General Characteristics		
1	**Abstract of Model Capabilities**	The MAILS modeling system combines a database of military aircraft emission rates with a line source dispersion model in order to estimate surface concentrations of criteria pollutants due to low-flying aircraft along Military Training Routes (MTRs). Criteria pollutants treated by the model are sulfur dioxide, nitrogen dioxide, carbon monoxide, particulate matter, and hydrocarbons. The model produces a screening report that can be used in environmental assessments and environmental impact statements for new or existing MTRs.
2	**Sponsor and/or Developing Organization**	Capt Leon Perkowski / Maj Mike Moss AFRL/MLQE, 139 Barnes Drive, Suite 2 Tyndall AFB, FL 32403 (850) 283-6249, DSN 523-6249 leon.perkowski@ccmail.aleq.tyndall.af.mil imy@ornl.gov
3	**Current Custodians**	Capt Leon Perkowski / Maj Mike Moss AFRL/MLQE, 139 Barnes Drive, Suite 2 Tyndall AFB, FL 32403 (850) 283-6249, DSN 523-6249 leon.perkowski@ccmail.aleq.tyndall.af.mil imy@ornl.gov
4	**Life-Cycle**	The development of MAILS was initiated in the late 1980's, concurrent with a project to estimate visibility and air quality impacts of low-altitude training flights. The MAILS code was an outgrowth of a simple model called SAILS (Single Aircraft Instantaneous Line Source) utilized internally for that effort. The database of many aircraft and ability to account for multiple aircraft operations over regulated averaging times was added in order to produce a product that would be useful for the wider USAF environmental community, and was released in present form in 1992.
5	**Model Description Summary**	The MAILS system combines an aircraft emissions database with a simple Gaussian line source dispersion model to calculate ground track concentrations of criteria pollutants in military training areas. The emissions database contains the following information for roughly 50 military aircraft types: airspeed, fuel rate, emission factor, number of engines and total emissions rate. The emission rate information is given for sulfur dioxide, nitrogen dioxide, carbon monoxide, particulates and hydrocarbons. The dispersion modeling portion of MAILS approximates a line source by using a series of Gaussian puff sources, with wind direction conservatively assumed parallel to the flight track. Ground level concentrations of the pollutants above may be calculated over one, three, eight, and 24-hour averaging periods, as well as one year, with adjustments applied to account for statistical variations in flight track about the stated centerline and for the intermittent nature of military training route operations. Model output is written to a file or to a printer in the form of a table that echoes input data and lists calculated concentrations for all requested pollutants at all requested averaging times. These concentrations are given both in micrograms/cubic meter and also as a percentage of the applicable National Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) Class I standards.
6	**Application Limitation**	The MAILS system is a narrowly focused application that is limited to calculating ground track pollutant concentrations along Military Training Routes (MTRs). Application to the more widely distributed flight paths involved in a Military Operations Area, for example, will produce very conservative estimates of surface concentration, potentially appropriate for screening purposes but not for more refined analyses. The conservative, screening nature of the model is reinforced by assumptions including the along-flight path wind direction and the calculation of surface concentrations based on a matrix of 49 wind speed/stability combinations, from which the maximum resulting concentrations are selected for reporting.
7	**Strengths/ Limitations**	**Strengths:** Simplicity; Fast operation; Small "footprint"; Direct applicability of output for intended purpose. **Limitations:** Inflexibility; Archaic user interface; Design hardwired for MTR application; Duplicates inputs often required for noise modeling. A possible upgrade project will recast the model with an up to date interface, expand flexibility as to aircraft types and operational parameters, and allow for input data swaps with applicable military range noise models.
8	**Model References**	**!** Liebsch, E.J. et al, MAILS Dispersion Model User's Guide (ESL-TR-89-59) **!** Liebsch, E.J., Development and Application of Procedures to Evaluate Air Quality and Visibility Impacts of Low-Altitude Flying Operations (ESL-TR-90-02) **!** Seitchek, G.D., Aircraft Engine Emissions Estimator (ESL-TR-85-14)

9	**Input Data/Parameter Requirements**	The user inputs a run title, selects standard or non-standard mode, selects the pollutant or pollutants of interest, selects an output destination (screen or file), enters the applicable number of aircraft/altitude combinations, the aircraft type and altitude for each combination, the mixing height, and the frequency of passes by the designated aircraft during the periods of analysis. A database supplies default values of airspeed and pollutant emission rate for each aircraft type.
10	**Output Summary**	The model outputs a summary of input parameters, calculated criteria pollutant ground track concentrations over various standards-based averaging times, and a comparison of the calculated concentration versus the most stringent applicable standard (usually PSD Class I increments).
11	**Applications**	Has been applied for numerous environmental assessments in support of flying operations on military training routes and in military operations areas. A primary user has been Air Combat Command (ACC/CEV).
12	**User-Friendliness**	Simple DOS-based database interface involving on-screen menu selection. Running a typical problem is a rapid process, easily learned by carrying out a small number of sample problems. Modifying the aircraft database is slightly more involved, but is described fully in the user manual.
13	**Hardware-Software Interface Constraints/ Requirements**	**Computer operating system:** PC-DOS, MS-DOS **Computer platform:** PC-compatible **Disk space requirements:** 2 MB **Run execution time** (for a typical problem)**:** 1-3 minutes **Programming language:** Foxbase Plus and MS-FORTRAN **Other computer peripheral information:** No information provided.
14	**Operational Parameters**	**Identify whether the code has any error diagnostic messages to assist the user in troubleshooting operational problems:** Yes **Set up time for:** . **Typical times are:** ***first-time user:*** 10 min ***experienced user:*** 5 min
15	**Surety Considerations**	**All quality assurance documentation:** **Benchmark runs:** Versus ISCST **Validation calculations:** Versus ISCST (see user guide) **Verification with field experiments that has been performed with respect to this code:** None
16	**Runtime Characteristics**	Depends on complexity of modeled scenario, but runs in 1-3 minutes for most scenarios, a bit slower (5-10 minutes) for complex scenarios on older (i.e., 80286, early 80386) platforms.

Specific Characteristics

Part A: Source Term Submodel Type

A1	**Source Term Algorithm?**	__YES ✔ NO

Part B: Dispersion Submodel Type

B1	**Gaussian**	**__Straight-line plume __Segmented plume __ Statistical plume ✔ Statistical puff**

Part C: Transport Submodel Type (Not Applicable.)

Part D: Fire Submodel Type (Not Applicable)

Part E: Energetic Events Submodel Type (Not Applicable)

Part F: Health Consequence Submodel Type (Not Applicable)

Part G: Effects and Countermeasures Submodel Type (Not Applicable)

Part H: Physical Features of Model

H1	**Stability Classification Turbulence Typing**	**Pasquill-Gilfford-Turner:** Yes Model implicitly uses stability categories as applied in the PTPLU and ISCST models. A matrix of 49 stability/wind conditions is applied, and the maximum resulting concentration is selected for a conservative, screening approach. **STAR:** No **Irwin:** No **Sigma theta:** No **Richardson number**: No **Monin-Obukhov length:** No **TKE-driven**: No **Split sigma:** No
H2	**Release Elevation**	**__ ground __ roof ✔ flight level**

H3	**Mixing Layer**	**__ trapping __ lofting ✔ reflection** **__ penetration __ inversion breakup fumigation** **__ temporal variability**
Part I: Model Input Requirements (See Item 9.)		
Part J: Model Output Capabilities (See Item 10.)		
Part K: Model Usage Considerations		
K1	**Ease of Model Use**	**Training required to run the model: __ background (years of education)** **3 hrs training time needed on the model to be able to exercise all model capabilities** **Training required to continue development of the model:** **__ background (years of education)** **__ training time needed on the model to be able to exercise all model capabilities**