

# REPORT DOCUMENTATION PAGE

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AFRL/PRS  
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Air Force Research Laboratory (AFMC)  
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14. ABSTRACT

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19a. NAME OF RESPONSIBLE PERSON

Leilani Richardson

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(661) 275-5015

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b. ABSTRACT

c. THIS PAGE

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A

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18 separate items enclosed

MEMORANDUM FOR PR (On-Site Contractor/In-House Publication)

FROM: PROI (TI) (STINFO)

29 February 2000

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-AB-2000-037**  
Campbell, D., Wadsworth, D., Wysong, I., Kaplan, C., "SUPREM DSMC: a New Scalable, Parallel, Reacting, Multidimensional Direct Simulation Monte Carlo Flow Code"

**JANNAF Plume Technology Meeting**  
**(Las Vegas, NV, 15-19 May 2000) (Deadline: 17 Apr 2000)**

**(Statement A)**

1. This request has been reviewed by the Foreign Disclosure Office for: a.) appropriateness of distribution statement, b.) military/national critical technology, c.) export controls or distribution restrictions, d.) appropriateness for release to a foreign nation, and e.) technical sensitivity and/or economic sensitivity.

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Signature \_\_\_\_\_ Date \_\_\_\_\_

2. This request has been reviewed by the Public Affairs Office for: a.) appropriateness for public release and/or b) possible higher headquarters review.

Comments: \_\_\_\_\_  
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Signature \_\_\_\_\_ Date \_\_\_\_\_

3. This request has been reviewed by the STINFO for: a.) changes if approved as amended, b.) appropriateness of distribution statement, c.) military/national critical technology, d.) economic sensitivity, e.) parallel review completed if required, and f.) format and completion of meeting clearance form if required

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Signature \_\_\_\_\_ Date \_\_\_\_\_

4. This request has been reviewed by PR for: a.) technical accuracy, b.) appropriateness for audience, c.) appropriateness of distribution statement, d.) technical sensitivity and economic sensitivity, e.) military/national critical technology, and f.) data rights and patentability

Comments: \_\_\_\_\_  
\_\_\_\_\_

APPROVED/APPROVED AS AMENDED/DISAPPROVED

\_\_\_\_\_  
ROBERT C. CORLEY (Date)  
Senior Scientist (Propulsion)  
Propulsion Directorate

**SUPREM DSMC: a New Scalable, Parallel, Reacting, Multidimensional Direct  
Simulation Monte Carlo Flow Code**

**David H. Campbell, Dean Wadsworth  
ERC, Inc.**

**Ingrid Wysong  
Air Force Research Laboratory**

**Carolyn Kaplan  
Naval Research Laboratory**

An AFRL/NRL team has recently been selected to develop a scalable, parallel, reacting, multidimensional Direct Simulation Monte Carlo (DSMC) code for the DOD user community under the High Performance Computing Modernization Office (HPCMO) Common HPC Software Support Initiative (CHSSI). This paper will introduce the Exhaust Plume community to this three year development effort and present the overall goals, schedule, and present status of this new code.

The goal of this effort is to develop and transition to the DoD user community a modern, scalable DSMC code based on the integration of state-of-the-art collision models with advanced parallelization methods, gridding algorithms and data structures. While the paramount characteristics of the code will be robustness and ease of use, other goals include the following code capabilities:

- Parallel, scalable solution of CPU-intensive 3-D, unsteady, reacting flows
- Accurate representation of and resolution of highly nonequilibrium chemical and collisional processes by incorporating validated physical models
- Database of key reaction rates and molecular constants
- Automated grid adaptation and related capabilities to allow use by a broad range of nonexpert users
- Standardized and documented code operation and software-design methodology
- Easily extendable user interface and data structures to allow enduring use and continued code enhancement and customization

These code capabilities should provide a valuable tool for analysis of a wide range of exhaust plume problems, as well as find use in microelectro-mechanical device development, hypersonic flight and reentry vehicle analysis, and investigation of spacecraft environments.

**DISTRIBUTION STATEMENT A**  
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