

# Unclassified Publications of Lincoln Laboratory

Volume 12

31 December 1986

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**Lincoln Laboratory**

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

*LEXINGTON, MASSACHUSETTS*



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Prepared under Electronic Systems Division Contract F19628-85-C-0002.

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**VOLUME 12**

**31 DECEMBER 1986**

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FOR THE COMMANDER

A handwritten signature in black ink, reading "Thomas J. Alpert". The signature is written in a cursive style with a large, stylized initial "T".

Thomas J. Alpert, Major, USAF  
Chief, ESD Lincoln Laboratory Project Office

## **FOREWORD**

Volume 12 of Unclassified Publications of Lincoln Laboratory lists reports published from 31 December 1985 to 31 December 1986, as well as updated information on earlier publications.

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| 751    | The Completion of a Star Catalog for the Optical Aircraft Measurements Program              | Taff, L.G.                                      | 7 Apr. 1986  | ADA168017 |
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| 5505A | Limitations on Power-Transfer Efficiency in Three-Guide Optical Couplers                | Donnelly, J.P.                                    | IEEE J. Quantum Electron., Vol. QE-22, No. 5, May 1986, pp. 610-616<br>ADA174742            |
| 5650  | Statistical Model-Based Algorithms for Image Analysis                                   | Therrien, C.W.<br>Quatieri, T.F.<br>Dudgeon, D.E. | Proc. IEEE, Vol. 74, No. 4, April 1986, pp. 532-551                                         |
| 5657  | <i>d</i> -Electron Orbital Eigenfunctions in a Trigonal Crystal Field                   | Dionne, G.F.<br>Palm, B.J.                        | J. Magn. Reson., Vol. 68, 15 June 1986, pp. 355-359<br>ADA170498                            |
| 5675  | Analysis of the Intensity Noise of Nearly Single-Longitudinal-Mode Semiconductor Lasers | Yee, S.T.K.                                       | IEEE J. Quantum Electron., Vol. QE-22, No. 2, February 1986, pp. 275-285                    |
| 5697A | The Effect of Linguistic Content Upon the Discrimination of Pitch in Monotone Stimuli   | Mack, M.A.<br>Gold, B.                            | J. Phonetics, Vol. 14, No. 2, April 1986, pp. 333-337                                       |
| 5704  | Heterodyne and Nonheterodyne Laser Transceivers                                         | Keyes, R.J.                                       | Rev. Sci. Instrum., Vol. 57, No. 4, April 1986, pp. 519-528<br>ADA168318                    |
| 5705  | Two Locations, Two Times, and the Element Set                                           | Taff, L.G.<br>Randall, P.M.S.                     | Celestial Mech., Vol. 37, No. 2, October 1985, pp. 149-159<br>ADA170553                     |
| 5712  | Electromagnetic Scattering by Arbitrarily Shaped Reflectors: Subreflector Efficiency    | Dion, A.R.<br>Muresan, L.V.                       | IEEE Trans. Antennas Propag., Vol. AP-33, No. 12, December 1985, pp. 1338-1346<br>ADA168254 |
| 5724A | Satellite Debris — Recent Measurements                                                  | Taff, L.G.                                        | J. Spacecr. Rockets, Vol. 23, No. 3, May/June 1986, pp. 342-346                             |
| 5726  | Heterodyne Spatial Tracking System for Optical Space Communication                      | Swanson, E.A.<br>Chan, V.W.S.                     | IEEE Trans. Commun., Vol. COM-34, No. 2, February 1986, pp. 118-126<br>ADA172604            |

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| 5733 | An Adaptive Detection Algorithm                                                                            | Kelly, E.J.                                      | IEEE Trans. Aerosp. Electron. Syst., Vol. AES-22, No. 1, March 1986, pp. 115-127 ADA174799         |
| 5739 | An Investigation of the Co:MgF <sub>2</sub> Laser System                                                   | Moulton, P.F.                                    | IEEE J. Quantum Electron., Vol. QE-21, No. 10, October 1985, pp. 1582-1595 ADA168437               |
| 5743 | The Statistical Performance of the MUSIC and the Minimum-Norm Algorithms in Resolving Plane Waves in Noise | Kaveh, M.<br>Barabell, A.J.                      | IEEE Trans. Acoust. Speech Signal Process., Vol. ASSP-34, No. 2, April 1986, pp. 331-341 ADA176104 |
| 5745 | Area Coverage Adaptive Nulling from Geosynchronous Satellites: Phased Arrays Versus Multiple-Beam Antennas | Mayhan, J.T.                                     | IEEE Trans. Antennas Propag., Vol. AP-34, No. 3, March 1986, pp. 410-419 ADA178934                 |
| 5746 | A Rate Equation Analysis for the Frequency Chirp to Modulated Power Ratio of a Semiconductor Diode Laser   | Welford, D.                                      | IEEE J. Quantum Electron., Vol. QE-21, No. 11, November 1985, pp. 1749-1751 ADA170554              |
| 5747 | Speech Analysis/Synthesis Based on a Sinusoidal Representation                                             | McAulay, R.J.<br>Quatieri, T.F.                  | IEEE Trans. Acoust. Speech Signal Process., Vol. ASSP-34, No. 4, August 1986, pp. 744-754          |
| 5752 | Comments on "Integral Equation Formulations for Imperfectly Conducting Scatterers"                         | Rogers, J.R.                                     | IEEE Trans. Antennas Propag., Vol. AP-33, No. 11, November 1985, pp. 1283-1284 ADA168204           |
| 5762 | Linewidth Control with Masked Ion Beam Lithography Using Stencil Masks                                     | Randall, J.N.<br>Bromley, E.I.<br>Economou, N.P. | J. Vac. Sci. Technol. B, Vol. 4, No. 1, Jan/Feb. 1986, pp. 10-14 ADA167747                         |
| 5767 | Double-Heterostructure InGaAs/InP PIN Photodetectors                                                       | Diadiuk, V.<br>Groves, S.H.                      | Solid-State Electron., Vol. 29, No. 2, February 1986, pp. 229-233 ADA167365                        |

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| 5769 | M-ary FSK Performance for Coherent Optical Communication Systems Using Semiconductor Lasers                                                      | Jeromin, L.L.<br>Chan, V.W.S.                                     | IEEE Trans. Commun., Vol. COM-34, No. 4, April 1986, pp. 375-381<br>ADA174704                  |
| 5770 | Absolute Frequencies of Lasing Transitions in Nine CO <sub>2</sub> Isotopic Species                                                              | Bradley, L.C., III<br>SooHoo, K.L.<br>Freed, C.                   | IEEE J. Quantum Electron., Vol. QE-22, No. 2, February 1986, pp. 234-267                       |
| 5771 | Superconductive Analog Signal Processing Devices                                                                                                 | Withers, R.S.                                                     | Supercond. Tech. Rev., No. 85-2, July 1985, pp. 1-6                                            |
| 5775 | Distribution of Nitrogen and Defects in SiO <sub>x</sub> N <sub>y</sub> /Si Structures Formed by the Thermal Nitridation of SiO <sub>2</sub> /Si | Vasquez, R.P.<br>Madhukar, A.<br>Grunthaner, F.J.<br>Naiman, M.L. | J. Appl. Phys., Vol. 59, No. 3, 1 February 1986, pp. 972-975                                   |
| 5776 | Comments on "Polygonal Coaxial Line with Round Center Conductor"                                                                                 | Abouzahra, M.D.                                                   | IEEE Trans. Microwave Theory Tech., Vol. MTT-34, No. 1, January 1986, pp. 195-196<br>ADA172742 |
| 5777 | The Contrast of Ion Beam Stencil Masks                                                                                                           | Randall, J.N.<br>Stern, L.A.<br>Donnelly, J.P.                    | J. Vac. Sci. Technol. B, Vol. 4, No. 1, Jan/Feb. 1986, pp. 201-204<br>ADA167612                |
| 5778 | Effect of Doping Profile Variations on the Performance of the Permeable Base Transistor                                                          | Gopinath, A.<br>Rankin, J.B.                                      | IEEE Trans. Electron Devices, Vol. ED-33, No. 6, June 1986, pp. 816-821<br>ADA174798           |
| 5779 | Sub-100-nm-Wide, Deep Trenches Defined by Reactive Ion Etching                                                                                   | Pang, S.W.<br>Randall, J.N.<br>Geis, M.W.                         | J. Vac. Sci. Technol. B, Vol. 4, No. 1, Jan/Feb. 1986, pp. 341-344<br>ADA167279                |

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| 5780 | The Effect of Spurious Intensity Modulation in Semiconductor Diode Lasers on the Performance of Optical Heterodyne Frequency Shift Keyed Communications Systems | Jeromin, L.L.<br>Welford, D.                                                                                | IEEE J. Lightwave Technol., Vol. LT-4, No. 6, June 1986, pp. 590-595<br>ADA176096 |
| 5788 | Excimer-Laser Etching of Diamond and Hard Carbon Films by Direct Writing and Optical Projection                                                                 | Rothschild, M.<br>Arnone, C.<br>Ehrlich, D.J.                                                               | J. Vac. Sci. Technol. B, Vol. 4, No. 1, Jan/Feb. 1986, pp. 310-314<br>ADA167438   |
| 5789 | SEKE: A Computer Model for Low Altitude Radar Propagation Over Irregular Terrain                                                                                | Ayasli, S.                                                                                                  | IEEE Trans. Antennas Propag., Vol. AP-34, No. 8, August 1986, pp. 1013-1023       |
| 5790 | Hot Jet Etching of GaAs and Si                                                                                                                                  | Geis, M.W.<br>Efremow, N.N., Jr.<br>Lincoln, G.A., Jr.                                                      | J. Vac. Sci. Technol. B, Vol. 4, No. 1, Jan/Feb. 1986, pp. 315-317<br>ADA167508   |
| 5791 | Optimization of Solvent Development in Radiation Induced Graft Lithography of Poly(methylmethacrylate)                                                          | Kim, S.Y.<br>Choi, J.<br>Pulver, D.<br>Moore, J.A.<br>Corelli, J.C.<br>Steckl, A.J.<br>Randall, J.N.        | J. Vac. Sci. Technol. B, Vol. 4, No. 1, Jan/Feb. 1986, pp. 403-408                |
| 5792 | Tunable Paramagnetic-Ion Lasers                                                                                                                                 | Moulton, P.F.                                                                                               | Chapter 2, <i>Laser Handbook</i> , Elsevier, NY, 1985, pp. 203-288                |
| 5794 | Anisotropic Etching of Al by a Directed Cl <sub>2</sub> Flux                                                                                                    | Efremow, N.N., Jr.<br>Geis, M.W.<br>Mountain, R.W.<br>Lincoln, G.A., Jr.<br>Randall, J.N.<br>Economou, N.P. | J. Vac. Sci. Technol. B, Vol. 4, No. 1, Jan/Feb. 1986, pp. 337-340<br>ADA167505   |
| 5796 | Cramér-Rao Lower Bounds on the Performance of Charge-Coupled-Device Optical Position Estimators                                                                 | Winick, K.A.                                                                                                | J. Opt. Soc. Am. A, Vol. 3, No. 11, November 1986, pp. 1809-1815                  |

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| 5797 | A Multimode Rate-Equation Analysis for Semiconductor Lasers Applied to the Direct Intensity Modulation of Individual Longitudinal Modes   | Yee, S.T.K.<br>Welford, D.                                                                   | IEEE J. Quantum Electron., Vol. QE-22, No. 11, November 1986, pp. 2116-2122      |
| 5799 | The Effect of He <sub>3</sub> on CO <sub>2</sub> Laser Power                                                                              | Marcus, S.<br>Stein, D.T.                                                                    | J. Appl. Phys., Vol. 59, No. 1, 1 January 1986, pp. 268-269 ADA163913            |
| 5800 | Atmospheric Turbulence-Induced Signal Fades on Optical Heterodyne Communication Links                                                     | Winick, K.A.                                                                                 | Appl. Opt., Vol. 25, No. 11, 1 June 1986, pp. 1817-1825 ADA170482                |
| 5801 | Theoretical Temperature Dependence of Solar Cell Parameters                                                                               | Fan, J.C.C.                                                                                  | Solar Cells, Vol. 17, No. 2-3, April-May 1986, pp. 309-315                       |
| 5802 | Spectroscopic and Laser Characteristics of Ti:Al <sub>2</sub> O <sub>3</sub>                                                              | Moulton, P.F.                                                                                | J. Opt. Soc. Am. B, Vol. 3, No. 1, January 1986, pp. 125-133                     |
| 5804 | Use of Zone-Melting Recrystallization to Fabricate a Three-Dimensional Structure Incorporating Power Bipolar and Field-Effect Transistors | Geis, M.W.<br>Chen, C.K.<br>Mountain, R.W.<br>Economou, N.P.<br>Lindley, W.T.<br>Hower, P.L. | IEEE Electron Device Lett., Vol. EDL-7, No. 1, January 1986, pp. 41-43 ADA169504 |
| 5805 | Surface Damage on GaAs Induced by Reactive Ion Etching and Sputter Etching                                                                | Pang, S.W.                                                                                   | J. Electrochem. Soc., Vol. 133, No. 4, April 1986, pp. 784-787 ADA170555         |
| 5809 | 10 to 40 GHz Doubler-Doubler Chain for SATCOM Applications                                                                                | Staecker, P.W.<br>Chick, R.W.                                                                | Microwave J., Vol. 28, No. 12, December 1985, pp. 87-105                         |
| 5810 | Characterization and Entrainment of Subboundaries and Defect Trails in Zone-Melting-Recrystallized Si Films                               | Geis, M.W.<br>Smith, H.I.<br>Chen, C.K.                                                      | J. Appl. Phys., Vol. 60, No. 3, 1 August 1986, pp. 1152-1160 ADA172571           |

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| 5812 | Laser Etching of 0.4- $\mu$ m Structures in CdTe by Dynamic Light Guiding                                              | Arnone, C.<br>Rothschild, M.<br>Ehrlich, D.J.                                           | Appl. Phys. Lett., Vol. 48, No. 11, 17 March 1986, pp. 736-738                                             |
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| 5814 | Millimeter-Wave Monolithic Circuits for Receiver and Transmitter Applications                                          | Chu, A.<br>Courtney, W.E.<br>Mahoney, L.J.<br>Clifton, B.J.                             | RCA Rev., Vol. 46, No. 4, December 1985, pp. 421-430                                                       |
| 5816 | Quantum-Well Charge-Coupled Devices for Charge-Coupled Device-Addressed Multiple-Quantum-Well Spatial Light Modulators | Goodhue, W.D.<br>Burke, B.E.<br>Nichols, K.B.<br>Metze, G.M.<br>Johnson, G.D.           | J. Vac. Sci. Technol. B, Vol. 4, No. 3, May/June 1986, pp. 769-772<br>ADA169503                            |
| 5819 | Hyperbolic Householder Transformations                                                                                 | Rader, C.M.<br>Steinhardt, A.O.                                                         | IEEE Trans. Acoust. Speech Signal Process., Vol. ASSP-34, No. 6, December 1986, pp. 1589-1602<br>ADA178932 |
| 5824 | Nickel-Zinc Microwave Ferrite with Stress-Insensitive Square Hysteresis Loop                                           | Dionne, G.F.<br>West, R.G.                                                              | Appl. Phys. Lett., Vol. 48, No. 21, 26 May 1986, pp. 1488-1490<br>ADA170545                                |
| 5825 | Coherent Summation of Laser Beams Using Binary Phase Gratings                                                          | Veldkamp, W.B.<br>Leger, J.R.<br>Swanson, G.J.                                          | Opt. Lett., Vol. 11, No. 5, May 1986, pp. 303-305<br>ADA169502                                             |
| 5826 | Coherent Beam Addition of GaAlAs Lasers by Binary Phase Gratings                                                       | Leger, J.R.<br>Swanson, G.J.<br>Veldkamp, W.B.                                          | Appl. Phys. Lett., Vol. 48, No. 14, 7 April 1986, pp. 888-890<br>ADA167573                                 |
| 5827 | Monolithic Integration of Si MOSFETs and GaAs MESFETs                                                                  | Choi, H-K.<br>Turner, G.W.<br>Tsaur, B-Y.                                               | IEEE Electron Device Lett., Vol. EDL-7, No. 4, April 1986, pp. 241-243                                     |

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| 5828 | Reduction of Radiation-Pressure-Induced Fluctuations in Interferometric Gravity-Wave Detectors                                             | Bondurant, R.S.                                                             | Phys. Rev. A, Vol. 34, No. 5, November 1986, pp. 3927-3931 ADA176087           |
| 5829 | Visible-Laser Photodeposition of Chromium Oxide Films and Single Crystals                                                                  | Arnone, C.<br>Rothschild, M.<br>Black, J.G.<br>Ehrlich, D.J.                | Appl. Phys. Lett., Vol. 48, No. 15, 14 April 1986, pp. 1018-1020 ADA168283     |
| 5830 | Electron-Pumped High-Efficiency Semiconductor Laser                                                                                        | Daneu, V.<br>DeGloria, D.P.<br>Sanchez, A.<br>Tong, F.<br>Osgood, R.M., Jr. | Appl. Phys. Lett., Vol. 49, No. 10, 8 September 1986, pp. 546-548 ADA174034    |
| 5831 | You Too Can Present a Paper                                                                                                                | Hovey, D.L.<br>Ponton, R.                                                   | Fusion (Toledo), Vol. 33, No. 1, February 1986, pp. 52-55                      |
| 5832 | Radiation-Hardened Silicon-on-Insulator Complementary Junction Field-Effect Transistors                                                    | Tsaur, B-Y.<br>Choi, H-K.                                                   | IEEE Electron Device Lett., Vol. EDL-7, No. 5, May 1986, pp. 324-326 ADA176070 |
| 5834 | New Capping Technique for Zone-Melting Recrystallization of Silicon-on-Insulator Films                                                     | Chen, C.K.<br>Geis, M.W.<br>Finn, M.C.<br>Tsaur, B-Y.                       | Appl. Phys. Lett., Vol. 48, No. 19, 12 May 1986, pp. 1300-1302 ADA169540       |
| 5836 | Electron Beam Stimulated Nonthermal Crystallization of CdS Surface Layers: Observations by Real-Time Atomic-Resolution Electron Microscopy | Ehrlich, D.J.<br>Smith, D.J.                                                | Appl. Phys. Lett., Vol. 48, No. 25, 23 June 1986, pp. 1751-1753                |
| 5837 | Electronic Structure of Deep-Lying Sulfur Centers in Si                                                                                    | Krag, W.E.<br>Kleiner, W.H.<br>Zeiger, H.J.                                 | Phys. Rev. B, Vol. 33, No. 12, 15 June 1986, pp. 8304-8320 ADA170466           |

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| 5840 | Speech Transformations Based on a Sinusoidal Representation                                                                                                                 | Quatieri, T.F.<br>McAulay, R.J.                                                 | IEEE Trans. Acoust.<br>Speech Signal Process.,<br>Vol. ASSP-34, No. 6,<br>December 1986,<br>pp. 1449-1464 |
| 5843 | The Huntsville Cooperative Meteorological Experiment (COHMEX)                                                                                                               | Dodge, J.<br>Arnold, J.<br>Wilson, G.<br>Evans, J.E.<br>Fujita, T.              | Bull. Am. Meteorol. Soc.,<br>Vol. 67, No. 4,<br>April 1986, pp. 417-419                                   |
| 5844 | Programmable, Secondary Frequency Standards Based Infrared Synthesizers for High Resolution Spectroscopy                                                                    | Freed, C.                                                                       | Chapter in <i>Methods of Laser Spectroscopy</i> ,<br>Plenum Press, NY, 1986,<br>pp. 151-161               |
| 5845 | Magnetic and Optical Measurements on Ti:Al <sub>2</sub> O <sub>3</sub> Crystals for Laser Applications: Concentration and Absorption Cross Section of Ti <sup>3+</sup> Ions | Aggarwal, R.L.<br>Sanchez, A.<br>Fahey, R.E.<br>Strauss, A.J.                   | Appl. Phys. Lett., Vol. 48,<br>No. 20, 19 May 1986,<br>pp. 1345-1347 ADA169762                            |
| 5846 | Room-Temperature Continuous-Wave Operation of a Ti:Al <sub>2</sub> O <sub>3</sub> Laser                                                                                     | Sanchez, A.<br>Fahey, R.E.<br>Strauss, A.J.<br>Aggarwal, R.L.                   | Opt. Lett., Vol. 11, No. 6,<br>June 1986, pp. 363-364<br>ADA170547                                        |
| 5848 | Titanium-Doped Semi-insulating InP Grown by the Liquid-Encapsulated Czochralski Method                                                                                      | Iseler, G.W.<br>Ahern, B.S.                                                     | Appl. Phys. Lett., Vol. 48,<br>No. 24, 16 June 1986,<br>pp. 1656-1657 ADA170409                           |

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|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------------------------------------------|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------|
| 1a. REPORT SECURITY CLASSIFICATION<br>Unclassified                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |       |                                                | 1b. RESTRICTIVE MARKINGS                                                                       |                                                                     |                               |
| 2a. SECURITY CLASSIFICATION AUTHORITY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |       |                                                | 3. DISTRIBUTION/AVAILABILITY OF REPORT<br>Approved for public release; distribution unlimited. |                                                                     |                               |
| 2b. DECLASSIFICATION/DOWNGRADING SCHEDULE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |       |                                                |                                                                                                |                                                                     |                               |
| 4. PERFORMING ORGANIZATION REPORT NUMBER(S)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |       |                                                | 5. MONITORING ORGANIZATION REPORT NUMBER(S)<br>ESD-TR-87-018                                   |                                                                     |                               |
| 6a. NAME OF PERFORMING ORGANIZATION<br>Lincoln Laboratory, MIT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       | 6b. OFFICE SYMBOL<br>(If applicable)           |                                                                                                | 7a. NAME OF MONITORING ORGANIZATION<br>Electronic Systems Division  |                               |
| 6c. ADDRESS (City, State, and Zip Code)<br>P.O. Box 73<br>Lexington, MA 02173-0073                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |       |                                                | 7b. ADDRESS (City, State, and Zip Code)<br>Hanscom AFB, MA 01731                               |                                                                     |                               |
| 8a. NAME OF FUNDING/SPONSORING ORGANIZATION<br>Air Force Systems Command, USAF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       | 8b. OFFICE SYMBOL<br>(If applicable)           |                                                                                                | 9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER<br>F19628-85-C-0002 |                               |
| 8c. ADDRESS (City, State, and Zip Code)<br>Andrews AFB<br>Washington, DC 20334                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |       |                                                | 10. SOURCE OF FUNDING NUMBERS                                                                  |                                                                     |                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |       |                                                | PROGRAM<br>ELEMENT NO.                                                                         | PROJECT<br>NO.                                                      | TASK<br>NO.                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |       |                                                | WORK UNIT<br>ACCESSION NO.                                                                     |                                                                     |                               |
| 11. TITLE (Include Security Classification)<br>Unclassified Publications of Lincoln Laboratory — Volume 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |       |                                                |                                                                                                |                                                                     |                               |
| 12. PERSONAL AUTHOR(S)<br>Publications Office                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |       |                                                |                                                                                                |                                                                     |                               |
| 13a. TYPE OF REPORT<br>Bibliography                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |       | 13b. TIME COVERED<br>FROM 12/31/85 TO 12/31/86 |                                                                                                | 14. DATE OF REPORT (Year, Month, Day)<br>1986, December, 31         |                               |
| 15. PAGE COUNT<br>68                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |       |                                                |                                                                                                |                                                                     |                               |
| 16. SUPPLEMENTARY NOTATION<br>None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |       |                                                |                                                                                                |                                                                     |                               |
| 17. COSATI CODES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |       |                                                | 18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)              |                                                                     |                               |
| FIELD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | GROUP | SUB-GROUP                                      |                                                                                                |                                                                     |                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |       |                                                | Bibliography                                                                                   |                                                                     |                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |       |                                                |                                                                                                |                                                                     |                               |
| 19. ABSTRACT (Continue on reverse if necessary and identify by block number)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |                                                |                                                                                                |                                                                     |                               |
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| 20. DISTRIBUTION/AVAILABILITY OF ABSTRACT<br><input type="checkbox"/> UNCLASSIFIED/UNLIMITED <input checked="" type="checkbox"/> SAME AS RPT. <input type="checkbox"/> DTIC USERS                                                                                                                                                                                                                                                                                                                                                                                                                                     |       |                                                | 21. ABSTRACT SECURITY CLASSIFICATION<br>Unclassified                                           |                                                                     |                               |
| 22a. NAME OF RESPONSIBLE INDIVIDUAL<br>Maj. Thomas J. Alpert, USAF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |       |                                                | 22b. TELEPHONE (Include Area Code)<br>(617) 863-5500, X-2330                                   |                                                                     | 22c. OFFICE SYMBOL<br>ESD/TML |