

GLOBAL EFFECTS OF NUCLEAR WAR

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# GLOBAL EFFECTS PROGRAM

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## OBJECTIVES:

1. TO REDUCE THE UNCERTAINTIES IN SIGNIFICANT PARAMETERS RELATING TO THE LONG-TERM, GLOBAL EFFECTS OF A LARGE-SCALE NUCLEAR EXCHANGE
2. TO DEVELOP A REASONABLE PREDICTIVE CAPABILITY FOR GLOBAL EFFECTS
3. TO PROVIDE A SCIENTIFIC BASIS FOR ESTIMATING THE CLIMATOLOGICAL AND ENVIRONMENTAL CONSEQUENCES OF SUCH AN EXCHANGE

GLOBAL EFFECTS PROGRAM

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ORGANIZATION:

COGNIZANT ADDST -----	DR. M. GILLESPIE
PROGRAM COORDINATOR -----	MR. PETER LUNN (RAAE)
DUST -----	DR. GEORGE ULLRICH (SPSS)
FIRES -----	DR. MICHAEL FRANKEL (SPTD)
ATMOSPHERIC EFFECTS -----	DR. LEON WITTWER (RAAE)
BIOMEDICAL EFFECTS -----	DR. DAVID AUTON (BEHR)
SCENARIOS, POLICY -----	COL. RICHARD WALKER (NASW)

GLOBAL EFFECTS PROGRAM

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SCOPE:

EXCHANGE SCENARIO

SOURCE FUNCTIONS ----- DUST

FIRES

FIREBALL CHEMISTRY

TRANSPORT AND DIFFUSION -----

MESOSCALE

GLOBAL

APPLICATIONS AND IMPLICATIONS

# GLOBAL EFFECTS PROGRAM

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## EXCHANGE SCENARIOS:

- DEVELOP GENERIC EXCHANGE SCENARIOS TO PLACE SOURCE TERMS IN CONTEXT OF TARGETING FACTORS
- APPLY SCIENTIFIC BOUNDS TO THE SCENARIOS WITH CONSIDERATION FOR THRESHOLD EFFECTS

DUST SOURCE FUNCTION:

- TOTAL DUST SWEEP-UP
  - CHARACTERIZE MASS DISTRIBUTION
- COAGULATION, SCAVENGING, RAINOUT
  - MECHANISM AND EFFECTS OF HUMIDITY ON COALESCENCE AND RAINOUT
- LOFTING

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## FIRES SOURCE FUNCTION:

- TOTAL IGNITION AREA ----- FUEL LOADING  
TOTAL IGNITED AREA  
FIRE SPREAD
- PARTICULATE PRODUCTION ----- REACTION KINETICS  
NON-FLAME CONTRIBUTIONS
- PARTICULATE LOFTING ----- LARGE-SCALE FIRE CHARACTERISTICS  
SCAVENGING, COAGULATION, RAINOUT  
ATMOSPHERIC INJECTION  
EXPERIMENTS

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## CHEMISTRY:

- CHEMICAL KINETICS OF FIRES AND FIREBALLS
- CHEMICAL CONSEQUENCES OF MESOSCALE AND GLOBAL TRANSPORT AND DIFFUSION PROCESSES

INCLUDING OPTICAL AND INFRARED ABSORPTION, EMISSION,  
SCATTERING



# GLOBAL EFFECTS PROGRAM

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## TRANSPORT AND DIFFUSION:

- FULLY-COUPLED 3-D GLOBAL CLIMATE MODEL (GCM)
- INCLUDE ---
  - PARTICULATE SOURCE FUNCTIONS
  - HORIZONTAL ADVECTION PROCESSES
  - VERTICAL MIXING
  - SOLAR RADIATION
  - PARTICULATE SCAVENGING
  - INHOMOGENEITIES
  - PARTICULATE, RADIATIVE, CIRCULATION FEEDBACKS
  - SEASONAL DIFFERENCES AND PARTICULATE SPREADING

FY 84 GLOBAL EFFECTS PROGRAM

● NEW OR REDIRECTED EFFORT

NASA (LANGLEY)

100K

MESOSCALE TRANSPORT,  
DIFFUSION

SAI

50K

SOURCE TERMS

PALOMAR

70K

POLICY IMPLICATIONS

LANL

40K

GLOBAL TRANSPORT,  
DIFFUSION

IDA

75K

CHEMISTRY, THERMAL BALANCE,  
SCOPING

● SUPPORTING EFFORTS

SAI

200K

SOVIET VIEW

IRT

350K

DUST, SMOKE, OBSCURATION  
ESTIMATES

● ADDITIONAL 400 - 600K PLANNED

FY 85 GLOBAL EFFECTS PROGRAM

- |   |        |                  |
|---|--------|------------------|
| ● FIRES SOURCE, PLUME DYNAMICS,<br>EARLY-TIME SCAVENGING      | 40%    | SPTD             |
| ● MICROSCALE PHYSICS, CHEMISTRY                               | 10%    | RAAE             |
| ● MESOSCALE TRANSPORT, DIFFUSION<br>THERMAL BALANCE           | 40%    | RAAE, BEHR, SPSS |
| ● GLOBAL TRANSPORT, DIFFUSION                                 | 10%    | RAAE             |
| ● EXCHANGE SCENARIOS, IMPLICATIONS                            | -      | NASW, NATA       |
| ● GLOBAL EFFECTS PROGRAM,<br>NOT INCLUDING REDIRECTED EFFORTS | \$1-2M |                  |

GLOBAL EFFECTS PROGRAM

● PARTICIPANTS (PLANNED AND POTENTIAL):

AASL

AFGL

AFWL

LANL

LLNL

NASA (AMES)

NASA (LANGLEY)

NCAR

BERKELEY RESEARCH

CRT

HARVARD

IDA

IRT

MIT

MRC

PALOMAR CORP.

PDI

PENN STATE

PRINCETON

PSR

RDA

SAI

SRI

U MIAMI

## GLOBAL EFFECTS SUMMARY

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- VERY LARGE UNCERTAINTIES IN CRITICAL PARAMETERS
- SERIOUS POTENTIAL FOR SEVERE CONSEQUENCES
  - STABILITY OF ATMOSPHERE
  - WEATHER AND CLIMATE
- RESEARCH WILL REDUCE UNCERTAINTIES, BUT NOT SOLVE ALL OF THE PROBLEMS

P O T E N T I A L   G L O B A L   E F F E C T S

