	General Characteristics	
1	**Abstract of Model Capabilities**	MARSS Version 3.1 is a stand-alone system. Meteorological data from the Weather Information Network Display System (WINDS), effluent dispersion from REEDM, and BLAST damage assessment model outputs are obtained as ASCII files from the Cyber 860 mainframe by the microVAXes using a communication link. Several main processes are available: meteorology, diffusion, safety map, and auxiliary display. The diffusion process provides the paths and toxic corridors predicted by the dispersion models OB/DG and/or LOMPUFF. The major functions available on MARSS Version 3.1 are graphic weather data displays (i.e., wind in "wind barb" form, wind field, towers display, flow contours, and area time series); tabular weather data displays; weather data update and display every five minutes; REEDM concentration isopleth display; etc.
2	**Sponsor and/or Developing Organization**	MARSS is sponsored by the National Aeronautical and Space Administration (NASA) at Kennedy Space Center (KSC).
3	**Last Custodian/ Point of Contact**	Bill Boyd ESMC/WE Patrick Air Force Base, FL 32925-6535 (305) 495-5915
4	**Life-Cycle**	MARSS was initially developed in 1985, and has undergone reviews and improvements over the past 11 years.
5	**Model Description Summary**	MARSS Version 3.1 is a stand-alone system implemented on three identical DEC MicroVAX II microcomputers, each driving multiple (i.e., up to eight) Tektronix model 4111 or 4211 color graphics terminals through a terminal server. This provides redundancy in the system in case of hardware problems. All calculations, display generation, and user interactions take place on the micro VAXes. Meteorological data from the WINDS network, effluent dispersion information from REEDM, and BLAST damage assessment model outputs are obtained as ASCII files from the Cyber 860 mainframe using a communications link. A mouse-driven user interface allows the selection of menu items or icons from the screen. Fast graphics are provided by the Tektronix PLOT 10 software package. The major functions available on MARSS version 3.1 are graphic weather displays, tabular weather displays, weather data update and display every five minutes, historical weather data archiving, retrieval, and redisplay; concurrent runs of up to 12 OB/DG and one LOMPUFF scenarios; graphic overlay preparation; REEDM concentration isopleth display, and tutorial helps.
6	**Application Limitation**	The OB/DG model is limited in its capabilities and does not fully leverage the complex array of meteorological data sources available. In addition the model has no ability to account for the vertical variations in the wind field. It is also limited to daytime periods of unstable onshore flow and can not account for the seabreeze and superimposed river breezes. It also can not address the complicating effects of thunderstorms; common to the area. It is unable to deal with elevated releases, and has a weak source strength submodel. The LOMPUFF model also can not account for vertical variations in the wind field.
7	**Strengths/ Limitations**	**Strengths:** Addresses specialty chemicals located at the Kennedy Space Center. Interactive graphics system. Dispersion coefficients based on field tracer studies. **Limitations:** The OB/DG and LOMPUFF models are restricted to cold spills (i.e., no fire or explosions) which behave as a neutrally buoyant gas. The OB/DG evaporation rate neglects the influence of wind, temperature, local heat transfer, and individual chemical characteristics that affect evaporation rate. OB/DG considers only wind direction in its treatment of effluent transport, since there is only dependence on vertical temperature gradient (which is correlated with wind speed). OB/DG is a straight-line model which can not leverage the three-dimensional data produced by the WINDS system. It also only calculates a centerline value and only roughly estimates plume footprint using 2-sigma width.
8	**Model References**	! Bobowicz, T.J., 1985, "The Meteorological and Range Safety Support (MARSS) System", in Proceedings JANNAF Safety and Environmental Protection Subcommittee Meeting, June 11-13, Los Angeles, CA. ! ENSCO, Inc., 1988, "User's Manual for Meteorological and Range Safety Support System, Version 3.0", ARS-MPR-88-15, ENSCO, Inc. ! Lane, R.E., Jr., and Evans, R.J., 1989, "The Meteorological and Range Safety Support (MARSS) System", in Proceedings of Fifth International Conference on Interactive Information and Processing Systems for Meteorology, Oceanography, and Hydrology, January 30 - February 3, Anaheim, CA. ! Taylor, G.E., and Schumann, R.A., 1986, "A Description of the Meteorological and Range Safety Support (MARSS) System", in Proceedings of Fifth Joint Conference on Applications of Air Pollution Meteorology, November 18-21, Chapel Hill, NC.

8	**Model References (Cont.)**	! Wiley, T.K., Schumann, R.A., Lane, R.E., McCoy, H.E., Evans, R.J., and Taylor, G.E., 1988, "Program Maintenance Manual for MARSS System", Version 3.0, Volume 1, Report ARS-MPM-88-14 Eastern Space and Missile Center, ENSCO, Inc., Melbourne, FL. ! Hosker, R.P., et al, "An Assessment of the Dispersion Models in the MARSS System Used at the Kennedy Space Center", NOAA Technical Memorandum ERL ARL-205, Air Resources Laboratory, Silver Spring, MD, December 1993.
9	**Input Data/Parameter Requirements**	Mean wind speed, standard deviation of wind direction, vertical temperature difference from WINDS, emission rates of monomethylhydrazine, hydrazine, nitrogen tetroxide, ammonia, Freon-21, hydrochloric acid, unsymmetrical dimethylhyrdazine, nitrogen dioxide, and other chemicals.
10	**Output Summary**	Graphic weather data displays, tabular weather data displays, weather data update and display every five minutes, concentration isopleths.
11	**Applications**	MARSS is exclusively used at the Kennedy Space Center. However, its algorithms are applicable to other locations, as long as the limitations of the model are observed.
12	**User-Friendliness**	Not evaluated.
13	**Hardware-Software Interface Constraints/ Requirements**	**Computer operating system:** DEC microVAX II. **Disk space requirements:** Unknown **Run execution time** (for a typical problem): Unknown **Programming language:** FORTRAN 77 **Other computer peripheral information:** Interfaces with the REEDM and BLAST codes.
15	**Surety Considerations**	**All quality assurance documentation:** Unknown **Benchmark runs:** Unknown **Validation calculations:** No Information Provided **Verification with field experiments that has been performed with respect to this code:**
16	**Runtime Characteristics**	Dispersion coefficients based on Ocean Breeze (Cape Canerval) and Dry Gulch (Vandenberg Air Force Base) tracer experiments. In 1985, McRae compared this model to field data obtained from a planned spill of about 6,000 kg of hydrazine in the Eagle 3 test in Nevada. The model underpredicted the concentration by a factor of four or more at about 800 meters downwind.

Specific Characteristics

Part A: Source Term Submodel Type

A1	**Source Term Algorithm?**	✔ YES __NO
A2	**For Chemical Consequence Assessment Models**	**Liquid spill: ✔ pool evaporation _ particulate resuspension** **Pressurized releases:__ two-phase jets__ flashing__ entrainment__ aerosol formation** **Solid spills: _ resuspension _ sublimation**

Part B: Dispersion Submodel Type

B1	**Gaussian**	**__Straight-line plume __Segmented plume __ Statistical plume ✔ Statistical puff**
B2	**Similarity**	**✔ Plume _ Puff** Note: LOMPUFF model. The OB/DG model is a purely empirical best fit to tracer data experiments.

Part C: Transport Submodel Type

C2	**Deterministic**	Both LOMPUFF and OB/DG are deterministic
C4	**Frame of Reference**	**✔ Eulerian __ Lagrangian __ Hybrid __ Eulerian-Lagrangian**

Part D: Fire Submodel Type (Not Applicable)

Part E: Energetic Events Submodel Type (Not Applicable)

Part F: Health Consequence Submodel Type

F1	**For Chemical Consequence Assessment Models Cont.)**	**Zones with flammable limits: __ UFL __ LFL** **Blast overpressure regions:** **Fire radiant energy zones:** **Risk qualification:** **Concentration: ✔ single value __ time-history __ integrated dose** **Probits:**

Part G: Effects and Countermeasures Submodel Type (No Information Provided.)		
Part H: Physical Features of Model		
H1	**Stability Classification Turbulence Typing**	**Pasquill-Gifford-Turner:** **STAR:** **Irwin:** **Sigma theta:** **Richardson number:** **Monin-Obukhov length:** **TKE-driven:** **Split sigma:** Turbulence typing by stability class is not employed by the OB/DG and LOMPUFF modules. OB/DG uses direct calculations from sigma theta and vertical difference parameters. LOMPUFF uses similarity theory to calculate dispersion parameters that are a function of Monin-Obukhov scaling length and diabetic correction factors.
H2	**Release Elevation**	**_✔_ ground __ roof**
H7	**Cloud Buoyancy**	**_✔_ neutral [passive] __ dense [negative] __ plume rise [positive]**
Part I: Model Input Requirements		
I1	**Radio(chemical) and Weapon Release Parameters**	**Release rate: _✔_ Continuous _✔_ Time dependent__ Instantaneous** **Release container characteristics: _✔_ vapor temperature** **_✔_ tank diameter** **_✔_ tank height _✔_ tank temperature _✔_ tank pressure_✔_ nozzle diameter** **_✔_ pipe length** **Jet release: _ initial size __ shape** **__ concentration profile at end of jet affected zone** **Release dimensions: _✔_ point __ line _✔_ area** **Release elevation: _✔_ ground __ roof __ stack**
I2	**Meteorological Parameters**	**Wind speed and wind direction: _✔_single point __ single tower/multiple point _ multiple towers** **Temperature: _ single point __ single tower/multiple point _ multiple towers** **Dew point temperature: _✔_ single point __ single tower/multiple point _ multiple towers** **Precipitation: __ single point __ single tower/multiple point _ multiple towers** **Turbulence typing parameters: __ temperature difference _✔_ sigma theta __ sigma phi _✔_ Monin-Obukhov length __ roughness length _ cloud cover __ incoming solar radiation __ user-specified** Note: OB/DG uses sigma theta, while LOMPUFF uses Monin-Obukhov similarity and roughness length. **Four dimensional meteorological fields from prognostic model:**
Part J: Model Output Capabilities		
J1	**Hazard Zone**	Yes
J2	**Graphic Contours and Resolution**	Yes
J4	**Tabular at Fixed Downwind Locations**	Yes
Part K: Model Usage Considerations (See Items 5 - 7.)		