REPORT NO. DOT-TSC-OST-72-34

REPORTS BIBLIOGRAPHY
DECEMBER 1972
UNLIMITED-DISTRIBUTION REPORTS

Transportation Systems Center
Management Services Division
Information Services Branch
Kendall Square
Cambridge MA 02142

SEPTEMBER 1973

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Prepared for
DEPARTMENT OF TRANSPORTATION
OFFICE OF THE SECRETARY
Washington DC 20590

Technical Report Documentation Page

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15. Supplementary Notes

Issued by the Transportation Systems Center, Management Services Division, Information Services Branch.

16. Abstract

This publication provides a listing of all unlimited distribution reports published by the Transportation Systems Center DOT from July 1970 through December 1972.

Reports available through the National Technical Information Service are listed. The reports are classified by sponsoring agency. A copy of the title page (which contains an abstract of the report) from each report is included.

17. Key Words	18. Distribution Statement
Bibliography Unlimited distribution	DOCUMENT IS AVAILABLE TO THE PUBLIC

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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Department of Transportation
Federal Aviation Administration

ACCESSIONED REPORTS

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FAA-71-3	Conceptual Network Model of the Air Transportation System, The Basic, Level 1 Model	AD733752
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FAA-71-6	Collision Model for NAT Region	AD733754
FAA-71-7	Evaluation of Air Traffic Control Models and Simulations	AD733755
FAA-71-8	Linearized Mathematical Models for DeHavilland Canada "Buffalo & Twinn Otter" STOL Transports	AD733756
FAA-71-9	Preliminary Survey of Potential STOL	AD744719
FAA-71-11	Simulation Model for Piper PA-30 Light Maneuverable Aircraft in the Final Approach	AD733757
FAA-71-13	Final Report: Oceanic Surveillance and Navigation Analysis, FY71	AD733758
FAA-71-14	Real Time Simulation Program for DeHavilland (Canada) "Buffalo" and Twin Otter STOL Transports	AD744720
FAA-71-15	Large Scale Systems - A Study of Computer Organization for Air Traffic Control Applications	AD733759
FAA-71-16	Systems Reliability and Recovery	AD733760
FAA-71-17	Time/Frequency Systems	AD733761
FAA-71-19	Clear Air Turbulence Radiometric Detection Program	AD733762
FAA-71-20	Dispersed Processing for ATC	AD733763
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FAA-71-23	Computer Systems Performance Measurement Techniques	AD733764
FAA-71-24	An Investigation of Microwave Landing Guidance System Signal Requirements for Conventionally Equipped Civilain Aircraft	AD737339
FAA-71-27	The Calculation of Aircraft Collision Probabilities	AD744722
FAA-71-29	Microwave Scanning Beam Approach and Landing System Phased Array Antenna	AD737511

Department of Transportation
Federal Aviation Administration

ACCESSIONED REPORTS

REPORT NO.	TITLE	ACCESSION NO.
FAA-71-30	Multibeam Aeronautical Satellite System Design	AD744861
FAA-72-1	Characteristics of a Signal Data Converter for a Multi-Runway Visibility Measuring System	AD744873
FAA-72-8	Evaluation of the FAA Advanced Flow Control Procedures	AD744862
FAA-72-9 (FAA-RD-72-27)	Considerations on the Relationship between White and Red Centerline Runway Lights and RVR	*
FAA-72-10	A Survey to Determine Flight Plan Data and Flight Schedule Accuracy	AD744876
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Department of Transportation
Federal Highway Administration

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FHWA-71-1	Automatic Date Reduction from Aerial Photographs-Phase 1 Report	PB-204 810

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Federal Railroad Administration

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FRA-71-2	Metroliner Auxiliary Power Electrical System Reliability Study	PB-204 795
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National Aeronautics and Space Administration

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NASA-70-1	Earth Survey Bibliography	N71-26398
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Department of Transportation
National Highway Traffic Safety Administration

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NHTSA-71-5	Survey of Non-Destructive Tire Inspection Techniques (DOT-HS-820-205)	PB-213 434
NHTSA-71-7	Measurement of Vehicle Contamination by Exhaust Gases (DOT-HS-820-202)	*
NHTSA-71-8	Evaluation of Length of Stain Gas Indicator Tubes for Measuring Carbon Monoxide in Air (DOT-HS-820-203)	PB-213 437
NHTSA-72-1	Occupant Motion Sensors: Rotational Accelerometer Development (DOT-HS-820-211)	*
NHTSA-72-1	Isolation of Flaws by Use of Thermal Differentials on a Tire under Mild Loading Conditions (DOT-HS-820-206)	*
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NHTSA-72-3	An Infrared Experiment on a Road Wheel During an FMVSS-109 Type Compliance Test	*
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OST-71-13	Design and Construction of a Portable Oculometer for use in TransportationOriented Human Factors Studies	PB-213 215
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OST-72-5	The Noise Exposure Model Mod-5 Volume I	PB-211 979
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DOT-TSC-142-1	A Systematic Study of Supersonic Jet Noise	PB-211 954
DOT-TSC-188-1	PWI Test and Development Resource Utilization	PB-212 495
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DOT-TSC-305-1	Study and Concept Formulation of a Fourth-Generation Air Traffic Control System Volume II - Study Report	PB-212 179
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DOT-TSC-306-1	Study and Concept Formulation of a Fourth-Generation Air Traffic Control System Volume IV - System Selection	PB-212 181
DOT-TSC-306-1	Study and Concept Formulation of a Fourth-Generation Air Traffic Control System Volume V - Recommended Research and Development	PB-212 182
DOT-TSC-315-1	User's Manual for the Prediction of Road Traffic Noise Computer Program	PB-213 295
DOT-TSC-369-1	Survey of Stratospheric Chemical Dynamics	PB-213 126

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DOT-TSC-369-2	Problem Areas of Stratospheric Chemical Dynamics	*
DOT-TSC-369-3	Survey of Stratospheric Aircraft Make Chemical Dynamics	*

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Department of Transportation
Federal Aviation Administration

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Report No.	Title
FAA-71-1	En Route Traffic Flow Simulation
FAA-71-3	Conceptual Network Model of the Air Transportation System, The Basic, Level 1 Model
FAA-71-4	A Functional Description of Air Traffic Control
FAA-71-5	The Impact of Inertial Navigation on Air Safety
FAA-71-6	Collision Risk Model for NAT Region
FAA-71-7	Evaluation of Air Traffic Control Models and Simulations
FAA-71-8	Linearized Mathematical Models for DeHavilland Canada "Buffalo & Twin Otter" STOL Transports
FAA-71-11	Simulation Model for the Piper PA-30 Light Maneuverable Aircraft in the Final Approach
FAA-71-13	Final Report: Oceanic Surveillance and Navigation Analysis, FY71
FAA-71-14	Real-Time Simulation Program for DeHavilland (Canada) "Buffalo" & "Twin Otter" STOL Transports
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FAA-71-20	Dispersed Processing for ATC
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FAA-71-29	Microwave Scanning Beam Approach and Landing System Phased Array Antenna
FAA-71-30	Multibean Aeronautical Satellite System Design
FAA-71-9	Preliminary Survey of Potential STOL Terminal Area Operational Requirements

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Report No.	Title
FAA-72-1	Characteristics of a Signal Data Converter for a Multi-Runway Visibility Measuring System
FAA-72-2	Vortex Sensing Tests at NAFEC
FAA-72-5	Path Changing Methods Applied to the 4-D Guidance of STOL Aircraft
FAA-72-6	Monopulse Azimuth Measurement in the ATC Radar Beacon System
FAA-72-7	The ILS Scattering Problem and Signal Detection Model
FAA-72-8	Evaluation of the FAA Advanced Flow Control Procedures
FAA-72-9 (FAA-RD-72-27)	Consideration on the Relationship Between White and Red Centerline Runway Lights and RVR
FAA-72-10	A Survey to Determine Flight Plan Data and Flight Schedule Accuracy
FAA-72-13	Aircraft Wake Vortex Sensing Systems
FAA-72-16 (FAA-RD-72-82)	ASDE-2 Transmitter Modifications
FAA-72-19 (FAA-RD-72-102)	All-Weather-Landing Operations Bibliography
FAA-72-25	Vortex Sensing Tests at Logan and Kennedy Airports

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-71-1		

4. Title and Subtitle	5. Report Date
EN ROUTE AIR TRAFFIC FLOW CONTROL SIMULATION	January 1971
	6. Performing Organization Code
7. Author(s) Manuel F. Medeiros, Jr.	8. Performing Organization Report No. DOT-TSC-FAA-71-1
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center Kendall Square Cambridge MA 20142	10. Work Unit No. (TRAIS) FA-17
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration Systems Research and Development Service Washington DC 20591	13. Type of Report and Period Covered Technical Report
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report covers the conception, design, development and initial implementation of an advanced simulation technique applied to a study of national air traffic flow and its control by En Route Air Route Traffic Control Centers (ARTCC). The simulation was intended to be the first step in gaining an insight into the utility and limitations of digital simulation for flow control studies. The report presents some of the major design objectives of the simulation and highlights the interactive operation and simulation control. Additional information on the programs design and structure is presented in the Appendices.

17. Key Words	18. Distribution Statement
Flow Control, Air Traffic Control, Simulation, Flow Control Procedures, Digital Simulation	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	66	

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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Conceptual Network Model of the Air Transportation System. The Basic, Level 1 Model		5. Report Date April 1971 6. Performing Organization Code
7. Author(s) Aurel N.de Hollan Arthur S. Priver		8. Performing Organization Report No. DOT-TSC-FAA-71-3
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Cambridge, Massachusetts 02142		10. Work Unit No. R1034, R1102 11. Contract or Grant No. FA-06 13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address Federal Aviation Administration Washington, D.C. 20590		Technical Report 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

A basic conceptual model of the entire Air Transportation System is being developed to serve as an analytical tool for studying the interactions among the System elements. The model is being designed to function in an interactive computer graphics environment which permits rapid alteration of rules and parameters, as well as continuous real-time graphical monitoring of system operations. The model described here is the first member in an evolving hierarchy of increasingly complex models, progressing in the direction of closer approximation to the real-world Air Transportation System.

17. Key Words	18. Distribution Statement
. Conceptual Transportation Systems Model .Flight Simulation .Input Package .Output Package	Unclassified-Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	44	

1. Report No. DOT-TSC-FAA-71-4	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle A Functional Description of Air Traffic Control		5. Report Date March 1971 6. Performing Organization Code
7. Author(s) J.R. COONAN and P. MPONTSIKARIS*		8. Performing Organization Report No.
9. Performing Organization Name and Address Transportation Systems Center 55 Broadway Cambridge, Ma. 02142		10. Work Unit No. FA-06 11. Contract or Grant No. 13. Type of Report and Period Covered TECHNICAL NOTE
12. Sponsoring Agency Name and Address Department of Transportation		14. Sponsoring Agency Code R1034

15. Supplementary Notes

*Service Technology Corporation
Cambridge, Ma. 02142

16. Abstract

This document contains a description of air traffic control in terms of generic operational functions. The functions are grouped by flight phase and by major system function (navigation, surveillance, control and communication). More detailed descriptions of these functions, and estimates of related parameters are contained in the appendix. A diagram is shown of the sequence of events for a typical IFR flight through the current ATC system. Also, certain aspects of ATC which cannot be described in terms of operational functions (e.g., legal responsibilities) are discussed.

17. Key Words	18. Distribution Statement
ATC Event Sequence ATC Functions	Unclassified - Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	81	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle The Impact of Inertial Navigation on Air Safety		5. Report Date May 1971 6. Performing Organization Code
7. Author(s) R.M. Hershkowitz, D. O'Mathuna and K.R. Britting		8. Performing Organization Report No. DOT-TSC-FAA-71-5
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center Cambridge, Massachusetts 02142		10. Work Unit No. R1032 11. Contract or Grant No. FA04 13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address Federal Aviation Administration Washington, D.C. 20590		Technical Report 14. Sponsoring Agency Code

15. Supplementary Notes
Presented to Institute of Navigation on April 14, 1971

16. Abstract An analysis of inertial navigation system performance data was carried out to assess the probable impact of inertial navigation on the aircraft collision risk in the North Atlantic region. These data were used to calculate the collision risk between two aircraft flying at the same nominal flight level on adjacent tracks. The inertial system's error sources are treated in a statistical sense to infer the en route error behavior from the terminal error data. Collision risk estimates are derived for easterly and westerly transatlantic flights. The results of this relatively conservative analysis show that there is strong evidence to support the concept that the widespread use of inertial navigators will lead to reduced separation standards in the North Atlantic region while maintaining present safety standards.

17. Key Words	18. Distribution Statement
•Inertial navigation •Collision risk model •En route navigation statistics •Blunders	Unclassified — Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	25	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle: Collision Risk Model for NAT Region		5. Report Date: May 1971 6. Performing Organization Code: PSA
7. Author(s): Ronald Hershkowitz		8. Performing Organization Report No.: DOT-TSC-FAA-71-6
9. Performing Organization Name and Address: Transportation Systems Center 55 Broadway Cambridge, Mass., 02142		10. Work Unit No.: R-1032 11. Contract or Grant No.: FA-04
12. Sponsoring Agency Name and Address: Federal Aviation Administration Washington, D. C. 20590		13. Type of Report and Period Covered: Technical Report 14. Sponsoring Agency Code

15. Supplementary Notes

Reprint of Report dated November, 1970

16. Abstract This paper reviews and summarizes the essential features of the collision risk model used to analyze the effects of separation standards on safety for the parallel tracking system employed in the North Atlantic. The derivation of the model is traced from a set of basic assumptions to formulation of various philosophies and a brief set of conclusions and recommendations for future work. Section VII contains a complete reference list.

17. Key Words	18. Distribution Statement		
Collision Risk Model Composite Problem Vertical Separation Lateral Separation	Unclassified-Unlimited		
19. Security Classif. (of this report): Unclassified	20. Security Classif. (of this page): Unclassified	21. No. of Pages: 55	22. Price

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Evaluation of Air Traffic Control Models and Simulations		5. Report Date June 1971 6. Performing Organization Code SA
7. Author(s) L.O. Higgins, Project Manager P.Mpontsikaris*MIT(ContractDOT/TSC-77)		8. Performing Organization Report No. DOT-TSC-FAA-71-7
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, Mass. 02142		10. Work Unit No. R1034 11. Contract or Grant No. 13. Type of Report and Period Covered Technical Report
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration 800 Independence Ave. Washington, D. C. 20590		14. Sponsoring Agency Code FA06

15. Supplementary Notes
*Service Technology Corporation
Cambridge, Mass. 02142

16. Abstract Approximately two hundred reports were identified as describing Air Traffic Control (ATC) modeling and simulation efforts. Of these, about ninety analytical and simulation models dealing with virtually all aspects of ATC were formally evaluated. The bibliography lists all the reports identified. There is an introduction to, and a summary of the evaluation effort as of this publication. The summary also contains a preliminary indication of which models may be of value for ATC concept evaluation; specifically traffic flow, safety and system loading aspects of proposed concepts. The remainder of the document is a catalog of the written evaluation of the ATC models. The models are divided into seven categories: (A) Airport Surface Traffic, (B) Runway, Departure/Arrivals, (C) Terminal Area, (D) Enroute, (E) ATC Systems (and miscellaneous), (F) Cost-Effectiveness Models, and (G) Safety Related Models. The catalog will be updated periodically.

17. Key Words	18. Distribution Statement
•Air Traffic Control (ATC) •Modeling and Simulation of ATC •Evaluation of ATC Models	Unclassified — Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle: Linearized Mathematical Models for DeHavilland Canada "Buffalo & Twin Otter" STOL Transports		5. Report Date
		6. Performing Organization Code: PGS
7. Author(s): R.A. MacDonald*, Mel Garelick*, and J. O'Grady		8. Performing Organization Report No.: DOT-TSC-FAA-71-8
9. Performing Organization Name and Address: Transportation Systems Center, 55 Broadway, Cambridge, Mass. 02142		10. Work Unit No.: FA-18
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12. Sponsoring Agency Name and Address: Department of Transportation		13. Type of Report and Period Covered: Technical Note
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15. Supplementary Notes

*Service Technology Corporation
Cambridge, Ma. 02142

16. Abstract

Linearized six degree of freedom rigid body aircraft equations of motion are presented in a stability axes system.

Values of stability derivatives are estimated for two representative STOL aircraft - the DeHavilland of Canada "Buffalo" and "Twin Otter." These estimates are based on analytical expressions included in the report. The combination of the equations of motion and the estimated stability derivatives provides an aircraft model which is useful for Navigation, Guidance and ATC Studies.

Resulting transient responses to control inputs are presented.

17. Key Words	18. Distribution Statement
•Aircraft Math Models •STOL Aircraft Stability & Control	Unlimited

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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-71-11		

4. Title and Subtitle	5. Report Date
SIMULATION MODEL FOR THE PIPER PA-30 LIGHT MANEUVERABLE AIRCRAFT IN THE FINAL APPROACH	June, 1971
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Joseph S. Koziol, Jr.	
9. Performing Organization Name and Address	10. Work Unit No.
TRANSPORTATION SYSTEMS CENTER 55 BROADWAY CAMBRIDGE, MASS. 02142	11. Contract or Grant No.
	13. Type of Report and Period Covered
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FAA/SRDS 800 Independence Avenue, S. W. Washington, D. C. 20590	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report describes the Piper PA-30 "Twin Comanche" aircraft and a representative autopilot during the final approach configuration for simulation purposes. The aircraft is modeled by linearized six-degree-of-freedom perturbation equations referenced to the aircraft stability axis. Other equations are presented which derive the body axis rates, velocities and accelerations, and ground referenced velocities (translation equations).

The autopilot is a representative system for automatic ILS approaches from initial localizer track down to decision height. The glideslope system is engaged by approaching the glidepath at constant altitude (usually in the altitude hold mode) on the localizer beam. The pilot must take over manually at the decision height since light aircraft are not normally equipped with automatic flare capability.

The aircraft autopilot model described herein has been used extensively in simulation studies at TSC and exhibits the expected behavior.

17. Key Words	18. Distribution Statement
Light maneuverable aircraft, autopilot model, final approach, simulation studies	Unclassified - Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	21	

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-71-13		

4. Title and Subtitle	5. Report Date
Final Report: Oceanic Surveillance and Navigation Analysis, FY 71	June 1971
	6. Performing Organization Code: PSA
7. Author(s): Ronald M. Hershkowitz	8. Performing Organization Report No.: DOT-TSC-FAA-71-13
9. Performing Organization Name and Address: Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts 02142	10. Work Unit No.: R-2105
	11. Contract or Grant No.: FA-04
12. Sponsoring Agency Name and Address: Federal Aviation Administration, Washington, D.C. 20590	13. Type of Report and Period Covered: Technical Report
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report summarizes the oceanic surveillance and navigation analysis performed at Transportation Systems Center under PPA FA-04 for FY 71. Three major efforts are reviewed and discussed herein: (1) a tutorial summary of the NAT/SPG collision risk model; (2) a study of the impact of inertial navigation on air safety; and (3) an investigation of the modeling techniques required to assess the effect of ATC satellite surveillance on separation standards in the North Atlantic region.

17. Key Words	18. Distribution Statement
Air Traffic Control Collision Risk Model Inertial Navigation Separation Standards Surveillance	Unclassified - Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		

Form DOT F 1700.7 (8-69)

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-71-14		

4. Title and Subtitle	5. Report Date
REAL-TIME SIMULATION PROGRAM FOR DE HAVILLAND (CANADA) "BUFFALO" AND "TWIN OTTER" STOL TRANSPORTS	JUNE 25, 1971
	6. Performing Organization Code: PGS
7. Author(s): R. A. MAC DONALD*, MEL GARELICK* & J. HAAS	8. Performing Organization Report No.
9. Performing Organization Name and Address: Transportation Systems Center, 55 Broadway, Cambridge, Mass. 02142	10. Work Unit No.: FA-18
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address: Department of Transportation	13. Type of Report and Period Covered: Technical Note
	14. Sponsoring Agency Code

15. Supplementary Notes

*Service Technology Corporation
Cambridge, Ma. 02142

16. Abstract

Simulation models of two representative STOL aircraft - the DeHavilland (Canada) "Buffalo" and "Twin Otter" transports - have been generated.

The aircraft are described by means of non-linear equations that will accomodate gross changes in angle of attack, pitch angle, flight path angle, velocity, and power setting. Aircraft motions in response to control inputs and external disturbances are related to Earth-fixed coordinates. The equations are programmed to run in "real time" so that they can be used in conjunction with a manned cockpit simulator. Provisions are made for pilot control inputs to the simulation, and conventional panel display parameters are generated.

The report includes representative simulation results which demonstrate that the simulation is an adequate representation of the two STOL aircraft being modeled.

17. Key Words	18. Distribution Statement
Aircraft Math Models STOL Aircraft Stability and Control Aircraft Simulation	Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		

Form DOT F 1700.7 (8-69)

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-71-15		

4. Title and Subtitle	5. Report Date
Large Scale Systems - A Study of Computer Organizations for Air Traffic Control Applications	June 15, 1971
	6. Performing Organization Code: TCC
7. Author(s): John Dumanian & David Clapp	8. Performing Organization Report No.
9. Performing Organization Name and Address: DOT/Transportation Systems Center, Computer Technology Division, 55 Broadway, Cambridge, MA 02142	10. Work Unit No.: FA-03
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address: FAA-SRDS-RD-123, FOB 10A, 800 Independence Ave., S.W., Washington, D.C. 20546	13. Type of Report and Period Covered: Technical Report
	14. Sponsoring Agency Code: FAA RD-123

15. Supplementary Notes

16. Abstract

Based on current sizing estimates and tracking algorithms, some computer organizations applicable to future air traffic control computing systems are described and assessed. Hardware and software problem areas are defined and solutions are outlined. System evaluation criteria are presented.

Section 1: delineates the objectives and approach, and furnishes definitions of computer hardware and software;
Section 2: presents the ATC data processing requirements: the anticipated traffic, the computer processing rates, and the methods for analyzing computer performance;
Section 3: describes current computing systems with capabilities for usage in near future ATC applications;
Section 4: denotes the algorithms which are to be used in the projected ATC programs;
Section 5: sums up the future prospects in ATC data processing, assesses the risks and points out some future work efforts.

17. Key Words	18. Distribution Statement
Computers NAS Stage A Data Processing ARTS III Data Processing	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	152	

Form DOT F 1700.7 (8-69)

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-71-16		

4. Title and Subtitle	5. Report Date
System Reliability and Recovery	June 15, 1971
	6. Performing Organization Code: TCC
7. Author(s): Charles A. Dancy, III	8. Performing Organization Report No.
9. Performing Organization Name and Address: DOT/Transportation Systems Center, Computer Technology Division/TCC, 55 Broadway, Cambridge, MA 02142	10. Work Unit No.: FA-03
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address: FAA-SRDS-RD 123, 800 Independence Ave., S.W., Washington, D.C. 20546	13. Type of Report and Period Covered: Technical Report
	14. Sponsoring Agency Code: FAA RD 123

15. Supplementary Notes

16. Abstract

This study exhibits a variety of reliability techniques applicable to future ATC data processing systems. Presently envisioned schemes for error detection, error interrupt and error analysis are considered, along with methods of retry, reconfiguration, task rescheduling and system restart. Reliability data are accumulated on present and planned ATC data processing systems and on certain commercial, military, and experimental computers having features applicable to future ATC tasks.

Included as well are discussions of reliability concepts, methods of reliability determination and criteria for judging system reliability and capability for recovery.

This work is connected with FA-03-1, Large Scale Systems.

17. Key Words	18. Distribution Statement
Reliability, recovery, reconfiguration, multiprocessor, failsafe/soft	Unclassified - Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	61	

Form DOT F 1700.7 (8-69)

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-71-17		

4. Title and Subtitle	5. Report Date
Time/Frequency Systems	June 30, 1971
	6. Performing Organization Code: TC
7. Author(s) E.H. Farr, L.A. Frasco, H.D. Goldfein, R.M. Snow	8. Performing Organization Report No.: DOT-TSC-FAA-71-17
9. Performing Organization Name and Address: Transportation Systems Center, 55 Broadway, Cambridge, Mass. 02142	10. Work Unit No.
	11. Contract or Grant No.
	13. Type of Report and Period Covered: Technical Report
12. Sponsoring Agency Name and Address: Federal Aviation Administration, 800 Independence Ave., S. W., Washington, D. C. 20590	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report summarizes the work performed at DOT/TSC on the Time/Frequency ATC System study project. Principal emphasis in this report is given to the evaluation and analysis of the technological risk areas. A survey and description of proposed T/F system is included. The technical risk areas include the effects of multipath on signalling over radio links. Material is presented which bears on the comparative analysis of T/F with alternative technologies, including satellite and beacon-based system concepts. It is concluded that the most critical problem areas requiring further study are (a) multipath effects on T/F systems, and (b) systems operability under non-ideal conditions leading to graceful degradability.

17. Key Words	18. Distribution Statement
. Time/Frequency . Multipath . ATC Systems . Coding	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	82	

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-71-18		

4. Title and Subtitle	5. Report Date
Proposed Control Tower and Cockpit Visibility Readouts Based on an Airport-Aircraft Information Flow System	July 1971
	6. Performing Organization Code: DOT/TSC/TER

7. Author(s)	8. Performing Organization Report No.
Hector C. Ingrao, J. R. Lifsitz	

9. Performing Organization Name and Address	10. Work Unit No.	11. Contract or Grant No.	13. Type of Report and Period Covered
Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA 02142	R2125	PPA FA-15	Technical Report

12. Sponsoring Agency Name and Address	14. Sponsoring Agency Code
Federal Aviation Administration 800 Independence Avenue S.W. Washington, D. C. 20590	RD-261

15. Supplementary Notes

16. Abstract

The problem of displaying visibility information to both controller and pilot is discussed in the context of visibility information flow in the airport-aircraft system.

The optimum amount of visibility information, as well as its rate of flow and display, depends both on the needs of the pilot during landing and on the air traffic control philosophy (tactical or strategic) chosen.

A rationale is provided to assist in the selection of flow rates and readouts. The relationship of visibility information to the magnitude of terminal information handled by the pilot is discussed. Several display formats are proposed, including one for the traffic controller and three different options for the pilot.

17. Key Words	18. Distribution Statement
Visibility Air Traffic Control Cockpit Display	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
U	U	43	

Form DOT F 1700.7 (8-69)

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-71-19		

4. Title and Subtitle	5. Report Date
Clear Air Turbulence Radiometric Detection Program	JULY 1971
	6. Performing Organization Code: TER
7. Author(s) George W. Wagner, G.G. Haroules, W.E. Brown	8. Performing Organization Report No.
9. Performing Organization Name and Address: DOT/Transportation Systems Center, 55 Broadway, Cambridge, MA 02142	10. Work Unit No.: FA-20
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address: U.S. Department of Transportation, Federal Aviation Administration, Washington, DC 20590	13. Type of Report and Period Covered: Annual Report FY-71 July 1, 1970-June 30, 1971
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report presents a review of accomplishments for the Clear Air Turbulence Detection Program. The objectives, instrumentation, supporting hardware and interfaces leading up to and including the test flights for the reporting period are given.

The ultimate goal of this program is the development of a remote method for detecting and thereby alerting high-altitude, high-speed aircraft in sufficient time to avoid the hazards associated with Clear Air Turbulence, CAT.

17. Key Words	18. Distribution Statement
radiometer	Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	47	

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-71-20		

4. Title and Subtitle	5. Report Date
Dispersed Processing for ATC	June 30, 1971
	6. Performing Organization Code: TCC

7. Author(s)	8. Performing Organization Report No.
Grant G. Paul & Robert M. Snow	

9. Performing Organization Name and Address	10. Work Unit No.	11. Contract or Grant No.
DOT/Transportation Systems Center 55 Broadway Cambridge, MA 02142	71-FA-0	FA-03-2

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered	14. Sponsoring Agency Code
Federal Aviation Agency 800 Independence Ave., S.W. Washington, D.C.	Interim Technical Report	

15. Supplementary Notes

16. Abstract

An analysis has been made of the potentialities and problems involved in assigning some computer processing and control functions to the remote sites in an upgraded third generation air traffic control system. Interrogator sites offer the most fruitful opportunities for remote processing. The minimal remote processing configuration consists of extraction, compaction, and encoding of locally derived data. With concurrent remote tracking, additional tasks may be added, including roll call generation, data link management, ground communications management, and IPC service. Phased-array management is considered to be the function of a separate dedicated controller. Attention is directed to the need for an "orderwire" net to avoid problems of floating control

17. Key Words	18. Distribution Statement
Dispersed Processing, Air Traffic Control, Remote Tracking, Data Link, Intermittent Positive Control, Discrete Addressing	Unclassified - Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	16	

Form DOT F 1700.7 (8-69)

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-71-21		

4. Title and Subtitle	5. Report Date
KEYBOARD AND MESSAGE EVALUATION FOR COCKPIT INPUT TO DATA LINK	November 1971
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Edwin H. Hilborn	
9. Performing Organization Name and Address	10. Work Unit No.
Department of Transportation Transportation Systems Center 55 Broadway Cambridge, MA. 02142	R-2149
	11. Contract or Grant No.
	FA16
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Department of Transportation Federal Aviation Administration Washington, D.C. 20590	Technical Report FY-1971
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract The project reported herein studied some methods for implementation of the man-machine interface of Digital Data Link for Air Traffic Control. An analysis of information transfer requirements indicated that a vocabulary of less than 200 words could yield meaningful messages for all routine ATC transactions. Keyboard configurations suitable for one-handed operation to yield alphanumeric outputs were studied and a ten-key character selection layout based upon sequential keying of the first two letters of the phonetic alphabet was developed. Tests with experimental subjects indicated that training time was no longer and keying proficiency at least as good as that achieved with the larger keyset suggested by ARINC.

A second-order mnemonic coding scheme based upon key letters of the words of messages was proposed as a means for reducing the number of required keystrokes to generate such messages.

17. Key Words	18. Distribution Statement
•Data Link •Air Traffic Control •Message Coding.	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	38	

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-71-23		

4. Title and Subtitle	5. Report Date
Computer Systems Performance Measurement Techniques	June 30, 1971
	6. Performing Organization Code: TCC

7. Author(s)	8. Performing Organization Report No.
Judith Gertler, Herbert Glynn, Vivian Hobbs, Frederick Woolfall	

9. Performing Organization Name and Address	10. Work Unit No.
DOT/Transportation Systems Center 55 Broadway Cambridge, MA 02142	FA-03
	11. Contract or Grant No.
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address Federal Aviation Administration 800 Independence Ave., S.W. Washington, D.C. 20546	Technical Report
	14. Sponsoring Agency Code: FAA RD-123

15. Supplementary Notes

16. Abstract

Computer system performance measurement techniques, tools, and approaches are presented as a foundation for future recommendations regarding the instrumentation of the ARTS ATC data processing subsystem for purposes of measurement and evaluation.

Section 1: Introduces the subject of computer system performance measurement and states objectives.

Section 2: Defines several computer system measurement approaches, describes the event-monitoring and statistical sampling software techniques, and discusses the various phases of a measurement process.

Appendix A: Defines the role of an Executive System in diverse computing environments and its effect on the design of a measurement package, discusses fundamental operational concepts of Executive Systems, and reviews ARTS III in terms of those concepts.

Appendix B: Surveys the state-of-the-art of available simulation languages and packages, summarizes their salient characteristics and provides guidelines for evaluation and selection of a simulation capability.

17. Key Words	18. Distribution Statement
Computer Measurement, ARTS III Data Processing, Executive Systems, Simulation	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	71	

Form DOT F 1700.7 (8-69)

1. Report No. DOT-TSC-FAA-71-24	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle An Investigation of Microwave Landing Guidance System Signal Requirements For Conventionally ~~Equipped Civilian Aircraft~~		5. Report Date June 1971 6. Performing Organization Code PGL
7. Author(s) Maurice H. Lanman III		8. Performing Organization Report No.
9. Performing Organization Name and Address DOT/Transportation Systems Center 55 Broadway Cambridge, Mass. 02142		10. Work Unit No. FA-08 11. Contract or Grant No.
12. Sponsoring Agency Name and Address Federal Aviation Administration Washington, D. C.		13. Type of Report and Period Covered Technical Report 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

This report describes efforts leading to the determination of minimum suitable scan rates for the azimuth and Elevation #1 functions of the microwave Landing Guidance System (LGS) proposed by RTCA SC-117, based on performance requirements of two conventionally equipped civilian aircraft. Two complementary methods are used; one involving a full nonlinear digital simulation, the other involving direct covariance matrix propagation. Wind and turbulence models, aircraft models and LGS models are described in detail. Safety and pilot acceptability criteria for performance evaluation are developed. Results are presented in terms of minimum scan rate maximum beam noise constraints. Limitations of the methods and data are also discussed and required further work outlined.

17. Key Words	18. Distribution Statement
Microwave Landing System Landing Guidance System Scanning Rate Scanning Beam ILS	Unclassified - Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	171	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-71-25		

4. Title and Subtitle	5. Report Date
Visibility Concepts and Measurement Techniques for Aviation Purposes	July 1971
	6. Performing Organization Code: DOT/TSC/TER
7. Author(s): G.T. Schappert	8. Performing Organization Report No.
9. Performing Organization Name and Address: Optical Devices Group, Transportation Systems Center, 55 Broadway, Cambridge, MA. 02142	10. Work Unit No.: R1043
	11. Contract or Grant No.
	13. Type of Report and Period Covered: Final Report
12. Sponsoring Agency Name and Address: Federal Aviation Administration, 800 Independence Avenue, S.W., Washington, D.C.	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract This is the final report #1 of the Visibility Measuring Devices project, PPA-FA-15-Q, carried out for the Federal Aviation Administration at the Transportation Systems Center, both under the Department of Transportation.

The report reviews present techniques for measuring atmospheric transmittance and its conversion to runway visual range. The response of the pilot to visual cues used in determining the visibility is discussed as a function of his cockpit environment. The lights utilized by the FAA as targets for visibility determinations are discussed and used in the computations.

New techniques for visibility measurements and new concepts and definitions are discussed and analyzed. The emphasis is on techniques for measuring slant visual range by means of optical remote sensing devices. Various problems relating to atmospheric modeling, signal processing, and eye safety aspects are discussed.

17. Key Words	18. Distribution Statement
Visibility Runway Visual Range Atmospheric Transmission, LIDAR	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
UNCLASSIFIED	UNCLASSIFIED	104	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-71-26		

4. Title and Subtitle	5. Report Date
Accurate Surveillance in the Terminal Area	Sept 1971
	6. Performing Organization Code: TER
7. Author(s): B. Kulke, R.T. Minkoff, G.G. Haroules	8. Performing Organization Report No.
9. Performing Organization Name and Address: Transportation Systems Center, 55 Broadway, Cambridge, Mass. 02142	10. Work Unit No.: R2132
	11. Contract or Grant No.: FA09
12. Sponsoring Agency Name and Address: Federal Aviation Administration, 800 Independence Ave. S.W., Washington, D.C.	13. Type of Report and Period Covered: Final Report
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The problem of deriving surveillance information from the MLS has been analyzed in terms of the available air-to-ground communication links. The results of this study indicate that the use of this approach is feasible and it is recommended that the configuration based on the DABS data link be included in the upgraded third-generation design to meet the high-density terminal-area surveillance requirements.

17. Key Words	18. Distribution Statement
Approach Surveillance Air-derived data Parallel-runway spacing	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	43	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-71-27		

4. Title and Subtitle	5. Report Date
The Calculation of Aircraft Collision Probabilities	October 1971
	6. Performing Organization Code: PD
7. Author(s): Juan F. Bellantoni	8. Performing Organization Report No.: DOT-TSC-FAA-71-27
9. Performing Organization Name and Address: Department of Transportation, Transportation Systems Center, Cambridge, MA.	10. Work Unit No.: FA17
	11. Contract or Grant No.
	13. Type of Report and Period Covered: Technical Report, FY 71
12. Sponsoring Agency Name and Address: Federal Aviation Administration, System Research and Development Service, 800 Independence Avenue, Washington DC	14. Sponsoring Agency Code: RD 150

15. Supplementary Notes

16. Abstract

The basic limitation of air traffic compression, from the safety point of view, is the increased risk of collision due to reduced separations. In order to evolve new procedures, and eventually a fully automatic system, it is desirable to have a means of calculating the collision probability for any prescribed flight paths. This paper extends the statistical-probabilistic method of collision probability calculation, which has been limited to parallel, straight line flight paths, to arbitrary flight paths and vehicle shapes. The general formula is specialized to the cases of large relative velocity, non-zero relative velocity, zero relative velocity, and spherical collision surface. The formulas are applied to independent curved landing approaches to parallel runways.

17. Key Words	18. Distribution Statement
Collision, Collision Probability, Air Traffic Control, Safety	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	41	

1. Report No. DOT-TSC-FAA-71-29	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Microwave Scanning Beam Approach and Landing System Phased Array Antenna		5. Report Date September 1971 6. Performing Organization Code TER
7. Author(s) R.M. Kalafus, G.J. Bishop, G.G. Haroules,		8. Performing Organization Report No.
9. Performing Organization Name and Address Transportation Systems Center 55 Broadway Cambridge, MA 02142		10. Work Unit No. PPA FA209 11. Contract or Grant No. R1030
12. Sponsoring Agency Name and Address Federal Aviation Administration Systems Research and Development Service Washington, DC 20590		13. Type of Report and Period Covered Annual Report July 1970 - July 1971 14. Sponsoring Agency Code

15. Supplementary Notes

P. Harris, F.J. LaRussa, P.J. Pantano, B. Rubinger, R.S. Yatsko (Authors Cont)

16. Abstract

The feasibility of the use of phased arrays for the proposed microwave landing guidance system (MLGS) is discussed. The effects of the use of planar and conical beam guidance on the choice of system configurations is investigated. The design of an experimental antenna to demonstrate feasibility is given.

17. Key Words	18. Distribution Statement		
aircraft guidance; cylindrical arrays; linear arrays; planar arrays; air traffic control; C-band; components; stripline; microstrip; propagation, microwave sources	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 312	22. Price

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-71-30		

4. Title and Subtitle	5. Report Date
MULTIBEAM AERONAUTICAL SATELLITE SYSTEM DESIGN	December 1971
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
L. M. Keane	
9. Performing Organization Name and Address	10. Work Unit No.
Department of Transportation Transportation Systems Center 55 Broadway Cambridge, MA 02142	R-2143
	11. Contract or Grant No.
	FA211
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address	Technical Report Oct. 1 - Dec. 31 1971
Department of Transportation Federal Aviation Administration Washington, D. C. 20590	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

A method is described which allows the identification of favored beam distributions for multiple beam aeronautical satellites. It is used to synthesize beam designs and compare the capacities of two satellite system configurations which cover the major Pacific routes. The first configuration has two satellites with eclipse capability adequate for housekeeping and independent aircraft surveillance; the second has additional battery capacity to provide 50% of the daylight communications capability in each satellite during eclipse. In this case, each satellite covers a limited portion of the full coverage area.

17. Key Words	18. Distribution Statement
Satellite, Aeronautical, Aerosat	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	76	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-71-9		

4. Title and Subtitle	5. Report Date
PRELIMINARY SURVEY OF POTENTIAL STOL TERMINAL AREA OPERATIONAL REQUIREMENTS	June 1971
	6. Performing Organization Code: PGS
7. Author(s): Lloyd E. Stevenson	8. Performing Organization Report No.: TSC-FAA-71-9
9. Performing Organization Name and Address: Department of Transportation, Transportation System Center, Cambridge, MA 02142	10. Work Unit No.: FN201
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address: Department of Transportation, Federal Aviation Administration, Systems Research Development Service, Washington, D.C. 20591	13. Type of Report and Period Covered: Interim Report
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

A preliminary survey of potential operational requirements for STOL in the terminal area has been made. The presentation of this survey is in three sections. The first section presents the motivation for the survey, which can be summarized as the necessity for the federal government to have a knowledge of the potential operational requirements of STOL. The second section discusses the markets in which STOL may be found viable. This discussion is limited to those aspects which are necessary to determine the effects of these markets on shaping future STOL operations. The final section consists of a description of terminal area operations as they currently exist, of possible operational changes that may occur exclusive of the introduction of STOL, and then of potential operational requirements of STOL in the terminal area.

17. Key Words	18. Distribution Statement
STOL Terminal Area Operations	Availability is unlimited. Document may be released to the National Technical Information Service, Springfield, Va., 22151, for sale to the public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	38	3.00 PC .95 MC

1. Report No. DOT-TSC-FAA-72-1	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle CHARACTERISTICS OF A SIGNAL DATA CONVERTER FOR A MULTI-RUNWAY VISIBILITY MEASURING SYSTEM		5. Report Date October 1971 6. Performing Organization Code
7. Author(s) H. C. Ingrao, J. R. Lifsitz		8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA. 02142		10. Work Unit No. R2125 11. Contract or Grant No. FA 215 13. Type of Report and Period Covered Technical Report June 1971-Nov. 1971
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration Washington, D.C. 20590		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract The characteristics of a signal data converter (SDC) are developed with application to airport visibility measuring systems. The SDC is discussed in the context of an evolutionary growth of the visibility measuring system stemming from the present FAA RVR measuring technique. A new SDC will be employed which will use state-of-the-art concepts and will be capable of handling future visibility measuring systems outputs to provide more comprehensive visibility information and display. Included in these outputs will be simultaneous signals from as many as nine transmissometers distributed three each along three runways. In addition, ground illuminance sensors will provide more background discrimination than the present day-night switch. Finally, the system will be expected to handle inputs from several kinds of target lights and to calculate and output for display several specialized visibility values (RVR,SVR,TVR). The SDC will be capable of modular expansion such that the capability for such future tasks will be available.

17. Key Words	18. Distribution Statement
• Visibility • Air Traffic Control • Signal Data Converter	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	30	

1. Report No. DOT-TSC-FAA-72-2	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle VORTEX SENSING TESTS AT NAFEC		5. Report Date January 1972 6. Performing Organization Code
7. Author(s) D. Burnham, J. Hallock, R. Kodis, T. Sullivan		8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA 02142		10. Work Unit No. R-2102 11. Contract or Grant No. FA-205 13. Type of Report and Period Covered Technical Report June 15-July 15,1971
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration Washington, D.C. 20590		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract This report describes the results of a series of tests conducted for the FAA at NAFEC by the DOT/Transportation Systems Center. The test objectives were to determine and evaluate some of the characteristics of three experimental techniques for the remote sensing of the wing-tip vortices generated by heavy commercial and military aircraft. These techniques involved (1) a pulsed, bistatic acoustic detection and ranging system (referred to as an acoustic radar); (2) a ground level pressure sensor; and (3) a ground level hot-wire anemometer. The tests were conducted both in conjunction with the instrumented tower and at the end of runway 13. Data were obtained and analyzed for a variety of aircraft including the DC-7, B-747, C-141 and C-5A. Results in the form of altitudes and times of tower hits and vortex tracks are presented and compared to the tower data wherever possible.

17. Key Words	18. Distribution Statement
Vortex Acoustic Sensor Pressure	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	72	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-72-5		

4. Title and Subtitle	5. Report Date
PATH CHANGING METHODS APPLIED TO THE 4-D GUIDANCE OF STOL AIRCRAFT	November 1971
	6. Performing Organization Code
7. Author(s) Robert J. Hynes, Edward B. Capen* and Lloyd E. Stevenson	8. Performing Organization Report No.
9. Performing Organization Name and Address Transportation Systems Center 55 Broadway Cambridge, MA 02142	10. Work Unit No. R2808
	11. Contract or Grant No. FA-218
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration Washington, D.C. 20591	13. Type of Report and Period Covered Technical Report
	14. Sponsoring Agency Code

15. Supplementary Notes

*Service Technology Corporation
Cambridge, MA 02142

16. Abstract

Prior to the advent of large-scale commercial STOL service, some challenging navigation and guidance problems must be solved. Proposed terminal area operations may require that these aircraft be capable of accurately flying complex flight paths, and in some situations, maintaining a time of arrival envelope at waypoints along these paths (4-D guidance capability). This report discusses problems that arise in performing 4-D guidance and presents the results of an initial investigation of two candidate 4-D guidance schemes that are based on the aircraft having a limited amount of protected airspace for maneuvering. Preliminary analysis and simulation results are presented and future work on the 4-D guidance of STOLS is outlined. The results although presented for STOLS are applicable also to the 4-D guidance of any RNAV equipped aircraft.

17. Key Words	18. Distribution Statement
4-D Guidance, Flight Path Planning, Steering Laws	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	42	

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-72-6		

4. Title and Subtitle	5. Report Date
MONOPULSE AZIMUTH MEASUREMENT IN THE ATC RADAR BEACON SYSTEM	December 1971
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Bernhard Kulke, Bruce Rubinger, George G. Haroules	

9. Performing Organization Name and Address	10. Work Unit No.
Department of Transportation Transportation Systems Center 55 Broadway Cambridge, MA 02142	R-2135
	11. Contract or Grant No. FA 219
	13. Type of Report and Period Covered Technical Report
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration Washington, D.C. 20590	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

A review is made of the application of sum-difference beam techniques to the ATC Radar Beacon System. A detailed error analysis is presented for the case of a monopulse azimuth measurement based on the existing beacon antenna with a modified feed network. A comparison of the total expected monopulse error with the azimuth error of the existing ATCRBS indicates that there is little to be gained by a monopulse modification. Without beam sharpening, the single-reply monopulse accuracy is less than that of the existing system. With beam sharpening and/or by using multiple reply information, the azimuth error is estimated to be as little as 1 or 2 Azimuth Change Pulses (ACP's), compared to 3 ACP's measured error for the Common Digitizer. However, the monopulse modification implies a considerable increase in system cost and complexity, and the estimated accuracy has not so far been demonstrated in the field. A monopulse modification for azimuth measurement in ATCRBS therefore is not recommended. In terms of fruit reduction, an advantage is obtainable by utilizing sum-difference techniques for artificial beam sharpening, but other solutions may be preferable.

17. Key Words	18. Distribution Statement
ATC Radar Beacon System, Monopulse Azimuth Measurement, Error Analysis, Sum-Difference Techniques	Availability is unlimited. Document may be released to the National Technical Information Service, Springfield, VA 22151, for sale to the public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	121	

Form DOT F 1700.7 (8-69)

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-72-7		

4. Title and Subtitle	5. Report Date
THE ILS SCATTERING PROBLEM AND SIGNAL DETECTION MODEL	February 1972
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
G. Chin, L. Jordan, D. Kahn *	

9. Performing Organization Name and Address	10. Work Unit No.
Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA. 02142	R 2103
	11. Contract or Grant No. FA207
	13. Type of Report and Period Covered Technical Report
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Systems Washington, D.C. 20590	14. Sponsoring Agency Code

15. Supplementary Notes

*S. Morin

16. Abstract

The construction of a mathematical model of The Instrument Landing System (ILS) multipath problem has been undertaken. This report presents the theoratical basis for any such model, a critique of previous models and newly achieved developments in ILS model construction.

17. Key Words

ILS, scattering theory, current deviation indication, derogation, receiver model, Doppler Shift, DDM

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	105	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-72-8		

4. Title and Subtitle	5. Report Date
EVALUATION OF THE FAA ADVANCED FLOW CONTROL PROCEDURES	January 1972
	6. Performing Organization Code
7. Author(s) J. F. Bellantoni J. R. Coonan, M.F. Medeiros	8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway Cambridge, MA 02142	10. Work Unit No. R-2137 11. Contract or Grant No. FA206
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration Washington, D. C. 20591	13. Type of Report and Period Covered Technical Report FY71-72 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report is an evaluation of the present FAA Advanced Flow Control Procedures (AFCP), based on data gathered from its implementation on February 5, 1971 and on a fast-time digital simulation of traffic feeding into the NY airports on that day. The report discusses the effectiveness of AFCP in theory, in the February 5 case study, and as modelled in the simulation. Recommendations are made 1) to retain the concept, 2) to modify the procedures, 3) to modify the computer program, and 4) to conduct further research.

17. Key Words	18. Distribution Statement
Flow Control, Advanced Flow Control Procedures, Air Traffic Control, Central Flow Control Facility	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	215	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FAA-RD-72-27		

4. Title and Subtitle	5. Report Date
CONSIDERATIONS ON THE RELATIONSHIP BETWEEN WHITE AND RED CENTERLINE RUNWAY LIGHTS AND RVR	January, 1972
	6. Performing Organization Code: DOT-TSC-FAA-72-9
7. Author(s): J. L. Horner	8. Performing Organization Report No.
9. Performing Organization Name and Address: Department of Transportation, Transportation Systems Center, 55 Broadway, Cambridge, MA 02142	10. Work Unit No.: R2125
	11. Contract or Grant No.: FA215
	13. Type of Report and Period Covered: Final Report, Dec.,71 to Jan. 72
12. Sponsoring Agency Name and Address: Department of Transportation, Federal Aviation Administration, Washington, D.C. 20590	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The runway visual range (RVR) for a Type L-850 bidirectional centerline runway light has been calculated for the red and white output ports at three different current settings for both day and night illuminance thresholds. The calculations are based on certain parameters measured in our laboratory on a sample light. The resulting RVRs are compared to the standard RVRs based on the High Intensity Runway Light (HIRL). An analysis is also included on the error introduced by ignoring the spectral transmittance of the atmosphere.

17. Key Words	18. Distribution Statement
Visibility, Visual Range, RVR	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	26	

1. Report No. DOT-TSC-FAA-72-10	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle A SURVEY TO DETERMINE FLIGHT PLAN DATA AND FLIGHT SCHEDULE ACCURACY		5. Report Date January 1972 6. Performing Organization Code
7. Author(s) John R. Coonan		8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA 02142		10. Work Unit No. R2137 11. Contract or Grant No. FA206
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration Washington, D.C. 20590		13. Type of Report and Period Covered Technical Report 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This survey determined Operational Flight Plan Data and Flight scheduling accuracy vs. published schedules and/or stored flight plan data. This accuracy was determined by sampling tracer flights of varying lengths, selected terminals, and high altitude sectors; then comparing this data with stored computer data, thus, revealing average delay areas. This information will aid operational analysts and programmers to construct flow control software programs.

17. Key Words	18. Distribution Statement		
Flow Control, Terminals, enroute, sectors, position reports	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 125	22. Price

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FAA-72-13		

4. Title and Subtitle	5. Report Date
AIRCRAFT WAKE VORTEX SENSING SYSTEMS	June 30, 1971
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
D. Burnham, M. Gorstein, J. Hallock, R. Kodis, I. McWilliams, T. Sullivan	

9. Performing Organization Name and Address	10. Work Unit No.
Department of Transportation Transportation Systems Center 55 Broadway Cambridge, Mass. 02142	R-2106
	11. Contract or Grant No. FA-205
	13. Type of Report and Period Covered Technical Report June 1971
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration 800 Independence Ave., S.W. Washington, D.C. 02590	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report summarizes and analyzes techniques, both active and passive that could be used to detect and measure air movements associated with wingtip vortex generation within an area or throughout a volume of terminal airspace. This study also indicates one or more useable techniques with an appraisal of expected performance and inherent limitations. Results of preliminary feasibility tests employing available technology are presented.

This report also discusses the Systems Studies to be performed on the wake vortex sensing problem. The major effort is directed toward the location of wake vortex hazard, and the generation of monitoring requirements for safe operation in the airport terminal environment.

17. Key Words	18. Distribution Statement
• Vortec • Acoustic • Sensor	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	65	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FAA-RD-72-82		

4. Title and Subtitle	5. Report Date
ASDE-2 TRANSMITTER MODIFICATIONS	September, 1972
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Henry R. Guarino	DOT-TSC-FAA-72-16

9. Performing Organization Name and Address	10. Work Unit No.
Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA 02142	R-2140
	11. Contract or Grant No. PPA-FA-221
	13. Type of Report and Period Covered

12. Sponsoring Agency Name and Address	
Department of Transportation Federal Aviation Administration Systems Research and Development Service Washington, DC 20591	Final Report
	14. Sponsoring Agency Code 083-601-02M

15. Supplementary Notes

16. Abstract In October 1971, TSC was assigned the task of assessing the current ASDE-2 maintenance problems. After studying the available statistics, obtained from various airports, it was quickly concluded that the preponderance of ASDE-2 radar failures originated in the modulator-transmitter section where the low mean time between failures was controlled by the following inter-related factors: 1) An undersized hydrogen thyratron driver for the power amplifier; 2) An inadequate trigger pulse amplifier output; 3) Poor operating conditions for the power amplifier tubes. The report analyzes these and other engineering inadaquacies and then describes in detail the modification of one channel of an ASDE radar, at TSC. To date the system has been operating for several months without any modulator failures. This is nearly fifty times longer than previous mean time between failures.

17. Key Words	18. Distribution Statement
	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	29	$3.00 PC $ .95 MF

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FAA-RD-72-102		

4. Title and Subtitle	5. Report Date
ALL-WEATHER-LANDING OPERATIONS BIBLIOGRAPHY	June 1972
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
James M. Morris	DOT-TSC-FAA-72-19

9. Performing Organization Name and Address	10. Work Unit No.
Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA 02142	R2118
	11. Contract or Grant No. FA207
	13. Type of Report and Period Covered Bibliography 1966 - 1971
12. Sponsoring Agency Name and Address Department of Transportation Federal Aviation Administration Systems Research and Devel. Service Washington, D.C. 20591	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The bibliography provides a selected coverage of several topic areas within the general subject of all-weather landing. The period covers the recent years of 1966 through 1971. The areas are as follows:

Approach and Landing,
Human Factors,
Navigation and Display Systems,
Requirements and Standards,
Safety, Reliability, and Maintenance.

17. Key Words	18. Distribution Statement
Landing, All-Weather Landing, Category III Operations, Low-Visibility	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	52	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FAA-RD-72-141		

4. Title and Subtitle	5. Report Date
VORTEX SENSING TESTS AT LOGAN AND KENNEDY AIRPORTS	December 1972
	6. Performing Organization Code: DOT-TSC-FAA-72-25
7. Author(s): T.Sullivan, D.Burnham, R.Kodis	8. Performing Organization Report No.
9. Performing Organization Name and Address: Department of Transportation, Transportation Systems Center, 55 Broadway, Cambridge, MA 02142	10. Work Unit No.: R-3116
	11. Contract or Grant No.: FA 305
12. Sponsoring Agency Name and Address: Department of Transportation, Federal Aviation Administration, Systems Research & Development Service, Washington, D.C. 20591	13. Type of Report and Period Covered: Final Report
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report describes a series of tests of wake vortex sensing systems at Logan and Kennedy Airports. Two systems, a pulsed acoustic radar (acdar) and an array of ground level pressure sensors, were tested. Site restrictions limited the Logan work to preliminary evaluation. The tests at Kennedy Airport established the general operating characteristics of both tracking systems. It was found that the acoustic sensor can detect and track the vortices of all commonly used commercial aircraft, though with varying degrees of sensitivity. The pressure sensors generally behaved best during conditions of low to moderate winds when the vortices could often be tracked laterally up to several hundred feet from the aircraft flight path.

17. Key Words	18. Distribution Statement
Vortex Sensing Tests, Acoustic Sensors, Wind Pressure Sensors, Aircraft Wake Vortices	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	136	

Department of Transportation
Federal Highway Administration

Unlimited Distribution Reports

Report No.	Title
FHWA-71-1	Automatic Data Reduction from Aerial Photographs - Phase I Report
FHWA-72-1	Manual for Highway Noise Prediction
FHWA-72-1	Manual for Highway Noise Prediction, Appendix B
FHWA-72-2	Manual for Highway Noise Prediction (Short Version)

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FHWA-71-1		

4. Title and Subtitle	5. Report Date
Automatic Data Reduction from Aerial Photographs - Phase I Report	8/15/71
	6. Performing Organization Code: TCD
7. Author(s): Juris G. Raudseps, David S. Prerau	8. Performing Organization Report No.
9. Performing Organization Name and Address: DOT/Transportation Systems Center, 55 Broadway, Cambridge, MA 02142	10. Work Unit No.: R-1016
	11. Contract or Grant No.: HW-05
12. Sponsoring Agency Name and Address: Federal Highway Administration, 800 Independence Avenue, S.W., Washington, D.C. 20546	13. Type of Report and Period Covered: Technical Report 7/1/70 - 6/30/71
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

Aerial photographs are useful in various studies of highway traffic behavior. From a timed sequence of aerial photographs of a fixed highway area, one can find for each vehicle crossing the area data on position, velocity, trajectory (i.e., entrancing, lane changing, and exiting) and type (i.e., car, truck, or bus). In this project, an interactive system consisting of a computer, a computer-controlled flying-spot scanner, and a graphics tablet is utilized to significantly automate the data reduction process. This report describes the current state-of-the-art of data reduction and the system being developed. The pertinent computer programs developed to date are documented in detail.

17. Key Words	18. Distribution Statement
	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	119	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FHWA-72-1		

4. Title and Subtitle	5. Report Date
MANUAL FOR HIGHWAY NOISE PREDICTION	March 1972
	6. Performing Organization Code
7. Author(s) J. E. Wesler	8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA 02142	10. Work Unit No. R-2519 11. Contract or Grant No. OS-207
12. Sponsoring Agency Name and Address Department of Transportation Federal Highway Administration Washington, DC 20590	13. Type of Report and Period Covered Technical Report 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This manual is intended for use as a tool in predicting the noise which will be generated by freely-flowing vehicle traffic along a highway of known characteristics. The manual presents two separate approaches to the prediction problem. The first approach utilizes a simple nomograph to provide first-approximation solutions to the traffic noise prediction problem. The second approach utilizes a computerized traffic noise simulation model, for more accurate and more flexible noise level predictions. This volume contains an explanation of the bases for both approaches, to indicate the assumptions and limitations inherent in the prediction procedures, and a User's Manual for the computer program. Appendix B, published under separate cover, contains the Programmer's Manual and the computer listing for the simulation model. A short version of this report without Appendices A and B, is published as Report DOT-TSC-FHWA-72-2 for convenient use by most users.

17. Key Words	18. Distribution Statement
Traffic Noise Prediction Highway Noise Simulation Traffic Noise Levels	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	75	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FHWA-72-1		

4. Title and Subtitle	5. Report Date
MANUAL FOR HIGHWAY NOISE PREDICTION APPENDIX B	March 1972
	6. Performing Organization Code
7. Author(s) J.E. Wesler	8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway Cambridge, MA 02142	10. Work Unit No. R-2519
	11. Contract or Grant No. OS-207
12. Sponsoring Agency Name and Address Department of Transportation Federal Highway Administration Washington, D.C. 20590	13. Type of Report and Period Covered Technical Report
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The basic manual, published as the first volume of this report, is intended for use as a tool in predicting noise levels which will be generated by freely-flowing vehicle traffic along a highway of known characteristics. The first volume explains the basis for the computerized prediction model, used for highway noise level prediction, and contains the user's manual for the computer program. This volume contains the programmer's manual for the computer program, and the program listing in FORTRAN IV.

17. Key Words	18. Distribution Statement
·Traffic noise prediction ·Highway noise simulation, ·Traffic noise levels	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	80	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FHWA-72-2		

4. Title and Subtitle	5. Report Date
MANUAL FOR HIGHWAY NOISE PREDICTION (SHORT VERSION)	March 1972
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
J. E. Wesler	
9. Performing Organization Name and Address	10. Work Unit No.
Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA 02142	R-2519
	11. Contract or Grant No.
	OS-207
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address	Technical Report
Department of Transportation Federal Highway Administration Washington, DC 20590	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract This manual is intended for use as a tool in predicting the noise which will be generated by freely-flowing vehicle traffic along a highway of known characteristics. The manual presents two separate approaches to the prediction problem. The first approach utilizes a simple nomograph to provide first-approximation solutions to the highway noise prediction problem. The second approach utilizes a computerized traffic noise simulation model, for more accurate and more flexible noise level predictions. This report is a short version of Report No. DOT-TSC-FHWA-72-1, consisting of only the first four sections of that longer report for more convenient use by most of those involved in highway noise predictions. This report contains a brief description of the bases for both prediction approaches, to indicate the assumptions and limitations inherent in the procedures, and a Users' Manual for the computer program. Appendicies A and B of the longer report provide a more detailed description of the prediction theory, and a Programmers' Manual.

17. Key Words	18. Distribution Statement
Traffic Noise Prediction, Highway Noise Simulation, Traffic Noise Levels	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	47	

Department of Transportation
Federal Railroad Administration

Unlimited Distribution Reports

Report No.	Title
FRA-71-1A	Power Conditioning for High-Speed Vehicles
FRA-71-2	Metroliner Auxiliary Power Electrical System Reliability Study
FRA-71-3	Technological Innovation in Grade Crossing Protective Systems
FRA-71-5	Train Control and Operations
FRA-71-7	Progress on the Ram Wing Concept with Emphasis on Lateral Dynamics
FRA-71-8	Communication for High-Speed Ground Transportation
FRA-72-2	Improvement of Metroliner Telephone Channel Capacity and Modeling of Telephone Channel Demands
FRA-72-3	Automatic Car Identification - An Evaluation
FRA-72-4	Automatic Car Identification - Evaluation
FRA-72-5	Measurements and Analysis of 115 kv Power Line Noise and its Effect on Pueblo Test Site Radio Links
FRA-72-7	Noncontact Power Collection for High-Speed Ground Transportation Systems (FRA-RT-73-7)

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Power Conditioning for High-Speed Tracked Vehicles		5. Report Date February 1971 6. Performing Organization Code
7. Author(s) F. L. Raposa		8. Performing Organization Report No. DOT-TSC-FRA-71-1A
9. Performing Organization Name and Address Transportation Systems Center 55 Broadway Cambridge, MA 02142		10. Work Unit No. 71RR-0 11. Contract or Grant No. RR05-0
12. Sponsoring Agency Name and Address Federal Railroad Administration		13. Type of Report and Period Covered Interim Technical Report 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The linear induction motor is to provide the propulsion of high-speed tracked vehicles and speed control of the motor is essential for vehicle operation. The purpose of power conditioning is to provide the matching interface between the available power and the desired power for driving the motor. As an integral part of the propulsion system the power conditioner provides the means for controlling both the thrust and the braking of the vehicle.

This interim technical report identifies and describes candidate power conditioners for driving linear induction motors in the variable frequency power mode. The power conditioners described include those for application with either on board electric power sources or with wayside electric power sources.

17. Key Words	18. Distribution Statement		
•Linear Induction Motor •Speed Control •Power Conditioner •On-Board Electric Power Sources •Wayside Electric Power Sources	Unclassified — Unlimited		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 65	22. Price

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FRA-71-2		

4. Title and Subtitle	5. Report Date
METROLINER AUXILIARY POWER ELECTRICAL SYSTEM RELIABILITY STUDY	June 1971
	6. Performing Organization Code
7. Author(s) J.D. Abbas and C.W. Watt, Jr.	8. Performing Organization Report No.
9. Performing Organization Name and Address Mechanical Engineering Division U.S. Dept. of Transportation 55 Broadway Cambridge, Mass.	10. Work Unit No. 11. Contract or Grant No.
12. Sponsoring Agency Name and Address Office of High Speed Ground Transportation - Federal Railroad Administration - 400 7th St.,SW, Wash., D.C.	13. Type of Report and Period Covered Interim Report 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The reliability of the electrical system of any vehicle is greatly affected by the way the system is configured. The propulsion and braking systems of a train must be unaffected by failures occurring in the nonessential power areas. With these criteria in mind the so-called "Auxiliary Power System" of the Metroliner car was analyzed. This auxiliary power system was found to be deficient in achieving these ends. Recommendations suggest methods of satisfying these criteria by segregating the essential from the nonessential elements, thereby enhancing the overall availability of the Metroliner car.

17. Key Words	18. Distribution Statement
	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
UNCLASSIFIED	UNCLASSIFIED	135	

1. Report No. DOT-TSC-FRA-71-3	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Technological Innovation in Grade Crossing Protective Systems		5. Report Date 1 June 1971 6. Performing Organization Code
7. Author(s) John B. Hopkins and Morrin E. Hazel		8. Performing Organization Report No.
9. Performing Organization Name and Address Transportation Systems Center U. S. Dept. of Transportation 55 Broadway, Cambridge, Mass.		10. Work Unit No. 11. Contract or Grant No. 13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address Federal Railroad Administration U. S. Dept. of Transportation Washington, D.C.		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

The constraints on innovative grade crossing protective systems are delineated and guidelines for development indicated. Inventory data has been arranged to permit an estimate of the classes of systems needed, the allowable costs, and contribution of various types of crossings to accidents. Many crossings warrant very limited expense and account for very few deaths. A number of approaches are possible for the intermediate cost classes, based on use of conventional signals with low-cost activation systems. Use of similar elements, singly or in combination, can also improve effectiveness of more expensive systems. The very high cost locations may well benefit from interconnection of train and vehicle detectors and small computers.

Extensive analysis and laboratory investigation has been carried out relating to a microwave telemetry alternative to conventional track circuits and possible crossing-located radar and impedance train detection systems.

17. Key Words	18. Distribution Statement
Grade crossing protection, train detection, microwave telemetry, railroad signals	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
U	U		

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FRA-71-5		

4. Title and Subtitle	5. Report Date
TRAIN CONTROL AND OPERATIONS	June, 1971
	6. Performing Organization Code: TME

7. Author(s)	8. Performing Organization Report No.
K. Hergenrother	

9. Performing Organization Name and Address	10. Work Unit No.
Transportation Systems Center 55 Broadway Cambridge, MA. 02142	11. Contract or Grant No.: RR01
	13. Type of Report and Period Covered: Final Report
12. Sponsoring Agency Name and Address Federal Railroad Administration Washington, D.C. 20591	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

ATO (automatic train operation) and ATC (automatic train control) systems are evaluated relative to available technology and cost-benefit. The technological evaluation shows that suitable mathematical models of the dynamics of long trains are required before substantial improvements can be made to ATO systems, and the present ATC systems are presently near optimum. The cost-benefit analysis concludes that only railroads which find CTC (centralized traffic control) economically desirable will also find that ATC offers improved operating economies. ATO does not seem economically or politically practical in the general railroad environment.

A brief evaluation is made of both the contribution of the railroad locomotive to air pollution and the possible means of controlling this pollution.

17. Key Words	18. Distribution Statement
• Automatic Train Operations • Automatic Train Control • Diesel Air Pollution	Unclassified-Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	31	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FRA-71-7		

4. Title and Subtitle	5. Report Date
PROGRESS ON THE RAM WING CONCEPT WITH EMPHASIS ON LATERAL DYNAMICS	June 1971
	6. Performing Organization Code
7. Author(s) Timothy M. Barrows	8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA 02142	10. Work Unit No. R2304 11. Contract or Grant No. RR207
12. Sponsoring Agency Name and Address Department of Transportation Federal Railroad Administration Washington, D.C. 20590	13. Type of Report and Period Covered Technical Report for Sept. 1970 to June 1971 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

Theoretical and experimental efforts conducted at TSC in the ram wing program are described. Glide Tests were performed using a simple ram wing model operating in an open rectangulat trough 50 feet long. Lift drag ratios of 13 were recorded, and a low-frequency roll oscillation was observed. A theorectical model for a flat-plate airfoil in a rectangular trough of infinite depth is described and compared with existing theories and experimental data. The lateral dynamics of tracked vehicles of this type are reviewed and the most important stability parameters are identified.

It is recommended that future research continue to focus on lateral dynamics and that careful experimental measurements be made for the stability derivatives.

17. Key Words	18. Distribution Statement
Ram Wing Ground Effect Lateral Dynamics	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unlimited	Unlimited	69	

1. Report No. DOT-TSC-FRA-71-8	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Communications for High Speed Ground Transportation		5. Report Date November 15, 1971 6. Performing Organization Code
7. Author(s) G. Chin, R. Eaves, L. Frenkel, and R. Kodis		8. Performing Organization Report No.
9. Performing Organization Name and Address Transportation Systems Center 55 Broadway Cambridge, Massachusetts 02142		10. Work Unit No. RR204 11. Contract or Grant No. R2305 13. Type of Report and Period Covered Technical Report
12. Sponsoring Agency Name and Address Federal Railroad Administration Washington, D.C. 20591		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract This report is an account of investigations and analyses undertaken for the OHSGT, beginning in July of 1970, which relate to communications systems for high speed ground vehicles. The authorized scope of the effort was at the rate of one man-year. The first task undertaken was a survey of work carried out by OHSGT contractors and others since 1968. Subsequently, specific aspects of the problem were explored in greater detail, and reports were prepared on the following:

(a) Mechanical Properties of Long Rigid Lines. (Section 2)
(b) Electromagnetic Properties of Surface Wave Couplers (Section 3).
(c) Electromagnetic Properties of Bends in Surface Wave Lines (Section 4).
(d) Propagation Properties of a Trench Line (Section 5).
(e) Pulse Code Modulation for Long Line Communications (Section 6).

17. Key Words	18. Distribution Statement
	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	62	

1. Report No. DOT-TSC-FRA-72-2	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle IMPROVEMENT OF METROLINER TELEPHONE CHANNEL CAPACITY AND MODELING OF TELEPHONE CHANNEL DEMANDS		5. Report Date March 1972 6. Performing Organization Code
7. Author(s) G.Y. Chin, R.E. Eaves, Jr. R.D. Kodis, P. Yoh		8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA 02142		10. Work Unit No. R-2305 11. Contract or Grant No. RR-204 13. Type of Report and Period Covered Technical Report December 1971-March 1972
12. Sponsoring Agency Name and Address Department of Transportation Federal Railroad Administration Washington, D.C. 20591		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract The channel capacity of the present Metroliner telephone system is analyzed and methods are proposed to increase that capacity without increasing the overall bandwidth. To determine the number of channels required, calculations have been carried out using two available mathematical models: the Erlang Modal and the Waiting Model. Three criteria have been used: (1) the probability that no channel is available, (2) the mean waiting time and (3) the probability of having to wait at least t minutes.

17. Key Words	18. Distribution Statement		
Mobile Telephone System, Channel Capacity, Demand Model	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.		
19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	42	

1. Report No. DOT-TSC-FRA-72-3	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle AUTOMATIC CAR IDENTIFICATION - AN EVALUATION		5. Report Date March 1, 1972 6. Performing Organization Code
7. Author(s) Kenneth F. Troup, III		8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA 02142		10. Work Unit No. R2545 11. Contract or Grant No. OS212
12. Sponsoring Agency Name and Address Department of Transportation Federal Railroad Administration Washington, D.C. 20591		13. Type of Report and Period Covered Technical Report Sept. 1971-Jan.1972 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

In response to a Federal Railroad Administration request, the Transportation Systems Center evaluated the Automatic Car Identification System (ACI) used on the nation's railroads. The ACI scanner was found to be adequate for reliable data output while the label was found to cause most problems with ACI data accuracy. System costs are discussed with several considerations which, depending on the application, can minimize system cost. A number of effective applications of ACI are cited. In addition several reasons why system implementation has not proceeded as planned are discussed. Finally, recommended Department of Transportation actions are included.

17. Key Words	18. Distribution Statement
•ACI •Railroad Information Systems •Terminal Improvements	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	30	

1. Report No. DOT-TSC-FRA-72-4	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle AUTOMATIC CAR IDENTIFICATION - AN EVALUATION		5. Report Date March 1, 1972 6. Performing Organization Code
7. Author(s) Kenneth F. Troup, III		8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA 02142		10. Work Unit No. R2545 11. Contract or Grant No. OS212
12. Sponsoring Agency Name and Address Department of Transportation Federal Railroad Administration Washington, D.C. 20591		13. Type of Report and Period Covered Technical Memorandum Sept.1971-Jan.1972 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

In response to a Federal Railroad Administration request, the Transportation Systems Center evaluated the Automatic Car Identification System (ACI) used on the nation's railroads. The ACI scanner was found to be adequate for reliable data output while the label was found to cause most problems with ACI data accuracy. System costs are discussed with several considerations which, depending on the application, can minimize system cost. A number of effective applications of ACI are cited. In addition several reasons why system implementation has not proceeded as planned are discussed. Finally, recommended Department of Transportation actions are included.

17. Key Words	18. Distribution Statement		
•ACI •Railroad Information Systems •Terminal Improvements	APPROVED FOR U.S. GOVERNMENT ONLY. TRANSMITTAL OF THIS DOCUMENT OUTSIDE THE U.S. GOVERNMENT MUST HAVE PRIOR APPROVAL OF THE FRA		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 32	22. Price

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-FRA-72-5		

4. Title and Subtitle	5. Report Date
MEASUREMENTS AND ANALYSIS OF 115 kV POWER LINE NOISE AND ITS EFFECT ON PUEBLO TEST SITE RADIO LINKS	May 1972
	6. Performing Organization Code
7. Author(s) R.E.Buck, R.E.Esposito, R.Gagnon E.T.Leonard, R.D.Kodis, P. Yoh	8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA. 02142	10. Work Unit No. R-2305 11. Contract or Grant No. RR-204
12. Sponsoring Agency Name and Address Department of Transportation Federal Railroad Administration Office of High Speed Ground Trans. Washington, D.C. 20591	13. Type of Report and Period Covered Technical Report Nov. 1971-May 1972 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

Noise measurements were made for 115 kV power lines near the frequencies 166, 217 and 406.8 MHz with a receiver bandwidth of 1 MHz. The measurements consisted of counting the numbers of pulses per minute at preset threshold values and RMS. The variations of the noise level vs the lateral distance from the power line were also measured. The worst noise level, -40 dBm, was observed at 217 MHz under a noisy power line. The results of these measurements show that, under normal conditions, power line noise will not have significant effects on the radio links at the Pueblo Test Site. Recommendation is made for a monitoring system to detect the level of a noisy power line when its noise reaches a preset level. Further studies are recommended of other possible noise sources -- automobile ignition noise, electrical equipment noise -- and of the multipath effects.

17. Key Words	18. Distribution Statement
.Power line noise .Radio noise .Impulse .Communications	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	45	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Multi-Sensor Navigation System Design*		5. Report Date March 1971 6. Performing Organization Code PG
7. Author(s) David Royal Downing		8. Performing Organization Report No. DOT-TSC-NASA-71-8
9. Performing Organization Name and Address Transportation Systems Center Cambridge, MA 02142		10. Work Unit No. R1027 11. Contract or Grant No.
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration		13. Type of Report and Period Covered Technical Report 14. Sponsoring Agency Code

15. Supplementary Notes *Submitted in partial fulfillment of the requirements for the degree of Doctor of Science, at the Massachusetts Institute of Technology, May 1970.

16. Abstract

This report treats the design of navigation systems that collect data from two or more on-board measurement subsystems and process this data in an on-board computer. Such systems are called Multi-Sensor Navigation Systems.

The design begins with the definition of the design requirements and a list of n sensors and c computers. A Design Procedure is then developed which automatically performs a systematic evaluation of the $(2^n-1) \times c$ candidate systems that may be formed. This procedure makes use of a model of the navigation system that includes sensor measurement errors and geometry, sensor sampling limits, data processing constraints, relative computer loading, and environmental disturbances. The performance of the system is determined by its terminal navigation uncertainty and dollar cost. The Design Procedure consists of three design options, three levels of evaluation, and a set of auxiliary data. By choosing from among the design options and the auxiliary data, the designer can tailor the Design Procedure to his particular application.

A design option is developed to answer each of the three following questions: (1) Which candidate system meets the system accuracy specification and has the lowest system cost? (2) For each sensor or computer chain, which is defined as the set of all systems containing that component, what is the system that satisfies the accuracy requirements and has the lowest cost? (3) Which systems satisfy the design accuracy requirements?

The system evaluation is accomplished using one optimal and two non-optimal techniques. The optimal performance evaluation uses the measurement schedule that minimizes the terminal uncertainty. A first-order optimization procedure is developed to determine this schedule. This uses optimal sampling logic derived by applying the Maximum Principle. One non-optimal analysis uses the idea that the addition of a sensor or the increase of the computer processing capability can not degrade the system's performance. The second non-optimal technique obtains approximate values of the system's accuracy by assuming measurement schedules that do not satisfy the processing constraint.

The Procedure is applicable to a large class of air or space missions for which a nominal trajectory can be defined. To illustrate how the Procedure would be used, the design of an aircraft navigation system for operation in the NE corridor is presented. This problem considers the configuration of a system starting with four candidate sensors and three candidate computers. The outputs from all three design options are presented and discussed.

17. Key Words	18. Distribution Statement
.Multi-Sensor Navigation Systems .Design Procedure .Design Option .System Evaluation	Unclassified – Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	138	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Metallization Failures		5. Report Date May 1971 6. Performing Organization Code TRE
7. Author(s) Rosemary Beatty		8. Performing Organization Report No. DOT-TSC-NASA-71-9
9. Performing Organization Name and Address Transportation Systems Center 55 Broadway Cambridge, Mass. 02142		10. Work Unit No. R-1130 11. Contract or Grant No. 13. Type of Report and Period Covered Technical Report
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, D.C. 20590		14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract Metallization-related failure mechanisms are a major cause of integrated circuit failures under accelerated stress and field operation conditions. Industry's approach has been, (1) a better understanding of the aluminum system, now the most widely used material, and (2) evaluation of alternative metal systems.

The newer and more complex multilevel metallization systems require low temperature deposition techniques and critical etching-through methods due to smaller geometry and closer spacing.

Aluminum metallization offers many advantages, but also has limitations. Alternative materials are being considered for large scale integrated arrays. This survey defines the merits and restrictions of metallization systems in current usage and those under development. Although no specific recommendations are made references can be drawn from the data presented. The advanced state of beam lead technology is apparent.

17. Key Words: Metallization Failures, Integrated Circuit Failures, Metallization Material, Multilevel Metallization, Integrated Circuit Design, Beam Lead Technology

18. Distribution Statement: Unclassified - Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	116	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Evaluation of Nondestructive Tensile Testing		5. Report Date May 1971 6. Performing Organization Code TME
7. Author(s) J. J. Bowe & S. M. Polcari		8. Performing Organization Report No. DOT-TSC-NASA-71-10
9. Performing Organization Name and Address DOT/Transportation Systems Center 55 Broadway Cambridge, MA 02142		10. Work Unit No. 125-25-22 11. Contract or Grant No. NA08 13. Type of Report and Period Covered Technical Report
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, D.C. 20590		14. Sponsoring Agency Code R1130
15. Supplementary Notes		

16. Abstract

This report presents the results of a series of experiments performed in the evaluation of nondestructive tensile testing of chip and wire bonds. Semiconductor devices were subjected to time-temperature excursions, static-load life testing and multiple pre-stressing loads to determine the feasibility of a nondestructive tensile testing approach. The report emphasizes the importance of the breaking angle in determining the ultimate tensile strength of a wire bond, a factor not generally recognized nor implemented in such determinations.

17. Key Words	18. Distribution Statement		
•Semiconductor Devices •Nondestructive Testing •Chip and Wire Bonding	Unclassified — Unlimited		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages	22. Price

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-NASA-71-12		

4. Title and Subtitle	5. Report Date
Optical Communications & Detection System	August 1971
	6. Performing Organization Code: TEC

7. Author(s)	8. Performing Organization Report No.
R.E. Buck, R. Gagnon, L.M. Jordan, S. Karp	DOT-TSC-NASA-71

9. Performing Organization Name and Address	10. Work Unit No.
U.S. Dept. of Transportation Transportation Systems Center Cambridge, MA 02124	NA03-1
	11. Contract or Grant No.
	13. Type of Report and Period Covered: Final Report July 1, 1970 - June 30, 1971
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, DC 20546	14. Sponsoring Agency Code

15. Supplementary Notes

Authors cont. E.T. Leonard, and S.J. Morin

16. Abstract The two milestones of the program (1) development of a high quantum efficiency 1.06 micron photoemissive surface and (2) narrow pulse propagation in the earth's atmosphere at 0.63 microns were completed.

Item 1 was completed in a contract award.

Item 2 was complete to the extent permitted by the weather conditions in that only two foggy days were encountered during the three month period.

The clear air measurements indicated that: pulse broadening in the atmosphere is less than 20 picoseconds or a coherence bandwidth in excess of 50 GHz; aperture averaging appears to progress with the square of the collector diameter for large diameters; statistics of aperture averaged signals remain log normal.

The measurements from one foggy day indicate: no pulse broadening was observed in fogs with ½ mile visibility although a 20 dB loss was encountered; no return from multiple scattering could be observed to a 4 degree field of view with a 20 dB dynamic range in the detector; no Doppler broadening greater than 1 KHz was observed with optical thickness as high as 4.

17. Key Words	18. Distribution Statement
Laser pulse broadening Earths Atmosphere 1.06 Micron Scintillation Fog Clear Air	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	101	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-NASA-71-13		

4. Title and Subtitle	5. Report Date
Measurements of Trans-atmospheric Attenuation Statistics at the Microwave Frequencies: 15, 19 and 34 GHz	June 1971
	6. Performing Organization Code: TER
7. Author(s): G.G.Haroules, W.E.Brown, III, G.J.Bishop	8. Performing Organization Report No.
9. Performing Organization Name and Address: U.S. Department of Transportation, Transportation Systems Center, Cambridge, Ma. 02142	10. Work Unit No.
	11. Contract or Grant No.
	13. Type of Report and Period Covered: Technical Report
12. Sponsoring Agency Name and Address: National Aeronautics and Space Administration, Washington, D.C. 20546	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

Attenuation statistics resulting from a twelve month observation program are presented. The sun is used as a source of microwave radiation. The dynamic range of atmospheric attenuation measurement capability is in excess of 30 dB. Solar radiation characteristics with amplitude variations of a few percent are easily measured, while at the same time provision is made to accommodate a 10 dB range above the quiet sun level if major solar flare activity occurs. The solar phenomenon was extracted from the data since it is not an objective of the measurement program. A discussion and analysis of the measurement technique is presented in support of the experimental data.

17. Key Words	18. Distribution Statement
Earth-to-space paths Electromagnetic Wave Propagation Atmospheric Attenuation	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	42	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-NASA-72-1		

4. Title and Subtitle	5. Report Date
FLIGHT TEST EVALUATION AND ANALYSIS OF AN OPTICAL IR PWI SYSTEM	30 June 1972
	6. Performing Organization Code
7. Author(s) C. O. Phillips, P. A. Concannon, D. Brandel and E. Meyer	8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA. 02142	10. Work Unit No.
	11. Contract or Grant No. NA06/NA07
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Office of Advanced Research and Technology Washington, D.C. 20546	13. Type of Report and Period Covered Final Report July 1970 - June 1972
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract This report documents the flight test results of the optical infrared (IR) Pilot Warning Instrument (PWI) system conducted by the Transportation Systems Center as part of an FAA/NASA PWI development program. The test program is described and the flight test data presented. The data is analyzed and used to calibrate a model that is developed to characterize the system performance. The cumulative probability of detection versus range for a given system threshold is calculated and compared with the PWI performance specification defined by the Collision Prevention Advisory Group (COPAG). The comparison indicates that the Optical IR PWI system tested met the COPAG specifications for a detection likelihood of 95% for a 1 nmi range for an appreciable fraction of the testing time. Even under the worst testing conditions encountered, the range at which this detection likelihood occured was sufficiently large to demonstrate feasibility and to recommend a continuation of the development effort for this approach. A series of recommendations for improving system performance and obtaining additional information needed to characterize that performance are included.

17. Key Words	18. Distribution Statement
Pilot Warning Instrument Collision Avoidance Electro Optical PWI System Optical IR PWI System	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	45	

Department of Transportation
National Highway Traffic Safety Administration

Unlimited Distribution Reports

ort No.	Title
B-71-1	Occupant Motion Sensors
SA-71-3	Development of Anticipatory Automobile Crash Sensors, (DOT-HS-820-200)
SA-71-4	Occupant Motion Sensors: Methods of Detection and Analysis, (DOT-HS-820-201)
SA-71-5	Survey of Non-Destructive Tire Inspection Techniques, (DOT-HS-820-205)
SA-71-7	Measurement of Vehicle Contamination by Exhaust Gases, (DOT-HS-820-202)
SA-71-8	Evaluation of Length-of-Stain Gas Indicator Tubes for Measuring Carbon Monoxide in Air, (DOT-HS-820-203)
SA-72-1	Occupant Motion Sensors: Rotational Accelerometer Development (DOT-HS-820-211)
SA-72-1	Isolation of Flaws by use of Thermal Differentials on a Tire under Mild Loading Conditions, (DOT-HS-820-206)
SA-72-2	Experiment in Assessing Color Separation Techniques for Identifying Small Density Variations in Tires
SA-72-3	An Infrared Experiment on a Road Wheel During an FMVSS-109 Type Compliance Test
SA-72-4	Holographic Techniques for Nondestructive Testing of Tires
-251-1	Preliminary Operation Requirements and Acceptability Criteria for the Cooperative Breath Analyzer, (DOT-HS-800-565)
-251-2	Field Test Plan for Evaluating the Cooperative Breath Analyzer, (DOT-HS-800-567)

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Occupant Motion Sensors		5. Report Date March 1971 6. Performing Organization Code TIM
7. Author(s) Joseph L. Horner Ph.D.		8. Performing Organization Report No. DOT-TSC-NHSB-71-1
9. Performing Organization Name and Address Transportation Systems Center		10. Work Unit No. R1057 11. Contract or Grant No. 71-HS-0
12. Sponsoring Agency Name and Address National Highway Safety Bureau Washington, D.C. 20591		13. Type of Report and Period Covered Technical Report July '70-Jan '71 14. Sponsoring Agency Code R-238-71

15. Supplementary Notes

16. Abstract

An analysis has been made of methods for measuring vehicle occupant motion during crash or impact conditions. The purpose of the measurements is to evaluate restraint system performance using human, anthropometric dummy, or animal occupants. A detailed Fourier frequency analysis is made of the sensor requirements. Potential candidate systems are evaluated, and five of these recommended for further development and field testing.

17. Key Words •Fourier Spectrum •Bandwidth •Acceleration •Rotational Motion •Sensors •Transducers

18. Distribution Statement
Unclassified — Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	54	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Development of Anticipatory Automobile Crash Sensors		5. Report Date June 30, 1971 6. Performing Organization Code TME
7. Author(s) Hopkins, Holmstrom, Apgar, Hazel, White, and Newfell		8. Performing Organization Report No. DOT-TSC-NHTSA-71-3
9. Performing Organization Name and Address Transportation Systems Center 55 Broadway Cambridge, Ma. 02142		10. Work Unit No. HS04 11. Contract or Grant No.
12. Sponsoring Agency Name and Address National Highway Traffic Safety Administration U.S. Department of Transportation Washington, D.C. 20591		13. Type of Report and Period Covered Annual Report 7/1/70-6/30/71 14. Sponsoring Agency Code R1056
15. Supplementary Notes		

16. Abstract A comprehensive examination is carried out to determine the basic system constraints and required operational characteristics for anticipatory sensing of impending automobile crashes. This is followed by consideration of a wide variety of possible sensing techniques and selection of those deserving of further study. Two methods are chosen, microwave radar and ultrasonic sonar, and the advantages, weaknesses, and uncertain areas of both are delineated.

Realization of both sensors is described. The radar sensor, comprising standard microwave components and solid state circuitry, has been installed on a test vehicle for characterization. Results are promising, but preliminary; the complexity of the sensing task and the reliability demands on the system require extensive analysis and testing before a conclusion can be drawn as to overall viability.

The sonar approach is a translation of the radar sensor into acoustic form. Transducers have been the subject of particular study and modification. Preliminary results suggest that environmental considerations and adequate target discrimination will be the major problem areas.

17. Key Words	18. Distribution Statement
•Automobile Safety •Occupant Protection •Passive Restraint Activation •Anticipatory Crash Sensing	Unclassified-Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		

TECHNICAL REPORT STANDARD TITLE PAGE

Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-NHTSA-71-4		

Title and Subtitle	5. Report Date
Occupant Motion Sensors: Methods of Detection and Analysis	July 1971
	6. Performing Organization Code: TIF

Author(s)	8. Performing Organization Report No.
J. L. Horner, D.S. Ofsevit, G.R. Plank, G. G. Lawrence	

Performing Organization Name and Address	10. Work Unit No.
Transportation Systems Center 55 Broadway Cambridge, Mass. 02142	R1057
	11. Contract or Grant No.: 71-HS-05
	13. Type of Report and Period Covered: Technical Report
Sponsoring Agency Name and Address National Highway Traffic Safety Administration Washington, D.C. 20591	14. Sponsoring Agency Code

Supplementary Notes

Abstract

A study has been made of methods for measuring occupant motion within a vehicle during crash or impact conditions. The purpose of the measurements is to evaluate restraint systems, using anthropometric dummy, animal, or human occupants.

A list of general specifications for occupant motion sensors was drawn up. This was used to establish criteria for evaluation of proposed systems. From a study of various possible systems, five were selected for further development. These systems were built and prepared for field testing. In addition, computer methods for Fourier analysis of the data produced by these systems have been developed in theory and in programs for a digital computer.

Key Words	18. Distribution Statement
Bandwidth, Acceleration, Rotational Motion, Angular Motion, Fourier Analysis, Digital, Sensor, Filtering, Transducer	Unclassified - Unlimited

Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	55	

Form DOT F 1700.7 (8-69)

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-NHTSA-71-5		

4. Title and Subtitle	5. Report Date
Survey of Non-Destructive Tire Inspection Techniques	July, 1971
	6. Performing Organization Code: TME
7. Author(s): A. L. Lavery, I. Litant, R. P. Ryan, N. Knable, H. L. Ceccon	8. Performing Organization Report No.
9. Performing Organization Name and Address: DOT/Transportation Systems Center, 55 Broadway, Cambridge, MA 02142	10. Work Unit No.: HS203
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address: National Highway Traffic Safety Administration	13. Type of Report and Period Covered: Preliminary Memorandum August/1970-June/1971
	14. Sponsoring Agency Code: R-2402

15. Supplementary Notes

16. Abstract

The status of several promising methods for non-destructive tire inspection is surveyed with the conclusion that radiographic, infrared, holographic and ultrasonic techniques warrant further evaluation. A program plan is outlined to correlate non-destructive tire inspection data to tire failure data. The emphasis is on inspection systems having sufficient resolution and discrimination capability to detect a broad range of "anomalies." The inspected tires will be subjected to dynamic wheel testing such as specified in Safety Standards 109. Failed tires will be analyzed to determine those anomalies that lead to tire failure and eventually to provide a capability for failure prediction based upon non-destructive inspection techniques.

17. Key Words	18. Distribution Statement
Non-Destructive Inspection, Tires, X-Ray, Infrared, Radiography, Holography, Resonance, Liquid Crystals	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	50	

Form DOT F 1700.7 (8-69)

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-NHTSA-71-7		

4. Title and Subtitle	5. Report Date
Measurement of Vehicle Contamination by Exhaust Gases	October 1, 1971
	6. Performing Organization Code: TIM

7. Author(s)	8. Performing Organization Report No.
Steven M. Mathews	

9. Performing Organization Name and Address	10. Work Unit No.
Transportation Systems Center 55 Broadway Cambridge, MA 02142	HS-201
	11. Contract or Grant No.
	13. Type of Report and Period Covered: Final Report
12. Sponsoring Agency Name and Address National Highway Traffic Safety Administration U.S. Department of Transportation Washington, D.C. 20591	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

An investigation of the concentration of carbon monoxide (CO) within the passenger compartment of motor vehicles has been made. A sample handling system has been developed to measure the concentrations of CO at as many as six locations inside and outside of a motor vehicle. To use this system effectively, a test procedure was developed with sixteen possible configurations of window, vent, and trunk lid openings. The sample system and test procedures were used on six different vehicles which represented several aerodynamic shapes and utilized different design features and auxiliary equipment. Data obtained in situations of low traffic density are presented.

17. Key Words	18. Distribution Statement
Automobile Safety, Carbon Monoxide, Exhaust Contamination of Passenger Compartment	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	74	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-NHTSA-71-8		

4. Title and Subtitle	5. Report Date
EVALUATION OF LENGTH-OF-STAIN GAS INDICATOR TUBES FOR MEASURING CARBON MONOXIDE IN AIR	November 1971
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Earl C. Klaubert, Joseph C. Sturm	
9. Performing Organization Name and Address	10. Work Unit No.
Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA 02142	R-2404
	11. Contract or Grant No.
	HS01
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Department of Transportation National Highway Traffic Safety Administration, 400 Seventh Street, SW Washington, D.C. 20591	Technical Note
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract Techniques for measurement of carbon monoxide (CO) in air are of utility in many aspects of automotive safety. Concentrations ranging from less than 0.01 to about 10 percent CO are of interest. Gas indicator tubes for carbon monoxide (CO) were considered to be potentially useful for this application. An empirical study was conducted to determine the degree of precision obtained from these tubes. A breadboard model of a semi-automated analyzer was constructed. The coiled tube sample reservoir permitted gas transport by following purge air with little mixing or dilution. One brand and type of indicator tube was evaluated at several different CO concentrations, gas flow rates, and at two different sample volumes. All tests were conducted at room temperature. The averaged values for ten tests at each experimental condition were found to fit very well to power-curve equations of the type predicted by theoretical analysis. The standard deviations for each group of tests indicated that any single measurement might differ from the true value by ±30 per cent.

17. Key Words	18. Distribution Statement
Carbon monoxide Gas analysis Gas indicator tubes	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	15	

1. Report No. DOT-HS-820-211	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle OCCUPANT MOTION SENSORS: ROTATIONAL ACCELEROMETER DEVELOPMENT		5. Report Date April 1972 6. Performing Organization Code TIF
7. Author(s) A. Warner, D. Ofsevit, G. Plank		8. Performing Organization Report No. DOT-TSC-NHTSA-72-1
9. Performing Organization Name and Address Transportation Systems Center 55 Broadway Cambridge, MA 02142		10. Work Unit No. 11. Contract or Grant No. 72-HS-05 13. Type of Report and Period Covered Technical Report
12. Sponsoring Agency Name and Address Department of Transportation National Highway Traffic Safety Administration Washington, DC 20590		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

A miniature mouthpiece rotational accelerometer has been developed to measure the angular acceleration of a head during vehicle crash or impact conditions. The device has been tested in the laboratory using a shake table and in the field using dummies and humans. The results of the testing show that while the accelerometer is sensitive to angular acceleration it is also sensitive to linear acceleration, and in practical applications a correction factor for linear accelerations must be applied to the rotational output.

17. Key Words	18. Distribution Statement
Acceleration, Accelerometer, Angular, Mouthpiece, Occupant Motion, Restraint System	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	35	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-NHTSA-72-1		

4. Title and Subtitle	5. Report Date
ISOLATION OF FLAWS BY USE OF THERMAL DIFFERENTIALS ON A TIRE UNDER MILD LOADING CONDITIONS	April 1972
	6. Performing Organization Code
7. Author(s) Stephen Bobo	8. Performing Organization Report No
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA 02142	10. Work Unit No. R2402
	11. Contract or Grant No. HS203
12. Sponsoring Agency Name and Address Department of Transportation National Highway Traffic Safety Administration Washington, D.C. 20591	13. Type of Report and Period Covered Preliminary Memorandum
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

An experiment was conducted using a Monsanto Infrared Tire Flaw Detector (TFD) to confirm the hypothesis that areas in tires having poor adhesion or separations tend to achieve a greater rate of temperature rise under conditions of moderate stress than unflawed areas. Three types of stress were tried: constant tire deflection; alteration of inflation pressure; alteration of wheel speed. Tire-to-wheel force in at least one case gave evidence of greater thermal rise rates than in other areas of the tire believed to be normal.

17. Key Words	18. Distribution Statement
Tire Flaw Detector Infrared Tire Inspection Nondestructive Tire Test	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	14	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle EXPERIMENT IN ASSESSING COLOR SEPARATION TECHNIQUES FOR IDENTIFYING SMALL DENSITY VARIATIONS IN TIRES		5. Report Date July 1972 6. Performing Organization Code
7. Author(s) Stephen N. Bobo		8. Performing Organization Report No. DOT-TSC-NHTSA-72-2
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway Cambridge, MA 02142		10. Work Unit No. R3402 11. Contract or Grant No. HS303 13. Type of Report and Period Covered Interim Report
12. Sponsoring Agency Name and Address Department of Transportation National Highway Traffic Safety Administration Research Institute Washington, D.C. 20590		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

An experimental color system was tested as an adjunct to the X-ray fluoroscopy system already in use. Shades of gray were translated into various colors as a means of enhancing small defects normally observed with difficulty, and to provide for more rapid identification of gross defects.

17. Key Words	18. Distribution Statement
Color Radiography Nondestructive Testing of Tires	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	17	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle AN INFRARED EXPERIMENT ON A ROAD WHEEL DURING AN FMVSS 109 TYPE COMPLIANCE TEST		5. Report Date June 1972 6. Performing Organization Code
7. Author(s) S.N. Bobo		8. Performing Organization Report No. DOT-TSC-NHTSA-72-3
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA. 02142		10. Work Unit No. R-2402 11. Contract or Grant No. HS-203 13. Type of Report and Period Covered Interim Report Mar. - Jun. 72
12. Sponsoring Agency Name and Address Department of Transportation National Highway Traffic Safety Admin. Research Institute Washington, D.C. 20591		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

This report outlines an experiment conducted at a compliance center to gain information on relating a tire's thermal performance during testing, to tire failure. To substantiate this correlation, the instrumentation used is described as well as the method of data retrieval. The tires were inspected by various non-destructive tests before and after compliance testing.

The population of inspected tires was inadequate for general conclusions about the relationship between temperature and failure but the data obtained indicates the technique shows promise. The experiment found a definite relationship between the number of tires being run on a test wheel and the thermal stress applied to those tires.

17. Key Words	18. Distribution Statement		
Tire Non-destructive Test, Non-destructive Compliance Test, Infrared Measurement	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.		
19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	36	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle HOLOGRAPHIC TECHNIQUES FOR NONDESTRUCTIVE TESTING OF TIRES		5. Report Date April, 1972 6. Performing Organization Code
7. Author(s) Harry L. Ceccon		8. Performing Organization Report No. DOT-TSC-NHTSA-72-4
9. Performing Organization Name and Address Department of Transportation Transportation System Center 55 Broadway, Cambridge, MA 02142		10. Work Unit No. R2402 11. Contract or Grant No. HS203
12. Sponsoring Agency Name and Address Department of Transportation National Highway Traffic Safety Ad. Research Institute Washington, D.C. 20590		13. Type of Report and Period Covered Interim Report 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

Holographic interferometric techniques were used in a development program to evaluate the feasibility of the technique in the nondestructive testing (NDT) of commercial automobile tires.

Passenger tires with built-in defects were holographically inspected to determine the types of tire defects that can be detected using this method. Separations and voids were located reliably. Defects other than separations and voids were detected in some cases.

A program is currently underway in which "off-the-shelf" passenger tires are first inspected holographically as well as by other NDT methods, then subjected to the Motor Vehicle Safety Standard 109 endurance or high speed tests, reholographed and then sectioned analytically. The objective of the program is to correlate nondestructive test data with tire failure.

17. Key Words	18. Distribution Statement
Nondestructive Testing of Tires Holographic Testing of Tires	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	64	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-251-1		

4. Title and Subtitle	5. Report Date
Preliminary Operational Requirements and Acceptability Criteria for the Cooperative Breath Analyzer	September 1971
	6. Performing Organization Code
7. Author(s) Oates, J. F. Jr., Jacobs, H. H.	8. Performing Organization Report No. ED-71-30
9. Performing Organization Name and Address Dunlap and Associates, Inc. One Parkland Drive Darien, Conn. 06820	10. Work Unit No. HS202
	11. Contract or Grant No. DOT-TSC-251
	13. Type of Report and Period Covered Technical
12. Sponsoring Agency Name and Address National Highway Traffic Safety Administration 400 Seventh St., S.W. Washington, D.C. 20591	14. Sponsoring Agency Code NHTSA 43-43

15. Supplementary Notes

16. Abstract

This report presents a series of criteria and requirements relevant to establishing user acceptability for the cooperative alcohol analyzer being developed by the Transportation Systems Center.

The information presented herein was obtained with the cooperation of police officials, judicial personnel, Alcohol Safety Action Project (ASAP) officials and government officials

17. Key Words	18. Distribution Statement
Alcohol measurements Alcohol breath testing	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	22	

1. Report No. DOT-TSC-251-2	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Field Test Plan for Evaluating the Cooperative Breath Analyzer		5. Report Date September 1971 6. Performing Organization Code
7. Author(s) Oates, J. F. Jr., Jacobs, H. H.		8. Performing Organization Report No. ED-71-32
9. Performing Organization Name and Address Dunlap and Associates, Inc. One Parkland Drive Darien, Conn. 06820		10. Work Unit No. HS202 11. Contract or Grant No. DOT-TSC-251
12. Sponsoring Agency Name and Address National Highway Traffic Safety Administration 400 Seventh St., S.W. Washington, D.C. 20591		13. Type of Report and Period Covered Technical 14. Sponsoring Agency Code NHTSA 43-43
15. Supplementary Notes		

16. Abstract

This report provides basic inputs to the Transportation Systems Center for their continuing development and evaluation of cooperative breath analyzers. Its primary purpose is to indicate a number of potential field test sites and to describe various available testing modalities.

17. Key Words	18. Distribution Statement
Alcohol measurements Alcohol breath testing	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	48	

Department of Transportation
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Unlimited Distribution Reports

Report No.	Title
OST-71-1	Guide to the Use of Air Dynamic Software System
OST-71-2	Programmer's Reference Manual for Dynamic Display Software System
OST-71-3	TRIP-The Transportation Routing and Intermodal Planning System: An Aid for Today's Traveler
OST-71-4	A Theory of Aircraft Collision Avoidance System Design and Evaluation
OST-71-5	Aircraft Emissions Survey
OST-71-6	Traffic Circle Model
OST-71-7	Vehicular Traffic Flow Theory and Tunnel Traffic Flow Measurements
OST-71-8	A Review of Available L-Band and VHF Aircraft Antennas for an Aircraft-Satellite Communications Link
OST-71-9	Modeling Transportation Systems: An Overview
OST-71-10	Transportation Systems Technology: A Twenty-Year Outlook
OST-71-11	Personalized Rapid Transit Systems: A First Analysis
OST-71-12	An Airport Airside Model
OST-71-13	Design and Construction of a Portable Oculometer for use in Transportation Oriented Human Factors Studies
OST-71-14	The Noise Exposure Model MOD 4
OST-71-16	Appendix C: The Noise Exposure Model MOD 4
OST-71-17	Reports Bibliography, October 1971 TSC U.S. Department of Transportation
OST-71-19	Multi-Modal Transportation System Simulation

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Unlimited Distribution Reports

Report No.	Title
OST-72-1	A Community Noise Survey of Medford, Massachusetts
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OST-72-3	Modern Control Aspects of Automatically Steered Vehicles
OST-72-5	The Noise Exposure Model MOD-5, Volume I, Volume II
OST-72-7	Automated Guideway Network Traffic Modeling
OST-72-10	Alternative Dual Mode Network Control Strategies
TSC-93-1	Modeling of F/STOL Noise in City Streets
TSC-142-1	A Systematic Study of Supersonic Jet Noise
DLM-71-1	Automated Patent Reporting System
OST-72-15	A Brief Survey of TSC Computing Facilities
OST-72-17	A Survey of Airport Access Analysis Techniques - Models, Data and a Research Program
OST-72-20	Computer, Modeling of Transportation - Generated Air Pollution, a State-of-the-Art Survey
OST-72-23	Five-Year Computer Technology Forecast

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle TRIP-The Transportation Routing and Intermodal Planning System: An Aid for Today's Traveler		5. Report Date January 1971 6. Performing Organization Code
7. Author(s) George Kovatch and Jack Taub*		8. Performing Organization Report No. DOT-TSC-OST-71-3
9. Performing Organization Name and Address Transportation Systems Center 55 Broadway Cambridge, MA 02142		10. Work Unit No. OS-12 11. Contract or Grant No.
12. Sponsoring Agency Name and Address Department of Transportation		13. Type of Report and Period Covered Technical Report 14. Sponsoring Agency Code R1070

15. Supplementary Notes

*Service Technology Corporation
Cambridge, MA 02142

16. Abstract

The Transportation Routing and Intermodal Planning (TRIP) System was conceived as an aid to today's traveler. It assumes a traveler wishes to choose from all available modes of transportation generally air, automobile, rail, and bus. It is based on the utilization of current computer display technology. The TRIP System accepts information from the traveler in real time while the traveler sits at an input terminal. The information describes the individual travel needs and desires. The computer produces actual travel plans with comparative cost and time data for each mode. Results of a demonstration on existing TSC computer equipment are reported. (In this report, the concept is described and possibilities for future development and potential application are given.)

17. Key Words • TRIP
• Computer Display Technology
• Comparative Cost and Time Data

18. Distribution Statement

Unclassified-Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	35	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle: A THEORY OF AIRCRAFT COLLISION AVOIDANCE SYSTEM DESIGN AND EVALUATION*		5. Report Date: MARCH, 1971 6. Performing Organization Code: PG
7. Author(s): Edmund J. Koenke		8. Performing Organization Report No.: DOT-TSC-OST-71-4
9. Performing Organization Name and Address: Transportation Systems Center 55 Broadway Cambridge, Ma. 02142		10. Work Unit No. 11. Contract or Grant No. 13. Type of Report and Period Covered: Technical Report
12. Sponsoring Agency Name and Address: Department of Transportation		14. Sponsoring Agency Code: G3000

15. Supplementary Notes: *Submitted in partial fulfillment of the requirements for the degree of Doctor of Science, at the Massachusetts Institute of Technology, March 1971

16. Abstract

The problem of aircraft anti-collision system design and evaluation is discussed in this work. Two evaluation criteria, *conflict ratio* and *probability of missed critical alarm* are formulated and are found to be independent of both traffic density and traffic model. These parameters depend only on system alarm thresholds, critical miss distances and relative position prediction uncertainty. This results in a simple method for system evaluation and examination of new anti-collision concepts. A closed-form method for estimating system alarm rate is also developed based on both a new traffic model and empirical data. Anti-collision systems are numerically compared by use of the criteria developed in this thesis. In the terminal area it is found that the *conflict ratio* ranges from about 900 for a simple PWI device to about 25 for a full state collision avoidance system. The difference in the en-route environment is found to be less severe. The design of a low conflict ratio collision avoidance system is also discussed in this thesis and both an algorithm and display are developed.

17. Key Words
Anti-collision system
Collision avoidance
Air traffic models
Collision detection and avoidance
Traffic model formulations (air)

18. Distribution Statement: Unclassified-Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	184	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Aircraft Emissions Survey		5. Report Date March 31, 1971 6. Performing Organization Code
7. Author(s) A.J. Broderick, W. F. Harriott, and R. A. Walter		8. Performing Organization Report No. DOT-TSC-OST-71-5
9. Performing Organization Name and Address DOT/Transportation Systems Center 55 Broadway Cambridge, MA 02142		10. Work Unit No. OS-10 11. Contract or Grant No. 71-OS
12. Sponsoring Agency Name and Address Department of Transportation 400 Seventh Street, S.W. Washington D.C. 20590		13. Type of Report and Period Covered Technical Memorandum, July 1, 1970 - March 31, 1971 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

This technical memorandum presents the preliminary results of a survey of transportation systems emissions monitoring requirements. Emissions of carbon monoxide, hydrocarbons, oxides of nitrogen and particulates from aircraft power plants, with emphasis on gas turbine engines, are considered. Measurement rationale for various types of aircraft is summarized. Instrumentation available for measuring these emissions is reviewed and a tabulation made of those techniques in current use. Instrumentation requiring further engineering development is briefly discussed.

17. Key Words	18. Distribution Statement		
•Air Pollution •Gas Turbines •Emissions •Jet Engines •Instrumentation	Unlimited		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages	22. Price

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.

4. Title and Subtitle	5. Report Date
Traffic Circle Model	May 1971
	6. Performing Organization Code: TCD
7. Author(s): Irwin Englander	8. Performing Organization Report No.: DOT-TSC-OST-71-6
9. Performing Organization Name and Address: Transportation Systems Center, 55 Broadway, Cambridge, Ma. 02142	10. Work Unit No.: R-1070
	11. Contract or Grant No.: DOT/TSC-16
12. Sponsoring Agency Name and Address: Department of Transportation, Office of the Secretary, Washington, D.C. 20590	13. Type of Report and Period Covered: Preliminary Memoranda
	14. Sponsoring Agency Code: OS-12

15. Supplementary Notes

16. Abstract

This report describes a dynamic model of a traffic circle which has been implemented on a CRT display terminal.

The model includes sufficient parameters to allow changes in the structure of the traffic circle, the frequency of traffic introduced to the circle by each entering road, the model of entering the circle (right of way), the frequency of traffic leaving the circle by each road, and vehicular spacing toward the circle.

17. Key Words	18. Distribution Statement
Dynamic Model Traffic Circle CRT Display Terminal	Unclassified-Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	14	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Vehicular Traffic Flow Theory and Tunnel Traffic Flow Measurements		5. Report Date June, 1971 6. Performing Organization Code TEC
7. Author(s) G. Chin, L. Jordan, D. Kahn, S. Morin, P. Yoh		8. Performing Organization Report No. DOT-TSC-71-7
9. Performing Organization Name and Address Transportation Systems Center 55 Broadway Cambridge, Mass. 02142		10. Work Unit No. OS-12 11. Contract or Grant No.
12. Sponsoring Agency Name and Address Office of the Secretary U.S. Department of Transportation Washington, D.C.		13. Type of Report and Period Covered Technical Report 14. Sponsoring Agency Code R1070

15. Supplementary Notes Traffic flow measurements taken with the cooperation of the Massachusetts Turnpike Authority, Tunnel Division.

16. Abstract

Vehicular traffic flow has been investigated theoretically and experimentally in order that peak hour collective traffic flow dynamics be understood and that the peak hour flow through the Callahan Tunnel be improved by means of traffic flow control and modification. Two theoretical models are suggested, the finite reaction time model and the asymmetrical response model, as predictive of observed traffic density dynamics, wave growth and asymmetry. Experimentally, a traffic flow profile of capacities, vehicle speeds and traffic densities in the Callahan Tunnel has been obtained, and relationships between slowdown wave phenomena and traffic flow, determined. Based on these, it is suggested that traffic flow may be improved with traffic flow modification procedures.

17. Key Words	18. Distribution Statement
•Traffic Flow •Tunnel Traffic •Congestion •Airport Access	Unclassified-Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	221	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle A Review of Available L-Band and VHF Aircraft Antennas for an Aircraft-Satellite Communications Link		5. Report Date May 1971 6. Performing Organization Code
7. Author(s) The Telecommunications Division		8. Performing Organization Report No. DOT-TSC-OST-71-8
9. Performing Organization Name and Address Transportation Systems Center 55 Broadway Cambridge, Mass., 02142		10. Work Unit No. R-1066 11. Contract or Grant No. OS08
12. Sponsoring Agency Name and Address Office of the Secretary of Transportation Washington, D.C., 20590		13. Type of Report and Period Covered Technical Report 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

One of the problems encountered in designing an aircraft to use a satellite system for communications (and for surveillance and navigation) is that of finding a suitable aircraft antenna. There is, at present, no antenna which will satisfy all requirements. The purpose of this paper is to briefly review the characteristics of some of the L-Band and VHF antennas which have been proposed for an aircraft-satellite link.

17. Key Words	18. Distribution Statement
• L-Band Antenna • VHF Antenna • Slot-Dipole Antenna • Boeing	Unclassified-Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	93	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Modeling Transportation Systems: An Overview		5. Report Date June 1971 6. Performing Organization Code TSC/SA
7. Author(s) George Kovatch and George Zames*		8. Performing Organization Report No. DOT-TSC-OST-71-9
9. Performing Organization Name and Address Transportation Systems Center 55 Broadway Cambridge, Massachusetts 02142		10. Work Unit No. OS12 11. Contract or Grant No.
12. Sponsoring Agency Name and Address Office of the Secretary of Transportation Washington, DC 20590		13. Type of Report and Period Covered Technical Report 14. Sponsoring Agency Code

15. Supplementary Notes

*Service Technology Corporation
55 Broadway, Cambridge, Massachusetts 02142

16. Abstract

The purpose of this report is to outline the role of systems analysis and mathematical modeling in the planning of transportation systems. The planning process is divided into three sectors (demand, supply, and policy) reflecting the demand for transportation services by the public, the ability of the system to deliver these services, and the effects of management policies on the equilibriation between supply and demand. The composition of each sector is examined and illustrated by samples from recent major transportation studies and the modeling literature. Emphasis is placed on structure, dynamics, and feedback effects.

17. Key Words	18. Distribution Statement		
•Transportation Modeling •Transportation Planning	Unclassified		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages	22. Price

TECHNICAL REPORT STANDARD TITLE PAG

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-71-10		

4. Title and Subtitle	5. Report Date
Transportation Systems Technology: A Twenty-Year Outlook	August 1, 1971
	6. Performing Organization Code: TSC
7. Author(s): George Kovatch*, John B. Barber, Robert F. Casey and George Zames†	8. Performing Organization Report No.: DOT-TSC-OST-71-10
9. Performing Organization Name and Address: Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts 02142	10. Work Unit No.: OP01
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address: Office of the Secretary of Transportation, Washington, D.C. 20590	13. Type of Report and Period Covered: Final Report: 10/70-8/71
	14. Sponsoring Agency Code

15. Supplementary Notes

*Project Manager
†Service Technology Corporation, Cambridge, Massachusetts 02142

16. Abstract

In this report an overall technology assessment of new and improved transportation systems is given. A broad survey has been made of new systems concepts for passenger and freight transportation in urban and interurban applications. Results of the findings are reported and projections of expected innovations and improvements are made along with discussion of some of the major limitations to wide scale applications over the next two decades. Recommendations for research and development emphasis in some of the more promising areas are given where possible although full analysis of cost factors and comparative analysis of competing systems were beyond the scope of this investigation.

17. Key Words	18. Distribution Statement
Transportation Technology Urban Transportation Interurban Transportation	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		

Form DOT F 1700.7 (8-69)

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-71-11		

4. Title and Subtitle	5. Report Date
Personalized Rapid Transit Systems: A First Analysis	August 1, 1971
	6. Performing Organization Code: TSC
7. Author(s): George Kovatch* and George Zames**	8. Performing Organization Report No.: DOT-TSC-OST-71-11
9. Performing Organization Name and Address: Transportation Systems Center, 55 Broadway, Cambridge, Massachusetts 02142	10. Work Unit No.: OP01
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address: Office of the Secretary of Transportation, Washington, D.C. 20590	13. Type of Report and Period Covered: Final Report: 10/70-8/71
	14. Sponsoring Agency Code

15. Supplementary Notes

* Project Manager and Coauthor

** Author, Service Technology Corporation, Cambridge, Mass. 02142

16. Abstract

In this report a preliminary systems analysis of the Personalized Rapid Transit System concept is given. It includes presentation of the significant advantages and disadvantages of the concept. Questions of system capacity, station capacity, urban grid design, and headway requirements are addressed. A review of current manufacturers' concepts is given with a functional classification of their major characteristics. Major component and system needs, which require further research and analysis, are described. A brief discussion of cost factors is also given.

17. Key Words	18. Distribution Statement
Transportation Systems Analysis PRT Systems Urban Transportation	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-71-12		

4. Title and Subtitle	5. Report Date
An Airport Airside System Model	June 1971
	6. Performing Organization Code: TCD
7. Author(s): Irwin Englander	8. Performing Organization Report No.
9. Performing Organization Name and Address: Transportation Systems Center, 55 Broadway, Cambridge, Ma. 02142	10. Work Unit No.: R-1106
	11. Contract or Grant No.: N/A
12. Sponsoring Agency Name and Address: Office of the Secretary, U.S. Department of Transportation, Washington, D.C. 20590	13. Type of Report and Period Covered: Technical Report
	14. Sponsoring Agency Code: OS-04

15. Supplementary Notes

16. Abstract

This model of an airport airside system simulates aircraft operations and controller functions in the terminal area, both in the air and on the ground. The model encompasses all operations between the terminal gate and the point of handoff between the enroute controller and the terminal controller.

17. Key Words	18. Distribution Statement
	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-71-13		

4. Title and Subtitle	5. Report Date
Design and construction of a Portable Oculometer for Use in Transportation Oriented Human Factors Studies	August 1971
	6. Performing Organization Code: T1

7. Author(s)	8. Performing Organization Report No.
Davis, P.W. Iannini, A. Lutz, J. Warner, A.	

9. Performing Organization Name and Address	10. Work Unit No.
DOT/TSC	OS11
	11. Contract or Grant No.
	13. Type of Report and Period Covered: Technical Report FY 71
12. Sponsoring Agency Name and Address: Office of the Assistant Secretary of Systems Development and Technology, 400 7th St. S.W., Washington, D.C.	14. Sponsoring Agency Code: TST-1

15. Supplementary Notes

16. Abstract

This report describes development of an instrument designed to acquire and process information about human visual performance. The instrument has the following features: (1) It can be operated in a variety of transportation environments including simulators, cars, trucks, trains, and air traffic control stations; (2) The visual performance measurements are made without alteration of the subject's normal visual behavior; and (3) The data can be presented to the experimenter as either a video picture of the scene with the fixation point superimposed, or as derived eye-motion parameters.

17. Key Words	18. Distribution Statement
Visual Performance, Eye-Motion Instrumentation, Pupilometry	Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Uncl.	38	

Form DOT F 1700.7 (8-69)

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-71-14		

4. Title and Subtitle	5. Report Date
The Noise Exposure Model MOD 4	August 1971
	6. Performing Organization Code: TME
7. Author(s): R. H. Hinckley and J. E. Wesler	8. Performing Organization Report No.: DOT-TSC-OST-71-14
9. Performing Organization Name and Address: Transportation Systems Center, 55 Broadway, Cambridge, MA 02142	10. Work Unit No.: OS-207
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address: Office of Noise Abatement, Department of Transportation, 400 Seventh Street, S.W., Washington, D. C. 20590	13. Type of Report and Period Covered: Technical Report
	14. Sponsoring Agency Code: R-2519

15. Supplementary Notes

16. Abstract

The purpose of this report is threefold:

1. To record the results of efforts at the Transportation Systems Center to refine and expand the Noise Exposure Model, which have specifically resulted in the MOD 4 version described herein;
2. To serve as a User's Manual for the preparation of input information for the Noise Exposure Model MOD 4; and
3. To document the computer program for the Noise Exposure Model MOD 4, primarily for the guidance of computer programmers.

17. Key Words	18. Distribution Statement
Noise exposure Noise Exposure Forecast (NEF) Airport noise	Unclassified - Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	90	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-71-16		

4. Title and Subtitle	5. Report Date
Appendix C: The Noise Exposure Model MOD4	August 1971
	6. Performing Organization Code TME
7. Author(s)	8. Performing Organization Report No. DOT-TSC-OST-71-16
9. Performing Organization Name and Address Transportation Systems Center 55 Broadway Cambridge, MA 02142	10. Work Unit No. OS-207
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address Office of Noise Abatement Department of Transportation 400 Seventh Street, S.W. Washington, D.C. 20590	13. Type of Report and Period Covered Technical Report
	14. Sponsoring Agency Code R-2519

15. Supplementary Notes

16. Abstract

17. Key Words	18. Distribution Statement
	Unclassified-Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	57	

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-71-17		

4. Title and Subtitle	5. Report Date
Reports Bibliography, October 1971 TSC, U.S. Department of Transportation	October 1971
	6. Performing Organization Code AMT
7. Author(s) Albert L. Waters	8. Performing Organization Report No. DOT-TSC-OST-71-17
9. Performing Organization Name and Address Technical Information Center U.S. Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, Mass. 02142	10. Work Unit No. G2150
	11. Contract or Grant No.
	13. Type of Report and Period Covered Reports Bibliography July 1970-Oct 1971
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Washington, D.C. 20590	14. Sponsoring Agency Code AMT

15. Supplementary Notes

Issued by the Transportation Systems Center, Technical Information Center

16. Abstract

This Reports Bibliography published at the Transportation Systems Center provides a substantive listing of Scientific Technical Reports published from July 1970 through October 1971.

Reports are arranged in 22 subject fields and are listed by Sponsoring Agency Name and Address. Abstracts of each Technical Report are presented providing a brief overview of substantive information in each report. The abstracts are cross referenced by COSATI field and subject title.

17. Key Words	18. Distribution Statement
	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	17	

Form DOT F 1700.7 (8-69)

1. Report No. DOT-TSC-OST-71-19	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle MULTI-MODAL TRANSPORTATION SYSTEM SIMULATION		5. Report Date July 1971 6. Performing Organization Code PDC
7. Author(s) Robert C. Ricci and Jean R. Roy		8. Performing Organization Report No.
9. Performing Organization Name and Address Transportation Systems Center 55 Broadway Cambridge, Ma 02142		10. Work Unit No. R1062 11. Contract or Grant No.
12. Sponsoring Agency Name and Address Office of the Secretary U.S. Department of Transportation Washington, D. C. 20590		13. Type of Report and Period Covered Technical Report 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

A laboratory with real-time simulation capability is being developed for simulating the command and control functions related to transportation systems. The initial effort in Advanced Air Traffic Control Techniques is defining and evaluating the most effective role of controllers in future ATC systems. The present laboratory status, the simulation models and structure, and programming techniques that are being used are discussed.

17. Key Words	18. Distribution Statement		
	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 24	22. Price

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-72-1		

4. Title and Subtitle	5. Report Date
A Community Noise Survey of Medford, Massachusetts	August 1971
	6. Performing Organization Code: TME
7. Author(s): Noise Abatement Group	8. Performing Organization Report No.
9. Performing Organization Name and Address: Transportation Systems Center, U.S. Department of Transportation, 55 Broadway, Cambridge, MA 02142	10. Work Unit No.: OS-207
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address: Office of Noise Abatement, U.S. Department of Transportation, Washington, D.C. 20591	13. Type of Report and Period Covered: February-May 1971
	14. Sponsoring Agency Code: TST-50

15. Supplementary Notes

16. Abstract

A noise measurement survey was conducted in Medford, Massachusetts, in order to assess the effect of transportation noise sources on the noise levels in a typical small city, and to obtain data to validate a mathematical simulation model developed for the prediction of community noise levels. Weekday measurements were made at 49 locations in the city. At five of these locations, measurements were taken for approximately 40 minutes each hour for an entire 24-hour period. At the remaining 44 locations, measurements were made for approximately one hour during the morning traffic rush hour, and for an hour at midday.

This report of the noise measurement survey contains detailed tabulations of the noise levels measured, time history charts, noise level analyses, site descriptions, and other information pertinent to the evaluation of community noise levels.

The overall average median noise level from all locations was 55.0 dEA for the morning rush hour, and 51.8 dBA for the midday period. The highest noise levels were measured near heavily traveled highways. Railroad traffic had no significant influence on the community noise levels, and aircraft influenced the overall noise levels only to a limited extent.

17. Key Words	18. Distribution Statement
Noise Abatement, Transportation Noise, Community Noise Levels	Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
UNCLASSIFIED	UNCLASSIFIED	594	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-72-2		

4. Title and Subtitle	5. Report Date
Measurement of Ambient Noise Levels in The Florida Everglades	September, 1971
	6. Performing Organization Code: TSC/TME
7. Author(s): Robert W. Quinn	8. Performing Organization Report No.
9. Performing Organization Name and Address: Transportation Systems Center (TSC), 55 Broadway, Cambridge, Mass. 02142	10. Work Unit No.: R-2519
	11. Contract or Grant No.: OS-207
12. Sponsoring Agency Name and Address: Office of Noise Abatement, Department of Transportation, 400 Seventh Street SW, Washington, D. C. 20591	13. Type of Report and Period Covered: Technical Note
	14. Sponsoring Agency Code: DOT/TST-50

15. Supplementary Notes

16. Abstract

Noise data recorded in and around a 100-square mile area of southern Florida during the period 16-22 March 1971 have been analyzed in the Noise Abatement Laboratory, Transportation Systems Center, Cambridge, Massachusetts. Nine locations were selected for measurement to obtain representative ambient noise levels in the area.

Tabulated data display a summary of the measured noise levels at each location, and include calculated values including the A-weighted noise levels exceeded 10%, 50%, and 90% of the measurement periods at each location.

17. Key Words	18. Distribution Statement
Noise levels, aircraft noise, noise measurement	Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
UNCLASSIFIED	UNCLASSIFIED	54	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-72-3		

4. Title and Subtitle	5. Report Date
MODERN CONTROL ASPECTS OF AUTOMATICALLY STEERED VEHICLES	December 1971
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Sam Pasternack	
9. Performing Organization Name and Address	10. Work Unit No.
Transportation Systems Center 55 Broadway Cambridge, Massachusetts 02142	R-2532
	11. Contract or Grant No.
	OS-218
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address	Technical Note
Office of the Secretary U.S. Dept of Transportation Washington, D.C. 20590	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

In the study of automatically steered rubber tired vehicles, little emphasis in the past has been placed on the steering control laws. This report examines the control law problem from the state variable point of view and it is shown that, except for possibly one velocity, the system is both controllable and observable allowing arbitrary system dynamics. It is also shown how optimal control theory may be used to select the feedback gains in order to minimize a cost function containing the square of the vehicle lateral acceleration.

17. Key Words	18. Distribution Statement
• Automatic Steering	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	20	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-72-5		

4. Title and Subtitle	5. Report Date
THE NOISE EXPOSURE MODEL NOD 5 VOLUME 1	November 1971 6. Performing Organization Code
7. Author(s) J. Taub, T. Foreman, B. Brownfield	8. Performing Organization Report No
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA 02142	10. Work Unit No. R-2519 11. Contract or Grant No. OS207
12. Sponsoring Agency Name and Address Department of Transportation Office of the Secretary Washington, D.C. 20590	13. Type of Report and Period Covered Technical Report 14 Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report contains three sections. The first two sections are contained in Volume 1 and may be described as follows:

Section 1. Airport Analysis - This section describes the Noise Exposure Model MOD-5 from the perspective of analysing an airport in order to develop the program input model.

Section 2. User's Manual - This section describes the process of developing the input model for the Noise Exposure Model MOD-5 from input data.

The final section will be published as Volume 2 and will be a programmer's manual. The purpose of this section will be to describe the Noise Exposure Model MOD-5 Computer Program.

17. Key Words	18. Distribution Statement
Noise Abatement Airport Aircraft Noise	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Publ c

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	94	

1. Report No. DOT-TSC-OST-72-5	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle THE NOISE EXPOSURE MODEL MOD 5 VOLUME 2		5. Report Date November 1971 6. Performing Organization Code
7. Author(s) J. Taub, T. Foreman, B. Brownfield		8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA 02142		10. Work Unit No. R-2519 11. Contract or Grant No. OS207 13. Type of Report and Period Covered Technical Report
12. Sponsoring Agency Name and Address Department of Transportation Office of the Secretary Washington, D.C. 20590		14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This volume is the Programmer's Manual describing the Noise Exposure Model MOD-5 Computer Program.

Volume 1 is the airport analysis and user manual. Volume 2 was revised in March of 1972 to correct inconsistancies in the initial version.

17. Key Words	18. Distribution Statement
•Noise Abatement •Airport Aircraft Noise	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	175	

1. Report No. DOT-TSC-OST-72-7	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle AUTOMATED GUIDEWAY NETWORK TRAFFIC MODELING		5. Report Date February 1972 6. Performing Organization Code
7. Author(s) Charles R. Toye		8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA 02142		10. Work Unit No. R2529 11. Contract or Grant No. OS218 13. Type of Report and Period Covered Technical Note
12. Sponsoring Agency Name and Address Department of Transportation Office of the Secretary Washington, D.C. 20590		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract In the literature concerning automated guideway transportation systems, such as dual mode, a great deal of effort has been expended on the use of deterministic reservation schemes and the problem of merging streams of vehicles. However, little attention has been focused on the problem of developing models to determine space allocation on the guideway as a function of the user service level required for satisfactory operation of the system. The problem must be addressed in the early design phase of any automative guideway system and is pertinent to site selection. This paper develops probability models and uses statistical variance analysis techniques to develop procedures which can be used to determine the required guideway space necessary to satisfy a user service level for a particular demand rate. It provides the building blocks upon which various network traffic management strategies can be developed.

The paper contains an explanation of the methodology involved, gives sample problems, and describes the simulation procedures that were employed to verify the results.

17. Key Words Automated Guideway Modeling, Simulation, Dual Mode, Network Traffic Modeling	18. Distribution Statement Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 30	22. Price

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-72-10		

4. Title and Subtitle	5. Report Date
ALTERNATIVE DUAL MODE NETWORK CONTROL STRATEGIES	March 1972
	6. Performing Organization Code
7. Author(s) Ronald D. Kangas	8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA 02142	10. Work Unit No. R 2529 11. Contract or Grant No. OS-218
12. Sponsoring Agency Name and Address Department of Transportation Office of the Secretary Washington, D.C. 20590	13. Type of Report and Period Covered Technical Note 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

From a literature survey a qualitative evaluation was made of four network control strategies for the fundamental control philosophy of the moving synchronous slot. In the literature concerning automated transportation systems, such as dual mode, a great deal of effort has been expended in discussing the pros and sometimes the cons of a specific control concept without reviewing other control strategies that may be available. This paper summarizes the major advantages and disadvantages associated with four control strategies for the moving synchronous slot. A description of each of these control strategies is provided and conclusions are made showing that the deterministic slot/cycle concept and the quasi-synchronous slot concept with entrance station throughput modulated by historic demand data are the most promising. Additional investigations of these two concepts showed that a further study of alternative network control strategies is needed, oriented towards addressing the issues of network capacity, interchange design, passenger convenience and system failure and recovery.

17. Key Words	18. Distribution Statement
Automatic Vehicle Network Control	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	29	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-93-1		

4. Title and Subtitle	5. Report Date
MODELING OF V/STOL NOISE IN CITY STREETS	15 November 1971
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Richard H. Lyon, Lalit Pande, Wayne A. Kinney	

9. Performing Organization Name and Address	10. Work Unit No.
Department of Mechanical Engineering Massachusetts Institute of Technology Cambridge, Mass. 02139	R-2519
	11. Contract or Grant No. DOT-TSC-93
	13. Type of Report and Period Covered: Contractor Report
12. Sponsoring Agency Name and Address Office of Noise Abatement Department of Transportation Washington, D.C. 20591	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The goals of this work were two-fold. First, to develop modeling techniques that will be helpful in studying a variety of noise propagation problems. These involve not only aircraft sources, but also surface traffic (automobiles, trucks, and rail vehicles) as well. The second and more narrow goal is the application of these modeling techniques to a specific problem, the propagation of V/STOL aircraft noise into an urban area.

Two particular flight-path-street-configuration situations were examined, using a 1:32 scale for the laboratory model. A steady-state aerodynamic noise source was used to simulate flyover noise. A second source for generating sound pulses was used for ray-tracing diagnoses.

The propagation effects of streets and buildings, which cause sound levels to differ from that in open flat terrain, are lumped together into a "Transmission Gain (TG)". A major part of the work reported here is the experimental evaluation of TG for various model configurations, flight paths, and microphone locations.

17. Key Words	18. Distribution Statement
• Noise levels • V/STOL noise • Noise propagation • Urban noise propagation	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
UNCLASSIFIED	UNCLASSIFIED	49	

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-142-1		

4. Title and Subtitle	5. Report Date
A Systematic Study of Supersonic Jet Noise	December 1971
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Jean F. Louis	

9. Performing Organization Name and Address	10. Work Unit No.
Department of Aeronautics and Astronautics Massachusetts Institute of Technology Cambridge, MA 02139	R-2519
	11. Contract or Grant No. DOT-TSC-142
	13. Type of Report and Period Covered Final Report
12. Sponsoring Agency Name and Address Office of Noise Abatement Department of Transportation Washington, D.C. 20590	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The purpose of this work is to study the acoustic fields associated with two different nozzle configurations; a rectangular and a circular. Both nozzles are designed with the same exit Mach number and have an identical momentum and energy flux..

The other main aim of this study is to establish scaling laws of supersonic jet noise. A shock tube is a very versatile apparatus for such an analysis. A short test time allows the use of a heat sink nozzle and eliminates the use of an anechoic chamber. So far tests have been made in the range of 1000-5000°R, for different levels of expansion and an exit Mach number of 2.7. In comparing the two nozzles, it is found that the rectangular nozzle is indeed quieter than the circular nozzle. The low acoustic efficiency of the over-expanded rectangular jet is related to a rapid deceleration of the jet through a system of strong shocks. At high temperature, this effect is not observed because an important density ratio exists across the shear layer which becomes very unstable due to the Taylor instability.

For both the circular and rectangular nozzle, the effect of temperature showed an increase in the directivity angle at high temperature which is correlated to an increase in eddy convective velocity, rather than refraction due to density gradients, which seems to play a secondary role.

The low temperature overexpanded jet showed a difference of about 2.6 db in the OPWL between the two nozzles. However, at this condition, for the rectangular nozzle, a difference of 8 db between the maximum and minimum noise direction is observed.

17. Key Words	18. Distribution Statement
Supersonic Jet noise Axisymmetric nozzle — Turbulent mixing Rectangular nozzle — Shock unsteadiness Mach wave Turbulence shock interaction	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
unclassified	unclassified	64	

Form DOT F 1700.7 (8-69)

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-DLM-71-1		

4. Title and Subtitle	5. Report Date
AUTOMATED PATENT REPORTING SYSTEM	10/1/71
	6. Performing Organization Code: AQP

7. Author(s)	8. Performing Organization Report No.
Herbert E. Farmer, Carmine J. Caso	None

9. Performing Organization Name and Address	10. Work Unit No.
Transportation Systems Center Data Services Division 55 Broadway Cambridge, Ma. 02142	G-1200
	11. Contract or Grant No.: None

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Transportation Systems Center Office of Patent Counsel	Technical Note 7/1/70 - 9/30/71
	14. Sponsoring Agency Code: DLM

15. Supplementary Notes

16. Abstract

This report represents complete documentation of the Automated Patent Reporting System (APRS) currently in operation at the Transportation Systems Center. The APRS was developed to satisfy TSC and DOT patent reporting needs. It has been designed to operate in a batch mode on an IBM-7094. Programming is in COBOL in order to simplify potential conversions to the maximum extent possible. The eleven reports generated by the APRS fall into three major groups: (1) docket information, (2) category information, and (3) summary reports. Samples of the reports generated are contained in Appendix A to this document.

The APRS works very well, and we are glad to share our system with others. Any Patent Counsel wishing to implement the Automated Patent Reporting System should forward this document to his data processing personnel for reference.

17. Key Words	18. Distribution Statement
Patent Invention	Unclassified-Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	45	

Form DOT F 1700.7 (8-69)

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-72-15		

4. Title and Subtitle	5. Report Date
A BRIEF SURVEY OF TSC COMPUTING FACILITIES	May 1972
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Andres Zellweger	

9. Performing Organization Name and Address	10. Work Unit No.
Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA 02142	R2558
	11. Contract or Grant No. OS223
	13. Type of Report and Period Covered Special Publication
12. Sponsoring Agency Name and Address Department of Transportation Office of the Secretary Washington, D.C. 20590	14. Sponsoring Agency Code

15. Supplementary Notes

This report was prepared for the TASF Program Office, TSC/PA.

16. Abstract

The Transportation Systems Center (TSC) has four, essentially separate, in-house computing facilities. We shall call them Honeywell Facility, the Hybrid Facility, the Multimode Simulation Facility, and the Central Facility. In addition to these four, several laboratories have their own minicomputers. This report reviews the hardware and software capabilities of these facilities. A final section discusses the strength and weaknesses of the current in-house general purpose computer capability.

17. Key Words	18. Distribution Statement
Computers, Facility, Transportation Systems Center	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	31	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-72-17		

4. Title and Subtitle	5. Report Date
A SURVEY OF AIRPORT ACCESS ANALYSIS TECHNIQUES - MODELS, DATA AND A RESEARCH PROGRAM	June 1972
	6. Performing Organization Code
7. Author(s) L. Brown, G.E. Paules, E. Roberts, K.H. Schaeffer	8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge MA 02142	10. Work Unit No. OS205
	11. Contract or Grant No. R2235
12. Sponsoring Agency Name and Address Department of Transportation Office of the Secretary Washington, D.C. 20590	13. Type of Report and Period Covered Technical Report
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The report points up the differences and similarities between airport access travel and general urban trip making. Models and surveys developed for, or applicable, to airport access planning are reviewed. A research program is proposed which would generate a standard airport technical planning package and establish a federal airport access planning assistance program to help local agencies in planning airport access demonstrations and improvements.

17. Key Words	18. Distribution Statement
Airport Access Modal Split Travel Survey Demonstrations	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	172	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-OST-72-20		

4. Title and Subtitle	5. Report Date
COMPUTER MODELING OF TRANSPORTATION-GENERATED AIR POLLUTION - A STATE-OF-THE-ART SURVEY	June 1972
	6. Performing Organization Code
7. Author(s) Eugene M. Darling Jr.	8. Performing Organization Report No.
9. Performing Organization Name and Address U.S. Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, Massachusetts 02142	10. Work Unit No.
	11. Contract or Grant No. OS-222
12. Sponsoring Agency Name and Address U.S. Department of Transportation Office of the Secretary Office of the Assistant Secretary for Systems Development and Technology Washington, D.C. 20590	13. Type of Report and Period Covered Final Report
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report surveys the state-of-the-art in air pollution modeling with particular emphasis on the modeling of dispersion from transportation sources. Models which have actually been implemented are stressed and the computational aspects of these models are treated in detail. Applications are discussed and validations are critically assessed. It was found that Gaussian and conservation of mass models are currently the most widely used tools for analyzing the dispersion of pollutants in the atmosphere. Models presently in operation are run on medium to large-scale computers of the IBM 360/50 class or greater and nearly all of these models are programmed in FORTRAN IV. Although existing models have been applied to a wide variety of air pollution problems, their performance has not been adequately evaluated. This deficiency is primarily due to the fact that, until recently, instrumented transportation test sites have not existed and hence very little validation data have heretofore been generated. However, such test sites do now exist and data from them is beginning to become available, hence the validation of dispersion models will soon be feasible.

17. Key Words	18. Distribution Statement
Computer Modeling, Air Pollution, Transportation Pollution Sources	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	131	

1. Report No. DOT-TSC-OST-72-23	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle FIVE-YEAR COMPUTER TECHNOLOGY FORECAST		5. Report Date December 1972 6. Performing Organization Code
7. Author(s) Andres Zellweger		8. Performing Organization Report No. DOT-TSC-OST-72-23
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center Kendall Square Cambridge, MA. 02142		10. Work Unit No. R3543 11. Contract or Grant No. OS323
12. Sponsoring Agency Name and Address Department of Transportation Office of the Secretary Office of R&D Policy Washington, D.C. 20590		13. Type of Report and Period Covered Final Report 14. Sponsoring Agency Code

15. Supplementary Notes

This report was prepared for the TASS Program Office, TSC/PA.

16. Abstract This report delineates the various computer system components and extrapolates past trends in light of industry goals and physical limitations to predict what individual components and entire systems will look like in the second half of this decade. The report will emphasize the nature of components (e.g. CPUs, primary memories, secondary memories, ultra large storage devices, etc.) and the system architectures that will be commercially available as "off-the-shelf" items rather than one-of-a-kind systems that might exist in five years.

17. Key Words	18. Distribution Statement
Computers, Memories, Processors, Networks, Forecast	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
UNCLASSIFIED	UNCLASSIFIED	102	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-UMTA-72-3		

4. Title and Subtitle	5. Report Date
Noise Level Measurements on the UMTA Mark I Diagnostic Car (R42 Model)	October, 1971
	6. Performing Organization Code
7. Author(s) Edward J. Rickley, Robert Quinn, George Byron	8. Performing Organization Report No.
9. Performing Organization Name and Address Transportation Systems Center (TSC) 55 Broadway Cambridge, Massachusetts 02142	10. Work Unit No. R2716
	11. Contract or Grant No. UM-204
12. Sponsoring Agency Name and Address Urban Mass Transportation Administration Department of Transportation Washington 25, D.C. 20590	13. Type of Report and Period Covered Technical Report May-August 1971
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The R42 Model mass transit car currently operating on the "N" line of the New York City Transit System was selected for experimentation and tests. For this purpose, the car was instrumented and designated as the UMTA Mark I Diagnostic Car.

Noise levels generated by "stop and go" operations of the Diagnostic Car were measured and tabulated in this report. Measurements were made inside of and outside the car during operation on the "N" line of the New York Transit System and during operation at the DOT High Speed Ground Test Center at Pueblo, Colorado.

The report contains tabulations of the noise levels measured, time history charts, 1/3-octave frequency analyses and pertinent comments on the information obtained.

17. Key Words	18. Distribution Statement
Noise Abatement, Transportation Noise, Mass Transit Cars	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	100	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-UMTA-72-1		

4. Title and Subtitle	5. Report Date
OPERATIONAL DIAL-A-RIDE COMPUTER PROGRAM, Test Scenarios And Test Data, VOLUME II	30 September 1971
	6. Performing Organization Code
7. Author(s) Juan F. Bellantoni	8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center Washington, D.C. 02142	10. Work Unit No. R2718
	11. Contract or Grant No. UM202
12. Sponsoring Agency Name and Address Department of Transportation Urban Mass Transportation Admin. Washington D.C. 20590	13. Type of Report and Period Covered Technical Report, FY71-72 Jan-Sept. 1971
	14. Sponsoring Agency Code

15. Supplementary Notes
This report consists of two volumes. Volume I contains the Test and Evaluation Report.

16. Abstract
This report presents the results of the evaluation of the MIT Urban Systems Laboratory's (USL's) Dial-A-Ride operational computer program. The evaluation was carried out by the Transportation Systems Center (TSC) under PPA UM-02, "Transportation Systems Computer Package", FY'72. The general purpose of the evaluation was to test the Operational Dial-A-Ride (O D-A-R) DOS Program against the work statement of November 24, 1970, for extension of the UMTA Grant MASS-MTD-6.

17. Key Words	18. Distribution Statement
Demand Responsive Systems, Dial-A-Ride, Dial-A-Bus, Operational D-A-R, Computer Dispatching	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	142	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-UMTA-72-1		

4. Title and Subtitle	5. Report Date
OPERATIONAL DIAL-A-RIDE COMPUTER PROGRAM, Test and Evaluation Report VOLUME I	30 September 1971
	6. Performing Organization Code
7. Author(s) Juan F. Bellantoni	8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center Washington, D.C. 02142	10. Work Unit No. R2718
	11. Contract or Grant No. UM202
12. Sponsoring Agency Name and Address Department of Transportation Urban Mass Transportation Admin. Washington D.C. 20590	13. Type of Report and Period Covered Technical Report, FY71-72 Jan-Sept. 1971
	14. Sponsoring Agency Code

15. Supplementary Notes

This report consists of two volumes. Volume II contains the Test Scenarios and Test Data for the O D-A-R Computer Program.

16. Abstract

This report presents the results of the evaluation of the MIT Urban Systems Laboratory's (USL's) Dial-A-Ride operational computer program. The evaluation was carried out by the Transportation Systems Center (TSC) under PPA UM-02, "Transportation Systems Computer Package", FY'72. The general purpose of the evaluation was to test the Operational Dial-A-Ride (O D-A-R) DOS program against the work statement of November 24, 1970, for extension of the UMTA Grant MASS-MTD-6.

17. Key Words	18. Distribution Statement
Demand Responsive Systems, Dial-A-Ride, Dial-A-Bus, Operational D-A-R, Computer Dispatching	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	142	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-UMTA-71-7		

4. Title and Subtitle	5. Report Date
Operation Dial-A-Ride Dispatching Program: Instructions for Using the System Tape	September 1971
	6. Performing Organization Code
7. Author(s) B. Paul Bushueff Jr.	8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center Cambridge, MA 02142	10. Work Unit No. R-2718
	11. Contract or Grant No. UM02
12. Sponsoring Agency Name and Address Department of Transportation Urban Mass Transportation Admin. Washington D.C. 20590	13. Type of Report and Period Covered Operating Handbook-for Deliverable Item.
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This handbook contains notes and instructions on using the magnetic tapes that contain the Operational Dial-A-Ride computer dispatching program that was produced by MIT Urban Systems Laboratory under Grant Mass MTD-6, for the Department of Transportation Urban Mass Transit Administration.

17. Key Words	18. Distribution Statement
Dial-A-Ride, Dial-A-Bus, Computer Dispatching, Bus routing, Dispatching Algorithms Computer Aided Routing	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	20	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-UMTA-71-6		

4. Title and Subtitle	5. Report Date
Ground Vehicle Communications & Control	July 1971
	6. Performing Organization Code
7. Author(s) R. E. Buck, L. A. Frasco, H. D. Goldfein, S. Karp, L. Klein, cont.	8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway Cambridge, MA 02142	10. Work Unit No. R-2008 11. Contract or Grant No. UM03-1
12. Sponsoring Agency Name and Address Department of Transportation Urban Mass Transportation Admin. Washington, DC 20590	13. Type of Report and Period Covered Annual Report July 1970-June 1971 14. Sponsoring Agency Code

15. Supplementary Notes

authors cont. E. T. Leonard, J. Liu, and P. Yoh

16. Abstract A program for improving vehicular communications in the urban environment is described. The first major item was the development of a capability to measure and record both the multipath structure of any particular urban channel and the associated noise environment. This will be accomplished by outfitting a van to make noise measurements and also to be the receiving site for suitably designed probing signals which will be transmitted from fixed locations. The frequencies to be used are: 149.95, 416.6 and 902.2 MHz.

The second part of the program is directed toward analyzing the noise and multipath characteristics measured above. Effort has been directed toward constructing a channel simulator and a communication system simulator.

Contractor reports are included.

17. Key Words	18. Distribution Statement
land mobile communications, electromagnetic noise, channel characterization	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	164	

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-UMTA-71-3		

4. Title and Subtitle	5. Report Date
Bibliography on Ground Vehicle Communication & Control: A KWIC Index	August 1971
	6. Performing Organization Code: TER
7. Author(s): W. I. Thompson, III	8. Performing Organization Report No.
9. Performing Organization Name and Address: Transportation Systems Center, 55 Broadway, Cambridge, MA 02142	10. Work Unit No.: UM03-1
	11. Contract or Grant No.
	13. Type of Report and Period Covered: Annual Report; Vol. II July 1971
12. Sponsoring Agency Name and Address: Urban Mass Transportation Administration, U.S. Department of Transportation, Washington, D.C. 20590	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This bibliography covers the subject of communication and control of ground vehicles. This covers the fields of land-mobile communication, computer aided traffic control, communication with high speed ground vehicles, and radio frequency noise. Emphasis is placed on the 150, 450 and 900 MHz frequency bands.

The bibliography has two indexes: a key word in context, KWIC index; and an author index. There are 1100 citations in the bibliography.

17. Key Words	18. Distribution Statement
Bibliography	Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	191	

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Department of Transportation
Urban Mass Transportation Administration

Unlimited Distribution Reports

Report No.	Title
UMTA-71-3	Bibliography on Ground Vehicle Communication & Control: A KWIC Index
UMTA-71-6	Ground Vehicle Communications & Control
UMTA-71-7	Operation Dial-A-Ride Dispatching Program: Instructions for using the Tape System
UMTA-72-1	Operational Dial-A-Ride Computer Program, Test and Evaluation Report Volume I
UMTA-72-3	Noise Level Measurements on the UMTA Mark I Diagnostic Car (R42 Model)
UMTA-72-5	Report of Subway Tunneling Needs of 13 Selected U.S. Cities
UMTA-72-8	Engineering Cost Analysis of the Urban-Tracked Air Cushion Vehicle System
TSC-194-1	Analysis of Potential Noise Sources of Tracked Air Cushion Vehicles (TAC)

Department of Transportation
United States Coast Board

Unlimited Distribution Reports

Report No.	Title
CG-71-1	Survey of Meteorological Remote Sensors
CG-71-3	Two Candidate Systems for Unmanned Fog Bank Detection
USCG-71-7	An Investigation of Oil Fluorescence as a Technique for the Remote Sensing of Oil Spills
CG-72-1	A Technique for Measuring the Behavior of a Navigational Buoy
USCG-72-2	Fog Bank Detector Field Tests: A Technical Summary
USCG-72-3	USCG Pollution Abatement Program: A Preliminary Study of Vessel and Boat Exhaust Emissions

1. Report No. DOT-TSC-194-1	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Analysis of Potential Noise Sources of Tracked Air Cushion Vehicles (TACV)		5. Report Date July 1971 6. Performing Organization Code 2178
7. Author(s) E.K. Bender, R.E. Hayden and H.H. Heller		8. Performing Organization Report No. UM-01
9. Performing Organization Name and Address Bolt Beranek and Newman Inc. 50 Moulton Street Cambridge, Mass. 02138		10. Work Unit No. DOT-TSC-194 11. Contract or Grant No.
12. Sponsoring Agency Name and Address Urban Mass Transportation Administration 400 Seventh Street Washington, DC 20580		13. Type of Report and Period Covered Contractor Report 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

This report presents an evaluation of the principal sources of noise from tracked air cushion vehicles (TACVs). The study is based on analyses of and laboratory experiments on existing TACVs and rapid transit systems.

Measurements of two French TACV systems were conducted, one a 44-passenger prototype suburban vehicle propelled by a linear induction motor (LIM), and the second an 80-passenger intercity vehicle powered by a gas turbine and shrouded pusher propeller.

Noise levels from a slider current-collection system were also obtained through measurements of the noise and vibration of a third-rail contact shoe on a rail rapid transit car.

17. Key Words	18. Distribution Statement		
Noise levels, Tracked Air Cushion Vehicles, Compressor Noise, Aerodynamic Noise, Linear Induction Motor Noise, Current-Collection noise.	Unlimited		
19. Security Classif. (of this report) UNCLASSIFIED	20. Security Classif. (of this page) UNCLASSIFIED	21. No. of Pages 104	22. Price

1. Report No. DOT-TSC-UMTA-72-8	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle ENGINEERING COST ANALYSIS OF THE URBAN-TRACKED AIR CUSHION VEHICLE SYSTEM		5. Report Date June 1972 6. Performing Organization Code
7. Author(s) John S. Hitz		8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA 02142		10. Work Unit No. R-2706 11. Contract or Grant No. UM-201 13. Type of Report and Period Covered Preliminary Memorandum Aug. 71 - Feb. 72
12. Sponsoring Agency Name and Address Department of Transportation Urban Mass Transportation Administration Washington, D.C. 20590		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

The Urban Tracked Air Cushion Vehicle (UTACV) is presently being developed as a means of improving urban transportation. Because implementation of the UTACV into revenue service will require the commitment of large amounts of capital resources, an investigation should be made to determine the capital cost and other financial requirements involved. Accordingly, this report covers the development of a cost analysis conducted for the UTACV. The report covers the development of a computer program used for determining the costs incurred in the application of the UTACV for various hypothetical situations and for performing sensitivity analyses for the cost parameters. Specifically, based on various levels of passenger demand, the computer program determines the system operating characteristics (number of vehicles, headway, trip time,etc.), total project cost, operating costs, revenues, and requirements for debt financing. The report will also describe a modification of the original computer program to include a comparative cost analysis between the UTACV and Rapid Rail, Express Bus and Line Haul PRT systems. The systems were compared over a wide range of passenger demands and operating conditions.

17. Key Words: Computer Program, UTACV Operating Characteristics, Capital Costs, Operating Costs, Financing Requirements, Parametric Cost Analysis, Comparative Cost Analysis between UTACV, Rapid Rail, Bus & PRT

18. Distribution Statement: Approval for U.S. Government only. Transmittal of this document outside the U.S. Government must have prior approval of the Transportation Systems Center.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	56	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-UMTA-72-5		

4. Title and Subtitle	5. Report Date
REPORT ON SUBWAY TUNNELING NEEDS OF 13 SELECTED U.S. CITIES, 1971-75	June 15, 1972
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
William Van Dyke	
9. Performing Organization Name and Address	10. Work Unit No.
Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, Mass. 02143	R-2722
	11. Contract or Grant No.
	UM204
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Department of Transportation Urban Mass Transportation Administration Washington, D.C. 20590	Technical Report
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report establishes proposed subway tunneling construction needs for thirteen selected U.S. cities during 1971-75 as given by the transit authorities. This information will be used to estimate the demand for subway tunnel construction. This demand estimate is an important criterion in the generation of an UMTA R&D program in tunneling. With the knowledge of the estimated demand in dollars as a function of the various types of construction, e.g., hard rock, soft ground, cut and cover, (including a breakdown of cost by function, i.e. excavation, mucking, etc.) research requirements will be established.

17. Key Words	18. Distribution Statement
Tunnels, Subway	Approved for Urban Mass Transportation Administration only. Transmittal of this document outside must have prior approval of the TSC UM204 Program Manager.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	38	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Survey of Meteorological Remote Sensors		5. Report Date May 1971 6. Performing Organization Code T1
7. Author(s) A. E. Barrington		8. Performing Organization Report No. DOT-TSC-CG-71-1
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, MA 02142		10. Work Unit No. R1004 11. Contract or Grant No. CG04
12. Sponsoring Agency Name and Address United States Coast Guard 400 Seventh St., S.W. Washington, D.C. 20591		13. Type of Report and Period Covered Technical Memorandum 7/1/70-5/15/71 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The preliminary results of a survey are presented which identify techniques for determining meteorological data by remote sensing, applicable to automatic data buoy platforms. Both passive and active techniques are reviewed with emphasis on the former, in view of their more advanced development status. The principal references listed in the bibliography section of the memorandum indicate that experimental data to date have been obtained using only stable instrument platforms in a clean environment. Operation on unstable instrument platforms in the severe ocean environment requires further study.

17. Key Words	18. Distribution Statement
•Meteorology •Remote Sensing •Data Buoy •Instrumentation	Unclassified — Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		

TECHNICAL REPORT STANDARD TITL

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-CG-71-3		

4. Title and Subtitle	5. Report Date
Two Candidate Systems for Unmanned Fog Bank Detection	June 1971
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Jack R. Lifsitz and Hector C. Ingrao	
9. Performing Organization Name and Address	10. Work Unit No.
Transportation Systems Center 55 Broadway Cambridge, Ma. 02142	CG-02/99-712104
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
U.S. Coast Guard, DAT Washington, D.C. 20591	Technical Report
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The detection of coastal fog banks by remote sensing methods discussed. The feasibility of laser backscattering (LIDAR) and infrared radiometry is explored in detail. These techniques are analyzed theoretically and experimental data are presented support ing the analysis. A design study is carried out for several laser systems, considering safety, reliability, cost, convenience, efficiency and maximum range. A fog bank detector utilizing a GaA laser array is described which best satisfies these criteria. Befo the prototype design is selected, a brief *in situ* test program is recommended, using apparatus designed at the Transportation System Center under Contract No. CG-02/99-712104, with the U.S. Coast Guard. In addition to clarifying several critical questions under lying the LIDAR design, the proposed test program would allow further evaluation of the infrared radiometric method. The latter technique, if its reliability can be verified, offers the advantag of being simpler and less expensive for fog bank detection than th LIDAR method.

17. Key Words	18. Distribution Statement
• Fog Bank Detection • LIDAR • Aid-to-Navigation • Radiometer	Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		

Form DOT F 1700.7 (8-69)

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
TSC-USCG-71-7		

4. Title and Subtitle	5. Report Date
An Investigation of Oil Fluorescence as a Technique for the Remote Sensing of Oil Spills	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
John F. Fantasia Thomas M. Hard and Hector C. Ingrao	

9. Performing Organization Name and Address	10. Work Unit No.
DOT/Transportation Systems Center 55 Broadway Cambridge, Mass. 02142	71-CG03
	11. Contract or Grant No.
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address U.S. Coast Guard 400 Seventh St. S.W./DAT-4 Washington, D.C. 20591	Technical Progress Report - July 1,70 to June 30, 1971
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The feasibility of remote sensing of oil spills by laser-excited oil fluorescence is investigated. The required parameters are measured in the laboratory; these parameters are fed into a physical model to predict signal and background levels; and the predictions are verified by field experiments. Airborne detection, identification, and quantification of oil spills at sea are shown to be feasible with existing equipment, day or night.

17. Key Words	18. Distribution Statement
• Oil Spills • Oil, Remote Sensing • Oil Fluorescence • Laser	Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
UNCL	UNCL		

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-CG-72-1		

4. Title and Subtitle	5. Report Date
A Technique for Measuring the Behavior of a Navigational Buoy	Sept. 1971
	6. Performing Organization Code: TER
7. Author(s): L.V. Babb, R.W. Wilmarth	8. Performing Organization Report No.: DOT-TSC-CG-72-1
9. Performing Organization Name and Address: U.S. Department of Transportation, Transportation Systems Center, Cambridge, MA 02142	10. Work Unit No.: CG01
	11. Contract or Grant No.
12. Sponsoring Agency Name and Address: U.S. Department of Transportation, U.S. Coast Guard, Washington, DC 20591	13. Type of Report and Period Covered: Technical Report, Nov 1970-July 1971
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract: A prototype instrumentation system has been developed and fabricated to furnish stability information about a moored navigational buoy. The parameters necessary to define this stability are listed and the electro-mechanical transducers selected to measure these parameters are discussed. By utilizing a command and data transmission telemetry system, analog data were recorded and used to determine the types of instrumentation best suited to this application. A discussion of the results of testing and project recommendations conclude the report.

17. Key Words	18. Distribution Statement
Buoy Behavior Telemetry Control	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	118	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-USCG-72-2		

4. Title and Subtitle	5. Report Date
FOG BANK DETECTOR FIELD TESTS: A TECHNICAL SUMMARY	December 1971
	6. Performing Organization Code
7. Author(s) Jack R. Lifsitz, Melvin Y. Yaffee	8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway Cambridge, MA. 02142	10. Work Unit No. R-2003 11. Contract or Grant No. CG-202
12. Sponsoring Agency Name and Address Department of Transportation U.S. Coast Guard Washington, D.C. 20591	13. Type of Report and Period Covered Technical Report Sept.1971-Dec.1971 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract This report summarizes the results of field experiments performed at Pt. Bonita, California, under the auspices of the U.S. Coast Guard, to test certain technical and operational assumptions underlying the design of a fog bank detector. The system under study, a laser LIDAR and a vertical-scanning infrared radiometer, have been discussed in detail in Report No. DOT-TSC-CG-71-3. Measurements of the peak power and shape of the return LIDAR pulse, and of the background levels, support the assumptions made in that report. The largest value of background spectral radiance measured, when a sunlit cloud fills the LIDAR receiver field-of-view, is 2 $\mu w/cm^2/Å/sr$ (at 6943 Å). The infrared radiometer was found to be susceptible to ambiguities serious enough to eliminate this method from use as a reliable fog detector at the present time. Based on the laser backscatter results, a LIDAR fog bank detector, using a GaAlAs laser diode array as the transmitting source, is recommended and conclusions regarding its technical performance are presented.

17. Key Words	18. Distribution Statement
• Fog Bank Detection • LIDAR • Aid-to-Navigation • Radiometer	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	36	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-USCG-72-3		

4. Title and Subtitle	5. Report Date
USCG Pollution Abatement Program: A Preliminary Study of Vessel and Boat Exhaust Emissions	Nov. 30, 1971
	6. Performing Organization Code
7. Author(s) R.A. Walter, A.J. Broderick, J.C. Sturm, E.C. Klaubert	8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Transportation Transportation Systems Center 55 Broadway Cambridge, MA 02142	10. Work Unit No. R-2002
	11. Contract or Grant No. CG 207
12. Sponsoring Agency Name and Address Department of Transportation U.S. Coast Guard Washington, D.C. 20591	13. Type of Report and Period Covered Technical Report July 1971-Nov.1971
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract A preliminary study of exhaust emissions from Coast Guard vessels and boats indicates that the Coast Guard fleet is an insignificant contributor to air pollution on a national and regional basis. Based upon fuel usage data, emission estimates by vessel class were made for the entire Coast Guard fleet and compared to other sources of marine and land air pollution. No estimates of the effects on air quality of the two-stroke cycle outboard engine could be made due to the lack of reliable data on their emissions.

A general review of the existing air quality legislation pointed up the scarcity and contradictory nature of present laws as related to vessel emissions.

Existing monitoring instrumentation and emission control techniques were evaluated with consideration to their usefulness in a ship-board environment.

17. Key Words
Vessel and Boat Emissions
Marine Air Pollution
Coast Guard Fleet Emissions
Air Quality

18. Distribution Statement
Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	129	

Department of Transportation
TSC Contractor Reports

Unlimited Distribution Reports

ort No.	Title
-50	North Atlantic Satellite ATC Center Study Final Report
-93-1	Modeling of V/STOL Noise in City Streets
-98	Maritime Services Satellite System Definition Study
-103-71-1	Analysis of Terminal Air Traffic Controller Functions Volume I, Volume II: Appendices
-131-3	Airspace Control Environment Simulator Final Report
-141-1	Study of the Performance of a Vortex Monitoring System
-142-1	A Systematic Study of Supersonic Jet Noise
-167-(6)	A Scale Model Aircraft & Antenna Pattern Test Program
-171-1	Developments of Methods for Predicting Airloads on TACV Configurations Due to Strong Crosswind Gusts
-188-1	PWI Test and Development Resource Utilization
-188-2	PWI Systems Survey
-194-1	Analysis of Potential Noise Sources of Tracked Air Cushion Vehicles (TACV)
-203-2	Dynamic Braking of the Urban Tracked Air Cushion Vehicle
-212-72-1	Functional Error Analysis and Modeling for ATC Systems Concepts Evaluation
-235	High-Level Data Communication Control Procedures for Air Traffic Control, Computer-to-Computer Data Interchange
-251-1	Preliminary Operational Requirements and Acceptability Criteria for the Cooperative Breath Analyzer
-251-2	Field Test Plan for Evaluating the Cooperative Breath Analyzer
-251-3	Methodologies for Estimating the Effectiveness of Alcohol Safety Interlock Systems

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Report No.	Title
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TSC-304-1	Fourth Generation Air Traffic Control Study Volume II
TSC-304-1	Fourth Generation Air Traffic Control Study Volume III
TSC-304-1	Fourth Generation Air Traffic Control Study Volume IV
TSC-306-1	Study and Concept Formulation of a Fourth Generation Air Traffic Control System Volume I Study Report
TSC-306-1	Study and Concept Formulation of a Fourth Generation Air Traffic Control System Volume II Study Report
TSC-306-1	Study and Concept Formulation of a Fourth Generation Air Traffic Control System Volume III Study Report
TSC-306-1	Study and Concept Formulation of a Fourth Generation Air Traffic Control System Volume IV Study Report
TSC-306-1	Study and Concept Formulation of a Fourth Generation Air Traffic Control System Volume V Study Report
TSC-310-1	Light Rail Transit Systems a Definition and Evaluation
TSC-315-1	User's Manual for the Prediction of Road Traffic Noise Computer Program
TSC-319-1	Fifteen-One-to-Sixteen-Thirty Technical and Managerial Lessons from one Experience in Introducing New Technology to Improve Urban Mass Transportation
TSC-369-1	Survey of Stratospheric Chemical Dynamics
TSC-369-2	Problem Areas of Stratospheric Chemical Dynamics
TSC-369-3	Survey of Stratospheric Aircraft Make Chemical Dynamics
TSC-PR-TI-5732-1	An Introduction to Railroad Operations

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-50		

4. Title and Subtitle	5. Report Date
North Atlantic Satellite ATC Center Study Final Report	April 19, 1971
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No
	FSC-71-5033

9. Performing Organization Name and Address	10. Work Unit No.
Federal Systems Division International Business Machines Corporation Gaithersburg, Maryland	11. Contract or Grant No. DOT-TSC-50
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address Department of Transportation Transportation Systems Center 55 Broadway Cambridge, Massachusetts 02142	Final Report August 18, 1970 - April 19, 1971
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

A study of present oceanic ATC methods leads to the conclusion that ATC in the North Atlantic should continue to be based on an organized track concept in those areas where traffic densities are high. However, there is clearly a need to improve communications in the North Atlantic area, and a satellite system can provide both communications and surveillance services. The satellite oceanic control center (SOCC) described is highly automated. In implementing such a system it appears desirable initially to use surveillance data derived from the inertial navigation system (INS) and transmitted via data link to the control center. Subsequently, independent surveillance data could be implemented by a two-satellite tone ranging scheme, with the aircraft transponding encoded pressure altitude. The implementation data provided for the proposed SOCC includes data flow paths, sizing analysis, facility design, and staging plan.

17. Key Words	18. Distribution Statement
North Atlantic oceanic control center satellite system air traffic control	Availability is unlimited. Document may be released to the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia, 22151, for sale to the public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	297	

Form DOT F 1700.7 (8-69)

1. Report No. DOT-TSC-93-1	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle MODELING OF V/STOL NOISE IN CITY STREETS		5. Report Date 15 November 1971 6. Performing Organization Code
7. Author(s) Richard H. Lyon, Lalit Pande, Wayne A. Kinney		8. Performing Organization Report No.
9. Performing Organization Name and Address Department of Mechanical Engineering Massachusetts Institute of Technology Cambridge, Mass. 02139		10. Work Unit No. R-2519 11. Contract or Grant No. DOT-TSC-93
12. Sponsoring Agency Name and Address Office of Noise Abatement Department of Transportation Washington, D.C. 20591		13. Type of Report and Period Covered Contractor Report 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

The goals of this work were two-fold. First, to develop modeling techniques that will be helpful in studying a variety of noise propagation problems. These involve not only aircraft sources, but also surface traffic (automobiles, trucks, and rail vehicles) as well. The second and more narrow goal is the application of these modeling techniques to a specific problem, the propagation of V/STOL aircraft noise into an urban area.

Two particular flight-path-street-configuration situations were examined, using a 1:32 scale for the laboratory model. A steady-state aerodynamic noise source was used to simulate flyover noise. A second source for generating sound pulses was used for ray-tracing diagnoses.

The propagation effects of streets and buildings, which cause sound levels to differ from that in open flat terrain, are lumped together into a "Transmission Gain (TG)". A major part of the work reported here is the experimental evaluation of TG for various model configurations, flight paths, and microphone locations.

17. Key Words	18. Distribution Statement
• Noise levels • V/STOL noise • Noise propagation • Urban noise propagation	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
UNCLASSIFIED	UNCLASSIFIED	49	

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-98		

4. Title and Subtitle	5. Report Date
Maritime Services Satellite System Definition Study	1 August 1971
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No
B.A. Mendoza, D.C. Lawson G.P. Heckert, J. D. Luse	DOT-TSC-98

9. Performing Organization Name and Address	10. Work Unit No.
Automated Marine International 500 Newport Center Drive Newport Beach, California 92660	11. Contract or Grant No. DOT-TSC-98
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address Department of Transportation Transportation Systems Center 55 Broadway Cambridge, Massachusetts 02142	Final Report - November 17, 1970 - August 1, 1971
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report reviews the requirements for voice and data communications to and from merchant ships at sea, for the period through 1980, and concludes that a global coverage satellite system of three synchronous satellites, each with a 10 voice-channel capacity, will meet forecast requirements provided that a disciplined demand access scheme is implemented. The present spacecraft technology is reviewed and certain critical spacecraft subsystem design criteria are assessed. The shipboard terminal is reviewed in detail, and the basic design constraints are established. The report concludes that an independent maritime satellite communications system is not only feasible with today's technology but inevitable, and that final definition and design of appropriate hardware should be undertaken at once.

17. Key Words	18. Distribution Statement
Maritime Mobile/Satellite Communications Multiple Access/Ship Populations/ Search and Rescue/Shipboard SATCOM Terminals/Maritime Satellite/Satellite and User Equipment	Availability is unlimited. Document may be released to the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia, 22151, for sale to the public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	388	

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TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-103-71-1		

4. Title and Subtitle	5. Report Date
Analysis of Terminal Air Traffic Controller Functions Volume I Volume II: Appendices	May 1971 6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Noll, R. B.; Scully, J. J.; Simpson, R. W. and Zvara, J.	
9. Performing Organization Name and Address	10. Work Unit No.
Aerospace Systems, Inc. One Vine Brook Park Burlington, Massachusetts 01803	11. Contract or Grant No. DOT-TSC-103
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Department of Transportation Transportation Systems Center 55 Broadway Cambridge, Massachusetts 02142	Final Technical Report January - May 1971 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

Air traffic controller functions in the terminal area are described for both the second generation (present system) and third generation (ARTS) air traffic control (ATC) system. Logan International Airport, Boston, Massachusetts and Atlanta Airport, Atlanta, Georgia represent the second and third generations, respectively. Controller position functions are briefly described, and a detailed presentation of controller duties and responsibilities at each position is given for the selected ATC facilities.

Operational sequence narratives and diagrams are presented for typical single thread events at each facility. Real-life operational sequence diagrams are presented for each control position at Atlanta.

Areas of potential improvement in ATC are discussed briefly. Operational position profiles and operational sequence diagrams for an advanced system are derived from similar material for the third generation system. A Runway Schedule Display is proposed as a potential area of investigation.

Supplementary material is presented describing the alphanumeric display of ARTS I at Atlanta and the computer inputs by which the controller interfaces with ARTS I.

17. Key Words	18. Distribution Statement
Terminal air traffic control; Air traffic controller functions; Operational sequence diagrams; Advanced generation air traffic control; ARTS I	Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	Vol.I - 77 Vol.II - 175	

Form DOT F 1700.7 (8-69)

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-131-3		

4. Title and Subtitle	5. Report Date
AIRSPACE CONTROL ENVIRONMENT SIMULATOR - FINAL REPORT	DECEMBER 22, 1971
	6. Performing Organization Code
7. Author(s) F. Benham, A. Hatch, S. Kass	8. Performing Organization Report No.
9. Performing Organization Name and Address Raytheon Company Wayland, Massachusetts, 01778	10. Work Unit No.
	11. Contract or Grant No. DOT-TSC-131
12. Sponsoring Agency Name and Address Transportation Systems Center Department of Transportation Cambridge, Massachusetts, 02142	13. Type of Report and Period Covered Design Plan - Final Report
	14. Sponsoring Agency Code

15. Supplementary Notes

Deliverable Item # 14 under Contract DOT-TSC-131

16. Abstract

The Airspace Control Environment Simulator is a software system designed to operate within a PDP-10 computer in conjunction with a DDP-516/ADDS-900 graphic display system. Its purpose is to provide the capability to conduct interactive experiments to explore the feasibility of new concepts for ATC automation. The simulation system design is described and operating procedures are provided for those who may wish to use the system. Complete program listings, principally in FORTRAN, are provided.

17. Key Words	18. Distribution Statement
Simulation ATC Experiments	Unclassified - Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	233	

1. Report No. DOT-TSC-141-1	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle STUDY OF THE PERFORMANCE REQUIREMENTS OF A VORTEX MONITORING SYSTEM - FINAL REPORT		5. Report Date March 1972 6. Performing Organization Code
7. Author(s) Roger W. Goff		8. Performing Organization Report No.
9. Performing Organization Name and Address Raytheon Company Advanced Development Laboratories, Equipment Div. Sudbury, MA 01776		10. Work Unit No. R2106 11. Contract or Grant No. DOT-TSC-141
12. Sponsoring Agency Name and Address Department of Transportation Transportation Systems Center Cambridge, MA 02142		13. Type of Report and Period Covered Technical Report March 1971- March 1972 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This study involved four basic task items. The first was a general review of the characteristics of trailing vortex wakes. The second task item involved the generation of envelopes showing the expected vortex drift for the Boeing 747 and 727 aircraft. The third task item was an investigation of the environmental factors with which a vortex monitoring system would interact. The final task item was the application of the vortex drift data and operational usage considerations to the investigation of the performance requirements for a vortex monitoring system.

17. Key Words

Vortex
Meterology

18. Distribution Statement

Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	133	

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-142-1		

4. Title and Subtitle	5. Report Date
A Systematic Study of Supersonic Jet Noise	December 1971
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Jean F. Louis	
9. Performing Organization Name and Address	10. Work Unit No.
Department of Aeronautics and Astronautics Massachusetts Institute of Technology Cambridge, MA 02139	R-2519
	11. Contract or Grant No.
	DOT-TSC-142
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Office of Noise Abatement Department of Transportation Washington, D.C. 20590	Final Report
	14. Sponsoring Agency Code
15. Supplementary Notes	

16. Abstract

The purpose of this work is to study the acoustic fields associated with two different nozzle configurations; a rectangular and a circular. Both nozzles are designed with the same exit Mach number and have an identical momentum and energy flux..

The other main aim of this study is to establish scaling laws of supersonic jet noise. A shock tube is a very versatile apparatus for such an analysis. A short test time allows the use of a heat sink nozzle and eliminates the use of an anechoic chamber. So far tests have been made in the range of 1000-5000°R, for different levels of expansion and an exit Mach number of 2.7. In comparing the two nozzles, it is found that the rectangular nozzle is indeed quieter than the circular nozzle. The low acoustic efficiency of the over-expanded rectangular jet is related to a rapid deceleration of the jet through a system of strong shocks. At high temperature, this effect is not observed because an important density ratio exists across the shear layer which becomes very unstable due to the Taylor instability.

For both the circular and rectangular nozzle, the effect of temperature showed an increase in the directivity angle at high temperature which is correlated to an increase in eddy convective velocity, rather than refraction due to density gradients, which seems to play a secondary role.

The low temperature overexpanded jet showed a difference of about 2.6 db in the OPWL between the two nozzles. However, at this condition, for the rectangular nozzle, a difference of 8 db between the maximum and minimum noise direction is observed.

17. Key Words	18. Distribution Statement
Supersonic Jet noise Axisymmetric nozzle Turbulent mixing Rectangular nozzle Shock unsteadiness Mach wave Turbulence shock interaction	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
unclassified	unclassified	64	

Form DOT F 1700.7 (8-69)

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT/TSC-167-(6)		

4. Title and Subtitle	5. Report Date
A SCALE MODEL AIRCRAFT & ANTENNA PATTERN TEST PROGRAM	November 15, 1971
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
William J. McCabe	
9. Performing Organization Name and Address	10. Work Unit No.
DIAMOND ANTENNA & MICROWAVE CORP. 35 RIVER STREET WINCHESTER, MASSACHUSETTS 01890	R2523
	11. Contract or Grant No. DOT/TSC-167
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
U.S. DEPARTMENT OF TRANSPORTATION TRANSPORTATION SYSTEMS CENTER CAMBRIDGE, MASSACHUSETTS 02142	April 71-Nov. 1971 Technical Report
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract This final report describes the program activity, coordinate systems, axes of rotation, and electromagnetic radiation patterns measured for flush mounted circularly polarized slot antennas installed in a 1/10th scale model of a Convair 880 aircraft. Pattern coverage was measured for five (5) locations of the antenna elements in the fuselage using a circularly polarized transmitting antenna. Polarization ratios were measured for a zenith pointing antenna over a 45° conical sector about the zenith direction $\theta = 0°$. The model aircraft construction and the antenna elements are also described. Punched paper binary coded tapes are attached as a separate package, and the tape punched hole schematic is described herein.

17. Key Words	18. Distribution Statement
Aircraft Antennas: Model Aircraft: Polarization: Antenna Coverage: Aerosat Sys: Aircraft Antenna Location	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
UNCLASSIFIED	UNCLASSIFIED	111	

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-171-1		

4. Title and Subtitle	5. Report Date
Development of Methods for Predicting Airloads on TACV Configurations Due to Strong Cross-Wind Gusts	March 27, 1972
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
J. Ray Ruetenik and Garabed Zartarian	KA TR-76
9. Performing Organization Name and Address	10. Work Unit No.
Kaman AviDyne 83 Second Avenue N.W. Industrial Park Burlington, Ma. 01803	11. Contract or Grant No. DOT-TSC-171
	13. Type of Report and Period Covered Interim Report
12. Sponsoring Agency Name and Address Department of Transportation Transportation Systems Center (TSC) Cambridge, MA 02142	14. Sponsoring Agency Code DOT/TSC

15. Supplementary Notes

16. Abstract Equations for predicting the transient side force and yawing moment on TACV cars due to a strong side gust are developed. The protection afforded by side rails is estimated. The equations account for transient slender-body effects and growth of vortices on the lee side. For a vehicle speed of 150 mph, the analysis indicates a side gust of 60 mph would produce a transient peak in side force of 1x the steady-state value for the first car to 4.3x for the third car. An unresolved uncertainty of a factor of two in predicting the steady-state side force on TACV models in wind-tunnel tests with a moving ground plane is attributed to flow effects between the vehicle bottom and the ground plane.

Because of questions regarding ground-plane simulation in wind-tunnel tests, effect of side rails on gust airloads, and the airloads due to passing trains, the feasibility of developing a facility for measuring forces and moments on moving models ie explored. It is concluded that a laboratory facility with a 25-30 ft track for testing 1-ft length models at 100 fps would provide useful data; principal development problems would be associated with model-support vibration and model-balance measurement. A larger facility with a 120-140 ft track for testing 4-5 ft length models would provide good Reynolds-number simulation, readily met model guideway tolerance requirements and greater ease of measurement.

17. Key Words	18. Distribution Statement
Tracked Air Cushion Vehicles Crosswinds Gust Loadings	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	106	

Form DOT F 1700.7 (8-69)

1. Report No. DOT-TSC-188-1	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle PWI TEST AND DEVELOPMENTAL RESOURCE UTILIZATION		5. Report Date 15 November 1971 6. Performing Organization Code
7. Author(s) Neal A. Carlson, Peter A. Grundy, H.R. Morth, E.M. Copps, J.H. Flanders		8. Performing Organization Report No.
9. Performing Organization Name and Address Intermetrics, Incorporated 701 Concord Avenue Cambridge, Mass. 02138		10. Work Unit No. R2150 11. Contract or Grant No. DOT-TSC-188
12. Sponsoring Agency Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, Mass. 02142		13. Type of Report and Period Covered Final Report Apr.-Nov. 1971 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract This report documents a study performed for TSC in support of its test and evaluation program for optical-infrared PWI systems, the primary objectives of the study being to assess the utility of existing test facilities and evaluation tools, and to identify the need for modifications or additions to these. The major physical characteristics of the Fecker and Loral PWI systems are described, and an analytic model presented for the incident radiant power received by the PWI device, including atmospheric transmission effects. The laboratory, ground, and flight test programs for optical-IR PWI systems conducted by TSC and (earlier) NASA/ERC are examined, including the objectives, test equipment and procedures, data analysis, and results of each. The utility of cockpit simulation facilities is assessed, in particular the TSC and MIT GAT-1's and the CDC slide projection system sponsored by FAA. The CASTE digital computer program for simulating PWI performance in selected air traffic environments is evaluated and modifications suggested. The results of a survey of PWI-related research are discussed and areas for further work noted. Finally, a status summary of the available PWI facilities and tools is provided, and the major conclusions and recommendations of the study presented.

17. Key Words	18. Distribution Statement
Electro-optical PWI Test programs Simulation facilities Evaluation tools	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	228	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-188-2		

4. Title and Subtitle	5. Report Date
PWI SYSTEMS SURVEY	15 November 1971
	6. Performing Organization Code
7. Author(s) James H. Flanders, Peter A. Grundy, Neal A. Carlson	8. Performing Organization Report No.
9. Performing Organization Name and Address Intermetrics Incorporated 701 Concord Avenue Cambridge, Mass. 02138	10. Work Unit No. R2150
	11. Contract or Grant No. DOT-TSC-188
12. Sponsoring Agency Name and Address Department of Transportation Transportation Systems Center 55 Broadway, Cambridge, Mass. 02142	13. Type of Report and Period Covered Final Report Apr.-Nov. 1971
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract This survey report presents a compilation, classification, and review of 176 documents related to PWI and CAS research and development. The selection of documents emphasizes those published from 1968 to the present, although earlier significant documents are included. Subject categories include: CAS System References; PWI System References; Proceedings and Literature Searches; Facilities and Programs; and Atmospheric Physics. A multi-dimensional classification code for CAS and PWI systems is developed and applied to candidate systems revealed during the survey. Written reviews of documents vary from a few lines to 2 or 3 pages, and are grouped according to subject.

17. Key Words	18. Distribution Statement
Pilot warning indicators Collision avoidance systems Annotated bibliography Literature survey	Availability is Unlimited. Document may be Released To the National Technical Information Service, Springfield, Virginia 22151, for Sale to the Public.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	156	

1. Report No. DOT-TSC-194-1	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Analysis of Potential Noise Sources of Tracked Air Cushion Vehicles (TACV)		5. Report Date July 1971 6. Performing Organization Code 2178
7. Author(s) E.K. Bender, R.E. Hayden and H.H. Heller		8. Performing Organization Report No. UM-01
9. Performing Organization Name and Address Bolt Beranek and Newman Inc. 50 Moulton Street Cambridge, Mass. 02138		10. Work Unit No. DOT-TSC-194 11. Contract or Grant No.
12. Sponsoring Agency Name and Address Urban Mass Transportation Administration 400 Seventh Street Washington, DC 20580		13. Type of Report and Period Covered Contractor Report 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

This report presents an evaluation of the principal sources of noise from tracked air cushion vehicles (TACVs). The study is based on analyses of and laboratory experiments on existing TACVs and rapid transit systems.

Measurements of two French TACV systems were conducted, one a 44-passenger prototype suburban vehicle propelled by a linear induction motor (LIM), and the second an 80-passenger intercity vehicle powered by a gas turbine and shrouded pusher propeller.

Noise levels from a slider current-collection system were also obtained through measurements of the noise and vibration of a third-rail contact shoe on a rail rapid transit car.

17. Key Words	18. Distribution Statement
Noise levels, Tracked Air Cushion Vehicles, Compressor Noise, Aerodynamic Noise, Linear Induction Motor Noise, Current-Collection noise.	Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
UNCLASSIFIED	UNCLASSIFIED	104	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-203-2		

4. Title and Subtitle	5. Report Date
Dynamic Braking of the Urban Tracked Air Cushion Vehicle	September 1971
	6. Performing Organization Code
7. Author(s) Alexander Kusko, Thorleif Knutrud, John J. Cain	8. Performing Organization Report No. DOT-TSC-203-2
9. Performing Organization Name and Address Alexander Kusko, Inc. 161 Highland Ave. Needham Heights, Mass. 02194	10. Work Unit No. R2709 - UM201 11. Contract or Grant No. DOT/TSC-203 13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address Department of Transportation Transportation Systems Center Cambridge, MA 02142	Technical Report 14. Sponsoring Agency Code

15. Supplementary Notes Prepared under Contract No. DOT-TSC-203 and Technical Directive DOT-TSC-203-2 for Frank L. Raposa, code TMP Technical Monitor U.S. DOT, TSC, Cambridge, Mass. 02142

16. Abstract

The linear induction motor for the Urban Tracked Air Cushion vehicle, proposed by both Rohr and LTV, will be used for dynamic braking by exciting the winding the direct current. Effective braking will be obtained using the reaction rail as the energy sink from 150 mph down to 20 to 30 mph, at which speed the mechanical brakes will be blended in. This report is a study of various concepts for implementing dynamic braking and includes a battery system, a battery chopper system, and a transformer-rectifier system. A comparison of battery-operated systems with a direct transformer-rectifier system shows that the transformer-rectifier is considerably lighter and adequate for the application. The estimated weight is 406 pounds.

17. Key Words	18. Distribution Statement
Electric Propulsion Electric Braking	Approved for U.S. Government only. Transmittal of this document outside the U.S. Government must have prior approval of the TSC.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	61	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-212-72-1		

4. Title and Subtitle	5. Report Date
Functional Error Analysis and Modeling for ATC System Concepts Evaluation	May 1972
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
William C. Hoffman, Walter M. Hollister (MIT), Robert W. Simpson (MIT)	ASI-TR-72-9

9. Performing Organization Name and Address	10. Work Unit No.
Aerospace Systems, Inc. One Vine Brook Park Burlington, Massachusetts 01803	11. Contract or Grant No. DOT-TSC-212
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address	Final Technical Report May 1971 through May 19
Transportation Systems Center 55 Broadway Cambridge, Massachusetts 02142	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

A functional error analysis and modeling study of the air traffic control (ATC) system is described. The work was performed to support the ATC system concepts evaluation program of the Transportation Systems Center (TSC), which will be conducted on their Multi-Modal Transportation System Simulation. The dominant functional error sources in the ATC system are identified and models of these errors are developed for implementation in the TSC simulation. The models are constructed to be as realistic as possible without placing excessive computational requirements on their realization. The models were developed in four categories: target dynamics, air data system, navigation systems and surveillance systems. The simulation wind model was also improved. The performance of the altitude, airspeed and heading command loops in the target dynamics model were numerically verified by digital computer simulation.

17. Key Words	18. Distribution Statement
Air traffic control, error analysis, error models, simulation, target dynamics, air data system, navigation systems, surveillance systems.	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	98	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle High Level Data Communication Control Procedures for Air Traffic Control, Computer-to-Computer Data Interchange		5. Report Date September, 1971 6. Performing Organization Code
7. Author(s) Robert E. Huettner, Edward B. Tymann		8. Performing Organization Report No.
9. Performing Organization Name and Address Honeywell, Inc. 2 Forbes Road, Lexington, Massachusetts 02173		10. Work Unit No. 11. Contract or Grant No. DOT-TSC-235
12. Sponsoring Agency Name and Address Transportation Systems Center 55 Broadway Cambridge, Mass. 02142		13. Type of Report and Period Covered Final Technical Report April-September 1971 14. Sponsoring Agency Code TC

15. Supplementary Notes

16. Abstract

This document defines link communication control procedures for ATC computer-to-computer data interchange, via point-to-point, full duplex communication links. These ATC control procedures have been developed to satisfy all requirements of the ATC computer data link environment, as established by ICAO ADIS Panel Working Groups 1 and 2.

These ATC control procedures are based on ISO draft proposal HDLC bit-oriented control procedures, but are not totally consistent with HDLC for reasons outlined in this document. The concept of balanced system operation is introduced as a basis for applying bit-oriented control procedures to the ATC system.

This document includes a complete definition of all required control procedure elements and also illustrates data transfer examples using ATC control procedures.

17. Key Words	18. Distribution Statement		
Air traffic control Control procedures Data communication Data interchange			
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 56	22. Price

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-251-1		

4. Title and Subtitle	5. Report Date
Preliminary Operational Requirements and Acceptability Criteria for the Cooperative Breath Analyzer	September 1971
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Oates, J. F. Jr., Jacobs, H. H.	ED-71-30
9. Performing Organization Name and Address	10. Work Unit No.
Dunlap and Associates, Inc. One Parkland Drive Darien, Conn. 06820	HS202
	11. Contract or Grant No.
	DOT-TSC-251
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
National Highway Traffic Safety Administration 400 Seventh St., S.W. Washington, D.C. 20591	Technical
	14. Sponsoring Agency Code
	NHTSA 43-43

15. Supplementary Notes

16. Abstract

This report presents a series of criteria and requirements relevant to establishing user acceptability for the cooperative alcohol analyzer being developed by the Transportation Systems Center.

The information presented herein was obtained with the cooperation of police officials, judicial personnel, Alcohol Safety Action Project (ASAP) officials and government officials

17. Key Words	18. Distribution Statement
Alcohol measurements Alcohol breath testing	Limited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	22	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-251-2		

4. Title and Subtitle	5. Report Date
Field Test Plan for Evaluating the Cooperative Breath Analyzer	September 1971
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Oates, J. F. Jr., Jacobs, H. H.	ED-71-32
9. Performing Organization Name and Address	10. Work Unit No.
Dunlap and Associates, Inc. One Parkland Drive Darien, Conn. 06820	HS202
	11. Contract or Grant No.
	DOT-TSC-251
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
National Highway Traffic Safety Administration 400 Seventh St., S.W. Washington, D.C. 20591	Technical
	14. Sponsoring Agency Code
	NHTSA 43-43

15. Supplementary Notes

16. Abstract

This report provides basic inputs to the Transportation Systems Center for their continuing development and evaluation of cooperative breath analyzers. Its primary purpose is to indicate a number of potential field test sites and to describe various available testing modalities.

17. Key Words	18. Distribution Statement
Alcohol measurements Alcohol breath testing	Limited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	48	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-251-3		

4. Title and Subtitle	5. Report Date
METHODOLOGIES FOR ESTIMATING THE EFFECTIVENESS OF ALCOHOL SAFETY INTERLOCK SYSTEMS	November 1971
	6. Performing Organization Code
7. Author(s) John F. Oates Jr., Robert T. McCay	8. Performing Organization Report No.
9. Performing Organization Name and Address Dunlap and Associates, Inc. One Parkland Drive Darien, Connecticut 06820	10. Work Unit No. HS202
	11. Contract or Grant No. DOT-TSC-251
12. Sponsoring Agency Name and Address Department of Transportation Transportation Systems Center Cambridge, MA. 02142	13. Type of Report and Period Covered Technical Report
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report provides methods and techniques to the Transportation Systems Center to support evaluation of Alcohol Safety Interlock Systems presently under development.

17. Key Words	18. Distribution Statement
Alcohol Measurements Measures of Effectiveness	Approved for U.S. Government only. Transmittal of this document outside of the U.S. Government must have prior approval of TSC.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	49	

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Fourth Generation Air Traffic Control Study - Summary		5. Report Date June 1972 6. Performing Organization Code DOT-TSC-304-1
7. Author(s) Autonetics		8. Performing Organization Report No.
9. Performing Organization Name and Address Autonetics 3370 Miraloma Avenue Anaheim, California 92803		10. Work Unit No. 11. Contract or Grant No. DOT-TSC-304-1
12. Sponsoring Agency Name and Address Department of Transportation Transportation Systems Center Cambridge, Mass. 02142		13. Type of Report and Period Covered Final Technical Report 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract A study and analysis was conducted to extend the work of the Air Traffic Control Advisory Committee in defining a Fourth Generation Air Traffic Control System capable of safe and economical management of CONUS and oceanic air traffic in the post 1990 time period. The analysis considered several candidate systems capable of managing air traffic over a wide variety of operational conditions. The relative advantages and disadvantages of each were identified and compared with the Upgraded Third Generation Air Traffic Control System. Technology requirements for the new concepts were identified and a development plan established.

17. Key Words	18. Distribution Statement		
Air Traffic Control, Satellite Systems, Airspace Structure, Systems Analysis, Operations Analysis	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.		
19. Security Classif. (of this report) UNCLASSIFIED	20. Security Classif. (of this page) UNCLASSIFIED	21. No. of Pages	22. Price

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Fourth Generation Air Traffic Control Study - Volume II		5. Report Date June 1972 6. Performing Organization Code DOT-TSC-304-1
7. Author(s) Autonetics		8. Performing Organization Report No.
9. Performing Organization Name and Address Autonetics 3370 Miraloma Avenue Anaheim, California 92803		10. Work Unit No. 11. Contract or Grant No. DOT-TSC-304-1
12. Sponsoring Agency Name and Address Department of Transportation Transportation Systems Center Cambridge, Mass. 02142		13. Type of Report and Period Covered Final Technical Report 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract A study and analysis was conducted to extend the work of the Air Traffic Control Advisory Committee in defining a Fourth Generation Air Traffic Control System capable of safe and economical management of CONUS and oceanic air traffic in the post 1990 time period. The analysis considered several candidate systems capable of managing air traffic over a wide variety of operational conditions. The relative advantages and disadvantages of each were identified and compared with the Upgraded Third Generation Air Traffic Control System. Technology requirements for the new concepts were identified and a development plan established.

17. Key Words	18. Distribution Statement		
Air Traffic Control, Satellite Systems, Airspace Structure, Systems Analysis, Operations Analysis	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.		
19. Security Classif. (of this report) UNCLASSIFIED	20. Security Classif. (of this page) UNCLASSIFIED	21. No. of Pages	22. Price

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Fourth Generation Air Traffic Control Study - Volume III		5. Report Date June 1972 6. Performing Organization Code DOT-TSC-304-1
7. Author(s) Autonetics		8. Performing Organization Report No.
9. Performing Organization Name and Address Autonetics 3370 Miraloma Avenue Anaheim, California 92803		10. Work Unit No. 11. Contract or Grant No. DOT-TSC-304-1 13. Type of Report and Period Covered Final Technical Report
12. Sponsoring Agency Name and Address Department of Transportation Transportation Systems Center Cambridge, Mass. 02142		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract A study and analysis was conducted to extend the work of the Air Traffic Control Advisory Committee in defining a Fourth Generation Air Traffic Control System capable of safe and economical management of CONUS and oceanic air traffic in the post 1990 time period. The analysis considered several candidate systems capable of managing air traffic over a wide variety of operational conditions. The relative advantages and disadvantages of each were identified and compared with the Upgraded Third Generation Air Traffic Control System. Technology requirements for the new concepts were identified and a development plan established.

17. Key Words	18. Distribution Statement		
Air Traffic Control, Satellite Systems, Airspace Structure, Systems Analysis, Operations Analysis	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD VIRGINIA 22151		
19. Security Classif. (of this report) UNCLASSIFIED	20. Security Classif. (of this page) UNCLASSIFIED	21. No. of Pages	22. Price

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Fourth Generation Air Traffic Control Study - Volume IV		5. Report Date June 1972 6. Performing Organization Code DOT-TSC-304
7. Author(s) Autonetics		8. Performing Organization Report No.
9. Performing Organization Name and Address Autonetics 3370 Miraloma Avenue Anaheim, California 92803		10. Work Unit No. 11. Contract or Grant No. DOT-TSC-304
12. Sponsoring Agency Name and Address Department of Transportation Transportation Systems Center Cambridge, Mass. 02142		13. Type of Report and Period Covered Final Technical Report 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract A study and analysis was conducted to extend the work of the Air Traffic Control Advisory Committee in defining a Fourth Generation Air Traffic Control System capable of safe and economical management of CONUS and oceanic air traffic in the post 1990 time period. The analysis considered several candidate systems capable of managing air traffic over a wide variety of operational conditions. The relative advantages and disadvantages of each were identified and compared with the Upgraded Third Generation Air Traffic Control System. Technology requirements for the new concepts were identified and a development plan established.

17. Key Words	18. Distribution Statement		
Air Traffic Control, Satellite Systems, Airspace Structure, Systems Analysis, Operations Analysis	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.		
19. Security Classif. (of this report) UNCLASSIFIED	20. Security Classif. (of this page) UNCLASSIFIED	21. No. of Pages	22. Price

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-306-1		

4. Title and Subtitle	5. Report Date
Study and Concept Formulation of a Fourth-Generation Air Traffic Control System Volume I -Study Report	April 1972
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No. D6-26058-1
9. Performing Organization Name and Address The Boeing Company Commercial Airplane Group P.O. Box 3707 Seattle, Washington 98124	10. Work Unit No.
	11. Contract or Grant No. DOT-TSC-145 and -306
12. Sponsoring Agency Name and Address Department of Transportation Transportation Systems Center Cambridge, Massachusetts 02142	13. Type of Report and Period Covered Final Report
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

The operational concept, projected passenger demand, ATC system performance tradeoff data, and subsystem technological alternatives were evaluated to select the two most promising candidate systems for a fourth-generation (1995) ATC system. These two candidates and the upgraded third-generation system were then compared and a final recommended fourth-generation ATC system selected. The recommended system was described as to technology, operation, implementation plan, and required research and development.

17. Key Words	18. Distribution Statement
Air traffic control, ATC, future ATC system, fourth-generation ATC system, air transportation, passenger demand, communications, data acquisition, data processing, navigation, guidance, airports, aircraft.	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		

Form DOT F 1700.7 (8-69)

TECHNICAL REPORT STANDARD TITLE PAGE

1 Report No	2 Government Accession No	3 Recipient's Catalog No
DOT-TSC-306-1		

4 Title and Subtitle	5 Report Date
Study and Concept Formulation of a Fourth Generation Air Traffic Control System volume II Technological Alternatives	April 1972
	6 Performing Organization Code
7 Author(s)	8 Performing Organization Report No D6-26058-2
9 Performing Organization Name and Address The Boeing Company Commercial Airplane Group P.O. Box 3707 Seattle, Washington 98124	10 Work Unit No 11 Contract or Grant No DOT-TSC-145 and DOT-TSC-306
12 Sponsoring Agency Name and Address **Department of Transportation** Transportation Systems Center Cambridge, Massachusetts 02142	13 Type of Report and Period Covered **Final Report** 14 Sponsoring Agency Code

15 Supplementary Notes

16 Abstract

This document presents the results of studies of alternative subsystem approaches applicable to the Fourth Generation Air Traffic Control System. Equipment currently in operation, that planned for near future implementation and various techniques proposed as possible future solutions to ATC requirements are included. Numerous ground-based and satellite-borne systems are discussed for providing the required navigation, surveillance, and communications functions. In addition the ground-based data processing and control equipment along with the required airborne equipment are treated.

These subsystem alternatives have been evaluated to provide a meaningful measure of their merits and where appropriate, future performance improvement levels have been postulated. This information forms the data base from which candidate ATC systems were selected as described in Volume IV - System Selection.

17 Key Words	18 Distribution Statement
Air Traffic Control, Air Navigation, Aircraft Surveillance, Communications, Data Link, Satellite Systems, Aircraft Guidance, Automatic Landing, Data Processing, Display Devices	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19 Security Classif (of this report)	20 Security Classif (of this page)	21 No of Pages	22 Price
Unclassified	Unclassified		

Form DOT F 1700.7 (8-69)

TECHNICAL REPORT STANDARD TITLE PAGE

1 Report No	2 Government Accession No	3 Recipient's Catalog No
DOT-TSC-306-1		

4 Title and Subtitle	5 Report Date
Study and Concept Formulation of a Fourth Generation Air Traffic Control System Volume III Demand and Trade Studies	April 1972
	6 Performing Organization Code
7 Author(s)	8 Performing Organization Report No
	D6-26058-3
9 Performing Organization Name and Address	10 Work Unit No
The Boeing Company Commercial Airplane Group P.O. Box 3707 Seattle, Washington 98124	11 Contract or Grant No DOT-TSC-145 and DOT-TSC-306
	13 Type of Report and Period Covered
12 Sponsoring Agency Name and Address	Final Report
Department of Transportation Transportation Systems Center Cambridge, Massachusetts 02142	14 Sponsoring Agency Code

15 Supplementary Notes

16 Abstract

Techniques and resulting data are developed in the areas of demand, data acquisition, traffic management, and communications. Each ares is subdivided to reflect the geographical region of operation as oceanic, domestic enroute, terminal area, and airport. ATC performance tradeoff information is developed parametrically to encompass a wide range of possibilities for the 1995 time period.

Data are presented for STOL, CTOL, and SST/CTOL airplane mix configurations. Separation criteria to meet potential demands, resulting impact on safety, and required improvements for surveillance, navigation, procedure, and communications are included. The effect of airport and runway splits are discussed and parallel runway separation requirements are analyzed. Various mixes of voice and digital communications are considered. Principal computer models used in this study are discussed.

17 Key Words	18 Distribution Statement
Air Traffic Control, ATC Performance Trade Studies, Airport Operations Analysis, Runway Acceptance Rates, Queuing Analysis, Airplane Traffic Projections, Computer Modeling	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19 Security Classif (of this report)	20 Security Classif (of this page)	21 No of Pages	22 Price
Unclassified	Unclassified		

Form DOT F 1700.7 (8-69)

TECHNICAL REPORT STANDARD TITLE PAGE

1 Report No	2 Government Accession No	3 Recipient's Catalog No
DOT-TSC-306-1		

4 Title and Subtitle	5 Report Date
Study and Concept Formulation Fourth Generation Air Traffic Control System Volume IV System Selection	April 1972
	6 Performing Organization Code
	8 Performing Organization Report No D6-26058-4
9 Performing Organization Name and Address The Boeing Company Commercial Airplane Group P.O. Box 3707 Seattle, Washington 98124	10 Work Unit No
	11 Contract or Grant No DOT-TSC-145 and DOT-TSC-306
12 Sponsoring Agency Name and Address Department of Transportation Transportation Systems Center Cambridge, Massachusetts 02142	13 Type of Report and Period Covered Final Report
	14 Sponsoring Agency Code

15 Supplementary Notes

16 Abstract

This volume describes the methodology used in selecting a fourth generation Air Traffic Control System consistent with U.S. air transportation needs in 1995, and provides a summary of the results. It includes the derivation and use of the computerized evaluation model, including the computer program for its implementation; the cost model and supporting cost data; implementation plans; the initial and final system selection processes and results; and recommendations for further study.

17 Key Words	18 Distribution Statement
Air Traffic Control, System Synthesis, Evaluation Model, Implementation Plan, Cost Estimation, Weighting Functions	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19 Security Classif (of this report)	20 Security Classif (of this page)	21 No of Pages	22 Price
Unclassified	Unclassified		

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TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. DOT - TSC - 306 - 1	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Study and Concept Formulation of a Fourth-Generation Air Traffic Control System Volume V - Recommended Research and Development		5. Report Date April 1972 6. Performing Organization Code
7. Author(s)		8. Performing Organization Report No. D6-26058-5
9. Performing Organization Name and Address The Boeing Company Commercial Airplane Group P.O. Box 3707 Seattle, Washington 98124		10. Work Unit No. 11. Contract or Grant No. DOT-TSC-145 and -306 13. Type of Report and Period Covered Final Draft
12. Sponsoring Agency Name and Address Department of Transportation Transportation Systems Center Cambridge, Massachusetts 02142		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

Research and development needed to support the fourth-generation ATC system implementation is described in this volume. A methodology and program plan for operational concept evaluation, a requirements plan for a surface guidance system, and a testing and evaluation schedule for subsystem technical feasibility are described. The impact of future developments on subsystem changes and overall system characteristics is described. Finally, the time phasing of system implementation is also discussed together with the basic criteria used in ATC implementation planning.

17. Key Words	18. Distribution Statement
Air traffic control, ATC, future ATC system, fourth-generation ATC system, air transportation, passenger demand, communications, data acquisition, data processing, navigation, guidance, airports, aircraft.	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	170	

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1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT-TSC-310-1		

4. Title and Subtitle	5. Report Date
LIGHT RAIL TRANSIT SYSTEMS - A DEFINITION AND EVALUATION	October 1972
	6. Performing Organization Code: PER
7. Author(s) Dr. Vukan R. Vuchic, Assoc. Prof. of Transport Engrg., Univ. of Pennsylvania	8. Performing Organization Report No.: DOT-TSC-310-1
9. Performing Organization Name and Address: Dr. Vukan R. Vuchic, 222 Moylan Avenue, Moylan, Pa. 19065	10. Work Unit No.: R3750 UM304
	11. Contract or Grant No.: DOT-TSC-310
12. Sponsoring Agency Name and Address: Department of Transportation, Urban Mass Transportation Administration, Office of Research, Development and Demonstra., Washington, D.C. 20590	13. Type of Report and Period Covered: FINAL REPORT
	14. Sponsoring Agency Code
15. Supplementary Notes	

16. Abstract

Rail transit represents a family of modes ranging from light rail to regional rapid transit systems and it can be utilized in a number of different cities and types of applications.

Many European cities of medium size employ very successfully light rail mode for gradual upgrading of transit service into partially or fully separated high speed, reliable transit systems. Analysis of these cities show that with population densities and auto ownership very similar to those in the United States cities, their transit systems offer a superior service and have much better usage than our cities.

Many modern features of light rail technology are not known in this country. Wider use of different rail systems, greatly increased transit financing, introduction of more qualified personnel into transit industry and improved transit planning and implementation procedures are recommended to close the gap in urban transportation between some more progressive European cities and their counterparts in this country.

17. Key Words	18. Distribution Statement
• Light rail transit systems • Urban rail • Rail transit • Public transportation	DOCUMENT IS AVAILABLE TO THE PUBLIC THROUGH THE NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VIRGINIA 22151.

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4. Title and Subtitle	5. Report Date
USER'S MANUAL FOR THE PREDICTION OF ROAD TRAFFIC NOISE COMPUTER PROGRAM	May 1972
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
U.J. Kurze, W.H. Levison, S. Serben	DOT-TSC-3154
9. Performing Organization Name and Address	10. Work Unit No.
Bolt Beranek and Newman, Inc., 50 Moulton Street Cambridge, MA 02138	R-2519
	11. Contract or Grant No. OS-207
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12. Sponsoring Agency Name and Address	Final Report
Department of Transportation Office of the Secretary Office of Noise Abatement Washington, DC 20590	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This manual is a guide for using a computer program for prediction of noise from freely flowing road traffic. The program is written in FORTRAN IV for use on the IBM-7094 computer at the Transportation Systems Center.

The manual consists of four parts. In the introduction, the limitations of the computer model are described. In the second part, acoustical properties of the traffic and sound propagation model are developed, and the analytical expressions used in the computer program are described. The third part contains a description of the structure of the computer program, and of the detailed calculation procedures. The fourth part gives practical guidelines for use of the computer program.

17. Key Words	18. Distribution Statement
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FIFTEEN-OH-ONE TO SIXTEEN-THIRTY TECHNICAL AND MANAGERIAL LESSONS FROM ONE EXPERIENCE IN INTRODUC- NEW TECHNOLOGY TO IMPROVE URBAN MASS TRANSPORTATION	November, 1972
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
Charlton R. Price, D Sam Scheele	DOT-TSC-319-1

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Social Engineering Technology 1722 Westwood Blvd. Los Angeles, Calif. 90024	R3750
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15. Supplementary Notes The preparation of this report has been financed by a DOT-Transportation Systems Center contract #319 to Social Engineering Technology of Los Angeles, California for the Urban Mass Transportation Administration, under the Urban Mass Transportation Act of 1964 and as amended in 1968.

16. Abstract

Acquiring 130 new, double-desk, self-propelled, electrically operated commuter rail cars numbered 1501 to 1630 is part of a five-year effort to improve service on the suburban lines in the South Chicago area operated by the Illinoise Central Railroad. The introduction of the cars and other improvements represent one instance of attempts to upgrade service in an existing system. In the course of this effort, experience has been acquired that can be useful both to systems that are being altered, and to totally new systems yet to be designed and developed.

This report deals with lessons learned and the insights or new ideas that emerged which may be useful for: (1) the further development of this particular system; (2) the conception, design, and development of similar systems elsewhere; (3) stimulation of designers and related systems; and (4) the practices of managers and planners responsible for improving urban mass transit services.

17. Key Words	18. Distribution Statement
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7. Author(s) Jerome Pressman		8. Performing Organization Report No. DOT-TSC-369-1
9. Performing Organization Name and Address Pressman Enterprises 4 Fessenden Way Lexington, Mass. 02173		10. Work Unit No. 11. Contract or Grant No. DOT-TSC-369
12. Sponsoring Agency Name and Address Department of Transportation Transportation Systems Center Cambridge, Mass.		13. Type of Report and Period Covered Interim Scientific Feb. 23, Apr. 23, 1972 14. Sponsoring Agency Code
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16. Abstract

A survey and critical evaluation of information pertaining to the natural stratospheric composition and chemical dynamics and to the perturbations that might be induced by the exhaust emissions of aircraft flying in the stratosphere.

17. Key Words	18. Distribution Statement		
Stratosphere, Pollution, SST, Stratospheric Aircraft, Stratospheric Chemical Dynamics, Ozone	Document is available to the public through the National Technical Information Service, Springfield, Va. 22151		
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7. Author(s) Jerome Pressman		8. Performing Organization Report No. DOT-TSC-369-2
9. Performing Organization Name and Address Pressman Enterprises 4 Fessenden Way Lexington, Mass. 02173		10. Work Unit No. 11. Contract or Grant No. DOT-TSC-369
12. Sponsoring Agency Name and Address		13. Type of Report and Period Covered Interim Scientific Apr 23 - 1 June, 1972 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

A report on recommendations identifying areas for further necessary study of natural stratospheric chemical dynamics and the perturbations that might be induced by the exhaust emissions of aircraft flying in the stratosphere.

17. Key Words Stratosphere, Pollution, SST, Stratospheric Aircraft, Stratospheric Chemical Dynamics, Ozone	18. Distribution Statement Document is available to the public through the National Technical Information Service, Springfield, Va. 22151		
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7. Author(s) Jerome Pressman		8. Performing Organization Report No. DOT-TSC-369-3
9. Performing Organization Name and Address Pressman Enterprises 4 Fessenden Way Lexington, Mass. 02173		10. Work Unit No. 11. Contract or Grant No. DOT-TSC-369
12. Sponsoring Agency Name and Address Department of Transportation Transportation Systems Center Cambridge, Mass.		13. Type of Report and Period Covered Interim Scientific May 23-July 23, 1972 14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

A survey and critical evaluation of information pertaining to the stratospheric aircraft wake chemical dynamics including both the hydrodynamics and chemistry of the phenomenon.

17. Key Words Stratosphere, Pollution, SST, Wake, Stratospheric Aircraft Ozone, Airplane Exhaust	18. Distribution Statement "Document is available to the public through the National Technical Information Service. Springfield, Va. 22151		
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4. Title and Subtitle AN INTRODUCTION TO RAILROAD OPERATIONS		5. Report Date June 1972 6. Performing Organization Code
7. Author(s) Wilfred H. Holland		8. Performing Organization Report No. DOT-TSC-PR-TI-5732-1
9. Performing Organization Name and Address Wilfred H. Holland 243 Charles Street Reading, Massachusetts 01867		10. Work Unit No. R2306 11. Contract or Grant No. 13. Type of Report and Period Covered Final Report
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16. Abstract

This report provides an overview of railroad operations as a guide for consultants and contractors unfamiliar with railroading. It includes definitions of railroad terms, a description of a typical railroad management organization, discussion of regulatory bodies and labor relations, and a detailed description of train operations, including signals, brake systems, locomotives, yard and freight operations, and the duties of the engineman.

17. Key Words Railroad Operations Management Organization Train, Locomotive, Engineman	18. Distribution Statement APPROVED FOR TSC HUMAN FACTORS BRANCH DISTRIBUTION ONLY. TRANSMITTAL OF THIS DOCUMENT OUTSIDE THE TRANSPORTATION SYSTEMS CENTER, DEPARTMENT OF TRANSPORTATION MUST HAVE PRIOR APPROVAL OF THE HUMAN FACTORS BRANCH.		
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