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Remotely Piloted Vehicles
1974-July, 1980
(Citations from the International Aerospace Abstracts Data Base)

New Mexico Univ.
Albuquerque

Prepared for
National Technical Information Service
Springfield, VA

Sep 80
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Sep 80
Samuel C. Mauk.

New Mexico Univ., Albuquerque. Technology Application Center.

National Technical Information Service, Springfield, VA.

Report period covered: Rept. for 1974-Jul 80


These citations from the international literature cover various aspects of remotely piloted vehicles. Included are articles concerning aircraft design, flight tests, aircraft control, cost effectiveness, automatic flight control, automatic pilots, and data links. Civil aviation applications are included, although military uses of remotely piloted vehicles are stressed. (This updated bibliography contains 224 citations, 43 of which are new additions to the previous edition.)

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Sample Citation from the IAA Data Base

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<tr>
<td>78A23667</td>
<td>Electrical Properties and Conduction Mechanisms of Ru-Based Thick-Film Cermet Resistors</td>
<td>A/Pike, G. E.; B/Seager, C. H.</td>
<td>Journal of Applied Physics, Vol. 48, Dec. 1977, p 5152-5159. 18 pages.</td>
<td>ABS an investigation is made of the electrical condition mechanisms in thick-film (cermet) resistors based on ruthenium. The temperature dependence of conductance, measured from 1.2-400 K, shows a significant decrease in conductance at low temperatures and a shallow maximum of several hundred kelvin. The reversible conductance as a function of electric field from 0-28 KV/CM is also considered. Electrical transport properties are evaluated for metal oxide particles extracted from fired resistors. Attention is given to various conduction mechanism models uniform, uniform channel, nontunneling barrier, and tunneling barrier model. Based on these results, a refined tunnel barrier model is developed and compared to experimental results.</td>
<td><em>Cermets</em>/Electrical Resistivity*/Metal Oxides*/Resistors*/Ruthenium*/Thick Films</td>
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SUBJECT TERMS
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BOA29671
UTTL: Design and test of mini-RPV demonstrator engines
ABS: The design and testing of three 15-kW (nominal), two-cylinder, two-stroke demonstrator engines for use on mini-RPV aircraft are discussed. The objective is to develop the technological base for engines in the 15-kW class so that they would be available for RPVs as they enter engineering development. Specific goals of the mini-RPV demonstrator engine program are defined. Test results show that changes are required to improve reliability, reliability, and maintainability. Test results for performance, altitude, noise, hot and cold starts, and electromagnetic interference are discussed.
MAJS: */AIRCRAFT ENGINES/ENGINE DESIGN/ENGINE TESTS/*LIGHT AIRCRAFT/*REOELY PILOTED VEHICLES

BOA29670
UTTL: RPV aeronautical and support system Supporting Technology Programs
AUTH: A/SIAHTON, R. O.: B/SMITH, G. N.
ABS: The paper discusses the six programs of the aeronautical and support systems area of the RPV Supporting Technology Program (STP). This program has three major areas: aeronautical and support systems: electro-optical systems; and data link and command systems. The six programs discussed concern propulsion, recovery systems, launch systems, fabrication techniques, servosystems, and propulsion. It is suggested that the STP will continue to be a valuable source of technology for future RPV systems.
MAJS: */AERONAUTICAL ENGINEERING/*REOELY PILOTED VEHICLES /*SUPPORT SYSTEMS

BOA29669
UTTL: Mini-RPV technology development
ABS: The paper discusses the Mini-RPV Research and Development Program intended to develop RPV technology at a low cost. The discussion covers the program background, aircraft design concepts, structural and system technology, avionic activities, vehicle recovery, and target strike investigations. Every attempt has been made to achieve acceptable performance at minimum cost. This program, begun several years ago, has resulted in the development of appropriate technology which has significantly helped in the positive display of total system capability.
MAJS: */AIRCRAFT DESIGN/AIRPLANE PRODUCTION COSTS/*REOELY PILOTED VEHICLES/*RESEARCH AND DEVELOPMENT

BOA29668
UTTL: Use of a simulator in the development of a RPV system
AUTH: A/HELOREN, N. J.
ABS: The concept of an RPV system simulator is being employed currently for SUPERVISOR, a medium-range surveillance and target acquisition system being developed for the British Army. The system uses a remotely piloted helicopter which carries an imaging sensor and is capable of relaying in real time the observation scene on the ground below to a ground control station. Attention is given to the aims and design of the SUPERVISOR System simulator. Care must be exercised that the use of the simulator is appropriate to the outputs required; otherwise, not only is the system itself likely to suffer but the credibility of the simulator to the topics it was designed to examine will also be questioned.
MAJS: */AIRCRAFT CONTROL/*COMPUTERIZED DESIGN/*CONTROL SIMULATION/*REOELY PILOTED VEHICLES/*SYSTEMS ENGINEERING/*TARGET ACQUISITION

BOA29666
UTTL: Antennas for RPV's
AUTH: A/WILLIAMS, N.; B/WRIGHT, P.; C/KEEN, K.; D/FOSTER, P. R.
ABS: Various antennas used in mini-RPV experiments are reviewed, and the development of a microwave antenna system for a secure data link is described. Considering antennas for an 1-band data link, coverage requirements for a vertically polarized antenna system
are summarized, and attention is given to the short range antenna. It is concluded that several antennas are needed to obtain acceptable performance and that throwing tips offered the best sites since they introduced the least obscuration.

**MAJS:** /AIRCRAFT ANTENNAS/*MICROWAVE ANTENNAS/*REMTELY PILOTED VEHICLES

**UTTL:** Real time infra red reconnaissance for RPV's

**AUTH:** A/ARIBTHNOTT, J.


**ABS:** Infrared linescan systems for airborne surveillance by remotely piloted vehicles are described, which are suitable for day and night military use as well as civil applications such as the detection of oil slicks on the observation of areas along overland pipelines. An optical system with a small infrared sensitive detector at the focus is used to scan the ground by revolving a mirror at high speed: performance of such a system includes resolution of 1.5 milliradians and sensitivity better than 0.25 C. The use of an airborne real time display or real time transmission to a display in a ground station is also discussed, for which either dry processed paper recorders or an entirely electronic display system may be utilized.

**MAJS:** /AERIAL RECONNAISSANCE/*/INFRARED SCANNERS/*REMOTE SENSORS/*REMTELY PILOTED VEHICLES

**UTTL:** Stabilized surveillance payloads

**AUTH:** A/SCHASCHK, E. G.


**ABS:** Stabilized sighting systems providing navigational assistance for remotely piloted vehicles are discussed, which use a directly coupled gyro/mirror technique with a charge injection device camera. Two methods of sightline stabilization are considered: mirror stabilization, which utilizes gyro precession from torques; and direct point stabilization, wherein a solid state TV camera is mounted to the inner gimbal of a two degree of freedom gyro with the sightline parallel to the spin axis. Also considered are payloads such as the laser module, which is appropriate either for target designation or range finding, and a simple surveillance system consisting of a solid state camera mounted to a gyro gimbal system.

**MAJS:** /AERIAL RECONNAISSANCE/*/AIRBORNE EQUIPMENT/*/NAVIGATION AIDS/*/REMTELY PILOTED VEHICLES/*SURVEILLANCE

**UTTL:** The design and manufacture of a prototype cost-effective R.P.V. engine

**AUTH:** A/ALLCN, P. B.


**ABS:** A prototype lightweight (about 7 lb), high performance, economical 70 cc RPV engine useful for harassment cranes is described. This engine features rear disk valve induction and Schneuie porting, uses glow ignition to give more power by using methanol for fuel, and has an opposed twin cylinder layout with minimum cylinder stagger and an ultrashort stroke configuration; fuel consumption is 1.25 lb per hp per hour.

**MAJS:** /AIRCRAFT ENGINES/*ENGINE DESIGN/*PROTOTYPES/*REMTELY PILOTED VEHICLES

**UTTL:** Power units for mini RPV's

**AUTH:** A/SROHT, D. P.


**ABS:** Production engines suitable for mini remotely piloted vehicles (RPVs), having minimum bulk and weight for a given power output are discussed, including engines designed for chain saws, snowmobiles, and go-carts. Attention is given to the carburetor, exhaust and fuel systems, and the alternator. Typical specification for such future mini-RPV engines include: rated output at 6500-8000 rpm, BMEP at rating 75-80 ps1, specific fuel consumption at cruise condition better than 0.75 lb/bhp hr, and specific weight of a running engine, not including exhaust system, better than 1 lb/bhp.

**MAJS:** /AIRCRAFT ENGINES/*ENGINE DESIGN/*REMTELY PILOTED VEHICLES
80A29661

UTTL: Development, flight test and application of RPV control law concepts for microprocessor based computers

AUTH: AYCOOLEY, M.


ABS: The control laws developed for use in a relatively small, slow digital computer, that is, the microprocessor flight control system, are described and subsequent flight testing is discussed. Analysis of the digital system and the techniques used are described; these include small perturbation z-transform analysis and extensive six-degree-of-freedom simulation modelling. Attention is also given to the application of the control law concepts to future vehicles such as the NASA high-G maneuverable aircraft technology (HIMAT) vehicle, which was designed to investigate high-G maneuvering capability, and the Navy FIREBIRD, a multirole, multiuse supersonic aerial target.

MAJL- ~/AIRCRAFT CONTROL/~/AIRCRAFT MANEUVERS/~/MICROPROCESSORS/~/REMOtELY PILOTED VEHICLES

80A29660

UTTL: Mini-RPV research

AUTH: A/COOLEY, M.; B/ROBINS, A. J.; C/FRARY, D. J.; D/STEEPHENSON, R.


ABS: The identification of aerodynamic derivatives (AOI) of a mini-remotely piloted research vehicles is considered, for which the extended Kalmann filter algorithm (Zuzlinski, 1980) is used for the extraction of airframe AOI from flight trial data. A 3-D simulation has been employed, and results indicate that the AOI in the pitch and roll planes can be identified using rate sensor measurements only, and that the yaw derivatives can be determined, provided lateral acceleration is measured.

MAJL- ~/AERODYNAMIC CHARACTERISTICS/~/AIRCRAFT CONTROL/~/REMOtELY PILOTED VEHICLES/~/RESEARCH AIRCRAFT

80A29659

UTTL: Aerofoils down to critical Reynolds numbers and the performance of remotely controlled gliders

AUTH: A/PATRICK, T. J.


ABS: The research into the aerofoil down to low lift/drag ratio with decreasing Reynolds numbers due to skin friction and separation. The critical behavior and supercritical improvement of profile drag coefficient are discussed, considering such wind tunnel results as the low-speed behavior of the Eppler (1985) 381 profile. It is found that there is a reduction of the lift/drag ratio available from aerofoils at low Re due to low incidence separation, causing a severe loss of C/Dmax with a large increase in form drag. In addition, the more intense shear of laminar boundary layers at relatively short distances from the aerofoil's leading edge means that skin friction drag coefficients are higher if Re is lower.

MAJL- ~/AERODYNAMIC CHARACTERISTICS/~/AIRCRAFT CONTROL/~/AIRFOIL PROFILES/~/GLIDERS/~/REMOtELY PILOTED VEHICLES/~/REYNOLDS NUMBER

80A29658

UTTL: RPV recovery systems

AUTH: A/Robert, A. C.; B/LY, J. D.; C/HEELE, T. G.


ABS: Recovery methods applicable for remotely piloted vehicles weighing between 100 and 400 lb with approach speeds of from about 50 to 100 kts are reviewed, including conventional landing (with and without arresting systems), parachutes (gliding and non-gliding types), net recovery (fixed and traveling nets), and wire engagement systems. In addition, included landing ramps, retrorockets and large pneumatic recovery cushions are considered. Attention is given to the necessary energy absorption devices, both the ground mounted systems such as drag chains and soft ground or gravel, and the airborne impact attenuation systems such as airbags, crushable structures, and parachute reel-in. It is concluded that the most economical methods are non-gliding parachutes and conventional landing, while net and arrester wire systems are effective but more expensive.

MAJL- ~/AIRCRAFT LANDING/~/RECOVERY/~/REMOtELY PILOTED VEHICLES/~/SYSTEMS ENGINEERING
80A29657
UTL: Parachute recovery systems. I - Parachute materials, applications and design. II - The recovery system as an integral part of vehicle design
AUTH: A/WHITE, B. W.; B/NORKEY, D.
ABS: Parachute recovery systems are discussed in terms of materials such as silk, spun bonded nylon, polyethylene, dacron, and woven nylon, and designs including conical, ribbon, shaped, flat and cruciform parachutes, the ring silet, and the ring sail. Attention is given to parachute deployment and inflation, taking into account the payload, the terminal velocity, and whether the parachute is for personnel or weapon retention. Integration of the parachute with the system is also discussed, and a comparison between a single parachute and a cluster is presented on the basis of performance, including system stability and the airspace needed to achieve terminal velocity.
MAJS: /*RECOVERY PARACHUTES*/REMOTELY PILOTED VEHICLES/* SYSTEMS ENGINEERING

80A29656
UTL: A low budget experimental RPV system
AUTH: A/SVILKHY, A. W.
ABS: An experimental remotely piloted vehicle system under consideration in Sweden is discussed, which uses a target drone and as much off-the-shelf avionics as possible. Attention is given to solid rocket booster launch, recovery via two stage parachute system, digital guidance and control, inertial navigation utilizing strapdown technology, and a terrain following system using a laser. Also considered are the engine, command and video links, the ground control station, and the testing program, including the loss factor.
MAJS: /*MILITARY TECHNOLOGY*/REMOTELY PILOTED VEHICLES/* SYSTEMS ENGINEERING

80A29655
UTL: VFW-Focke-concept for a ground-attack RPV
AUTH: A/SCHLENKIRCH, V.
ABS: System requirements for ground attack, remotely piloted vehicles (RPVs) for operation in the central European area are discussed. RPVs have advantages for high threat environment use and in terms of cost effectiveness. The data link guidance, target acquisition and weapon release aspects of RPVs are considered for three cases: stationary or quasi-stationary targets, self-radiating targets with restricted movement, and mobile point targets involving human decision making. In addition, details of the design, navigation system, target acquisition sensor system and armament for a particular recoverable RPV are presented.
MAJS: /*AIRCRAFT DESIGN*/ATTACK AIRCRAFT*/FOCKER AIRCRAFT*/ REMOTELY PILOTED VEHICLES/*TARGET ACQUISITION

80A29654
UTL: Unmanned aircraft systems research in the UK
AUTH: A/BENJAMIN, J.
ABS: Objectives, testing, and research on cost-effective unmanned aircraft (UMA) in the UK are reviewed. The design characteristics of tested UMA are given, including mass, dimensions, speed, range, and payload capabilities (2-15 kg), and vehicle instrumentation to enable autonomous or remote pilot control as well as telemetry of the onboard systems is considered. Areas of research are also discussed, including navigation, communications, airframe and engine improvements, and propulsion requirements.
MAJS: /*MILITARY AIRCRAFT*/REMOTELY PILOTED VEHICLES/* RESEARCH PROJECTS

80A29653
UTL: Prospects for advanced tactical RPV's
AUTH: A/SEIGEL
ABS: The concept, design, and operation of advanced tactical remotely piloted vehicles (AT-RPVs) which
attack fixed or transient targets at known locations particularly in high threat missions, and could also perform tactical air reconnaissance and electronic warfare, are discussed. Air-RPVs are to fly at low altitude with high subsonic velocity. The entire mission including weapon delivery being executed in a preprogrammed mode. Navigation by an autonomous dead-reckoning system insensitive to enemy electronic countermeasures, an update system, and filter/calibration processing is also considered, as are cost and operational effectiveness.

MAUS: /MILITARY AIRCRAFT / MILITARY TECHNOLOGY / REMOTELY PILOTED VEHICLES / WEAPON SYSTEMS

00420562

UTTL: Operations of unmanned aircraft
AUTH: A. SIMPSON, W. D.


ABS: Air, sea, and ground launched variants of unmanned aircraft for military uses, such as reconnaissance, target identification, electronic countermeasures, weapon delivery, and antisubmarine warfare, are discussed. Attention is given to jet powered and piston engined vehicles, and to recoverable and expendable types. Including cruise missiles and harassment crones. Suitable modifications or redesign for air and sea carriers of unmanned aircraft are discussed, and it is proposed that special carrier systems, including ships, light fixed wing aircraft, and airships should be designed.

MAUS: / MILITARY AIRCRAFT / MILITARY OPERATIONS / REMOTELY PILOTED VEHICLES / TECHNOLOGY UTILIZATION

00423651

UTTL: Remotely piloted vehicles: International Conference, Bristol, England, September 3-5, 1979, Conference Papers and Supplementary Papers Conference sponsored by the Royal Aeronautical Society and University of Bristol, Bristol, England, University of Bristol, 1979, Conference Papers, 190 p.; Supplementary Papers, 84 p. (For individual items see 000-29652 to 000-29674)

ABS: Remotely piloted vehicles (RPVs), which are useful for military purposes in high-threat environments and for civilian purposes because of cost effectiveness, are surveyed. Various RPV systems and operations are discussed in terms of design and testing, such as airframes, control systems, engines, navigation, communications and recovery systems. RPVs ranging from

harassment crones to mini-RPVs are considered as are payloads for surveillance, agricultural use and weapons delivery.

MAUS: / AIRCRAFT DESIGN / CONFERENCES / MILITARY TECHNOLOGY / REMOTELY PILOTED VEHICLES

80272726

UTTL: Firebrand anti-ship missile target - Flight test program objectives and vehicle instrumentation
AUTH: A. LEMHAN, L. O.

ABS: The paper examines the firebrand supersonic anti-ship missile target system which will provide realistic threat simulation for test and evaluation of ship defense weapons systems. The flight test plans including the vehicle configuration requirements and objectives for the evaluation phase of the contractor test and evaluation and Navy Technical Evaluation are discussed; contract evaluation flights which will collect mission profile data and reliability data are described. Instrumentation requirements for each hardware configuration are defined, and a summary of the planned flight test schedules is presented.

MAUS: / AVIONICS / FLIGHT TEST INSTRUMENTS / MISSILE COMPONENTS / MISSILE CONFIGURATIONS / REMOTELY PILOTED VEHICLES / TARGET SIMULATORS

00425820

UTTL: Airborne spacecraft - A remotely powered, high-altitude RPV for environmental applications

ABS: A high-altitude, unmanned, propeller-driven electric airplane is proposed for remote sensing of environmental phenomena. With motive power from surface-mounted solar arrays or microwave receivers, flight endurance of weeks to months could be anticipated. The proposed system offers unique capability for monitoring oceanic and atmospheric characteristics on local or regional scale. Coastal marine and tropospheric research activities, which require temporal resolutions of 2-72 hours, would be prime application areas. Potential missions might
include the monitoring of ocean disposals, episodic marine biological events, and river/ocean interactions. Preliminary sizing and performance calculations are presented along with possible mission scenarios and payload complements.

MAJS: /AERIAL RECONNAISSANCE/AIRCRAFT DESIGN/ ELECTRIC MOTORS/MICROWAVE TRANSMISSION/ REMOTELY PILOTED VEHICLES/SOLAR ENERGY CONVERSION

UTTL: Techniques of DPCM picture coding for RPV IV
AUTH: A/LIPPARD, R.
Piscataway. N.J., Institute of Electrical and Electronics Engineers, Inc., 1979. p. 52.4.1-52.4.5.

ABS: Methods for obtaining low bit rates of digitally encode video signals are discussed. These methods are relevant, especially in increasing the efficiency of noise-resistant video links for remotely piloted vehicles (RPVs). The techniques described provide rates of 1.5 and 2 bits per picture element (pel), and are based on differential PCM (DPCM) with fixed-length words. In the 1.5-bit mode every two adjacent pel's are block-coded with 3 bits. The bit suitable two-dimensional prediction process uses four pel's. The further two-dimensional prediction or temporal filtering leads to further improvements in picture quality, with respect to reduced effects of quantizing and channel errors. The efficiency can be increased by coding the central (or target) area with a higher accuracy than the rest of the picture. Performance results are presented in terms of still pictures and video scenes. The DPCM techniques are compared with transform coding, operating under the same conditions.

MAJS: /CODING/DIGITAL TELEVISION/PULSE CODE MODULATION/ REMOTELY PILOTED VEHICLES

80A25981

UTTL: Advanced bandwidth compression schemes
AUTH: A/SINER, G. D.

ABS: Bandwidth compression schemes have found useful application in improving the transmission of transmitted information. Such data reduction methods are particularly needed in the case of RPV imagery transmission. The Night Vision and Electro-Optics Laboratory has undertaken separate studies to access the feasibility of obtaining 1000 to 1 and 10,000 to 1 compression ratios. The approach of such data reduction necessitates a considerable degree of local intelligence in which specially selected scene information only, is transmitted. The 1000 to 1 concept involves sending with fidelity, just such information that is deemed to be of especial value to the RPV mission. In the case of 10,000 to 1 ratio the image is segmented, classified and only coordinates and image descriptors are transmitted.

MAJS: /BANDWIDTH/DATA COMPRESSION/IMAGE PROCESSING/NOISE REDUCTION/ REMOTELY PILOTED VEHICLES/VIDEO COMMUNICATION

80A24942

UTTL: Pyrotechnic delay cutters for more severe acceleration and temperature environments
AUTH: A/GRICKS, D. M.; B/VALENTA, F. U.

ABS: The U.S. Air Force has experienced failures with In-service reliability line pyrotechnic delay cutters employed in Mid-Air Retrieval System (MARS) for remotely piloted vehicle (RPV) recovery. The failures have been attributed to environmental conditions during MARS deployment. The Naval Ordnance Station, Indian Head MD (NAVORDSTA) is currently completing the development of two pyrotechnic delay cutters providing a different time delays. The cutters are required to operate under sustained high acceleration loading and to a cold temperature extreme of -120 F. Other design features to optimize cutting capability and minimize mechanical pull force initiation levels have also been incorporated.

MAJS: /AMBIENT TEMPERATURE/PARACHUTE DESCENT/PILOTELESS AIRCRAFT/ PYROTECHNICS/ REMOTELY PILOTED VEHICLES

80A11775

UTTL: Take-off and landing problems of ship based RPVs
AUTH: A/ELTER, M.

ABS: The paper deals with some aspects of take-off and landing of ship remotely piloted vehicles (RPVs) on ship decks. Experience obtained with Donnell's Aerodynamic concept of combining VTOL properties with high-speed flight is discussed. Some results of evaluation studies are noted.
MAJS: /AIRCRAFT LANDING/*OPERATIONAL PROBLEMS/*REMOtELY PILOTED VEHICLES/*TAKEOFF RUNS

UTLT: Technical concept for a strike-RPV flight guidance and weapon delivery system

AUTH: A. KRHEIBAUM, G.


ABS: Tactical strike RPVs are intended to complement (rather than replace) other weapon systems in such missions where target detection and identification by the pilot are not required. In the present paper, some experience obtained in the design and development of strike RPVs during the past seven years is reviewed, along with the respective flight guidance and weapon delivery systems.

MAJS: /FLIGHT CONTROL/*MILITARY AIRCRAFT/*REMOtELY PILOTED VEHICLES/*WEAPONS DELIVERY

79448615

UTLT: Advanced RPV electrical systems

AUTH: A. MILLER, F. L.


ABS: The paper surveys the possible improvements that can be made in the electrical power systems (EPS) of remotely piloted vehicles (RPV). It is noted that off the shelf hardware, which is commonly used due to cost considerations, is becoming inadequate for the tasks and is causing operational difficulties. Attention is given to the EPS design philosophy and some specific problems such as the lack of adequate generated power, interconnection difficulties, reliability and maintainability problems such as those associated with batteries and high life cycle costs. Several types of RPVs are described such as the HALE RPV, the mini RPV, and the TES. Technological improvements considered include: rare earth permanent magnets, flat wire and printed circuit cable, and fiber optics.

MAJS: /ELECTRIC POWER SUPPLIES/*MILITARY AIRCRAFT/*REMOtELY PILOTED VEHICLES/*TECHNOLOGY UTILIZATION

79448608

UTLT: Microprocessor-based digital autopilot development for the X00M-106 Mini-RPV

AUTH: A. ROGER, O. D.; B/ TIEZ, D. E.; C/LAMONT, G. B.


ABS: Contemporary integrated circuit technology permits the employment of microprocessors in the design of small remotely piloted vehicles. The development of a microprocessor based autopilot for the X00M-106 Mini-Remotely Piloted Vehicles (RPV) is described in this paper. With ultra-low component cost as a primary goal, the autopilot design uses the RCA CDP-1802 microprocessor. The digital autopilot was developed through the breadboard state with performance testing accomplished via hybrid simulation. Aircraft transfer functions were first derived from aerodynamic wind tunnel data. Then a complete Control analysis was made of the existing analog autopilot, sensors, actuators, and aircraft dynamics. This was followed by synthesis of the digital control algorithms from the digitization of the analog control laws. Hardware was selected based on system requirements, and software to execute the digital algorithms was developed. The
results of testing by hybrid simulation indicates that the performance of the digital autopilot is very comparable to the existing analog autopilot. Sources of minor discrepancies are discussed.

MAUS: /*AIRCRAFT DESIGN/*AUTOMATIC PILOTS/*COMPUTERIZED DESIGN/*DIGITAL NAVIGATION/*MICROPROCESSORS/*REMTELY PILOTED VEHICLES

79A47801
UTTL: Compass Cope airframe design history
AUTH: A/BROWN, R. B.

ABS: Preliminary design decisions on the project phase (1971-1973) and flight tests (1973-1974) of the Compass Cope remotely piloted vehicle are discussed. Mission-related decisions are presented along with engine and power plant, wing, landing gear, body, empennage, and flight control design decisions. Wind-tunnel and flight-test results are discussed. It is noted that the podded single-engine airplane arrangement utilized can be considered as a potential standard for future single-engine high-altitude surveillance designs, manned or unmanned. The airframe design features discussed also include a composite and bonded primary structure with maximum use of honeycomb and foam core, as well as integral wing fuel containment within a honeycomb basic structure.

MAUS: /*AIRCRAFT DESIGN/*PRODUCT DEVELOPMENT/*RECONNAISSANCE AIRCRAFT/*REMTELY PILOTED VEHICLES

79A47876
UTTL: Flight control systems development of highly maneuverable aircraft technology /HIMAT/ vehicle

ABS: The highly maneuverable aircraft technology (HIMAT) program was conceived to demonstrate advanced technology concepts through scaled-aircraft flight tests using a remotely piloted technique. Closed-loop primary flight control is performed from a ground-based cockpit, utilizing a digital computer and up/down telemetry links. A backup flight control system for emergency operation resides in an onboard computer. The onboard systems are designed to provide fail-operational capabilities and utilize two microcomputers, dual uplink receiver/decoders, and redundant hydraulic actuation and power systems. This paper discusses the design and validation of the primary and backup digital flight control systems as well as the unique pilot and specialized systems interfaces.

MAUS: /*DIGITAL COMMAND SYSTEMS/*GROUND BASED CONTROL/*REMTELY PILOTED VEHICLES/*RESEARCH AIRCRAFT

79A45367
UTTL: Minimum expected cost control of linear systems with uncertain parameters - Application to remotely piloted vehicle flight control systems
AUTH: A/VINKLER, A; B/LY, U.-L; C/CANNON, R. H., JR.; D/WOOD, L. J.

ABS: An efficient technique for designing constant gain feedback controllers for linear systems having uncertain or variable parameters is presented and demonstrated for a realistic RPV design. This controller design technique - named Minimum Expected Cost Control - produces closed-loop system behavior which is acceptable for all values of the parameters within specified limits and is optimum in some overall sense. The technique is used to design a constant gain lateral auto-pilot for an RPV that will fly at a wide range of altitudes and airspeeds. Both full and partial state feedback situations are considered. Extension of the method to the design of dynamic compensators is shown to be straightforward.

MAUS: /*AUTOMATIC PILOTS/*COST ESTIMATES/*FEEDBACK CONTROL/*FLIGHT CONTROL/*REMTELY PILOTED VEHICLES

79A442401
UTTL: Unmanned mini-blimp system
AUTH: A/SEEHANN, G. R.; B/BROWN, G. J.; C/HARRIS, G. L.

ABS: Technology development of an unmanned (remotely piloted) mini-blimp (RPB) during the past four years are discussed including aerodynamics, propulsion, flight control, envelope and car construction. Flight test results of two prototype systems are presented. Applications are numerous for both civil and military. This paper deals primarily with civil applications such as law enforcement, customs and immigration, pollution monitoring, and surveillance and patrol. A
law-enforcement RP\&B systems are presented in detail including technical and operational data. Funding is required for a full scale demonstration in a civilian application before implementation in an urban area. M\&S: /AERIAL RECONNAISSANCE//AIRSHIPS//REMOTELY PILOTED VEHICLES//TECHNOLOGY UTILIZATION

79A36684

UTTL: Drone formation control system /DFCS/ - A new generation test range system
AUTH: A/RISE, W. A.; B/REHM, K. D.

ABS: The Drone Formation Control System (DFCS) has been operating at the White Sands Missile Range since September 1976. This paper briefly describes the DFCS and some of the missions performed by it. A brief description of system hardware emphasizes the data link and display subsystems. The DFCS uses distance-measuring equipment to locate a drone; then, the DFCS compares the present drone position to that desired and generates the commands necessary to bring the drone to the desired location. The paper highlights some of the various types of missions the DFCS can support and discusses missions that used DVM-34d and PGW-12s in single and multiple aircraft formations at all altitudes. Included are manuel and automatic control, high-\'g\' maneuvers, and the takeoff and landing of GF102 and GF86 drones. The effects of multipath on DFCS data link performance over land and water are also presented. MAJS: /AUTOMATIC FLIGHT CONTROL//DRONE AIRCRAFT// REMOTELY PILOTED VEHICLES//SYSTEMS ANALYSIS//TEST RANGES

79A32136

UTTL: Tactical pilotless aircraft - Do they really have a future
AUTH: A/BULLOCH, C.

ABS: Configuration and tactical roles of pilotless aircraft are discussed, together with a review of a Navy program projected to devise a vehicle launchable in a tail-sitting attitude from vessels not otherwise equipped to handle aircraft. There are three basic types of pilotless aircraft: (1) drones, needing no human intervention after launching, (2) remotely piloted vehicles (RPVs), tracked and controlled by an operator located near the forward edge of the battle area, and (3) hybrid systems, utilizing a planned mission program together with remote piloting for the launch and recovery phases. The classic configuration for drones and RPVs has been a small aircraft, or missile shaped body, powered by a turbojet engine with 57-770 kg thrust. The vehicles are generally launched by a solid rocket booster technique, and recovered by parachute. Of the various military applications of the pilotless aircraft, battlefield surveillance, saturation, and harassment are the most important. MAJS: /AIRCRAFT DESIGN//MILITARY AIRCRAFT//PILOTLESS AIRCRAFT//REMOTE PILOTED VEHICLES//TECHNICAL FORECASTING

79A26627

UTTL: Foam Impact Attenuation System
AUTH: A/MEHFFIE, S. R.

ABS: A ground impact attenuation system for aerospace vehicles based on foamed-in-place polyurethane foam has been developed. The concept was reduced to practice and developed to the prototype stage during a three-year Air Force investigation beginning in 1975. A series of 91 full scale tests of the FIAS (Foam Impact Attenuation System) against the requirements of the AQM-34V remotely piloted vehicle demonstrated the system's performance with a 60-sec operating time. Subsequent work has produced a foam dispensing system capable of achieving a FIAS deployment time of 5 sec. Spinoffs from this program have created new concepts in deployable composite structures. MAJS: /AIRCRAFT LANDING//IMPACT LOADS//POLYURETHANE FOAM// REMOTELY PILOTED VEHICLES//SHOCK ABSORBERS

79A19888

UTTL: Air attack RPVs
AUTH: A/SPINTZIK, J.; B/STARKA, P.

ABS: The air attack RPV weapons system is expected to fulfill the task of combating highly defended fixed and mobile targets, especially at the beginning of a conflict. Studies have shown that the recoverable vehicle is more cost-effective than the nonrecoverable, expendable RPV at loss rates of between approximately 3 and 50%. At loss rates above 50%, which can be expected at greater penetration depths, the expendable RPV becomes more cost-effective. Since the air attack
RPV is less costly than an aircraft, for a given budget the mixed fleet of aircraft and air attack RPVs is essentially larger than a fleet of all aircraft. For DoD unmanned combat aircraft equipped with a hybrid navigation system, consisting of a strapdown measuring system and an analog matched filter with suitable support system, a CEP value of less than 50 m is expected, independent of the range. MAJS: /ATTACK AIRCRAFT/*DROVE AIRCRAFT/*REMOtELY PILOTED VEHICLES/*WEAPON SYSTEMS

79A18198
UTTL: Applied problems of the optimal dynamic control theory of unmanned flight vehicles
AUTH: A/DMITRIEVSKII, A. A.; B/LYSEnko, L. N.
ABS: The book deals with methods that can be used to solve applied problems of optimizing the motion of rockets and missiles within the framework of a modern theory of control in the space of states. Attention is given to optimal control models, including determinate, stochastic, and game-theoretic models, and to the mathematical formalization of dynamic processes and synthesis of optimal control systems. The control plants considered are described by linear and nonlinear ordinary differential equations, by finite-difference equations with variable coefficients, and by stochastic differential equations. The potentials of the theory and means of applying it are demonstrated by examples. MAJS: /AUTOMATIC FLIGHT CONTROL/*CONTROL THEORY/*MISSILE CONTROL/*OPTIMAL CONTROL/*REMOtELY PILOTED VEHICLES

79A18136
UTTL: High-performance VTOL for over-the-horizon targeting
AUTH: A/SCHWADERER, R. F.
ABS: This paper presents an evaluation of manned and remotely piloted high-performance VTOL designed to operate from small surface combatants and provide over-the-horizon (OTH) targeting for surface-to-surface cruise missiles. Three system concepts are considered: a manned aircraft operating alone, a manned aircraft operating in conjunction with a remotely piloted vehicle (RPV), and the RPVs operating together. Representative mission loads are established for each vehicle. Mission requirements, in terms of radius and time-on-station, are derived according to the size and range of the target's uncertainty area. Vehicle takeoff gross weights (TOGW) compatible with operations from small combatants and system life-cycle costs (LCC) are determined to satisfy the mission requirements. The three OTH targeting system concepts are compared on the basis of LCC for equal effectiveness and the advantages and disadvantages of each are summarized. MAJS: /AIRCRAFT DESIGN/*MILITARY OPERATIONS/*MISSILE CONTROL/*REMOtELY PILOTED VEHICLES/*TARGET ACQUISITION/*VERTICAL TAKEOFF AIRCRAFT

79A14659
UTTL: Unmanned flight vehicle design parameter selection
AUTH: A/ZAIPOV, N. G.; B/SIRAZETDINOV, T. K.
ABS: (For abstract see issue 12. p. 2098, Accession no. A78-32250)
MAJS: /AIRCRAFT DESIGN/*COMPUTERIZED DESIGN/*CONTROL CONFIGURED VEHICLES/*FLIGHT OPTIMIZATION/*REMOtELY PILOTED VEHICLES

79A14613
UTTL: A miniature air sonar altimeter
AUTH: A/ROSS, C. M.
ABS: An air sonar echo ranging device was developed in prototype form to demonstrate the effectiveness of a single-transducer system, requiring little adjustment for optimum performance. The device is intended primarily as an altimeter for use on miniature remotely piloted aircraft for terrain following applications. This paper describes the single-transducer system design and the associated electronics. Particular attention is given to limitations of near range in the transducer system due to the inherent high Q of the transducer and reverberation in the back mass. MAJS: /ALTIMETERS/*MINIATURE ELECTRONIC EQUIPMENT/*REMOtELY PILOTED VEHICLES/*SONAR/*SOUND DETECTING AND RANGING/*TERRAIN FOLLOWING AIRCRAFT

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79A14053
UTTL: Weapons delivery of conventional air-ground weaponry
AUTH: A/KLEINART, W. D.; B/SCHLEINKRICH, P.
ABS: Simulations of the release of conventional air-ground weapons from low-flying RPVs in high-speed low-level flight were carried out in order to study the effect of individual release errors on the target errors. The release errors, obtained from the dynamic behavior of the carrier in the aiming flight phase, were also simulated. The results enable to formulate additional requirements on the weapons guidance computer. More time between the end of the conversion maneuver and weapons release is shown to be desirable.
MAJS: */TECHNOLOGY/*FLIGHT SIMULATION/*REMOtELY PILOTED VEHICLES/*WEAPON SYSTEMS

79A13226
UTTL: Communications management by the remote system - An adaptive approach
AUTH: A/PURCELL, D.; B/STEFEL, P.
ABS: A variety of factors have to be considered in connection with the efficient management of communications between a remote system and a supervisory human operator. Examples include noise, channel capacity, and time considerations. There may also be problems regarding energy consumption, operator attention demands, and even hazards of detection. It is proposed to optimize the communications by placing much of the responsibility for communications evaluation and management with the remote element. Evaluation of the system is improved by a computer analysis which is then compared with human supervision of communications. An approach for implementing such a system is discussed. Attention is given to the models and the communication system, the schematic representation of an adaptive decision model, the decision aiding process, and simulation tests.
MAJS: */ADAPTIVE CONTROL/*AUTOMATIC PILOTS/*DECISION MAKING/*INFORMATION MANAGEMENT/*MAN MACHINE SYSTEMS/*REMOtELY PILOTED VEHICLES

79A12611
UTTL: A digital real-time intraframe video bandwidth compression system
ABS: The implementation of a digital, real-time, intraframe video compression system into hardware for the integrated communication and Navigation Systems of the Army's Aquila remotely powered vehicle is reported. The basic system concept and operation are reviewed along with the associated algorithms (cosine transform, integer implementation, coefficient standardization, and the differential pulse code modulation on encoder). The compression assembly is evaluated in terms of the nine-by-nine-bit sign magnitude multiplier, the nine-bit adder, and the dual register retimer. The direct cosine transform
processor, which serves as a pipeline processing two elements at a time. It is described. The development of hybrid modules for the airborne circuitry, the building of a ground-based decoding unit, and the simulator performance are outlined.

MAUS: */DATA COMPRESSION*/DIGITAL SYSTEMS*/IMAGE PROCESSING*/REAL TIME OPERATION*/REMTELY PILOTED VEHICLES*/TELEVISION TRANSMISSION

79A11480

UTTL: Modelling and analysis using SAINT - A combined discrete/continuous network simulation language
AUTH: A/WORTMAN, D. B.; B/DUKET, S. D.; C/SEIFERT, D. J.
ABS: A network modelling and simulation technique, called Systems Analysis of Integrated Networks of Tasks (SAINT), has been developed to assist in the design and analysis of complex man-machine systems. SAINT allows engineers and human factors specialists to develop system models in which men, machines, and environmental conditions are represented as elements of a network. SAINT has been used to determine the feasibility of integrating human resources data and maintenance task data with computer simulation techniques to form a computer-based tool for performing safety analyses of nuclear systems. Aspects of network modelling and analysis are discussed along with SAINT modelling concepts. Attention is also given to the SAINT simulation program.

MAUS: */COMPUTERIZED SIMULATION*/MAN MACHINE SYSTEMS*/NETWORK ANALYSIS*/PROGRAMMING LANGUAGES*/REMTELY PILOTED VEHICLES*/SYSTEMS ANALYSIS

79A10820

UTTL: 20 hp mini-RP demonstrator engine programs
AUTH: A/JOHNSON, E. T.; B/SMITH, K. F.; C/MARSTILLER, J. K.
ABS: This paper presents the selection, design, and initial testing of a 15 kw (20-hp), two-cylinder, two-stroke demonstrator engines for use on mini-RP aircraft. The objectives are (1) to provide a technology base for mini-RP engines using current high-production components; (2) to identify areas where future development and procurement costs can be reduced without compromising the propulsion system's ability, and survivability of the Concepts. Future development work must, therefore, be aimed at applying this technology base to a propulsion system design to meet specific mini-RP applications.

MAUS: */AIRCRAFT ENGINES*/ENGINE DESIGN*/ENGINE TESTS*/MILITARY TECHNOLOGY*/REMTELY PILOTED VEHICLES

78A52498

UTTL: A visual simulation procedure for the processing of television images with reduced frame rates in the case of representations of outside views from remotely piloted vehicles
AUTH: A/SCHULZ-HELBACH, K. D.
ABS: The transmission of image information from a remotely piloted vehicle to the ground station is of importance for a successful mission. Particular attention must, therefore, be given to approaches which will prevent a disturbance or interruption of this communication link. A description is presented of a number of such approaches, taking into account human factor considerations. Approaches which can be used with reduced image transmission time are discussed in the case of a disturbed information channel are discussed, taking into account a reduction of the amount of information transmitted per picture and an increase in image transmission time. The properties of image sensors for reduced frame rates are examined. Attention is also given to details of image processing, which in case of an employment of the considered approaches is necessary to add missing information regarding the motion of the remotely piloted vehicle.

MAUS: */AERIAL RECONNAISSANCE*/FLIGHT SIMULATORS*/IMAGE PROCESSING*/REMTELY PILOTED VEHICLES*/TELEVISION RECEPTION*/VISUAL OBSERVATION

78A50184

UTTL: Guaranteed cost control of linear systems with uncertain parameters - Application to remotely piloted vehicle flight control systems
AUTH: A/VINKLER, A.; B/WOOD, L. J.
ABS: In many physical systems, an accurate knowledge of certain parameters is very difficult or very expensive
to obtain. The designer of an RPV flight control system, for example, frequently has available little data regarding aerodynamic coefficients, due to a lack of wind tunnel tests. Based on the concept of guaranteed cost control, an algorithm has been developed to analyze the effect of parameter uncertainties on closed-loop system stability. An extension of this algorithm results in a technique for choosing constant feedback gains which result in stable closed-loop behavior for a range of parameter values. This technique has been applied to the design of a lateral autopilot for a rudimentary RPV with uncertainties in aerodynamic coefficients.

MAJS: */ALGORITHMS/*AUTOMATIC FLIGHT CONTROL/*FEEDBACK CONTROL/*LINEAR SYSTEMS/*OPTIMAL CONTROL/*REMOTELY PILOTED VEHICLES/*SYSTEMS STABILITY

78A050103
UTTL: The evolution of a remotely piloted vehicle microprocessor flight control system
AUTH: A/WOOLLEY, M.

ABS: The development of a microprocessor flight control system (MFCS) for RPVs is traced through the evolution of the control concepts to the flight testing of the MFCS. RPV control law concepts were applied in the digital system and provided a natural division for multiple computations, significantly alleviating computational requirements. Analytical aspects of the design process, such as z-transform analyses, sample rate determination, computational constraints and simulation analyses are discussed. Data obtained from the testbed vehicle flight tests are presented and compared with simulation results and with the test data for a current analog system.

MAJS: */AUTOMATIC FLIGHT CONTROL/*MICROPROCESSORS/*NUMERICAL CONTROL/*REMOTELY PILOTED VEHICLES

78A050102
UTTL: Guidance and control problems in semiautomatic recovery of the Aquila RPV
AUTH: A/BEALL, T. R.

ABS: This paper describes the recovery system for the Aquila RPV developed by Lockheed Missiles & Space Company, Inc. (LMSC), for the U.S. Army. The approach flight control concept is presented, as are the guidance and command algorithms that control the flight to a fixed glide slope boresighted to a TV camera. The camera is located on the ground behind a vertical net and is adjusted to define a 4-deg glide slope leading into the net. To recover the RPV, an operator controls the motion of a cursor on the TV screen to follow the RPV image as closely as possible. The coordinates of the cursor provide the basis for the guidance command algorithms. Also, in this paper the predominant sources of error in the recovery system are identified and analyzed, computer modeling of the human operator transfer function is discussed, and the effects of sharp-edged gusts on recovery performance are presented.

MAJS: */AIRCRAFT GUIDANCE/*APPROACH CONTROL/*NETS/*REMOTELY PILOTED VEHICLES/*TELEVISION CAMERAS

78A050101
UTTL: RPV flying qualities design criteria
AUTH: A/HEICHBER, T. L.; B/WILER, C. D.

ABS: In late 1976, a contract with an American aerospace company was initiated by the Air Force with the objective to establish a framework for remotely piloted vehicle (RPV) flying qualities criteria. Later phases of the program were to provide data for that framework. One of the essential aspects of RPV flying qualities criteria is that they must consider the total RPV system. This includes not only vehicle stability and control, but must also encompass automatic and manual control, command and data link, and man-machine interfaces. The general organization of the scope and classification section is considered, taking into account vehicle classes, flight phases, and the level of RPV flying qualities. The system requirements examined are related to automatic control, manual control, stability margins, operation and interface, and atmospheric disturbances.

MAJS: */AIRCRAFT CONTROL/*AIRCRAFT DESIGN/*FLIGHT CHARACTERISTICS/*FLIGHT CONTROL/*REMOTELY PILOTED VEHICLES

78A050179
UTTL: Shipboard launch and recovery of RPV helicopters in high-sea states
AUTH: E/EVANS, R. P.; B/SCHULZE, E.

ABS: We have recently completed an analytical design of a fully automatic helicopter shipboard recovery system. Two simulated vehicles were used in the study, the Gyrocyn MH-50 drone helicopter and a Development Sciences, Inc. (DSI) rotary-wing research RPV. Guidance and control algorithms were developed to successfully land the aircraft on board a non-aviation ship in high seas. The study employed six DOF helicopter models and recorded ship motion data in both fully automatic and remote pilot-in-the-loop simulations which were used to establish statistical performance. The simulation, developed system and the tradeoffs that led to the final design are described in this paper. The expected performance as a function of recovery conditions and recommended criteria for successful recovery are presented. The study indicates that safe launch and recovery in sea state 5 are possible.

MAJS: AUTOMATIC LANDING CONTROL/*HELICOPTER CONTROL/* MILITARY OPERATIONS/*REMOtELY PILOTED VEHICLES/*SEA LAUNCHING/*SEA STATES/*VERTICAL LANDING

78A46902

UTVL: Effectiveness of basic display augmentation in vehicular control by visual field cues


ABS: The paper investigates the effectiveness of different basic display augmentation concepts - fixed reticle, velocity vector, and predicted future vehicle path - for RPVs controlled by a vehicle-mounted TV camera. The task is lateral manual control of a low flying RPV along a straight reference line in the presence of random side gusts. The man-machine system and the visual interface are modeled as a linear time-invariant system. Minimization of a quadratic performance criterion is assumed to underlie the control strategy of a well-trained human operator. The solution for the optimal feedback matrix enables the explicit computation of the variances of lateral deviation and directional error of the vehicle, and of the control force which are used as performance measures.

MAJS: DISPLAY DEVICES/*REMOtELY PILOTED VEHICLES/*VISUAL CONTROL/*VISUAL FIELDS

78A47108

UTVL: The HIKAT RPV system


ABS: Two remotely piloted research vehicles (RPVs) which are 4% scale versions of an advanced highly maneuverable fighter design have been delivered to NASA for flight testing. These research airplanes will demonstrate the contribution to the future air-to-air fighter of several advanced technologies, including aerelastic tailoring, supercritical airfoils, close-coupled canard, variable camber, and advanced composite materials. Digital fly-by-wire control technology is employed with the control laws being implemented in a ground-based computer. The HIKAT is designed with a 12-g limit load factor and can perform sustained maneuvering at 8 g at 0.9 M at 25,000-foot altitude. The HIKAT has been designed and fabricated with a modular approach which facilitates modification for testing of other structural, aerodynamic, propulsion, or flight-control concepts. The HIKAT RPVs will be launched from a B-52 and flown through their test flight mission by a ground-based pilot. Testing will be made on a dry land field, utilizing skis rather than wheels on the landing gear.

MAJS: AIRCRAFT DESIGN/*AIRCRAFT MANEUVERS/*FIGHTER AIRCRAFT/*GROUND BASED CONTROL/*REMOtELY PILOTED VEHICLES/*RESEARCH VEHICLES

78A41807

UTVL: Aircraft operating environments around high speed ships


ABS: A wind tunnel study was conducted to determine the flowfield around a hydrofoil ship. It was to determine the operating environment for a remotely piloted vehicle in the vicinity of the ship. Flow visualization tests were conducted using smoke and wool tufts. Tests were run using an RPV model mounted on a traverse such that it could simulate aircraft reactions to the flow. Velocity profiles were examined in detail at two stations along the ship's keel. All tests were run over a range of ship yaw angles between plus or minus 15 deg. Tests were run with and without ship stack exhaust simulation. The dominant feature was always two vortices along the ship's deck edge which may make aircraft operation from high speed ships difficult, if not impossible.
AIRCRAFT STABILITY/FLOW DISTRIBUTION/HYDROFOIL CRAFT/REMOTELY PILOTED VEHICLES/SEA LAUNCHING/VELOCITY DISTRIBUTION

78A40205

UTTL: Imaging sensors for RPVs
AUTH: A/SHERMAN, N.; B/STICH, K.


ABS: Mission requirements for mini RPVs are given which set the boundary conditions for electro-optical sensor operation. Sensor performance goals are postulated and from these objectives a class of sensor is identified. These include high performance thermal imaging and synthetic television as well as more austere intensified solid state imagers and pyroelectric vidicons. Current development status and improvements for these devices is forecast. Finally some system design features are given for various stabilization schemes.

MAJS: /AERIAL RECONNAISSANCE/ELECTRO-OPTICAL PHOTOGRAPHY/IMAGING TECHNIQUES/REMOTE SENSORS/REMOTELY PILOTED VEHICLES/HEAT MAPPING

78A38522

UTTL: Grumman's radio-controlled experimental air force
AUTH: A/FRISCH, B.


ABS: Construction of V/STOL and forward-swept-wing experimental aircraft models is discussed. The models may provide a good indication of the static stability and control characteristics of aircraft, though they are not generally useful in studying the stall regime and the V/STOL hovering case. Spin testing through use of the foam/balsa/crystal models is also possible.

MAJS: /AIRCRAFT MODELS/GRUMMAN AIRCRAFT/RADIO CONTROL/REMOTELY PILOTED VEHICLES/SWEPT FORWARD WINGS/V/STOL AIRCRAFT

78A38521

UTTL: High-flying Mini-Sniffer RPV - Mars bound


ABS: The Mini-Sniffer is a small unmanned survey aircraft developed by NASA to conduct turbulence and atmospheric pollution measurements from ground level to an altitude of 90,000 ft. Carrying a 25-lb air-sampling apparatus, the Mini-Sniffer typically cruises for one hour at 70,000 ft before being remotely piloted back to earth. A hydrazine monopropellant engine powers the craft, while a PCM tolerometer system and a radar transponder provide control functions. Development of a high-performance lightweight molds-number airfoil could make the research craft suitable for a low-altitude terrain-following mission on Mars.

MAJS: /MARS ATMOSPHERE/PILOTLESS AIRCRAFT/POLLUTION MONITORING/RECONNAISSANCE AIRCRAFT/REMOTELY PILOTED VEHICLES/TERRAIN FOLLOWING AIRCRAFT

78A32258

UTTL: The problem of choosing design parameters for unpiloted flight-vehicles
AUTH: A/ZARIPOV, N. G.; B/SIRAZETDINOV, T. K.


ABS: The paper considers the analytical design of a hypothetical unpiloted flight-vehicle; the problem is posed in terms of a system of ordinary differential equations with inequality constraints on the phase coordinates and controlling parameters. The controlling parameters examined are initial thrust conditions, initial load on the vehicle and the operational time of the engine.

MAJS: /AIRCRAFT DESIGN/COMPUTERIZED DESIGN/CONTROL CONFIGURED VEHICLES/FLIGHT OPTIMIZATION/REMOTELY PILOTED VEHICLES

78A30506

UTTL: Remotely piloted aircraft in the civil environment
AUTH: A/GREGORY, T. J.; B/NEELMS, W. P.; C/KARKARKAR, J. S.

CORP: National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.


ABS: Improved remotely piloted aircraft (RPAs), i.e., incorporating reductions in size, weight, and cost, are becoming available for civilian applications. Existing RPA programs are described and predicted into the future. Attention is given to the NASA Mini-Sniffer, which will fly to altitudes of more than 20,000 m, sample the atmosphere behind supersonic cruise aircraft, and telemeter the data to ground stations. Design and operating parameters of the aircraft are given, especially the optical sensing systems, and civilian RPA uses are outlined, including airborne research, remote mapping, rescue, message...
relay, and transportation of need materials. Civil regulatory factors are also dealt with.

**MAJS:** /AIRCRAFT DESIGN/ CIVIL AVIATION/ COST REDUCTION/ REMOTELY PILOTED VEHICLES/ TECHNOLOGY TRANSFER/ WEIGHT REDUCTION

**78A28148**

**UTTL:** Display augmentation in manual control of remotely piloted vehicles

**AUTH:** A/HERHAW, S. J.; B/GRUNWALD, A. J.  
Research supported by the Ministry of Defence.

**ABS:** The effectiveness of display aids for manual control of remotely piloted vehicles by television during landing approach is investigated. The task is lateral and vertical control along a required glide-slope trajectory in the presence of lateral and vertical random disturbances. By super-imposing suitable glide-slope reference lines on the TV monitor, the glide-slope error can be derived directly from the visual field. It is theoretically investigated whether and under what conditions the display of higher-order state components is required. It is shown that for a body-mounted camera, essential angular rate information can be detected from the vertical relative motion of the visual field due to vehicle pitching. This information is particularly required for relatively slow vehicle dynamics, Rapid pitching, which occurs with fast vehicle dynamics, may be detrimental to the effective control. These disturbing motions can be easily eliminated by a gyro-stabilized camera, but the essential angular and pitch information is also eliminated and control becomes difficult. A display configuration is proposed in which position, rate, and acceleration cues are derived from a single error displayed by special reference bars.

**MAJS:** /AIRCRAFT CONTROL/ LANDING AIDS/ MANUAL CONTROL/ REMOTELY PILOTED VEHICLES/ TELEVISION EQUIPMENT

**78A23634**

**UTTL:** Design and analysis of propellers for low Reynolds number application to mini-RPVs

**AUTH:** A/BORST, H. V.  
27 p.

**ABS:** This report presents the design and analysis of propellers applied to mini-remotely piloted vehicles along with the methods used. Modifications to the airfoil data used for predicting the profile drag losses were necessary to account for operation at the low Reynolds number encountered by mini-RPV propellors. The correction was determined from the available airfoil data and low Reynolds number propeller test data. Using the revised methods of propeller analysis, optimum propellers were designed and analyzed. The study showed that improved performance can be obtained with new propeller designs.

**MAJS:** /DESIGN ANALYSIS/ PROPELLERS/ REMOTELY PILOTED VEHICLES

**78A23632**

**UTTL:** Suitability of military specification lubricants for two-stroke RPV engines

**AUTH:** A/MARECH, H. W., J.R.; B/RUSSELL, J. A.; C/SMITH, K. F.  
13 p.

**ABS:** The Army is exploring the feasibility of using Remotely Piloted Vehicles (RPVs) in a multi-mission role. Powerplants for these RPVs are to be small, two-stroke, air-cooled, reciprocating engines which require a fuel/oil mix for operation. As no federal or military specification lubricant exists for this application, this paper details results of an analytical/experimental investigation to evaluate the suitability of existing MIL SPEC lubricant classes for Army RPV use. Performance of a limited sampling of military specification lubricants was evaluated by cyclic testing with a small two-stroke, air-cooled piston engine currently used in the Army AQUILA RPV. An ansoless dispersant lubricant qualified to Boating Industry of America standards for two-cycle, water-cooled engines (BIA/TC-W) was used as a reference. Standard magneto ignition and engine cooling were used in 20 of the 23 tests. The final three tests explored the combined effects of capacitive discharge ignition and elevated cylinder head temperature. Standard magneto ignition and engine cooling were used in 20 of the 23 tests. The final three tests explored the combined effects of capacitive discharge ignition and elevated cylinder head temperature.

**MAJS:** /EQUIPMENT SPECIFICATIONS/ LUBRICANT TESTS/ LUBRICATING OILS/ MILITARY TECHNOLOGY/ REMOTELY PILOTED VEHICLES

**78A20485**

**UTTL:** Use of radio-controlled miniature aircraft for marine atmosphere sampling

**AUTH:** A/HESS, F. A.  
297-302

**ABS:** The use of Radio-Controlled Miniature Aircraft by the Woods Hole Oceanographic Institution for obtaining marine air samples is discussed. The particular requirements for gaseous as well as large-volume particulate sampling are discussed and at-sea tests are described.
performed from the R/V 'Knorr' are described. Handling and logistics of use as well as aircraft characteristics are discussed.

MAJS: /AIR SAMPLING/ENVIRONMENTS/RADIO CONTROL/*REMOTELY PILOTED VEHICLES

78A17548

UTL: A millimeter wave surveillance radar for RPVs
AUTH: A/KOCOSKY, L. H.; B/GRAZIANO, R. S.; C/WAGNER, R.; D/DUHLAP, D.

ABS: The development of a millimeter radar intended for use on small remotely piloted vehicles (Mini-RPVs) is described. The system will operate in adverse weather and will provide air traffic control data for tactical surveillance. The radar mode to include fixed target enhancement, high resolution ground map, and moving target detection. Two mission scenarios based on the radar's high resolution are examined, and several system components are described. The system is undergoing ground and airborne testing.

MAJS: /MICROWAVE EQUIPMENT/MILLIMETER WAVES/RADAR RESOLUTION/REMOTE PILOTED VEHICLES/SURVEILLANCE RADAR

78A16100

UTL: Remotely piloted aircraft in the civil environment

ABS: Remotely piloted aircraft (RPA's) are of increasing interest to the military and others, as evidenced by a number of technology and development programs that are currently funded or planned. These programs have led to a number of test aircraft with significant capabilities, and future remotely piloted aircraft are forecast to become even more capable as the technology in a number of important subsystem areas is progressing at a rapid rate. As the size, weight and cost of RPA's is reduced, the prospect of using them for civilian applications becomes more likely.

MAJS: /CIVIL AVIATION/REMOTE PILOTED VEHICLES/RESEARCH AIRCRAFT/TECHNOLOGY UTILIZATION

78A15613

UTL: RPV video digital multiplexing system
AUTH: A/MCLUNG, T.; B/NORRISON, R.; C/GASTON, D. W.

ABS: Transmission of video data from RPV's to the ground control officer requires a secure, yet high fidelity, medium. Further, multiple channels must be handled to simplify security measures and minimize system size and weight, both on the airborne vehicle as well as the ground station. A system which uses digital modulation to achieve 8:1 data compression resulting in 7 mhz bandwidth is described. System timing, hardware, and actual deocoded video results as they vary with system update rate and resolution of the encoding are presented.

MAJS: /AIRCRAFT COMMUNICATION/DIGITAL SYSTEMS/REMOTE PILOTED VEHICLES/VIDEO DATA

78A13450

UTL: The AFIT remotely piloted vehicle
AUTH: A/KOLET, S. A.

ABS: The Air Force Institute of Technology (AFIT) has proposed to construct for a small remote piloted vehicle (RPV) use for battlefield reconnaissance and studies such as tracking tests and air sampling investigations. The design has a canard configuration and twin propellers. It is controlled by a commercial off-the-shelf radio control unit. A one-third scale model has been built for wind tunnel testing. Although the RPV construction was completed in 1976, it has not been flown to date as initial test flights to determine air worthiness have not been performed as yet.

MAJS: /REMOTE PILOTED VEHICLES/WIND TUNNEL MODELS

78A12695

UTL: Dual device redundancy management
AUTH: A/SMITH, L. A.; B/WILLIAMS, P. G.

ABS: Dual control systems which can detect and isolate a faulty component are an attractive solution to automatic control systems that require a high degree of reliability with minimum cost, weight, and volume.
The analysis described in this paper is based on a RPV flight control system for which a failure would mean an air vehicle loss. Each of the flight control system's dual components is monitored as a pair and can be individually isolated from the system by the onboard automatic redundancy management function or by the ground operator. A performance exceedance monitor provides a complete swap of all online/offline components should the air vehicle exceed its performance boundaries for an unknown cause, and a minimum operational software subset is defined as the operational recovery configuration.

MAJS: **AIRBORNE/SPACEBORNE COMPUTERS/AUTOMATIC FLIGHT CONTROL/FAIL-SAFE SYSTEMS/RENDUNANT COMPONENTS/RELIABILITY ENGINEERING/REOTEELY PILOTED VEHICLES**

**70A12203**

**UTTL:** Distributed processor control of a multiple beam adaptive array for telemetry, command and control of airborne vehicles /RPV's/

**AUTH:** A/BUSTELO, R. A.; B/WILSON, S. S.; C/SORRENTINO, P. P.


**ABS:** A multi-level distributed processor developed to control a multiple function phased array antenna is described. The antenna system provides multiple target tracking for command and control of RPV's, and adaptive pattern shaping for telemetry. A hierarchical architecture is defined which implements system, beam and element control using distributed microprocessors. Interprocessor communication is accomplished via a high speed shared memory. Design technology in the various micropprocessors and peripheral hardware processors is matched to the computational complexity and execution speed required at each level of control. This multi-level, functionally partitioned implementation results in modular, compact, efficient, and adaptable software reliability than the traditional mini-computer approach.

MAJS: **BEAM SWITCHING/COMMAND AND CONTROL/DIGITAL COMMAND SYSTEMS/PHASED ARRAYS/RADIO TELEMETRY/REOTEELY PILOTED VEHICLES**

**77A51180**

**UTTL:** Precision location, navigation and guidance using DME techniques

**AUTH:** A/Raney, J. T.; B/Rehm, R. D.


**ABS:** A Distance Measurement Equipment (DME) approach for a precision location, navigation and control system which has multi-mission applications is presented. Specifically, a description is given of the Drone Formation Control System (DFCS) which is intended to provide simultaneous location, navigation, guidance, and control and telemetry functions of up to six Remotely Piloted Vehicles (RPVs) from takeoff to landing plus precision location and navigation of four additional vehicles. Features discussed include automatic rendezvous, collision avoidance, manual/automatic control, and formation flying. The control and navigational concepts leading to accuracies of 23 feet in absolute position and 19 feet in relative position are discussed. The application of DME systems to other range instrumentation tasks, such as NFR (Mobile Sea Range), ATC (Air Traffic Control), RPV mission guidance and control, and weapon guidance applications is also considered.

MAJS: **AIR NAVIGATION/AIRCRAFT CONTROL/AIRCRAFT GUIDANCE/DISTANCE MEASURING EQUIPMENT/POSITION LOCATION/REOTEELY PILOTED VEHICLES**

**77A47353**

**UTTL:** Ducted-fan VTOL RPV system

**AUTH:** A/JOHNSON, R. A.; B/SKALL, R. D.


**ABS:** A ducted-fan RPV research test vehicle which is a small, four-foot duct diameter airframe that will be capable of hover and transition to forward flight has been developed. The principle features of this airframe are its ability to take off and land vertically in confined and unprepared areas and the capacity for non-pilot trained personnel to operate the vehicle simply and safely. Ground tests were conducted on the vehicle to verify the thrust and control motors statically and to demonstrate controllability and transition characteristics on a tether rig.

MAJS: **DUCTED FANS/GROUND TESTS/HOVERING/REOTEELY PILOTED VEHICLES/VERTICAL LANDING/VERTICAL TAKEOFF**
77A47352
UTTL: Remote rate control for RPVs
AUTH: A/KIRSCH, J.
In: The RPV - Complement to manned systems:
Proceedings of the Fourth Annual Symposium,
Washington, D.C., June 5-9, 1977. (77-47333 22-05)
Dayton, Ohio, National Association for Remotely
ABS: The paper proposes a tactile control system which
would provide the ground controller of an RPV with the
sensitivity to detect the error rate of change and enable
him to be alert to a fast buildup of error.
Tactile signals could be used to present rate
information as an alternative to 'quickening' a visual
display. The video-tactile system would use two
channels of information to provide a natural and
innate instinctive method of control. The rate information
could be extracted and telemetered to a control
operator as tactile stimuli.
MAJS:/*DISPLAY DEVICES*/ERROR CORRECTING DEVICES*/GROUND
BASED CONTROL*/REMOTE CONTROL*/REMOTELY PILOTED
VEHICLES*/TACTILE DISCRIMINATION

77A47350
UTTL: Advanced avionics for the Advanced Remotely Piloted
Vehicle (ARPV)
AUTH: A/PERRY, J. L.; B/GOYAL, V. K.; C/ZIESIG, D. R.
In: The RPV - Complement to manned systems:
Proceedings of the Fourth Annual Symposium,
Washington, D.C., June 5-9, 1977. (77-47333 22-05)
Dayton, Ohio, National Association for Remotely
ABS: The Advanced Remotely Piloted Vehicle (ARPV) is a new
Air Force weapons system intended to perform
Reconnaissance (Recce), Electronic Warfare (EW), and
Strike missions in support of manned tactical
aircraft. A single multi-mission multipurpose ARPV
design appears more cost-effective than a
proliferation of different RPV designs, each tailored
to a specific mission. The ARPV's hardware and
software must be capable of rapid change, from mission
to mission. To achieve this required flexibility while
maintaining low life cycle cost, the Air Force
Avionics Laboratory (AFAL) launched an investigation
of the use of advanced multiplexing and microcomputer
techniques to the ARPV. The results of this effort are
presented, and include a proposed data bus
architecture which is a logical extension of the Air
Force's Digital Avionics Information System (DAIS).
MAJS:/*AERIAL RECONNAISSANCE*/AIRBORNE/SPACEBORNE COMPUTERS
/*AVIONICS*/ELECTRONIC CONTROL*/REMOTELY PILOTED
VEHICLES*/WEAPON SYSTEMS

77A47349
UTTL: An evaluation of future RPV automatic navigation
AUTH: A/MC KEEL, G. J.
In: The RPV - Complement to manned systems:
Proceedings of the Fourth Annual Symposium,
Washington, D.C., June 5-9, 1977. (77-47333 22-05)
Dayton, Ohio, National Association for Remotely
Piloted Vehicles, 1977, p. 117-120.
ABS: A miniature, rotary-wing, RPV, designed and built by
Atlantic Research Corporation, has been shown to be
stable in flight and capable of carrying various
reconnaissance payloads. The experimental aircraft has
flown in several test configurations. Average all-up
weight, including fuel for an hour and payload, has
been approximately 26 pounds. Payloads have included a
television camera and a fiber-optic air-to-ground link, and a
motion-picture camera. The objective of the in-house
project was to demonstrate system feasibility. It is
envisioned that, with further system development, this
type of RPV can complement manned systems in a variety
of functions, both in civil and in military
applications.
MAJS:/*AERIAL RECONNAISSANCE*/LIGHT AIRCRAFT*/PAYLOADS*
REMOTELY PILOTED VEHICLES*/ROTARY WING AIRCRAFT
77A47349
UTTL: Microcomputer RPV stabilization and control system
AUTH: A/EISLINGER, R. C.

ABSTRACT: Utilization of a microcomputer in a typical mini-middle type remote piloted vehicle (RPV) system is explored, with attention given to software development. Built-in testing procedures and automatic checkout, in addition to in-flight RPV control and stabilization, are realizable with availability of 16-bit microprocessors with high-density memories capable of functioning over the full range of military environments. Input/output signals processed by the microcomputer in the RPV system are tabulated and discussed.

MAJORS: /*AIRCRAFT STABILITY*/AUTOMATIC TEST EQUIPMENT/*FLIGHT CONTROL*/LIGHT AIRCRAFT/MICROPROCESSORS/*REMOtELY PILOTED VEHICLES*/

77A47347
UTTL: Development of a small, low cost turbojet engine with thrust augmentation
AUTH: A/ELROOD, W. C.; B/WRIGHT, H. E.; C/WOLFE, B. L., JR.; D/CURNIAK, J. D.; E/WILKINSON, D. B.
In: The RPV - Complement to manned systems; Proceedings of the Fourth Annual Symposium, Dayton, Ohio, National Association for Remotely Piloted Vehicles, 1977. pp. 89-95.

ABSTRACT: Turbosuperchargers from two manufacturers were successfully converted to turbojet engines, with one engine run up from idle to maximum thrust while limiting the turbine inlet temperature to 1250 K. The smaller of the two turbosupercharger systems selected for conversion (designated J-1 and J-3 engines) was the first to be converted to a turbojet engine (the J-1 unit) and subsequently the conventional combustor was replaced with a catalytic reactor (then designated the J-3 unit). The J-3 engine weighed 13.15 kg (29 lb-m) excluding the oil system and produced 133N (30 lb-f) thrust with a turbine inlet temperature of 1250 K while operating on hydrogen as a fuel. The larger turbosupercharger designated the J-2 unit operating with JP-4 as a fuel and limiting the turbine inlet temperature to 1250 K produced 330 N (74.5 lb-f) thrust dry and 483 N (109 lb-f) with afterburner. The thrust specific fuel consumption ranged from 2.2 to 3.6.

MAJORS: /*JET ENGINE*//*JET THRUST*//*LOW COST*//*REMOtELY PILOTED VEHICLES*//*THRUST AUGMENTATION*/TURBOJET ENGINES*/

77A47346
UTTL: An alternate recovery system for the Aquila

ABSTRACT: A soft-landing variant recovery system for the Aquila mini-RPV is described. A hydraulic drag brake arrangement is employed for test horizontal deceleration and an air mattress to facilitate vertical deceleration. The arrangements can be set up within 2 hr and dismantled within 2 hr. The RPV can be hauled to launch site and from recovery site in a pickup truck.

MAJORS: /*AIRCRAFT BRAKES*//*DECELERATION*//*RECOVERABLE LAUNCH VEHICLES*//*REMOtELY PILOTED VEHICLES*//*SOFT LANDING*//*VERTICAL LANDING*/

77A47345
UTTL: Multiple Drone Control development
AUTH: A/WINKLER, F. E.
In: The RPV - Complement to manned systems; Proceedings of the Fourth Annual Symposium, Dayton, Ohio, National Association for Remotely Piloted Vehicles, 1977. p. 79-84.

ABSTRACT: This paper discusses the development of the Multiple Drone Control (MDC) system and its application in the use of multiple RPVs for operational EW missions. The system evolution from one-on-one control, using the AN/UPO-3 Microwave Command Guidance System (MCDS), to the Multiple Drone Control/Strike System (MDC/SS) as described, 50C/5S, currently completing DT&E and 10T&E flight testing, is discussed, including flight test results and operational capabilities. Other potential applications of the current configuration are noted and possible future evolution of the system is discussed.

MAJORS: /*AIRCORNE/SPACEBORNE COMPUTERS*//*DRONE VEHICLES*//*ELECTRONIC CONTROL*//*FLIGHT TESTS*//*REMOtELY PILOTED VEHICLES*//*WEAPON SYSTEMS*/

PAGE 21 (ITEMS 83-86 OF 224)
77347344

UTTL: Development of an ultra-low-cost gas turbine
AUTH: A/BACRST, C. F.; B/NORFREN, W. M.

ABS: By utilizing the aerodynamic components from a high-production, low-cost truck engine turbocharger, a new generation of ultra-low-cost turbine engines is developed. A series of engines in the 100- to 200-pound thrust class under development by Garrett/A11Research is presented. One engine is a simple conversion of the Model T-18A turbocharger to an engine with 100-pounds thrust. A second version redesigns the turbine and adds a sudden expansion burner for augmentation and produces about 200-pounds thrust. Both engines were fabricated and successfully run in sea-level thrust stands. Testing of these prototypes proved the performance capability of this concept and provided the basis for future engine development.

MAJS: /ENGINE DESIGN/ENGINE TESTS/GAS TURBINE ENGINES/LOW COST/REMOTE PILOTED VEHICLES/TURBOJET ENGINES

77347343

UTTL: Synergistic growth of ITCs to a tactical RPV C2 system
AUTH: A/DARROW, D.

ABS: This paper presents a brief technical overview and summary of test results on the Integrated Target Control System (ITCS) developed by Motorola under contract to Naval Air Systems Command. A wideband anti-jam data link developed under a Motorola Independent Research and Development Program is also discussed. ITCS was developed as a set of control stations operating at ranges to 250 nautical miles and associated target avionics. It is the most modern, operational, integrated system in existence today for command, control, and tracking of unilatered vehicles. The technology and hands-on experience gained from the ITCS program are directly applicable to tactical RPV command, control, and information transfer problems. The proven hardware and operational experience gained from ITCS coupled with demonstrated hardware and state-of-the-art technology from the Motorola anti-jam wideband data link provide the basis for an advanced design, high performance, cost effective RPV command, control, and information transfer system.

MAJS: /AVIONICS/COST EFFECTIVENESS/ELECTRONIC CONTROL/REMOTE PILOTED VEHICLES/TARGET ACQUISITION

77347342

UTTL: The mini-RPV, cost effectiveness in a tactical environment
AUTH: A/ROSE, E. A., JR.; B/BUDIANSKY, J. H.

ABS: A cost effectiveness analysis to examine RPV deployment in defense suppression, 'Jotter mine', and jamming is described. Scenarios are used to develop rational for cost effectiveness tradeoffs that demonstrate aid to manned systems in the battlefield. Mission profiles in hypothetical but reasonable European scenarios are used as a background for the analysis. Examples of low cost component technology and manufacturing techniques being used to develop operational systems, and representative RPV hardware, are included.

MAJS: /COST EFFECTIVENESS/DEPLOYMENT/ENVIRONMENT MODELS/FIGHTER AIRCRAFT/REMOTE PILOTED VEHICLES

77347341

UTTL: Tethered hover flight tests of a vertical attitude takeoff and landing remotely piloted vehicle
AUTH: A/EILERTSON, W. H.

ABS: Vertical attitude takeoff and landing offers attractive advantages to the Navy in that ship interface problems are alleviated. A 560-lb demonstration vehicle was designed to assess these advantages. This vehicle will be flight tested to assess vertical hover capability in the turbulent aerodynamic wake generated by a ship's superstructure which is underway. The design incorporates a close coupled canard/deltawing configuration. Components from the Harpoon missile are utilized. Tethered flight tests in hover were recently demonstrated successfully.

MAJS: /FLIGHT TESTS/HOVERING/REMOTE PILOTED VEHICLES/TETHERING/VERTICAL LANDING/VERTICAL TAKEOFF
77A473340

UTL: Selection of optimum RPV operational launch and recovery techniques

AUTH: A/POPOCKI, W. J.


ABS: A qualitative study of production, technology, and cost control problems in working out optimum launch and recovery techniques for combat RPVs (remotely piloted vehicles) is presented. Cost/benefit/risk analysis and life cycle cost analysis studies are described. Candidate systems and hardware for RPV launch and recovery operations are listed and compared. The study is recommended as an attack on problems not amenable to detailed quantitative procedures, while offering reasonably rapid convergence to the most appropriate candidates to be given closer attention in system development.

MAJS: /*AIRCRAFT DESIGN/*COST ANALYSIS/*LAUNCHING/* PRODUCTION ENGINEERING/*RECOVERABLE LAUNCH VEHICLES/* REMOTELY PILOTED VEHICLES

77A473339

UTL: U.S./F.R.G. advanced tactical RPV requirements as perceived by Boeing and Dornier

AUTH: A/DOHRITI, D. J.; B/SCHWEIZER, P. H.; C/SPINTZYK, J.


ABS: Tactical combat requirements for effective use of remotely piloted vehicles (RPV) are assessed for a central European scenario. Reliance on RPVs is found best advised when combat attrition rates are high and a certain range of fixed or transient targets are to be engaged. Mixes of RPVs and manned aircraft are considered. Alert capability, survivability on the ground, 24-hour all-weather capability, and RPV use as decoys and provocations are highlighted. Recommended recon missions include: detailed zone reconnaissance of concentrated armor, area activity sampling along communication routes, and bomb damage assessment after strikes. Low cost, modest personnel requirements, and saving of trained personnel for other tasks are emphasized.

MAJS: /*AIRCRAFT DESIGN/*COST EFFECTIVENESS/*DESIGN ANALYSIS /*REMOLOY PILOTED VEHICLES/*USER REQUIREMENTS/*WEAPON SYSTEMS

77A47338

UTL: The development of the XMOM-105 Aquila mini-RPV system

AUTH: A/SCHNEELY, F. D.


ABS: The Army's Aquila program began in January 1975 with the objective of demonstrating the application of mini-RPV technology to missions of surveillance, artillery fire adjustment, and laser designation. This paper reviews major events during the course of the program with emphasis on technical, scheduling, and programmatic aspects. Particular emphasis is placed on the system aspects of mini-RPVs and innovative test approaches. Film and video highlights of launch and recovery operations are shown along with imaging data from onboard sensors.

MAJS: /*GROUND BASED CONTROL/*RECOVERABLE LAUNCH VEHICLES/*REMOTE CONTROL/*REMOLOY PILOTED VEHICLES/*SURVEILLANCE

77A47337

UTL: Tactical expendable drone system / TEDS/

AUTH: A/CAPERTON, O. H.


ABS: Tactical combat uses of TEDS (tactical expendable drones) in strike and support missions are outlined, and results of validation and flight tests are presented. Decay service against hostile AAA and/or SAM, couple as a diversionary decoy strike force, penetration aid for area-protected jammer, and target acquisition support applications are described. Saturation and dilution of hostile defense systems are emphasized. Production, storage, maintenance, combat deployment, and launch of TEDS are outlined.

MAJS: /*AIRCRAFT DESIGN/*DECOYS/*DRONE VEHICLES/*REMOLOY PILOTED VEHICLES/*TARGET ACQUISITION

77A47336

UTL: Applications of Tomahawk cruise missile

AUTH: A/LYNCH, R. A.; B/SUTLIFF, J. D.; C/MURPHY, L. E.; JR.; D/KARMAZIN, W. R.


ABS: The versatility and durability of the Tomahawk cruise missile incorporated into an RPV system are recommended. Originally designed for submarine launch, the Tomahawk in its RPV format can be launched from ground, vehicles, shipboard, or aircraft, with a quick-connect 1000-lb payload and a range of 1500 nautical mi. Recoverability and prompt reusability are additional advantages of the weapon system. Reconnaissance, jamming and clogging nuisance missions and strikes against hard targets and sheltered or revetted aircraft are possible applications.

MAJS: /*CRUISE MISSILES*/MISSILE LAUNCHERS*/REMOTELY PILOTED VEHICLES*/REUSABLE LAUNCH VEHICLE*/TARGET ACQUISITION

77A47335
UTTL: Operational concept for a battlefield surveillance RPV system /Canadair CL-227/
AUTH: A/KE#R, J. P.

ABS: An operational concept is described for a battlefield surveillance RPV system designed to provide field commanders with an organic capability for real-time surveillance over enemy terrain; immediate acquisition of targets and fire adjustment-target designation. The RPV system comprises Control Stations, RPV Stations and RPV's with Payloads; it is the Canadair CL-227 system. The systems characteristics provide the basis for an operational concept whereby RPV preparation, take-off, landing and servicing is undertaken well to the rear while control during a mission is exercised by a forward station. The phases of such an operation are described together with a maintenance concept.

MAJS: /*GROUND BASED CONTROL*/REAL TIME OPERATION*/REMOTE CONTROL*/REMOTELY PILOTED VEHICLES*/SURVEILLANCE*/TARGET ACQUISITION

77A47334
UTTL: Complementary roles for RPVs in support of tactical manned aircraft
AUTH: A/ZRAXET, C. A.; B/ROSE, S. E.

ABS: As a result of new technology in computer, sensor and communications electronics, it is feasible that future tactical strike aircraft to control a supporting force of 'smart' RPVs which are able to operate semi-autonomously in a number of missions without continual remote control. The RPVs have the inherent capability to electronically sense the threat environment, take self-initiated evasive maneuvers and transmit this data to other RPVs and the manned aircraft. By providing this information to the data-processing capability distributed among the aircraft, the RPVs and ground tactical control centers, it will be feasible in real time, to reconfigure the overall attack against the most recently perceived threat. The use of RPVs in support of tactical manned aircraft promises to significantly reduce the cost and to increase the size and effectiveness of the total fleet.

MAJS: /*AIRCRAFT/SURVEY VEHICLES*/AIRCRAFT MANEUVERS*/COST REDUCTION*/REMOTE CONTROL*/REMOTELY PILOTED VEHICLES*/SURVEILLANCE

77A47333
UTTL: The RPV + Complement to manned systems: Proceedings of the Fourth Annual Symposium, Washington, D.C., June 5-9, 1977
Symposium sponsored by the National Association for Remotely Piloted Vehicles. Dayton, Ohio, National Association for Remotely Piloted Vehicles. 1977. 182 p
(FOR individual items see A77-47334 to A77-47354)

ABS: Attention is given to complementary roles for RPVs in support of tactical manned aircraft. An operational concept for a battlefield surveillance RPV system (Canadair CL-227). RPV applications of the Tomahawk cruise missile, and the Aquila mini-RPV program. The selection of optimum RPV operational launch and recovery techniques, tethered hover flight tests of a vertical attitude takeoff and landing RPV, the development of an ultra-low-cost gas turbine for RPV applications, and the development of the Multiple Drone Control System are also considered.

MAJS: /*CONFERENCES*/FIGHTER AIRCRAFT*/RECOVERABLE LAUNCH VEHICLES*/REMOTELY PILOTED VEHICLES

77A44443
UTTL: The remotely piloted helicopter
AUTH: A/RAULKNER, A. J.; B/SIMONS, I. A.
In: Vertica: vol. 1. no. 3. 1977. p. 231-238.

ABS: This article describes some of the fundamental problems associated with current fixed wing remotely piloted vehicles, particularly during launch and recovery, and introduces the idea of a small remotely
piloted helicopter in the role of real time surveillance and reconnaissance. It is argued that a co-axially rotor helicopter with a plan-symmetric fuselage is the most suitable configuration for remote piloting as it offers the simplest form of pilot controls, minimizes rotor cross-couplings and permits a cartesian mode of co-rotation. The problems associated with the aerodynamic shape of the fuselage are indicated and the importance of automatic stabilization is discussed in some detail. Finally a brief account is given of some experimental flight testing carried out on a small scale co-axial helicopter.

MAJS: /*AIRCRAFT CONFIGURATIONS*/HELMET CONTROL*/HELMET DESIGN/*REMOTELY PILOTED VEHICLES

77A44082

UTTL: Solution of the basic problem of discontinuous dynamic system control

ABS: (For abstract see issue 14, p. 2395, Accession no. A77-32062)

MAJS: /*CONTROL THEORY**DYNAMIC CONTROL*/FLIGHT CONTROL*/NONLINEAR SYSTEMS/*REMOTELY PILOTED VEHICLES

77A42276

UTTL: Vertical landing attitude control of a remotely piloted vehicle using jet vanes in the engine exhausts

ABS: An attitude control system for a remotely piloted vehicle is investigated. The RPV is a vertical takeoff and landing vehicle which is to be operated from a non-aviation ship. The RPV lands with its two wing tip mounted engines tilted vertically, providing all of the RPV's lift. Since the conventional aerodynamic control surfaces are ineffective during the low speed vertical landing, control is achieved by deflecting jet vanes in the high energy engine exhausts. Jet vane control effectiveness, as well as simulation results of the RPV landing maneuver, are discussed.

MAJS: /*ATTITUDE CONTROL*/JET ENGINES*/JET VANES*/REMOTELY PILOTED VEHICLES*/VERTICAL LANDING*/VERTICAL TAKEOFF

77A41928

UTTL: The future of rotorcraft in aviation
AUTH: A/JONES, J. P.

ABS: The evaluation concerning the future of rotorcraft takes into account the conventional helicopter, the supersonic rotor helicopter, the tilt (wing) rotor, and remotely piloted helicopters. With respect to the conventional helicopter it is expected that new developments will more than double its cost-effectiveness. The aerodynamic problems of the helicopter disappear if rotation at supersonic tip speeds is employed. There are, however, problems of increased noise and power consumption for the supersonic rotor helicopter, which will probably limit its use to military applications. Convertible rotorcraft have possibly the best technical chance of finding a civil market, but the investment requirements are high. Remotely piloted helicopters require a long period of engineering development work, which will probably only be performed in connection with extended military service.

MAJS: /*COST EFFECTIVENESS*/HELMET DESIGN*/REMOTELY PILOTED VEHICLES*/ROTORCRAFT AIRCRAFT*/TECHNOLOGICAL FORECASTING*/TILT ROTOR AIRCRAFT

77A40708

UTTL: The concept of remotely piloted helicopters
AUTH: A/SIMONS, I. A.

ABS: The features required in, and some of the problems associated with, a battlefield surveillance system utilizing a mini-rpv are reviewed as a case is made for the use of a helicopter in this role. A plan-symmetric, coaxial rotor helicopter is proposed and its advantages and disadvantages are pointed out. In particular its flight control system and flight characteristics are discussed in some detail. The small research remotely-piloted helicopters of this type built by Westland Helicopters are described and finally mention is made of a more sophisticated project presently under construction.

MAJS: /*HELMET DESIGN*/MILITARY HELICOPTERS*/RECONNAISSANCE AIRCRAFT*/REMOTELY PILOITED VEHICLES
77A39519

UTTIL: Project work on a strike RPV
AUTH: A/SPINTZKA, J.

ABS: A proposal for a highly cost-effective strike RPV with
high deterrent value is outlined. The RPV is intended
for launch from rear fields for sorties against
previously reconnoitered mobile or fixed targets. Both
outward and return flight are pre-programmed and take
place near the ground at high speeds. Low-level
bombing is carried out without terminal guidance.
Landing is automatic. A hybrid navigation system, with
a strapdown inertial system for air-derived
navigation, is under consideration. A configuration
with fuselage-stored weapons and external engines
appears suitable.

MAJS: /"ATTACK AIRCRAFT"/"REMOTELY PILOTED VEHICLES

77A32918

UTTIL: Drone and RPV programmes at Dornier
AUTH: A/KLAAR, W.

ABS: Remotely Piloted Vehicle (RPV) development programs
have undergone a gradual change of objectives. The
original expectation that the problem of vulnerability
of manned aircraft could be completely circumvented by
the use of RPVs has given way to the interest in the
development of RPVs for some more modest tasks to be
performed on a largely automated mission requiring
a minimum amount of intervention from the remote
pilot. RPV programs and applications under
consideration or in progress for the armies, navies
and air forces of the NATO countries are briefly
discussed. The advantages of international cooperation
in RPV development are outlined.

MAJS: /"DRONE VEHICLES"/"REMOTELY PILOTED VEHICLES

77A38591

UTTIL: Low cost RPV booster
AUTH: A/STEPHEN, W. A.; B/SCHOEN, L. L.; C/EATOUGH, R. G.
American Institute of Aeronautics and Astronautics and
Society of Automotive Engineers, Propulsion
Conference, 13th, Orlando, Fla., July 11-13, 1977,
AIAA 6 p.

ABS: Low cost RPV operation requires use of a simple cost
effective booster system. The cost of a solid rocket
booster can be significantly reduced by use of a
nozzleless motor configuration. The nozzleless concept
feasibility has been demonstrated and evaluated in
quite some detail. However, until recently, methods
for steering the nozzleless motor had not been
defined. C/S, in conjunction with TRW, has
demonstrated the capability of integrating the
nozzleless motor and thrust vector control (TVC)
system to provide a low cost method of an advanced
RPV. This propulsion system offers the U.S. Air Force
a system which will meet the performance requirements,
and significantly surpass service life estimate of the
system.

MAJS: /"BOOSTER ROCKET ENGINES"/"COST REDUCTION"/"NOZZLELESS
ROCKET ENGINES"/"REMOTE PILOTED VEHICLES"/"ROCKET
ENGINE DESIGN"/"SOLID ROCKET PROPELLANTS"/"THRUST VECTOR
CONTROL

77A37379

UTTIL: Advantages of a time division multiplex data bus for
remotely piloted vehicle built-in-test
AUTH: A/QUALLS, L. R.
In: NAECON '76; Proceedings of the National Aerospace
and Electronics Conference, Dayton, Ohio, May 18-20,
1976. (A77-37352 17-33) New York, Institute of
203-207.

ABS: Avionics systems in new weapon systems such as the
F-15 use a digital time division multiplex technique
to integrate sensors, computers, and displays. This
technique, as outlined in the MIL-STD-1553 Internal
Aircraft Time Division Multiplex Data Bus, can also be
used to controlize Built-In-Test (BIT) during
design and in-flight checks. This Paper describes
the support concepts required for Avionics Systems
Integrated with a MIL-STD-1553 Data Bus. The unique
features of a MIL-STD-1553 system, command-response
message format, and allocated mode command and
collection of the system status word, are reviewed.
Advantages of the MIL-STD-1553 Data Bus for
Built-In-Test are described.

MAJS: /"AVIONICS"/"CHANNELS (DATA TRANSMISSION)"/"REMOTELY
PILOTED VEHICLES"/"TEST EQUIPMENT"/"TIME DIVISION
MULTIPLEXING

77A37365

UTTIL: A new ASD approach to avionic systems engineering
AUTH: A/GIFFORD, C. A.
In: NAECON '76; Proceedings of the National Aerospace
and Electronics Conference, Dayton, Ohio, May 18-20,
1976. (A77-37352 17-33) New York, Institute of
98-99.

ABS: A study team concept to avionic systems engineering is
described which includes literature searches,
independent analyses, and avionics configuration hot
benchings. Particular attention is given to the use of both
mini and major hot benching in the advanced
remotely piloted vehicle program.

MAJS: */AVIONICS*/MILITARY AVIATION/REMODELY PILOTED VEHICLES*/SYSTEMS ENGINEERING

77A32022

UTTL: A naval V TOL RPV in testing
AUTH: A/EILERTSON, W. H.

ABS: Progress in light-weight electronics has caused the Navy to assess the advantages that might accrue from the use of remotely piloted vehicles (RPVs). Analyses indicate that RPVs can be 60% lighter and cost only a third as much as comparable manned aircraft intended for similar missions. RPVs would improve the Navy's air support and favorably complement manned aircraft. They could be designed to fly low-endurance missions (free of constraints imposed on manned aircraft) and to be highly maneuverable against heavily defended targets. They would not, however, replace manned aircraft in support missions requiring high reliability in engaging targets posing an immediate threat to the fleet. In the present paper, tests are described which demonstrated the advantages of vertical-attitude takeoff and landing (VATOL) over other approaches to launching and recovering RPVs.

MAJS: */CGST REDUCTION*/FLIGHT TESTS/REMODELY PILOTED VEHICLES*/VERTICAL LANDING/VERTICAL TAKEOFF AIRCRAFT

77A34931

UTTL: Tethered hover tests of the X-19M-100A vertical attitude takeoff and landing demonstration vehicle
AUTH: A/EILERTSON, W. H.

ABS: Vertical attitude takeoff and landing (VATOL) offers an attractive solution to the launch and recovery of Navy RPVs as well as future manned VSTOL aircraft aboard ships. This paper reviews the DTNSRDC V TOL program with attention given to the demonstration vehicle guidance and control, aerodynamic characteristics in hover, and jet vane performance. Particular attention is given to flight simulation hover flight phase and tethered hover flight tests.

MAJS: */FLIGHT TEST VEHICLES*/HOVERING STABILITY/REMODELY PILOTED VEHICLES*/VERTICAL LANDING/VERTICAL TAKEOFF AIRCRAFT

77A32823

UTTL: Contribution to the solution of the basic control problem for a discontinuous dynamic system
AUTH: A/SIRZIPOV, N. G.; B/SIRZIPOV, T. K.

ABS: A solution is obtained to the problem of constructing a control process described by a discontinuous system of differential equations, such that the phase coordinates, or the values of certain functionals, come to lie within a prescribed region. The problem of determining such parameters of a remotely controlled craft as the load at the mid-section of the fuselage and the moment of starting the engine is examined as an example.

MAJS: */CONTROL THEORY*/DYNAMIC CONTROL*/FLIGHT CONTROL/ NONLINEAR SYSTEMS*/REMODELY PILOTED VEHICLES

77A28982

UTTL: A critical comparison of fast transforms for image data compression
AUTH: A/GRISWOLD, N. C.; B/HARALICK, R. M.

ABS: With application to imagery for RPVs, a number of transformed coding compressions using six bits, 512 x 512 images with 16 x 16 windows for various transforms have been compared. In order of worst to best performance, the transforms were Hadamard, Fourier, slant, discrete linear basis, discrete cosine, and fast Haar. Good performance was achieved for the three latter transforms for compression ratios of 12:1 or 1/2 bit per pixel.

MAJS: */AIRCRAFT COMMUNICATION*/DATA COMPRESSION*/REMODELY PILOTED VEHICLES*/SIGNAL ENCODING*/TRANSFORMATIONS (MATHEMATICS)

77A28970

UTTL: Video link data compression for remote sensors
AUTH: A/ESSMAN, J. E.; B/HUA, O. D.; C/GRISWOLD, N. C.

ABS: This paper summarizes a research study on data compression techniques applicable for Remote Piloted Vehicles (RPV). Interframe techniques are considered and algorithms are determined to account for motion in
frame-to-frame aerial photographs resulting in large bit reduction ratios provided that the various parameters of the mission such as altitude, velocity, etc. are accurately known. Differential encoding is used to further reduce bandwidth. Intraframe techniques suitable for the RPV mission including two-dimensional transform techniques and hybrid coding schemes are investigated and evaluated. It is shown that the hybrid schemes using Hadamard transform in one spatial direction and DPCM in the other spatial direction performs equivalent and at times superior to 2-dimensional transform techniques. The effects of channel errors on both the transform and hybrid coding schemes are investigated. Although the hybrid coding scheme is shown to be more sensitive to noise, optimization of the prediction coefficient results in satisfactory performance in a noisy environment. An adaptive scheme is considered which shows improved resolution in regions of high activity within the picture.

MAJS: /DATA COMPRESSION/DATA LINKS/REMOTE SENSORS/ REMOTE PILOTED VEHICLES/VIDEO DATA

77A26468

UTTL: RPV video communications - A new challenge to video data compression

AUTH: A/WANG, R. T. P.

ABS: The paper examines the general scenario in which the RPV video capability will be used, with emphasis on video information content and visual search. Attention is given to such video data compression techniques as slow frame rate TV, hybrid transform/DPCM algorithm, the Hadamard transform algorithm, and source information adaptive coding.

MAJS: /AIRCRAFT COMMUNICATION/DATA COMPRESSION/REMOTE PILOTED VEHICLES/VIDEO COMMUNICATION/VIDEO DATA

77A28967

UTTL: Adaptive Haar transform video bandwidth reduction system for RPV's

AUTH: A/REIS, J. J.; B/LYNNCH, R. T.; C/EUTMAN, J.

ABS: A video bandwidth compression system for RPVs, based on the fast two-dimensional Haar transform and an adaptive compression technique, is described. After the video signals are Haar-transformed, the resulting transform coefficients are adaptively filtered to achieve low transmission data rates of less than 1 bit/pel, while maintaining good picture quality.

MAJS: /AIRCRAFT COMMUNICATION/BANDWIDTH/DATA COMPRESSION /REMOTE PILOTED VEHICLES/TRANSFORMATIONS (MATHEMATICS)/VIDEO COMMUNICATION

77A28209

UTTL: The HIMAT RPV propulsion control system

AUTH: A/BAYATI, J. E.

ABS: The paper describes the multirole propulsion control system concept developed for Phase III of the Highly Maneuverable Aircraft Technology (HIMAT) program. Control requirements are discussed, and a block diagram of the airborne integrated control system is provided. Consideration is given to thrust reverse, multimode control, the main fuel control, the afterburner fuel control, and the throat- and jet-nozzle actuation systems. Ground-pilot tasks and aids are briefly outlined.

MAJS: /AIRCRAFT CONTROL/FIGHTER AIRCRAFT/PROPULSION SYSTEM PERFORMANCE/REMOTE PILOTED VEHICLES/TURBOJET ENGINE CONTROL

77A23539

UTTL: A night photo system for remotely piloted vehicles

AUTH: A/APP, H. S.

ABS: The Air Force Avionics Laboratory has developed a night photo system designated as the KS-126A. The KS-126A was designed for the weight-power and size constraints associated with RPV aircraft. The system consists of a pulsed illuminator synchronized to a single 70mm camera. The camera is unique in two respects: (1) one tube; (2) the camera makes use of a rotating carousel or turntable having three prisms, each one providing a 40 x 40 inch view of the ground. The system was delivered in an RF4C centerline pod so that flight testing could be effectively accomplished by a controllable high performance aircraft. Results of experiments to simulate the RPV flight environment in a ground dynamic analyzer and the RF4C centerline...
Pod will be discussed. Also the flight test results and K5-125/BD4-34C vehicle interface problems will be addressed.

**MAJS:** /AERIAL PHOTOGRAPHY/*FLIGHT TESTS/*FRAMING CAMERAS/*INFRARED PHOTOGRAPHY/*LIGHT FLIGHTS (AIRCRAFT)/*REMOTELY PILOTED VEHICLES

77A23521

**UTTL:** RPV sensor system interface

**AUTH:** A/ROGERS, H. N.


**ABS:** Remotely Piloted Vehicles (RPVs) are versatile aerial platforms which can be piloted by radio link from a remote control point. The latest model features a removable modular nose designed to carry a variety of payloads for reconnaissance, electronic warfare and strike missions. This paper describes the interface of three sensor systems to RPVs - the K5-120 camera, the Perkin-Elmer KA-98 prototype laser line scanner and the prototype Philco Ford laser target designator. The interface to the modular nose YEGM-34C multi-mission RPV is discussed along with the interfaces to the BD4-34D and AOM-34C RPVs. A brief history of reconnaissance RPVs is given.

**MAJS:** /AERIAL RECONNAISSANCE/*DATA COLLECTION PLATFORMS/*RECONNAISSANCE AIRCRAFT/*REMOTE SENSORS/*REMOTELY PILOTED VEHICLES

77A20867

**UTTL:** Attitude control of a pilotless aircraft by radioactive probes


**ABS:** The servocontrol of the attitude of an RPV can be based on the natural electric field within the atmosphere. The vehicle movements are detected, around the roll and pitch axes, by means of radioactive probes installed at the wing tips and at the front and back ends of the fuselage. The electric signals provided by these probes are preprocessed, then mixed with the orders from the ground and directed to the aircraft servocontrols. The study presented in this paper is mainly oriented towards the understanding of the physical mechanisms intervening in the use of radioactive probes, and on the perturbations due to spurious electric charges generated by the engine exhaust gases.

**MAJS:** /ATTITUDE CONTROL/*RADIATION DETECTORS/*RADIOACTIVE MATERIALS/*REMOTELY PILOTED VEHICLES/*SERVOCONTROL

77A20682

**UTTL:** Navigation for sea based RPVs

**AUTH:** A/NEWKARN, L.


**ABS:** Navigation instrumentation is necessary for each mission of sea-based remotely piloted vehicle (RPV). The paper examines the impact of each phase of the mission, including launch at sea, traversal to the operations area, critical mission flight operations, and at sea recovery. Constraints resulting from the use of existing navigation techniques are identified. Launched from a carrier, RPV navigation systems requiring preflight data loading and initialization procedures have the benefit of support systems available for similar functions aboard manned aircraft. The journey to the operations area may be navigated using a variety of methods ranging from remote control for line-of-sight operations to completely preprogrammed flight controls for over-the-horizon traversals. Included in the discussion are additional design requirements and limitations on RPV navigation system alternatives. It is concluded that the constraints and requirements peculiar to sea-launched RPVs will challenge the limits of the state of the art of navigation.

**MAJS:** /MARINE TECHNOLOGY/*MILITARY OPERATIONS/*NAVIGATION INSTRUMENTS/*REMOTELY PILOTED VEHICLES/*SEA LAUNCHING

77A20628

**UTTL:** B.A.C. experience with small fixed wing and rotary wing R.P.Vs

**AUTH:** A/STEPHENSON, R.


**ABS:** A description is given of research programs conducted with the aid of the Big-Wig model aircraft. The aircraft has a high wing of 2 meters span and a useful payload of about 2 kg. An investigation of electrostatic autostabilizing techniques is reported. Other experiments were related to the use of an optical beam riding system to guide a remotely piloted vehicle. The development of a mini-RPV for
surveillance or defense suppression roles is discussed along with the selection of a suitable model for rotary wing development studies. The selected model was modified to improve its payload capacity while retaining mechanical reliability.

MAJr: /*FIXED WINGS*/RESEARCH AND DEVELOPMENT/ROTARY WING AIRCRAFT

77A20627

UTTL: Skyspy - A ducted RPV fan
AUTH: A/FALSON, H. S.


ABS: The essential elements of Skyspy include a fan, an engine to drive it, a duct enclosing the fan, control surfaces in the jet, and the closed loop control systems and sensors to govern the pitch, roll, yaw, and axial motions of the airframe. The ability of Skyspy to hover or fly at very low speeds is an important factor in operations related to the surveillance of a static or slowly moving objective and search missions at low speeds. Higher forward speeds can be obtained by inclination of the complete airframe. The development of an experimental vehicle is discussed. Attention is also given to the employment of Skyspy as a relay station, details concerning its payload, aspects of vehicle control, and takeoff and landing operations.

MAJg: /*AIRCRAFT PERFORMANCE*/UK/STOL AIRCRAFT

77A20626

UTTL: The Aerodyne - An R.P.V. with multiple capability
AUTH: A/AMTE, A. J.; B/HARMS, G.


ABS: The propulsion system of the Aerodyne uses a gas turbine engine to drive a ducted fan. The static thrust obtained is sufficient to carry the weight of the vehicle. Like the helicopter, the Aerodyne can hover, take off and land vertically. For forward flight the flaps which direct the fan output are gradually changed to the horizontal. The development of an experimental Aerodyne vehicle by a German aerospace company is discussed. Aerodyne configurations for maritime and battlefield operations are considered and a description is presented of a system concept for battlefield operation. A computer in a command vehicle will be used for picture processing, Aerodyne tracking, mission planning, and for equipment testing and check-out.

MAJV: /*AIRCRAFT CONFIGURATIONS*/UK/STOL AIRCRAFT

77A20625

UTTL: R.P.V. sensor data - A real time problem
AUTH: A/HOWE, M. B.


ABS: Technical and data handling problems associated with the use of imaging sensors in an RPV are discussed, taking into account as an example conditions in the case of the AN/USD 501 reconnaissance drone system and its projected successor the USD 502. Questions of suitable data display for an efficient information evaluation are discussed. Attention is given to the requirements of a generalized data transmission system, the sensor characteristics, and methods of storage and scan conversion. The digital converter is found to be the most attractive technically.

MAJr: /*AVIONICS*/DATA SYSTEMS/OPERATIONAL PROBLEMS/*REAL TIME OPERATION*/REMOTE SENSORS/REMOPIOLED VEHICLES

77A20624

UTTL: The minimum R.P.V.


ABS: Questions related to the use of mini RPVs as test vehicles for the development and flight proving of small sensors and instruments are discussed. It is pointed out that such vehicles have also limited operational capability if they can be equipped with suitable sensing devices. Tests with a single rotor helicopter model are considered, taking into account approaches for overcoming certain control problems. Possibilities concerning the employment of fixed wing mini RPVs are also investigated, giving attention to the use of electrostatic autopilots of various designs.

MAJg: /*AIRCRAFT INSTRUMENTS*/REMOTE SENSORS/REMOPIOLED VEHICLES/*TEST VEHICLES
77A20623
UTTL: Convertible aircraft
AUTH: A/SIMPSON, W. D.
ABS: A convertible aircraft is defined as a machine which can be flown manned, but with a manual or remote
override so that it may be controlled as an RPV. In addition, it may also be flown unmanned as a
conventional RPV. Unmanned convertibles can be
controlled either by a ground operator or from a
manned convertible. The basic aircraft will be a low
cost, light fixed wing machine probably powered by a
piston engine. Suitable design characteristics for
convertible aircraft are considered. Attention is
given to the operational use of convertible aircraft
by the Army and the Navy.
MAJS: /*AIRCRAFT DESIGN/ LIGHT AIRCRAFT/ MILITARY AIRCRAFT/ REMOTELY PILOTEO VEHICLES

77A20622
UTTL: Remotely piloted vehicles - The influence of system
of applied technology
AUTH: A/WESLEY, A. C.
ABS: A description of the characteristics of RPV systems is
presented. Both fixed and rotating wing types are
used. The range of overall systems extends from single
to vehicles operated locally to multiple
controlled vehicles operated by complex command posts having
control of many vehicles which may penetrate deeply
into enemy country. Communication techniques and
questions of navigation and flight control are also
discussed along with electro-magnetic sensors and
data handling and processing.
MAJS: /*AVIONICS/ REMOTELY PILOTEO VEHICLES/ SYSTEMS ANALYSIS

77A20621
UTTL: The R.P.V. in perspective
AUTH: A/DELLING, R.
ABS: The term RPV is used to cover a vehicle which
incorporates some combination of remotely piloted,
preprogrammed, and autonomous operating facilities.
Factors leading to an unmanned aircraft are examined
and suitable roles for the RPV are considered. The
roles are related to target simulation, general
surveillance, specific reconnaissance, artillery
spotting, the creation of confusion, and jamming.
Research and development problems are also discussed,
taking into account engines, sensors, navigation,
remote control, the data link, and aspects of search
and recovery.
MAJS: /*CIVIL AVIATION/ MILITARY AVIATION/ REMOTELY PILOTEO VEHICLES

77A20620
UTTL: R.PVs in the maritime environment
AUTH: A/CLITHEROW, K. D. D.
ABS: A major threat to ships in the field of above water
warfare at sea comes from missiles. A number of
approaches utilizing RPVs can be employed in meeting
such a threat. Attention is given to questions of
target identification, the employment of RPVs for
electronic Countermeasures designed to destroy or
defeat attacking missiles, the use of RPVs in
antisubmarine warfare, RPV payloads, and problems
related to the transportation of an RPV on a ship.
MAJS: /*ANTI-MISSILE DEFENSE/ MARINE ENVIRONMENTS/ REMOTELY PILOTED VEHICLES

77A20619
UTTL: Remotely piloted vehicles - An Air Force view
AUTH: A/MITCHELL
ABS: A description is given of the current operational
roles of remotely piloted vehicles and characteristics are examined, taking into account
aspects of vulnerability/survivability, mission
effectiveness, data links, guidance and control, and
operational command and control. Flight regimes at low
altitude, medium altitude, and high altitude are
considered. Attention is given to reconnaissance,
target acquisition and tracking, electronic warfare,
weapon delivery, air-to-air combat, defense
suppression, RPV operating experience to date in the
RAF, RPV problem areas, and the most fruitful areas
for future study.
MAJS: /*AIR DEFENSE/ MILITARY AIRCRAFT/ REMOTELY PILOTED VEHICLES/ TECHNOLOGY UTILIZATION
An Air Force view concerning remotely piloted vehicles is presented and RPVs in the maritime environment are considered. Attention is given to an evaluation of the strengths and weaknesses of RPVs, the influence of system thinking on applied technology in the case of RPVs, U.S. Air Force UAV activity, convertible aircraft, the minimum RPV, RPV sensor data as a real-time problem, the Aerodyne as an RPV with multiple capability, the ducted fan RPV Skyspeed, and the emergence of a British aerospace company with small fixed wing and rotary RPVs. Individual items are announced in this issue.

MAJS: /CONFERENCE/REMOTE PILOTED VEHICLES

Automatic control system synthesis for longitudinal motion of a RPV

AUTH: A. DANESHEV, B.


A control system for longitudinal remotely piloted vehicle (RPV) motions is synthesized for three dynamic control modes: automatic stabilization, assigned mode, and control through the operation of a damping system. A structural arrangement is developed for the three control and stabilization modes. Introduction of a nonlinear element and its effect on mode of saturation and reduction of system gain are studied. Analog computer simulation of the system is discussed. Linear and nonlinear parts of the synthesis approach are delineated, and automatic variation of maximum system pitch with flight speed control is studied. Angular control and lateral control is also possible with the system developed.

MAJS: /AIRCRAFT CONTROL/AUTOMATIC FLIGHT CONTROL/LONGITUDINAL CONTROL/REMOTE PILOTED VEHICLES

Unmanned aircraft in air warfare of the future

AUTH: A. SHILLITO, B. J.


A focus is presented for increased funding of research and development on remotely piloted vehicles (RPV) for tactical air support, reconnaissance, diversionary and attack operations, ECM, and defense against cruise missiles. Use of RPVs in Vietnam for recon, chaff, jamming, ECM, and securing data on SAM fusing and destroeying with no loss in personnel is reviewed.

Future RPV and mini-RPV use in tactical air operations (laying minefields, overwhelming hostile defense radar net at selected points, attack RPVs on key targets, softening up for attack by manned aircraft, laying chaff corridors and jamming, ECM) is recommended. In addition to use as low-cost decoys, false target generators, and other spoofing missions. Expected advances will include: lower operating costs, all-weather vision, computer storage of decision-making routines, low IR signature and low radar cross section, and use of lasers, IR sensors, low light level devices, and compact high-resolution radar.

MAJS: /AIRCRAFT DESIGN/MILITARY AIRCRAFT/REMOTE PILOTED VEHICLES/TECHNOLOGICAL FORECASTING/WARFARE
77A6540
UTTL: Mobile data radio
AUTH: A/BAUERLE, R.
ABS: An investigation is conducted concerning the parameters which affect the quality of communication in the use of mobile transmitters and receivers. Questions of data transmission by radio in the VHF range between a stationary transmitter and a receiver which is in motion are discussed, taking into account aspects of radio wave propagation, transmission error characteristics, and problems of data transmission to low-flying flight vehicles as, for instance, remotely piloted vehicles.
MAJS: /*DATA TRANSMISSION*/FREQUENCY ASSIGNMENT/*GROUND-AIR GROUND COMMUNICATIONS*/RADIO COMMUNICATION/*REMOTELY PILOTED VEHICLES*/TRANSMITTERS

77A12000
UTTL: VTOL RPVs - A technology assessment
AUTH: A/LICENBAUER, B.
ABS: Military uses and advantages of VTOL remotely piloted vehicles (RPV) and VTOL RPV development problems are discussed, along with the state of the art. Means of RPV recovery and launch, and numerous VTOL concepts. The factor of optimal cost of VTOL systems is measured against the total system costs for non-VTOL craft (including landing field or aircraft carrier construction costs and operating costs, ground transportation costs, accident rates), and VTOL advantages where no design accommodation for onboard crew is needed are emphasized (including feasibility of tail-sitter designs, size, availability of all known VTOL approaches). VTOL concepts considered and compared for RPV application include: jet lift, ramjet lift, augmented thrust (with lift fan and ejector type flow augmenters), shrouded propeller/fans, open propeller/rotor, and VATOL (vertical attitude TOL - tail-sitter configuration).
MAJS: /*DRONE AIRCRAFT*/MILITARY AIRCRAFT/*REMOTELY PILOTED VEHICLES*/TECHNOLOGY ASSESSMENT/*VERTICAL TAKEOFF AIRCRAFT

77A11625
UTTL: 'C.22', the new French target drone
AUTH: A/LANGEREUX, P.
ABS: The new C.22 is a subsonic, remotely controlled, target drone of variable speed. It is to replace the target drone of the type CT20. It is expected that the mass production of the C.22 will begin in 1981. The target drone is to be propelled by the turbojet engine TRI 60 which is also to be used in the remotely piloted vehicles. The C.22 will be equipped with a towed target for gunnery-training exercises of antiaircraft artillery and for tests conducted with surface to air missiles. The C.22 will be able to attain a speed of 0.95 Mach.
MAJS: /*AIRCRAFT DESIGN*/REMOTE CONTROL*/REMOTELY PILOTED VEHICLES*/SUBSONIC AIRCRAFT*/TARGET DRONE AIRCRAFT

76A46455
UTTL: The use of combination sequences in a multiple access environment
AUTH: A/MILSTEIN, L. B.
ABS: The fundamental problem of code division multiple access communications is designing codes with good autocorrelation properties for each individual user who at the same time keeps the cross correlation between the codes of any two different users uniformly low. This paper develops a procedure for solving this problem, which consists of generating long codes by combining short sequences on a chip by chip basis using a logical combining law, and illustrates the procedure by a lying it to multiple access communications involving a remotely piloted vehicle.
MAJS: /*AUTOCORRELATION*/BINARY CODES/MULTIPLEXING/*REMOTELY PILOTED VEHICLES*/SIGNAL ENCODING/*TRANSMISSION EFFICIENCY

76A46263
UTTL: RPV developments plumb the field's potential
AUTH: A/KNAKKE, T. W.
ABS: Problems in the design and acceptance of remotely piloted vehicles (RPV) as military systems are surveyed. Major development programs of RPVs and mini-RPVs are described briefly. RPV applications in reconnaissance, strike missions, laser target designation, night sensor or weather sensor.
operations. ECM, and data link service, as tactical warfare systems and carriers of area weapons significantly extending both manned and unmanned standoff missiles, are examined. Command, control, communications, allocation of workload in military theaters, and RPV reliability, survivability, plus special problems to be resolved in the landing, launch, and retrieval of RPVs are discussed.

**MAJS:** //AIRCRAFT DESIGN//COST EFFECTIVENESS//MILITARY AIRCRAFT//REMOtELY PILO TED VEHICLES

76A45981

**UTTL:** A CAO bandwidth-reduction system for RPV video transmission

**AUTH:** A/Pearson, J. J.


**ABS:** A bandwidth compression system for the transmission of video images from remotely piloted vehicles has been built and demonstrated. Novel features of this system are the use of the Constant Area Quantization (CAQ) technique to obtain spatial bit rate reduction of 6:1 and a rugged and compact scan converter, based on a core memory, to accommodate temporal frame rate reduction. Based on the ability of the human eye to perceive more detail in high contrast regions than in low, the CAQ method transmits higher resolution in the former areas. The original six-bit digitized video is converted to a three level signal by the quantizing circuit and then Huffman-encrypted to exploit its statistical properties and reduce it further to one bit per pixel. These circuits operate on one line of the picture at a time, and can handle information at full video (10 MHz) rate. The compressed information when received on the ground is stored in a two-frame (500,000 bit) digital core memory.

**MAJS:** //DATA COMPRESSION//REMOtELY PILO TED VEHICLES//SIGNAL ENCODING//TRANSMISSION EFFICIENCY//VIDEO COMMUNICATION

76A45994

**UTTL:** Functional and reliability requirements concerning RPV's from the point of view of traffic safety and military cost effectiveness

**AUTH:** A/Kaschuetz, H.; B/Krogull, B.


**ABS:** The employment of unmanned aircraft for military objectives provides a possibility to perform certain operations more efficiently or at lower cost than with alternate manned systems. However, the differences in the characteristics of unmanned and manned systems have to be taken into account in considering the implications of RPV operation on peace-time and peacetime conditions. Questions regarding the application of the regulations of the air law on RPV operation are discussed. A reliability analysis of RPV's is conducted and aspects of cost effectiveness are investigated.

**MAJS:** //AIRCRAFT RELIABILITY//AIRCRAFT SAFETY//COST EFFECTIVENESS//MILITARY AIRCRAFT//REMOtELY PILO TED VEHICLES

76A40593

**UTTL:** Sensor systems for target acquisition and the determination of target location. I, II

**AUTH:** A/Meyeroff, K.; B/Siebecker, H. K.


**ABS:** A description is given of a television camera with novel characteristics for RPV experiments which is being developed by a company in West Germany. The camera makes use of a switching mechanism for the image amplifier component of the device to assure image sharpness in the case of camera motion. The camera can also be used in night operations. Another development reported are television cameras with CCD arrays which are especially suited for mini-RPVS. Attention is also given to tracker system developments for 'intelligent' sensor systems. A number of future developments are also examined, taking into account advanced optical systems, PbSnTe and PbSnSe detectors, reductions in detector element dimensions, and price reductions as a consequence of the use of integrated-circuit technology.

**MAJS:** //MINITRACK SYSTEM//OPTICAL TRACKING//REMOtELY PILO TED VEHICLES//TARGET ACQUISITION//TELEVISION CAMERAS//TRACKING (POSITION)

76A45942

**UTTL:** Proposal for an air/ground-RPV system and prospects for future technological objectives

**AUTH:** A/Moehring, M.; B/Schmitzlein, H.


**ABS:** Mission requirements and system characteristics for RPV applications are examined and the use of RPV's for
defense suppression missions is considered. The complexity of RPV design requirements depends on their intended employment. A stepwise introduction of RPVs in three stages is, therefore, proposed. The design of the first stage is based on the use of current technology. The range of applications of the RPVs of the first stage is, however, restricted. RPVs of the third stage would be suitable for a wide range of missions. An implementation of their envisaged functional characteristics and capabilities would require the solution of certain technical problems on the basis of new technological developments. The capabilities of RPVs of the second stage lie between those of the first and the third stage. The characteristics of the three design alternatives are discussed.

MAJS: /AIR DEFENSE/AIR TO SURFACE MISSILES/MILITARY AIRCRAFT/REMTLY PILOTED VEHICLES/TARGET ACQUISITION/WEAPON SYSTEMS

UTTL: Interference-proof intelligence transmission and interference-proof distance measurement for RPV applications

AUTH: A/SEPP, H.
Deutsche Gesellschaft fuer Luft- und Raumfahrt.

ABS: A description is presented of an interference-proof communication method. The described method can also be used in interference-proof distance measurements. The new method is particularly suited for RPV applications. Its use is, however, not restricted to such applications. The considered approach is based on the use of a pseudo-noise-phase-shift-keying procedure. The position of RPV can be determined with the aid of distance measurements in relation to a number of points the location of which is known.

MAJS: /AIRCRAFT COMMUNICATION/DISTANCE MEASURING EQUIPMENT/ELECTROMAGNETIC INTERFERENCE/ELECTRONIC COUNTERMEASURES/REMTLY PILOTED VEHICLES/SIGNAL TRANSMISSION

76A45490

UTTL: Objective and status of the KEL program 'RPV key techniques'

AUTH: A/PFEN, J.
Deutsche Gesellschaft fuer Luft- und Raumfahrt.

ABS: Targets for RPV missions are considered along with aspects of target recognition. A brief description of the objectives of parametric studies is presented. These objectives take into account performance factors in target acquisition in operations which include men, the ground-based behavior in a high-speed low altitude carrier system, and the reduction of transmission bandwidth for data transmission. A brief outline is given of the technological basis for the implementation of the considered objectives. The division of the experimental system in subsystems is discussed. Investigations which are needed are to be conducted with the aid of a flying laboratory.

MAJS: /GROUND CONTROL RADIO TELEPRTY/REMTLY PILOTED VEHICLES/TARGET ACQUISITION/TRANSPONDER CONTROL GROUP

76A45489

UTTL: Existing RPV programs

AUTH: A/WEISS, M. J.
Deutsche Gesellschaft fuer Luft- und Raumfahrt.

ABS: The article surveys existing material on remotely piloted vehicles and their actions primarily Canadian and US developments. The West German CLB9 reconnaissance drone is discussed. RPV system requirements and various RPV functions are reviewed: target designation, spotting and firing control, time in target area, automatic operation, low radar profile, vulnerability to hostile counteraction, testing and maintenance. Retrievalable and reusable RPVs, midair retrieval techniques, drogue and parachute landing, operation from road launchers or from ship decks, and high-flying standoff RPVs are discussed. The use of one-way one-shot RPVs for ECM missions is also discussed.

MAJS: /MILITARY AVIATION/REMTLY PILOTED VEHICLES

76A45488

UTTL: Means and procedures for obtaining an adequate survival probability in the case of RPV

AUTH: A/BEISEN/FRZ. H. J.; B/SCHLENNICH, V.
Deutsche Gesellschaft fuer Luft- und Raumfahrt.

ABS: An investigation is conducted concerning the dangers and hazards to which an RPV is exposed during ground attack missions, taking into account approaches for enhancing the chances of RPV survival. RPV design concepts for implementing these approaches are considered and the meaning of the term 'adequate survival probability' is discussed. Attention is given to tactical measures, including a flight close to the
ground, and to RPV design characteristics which will make the detection and tracking of the RPV by the enemy more difficult.

**MAJS:** /*AIRCRAFT DETECTION*/AIRCRAFT SURVIVABILITY/*ATTACK AIRCRAFT*/MILITARY AIRCRAFT/REMTELY PILOTED VEHICLES

**UTTL:** Application and employment of RPV's in Central Europe

**AUTH:** A/SPIETZ, J.: B/HARKS, G.


**ABS:** The considered employment possibilities are related to air reconnaissance, attack missions, and air defense suppression. Mission and system concepts for the considered applications are discussed and the technological requirements are examined. A more detailed description is presented of RPV's for directing artillery fire and of RPV's for ground attack missions. An analysis is conducted of RPV-related objectives of the armed forces of West Germany, taking into account general problems of the defense of central Europe and specific tasks of the armed forces of the air force.

**MAJS:** /*AIR DEFENSE*/FIRE CONTROL*/MILITARY AIRCRAFT*/REMTELY PILOTED VEHICLES*/WEAPON SYSTEMS

**UTTL:** Propective markets and design concepts for civilian remotely piloted aircraft


**ABS:** This paper summarizes a study that examines the technical, economic, and environmental aspects of remotely piloted vehicles (RPV's) in the civil environment. A market survey was conducted in which 35 civil applications of RPV's were identified. For a number of these uses, vehicle and system concepts were defined, benefit and cost comparisons were made with present methods, and the influence of safety and environmental implications was assessed. The results suggest a sizable potential demand for the use of RPV's in the civil sector, and some of the applications show promising cost savings over established methods. A focused technology effort could provide the safety assurances needed for routine civilian operation of RPV's.

**MAJS:** /*AIRCRAFT DESIGN*/CIVIL AVIATION*/REMTELY PILOTED VEHICLES*/USER REQUIREMENTS*/UTILITY AIRCRAFT

**UTTL:** Automatized optimization techniques for aircraft synthesis


**ABS:** Application of numerical optimization techniques to automated conceptual aircraft design is examined. These methods are shown to be a general and efficient way to obtain quantitative information for evaluating alternative new vehicle projects. Fully automated design is compared with traditional point design methods and time and resource requirements for automated design are given. The NASA Ames Research Center aircraft synthesis program (ACSNT) is described with special attention to calculation of the weight of a vehicle to fly a specified mission. The ACSNT procedures for automatically obtaining sensitivity of the design (aircraft weight, performance and cost) to various vehicle, mission, and material technology parameters are presented. Examples are used to demonstrate the efficient application of these techniques.

**MAJS:** /*AIRCRAFT DESIGN*/COMPUTERIZED DESIGN*/REMTELY PILOTED VEHICLES

**UTTL:** Investigation of the absolute stability of an elastic aircraft during flight on course


**ABS:** The paper uses the Liapunov vector function method to examine the effect of the elastic properties of an automatically piloted aircraft on its flight on course. The dimension of the system of differential equations describing the motion of the aircraft is equal to infinite. and, during bending of the aircraft, there is an unlimited number of degrees of freedom in the form of elastic vibration modes. Each mode is represented as a second order differential equation.

**MAJS:** /*AIRCRAFT STABILITY*/ELASTIC BODIES*/FLIGHT CHARACTERISTICS*/REMTELY PILOTED VEHICLES

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MULTIBEAM ADAPTIVE ARRAY FOR RPV ANTIJAM COMMUNICATION

AUTH: A/NOVI, T. T.; B/SCHWARTZ, L.


ABS: An adaptive array employs a multibeam adaptive array for the simultaneous communications of command control along with telemetry data from 20 remotely piloted vehicles (RPVs) to a command station. It is assumed that the RPVs are on a mission beyond the forward edge of the battle area and that communication links must be established to and from each RPV in the presence of many airborne and/or surface-based jammers. With the data link being operated at C-band. The concept evaluated employs an airborne array but locates all of the complex beam forming and adaptive jammer processor functions for each RPV on the ground, hence its name Adaptive Ground Implemented Phase Array or AGIPA. Although a tethered rotor vehicle is considered for the relay platform, the basic multibeam antijam concept is applicable whether the array is remotely suspended in space or on the ground. The system approach for multibeam adaptive arrays using the AGIPA concept is discussed in detail.

MAJS: /ELECTRONIC COUNTERMEASURES/JAMMERS/MULTICOMMUNICATION/BASED ARRAYS/RADIO FREQUENCY INTERFERENCE/REMOTE PILOTED VEHICLES

SIMULATION OF A REMOTELY PILOTED VEHICLE/DRONE CONTROL FACILITY USING SAINT

AUTH: A/KORTMER, R. N.; B/DUKET, S. D.; C/SEIFERT, D. J.


ABS: Systems analysis of integrated networks of tasks referred to as SAINT provides the simulation concepts necessary to model man and the machine in the face of environmental factors. A remotely piloted vehicle/drone control facility (RPV/DCF) is designed to simulate. In a real-time environment, a mission consisting of a group of RPVs flying to a target and returning to home base. The paper discusses both the SAINT modeling and simulation techniques and the SAINT model of the RPV/DCF. Decomposing an overall system into its components and then providing a vehicle to integrate the components into system performance is in the true spirit of the systems approach to problem solving. SAINT is shown to be a powerful tool in the modeling and analysis of complex systems.
MAJS: /MILITARY AIRCRAFT/OPERATIONAL PROBLEMS/REMOtELY PILOTED VEHICLES

76A41975

UTTL: The challenge of tactical RPV command and control
AUTH: A/COMFORT, G. C.; B/BONGIOVI, R. P.

ABS: Factors affecting the design and development of Remotely Piloted Vehicle (RPV) systems are discussed. Particular attention is given to the requirements for command and control as reflected in the RPV Mission Control System (RMCS), which is being coordinated with the ECM-34C, Compass Cope, and advanced RPV (ARPV) programs. The RPV RMCS will serve to integrate these elements into a system responsive to the Tactical Air Control System, and will extend beyond the status monitoring/data recording function to include more extensive commands. Information dissemination in near real time, and potentially a positioning capability. The program will increase RPV system flexibility and position by replacing the current command capability with a simultaneous command capability which could support mission achievement across a broader spectrum of vehicle performance. Automated procedures will be developed to rapidly program RPVs prior to launch and may include mission program up to and including real time. User needs will be translated into mission profiles and a real time link will be available between the vehicle on its mission and the theater commander.

MAJS: /AIRCRAFT DESIGN/COMMAND AND CONTROL/REMOtELY PILOTED VEHICLES/SYSTEMS ENGINEERING

76A41974

UTTL: The users experience with operational RPVs
AUTH: A/RUPPERTHAL, F. E.

ABS: The Strategic Air Command's (SAC) Operational Remotely Piloted Vehicle (RPV) program is described, with emphasis on the problems encountered that have had an adverse effect upon the operational employment of RPV systems. A brief review is given of SAC's operational concept and the equipment used for the past decade to accomplish these missions. Ideas on the technical innovations necessary to alleviate problem areas associated with the employment of RPVs are discussed. Subjects covered include command and control equipment, RPV recovery, training, and RPV design.

MAJS: /MILITARY AIRCRAFT/REMOtELY PILOTED VEHICLES

76A41973

UTTL: The future role of RPVs in TCAIR
AUTH: A/BURKLEY, G. W.

ABS: The role of tactical aircraft (TCAIR) in modern warfare is examined to identify windows of opportunity in the Department of Defense budget for the procurement of Remotely Piloted Vehicles (RPV). The inventory projections for early warning and control, reconnaissance, electronic warfare, air-to-air capability, direct air support, and all-weather interception are examined, and the ability of RPVs to serve a useful function in these areas is considered. The timeline for the introduction of TCAIR systems, including RPVs, are identified: 1978-1984 and after 2010.

MAJS: /MILITARY AIRCRAFT/REMOtELY PILOTED VEHICLES/TECHNOCICAL FORECASTING

76A41972

UTTL: Design for attrition
AUTH: A/KLOSTERMAN, W. R.

ABS: An analytical technique which allows comparison of the capabilities of widely differing weapon systems in an attrition environment is used to investigate the design criteria for Remotely Piloted Vehicles. It is shown that in a severe attrition environment, small strike vehicles are more effective. The criteria used to evaluate the effectiveness of strike vehicles stress resources expended to obtain the de
76441971

UTTL: The role of propulsion in effecting low cost RPV operations
AUTH: A/BURGE, H. L.; B/HARDGROVE, J. A.; C/STEPHENS, W.

ABS: To achieve low cost RPV operation requires design principles which result in across-the-board cost effectiveness. This paper deals with two aspects of propulsion design cost effectiveness: launch propulsion and sustaining flight propulsion. In the case of the expendable vehicle the overall system must incorporate principles which are compatible with the expendable munitions round approach. To achieve maximum cost effectiveness in massive sortie deployment while maintaining high mobility levels requires a low cost launching concept. The jet takeoff thrust vector controlled booster motor is examined for the low cost launching propulsion. The pulse jet is examined as a viable sustainer engine concept for the expendable vehicle.

MAUS: /"COST EFFECTIVENESS"/PROPULSION SYSTEM CONFIGURATIONS

/*REMOTELY PILOITED VEHICLES*/

76441970

UTTL: Acceptable cost ratios for several RPV missions
AUTH: A/ABRIEN, D. J.

ABS: The cost-effectiveness of using Remotely Piloted Vehicles in different roles (surveillance, strike, etc.) with the current mission requirements and personnel for surveillance and evaluation of the RPV's offer significant savings in operation and maintenance costs and personnel for surveillance and evaluation of the RPV's offer significant savings in operation and maintenance costs.

MAUS: /*CIVIL AVIATION*/MARKET RESEARCH/*REMOTELY PILOITED VEHICLES*/TECHNOLOGY UTILIZATION

76441967


ABS: The papers cover a variety of industry suggested issues such as the design and the use of remotely piloted vehicles (RPV) for civil and military applications. Topics include the role of propulsion in the cost effectiveness of RPV; FAA regulations of RPV flights; civil uses of remotely piloted aircraft; and the RPV's experience with operational RPV.

MAUS: /*CIVIL AVIATION*/CONFERENCES/*MILITARY TECHNOLOGY*/REMOTELY PILOITED VEHICLES
76A41451
UTTL: Mini-MPV flight dynamics measurements
AUTH: A. JARVINEN, P. O.; B. BRUCE, C. F.
ARPA-Army-sponsored research.
ABS: Experimental measurements are presented of the flight dynamic motions of a representative Mini-MPV at altitudes below one kilometer in gusty air at Ft. Huachuca, Arizona. Delta-wing Mini-MPV airborne motions during open-loop and autopilot flight were measured with an on-board three-axis linear accelerometer/angular accelerometer package while atmospheric gustiness conditions were measured with a gust van mounted on a boom forward of the aircraft. A 32-channel pulse amplitude modulation telemetry system transmitted the data from the Mini-MPV to the ground where it was recorded on magnetic tape and also displayed in real time. Significant data was obtained on vehicle response to gusty air and due to maneuver commands and a summary of the data is presented.
MAJS: /*AIRCRAFT STABILITY*/DYNAMIC RESPONSE*/FLIGHT CHARACTERISTICS*/FLIGHT STABILITY TESTS*/REMOTELY PILOTED VEHICLES

76A43098
UTTL: Linear array applications to remotely piloted vehicles
AUTH: A. SPOERRI, S.
ARPA-sponsored research.
ABS: The potential of an electronically scanned linear array for ground mapping and for detection and tracking of ground targets is surveyed, with emphasis on the selection of radar parameters. The coverage of an electronically scanned linear array in forward looking and side looking, the coherent Doppler spectrum for clutter discrimination, suitable data processing techniques, use of displaced phase center antennas and synthetic aperture radars, beam resolution, sensitivity, and electronic scanning techniques are discussed. Radar mapping and target tracking from remotely piloted vehicles can be used in geologic resources surveys, earth remote sensing (flocc and fire control, crop surveys and pest control), monitoring of military activity (in treaty enforcement or hostile operations), ground traffic monitoring, and rescue operations.
MAJS: /*AIRCRAFT ANTENNAS*/LINEAR ARRAYS*/MICROWAVE ANTENNAS */RADAR SCANNING*/REMOTELY PILOTED VEHICLES/*SIDE-LOOKING RADAR

76A43239
UTTL: Antiship cruise missile threat simulation utilizing a RPV
AUTH: A. GERRITY, R. J.; B. GEVAERT, G.
ABS: A digital/analog hybrid real time simulator system for simulating a cruise missile threat to ship targets in an open sea environment. In order to test antiship missile defense systems, is described, with testing equipment and test sequences. A TACAN guidance augmentation system (TGAS) is developed and flight-tested on a drone aircraft; for RPV simulation of the attacking missile. The missile flight is executed with a surface or air launch beyond the horizon, and tracking of a programmed altitude/heading profile until a TACAN signal is intercepted. Two basic RPV profiles are specified for the drone: a straight-in descent profile and a steep descent profile (the pre-descent portions of the profiles are identical). Automatic backup mode switching and redundant abort functions add to mission success and safety. Flight control hardware and sensor hardware are described and illustrated.
MAJS: /*AIRCRAFT GUIDANCE*/ANTIMISSILE DEFENSE*/COMPUTERIZED
SIMULATION/*MISSILE SIMULATORS/*REMOTELY PILOTED VEHICLES/*TACAN

76A32632
UTTL: The Boeing Compass Cope Program
AUTH: A/NCAPERSON, R. L

ABS: The Boeing Compass Cope Program is an RPV system where the pilot remotely flies the vehicle from the command module using standard aircraft instruments and controls. A modified AN/TPW-2 microwave command and guidance system provides air vehicle position tracking and data transmit and receive functions when the command module pilot is controlling the vehicle. A loss of Carrier Program will automatically take over control of the vehicle if the command and control link is interrupted for more than 1.5 seconds on the ground or 5.0 seconds during flight. The flight testing and operation of two RPVs - XOM-93A and YOM-94A - are discussed.

MAJS: /*BOEING AIRCRAFT/*COMAND AND CONTROL/*COMAND GUIDANCE/*FLIGHT TESTS/*REMOTELY PILOTED VEHICLES

76A32243
UTTL: Saint simulation of a remotely piloted vehicle/drone control facility
AUTH: A/KWARTMAN, D. B.; B/DUKET, S. D.; C/SEIFERT, D. J.

ABS: Saint is a modeling and simulation technique that provides the concepts necessary to model systems that contain tasks (discrete elements), state variables (continuous elements), and interactions between them. Saint has been designed to facilitate the modeling and analysis of complex man-machine systems. This paper describes a Saint network model of a real-time simulation of a drone control facility (DCF) in which operators monitor and control the flight of simulated remotely piloted vehicles (RPVs) through the use of visual (CRT) displays.

MAJS: /*COMPLEX SYSTEMS/*COMPUTERIZED SIMULATION/*FLIGHT CONTROL/*MAN MACHINE SYSTEMS/*REMOTELY PILOTED VEHICLES/*SYSTEMS ANALYSIS

76A30180
UTTL: Piloting-navigational visual television indicator
AUTH: A/KUPRIANOV, S.; B/TSEVIKOV, R.

ABS: The problem of designing a piloting-navigational visual television indicator in a remote control system for movable objects with a large number of degrees of freedom (for example, aircraft and submarine equipment) is considered. The operating block diagram of a visual pilot indicator giving a generalized image on the TV screen corresponding to the real-time spatial situation is shown. The modes of indication for heading, bank, pitch, height, and velocity are considered.

MAJS: /*DISPLAY DEVICES/*NAVIGATION AIDS/*REMOTE CONTROL/*REMOTELY PILOTED VEHICLES/*VISUAL AIDS

76A29494
UTTL: In flight simulation - A unique approach to flight testing an all-weather landing system
AUTH: A/HUBER, R. P.; B/REYNOLDS, P. A.

ABS: A variable stability aircraft has been used as a test bed for the development and performance evaluation of an all-weather landing system for a remotely piloted vehicle (RPV). The advantages and limitations of using a variable stability aircraft for this application are discussed. The implementation of the RPV autoland system on the total in-flight simulator (TIFS) is outlined. Included are the techniques for and the problems associated with flight simulation to touchdown and throughout rollout. Typical performance data obtained in the flight simulation are presented.

MAJS: /*AIRCRAFT LANDING/*ALL-WEATHER LANDING SYSTEMS/*FLIGHT SIMULATION/*FLIGHT TESTS/*LANDING SIMULATION/*REMOTELY PILOTED VEHICLES

76A25721
UTTL: RPRV research focus on HIMAT
AUTH: A/LOCKENOUR, J. L.; B/LAYTON, G. P.

ABS: A review is presented of the F-15 Remotely Piloted Research Vehicle (RPRV) project. The F-15 RPRV is air-launched from a B-52 at 50,000 ft.
launch a series of research maneuvers are performed during an unpowered descent to a recovery altitude. Another RPRV program considered is the Highly Maneuverable Aircraft Technology (HiMAT) program. This program is designed to use RPRV to speed the technology transition from wind tunnel to flight and to reduce the cost of aeronautical experiments. It is pointed out that HiMAT will make extensive use of composite materials.

MAJUS: /AIRCRAFT MANEUVERS/*F-15 AIRCRAFT/*REMARLY PILOTED VEHICLES/*RESEARCH AIRCRAFT/*RESEARCH VEHICLES

76A24003

UTTL: Small format photography for mini-RPV
AUTH: A/ORLANDO, G.


ABS: Studies have been carried out to develop a basic design concept for a camera system to be used with radio-guided drones in aerial surveillance missions. A panoramic camera concept with use of a 35-mm format was selected for further development. Flight tests and computer analysis indicate that a simple camera system with a single fast shutter speed of 1/2000 sec and a single high aperture setting of f/1.4 will provide acceptable photographs over a significant part of the day. An experimental developing formulation, POTA, makes it possible to overexpose a negative by 7 stops and still obtain usable imagery, eliminating the need for automatic aperture control.

MAJUS: /AERIAL PHOTOGRAPHY/*DRONE AIRCRAFT/*PANORAMIC CAMERAS/*REMARLY PILOTED VEHICLES

76A22294

UTTL: Electronic fuel controls for missile and RPV gas turbines
AUTH: A/CROPPER, G. D.

ABS: Current gas turbine fuel controls for unmanned applications usually employ electronic computation control for parameters. Several possible control systems are discussed, examples of a simple target drone control and more complex control methods are described in some detail. Finally, some comments are made on likely future trends in electronic control design.

MAJUS: /ELECTRONIC CONTROL/*FUEL CONTROL/*GAS TURBINE ENGINES/*NUMERICAL CONTROL/*REMARKLY PILOTED VEHICLES/*ROCKET ENGINE CONTROL

76A19424

UTTL: Applied software engineering - A real-time simulator case history
AUTH: A/MECCAMON, S. R.

ABS: The paper describes the development of the data-processing subsystem for an interactive close-loop real-time simulator of a command and control system for remotely piloted vehicles. The software engineering tools used in this project are discussed in detail, including the program generation center, the system and software teams, and the use of modular top-down programming. The code-generation procedure is outlined along with rules for the implementation of structured programming. It is shown that a programmer productivity of 24 source-code lines per day was achieved on this job.
MAJS: /*CASE HISTORIES*/COMAND AND CONTROL/*COMPUTER PROGRAMMING*/CONTROL SIMULATION/*REAL TIME OPERATION*/ REMOTELY PILOTED VEHICLES

76A18289
UTIL: RPV - Perspectives of a military application
AUTH: A/HEILMANN, K.
Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, 8th, Bonn, West Germany, Sept. 16-18, 1975, 45 p. In German.

ABS: Remotely piloted vehicles (RPV) are unmanned flight vehicles which are suited for a number of military uses. Such uses include missions with a great risk factor. Considered RPV missions are related to reconnaissance, air attack, and electronic warfare. Employment possibilities for RPV depend on a number of vital techniques involving interference-free data transmission and target recognition. An important factor is also the incorporation of RPV systems into existing military structures. A description of various types of RPV is presented.

MAJS: //MILITARY TECHNOLOGY/*REMOTELY PILOTED VEHICLES/* UNMANNED SPACECRAFT/*WEAPON SYSTEMS

76A1705:
UTIL: Free flight tests with remote-controlled models of reentry vehicles
AUTH: A/ROHNE, K.

ABS: Free-flight tests with remotely controlled models of reentry vehicles have been performed in order to investigate their low speed and landing characteristics. Remote controlling was not performed by visual contact but by telemetry emitter and receiver, process calculator and a flight instrument panel in the ground-based control station. The free-flight model was launched at an altitude of 28,000 ft on the NAMFI-range near the island Crete from a military transport aircraft. The original flight program had to be drastically reduced by unforeseen difficulties bound to local circumstances on the test range. Nevertheless good results have been obtained by the identification and extraction of the dependence of the lift coefficient, the drag coefficient and the pitch moment coefficient of the angle of attack. These results are compared with those obtained by theoretical investigations and by wind tunnel tests. Some data about the dynamic behavior have also been obtained.

MAJS: /*FLIGHT TESTS*/FREE FLIGHT/*REENTRY VEHICLES/* REMOTELY PILOTED VEHICLES/*SPACECRAFT MODELS

76A14577
UTIL: The reliability of flight vehicles
AUTH: A/VOLOKOV, L. I.; G/SHISHKEVICH, A. M.
Moscow, Izdatel'stvo Vysshaya Shkola, 1975, 296 p. In Russian.

ABS: The book treats various aspects of the reliability of un piloted, automatically controlled flight vehicles. Topics discussed include engineering methods for calculating reliability at the design stage, structural reliability of flight vehicles, reliability of the onboard electronic and navigation systems, reliability in relation to the final finetuning of systems and structures, and methods for optimizing the reliability design.

MAJS: /*COMPONENT RELIABILITY*/PROBABILITY THEORY/ RELIABILITY ANALYSIS/*REMOTELY PILOTED VEHICLES/* SPACECRAFT DESIGN

76A14403
UTIL: Remotely piloted vehicle/vertical attitude take-off and landing demonstration vehicle
AUTH: A/ELERTSON, W. H.

ABS: Launch and recovery of RPVs aboard ship has been identified by the Navy as a major design impact area. Vertical attitude take-off and landing offers attractive advantages to the Navy in that ship/RPV interface problems are alleviated. A 560-lb demonstration vehicle has been designed and constructed to test these advantages. This vehicle during 1975 will be flight tested to assess vertical hover capability of the RPV in the turbulent aerodynamic wake generated by a ships superstructure while underway. The design incorporates a close coupled canard/delta wing configuration. Components from the KOM74A target drone as well as the Harpoon missile are utilized. Other Navy laboratories are cooperating in support of engine installation design and test (NHC), guidance and control (NUSC), power circuitry (NATC), and flight tests (PNR/NHC). Flight tests in hover, horizontal flight, transition (at safe altitudes) and ship docking are planned.

MAJS: //AIRCRAFT LANDING/*FLIGHT TESTS/*REMOTELY PILOTED VEHICLES/*VERTICAL TAKEOFF AIRCRAFT
UTTL: Parachute deployment process evaluation using a simple dynamic testing technique
AUTH: A/SPEELMAN, R. J., III
ABS: A simple and inexpensive testing technique exists for conducting detailed evaluation of recovery system deployment processes occurring under dynamic conditions. Benefits and limitations of the technique as well as some of the detailed observations obtained in its application to preflight evaluation of a new RPV recovery system are described. Application of the technique to detailed deployment problems not normally detected through bench tear down examinations, is typical of those detected through flight testing. Flight tests of the corrected system configuration revealed no additional problems. The technique in essence simply involves connecting the main riser of the packed parachute to an immobile object through use of a large cable, accelerating the pack to a predetermined velocity and as the cable draws tight to deploy the parachute, initiate high speed cameras to record the deployment for subsequent detailed evaluation.
MAJS: /DEPLOYMENT/DYNAMIC TESTS/ PARACHUTE DESCENT/ RF COVERAGE PARACHUTES/ REMOTELY PILOTED VEHICLES

UTTL: An analytical model for the control of low flying aircraft and vehicles by visual cues
AUTH: A/GRUNDHAL, A.
ABS: This paper presents the development and experimental validation of an analytical model for manual visual field control (VFC) of aircraft. A basic model for the control oriented visual field information (VFI) is proposed and formulated in a test optimal control framework. A special case of VFC is studied, namely, the manual lateral control of a TV-guided remotely piloted vehicle (RPV) along a straight reference trajectory in the presence of side gusts. For experimental validation, a five-degree-of-freedom fixed-base simulator has been constructed to simulate a RPV flight along a nominally straight reference trajectory.
MAJS: AIRCRAFT CONTROL/MATHEMATICAL MODELS/OPTIMAL CONTROL/ REMOTELY PILOTED VEHICLES/TERRAIN FOLLOWING AIRCRAFT/ VISUAL CONTROL

UTTL: Electronic warfare - Military needs propel mini-RPVs into tactical flight tests
AUTH: A/DAVIS, R. T.
ABS: Various new flight-tested mini-RPV prototypes are illustrated and explained. They range from 45 to 190 pounds in weight with engines of 2-14 horsepower, and most contain a TV camera and laser relay beam for homing in on targets by large boing aircraft. Other possible payloads include radar jammers, simple decoys, and kamikaze warheads. The vehicles can be controlled directly from ground stations or through links with larger aircraft.
MAJS: AUTOMATIC PILOTS/ELECTRONIC CONTROL/FLIGHT TESTS/MILITARY TECHNOLOGY/ MINIATURIZATION/ REMOTELY PILOTED VEHICLES

UTTL: RPV command and control
AUTH: A/FEDERMAN, H. M.
ABS: The construction and testing of several prototypes has shown that the mini-RPV concept involving the use of lightweight remotely piloted vehicles for military reconnaissance, surveillance, and target acquisition applications is viable. Problems which have to be solved are related to the data links, including the control link from the ground station to the RPV, the telemetry link that reports RPV status, and the video downlink if one is used. A combination of techniques is to be used to provide satisfactory data links. The techniques make use of spread spectrum modulation, adaptive array antennas, and video bandwidth compression.
MAJS: COMMAND AND CONTROL/DATA LINKS/MILITARY AIRCRAFT/ RADIO TELEMETRY/ REMOTELY PILOTED VEHICLES

UTTL: Automatic control of drones and RPV's in formation
AUTH: A/LEE, M. H., JR.; B/RICHARDSON, L. T.
ABS: A system for automatic formation control of target vehicles has been developed and successfully demonstrated by flight testing. The system, which was designed for navigation, guidance, and control of up to six vehicles simultaneously, employs distance
measuring equipment (DME) for tracking/navigation. Simulation was employed extensively to minimize risks and reduce flight testing time. The system and the tools used in its development and evaluation are described. Also presented are results of flight tests of two HOM-34D target vehicles guided along precise flight paths in closely spaced formations.

MAJS: /*AUTOMATIC FLIGHT CONTROL*/COMMAND GUIDANCE/*COMPUTERIZED SIMULATION*/DIGITAL NAVIGATION/*REMOTELY PILOTED VEHICLES*/TARGET DRONE AIRCRAFT

75A41662

UTTL: Optimal design of a Mini-RPV lateral autopilot
AUTH: A/BAIR-ITZMACK, I. Y.; B/FOREL, E.

ABS: In this paper the design of a lateral autopilot for a miniature remotely piloted vehicle (RPV) is described. The structure of the autopilot is predetermined, as well as the measured variables. Even though alleron alone is used to control the RPV, the system is completely controllable. Using several indices of performance the best autopilot gains are determined by minimizing these indices. The minimization is carried out in the complex plane and comparison is made with state space methods. When a single error, such as heading error, is considered, the complex plane minimization procedure is superior. The RPV will not due to the Dutch roll mode stay close to the imaginary axis, although heavy penalty is imposed by the performance index on a persisting error. The pole placement is restricted by the fact that the trace of the system matrix is constant. Although no rudder is used, the vehicle executes coordinated turns due to its natural coordination quality.

MAJS: /*AUTOMATIC PILOTS*/DESIGN ANALYSIS/*LATERAL CONTROL*/OPTIMIZATION/*REMOTELY PILOTED VEHICLES

75A37697

UTTL: Imaging systems for RPV's
AUTH: A/MEACHAM, J. H.

ABS: Emerging RPV systems place new emphasis on the need for small, low-power, imaging systems which fulfill the requirements of navigation and recovery, as well as target acquisition, identification, and designation. Design approaches are discussed which led to the development of a modular family of day/night imaging systems. Flight tests are used to support the selection of an appropriate system for a particular scenario. Areas covered include special signal processing techniques, sensor trade-offs, and roll-off state imaging systems.

MAJS: /*AVIONICS*/IMAGE MOTION COMPENSATION/*IMAGING TECHNIQUES*/REMOTELY PILOTED VEHICLES

75A37689

UTTL: RPV Simulation/Evaluation Program /RSEP/
AUTH: A/STOVALL, J. P.

ABS: RSEP is a two-part digital computer program which simulates the flight of RPV's engaged in a strike mission and evaluates the contribution of a candidate set of avionics to mission success. The principal avionics functions that are modeled in the simulation are navigation, communications, target acquisition and tracking and weapon launch. The evaluation portion of the program uses data from the simulation along with a realistic logic to account for the interrelationships among mission events in order to develop a set of overall measures of avionic system effectiveness. In the course of exercising RSEP for a number of candidate systems, it has been found to be a flexible tool for conducting trade-offs and identifying preferred systems and techniques.

MAJS: /*AIRCRAFT INSTRUMENTS*/AVIONICS/COMPUTER PROGRAMS/*DIGITAL SIMULATION*/FLIGHT SIMULATION/*REMOTELY PILOTED VEHICLES

75A37602

UTTL: HASPA design and flight test objectives
AUTH: A/PETRONE, F. J.; B/WEISEL, P. R.

ABS: In the early Fall of 1975 the first of four scheduled flights to be conducted in the High Altitude Superpressed Powered Aerosat (HASPA) Program will take place. The vehicle is a remotely piloted airship of some 800,000 cubic feet volume which will operate at an altitude near 70,000 feet. This paper briefly describes the evolution of the concept and presents a general design overview. The propulsion system and the different power supplies to be used on the three
powered flights are described. The power supplies are primary Ag/zn batteries, an H2/O2 fuel cell, and a solar array-secondary battery combination. These units are to provide both operating power and propulsion power for nominal periods of 30 hours, 7 days, and 3c days respectively. The flight test objectives and test measurement programs are described along with the launch, flight and recovery procedures. Most of the equipment being used in the test program has been designed to allow for maximum use of existing hardware which will minimize the program length and cost.

**MAJS: /AIRCRAFT DESIGN/AIRSHIPS/FLIGHT TESTS/REMITELY PILOTED VEHICLES**

75A35761

**UTTL:** The age of the RPV data bus or the data bus comes of age

**AUTH:** A/PICO, L. C.

In: Automatic support systems for advanced maintainability; Symposium, San Diego, Calif., October 30-November 1, 1974, Conference Record. (A75-35251)

**ABS:** The use of the airborne onboard processor to operate in a fault-tolerant controlled mode for self-validation, and subsequent validation of subsystems that are connected to a multiplexed digital data bus, are described. This multiplexed digital data bus concept permits avionics system evaluation without the need for several special test connectors interfacing at the interface unit, typical of the present computer test systems. This test concept eliminates the many measurement instruments traditionally used for this purpose. The processor instruction and priority schemes are used to individually address each RPV subsystem and conduct evaluations. Tests can be selectively structured to permit varying levels of test complexity.

**MAJS: /AIRBORNE/SPACELIONE COMPUTERS/AUTOMATIC TEST EQUIPMENT/AVIONICS/CHANNELS (DATA TRANSMISSION)/MULTIPLEXING/REMITELY PILOTED VEHICLES**

75A342725

**UTTL:** System concept and key problems concerning piloted, remotely-controlled combat aircraft U/k

**AUTH:** A/SPINZUK, J.; B/STARKE, P.


**ABS:** Piloted, remotely-controlled flight vehicles show great promise for combat missions involving strongly defended ground targets. An employment of such unmanned aircraft is considered in the case of typical area targets in connection with the provision of air support and missions which have the objective to isolate the combat area. A description of the considered vehicle concept is given. Key problems are related to target recognition, data transmission, target search, the projectile design, flight control, and vehicle navigation. Attention is also given to an experimental system for the study of the various problem areas.

**MAJS: /AIRCRAFT DESIGN/FIGHTER AIRCRAFT/MILITARY TECHNOLOGY/REMITELY PILOTED VEHICLES**

75A24252

**AUTH:** A/SALLEMBERGER, W. B.


**ABS:** A radar control system for the F-102A aircraft is described. The POM-102 target system, as it is designated, features a dual redundant (two sets of radar and controls) mobile ground station, a fixed ground station, and two fixed ground radar sources. The primary role of the mobile ground station has a 50-n mi range and a 2-kw output. It controls the plane during takeoff and recovery and during close-in missions. The aircraft contains a 7.5-lb rod charge for destructive purposes and a scoring system consisting of four antenna assemblies containing two independent receiving elements, one horizontally and the other vertically polarized. Applications envisioned for the target system include interdiction, surveillance, reconnaissance, ECM, decoy, defense suppression, and air superiority.

**MAJS: /AIRCRAFT CONTROL/F-102 AIRCRAFT/GROUND BASED CONTROLS/REMITELY PILOTED VEHICLES**

75A2628

**AUTH:** A/SCHAIN, G. R.; B/HARRIS, G. L.; C/BROWN, G. J.


**ABS:** The present work deals with the various aspects of a remotely piloted mini-LTA (lighter-than-air) vehicle for buoyant or inflatable balloon. Problems, monitoring and measurement in civilian and military applications. Applications, operations, and economics are discussed. A brief design of about 5000 sq ft, 55 ft in length and 13 ft in diameter has been selected for the remotely piloted vehicle (RPV). Advantages of the LTA vehicle...
over current HTA craft include endurance, good top
speed, low pollution, no minimum speed, low vibration
levels, low maintenance, stable platform, safety to
ground personnel and property, flexibility (versatility),
economy, low operator skill
requirements, low radar cross-section, and ease of
launch and recovery.

MAJS: /AERIAL RECONNAISSANCE/*AIRSHIPS/*REMTELY PILOTED
VEHICLES/*TECHNOLOGY UTILIZATION

75A25778

UTTL: A preliminary investigation of remotely piloted vehicles for airframe noise research
AUTH: A/FRATTELLO, D. J.; B/SHEARIN, J. G.,
American Institute of Aeronautics and Astronautics,
24-26, 1975. 7 p.

ABS: Aircraft noise encountered in the community is caused predominately by the aircraft engine. However,
expected advances in engine noise technology combined
with recent experimental evidence indicate that
carframe (non-propulsive) noise may be a significant
aircraft noise component in the future. Thus, methods
for research into control of this type of noise are
being evaluated and a technique based on the remotely
piloted vehicle (RPV) concept appears to overcome some
of the difficulties encountered with other test

MAJS: /AIRCRAFT NOISE/*AIRFRAMES/*FULL SCALE TESTS/*NGISE
GENERATORS/*REMTELY PILOTED VEHICLES

75A19580

UTTL: Target acquisition in remotely piloted vehicles
AUTH: A/SPINTZKY, J.; B/STARKE, P.,
Dornier-Post (English Editor), no. 3-4, 1974, p.
28-31.

ABS: Results of RPV missions flown against previously
registered targets are discussed in re visual
detection range, angular resolution, image aperture,
target acquisition and engagement, and control
station. Visual detection range fell off with darkness
or poor target contrast; targets were recognizable
with angular resolutions of 0.2 to 0.3 radial; the
smallest possible horizontal image aperture was the
most efficient; a combination image sensor system
working in two spectral ranges was the most promising
solution to the target acquisition and engagement
problem. The control station design featured RPV
controlled by one man (the pilot).

MAJS: /AERIAL RECONNAISSANCE/*MILITARY TECHNOLOGY/*REMTELY
PILOTED VEHICLES/*TARGET ACQUISITION

75A15170

UTTL: Chirping RPV data links for ECM protection
AUTH: A/O'TO, J.,
USAER-Amfponsored research.

ABS: A review is presented of the signal processing
involved in a chrip modem for transmitting and
receiving digital data for an RPV command link. The
device would have to be up and down converted to
microwave frequencies if used for RPV communications.
Signal processing with reflective-array compressors is
considered along with the chirp modulator, jamming
problems, and the prototype links developed.

MAJS: /CHIRP SIGNALS/*DATA LINKS/*ELECTRONIC
COUNTERMEASURES/*MODEMS/*REMTELY PILOTED VEHICLES

PAGE 47 ( ITEMS 194 - 197 OF 224)
75A11724

UTTL: An inexpensive jet engine, dream or reality
AUTH: A/FURRY, MR.

ABS: Discussion of the development of an expendable, short-lived jet engine of ultimate design simplicity and suitable for mass production by processes of moderate tooling requirements, intended for the propulsion of remotely piloted vehicles for ground or sea attack reconnaissance, illumination, decoy, interference, and target practice missions. A brief description of the French TRI 60 jet engine is presented.

MAJS: /AIRCRAFT ENGINES/*COST EFFECTIVENESS/*ENGINE DESIGN /*REMOTELY PILOTED VEHICLES/*TURBOPET ENGINES

75A10623

UTTL: Mini-RPV's for cheap and no risk air power
AUTH: A/DAVIS, R. T.

ABS: 100 cost technology to be used in mini-RPV aircraft with special attention given to reconnaissance and surveillance missions. Different video-compression techniques are described from the standpoint of frame-rate reduction, resolution reduction, and image transformation. The Advanced Research Projects Agency (ARPA) is evaluating three spread-spectrum techniques including direct-sequence pseudo-noise, frequency hop, and chirp radar communications. A table summarizes the anti-jam margins that are possible by each spread-spectrum method. The building of a mini-RPV with C-band command and data links called the Mark II and intended for use in the battle field support is discussed. Present program efforts aim to develop propulsion units that will meet with military standards, secure up/down links, and multiple RPV control system.

MAJS: /ATTACK AIRCRAFT/*COST EFFECTIVENESS/*MILITARY TECHNOLOGY/*RECONNAISSANCE AIRCRAFT/*REMOTELY PILOTED VEHICLES

75A10168

UTTL: Drone/RPV systems
AUTH: A/MEINENWAY, W. W.

ABS: Consideration of the Remotely Piloted Vehicle (RPV) as a low cost system with applications in diverse roles of aerospace tactics. Special attention is given to the application of the RPV to aerospace power and system elements, to the research and development activity currently underway. The drone/RPV design is discussed from the point of view of a total weapon system, with the control guidance as an essential element reviewed in detail. Additional programs and applications are Weather/Airmospheric Sampling, the Low Altitude Multi-Purpose Drone (LAMPS), the Mini Drone, Remote Data Retrieval System (CDRS).

MAJS: /AIRCRAFT DESIGN/*DRONE AIRCRAFT/*MILITARY AIRCRAFT/*REMOTELY PILOTED VEHICLES/*TECHNOLOGY ASSESSMENT

74A45399

UTTL: RPV potential for naval applications
AUTH: A/BRYAN, C. V.; J. M. PENNINGTON, J. H.

ABS: Prime objectives for the employment of RPVs in naval warfare include tactical reconnaissance, open-ocean surveillance, antisubmarine warfare, strike support, airborne early warning, and command and control. However, some challenging problems remain to be solved before RPVs can play a vital role in sea control and projection of naval forces. A number of the technical and operational risk areas are considered, giving attention to data links, questions of target acquisition and identification, launch and recovery problems, the establishment of a shipboard control station, questions of maintainability and reliability, and aspects of airspace control.

MAJS: /ANTISUBMARINE WARFARE/*COMMAND AND CONTROL/*RECONNAISSANCE AIRCRAFT/*REMOTELY PILOTED VEHICLES

74A45308

UTTL: Air Force concepts for RPV application
AUTH: A/PEAKER, J. A.

ABS: The RPVs are to complement the manned force and to increase its effectiveness. RPVs can, thus, provide the equivalent of enemy radar, in support of a strike penetration. An RPV remotely controlled by a man can be used to conduct an important mission in a highly defended or politically sensitive area. Operational vehicles presently available possess a demonstrated ability to provide low- and high-altitude photo reconnaissance and signal intelligence in high-threat end/or poor-weather conditions. New uses of RPVs being considered include the relay of control signals and an employment as a wide-band data link for transmitting images from TV or other sensors. High-altitude, long-endurance vehicles could provide continuous surveillance of ocean or land areas. Low-altitude mini-RPV could be used for real-time reconnaissance in a local battle area.

MAJS: /COST EFFECTIVENESS/*ELECTRONIC COUNTERMEASURES/*
RECONNAISSANCE AIRCRAFT/REMOTE PILOTED VEHICLES/TARGET ACQUISITION

74445307
UTTL: Remotely piloted vehicles for the Army
AUTH: A/GARBER, V.

ABS: Early developments concerning remotely piloted vehicles (RPV) during the time from 1956 to 1967 are briefly examined. After a short period of inactivity in this field the investigations concerning the development of RPVs were resumed following a study of the Defense Science Board in 1971. The group conducting the study recommended the development of an RPV for performing surveillance and target-acquisition missions within the range of conventional artillery. Another mission involved the use of a miniature aircraft or slow-burning rockets in a 'Kamikaze' role to attack forward-element point targets of high value. Potential RPV applications were reviewed in the fall of 1973. Details and results of the various RPV-related studies conducted are presented, giving attention to the role of radar, automatic data processing, data links, symbiotic displays, and radar cross section reduction.

MAJS: /*DRONE AIRCRAFT/RECONNAISSANCE AIRCRAFT/REMOTE PILOTED VEHICLES/TARGET ACQUISITION

74443003
UTTL: NASA Flight Research Center scale F-15 remotely piloted research vehicle program
AUTH: A/LAYTON, G. P.

ABS: The NASA Flight Research Center undertook a remotely piloted research vehicle (RPV) program with a 3/8-scale model of an F-15 aircraft to determine the usefulness of the RPV testing technique in high-risk flight testing such as spin testing. The results of the first flights of the program are presented. The program has shown that the RPV technique, including the use of a digital control system, is a viable method for obtaining flight research data. Also presented are some negative aspects that have been learned about the RPV technique in terms of model size, command frequency, and launch technique.

MAJS: /*F-15 AIRCRAFT/*NASA PROGRAM/*REMOTE PILOTED VEHICLES/*RESEARCH AIRCRAFT

74441663
UTTL: V/STOL demonstrator vehicle for ejector thrust augmentation technology

ABS: The objective of this effort was to design a vehicle for the inflight demonstration of an ejector thrust augmentation concept. The approach was a design arrangement and parametric study based on an off-the-shelf engine. The result is a small, remotely piloted vehicle (RPV) specifically designed as a V/STOL ejector concept. The size, or injection area ratio of the ejectors is an optimum 13.5, which produces a thrust augmentation ratio of 1.66, or a VTOL weight of 896 pounds. The ejector installation is fully vectorable from hover to a maximum speed of 227 knots. Yet its additional payload potential is reflected by a 80 per cent overload capability with a 100 foot STOL ground roll. At the VTOL weight, a 30-gallon fuel payload gives a 100 minute endurance at sea level.

MAJS: /*AIRCRAFT DESIGN/EJECTORS/REMOTE PILOTED VEHICLES/*THRUST Augmentation/*V/STOL AIRCRAFT

74440488
UTTL: Command and control challenge for RPVs
AUTH: A/COLE, S. J.; B/FRANKLIN, C. E.; C/PRINS, D. W. S.

ABS: Discussion of recent progressive developments and future trends in subsystem features of remotely piloted vehicles (RPVs). Subsystem advances for RPVs reflecting a broad base of technology in other military areas are reviewed, along with more general RPV developments. Special attention is given to such subsystems as 2-axis stabilized gimbals, TV, forward looking infrared, radar with stabilized pointing mirrors, laser designators, RPV autopilots with sensors, 8000-word general-purpose computers, and onboard navigation aids. Areas of R&D, inviting further efforts in the coming years are shown to include data processing, integration with command and control elements, and multisensor integration.

MAJS: /*AUTOMATIC PILOTS/*COMMAND AND CONTROL/*COMPUTER TECHNIQUES/*REMOTE PILOTED VEHICLES/*TECHNICAL FORECASTING
74440487

UTTL: The Mini-RPV: Big potential - Small cost
AUTH: E/KRESA, K.; B/KIRLIN, W. F.

ABS: A large sample of representative accomplishments in the area of very small remotely piloted vehicles (Mini-RPVs) is reviewed, and the key considerations in their development and applications are discussed. Mini-RPVs are shown to offer endurance, stealth, high payload, and large economies. Nowhere in the RPV family is the removal of man from the cockpit of such a dramatic effect on size and weight reduction as in Mini-RPVs. In its basic form, a Mini-RPV includes a gross weight of 20 to 40 lbs a sensor package weighing from 5 to 35 lbs, a data link sized to data rates and communications distances desired and generally weighing 1 to 5 lbs, some form of simple navigation and attitude control weighing less than 2 lbs, and an airframe, engine, and fuel making up the rest of the gross weight. The performance of these Mini-RPV systems spans penetration ranges from 10 to 150 nautical miles, with times on station from 1 to 3 hrs.

MAJS: /*COST EFFECTIVENESS*/ MINIATURIZATION/*REMOTELY PILOTED VEHICLES*/TECHNOLOGY UTILIZATION/*WEIGHT ANALYSIS

74440106

UTTL: RPVs - Exploring civilian applications
AUTH: A/GREGORY, T. J.; B/BAILEY, R. O.; C/NEIL, W. P.

ABS: Discussion of the civilian application possibilities for remotely piloted vehicle (RPV) systems. Following a listing of all possible desert, coastal, forest, agricultural, and urban RPV missions, a thorough examination is presented of some possible RPV aircraft applications as those of forest-fire detection and mapping. Some of the major obstacles to such civilian missions are also reviewed.

MAJS: /*AIRBORNE EQUIPMENT*/ MISSION PLANNING/*REMOTELY PILOTED VEHICLES*/TECHNOLOGY UTILIZATION

74439665

UTTL: Null-steering array for RPV application
AUTH: A/RASSMEIER, G. G.; B/MARTIN, G. P.; C/PAYNE, L. M.
D/LEHMAN, D. F.

ABS: Examination of the technical requirements for effective and secure command/control/communications data links to and from a proposed ship-deployable remotely piloted vehicle adaptable for use in tactical reconnaissance and/or targeting missions. Particular emphasis is given to two critical areas demanding higher performance capability than that afforded by current operational systems: (1) line-of-sight navigational tracking for extended ranges up to 100 miles over water under constantly-changing sea conditions; and (2) electronic countermeasures security of up and down links.

MAJS: /*AERIAL RECONNAISSANCE*/ COMMAND AND CONTROL/*DATA LINKS*/REMOTELY PILOTED VEHICLES/*TARGET ACQUISITION/*VIDEO DATA
74A34046
UTTL: Flight test evaluation of a low cost electrostatic autopilot
AUTH: A/NAUNSY, C. D.; B/BERGSTROM, D. K.
ABS: The test and evaluation program described was conducted to gain insight into the concept of a simple RPV autopilot, and to obtain practical experience in its application. The test system is described and its theory is outlined. Particular attention is given to the solution of the major problems encountered in the program. Conclusions of recommendations derived from the test data are presented.
MAJS: /AIR POLLUTION/AIRCRAFT DESIGN/CANARD CONFIGURATIONS/ENVIRONMENTAL MONITORING/REMOTELY PILOTTED VEHICLES/STRATOSPHERE

74A26860
UTTL: Structural aspects of current RPV's
AUTH: A/HOUREY, D. J.
ABS: A review of the current AQM-34, AQM-91, and BGM-34 series of remotely piloted vehicles (RPVs) discusses many structural design requirements similar to their manned counterparts. There are also numerous differences due to the RPV's unique requirements. The results of structural analyses and tests are shown in order to highlight the importance of the C-130 launch airplane upon RPV loads while captive. The important effects are from aerodynamic interference and from elastic structural response of the C-130. Simulation of the dynamics of parachute recovery illustrates the complex nature of this unique RPV structural requirement. Ground impact loads from tests are shown to be a function of recovery weight and the type of terrain upon which the impact occurs.
MAJS: /AERODYNAMIC LOADS/AIRCRAFT DESIGN/REMOTE PILOTTED VEHICLES/STRUCTURAL DESIGN CRITERIA

74A25949
UTTL: Experimental system for future remotely piloted vehicles
AUTH: A/SPINTZK, J.
ABS: Unmanned remote-controlled combat aircraft, known as remotely piloted vehicles or RPVs, may well acquire great importance, alongside the conventional manned aircraft. The German armed forces could save upkeep costs in peacetime with the aid of RPVs. Defence capability would not suffer thereby, since RPVs promise greater efficiency in operation. An especially interesting aspect is the use of RPVs against attacking armed units and other strongly defended ground targets in the combat area. The RPV system envisaged by Dornier consists of one or more vehicles, a flying relay station, and a mobile ground control station.
MAJS: /ATTACK AIRCRAFT/AUTOMATIC PILOTS/GROUND BASED CONTROL/REMOTE PILOTTED VEHICLES

74A27849
UTTL: Stratospheric survey aircraft developed
AUTH: A/REED, R. D.
ABS: The merits of the RPRV (remotely piloted research vehicle) concept are discussed, along with its historical background and development culminating in the 3-B-scale F-15. The use of RPRVs is shown to be especially attractive when testing must be done at low cost, or in quick response to demand, or when hazardous testing must assure the safety of proceeding manned vehicles.
MAJS: /AIRCRAFT CONTROL/AUTOMATIC PILOTS/FLIGHT TESTS/REMOTE PILOTTED VEHICLES/RESEARCH VEHICLES
74A25400
UTTL: Remotely piloted vehicles as remote sensing platforms
AUTH: A/YOUNG, J. A.
ABS: Technology advances have made possible a large number of useful and economical remotely piloted vehicles (RPV). The operation of several RPV's is described, and their possible use in remote sensing in the atmospheric and earth resources sciences is discussed. One advantage they may have over remote sensing satellites is that they can obtain greater data density and higher resolution. There are high, low, and intermediate altitude capability needs, various speed and range requirements, a number of structural demands, and a spectrum of payload requirements. Cost advantages are discussed in terms of the coupling of similar needs and vehicle requirements.
MAJS: /*MILITARY AIRCRAFT/MISSILE DESIGN/REMOTELY PILOTED VEHICLES*/

74A11576
UTTL: Further development of the JT15D turbofan
AUTH: A/ANSCHUTZ, R. H.; B/COOK, D. L.
ABS: When the JT15D engine was first considered for potential high-altitude, low flight speed, long-endurance RPV applications by the U.S. Air Force, the questions were: (1) will the engine run at high altitudes, (2) can it deliver the required thrust, (3) can it deliver the required power extraction, (4) what is the specific fuel consumption, (5) what are the system modifications needed, (6) what is the optimum control system, and (7) are there other unknowns. A JT15D turbofan engine, with only minor modifications which were easily incorporated into engines coming off the production line, proved more than adequate to achieve predicted endurance goals and measured performance.
MAJS: /*AIRCRAFT PARTS/ENGINE DESIGN/ENGINE TESTS/REMOTELY PILOTED VEHICLES/TURBOFAN ENGINES*/

73A45239
UTTL: A review of the American RPV Scene.
AUTH: A/STABLER, I.
ABS: The remotely piloted vehicle (RPV) can, in the opinion of its adherents, offer many of the capabilities of manned aircraft for a fraction of the cost. Applications being considered include several reconnaissance roles, electronic warfare systems, target acquisition, weapon delivery, air-to-air combat, and various combinations of these. Vehicles in hardware form include both expendable and nonexpansible systems. A number of current RPV projects undertaken by various manufacturers are
reviewed. It is emphasized that electronics are vital to the success of the overall RPV concept.

MAJS: /"COMBAT/*/ELECTRONIC COUNTERMEASURES/*/REMOTE PILOTED VEHICLES/*/WEAPON SYSTEMS

73A42533

UTTL: A technology tool for urban applications - The remotely piloted blimp.

AUTH: A/SEEMANN, G. R., B/HARRIS, G. L.; C/BROWN, G. J.; D/CULLIAN, C. A.


ABS: The remotely piloted blimp concept is to provide flexible, safe, economical airborne surveillance, measurement of monitoring systems for urban applications. The Traffic Eye, Enforcement Eye, and Enviro Eye are basically remotely piloted, ultra slow, low altitude buoymant airborne platforms equipped with television cameras. The flight characteristics of the blimp are discussed together with questions of control, takeoff, landing, and ground support.

MAJS: /"AIRSHIPS/*/REMOTE PILOTED VEHICLES/*/TECHNOLOGY UTILIZATION/*/URBAN RESEARCH

73A37322

UTTL: Application of self-organizing control to remote piloting of vehicles.

AUTH: A/BARON, R. L., B/GAGNON, R. A.


USAF-sponsored research.

ABS: All electrooptical (E-O) and electromagnetic (E-M) instruments for remotely manned spacecraft and aircraft can measure phenomena indicative of the magnitude of the resultant bearing angle (bore sight angle) between a fiducial axis in the instrument assembly and an external point target or signal source. It is shown that the remote piloting of vehicles can be materially aided by the use of simple E-O or E-M sensors in primary or backup control systems which can successfully employ self-organizing control logic to process input information under circumstances that would be highly confusing for the remote pilot, thus providing means to augment his actions or take over from him in automatic modes of control.

MAJS: /"MAN MACHINE SYSTEMS/*/REMOTE CONTROL/*/REMOTE SENSORS /*REMOTE PILOTED VEHICLES/*/SELF ORGANIZING SYSTEMS

73A15379

UTTL: Electronic warfare and remotely piloted vehicles.

AUTH: A/SUMMERS, C. S.


ABS: Discussion of electronic warfare tactics which may be employed against remotely piloted unmanned aircraft serving either for reconnaissance purposes or for weapons delivery. Deception and confusion of the vehicle control system by jamming and false-signal transmissions are examined along with possible capture of control over the vehicle. Countermeasures which may be designed into the vehicle include the use of highly directional antennas and sophisticated signal discrimination systems.

MAJS: /*ELECTRONIC COUNTERMEASURES/*/RECONNAISSANCE AIRCRAFT /*REMOTE PILOTED VEHICLES/*/TACTICS/*/WARFARE/*/WEAPON SYSTEMS

73A12695

UTTL: Introducing the electrostatic autopilot.

AUTH: A/HILL, M. L.


ABS: The electrostatic autopilot consists of a patch of resistive material mounted on each wing tip and on the nose and tail of an aircraft along with two highly sensitive differential voltmeters. The stabilization system developed appears, under the conditions investigated, to be a conventional system employing precision mechanical gyro's. The autopilot weighs about 3 oz., uses milliwatts of power, and has no moving parts. Flight tests conducted with the device are reported, giving attention to the demonstration and pitch stabilization. Ten hours of operational CAT flight of the pitch stabilizing system in early May 1972 yielded numerous quantitative telemetry records. Principles of atmospheric electricity are discussed and a simplified fair weather model for electrostatic stabilization is presented.

MAJS: /*ATMOSPHERIC ELECTRICITY/*/AUTOMATIC PILOTS/*/ELECTRIC FIELDS/*/ELECTROSTATIC CHARGE/*/LINES OF FORCE/*/REMOTE PILOTED VEHICLES

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