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ANALYZING MCCRES DATA,

by

Zeev Barzily

Serial-T-427
5 August 1980

The George Washington University
School of Engineering and Applied Science
Institute for Management Science and Engineering

THE GEORGE WASHINGTON UNIVERSITY
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Program in Logistics

Abstract
of
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obtained. The analysis determines the weaknesses and strengths of units,
helps plan future evaluations, and serves as a tool for planning of
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20 ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Marine Corps Combat Readiness Evaluation System (MCCRES) is designed to evaluate the state of readiness of Marine units. The present report describes MCCRES and suggests a method for analyzing the data obtained. The analysis determines the weaknesses and strengths of units, helps plan future evaluations, and serves as a tool for planning of training programs.

ANALYZING MCCRES DATA

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I. Introduction

The Marine Corps Combat Readiness Evaluation System (MCCRES)
evaluates the performance of Marine units in simulated combat. Specific
tests have been designed to evaluate infantry units, rotary wing and
observation squadrons, combat support elements, and combat service
support units. The present report deals with evaluating the performance
of infantry battalions as described in Volume II of MCCRES.

A major difficulty in measuring the readiness of a military unit
results from the fact that the unit is not evaluated under real combat
conditions. It is evaluated instead while executing several exercises
representing typical operations the unit is supposed to be able to
execute. To avoid this difficulty it is common to replace the question
"Can the unit do the job?" by "How 'close' is the execution to the
doctrine." It is assumed that units which follow the doctrine closely
are likely to be able to do the job.

Methods for assessing the readiness of military units are discussed
in our survey [1] . In that report we conclude that the most promising

approach, in our opinion, is the data analysis approach. The present
paper applies this approach. In Section II we describe how the data
are collected and in Sections III and IV we propose a method for
analyzing data that come from MCCRES evaluations. The analysis aims
at helping to determine measures to improve the performance of battalions
in MCCRES and to determine efficient evaluation procedures.

II. Description of the Test for Infantry Units

Volume 11 of MCCRES consist of five sections. Each section
consists of Mission Performance Standards (MPS). The MPS in turn consist
of tasks and each task consists of requirements, which are the most
elementary part of MCCRES. The composition of Volume 11 of MCCRES is
given in Figures 1, 2, 3, and 4. The only missing section in the figures
is the fifth, Section 2X - Standard Performance Tests. This section
is not discussed in the present report. We do not list the require-
ments in Figures 1-4, because they number 793. But the requirements are
classified according to the ten categories of Section III and in the four
figures we present the breakdown of the requirements into these ten
categories.

The requirements pose questions that, when applicable, can be
answered either by YES or by NO. A unit scores a "YES" if all conditions
of the requirement are satisfied, otherwise, it scores a NO. As an
example we list here the requirements that constitute the task 2B.1.1 -
Debarkation for MPS 29B.1 - Surface assault.

> 2B.1.1.1 - Unit prepares for debarkation:
>   muster personnel, inspects arms and
>   equipment, and issues ammunition
>
> 2B.1.1.2 - Final debarkation schedules established (KI)
>
> 2B.1.1.3 - Debarkation teams report to debark stations
>   when called away (KI)
>
> 2B.1.1.4 - Vehicle drivers man vehicles when called away (KI)
>
> 2B.1.1.5 - Individual marines board assault amphibians and
>   landing craft in an expeditious manner (KI)

			1	2	3	4	5	6	7	8	9	10
	TASKS		R E P O R	P R E P A	C O D M U	P E E R L D	D E L A V N	P L A N N	C O N F O	E X E C U	P R O V I	S U P E R

	TASKS	1	2	3	4	5	6	7	8	9	10
	2.A.1.1 ......DISCIPLINE	0	0	1	5	0	0	0	0	0	3
	2.A.1.2 ......DISPERSION	0	0	0	2	0	0	0	0	0	3
	2.A.1.3 ......USE OF COVER	0	0	0	2	0	0	0	0	0	3
	2.A.1.4 ......USE OF CAMOUFLAGE AND CONCEALMENT	0	0	0	2	0	0	1	0	2	0
MPS 2.A.1	2.A.1.5 ......SECURITY ACTIONS	2	2	0	0	0	1	3	1	0	0
	2.A.1.6 ......RECONNAISSANCE PATROLLING	1	3	0	0	0	1	2	3	0	0
CONTINUING ACTIONS	2.A.1.7 ......COMBAT PATROLLING*	1	3	0	0	0	1	2	3	0	0
BY	2.A.1.8 ...RESPONSE TO ENEMY ELECTRONIC WARFARE CAPABILITIES	2	1	3	1	0	0	0	0	0	1
MARINES	2.A.1.9 ...RESPONSE TO ENEMY CHEMICAL CAPABILITIES*	2	0	0	1	0	0	3	3	1	0
	2.A.1.10 ...RESPONSE TO ENEMY AIR CAPABILITIES*	1	0	0	2	0	0	3	1	0	0
	2.A.1.11 ...HANDLING OF PRISONERS OF WAR*	1	0	0	0	0	0	4	1	0	0
	2.A.1.12 ...CASUALTY HANDLING	1	0	0	4	0	0	0	1	0	0
	2.A.2.1 ......MANEUVER CONTROL	1	0	0	0	0	0	1	5	0	0
	2.A.2.2 ...RESPONSE TO DIRECTION FROM HIGHER HEADQUARTERS	1	0	1	0	0	0	1	1	0	0
	2.A.2.3 ......CONTROL OF ORGANIC FIREPOWER	0	0	1	0	2	1	1	2	0	0
	2.A.2.4 ...CONTROL OF ATTACHED AND SUPPORTING FIREPOWER ASSETS	0	0	3	0	2	2	1	0	0	0
MPS 2.A.2	2.A.2.5 ...CONTROL OF SUPPORTING NAVAL GUNFIRE*	0	0	4	0	2	2	1	0	0	0
	2.A.2.6 ...CONTROL OF AIR DELIVERED FIREPOWER*	0	0	3	0	2	1	2	0	0	0
COMMAND	2.A.2.7 ...LANDING ZONE CONTROL AND OPERATION	0	0	1	0	0	1	3	0	2	0
AND	2.A.2.8 ...COORDINATION OF INTELLIGENCE EFFORT	2	0	1	0	0	2	3	0	0	2
CONTROL	2.A.2.9 ...COMMUNICATIONS COORDINATION	1	0	6	1	0	0	0	1	0	0
	2.A.2.10 ...COORDINATION OF LOGISTIC EFFORT	1	0	0	0	0	1	0	0	5	1
	2.A.2.11 ...COORDINATION OF CASUALTY TREATMENT AND EVACUATION	1	0	0	0	0	0	2	0	3	0
	2.A.2.12 ...REPORTS CONTROL	2	0	0	0	0	0	3	0	0	0
	2.A.3.1 ......FSCC OPERATION	0	0	1	0	8	1	1	0	0	0
	2.A.3.2 ......FSCC MISSION PROCESSING	0	0	1	0	6	0	0	0	0	0
MPS 2.A.3	2.A.3.3 ......MISSION CLEARANCE	0	0	0	0	6	0	0	0	0	0
	2.A.3.4 ......OFFENSIVE FIRE SUPPORT	0	0	0	0	7	0	0	0	0	0
FIRE SUPPORT	2.A.3.5 ......DEFENSIVE FIRE SUPPORT	0	0	0	0	9	0	0	0	0	0
COORDINATION	2.A.3.6 ......COUNTERFIRE PROGRAMS*	0	0	0	0	5	4	0	0	0	0
	2.A.3.7 ......TARGET INFORMATION PROCESSING BY FSCC	0	0	0	0	7	0	0	0	0	0

NOTE: * DENOTES AN OPTIONAL TASK

FIGURE 1   SECTION 2.A: MISSION PERFORMANCE STANDARDS APPLICABLE TO ALL EVALUATIONS IN MCCRES

REQUIREMENTS
COUNTS BY
CATEGORIES

TASKS			1	2	3	4	5	6	7	8	9	10
			R	P	C	P	D	P	C	E	P	S
			E	R	O	E	E	L	O	X	R	U
			P	E	M	R	L	A	N	E	O	P
			O	P	M	F	I	N	F	C	V	E
			R	A	U	G	V	N	O	U	I	R
MPS 2.8.1	2.8.1.1	....................DEMARKATION	1	0	0	0	0	1	2	2	0	2
	2.8.1.2	....................ASSAULT ACROSS THE BEACH	2	0	0	1	1	3	0	3	0	0
	2.8.1.3	....................SEIZURE OF OBJECTIVES	2	0	0	0	1	1	0	3	0	0
SURFACE ASSAULT	2.8.1.4	....................BUILDUP OF COMBAT POWER ASHORE	2	0	0	0	0	0	1	1	3	0
	2.8.2.1	....................PLANNING	1	2	0	0	0	6	0	0	0	0
	2.8.2.2	....................PREPARATION	0	3	0	0	0	1	0	0	2	2
MPS 2.8.2	2.8.2.3	....................EMPLANEMENT	0	0	0	1	0	0	1	2	0	0
	2.8.2.4	....................ASSAULT INTO LANDING ZONE	1	0	0	1	0	0	1	2	0	0
HELICOPTERBORNE	2.8.2.5	....................SECURING THE LANDING ZONE	1	0	0	0	2	1	1	3	0	0
ASSAULT	2.8.2.6	....................SEIZURE OF ASSIGNED OBJECTIVE	2	0	0	0	0	0	0	3	0	0
	2.8.2.7	....................LINKUP	2	1	1	0	0	1	0	2	0	0
MPS 2.8.3	2.8.3.1	....................PREPARATION	2	4	1	0	0	2	0	0	0	0
	2.8.3.2	....................ROUTE COLUMN	1	0	1	0	0	0	0	3	0	0
MOVEMENT	2.8.3.3	....................TACTICAL COLUMN	3	1	1	0	0	0	0	5	0	0
TO	2.8.3.4	....................APPROACH MARCH*	2	0	0	0	0	0	1	6	0	0
CONTACT*	2.8.3.5	....................MEETING ENGAGEMENT*	1	1	0	0	1	1	0	2	0	0

NOTES: * DENOTES AN OPTIONAL MPS   * DENOTES AN OPTIONAL TASK

FIGURE 2.1   SECTION 2.8: MISSION PERFORMANCE STANDARDS APPLICABLE TO AMPHIBIOUS ASSAULT
AND NORMAL COMBAT OPERATIONS ASHORE (PART 1 OF 2)

	TASKS		1 R E P O R	2 P R E P A	3 C O M N U	4 P E R F O	5 D E L I V	6 P L A N N	7 C O N F O	8 E X E C U	9 P R D V I	10 S U P E R

REQUIREMENTS COUNTS BY CATEGORIES

MPS / Group	Task	Description	1	2	3	4	5	6	7	8	9	10
MPS 2.8.4 ATTACK	2.8.4.1	PLANNING	1	2	0	0	0	4	1	0	0	0
	2.8.4.2	PREPARATION	0	2	1	0	0	0	1	1	2	1
	2.8.4.3	PRELIMINARY OPERATIONS	0	0	0	0	0	3	1	2	0	0
	2.8.4.4	MANEUVER FORWARD OF LOD AND SHORT OF FINAL COORDINATION LINE	3	0	0	0	1	1	0	4	0	0
	2.8.4.5	ASSAULT FROM FINAL COORDINATION LINE THROUGH THE OBJECTIVE	1	0	0	0	0	0	0	5	0	0
	2.8.4.6	CONSOLIDATION	3	2	0	0	0	2	2	1	0	0
	2.8.4.7	EMPLOYMENT OF THE RESERVE	1	0	0	0	0	1	3	1	0	0
	2.8.4.8	RESPONSE TO COUNTERATTACK*	2	0	0	0	1	1	2	2	0	0
	2.8.4.9	COMMAND POST DISPLACEMENT*	1	0	0	0	0	2	1	1	0	0
MPS 2.8.5 NIGHT ATTACK	2.8.5.1	PLANNING	1	3	0	0	0	4	1	0	0	0
	2.8.5.2	PREPARATION	0	3	1	0	0	1	1	0	0	0
	2.8.5.3	MANEUVER TO LINE OF DEPARTURE	0	0	0	0	0	0	3	1	0	0
	2.8.5.4	MANEUVER BETWEEN THE LOD AND THE PROBABLE LINE OF DEPLOYMENT	1	0	1	1	0	1	1	4	0	0
	2.8.5.5	ASSAULT FROM PLD THROUGH OBJECTIVE	1	0	1	1	0	0	0	3	0	0
	2.8.5.6	CONSOLIDATION AND MOVEMENT OF THE RESERVE*	2	1	0	0	0	4	1	0	1	0
	2.8.5.7	NIGHT COMMAND POST DISPLACEMENT*	1	0	0	1	0	3	1	1	0	0
MPS 2.8.6 DEFENSE	2.8.6.1	PLANNING	1	2	1	0	0	7	0	0	0	0
	2.8.6.2	ORGANIZATION OF THE GROUND	0	2	1	1	0	4	1	0	0	0
	2.8.6.3	ACTIONS FORWARD OF THE FEBA*	2	0	0	0	2	1	5	0	0	0
	2.8.6.4	ACTIONS ON THE FEBA*	1	0	0	2	0	1	0	2	0	0
	2.8.6.5	ACTIONS WITHIN THE POSITION*	1	1	0	0	0	0	1	3	0	0
	2.8.6.6	COUNTERATTACK*	3	0	0	0	0	2	1	2	2	0
MPS 2.8.7 RETROGRADE OPERATIONS*	2.8.7.1	PLANNING	1	1	0	0	0	4	0	0	0	0
	2.8.7.2	PREPARATION	1	1	0	0	0	3	0	0	3	0
	2.8.7.3	DELAYING ACTION	3	0	0	0	0	1	0	6	0	0
	2.8.7.4	WITHDRAWAL UNDER ENEMY PRESSURE	2	0	0	0	1	2	0	3	0	0
	2.8.7.5	WITHDRAWAL WITHOUT ENEMY PRESSURE	2	0	0	0	0	3	0	4	0	0
	2.8.7.6	RETIREMENT	2	0	0	0	0	3	0	1	0	0

NOTES: * DENOTES AN OPTIONAL MPS   * DENOTES AN OPTIONAL TASK

FIGURE 2.2   SECTION 2.8: MISSION PERFORMANCE STANDARDS APPLICABLE TO AMPHIBIOUS ASSAULT AND NORMAL COMBAT OPERATIONS ASHORE (PART 2 OF 2)

REQUIREMENTS COUNTS BY CATEGORIES

TASKS	1 R E P O R	2 P R E P A	3 C O M M U	4 P E R F O	5 D E L I V	6 P L A N N	7 C O N F O	8 E X E C U	9 P R O V I	10 S U P E R
MPS 2.C.1 2.C.1.1 ....PLANNING	1	2	0	0	0	4	0	0	0	0
2.C.1.2 ....PREPARATION	0	1	1	0	0	0	0	2	0	2
2.C.1.3 ....TANKS AND INFANTRY ON SAME AXIS*	2	0	0	0	0	2	0	5	0	0
TANK-INFANTRY 2.C.1.4 ....TANKS AND INFANTRY ON CONVERGING AXES*	2	0	0	0	1	1	0	7	0	0
OPERATIONS* 2.C.1.5 ....TANKS SUPPORT BY FIRE ONLY*	2	0	0	0	0	1	0	3	0	0
MPS 2.C.2 2.C.2.1 ....PLANNING	1	2	1	0	0	2	0	0	0	0
MECHANIZED 2.C.2.2 ....PREPARATION	0	4	0	0	0	1	2	0	0	0
OPERATIONS 2.C.2.3 ....MOUNTED MANEUVER	2	0	0	0	1	2	0	4	0	0
2.C.3.1 ....PLANNING	1	2	0	0	1	4	0	0	1	0
MPS 2.C.3 2.C.3.2 ....PREPARATION	0	3	1	0	0	1	0	0	1	0
2.C.3.3 ....ISOLATION OF THE BUILT UP AREA	2	0	0	0	1	0	0	2	0	0
MILITARY OPERATIONS 2.C.3.4 ....SEIZURE OF AN INITIAL FOOTHOLD IN BUILT UP AREA	1	0	0	0	1	0	0	2	0	0
IN 2.C.3.5 ...ADVANCE THROUGH BUILT UP AREA AND EJECTION OF ENEMY FORCE	1	0	0	0	0	0	0	7	0	0
BUILT UP AREAS* 2.C.3.6 ....ASSUMPTION OF THE DEFENSE IN A BUILT UP AREA	2	0	1	0	0	6	1	1	0	0
MPS 2.C.4 2.C.4.1 ....PLANNING AND PREPARATION	1	3	0	0	0	4	0	0	0	0
EVACUATION 2.C.4.2 ....INITIAL SCREENING OF EVACUEES	3	0	0	0	0	0	2	0	0	0
OPERATIONS* 2.C.4.3 .SECURITY RESPONSIBILITIES FOR THE EVACUATION CONTROL CENTER	0	0	0	0	0	1	2	0	0	0
2.C.5.1 ....PLANNING	X	X	X	X	X	X	X	X	X	X
2.C.5.2 ....PREPARATION	X	X	X	X	X	X	X	X	X	X
2.C.5.3 ....CONCEPT OF OPERATIONS	X	X	X	X	X	X	X	X	X	X
2.C.5.4 ....TASK ORGANIZATION	X	X	X	X	X	X	X	X	X	X
2.C.5.5 ....SCHEME OF MANEUVER	X	X	X	X	X	X	X	X	X	X
MPS 2.C.5 2.C.5.6 ....SHIP TO SHORE MOVEMENT	X	X	X	X	X	X	X	X	X	X
2.C.5.7 ....APPROACH TO RAID OBJECTIVE	X	X	X	X	X	X	X	X	X	X
AMPHIBIOUS RAID* 2.C.5.8 ....ASSAULT ON THE RAID OBJECTIVE	X	X	X	X	X	X	X	X	X	X
2.C.5.9 ....RETIREMENT TO THE EXTRACTION POINT	X	X	X	X	X	X	X	X	X	X
2.C.5.10............REEMBARKATION	X	X	X	X	X	X	X	X	X	X
2.C.5.11............DEBRIEF	X	X	X	X	X	X	X	X	X	X
2.C.5.12....SPECIAL CONSIDERATIONS FOR NIGHT OPERATION	X	X	X	X	X	X	X	X	X	X

NOTES: + DENOTES AN OPTIONAL MPS   * DENOTES AN OPTIONAL TASK

FIGURE 3   SECTION 2.C: MISSION PERFORMANCE STANDARDS APPLICABLE TO SPECIALIZED COMBAT OPERATIONS*

REQUIREMENTS
COUNTS BY
CATEGORIES

TASKS			1	2	3	4	5	6	7	8	9	10
			R	P	C	P	D	P	C	E	P	S
			E	R	O	E	E	L	O	X	R	U
			P	E	M	R	L	A	M	E	O	P
			O	P	M	F	I	N	F	C	V	E
			R	A	U	D	V	N	O	U	I	R
	MPS 2.D.1	2.D.1.1 ...INITIAL PLANNING PROCEDURES	1	2	0	0	0	6	0	0	0	0
		2.D.1.2 ...SCHEME OF MANEUVER	0	0	0	0	0	8	0	0	0	0
		2.D.1.3 ...LANDING PLAN	0	0	0	0	0	7	0	0	0	0
		2.D.1.4 ...FIRE SUPPORT PLANNING	0	0	0	0	8	0	0	0	0	0
	AMPHIBIOUS	2.D.1.5 ...INTELLIGENCE PLANNING	1	1	0	0	0	5	0	0	0	0
	ASSAULT	2.D.1.6 ...COMMUNICATIONS PLANNING	0	1	6	0	0	1	0	0	0	0
	PLANNING	2.D.1.7 ...ADMIN/LOGISTICS PLANNING	0	0	0	0	0	0	0	0	4	0
		2.D.1.8 ...EMBARKATION PLANNING	0	0	0	0	0	6	0	0	0	0
		2.D.1.9 ...REHEARSAL PLAN+	0	0	0	0	0	6	0	0	0	0
	MPS 2.D.2	2.D.2.1 ...PREPARATION	1	5	0	0	0	0	1	0	2	0
	EMBARKATION	2.D.2.2 ...CONTROL MEASURES AT POE	0	1	1	0	0	2	1	0	0	0
	FOR	2.D.2.3 ...MOVEMENT TO POE	0	1	0	0	0	0	1	0	5	0
	AMPHIBIOUS ASSAULT+	2.D.2.4 ...LOADING	1	0	0	0	0	0	0	3	2	0
	MPS 2.D.3	2.D.3.1 ...SEA TRANSIT	0	7	0	0	0	1	0	0	0	0
SEA TRAN + REHEARSAL+		2.D.3.2 ...REHEARSAL	0	5	1	0	0	3	0	0	0	0

NOTES: + DENOTES AN OPTIONAL MPS   + DENOTES AN OPTIONAL TASK

FIGURE 4   SECTION 2.D: MISSION PERFORMANCE STANDARDS APPLICABLE TO OPERATIONAL ACTIONS DEPENDENT UPON OUTSIDE ASSETS+

2E.1.1.6 -   Identifying boat paddles displayed

2B.1.1.7 -   Radio silence maintained until LOD crossed
             unless CATF specifically authorizes easing
             of EMCON

2B.1.1.8 -   Unit reports crossing of LOD to high HQ.

In many cases there are Key Indicators (KI) for the evaluators which
list specific items and precise details necessary for a score of YES;
these introduce considerable objectivity and uniformity.

Throughout this report we refer to the sections, missions, tasks,
and requirements as elements belonging to level 1, level 2, level 3 and
level 4, respectively. As explained earlier, each element in level i
(i = 1, 2, 3) consists of several elements in the (i+1)st level. The
elements in the (i+1)st level will be designated as the partition of
the element. The relative importance of the elements of a partition is
reflected by the weights assigned to them. For example, the four tasks
of MPS 2B.1 - Surface assault, see Figure 2.1, have the weights 40,
100, 100, and 70, respectively.

The evaluation process starts with the determination of the
applicable elements. This determination is necessary since evaluating
all MCCRES elements in a single exercise would require such a long period
of time and so many resources as to be impractical. If the applicable
elements are carefully selected, then an accurate picture of the state
of readiness of a unit can be obtained even though some elements are
omitted. After deciding on the applicable elements then, the weights
of those elements are normalized. For example, if 2B.1.1, 2B.1.2,
and 2B.1.3 are applicable and 2B.1.4 is not, then using the nonnormalized
weights given earlier yield the following respective normalized weights

$$\frac{40}{240} \, , \quad \frac{100}{240} \, , \quad \frac{100}{240}$$

Finally, we obtain an absolute weight for each applicable requirement
of an evaluation by multiplying its normalized weight by the normalized
weights of its task, MPS, and section. By following this procedure the
sum of the requirement's absolute weights equals unity. The evaluation
score is defined to equal the sum of the absolute weights in which the
unit obtained a "YES."

As indicated earlier, the first phase of an evaluation is the
determination of the applicable parts. Some parts must be applied
whenever an evaluation is conducted while others are optional and are
to be selected by the units command. In Figures 1-4 we indicate
the optional and compulsory parts of MCCRES. (The next section includes
a discussion of the determination of an evaluation's applicable parts.)
Deciding not to apply a part means that all related parts in lower levels
become Not Applicable (N/A). Sections C and D, for example, are optional.
Thus, if Section C is chosen to be N/A in an evaluation then all of the
Mission Performance Standards, Tasks, and Requirements related to C
become N/A. If, on the other hand, it is decided to apply Section C,
then C2 is compulsory but C1, C3, and C4 are optional. Examining Figures
1-4 we find that the compulsory parts of Volume II constitute about
50 percent of the total number of requirements.

The second phase of an evaluation is the evaluators' briefing.
The evaluators are usually officers whose battalions are to be evaluated
in the near future and this experience with MCCRES helps them to prepare
for their evaluation. In the briefing the evaluators are assigned to the
unit's components and are informed about the applicable parts of MCCRES.
They are also instructed how to observe the details of the battalion's
performance and how to decide on the YESs and NOs.

The next phase is the simulated combat. While the unit is
executing, the evaluators take notes and decide on the scores. The
evaluators' task is very tedious since they have to pay attention to
numerous aspects of the execution and have to make many quick judgments.

When the simulated combat is over, the evaluators gather and under the supervision of the senior evaluator they decide on a common score for each requirement. This score reflects the overall performance of the battalion. The common scores then yield the evaluation's score.

III. A Categorization of MCCRES Requirements

The YESs and the NOs of an evaluation contain considerable information concerning the weaknesses and the strengths of the battalion. The difficulty in analyzing the data is due to the high dimensionality - several hundred requirements. To overcome this difficulty we initiated classifying all the requirements according to a set of mutually exclusive and exhaustive categories. A preliminary set of nine categories was suggested by us and a tenth category was added through an audit by instructors at the Infantry Officers Course, basic School. The ten categories, where the numbering has no special significance, are as follows.

1. REPORTING to higher levels of command

2. PREPARING for operations

3. COMMUNICATING (including Communications SOPs)

4. PERFORMING as Marines (discipline, dispersion, camouflage concealment, using weapons, and so on)

5. DELIVERING supporting fire

6. PLANNING of operations

7. CONFORMING to doctrine

8. EXECUTING operations

9. PROVIDING combat service support (including medical support)

10. SUPERVISING required actions of individual Marines.

Each category corresponds to a vital aspect of the unit's performance

during the evaluation and each requirement is to be assigned to the single
category judged to most closely fit the most essential feature of the
requirement. The above categories are chosen so that they not only make it
possible to classify the requirements but so that they correspond to special
areas for training and remedial actions which can be used to improve combat
readiness.

We now explain in some detail the meaning of the ten categories. In
general, commands of units are mainly evaluated by the following categories:
6(Planning), 2(Preparing), 8(Executing), 1(Reporting), 7(Conforming),
and 10(Supervising). The performance of individual Marines is evaluated
by 4(Performing) and the performance of some special groups is evaluated
by: 3(Communicating), 5(Delivering), and 9(Providing).

Performance of the Command

Let us consider the six categories that mainly evaluate command.
The first is 6(Planning of operations). This category deals with the
question: How well are the operations planned? Examples are

    2A.1.5.4 - Patrols not dispatched on repetitive or
                stereotyped routes

    2B.4.8.5 - Reserve is positioned to assist forward elements
                in containing any penetration

    2B.6.1.3 - Staff coordination IAW FMFM 3-1; emphasis:
                organization of the ground, integration of
                fire planning, security operations, and
                intelligence collection

    2B.6.2.2 - Machine guns are positioned to deliver
                flanking interlocking grazing fire from
                mutually supporting positions.

The next is 2(Preparing for operations). Preparations start after some
phases of planning have been completed. Preparations include issuing
orders, rehearsals, and accomplishing some other preliminaries. Examples
are

    2A.1.5.5 - Marines assigned to security actions
                thoroughly briefed and inspected

2A.1.6.2 - Unit to patrol is alerted a minimun of four
hours prior to patrols

2B.2.2.1 - Individual Marines and their equipment
inspected

2C.3.2.4 - Small unit leaders in assault elements
conduct rehearsal of specialized techniques
required (LI).

Next is 8(Executing operations). These requirements measure the leader-
ship of the unit's command and the teamwork. Examples are

2A.2.1.2 - Unit exercises control over maneuver of
subordinate elements (KI)

2B.1.1.3 - Debarkation teams report to debark stations
when called away (KI)

2B.4.3.6 - Assault elements move into attack positions

2B.2.3.3 - Speed and momentum of movement maintained

2C.3.6.10- Attacking enemy forces halted and ejected
from built up areas.

Next is 1(Reporting to higher levels of command). Included here are
acknowledgments of receiving orders, reports on progress of operations,
and reports on information obtained about the enemy. Examples are

2B.4.4.7 - Bypassed enemy units reported by assault
elements

2B.4.8.1 - Security elements report enemy counter-
attack preparations

2B.4.8.4 - Unit reports counterattack to higher HQ

2B.1.5.6 - Seizure of objective reported to higher HQ

Next is 7(Conforming to doctrine). Examines the technical knowledge
of the command. These requirements are normally easy to satisfy provided

the command does not forget (or overlook) them. Examples are

    2A.1.9.2 - Unit has an alarm system for gas or other chemical attack

    2A.2.1.1 - Unit has and uses an operation SOP

    2B.5.3.1 - Security element provides guides to lead assault elements to LOD

    2C.4.2.2 - Marines who make the initial contact immediately begin screening evacuees into categories (KI).

Last is 10(Supervising required actions of individual Marines). Requirements here are satisfied through observation and appropriate direction. These are usually provided at company commander or lower levels. Examples are

    2A.1.1.2 - Weapons maintenance discipline

    2A.1.3.2 - Halted elements do not remain in exposed locales, moving immediately into nearest cover.

Performance of Individual Marines

Here the requirements concern how well the Marines, as individuals, are prepared to execute their jobs. All are classified under 4(Performing as Marines). Principal concerns are discipline, dispersion, camouflage, concealment, using weapons, and so on. Examples are

    2A.1.10.4 - When attacked, Marines, including officers and NCOs, react by taking cover

    2A.2.10.5 - Unit keeps stockpiles of material and ammunition dispersed

    2B.2.4.1 - On landing, Marines deplane quickly and safely and disperse as helicopters lift out of zone

    2B.4.5.2 - Assault elements deliver heavy volume of fire as they close on objective.

The Performance of Some Special Groups

Three categories fall under this heading. The first is
3(Communicating). These requirements deal with the performance of the
teams in charge of the operation of the radio and wire communications.
The question is: can the units properly transmit the required informa-
tion? Also included are communications SOPs. Examples are

> 2A.1.8.1 - All radio nets specified as covered circuits
> in the communications plan operate in the
> covered modes
>
> 2A.2.2.3 - Unit enters tactical and command nets of
> higher HQ
>
> 2A.2.7.4 - LZ communications provide positive control
> of inbound and outbound helicopters (KI)
>
> 2A.3.2.1 - FSCC communications are functioning (KI)

The next is 5(Delivering supporting fire). This category evaluates the
entire performance of the supporting fire units. Examples are

> 2A.3.2.3 - Routine calls for fire are monitored, recorded,
> and plotted
>
> 2A.3.6.1 - Counterfire priorities are included in fire
> support planning
>
> 2B.1.3.3 - As soon as direct support artillery is
> emplaced, FO's with lead elements direct
> fire against appropriate targets
>
> 2B-4.8.3 - All available fire support employed against
> counterattack.

Last is 9(Providing combat service support). The performance of the
logistics and medical groups is evaluated here. Examples are

> 2B.1.4.4 - Emergency resupply capability retained as
> material is staged ashore (KI)

2B.4.2.6 - Vehicles checked for fuel state and refueled.

2B.6.6.9 - Immediate action taken to reconstitute supply
and ammunition levels prescribed for the
position in the defense oider

2C.3.2.3 - Specialized equipment issued (KI).

The following table gives some indication of the relative
importance of the ten categories. (See Figures 1-4 for more details.)

Table 1: The relative importance of the ten categories.

Categories	Number of Requirements	Percentage of number of requirements under this Category	Weight of Category
1. REPORTING	105	13	5
2. PREPARING	81	10	7
3. COMMUNICATING	48	6	7
4. PERFORMING	29	4	9
5. DELIVERING	78	10	17
6. PLANNING	167	21	14
7. CONFORMING	81	10	11
8. EXECUTING	144	18	19
9. PROVIDING	41	5	5
10. SUPERVISING	19	3	6
TOTAL	793	100	100

From general considerations it would be desirable to avoid using categories
in which very few requirements appear (because this would tend to indicate
that such categories were relatively unimportant) or in which too many

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appear (because this would indicate that there might be duplication of
concepts or that potential information was being lost through excessive
aggregation).

A computer program has been written to do the following.

(1) Calculate evaluations scores

(2) Repeat the above calculations under the change
      that all requirements are given equal weights

(3) Compute categories scores. (Total weights of YESs
      divided by total weights of applicable requirements.)

The computer program was run with data of 13 evaluations. The Not Appli-
cable (N/A) parts of these evaluations are given in Table 2 and the
results of the computer runs are shown in Table 3. The mean score of
category, the right-hand-side column of Table 3 is simply the mean of
the scores of the category in the 13 evaluations. The unweighted scores
are the scores obtained when it is assumed that all applicable require-
ments have the same weights.

Examining the results of Table 3 we realize that Category
4(Performing as Marines) scores 70 on the average, which is lower than
the others. It is also interesting to note that Category 5 scores 93
on the average, which is better than the others. Each of the units has
its weaknesses and strengths. Unit Number 1, for example, was weak in
Categories 4 (60.0%), 8 (69.8%), 9 (69.1%), and 10 (67.6%). But this unit
performed very well in Categories 3 (100%), and 6 (93%). The results
shown in Table 3 indicate that all units have their strengths and
weaknesses, and thus calculating these scores can help in planning of
remedial training.

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Table 2: List of N/A Sections, MPSs, and Tasks in 13 Evaluations.

Set No.	Number of Applicable Requirements	List of N/A Parts
1	610	B4.9, B5, B6.4, B6.5, B6.6, B7.3, B7.4, B7.6, B1, C3
2	677	B5.7, B6.3, B6.4, B7.3, B7.4, B7.5, B7.6, C1.4, C1.5, C3
3	378	B1, B2, B3.2, B4.8, B5, B7, C, D
4	488	A1.7, A3.6, B3.2, B4.8, B5, B6.4, B6.6, B7.3, B7.4, C1, C3, D
5	542	B2.3, B3.4, B3.5, B4.8, B5.6, B5.7, B6, B7.3, B7.4, B7.6, C1, C3, D1.9, D2, D3, D4
6	434	B2, B3, B5, B7, C1.4, C3, C4, D
7	484	A1.9, A1.10, A2.5, B3, B4.9, B5, B6.4, B6.5, B6.6, B7, C, D4
8	486	A1.8, A1.9, A1.10, A2.5, B1, B6.3, B6.4, B6.5, B6.6, B7, C1, C4, D
9	566	B1, B3.5, B5.7, B6.6, B7.6, C3, C4, D
10	592	A1.7, B2.7, B5, B6.3, B6.4, B7.3, B7.4, B7.6, C1, C3, D2.2, D2.3
11	246	A1.4, A1.7, A1.8, A1.10, A1.11, A1.12, A2.2, A2.3, A2.4, A2.5, A2.6, A2.7, A2.10, A2.11, A2.12, A3.2, A3.3, A3.5, A3.6, A3.7, B1, B2, B3, B4.7, B4.8, B4.9, B5.6, B5.7, B6, B7, C1, C2, C4, D
12	539	A2.5, B1, B3, B5, B7, C1.4, C3, C4, D
13	287	A1.6, A2.4, A2.5, A2.6, A2.7, A3, B1, B2, B3, B4.7, B4.9, B5, B6.5, B7, C1.4, C3, C4, D

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Table 3: Categories scores of 13 Evaluations.

Scores of	Evaluation Number													Mean Score of Category
	1	2	3	4	5	6	7	8	9	10	11	12	13	
Cat. 1	86	91	98	89	70	90	94	41	86	85	100	100	97	87
Cat. 2	83	95	64	81	83	100	84	34	77	76	100	88	90	81
Cat. 3	100	90	89	76	93	68	94	86	97	88	42	82	71	83
Cat. 4	60	74	46	87	86	93	71	36	96	76	54	69	68	70
Cat. 5	81	94	82	97	96	92	99	77	100	90	100	97	100	93
Cat. 6	93	91	80	93	95	92	96	52	84	79	99	90	100	88
Cat. 7	82	77	83	87	88	94	94	54	90	73	75	87	93	83
Cat. 8	70	98	90	94	93	91	90	76	87	89	99	89	96	89
Cat. 9	69	76	89	99	79	100	94	26	91	74	100	97	100	84
Cat 10	68	81	84	100	90	100	74	69	100	100	100	73	72	85
Evaluation Score	80	89	80	91	87	91	90	61	91	83	87	87	88	85
Weighted Score	85	93	85	94	87	93	93	61	90	87	97	89	92	88

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IV.   Using MCCRES Data for Planning the Training and Testing Programs

The key assumption in this section is that requirements belonging
to the same category pose similar demands on the unit's components and,
thus, have the same probability of scoring a YES. This assumption
is related to but not implied by the definition of the categorization.
We examine the feasibility of this assumption in two ways. First we
compare MPS category scores to evaluations categories scores in several
evaluations. The results are given in Table 4. (The numbers in
parentheses in the table are the numbers of the MPS requirements
belonging to the given category.) We then examine the effects of
reducing the number of applicable requirements on the evaluations and
categories scores. We use the 13 evaluations of Table 2 and for each
evaluation we ran three cases in which some of the optional applicable
parts were removed by assigning them as N/A. A description of the 39
cases and the results of the computer runs are given in the appendix.
The results are summarized in Figures 5 and 6. In all cases examined,
we observed that the categories scores came close to the original
categories scores. This observation indicates that our assumption
is reasonable.

The data in Table 4 and in Figures 5 and 6 strongly suggest
that the number of applicable requirements can be substantially
lower than 793 while the category scores still remain precise.
This result is important because the evaluation of a battalion on
all requirements would require substantial resources. Note that only
about 50 percent of the requirements must be applied whenever an evalua-
tion is conducted, while the others should be chosen according to the
expected deployment of the unit and the available resources. The second
result is related to the determination of a training program and is
discussed in the remainder of this section.

Several factors such as the available budget, the length of the
training period, and possible future deployment should be taken into

Table 4: Some MPS category scores compared to evaluation category scores.

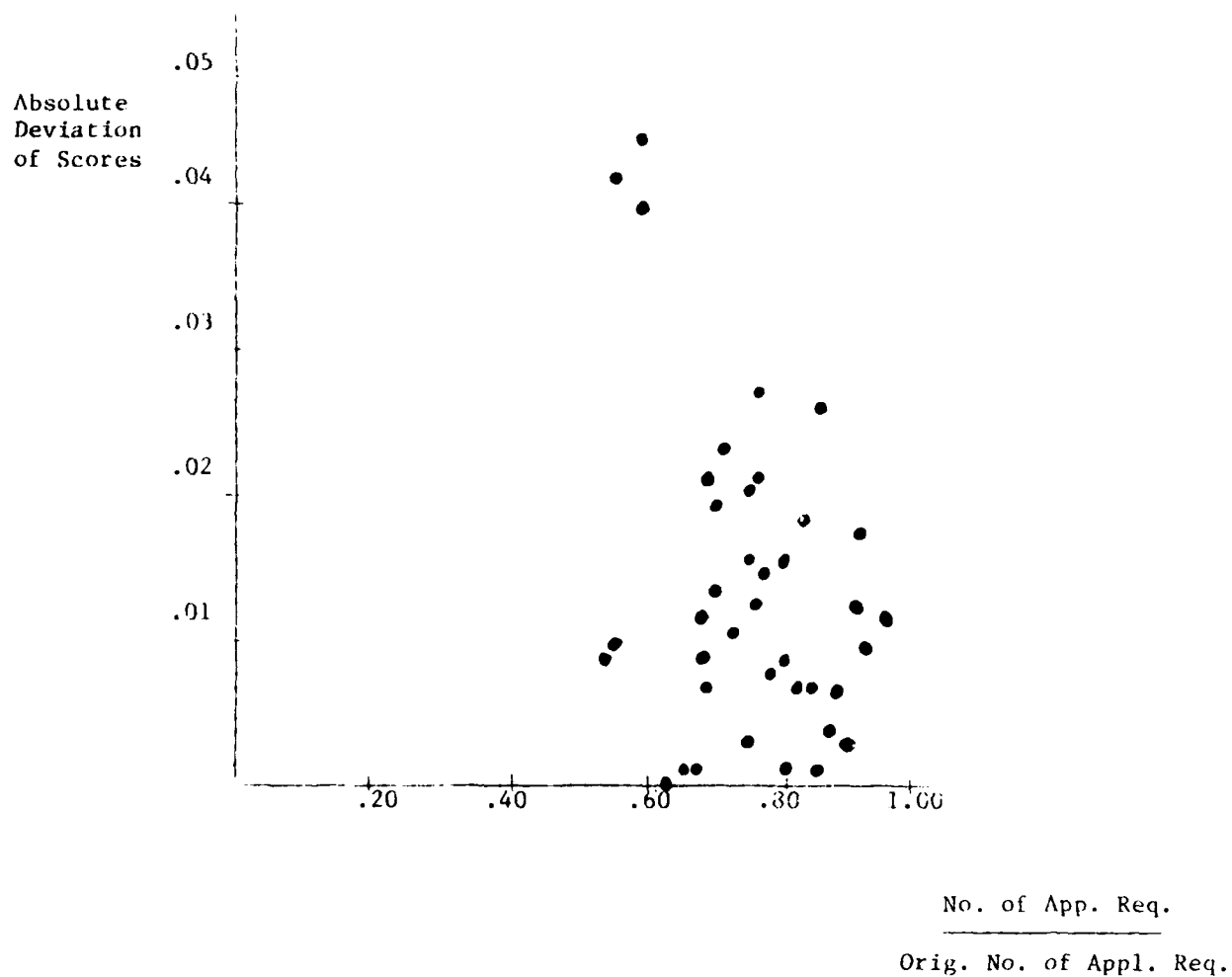| Evalua-tion Number	Scores of	Category Number									
		1	2	3	4	5	6	7	8	9	10
1	MPS 2.A.1	82 (11)	44 (9)	100 (4)	58 (19)	– (0)	100 (3)	72 (13)	31 (13)	67 (3)	80 (10)
	Entire Evaluation	86	83	100	60	81	93	82	70	69	68
2	MPS 2.A.2	100 (9)	– (0)	100 (20)	100 (1)	100 (8)	100 (10)	89 (18)	100 (9)	100 (10)	100 (3)
	Entire Evaluation	91	95	90	75	94	92	77	98	75	81
3	MPS 2.A.3	– (0)	– (0)	100 (2)	– (0)	77 (44)	67 (3)	100 (1)	– (0)	– (0)	– (0)
	Entire Evaluation	98	65	90	46	82	80	83	90	89	85
4	MPS 2.B.4	100 (8)	100 (6)	100 (1)	– (0)	50 (2)	100 (8)	80 (5)	100 (14)	100 (2)	100 (1)
	MPS 2.B.6	100 (3)	75 (4)	100 (2)	100 (1)	100 (2)	100 (11)	100 (4)	– (0)	– (0)	– (0)
	Entire Evaluation	89	81	76	87	97	94	87	94	99	100

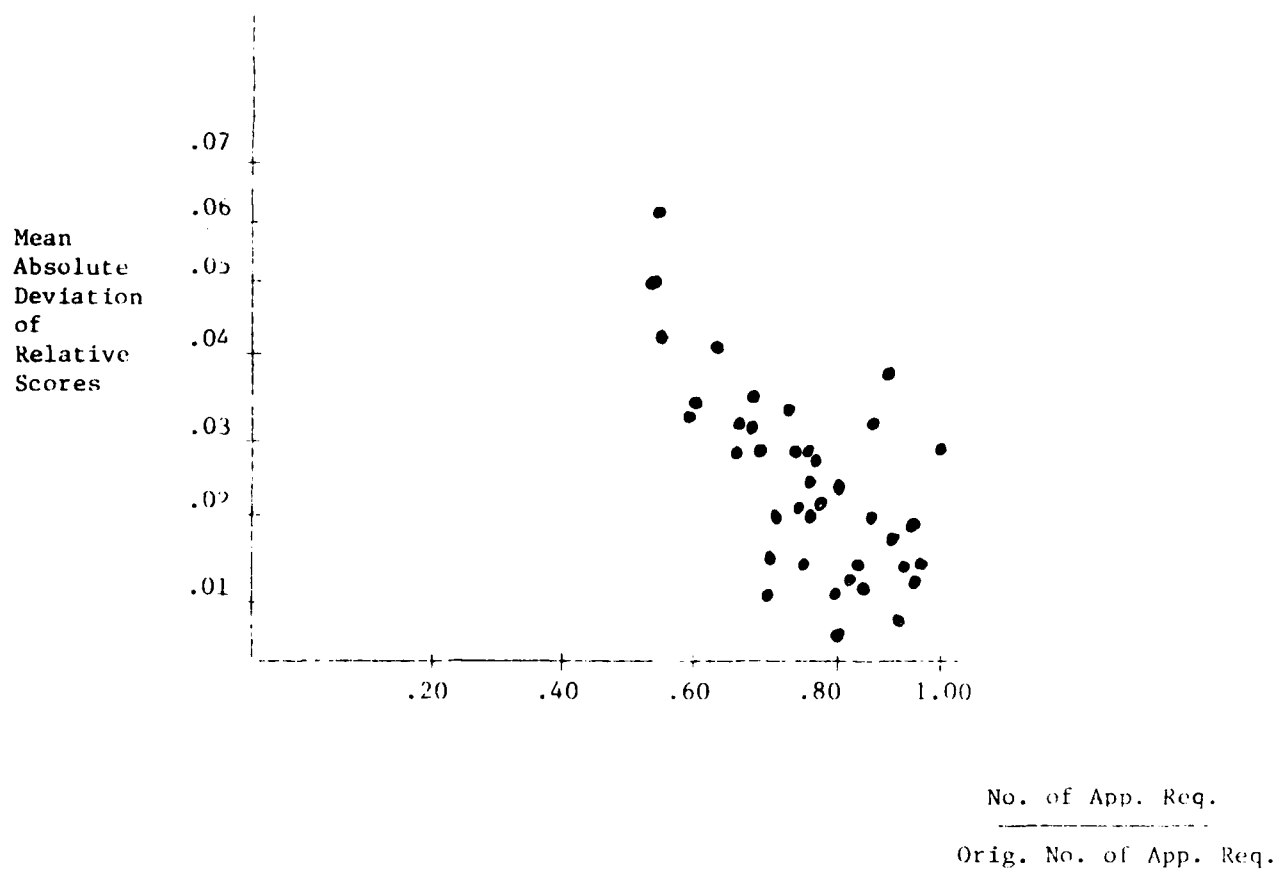Figure 5: Absolute deviations of the scores of the evaluations in the 39 cases.

Figure 6: Mean absolute deviations of categories scores in the 39 cases.

account when a training program of a Marine Unit is determined. For example, it may be desired to train a unit under severe budget constraints for a helicopterborne assault. Then it may be useful initially to train the unit to execute lower cost but related MPSs and only later to begin execution of the more expensive helicopterborne assaults. Another example might be that one wants to train a unit for the execution of a night attack. There the question could be: how can some daytime MPSs be selected that can also serve to train the unit for night attacks? We are interested therefore in a method for measuring "distance" between MPSs. Namely, two MPSs are considered to be "close" if they require similar efforts from a unit's components so that training for either one will also improve the performance of the other.

To be able to measure distance between MPSs we define the composition of an MPS as the distribution of the number of its requirements among the ten categories. (We prefer to calculate the distribution of the number or requirements rather than the distribution of their weights because of mathematical convenience, but the results do not change much if the second alternative is taken.) Table 5 presents the composition of the MPSs. We explain the entries of the table by explaining those of the first row. The number 90 in the final column indicates that MPS 2.A.1 contains 90 requirements: twelve percent of them belong to category 1 (11 requirements), ten percent belong to category 2 (9 requirements), and so on. We see that MPS 2.A.1 contains the smallest (17). Some MPSs contain requirements belonging to many categories, 2.D.3 for example. Now, define the distance between the composition of two MPSs as the sum of absolute deviations between their composition entries. For example, referring to the data in Table 5, we calculate the distance between the composition of 2.A.1 and 2.A.2 as the sum of absolute values

$$|12-10|+|10-0|+|5-23|+|21-1|+|0-9|+|3-11|+|20-21|+|15-10|+|3-11|+|11-4|$$

$$=2+10+18+20+9+8+1+5+8+7$$

$$=86.$$

Table 5: Composition of the MPS.

MPS	Cat. 1	Cat. 2	Cat. 3	Cat. 4	Cat. 5	Cat. 6	Cat. 7	Cat. 8	Cat. 9	Cat. 10	No. of Requirements
2.A.1	12	10	5	21	0	3	20	15	3	11	90
2.A.2	10	0	23	1	9	11	21	10	11	4	88
2.A.3	0	0	3	0	86	9	2	0	0	0	56
2.B.1	22	0	0	3	6	16	9.5	28	9.5	6	32
2.B.2	15	13	2	4 1/4	4 1/4	20	7	26	4 1/4	4 1/4	46
2.B.3	23	15	8	0	2.5	8	2.5	41	0	0	39
2.B.4	18	9	2	0	3	21	16	26	3	2	66
2.B.5	12	14	6	6	0	26	16	18	2	0	50
2.B.6	15	10	4	6	4	29	15	13	4	0	52
2.B.7	24	4	0	0	2	34	0	30	6	0	47
2.C.1	18	8	3	0	3	20	0	43	0	5	39
2.C.2	13	27	5	0	5	23	9	18	0	0	22
2.C.3	16	12	5	0	7	25	2	28	5	0	43
2.C.4	25	19	0	0	0	31	25	0	0	0	16
2.D.1	3	6	10	0	13	62	0	0	6	0	63
2.D.2	7	26	4	0	0	7	11	11	34	0	27
2.D.3	0	71	6	0	0	23	0	0	0	0	17

This form of distance is often used and it has useful mathematical properties. The distance between two MPSs varies from 0, where they have the same composition, to 200 (where they do not have any categories in common). The choice of this distance function is logical if all categories are equally important and if any two deviations of x percent are as meaningful as one deviation of 2x percent. Table 6 presents the distance between each pair of the 17 MPSs of Volume II of MCCRES. The numbers in the parentheses are the distances between the MPSs. We realize that some MPSs have many close MPSs, 2.B.1, 2.B.2, for example, while others like 2.A.3 and 2.D.3 do not.

V. Summary

In the present report we have described MCCRES and some analysis performed on MCCRES data. We feel that MCCRES has the following merits.

(a) Most requirements are requests for descriptive data and not for judgments. Judgments were previously made by defining the requirements and assigning weights.

(b) The details of the doctrine are given and interpreted in the requirements, thus avoiding the possibility of being mis-interpreted or forgotten by the evaluators.

(c) The execution of most requirements consume short time periods and thus the evaluator's memories are not overburdened.

(d) Assigning a score of a YES or NO is easier than assigning scores on any other scale.

(e) The set of requirements exhausts the details of the executions.

Table 6: The distances between the MPS in Volume II

MPS	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th	15th	16th
2.A.1	B.5(62)	B.6(68)	B.4(75)	B.2(79)	A.2(88)	B.1(97)	C.3(100)	C.2(102)	D.2(102)	B.3(105)	C.1(110)	C.4(110)	B.7(125)	D.1(150)	C.3(164)	A.3(144)
2.A.2	B.1(78)	B.6(82)	B.4(86)	B.5(88)	A.1(88)	B.2(91)	C.2(100)	C.3(100)	D.2(100)	C.4(116)	B.3(118)	C.1(118)	B.7(122)	D.1(122)	A.3(152)	D.3(166)
2.A.3	D.1(150)	A.2(152)	C.3(158)	C.2(162)	B.6(164)	B.2(166)	B.1(166)	B.4(168)	B.3(169)	C.1(170)	B.5(172)	D.2(176)	D.3(176)	C.4(177)	B.7(178)	A.1(191)
2.B.1	B.2(41)	B.4(45)	B.7(52)	C.3(52)	C.1(60)	B.6(71)	A.2(78)	C.2(78)	B.5(79)	B.1(84)	A.1(97)	C.4(105)	D.2(112)	D.1(138)	A.3(166)	D.3(168)
2.B.2	B.4(26)	C.3(29)	B.1(41)	B.6(42)	B.5(44)	C.1(44)	C.2(46)	B.7(58)	B.3(62)	A.1(79)	C.4(90)	A.2(93)	D.2(98)	D.1(121)	D.3(130)	A.3(166)
2.B.3	C.1(34)	C.3(53)	B.2(62)	B.4(64)	B.7(66)	C.2(72)	B.5(77)	B.1(84)	B.6(90)	C.4(103)	A.1(105)	D.2(107)	A.2(116)	D.3(142)	D.1(146)	A.3(164)
2.B.4	B.2(26)	C.3(36)	B.6(38)	B.5(40)	C.1(42)	B.1(45)	C.2(50)	B.7(52)	B.3(64)	C.4(72)	A.1(75)	A.2(86)	D.2(100)	D.1(124)	D.3(136)	A.3(168)
2.B.5	B.6(25)	C.2(38)	B.4(40)	B.2(43)	C.3(48)	A.1(62)	C.4(64)	B.7(76)	B.3(77)	C.1(78)	B.1(79)	A.2(88)	D.2(88)	D.1(114)	D.3(114)	A.3(172)
2.B.6	B.5(25)	B.4(38)	B.2(42)	C.3(46)	C.2(48)	C.4(62)	B.7(66)	A.1(68)	B.1(71)	C.1(76)	A.2(82)	B.3(90)	D.2(92)	D.1(100)	D.3(126)	A.3(164)
2.B.7	C.3(40)	B.1(52)	B.4(52)	C.1(52)	B.2(58)	B.3(66)	B.6(66)	B.5(76)	C.2(78)	C.4(82)	D.1(102)	A.2(122)	A.1(125)	D.2(130)	D.3(146)	A.3(178)
2.C.1	B.3(39)	B.4(42)	B.2(44)	C.3(44)	B.7(52)	B.1(60)	C.2(70)	B.6(76)	B.5(78)	C.4(108)	A.1(110)	A.2(118)	D.2(128)	D.1(130)	D.3(138)	A.3(170)
2.C.2	B.5(38)	C.3(44)	B.2(46)	B.6(48)	B.4(50)	C.1(70)	B.3(72)	C.4(72)	D.2(72)	B.1(78)	B.7(78)	D.3(90)	A.2(100)	A.1(102)	D.1(116)	A.3(162)
2.C.3	B.2(24)	B.7(40)	B.4(36)	C.1(44)	C.2(44)	B.6(46)	B.5(48)	B.1(52)	B.3(53)	D.1(88)	C.4(90)	A.2(100)	A.1(100)	D.2(104)	D.3(120)	A.3(158)
2.C.4	B.6(62)	B.5(64)	B.4(72)	C.2(72)	B.7(82)	C.3(90)	B.2(90)	B.3(103)	B.1(105)	C.1(108)	A.1(110)	D.2(112)	A.2(116)	D.3(116)	D.1(120)	A.3(177)
2.D.1	C.3(88)	B.6(100)	B.7(102)	B.5(114)	C.2(116)	C.4(120)	B.2(121)	A.2(122)	B.4(124)	D.3(126)	C.1(130)	B.1(138)	B.3(146)	D.2(148)	A.1(150)	A.3(150)
2.D.2	C.2(72)	B.5(88)	B.6(92)	B.2(97.5)	A.2(100)	B.4(100)	A.1(102)	C.3(104)	B.3(107)	B.1(112)	C.4(112)	D.3(115)	C.1(128)	B.7(130)	D.1(148)	A.3(176)
2.D.3	C.2(90)	B.5(114)	D.2(115)	C.4(116)	C.3(120)	B.6(126)	D.1(126)	B.2(130)	B.4(136)	C.1(138)	B.3(142)	B.7(146)	A.1(164)	A.2(166)	B.1(168)	A.3(176)

The merits described above help the evaluators to assign objective scores.

The analysis of the evaluations data has three objectives. The first objective is to determine the weaknesses and strengths of the evaluated battalions. We reach this goal by calculating categories scores. These scores can help determine remedial actions; for example, to improve a poor performance in category 6 (Planning) it may be efficient to train the Marines involved in planning by assigning them several operations to plan. The second objective is the examination of the sensitivity of the scores to the number of applicable requirements. Here we observe that reducing the number of applicable requirements to about 60 percent yields scores which are fairly precise. The third objective is the determination of close MPSs. Here we define a measure of distance between MPSs. We believe that close MPSs, according to the proposed measures, require similar efforts from units' components and thus training for an MPS will improve the performance in all MPSs that are close. As we obtain more MCCRES evaluation data we will be able statistically to test our findings in objectives two and three.

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APPENDIX

The sensitivity of evaluations and categories scores to reductions of
the numbers of applicable requirements.

Table A.1: Additional N/A Parts to the data sets of Table 2

Set No.	Case No.	List of N/A Parts (Additional)
1	1	A1.7, A1.9, A1.10, A1.11, A2.5, A3.6, B.3, B4.8, B3.6, B7, C, D
	2	A1.7, A2.5, B3, C4, D
	3	A1.9, A1.10, A3.6, C, D3
2	4	A1.7, A1.9, A1.10, A1.11, A2.5, A3.6, B3, B4.8, B4.9, B5.6, B6.6, B7, C, D
	5	C, D
	6	A1.7, A1.9, B3.5, B3.6, C1, D
3	7	A1.7, A1.9, A1.10, A1.11, A2.5, A3.6, B3, B4.9, B6.3, B6.4, B6.5, B6.6
	8	A1.10, A2.5, B3, B4.9, B6.3, B7.5
	9	A1.9, B3.6, B6.4, B6.5
4	10	A1.9, A1.11, A2.5, B3, B4.9, B6.3, B6.5, B7, C
	11	A1.11, B3, B4.9, B6.3, B6.5, B7
	12	B7, C4

Set No.	Case No.	List of N/A Parts (Additional)
5	13	A1.7, A1.9, A1.10, A1.11, A2.5, A3.6, B3, B4.9, B7, C, D
	14	A1.9, A1.11, B3, B4.9, C
	15	A1.7, A1.10, A2.5, B7, D
6	16	A1.7, A1.9, A1.10, A1.11, A2.5, A3.6, B4.8, B4.9, B6.4, B6.5, B6.6, C
	17	A1.7, A1.11, A2.5, B6.4, B6.6, C1
	18	A1.9, A1.10, A3.6, B4.9, B6.3, C1.3
7	19	A1.7, A1.11, A3.6, B6.3, D
	20	A1.7, B4.8, D1.9, D2
8	21	A1.11, A3.6, B6.3, D3
	22	A1.7, A1.11, A3.6, B3, B4.8, B4.9, B5.6, B5.7, C
	23	A1.7, B3.6
	24	A.11, A3.6, B4.8, B5.6, C3
9	25	A1.7, A1.9, A1.10, A1.11, A2.5, A3.6, B3, B4.8, B4.9, B5.6, B6.4, B6.5, B7, C

Set No.	Case No.	List of N/A Parts (Additional)
9	26	A1.9, B3, B4.9, B5.6, B6.6, B5.5, B7.3, B7.4, C
	27	A1.10, A2.5, B3.4, B4.9, B6.4, B7, C1
10	28	A1.9, A1.10, A1.11, A2.5, A3.6, B3, B4.8, B4.9, B6.5, B6.6, B7, C, D
	29	A1.9, A1.11, B3, B4.9, B6.6, D2, D3
	30	A1.10, A2.5, A6.6, B3.4, B4.8, B7, D
	31	A1.9, C
13	32	C
	33	A1.9
14	34	A1.7, A1.9, A1.10, A1.11, A3.6, B4.8, B4.9, B6.3, B6.4, B6.5, B6.6, C
	35	A1.9, A1.11, B4.8, B4.9, B6.3, B6.5, C
	36	A1.7, A1.10, B6.4, B6.5, C1.3, C1.5
15	37	A1.7, A1.9, A1.10, A1.11, B4.8, B6.3, B6.4, B6.6, C
	38	A1.7, A1.11, B6.3, B6.6, C
	39	A1.9, A1.10, B4.8, B6.3, B6.4, C

Table A.2: Evaluations and Categories Scores in the Cases
Described in Table 7.

(The first case in each evaluation set contains only compulsory items)

Score of Category No.	Set No. 1	Case 1	Case 2	Case 3
1	86	84	85	87
2	83	76	84	71
3	100	100	100	100
4	60	69	60	68
5	81	79	80	81
6	93	93	93	96
7	82	71	79	76
8	69	80	65	76
9	69	66	69	67
10	69	68	69	68
Evaluation score	80	79	78	81
No. of No's	92	55	75	76
No. of applicable requirements	610	334	429	529

Score of Category No.	Set No. 2	Case 4	Case 5	Case 6
1	91	85	89	89
2	95	93	94	91
3	90	85	88	88
4	74	76	74	76
5	94	94	94	94
6	91	99	89	88
7	77	97	76	78
8	98	99	98	99
9	76	67	71	71
10	81	80	80	80
Evaluation score	89	90	87	87
No. of No's	47	26	39	37
No. of applicable requirements	677	368	510	512

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Score of Category No.	Set No. 3	Case 7	Case 8	Case 9
1	98	97	97	97
2	64	75	66	64
3	89	88	89	89
4	46	49	47	47
5	82	82	82	81
6	80	79	79	85
7	83	70	78	82
8	90	96	86	93
9	89	88	89	88
10	85	84	85	84
Evaluation score	80	79	79	81
No. of No's	56	40	53	48
No. of applicable requirements	378	256	313	347

Score of Category No.	Set No. 4	Case 10	Case 11	Case 12
1	89	88	87	93
2	81	65	77	82
3	76	72	76	76
4	87	86	87	87
5	97	97	97	97
6	93	100	95	100
7	87	85	84	93
8	93	91	93	94
9	99	100	100	100
10	100	100	100	100
Evaluation score	91	90	90	93
No. of No's	30	22	27	23
No. of applicable requirements	488	334	398	443

Score of Category No.	Set No. 5	Case 13	Case 14	Case 15
1	70	86	79	74
2	83	82	84	82
3	93	93	95	91
4	86	89	86	90
5	96	95	96	95
6	95	88	94	92
7	88	85	85	88
8	74	78	73	78
9	79	79	76	73
10	90	91	91	90
Evaluation score	87	87	87	87
No. of No's	72	41	55	58
No. of applicable requirements	542	344	459	436

Score of Category No.	Set No. 6	Case 16	Case 17	Case 18
1	90	100	89	100
2	100	100	100	100
3	68	67	71	69
4	93	91	92	92
5	92	94	92	94
6	92	97	88	94
7	94	83	93	92
8	90	86	89	90
9	100	100	100	100
10	100	100	100	100
Evaluation score	92	91	91	92
No. of No's	29	19	27	23
No. of applicable requirements	434	288	365	384

Score of Category No.	Set No. 7	Case 19	Case 20	Case 21
1	94	92	95	92
2	84	74	82	80
3	94	94	93	93
4	71	71	71	70
5	99	99	99	99
6	96	92	96	94
7	94	92	95	93
8	89	88	89	89
9	94	92	93	95
10	75	75	75	75
Evaluation score	90	88	90	89
No. of No's	34	30	31	32
No. of applicable requirements	484	342	433	442

Score of Category No.	Set No. 8	Case 22	Case 23	Case 24
1	41	31	40	31
2	34	41	44	29
3	86	84	85	86
4	36	36	36	36
5	78	82	80	79
6	52	55	56	49
7	54	51	61	43
8	76	73	74	74
9	26	24	24	24
10	69	69	69	69
Evaluation score	61	61	62	58
No. of No's	189	125	134	168
No. of applicable requirements	486	328	372	411

Score of Category No.	Set No. 9	Case 25	Case 26	Case 27
1	86	93	86	88
2	77	89	89	78
3	97	97	97	97
4	96	96	96	96
5	100	100	100	100
6	84	95	87	85
7	90	91	89	93
8	87	93	90	89
9	91	91	88	92
10	100	100	100	100
Evaluation score	91	95	93	92
No. of No's	54	29	42	39
No. of applicable requirements	566	336	424	450

Score of Category No.	Set No. 10	Case 28	Case 29	Case 30
1	85	90	85	88
2	76	72	77	69
3	88	86	88	86
4	76	78	75	78
5	90	90	90	90
6	79	86	87	78
7	73	86	78	78
8	89	100	95	92
9	74	53	64	60
10	100	100	100	100
Evaluation score	83	87	86	84
No. of No's	79	38	55	59
No. of applicable requirements	592	327	452	432

Score of Category No.	Set No. 11	Case 31	Case 32	Case 33
1	100	100	100	100
2	100	100	100	100
3	42	41	40	43
4	54	51	54	51
5	100	100	100	100
6	99	99	99	100
7	75	100	74	100
8	99	100	98	100
9	100	100	100	100
10	100	100	100	100
Evaluation score	87	87	85	88
No. of No's	8	5	8	5
No. of applicable requirements	46	163	173	206

Score of Category No.	Set No. 12	Case 34	Case 35	Case 36
1	100	100	100	100
2	88	95	94	89
3	82	80	81	82
4	69	61	70	63
5	97	96	96	97
6	90	95	95	90
7	87	91	92	84
8	89	90	91	87
9	97	97	97	97
10	73	71	71	75
Evaluation score	87	87	88	86
No. of No's	47	34	34	47
No. of applicable requirements	439	302	344	395

Score of Category No.	Set No. 13	Case 37	Case 38	Case 39
1	97	95	97	97
2	90	93	92	88
3	71	62	66	66
4	68	55	69	57
5	100	100	100	100
6	100	100	100	100
7	93	97	98	98
8	96	100	98	93
9	100	100	100	100
10	72	72	72	72
Evaluation score	88	83	86	85
No. of No's	24	18	19	21
No. of applicable requirements	287	170	201	218

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