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CACDA JIFFY III WAR GAME
VOLUME I
EXECUTIVE SUMMARY

Technical Report 5-80

UNITED STATES ARMY
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Technical Report TR 5-80
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US Army Combined Arms Studies and Analysis Activity

Fort Leavenworth, Kansas 66027

CACDA JIFFY III WAR GAME

VOLUME I

EXECUTIVE SUMMARY

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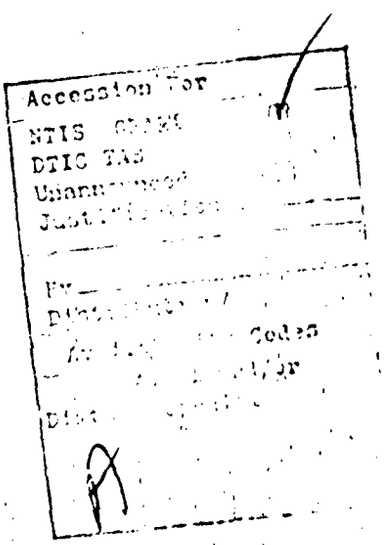

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This report is one of a set of five volumes produced to document the combat assessment methodologies and automated features of the Combined Arms Combat Development Activity (CACDA) JIFFY III war gaming process, developed to support TRADOC SCORES scenario development and force evaluation efforts. This report contains a summary description of the JIFFY III model, including background of the model development and its composition. The other four volumes in the set are methodology (Vol II), the classified data and their sources (Vol III), the User's Manual (Vol IV), and the Programmer's Manual (Vol V).

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FOREWORD

The Jiffy III War Game model was used in the development of the SCORES Europe III scenario, which provides the combat developments community with a common base of assumptions, threat forces, weapons, organizations, terrain, and tactics for the 1986 timeframe. The 1977 version of Jiffy was extensively modified and improved for the Europe III work. This report documents the Jiffy III model as used for Europe III and incorporates significant portions of the CACDA Jiffy War Game Documentation, Technical Manuals TR 2-77, TR 3-77, and TR 4-77, originally published in 1977. This report documents all of the changes and improvements completed through April 1980.

There are five volumes of Jiffy III War Game documentation. The first volume is the Executive Summary. Volume II is the Methodology, which describes the overall Jiffy III War Game methodology including detailed descriptions of the combat assessment equations. The computer calculates the attritions based on these equations. The unclassified portions of the data are given in Volume II. Volume III contains classified data as required for the Jiffy III model. Volume IV is the Users Manual, which contains a discussion of the manual aspects and the automated features of the gaming process and exemplifies the relationship between them through some sample runs. Volume V, the Programmers Manual, consists of descriptions and FORTRAN code of all programs and routines associated with the Jiffy III game.

This report was compiled principally by Drs. Channing L. Pao and Robert J. Schwabauer. The compilers wish to acknowledge the SCORES gaming staff of the Combined Arms Combat Development Activity who served as consultants during the methodology improvement.

ABSTRACT

This report is one of a set of five volumes produced to document the combat assessment methodologies and automated features of the Combined Arms Combat Developments Activity (CACDA) Jiffy III war gaming process. The Jiffy process was originally developed to support the TRADOC Scenario Oriented Recurring Evaluation System (SCORES) scenario development and force evaluation efforts. In 1978, the 1977 version of the Jiffy was extensively modified and improved to support Europe III scenario gaming through March 1980. This report documents the Jiffy model used for that gaming. Volume II of this report contains the methodologies used in the automated routines of the Jiffy III Game. An unclassified data base, which was developed for test and demonstration purposes, is presented in Volume II. The classified data used in the Jiffy III Game during secure production runs, and their sources, are published separately as Volume III to keep the methodology volume unclassified. The other three volumes in the set are the Executive Summary (Volume I), the Users Manual (Volume IV), and the Programmers Manual (Volume V).

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CACDA JIFFY III WAR GAME TECHNICAL MANUAL

EXECUTIVE SUMMARY

1. INTRODUCTION.

a. Purpose. The purpose of this volume is to provide a summary description of the Jiffy III model, including background of the model development and its composition. Model capabilities and limitations are presented in conjunction with the summary descriptions. General categories of data and minimum computer system requirements are also included. The Jiffy model undergoes frequent modification and improvement for new scenarios and studies. This report documents all the changes and improvements completed through April 1980.

b. Organization. Jiffy III is documented in five volumes. This executive summary volume consists of three main parts. Paragraph 2 contains a statement of the purpose of the Jiffy III model followed by a brief history of the model development. Paragraph 3 presents the model's capabilities and limitations, a summary of gamer interactions, and general data requirements. The last paragraph specifies the minimum computer system requirements for execution of the model.

2. MODEL PURPOSE AND BACKGROUND.

a. Model Purpose.

(1) The Jiffy III war game model was used specifically to develop the TRADOC Scenario Oriented Recurring Evaluation System (SCORES) Europe III scenario, which provides the combat developments community with a common base of assumptions, threat forces, weapons, organizations, terrain, and tactics for the 1986 timeframe.

(2) The Jiffy model is useful in general to facilitate identification of necessary improvements to doctrine, organizations, and materiel and to facilitate rapid assessment of proposed concepts and changes to friendly forces.

b. Background.

(1) The Jiffy Game has existed, as a manual war game, since the late 1960's. In its early stages, the game was completely manual and, correspondingly, its assessment methodology was simplistic based on the firepower scores of a few key weapon systems. In late 1973, USATRADOC established the Scenario Oriented Recurring Evaluation System (SCORES), the standard scenario development process that was to be based on the Jiffy Game. With the advent of SCORES, it was recognized that the simplistic, firepower score-driven Jiffy Game,

although responsive, was not of adequate resolution to produce the quality product expected from SCORES. Thus, the Jiffy Game underwent major methodology modifications, which allowed the gaming of the complete spectrum of conventional weapon systems and upgraded the assessment methodologies to use weapon characteristics as the basis for assessments. However, as the level of detail increased, the number of manual calculations and the amount of data required to make the calculations also increased. Finally, it became necessary to automate the assessment calculations to maintain the Jiffy Game's responsiveness. The automation process was completed in May 1975. This methodology was developed principally by MAJ Karl Lowe, assisted by LTC Tom Buff, MAJ Ken Nash, and MAJ Bob Riddick, and was documented in July 1975 with the publishing of the USACACDA SCORES "Jiffy" War Gaming Methodology.

(2) In the fall of 1975, as a quality assurance measure, the Jiffy Game methodology was subjected to sensitivity analysis. A Jiffy Game improvement program was initiated as a result of the analysis. The improvement program basically accomplished three tasks. First, the assessment methodology was modified and improved. Second, the capability to maintain on computer files a hierarchy of units consistent with the overall gaming methodology was added to the Jiffy Game in 1977. Finally, detailed documentation of the revised methodology and all supporting computer programs was published in 1977 by Mr. Timothy J. Bailey, Mr. Gerald A. Martin, and MAJ Francis W. O'Brien of CACDA. This report incorporates substantial portions of the 1977 documentation.

(3) In 1978, TRADOC directed CACDA to develop the SCORES Europe III Scenario in the 1986 timeframe and employ new weapons, doctrine, and organizations to assess combat and combat support units. The Jiffy Game model was extensively modified for the Europe III gaming; and further improvements in areas such as EW, smoke, dust, thermal sights, and the attack helicopter/air defense assessment subroutines were made. This report documents the Jiffy III Game model used for Europe III gaming.

3. SUMMARY DESCRIPTION.

a. Game Objective and Resolution. Jiffy III is a low resolution game suitable for making rapid assessment of proposed concepts and the effects of changes to both friendly and threat forces, equipment, doctrine, and tactics. During an application of the model, the corps front is divided into sectors in which the rate-of-advance and combat assessment calculations are made. The sectors are typically Blue battalion sized, which corresponds to the portion of the corps front that is the area of operation for a Blue battalion. The unit resolution in the game is generally at the Blue company and Red battalion levels.

b. Model Capabilities and Limitations.

(1) Model capabilities. The Jiffy III war game model is a computer-assisted, two-sided, interactive manual war game, which is designed to be oriented toward the military gamer. The Jiffy III model computer program computes combat assessments and maintains history files for each sector played as well as cumulative totals for all sectors. Specific capabilities represented in the Jiffy III model are as follows:

(a) Weapon systems in the 1986 timeframe.

(b) Indirect fire. The Jiffy III model indirect fire assessment methodology determines the materiel and personnel losses resulting from the play of three phases of indirect fire support: preparation/counterpreparation fires; combat support fires, e.g., close support, counterbattery, air defense suppression; and final protective fires. The assessment methodology is one-sided and is repeated for all indirect fire weapon-target combinations. The methodology addresses each force, in turn, and computes the expected number of casualties a force's indirect fire assets can inflict on the opposition as determined by the number of each specific area target contained in the enemy force, the number of battery missions available for firing at each specific area target, and the combination of these parameters in the nonlinear assessment equation. The computed losses are not subtracted from the force until all assessments in a phase of indirect fire combat have been made, so the order of assessing the forces does not affect the outcome.

(c) Minefields. The minefield assessments determine the attrition of dismounted infantry personnel and armored vehicles as a result of an attacking force passing through a mined sector using "bull" tactics or a hasty breach technique. The model considers both conventional and FASCAM minefields against attacker weapon systems; defenders are not assessed. The expected losses are determined linearly based on minefield density and minefield-sector geometry, which is input by the gamers. Minefield density is dependent on the characteristics of the mine and the means of employment (manual, mechanically, and artillery delivered mines).

(d) Armor/antiarmor. The armor/antiarmor assessment portrays the exchange of fire between the armored and antiarmor elements of the opposing maneuver units. Only tanks, antitank weapons, and other armored vehicles are considered in the actual assessment as firers and as targets. DIVAD, ZSU-23-4 and ZSU-37-2 are also played as targets only. The single shot kill probabilities and expected number of rounds fired by participating weapons are used to determine actual losses of tanks, other armor vehicles, and dismounted

antitank weapons. It also considers day/night, dust, thermal sights and smoke conditions.

(e) Infantry. Infantry casualties are assessed in each type of combat assessment in the Jiffy III game. Mounted infantrymen are attrited in direct proportion to losses of infantry personnel-carrying vehicles. The loss of a crew-served weapon system results in the loss of a portion of its crew as well. Dismounted infantry are simply potential targets for which probabilities of kill have been developed and against which fire is allocated.

(f) Attack helicopter/air defense. Attack helicopter and air defense assessments are considered simultaneously in the Jiffy III game in order to portray the interactions between these two types of systems realistically. The helicopter mission profile is portrayed not as a single attack but as a series of helicopter pop-ups. It also considers day/night, dust, thermal sights, and smoke conditions.

(g) TACAIR assessments. Casualties incurred during TACAIR attack missions are assessed by the US Air Force Tactical Fighter Weapons Center (USAFTFWC). The losses resulting from TACAIR combat can be added to the losses resulting from the Jiffy combat assessments so that they are apportioned to units on the force file.

(h) Thermal, Optical and Image Intensifier sights. These sights are played in the armor/antiarmor and attack helicopter assessment routines. A set of data, called "Expected Number of Completed Firings," which is a function of type of terrain, range, and visibility, is used in the armor/antiarmor routine. The probability of detection for thermal sights is used for the attack helicopter routine. Weapon systems equipped with thermal sights are assumed to be not affected by smoke in the Jiffy III game.

(i) Smoke. Smoke is not explicitly modeled in Jiffy, but rather for each force the portion of friendly units self-smoked and the fraction of the enemy force smoked are determined off-line. These numbers are an average effect during the entire critical incident and are used in the rate of advance calculations, in the attack helicopter/air defense assessments, and in the CLGP routine. The armor/antiarmor routine also considers the effects of smoke. The armor/antiarmor smoke fractions are determined by gamer judgment for each separate engagement and last for only the duration of that engagement. Smoke also affects the indirect fire assessments by reducing the number of HE/ICM battery missions by the appropriate number of smoke missions.

(j) Dust. Dust is played by computing precision guided missile abort rates based on the dust level. Dust level is determined from the artillery round density level, which is defined as the

expected number of rounds impacting per minute per maneuver unit area. Three levels of dust are played with no interpolation between levels: no dust, light dust, and heavy dust. The dust abort rates affect the number of unaborted rounds for CLGP, antitank guided missiles, and AH missiles.

(k) Electronic warfare (EW). EW is accounted for in the rate of advance routine and in the artillery assessments routine. In the rate of advance routine, EW degrades the firepower score. In the artillery assessment routine EW degrades the number of each force's battery missions.

(l) Automatic computation of the mass value of ground units as required by the Tactical Air Land Operation (TALON) Model. The purpose of computation of the mass value of ground units is to keep the ground games synchronized in Jiffy and the TALON war games. The mass value describes the relative target value of the ground units, enabling the Air Force to input the air-to-land effects quantification into the SCORES scenario building process.

(m) Recoverable and nonrecoverable weapons. The Jiffy model calculates the portions of weapon systems lost in combat that are recoverable and nonrecoverable. The nonrecoverable losses are those weapon systems assumed to be destroyed or not able to be recovered due to adversities of terrain or tactical situation. The recoverable weapon systems are those accessible and repairable.

(n) Postprocessor. The output from Jiffy gaming is voluminous and consists of detailed unit status reports and gaming reports. All these reports pertain only to a critical incident (CI). The postprocessor is designed to provide specified game output reports as well as cumulative game output reports. These outputs can be formulated into several specified measures of effectiveness (MOEs) such as loss exchange ratio (LER), initial force ratio (IFR), and ratio statistics given both by all major systems and by armor systems, etc. The format of the loss by source-of-loss tables has been expanded to give losses by victim weapon system category in addition to weapon system type.

(2) Model assumptions and limitations.

(a) In general, the Jiffy III model does not consider any synergistic effects among the different combat assessments; the interactions are done off line by the gamers.

(b) Combat activities in each sector are independent; the interactions are done off line by the gamers.

(c) Rate of advance is based on firepower scores adjusted for terrain, visibility, the tactical situation, mines, smoke, and EW.

(d) Military worth values are used to determine the relative importance of the targets in the indirect fire assessment routine.

(e) Target acquisition probabilities are based on the probabilities of knowledge (POK) concept developed by representatives of the military intelligence and electronic warfare communities and updated by USACACDA and coordinated with USA Intelligence Center and Schools.

(f) Effects of radars are played at an aggregated level using a percent of knowledge table.

(g) Area targets are homogeneous and generally company size.

(h) Ammunition expenditures reflect only the number of rounds fired at the opposing force. They do not include rounds lost to combat damage.

(i) Jiffy III is a low resolution model and should be limited to studying trends, not for explicitly determining the effectiveness of a particular weapon or system.

c. Gamer Interactions and Inputs.

(1) General. Jiffy III is an open war game. Gamers manipulate forces, using maps and performance indicators, to simulate ground combat. Gamer inputs are integrated in the computer model to assess the combat. It is essential to maintain a proper perspective throughout this procedure to insure that Jiffy is not used for an investigation beyond its capability. The decisions made by the commanders are a major portion of the entire process and must be reflected effectively in each critical incident. The overall sequence of events is summarized in figure 1.

(2) Gamer interactions. The Jiffy game is played interactively through the assessment officer, who operates the computer terminal. Gamer input of force structures is required, and gamers interact at the decision points appearing on the terminal screen and outlined below:

. Load forces into a sector.

. Calculate rate of advance.

. Assess combat (options to play smoke, thermal sight, EW, etc.).

. Apportion combat losses to units.

. Display battle statistics.

. Display weapon arrays.

. Add Standard Reference Codes (SRC) to the SRC file.

. Restart at previously gamed CI.

. End game and/or update history files.

. Reset element array.

. Review previous run.

. Reset terminal output (connect, disconnect).

(3) Gamer inputs and considerations. Considerations required of gamers for major subroutines are summarized below:

(a) Rate of advance subroutine.

. Type engagement--fortified/prepared/hasty defense, delay, withdrawal, and meeting engagement.

. Attacker posture--frontal attack, single envelopment, and double envelopment.

. Type terrain--open, rolling, hilly, and mountainous.

. Visibility--reported weather.

. Mines/barriers.

. Mounted/dismounted attack.

. Duration of attack.

. Smoke--type, self-generated, and frontage to determine percent obscured.

. EW--number missions available and target priority.

(b) Indirect fire subroutine.

- Number of firing batteries.
- Hours of fire support.
- Type of mission--final protective fire, preparatory/counterpreparatory, counterbattery, air defense suppression, and combat support.
- Number of CLGP missions.
- EW--number missions available and target priority.
- Percent smoke firers--number of batteries available and strength, desired smoke frontage, round capability, and importance of other missions.

(c) Minefield subroutine.

- Meters of minefield front.
- Mine density per square meter.
- Fraction of minefield that can be bypassed--deployment of units, number of units, unit missions, and length of critical incident.
- Meters of trafficable terrain--map study of sector.
- Percent of unit entering minefield--deployment of units, number of units, unit missions, defender strength/status, and type unit/strength.
- Type of minefield--conventional (laid mechanically or manually), GEMMS, and FASCAM.

(d) Armor/antiarmor subroutine.

- Number of systems.
- Type engagement--fortified/prepared/hasty defense, meeting engagements, delay, and withdrawal.
- Type of terrain--open, rolling, hilly, and mountainous.
- Visibility--reported weather.

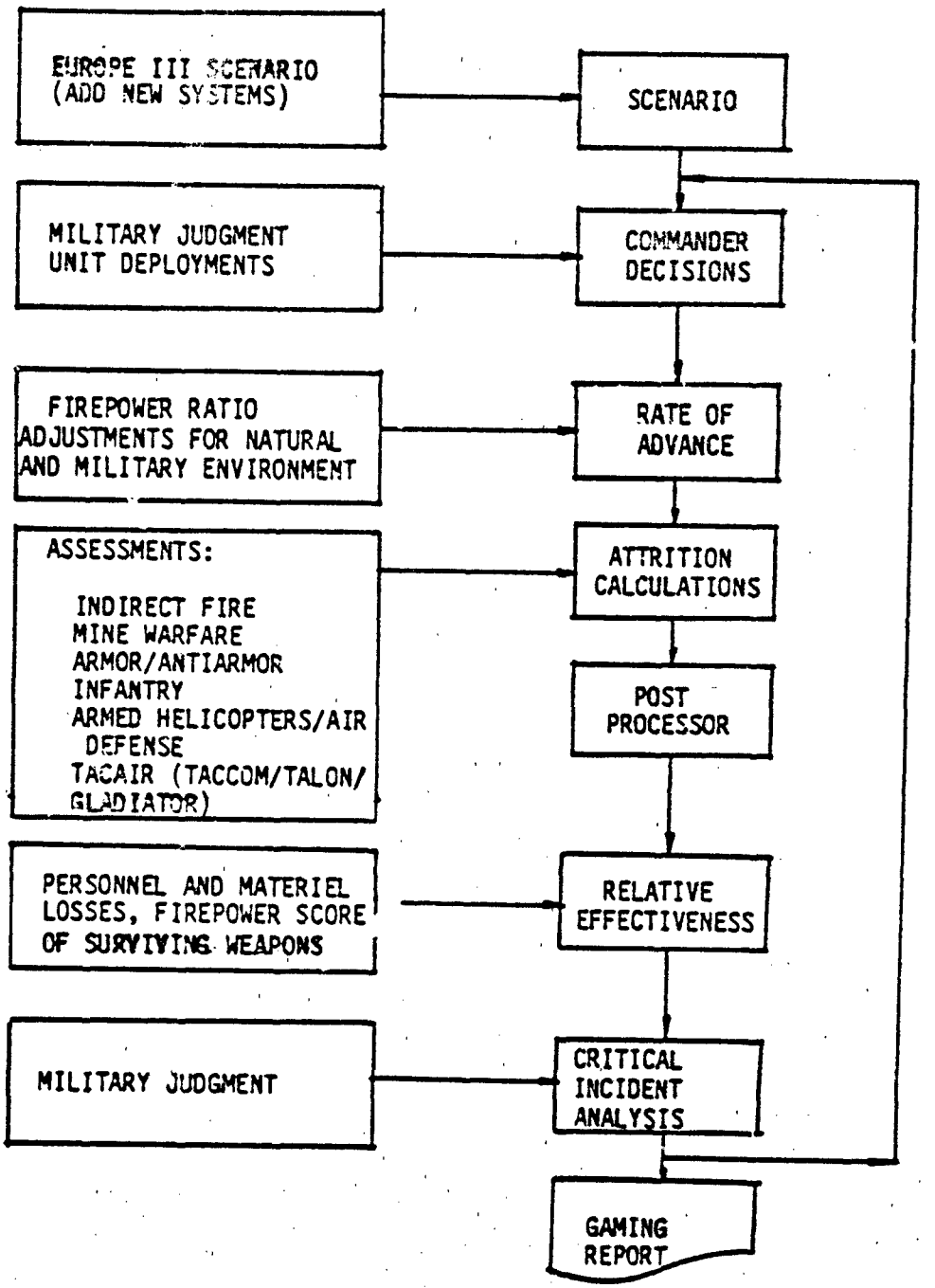

Figure 1. Jiffy War Gaming Process

- Target range and percent engaged--mission of both sides, range of last CI engagement, terrain, avenues of approach, unit strength/mix of vehicles/type unit, and length of time in position.

- Smoke--number of batteries available and strength, round capability, importance of other fire missions, and mission.

(e) Infantry subroutine.

- Tactics employed--ambush, fortified/prepared/hasty defense, meeting engagement, and delay/withdrawal.

- Forces engaged--fraction of forces in sector, units to dismount, unit deployment/posture, and CI length.

- Duration of combat.

(f) Attack helicopter/air defense subroutine.

- Weapons control status.

- Percent AD committed--terrain, number of systems, tactical deployment, suspected firing positions, and perceived AH threat.

- Target priority.

- Helicopter standoff distance/type AH attack (autonomous/indirect)--mission, terrain, day/night, size of cell and mix, AD threat, and number of AH/scouts available.

d. Data Requirements. The data base required for the Jiffy III game consists of both unclassified and classified data. The major categories of data are listed below.

(1) Multi-System or General:

- Operational Availability Data

- Suppression Factors

- Rate of Advance Data

- Visibility

- Combat Intensity Level Factors
- Percents of Force Deployed Forward
- Materiel Losses Per Man Lost
- Crewmen Killed Per Weapon System
- Equipment Repairability Data
- Firepower Scores
- Red Equipment Replacement Policy
- Dust Factor

(2) Indirect Fire:

- Tubes per Battery
- Military Worth
- IDF Level Data
- Elements per Area Target
- Non-Targeted Missions
- Probability of Knowledge
- Rates of Fire
- Fractional Damage Tables
- CLGP Kill Probabilities
- Probability that GLLD not Suppressed or the RPV survives

(3) Minefield:

- Hours to Manually Emplace Mines
- Hours to Mechanically Emplace Mines
- Minefield Density
- Antitank Minefield Lethality Data

- Antipersonnel Minefield Lethality Data
- FASCAM Antitank Lethality Data

(4) Armor/Antiarmor:

- Expected Number of Completed Firings
- Acquisition Data
- Thermal Visibility
- Category Weights
- Infantry Personnel Killed per Antitank Weapon
- Kill Probabilities

(5) Infantry:

- Casualty Rates
- Ambush Casualty Rates

(6) Attack Helicopter/Air Defense:

- Helicopter Rates of Fire
- Helicopter Ordnance Loads
- AD Weapon Control Factors
- AH Kill Probabilities
- AD Kill Probabilities
- Probabilities of line of sight
- Sorties Available
- Dust Factors
- Suppression Factors
- Probabilities of Acquisition or Detection
- Maximum Numbers of Pop-Ups

e. Program Size. The Jiffy III model programs, including postprocessor and associated utility programs, consist of approximately 8500 FORTRAN statements.

4. COMPUTER SYSTEM REQUIREMENTS. The minimum computer system requirements for execution of the Jiffy III model are listed below.

Core storage capacity -- 150,000 words (octal)

Magnetic disk capability -- 50,000 Physical Record Unit (PRU)

Interactive terminal -- 2

Printer -- 2

Software feature -- FORTRAN IV Extended Compiler
20 Segments
Mass storage input/output

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