**

Signal-to-noise ratio of radiometer system calculated. Publication from NASA's Jet Propulsion Laboratory presents calculations of power radiated from natural emitter on Earth to microwave collecting aperture on aircraft or spacecraft. Analysis develops power-transfer criteria for detection of emitting object by collecting aperture (that is, by antenna and its receiver). Resulting formulas used in design of radiometer systems.

B86-10033
DEFORMABLE SUBREFLECTOR COMPUTED BY GEOMETRIC OPTICS
W. F. WILLIAMS (Caltech)
Jun. 1986
NPO-16405 **Vol. 10, No. 1, P. 78**

Distorted antenna surfaces forced to produce a uniform wave front. SUBFORMING employs geometric optics in determining subreflector coordinates to match main reflector surface with known distortions. Antenna with distorted paraboloidal reflecting surface forced to produce uniform wave front by using a Cassegrainian geometry with path-length-compensating subreflector. Program written in FORTRAN V for batch execution.

B86-10034
COMPUTING COMPOSITION/DEPTH PROFILES FROM X-RAY DIFFRACTION
K. E. WIEDEMANN (Analytical Services and Materials, Inc.) and J. UNNAM
Jun. 1986
LAR-13356 **Vol. 10, No. 1, P. 78**

Diffraction-intensity bands deconvolved relatively quickly. TIBAC constructs composition/depth profiles from X-ray diffraction-intensity bands. Intensity band extremely sensitive to shape of composition/depth profile. TIBAC incorporates straightforward transformation of intensity band that retains accuracy of earlier simulation models, but is several orders of magnitude faster in total computational time. TIBAC written in FORTRAN 77 for batch execution.

B86-10035
THERMODYNAMIC CALCULATIONS FOR COMPLEX CHEMICAL MIXTURES
B. J. MCBRIDE
Jun. 1986
LEW-14166 **Vol. 10, No. 1, P. 79**

General computer program, CECTRP, developed for calculation of thermodynamic properties of complex mixtures with option to calculate transport properties of these mixtures. Free-energy minimization technique used in equilibrium calculation. Rigorous equations used in transport calculations. Program calculates equilibrium compositions and corresponding thermodynamic and transport properties of mixtures. CECTRP accommodates up to 24 reactants, 20 elements, and 600 products, 400 of which are condensed. Written in FORTRAN IV for any large computer system.

B86-10118
HEAT-PIPE ARRAY FOR LARGE-AREA COOLING
F. EDELSTEIN (Grumman Aerospace Corp.) and R. F. BROWN (Grumman Aerospace Corp.)
May 1986
MSC-20946 **Vol. 10, No. 2, P. 64**

High rates of heat transfer anticipated. Prototype evaporative cold plate gathers waste heat from equipment mounted on it. Plate made by welding together flanges of several sections of heat pipe. Since plate separates liquid and vapor phases at inlet and outlet ports, eliminates complexities and uncertainties of two-phase flow in zero gravity. On earth, inlet valve enables plate to operate at relatively-large height differences with other plates in same system.

B86-10119
HIGH-FLUX ATOMIC-OXYGEN SOURCE
A. CHUTJIAN (Caltech) and O. ORIENT (Caltech)

May 1986
NPO-16640 **Vol. 10, No. 2, P. 66**

Beams of pure ground-state oxygen atoms produced. Accelerated electrons strike beam of O2 gas in dissociative-attachment region, producing Oions. O- ions accelerated to desired final energy and pass through photodetachment region to form 0(3P) atoms. These pass between electric field plates to remove O- and e and strike target. Designed specifically to study degradation of materials and spacecraft glow phenomena in low Earth orbits, used to study gas-phase collision phenomena involving energetic oxygen atoms.

B86-10120
PARTIAL-TRANSMISSION SCINTILLATION DETECTOR FOR IONS
C. J. MALONE (Caltech) and J. A. ZOUTENDYK (Caltech)
May 1986
NPO-16501 **Vol. 10, No. 2, P. 68**

Only outer portion of ion beam sampled to prevent unnecessary energy losses. Measurement device allows only periphery of beam to pass through scintillation material. Total flux in uniform beam inferred from peripheral flux. Device provides readings without reducing energy of ions in middle of beam. Measurement device developed for ion beams used in studies of how fast heavy ions affect integrated-circuit chips.

B86-10121
SOLID-SORBENT AIR SAMPLER
T. J. GALEN (Northrop Services, Inc.)
May 1986
MSC-20653 **Vol. 10, No. 2, P. 68**

Portable unit takes eight 24-hour samples. Volatile organic compounds in air collected for analysis by portable, self-contained sampling apparatus. Sampled air drawn through sorbent material, commercial porous polymer of 2, 3-diphenyl-p-phenylene oxide. High-boiling-point organic compounds adsorbed onto polymer, while low-boiling-point organics pass through and returned to atmosphere. Sampler includes eight sample tubes filled with polymeric sorbent. Organic compounds in atmosphere absorbed when air pumped through sorbent. Designed for checking air in spacecraft, sampler adaptable to other applications as leak detection, gas-mixture analysis, and ambient-air monitoring.

B86-10122
MAPPING THE STRUCTURE OF HETEROGENEOUS MATERIALS
L. D. STRAND (Caltech), N. S. COHEN (Caltech), and M. A. HERNAN (Caltech)
May 1986
NPO-16487 **Vol. 10, No. 2, P. 70**

Image-processing microdensitometer/Fourier analyzer yields statistics of subcomponent distribution. Nondestructive method for studying structure heterogeneous materials uses energy-dispersive X-ray analysis in scanning electron microscope. Scanning microdensitometer/Fourier analyzer (SMFA) is applied to SEM images to obtain statistics about sample structure. Method originally developed for studying effect on combustion of fine structure of composite solid propellants.

B86-10123
ELECTRO-OPTICAL TUNING OF FABRY-PEROT INTERFEROMETERS
G. K. SCHWEMMER
May 1986
GSC-12971 **Vol. 10, No. 2, P. 72**

Compact unit operates much faster than conventional piezoelectric scanners. High voltage creates electric field in Pockels cell, changing refractive properties. Cell changes optical path length between mirrors without mechanically moving anything in gap. High voltage varied rapidly to scan interferometer. Voltage applied longitudinally or transversely, depending on type of Pockels cell. New electro-optic scanner scans given range in one-millionth time of piezoelectric scanner - tens to hundreds of nanoseconds per interferometer order. Also reducing size of interferometer.

B86-10124
RECORDING INTERFEROGRAMS HOLOGRAPHICALLY
E. R. COMEENS (TAI Corp.) and R. L. KURTZ (TAI Corp.)
May 1986
MFS-26024 **Vol. 10, No. 2, P. 74**

Images of experiments stored for later analysis Classical interferometer modified for holography by removing entrance semi-reflecting mirror and inserting holographic recording in one of legs. Collimated laser beam projected through hologram and directed to remaining semitransparent mirror. Combines with reference beam from same laser to form virtual image of original experiment. Developed for experiments on crystal growth during space flights. Images recorded rapidly under constraints of experiments and later examined on ground.

B86-10125
COMPARATIVE THERMAL-CONDUCTIVITY TEST TECHNIQUE
C. N. WEBSTER (LTV Aerospace Corp.) and J. K. WILLIS (LTV Aerospace Corp.)
May 1986
MSC-20980 **Vol. 10, No. 2, P. 75**

Approximate thermal conductivities determined rapidly. Two specimens, to be compared, placed in assembly with insulation. One end of assembly placed in furnace. Temperature of furnace, of each end, and of center of each specimen recorded. Procedure used to rate quickly candidate materials for applications in which thermal conductivity prime consideration.

B86-10126
THREE-DIMENSIONAL RADIATIVE-TRANSFER EQUATION
J. V. MARTONCHIK (Caltech) and D. J. DINER (Caltech)
May 1986
NPO-16563 **Vol. 10, No. 2, P. 76**

Progress made toward interpretation of radiometric observations. Paper discusses equation of radiative transfer in three-dimensional, inhomogeneous, scattering medium illuminated from above and bounded below by laterallyinhomogeneous, reflective plane. Representation of radiation field with full three-dimensional variability derived by use of spatial Fourier transform and matrix-operator techniques developed previously for one-dimensional version of problem. Equations useful for radiometric measurements from aircraft and spacecraft. Although derivations and resulting equations complicated, use of Fourier-transform, matrix-operator approach to solve practical problems simpler than direct solution of complete three-dimensional, linear wave equations.

B86-10216
ECHELLE/GRISM SPECTROGRAPH
A. A. DANTZLER
May 1986
GSC-12977 **Vol. 10, No. 3, P.54**

More even spectral dispersion over detector area makes all wavelengths more distinguishable. Proposed echelle spectrograph includes grating/prism combination, called 'grism,' to make spectral dispersion over detector more even than usually in such instruments. Instrument performance improved, with little additional manufacturing effort. Furthermore, since grism placed within collimated light and its faces are optically flat, introduces no aberrations into optical system.

B86-10217
VACUUM-ULTRAVIOLET INTENSITY-CALIBRATION STANDARD
J. M. AJELLO (Caltech) and B. O. FRANKLIN (Caltech)
May 1986

NPO-16621 **Vol. 10, No. 3, P. 56**

Portable light source enables calibration of spectrometers. Vacuum Ultraviolet Light (40 to 200 nm) produced in electron-impact emission chamber by leading beam of gas across electron beam. Photons observed at right angles to electron-beam axis. Previously, there were blackbody standards in visible and near ultraviolet, but no intensity-calibration standards in VUV.

B86-10218

MEASURING SEEBECK COEFFICIENTS WITH LARGE THERMAL GRADIENTS

C. WOOD (Caltech), A. CHMIELEWSKI (Caltech), and L. D. ZOLTAN (Caltech)

May 1986

NPO-16667 **Vol. 10, No. 3, P. 57**

Apparatus takes measurements and analyzes data automatically. Cylindrical sample is pressed between heater and water-cooled baseplate. Thermocouples at opposite ends of sample provide both temperatures and Seebeck voltages. Conveniently shaped samples used, and results calculated by microcomputer and printed out.

B86-10219

SUNLIGHT SIMULATOR FOR PHOTOVOLTAIC TESTING

R. L. MUELLER (Caltech)

May 1986

NPO-16696 **Vol. 10, No. 3, P. 58**

Light with normalized spectral irradiance resembling that of airmass 1.5 sunlight striking surface of Earth produced by use of ultraviolet filter to modify output of set of flashlamps used as large-area pulsed solar simulator (LAPSS). Filtered LAPSS light allows more realistic measurements of output of photovoltaic devices when using silicon reference cell having different spectral response characteristic.

B86-10220

ELECTRON-DIFFRACTION ANALYSIS OF GROWTH OF GAAS

B. F. LEWIS (Caltech), F. J. GRUNTHANER (Caltech), A. MADHUKAR (Caltech), T. C. LEE (Caltech), and R. FERNANDEZ (Caltech)

May 1986

NPO-16755 **Vol. 10, No. 3, P. 59**

Report describes experiments that used reflection high-energy-electron diffraction (RHEED) to investigate behavior of GaAs surfaces during and after growth by molecular-beam epitaxy (MBE). Experimental results show dynamic RHEED measurements useful both as probes of surface and growth kinetics and as methods for determining and reproducing surface and growth conditions.

B86-10234

PREDICTING THE COSMIC-RAY ENVIRONMENT NEAR EARTH

L. EDMONDS

May 1986

NPO-16617 **Vol. 10, No. 3, P. 78**

Package of computer programs developed to predict cosmic-ray environment for spacecraft in orbit near Earth. Single cosmic-ray particle deposits enough electrical charge on sensitive area of individual circuit to change bit state. Single-event upsets may not cause permanent damage but upset functioning devices. Used to predict upset rate for space mission. Also calculates time-average cosmic-ray environment for multiple circular orbits, fragments of trajectories, and isolated points. Package written in HPL for interactive execution and implemented on HP 9825B desktop computer.

B86-10325

INTERFEROMETER FOR OBSERVING COMPRESSIBLE FLOW

W. BACNALO (Aerometric, Inc.) and M. HOUSER (Aerometrics, Inc.)

Jul. 1986

ARC-11549 **Vol. 10, No. 4, P. 60**

Moving pictures show changing flow-field contours. Optical interferometer enables instantaneous visualization of compressible fluid flows. Relatively immune to vibration, unit suited to observation of flows over models in large wind tunnels. In improved point-diffraction interferometer, reference beam generated by pinhole (point) diffraction at place in object beam outside experimental volume. Object under test positioned so interior or supporting stand lies in shadows of turning mirrors.

B86-10326

ULTRASONIC VERIFICATION OF METAL-GRAIN SIZE

E. R. GENERAZIO

Jul. 1986 See Also N84-32849/NSP

LEW-14283 **Vol. 10, No. 4, P. 61**

Ultrasonic attenuation as function of frequency determined for metal sample having known mean grain diameter. Once function determined for one sample of material, scaled to determine mean grain size of other samples of materials. Results suggest ultrasonic approach viable for verifying effects of heat treatments that vary grain size. Uses of this technology include nondestructive ultrasonic verification size heat treatments and other online inspection systems.

B86-10327

SOLAR-POWERED WATER ELECTROLYZER

O. J. HANCOCK, JR. (Florida Solar Energy Center)

Jul. 1986

KSC-11297 **Vol. 10, No. 4, P. 61**

Electrolyzer produces hydrogen and oxygen from water using solar photovoltaic electricity directly, without conditioning. Hydrogen used as energy-storage medium to be burned when needed to generate heat or electricity for domestic use.

B86-10328

ELLIPSOMETRIC MONITORING OF FILM DEPOSITION

D. B. BICKLER (Caltech)

Jul. 1986

NPO-16791 **Vol. 10, No. 4, P. 62**

Impurities detected nondestructively during processing. In proposed system, surface of growing amorphous-silicon film monitored by ellipsometer at wavelength or combination of wavelengths at which impurity or impurities of interest absorb light strongly.

B86-10329

CONVECTION IN A SOLIDIFYING BINARY MIXTURE

B. ANTAR (University of Tennessee) and F. COLLINS (University of Tennessee)

Jul. 1986

MFS-27092 **Vol. 10, No. 4, P. 63**

Temperature and concentration profiles calculated. Study expands on earlier work including more realistic, mathematically complicating physical effects and yet retains simple geometry and enough simplifying assumptions to make equations solvable. Leads to improved understanding of metal and glass production, material processing in low low gravity other important material processing problems.

B86-10430

INCREASING THE DEPOSITION RATE OF SILICON

R. LUTWACK (Caltech) and K. A. YAMAKAWA (Caltech)

Sep. 1986

NPO-15911 **Vol. 10, No. 5, P. 62**

Modified Siemens reactor enables chemical vapor deposition (CVD) of silicon to occur simultaneously on inner and outer surfaces of hollow cylinder, resulting in increase in mass of silicon deposited per unit time. Outer reactor for silicon deposition made from quartz or stainless steel. Hollow cylinder either single resistance-heated hollow cylinder about 5 to 10 cm or greater in diameter or

1-cm-diameter rods aligned in circular channels at top and bottom, initial circles being 5 to 10 cm in diameter or greater.

B86-10431
TANDEM-MIRROR ION SOURCE
A. BIDDLE, N. STONE, D. REASONER, W. CHISHOLM, and J. REYNOLDS
Sep. 1986
MFS-28122 **Vol. 10, No. 5, P. 63**

Improved ion source produces beam of ions at any kinetic energy from 1 to 1,000 eV, with little spread in energy or angle. Such ion beams useful in studies of surface properties of materials, surface etching, deposition, and development of plasma-diagnostic instrumentation. Tandem-mirror ion source uses electrostatic and magnetic fields to keep electrons in ionization chamber and assure uniform output ion beam having low divergence in energy and angle.

B86-10432
FIELD FUNNELING AND RANGE STRAGGLING IN SILICON DETECTORS
J. A. ZOUTENDYK (Caltech) and C. J. MALONE (Caltech)
Sep. 1986
NPO-16584 **Vol. 10, No. 5, P. 64**

Magnitudes of field funneling and range straggling determined in silicon-surface-barrier (Schottky-barrier) charged-particle detectors (SSBD's) through meaurement of charges collected from alpha-particle tracks. Method used extended to straightforward measurement of charge collection from heavy-ion tracks in these and other semiconductor devices. Such measurements used to assess single-event upsets in integrated-circuit chips, with view toward making them resistant to radiation. Field funneling and range straggling measured with electronic system in which charge collected from individual ions measured and recorded by multichannel analyzer.

B86-10433
ESTIMATING MICROWAVE DELAY BY ATMOSPHERIC WATER
S. E. ROBINSON (Caltech)
Sep. 1986
NPO-16642 **Vol. 10, No. 5, P. 68**

Tropospheric path delays for microwave very-long-baseline interferometry (VLBI) estimated with algorithm that determines and explicitly integrates simple water-vapor distribution based on temperature data from water-vapor radiometer (WVR) and emission model. Although computationally complex, method readily accommodates even dramatic changes in observation conditions, emission model, and WVR equipment. Algorithm accommodates changes in observation conditions, emission model, and radiometer hardware.

B86-10434
MEASURING SODIUM CHLORIDE CONTENTS OF AEROSOLS
M. P. SINHA (Caltech) and S. K. FRIEDLANDER (Caltech)
Sep. 1986
NPO-16722 **Vol. 10, No. 5, P. 69**

Amount of sodium chloride in individual aerosol particles measured in real time by analyzer that includes mass spectrometer. Analyzer used to determine mass distributions of active agents in therapeutic or diagnostic aerosols derived from saline solutions and in analyzing ocean spray. Aerosol particles composed of sodium chloride introduced into oven, where individually vaporized on hot wall. Vapor molecules thermally dissociated, and some of resulting sodium atoms ionized on wall. Ions leave oven in burst and analyzed by spectrometer, which is set to monitor sodium-ion intensity.

B86-10435
QUIET PLASMA SOURCE
P. L. LEUNG (Caltech)
Sep. 1986
NPO-16215 **Vol. 10, No. 5, P. 69**

Synthesis of plasma from separate ion and electron emitters suppresses electromagnetic interference. Source employs separate emitters for electrons and ions. Plasma source used to simulate variety of astrophysical phenomena and space-plasma effects. For example, used in studies of propagation of electromagnetic waves in plasmas. Serves as interference-free charge neutralizer.

B86-10436
MEASURING COMBUSTION ADVANCE IN SOLID PROPELLANTS
L. C. YANG (Caltech)
Sep. 1986
NPO-16585 **Vol. 10, No. 5, P. 70**

Set of gauges on solid-propellant rocket motor with electrically insulating case measures advance of combustion front and local erosion rates of propellant and insulation. Data furnished by gauges aid in motor design, failure analysis, and performance prediction. Technique useful in determining propellant uniformity and electrical properties of exhaust plum. Gauges used both in flight and on ground. Foilgauge technique also useful in basic research on pulsed plasmas or combustion of solids.

B86-10437
DETERMINING MONTHLY MEAN HUMIDITIES FROM SATELLITE DATA
W. Y. T. LIU (Caltech) and P. P. NIILER (Caltech)
Sep. 1986
NPO-16529 **Vol. 10, No. 5, P. 72**

Report describes statistical study to estimate monthly average humidity of marine surface layer of atmosphere from measurements by radiometers on satellites. Study part of continuing effort to determine flux density of latent heat due to evaporation at ocean surface. Such observations and measurements important because latent-heat flux affects weather and temperature and salinity of upper ocean layers.

B86-10438
REFLECTIVE SHIELDS FOR ARTIFICIAL SATELLITES
F. L. BOUQUET (Caltech)
Sep. 1986
NPO-16428 **Vol. 10, No. 5, P. 72**

Report proposes reflective shield that protects spacecraft from radiant energy. Also gives some protection against particle beams and cosmic rays. Conceptual shield essentially advanced version of decorative multifaceted mirror balls often hung over dance floors. Mirror facets disperse radiant energy in many directions.

B86-10489
PHOTOCURRENT IMAGING DETECTS SOLAR-MODULE DEFECTS
Q. KIM (Caltech), A. SHUMKA (Caltech), and J. TRASK (Caltech)
Nov. 1986
NPO-16658 **Vol. 10, No. 6, P. 42**

Raster-scanned laser beam excites photocurrents in thin-film amorphous silicon devices. Solar-cell laser scanner uses two galvanometer-driven mirrors to scan laser-beam spot over surface of module or cell under test. Position signals from scan controllers used to index storage of photocurrent signal data in scan-converter image memory. Stored image displayed on television monitor.

B86-10490
FURNACE FOR TENSILE TESTING OF FLEXIBLE CERAMICS
M. SMITH, C. A. ESTRELLA, and V. W. KATVALA
Nov. 1986
ARC-11589 **Vol. 10, No. 6, P. 44**

Ceramic cloth and thread tested quickly at temperatures up to 1,250 degree C. Tensile strengths of ceramic cloths

and threads measured conveniently in new furnace at specified temperatures up to 1,250 degree C, using ordinary mechanical tester. Samples heated along part of their lengths in furnace slots. Interchangeable furnace chambers and matching heating elements sized to match size of tested ceramic material.

B86-10491
STAR-VIEWING SCHEDULER
O. T. GUFFIN, B. H. ROBERTS (Boeing Computer Support Service), and P. L. WILLIAMSON (Boeing Computer Support Service)
Nov. 1986
MFS-28089 **Vol. 10, No. 6, P. 45**

Strategy and algorithm produce well-balanced timetable that accommodates many constraints. Strategy for scheduling star observations on Space Shuttle astronomy missions ensures best use of three future ultraviolet telescopes. Strategy, described in report, takes into account such diverse factors as maneuvers of Space Shuttle orbiter, interference by Moon, occultation by Earth, reflections, unstaffed periods during crew rotation, encounters with South Atlantic anomaly, and obscuration during dispersal of ejected water.

B86-10502
UPDATED THERMAL-RADIATION PROGRAM
R. A. VOGT
Nov. 1986
MSC-20448; MSC-21030 **Vol. 10, No. 6, P. 60**

Thermal Radiation Analyzer System, TRASYS II, is computer-software system with generalized capability to solve radiation-related aspects of thermal-analysis problems. Used in conjunction with generalized thermal-analysis program, any thermal problem expressed in terms of lumped-parameter R-C thermal network solved.

04 MATERIALS

B86-10036
LOW-GRAVITY ALLOY STUDIES ON AIRCRAFT
P. A. CURRERI, M. H. JOHNSTON, R. E. SHURNEY, W. S. ALTER, D. M. STEFANESCU, and J. C. HENDRIX
Jun. 1986
MFS-25967 **Vol. 10, No. 1, P. 80**

Controlled solidification continued through many dives. Since each dive gives 20 to 30 seconds in which gravity is 0.001 to 0.1 its normal value, and aircraft may make about ten low-gravity maneuvers in mission, technique allows substantial time to conduct a low-gravity experiment. In directional solidification, liquid/solid interface advanced slowly through rod of sample alloy. Solidification continues during several aircraft maneuvers. Known solidification rate of sample correlated with accelerometer data to find gravity value during solidification for any point in sample. Thermal gradient and solidification rate controlled independently.

B86-10037
MONITORING PREPREGS AS THEY CURE
P. R. YOUNG, J. R. GLEASON (U.S. Army Structures Laboratory), and A. C. CHANG (Kentron International, Inc.)
Jun. 1986
LAR-13335 **Vol. 10, No. 1, P. 82**

Quality IR spectra obtained in dynamic heating environment. New technique obtains quality infrared spectra on graphite-fiber-reinforced, polymeric-matrix-resin prepregs as they cure. Technique resulted from modification of diffuse reflectance/Fourier transform infrared (DR/FTIR) technique previously used to analyze environmentally exposed cured graphite composites. Technique contribute to better understanding of prepreg chemistry/temperature relationships and development of more efficient processing cycles for advanced materials.

B86-10038
LOW-COBALT POWDER-METALLURGY SUPERALLOY
F. H. HARF
Jun. 1986
LEW-14113 **Vol. 10, No. 1, P. 84**

Highly-stressed jet-engine parts made with less cobalt. Udimet 700* (or equivalent) is common nickel-based superalloy used in hot sections of jet engines for many years. This alloy, while normally used in wrought condition, also gas-atomized into prealloyed powder-metallurgy (PM) product. Product can be consolidated by hot isostatically pressing (HIPPM condition) and formed into parts such as turbine disk. Such jet-engine disks 'see' both high stresses and temperatures to 1,400 degrees F (760 degrees C).

B86-10039
MAKING HIGH-POROSITY ALLOY SPHEROIDS
E. C. ETHRIDGE, P. A. CURRERI, and M. KELLEY
Jun. 1986
MFS-25997 **Vol. 10, No. 1, P. 85**

Noncontact process yields low-density, porous microstructure. Small spheroids of porous alloys with large surface area per unit volume produced by containerless processing method. Without container walls to serve as nucleation sites, alloy cools to well below normal freezing point without solidifying. Solidification then proceeds rapidly; interdendritic liquid pulled out by growing crystals, resulting in porous microstructure. The more rapid the cooling rate, the faster crystals grow and more porous solid becomes. Drop-tube method useful in creating porous microstructures from other materials including oxides, carbides, and organic materials. Other means of containerless processing - acoustic or air-jet levitation, low-gravity float melting, melt spinning, or jet spraying, adapted to process.

B86-10040
REDUCING SODIUM CONTAMINATION IN MOS DEVICES
R. F. DEHAYE and W. R. FELTNER
Jun. 1986
MFS-28034 **Vol. 10, No. 1, P. 86**

Method of removing positive ions from oxides in metal-oxide-semiconductor (MOS) transistors and intergrated circuits ensure freedom from contamination by sodium and other mobile positive ions. Electric field applied during oxide growth to push mobile Na + ions to surface. After cooling from growth temperature, field turned off and Na + contaminated surface layer etched away. New method intended to supplement established methods of minimizing ion contamination, such as scrupulous cleanliness in processing, purging with hydrogen chloride to react with and remove contaminants, and growing extra-thick gate oxide, then etching it to remove large portion of contaminants concentrated near surface.

B86-10041
PRESSURE-SENSITIVE RESISTOR MATERIAL
E. R. DU FRESNE (Caltech)
Jun. 1986
NPO-16537 **Vol. 10, No. 1, P. 86**

Low-conductivity particles in rubber offer wide dynamic range. Sensor consists of particles of relatively low conductivity embedded in rubber. Resistance of sensor decreases by about 100 times as pressure on it increases from zero to 0.8 MN/M to the second power. Resistor promising candidate as tactile sensor for robots and remote manipulators.

B86-10042
COLORLESS POLYIMIDE CONTAINING PHENOXY-LINKED DIAMINES
A. K. ST. CLAIR and T. L. ST. CLAIR

Jun. 1986
LAR-13353 **Vol. 10, No. 1, P. 87**

Tough, optically transparent films produced. Polyimides having this molecular structure form tough, transparent films. Films made transparent by careful control of manufacturing conditions, including use of highly purified monomers. Need for high-temperature, flexible polymeric films and coating materials that have high optical transparency in 300- to 600nm range of electro-magnetic spectrum for use on antennas, solar cells, and thermal-control coatings.

B86-10127
BALL-AND-SOCKET MOUNT FOR INSTRUMENTS
E. KAELBER (Perkin-Elmer Corp.)
May 1986
MFS-28064 **Vol. 10, No. 2, P. 78**

Jaws engage instrument precisely but release it readily. Mounting mechanism holds scientific instrument securely, allows instrument to be oriented, and minimizes conduction of heat to and from instrument. Mechanism also allows quick replacement of instrument.

B86-10128
SI3N4-BASED CERAMIC WITH GREATER HOT STRENGTH
S. DUTTA and B. BUZEK
May 1986
LEW-14193 **Vol. 10, No. 2, P. 80**

Zyttrite-doped material outperforms MgO-doped material above 1,200 degrees C. New ceramic material produced by addition of 10 weight percent zyttrite (yttria-stabilized zirconia) to (silicon nitride) offers significantly-improved high-temperature properties (those of MgO-doped Si3N4 ceramic). Work also showed that controlled Si3N4 powder with 10 weight percent zyttrite, significant improvement in room-temperature strength achieved. Variety of high-temperature structural applications are silicon nitride and silicon carbide. Potential for use in aircraft and automobile engines and in electric-power generating systems. Improved properties strongly suggest that the 10-weight percent zyttrite/Si3N4 material has strong potential for high-temperature applications.

B86-10129
COMPRESSION-FAILURE MECHANISMS IN COMPOSITE LAMINATES
M. J. SHUART, J. G. WILLIAMS, and P. A. COOPER
May 1986 See Also (N81-26183 and N84-20259)
LAR-13345 **Vol. 10, No. 2, P. 80**

Failure mechanisms observed using transparent fiberglass/epoxy birefringent materials. Technique based on use of transparent fiberglass/epoxy birefringent material. Transparency allows visual observation of location of initial laminate failure and of subsequent failure propagation; birefringence allows laminate stress distribution to be observed during test and also after test if permanent residual stresses occur. Nondestructive technique developed to observe failure as it develops and as propagates within laminate.

B86-10130
DETOXIFICATION OF HALON FIRE-EXTINGUISHANT PRODUCTS
E. L. MILLER (Lockheed Engineering & Management Services, Inc.)
May 1986
MSC-20962 **Vol. 10, No. 2, P. 82**

Ammonia compounds absorb toxic hydrogen halides as they are produced. Toxic acid vapors resulting from use of Halon (or equivalent) fire extinguishers immediately changed into nontoxic ammonium compounds when extinguishers contain some ammonia or ammonium carbonate. If ammonium carbonate used, particle size of resulting neutral compounds controlled to eliminate virtually any absorption into the lungs.

B86-10131
PHOSPHAZENE POLYMERS CONTAINING CARBORANE
L. L. FEWELL, J. A. PARKER, and R. J. BASI (San Jose State University)
May 1986
ARC-11487 **Vol. 10, No. 2, P. 83**

Addition of carborane increases thermal stability. Carborane-substituted polyphosphazenes prepared by thermal polymerization of phenylcarbonyl-pentachlorocyclotriphosphazene followed by reaction with sodium trifluoroethoxide to replace remaining chlorine atoms with trifluoroethoxy groups. Improved polymers offer high char yields and resistance to hydrolysis.

B86-10132
ROOM-TEMPERATURE DEPOSITION OF NBN SUPERCONDUCTING FILMS
S. THAKOOR (Caltech), J. L. LAMB (Caltech), A. P. THAKOOR (Caltech), and S. K. KHANNA (Caltech)
May 1986
NPO-16681 **Vol. 10, No. 2, P. 84**

Films with high superconducting transition temperatures deposited by reactive magnetron sputtering. Since deposition process does not involve significantly high substrate temperatures, employed to deposit counter electrode in superconductor/insulator/superconductor junction without causing any thermal or mechanical degradation of underlying delicate tunneling barrier. Substrates for room-temperature deposition of NbN polymeric or coated with photoresist, making films accessible to conventional lithographic patterning techniques. Further refinements in deposition technique yield films with smaller transition widths, Tc of which might approach predicted value of 18 K.

B86-10133
INCREASING THE CRYOGENIC TOUGHNESS OF STEELS
H. F. RUSH
May 1986 See Also (N84-30014)
LAR-13376 **Vol. 10, No. 2, P. 85**

Grain-refining heat treatments increase toughness without substantial strength loss. Five alloys selected for study, all at or near technological limit. Results showed clearly grain sizes of these alloys refined by such heat treatments and grain refinement results in large improvement in toughness without substantial loss in strength. Best improvements seen in HP-9-4-20 Steel, at low-strength end of technological limit, and in Maraging 200, at high-strength end. These alloys, in grainrefined condition, considered for model applications in high-Reynolds-number cryogenic wind tunnels.

B86-10134
IMPACT-RESISTANT CERAMIC COATING
W. H. WHEELER (Lockheed Missiles & Space Co.), J. F. CREEDON (Lockheed Missiles & Space Co.), and Y. D. IZU (Lockheed Missiles & Space Co.)
May 1986
MSC-20829 **Vol. 10, No. 2, P. 86**

Refractory fibers more than double strength of coating. Impact strengths of ceramic coatings increase with increasing whisker content. Silicon carbide whiskers clearly produce largest increase, and improvement grows even more with high-temperature sintering. Coating also improves thermal and mechanical properties of electromagnetic components, mirrors, furnace linings, and ceramic parts of advanced internal-combustion engines.

B86-10135
CARBON SHIELDS FOR INTERCALATED FIBER CONDUCTORS
B. A. BANKS and J. A. WOOLLAM (University of Nebraska)
May 1986 See Also (N81-21129)
LEW-14063 **Vol. 10, No. 2, P. 86**

Stability in air increased by depositing amorphous carbon. Initially graphite fibers intercalated (insertion of atoms or molecules between graphite layers). Next, conduc-

tor coated with diamondlike amorphous carbon. Coating applied in same chamber as intercalation reaction or alternate deposichamber is used. Deposition of carbon accomplished by any number of techniques. tion Ion-beam sputter-deposition and RF plasma techniques have been used, but dc plasma and others work also. Potential uses include conductive epoxy composites, tether conductors, signal wire, and power cables.

B86-10136
PRODUCING LARGE-PARTICLE MONODISPERSE LATEXES
J. W. VANDERHOFF (Lehigh University)
May 1986
MFS-26026 **Vol. 10, No. 2, P. 87**

Chemical process produces latex particles of relatively large, uniform size for use as size standards for instrument calibration. Process, based on seeding of mixture by very small latex particles, yields particles measuring 2 to 30 micrometer or more in average size. Produces monodisperse latexes in which deviation from average size is less than 2 percent. Particles used directly, without tedious separation procedures for removing off-size particles.

B86-10137
PROCESS PRODUCES LOW-SECONDARY-ELECTRON-EMISSION SURFACES
A. N. CURREN, K. A. JENSEN, and R. F. ROMAN
May 1986
LEW-14130 **Vol. 10, No. 2, P. 88**

Textured carbon layer applied to copper by sputtering. Carbon surface characterized by dense, random array of needle-like spires or peaks that extend perpendicularly from local copper surface. Spires approximately 7 micrometers in height and spaced approximately 3 micrometers apart, on average. Copper substrate essentially completely covered by carbon layer, is tenacious and not damaged by vibration loadings representative of multistage depressed collector (MDC) applications. Process developed primarily to provide extremely low-secondary-electron-emission surface for copper for use as high-efficiency electrodes in MDC's for microwave amplifier traveling-wave tubes (TWT's). Tubes widely used in space communications, aircraft, and terrestrial applications.

B86-10138
ANTISOILING COATINGS FOR SOLAR-ENERGY DEVICES
E. F. CUDDIHY (Caltech) and P. WILLIS (Springborn Laboratories)
May 1986
NPO-16552 **Vol. 10, No. 2, P. 90**

Fluorocarbons resist formation of adherent deposits. Promising coating materials reduce soiling of solar photovoltaic modules and possibly solar thermal collectors. Contaminating layers of various degrees of adherence form on surfaces of devices, partially blocking incident solar energy, reducing output power. Loose soil deposits during dry periods but washed off by rain. New coatings help prevent formation of more-adherent, chemically and physically bonded layers rain alone cannot wash away.

B86-10139
HEAT- AND RADIATION-RESISTANT LUBRICANTS FOR METALS
E. A. LAWTON (Caltech)
May 1986
NPO-16341 **Vol. 10, No. 2, P. 92**

Protective and lubricating coatings formed in situ. Orthophthalonitrile reacts with metal-surface asperities at high frictional temperatures to form lubricating films of metal phthalocyanine. Compounds also formed with hot metal fragments torn from asperities. Bearing surfaces better protected from scoring, and fragments rendered less harmful to base fluids. Lubricants useful as additives to oils and greases in gears, transmissions, motors, and other machines where rubbing loads between metal parts may be severe. Because of their low volatility and lack of requirement for air or moisture, lubricants also useful in vacuums.

B86-10140
FUNDAMENTALS OF ALLOY SOLIDIFICATION
F. HARF
May 1986 See Also (N84-34589)
LEW-14229 **Vol. 10, No. 2, P. 93**

Potential benefits of microgravity processing discussed. Symposium held at Lewis Research Center in September of 1984 on subject of microgravity and some basic metallurgical factors involved in production of metals. General metallurgical areas of interest were metal solidification and processing. Five specific areas covered included undercooling of liquids, porosity, microstructure, solidification, and segregation. Theme of symposium: Possible benefits of microgravity processing and beneficial effects on industry processing. Information readily lends itself to inclusion in educational programs at college level.

B86-10141
COMPOSITE REFRACTORY FELT/CERAMIC MATERIAL
D. B. ERCEGOVIC, C. L. WALKER, and C. T. NORGREN
May 1986 See Also (N84-14145)
LEW-14238 **Vol. 10, No. 2, P. 93**

Ceramic protective coatings on combustor liners adhere better. Report discloses results of recent combustor-liner research where thick yttria-stabilized zirconia ceramic was plasma-sprayed on BRUNSBOND substrates and exposed to nearly stoichiometric combustion. Combustor screening tests exposed 30 test specimens to nearly-stoichiometric flame temperatures of 3,450 degrees F (2,170 K) for 4 cycles. After completion of screening tests, all 30 specimens showed no visible evidence of discoloration or failure. There were no mudflat cracks, felt/ceramic, or backing/felt separations on any panels.

B86-10142
INTRAPLY HYBRID COMPOSITE DESIGN
C. C. CHAMIS and J. H. SINCLAIR
May 1986
LEW-14079 **Vol. 10, No. 2, P. 94**

Several theoretical approaches combined in program. Intraply hybrid composites investigated theoretically and experimentally at Lewis Research Center. Theories developed during investigations and corroborated by attendant experiments used to develop computer program identified as INHYD (Intraply Hybrid Composite Design). INHYD includes several composites micromechanics theories, intraply hybrid composite theories, and integrated hygrothermomechanical theory. Equations from theories used by program as appropriate for user's specific applications.

B86-10221
ETCHING SILICON FILMS WITH XENON DIFLUORIDE
M. H. HECHT (Caltech)
May 1986
NPO-16527; NPO-16528 **Vol. 10, No. 3, P. 62**

Microscopic circuit structures prepared for probing. Xenon difluoride removes relatively large amounts of silicon from integrated-circuit or solar-cell structures while leaving SiO2, Si3N4, Al2O3, and other compounds intact. In Etching Apparatus, solid XeF2 sublimated in vacuum, then allowed to flow over sample at controlled rate and pressure. Wafer etched from back to expose SiO2 and Al layers for spectroscopic analysis of SiO2/Al interface. Using XeF2 technique, silicon wafer with oxide layer reduced in thickness from standard 300 micrometer to as little as 10 nanometer without adversely affecting oxide.

B86-10222
PREVENTING DELAMINATION OF SILVERIZED FEP FILMS
L. DOMNIKOV (Hughes Aircraft Co.), J. MAY (Hughes Aircraft Co.), and R. GALLEGO (Hughes Aircraft Co.)

May 1986
MSC-20460 **Vol. 10, No. 3, P. 64**
Edge treatment inhibits attack by moisture. New technique prevents delamination by sealing edges where delamination starts. Samples of aluminum/FEP/silver laminate survive humidity tests and other environmental tests when edges of layers are covered by epoxy bead. Untreated laminates, in contrast, deteriorated seriously during such tests.

B86-10223
LIGHTWEIGHT CERAMIC INSULATION
W. H. WHEELER (Lockheed Missiles & Space Co., Inc.) and J. F. CREEDON (Lockheed Missiles & Space Co., Inc.)
May 1986
MSC-20831 **Vol. 10, No. 3, P. 65**
Fiber burnout process yields low densities. Low density attained by process of sacrificial burnout. Graphite or carbon fibers mixed into slurry of silica, alumina, and boron-compound fibers in amounts ranging from 25 to 75 percent of total fiber content by weight. Mixture formed into blocks and dried. Blocks placed in kiln and heated to 1,600 degrees F(870 degrees C) for several hours. Graphite or carbon fibers slowly oxidize away, leaving voids and reducing block density. Finally, blocks heated to 2,350 degrees F (1,290 degrees C) for 90 minutes to bond remaining ceramic fibers together. Developed for use on Space Shuttle and other spacecraft, rigid insulation machined to requisite shape and bonded in place.

B86-10224
TOUGHER ADDITION POLYIMIDES CONTAINING SILOXANE
T. L. ST. CLAIR and S. MAUDGAL (National Research Council)
May 1986
LAR-13304 **Vol. 10, No. 3, P. 65**
Laminates show increased impact resistances and other desirable mechanical properties. Bismaleamic acid extended by reaction of diaminosiloxane with maleic anhydride in 1:1 molar ratio, followed by reaction with half this molar ratio of aromatic dianhydride. Bismaleamic acid also extended by reaction of diaminosiloxane with maleic anhydride in 1:2 molar ratio, followed by reaction with half this molar ratio of aromatic diamine (Michael-addition reaction). Impact resistances improved over those of unmodified bismaleimide, showing significant increase in toughness. Aromatic addition polyimides developed as both matrix and adhesive resins for applications on future aircraft and spacecraft.

B86-10225
FAST GLAZING OF ALUMINA/SILICA TILES
J. F. CREEDON (Lockheed Missiles & Space Co., Inc.), E. R. GZOWSKI (Lockheed Missiles & Space Co., Inc.), and W. H. WHEELER (Lockheed Missiles & Space Co., Inc.)
May 1986
MSC-20976 **Vol. 10, No. 3, P. 66**
Technique for applying ceramic coating to fibrous silica/alumina insulation tiles prevents cracks and substantially reduces firing time. To reduce thermal stresses in tile being coated, high-temperature, shorttime firing schedule implemented. Such schedule allows coating to mature while substrate remains at relatively low temperature, reducing stress differential between coating and substrate. Technique used to repair tiles with damaged coatings and possibly used in heat-treating objects made of materials having different thermal-expansion coefficients.

B86-10226
A METHOD FOR CHARACTERIZING PMR-15 RESIN
G. D. ROBERTS and R. W. LAUVER
May 1986
LEW-14253 **Vol. 10, No. 3, P. 67**
Quantitative analysis technique based on reverse-phase, high-performance liquid chromatography (HPLC) and paired-ion chromatography (PIC) developed for PMR-15 resins. In reverse-phase HPLC experiment, polar solvent containing material to be analyzed passed through column packed with nonpolar substrate. Composition of PMR-15 Resin of 50 weight percent changes as resin ages at room temperature. Verification of proper resin formulation and analysis of changes in resin composition during storage important to manufacturers of PMR-15 polymer matrix composite parts. Technique especially suitable for commercial use by manufacturers of high-performance composite components.

B86-10227
REINFORCING THE SEPARATORS FOR LITHIUM/CARBON CELLS
E. R. DU FRESNE (Caltech)
May 1986
NPO-16619 **Vol. 10, No. 3, P. 70**
Fabrication of lithium/carbon batteries simplified by attachment of perforated nickel-foil, graphite-cloth, or graphite-paper backings to glass-fiber separators. Both nickel and carbon backings appear viable. Because perforated nickel foil already manufactured by electroforming, no obstacle to creation of very thin, very porous nickel foil to serve as backing: Thicknesses of 20 micrometers with porosities above 50 percent practicable.

B86-10228
MATERIAL FOR FAST CUTTING
A. PEREZ (Rockwell International Corp.)
May 1986
MFS-29130 **Vol. 10, No. 3, P. 70**
New material for cutting tools increases productivity of machining processes. Material, called Iscanite (or equivalent), based on silicon nitride contains more than 90 percent silicon. Combines impact resistance close to that of coated carbides with heat and wear resistance close to those of aluminum oxide ceramics. Material used for cutting on old or new machine tools and makes it possible to exploit fully power and speed of machine.

B86-10229
EFFECTS OF RADIATION ON COATINGS
F. L. BOUQUET (Caltech), V. F. HRIBAR (Caltech), and E. C. METZLER (Caltech)
May 1986
NPO-16533 **Vol. 10, No. 3, P. 71**
Tests help to insure reliability in hostile environment. Tests of radiation damage to materials used in outer coverings of spacecraft described in 25-page report. Materials exposed to ionizing radiation then examined for degradation of desirable mechanical, electrical, and optical properties. Experimental results and test methods applicable to aircraft, scientific instrumentation, and other equipment subject to ionizing radiation, electrostatic discharge, or both.

B86-10230
TESTS OF SOLAR-ARRAY ENCAPSULANTS
R. H. LIANG (Caltech), K. L. ODA (Caltech), S. Y. CHUNG (Caltech), M. V. SMITH (Caltech), and A. GUPTA (Caltech)
May 1986 See Also N83-33339/NSP
NPO-16387 **Vol. 10, No. 3, P. 71**
Materials tested for degradation by heat and light. Report presents early results of continuing series of photothermal aging tests of some candidate encapsulating materials for solar photovoltaic modules. Objectives of testing program: contribute to development of durable, low-cost encapsulants and predict lifetimes of encapsulated photovoltaic modules placed outdoors. Toward these ends, tests designed to reveal physical and chemical degradation mechanisms that affect encapsulants.

B86-10231
SEPARATION IN BINARY ALLOYS
D. O. FRAZIER, B. R. FACEMIRE, W. F. KAUKLER, W. K. WITHEROW, and U. FANNING
May 1986 See Also N84-24773/NSP

MFS-27074 **Vol. 10, No. 3, P. 72**

Studies of monotectic alloys and alloy analogs reviewed. Report surveys research on liquid/liquid and solid/liquid separation in binary monotectic alloys. Emphasizes separation processes in low gravity, such as in outer space or in free fall in drop towers. Advances in methods of controlling separation in experiments highlighted.

B86-10232
CRACK GROWTH IN SINGLE-CRYSTAL SILICON
C. P. CHEN (Caltech) and M. H. LEIPOLD (Caltech)
May 1986
NPO-16757 **Vol. 10, No. 3, P. 73**

Report describes experiments on crack growth in single-crystal silicon at room temperature in air. Crack growth in (111) cleavage plane of wafers, 50 by 100 by 0.76 mm in dimension, cut from Czochralski single-crystal silicon studied by double-torsion load-relaxation method and by acoustic-emission measurements. Scanning electron microscopy and X-ray topography also employed. Results aid in design and fabrication of silicon photovoltaic and microelectronic devices.

B86-10330
FIRE-RESISTANT POLYIMIDES CONTAINING PHOSPHORUS
J. MIKROYANNIDIS
Jul. 1986
ARC-11522 **Vol. 10, No. 4, P. 64**

Limiting oxygen index increased. Copolyimide with a group containing phosphorus synthesized from 1-2,4-diaminobenzene, m-phenylenediamine, and tetracarboxylic dianhydride. Copolymer more fire resistant than corresponding polyimide without phosphorus.

B86-10331
SULFONE/ESTER POLYMERS CONTAINING PENDENT ETHYNYL GROUPS
P. M. HERGENROTHER and B. J. JENSEN
Jul. 1986
LAR-13316 **Vol. 10, No. 4, P. 66**

Two processes make high-performance polymers resistant to solvents, without compromising mechanical characteristics. Polymers show improved solvent resistance while retaining high toughness, thermoformability, and mechanical performance. Multistep process involves conversion of pendent bromo group to ethynyl group, while direct process involves reacting hydroxy-terminated sulfone oligomers or polymers with stoichiometric amount of 5-(4-ethynylphenoxy) isophthaloyl chloride. Applications for new polymers include adhesives, composite resin matrices, moldings, ultrafiltration membranes, protective coatings, and such electrical insulators as thin films for microelectronic circuitry.

B86-10332
POWDER EXTINGUISHANTS FOR JET-FUEL FIRES
R. L. ALTMAN, L. A. MAYER (San Jose University), and A. C. LING (San Jose University)
Jul. 1986
ARC-11252 **Vol. 10, No. 4, P. 68**

Mixtures of alkali metal dawsonite and metal halide show superior performance. In tests of new dry powder fire extinguishants, mixtures of potassium dawsonite with either stannous iodide or potassium iodide found effective for extinguishing jet-fuel fires on hot metal surfaces (up to 900 degrees C). Mixtures performed more effectively than either compound alone.

B86-10333
PROCESS FOR MAKING TRIS(N-METHYLAMINO) METHYLSILANE
J. M. CLEMONS, B. G. PENN, and F. E. LEDBETTER, III
Jul. 1986
MFS-28143 **Vol. 10, No. 4, P. 69**

Efficient process aids production of silicon carbide/silicon nitride fibers. Fibers 10 to the sixth power times as electrically resistive as carbon fibers having similar mechanical properties; promising replacements for carbon fibers in composite materials in which high conductivity poses hazard.

B86-10334
COMPOSITE LIGHTNING RODS FOR AIRCRAFT
C. F. BRYAN, JR.
Jul. 1986
LAR-13470 **Vol. 10, No. 4, P. 69**

Composite, lightweight sacrificial tip with graphite designed reduces lightning-strike damage to composite parts of aircraft and dissipates harmful electrical energy. Device consists of slender composite rod fabricated from highly-conductive unidirectional reinforcing fibers in matrix material. Rods strategically installed in trailing edges of aircraft wings, tails, winglets, control surfaces, and rearward-most portion of aft fuselage.

B86-10439
LIGHTWEIGHT, FIRE-RESISTANT GRAPHITE COMPOSITES
D. A. KOURTIDES, J. A. PARKER, and MING-TA-HSU (H.C. Chemical Corp.)
Sep. 1986
ARC-11615 **Vol. 10, No. 5, P. 74**

Aircraft safety improved with interior paneling made of new laminate with good thermophysical properties. Featuring lightweight graphite composite, laminate more heat-and flame-resistant and produces much less smoke in fire than commonly used epoxy-resin-containing laminates. New laminate prepared without epoxy resin. Graphite unidirectional cloth preimpregnated with blend of vinyl polystyrylpyridine and bismaleimide (VPSP-BMI). Either of two types of VPSP-BMI blend used, depending on method of preparation of chemicals and technique used to fabricate panel.

B86-10440
ION-PLATED SOFT METALLIC FILMS REDUCE FRICTION AND WEAR
T. SPALVINS
Sep. 1986 See Also N85-29085/NSP
LEW-14311 **Vol. 10, No. 5, P. 78**

Ion plating is ion-assisted or glow-discharge surface-deposition technique. In this process, ions or energetic atoms transfer energy, momentum, and charge to substrate and deposited surface film. Process controlled to modify physical characteristics of surface, subsurface chemical conditions, and surface and subsurface microstructures as well. Ion plating with such soft, thin metallic films as gold, silver, or lead has great potential for producing self-contained lubricating surfaces. Such films reduce friction, wear, and corrosion on sliding or rotating mechanical surfaces used in wide range of environments.

B86-10441
DETECTING PORES IN SIC COATINGS
A. B. HAMILTON (LTV Aerospace and Defense), K. L. TUMMONS (LTV Aerospace and Defense), and J. W. LAWTON (LTV Aerospace and Defense)
Sep. 1986
MSC-21041 **Vol. 10, No. 5, P. 78**

Liquid-penetrant/fluorescence technique reveals cracks and pinholes in protective coatings. Developed for checking quality of overcoatings on silicon carbide layers on advanced carbon/carbon substrates. Technique similar to other liquid-penetrant/fluorescence techniques used to make pores visible. Porous areas absorb more suspension and therefore accumulate more fluorescent particles. They fluoresce more brightly than their surroundings.

B86-10442
CHEMICAL FRACTURING OF REFRACTORY-METAL VESSELS
R. J. CAMPANA (GA Technologies Inc.)
Sep. 1986

NPO-16541 **Vol. 10, No. 5, P. 80**

Localized reactions cause refractory-metal vessels to break up at predetermined temperatures. Device following concept designed to break up along predetermined lines into smaller pieces at temperature significantly below melting point of metal from which made. Possible applications include fire extinguishers that breakup to release extinguishing gas in enclosed areas, pressure vessels that could otherwise burst dangerously in fire, and self-destroying devices. Technique particularly suitable modification to already existing structures.

B86-10443
ABRASION-RESISTANT COATING FOR FLEXIBLE INSULATION
D. MUI (Rockwell International Corp.) and R. E. HEADDING (Rockwell International Corp.)
Sep. 1986
MSC-20799 **Vol. 10, No. 5, P. 80**

Ceramic coating increases durability and heat resistance of flexible high-temperature insulation. Coating compatible with quartz-fabric insulation allowing it to remain flexible during and after repeated exposures to temperatures of 1,800 degree F (982 degree C). Prevents fabric from becoming brittle while increasing resistance to aerodynamic abrasion and loading. Coating consists of penetrating precoat and topcoat. Major ingredients high-purity colloidal silica binder and ground silica filler, which ensure stability and compatibility with fabric at high temperatures. Both precoat and topcoat cured at room temperature.

B86-10444
POLYIMIDE OF MODIFIED MELT FLOW AND TOUGHNESS
T. L. ST. CLAIR and H. D. BURKS
Sep. 1986 See Also U.S. Patent No. 4,552,931
LAR-13135 **Vol. 10, No. 5, P. 81**

Linear aromatic polyphenylene ether sulfideimide (BDSDA/APB) polymer molded, used as resin, and cast into thin films. In effort to improve further both use properties and amenability to process BDSDA/APB, molecular weight of polymer varied by variations in percentage of end capping. Effect of end capping BDSDA/APB determined by measurement of polymer melt viscosity and fracture-energy values for different number-average synthesized molecular weights.

B86-10445
BATCH GAS-SAMPLING SYSTEM
J. DIAZ, VERNON (Lockheed Engineering and Management Services Co., Inc.), E. L. MILLER (Lockheed Engineering and Management Services Co., Inc.), and F. P. ROLLINS (Lockheed Engineering and Management Services Co., Inc.)
Sep. 1986
MSC-20977 **Vol. 10, No. 5, P. 82**

Sampler collects air or other gases in consistent way and stabilizes them for later chemical analysis. Device used for concentrations ranging from few parts per million to 100 percent. Also separates and collects particles in gas for analysis. Gas flows into vacuum sphere when solenoid valve opened. As it passes through conversion tube, constituent of gas forms stable compound that remains in conversion tube for analysis at later time. Sampler parts made of glass, polytetrafluoroethylene, and stainless steel so they do not react with sample.

B86-10446
PRODUCING SILICON CARBIDE/SILICON NITRIDE FIBERS
(Innovator Not Given(Bjorksten Research Laboratory, Inc.) Sep. 1986
MFS-27123 **Vol. 10, No. 5, P. 82**

Manufacturing process makes CxSiyNz fibers. Precursor fibers spun from extruding machine charged with polycarbosilazane resin. When pyrolyzed, resin converted to cross-linked mixture of silicon carbide and silicon nitride, still in fiber form. CxSiyNz fibers promising substitutes for carbon fibers in high-strength, low-weight composites where high electrical conductivity unwanted.

B86-10447
OXYGEN-CONCENTRATING CELL
K. BUEHLER
Sep. 1986
KSC-11335 **Vol. 10, No. 5, P. 83**

High-purity oxygen produced from breathing air or from propellant-grade oxygen in oxygen-concentrating cell. Operating economics of concentrator attractive: Energy consumption about 4 Wh per liter of oxygen, slightly lower than conventional electrochemical oxygen extractors.

B86-10448
LUBRICANTS AND ADDITIVES AFFECT SPUR-GEAR FATIGUE
H. SCIBBE, D. TOWNSEND, P. ARON, and E. ZARETSKY
Sep. 1986 See Also N85-13234/NSP, N85-16099/NSP, N85-28373/NSP
LEW-14314 **Vol. 10, No. 5, P. 84**

Surface-fatigue tests conducted with AISI 9310 steel spur gears show surface-fatigue life of AISI 9310 steel spur gears increased as much as 400 percent by addition of small amount of phosphorus-type extreme-pressure (EP) additive in lubricant. Antiwear or EP additives either absorbed onto surface or react with surface to form protective coating or surface film. Boundary film provides barrier that prevents contact of metal surfaces and provides low shear strength, which reduces friction coefficient below base metal.

B86-10449
POLYIMIDE FILM OF INCREASED TEAR STRENGTH
A. K. ST. CLAIR, J. A. HINKLEY, and S. A. EZZELL (Virginia Polytechnic Institute and State University)
Sep. 1986
LAR-13491 **Vol. 10, No. 5, P. 85**

High-temperature linear aromatic polyimide with improved resistance to tearing made by new process that incorporates elastomer into polyimide. Linear aromatic condensation polyimides are materials of prime choice for use as films and coatings on advanced spacecraft and aircraft where durability at temperatures in range of 200 to 300 degree C required. Elastomer-containing polyimide film with improved toughness proves useful for applications where resistance to tearing and long-term thermal stability necessary. Desired resistance to tearing achieved by careful control of amount and chemical composition of added elastomer.

B86-10450
HIGH-TEMPERATURE ALLOYS FOR AUTOMOTIVE STIRLING ENGINES
J. R. STEPHENS and R. H. TITRAN
Sep. 1986 See Also N84-28963/NSP
LEW-14325 **Vol. 10, No. 5, P. 86**

Stirling engine is external-combustion engine that offers fuel economy, low emissions, low noise, and low vibrations. One of most critical areas in engine development concerns material selection for component parts. Alloys CG-27 and XF-818 identified capable of withstanding rigorous requirements of automotive Stirling engine. Alloys chosen for availability, performance, and manufacturability. Advanced iron-base alloys have potential for variety of applications, including stationary solar-power systems.

B86-10451
RESPONSES OF DIELECTRICS TO SPACE RADIATION
F. L. BOUQUET (Caltech)
Sep. 1986
NPO-16687 **Vol. 10, No. 5, P. 89**

Nature, extent, and possible prevention of radiation damage discussed. Report summarizes likely effects of high-energy radiation in outer space on variety of commercially-available dielectric materials used in spacecraft.

Effects reported on basis of recent Galileo tests, unpublished tests involving proton or electron irradiation, and published information. In general, organic materials with carbon or inorganic fillers most resistant to radiation.

B86-10452
THERMAL CONDUCTANCES OF PRESSED COPPER CONTACTS
L. SALERNO, P. KITTEL, and A. SPIVAK (Trans Bay Electronics)
Sep. 1986
ARC-11572 **Vol. 10, No. 5, P. 89**

Report describes investigation of thermal conductivities of smooth copper contacts pressed together at liquid-helium temperatures. Investigation prompted by need for accurate thermal models for infrared detectors and other cryogenic instruments.

B86-10492
HOSE- AND TUBE-CLEANING MODULE
F. P. ROLLINS (Lockheed-EMSCO) and J. S. GLASS (Lockheed-EMSCO)
Nov. 1986
MSC-20857 **Vol. 10, No. 6, P. 46**

Self-contained, single-use module enables hose or tube to be cleaned thoroughly in field, in one operation, using water of unknown or questionable quality. Previously, chemicals for flow cleaning had to be mixed, diluted and pumped through tubes and hoses in many successive steps; deionizers, water-treatment facilities, and chemical storage required. With proposed device cleaning performed safely, without special training. Ready to use, device packaged as cleaning kit with tube to be cleaned.

B86-10493
FIRE-RESISTANT BELT PANEL FOR AIRPLANE WINDOWS
E. L. TRABOLD (McDonnell Douglas Corp.) and M. F. MURPHY (McDonnell Douglas Corp.)
Nov. 1986
MSC-21064 **Vol. 10, No. 6, P. 48**

Window-belt panel for airplanes fire resistant and generates little smoke when exposed to flames. Panel incorporates fire-shield layer adding minimal weight but delays or prevents fire from burning through. Structural core of panel is Nomex or equivalent polyamide paper honeycomb. Fire shield, made of fluororubber sheet, incorporated in multiple-ply facing bonded to core. Outer layers of multiple-ply facing and back face of panel consist of biwoven carbon-cloth impregnated with phenolic resin.

B86-10494
FIRE-RESISTANT AIRCRAFT CEILINGS
E. A. TRABOLD (McDonnell Douglas Corp.) and M. F. MURPHY (McDonnell Douglas Corp.)
Nov. 1986
MSC-21065 **Vol. 10, No. 6, P. 48**

Ceiling panel for airplane cabins more fire resistant than conventional panels. New panel incorporates core of polyimide foam as fire shield. Core significantly delays burn-through by flames and offers passengers greater protection.

B86-10495
TWO-STEP VAPOR/LIQUID/SOLID PURIFICATION
L. R. HOLLAND (University of Alabama, Huntsville)
Nov. 1986
MFS-26004 **Vol. 10, No. 6, P. 51**

Vertical distillation system combines in single operation advantages of multiple zone refining with those of distillation. Developed specifically to load Bridgman-Stockbarger (vertical-solidification) growth ampoules with ultrapure tellurium and cadmium, system, with suitable modifications, serves as material refiner. In first phase of purification process, ampoule heated to drive off absorbed volatiles. Second phase, evaporator heated to drive off volatiles in charge. Third phase, slowly descending heater causes distillation from evaporator to growing crystal in ampoule.

B86-10496
STRONG ADHESIVE TAPE FOR COLD ENVIRONMENTS
T. G. WOODS (McDonnell Douglas Corp.)
Nov. 1986
MSC-20924 **Vol. 10, No. 6, P. 52**

Strong tape remains sticky over wide temperature range. Strong tape for low temperatures consists of two layers of polyimide tape with layer of reinforcing mesh. Improved tape devised for repairs in space also finds use on Earth in polar regions and in superconducting applications. Tape retains adherence and strength at extreme temperatures, where conventional tapes fail.

B86-10497
FUEL MANIFOLD RESISTS EMBRITTLEMENT BY HYDROGEN
T. ADAMS (Rockwell International Corp.)
Nov. 1986
MFS-29089 **Vol. 10, No. 6, P. 54**

Completely-cast hydrogen-compatible alloy preferable to protective plating. Complexity of plating, welding, and brazing unnecessary if hydrogen-compatible alloy used for entire casting instead of protective overlay. Parts exposed to high-pressure hydrogen made immune to hydrogen embrittlement if fabricated from new alloy, Incoly 903 (or equivalent). Material strong and compatible with hydrogen at all temperatures and adapted for outlet manifold of Space Shuttle main combustion chamber.

B86-10498
IRON/PHOSPHORUS ALLOYS FOR CONTINUOUS CASTING
E. R. DUFRESNE (Caltech)
Nov. 1986
NPO-16611 **Vol. 10, No. 6, P. 54**

Continuous casting becomes practicable because of reduced eutectic temperature. Experimental ferrous alloy has melting point about 350 degrees C lower than conventional steels, making possible to cast structural members and eliminating need for hot rolling. Product has normal metal structure and good physical properties. Process used to make rails, beams, slabs, channels, and pipes.

B86-10499
POLYETHER/POLYESTER GRAFT COPOLYMERS
V. L. BELL, JR., N. WAKELYN, D. M. STOAKLEY, and K. M. PROCTOR
Nov. 1986
LAR-13447 **Vol. 10, No. 6, P. 55**

Higher solvent resistance achieved along with lower melting temperature. New technique provides method of preparing copolymers with polypivalolactone segments grafted onto poly (2,6-dimethyl-phenylene oxide) backbone. Process makes strong materials with improved solvent resistance and crystalline, thermally-reversible crosslinks. Resulting graft copolymers easier to fabricate into useful articles, including thin films, sheets, fibers, foams, laminates, and moldings.

B86-10500
LOW-RESISTIVITY ZINC SELENIDE FOR HETEROJUNCTIONS
R. J. STIRN (Caltech)
Nov. 1986
NPO-16475 **Vol. 10, No. 6, P. 56**

Magnetron reactive sputtering enables doping of this semiconductor. Proposed method of reactive sputtering combined with doping shows potential for yielding low-resistivity zinc selenide films. Zinc selenide attractive material for forming heterojunctions with other semiconductor compounds as zinc phosphide, cadmium telluride, and gallium arsenide. Semiconductor junctions promising for future optoelectronic devices, including solar cells and

electroluminescent displays. Resistivities of zinc selenide layers deposited by evaporation or chemical vapor deposition too high to form practical heterojunctions.

B86-10501
CHEMICAL CHARACTERIZATION OF PHENOL/ FORMALDEHYDE RESINS
T. H. BRAYDEN (LTV Aerospace and Defense Co.)
Nov. 1986
MSC-21055 **Vol. 10, No. 6, P. 59**

Report discusses tests of commercial phenol/ formaldehyde resins to establish relationships among composition before use, behavior during curing, and strength after curing. Resin used in carbon/carbon laminates. In curing process, two molecules of phenol joined together in sequence of reactions involving molecule of formaldehyde. Last step of sequence, molecule of water released. Sequence repeats until one of ingredients used up, leaving solidified thermoset plastic. Issues to be resolved: number and relative abundances of ingredients, presence of certain chemical groups, heat-producing ability of resin, and range of molecular weights present.

05 LIFE SCIENCES

B86-10043
SELF-CONTAINED NEUTRAL-BUOYANCY SUIT
B. E. BOSWELL (McDonnell Douglas Corp.), B. J. WALLACE (McDonnell Douglas Corp.), and T. G. WOODS (McDonnell Douglas Corp.)
Jun. 1986
MSC-20424 **Vol. 10, No. 1, P. 90**

Report discusses self-contained diving suit used in simulations of zero-gravity maneuvers in space suit. Method, called neutral-buoyancy immersion, useful in preparing astronauts for extravehicular activity.

B86-10195
VISUAL-ACCOMMODATION TRAINER/TESTER
R. J. RANDLE, JR.
Jun. 1986
ARC-11426 **Vol. 10, No. 2, P. 148**

Ophthalmic instrument tests and helps develop focusing ability. Movable stage on a fixed base permits adjustment of effective target position as perceived by subject. Various apertures used to perform tests and training procedures. Ophthalmic instrument provides four functions: it measures visual near and far points; provides focus stimulus in vision research; measures visual-accommodation resting position; can be used to train for volitional control of person's focus response.

B86-10196
SPRING SMALL GRAINS AREA ESTIMATION
W. F. PALMER (Lockheed Engineering & Management Services Co., Inc.) and R. J. MOHLER (Lockheed Engineering & Management Services Co., Inc.)
Jun. 1986
MSC-20973 **Vol. 10, No. 2, P. 149**

SSG3 automatically estimates acreage of spring small grains from Landsat data. Report describes development and testing of a computerized technique for using Landsat multispectral scanner (MSS) data to estimate acreage of spring small grains (wheat, barley, and oats). Application of technique to analysis of four years of data from United States and Canada yielded estimates of accuracy comparable to those obtained through procedures that rely on trained analysis.

B86-10307
SMALL-PORTION WATER DISPENSER
J. C. JOERNS (Technology, Inc.)
May 1986
MSC-20534 **Vol. 10, No. 3, P. 152**

Pressure regulated and flow timed to control amount dispensed. Dispenser provides measured amount of water for reconstituting dehydrated foods and beverages. Dispenser holds food or beverage package while being filled with either cold or room-temperature water. Other uses might include dispensing of fluids or medicine. Pressure regulator in dispenser reduces varying pressure of water supply to constant pressure. Electronic timer stops flow after predetermined length of time. Timed flow at regulated pressure ensures controlled volume of water dispensed.

B86-10308
ROTATING APPARATUS FOR ISOELECTRIC FOCUSING
M. BIER (University of Arizona)
May 1986
MFS-26012 **Vol. 10, No. 3, P. 152**

Remixing of separated fractions prevented. Improved isoelectric focusing apparatus helps to prevent electro-osmosis and convection, both of which cause remixing of separated fractions. Fractionating column segmented and rotated about horizontal axis: Only combined effects of both features fully effective in making good separations. Improved apparatus slowly rotated continuously or rocked (at rotational amplitude of at least 180 degrees) about its horizontal axis so average gravitational vector experienced by fluid is zero and convection is therefore suppressed. Electro-osmosis suppressed and convection further suppressed by separating column into disk-like compartments along its length with filters. Experiments have shown dimensions of apparatus not critical. Typical compartment and column volumes are 2 and 40 ml, respectively. Rotation speeds lie between 3 and 30 rpm.

B86-10408
FILTER BED OF PACKED SPHERES
D. D. ELLEMAN (Caltech) and T. G. WANG (Caltech)
Jul. 1986
NPO-15906 **Vol. 10, No. 4, P. 140**

Spheres sized and treated for desired sieve properties. Filter constructed from densely packed spheres restrained by screens. Hollow gas-filled plastic or metal spheres normally used. Manufactured within one percent or better diameter tolerance. Normally, all spheres in filter of same nominal diameter. Filter used as sieve to pass only particles smaller than given size or to retain particles larger than that size. Options available under filter concept make it easy to design for specific applications.

B86-10409
CONTRAST-SENSITIVITY RESEARCH
T. A. LAWTON (Caltech)
Jul. 1986
NPO-16643 **Vol. 10, No. 4, P. 141**

Report presents study of visual effects of frequencies of luminance patterns and particularly how frequency components affect visibilty of spatial phase differences over several octaves. Of interest to researchers engaged in development of algorithms relating to visual processing in robots, incorporation of human factors in design of visual displays, and development of set of rules visual system uses to reconstruct three-dimensional perception from two-dimensional neural representation.

B86-10480
ESTIMATING CROP YIELDS FROM MULTISPECTRAL REFLECTANCE
C. DAUGHTRY (Purdue University)
Sep. 1986
MSC-21060 **Vol. 10, No. 5, P. 126**

Three reports describe research on proposed method for estimating crop yields by combining meteorological data

with satellite measurements of reflected radiation to estimate crop-absorbed radiation. Concept, when tested over large areas, forms basis for evaluating crop conditions and estimating yields over regions where ground observations too costly or too difficult.

B86-10526
PHOTOELECTRONIC MONITOR OF MOTION SICKNESS
C. M. OMAN (Massachusetts Institute of Technology) and W. J. COOK (Massachusetts Institute of Technology)
Nov. 1986
MSC-20794 **Vol. 10, No. 6, P. 94**

Instrument includes gallium arsenide light-emitting diode (LED) and silicon phototransistor with infrared filter, all cast in single plastic housing. Housing attached to subject's face with transparent doublesided adhesive tape. LED directs pulses of infrared light to skin, which reflects them to phototransistor. Phototransistor produces signal that is processed by external circuits to yield plot of infrared reflectance with time. External circuits temperature-compensated and respond only to pulsed component of detector output, rejecting those components caused by stray light. Circuits also extract blood-volume pulse amplitude and heart rate.

B86-10527
COLLECTION OF HUMAN WASTES ON LONG MISSIONS
D. C. JENNINGS (United Technologies Corp.), T. A. LEWIS (United Technologies Corp.), and H. F. BROSE (United Technologies Corp.)
Nov. 1986 See Also N85-17552/NSP
MSC-20968 **Vol. 10, No. 6, P. 95**

Report evaluates and compares three alternative approaches to hygienic containment of human wastes. Three practical means of waste collection: filter-bag collection with compaction by fan suction, canister collection with compaction by force applied to compaction cups or disks, and sleeve collection with compaction by rollers and winding on reel. Potentially useful in airplanes, buses, boats, trains, and campers and temporary toilets for construction sites and outdoor gatherings.

06 MECHANICS

B86-10044
CRADLES FOR SUPPORT IN TRANSIT
W. H. CRANE (Lockheed Missiles & Space Co., Inc.) and H. T. FISHER (Lockheed Missiles & Space Co., Inc.)
Jun. 1986
MSC-20725 **Vol. 10, No. 1, P. 92**

C-shaped cradles distribute weight of large objects. Originally developed for holding satellite in bay of Space Shuttle orbiter, concept also adaptable to such terrestrial uses as carrying odd-shaped equipment by truck. Cradle set consists of single prime cradle and several basic cradles. Composed of bar bent into a half circle, each cradle has own keel and longeron trunnions that brace structure by mating with receptacles in vehicle and its own foam pads, on which load rests. One 548-lb (249-kg) cradle supports up to 3,000 lb (1,361 kg); thus, 15,000-lb (6,800-kg) object requires five cradles distributed along its length. Through their trunnions, cradles spread weight of load along vehicle.

B86-10045
INTERNALLY WRENCHING NUT
R. G. CORTES (Rockwell International Corp.)
Jun. 1986
MFS-29068 **Vol. 10, No. 1, P. 93**

Less space needed for installation and removal. Nut for use with short bolts torqued with allen wrench. In contrast with standard hexagonal nuts, new nut requires no external wrench clearance on installation surface. Nut has many uses in assemblies where space is limited, especially in automotive and aircraft industries.

B86-10046
SELF-ALINING END SUPPORTS FOR ENERGY ABSORBER
E. ALFARO-BOU, C. P. EICHELBERGER, and E. FASANELLA (Kentron International, Inc.)
Jun. 1986
LAR-13295 **Vol. 10, No. 1, P. 94**

Simple devices stabilize axially-loaded compressive members. Energy-absorbing column held by two end supports, which stabilize column and tolerate misalinement. Column absorbs excess load by collapsing lengthwise. Self-alining supports small, lightweight, and almost maintenance-free. Their use eliminates alinement problem, opening up more applications and providing higher reliability for compressively-loaded energy absorbers.

B86-10047
COMBINED DEVICES FOR TURBULENT-DRAG REDUCTION
M. J. WALSH, J. B. ANDERS, JR., and J. N. HEFNER
Jun. 1986
LAR-13286 **Vol. 10, No. 1, P. 94**

Aircraft skin-friction drag reduced as much as 15 percent. One effective drag-reduction technique involves use of riblets. Riblets are longitudinal striations or grooves machined on originally smooth surface. Grooves alined with flow. Grooves have depths and spacings on order of turbulent wallstreak and burst dimensions and designed to change near-wall structure of turbulent boundary layer. Another approach, using large-eddy-breakup (LEBU) devices, or turbulence manipulators or ribbons also demonstrated reductions in local skin friction and net drag in air. LEBU device consists of thin, ribbonlike strips or airfoils suspended parallel to test surface and positioned within turbulent boundary layer. Technique potentially reduce net skin-friction drag by at least 15 percent on turbulent boundary layer of aircraft, representing possible annual savings in fuel costs of $300 to $400 million for U.S. commercial fleet. Also applicable to friction-loss reduction inside pipes and ducts, contributing to increased efficiency of pumps, heat exchangers, air conditioners, and other devices involving fluid flow.

B86-10048
CLIP-ON EXTENSOMETER
A. M. C. HOLMES (Lockheed Missiles & Space Co., Inc.) and M. C. DUGGAN (Lockheed Missiles & Space Co., Inc.)
Jun. 1986
MSC-20710 **Vol. 10, No. 1, P. 96**

Flexural clamp eliminates problems of operator variability. Extensometer opens and closes like clothespin and placed easily on specimen. Dimensions of block specimen are 1 by 1 by 2.2 inches (2.54 by 2.54 by 5.59 centimeters). By constructing central flexure units of various widths, one adapts extensometer to handle specimens ranging from thin strips to those many inches thick. New design reduces measurement errors caused by variability among test operators.

B86-10049
PRECISE-CONDUCTANCE VALVE INSERT
R. A. OUTLAW and R. F. HOYT
Jun. 1986
LAR-13340 **Vol. 10, No. 1, P. 97**

Valve modification provides two operating modes fully open and small, precise leak. Copper insert with radially oriented holes allows small, controllable, precise effusion rate when valve closed or nearly unobstructed flow when

valve open. Numerous applications in surface physics, vacuum physics, materials science, gas kinetics, thin films, and other areas of research requiring measured flows of gas into or out of system.

B86-10050
DETECTING CAVITATION PITTING WITHOUT DISASSEMBLY
S. BARKHOUDARIAN (Rockwell International Corp.)
Jun. 1986
MFS-19902 **Vol. 10, No. 1, P. 98**

Technique for detecting cavitation pitting in pumps, turbines, and other machinery uses low-level nuclear irradiation. Isotopes concentrated below surface emit gamma radiation, a portion of which is attenuated by overlying material. Where there are cavitation pits, output of gamma-ray detector fluctuates as detector is scanned near pits. Important to detect cavitation pits because nozzle, turbine blade, or other pump component weakened by cavitation could fail catastrophically and cause machine to explode.

B86-10051
A RAPID ATTACHMENT OF STRAIN GAGES
T. D. SCHOTT, R. L. FOX, and J. D. BUCKLEY
Jun. 1986
LAR-13237 **Vol. 10, No. 1, P. 98**

Hand-held toroidal gun concentrates heat in localized area. New method for bonding film gages eliminates time-consuming oven curing Hand-held 'gun,' operates on induction heating to concentrate heat in localized area. Ferritic plate added for low-reluctance or no-reluctance surfaces.

B86-10052
EASILY ACCESSIBLE CAMERA MOUNT
H. E. CHALSON (PRC Systems Services)
Jun. 1986
KSC-11316 **Vol. 10, No. 1, P. 99**

Modified mount enables fast alinement of movie cameras in explosion-proof housings. Screw on side and readily reached through side door of housing. Mount includes right-angle drive mechanism containing two miter gears that turn threaded shaft. Shaft drives movable dovetail clamping jaw that engages fixed dovetail plate on camera. Mechanism alines camera in housing and secures it. Reduces installation time by 80 percent.

B86-10053
GRAPHICAL METHOD FOR PREDICTING STEADY-STATE TEMPERATURE
R. L. CASE, JR. (Rockwell International Corp.)
Jun. 1986
MSC-20835 **Vol. 10, No. 1, P. 100**

Temperature that heated or cooled passive system will reach is predicted from temperature-versus-time curves. Intersection of two lines in graphical construction gives asymptotic temperature of system. Developed for analyzing thermal anomalies during flights of Space Shuttle, graphical method also applicable to everyday heating and cooling problems.

B86-10054
ICE DETECTOR FOR AIRCRAFT
L. M. WEINSTEIN
Jun. 1986
LAR-13403 **Vol. 10, No. 1, P. 100**

Thickness of ice on aircraft measured by flush-mounted sensor. Detector consists of following: flush-mounted sensor with three separate components, temperature-measuring circuit, configuration of which is based on type of sensor used, two capacitance-measuring circuits, and logic circuit that uses outputs of other three circuits to determine presence of ice and its thickness. Information required to determine whether efforts to remove ice, such as heating or change in flight speed or elevation, should be initiated.

B86-10055
HIGH-PERFORMANCE HEAT PIPE WITH SCREEN MESH
J. P. ALARIO (Grumman Aerospace Corp.), R. F. BROWN (Grumman Aerospace Corp.), and R. KOSSON (Grumman Aerospace Corp.)
Jun. 1986
MSC-20497 **Vol. 10, No. 1, P. 101**

Liquid distributed more evenly in evaporator section. Improved heat pipe contains an artery and wick rolled from stainless-steel screen of 180 mesh (openings about 80 micrometers). Screen material helps to prevent dryout in evaporator section by conducting liquid through hotspots and to vaporchannel wall. Insert reduces incidence of dryout at hotspots or during intervals of general thermal overload.

B86-10056
MEASURING GEARBOX TORQUE LOSS
L. F. SCHMIDT (Caltech)
Jun. 1986
NPO-15794 **Vol. 10, No. 1, P. 102**

Accuracy increased by measuring small torque differences directly. Input and output torques are balanced by mechanical linkage in transmission-testing apparatus. Force applied to load cell proportional to frictional torque loss in transmission. Apparatus measures portion of input torque lost to friction in automotive transmissions or other gearbox. Apparatus more sensitive than previous measuring systems.

B86-10057
MEASURING HEAT-EXCHANGER WATER LEAKAGE
J. ZAMPICENI (United Technologies Corp.)
Jun. 1986
MSC-20811 **Vol. 10, No. 1, P. 103**

Water leakage in heat exchanger measured directly with help of electroytic hygrometer. In new technique, flow of nitrogen gas set up in one loop of heat exchanger.Other loop filled with water under pressure. Water concentration produced by leakage of water into nitrogen flow measured by hygrometer. New measurement method determines water concentrations up to 2,000 parts per million with accuracy of +/- 5 percent.

B86-10058
OPTIMIZED BOLTED JOINT
L. J. HART-SMITH (McDonnell Douglas Corp.), B. L. BUNIN (McDonnell Douglas Corp.), and D. J. WATTS (McDonnell Douglas Corp.)
Jun. 1986 See Also (X83-10287)
LAR-13250 **Vol. 10, No. 1, P. 103**

Computer technique aids joint optimization. Load-sharing between fasteners in multirow bolted composite joints computed by nonlinear-analysis computer program. Input to analysis was load-deflection data from 180 specimens tested as part of program to develop technology of structural joints for advanced transport aircraft. Bolt design optimization technique applicable to major joints in composite materials for primary and secondary structures and generally applicable for metal joints as well.

B86-10059
LASER HOLDER AIDS CENTERING OF X-RAY HEAD
D. V. BULTHUIS (Rockwell International Corp.) and D. D. KETTERING (Rockwell International Corp.)
Jun. 1986
MFS-29067 **Vol. 10, No. 1, P. 104**

Laser holder used when alining X-ray head makes procedure safer and more reliable. Laser holder assembly attached to X-ray head to enable head to be alined optically before X-ray exposure. When laser in operating position laser beam shines on spot later illuminated with X-rays. New holder grips laser securely, maintains alinement, does not interfere with head placement, and requires only one 110-V power cord.

B86-10060
HIGHER SENSITIVITY IN X-RAY PHOTOGRAPHY

R. N. BUGGLE (Honeywell, Inc.)
Jun. 1986
MFS-28026 **Vol. 10, No. 1, P. 105**

Hidden defects revealed if X-ray energy decreased as exposure progresses. Declining-potential X-ray photography detects fractures in thin metal sheet covered by unbroken sheet of twice thickness. Originally developed to check solder connections on multilayer circuit boards, technique has potential for other nondestructive testing.

B86-10061
SIMPLIFIED RIDE-COMFORT PROGRAM
J. D. LEATHERWOOD and L. M. BARKER (System Development Corp.)
Jun. 1986
LAR-13289 **Vol. 10, No. 1, P. 107**

Vibration and noise contributions to discomfort quantified. RIDEQUL estimates passenger ride comfort within air- and surface-transportion systems. Provides engineers with reliable method of objectively predicting and evaluating vehicle ride quality. Transforms individual elements of noise and vibration characteristics of vehicle into subjective units and combines these units to produce single discomfort index. Program written in FORTRAN 77 for interactive or batch execution.

B86-10143
ANALYZING STATIC LOADING OF COMPLEX STRUCTURES
D. C. GALLEAR (Rockwell International Corp.)
May 1986
MSC-20896 **Vol. 10, No. 2, P. 98**

Critical loading conditions determined from analysis of each structural element. Automated Thrust Structures Loads and Stresses (ATLAS) system is series of programs developed to analyze elements of complex structure under static-loading conditions. ATLAS calculates internal loads, beam-bending loads, column- and web-buckling loads, beam and panel stresses, and beam-corner stresses. Programs written in FORTRAN IV and Assembler for batch execution.

B86-10144
SHADOWED SPACE HEATING OF SPARSE STRUCTURES
J. L. ONEILL (General Dynamics Corp.) and J. L. ZICH (General Dynamics Corp.)
May 1986
LEW-13977 **Vol. 10, No. 2, P. 98**

Complete heat-flux and temperature maps computed. Computer program SSQ developed to address and quantify complex, solar-shadowing conditions inherent in sparse, lattice-type space structures. Analysis procedure one of assessing partial shadowing of structural elements by multiple, similar slender members. Program yields schedules of incident-solar, Earth-thermal, and Earth-albedo radiation throughout complete orbit for elemental locations on selected structural members. Thermal response computed in optional routine. Complete heat-flux and temperature mapping obtained by repeated computations for selected elements of interest.

B86-10145
RENDEZVOUS BET PROGRAM
W. M. LEAR (TRW, Inc.)
May 1986
MSC-20785 **Vol. 10, No. 2, P. 98**

Computes relative positions of two vehicles in concentric orbits. LRBET3 program best-estimate-of-trajectory (BET) calculation for postflight trajectory analysis of Shuttle orbital rendezvous maneuvers. LRBET3 produces estimated measurements for reconstructing relative positions of two vehicles. Kalman filter and smoothing filter applied to relative measurement input data to estimate state vector, reduce noise, and produce BET output. BET calculation minimizes variances of all trajectory estimation errors. LRBET3 written in FORTRAN IV for batch execution.

B86-10146
VARIABLE-CONDUCTANCE HEAT PIPES
D. ANTONIUK (TRW, Inc.)
May 1986
LEW-14075 **Vol. 10, No. 2, P. 100**

In response to need to accurately and efficiently predict performance of variable-conductance heat pipes (VCHP's) incorporated in spacecraft thermal-control systems, computer code VCHPDA developed to interact with thermal analyzer programs such as SINDA (Systems Improved Numerical Differencing Analyzer). Calculates length of gas-blocked region and vapor temperature in active portion. Advantages of VCHPDA over prior programs improved accuracy, unconditional stability, and increased efficiency of solution resulting from novel approach and use of state-of-the-art numerical techniques for solving VCHP mathematical model. Code valuable tool in design and evaluation of advanced thermal-control systems using variable-conductance heat pipes. Written in FORTRAN IV for use on CDC 600 computers.

B86-10147
PROGRAMING STRUCTURAL SYNTHESIS SYSTEM
J. ROGERS, JAMESL.
May 1986
LAR-13408 **Vol. 10, No. 2, P. 100**

Program aids research in analysis and optimization. Programing Structural Synthesis System (PROSSS2) developed to provide structural-synthesis capability by combining access to SPAR with CONMIN program and set of interface procedures. SPAR is large general-purpose finite-element structural-analysis program, and CONMIN is large general-purpose optimization program. PROSSS2 written in FORTRAN IV for batch execution.

B86-10148
VIBRATION-RESPONSE ANALYSIS
L. M. BOWMAN (U.S. Army Aviation Systems Command)
Jun. 1986
LAR-13291 **Vol. 10, No. 2, P. 100**

Dynamic behaviors of structures analyzed interactively. Interactive steadystate vibration-response program, VIBRA, developed. Frequency-response analyses commonly used in evaluating dynamic behaviors of structures subjected to cyclic external forces. VIBRA calculates frequency response using modal-superposition approach. Method applicable to single or multiple forces applied to linear, proportionally damped structure in which damping is viscous or structural. VIBRA written in FORTRAN 77 for interactive execution.

B86-10149
FATIGUE-CRACK-GROWTH STRUCTURAL ANALYSIS
J. NEWMAN, J.C.
May 1986
LAR-13412 **Vol. 10, No. 2, P. 102**

Elastic and plastic deformations calculated under variety of loading conditions. Prediction of fatigue-crack-growth lives made with Fatigue-Crack-Growth Structural Analysis (FASTRAN) computer program. As cyclic loads are applied to initial crack configuration, FASTRAN predicts crack length and other parameters until complete break occurs. Loads are tensile or compressive and of variable or constant amplitude. FASTRAN incorporates linear-elastic fracture mechanics with modifications of load-interaction effects caused by crack closure. FASTRAN considered research tool, because of lengthy calculation times. FASTRAN written in FORTRAN IV for batch execution.

B86-10160
QUICK-CONNECT HEAVY-DUTY FASTENER
D. M. MOORE (Caltech)
Jun. 1986
NPO-16370 **Vol. 10, No. 2, P. 108**

Attaching device combines fast connection and disconnection with high strength. T-shaped stud engages groove in receptacle after one-quarter turn. Further turning tightens

nut on receptacle. Like quarter-turn attaching devices, connected and disconnected quickly. Like threaded devices, adjusted to desired preload, withstand high loads, and accommodate wide range of grip lengths.

B86-10161
STABLE EJECTION SEAT
R. S. HIRSCH (Rockwell International Corp.)
Jun. 1986
MSC-20780 **Vol. 10, No. 2, P. 109**

Drogue chute for ejection seat slows down seat in more stable fashion than conventional parachutes and thus improves chances for survival. Square drogue linked to seat from its corners suppresses tendency of seat to rotate in pitch and yaw. New parachute expected to reduce dynamic forces on ejected person and extend maximum possible ejection altitude by 50 percent. Used at high or low speeds.

B86-10162
FINITE-ELEMENT FRACTURE ANALYSIS OF PINS AND BOLTS
K. J. NORD (Teledyne Brown Engineering Corp.)
Jun. 1986
MFS-28061 **Vol. 10, No. 2, P. 110**

Stress intensities calculated in bending and tension. Finite-element stress-analysis method gives stress-intensity estimates for surface flaws on smooth and threaded round bars. Calculations done for purely tensile and purely bending loads. Results, presented in dimensionless form, useful for determining fatigue lives of bolts and pins.

B86-10163
THREE-AXIS LOAD-CELL ASSEMBLY
G. R. REWERTS (Ametek, Inc.)
Jun. 1986
MSC-20875 **Vol. 10, No. 2, P. 111**

Force-measuring device both sensitive and rugged. Load-cell assembly placed between manipulator and object being manipulated. Load cells measure forces on object almost directly, without interference by intervening manipulator forces. Developed for use with remote manipulator that bends cryogenic ducts. Device rugged and functions over wide range, having applications in automatic testing equipment, industrial robots, and force-measuring equipment.

B86-10164
ACOUSTIC/MAGNETIC STRESS SENSOR
J. S. HEYMAN and M. NAMKUNG (College of William and Mary)
Jun. 1986
LAR-13320 **Vol. 10, No. 2, P. 112**

High-resolution sensor fast, portable, does not require permanent bonding to structure. Sensor measures nondestructively type (compressive or tensile) and magnitude of stresses and stress gradients present in class of materials. Includes precise high-resolution acoustic interferometer, sending acoustic transducer, receiving acoustic transducer, electromagnet coil and core, power supply, and magnetic-field-measuring device such as Hall probe. This measurement especially important for construction and applications where steel is widely used. Sensor useful especially for nondestructive evaluation of stress in steel members because of portability, rapid testing, and nonpermanent installation.

B86-10165
MATCHING VIBRATION TESTING TO 'REAL-WORLD' CONDITIONS
A. D. OLSEN, JR. (Beech Aircraft Corp.) and A. V. KEBLAITIS (Rockwell International Corp.)
Jun. 1986
MSC-20665 **Vol. 10, No. 2, P. 113**

Vibration spectrum of test machine adjusted to that observed in operation. Test specimen placed in test fixture and attached to shaker. Shaker initially operated at one-quarter full level of input spectrum to prevent overloading. Short vibration test run, and specimen response compared to control spectrum. Imput spectrum then adjusted until response resembles control spectrum.

B86-10166
STRESS MEASUREMENT BY GEOMETRICAL OPTICS
R. S. ROBINSON (Colorado State University) and S. M. ROSSNAGEL (Colorado State University)
Jun. 1986 See Also (N84-18322)
LEW-14169 **Vol. 10, No. 2, P. 114**

Fast, simple technique measures stresses in thin films. Sample disk bowed by stress into approximately spherical shape. Reflected image of disk magnified by amount related to curvature and, therefore, stress. Method requires sample substrate, such as cheap microscope cover slide, two mirrors, laser light beam, and screen.

B86-10167
VARIABLE CONTROL PORT FOR FLUIDIC CONTROL DEVICE
E. R. COLLINS, JR. (Caltech)
Jun. 1986
NPO-16603 **Vol. 10, No. 2, P. 114**

Volume and velocity of control flow independently adjustable. In proposed device rotatable D-shaped control sector throttles down control port or open it completely and set to any intermediate control-port cross-sectional area. Although adjustment affects volume and control-port head loss, volume and velocity controlled independently by also adjusting fluid-supply pressure. Allows adjustment to wider range of control conditions and ability to maximize control efficiency. Fluidic control theory suggests possibility of improvement in control ratio of at least 2:1 over conventional devices.

B86-10168
MEASURING WATER-LAYER THICKNESS
N. FAULCON
Jun. 1986
LAR-13347 **Vol. 10, No. 2, P. 115**

Technique uses optical proximity detector. Detector consists of sensing probe, cartridge containing photocell and light source, and electronics package, housed in metal carrying case. Light transmitted from fiber-optic probe reflected by observed surface and transmitted back through probe to photoreceiver, output of which indicated on digital voltmeter or other suitable instrument. Sensor used to detect presence of bubbles or particles in water stream or to trigger alarm when condensing water becomes present in bottom of supposedly dry tank. Fiber-optic probes of sizes up to 0.265 in. (7.24 mm) with varying sensitivities and configurations available for use with system.

B86-10169
DYNAMIC PRESSURE CALIBRATION STANDARD
P. C. SCHUTTE, K. H. CATE, and S. D. YOUNG (West Virginia Institute of Technology)
Jun. 1986
LAR-13443 **Vol. 10, No. 2, P. 116**

Vibrating columns of fluid used to calibrate transducers. Dynamic pressure calibration standard developed for calibrating flush diaphragm-mounted pressure transducers. Pressures up to 20 kPa (3 psi) accurately generated over frequency range of 50 to 1,800 Hz. System includes two conically shaped aluminum columns one 5 cm (2 in.) high for low pressures and another 11 cm (4.3 in.) high for higher pressures, each filled with viscous fluid. Each column mounted on armature of vibration exciter, which imparts sinusoidally varying acceleration to fluid column. Signal noise low, and waveform highly dependent on quality of drive signal in vibration exciter.

B86-10170
MIXER ANALYSIS OF NACELLE/NOZZLE FLOW
T. J. BARBER (United Technologies Corp.) and R. AMIET
Jun. 1986

LEW-14073 **Vol. 10, No. 2, P. 117**

Flow over idealized nozzle computed. Analysis and computer program calculate flow over idealized mixer nozzle. Nozzle idealized by unwrapping it so planform lies in z=O plane. Linearized compresible flow used to calculate flow and mixer shape given loading on mixer. End goal to achieve maximum amount of mixing downstream of mixer while retaining reasonable shape for mixer. Because analysis assumes linearized flow, calculation of effects of deep lobe penetration cannot be made using this program.

B86-10235

PREDICTING AIRCRAFT SPRAY PATTERNS ON CROPS

M. E. TESKE (Continuum Dynamics, Inc.) and A. J. BILANIN (Continuum Dynamics, Inc.)

May 1986

LAR-13432 **Vol. 10, No. 3, P. 78**

Agricultural Dispersion Prediction (AGDISP) system developed to predict deposition of agricultural material released from rotary- and fixed-wing aircraft. AGDISP computes ensemble average mean motion resulting from turbulent fluid fluctuations. Used to examine ways of making dispersal process more efficient by insuring uniformity, reducing waste, and saving money. Programs in AGDISP system written in FORTRAN IV for interactive execution.

B86-10236

ESTIMATING AVERAGE WIND VELOCITY ALONG A TRAJECTORY

P. BERTSCH (McDonnell Douglas Corp.)

May 1986

MSC-20792 **Vol. 10, No. 3, P. 78**

Average Wind Velocity (VWAVE) program calculates average wind velocity over time for particular vehicle trajectory. Calculation based on wind profile, which is wind magnitude at various altitudes. Average of wind profile over altitude does not correlate well with actual apparent effect of wind. Wind profiles with low average velocities more severe than some wind profiles with high average velocities. VWAVE written in FORTRAN V for interactive execution.

B86-10237

RESEARCH PROGRAM FOR VIBRATION CONTROL IN STRUCTURES

D. L. MINGORI (H.R. Textron, Inc.) and J. S. GIBSON (H. R. Textron, Inc.)

May 1986

NPO-16615 **Vol. 10, No. 3, P. 80**

Purpose of program to apply control theory to large space structures (LSS's) and design practical compensator for suppressing vibration. Program models LSS as distributed system. Control theory applied to produce compensator described by functional gains and transfer functions. Used for comparison of robustness of low- and high-order compensators that control surface vibrations of realistic wrap-rib antenna. Program written in FORTRAN for batch execution.

B86-10238

FLUTTER AND VIBRATION ANIMATION PROGRAM

R. L. TISCHNER (Rockwell International Corp.)

May 1986

MSC-20895 **Vol. 10, No. 3, P. 80**

Flutter and Vibration Animation (FLUVIAN) program produces animated picture of structure as it vibrates at constant amplitude. Permits visual observation of fluttering motion of components as they oscillate in combination of modes. Animated display provides insight into local deflection patterns induced in structure, overlooked if modal deflection patterns were separately examined and combined mentally. FLUVIAN program written in FORTRAN 77 for interactive execution.

B86-10239

COMBINING STRUCTURAL AND SUBSTRUCTURAL MATHEMATICAL MODELS

V. K. CHOA (Rockwell International Corp.)

May 1986

MSC-20897 **Vol. 10, No. 3, P. 80**

Automation reduces input length and potential data-entry errors. Matrix Automated Reduction and Coupling (MARC) program used for combining NASTRAN substructural models with primary structural model MARC also constructs job-control language (JCL) stream for NASTRAN batch job that utilizes previously-written user library of dynamic models. Minimizes lengthy input and reduces potential data-entry errors. MARC procedure used in assembling Space Shuttle orbiter dynamic models since 1983 and reduced NASTRAN modeling input time by as much as 50 percent. MARC program written in FORTRAN IV for interactive execution.

B86-10240

ANALYZING SHUTTLE ORBITER TRAJECTORIES

W. M. LEAR (TRW, Inc)

May 1986

MSC-20786 **Vol. 10, No. 3, P. 80**

LRBET4 program best-estimated-of-trajectory (BET) calculation for post-flight trajectory analysis of Shuttle orbiter. Produces estimated measurements for comparing predicted and actual trajectory of Earth-orbiting spacecraft. Kalman filter and smoothing filter applied to input data to estimate state vector, reduce noise, and produce BET. LRBET4 written in FORTRAN IV for batch execution.

B86-10241

PREDICTING FAILURES OF COMPOSITE, SPHERICAL PRESSURE VESSELS

J. D. DOZIER

May 1986

MFS-27050 **Vol. 10, No. 3. P. 82**

Long-term viscoelastic effects computed to predict bursts. Spherical pressure vessels commonly made of filamentary composites for applications they must light in weight. Program developed for predicting failure of such vessel over long time span. Short-term failure pressures (bursting points) predicted, but long-term structual integrity of laminated vessels studied only now.

B86-10253

VARIABLE-FRICTION SECONDARY FACE SEALS

E. DIRUSSO

May 1986

LEW-14170 **Vol. 10, No. 3, P. 92**

Feedback-controlled friction or damping suppresses vibrations. Variable-friction secondary seal conceived to control vibration and stability of primary seal ring over wide range of conditions. By varying friction force or damping applied to primary seal ring, vibration controlled to provide stable operation. Advantages of 'variable-friction secondary seal:' face-seal stability controlled as function of primary-ring vibration amplitudes, and also friction remotely changed to achieve acceptable vibration amplitudes for large range of seal-operating conditions without compromising secondary-seal performance. Concept also useful in seal testing in which dynamic stability of face seals is under evaluation.

B86-10254

MEASURING THICKNESSES OF COATINGS ON METALS

G. M. COTTY, JR. (Martin Marietta Corp.)

May 1986

MFS-28126 **Vol. 10, No. 3, P. 94**

Digital light sensor and eddy-current sensor measure thickness without contact. Surface of Coating reflects laser beam to optical sensor. Position of reflected spot on sensor used by microcomputer to calculate coating thickness. Eddy-current sensor maintains constant distance between optical sensor and metal substrate. When capabilities of available components fully exploited, instrument measures coatings from 0.001 to 6 in. (0.0025 to 15 cm) thick with accuracy of 1 part in 4,000. Instrument readily incorporated in automatic production and inspection systems. Used to

inspect thermal-insulation layers, paint, and protective coatings. Also used to control application of coatings to preset thicknesses.

B86-10255
EQUATIONS FOR ANNULAR-HEAT-TRANSFER COEFFICIENTS
B. YAO (Rockwell International Corp.)
May 1986
MFS-29074 **Vol. 10, No. 3, P. 96**

Tables of coefficients converted to algebraic expressions. Plot of Equation for Nusselt number agrees closely with points from tabulated data. Equation for Nusselt number and those for coefficients A and B obtained by regression analysis of data. Other plots also show close agreement for radius of 0.1 and 0.2. In equation form, coefficients incorporated into mathematical models more readily than as tabular data. Equations simplify design and analysis of heat exchangers.

B86-10256
CONTINUOUS, MULTIELEMENT, HOT-FILM TRANSITION GAGE
B. HOLMES, J. MCPHERSON, F. HARRIS, J. DIAMOND, N. JOHNSON, and J. CHAPMAN (Kentron International, Inc.)
May 1986
LAR-13319 **Vol. 10, No. 3, P. 97**

Accurate measurement of location where laminar boundary layer undergoes transition to turbulent one serves many purposes in basic aero-dynamic research and developmental testing. Individual gages must be staggered to prevent formation of turbulence at gages downstream. This arrangement precludes accurate measurements of laminar/turbulent transition regions along streamline. Complete understanding of performance, stability, and control of laminar-flow airplane requires knowledge of transition locations on wing surface, empennage surfaces, fuselage, and nacelles. Visual, acoustic, and electronic methods capable of providing this transition information.

B86-10257
TWO-AXIS, SELF-NULLING SKIN-FRICTION BALANCE
P. TCHENG and F. H. SUPPLEE, JR.
May 1986
LAR-13294 **Vol. 10, No. 3. P. 98**

Two-dimensional aerodynamic skin-friction force measured directly. Disk-shaped prototype design has overall dimensions of 1.25 (3.18 centimeters) diameter and 0.5 inch (1.27 centimeters) height. Unique mechanism consisting of two flexural pivoted arms connected in tandem but at right angle with each other designed to impart plane motion needed to sense two-axis flow over sensing element of balance. Sensing element, 0.370 inch (0.940 centimeter) in diameter, attached to end of second arm is servoed by two restoring-force motors orthogonally mounted in plane of airflow. Mechanism allows free plane motion of sensing element with no friction, and balance self-nulled to provide direct plane skin-friction force measurements continuously.

B86-10258
ACOUSTIC-LINER ADMITTANCE IN A DUCT
W. R. WATSON
May 1986 See Also N84-27543/NSP
LAR-13399 **Vol. 10, No. 3, P. 99**

Method calculates admittance from easily obtainable values. New method for calculating acoustic-liner admittance in rectangular duct with grazing flow based on finite-element discretization of acoustic field and reposing of unknown admittance value as linear eigenvalue problem on admittance value. Problem solved by Gaussian elimination. Unlike existing methods, present method extendable to mean flows with two-dimensional boundary layers as well. In presence of shear, results of method compared well with results of Runge-Kutta integration technique.

B86-10259
SENSING HORIZONTAL HEADING IN AIRCRAFT MANEUVERS
K. T. COWDIN
May 1986
FRC-11043 **Vol. 10, No. 3, P. 100**

Modified gyroscopic system indicates geographic heading even in nearly vertical flight. Gyroscopes and gimbals of system assume this configuration when aircraft has pitched into vertical dive. Outer roll gimbal fixed with respect to aircraft frame in this orientation. Now, azimuth signal in modified system indicates what aircraft heading would be if it were to resume level flight from climb or dive.

B86-10260
MEASURING ACOUSTIC-RADIATION STRESSES IN MATERIALS
J. H. CANTRELL, JR. and W. T. YOST
May 1986
LAR-13440 **Vol. 10, No. 3, P. 101**

System measures nonlinearity parameters of materials. Uses static strain generated by acoustic wave propagating in material. Since static strain is effectively 'dc' component of waveform distortion, problems associated with phase-cancellation artifacts disappear. Further, sign of nonlinearity parameter obtained by simple inspection of measured signal polarity. These features make this system very amenable to use in field. System expected to become standard for acoustic-radiation-stress measurements for solids and liquids and for characterization of material properties related to strength and residual or applied stresses. Also expected to become standard for transducer calibration.

B86-10261
SPRING-LOADED JOULE-THOMSON VALVE
J. A. JONES (Caltech) and M. J. BRITCLIFFE (Caltech)
May 1986
NPO-16546 **Vol. 10, No. 3, P. 101**

Improved design reduces clogging and maintains constant pressure drop as flow rate varies. Spring-Loaded Joule-Thomson Valve pressure drop regulated by spring pushing stainless-steel ball against soft brass seat. Pressure drop remains nearly constant, regardless of helium flow rate and of any gas contaminants frozen on valve seat. Because spring-loaded J-T valve maintains constant pressure drop, upstream room-temperature throttle valve adjusts flow rate precisely for any given upstream pressure. In addition, new valve relatively invulnerable to frozen gas contaminants, which clog fixed-orifice J-T valves.

B86-10262
FEEDBACK-CONTROLLED REGULATION OF GAS PRESSURE
J. C. SMITH and P. LEONE
May 1986
GSC-12990 **Vol. 10, No. 3, P. 102**

Internal pressure maintained over wide range of external pressures and exhaust rates. Gaseous pressure in liquid-nitrogen Dewar regulated by movable tapered plug, positioned automatically in response to signals generated by piezoelectric pressure transducer. Designed specifically to maintain airborne infrared detectors at constant temperature in evaporating liquid nitrogen, system modified to regulate pressure in other enclosed systems.

B86-10263
PARALLEL-END-POINT DRAFTING COMPASS
J. CRONANDER (Rockwell International Corp.)
May 1986
MFS-29070 **Vol. 10, No. 3, P. 103**

Parallelogram linkage ensures greater accuracy in drafting and scribing. Two members of arm of compass remain parallel for all angles pair makes with hub axis. They maintain opposing end members in parallelism. Parallelogram-linkage principle used on dividers as well as on compasses.

B86-10264
EVALUATION OF MATHEMATICAL TURBULENCE MODELS
M. NALLASAMY
May 1986 See Also N85-25757/NSP
MFS-27118 **Vol. 10, No. 3, P. 104**
Simplified models for internal flow described, and their predictions compared with experimental results. Report presents account of various models used in computation of turbulent flows. Applications of these models to internal flows evaluated by analysis of predictions of various turbulence models in some important flow configurations.

B86-10265
CORRECTING FOR SUPPORTS IN STRUCTURAL DYNAMIC TESTING
B. K. WADA (Caltech), C. P. KUO (Caltech), and R. J. GLASER (Caltech)
May 1986
NPO-16620 **Vol. 10, No. 3, P. 104**
Testing under variety of support conditions combined with computer analysis to update mathematical models to match test data. Report suggests dynamic characteristics of large space structures predicted, without full-scale testing, by method that combines experiment and analysis. Method, multiple-boundary-condition testing, developed for such large space structures as dish antennas, towers, and solar-cell arrays.

B86-10336
NONLINEAR SUPERSONIC FULL POTENTIAL ANALYSIS
V. SHANKAR (Rockwell International Corp.) and K. SZEMA (Rockwell International Corp.)
Jul. 1986
LAR-13413 **Vol. 10, No. 4, P. 72**
Supersonic Implicit Marching Program (SIMP) applies numerical method, based on conservative form of full potential equation, to problem of three-dimensional supersonic flows with embedded subsonic regions. Conservative formulation of problem provides ability to capture shocks and to assess accurately impact of sweep, thickness, and lift for conditions where linear theory unsatisfactory. Technique uses characteristic signal-propagation theory to control density biasing for treatment of shocks (including embedded shocks) and mixed elliptic/hyperbolic crossflow. SIMP written in FORTRAN 77.

B86-10337
CALCULATING AERODYNAMIC-STABILITY DERIVATIVES
C. E. LAN (University of Kansas Center for Research, Inc.)
Jul. 1986
LAR-13471 **Vol. 10, No. 4, P. 72**
VORSTAB program developed to calculate lateral-directional characteristics of nonplanar wing/body combinations in subsonic flow. Mathematically determines effects of edge-separated vortex flow, including augmented vortex lift, strake-induced downwash, and vortex breakdown. VORSTAB written in FORTRAN IV.

B86-10338
WING-DESIGN PROGRAM FOR SUBSONIC OR SUPERSONIC SPEEDS
H. W. CARLSON (Kentron International, Inc.) and K. B. WALKLEY (Kentron International, Inc.)
Jul. 1986
LAR-13315 **Vol. 10, No. 4, P. 72**
Surface of mildest possible camber generated. WINGDES provides analysis, design capability and is applicable to both subsonic and supersonic flows. Optimization carried out for entire wing or for designated leading- and trailing-edge areas, for design of missionadaptive surfaces. WINGDES written in FORTRAN IV.

B86-10349
ULTRASONIC INSPECTION NEAR SMALL BORES
R. G. PARENT (Rockwell International Corp.)
Jul. 1986
MFS-29024 **Vol. 10, No. 4, P. 80**
Portable ultrasonic probe makes it possible to inspect for hidden cracks near insides of narrow tubes. Using pulse-echo technique, instrument detects cracks as small as 0.015-in. (0.38-mm) deep. Used for nondestructive inspection of other hard-to-reach places where conventional large transducers will not fit or where difficult to apply coupling liquid for contact ultrasonic testing. Inspects bore of tubelike fitting. Instrument makes it unnecessary to disassemble fitting to check for cracks. Precise orientation of transducer with respect to part not necessary for detecting cracks.

B86-10350
BETA BACKSCATTER MEASURES THE HARDNESS OF RUBBER
E. T. MORRISSEY (Rockwell International Corp.) and F. N. ROJE (Rockwell International Corp.)
Jul. 1986
MSC-20991 **Vol. 10, No. 4, P. 82**
Nondestructive testing method determines hardness, on Shore scale, of room-temperature-vulcanizing silicone rubber. Measures backscattered beta particles; backscattered radiation count directly proportional to Shore hardness. Test set calibrated with specimen, Shore hardness known from mechanical durometer test. Specimen of unknown hardness tested, and radiation count recorded. Count compared with known sample to find Shore hardness of unknown.

B86-10351
OMNIVECTOR PROBE MEASURES AIRFLOW
L. KRAUSE and G. FRALICK
Jul. 1986
LEW-13830 **Vol. 10, No. 4, P. 84**
Problems overcome with development of new omnivector anemometer. Includes cylindrical sensing element with eight strain gages. Gages, connected in two Wheatstone bridges, sense two perpendicular components of flow across cylinder. Designed and tested, has fixed-position sensing element capable of simultaneoulsy measuring steady and unsteady velocity head and flow direction of moving fluid over complete 360-degree angle in two-dimensional flow.

B86-10352
IMPROVED TECHNIQUE FOR FINDING VIBRATION PARAMETERS
L. V. ANDREW (Rockwell International Corp.) and C. C. PARK (Rockwell International Corp.)
Jul. 1986
MSC-20901 **Vol. 10, No. 4, P. 86**
Filtering and sample manipulation reduce noise effects. Analysis technique improves extraction of vibrational frequencies and damping rates from measurements of vibrations of complicated structure. Structural vibrations measured by accelerometers. Outputs digitized at frequency high enough to cover all modes of interest. Use of method on set of vibrational measurements from Space Shuttle, raised level of coherence from previous values below 50 percent to values between 90 and 99 percent

B86-10353
SYNCHRONOUSLY DEPLOYABLE TRUSS STRUCTURES
M. D. RHODES and J. M. HEDGEPETH (Astro Research Corp.)
Jul. 1986
LAR-13490 **Vol. 10, No. 4, P. 86**
Structure lightweight, readily deployed, and has reliable joints. New truss concept, designated as 'pac truss,' developed. Features easy deployment without need for complex mechanisms. Structures of this type deployed in free flight by controlled release of stored energy in torsional springs at selected hinges located throughout structure. Double-folding technique used in beam model applicable

to flat planar trusses, allowing structures of large expanse to fold into compact packages and be deployed for space-platform applications.

B86-10354
DETECTING FOREIGN PARTICLES IN WIND TUNNELS
H. L. SHARP (Rockwell International Corp.), P. A. HOGENSON (Rockwell International Corp.), and W. D. EMDE (Rockwell International Corp.)
Jul. 1986
MSC-20850 **Vol. 10, No. 4, P. 87**
Simple scratch test tells whether particles, which distort results, present in test. Detector developed for tests of abrasion resistance of flexible insulation blankets. Now, when detector indicates particles present in test, results interpreted accordingly. Small pits and scratches on metal foil indicate particles struck surface during wind-tunnel test. Detector used in tests of paints and coatings to determine whether abrasive particles present.

B86-10355
MONITORING TEMPERATURES INDIRECTLY IN COOLED COMBUSTORS
W. WAGNER (Rockwell International Corp.)
Jul. 1986
MFS-29061 **Vol. 10, No. 4, P. 88**
Noninvasive monitoring of temperatures on inner surface of combustion liner of cooled combustor increases liner life, thereby increasing combustor reliability and performance. Technique used in furnaces, reactors, jet engines, rocket engines, stationary turbines, combustors, and heat exchangers. Growth of internal overheating streaks monitored using output from array of thermocouples on outside wall of combustor. Computer analysis of output indicates temperature pattern on combustor lining. Use of data enables timely liner maintenance or overhaul.

B86-10356
MEASUREMENT OF DYNAMIC BOLT-STRESS
S. BARKHOUNDARIAN (Rockwell International Corp.)
Jul. 1986
MFS-29058 **Vol. 10, No. 4, P. 89**
Ultrasonic method provides record of changing stresses in dynamically loaded bolts. Makes available history of stress cycles, from which fatigue state and remaining bolt life inferred.

B86-10357
DETERMINING CHAOTIC INSTABILITIES IN MECHANICAL SYSTEMS
M. A. ZAK (Caltech)
Jul. 1986
NPO-16709 **Vol. 10, No. 4, P. 89**
Theoretical developments enable suppression of chaotic structual motions. Theory enables prediction, avoidance, and suppression of chaotic vibrations in structures, especially using dynamic feedback stabilization. In new formulation, motion both repeatable and predictable.

B86-10358
MULTISHAKER MODAL TESTING
R. R. CRAIG, JR. (University of Texas)
Jul. 1986 See Also N85-33544/NSP
MFS-27132 **Vol. 10, No. 4, P. 90**
Abstracts summarize time- and frequency-domain component-mode synthesis methods for damped systems. Abstracts of six papers on vibration analysis and summary of contributions and recommendations contained in them presented in 14-page report on multishaker modal testing.

B86-10359
FATIGUE CRITERION FOR SYSTEM DESIGN
E. V. ZERETSKY
Jul. 1986 See Also N85-27226/NSP
LEW-14344 **Vol. 10, No. 4, P. 90**
Report discusses principles of structural-life prediction. Generalized methodology developed for structural life prediction, design, and reliability, based upon fatigue criterion. Approach incorporates computed life of elemental stress volumes of complex machine elements to predict system life. Results of coupon fatigue testing incorporated into analysis, allowing for life prediction and component or structural renewal rates, with reasonable statistical certainty.

B86-10360
SCUFFING AND LUBRICATION OF GEARS AND BEARINGS
B. HAMROCK and L. HOUPERT (National Research Council)
Jul. 1986 See Also N85-34408/NSP
LEW-14364 **Vol. 10, No. 4, P. 91**
New Reynolds equation developed for elastohydrodynamic-lubrication analysis. Method developed to study macro- and micro-EHL, without restriction on load applied to contact. Macro-EHL refers to lubricant-film thickness developed in inlet zone of EHL conjunction. Powerful tool used to study scuffing. Using new approach, researchers have analyzed stress concentrations near both bump and groove in bearing surface.

B86-10455
ACOUSTIC COUPLER FOR MONITORING BEARING WEAR
W. JOLLY (Southwest Research Institute)
Sep. 1986
MFS-27077 **Vol. 10, No. 5, P. 94**
Concept for acoustic coupler allows sound efficiently conveyed from bearings to external sensor. Noise from bearings in bearing test machine monitored for signs of incipient failure. Straight-through acoustic-coupler assembly inserted through existing ports in housing of bearing-testing machine. Threaded electrical connector at top rotated to adjust force applied to sensing element and contact bearing.

B86-10456
TESTING GIMBAL AXES BEFORE COMPLETE ASSEMBLY
W. BABIS (Hughes Aircraft Co.)
Sep. 1986
MSC-20809 **Vol. 10, No. 5, P. 96**
Early testing increases chances assembly will function well without expensive rework. Developed for antenna gimbals, test eliminates delay and costs ensued when fully assembled antenna fails because of excessive torque and friction in gimbal. Gimbal housing mounted above rotary table. Gimbal axis tested connected to torque transducer on table. With exception of special holder for gimbal housing, all of testing instruments commercially available items.

B86-10457
PERTURBATION METHOD FOR COMPUTATIONAL FLUID-DYNAMICAL EQUATIONS
L. J. CHOW, T. H. PULLIAM, and J. L. STEGER (Stanford University)
Sep. 1986
ARC-11550 **Vol. 10, No. 5, P. 98**
Perturbation technique yields accurate flow solutions using as few as one-fourth number of grid points required by finite-difference methods. Technique originally developed to solve Euler equations of two-dimensional, steady, inviscid transonic flow about airfoils, applicable to arbitrary equation sets and higher dimensions. New perturbations scheme used in design cycle where potential solutions generated routinely; Euler perturbation method used in second-cut analysis. Method also used to couple other equation sets.

B86-10458
CAPACITIVE GAUGE MEASURES FILM THICKNESS
H. L. SEEGMILLER
Sep. 1986
ARC-11449 **Vol. 10, No. 5, P. 103**

Rugged capacitive transducer measures thickness of film of liquid flowing over wind-tunnel model or other object. Transducer mounted flush with surface of model to preserve model outline, thus minimally disturbing wind-tunnel and film flows. Additional uses include thickness control of paint or nonmetallic solid films.

B86-10459
STUDYING TRANSONIC GASES WITH A HYDRAULIC ANALOG
W. WAGNER (Rockwell International Corp.) and F. LEPORE (Rockwell International Corp.)
Sep. 1986
MFS-29100 **Vol. 10, No. 5, P. 104**
Water table for hydraulic-flow research yields valuable information about gas flow at transonic speeds. Used to study fuel and oxidizer flow in high-pressure rocket engines. Method applied to gas flows in such equipment as furnaces, nozzles, and chemical lasers. Especially suitable when wall contours nonuniform, discontinuous, or unusually shaped. Wall shapes changed quickly for study and evaluated on spot. Method used instead of computer simulation when computer models unavailable, inaccurate, or costly to run.

B86-10460
SEALING A LOOSELY FITTING VALVE ASSEMBLY
L. GOFF (Rockwell International Corp.) and G. TELLIER (Rockwell International Corp.)
Sep. 1986
MFS-29051 **Vol. 10, No. 5, P. 105**
Double-ring seal avoids expense of remachining or redesigning valve parts. Mating fittings on valve sealed by pair of rings - one O-ring and backup ring. Backup ring fills relatively large gap between parts. Prevents softer O-ring from being pushed into and through gap.

B86-10504
MEASURING HOLE ELONGATION IN BOLTED JOINTS
G. R. WICHOREK
Nov. 1986
LAR-13453 **Vol. 10, No. 6, P. 62**
Measurement does not affect joint parameters. Verification of analytical and strength-prediction methods for bolted composite joints based generally on data obtained experimentally from double-lap-joint specimens. In mechanically fastened joints, stresses maximal at fastener holes. Ability to measure accurately hole elongations without affecting joint parameters provides better understanding of elastic and plastic behavior of joint material leading to failure mechanisms in mechanically fastened joints required for design of more-efficient, lightweight composite joints.

B86-10505
REDUNDANT PYROTECHNIC/MANUAL RELEASE MECHANISM
G. M. KYRIAS (Martin Marietta Corp.)
Nov. 1986
MFS-28096 **Vol. 10, No. 6, P. 63**
Release mechanism designed operable by remote control even if many of its components fail. In event it becomes inoperable, still actuated manually.

B86-10506
ONE-PIECE FORCE-TRANSDUCER BODY
R. A. MEYER (MTS Systems Corp.)
Nov. 1986
MFS-28140 **Vol. 10, No. 6, P. 64**
Rugged unit designed to operate in severe environment. Force-transducer body designed for measurement of loads on specimens tested in hydrogen gas at temperatures up to 2,000 degree F (1,090 degree C). Body has symmetrical radial-shear-beam configuration and machined in one piece from bar stock.

B86-10507
SHAPE DETERMINATION FOR LARGE STATIC STRUCTURES
G. RODRIGUEZ (Caltech) and R. E. SCHEID, JR. (Caltech)
Nov. 1986
NPO-16781 **Vol. 10, No. 6, P. 71**
Parameter and shape estimates updated from new measurements. Involves statistical structural analysis, statistical electromagneticfield analysis, filtering, measurement modeling, and iterative prediction/correction procedures. Estimating algorithms result from generalizations of Kalman statistical-filter theory.

B86-10508
MEASURING ATMOSPHERIC TURBULENCE WITH LIDAR
W. FROST (FWG Associates, Inc.) and H. KUANG (FWG Associates, Inc.)
Nov. 1986 See also N84-17574/NSP
MFS-27058 **Vol. 10, No. 6, P. 73**
Laser Doppler measurements promise reliably accurate indications of wind speed and turbulence. Report compares two kinds of measurements of wind and turbulence: from instruments aboard aircraft and from ground-based Doppler measurements by laser ranging equipment (lidar).

B86-10529
AERODYNAMIC PREDICTION FOR SUPERSONIC CANARD-TAIL MISSILES
M. F. DILLENIUS (Nielsen Engineering and Research, Inc.)
Nov. 1986
LAR-13527 **Special Edition, P. 39**
LRCDM2 computer program developed to calculate pressure distribution at points on surfaces of complete supersonic missile. Missile comprises up to two finned sections attached to axisymmetric body of circular cross section. Includes effects of vortex shedding due to forebody and forward fins, providing more accurate rolling moments. LRCDM2 written in FORTRAN IV.

B86-10530
ORBITAL-LIFETIME PROGRAM
L. H. ORR
Nov. 1986
LAR-13557 **Special Edition, P. 39**
Orbital Lifetime Program (OL) analyzes long-term motion of Earth-orbiting spacecraft at altitudes of up to 2,500 km. Models perturbations to orbit caused by solar-radiation pressure, atmospheric drag, and gravitational effects of Sun, Moon, and oblate Earth. Used to predict orbital lifetime and decay rate of satellites. OL written in FORTRAN 77.

07 MACHINERY

B86-10062
TRANSFER MECHANISMS FOR HEAVY LOADS
V. CASSISI
Jun. 1986
KSC-11292 **Vol. 10, No. 1, P. 108**
Soft hydraulic system gently maneuvers loads. Upper and lower load-transfer mechanisms attach through mounting holes in vertical beam adjustable or gross positioning. Fine positioning of load accomplished by hydraulic cylinders that move trunnion support and trunnion clamp through short distances. Useful in transferring large loads in railroads, agriculture, shipping, manufacturing, and even precision assembly of large items.

B86-10063
MULTILEG HEAT-PIPE EVAPORATOR

J. P. ALARIO (Grumman Aerospace Corp.) and R. A. HASLETT (Grumman Aerospace Corp.)
Jun. 1986
MSC-20812 **Vol. 10, No. 1, P. 109**

Parallel pipes provide high heat flow from small heat exchanger. Six parallel heat pipes extract heat from overlying heat exchanger, forming evaporator. Vapor channel in pipe contains wick that extends into screen tube in liquid channel. Rods in each channel hold wick and screen tube in place. Evaporator compact rather than extended and more compatible with existing heat-exchanger geometries. Prototype six-pipe evaporator only 0.3 m wide and 0.71 m long. With ammonia as working fluid, transports heat to finned condenser at rate of 1,200 W.

B86-10064
MANUAL 'GUILLOTINE' WIRECUTTER
W. J. WEDLAKE (McDonnell Douglas Corp.)
Jun. 1986
MSC-20926 **Vol. 10, No. 1, P. 110**

Many wires cut in one operation. Guillotine wirecutter powered by handcrank. Crank turns recirculating-ball screw, which pushes blade through bundle of wires in cutting block. Designed to help astronauts break through spacecraft payload cables while working outside spacecraft. Used on Earth for emergency cable separation or cable trimming in production.

B86-10065
MANIFOLD COAL-SLURRY TRANSPORT SYSTEM
S. G. LIDDLE (Caltech), J. M. ESTUS (Caltech), and M. L. LAVIN (Caltech)
Jun. 1986
NPO-16471 **Vol. 10, No. 1, P. 110**

Feeding several slurry pipes into main pipeline reduces congestion in coal mines. System based on manifold concept: feeder pipelines from each working entry joined to main pipeline that carries coal slurry out of panel and onto surface. Manifold concept makes coal-slurry haulage much simpler than existing slurry systems.

B86-10066
HEAT PIPE PRECOOLS AND REHEATS DEHUMIDIFIED AIR
R. C. KONING, W. H. BOGGS, U. R. BARNETT, and K. DINH (Dinh Co.)
Jun. 1986
KSC-11311 **Vol. 10, No. 1, P. 111**

Precooling and reheating by heat pipe reduces operating costs of air-conditioning. Warm air returned from air-conditioned space and cooled air supplied are precooled and reheated, respectively, by each other through a heat pipe. Heat-pipe technology brought to bear on problem of conserving airconditioning energy in hot, humid environments. Any increase in the cost of equipment due to installation of heat-pipe heat exchangers expected to be recovered in energy savings during service period of 2 years or less.

B86-10067
JIG FOR REMOVING RIVETS
T. P. ROEBUCK (Rockwell International Corp.) and A. E. HOUSER (Rockwell International Corp.)
Jun. 1986
MSC-20757 **Vol. 10, No. 1, P. 113**

Drill-press jig used to remove improperly installed rivets. Drill-press jig makes possible to drill accurately-centered, straight holes through rivets. Key component of jig is a drill bushing with spherical recess machined into base. Contour of recess matches contour of rivet head. Operator holds jig handle with one hand and controls drill with other. Handle and screw head hold drill bit in place over center of rivet so rivet drilled out through its axis. With rivet removed, parts separated and refastened or reused elsewhere.

B86-10068
DETECTION OF MACHINING CHIPS BY PRESSURE REVERSAL
L. M. WYETT (Rockwell International Corp.)
Jun. 1986
MFS-29076 **Vol. 10, No. 1, P. 114**

Inaccessible interior spaces inspected acoustically. In acoustic inspection, inlet and outlet ports of component connected to pneumatic hoses of apparatus that rapidly reverses induced pressure differential. If loose particles inside this component, they will generate noise detected by series of contact microphones attached to component. Noise indicates general location of contaminants, and its characteristic helps in identifying particles from their acoustic signatures.

B86-10069
DIGITAL CONTROLLER FOR A REMOTE MANIPULATOR
A. K. BEJCZY (Caltech) and S. LEE (Caltech)
Jun. 1986
NPO-16470 **Vol. 10, No. 1, P. 114**

Sealed forces and displacements fed back to operator to facilitate control. Processing of data distributed among six microcomputers. Each microcomputer dedicated to specific task and communicates with others at same station or at opposite station.

B86-10070
PORTABLE HYDRAULIC POWERPACK
L. A. ANDERSON (University of Central Florida), R. L. HENRY (University of Central Florida), O. H. FEDOR (Lockheed Corp.), and L. J. OWENS (Planning Research Corp.)
Jun. 1986
KSC-11318 **Vol. 10, No. 1, P. 115**

Rechargeable hydraulic powerpack functions as lightweight, compact source of mechanical energy. Self-contained hydraulic powerpack derives energy from solid chemical charge. Combustion of charge initiated by small hammer, and revolving feeder replaces charges expended. Combustion gases cool during expansion in turbine and not too hot for release to atmosphere. Unit has applications driving wheelchairs and operating drills, winches, and other equipment in remote areas. Also replaces electric motors and internal-combustion engines as source of power in explosive atmospheres.

B86-10071
OSCILLATION DAMPER WITH TWO SPRING RATES
D. R. SEVILLA (Caltech)
Jun. 1986
NPO-16223 **Vol. 10, No. 1, P. 116**

Hydraulic damping used in device developed to stabilize vibrating structure in space. Damping mechanism stops oscillation of attached boom. Two bellows provide fluid damping. Springs are engaged when extra spring force required. Otherwise they retract. Mechanism especially useful for arresting oscillatory motion of slender boom with large mass. On Earth, such configurations arise in design of masts and cranes.

B86-10072
DUAL-FLOW-RATE VALVE
R. H. ALLBRITAIN (Rockwell International Corp.)
Jun. 1986
MSC-20849 **Vol. 10, No. 1, P. 116**

Flow-control device precisely adjusted for two rates. Heart of two-position valve is sliding poppet. At far-right position, poppet allows low flow. At far-left position, allows high flow. Valve supplies high-pressure gas at either of two preselected flow rates. Valve adjustable between 0.12 and 1.2 lb/s (0.054 and 0.54 kg/s) of hydrogen at 3,300 lb/in.2 (23 MN/m2) and 80 degrees F (27 degrees C). Two flow rates preadjusted between these limits in increments of 0.01 lb/s (0.0045 kg/s).

B86-10073
ROTARY JOINTS WITH ELECTRICAL CONNECTIONS
F. W. OSBORN (Caltech)
Jun. 1986
NPO-16250 **Vol. 10, No. 1, P. 117**
Power and data transmitted on many channels. Two different rotary joints equipped with electrical connections between rotating and stationary parts. One joint transmits axial thrust and serves as interface between spinning and nonspinning parts of Galileo spacecraft. Other is scanning (limited-rotation) joint that aims scientific instruments from nonspinning part. Selected features of both useful to designers of robots, advanced production equipment, and remotely controlled instruments.

B86-10074
EMERGENCY BRAKE FOR TRACKED VEHICLES
G. L. GREEN (Pan American World Airways, Inc.) and S. L. HOOPER (Pan American World Airways, Inc.)
Jun. 1986
MSC-20513 **Vol. 10, No. 1, P. 118**
Caliper brake automatically stops tracked vehicle as vehicle nears end of travel. Bar on vehicle, traveling to right, dislodges block between brake pads. Pads then press against bar, slowing vehicle by friction. Emergency-braking system suitable for elevators, amusement rides and machine tools.

B86-10075
'CURTAINLESS' WINDOW
D. L. CONNELLY
Jun. 1986
MSC-18417 **Vol. 10, No. 1, P. 119**
Liquid flow switches window from transparency to opacity. Pump transfers liquid from reservoir to window voids. Gas-venting pipe transfers gas to reservoir when window is filling and to window when window is emptying.

B86-10076
SECURE DISPOSAL CONTAINER FOR CLASSIFIED PAPERS
E. R. COLLINS, JR. (Caltech)
Jun. 1986
NPO-16517 **Vol. 10, No. 1, P. 120**
Meshing steel combs retain papers when container overturned. Comblike shutters installed on hinges near deflectors. If container is upright, combs hang vertically and out of way. When container is tipped or overturned, gravity forces one or both of combs to fall over opening. When this happens, teeth intermesh and container opening covered, preventing its contents from falling out.

B86-10077
ROTATING DRIVE FOR ELECTRICAL-ARC MACHINING
C. D. FRANSEN (Rockwell International Corp.)
Jun. 1986
MFS-19946 **Vol. 10, No. 1, P. 120**
Rotating drive improves quality of holes made by electrical-arc machining. Mechanism (Uni-tek, rotary head, or equivalent) attached to electrical-arc system. Drive rotates electrode as though it were mechanical drill, while an arc disintegrates metal in workpiece, thereby creating hole. Rotating electrode method often used in electric-discharge machining. NASA innovation is application of technique to electrical-arc machining.

B86-10078
VARIABLE-DISPLACEMENT HYDRAULIC DRIVE UNIT
D. J. LANG (Sundstrand Energy Systems), D. J. LINTON (Sundstrand Energy Systems), and A. MARKUNAS (Sundstrand Energy Systems)
Jun. 1986
MSC-20728 **Vol. 10, No. 1, P. 121**
Hydraulic power controlled through multiple feedback loops. In hydraulic drive unit, power closely matched to demand, thereby saving energy. Hydraulic flow to and from motor adjusted by motor-control valve connected to wobbler. Wobbler angle determines motor-control-valve position, which in turn determines motor displacement. Concept applicable to machine tools, aircraft controls, and marine controls.

B86-10079
SURVEY OF HAND CONTROLLERS FOR TELEOPERATION
T. L. BROOKS (Caltech) and A. K. BEJCZY (Caltech)
Jun. 1986
NPO-16610 **Vol. 10, No. 1, P. 121**
Report surveys handgrip designs, control-input devices, and control strategies. 83-page report presents comprehensive survey of hand-controller technology in three major categories: handgrip design, control-input devices, and control strategies. Approach taken in review to identify and describe existing handgrips, control-input devices and control strategies, and new components and techniques that become elements of advanced hand controllers to satisfy increasing performance requirements for teleoperation in future.

B86-10150
AIRCRAFT TAKEOFF AND LANDING ANALYSIS
J. R. MCGEHEE
Jun. 1986
LAR-13390 **Vol. 10, No. 2, P. 102**
Behavior of flexible or rigid aircraft simulated under variety of conditions. Active Gear, Flexible Aircraft Takeoff and Landing Analysis program, AGFATL, completely simulates aircraft takeoff and landing dynamics. AGFATL represents airplane either as rigid body with six degrees of freedom or as flexible body with multiple degrees of freedom. AGFATL written in FORTRAN IV for batch execution.

B86-10151
NONCONICAL RELAXATION FOR SUPERSONIC POTENTIAL FLOW
M. J. SICLARI (Grumman Aerospace Corp.)
Jun. 1986
LAR-13346 **Vol. 10, No. 2, P. 104**
Nonlinear, three-dimensional effects computed from full potential-flow equation. Nonconical Relaxation program, NCOREL, employs new computational technique for prediction of inviscid, nonlinear supersonic aerodynamics. Unlike conventional linear potential equations, NCOREL utilizes full potential flow equation to predict formation of supercritical crossflow regions, embedded shocks, and bow shocks. NCOREL written in FORTRAN IV for batch execution.

B86-10152
ANALYSIS OF LUBRICANT JET FLOW
D. P. TOWNSEND and L. S. AKIN (California State University at Long Beach)
Jun. 1986 See Also (N84-29224)
LEW-14242 **Vol. 10, No. 2, P. 104**
Computer program, IMPOUT 2, developed using newly-established 'limit formulas' to prevent lubricant non-impingement on pinion. Program used to analyze impingement depth on gear teeth for oil jet located at out-of-mesh position with arbitrary offset and inclination angles and with arbitrary addendum and center-distance modification. IMPOUT 2 program written in ANSI FORTRAN IV for use on CDC 750.

B86-10153
AERODYNAMIC CHARACTERISTICS OF NACA 16-SERIES AIRFOILS
C. M. MAKSYMIUK and S. A. WATSON VIKEN (University of Kansas Center for Research, Inc.)
Jun. 1986
LAR-13355 **Vol. 10, No. 2, P. 104**
Standard data from literature incorporated into program. Comprehensive and easily-accessible data bank of aerodynamic characteristics of NACA 16-series airfoils incorporated

into AIRFOIL program for use in propeller performance research. Low-drag, high-critical-speed airfoils effective in advanced turbo-prop designs currently under investigation. AIRFOIL written in FORTRAN IV for batch execution.

B86-10154
WALL INTERFERENCE IN TWO-DIMENSIONAL WIND TUNNELS
W. B. KEMP, JR. (Virginia Associated Research Campus)
Jun. 1986
LAR-13394 **Vol. 10, No. 2, P. 104**

Viscosity and tunnel-wall constraints introduced via boundary conditions. TWINTN4 computer program developed to implement method of posttest assessment of wall interference in two-dimensional wind tunnels. Offers two methods for combining sidewall boundary-layer effects with upper and lower wall interference. In sequential procedure, Sewall method used to define flow free of sidewall effects, then assessed for upper and lower wall effects. In unified procedure, wind-tunnel flow equations altered to incorporate effects from all four walls at once. Program written in FORTRAN IV for batch execution.

B86-10155
PREDICTING VORTEX SHEDDING IN SUPERSONIC FLOW
M. R. MENDENHALL (Nielsen Engineering and Research, Inc.) and S. C. PERKINS, JR. (Nielsen Engineering and Research, Inc.)
Jun. 1986
LAR-13375 **Vol. 10, No. 2, P. 106**

Nonlinear aerodyanmic characteristics of missile bodies computed. Program NOZVTX calculates nonlinear aerodynamic characteristics and flow fields of missile bodies at various angles-of-attack and roll in supersonic flow. Output includes geometry, centroids, and surface pressure of source panels and positions, strengths, and velocity components of shed vortexes. NOZVTX written in FORTRAN IV for batch execution.

B86-10156
PREDICTING WALL MODIFICATIONS FOR ADAPTIVE WIND TUNNELS
J. L. EVERHART
Jun. 1986
LAR-13301 **Vol. 10, No. 2, P. 106**

Wall shape changed iteratively until it matches streamlines. FLEXWAL predicts upper and lower wall modifications necessary to remove wall-interference effects in adaptive-wall wind tunnels. FLEXWAL aids in elimination of wall-interference effects on objects tested in typical two-dimensional wind tunnel with rigid sidewalls and flexible, solid floor and ceiling boundaries. Iterative procedure valid for subsonic and transonic test conditions, and convergence of method verified both analytically and experimentally. FLEXWAL written in FORTRAN IV for batch execution.

B86-10157
TWO PROGRAMS FOR SUPERSONIC WING DESIGN AND ANALYSIS
W. H. MASON (Grumman Aerospace Corp.), B. S. ROSEN (Grumman Aerospace Corp.), and B. GROSSMAN (Grumman Aerospace Corp.)
Jun. 1986
LAR-13239 **Vol. 10, No. 2, P. 106**

COREL and W12SC3 useful in aerodynamic design and analysis of wings for supersonic speeds. COREL (Conical Relaxation) program solves nonlinear full potential equation for spanwise section of wing in crossflow plane, and option exists to correct result for nonconical geometry. W12SC3 applies linear-theory panel methods to compute solutions for wing/body configuration. Programs restricted to supersonic flows and useful for many design, analysis, and optimization applications. COREL and W12SC3 written in FORTRAN IV for batch execution.

B86-10158
SECOND-ORDER-POTENTIAL ANALYSIS AND OPTIMIZATION
W. C. CLEVER (Rockwell International Corp.)
Jun. 1986
LAR-13314 **Vol. 10, No. 2, P. 107**

Optimum camber designed for supersonic and hypersonic vehicles. Second Order Potential Analysis and Optimization (SOPA) package set of computer programs used to predict aerodynamic characteristics and design optimum camber for both supersonic and hypersonic vehicles. Analysis program incorporates second-order-potential, small-disturbance theory for analysis of wing/body configurations. Optimization program uses analysis results to generate optimum camber, twist, or flap deflections by minimizing zero suction drag. SOPA written in FORTRAN V for batch execution.

B86-10171
DEVICE FOR EXTRACTING FLAVORS AND FRAGRANCES
F. R. CHANG
Jun. 1986
MSC-20761 **Vol. 10, No. 2, P. 118**

Machine for making coffee and tea in weightless environment may prove even more valuable on Earth as general extraction apparatus. Zero-gravity beverage maker uses piston instead of gravity to move hot water and beverage from one chamber to other and dispense beverage. Machine functions like conventional coffeemaker during part of operating cycle and includes additional features that enable operation not only in zero gravity but also extraction under pressure in presence or absence of gravity.

B86-10172
MULTIPURPOSE SCRIBING AND DRAWING TOOL
J. M. ELLIS
Jun. 1986
MSC-20913 **Vol. 10, No. 2, P. 119**

Two-part tool reconfigured for variety of jobs. Tool performs several functions useful in layout. Lines, curves, and angles made visible as either bright scribe marks or as dark pencil (or ink) marks. Multipurpose tool speeds up laying out of patterns on sheet metal, wood, plastic, or paper. Tool is carried in pocket, then quickly assembled for service as height gauge, pair of dividers, protractor, surface gauge, or square.

B86-10173
VARIABLE-FORCE EDDY-CURRENT DAMPER
R. E. CUNNINGHAM
Jun. 1986
LEW-13717 **Vol. 10, No. 2, P. 120**

Variable damping achieved without problems of containing viscous fluids. Eddy-current damping obtained by moving copper or aluminum conductors through magnetic fields. Position of magnet carrier determines amount of field engagement and, therefore, amount of damping. Three advantages of concept: Magnitudes of stiffness and damping continously varied from maximum to zero without bringing rotor or shaft to stop; used in rotating machines not having viscous fluids available such as lubricating oils; produces sizable damping forces in machines that pump liquid hydrogen at - 246 degrees C and liquid oxygen at - 183 degrees C and are compact in size.

B86-10174
IMPROVED SEAL FOR NTF FAN SHAFT
E. A. CROSSLEY, JR., J. A. JONES, R. MESSIER, G. W. JOHNSON, and K. FELTON (North Carolina State University)
Jun. 1986
LAR-13218 **Vol. 10, No. 2, P. 127**

New seal more effective and lasts longer. Seal consists of five felt rings interspersed with four polytetrafluoroethylene rings having inner diameter slightly larger than shaft.

Spaces between polytetrafluoroethylene rings and shaft produce labyrinth effect, which increases degree of sealing.

B86-10175
GENTLE END EFFECTOR FOR ROBOTS
W. S. WEBB (Honeywell, Inc.)
Jun. 1986
MFS-28119 **Vol. 10, No. 2, P. 128**

Gripper handles electronic components without damaging them. Driven by dc motor, movable jaw gently clamps electronic component. Grips such electronic components as resistors, capacitors, and transistors without damaging them and holds them during soldering or other processing.

B86-10176
AUTOMATED CONDUIT UNLOADING
E. V. LEWIS (Caltech)
Jun. 1986
NPO-16187 **Vol. 10, No. 2, P. 129**

Large, cumbersome pipes removed from trailer by one operator. Swivel-truck trailer carries conduit and unloads it. Vertical bins interconnected by web belts that elevate conduit sections for delivery by gravity to unloading point. Trailer loaded with slurry-pipe sections 6 inches (15.2 centimeters) in diameter, but bin width readily changed to hold other sizes. Simple adjustments in bin-partition and web-belt positions needed to adapt system to different conduit cross sections.

B86-10177
OIL-FREE COMPRESSOR
D. G. FITZJERRELL (Management and Technical Services Co.), T. L. BELVER (Management and Technical Services Co.), and H. E. MOORE (Management and Technical Services Co.)
Jun. 1986
MSC-20860 **Vol. 10, No. 2, P. 130**

Compressor pistons moved by eccentric shaft need no lubricants. Compressor has shaft, middle section is eccentric in relation to end sections. Driven by brushless dc motor, shaft turns inner races of set of four cam bearings. Outer cam-bearing races in turn actuate four pistons spaced equally apart, around and along shaft. Each outer bearing race held in position by pressure exerted on it by piston. Because no frictional motion between piston and outer bearing race, lubricant between them unnecessary. Cam bearings themselves contain potted internal lubricant. Originally proposed for use in space, new compressor for refrigerators or freezers does not depend on pool of oil for lubricating its pistons. Operated in any orientation.

B86-10178
PRESSURE-LETDOWN MACHINE FOR A COAL REACTOR
G. S. PERKINS (Caltech) and W. B. MABE (Caltech)
Jun. 1986
NPO-15083 **Vol. 10, No. 2, P. 131**

Pumps operating in reverse generate power. Conceptual pressure-letdown machine for coal-liquefaction system extracts energy from expansion of product fluid. Mud pumps, originally intended for use in oil drilling, operated in reverse so their motors act as generators. Several pumps operated in alternating phase to obtain multiple stages of letdown from inlet pressure to outlet pressure. About 75 percent of work generates inlet pressure recoverable as electrical energy.

B86-10179
HELICOPTER TAIL-BOOM STRAKES
H. L. KELLEY (U.S. Army Aerostructures Directorate), A. E. PHELPS III (U.S. Army Aerostructures Directorate), and J. C. WILSON (U.S. Army Aerostructures Directorate)
Jun. 1986
LAR-13233 **Vol. 10, No. 2, P. 132**

Yaw control and overall efficiency increased at hover and low speeds. Wind-tunnel investigation showed strake located on left side of tail boom has potential to reduce high adverse side loads on tail boom in hover and in sideward flight. Test demonstrated addition of single long strake to left side of tail boom most effective configuration for reducing left pedal requirements in right sideward flight.

B86-10180
AIR-BEARING TABLE FOR MACHINE SHOPS
D. AMBRISCO (Rockwell International Corp.)
Jun. 1986
MFS-29035 **Vol. 10, No. 2, P. 134**

Frequent workpiece repositioning made easier. Air-bearing table facilitates movement of heavy workpiece during machining or between repeated operations at different positions. Table assembly consists of work-pieces-supporting fixture riding on air bearing. Table especially useful for inertia welding, in which ease of mobility is important.

B86-10181
ELECTROMECHANICAL TURBOPROP-PITCH-CONTROL MECHANISM
B. M. STEINETZ, S. LOWENTHAL, D. F. SARGISSON (General Electric Co.), and G. WHITE (Transmission Research, Inc.)
Jun. 1986 See Also (N84-25605)
LEW-14234 **Vol. 10, No. 2, P. 134**

Propeller-control system autonomous and tolerant of failure. Mounting electrical-power module and conditioning/control systems inboard rotating propeller hub eliminates failure-prone slipring devices and creates autonomous, failure-tolerant propeller-control system. Modular component design facilitates on-the-wing maintenance. System highly adaptive to various sizes and gearbox configurations. Features and capabilities described unmatched by any comparable PCM now in existence. These capabilities needed by large, fuel-efficient, commuter turboprop aircraft now being developed by aircraft industry.

B86-10182
OPERATING A REMOTE MANIPULATOR IN SIMULATED LOW GRAVITY
A. K. BEJCZY (Caltech) and K. M. CORKER (Caltech)
Jun. 1986
NPO-16477 **Vol. 10, No. 2, P. 137**

Efforts to control remote manipulators in simulated microgravity described in report. Experiments conducted to determine effects of weightlessness on performance of operator controlling remote manipulator, or slave arm, by master arm at control station. Report concludes microgravity disturbs neuromotor control of human arm. Also suggests disturbance compensated for by adjustments in controller.

B86-10242
HYTESS-HYPOTHETICAL TURBOFAN-ENGINE SIMPLIFIED SIMULATION
W. MERRILL, C. BEATTIE (Pratt & Whitney Aircraft Co.), R. LAPRAD (Pratt & Whitney Aircraft Co.), S. ROCK (Systems Control Technology, Inc.), and M. AKHTER (Systems Control Technology, Inc.)
May 1986
LEW-14020 **Vol. 10, No. 3, P. 82**

Simulated characteristics mimic those of advanced turbofan engines. Computer program developed to offer those interested in engine dynamics and controls research efficient, realistic, and easily-used engine simulation. Simulation developed from linearized operating-point models but still retains essential nonlinear engine effects. Representative of hypothetical, low-bypass-ratio, twin-spool, axialflow turbofan engine. Program written in FORTRAN IV.

B86-10243
AIRCRAFT ROLLOUT ITERATIVE ENERGY SIMULATION
L. KINOSHITA (Rockwell International Corp.)
May 1986
MSC-20816 **Vol. 10, No. 3, P. 82**

Aircraft Rollout Iterative Energy Simulation (ARIES) program analyzes aircraft-brake performance during rollout. Simulates three-degree-of-freedom rollout after nose-gear touchdown. Amount of brake energy dissipated during aircraft landing determines life expectancy of brake pads. ARIES incorporates brake pressure, actual flight data, crosswinds, and runway characteristics to calculate following: brake energy during rollout for up to four independent brake systems; time profiles of rollout distance, velocity, deceleration, and lateral runway position; and all aerodynamic moments on aircraft. ARIES written in FORTRAN 77 for batch execution.

B86-10244
ESTIMATING TRANSIENT PRESSURE SURGES IN CRYOGENIC SYSTEMS
P. PFISTER (University of Central Florida), F. GUNNERSON (University of Central Florida), and E. HOSLER (University of Central Florida)
May 1986
KSC-11312 **Vol. 10, No. 3, P. 83**

Potentially-damaging pressure waves anticipated and, therefore, avoided. Mathematical model developed for prediction of pressure behavior in single- and two-phase cryogenic systems. Transient liquid-flow analysis modified to incorporate behavior of vapor bubbles and used to predict maximum pressure in cryogenic transfer systems consisting of complex pipe and valve arrangements under both steady-state and transient conditions. Simulation compared favorably with data obtained during transfer of liquid oxygen from ground storage tanks to Space Shuttle orbiter external tanks. Program written in FORTRAN 77 for batch execution.

B86-10245
COMPUTING COOLING FLOWS IN TURBINES
J. GAUNTNER
May 1986
LEW-13999 **Vol. 10, No. 3, P. 83**

Algorithm developed for calculating both quantity of compressor bleed flow required to cool turbine and resulting decrease in efficiency due to cooling air injected into gas stream. Program intended for use with axial-flow, air-breathing, jet-propulsion engines with variety of airfoil-cooling configurations. Algorithm results compared extremely well with figures given by major engine manufacturers for given bulk-metal temperatures and cooling configurations. Program written in FORTRAN IV for batch execution.

B86-10246
FOUR-CYLINDER STIRLING-ENGINE COMPUTER PROGRAM
C. J. DANIELE and C. F. LORENZO
May 1986
LEW-14155 **Vol. 10, No. 3, P. 83**

Computer program developed for simulating steady-state and transient performance of four-cylinder Stirling engine. In model, four cylinders interconnected by four working spaces. Each working space contains seven volumes: one for expansion space, heater, cooler, and compression space and three for regenerator. Thermal time constant for regenerator mass associated with each regenator gas volume. Former code generates results very quickly, since it has only 14 state variables with no energy equation. Current code then used to study various aspects of Stirling engine in much more detail. Program written in FORTRAN IV for use on IBM 370 computer.

B86-10266
MODIFIED COBALT DRILLS WITH OIL PASSAGES
E. HUTCHISON (Rockwell International Corp.) and D. RICHARDSON (Rockwell International Corp.)
May 1986
MFS-29137 **Vol. 10, No. 3, P. 106**

Oil forced through drill shanks to lubricate cutting edges. Drill bits cooled and lubricated by oil forced through drill shanks and out holes adjacent to bits. This cooling technique increases drillbit life and allows increased drill feed rates.

B86-10267
SPIRAL-GROOVE RING SEAL FOR COUNTER-ROTATING SHAFTS
E. DIRUSSO
May 1986 See Also N83-25712/NSP
LEW-14248 **Vol. 10, No. 3, P. 107**

Self-lubricating seal tolerates high sliding speeds. Application of self-acting geometry in form of spiral grooves to faces of ring-seal housing maintains thin air film of relatively high stiffness between seal ring and housing, enabling seal to operate in noncontacting mode over entire engine-operating range. Potential application in sealing fan-bleed air between two counter-rotating shafts in advanced gas-turbine engines.

B86-10268
DESIGNING POWER-TRANSMISSION SHAFTING
S. H. LOEWENTHAL
May 1986 See Also N84-27041/NSP
LEW-14240 **Vol. 10, No. 3, P. 109**

Consideration of stress and fatigue life gives better designs. Shafting-design procedure developed based on fatigue-strength considerations. Method accounts for effects of static and constant-amplitude fluctuating loads. Also provides shaft-diameter estimates for variable-amplitude-loading duty cycles. Method lends itself to computer-aided design of both aerospace and industrial shafting.

B86-10269
LOCATING CRACKS AMID PITTING AND CORROSION
P. P. FAHEY (Fairchild Republic Co.)
May 1986
MSC-20311 **Vol. 10, No. 3, P. 110**

Use of two fluorescent penetrants reveals cracks. New inspection technique for locating cracks in metal parts. Dual-dye technique used to inspect metal parts having surface-roughness-height ratings from 125 to 450 microinch (3.2 to 11.4 micrometer). Parts have included shot-peened machined aluminum extrusions; partially machined aluminum castings; aluminum, steel, and titanium tabular weldments; aircraft landing-gear components; chemically milled aluminum sheet and extrusions; and rough-machined aluminum and steel forgings. Also used on nonporous ceraminc parts.

B86-10270
ELIMINATING THERMAL CRACKS IN FLANGE/DUCT JOINTS
J. E. ADAMS (Rockwell International Corp.)
May 1986
MSC-20833 **Vol. 10, No. 3, P. 111**

Improved technique for attaching aluminum flange to aramid/epoxy duct prevents subsequent development of cracks in joint during thermal stress. Flange butted against cylindrical mold on which duct is fabricated. Flange has tapered neck so will nest in duct opening. Epoxy-impregnated aramid tape wrapped around mold so tape overlaps flange. While tape is wrapped, pressure applied to it and inside of flange as heated uniformly to maximum expected operating temperature. Heat and pressure maintained until aramid/epoxy laminations have cured.

B86-10271
ADAPTING INSPECTION DATA FOR COMPUTER NUMERICAL CONTROL
E. E. HUTCHISON (Rockwell International Corp.)
May 1986
MFS-29117 **Vol. 10, No. 3, P. 112**

Machining time for repetitive tasks reduced. Program converts measurements of stub post locations by coordinate-measuring machine into form used by numerical-control computer. Work time thus reduced by 10 to 15 minutes for each post. Since there are 600 such posts on each

injector, time saved per injector is 100 to 150 hours. With modifications this approach applicable to machining of many precise holes on large machine frames and similar objects.

B86-10272
NON-BACK-DRIVABLE, FREEWHEELING COUPLING
W. LLEWELLIN (Martin Marietta Corp.)
May 1986
MSC-20475 **Vol. 10, No. 3, P. 112**

Cables reeled in and out with less risk of tangling. Opposing teeth engage with clockwise rotation and disengage with clockwise rotation of crank. Driving plate moves axially with respect to driven plate on ball points to engage and disengage. Clutch developed for reeling and unreeling tether line used to link astronaut to space vehicle. Allows line pulled out freely and helps to prevent line from tangling in reel housing when crank is turned backward. New clutch concept also applicable to fishing reels, toys, and safety-line mechanisms.

B86-10273
EFFECTS OF GEAR-CUTTER GEOMETRY ON PERFORMANCE
D. FOLENTA (Transmission Technology Co., Inc.)
May 1986
LEW-14243 **Vol. 10, No. 3, P. 114**

Bending stress reduced by improving tooth-fillet design. Using optimized gear-cutter design technology, gear designer reduces bending stresses by up to 20 percent. Reduction in bending stress is result of improved geometry of tooth fillet, which, in turn, results in significant improvement in horsepower-per-pound ratio. Gears run quieter and smoother than spur-gear system.

B86-10274
HIGH-SPEED PROPELLER FOR AIRCRAFT
D. A. SAGERSER and B. S. GATZEN (Div. of United Technologies Inc.)
May 1986 See Also NASA TM-83736, N84-29878/NSP
LEW-14241 **Vol. 10, No. 3, P. 115**

Engine efficiency increased. Propeller blades required to be quite thin and highly swept to minimize compressibility losses and propeller noise during high-speed cruise. Use of 8 or 10 blades with highpropeller-power loading allows overall propeller diameter to be kept relatively small. Area-ruled spinner and integrated nacelle shape reduce compressibility losses in propeller hub region. Finally, large modern turboshaft engine and gearbox provide power to advanced propeller. Fuel savings of 30 to 50 percent over present systems anticipated. Propfan system adaptable to number of applications, such as highspeed (subsonic) business and general-aviation aircraft, and military aircraft including V/STOL.

B86-10275
PUMP FOR SATURATED LIQUIDS
D. G. ELLIOTT (Caltech)
May 1986
NPO-16152 **Vol. 10, No. 3, P. 117**

Boiling liquids pumped by device based on proven components. Expanding saturated liquid in nozzle and diverting its phases along separate paths in liquid/vapor separator raises pressure of liquid. Liquid cooled in process. Pump makes it unnecessary to pressurize cryogenic liquids in order to pump them. Problems of introducing noncondensable pressurizing gas avoided.

B86-10276
RECEPTACLE FOR OPTICAL-FIBER SCRAPS
R. NEVIN (Lockheed Space Operations Co.)
May 1986
KSC-11326 **Vol. 10, No. 3, P. 117**

Small pieces of glass trapped by moving air. Device traps fibers in section of black air-conditioner filter material. Filter section rests on metal screen above axial fan, which pulls air down through filter. Fan is small, quiet unit of type ordinarily used to cool electronic equipment.

B86-98276
THERMALLY-INTEGRATED FUEL-CELL/ELECTROLYZER SYSTEMS
J. GAROW (United Technologies Corp.), K. MICHAELS (United Technologies Corp.), and R. MARTIN (United Technologies Corp.)
May 1986
LEW-14235 **Vol. 10, No. 3, P. 118**

New and more efficient method of thermally integrating fuel cell and electrolyzer designed. Design addresses thermal integration of fuel cell and water electrolyzer in regenerative fuel-cell system. System configuration provides thermal integration with single coolant loop. Configuration does not have thermal limitations associated with trying to transfer heat between two coolant loops. Design less complex and more reliable than prior designs. Adaptable to standalone power systems in conjunction with solar panels for remote-area applications.

B86-10278
HYDRAULIC ACTUATOR FOR GANGED CONTROL RODS
D. C. THOMPSON (Westinghouse Electric Corp.) and R. M. ROBEY (Westinghouse Electric Corp.)
May 1986
NPO-16503 **Vol. 10, No. 3, P. 119**

Hydraulic actuator moves several nuclear-reactor control rods in unison. Electromagnetic pump pushes liquid lithium against ends of control rods, forcing them out of or into nuclear reactor. Color arrows show lithium flow for reactor startup and operation. Flow reversed for shutdown. Conceived for use aboard spacecraft, actuator principle applied to terrestrial hydraulic machinery involving motion of ganged rods.

B86-10279
IGNITION SYSTEM FOR GASEOUS PROPELLANTS
R. A. PIERON (Rockwell International Corp.)
May 1986
MFS-29125 **Vol. 10, No. 3, P. 120**

Installation of spark plug in fuel-injection manifold of coaxial injector promotes more efficient cooling of combustor walls in rocket and turbine engines. After ignition occurs in fuel injector, combustion maintained in cooled main combustor leaving spark-plug tip in cool, clean environment. Eighteen tests have proven this injector design; no ignition failures occurred in 8,000 seconds of operation with gaseous oxygen and hydrogen. System also used with other propellants gaseous in ignition phase.

B86-10280
RIGID/COMPLIANT HELICOPTER ROTOR
P. JEFFERY (United Technologies Corp.)
May 1986 See Also N82/32341/NSP
ARC-11518 **Vol. 10, No. 3, P. 121**

Rotor structure ensures both effective aerodynamic support and efficient pitch changes. Four blades are shells with rigid inner I-beam arms integrated with rotor hub. Through each blade, control arm extends from pitch-control actuator in hub. Elastomeric bearings allow control arms to twist blades and thus change blade pitch without turning I-beam arms. Centrifugal force carried by tension strap. Leading and lagging movements of blades restrained by dampers. Ducts inside leading and trailing edges of blade shells carry air for partial cyclic aerodynamic control of lift and pitch. Structure permits more efficient pitch control with less weight. At same time, improves reliability through redundancy in supports and control mechanisms.

B86-10281
HELICOPTER PITCH-CONTROL MECHANISM REDUCES VIBRATION
H. LEMONT (United Technologies Corp.)
May 1986 See Also N82-32341/NSP

ARC-11513 **Vol. 10, No. 3, P. 122**

Large forces accommodated without increasing weight of helicopter structure. New mechanism yields stiffer control and improves accuracy of pitch changes under load. As result, heavy casting not for gearbox, nor extra reinforcing members needed for fuselage bulkheads, stringers, skin, and other parts. In new mechanism, reaction forces developed in rotor hub. Long load paths to gearbox and fuselage elminated. Reaction member rigidly attached to hub and rotates with it. At lower end of reaction member, bearing forms bridge to fuselage through stationary beam and antirotation link. Beam connected to reaction plate through rods.

B86-10282
CONTROLLED-TEMPERATURE HOT-AIR GUN
M. C. MUNOZ (Rockwell International Corp.)
May 1986
MSC-20693 **Vol. 10, No. 3, P. 123**

Materials that find applications in wind tunnels first tested in laboratory. Hot-Air Gun differs from commercial units in that flow rate and temperature monitored and controlled. With typical compressed-airsupply pressure of 25 to 38 psi (170 to 260 kPa), flow rate and maximum temperature are 34 stdft3/min (0.96 stdm3/min) and 1,090 degrees F (590 degrees C), respectively. Resembling elaborate but carefully regulated hot-air gun, setup used to apply blasts of air temperatures above 1,500 degrees F (815 degrees C) to test specimens.

B86-10283
ADJUSTABLE TOOLING FOR BENDING BRAKE
J. M. ELLIS
May 1986
MSC-20730 **Vol. 10, No. 3, P. 124**

Deep metal boxes and other parts easily fabricated. Adjustable tooling jig for bending brake accommodates spacing blocks and either standard male press-brake die or bar die. Holds spacer blocks, press-brake die, bar window die, or combination of three. Typical bending operations include bending of cut metal sheet into box and bending of metal strip into bracket with multiple inward 90 degree bends. By increasing free space available for bending sheet-metal parts jig makes it easier to fabricate such items as deep metal boxes or brackets with right-angle bends.

B86-10284
ORBITAL-TRANSFER VEHICLE WITH AERODYNAMIC BRAKING
C. D. SCOTT, K. NAGY, B. B. ROBERTS, R. C. RIED, K. KROLL, and J. GAMBLE
May 1986
MSC-20921 **Vol. 10, No. 3, P. 125**

Vehicle includes airbrake for deceleration into lower orbit. Report describes vehicle for carrying payloads between low and high orbits around Earth. Vehicle uses thin, upper atmosphere for braking when returning to low orbit. Since less propellant needed than required for full retrorocket braking, vehicle carries larger payload and therefore reduces cost of space transportation.

B86-10285
ALGORITHM FOR CALIBRATING ROBOT ARMS
S. A. HAYATI (Caltech) and M. MIRMIRANI (California State University, Los Angeles)
May 1986
NPO-16569 **Vol. 10, No. 3, P. 126**

Robots made to less demanding specifications and yet be more accurate. Method, described in published paper, used on any serial-link robot with any combination of revolute and primatic joints. Increases accuracy of positioning manipulator at any point in workspace relative to fixed coordinate system. Accurate absolute positioning capability particularly useful for those tasks where robot is issued target location by external sensory devices, such as vision system. With new method, ultraprecise manufacturing and high-resolution measurements of robot components unnecessary. Method therefore reduces cost of robots in addition to increasing robot accuracy.

B86-10286
OVERCOMING ROBOT-ARM JOINT SINGULARITIES
L. K. BARKER and J. A. HOUCK
May 1986 See Also N85-15446/NSP
LAR-13415 **Vol. 10, No. 3, P. 126**

Kinematic equations allow arm to pass smoothly through singular region. Report discusses mathematical singularities in equations of robot-arm control. Operator commands robot arm to move in direction relative to its own axis system by specifying velocity in that direction. Velocity command then resolved into individual-joint rotational velocities in robot arm to effect motion. However, usual resolved-rate equations become singular when robot arm is straightened.

B86-10287
THEORY AND TESTS OF TWO-PHASE TURBINES
D. G. ELLIOTT (Caltech)
May 1986 See Also NASA CR-168834
NPO-16039 **Vol. 10, No. 3, P. 126**

New turbines open possibility of new types of power cycles. Report describes theoretical analysis and experimental testing of two-phase impulse turbines. Such turbines open possibility of new types of power cycles operating with extremely wet mixtures of steam and water, organic fluids, or immiscible liquids and gases. Possible applications are geothermal power, waste-heat recovery, refrigerant expansion, solar conversion, transportation, and engine-bottoming cycles.

B86-10288
CRASH TESTS OF PROTECTIVE AIRPLANE FLOORS
H. D. CARDEN
May 1986 See Also N85-13267/NSP
LAR-13414 **Vol. 10, No. 3, P. 127**

Energy-absorbing floors reduce structural buckling and impact forces on occupants. 56-page report discusses crash tests of energy-absorbing aircraft floors. Describes test facility and procedures; airplanes, structural modifications, and seats; crash dynamics; floor and seat behavior; and responses of anthropometric dummies seated in airplanes. Also presents plots of accelerations, photographs and diagrams of test facility, and photographs and drawings of airplanes before, during, and after testing.

B86-10339
DYNAMIC TOOTH LOADS FOR SPUR GEARS
R. CORNELL (United Technologies Corp.) and W. WESTERVELT (United Technologies Corp.)
Jul. 1986
LEW-14099 **Vol. 10, No. 4, P. 74**

Computer program developed using time-history, interactive, closed-form solution for dynamic tooth loads for both low- and high-contact-ratio spur gears. Facilitates application of high-contact-ratio spurgear concepts. Program written in FORTRAN IV.

B86-10361
LIQUID SCAVENGER FOR SEPARATOR/PUMP
P. F. BERG (United Technologies Corp.)
Jul. 1986
MSC-20632 **Vol. 10, No. 4, P. 92**

Pump for hydrogen modified to remove moisture that condenses in impeller stage. Impeller-pump housing has circumferential groove leading to exit hole near high-pressure outlet. As impeller disk rotates, flings water droplets condensed in pump toward groove. Aerodynamic drag drives water around groove to exit hole.

B86-10362
CENTRALLY-RUPTURING SQUIB-CLOSURE DISKS
R. RICHTER (Caltech)
Jul. 1986

NPO-16707 **Vol. 10, No. 4, P. 93**

Rupture-disk design makes squib action more predictable. In new design, center of rupture disk contains cruciform indentation in which thickness reduced to about 0.5 mil (0.013 mm). Reduces strength of center of rupture disk in same manner as that of pull tabs on beverage cans; therefore, disk will fail predictably in center.

B86-10363
RETRACTABLE SUN SHADE
A. FRANK (Grumman Aerospace Corp.), S. F. DERESPINIS (Grumman Aerospace Corp.), and J. MOCKOVCIAK, JOHN (Grumman Aerospace Corp.)
Jul. 1986
MSC-21062 **Vol. 10, No. 4, P. 94**

Window-shade type spring roller contains blanket, taken up by rotating cylindrical frame and held by frame over area to be shaded. Blanket made of tough, opaque polyimide material. Readily unfurled by mechanism to protect space it encloses from Sun. Blanket forms arched canopy over space and allows full access to it from below. When shading not needed, retracted mechanism stores blanket compactly. Developed for protecting sensitive Space Shuttle payloads from direct sunlight while cargo-bay doors open. Adapted to shading of greenhouses, swimming pools, and boats.

B86-10364
DIRECTION-SENSITIVE LATCH
W. R. ACRES
Jul. 1986
MSC-20910 **Vol. 10, No. 4, P. 95**

Mechanism eliminates clearance and applies positive load latched to member. Simpler and lighter than previous direction-sensitive latches (also called 'vector-sensitive latches'). New mechanism well suited to operation by automatic control or by remote controlled manipulator. Stages of latching process begin with application of downward force to secondary member, causing it to displace roller. After secondary member has passed roller and joined primary member, actuator removes clearance between roller and secondary member.

B86-10365
MOBILE REMOTE MANIPULATOR
S. CORYELL (Grumman Aerospace Corp.) and R. E. OLSEN (Grumman Aerospace Corp.)
Jul. 1986
MSC-21051 **Vol. 10, No. 4, P. 96**

Turret, roll arm, and trolley enhance manipulator dexterity. Remote manipulator moves on trolley base along structure. Roll-axis arm positions manipulator arm so it can extend end effector under structure. Yaw-axis rotation gives added reach to arm above structure. Designed for handling, inspecting, and maintaining modules of space station. Manipulators having such capabilities useful on Earth; robots in manufacturing, erection of large structures, or performing complicated tasks in hazardous locations.

B86-10366
LIGHTWEIGHT MOTORIZED VALVE
R. GONZALEZ (Rockwell International Corp.) and J. VANDEWALLE (Parker-Hannifin Corp.)
Jul. 1986
MSC-20848 **Vol. 10, No. 4, P. 97**

Redesigned actuator assembly weighs 50 percent less. Isolator valve operated by ac motor instead of usual dc solenoid. Valve weighs only 3 lb (1.4 kg). New valve functions with either two-phase or three-phase power. Developed for isolating fluids in propellant tanks, manifolds, and interconnecting lines of Space Shuttle reaction control and orbital maneuvering subsystems, valve suited to applications in which leakage must be kept to minimum at high pressure differences - in petroleum and chemical processing.

B86-10367
HEAT PIPES REDUCE ENGINE-EXHAUST EMISSIONS
D. F. SCHULTZ
Jul. 1986
LEW-12590 **Vol. 10, No. 4, P. 97**

Increased fuel vaporization raises engine efficiency. Heat-pipe technology increased efficiency of heat transfer beyond that obtained by metallic conduction. Resulted in both improved engine operation and reduction in fuel consumption. Raw-material conservation through reduced dependence on strategic materials also benefit from this type of heat-pipe technology. Applications result in improved engine performance and cleaner environment.

B86-10368
NEW ALLOY FOR GLASS-TO-METAL SEALS
A. J. SCHMUCK (McDonnell Douglas Corp.)
Jul. 1986
MSC-21023 **Vol. 10, No. 4, P. 100**

Coefficient of thermal expansion approximates that of glass more closely. Alloy composed of about 60 percent iron, 40 percent nickel, and traces of six other elements. Developed as replacement for Kovar Fe/Ni/Co alloy in ferrule-and-tube assembly, new alloy has same strength, solderability, and compatibility with fuel as does Kovar. Used in glass-to-metal seals without excessive residual stresses. Potential for other applications in which low thermal expansion important; mechanical measuring devices and precise sliding parts that must function over wide temperature ranges.

B86-10369
TORQUE-SUMMING BRUSHLESS MOTOR
J. G. VAIDYA (Sundstrand Advanced Technology Group)
Jul. 1986
MSC-20986 **Vol. 10, No. 4, P. 100**

Torque channels function cooperatively but electrically independent for reliability. Brushless, electronically-commutated dc motor sums electromagnetic torques on four channels and applies them to single shaft. Motor operates with any combination of channels and continues if one or more of channels fail electrically. Motor employs single stator and rotor and mechanically simple; however, each of channels electrically isolated from other so that failure of one does not adversely affect others.

B86-10370
CLEANING HIGH-VOLTAGE EQUIPMENT WITH CORNCOB GRIT
C. CAVENESS (Rockwell International Corp.)
Jul. 1986
MSC-20180 **Vol. 10, No. 4, P. 101**

High electrical resistance of particles makes power shutdown unnecessary. New, inexpensive method of cleaning high-voltage electrical equipment uses plentiful agricultural product corncob grit. Method removes dirt and debris from transformers, circuit breakers, and similar equipment. Suitable for utilities, large utility customers, and electrical-maintenance services.

B86-10371
HYDRAULIC-LEAK DETECTOR FOR HIDDEN JOINTS
G. E. ANDERSON (Rockwell International Corp.) and S. LOO (Rockwell International Corp.)
Jul. 1986
MSC-20783 **Vol. 10, No. 4, P. 102**

Slow leakage of fluid made obvious. Indicator consists of wick wrapped at one end around joint to be monitored. Wick absorbs hydraulic fluid leaking from joint and transmits to opposite end, located outside cover plate and visible to inspector. Leakage manifested as discoloration of outside end of wick. Indicator reveals leaks in hidden fittings on hydraulic lines. Fast inspection of joints without disassembly. Used in aerospace, petroleum, chemical, nuclear, and other industries where removing covers for inspection impossible, difficult, or time-consuming.

B86-10372
MEASURING CONTINUOUS-PATH ACCURACIES OF ROBOTS
T. A. ALLISON (Rockwell International Corp.) and G. A. ARNOLD (Rockwell International Corp.)
Jul. 1986
MFS-29121 **Vol. 10, No. 4, P. 102**
Sensors yield data on deviation from predetermined path and speed. Accuracy and repeatability of continuous-path robot motion measured with new method. Determines ability of robot to maintain tool orientation. Used with any type of manipulator arm and with separate, coordinated part positioner. Noncontacting eddy-current sensors measure distance from tool to aluminum path plate as robot end effector moves tool at prescribed distance from plate. Flat, sloped, curved, and other shapes used for path plate.

B86-10373
CLEANING OF LIQUID N2O4
G. R. PFEIFER (The Marquardt Co.)
Jul. 1986
MSC-20989 **Vol. 10, No. 4, P. 103**
Technique useful in reducing clogging of fluid lines. Metal nitrate impurities precipitated from N2O4 by cooling N2O4 in heat exchanger and passing through hydraulic pump. Precipitate removed by fine membrane filter. Technique developed for cleaning of liquid N2O4 adaptable to cleaning of variety of industrial fluids, including fuels.

B86-10374
TWO-ARM-MANIPULATOR CONTROLLER
S. CORYELL (Grumman Aerospace Corp.) and R. E. OLSEN (Grumman Aerospace Corp.)
Jul. 1986
MSC-21049 **Vol. 10, No. 4, P. 104**
Shoulder harness allows wearer to control simultaneously and independently two remote manipulator arms and end effectors. Each manipulator arm would have 7 degrees of freedom. Two arm mechanisms of controller moved by operator's arms and hands. Remote manipulator, located elsewhere, responds to operator's arm and hand movements. Adjustable shoulder straps, waist belt, and leg straps hold harness securely on wearer. Mechanisms and harness allow operator to reach almost normally at control station.

B86-10375
TOXIC-WASTE DISPOSAL BY COMBUSTION IN CONTAINERS
J. HOUSEMAN (Caltech), J. B. STEPHENS (Caltech), P. I. MOYNIHAN (Caltech), L. E. COMPTON (Caltech), and J. J. KALVINSKAS (Caltech)
Jul. 1986
NPO-16710 **Vol. 10, No. 4, P. 106**
Chemical wastes burned with minimal handling in storage containers. Technique for disposing of chemical munitions by burning them inside shells applies to disposal of toxic materials stored in drums. Fast, economical procedure overcomes heat-transfer limitations of conventional furnace designs by providing direct contact of oxygenrich combustion gases with toxic agent. No need to handle waste material, and container also decontaminated in process. Oxygen-rich torch flame cuts burster well and causes vaporization and combustion of toxic agent contained in shell.

B86-10376
TOXIC-WASTE DISPOSAL BY DRAIN-IN-FURNACE TECHNIQUE
L. E. COMPTON (Caltech), J. B. STEPHENS (Caltech), P. I. MOYNIHAN (Caltech), J. HOUSEMAN (Caltech), and J. J. KALVINSKAS (Caltech)
Jul. 1986
NPO-16579 **Vol. 10, No. 4, P. 107**
Compact furnace moved from site to site. Toxic industrial waste destroyed using furnace concept developed for disposal of toxic munitions. Toxic waste drained into furnace where incinerated immediately. In furnace toxic agent rapidly drained and destroyed in small combustion chamber between upper and lower layers of hot ceramic balls

B86-10377
NOZZLE EXTENSION FOR SAFETY AIR GUN
H. N. ZUMBRUN and D. R. CROOM, JR.
Jul. 1986
LAR-13366 **Vol. 10, No. 4, P. 108**
New nozzle-extension design overcomes problems and incorporates original commercial nozzle, retaining intrinsic safety features. Components include extension tube, length of which made to suit application; adaptor fitting, and nozzle adaptor repinned to maintain original safety features. Design moves conical airstream to end of extension to blow machine chips away from operator. Nozzle-extension modification allows safe and efficient operation of machine tools while maintaining integrity of orginial safety-air-gun design.

B86-10378
COAL-BASED FUEL-CELL POWERPLANTS
J. F. FERRAL (Caltech), A. W. PAPPANO (Caltech), and C. N. JENNINGS (Caltech)
Jul. 1986
NPO-16543 **Vol. 10, No. 4, P. 108**
Report assesses advanced technology design alternatives for integrated coal-gasifier/fuel-cell powerplants. Various gasifier, cleanup, and fuelcell options evaluated. Evaluation includes adjustments to assumed performances and costs of proposed technologies where required. Analysis identifies uncertainties remaining in designs and most promising alternatives and research and development required to develop these technologies. Bulk of report summary and detailed analysis of six major conceptual designs and variations of each. All designs for plant that uses Illinois No. 6 coal and produces 675 MW of net power.

B86-10379
LIFETIMES AND RELIABILITIES OF BEVEL-GEAR DRIVE TRAINS
D. LEWICKI, J. COX, M. SAVAGE (University of Akron), and C. BRIKMANIS (University of Akron)
Jul. 1986 See Also N85-27227/NSP
LEW-14372 **Vol. 10, No. 4, P. 109**
Statistical methods used to predict system lifetimes from component lifetimes. Report shows how to use information to determine system life of drive train, using methods of probability and statistics. Presents life and reliability model for bevel-gear drive trains. Bevel-gear and support-bearing lives analyzed for each gear and bearing in drive train, with results statistically combined to produce system life for entire drive train. Numerical example included.

B86-10380
INTERCHANGEABLE TOOLS FOR REMOTE MANIPULATORS
J. C. CODY (SRS Technologies)
Jul. 1986
MFS-27125 **Vol. 10, No. 4, P. 109**
Report presents concepts and specifications for set of interchangeable end-effector tools used on remotely operated manipulator to work on satellites in orbit. Tools make urgent repairs, do routine maintenance, transfer fluids, construct and assemble satellites, and deploy and retract appendages. With modifications, tool concepts and systematic approach to tool design applicable to such terrestrial uses as industrial robots, manually operated tools, and safety equipment. Report discusses concept for tool-storage system that holds tools securely when not used but kept accessible to manipulator.

B86-10381
SOLAR THERMAL ROCKET PROPULSION
J. C. SERCEL (Caltech)

Jul. 1986
NPO-16654 **Vol. 10, No. 4, P. 109**
Paper analyzes potential of solar thermal rockets as means of propulsion for planetary spacecraft. Solar thermal rocket uses concentrated Sunlight to heat working fluid expelled through nozzle to produce thrust.

B86-10382
STUDIES OF PILOT-INDUCED OSCILLATION
B. G. POWERS
Jul. 1986 See Also N84-20566/NSP
ARC-11601 **Vol. 10, No. 4, P. 110**
Total In-Flight Simulator permits reliable evaluation of landing characteristics of aircraft with PIO. Report discusses simulation requirements for investigating PIO characteristics and includes evaluation of relative merits of simulators. Observations of interest to those studying landing characteristics of other aircraft and to those designing pilot-training programs.

B86-10383
PROPERTIES OF COMBUSTION GASES
J. D. WEAR, R. E. JONES, A. M. TROUT, and B. J. MCBRIDE
Jul. 1986 See Also N85-10064/NSP and N85-21168/NSP
LEW-14275 **Vol. 10, No. 4, P. 110**
New series of reports: First report lists data from combustion of ASTM Jet A fuel and dry air; second report presents tables and figures for combustion-gas properties of natural-gas fuel and dry air, and equivalent ratios.

B86-10461
CONTINUOUS REMOVAL OF COAL-GASIFICATION RESIDUE
E. R. COLLINS, JR. (Caltech), J. SUITOR (Caltech), and D. DUBIS (Caltech)
Sep. 1986
NPO-16605 **Vol. 10, No. 5, P. 106**
Continuous-flow hopper processes solid residue from coal gasification, converting it from ashes, cinders, and clinkers to particles size of sand granules. Unit does not require repeated depressurization of lockhopper to admit and release materials. Therefore consumes less energy. Because unit has no airlock valves opened and closed repeatedly on hot, abrasive particles, subjected to lesser wear. Coal-gasification residue flows slowly through pressure-letdown device. Material enters and leaves continuously. Cleanout door on each pressure-letdown chamber allows access for maintenance and emergencies.

B86-10462
EFFECTS OF STRUCTURAL FLEXIBILITY ON AIRCRAFT-ENGINE MOUNTS
W. H. PHILLIPS
Sep. 1986 See Also N84-16590/NSP
LAR-13305 **Vol. 10, No. 5, P. 109**
Analysis extends technique for design of widely used type of vibration-isolating mounts for aircraft engines, in which rubber mounting pads located in plane behind center of gravity of engine-propeller combination. New analysis treats problem in statics. Results of simple approach useful in providing equations for design of vibration-isolating mounts. Equations applicable in usual situation in which engine-mount structure itself relatively light and placed between large mass of engine and other heavy components of airplane.

B86-10463
SHOCK-ABSORBENT BALL-SCREW MECHANISM
O. A. HIRR, JR., and R. W. MENEELY
Sep. 1986
ARC-11366 **Vol. 10, No. 5, P. 110**
Actuator containing two ball screws in series employs Belleville springs to reduce impact loads, thereby increasing life expectancy. New application of springs increases reliability of equipment in which ball screws commonly used. Set of three springs within lower screw of ball-screw mechanism absorbs impacts that result when parts reach their upper and lower limits of movement. Mechanism designed with Belleville springs as shock-absorbing elements because springs have good energy-to-volume ratio and easily stacked to attain any stiffness and travel.

B86-10464
IMPROVED ORIFICE PLATE FOR SPRAY GUN
W. CUNNINGHAM (Martin Marietta Corp.)
Sep. 1986
MFS-28110 **Vol. 10, No. 5, P. 111**
Erratic spray pattern of commercial spray gun changed to repeatable one by simple redesign of two parts. In modified spray gun orifice plate and polytetrafluoroethylene bushing redesigned to assure centering and alignment with nozzle. Such improvement useful in many industrial applications requiring repeatable spray patterns. Might include spraying of foam insulation, paint, other protective coatings, detergents, abrasives, adhesives, process chemicals, or fuels. Unmodified spray gun produces erratic spray because lateral misalignment between orifice plate and nozzle.

B86-10465
FLOW INJECTOR WOULD KEEP SLURRY FROM SETTLING
E. V. LEWIS (Caltech)
Sep. 1986
NPO-16186 **Vol. 10, No. 5, P. 112**
Ring nozzle helps to prevent choking of coal-slurry pipelines. Intended originally for use in coal mines, nozzle concept generally applicable to short-haul slurry pipelines where high-pressure water (or other slurry fluid) available. Extra water injected into flow near wall of slurry pipe to keep slurry particles from setting and blocking pipe.

B86-10466
LIQUID/GAS VORTEX SEPARATOR
B. G. MORRIS
Sep. 1986
MSC-21058 **Vol. 10, No. 5, P. 112**
Liquid/gas separator vents gas from tank of liquid that contains gas randomly distributed in bubbles. Centrifugal force separates liquid and gas, forcing liquid out of vortex tube through venturi tube. Gas vented through exhaust port. When liquid detected in vent tube, exhaust port closed, and liquid/gas mixture in vent tube drawn back into tank through venturi.

B86-10467
AUTOMATED ROTATING-MACHINERY ANALYSIS
J. CLARK (Rockwell International Corp.)
Sep. 1986
MFS-19912 **Vol. 10, No. 5, P. 113**
Computer-controlled automatic system processes accelerometer data from rotating machines, producing mathematical description and graphical display of shaft motion. Program saves processing time, readily identifies type of motion (circular, looped, or elliptical), provides annotated assessments to assist in failure analysis, alerts user to look for distinctive characteristics of machinery, and creates informative plots.

B86-10468
BIDIRECTIONAL, AUTOMATIC COAL-MINING MACHINE
E. R. COLLINS, JR. (Caltech)
Sep. 1986
NPO-15860 **Vol. 10, No. 5, P. 116**
Proposed coal-mining machine operates in both forward and reverse directions along mine face. New design increases efficiency and productivity, because does not stop cutting as it retreats to starting position after completing pass along face. To further increase efficiency, automatic miner carries its own machinery for crushing coal and

feeding it to slurry-transport tube. Dual-drum mining machine cuts coal in two layers, crushes, mixes with water, and feeds it as slurry to haulage tube. At end of pass, foward drum raised so it becomes rear drum, and rear drum lowered, becoming forward drum for return pass.

B86-10469
HEAT RADIATORS FOR ELECTROMAGNETIC PUMPS
R. J. CAMPANA (GA Technologies, Inc.)
Sep. 1986
NPO-16458 **Vol. 10, No. 5, P. 117**
Report proposes use of carbon/carbon composite radiators in electromagnetic coolant pumps of nuclear reactors on spacecraft. Carbon/carbon composite materials function well at temperatures in excess of 2,200 K. Aluminum has melting temperature of only 880 K.

B86-10470
LONG, THIN, DEPLOYABLE MAST
L. A. FINLEY (Astro Research Corp.)
Sep. 1986
MFS-27088 **Vol. 10, No. 5, P. 117**
Report describes 15-m-long deployable mast and discusses design and development that went into making product. Only 0.6 m long when stowed, mast extends itself to its full length. Although extended mast long and narrow, with aspect ratio of 67:1, it resists bending.

B86-10509
CIRCULATION-CONTROL VARIABLE-PITCH PROPELLER
H. D. GARNER
Nov. 1986 See also N85-29959/NSP
LAR-12740 **Vol. 10, No. 6, P. 74**
Circulation-control variable-pitch propeller has large lift value at moderate blowing coefficients. Based on circulation-control airfoil concept, has no moving parts other than needed for propeller rotation. Substituted for conventional variable-pitch propeller airfoil, lowers manufacturing costs, reduces maintenance, and improves reliability.

B86-10510
PITCH CONTROL FOR HELICOPTER ROTORS
P. JEFFERY (United Technologies Corp.) and G. LUECKE (United Technologies Corp.)
Nov. 1986
ARC-11517 **Vol. 10, No. 6, P. 76**
Pitch controller for helicopter rotors uses hub-mounted actuators located symmetrically between rotor blades. New controller designed for X-wing rotors requiring collective pitch control; pitch of all blades must be changed by same amount. Collective control allows rotor trimmed during variety of flight regimes, particularly during hovering and fixed-wing flight.

B86-10511
ALGORITHM FOR FUEL-CONSERVATIVE AIRPLANE DESCENTS
C. E. KNOX, D. D. VICROY, and D. A. SIMMON (United Airlines, Inc.)
Nov. 1986 See also N83-25707/NSP, N84-29871/NSP and N85-26705/NSP
LAR-13492 **Vol. 10, No. 6, P. 77**
Federal Aviation Administration implementing automated, time-based metering form of air-traffic control (ATC) with profile-descent procedures for arrivals into terminal area. Measures provide fuel savings by matching arrival of airplanes to airport acceptance rate through time-control computations and allowing pilot to descend at his discretion from cruise altitude to designated metering-fix altitude in idle-thrust clean configuration. Airborne descent algorithm developed compatible with time-based metering and profile-descent procedures and designed to improve accuracy of delivering airplane during fuel-efficient descent to metering fix at time designated by the ATC system.

B86-10512
ANALYSIS OF LEAKAGE FLOWS IN TURBOMACHINERY
M. M. SINDIR (Rockwell International Corp.)
Nov. 1986
MFS-29152 **Vol. 10, No. 6, P. 78**
Navier-Stokes calculations predict leakage flow in high-pressure fuel pump. Accurate calculation of internal turbomachinery flow dynamics helps spot possible failure modes and establishes coupling between cyclic loading and structural dynamics. Approach also useful in analyzing two-and quasi-three-dimensional leakage flows in other turbomachinery components.

B86-10513
BALANCING HIGH-SPEED ROTORS AT LOW SPEED
J. GIORDANO (Mechanical Technology, Inc.) and E. ZORZI (Mechanical Technology, Inc.)
Nov. 1986
MFS-28130 **Vol. 10, No. 6, P. 79**
Flexible balancing reduces vibrations at operating speeds. Highspeed rotors in turbomachines dynamically balanced at fraction of operating rotor speed. New method takes into account rotor flexible rather than rigid.

B86-10514
FLEXIBLE-ROTOR BALANCING DEMONSTRATION
J. GIORDANO (Mechanical Technology, Inc.) and E. ZORZI (Mechanical Technology, Inc.)
Nov. 1986
MFS-28132 **Vol. 10, No. 6, P. 80**
Report describes method for balancing high-speed rotors at relatively low speeds and discusses demonstration of method on laboratory test rig. Method ensures rotor brought up to speeds well over 20,000 r/min smoothly, without excessive vibration amplitude at critical speeds or at operating speed.

B86-10515
LIQUID-HYDROGEN POLYGENERATION SYSTEM
P. MINDERMAN, G. GUTKOWSKI, L. MANFREDI, J. KING, and F. HOWARD
Nov. 1986
KSC-11304 **Vol. 10, No. 6, P. 80**
Polygeneration system uses existing technology in integrated process to produce liquid hydrogen space-vehicle propellant and secondary products as gaseous nitrogen, electrical energy, and thermal energy. Makes commercial launch services economical. Lowers expected cost of liquid hydrogen by utilizing relatively cheap coal feedstocks and by reducing electrical costs associated with producing liquid hydrogen.

B86-10516
SYNOPSIS OF MAGNETOHYDRODYNAMIC POWER GENERATION
J. L. SMITH
Nov. 1986 See Also N84-25458/NSP
MFS-27073 **Vol. 10, No. 6, P. 81**
Concise summary of magnetohydrodynamic (MHD) theory, history, and future trends presented in report. Worldwide research on MHD covered, and selected data from key research projects included. Magnetohydrodynamic generator produces electric current by passing fluid at high speed through strong magnetic field. Fluid ionized gas, plasma, or liquid metal. Magnetohydrodynamic generators offer potential for high efficiency, low power cost, and cleaner emissions.

B86-10531
ADVANCED ROTORDYNAMIC NONLINEAR TRANSIENT SIMULATION
D. G. BECHT (Rockwell International Corp.)
Nov. 1986
MFS-19939 **Special Edition, P. 40**
Advanced rotordynamic nonlinear transient-simulation program, TRANSIM, developed to predict response of

high-performance rotating machinery to variety of forcing functions. Works by modal superposition of rotor and casing subsystems. Transient response of system calculated by numerical integration of equations of motion, performed in modal coordinates. Resulting data transformed back into physical coordinates as required to determine user-requested loads and accelerations as function of time. Used to analyze Space Shuttle main engine high-pressure fuel turbopump. TRANSIM written in FORTRAN 77.

08 FABRICATION TECHNOLOGY

B86-10080
ATTACHING METAL FASTENERS TO SILICA TILES
J. W. HOLT (Rockwell International Corp.), S. Y. YOSHINO (Rockwell International Corp.), and L. W. SMISER (Rockwell International Corp.)
Jun. 1986
MSC-20537 **Vol. 10, No. 1, P. 122**

Stress distributed so high load borne. Fastener bonded in densified hole or captured in plug of similar refractory material, which in turn bonded in hole in parent tile. Plug or bonding distributes mechanical load from fastener to broad region surrounding fastener, reducing local stress concentration and likelihood of breakage. Bonded-plug method has been successful in attaching mechanical fasteners to porous silica refractory tiles used on outer surface of Space Shuttle orbiter.

B86-10081
COMPACT PLASMA DEPOSITION CHAMBER
D. B. BICKLER (Caltech)
Jun. 1986
NPO-16469 **Vol. 10, No. 1, P. 123**

Contamination and nonuniformity are reduced. Substrates serve as walls of deposition chamber in configuration for plasma deposition of amorphous silicon. New chamber intended for production of amorphous silicon solar cells. Design reduces requirements on chamber size and expected to increase product quality.

B86-10082
LUBRICATING HOLES FOR CORRODED NUTS AND BOLTS
B. G. PENN, J. M. CLEMONS, and F. E. LEDBETTER, JR.
Jun. 1986
MFS-28086 **Vol. 10, No. 1, P. 123**

Corroded fasteners taken apart more easily. Lubricating holes bored to thread from three of flats. Holes facilitate application of penetrating oil to help loosen nut when rusted onto bolt. Holes make it possible to apply lubricants and rust removers directly to more of thread than otherwise reachable.

B86-10083
RAPID ADHESIVE BONDING OF COMPOSITES
B. A. STEIN, J. R. TYERYAR, R. L. FOX, J. STERLING, S. ELMO, J. D. BUCKLEY, S. V. INGE, JR., L. G. BURCHER, and R. E. WRIGHT, JR.
Jun. 1986 See Also (N84-29968)
LAR-13277 **Vol. 10, No. 1, P. 124**

Strong bonds created in less time and with less power than use of conventional bonding methods. Rapid adhesive bonding (RAB) technique for composites uses high-frequency induction heating toroids to quickly heat metallic susceptor impregnated with thermoplastic adhesive or sandwiched between thermoset or thermoplastic adhesive cloths or films. Susceptor steel screen or perforated steel foil.

B86-10084
SOLAR-CELL-JUNCTION PROCESSING SYSTEM
S. N. BUNKER (Spire Corporation) and A. J. ARMINI (Spire Corporation)
Jun. 1986
NPO-16540 **Vol. 10, No. 1, P. 125**

System under development reduces equipment costs. Processing system will produce solar-cell junctions on 4 in. (10.2 cm) round silicon wafers at rate of 10 to seventh power per year. System includes non-mass-analyzed ion implanter, microcomputer-controlled, pulsed-electron-beam annealer, and wafer-transport system with vacuum interlock. These features eliminate large, expensive magnet and plates, circuitry, and power source otherwise needed for scanning.

B86-10085
LEAKPROOF SWAGED JOINTS IN THIN-WALL TUBING
F. H. STUCKENBERG (Rockwell International Corp.), L. K. CROCKETT (Rockwell International Corp.), and W. E. SNYDER (Deutsch Co.)
Jun. 1986
MSC-20882 **Vol. 10, No. 1, P. 126**

Tubular inserts reinforce joints, reducing incidence of leaks. In new swaging technique, tubular inserts placed inside ends of both tubes to be joined. Made from thicker-wall tubing with outside diameter that matches inside diameter of thin tubing swaged, inserts support tube ends at joint. They ensure more uniform contact between swage fitting and tubing. New swaging technique developed for Al/Ti/V-alloy hydraulic supply lines.

B86-10086
DETECTING CONTAMINANT PARTICLES ACOUSTICALLY
L. M. WYETT (Rockwell International Corp.)
Jun. 1986
MFS-29078 **Vol. 10, No. 1, P. 127**

Apparatus 'listens' for particles in interior of complex turbomachinery. Contact microphones are attached at several points on pump housing. Acoustic transducer also attached to housing to excite entire pump with sound. Frequency of sound is slowly raised until pump resonates. Microphones detect noise of loose particles scraping against pump parts. Such as machining chips in turbopumps or other machinery without disassembly.

B86-10087
FINDING BRAZING VOIDS BY HOLOGRAPHY
R. GALLUCCIO (United Technologies Corp.)
Jun. 1986
MSC-20495 **Vol. 10, No. 1, P. 127**

Vibration-induced interference fringes reveal locations of defects. Holographic apparatus used to view object while vibrated ultrasonically. Interference fringes in hologram reveal brazing defects. Holographic technique locates small voids in large brazed joints. Identifies unbrazed regions 1 in. to second power (6 cm to the second power) or less in area.

B86-10088
ELECTROMAGNETIC HAMMER FOR METALWORKING
S. A. ANDERSON (Martin Marietta Corp.), F. BRUNET (Martin Marietta Corp.), A. DOWD (Martin Marietta Corp.), R. DURHAM (Martin Marietta Corp.), J. EZELL (Martin Marietta Corp.), G. GORR (Martin Marietta Corp.), D. HARTLEY (Martin Marietta Corp.), F. JACKSON (Martin Marietta Corp.), J. MARCHAND (Martin Marietta Corp.), W. MACFARLANE (Martin Marietta Corp.) et al
Jun. 1986
MFS-27096 **Vol. 10, No. 1, P. 128**

High eddy currents apply pressure for cold-forming. Coil housing constructed for mechanical strength to hold coil

against magnetic force, to maintain electrical contact with coil ends, and to maintain insulation between coil turns. Drilled holes placed to facilitate release of bubbles during potting. In contrast with mechanical hammers, electromagnetic hammer requires no dynamic material contact with workpiece; consequently, produces almost no change in metal grain structure.

B86-10089
FORGING OXIDE-DISPERSION-STRENGTHENED SUPERALLOYS
F. H. HARF, T. K. GLASGOW, D. J. MORACZ (TRW, Inc.), and C. M. AUSTIN (TRW, Inc.)
Jun. 1986 See Also (N84-25711)
LEW-14179 **Vol. 10, No. 1, P. 129**
Cladding of mild steel prevents surface cracking when alloy contacts die. Continual need for improvements in properties of alloys capable of withstanding elevated temperatures. Accomplished by using oxide-dispersion-strengthened superalloys such as Inconel Alloy MA 6000. Elevated tensile properties of forged alloy equal those of hot-rolled MA 6000 bar. Stress-rupture properties somewhat lower than those of bar stock but, at 1,100 degress C, exceed those of strongest commercial single crystal, directionally solidified and conventionally cast superalloys.

B86-10090
ACOUSTIC-EMISSION WELD-PENETRATION MONITOR
J. MARAM (Rockwell International Corp.) and J. COLLINS (Rockwell International Corp.)
Jun. 1986
MFS-29064 **Vol. 10, No. 1, P. 135**
Weld penetration monitored by detection of high-frequency acoustic emissions produced by advancing weld pool as it melts and solidifies in workpiece. Acoustic emission from TIG butt weld measured with 300-kHz resonant transducer. Rise in emission level coincides with cessation of weld penetration due to sudden reduction in welding current. Such monitoring applied to control of automated and robotic welders.

B86-10091
HOLDER FOR TINNING MICROCIRCUIT LEADS
G. G. GILBERT (Sperry Rand Corp.) and G. D. FIELDER (Sperry Rand Corp.)
Jun. 1986
MSC-20662 **Vol. 10, No. 1, P. 136**
Heat-sinking tool holds microcircuits for lead tinning while protecting circuits from heat of tinning solder. Microcircuit holder dips leads in molten solder. Holder shields microcircuit from solder heat while leads immersed and absorbs heat conducted through leads. Thus keeps microcircuit relatively cool. Application tool was developed for requires tinning not closer than 0.02 in. (0.5 mm) from package body or its glass seals.

B86-10092
IMPROVEMENTS IN IONIZED CLUSTER-BEAM DEPOSITION
D. J. FITZGERALD (Caltech), L. E. COMPTON (Caltech), and E. V. PAWLIK (Caltech)
Jun. 1986
NPO-16518 **Vol. 10, No. 1, P. 137**
Lower temperatures result in higher purity and fewer equipment problems. In cluster-beam deposition, clusters of atoms formed by adiabatic expansion nozzle and with proper nozzle design, expanding vapor cools sufficiently to become super-saturated and form clusters of material deposited. Clusters are ionized and accelerated in electric field and then impacted on substrate where films form. Improved cluster-beam technique useful for deposition of refractory metals.

B86-10093
HERMETIC EDGE SEALS FOR PHOTOVOLTAIC MODULES
M. J. NOWLAN (Spire Corp.)
Jun. 1986
NPO-16427 **Vol. 10, No. 1, P. 138**
Corrosive atmospheric agents excluded to prolong cell life. Combination of two sealing techniques makes possible to protect solar cells from water vapor, oxygen, and other corrosive atmospheric constituents. Using three-step process, glass-to-metal hermetic seal formed around edge of solar-cell module. Elastomer seals used previously not as effective because they are permeable to water vapor and atmospheric gases.

B86-10094
TELEVISION MONITORING SYSTEM FOR WELDING
K. VALLOW (Rockwell International) and S. GORDON (Rockwell International)
Jun. 1986
MFS-29104 **Vol. 10, No. 1, P. 138**
Welding process in visually inaccessible spots viewed and recorded. Television system enables monitoring of welding in visually inaccessible locations. System assists welding operations and provide video record, used for weld analysis and welder training.

B86-10095
WRINKLE-FREE HYDROFORMING OF WIRE MESH
J. FADNESS (Rockwell International Corp.)
Jun. 1986
MFS-29111 **Vol. 10, No. 1, P. 139**
Plastic films lubricate workpiece so it deforms smoothly. Thin layers of plastic below top die and above bottom die ensure wire screen slides as shaped by hydroforming. Plastic layers are 0.0043 in. (0.11 m) thick. Preformed to contours of dies and final workpiece. New method of hydroforming fine-wire-mesh heat-shield screens eliminates wrinkles and marks. Prevents screen from being damaged and pores from becoming blocked.

B86-10183
ION-DEPOSITED POLISHED COATINGS
B. A. BANKS
Jun. 1986 See Also (N81-19278)
LEW-13545 **Vol. 10, No. 2, P. 138**
Polished, dense, adherent coatings relatively free of imperfections. New process consists of using broad-beam ion source in evacuated chamber to ion-clean rotating surface that allows grazing incidence of ion beam. This sputter cleans off absorbed gases, organic contaminants, and oxides of mirror surface. In addition to cleaning, surface protrusions sputter-etched away. Process particularly adaptable to polishing of various substrates for optical or esthetic purposes.

B86-10184
HEAT BONDING OF IRRADIATED ETHYLENE VINYL ACETATE
D. H. SLACK (ILC Dover)
Jun. 1986
MSC-20320 **Vol. 10, No. 2, P. 139**
Reliable method now available for joining parts of this difficult-to-bond material. Heating fixture encircles ethylene vinyl acetate multiple-socket part, providing heat to it and to tubes inserted in it. Fixtures specially designed to match parts to be bonded. Tube-and-socket bonds made with this technique subjected to tensile tests. Bond strengths of 50 percent that of base material obtained consistently.

B86-10185
THERMOPLASTIC COMPOSITES FOR RESEARCH-MODEL COMPONENTS
B. F. GUENTHER and P. VASQUEZ
Jun. 1986
LAR-13348 **Vol. 10, No. 2, P. 140**
Oriented unidirectional prepreg tapes formed in ceramic molds. New technique developed at Langley Research Center, using ceramic mold for fabrication of models from

graphite/thermoplastic materials. Upper surface of wings and fuselage of advanced airplane selected as shape to test fabrication technique. Technique well suited for other complex shapes as well. Thermoplastic composite easily workable with normal shop equipment and painted and repaired by standard methods.

B86-10186
CONTROLLING ARC LENGTH IN PLASMA WELDING
W. F. ICELAND (Rockwell International Corp.)
Jun. 1986
MSC-20900 **Vol. 10, No. 2, P. 141**

Circuit maintains arc length on irregularly shaped workpieces. Length of plasma arc continuously adjusted by control circuit to maintain commanded value. After pilot arc is established, contactor closed and transfers arc to workpiece. Control circuit then half-wave rectifies ac arc voltage to produce dc control signal proportional to arc length. Circuit added to plasma arc welding machines with few wiring changes. Welds made with circuit cleaner and require less rework than welds made without it. Beads smooth and free of inclusions.

B86-10187
OPTICAL MONITORING OF WELD PENETRATION
J. MARAM (Rockwell International Corp.)
Jun. 1986
MFS-29107 **Vol. 10, No. 2, P. 142**

Robotic welding controlled by reliable, relatively-noise-free optoelectronic unit. Bounding off meniscus of pool of molten metal, laser beam impinges on position-sensitive photodetector. Beam diameter adjusted for width of weld. Optical filters screen out light from arc. Made from small, low-cost components and utilizing optical fibers to conduct signals, system immune to electromagnetic interference common in industrial environments. Aimed for automatic welders, robot welders in particular and also adaptable to other types of welding, including tungsten/inert-gas, laser, and electron-beam techniques.

B86-10188
CRYSTAL-GROWING CRUCIBLE TO SUPPRESS CONVECTION
R. RICHTER (Caltech)
Jun. 1986
NPO-16597 **Vol. 10, P. 2, P. 142**

Platform under growth region stabilizes melt for more uniform crystal growth. In new crucible, platform just below growth interface so melt is too shallow to support convection. Critical depth for onset of pertinent instability calculated from heat flux through surface of melt, volume coefficient of thermal expansion, thermal conductivity, thermal diffusivity, and kinematic viscosity.

B86-10189
VOID-FREE LID FOR FOOD PACKAGING
C. D. WATSON (ESD Corp.) and W. P. FARRIS (ESD Corp.)
Jun. 1986
MSC-20661 **Vol. 10, No. 2, P. 143**

Flexible cover eliminates air pockets in sealed container. Universal food-package lid formed from flexible plastic. Partially folded, lid unfolded by depressing center portion. Height of flat portion of lid above flange thereby reduced. Pressure of food against central oval depression pops it out, forming dome that provides finger grip for mixing contents with water or opening lid. Therefore food stays fresh, allows compact stacking of partially filled containers, and resists crushing. Originally developed for packaging dehydrated food for use in human consumption on Space Shuttle missions. Other uses include home canning and commercial food packaging.

B86-10190
METALIZING SOLAR CELLS BY SELECTIVE ELECTROPLATING
S. DUTTA (Westinghouse Electric Corp.) and P. A. PALASCHAK (Westinghouse Electric Corp.) p.)
Jun. 1986
NPO-16600 **Vol. 10, No. 2, P. 144**

Contact patterns traced by laser scanning. Conductor paths deposited on silicon solar-cell wafers by laser irradiation followed by electroplating. Laser-assisted metalization technique offers better resolution and lower contact resistance than does conventional metalization by screen printing. At the same time, less expensive than metalization with masks and photolithography.

B86-10191
TRANSFER CASTING FROM ION-BEAM-TEXTURED SURFACES
B. A. BANKS, A. J. WEIGAND, and J. S. SOVEY
Jun. 1986 See Also (N81-21129)
LEW-13120 **Vol. 10, No. 2, P. 144**

Textured surfaces created on metals, ceramics, and polymers. Electron-bombardment ion thrustor used as neutralized-ion-beam source. Beam of directed, energetic ions alter surface chemistry and/or morphology of many materials. By adjusting ion energy and ion-beam current density impinging upon target, precise surface modifications obtained without risk of target-material melting or bulk decomposition. Technique developed to generate precise, controllable, surface microstructures on metals, ceramics, and polymers.

B86-10192
MAKING LATEX MICROSPHERES IN SPACE
D. M. KORNFELD, J. W. VANDERHOFF (Lehigh University), M. S. EL-AASSER (Lehigh University), F. J. MICALE (Lehigh University), E. D. SUDOL (Lehigh University), C. M. TSENG (Lehigh University), and A. SILWANOWICZ (Lehigh University)
Jun. 1986
MFS-27085 **Vol. 10, No. 2, P. 145**

Equipment yields larger, more uniform particles. Two NASA reports describe first commercial product to be manufactured in space. Product monodisperse latex, suspension of spherical particles of essentially same diameter. Carried aboard Space Shuttle on its orbital missions, monodisperse latex reactor (MLR) produces spheres of much larger size than possible on Earth. Microspheres 30 micrometers in diameter produced, whereas 5 micrometers is limit for Earthbound reactors. Microspheres as large as 100 micrometers scheduled for production in MLR.

B86-10289
THERMALLY-ACTIVATED METAL-TO-GLASS BONDING
B. D. GALLAGHER (Caltech)
May 1986
NPO-16423 **Vol. 10, No. 3, P. 128**

Hermetic seals formed easily by use of metallo-organic film. Metallo-organic film thermally bonded to glass and soldered or welded to form hermetic seal. Film applied as ink consisting of silver neodecanoate in xylene. Relative amounts of ingredients selected to obtain desired viscosity. Material applied by printing or even by scribing with pen. Sealing technique useful in making solar-cell modules, microelectronic packages, and other hermetic silicon devices.

B86-10290
ELECTROCHEMICAL PROCESS MAKES FINE NEEDLES
J. L. WATKINS (Caltech)
May 1986
NPO-16311 **Vol. 10, No. 3, P. 135**

Electrochemical process makes fine tungsten needles for use as microscopic probes or field-emission cathodes. Etching vessel filled with dense, inert lower liquid covered by less-dense, caustic etching solution. Newly formed needle breaks off upper part of wire in etchant and falls into can in inert liquid below. Improved process does not

require close monitoring and left unattended for an indefinite time.

B86-10291
FILTERS FOR SUBMILLIMETER ELECTROMAGNETIC WAVES
C. M. BERDAHL (Caltech)
May 1986
NPO-16498 **Vol. 10, No. 3, P. 136**

A new manufacturing process produces filters strong, yet have small, precise dimensions and smooth surface finish essential for dichroic filtering at submillimeter wavelengths. Many filters, each one essentially wafer containing fine metal grid made at same time. Stacked square wires plated, fused, and etched to form arrays of holes. Grid of nickel and tin held in brass ring. Wall thickness, thickness of filter (hole depth) and lateral hole dimensions all depend upon operating frequency and filter characteristics.

B86-10292
WELD REPAIR OF THIN ALUMINUM SHEET
C. S. BEUYUKIAN (Rockwell International Corp.) and M. J. MITCHELL (Rockwell International Corp.)
May 1986
MSC-20902 **Vol. 10, No. 3, P. 137**

Weld repairing of thin aluminum sheets now possible, using niobium shield and copper heat sinks. Refractory niobium shield protects aluminum adjacent to hole, while copper heat sinks help conduct heat away from repair site. Technique limits tungsten/inert-gas (TIG) welding bombardment zone to melt area, leaving surrounding areas around weld unaffected. Used successfully to repair aluminum cold plates on Space Shuttle, Commercial applications, especially in sealing fractures, dents, and holes in thin aluminum face sheets or clad brazing sheet in cold plates, heat exchangers, coolers, and Solar panels. While particularly suited to thin aluminum sheet, this process also used in thicker aluminum material to prevent surface damage near weld area.

B86-10293
REPAIRING HARD-TO-REACH CRACKS IN HEAT-EXCHANGER TUBES
S. MILLS, R.C. (Rockwell International Corp.) and J. DUESBERG (Rockwell International Corp.)
May 1986
MFS-29128 **Vol. 10, No. 3, P. 138**

Inaccessible leaks repaired from accessible side of tube. Fish-Mouth insert placed in cut in leaky heat-exchanger tube. Insert welded or brazed to tube, and remaining open area of cut patched. Method developed for repairing leaks in nozzle coolant tubes of Space Shuttle main engine. Method also used on other types of tubular heat exchangers.

B86-10294
DEPOSITING DIAMONDLIKE CARBON FILMS
M. J. MIRTICH, J. S. SOVEY, and B. A. BANKS
May 1986 See Also N84-31512/NSP
LEW-14080 **Vol. 10, No. 3, P. 139**

New process demonstrated to make thin films (usually thousands of angstroms to few microns thick) that have properties of diamonds. Various plasma and ion-beam techniques employed to generate films. Films made by radio-frequency plasma decomposition of hydrocarbon gas or other alkanes, by low-energy carbon-ion-beam deposition, or by ion plating and dual ion technique using carbon target. Advantages of new process over others are films produced, though amorphous, are clear, extremely hard, chemically inert, of high resistivity, and have index of refraction of 3.2 properties similar to those of single-crystal diamonds. Films have possible uses in microelectronic applications, high-energy-laser and plastic windows, corrosion protection for metals, and other applications where desired properties of film shaped during the film-formation process.

B86-10295
MASKING TECHNIQUE FOR ION-BEAM SPUTTER ETCHING
B. A. BANKS and S. K. RUTLEDGE
May 1986 See Also N82-28445/NSP
LEW-13899 **Vol. 10, No. 3, P. 140**

Improved process for fabrication of integrated circuits developed. Technique utilizes simultaneous ion-beam sputter etching and carbon sputter deposition in conjunction with carbon sputter mask or organic mask decomposed to produce carbon-rich sputter-mask surface. Sputter etching process replenishes sputter mask with carbon to prevent premature mask loss.

B86-10296
UNITIZED NUT-AND-WASHER ASSEMBLY
P. J. ROSSI (Rockwell International Corp.)
May 1986
MSC-20903 **Vol. 10, No. 3, P. 141**

Combination nut, washer, and lockwasher secures parts quickly without damaging metal finishes. Nut and lockwasher are captured by bent tabs of flat washer in this concept for unified fastener. Optional perforated tab on flat washer allows easy tagging and storage. Fastener intended for attaching leads and buses to studs on electronic equipment.

B86-10297
COMPOSITE FASTENERS
G. S. NG
May 1986
LAR-13058 **Vol. 10, No. 3, P. 142**

Flexible composite fasteners made of polyvinyl chloride or other resilient synthetic material designed for joining together various materials which may vary slightly in thickness during use. Fasteners easily installed and removed by hand and maintain approximately same tension in bonding materials together, regardless of subsequent movements of materials. Design and choice of material of new fasteners enables variety of uses, as book binders, hole sealers, insulating fasteners for electronic circuitry, or break-away energy-absorbing fasteners for vehicles in crashes.

B86-10298
ACOUSTIC TRANSLATION OF AN ACOUSTICALLY LEVITATED SAMPLE
M. B. BARMATZ (Caltech) and J. L. ALLEN (Caltech)
May 1986
NPO-16675 **Vol. 10, No. 3, P. 144**

Acoustic-levitation apparatus uses only one acoustic mode to move sample from one region of chamber to another. Sample heated and cooled quickly by translation between hot and cold regions of levitation chamber. Levitated sample is raised into furnace region by raising plunger. Frequency of sound produced by transducers adjusted by feedback system to maintain (102) resonant mode, which levitates sample midway between transducers and plunger regardless of plunger position.

B86-10299
ACOUSTIC LEVITATOR MAINTAINS RESONANCE
M. B. BARMATZ (Caltech) and M. S. GASPAR (Caltech)
May 1986
NPO-16649 **Vol. 10, No. 3, P. 145**

Transducer loading characteristics allow resonance tracked at high temperature. Acoustic-levitation chamber length automatically adjusted to maintain resonance at constant acoustic frequency as temperature changes. Developed for containerless processing of materials at high temperatures, system does not rely on microphones as resonance sensors, since microphones are difficult to fabricate for use at temperatures above 500 degrees C. Instead, system uses acoustic transducer itself as sensor.

B86-10300
XENON-ION DRILLING OF TUNGSTEN FILMS
C. E. GARNER (Caltech)
May 1986
NPO-16626 **Vol. 10, No. 3, P. 145**

High-velocity xenon ions used to drill holes of controlled

size and distribution through tungsten layer that sheaths surface of controlled-porosity dispenser cathode of traveling wave-tube electron emitter. Controlled-porosity dispenser cathode employs barium/calcium/ aluminum oxide mixture that migrates through pores in cathode surface, thus coating it and reducing its work function. Rapid, precise drilling technique applied to films of other metals and used in other applications where micron-scale holes required. Method requires only few hours, as opposed to tens of hours by prior methods.

B86-10301
LASER CUTTING OF THIN NICKEL BELLOWS
C. L. BUTLER (Rockwell International Corp.)
May 1986
MFS-29133 **Vol. 10, No. 3, P. 146**

Laser cutting technique produces narrow, precise, fast, and repeatable cuts in thin nickel-allow bellows material. Laser cutting operation uses intense focused beam to melt material and assisting gas to force melted material through part thickness, creating void. When part rotated or moved longitudinally, melting and material removal continuous and creates narrow, fast, precise, and repeatable cut. Technique used to produce cuts of specified depths less than material thickness. Avoids distortion, dents, and nicks produced in delicate materials during lathe trimming operations, which require high cutting-tool pressure and holding-fixture forces.

B86-10302
THEORETICAL FOUNDATION FOR WELD MODELING
S. TRAUGOTT (Martin Marietta Corp.)
May 1986
MFS-27095 **Vol. 10, No. 3, P. 147**

Differential equations describe physics of tungsten/inert-gas and plasma-arc welding in aluminum. Report collects and describes necessary theoretical foundation upon which numerical welding model is constructed for tungsten/inert gas or plasma-arc welding in aluminum without keyhole. Governing partial differential equations for flow of heat, metal, and current given, together with boundary conditions relevant to welding process. Numerical estimates for relative importance of various phenomena and required properties of 2219 aluminum included

B86-10340
PROGRAM FOR HEAT FLOW IN WELDING
A. C. NUNES, JR. and M. GRAHAM
Jul. 1986
MFS-28081 **Vol. 10, No. 4, P. 74**

Program contains numerical model of temperature distribution in vicinity of weld. Weld model used to produce estimated welding-power requirements, welding-power-loss analysis, heat-affected-zone temperature history, and weld-puddle cross-section plots. Applied to gas/tungsten-arc, plasma-arc, electron-beam, and laser-beam welds on wide plates under steady conditions. User predicts power requirements and temperature distributions. Weld model written in BASIC.

B86-10384
TELESCOPING SPACE-STATION MODULES
R. D. WITCOFSKI
Jul. 1986
LAR-13330 **Vol. 10, No. 4, P. 112**

New telescoping-space-station design involves module within a module. After being carried to orbit within payload bay of Space Shuttle orbiter, outer module telescopically deployed to achieve nearly twice as much usable space-station volume per Space Shuttle launch. Closed-loop or 'race-track' space-station configurations possible with this concept and provide additional benefits. One benefit involves making one of modules double-walled haven safe from debris, radiation, and like. Module accessible from either end, and readily available to all positions in space station. Concept also provides flexibility in methods in which Space Shuttle orbiter docked or berthed with space station and decrease chances of damage.

B86-10385
THERMAL-STRESS-FREE FASTENERS FOR ORTHOTROPIC MATERIALS
M. L. BLOSSER, R. R. MCWITHEY, and T. F. KEARNS (Institute for Defense Analyses)
Jul. 1986 See Also N84-13614/NSP
LAR-13325 **Vol. 10, No. 4, P. 113**

Theoretical basis for design of thermal-stress-free fasteners developed. Two-dimensional analysis defines shapes of interfaces between materials. Design technique determines fastener shapes that maintain tight thermal-stress-free joint while joint undergoes uniform temperature change.

B86-10386
MODULAR FIREWALLS FOR STORAGE AREAS
O. H. FEDOR and L. J. OWENS
Jul. 1986
KSC-11276 **Vol. 10, No. 4, P. 114**

Giant honeycomb structures assembled in modular units. Flammable materials stored in cells. Walls insulated with firebrick to prevent spread of fire among cells. Portable, modular barrier withstands heat of combustion for limited time and confines combustion products horizontally to prevent fire from spreading. Barrier absorbs heat energy by ablation and not meant to be reused. Designed to keep fires from spreading among segments of solid rocket propellant in storage, barrier erected between storage units of other flammable or explosive materials; tanks of petroleum or liquid natural gas. Barrier adequate for most industrial purposes.

B86-10387
FASTER EDGE-DEFINE SILICON-RIBBON GROWTH
R. RICHTER (Caltech)
Jul. 1986
NPO-16692 **Vol. 10, No. 4, P. 115**

End-cooling allows faster growth and yields single-crystal ribbons. Improvement in edge-defined film-fed process for growing silicon ribbons increases speed of growth and improves quality of silicon product. Also produces silicon sheets, webs, or boules. Cold shoes cool melt at ends of emerging sheet. Since solidification at ends now occurs before end menisci reach maximum height, ribbon drawn substantially faster.

B86-10388
LIGHTWEIGHT FORMS FOR EPOXY/ARAMID DUCTS
E. W. MIX (Rockwell International Corp.), A. N. ANDERSON (Rockwell International Corp.), and S. BEDFORD (Rockwell International Corp.)
Jul. 1986
MSC-20957 **Vol. 10, No. 4, P. 116**

Aluminum mandrels easy to remove. Lightweight aluminum mandrel for shaping epoxy/aramid ducts simplifies and speeds production. In new process, glass-reinforced epoxy/aramid cloth wrapped on aluminum mandrel. Stainless-steel flanges and other hardware fitted on duct and held by simple tooling. Entire assembly placed in oven to cure epoxy. After curing, assembly placed in alkaline bath dissolves aluminum mandrel in about 4 hours. Epoxy/aramid shell ready for use as duct. Aluminum mandrel used to make ducts of various inside diameters up to 6 in. Standard aluminum forms used. Conventional tube-bending equipment produces requisite curves in mandrels.

B86-10389
LOW-FLAMMABILITY PTFE FOR HIGH-OXYGEN ENVIRONMENTS
E. WALLE (Martin Marietta Corp.), B. FALLON (Martin Marietta Corp.), and A. SHEPPARD (Martin Marietta Corp.)
Jul. 1986
MFS-28127 **Vol. 10, No. 4, P. 117**

Modified forming process removes volatile combustible materials. Flammability of cable-wrapping tape reduced by altering tape-manufacturing process. In new manufacturing process, tape formed by proprietary process of screw extrusion, followed by washing in solvent and drying. Tape then wrapped as before. Spectrogram taken after extrusion, washing, and drying shows lower hydrocarbon content. PTFE formed by new process suited to oxygen-rich environments. Safe in liquid oxygen of Space Shuttle tank and in medical uses; thin-wall shrinkable tubing in hospital test equipment, surgical instruments, and implants.

B86-10390
JOINT FOR RAPID STRUCTURAL ASSEMBLY
M. D. RHODES
Jul. 1986
LAR-13489 **Vol. 10, No. 4, P. 117**

Quickly attaching joint used in variety of truss structures. Split ring made in one piece and split radially after final machining. Mating tapers on split ring and endbells small: approximately 7 degrees. Tapers of this range permit high internal preloads to be obtained, yet parts easily separated when collar released. Results from tests on developmental model indicate load-displacement response linear and substantial preloading accomplished. Quickly-erecting truss structures have variety of applications, from Earth to space-station keel beams, antenna masts, and large platforms.

B86-10391
WELDING AND BRAZING SILICON CARBIDE
T. J. MOORE
Jul. 1986
LEW-14251 **Vol. 10, No. 4, P. 118**

Hot isostatic pressing and conventional furnace brazing effective under right conditions. Study performed showed feasibility of welding SiC using several welding and brazing techniques. Use of SiC improves engine efficiency by allowing increase in operating temperature. SiC successfully hot-pressure-welded at 3,550 degrees F (1,950 degrees C) in argon. Refinements of solid-state welding and brazing procedures used sufficient for some specific industrial applications.

B86-10392
MAKING A LIGHTWEIGHT BATTERY PLAQUE
M. A. REID, R. E. POST, and D. SOLTIS
Jul. 1986 See Also N84-32357/NSP
LEW-13349 **Vol. 10, No. 4, P. 119**

Plaque formed in porous plastic by electroless plating. Lightweight plaque prepared by electroless plating of porous plastic contains embedded wire or expanded metal grid. Plastic may or may not be filled with soluble pore former. If it contains soluble pore former, treated to remove soluble pore former and increase porosity. Porous plastic then clamped into rig that allows plating solutions to flow through plastic. Lightweight nickel plaque used as electrode substrate for alkaline batteries, chiefly Ni and Cd electrodes, and for use as electrolyte-reservoir plates for fuel cells.

B86-10393
PRESSURE RIG FOR REPETITIVE CASTING
P. VASQUEZ and W. R. HUTTO
Jul. 1986
LAR-13485 **Vol. 10, No. 4, P. 120**

Equipment life increased by improved insulation. New design cuts time of preparation for casting from several days to about 1 hour. Savings due to elimination of lengthy heating and drying operations associated with preparation of ceramic mold. Quality of casting improved because moisture in cavity eliminated by use of insulating material, and more uniform pressure applied to process. Commercial blanket insulator protects components from heat, increasing life of pressure rig and enabling repeated use. Improved heat protection allows casting of brass and other alloys with higher melting temperatures in pressure rig.

B86-10394
AUTOMATIC-CONTROL SYSTEM FOR SAFER BRAZING
J. A. STEIN (Rockwell International Corp.) and M. A. VANASSE (Rockwell International Corp.)
Jul. 1986
MSC-20881 **Vol. 10, No. 4, P. 121**

Automatic-control system for radio-frequency (RF) induction brazing of metal tubing reduces probability of operator errors, increases safety, and ensures high-quality brazed joints. Unit combines functions of gas control and electric-power control. Minimizes unnecessary flow of argon gas into work area and prevents electrical shocks from RF terminals. Controller will not allow power to flow from RF generator to brazing head unless work has been firmly attached to head and has actuated micro-switch. Potential shock hazard eliminated. Flow of argon for purging and cooling must be turned on and adjusted before brazing power applied. Provision ensures power not applied prematurely, causing damaged work or poor-quality joints. Controller automatically turns off argon flow at conclusion of brazing so potentially suffocating gas does not accumulate in confined areas.

B86-10395
COATING CIRCUIT BOARDS WITH SILICONE
S. GAUDIANO
Jul. 1986
MSC-21020 **Vol. 10, No. 4, P. 121**

Techniques appropriate to boards containing CMOS circuits detailed. Document presents procedure for applying thin conformal coating to such electronic assemblies as printed-circuit boards and wire-wrapped boards. Coating is from 1 to 7 mils (25 to 178 micrometers) thick and composed of room-temperature-vulcanizing (RTV) silicone. Specifies materials, equipment, spraying method, and quality requirements. Takes into account special needs of circuits made with complementary metal-oxide/semiconductor (CMOS) devices on circuit boards. Special attention given to preventing damage by electrostatic discharge, to which CMOS circuits especially sensitive.

B86-10396
INVESTING IN A LARGE STRETCH PRESS
M. CHOATE (Boeing Aerospace Co.), W. NEALSON (Boeing Aerospace Co.), G. JAY (Boeing Aerospace Co.), and W. BUSS (Boeing Aerospace Co.)
Jul. 1986
MFS-27126 **Vol. 10, No. 4, P. 122**

Press for forming large aluminum parts from plates provides substantial economies. Study assessed advantages and disadvantages of investing in large stretch-forming press, and also developed procurement specification for press.

B86-10397
EXPLOITING THE VACUUM OF SPACE
R. J. NAUMANN
Jul. 1986
MFS-28139 **Vol. 10, No. 4, P. 122**

Molecular-beam epitaxy and other processes tested with minimal contamination. Vacuum experimental facility for outer space creates vacuums higher than those available in terrestrial vacuum chambers. Facility minimizes contamination of work from walls and allows rapid removal of gases and heat generated by experimental processes. Used for processes such as molecular-beam epitaxy (growing semiconductor superlattices), metal-organic chemical vapor deposition, coating mirrors and other optical components, and ultrapurification.

B86-10398
PHYSICS OF FUSION WELDING
J. NUNES, A.C.
Jul. 1986 See Also N86-11473/NSP
MFS-27138 **Vol. 10, No. 4, P. 123**

Applicabilities and limitations of three techniques ana-

lyzed. NASA technical memorandum discusses physics of electron-beam gas/tungsten-arc, and laser-beam welding. From comparison of capabilities and limitations of each technique with regard to various welding conditions and materials, possible to develop criteria for selecting best welding technique in specific application. All three techniques classified as fusion welding; small volume of workpiece melted by intense heat source. Heat source moved along seam, leaving in wake solid metal that joins seam edges together.

B86-10399
PROPERTIES OF VPPA-WELDED 2219-T87 ALUMINUM
W. WILSON and W. A. JEMIAN (Auburn University)
Jul. 1986
MFS-27105 **Vol. 10, No. 4, P. 123**

Metallurgical properties and effects of welding described. Report describes investigation of welding of 2219-T87 aluminum alloy by variable-polarity plasma-arc (VPPA) process. Research was to determine highest strength attainable with this alloy and process and to estimate changes in weld properties caused by variations of process controls. Alloy 2219 strong and heat treatable and retains structural integrity up to 600 degrees F (316 degress C). Is principal structural alloy of Space Shuttle external tank. VPPA process offers many advantages and replaces tungsten/inert-gas process used. In over 24,000 in. (610 m) of welds on tank, there has been no internal defect requiring manual repair.

B86-10400
DEPLOYABLE CONSTRUCTION PLATFORM
R. M. GATES (Boeing Aerospace Co.) and K. P. HERNLEY (Boeing Aerosspace Co.)
Jul. 1986
MFS-28117 **Vol. 10, No. 4, P. 124**

Structure folds compactly for transportation but opens into large work and storage area. Platform central location for building structures, storing equipment and parts, and servicing and checking out space vehicles. Provides electrical power, lighting, and tools. Developed for use on space station, includes folding structural parts adaptable to portable or field-assembled terrestrial structures.

B86-10471
MAKING HIGHLY PURE GLASS RODS
R. J. NAUMANN
Sep. 1986
MFS-28090 **Vol. 10, No. 5, P. 118**

Proposed quasi-containerless method for making glass rods or fibers minimizes contact between processing equipment and product. Method allows greater range of product sizes and shapes than achieved in experiments on containerless processing. Molten zone established in polycrystalline rod. Furnace sections separated, and glass rod solidifies between them. Clamp supports solid glass as it grows in length. Pulling clamp rapidly away from melt draws glass fiber. Fiber diameter controlled by adjustment of pulling rate.

B86-10472
IMPROVED JOINT DESIGN FOR BOX-STIFFENED PANELS
R. C. DAVIS and P. L. MOSES (PRC Kentron, Inc.)
Sep. 1986 See Also N85-33537/NSP
LAR-13460 **Vol. 10, No. 5, P. 119**

Mass and strength analyses and system requirements identified titanium-box-stiffened-skin wall candidate for lightweight fuselage of pressurized vehicle. Photoelastic models of stiffener-to-skin joint used to identify quickly modifications to joint that lowers severity of stress concentration. Results with various photoelastic models cut from polyurethane sheet led to novel diffusion-bond joint with reduced stress concentration.

B86-10473
SMOOTHER SCRIBING OF SILICON WAFERS
S. DANYLUK (University of Illinois for Caltech)
Sep. 1986
NPO-16568 **Vol. 10, No. 5, P. 120**

Proposed new tool used to scribe silicon wafers into chips more smoothly than before. New scriber produces surface that appears ductile. Scribed groove cuts have relatively smooth walls. Scriber consists of diamond pyramid point on rigid shaft. Ethanol flows through shaft and around point, like ink in ballpoint pen. Ethanol has significantly different effect for scribing silicon than water, used in conventional diamond scribers.

B86-10474
ROBOTIC VISION FOR WELDING
R. W. RICHARDSON (Ohio State University Research Foundation)
Sep. 1986
MFS-27119 **Vol. 10, No. 5, P. 121**

Vision system for robotic welder looks at weld along axis of welding electrode. Gives robot view of most of weld area, including yet-unwelded joint, weld pool, and completed weld bead. Protected within welding-torch body, lens and fiber bundle give robot closeup view of weld in progress. Relayed to video camera on robot manipulator frame, weld image provides data for automatic control of robot motion and welding parameters.

B86-10475
FLEXIBLE DIAPHRAGM WITHSTANDS EXTREME TEMPERATURES
G. LERMA (Rockwell International Corp.)
Sep. 1986
MSC-20797 **Vol. 10, No. 5, P. 122**

Diaphragm seal retains flexibility throughout temperature range of -200 to +600 degree F (-129 to +316 degree C). Diaphragm durable, simple, versatile, and relatively inexpensive to manufacture. Suitable for refrigeration seals, autoclaves, storage lockers, and other sealing applications subjected to extreme temperature differentials.

B86-10476
REPAIRING FOAM INSULATION
J. CORBIN (Martin Marietta Corp.) and D. BURAS (Martin Marietta Corp.)
Sep. 1986
MFS-28109 **Vol. 10, No. 5, P. 123**

Large holes in polyurethane foam insulation repaired reliably by simple method. Little skill needed to apply method, used for overhead repairs as well as for those in other orientations. Plug positioned in hole to be filled and held in place with mounting fixture. Fresh liquid foam injected through plug to bond it in place. As foam cures and expands, it displaces plug outward. Protrusion later removed.

B86-10477
LIQUID-DOPANT FABRICATION OF SOLAR CELLS
P. ALEXANDER, JR. (Caltech) and R. B. CAMPBELL (Westinghouse Corp.)
Sep. 1986
NPO-16652 **Vol. 10, No. 5, P. 124**

Liquid dopants and liquid masks used to produce front and back junctions of solar cells. Resulting cells equal in efficiency to those fabricated by more-expensive gaseous-diffusion technique.

B86-10478
DEVELOPMENT OF GRAPHITE/EPOXY CORNER FITTINGS
G. FAILE, R. HOLLIS, F. LEDBETTER, J. MALDONADO, J. SLEDD, J. STUCKEY, G. WAGGONER, and E. ENGLER
Sep. 1986 See Also N85-32147/NSP
MFS-27129 **Vol. 10, No. 5, P. 124**

Report documents development project aimed at improv-

ing design and load-carrying ability of complicated corner fitting for optical bench. New fitting made of graphite filaments in epoxy-resin matrix. Composite material selected as replacement for titanium because lighter and dimensions change little with temperature variations.

B86-10517
LIGHTWEIGHT, NESTING STRUTS
R. M. GATES (The Boeing Co.) and K. P. HERNLEY (The Boeing Co.)
Nov. 1986
MFS-28116 **Vol. 10, No. 6, P. 82**

Hollow cones easily assembled to form trusses. Struts made of graphite-fiber-reinforced epoxy resin tapered for stiffness and compact nesting for transportation. Developed for building large truss structures in space. Useful on Earth in small structures where great strength not required.

B86-10518
PRODUCING REFRACTORY MICROBALLOONS
M. C. LEE (Caltech), C. SCHILLING (Caltech), G. O. LADNER, JR. (Caltech), and T. WANG (Caltech)
Nov. 1986
NPO-16489 **Vol. 10, No. 6, P. 83**

Metals, ceramics, and glasses just some of possible raw materials. Key components of equipment for new microballoon fabrication process nozzle, crucible assembly, and drop tube. Recessed, conical inner orifice aids in producing uniform, symmetrical microballoons. All-graphite crucible assembly resistant to misalinement and cracks. Drop tube ensures timely solidification of microballoons used in fluidized-bed heat exchangers; as containers for hazardous materials; catalysts in chemical and pharmaceutical processes; solid fuel for rockets; fuel containers for fusion power experiments; shock-wave dampers; and starting materials for high-strength, low-density sintered alloys and ceramics.

B86-10519
LASER VACUUM FURNACE FOR ZONE REFINING
D. B. GRINER (Penn-Penn Research Corp.), F. W. ZURBURG (Penn-Penn Research Corp.), and W. M. PENN (Penn-Penn Research Corp.)
Nov. 1986
MFS-26043 **Vol. 10, No. 6, P. 84**

Laser beam scanned to produce moving melt zone. Experimental laser-vacuum furnace scans crystalline wafer with high-power CO2-laser beam to generate precise melt zone with precise control of temperature gradients around zone. Intended for zone refining of silicon or other semiconductors in low gravity, apparatus used in normal gravity.

B86-10520
STORING CHEMICALS IN PACKED SPHERES
T. G. WANG (Caltech) and D. D. ELLEMAN (Caltech)
Nov. 1986
NPO-16316 **Vol. 10, No. 6, P. 85**

Reactants released by crushing or puncturing. Agglomerated gas-filled spheres hexagonally close packed and sintered or glued together into rods strung together at ends. Rods fed into crushing machine to release material in spheres as needed.

B86-10521
MULTIFUNCTION VACUUM CHAMBER FOR IC METALLIZATION
D. E. ROUTH and G. SHARMA
Nov. 1986 See Also U.S. Patent No. 4,437,961
MFS-25670 **Vol. 10, No, 6, P. 86**

Vacuum system chamber processing multilayer metallization on integrated circuits (IC's) performs four operations ordinarily done in separated equipment. Chamber etches holes, removes photoresist, cleans by sputter etching, and deposits final layer of metal. Combined-function chamber costs less than separate equipment. Chamber avoids exposing integrated circuits to room air and, to oxidation and dust, between steps. Eliminates time spent in transferring circuits from one apparatus to next.

B86-10522
COVERING CAVITIES BY ELECTRODEPOSITION
M. SCHMEETS (Rockwell International Corp.) and J. DUESBERG (Rockwell International Corp.)
Nov. 1986
MFS-29084 **Vol. 10, No. 6, P. 87**

Reworking technique allows complex surfaces to be reshaped. Contours of large machined parts reworked quickly and inexpensively by electrodeposition and machining, with little risk of damage. Reworking method employs simple, reliable, well-known procedures.

B86-10523
LEVITATION WITH A SINGLE ACOUSTIC DRIVER
M. B. BARMATZ (Caltech), M. S. GASPAR (Caltech), and J. L. ALLEN (Caltech)
Nov. 1986
NPO-16246/NPO-16376 **Vol. 10, No. 6, P. 89**

Pair of reports describes acoustic-levitation systems in which only one acoustic resonance mode excited, and only one driver needed. Systems employ levitation chambers of rectangular and cylindrical geometries. Reports first describe single mode concept and indicate which modes used to levitate sample without rotation. Reports then describe systems in which controlled rotation of sample introduced.

09 MATHEMATICS AND INFORMATION SCIENCES

B86-10096
DERIVATIVES OF THE ARITHMETIC-GEOMETRIC MEAN
F. B. TATON (Engineering Analysis, Inc.)
Jun. 1986
MFS-26018 **Vol. 10, No. 1, P. 140**

Developed for theoretical studies of lightning requiring estimates of electric fields in clouds, the technique is expected to reduce computation time and improve accuracy.

B86-10159
SHADED-COLOR PICTURE GENERATION OF COMPUTER-DEFINED ARBITRARY SHAPES
J. V. COZZOLONGO, D. L. HERMSTAD (Informatics General Corp.), D. S. MCCOY (Informatics General Corp.), and J. CLARK (Silicon Graphics)
Jun. 1986
ARC-11496 **Vol. 10, No. 2, P. 107**

SHADE computer program generates realistic color-shaded pictures from computer-defined arbitrary shapes. Objects defined for computer representation displayed as smooth, color-shaded surfaces, including varying degrees of transparency. Results also used for presentation of computational results. By performing color mapping, SHADE colors model surface to display analysis results as pressures, stresses, and temperatures. NASA has used SHADE extensively in sign and analysis of high-performance aircraft. Industry should find applications for SHADE in computer-aided design and computer-aided manufacturing. SHADE written in VAX FORTRAN and MACRO Assembler for either interactive or batch execution.

B86-10193
SIMPLIFIED DECODING OF CONVOLUTIONAL CODES
T. K. TRUONG (Caltech) and I. S. REED (Caltech)
Jun. 1986
NPO-16514 **Vol. 10, No. 2, P. 146**

Some complicated intermediate steps shortened or eliminated. Decoding of convolutional error-correcting digital codes simplified by new errortrellis syndrome technique. In new technique, syndrome vector not computed. Instead, advantage taken of newly-derived mathematical identities simplify decision tree, folding it back on itself into form called 'error trellis.' This trellis graph of all path solutions of syndrome equations. Each path through trellis corresponds to specific set of decisions as to received digits. Existing decoding algorithms combined with new mathematical identities reduce number of combinations of errors considered and enable computation of correction vector directly from data and check bits as received.

B86-10194
REPORT ON COMPUTER PROGRAMS FOR ROBOTIC VISION
R. T. CUNNINGHAM (Caltech) and E. P. KAN (Caltech)
Jun. 1986
NPO-16565 **Vol. 10, No. 2, P. 146**

Collection of programs supports robotic research. Report describes computer-vision software library NASA's Jet Propulsion Laboratory. Programs evolved during past 10 years of research into robotics. Collection includes low- and high-level image-processing software proved in applications ranging from factory automation to spacecraft tracking and grappling. Programs fall into several overlapping categories. Image utilities category are low-level routines that provide computer access to image data and some simple graphical capabilities for displaying results of image processing.

B86-10247
GRAPHICS PROGRAMS FOR THE DEC VAX COMPUTER
D. LONG (Caltech)
May 1986
NPO-16666 **Vol. 10, No. 3, P. 86**

Variety of plots available in video or printed form. LONGLIB library of computer programs set of subroutines designed for vector plotting on cathode-ray tubes and dot-matrix printers. LONGLIB subroutines invoked by program calls similar to standard CALCOMP routines. In addition to basic plotting routines, LONGLIB contains extensive set of routines to allow viewport clipping, extended character sets, graphic input, gray-level plots, polar plots, and three-dimensional plotting with or without removal of hidden lines. LONGLIB written in FORTRAN 77 and C for batch execution.

B86-10248
COMPUTING BENEFITS AND COSTS FOR PROPULSION SYSTEMS
K. HAMLYN (Martin Marietta Denver Aerospace), R. ROBERTSON (Martin Marietta Denver Aerospace), and L. ROSE (Martin Marietta Denver Aerospace)
May 1986
LEW-14129 **Vol. 10, No. 3, P. 86**

Flexible computer model developed for evaluating benefits and costs of placing large space systems into operational orbits. Model contains performance envelopes of three primary propulsion systems for orbit transfer based on three low-thrust engines. Allows for any mission model to be input into program. Model also allows user to easily vary program to examine effects of various ratings and weighting of benefit parameters for baseline engines. Program written in FORTRAN IV for use on IBM 370 computer.

B86-10249
ANALYZING MULTIDIMENSIONAL IMAGE DATA
S. W. WHARTON
May 1986
GSC-12935 **Vol. 10, No. 3, P. 86**

Six computer programs perform histogram cluster analysis. Histogram cluster Analysis Procedure (HICAP) developed to perform unsupervised classification of multidimensional image data. Clustering approach used in HICAP based on algorithm which uses multidimensional histogram to perform unsupervised classification of four-dimensional Landsat multispectral-scanner data. HICAP generalizes this procedure to process up to 32-bit data with arbitrary number of dimensions. Also incorporates efficiency improvements so classification requires less computation than original algorithm. Computational savings afforded by HICAP increase with number of dimensions in data. HICAP programs written in FORTRAN 77 for batch or interactive execution.

B86-10250
HIGH-LEVEL DATA-ABSTRACTION SYSTEM
P. A. FISHWICK (Kentron International, Inc.)
May 1986
LAR-13244 **Vol. 10, No. 3, P. 88**

Communication with data-base processor flexible and efficient. High Level Data Abstraction (HILDA) system is three-layer system supporting data-abstraction features of Intel data-base processor (DBP). Purpose of HILDA establishment of flexible method of efficiently communicating with DBP. Power of HILDA lies in its extensibility with regard to syntax and semantic changes. HILDA's high-level query language readily modified. Offers powerful potential to computer sites where DBP attached to DEC VAX-series computer. HILDA system written in Pascal and FORTRAN 77 for interactive execution.

B86-10251
CONSTANT-ELASTICITY-OF-SUBSTITUTION SIMULATION
G. REITER (Caltech)
May 1986
NPO-16524 **Vol. 10, No. 3, P. 88**

Program simulates constant elasticity-of-substitution (CES) production function. CES function used by economic analysts to examine production costs as well as uncertainties in production. User provides such input parameters as price of labor, price of capital, and dispersion levels. CES minimizes expected cost to produce capital-uncertainty pair. By varying capital-value input, one obtains series of capital-uncertainty pairs. Capital-uncertainty pairs then used to generate several cost curves. CES program menu driven and features specific print menu for examining selected output curves. Program written in BASIC for interactive execution and implemented on IBM PC-series computer.

B86-10252
AN EXPERT-SYSTEM ENGINE WITH OPERATIVE PROBABILITIES
N. E. ORLANDO, M. T. PALMER, and R. S. WALLACE (Carnegie-Mellon University)
May 1986
LAR-13382 **Vol. 10, No. 3, P. 90**

Program enables proof-of-concepts tests of expert systems under development. AESOP is rule-based inference engine for expert system, which makes decisions about particular situation given user-supplied hypotheses, rules, and answers to questions drawn from rules. If knowledge base containing hypotheses and rules governing environment is available to AESOP, almost any situation within that environment resolved by answering questions asked by AESOP. Questions answered with YES, NO, MAYBE, DON'T KNOW, DON'T CARE, or with probability factor ranging from 0 to 10. AESOP written in Franz LISP for interactive execution.

B86-10303
DIGITAL FILTER SEPARATES SIGNAL FROM NOISE
W. M. LEAR (TRW, Inc.)
May 1986
MSC-20914 **Vol. 10, No. 3, P. 148**

Variance of signal-estimation error minimized. Mathematical technique extracts best estimates of signal component from periodic digital samples of signal plus noise.

Technique combines Kalmanand smoothingfilter algorithms to minimize mean-square estimation error based on past, present, and predicted samples of signal plus noise. Technique useful in image analysis and other applications involving processing of noisy signals.

B86-10304
ADAPTIVE QUANTIZER FOR BURST SYNTHETIC-APERTURE RADAR
T. H. JOO (Caltech), D. N. HELD (Caltech), R. L. JORDAN (Caltech), and F. K. LI (Caltech)
May 1986
NPO-16582 **Vol. 10, No. 3, P. 149**

Adaptive quantizer for burst-mode synthetic-aperture radar reduces data rate of return signal. Device, called block floating-point quantizer (BFPQ) basically analog-to-digital converter that covers wide dynamic range and discards appropriate lower order bits. BFPQ is, in effect, digital approximator with automatic gain control. Moves floating-point marker binary representation of signal data in accordance with perceived dynamic range. Available step sizes thus limited to multiples of underlying smallest quantization step (represented by lowest order bit). Retains only first K most significant bits of signal; (L,K) BFPQ is one that does K-bit quantization of signal originally quantized to L bits. Quantization error simply difference between actual signal level and its binary approximation. Other potential applications for BFPQ include speech compression and picture-data compression.

B86-10305
AUTONOMOUS ORBITAL CALCULATION FOR SATELLITES
K. D. MEASE (Caltech), M. S. RYNE (Caltech), and L. J. WOOD (Caltech)
May 1986
NPO-16532 **Vol. 10, No. 3, P. 150**

Onboard orbital navigation system reduces dependence on Earth-to-satellite links. Report discusses mathematics of proposed navigation subsystem that keeps geostationary satellite in proper orbit without ground control. Subsystem uses data from Earth and Sun sensors to activate thrusters for station-keeping maneuvers. With sensors already on satellites for determining attitude, subsystem maintains satellite within 3 degrees of specified equatorial longitude for up to 6 months. With more accurate sensors, subsystem able to maintain orbit within 0.1 degrees.

B86-10306
DECLUTTERING METHODS FOR COMPUTER-GENERATED GRAPHIC DISPLAYS
J. SCHULTZ, E.EUGENE (Caltech)
May 1986
NPO-16733 **Vol. 10, No. 3, P. 151**

Symbol simplification and contrasting enhance viewer's ability to detect particular symbol. Report describes experiments designed to indicate how various decluttering methods affect viewer's abilities to distinguish essential from nonessential features on computer-generated graphic displays. Results indicate partial removal of nonessential graphic features through symbol simplification effective in decluttering as total removal of nonessential graphic features.

B86-10341
PROGRAM FOR GENERATING GRAPHS AND CHARTS
C. T. ACKERSON
Jul. 1986
GSC-12925 **Vol. 10, No. 4, P. 74**

Office Automation Pilot (OAP) Graphics Database system offers IBM personal computer user assistance in producing wide variety of graphs and charts and convenient data-base system, called chart base, for creating and maintaining data associated with graphs and charts. Thirteen different graphics packages available. Access graphics capabilities obtained in similar manner. User chooses creation, revision, or chart-base-maintenance options from initial menu; Enters or modifies data displayed on graphic chart. OAP graphics data-base system written in Microsoft PASCAL.

B86-10342
SCANNING PROGRAM
W. C. MATTISON (OAO Corp.)
Jul. 1986
MSC-20904 **Vol. 10, No. 4, P. 76**

SCAN program uses scanning algorithm to locate tokens in line of input data. Tokens can be command words, numbers, data values, labels. Using SCAN subroutines, user extracts tokens from character strings in languages with simple or complex syntax. SCAN thoroughly tested and implemented in NASA's Descent Design System for Shuttle orbiter. SCAN useful for other programs requiring input scanning. SCAN written in FORTRAN 77.

B86-10343
COLLECTOR-OUTPUT ANALYSIS PROGRAM
D. R. GLANDORF (Lockheed Engineering and Management Services Co., Inc.) and R. F. PHILLIPS, JR. (Lockheed Engineering and Management Services Co., Inc.)
Jul. 1986
MSC-20866 **Vol. 10, No. 4, P. 76**

Collector-Output Analysis Program (COAP) programmer's aid for analyzing output produced by UNIVAC collector (MAP processor). COAP developed to aid in design of segmentation structures for programs with large memory requirements and numerous elements but of value in understanding relationships among components of any program. Crossreference indexes and supplemental information produced. COAP written in FORTRAN 77.

B86-10344
LANGUAGE AND PROGRAM FOR DOCUMENTING SOFTWARE DESIGN
H. KLEINE (Caltech) and T. M. ZEPKO (Caltech)
Jul. 1986
NPO-16511 **Vol. 10, No. 4, P. 76**

Software Design and Documentation Language (SDDL) provides effective communication medium to support design and documentation of complex software applications. SDDL supports communication among all members of software design team and provides for production of informative documentation on design effort. Use of SDDL-generated document to analyze design makes it possible to eliminate many errors not detected until coding and testing attempted. SDDL processor program translates designer's creative thinking into effective document for communication. Processor performs as many automatic functions as possible, freeing designer's energy for creative effort. SDDL processor program written in PASCAL.

B86-10345
FITTING POLYNOMIAL EQUATIONS TO CURVES AND SURFACES
P. D. ARBUCKLE, S. M. SLIWA, and S. H. TIFFANY
Jul. 1986
LAR-13457 **Vol. 10, No. 4, P. 78**

FIT is computer program for interactively determining least-squares polynomial equations that fit user-supplied data. Finds leastsquares fits for functions of two independent variables. Interactive graphical and editing capabilities in FIT enables user to control polynomial equations to be fitted to data arising from most practical applications. FIT written in FORTRAN and COMPASS.

B86-10346
STRUCTURED DESIGN LANGUAGE FOR COMPUTER PROGRAMS
W. H. PACE, JR. (TRW, Inc.)
Jul. 1986
MSC-20917 **Vol. 10, No. 4, P. 78**

Box language used at all stages of program develop-

ment. Developed to provide improved productivity in designing, coding, and maintaining computer programs. BOX system written in FORTRAN 77 for batch execution.

B86-10347
WORKSPACE PROGRAM FOR COMPLEX-NUMBER ARITHMETIC
M. C. PATRICK and J. HOWELL, LEONARDW.
Jul. 1986
MFS-28111 **Vol. 10, No. 4, P. 78**

COMPLEX is workspace program designed to empower APL with complex-number capabilities. Complex-variable methods provide analytical tools invaluable for applications in mathematics, science, and engineering. COMPLEX written in APL.

B86-10348
ESTIMATING PRICES OF PRODUCTS
R. W. ASTER (Caltech), R. G. CHAMBERLAIN (Caltech), S. C. ZENDEJAS (Caltech), T. S. LEE (Caltech), and S. MALHOTRA (Caltech)
Jul. 1986
NPO-16583 **Vol. 10, No. 4, P. 79**

Company-wide or process-wide production simulated. Price Estimation Guidelines (IPEG) program provides simple, accurate estimates of prices of manufactured products. Simplification of SAMIS allows analyst with limited time and computing resources to perform greater number of sensitivity studies. Although developed for photovoltaic industry, readily adaptable to standard assembly-line type of manufacturing industry. IPEG program estimates annual production price per unit. IPEG/PC program written in TURBO PASCAL.

B86-10401
FUNCTION-KEYPAD TEMPLATE FILER
P. A. HEADLEY (Caltech)
Jul. 1986
NPO-16676 **Vol. 10, No. 4, P. 126**

Each page of filer shows various keypad designations corresponding to variety of software packages. Filer has various templates bound together so they are indexed easily and stand up for ready viewing. Template filers are made of inexpensive materials. Templates of various manufacturers can be added in pages appropriately die cut to receive them. Microcomputer operators using variety of software packages assisted by simple filer that illustrates various keyboard functions corresponding to different software packages. Keyboard functions change, depending on selected software. Filer has set of templates showing keyboard functions for various software packages. Templates set up quickly as desktop references to key functions.

B86-10402
SOLVING NONLINEAR COUPLED DIFFERENTIAL EQUATIONS
L. MITCHELL (Virginia Polytechnical Institute) and J. DAVID (Virginia Polytechnical Institute)
Jul. 1986
LEW-14165 **Vol. 10, No. 4, P. 127**

Harmonic balance method developed to obtain approximate steady-state solutions for nonlinear coupled ordinary differential equations. Method usable with transfer matrices commonly used to analyze shaft systems. Solution to nonlinear equation, with periodic forcing function represented as sum of series similar to Fourier series but with form of terms suggested by equation itself.

B86-10403
ECONOMIC COMPARISON OF PROCESSES USING SPREADSHEET PROGRAMS
J. F. FERRALL (Caltech), A. W. PAPPANO (Caltech), and C. N. JENNINGS (Caltech)
Jul. 1986
NPO-16660 **Vol. 10, No. 4, P. 128**

Inexpensive approach aids plant-design decisions. Commercially available electronic spreadsheet programs aid economic comparison of different processes for producing particular end products. Facilitates plantdesign decisions without requiring large expenditures for powerful mainframe computers.

B86-10404
COMPUTER PROGRAM TO TRANSLITERATE INTO ARABIC
E. STEPHAN
Jul. 1986
KSC-11342 **Vol 10, No. 4, P. 135**

Conceptual program for TRS-80, Model 12 (or equivalent) computer transliterates from English letters of computer keyboard to Arabic characters in output of associated printer. Program automatically changes character sequence from left-to-right of English to right-toleft of Arabic.

B86-10405
LARGER CONVERGENCE ZONES FOR NEWTON'S METHOD
C. W. CAMPBELL
Jul. 1986 See Also N85-28656/NSP
MFS-27124 **Vol. 10, No. 4, P. 135**

Iterative technique applies over wider range of initial guesses. New theorem describes convergence zone of Newton's iterative method for finding zeros of real function. Involves two points, Xp and Xp*, called primary conjugate points. If exact solution lies between these points (Xp is less than Xz is less than Xp*) and no other conjugate points in interval, then according to theorem, subsequent iterations will converge upon exact solution if initial guess lies in interval.

B86-10406
FIVE-PARAMETER BIVARIATE PROBABILITY DISTRIBUTION
J. TUBBS, D. BREWER, and O. W. SMITH
Jul. 1986 See Also N84-15866/NSP
MFS-27061 **Vol. 10, No. 4, P. 136**

NASA technical memorandum presents four papers about five-parameter bivariate gamma class of probability distributions. With some overlap of subject matter, papers address different aspects of theories of these distributions and use in forming statistical models of such phenomena as wind gusts. Provides acceptable results for defining constraints in problems designing aircraft and spacecraft to withstand large wind-gust loads.

B86-10407
CODES WITH PARITY CONDITIONS ON SUBSETS OF COORDINATES
E. POSNER (Caltech) and Z. REICHSTEIN (Caltech)
Jul. 1986
NPO-16572 **Vol. 10, No. 4, P. 138**

New theorems aid search for efficient code alphabets. Paper discusses theory of finding largest binary codes 2k bits in length, in which all words differ from each other in at least d places and in which words truncated by ignoring certain subsets of bit positions belong to shorter linear codes.

B86-10479
ESTIMATING WALL-INDUCED VELOCITIES IN WIND TUNNELS
E. T. SCHAIRER
Sep. 1986
ARC-11586 **Vol. 10, No. 5, P. 125**

Estimates of wall effects in two-dimensional wind tunnel obtained using upwash measurements on two contours near test model. Method derived from combination of prior techniques that correct for wall effects. Improved method limited to flows described by linear equations. Method accurately predicted wall-induced velocities along centerline of theoretical wind tunnel and confirmed that wall adjustments substantially reduced wall interference.

B86-10503
NASA TEST FILE
S. GORDON
Nov. 1986
GSC-12988 **Vol. 10, No.6, P. 61**

Test File is data file containing computer-aided design (CAD) data formatted according to National Bureau of Standards Initial Graphic Exchange Specification (IGES). File created for purpose of conducting NASA tests to determine to what extent dissimilar CAD systems exchange data using the IGES standard formats and IGES translators.

B86-10524
MULTIPLE GRIDS IN FINITE-DIFFERENCE FLOW ANALYSIS
F. C. DOUGHERTY, J. L. STEGER (Stanford University), and J. A. BENEK (Calspan Corp.)
Nov. 1986
ARC-11491 **Vol. 10, No. 6, P. 90**

Multiple solutions superimposed to resolve flows about complex configurations. Use of multiple, overset grids in computational fluid dynamics extends application of finite-difference methods to more complex configurations. Rather than trying to generate single mesh about all components of configuration, multiple, individual meshes used, then overset on major grid. Major grid used to resolve flow field or wrapped around main component.

B86-10525
'NOISELESS' DATA-COMPRESSION ALGORITHM
R. F. RICE (Caltech) and J. J. LEE (Caltech)
Nov. 1986 See Also N85-35219/NSP
NPO-16712 **Vol. 10, No. 6, P. 92**

Gamma-ray spectrometer data compressed to enable more frequent sampling. Proposed data-compression algorithm efficiently represents gamma-ray spectrometer spectra at any spectrum collection interval from 5 seconds to 5 minutes. Data representations 'noiseless' (Data exactly constructed). Techniques useful in designing data-compression algorithms for other spectral instruments, which have varying data-rate requirements.

B86-10532
PROGRAM FOR EXPERIMENTATION WITH EXPERT SYSTEMS
S. W. ENGLE (Informatics General Corp.)
Nov. 1986
ARC-11688 **Special Edition, P. 40**

CERBERUS is forward-chaining, knowledge-based system program useful for experimentation with expert systems. Inference-engine mechanism performs deductions according to user-supplied rule set. Information stored in intermediate area, and user interrogated only when no applicable data found in storage. Each assertion posed by CERBERUS answered with certainty ranging from 0 to 100 percent. Rule processor stops investigating applicable rules when goal reaches certainty of 95 percent or higher. Capable of operating for wide variety of domains. Sample rule files included for animal identification, pixel classification in image processing, and rudimentary car repair for novice mechanic. User supplies set of end goals or actions. System complexity decided by user's rule file. CERBERUS written in FORTRAN 77.

B86-10533
LISTING RELATIONSHIPS AMONG SUBROUTINES
C. GUEST (Informatics General Corp.)
Nov. 1986
ARC-11609 **Special Edition, P. 41**

HIERARCHY program is tool that assists users in obtaining information about relationships among subroutines in computer program. HIERARCHY written in FORTRAN 77.

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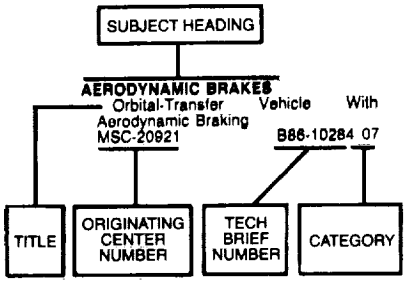

The title of each Tech Brief is listed under several selected subject headings to provide the user with a variety of approaches in his search for specific information. The Tech Brief number, e.g., B86-10284, is located under and to the right of the title and is followed by a two-digit number, e.g., 07, which designates the subject category in which the entire entry can be found.

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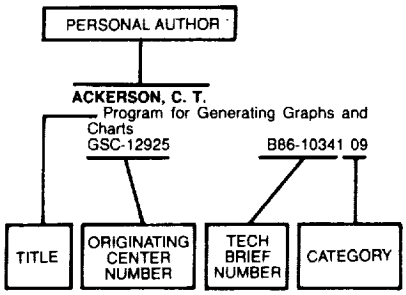

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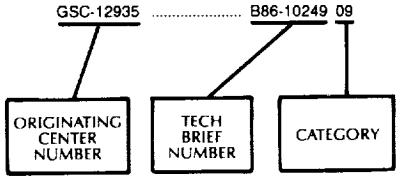

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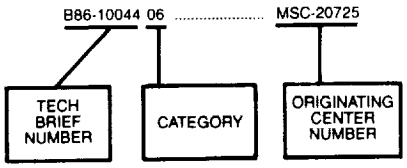

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