

**CORRECTING FOR ATTENUATION  
EFFECTS IN OPTICAL PATTERNATION OF  
SPRAYS**

DEMONSTRATION OF CORRECTION  
METHODOLOGY DEVELOPED BY  
V.G. MCDONELL, ERC & D.G. TALLEY, AFRL

AIR FORCE CONTRACT F04611-97-C-0084

20021030 064

*Distribution statement: Approved for public release; distribution unlimited.*

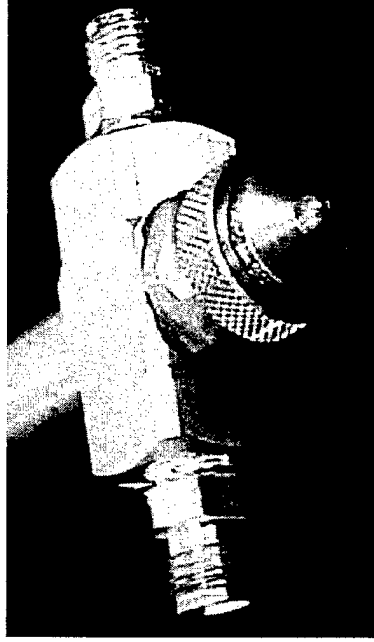
# **MOTIVATION**

- “OPTICAL PATTERNATION” OF SPRAYS
  - PLANAR LASER INDUCED FLUORESCENCE APPROACH
  - DISTRIBUTION OF MASS THROUGHOUT SPRAY
  - NON-INTRUSIVE
  - RAPID
  - GAINING ACCEPTANCE AS SPRAY DIAGNOSTIC
- BARRIERS TO QUANTITATIVE RESULTS
  - CAMERA RESPONSE ISSUES
  - ATTENUATION OF EXCITING LIGHT
  - ATTENUATION OF SIGNAL LIGHT

# **ADDRESSING BARRIERS**

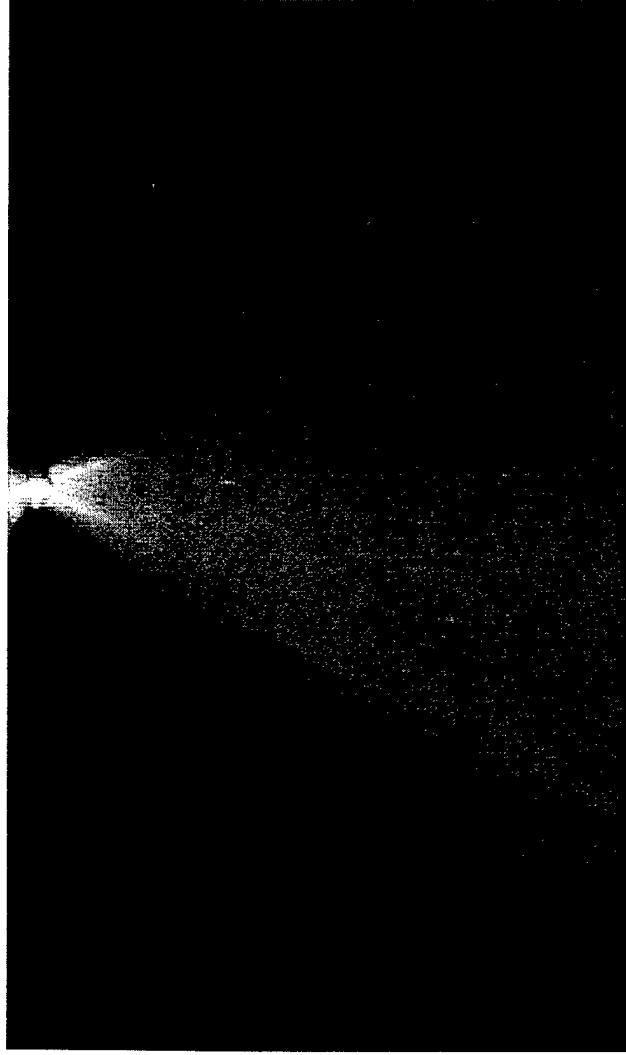
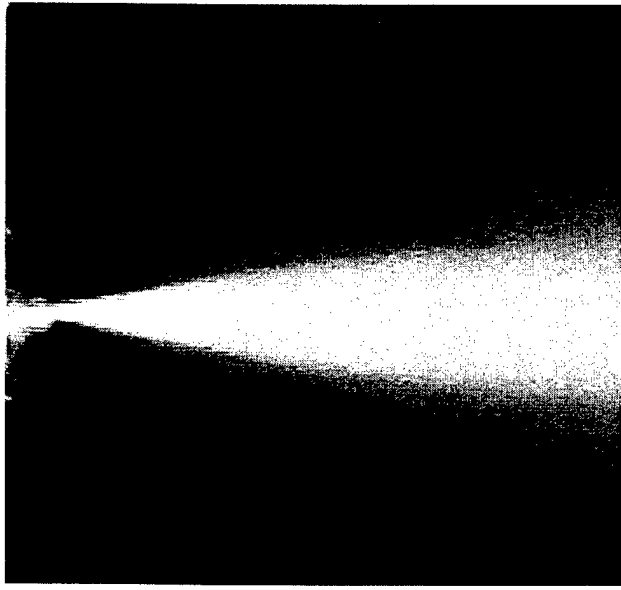
- NOVEL METHODOLOGY HAS BEEN DEVELOPED TO SIMULTANEOUSLY ACCOUNT FOR ATTENUATION OF
  - EXCITATION LIGHT
  - SIGNAL LIGHT

# ***DEMONSTRATION STUDY***



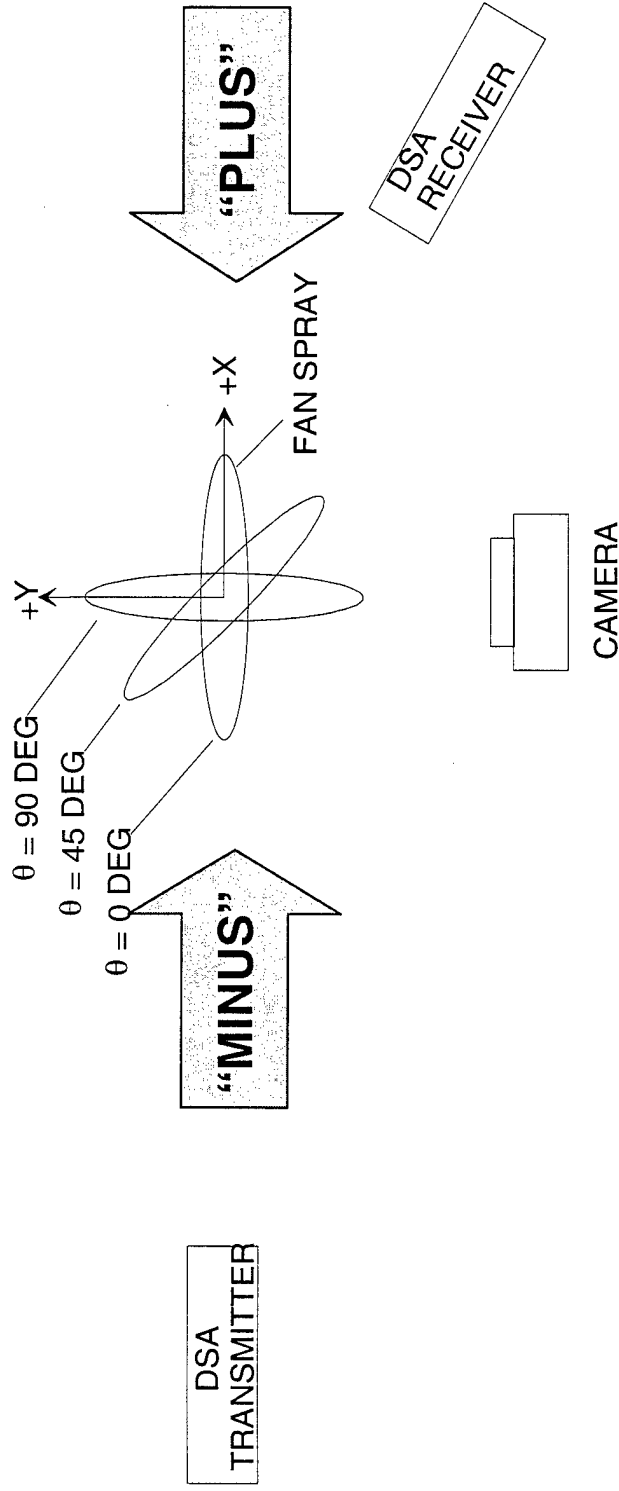
**TWIN-FLUID FAN SPRAY:**

- **CONTROLLED ATTENUATION EFFECTS**
- **SYMMETRIC ELLIPTIC DISTRIBUTION**



# DEMONSTRATION STUDY

## • TOP VIEW ORIENTATION



## ATTRIBUTES:

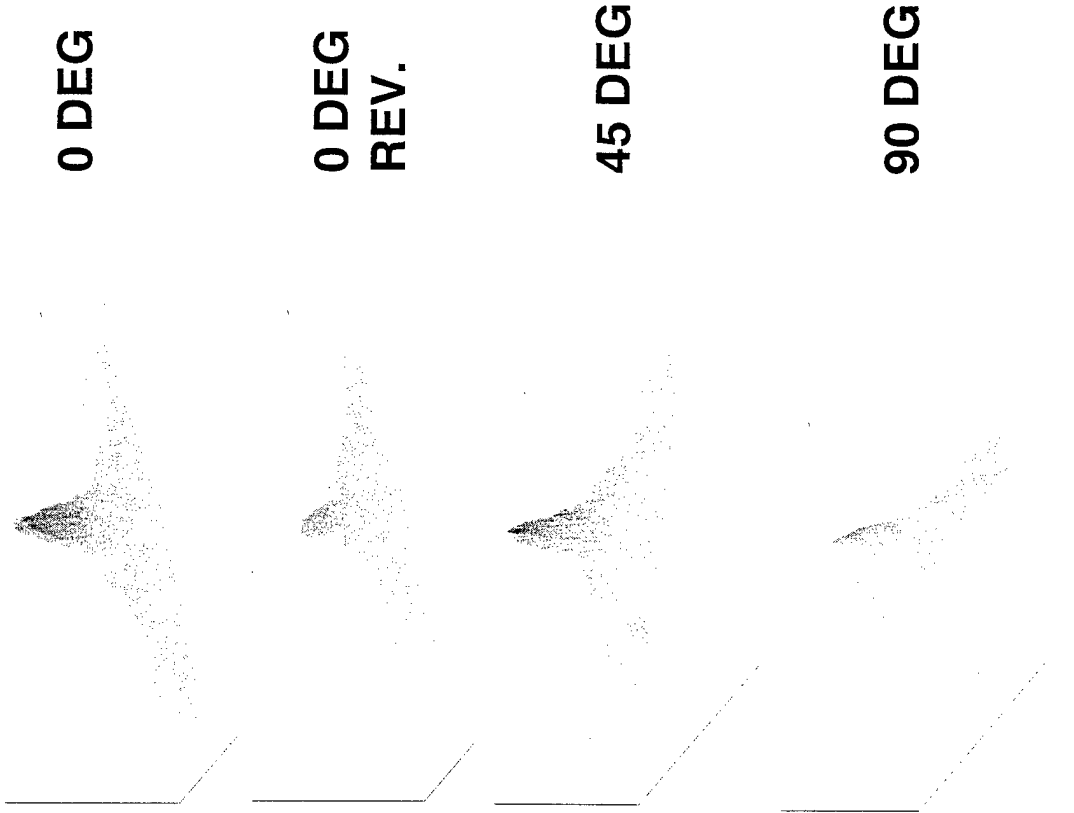
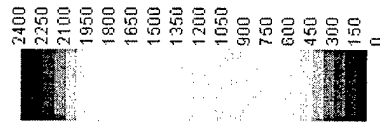
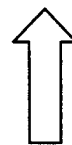
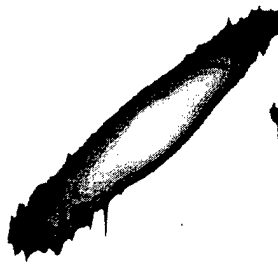
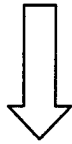
0-DEG: MAXIMUM INCIDENT LIGHT ATTENUATION

90-DEG: MAXIMUM SIGNAL ATTENUATION

45-DEG: MINIMUM INCIDENT LIGHT OR SIGNAL ATTENUATION

# DEMONSTRATION STUDY

• UNCORRECTED IMAGES



# DEMONSTRATION STUDY

- IMPORTANCE OF CORRECTION: UPPER AND LOWER IMAGES SHOULD BE IDENTICAL BUT ROTATED

CORRECTION FOR  
INCIDENT LIGHT  
ONLY

PRESENT FULL  
CORRECTION

UNCORRECTED



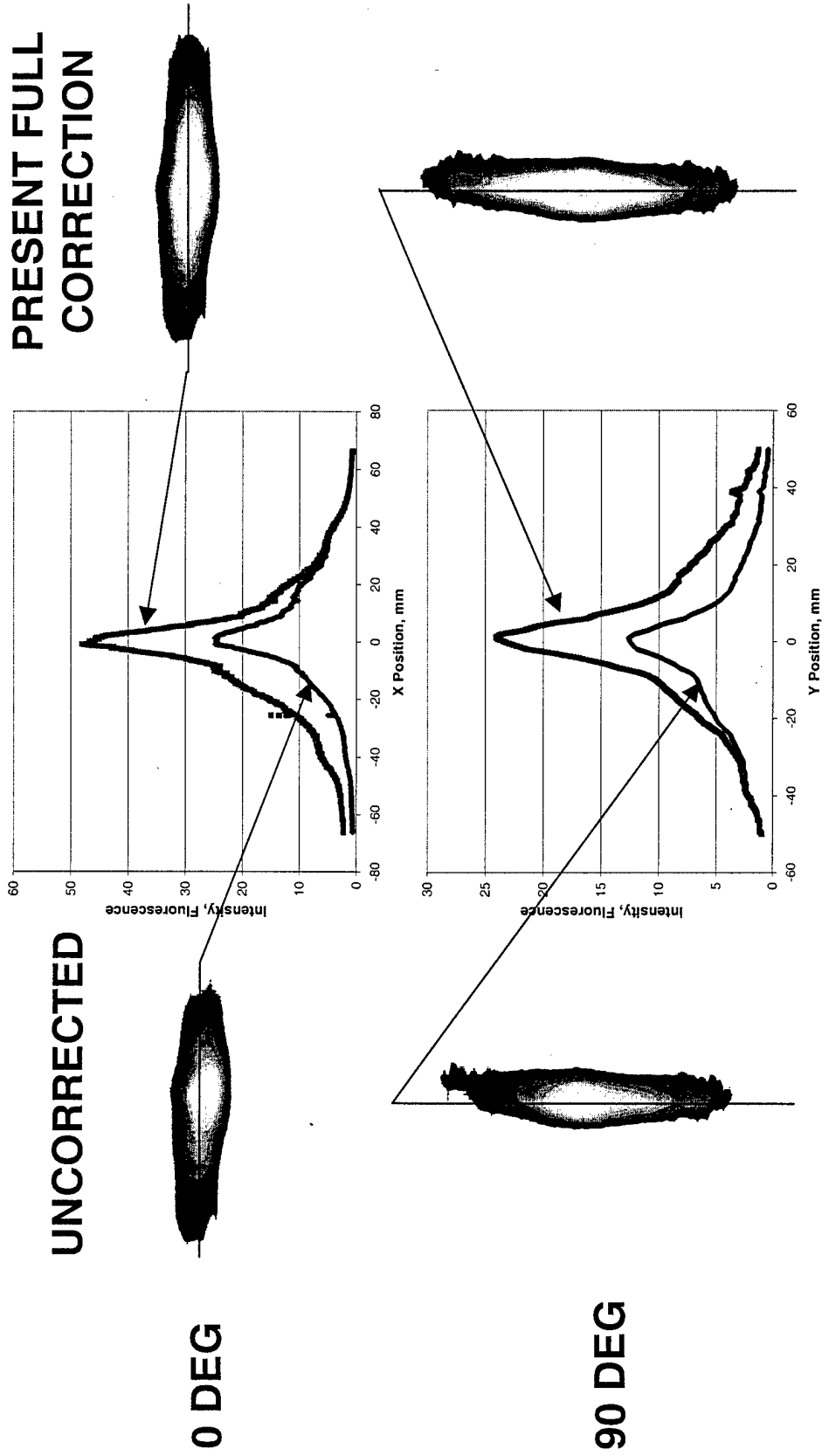
0 DEG



90 DEG

# DEMONSTRATION STUDY

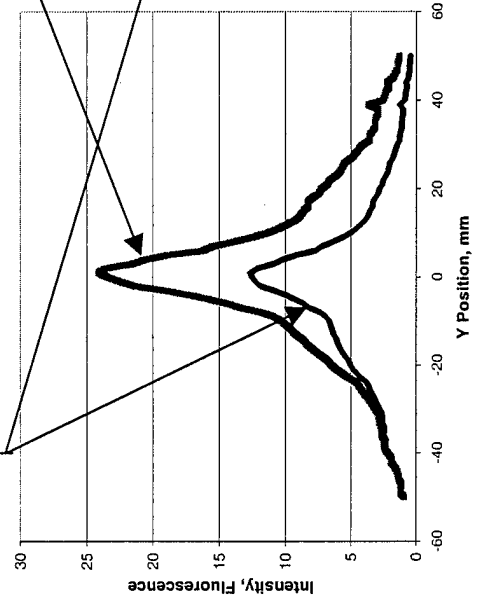
- IMPORTANCE OF CORRECTION: LINE PROFILES



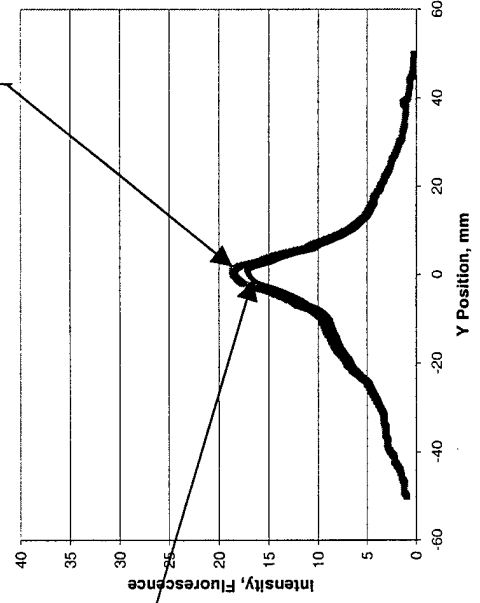
# DEMONSTRATION STUDY

- IMPORTANCE OF CORRECTION FOR SIGNAL: 90 DEG ORIENTATION

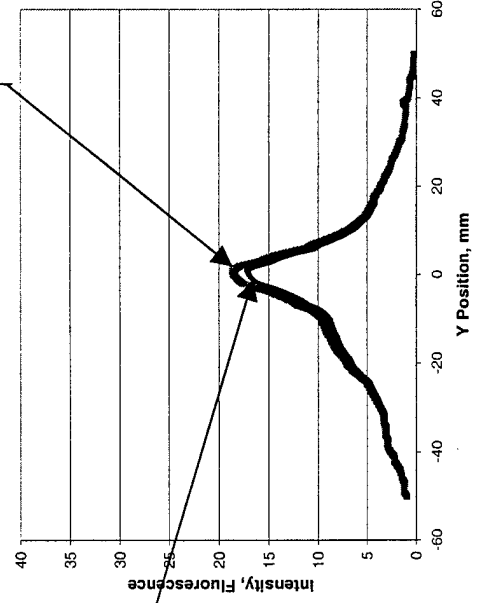
UNCORRECTED



PRESENT FULL CORRECTION

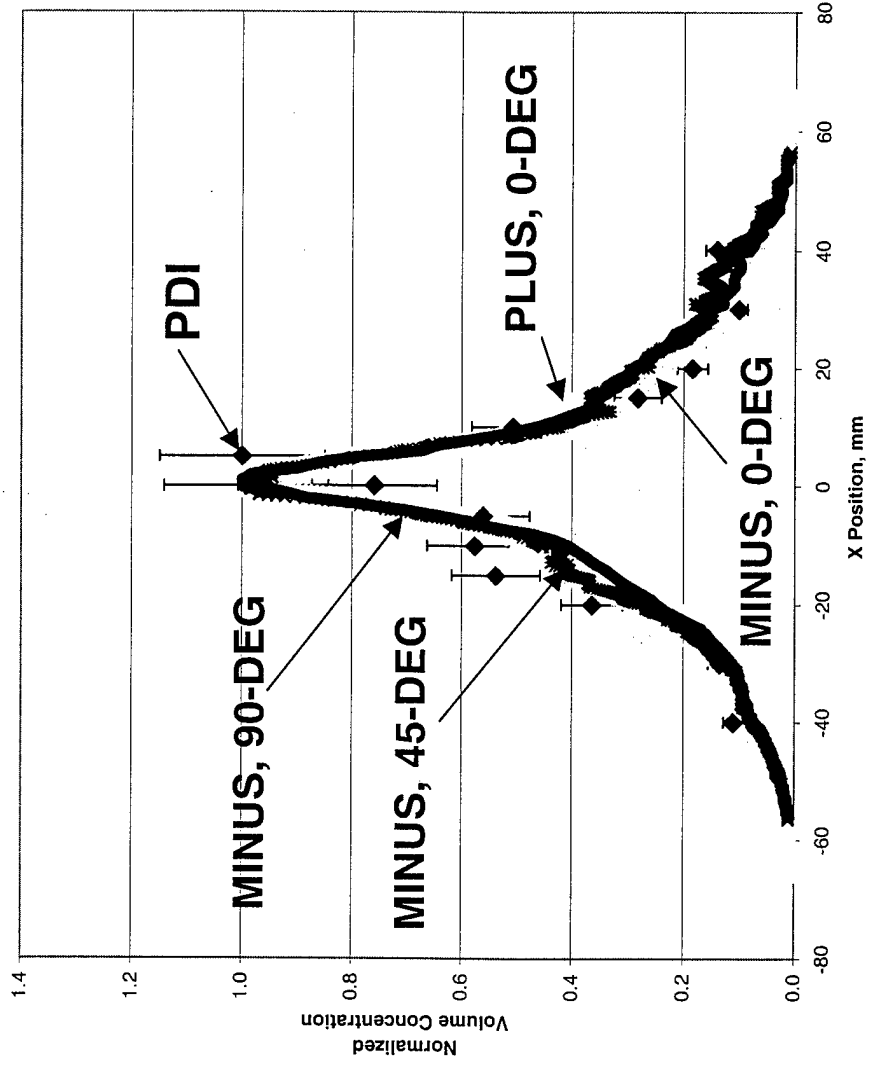


CORRECTION FOR INCIDENT LIGHT ONLY



# DEMONSTRATION STUDY

- COMPARISON OF CORRECTED VOLUME CONCENTRATION TO PDI



# CONCLUSIONS

- CORRECTION REQUIRED FOR ACCURATE RESULTS IN SPRAYS WITH SIGNIFICANT OPTICAL THICKNESS
  - INCIDENT LIGHT
  - SIGNAL LIGHT
- METHODOLOGY HAS BEEN DEVELOPED TO ACCOUNT FOR ATTENUATION OF BOTH INCIDENT AND SIGNAL LIGHT
- DEMONSTRATIONS TO DATE HAVE REVEALED GOOD PERFORMANCE
  - 63% "OBSCURATION"

MEMORANDUM FOR PR (Contractor/In-House Publication)

FROM: PROI (TI) (STINFO)

23 Jun 2000

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-TP-2000-140**  
V. McDonel (ERC); D. Talley (AFRL/PRSA), "Correcting for Attenuation Effects in Optical  
Patternation of Sprays"

**10<sup>th</sup> International Symposium on Applications of Laser Techniques to Fluid (Statement A)  
Mechanics (Lisbon, Portugal, 10-13 Jul 00)**  
**8<sup>th</sup> International Conference on Liquid Atomization and Spray Systems**  
**(Pasadena, CA, 16-20 June 00) (Submission Deadline: 19 Jun 00)**

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: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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

\_\_\_\_\_  
LESLIE S. PERKINS, Ph.D (Date)  
Staff Scientist  
Propulsion Directorate