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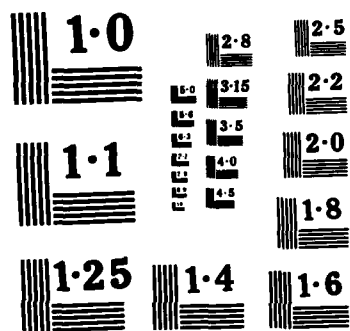
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HUMAN RESOURCES

**FIELD TEST OF THE METHODOLOGY FOR GENERATING
EFFICIENCY AND EFFECTIVENESS MEASURES**

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Summary

The purpose of this research was to conduct a field test of the methodology for generating efficiency and effectiveness measures (MGEEM). The objectives were to evaluate: (a) the number and types of measures developed; (b) the acceptability of the process and its results to participants (e.g., unit commanders); (c) the cost effectiveness of the measures in terms of their use of existing data; and (d) the extent to which independent applications of the methodology to similar organizations produced similar sets of measures.

Three functional areas -- Administration, Propulsion Maintenance, and Weather -- were selected for this field test. Eight separate organizations in each of the three functions served as the test sites. For each organization, a prioritized list of Key Result Areas (KRAs) -- categories of results which the organization is expected to accomplish -- were developed, along with quantitative efficiency and effectiveness indicators for each KRA. Implementation of the MGEEM involved four activities: (1) development of a systems diagram showing the inputs, outputs, organizational structure and required contacts with other organizations; (2) establishment of a management team consisting of the unit commander and his/her subordinates to develop KRAs for their organization by means of the Nominal Group Technique; (3) establishment of a second team to develop and prioritize a list of quantitative indicators for each of the KRAs developed by the first team; and finally (4) review of the list of indicators by the unit commander who could modify or delete indicators judged not important or not feasible to measure. Following these activities, participants from each team were asked to complete a feedback form that obtained their reactions to the process.

Results showed that the MGEEM led to a usable number of indicators for each organization, with a larger percentage of effectiveness (80 to 95 percent) as opposed to efficiency indicators. The process and its results were judged as very acceptable and useful to all but one of the participants. The indicators generated were judged cost effective to implement since approximately 80 to 90 percent made use of existing data. Finally, the indicators were found to have relatively low consistency from organization to organization within the three functional areas. Measures of average pairwise overlap for lists of indicators within functional areas ranged from 11 to approximately 19 percent. Overlap for KRAs was higher, ranging from 38 to 59 percent.

Although the field test demonstrated that the MGEEM led to results generally judged to be useful, acceptable and cost effective, the lack of consistency in productivity indexes from organization to organization indicates the need for a follow-up process to resolve the differences so as to develop a set of

commonly applicable productivity criteria. The paper offers some additional modifications to the MGEEM process to improve the consistency from site to site and to better "set the stage" for participants.

Preface

This is the final technical paper for Contract No. F33615-79-C0019, Taxonomy and Codification of Productivity Criteria. This part of the effort focused on field testing a methodology for generating organizational productivity indicators. The work was produced under Work Unit 77340810. Previous technical publications produced under this contract were AFHRL-TR-81-12, Manager's Guide to Productivity Improvement Resources and Programs; AFHRL-TR-81-6, Measuring and Enhancing Organizational Productivity: An Annotated Bibliography; and AFHRL-TR-81-9, Productivity Measurement Methods: Classification, Critique, and Implications for the Air Force.

The authors wish to thank the Air Force Productivity and Research Office (AF/MPME) for its support and assistance in gaining access to field locations. Management Engineering Teams at the bases visited provided excellent support and coordination for the project. The researchers were inspired by the enthusiastic support and participation of Air Force members in the 24 organizations involved in the effort. Without their support, indulgence, and cooperation, this work would not have been possible.

A special note of gratitude is expressed to Mr. Robert B. Leckliter, former Productivity Principal for the Tactical Air Command (TAC). He assisted the project team during visits to TAC bases and spent a week observing the process at one TAC base. His suggestions and critique of the process were extremely perceptive and valuable.

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I. INTRODUCTION

Among the most serious obstacles to the study of productivity is the so-called "criterion problem," that is, the measurement or assessment of productivity itself. Most published studies of productivity rely on indirect methods of productivity measurement, usually on perceptions of productivity reported by supervisors and job incumbents (e.g., Berry & Matthews, 1983; Field & Hightower, 1983). Few investigations employ productivity criteria from engineering studies (Tuttle, 1981). As a consequence of the widespread use of subjective criterion measurement, the results of many studies of productivity are of questionable validity and limited generality. Efforts to enhance productivity in Air Force organizations have been similarly hampered by a lack of acceptable productivity measurement procedures.

Based on interviews with Air Force commanders, staff officers, and researchers, Tuttle (1981) developed the following definition of productivity for use in Air Force productivity enhancement efforts:

Productivity in Air Force organizations refers to the volume of resources used to produce products and services (efficiency) and the extent to which these products and services conform to acceptable standards of mission performance (effectiveness) (Tuttle, 1981, p. 30).

Air Force commanders devote considerable time and resources to the measurement and tracking of productivity. For example, commanders of some organizations (e.g., Maintenance) have time standards which permit the calculation of performance efficiency ratios, whereas others (e.g., Weather) track after-the-fact quality control to assure the accuracy of their products (e.g., weather observations, forecasts, and warnings). Despite this considerable investment in measurement data, productivity measurement practices vary considerably from organization to organization in terms of what is measured, how it is measured and how useful the measures are (R. Wilkerson, personal communication, May 2, 1982). As a result, productivity criteria for cross-organizational research are not widely available.

In order to accurately assess organizational performance, evaluate planning and resource allocation decisions, and conduct research and development (R & D) on the effectiveness of alternative management practices across organizational settings, measures which include indicators of efficiency and effectiveness are required. To have maximum utility for R & D purposes, the measures should be consistent or similar across organizations that perform similar functions, they should cover all key facets of mission performance, and they should include indicators of both efficiency and effectiveness (Tuttle, 1981). Moreover, indicators should possess the following characteristics (A.T.

Kearney, Inc., 1978, pp. 11-13):

1. Completeness. All significant facets of the organization's mission should be covered,
2. Comparability. Measures should remain applicable from one time period to another,
3. Input coverage. The output indicators should cover all significant results obtained from all controllable inputs to the production process (e.g., the results produced by the work hours of all people working in the organization),
4. Compatibility with existing data sources. Measures should make maximum use of existing data sources,
5. Cost-effectiveness. The costs of measurement should not exceed the benefits obtained,
6. Acceptability. The indicators should be meaningful and acceptable to those whose performance is being measured.

Finally, individual indicators should possess the following characteristics (Hurst, 1980, pp. 43-49):

1. Validity. Indicators should accurately reflect changes in the organization's performance,
2. Uniqueness. Indicators should be relatively independent of each other,
3. Understandability. Individuals being measured should understand how their performance is reflected in the indicators being used,
4. Controllability. Organizational members should be able, through their actions on the job, to produce changes in the indicators which are related to their performance,
5. Reliability. Indicators should yield information that is repeatable over time, assuming that performance levels remain the same.

A methodology involving group decision-making procedures was proposed and described by Tuttle (1981), to generate objective measures of organizational productivity in Air Force organizations. This procedure is referred to as the methodology for generating efficiency and effectiveness measures (MGEEM) and was designed specifically to produce "hard" measures of organizational productivity in organizations that have few or no such existing measures. The purpose of the present effort was to conduct a field test to evaluate the MGEEM in terms of its

capability to develop productivity indicators for research and management purposes. The field test focused on four questions. First, to what extent does the MGEEM yield a usable number of efficiency and effectiveness measures? Second, how acceptable are the MGEEM processes and products to personnel within organizations studied? Third, how cost-effective are the productivity measures developed by the MGEEM? Fourth, how similar or consistent are measures generated by similar organizations?

With respect to the fourth question, several a priori predictions were made regarding the judged similarity between organizations. Factors which were hypothesized to contribute to differences in KRAs and indicators included command differences, differences in the extent to which performance measurement is institutionalized within the function, homogeneity of the organizations, and unintentional differences produced by inconsistency of the measurement coordinators. For example, those functions which consistently had a single coordinator (Propulsion and Weather) should be more similar than Administration, which was split between two measurement coordinators. Weighing all these factors, within-organization similarity between lists of KRAs for similar organizations was predicted to be greater than the similarity between lists of indicators. Additionally, between-organization similarity of both indicator and KRA ratings was predicted to be greater for Weather than for any of the other two functions and to be greater for Propulsion than for Administration. The researchers predicted that the highest similarity ratings would be obtained among organizations in the Weather function because: all Weather organizations belong to a single command; measurement of many facets of Weather performance is common practice; and although personnel in Weather organizations fall into one of three job functions, they are highly interrelated and have a common focus.

The next most similar indicators were predicted in Propulsion. Although the Propulsion organizations cut across three commands, the work is quite similar, performance measurement is used extensively in maintenance organizations, the work performed is perhaps the most homogeneous of the three functions studied; and a single coordinator was used. The lowest similarity values were predicted for Administration. Not only do the Administration organizations span three commands, they did not employ measures of performance to the extent that the other two functions did. In addition, the work in an Administration Division was separated into three functions and these were geographically separated as well. Finally, two measurement coordinators were employed in the work with Administration organizations.

than do indicator ratings. This is true for both commander/deputy and research ratings. In general, the similarity ratings by function conform to the predictions that Administration had the lowest ratings for KRAs and indicators based on ratings by both commanders/deputies

Table 7. Average Percent of Overlap for KRAs and Indicators

Function	Command/Deputy Ratings		Researcher Ratings	
	<u>N</u> KRAs	<u>N</u> Indicators	<u>N</u> KRAs	<u>N</u> Indicators
Administration	37.8	10.8	21.6	6.1
Propulsion	58.9	18.8	35.1	11.9
Weather	48.6	18.8	46.5	18.9

and researchers. Using researcher ratings, Propulsion shows a lower average similarity than does Weather for both KRAs and indicators. Since participant ratings for Propulsion are based on incomplete data due to the low response rate, the participant ratings may be questionable and less reliable than researcher ratings.

Table 6 presents the results of the analysis of indicators with respect to use of existing data. For both Administration and Propulsion, the percentages of indicators that required no new data collection exceeded 90 percent. For Weather, the figure was 79.7.

Table 6. Number and Percentage of Indicators
Able to be Formed from Existing Data by Function

Function	No. Indicators	No. From Existing Data	Percent From Existing Data
Administration	154	141	91.6
Propulsion	152	145	95.4
Weather	178	142	79.8

Similarity of KRA's and Indicators Across Organizations

In the original statement of the MGEEM (Tuttle, 1981), Phase IV of the methodology provided a means of resolving differences between results from similar organizations within a function to arrive at a common set of KRAs and indicators. A set of indicators which can be applied across similar organizations is necessary if they are to be used as productivity measures in cross-organizational research. As has been stated, one objective of the field test was to determine the degree of similarity of indicators generated from different organizations within the same function that exists, prior to attempts to "force" similarity. Therefore, the Phase IV of the MGEEM design to "force" similarity was not applied, in this field test.

At least two questions are involved in the similarity analyses. First, how does one assess similarity? That is, what is the metric? Second, given an acceptable metric, what is a sufficient level of overlap to justify the conclusion that the MGEEM produces a satisfactory level of similarity?

The metric previously developed to assess similarity was the average percent of overlap between pairs of similar organizations. This measure was computed separately for KRAs and indicators on the basis of ratings made by commanders/deputies and researchers.

Table 7 presents the similarity rating results. For all three functions, the KRA ratings show higher levels of similarity

Another comment from a Group B participant illustrates the perceived educational effect the process had on participants. The following comment is from an assistant crew chief.

Helped me gain insight as to the overall branch mission and some of the problems incurred. Also, by participating in the process, I gained a feeling of having my views considered by higher headquarters.

Two additional comments from Group B participants illustrate the benefits of the process. First, from a branch chief:

This type of survey is greatly needed in our system. Normally, we don't talk to each other enough.

Next, from a management assistant:

I feel we achieved a better understanding of what our problems are and how to best solve them. If we achieve 10% of what was discussed in the sessions, I feel we were successful in making a change for the better in our attitudes and productivity.

In summary, with only one exception, the MGEEM was viewed favorably by unit commanders. Other management and non-management participants, as a whole, felt that the process and its results were quite acceptable. Thus, in terms of participant reaction, the MGEEM was favorably evaluated.

Cost Effectiveness of the Indicators

A third important aspect of the field test was determining the extent to which data to form indicators developed by MGEEM are currently available. There are at least three forms of existing data. The most obvious are numbers or entries in particular blocks on existing reporting forms. Another type of existing data includes entries on management information system products provided to managers/commanders by staff support agencies or higher headquarters. Finally, there is a variety of local data including status boards, customer feedback forms received, duty rosters, etc. In the latter case, data are often available but are not tabulated in the format required to form the indicator. Nevertheless, all three categories are considered together in this discussion under the heading of "existing data." If an indicator required the establishment of a new log or some other form of initial data collection, the indicator was considered not to make use of existing data. The fact that an indicator for which data are not now available is included in the final list means that a unit commander has made the determination that the cost of additional data collection is warranted by the value of the indicator. Otherwise the indicator would have been eliminated in the review process.

using his suggestions and recommendations in developing key indicators. Overall an excellent session.

Some commanders expressed skepticism with the assumptions underlying the process, as indicated by the following comment.

The approach was sound and refreshing. I'm still not totally convinced of the validity of letting employees develop indicators of our Key Result Areas. Management thinking is often quite different from that of the employees when it comes to measuring results.

Several Group A participants commented that the results of the process did not surprise them or generate anything new. An example of such a comment is the following:

Every KRA listed as important to us merely repeats the good management techniques in Air Force Regulations or Air Force Manuals. We proved that the 'book' is right.

Only one participant expressed a negative view toward the process. This unit commander missed the part of the session which described the purpose of the process, but he participated in the remainder of a Group A session. He stated:

The coordinator did not understand the structure, mission, or policy-making procedures of the Air Force. The overall objective of a wing is to mobilize and fight in a deployment posture. Air Force units can't be measured the same way as a civilian company.

Participants in Group B had some mixed feelings about the process. On one hand, they found the sessions interesting and different from the usual work-related meeting. On the other hand, they were skeptical that any one would listen to their ideas or that anything would change as a result of their participation. These mixed attitudes are vividly expressed by a subordinate of the commander whose negative view is expressed above.

I feel that managers in Group B should have had more time. Perhaps the coordinator should have explained in more detail how KRAs were developed in Group A. I am enthusiastic about the procedures being used in the measurement process as they seemed to open our eyes to the other duties, requirements, needs of each DA section. You had two strikes against you from the start since most managers seem to feel it was a waste of time. The management/supervisor/technician exchanging ideas in this type of atmosphere seemed to be very healthy for all of us. Don't think any of us are certain that the results achieved will be applied. But I can say that we all enjoyed it.

The results for Group A showed a high degree of understanding of the purpose of the process; on a nine-point scale, the average ratings were 8.3, 8.1, and 8.3, respectively, for Administration, Propulsion, and Weather. The results also showed a very favorable reaction to the coordinator (8.4; 8.2; 8.8) and the working climate created (8.5; 8.6; 8.7). The consistency of these results across functional areas suggests that the work as measurement coordinators by the two researchers was perceived similarly by participants in the three functions.

Using a nine-point scale, Group A participants in the three functions rated the MGEEM task as only moderately difficult (5.4; 4.7; 5.6) but interesting (8.1; 7.8; 8.1). The KRAs were viewed as acceptable to Group A members (8.0; 7.8; 7.9), as was the priority ranking of KRAs (7.9; 7.8; 7.9). Group A rated itself as very successful (8.1; 8.1; 8.1) and rated the success of the total MGEEM as only slightly less successful (7.9; 7.7; 7.4). For all three functions, the members of Group A expressed a slight increase in productivity awareness as a result of participating in the process (3.7/4.3; 4.0/4.9; 3.8/4.2).

The results from Group B are very similar to those for Group A. Group B members expressed satisfaction with their success in generating indicators (7.5; 8.2; 7.6) and felt that the process was beneficial to them in helping to better understand their organization's mission (7.2; 7.7; 7.3). As with Group A, Group B members expressed satisfaction with the role of the coordinator (7.9; 8.2; 8.5), the working climate created (8.4; 8.6; 8.5), and with the process used (7.9; 8.1; 7.7). They, too, found their task only moderately difficult (6.3; 5.2; 6.5) but interesting (7.7; 8.0; 7.4). Compared to Group A, members of Group B expressed a slightly lower initial level of productivity awareness, but also felt that the process raised that level of awareness (3.4/3.8; 3.6/4.2; 3.2/3.9).

Further insight into the meaning of these ratings can be gleaned from the "write-in" remarks of participants. The following comments provide an overview of the range of participant attitudes. The commander of one weather detachment observed:

The process was extremely beneficial to the people -- whole unit, but especially Group B. They are more aware of management's position and feel they are now participants. I expect morale to improve even if no changes are made. This plus the feedback are key benefits.

Another commander expressed some ideas for expanding the process:

A third session including the commander with Group B participants would have been beneficial (with the researcher present). We will eventually follow-up with this. Also, an extended session with the coordinator

Table 5. Participant Feedback Report Results - Group B

Item Description	Administration		Propulsion		Weather	
	N = 54 Mean	SD	N = 59 Mean	SD	N = 30 Mean	SD
4. Understanding the process ^a	7.5	1.8	7.9	1.3	7.7	1.5
5. Understanding the instructions	7.9	1.5	8.3	1.1	8.2	0.9
6. Importance of coordinator	7.9	1.6	8.2	1.2	8.5	0.8
7. Coordinator's attitude	8.4	1.1	8.7	0.6	8.9	0.4
8. Working climate created	8.4	1.2	8.6	0.9	8.5	0.7
9. Time for Group B's task	7.6	1.8	7.9	1.7	7.9	1.6
10. Difficulty of Group B's task	6.3	2.5	5.2	2.7	6.5	1.8
11. Interest in Group B's task	7.7	1.7	8.0	1.1	7.4	1.6
12. Understanding meaning of indicator types	7.7	1.5	7.9	1.3	7.6	1.3
13. Round-robin process	7.9	1.5	8.1	1.2	7.7	1.3
14. Acceptability of indicators	7.4	1.6	8.1	1.2	7.4	1.1
15. Acceptability of indicator ranking	7.3	1.6	7.9	1.2	7.2	1.4
16. Success of Group B	7.5	1.5	8.2	1.6	7.6	1.4
17. Benefits to you	7.2	1.9	7.7	1.5	7.3	1.5
18. Productivity awareness ^b Pre MGEEM Sessions	3.4	0.8	3.6	0.9	3.2	0.9
19. Productivity awareness Post MGEEM Sessions	3.8	0.9	4.2	0.7	3.9	0.6

^a Items 4-17 used a nine-point scale: 1=low, 9=high.

^b Items 18-19 used a five-point scale: 1=low, 5=high.

Group A members who were also members of Group B filled out a Participant Feedback Report for both groups.

Table 4. Participant Feedback Report Results - Group A

Item Description	Administration		Propulsion		Weather	
	Mean	SD	Mean	SD	Mean	SD
4. Understanding the process ^a	8.3	1.3	8.1	1.3	8.3	0.8
5. Understanding the instructions	8.5	1.2	8.2	1.3	8.7	0.6
6. Importance of coordinator	8.4	1.3	8.2	1.3	8.8	0.7
7. Coordinator's attitude	8.6	1.1	8.7	0.9	8.9	0.2
8. Working climate created	8.5	1.2	8.6	0.9	8.7	0.6
9. Time for Group A's task	8.4	1.2	7.9	1.4	7.8	1.8
10. Difficulty of Group A's task	5.4	3.0	4.7	2.4	5.6	2.5
11. Interest in Group A's task	8.1	1.4	7.8	1.4	8.1	1.2
12. Understanding meaning of KRAs	8.3	1.3	8.2	1.1	8.3	0.7
13. Round-robin process	8.3	1.3	8.1	1.1	8.1	1.0
14. Acceptability of KRAs	8.0	1.3	7.8	1.2	7.9	0.9
15. Acceptability of KRA ranking	7.9	1.2	7.8	1.0	7.9	0.9
16. Success of Group A	8.1	1.4	8.1	1.2	8.1	1.0
17. Success of total process-A & B	7.9	1.3	7.7	1.5	7.4	1.1
18. Pre-Productivity awareness ^b	3.7	0.9	4.0	0.8	3.8	0.9
19. Past-Productivity awareness	4.3	0.9	4.9	0.8	4.2	0.6

^aItems 4-17 used a nine-point scale: 1=low, 9=high.

^bItems 18-19 used a five-point scale: 1=low, 5=high.

Table 3. Classification of Indicators by Function and Type

		Indicator Type											
Functional Area	Total No. Ind.	Efficiency					Effectiveness						
		1	2	3	Total	%	1	2	3	4	Total	%	
Administration	154	7	5	9	21	14	70	29	21	13	133	86	
Propulsion	152	4	2	2	8	5	74	31	28	11	144	95	
Weather	178	3	2	6	11	6	48	76	27	16	167	94	

indicators were of the effectiveness type, while for Administration units, 86% were effectiveness indicators. This preponderance of effectiveness indicators, as compared to efficiency indicators, has several implications which will be addressed later in this paper.

Acceptability of the Process to Participants

The Participant Feedback Report form, described in the Methods Section, was used to obtain the formal reactions of participants to the Group A and B sessions. Results are summarized in Table 4 for Group A members and Table 5 for Group B members.

Table 2. Average Number of KRAs and Indicators per Organization

	No. KRAs	No. Indicators	No. Indicators per KRA
Administration	5.5	19.3	3.5
Propulsion	4.9	19.0	3.8
Weather	8.3	22.1	2.7

The mix of efficiency and effectiveness indicators developed by the MGEEM is shown in Table 3. Indicators were classified into two categories according to the following definitions:

Efficiency Indicators:

Type 1 = Output/Input (e.g. No. bags of mail sorted/No. hours worked)

Type 2 = Standard Output/Actual Output (Std. no. hours to repair engine/Actual no. hours required)

Type 3 = Actual Utilization/Potential Utilization (No. square feet warehouse space used/No. square feet available)

Effectiveness Indicators:

Type 1 = Goals Achieved (No. space engines available/Planned No. engines available)

Type 2 = Quality (No. weather observations submitted error free/No. weather observations submitted)

Type 3 = Internal Impact (Avg. No. work hours lost due to accidents)

Type 4 = External Impact (Property damage due to unforecast weather)

In each function studied, the majority of indicators generated were effectiveness indicators. The largest proportion of effectiveness indicators was found in Propulsion organizations, where 95% of the generated indicators were concerned with effectiveness. For Weather organizations, 94% of the generated

III. RESULTS

Four questions were addressed in this field test. First, to what extent did the MGEEM produce a usable number of both efficiency and effectiveness indicators? Second, how acceptable were the MGEEM process and its results to personnel within the organizations visited? Third, to what extent did the generated indicators make use of existing data? Finally, how similar were the generated KRAs and indicators among organizations within each function?

Selected KRAs and indicators which resulted from application of the MGEEM are presented in Appendices C (Administration), D (Propulsion), and E (Weather). The indicators presented are those which survived the final review process by commanders of the target organizations. A similar list for each of the 24 target organizations, along with the similarity ratings, and participant reactions to the process comprise the raw data used to assess the utility of the MGEEM.

Number and Types of Indicators Generated

In the application of the MGEEM, productivity is defined in terms of efficiency and effectiveness. In addition, a design criterion for the methodology states that it should produce multiple indicators which adequately cover the mission of the organization. Thus, a basic concern of the field test had to do with the number and type of indicators generated. Does the methodology yield an adequate number to cover the major mission facets, without producing so many indicators as to make them unmanageable? Secondly, does the methodology lead to a reasonable mix of both efficiency and effectiveness indicators?

The first of these questions is addressed by the data in Table 2. The average number of KRAs per organization ranged from 4.9 for Propulsion to 8.3 for Weather. This number reflects differences in facilitator style as much as it did differences in the organizations. For example in the NGT process, one facilitator tended to force groups to "pick the top 5" KRAs, where as the other researcher "allowed" the groups to select the top 7-10. On the average, the number of indicators generated per organization ranges from about 19 in Propulsion and Administration to 22 in Weather. Then the number of indicators did not vary as much as the number of KRAs. This is due to the fact that the more KRAs which were generated, the fewer the indicators per KRA. The average number of indicators per KRA ranges from 2.7 in Weather to 3.8 in Propulsion.

commander's organization with the KRAs and indicators generated by each of the seven other organizations within the function. The rater was instructed to examine the items on List 1 (the rater's list of KRAs), one item at a time, and determine if that item was the same as or was a subset of an item on List 2. Then, similar comparisons were made between a second pair of organizations until all comparisons were made between the rater's organization and the seven others, separately for KRAs and indicators. Thus, each commander rated the similarity between all possible pairings of the rater's organization's KRAs and indicators with the other seven in the same function.

To provide a second set of similarity ratings, the researchers also rated KRAs and indicators for all possible pairings of organizations within each of the three functions. Researcher ratings, presumably using a consistent frame of reference across all organizations, provided a "second opinion" on the similarity of KRAs and indicators across like organizations.

Similarity scores for pairs of organizations were computed by dividing the number of items indicated as being similar on both lists by the total number of items on the two lists and then multiplying by 100. If all items on the two lists being compared were rated as similar, the similarity (or percentage of overlap) would be 100%. If no items were rated as similar on either list, indicating that the two lists had no items in common, the percentage of overlap would be 0%. Similarity scores were computed for each pair of organizations within each function, based both on participants' (i.e., commanders and deputies) and researchers' ratings.

Data from commanders/deputies were obtained from rating booklets, which were mailed several months after the field visits. For Administration, the return rate was 50 percent for KRA ratings and 25 percent for indicator ratings. In Propulsion, the return rates were 25 percent for KRAs and 19 percent for indicators. In Weather, the return rates were 88 percent for KRAs and 69 percent for indicators. Thus, the similarity analyses are based on a less-than-desirable number of ratings, especially in the Propulsion function.

usually required to achieve consensus.

Following the generation of KRAs by Group A, Group B was formed. Group B consisted of all members of Group A (except the commander) and their immediate subordinates. Group B was tasked to develop and prioritize "indicators" of efficiency and effectiveness for each KRA. Using the NGT, a list of indicators was developed for each KRA.

Each organization in the study was visited by a researcher for 5 days. On the first day, an inbriefing and familiarization with the subject organization was conducted. On the second day, Group A was formed and KRAs were developed. Days three and four involved the generation of indicators by Group B. Day five consisted of a review of the KRAs and indicators with the commander of the organization. In addition, this discussion with the commander identified existing data sources which could provide information required to form the indicators in actual operational use.

Tuttle (1981) provides a more extensive treatment of the rationale underlying the MGEEM and its development.

Participant Feedback

Following the MGEEM implementation, The Participant Feedback Report was used to obtain participant reactions. The Participant Feedback Report consists of 20 questions. Examples of the feedback forms sent to members of Teams A and B are found in Appendices A and B respectively. Items 1-3 were demographic questions, and item 20 was an open-ended item. The remaining items used a Likert-type scale to rate various aspects of the MGEEM and its results. The anchor terms varied somewhat from item to item, but the least favorable reaction was usually weighted a "1" and the most favorable reaction a "9" (items 4-17) or a "5" (items 18-19).

MGEEM Follow-Up

Following completion of the base visits, a list of final KRAs and indicators developed by each organization was prepared. These lists were mailed to unit commanders for review and comment. After final changes suggested by commanders were made in the lists, rating booklets were prepared for the final phase of data collection. This involved assessment of the similarity of KRAs and indicators across organizations within each functional area.

Similarity Assessment

The assessment of similarity was accomplished through ratings by unit commanders or their deputies. The rating task involved comparing lists of KRAs and indicators obtained from the

Table 1. Final Base Sample

Command	Base	Weather	Administration	Propulsion
ATC ^a	Williams AFB, AZ			X
MAC ^b	Laughlin AFB, TX			X
MAC	Andrews AFB, MD	X	X	X
MAC	McChord AFB, WA	X	X	X
MAC	Travis AFB, CA	X	X	X
SAC ^c	Barksdale AFB, LA			X
SAC	Griffiss AFB, NY	X	X	X
SAC ^d	March AFB, CA	X	X	X
TAC ^d	Bergstrom AFB, TX	X	X	
TAC	Luke AFB, AZ	X	X	
TAC	Shaw AFB, SC	X	X	

^aAir Training Command (ATC)

^bMilitary Airlift Command (MAC)

^cStrategic Air Command (SAC)

^dTactical Air Command (TAC)

MGEEM Methodology

The MGEEM involves a group decision-making process known as the Nominal Group Technique (Delbecq, Van de Ven, and Gustafson, 1975). The Nominal Group Technique (NGT) consists of six steps: (a) silent generation of ideas by individual group members, (b) round-robin listing of ideas, (c) discussion and clarification of ideas developed, (d) voting to prioritize items from the list, (e) further discussion and clarification of items and voting patterns, and (f) additional voting and discussion, if necessary, to achieve consensus. The NGT requires a skilled group facilitator or measurement coordinator to conduct the process. The facilitator, while guiding the group in making decisions, must not attempt to lead the group toward any particular decision. In the field test, the researchers performed the role of facilitator.

The NGT process was used in the field test to generate: (a) Key Result Areas (KRAs) and (b) Indicators. Two groups of organizational members were involved in the NGT process. The KRA development group, Group A, consisted of the organization's commander and representatives from the next lower level of management. KRAs were generated in response to the question, "What results does the Air Force pay this organization to accomplish?" Potential KRAs were proposed by members of Group A which were presumed to tap the basic facets of the organization's mission. Group A then voted to prioritize six to nine KRAs. Two or three rounds of voting, each followed by discussion, were

II. METHOD

Function and Base Selection

The function selection process was guided by five criteria. First, in order for the results of the field test to be generalizable, the functions selected should be qualitatively different from each other. Second, the functions should be important to the Air Force in terms of the number of people involved and in terms of the relationship of the function to the primary flying mission of the Air Force. Third, the functions selected should be ones for which measures do not currently exist in the Air Force productivity measurement program, but which are under consideration for inclusion in this program. Fourth, there should be a sufficient number of people at a base in the function to permit formation of the MGEEM teams without excessively disrupting the organization's normal work performance. Finally, the functional area should not be so technical that the productivity criteria developed would only have meaning for specialists in the functional area; i.e., the technology involved in the function should be comprehensible to a lay person.

Consultation with representatives of the Air Force Productivity and Research Office (AF/MPME) and the project monitor at the Air Force Human Resources Laboratory (AFHRL/MODP) resulted in the selection of three functions. Their Air Force Functional Account Codes were Administration (11XXXX), Aircraft Maintenance--Propulsion (232XXX), and Weather (34XXXX). Within these functions, the organizational units selected were the Central Base Administration Division, Aircraft Maintenance--Propulsion Branch, and the Base Weather Detachment. For economic reasons, a decision was made to restrict the field test to 24 organizations: eight in each of the three functions. Thus, the base selection problem concerned how to select the minimum number of bases in order to satisfy the following sampling criteria. First, there should be a minimum of 20 people in each target function (i.e., Administration, Propulsion, or Weather) at the base. Second, the bases should represent at least three Major Commands (MAJCOMS). Third, ideally, more than one function would be located at a selected base, to minimize travel time and costs. Fourth, the selected bases should be "typical" of the Air Force (e.g., not a command headquarters).

Application of the criteria led to the selection of the bases shown in Table 1. A total of 11 bases were selected, which provided the 24 target organizations. Four MAJCOMS were represented, and all but three of the bases had at least two target organizations.

IV. DISCUSSION

The purpose of this investigation was to conduct a field test of the MGEEM in order to determine its applicability for generating appropriate research criteria and use as a management tool. This section will consider the evidence in these two areas and will also consider implications for additional research and suggested modifications to the MGEEM.

Implications for Use of MGEEM in Inter-Organizational Research

Use of the MGEEM for research purposes requires that the process should lead to a set of reliable, valid and important indicators which are common to a range of similar organizations and that the process is acceptable to unit commanders and organization members. This study yielded KRAs with moderate similarity between organizations and indicators with generally low similarity. While the original statement of MGEEM (Tuttle, 1981) included a phase designed to produce a common set of indicators, this phase was intentionally omitted in the present research to determine similarity levels when KRAs and indicators are free to vary. Therefore, this research demonstrated that a commonizing phase is necessary in order to obtain sufficiently high levels of similarity to permit cross-organizational research. However, the process did yield indicators which were judged important and acceptable to unit commanders. In order to assess reliability and validity, other than face validity, the indicators must be made operational and assessed statistically.

Assessments of commonality, when each organization was completely free to generate its own KRAs and indicator set, demonstrate that similar organizations develop Key Result Areas and indicators which show only low to moderate inter-organization similarity. This provides evidence that the commonizing phase of MGEEM is necessary in order to obtain a common set of indicators for use across similar organizations.

To understand the meaning of the similarity scores, refer to Tables 8 and 9. Table 8 lists KRAs for two Weather organizations. Organization 2 has seven KRAs and organization 5 has 10 KRAs. These two organizations received a KRA similarity value of 70%. This computation procedure is presented in Table 9.

Table 8: Comparison of KRAs for Weather Organizations 2 and 5

Weather Organization 2	Weather Organization 5
KRA 1-Training and Maintain Skills required for wartime mission	KRA 1-Issue accurate terminal area forecasts
KRA 2-Provide weather warnings and advisories of hazardous weather	KRA 2-Accurately and timely record and transmit weather observations
KRA 3-Provide accurate forecasts for use by local commanders	KRA 3-Issue timely and accurate weather warnings
KRA 4-Provide current weather observations locally to military and civilian users and transmit them to national and international users	KRA 4-Issue metwatch forecast advisories
KRA 5-Carry out management and supervisory duties required to maintain skilled and motivated personnel, serviceable equipment, necessary records, and adequately kept facilities	KRA 5-Prepare SAC alert packages
KRA 6-Brief outbound crews on in-route and landing weather world wide and metwatch aircraft as required	KRA 6-Provide routine and special briefings to aircrews
KRA 7-Provide social forecasts as required	KRA 7-Meet the needs of operational requirements and unit personnel through good personnel management
	KRA 8-Provide staff weather support to decision-makers in completing their missions
	KRA 9-Conduct job related training
	KRA 10-Provide capability to support EWO/contingencies operations

KRAs 1, 3, 4 and 6 from Organization 2 were substantially the same as KRAs 10, 1, 2 and 6 in Organization 5. KRA 2 (Org. 2) was more general than any KRA in Org. 5 in that it encompassed KRA No. 3 and 4 (Org. 5). Therefore KRA 2 (Org. 2) was not counted as being the same as any KRA in Org. 5. However, KRAs 3 and 4 (Org. 5) were counted as being substantially the same as KRA 2 in Org. 2. Likewise, KRA 5 (Org. 2) encompassed but was not identical to KRAs 7 and 9 (Org. 5). KRAs 7 (Org. 2) and 5 and 8 (Org. 5) were unique. Therefore, as shown in Table 9 this

leads to 12 out of 17 KRAs being considered substantially the same between the two organizations, yielding a value of 70% overlap.

Table 9: Analysis of KRA Similarity Determination

KRA No. - Organization 2	Comparable KRA(s) - Organization 5
1	10
2	3 and 4
3	1
4	2
5	7 and 9
6	6
7	None

5 and 8 were unique to Org. No. 5

Similarity Computation = No. KRAs in Common (Org. 2 vs. Org. 5)

$$\begin{array}{r}
 \text{Total Combined No. KRAs} \\
 = 12 \\
 \text{---} \\
 17 \\
 = .70
 \end{array}$$

To illustrate how the commonizing process for MGEEM would work to increase similarity, consider KRA 2 for Org. 2. This KRA covers both warnings and metwatch advisories. Organization 5 chose to split these into two KRAs. If the commonizing process were used to resolve this difference between these two organizations in terms of the level of specificity of the item, "commonality" would be increased. Similarly, this would be expected to occur for KRA 5 (Org. 2) and KRAs 7 and 9 (Org. 5). The unique KRAs 7 (Org. 2) and 5 and 8 (Org. 5) may not be resolved. For example, "social forecasts," e.g. whether or not it will rain on the general's cocktail party, are provided by all weather detachments but this does not constitute a significant

part of a unit's workload and, therefore, probably does not belong in a productivity measurement system. On the other hand, "preparing SAC alert packages" would be unique to weather detachments located on SAC bases; therefore, it is a unique and significant mission requirement.

Applying the commonizing phase of MGEEM to these two organizations would likely raise overlap from 70% to at least 87%. This is because KRA 7 (Org. 2) would drop out, and a common level of specificity would be agreed upon for KRAs 2 and 5 (Org. 2) and 3, 4, 7, 9 (Org. 5).

Since indicators are developed from KRAs, any differences in KRAs are magnified in the indicator development process. Thus, it is not surprising that indicator similarity is considerably lower than KRA similarity. However, as illustrated above for KRAs, the commonizing process if applied to indicators would be expected to lead to a substantial increase in similarity scores between similar organizations. The magnitude of the expected gain will vary depending on the "true" similarity of mission requirements between presumably similar organizations. However, it would seem highly likely that a sufficient level of similarity could be attained to permit development of a core set of indicators for use in research across similar organizations. Additional research with various commonizing strategies will be required to substantiate this hypothesis.

Implications for Use of the MGEEM Within Organizations

The results of the field test clearly demonstrate that the MGEEM is useful in generating productivity indicators for uses within organizations. These uses, both diagnostic and therapeutic in nature, do not appear to be affected by limitations in inter-organizational generality. The high acceptability of the MGEEM to field test participants and its apparent ability to utilize existing data sources for most indicators developed underscore the potential utility of the methodology as a management tool.

Efficiency vs. Effectiveness Indicators - What's Appropriate

A very high percentage of indicators generated were effectiveness as opposed to efficiency indicators. The reasons for this are not clear. There is some evidence from anecdotal data collected by the researchers following the group sessions that efficiency is not a major concern of Group B participants. Group B members tended to look at costs and resource allocation as problems for higher management; thus, they did not suggest many efficiency indicators. These individuals tended to view resources as "given." Their major concern was with getting the job done. Some participants stated that if they ran out of resources (fuel, material, supplies, etc.), more would be provided because the job must be done. Thus, there appeared to

be little incentive at this level to minimize resource expenditures. This relative lack of concern for efficiency contrasts sharply with attitudes expressed by base, squadron, and wing commanders who were interviewed during the research. Commanders were quite concerned with efficiency and effectiveness. With respect to the Air Force productivity improvement efforts, an important organizational issue is what should be the level of concern with efficiency vs. effectiveness at various organizational levels. Once that is answered, the next question relates to the organizational and managerial factors which promote concern for efficiency in those organizations where it is most appropriate. Based on the results of this study, there appear to be differences between organizations in the extent to which efficiency is a priority. Possible factors affecting this concern seem to be level of the organization (division vs. branch), civilian vs. military mix, nature of the work performed, etc. This issue also appears worthy of additional research. It is potentially the most significant research issue identified.

Implications for Modifications to MGEEM

A number of observations from the field test experience with the MGEEM resulted in suggestions for further improvement of the procedure. For instance, it became clear that the measurement coordinator must be skilled in conducting group decision-making sessions. The importance of this factor is difficult to overstate. A poorly trained or poorly skilled measurement coordinator could lose control of the process and less valid indicators might be developed. In preliminary sessions with participants, the measurement coordinator should provide explicit examples of KRAs and indicators and describe the whole process to participants. Questions should be posed carefully and unambiguously. From an organizational viewpoint, it should be made clear to all participants that the unit commander fully supports the process. Additionally, for use in operational settings the MGEEM requires somewhat more time than was allocated during the research program. While one 3-hour session was sufficient to develop KRAs, two 3-hour sessions were needed to develop a comprehensive list of indicators for all KRAs. Following these structured sessions, group meetings or "sanity checks" with Group A and Group B for the purpose of reviewing and "polishing" the KRAs and indicators would be recommended. Finally, the quality of the results depends on the abilities of the participants. Experienced, knowledgeable, and highly verbal team members yield the best results. Accordingly, efforts should be made to assign such personnel to participate in the MGEEM process.

These observations have been incorporated into a modified MGEEM, which is outlined in Appendix F.

V. CONCLUSIONS

The field test of the MGEEM methodology demonstrated the following. First, the MGEEM led to a set of indicators judged important and feasible by commanders. Second, there was moderate similarity between organizations within a function with respect to KRAs and generally low similarity between organizations with respect to indicators. A seemingly disproportionate subset of the indicators developed were measures of effectiveness as opposed to efficiency. Third, the process was highly acceptable to participants. Fourth, the indicators would appear to be cost effective to implement since a high percentage make use of existing data. These findings have implications for both research applications of the methodology and for organizational productivity measurement and enhancement applications.

REFERENCES

- Berry, G.A., & Matthews, M.D. (1983, March). Predicting job satisfaction and job performance. Proceedings of the 24th Annual Meeting of the Military Testing Association (AFHRL-TP-83-16, AD A126554). Brooks AFB, TX: Manpower and Personnel Division, Air Force Human Resources Laboratory, pp. 20-24.
- Delbecq, A.L., VandeVen, A.H., & Gustafson, D.H. (1975). Group techniques for program planning. Glenview, IL: Scott, Foresman and Company.
- Field, H.S., & Hightower, J. (1983, March). Productivity and consulting: A new look of objective measures. Proceedings of the 24th Annual Meeting of the Military Testing Association (AFHRL-TP-83-16, AD A126554). Brooks AFB, TX: Manpower and Personnel Division, Air Force Human Resources Laboratory, pp. 25-29.
- Hurst, E.G. (1980). Attributes of performance measures. Public Productivity Review, 4(1), 43-50.
- Kearney, A.T., Inc. (1978). Measuring productivity in physical distribution. Chicago, IL: National Council of Physical Distribution Management.
- Tuttle, T.C. (1981, September). Productivity measurement methods: Classification, critique, and implications for the Air Force (AFHRL-TR-81-9, AD-A105267). Brooks AFB, TX: Manpower and Personnel Division, Air Force Human Resources Laboratory.
- Wilkinson, R.E., personal communication, 1982.

APPENDIX A

Base _____

Target Work Center _____

Participant Feedback Report -- Team A

Instructions

You recently participated in a measurement process conducted by the Maryland Center for Productivity and Quality of Working Life designed to generate Key Results Areas and productivity Indicators for the work center indicated at the top right of this form. Please indicate your reactions to these procedures and the results by responding to the following questions. Thank you for your cooperation.

Background Information

1. Your Position Title/Function _____
2. Length of time in your present position ____years ____months
3. (a) Status ____ Military (b) TAFMS: ____years ____months
____ Civilian

Reactions to the Process

Please circle the number which best indicates your reaction to the element of the measurement process listed below.

4. Your understanding of the purpose of the measurement process
Poor Understanding 1 2 3 4 5 6 7 8 9 Good Understanding
5. Instructions provided by the coordinator
Not Clear 1 2 3 4 5 6 7 8 9 Clear
6. Importance of a coordinator to the process
Not Important 1 2 3 4 5 6 7 8 9 Important
7. The coordinator's attitude toward the process
Negative 1 2 3 4 5 6 7 8 9 Positive
8. The working climate created by the coordinator
Not Conducive to 1 2 3 4 5 6 7 8 9 Conducive to
Open Discussion Open Discussion

9. The time allocated for Team A's task
Insufficient 1 2 3 4 5 6 7 8 9 Sufficient
10. The difficulty of Team A's task (generating and ranking Key Results Areas)
Not Difficult 1 2 3 4 5 6 7 8 9 Difficult
11. Your reaction to Team A's task
Not Interesting 1 2 3 4 5 6 7 8 9 Interesting
12. Your understanding of the meaning of Key Results Areas
Not Clear 1 2 3 4 5 6 7 8 9 Clear
13. The round-robin process used to generate Key Results Areas
Not Successful 1 2 3 4 5 6 7 8 9 Successful
14. The acceptability to the members of your Team of the Key Results Areas generated
Not Acceptable 1 2 3 4 5 6 7 8 9 Acceptable
15. The acceptability to the members of your Team of the priority ordering of Key Results Areas
Not Acceptable 1 2 3 4 5 6 7 8 9 Acceptable
16. How would you rate the overall success of Team A in developing a useful set of Key Results Areas
Not Successful 1 2 3 4 5 6 7 8 9 Successful
17. How would you rate the success of the total process (Teams A and B) in developing a useful set of Key Results Areas and Indicators
Not Successful 1 2 3 4 5 6 7 8 9 Successful
18. Prior to participating in this measurement process, how would you describe your level of awareness of the meaning of productivity in Air Force Organizations?

(Check one)

1. _____ Very Low
2. _____ Low
3. _____ Moderate
4. _____ High
5. _____ Very High

19. As a result of participating in this process, how would you describe your current level of awareness of the meaning of productivity in Air Force organizations?

(Check one)

- 1. _____ Very Low
- 2. _____ Low
- 3. _____ Moderate
- 4. _____ High
- 5. _____ Very High

20. What other reactions do you have to the process, its results, or its utility for your organization?

APPENDIX B

Base _____

Target Organization _____

Participant Feedback Report -- Team B

Instructions

You recently participated in a measurement process conducted by the Maryland Center for Productivity and Quality of Working Life designed to generate productivity indicators for the organization listed in the top right corner of this form. Please indicate your assessment of this process and the resulting indicators by responding to the following questions.

Background Information

1. Your Position Title/Function _____
2. Length of time in your present position ____year ____month
3. (a) Status ____ Military (b) TAFMS: ____year ____month
____ Civilian

Reactions to the Process

Please circle the number which best indicates your reaction to the element of the measurement process listed below.

4. Your understanding of the purpose of the measurement process
Poor Understanding 1 2 3 4 5 6 7 8 9 Good Understanding
5. Instructions provided by the coordinator
Not Clear 1 2 3 4 5 6 7 8 9 Clear
6. Importance of the coordinator to the process
Not Important 1 2 3 4 5 6 7 8 9 Important
7. The coordinator's attitude toward the process
Negative 1 2 3 4 5 6 7 8 9 Positive
8. The working climate created by the coordinator
Not Conducive to 1 2 3 4 5 6 7 8 9 Conducive to
Open Discussion Open Discussion

9. The time allocated for Team B's task (generating and ranking Indicators for Key Results Areas)

Insufficient 1 2 3 4 5 6 7 8 9 Sufficient

10. The difficulty of Team B's task

Not Difficult 1 2 3 4 5 6 7 8 9 Difficult

11. Your reaction to Team B's task

Not Interesting 1 2 3 4 5 6 7 8 9 Interesting

12. Your understanding of the meaning of efficiency and effectiveness Indicators

Not Clear 1 2 3 4 5 6 7 8 9 Clear

13. The round robin process used to generate Indicators

Not Successful 1 2 3 4 5 6 7 8 9 Successful

14. The acceptability to the members of your Team of the Indicators generated

Not Acceptable 1 2 3 4 5 6 7 8 9 Acceptable

15. The acceptability to members of your Team of the priority ordering of Indicators

Not Acceptable 1 2 3 4 5 6 7 8 9 Acceptable

16. How would you rate the overall success of Team B in developing a useful set of Indicators

Not Successful 1 2 3 4 5 6 7 8 9 Successful

17. The benefits to you of the process in terms of providing a better understanding of the total organization's mission

Not Beneficial 1 2 3 4 5 6 7 8 9 Beneficial

18. Prior to participating in this measurement process, how would you describe your level of awareness of the meaning of productivity in Air Force organizations?

(Check one)

1. _____ Very Low
2. _____ Low
3. _____ Moderate
4. _____ High
5. _____ Very High

Revised MGEEM -- Outline of Process

The MGEEM consists of six phases:

Phase 1: Decision to Measure Productivity

Phase 2: Organizational Familiarization

Phase 3: Development of Key Result Areas

Phase 4: Development of Indicators

Phase 5: Refinement of Indicators and Data Sources

Phase 6: Generalization of Indicators

Phase 1: Decision to Measure Productivity

- *1.1. Defining goals of the measurement activity
- 1.2. Select measurement coordinator
- *1.3. Develop a working definition of productivity
- *1.4. Analyze forces for and against implementation of the measurement methodology
- *1.5. Finalize measurement plan
- *1.6. Obtain necessary organizational commitments

Phase 2: Organizational Familiarization

- *2.1. Review existing documentation
- *2.2. Visit the target organization or a similar organization
- 2.3. Define organizational boundaries
- 2.4. Construct organizational diagram

Phase 3: Development of Key Result Areas

- 3.1. Form Team A
- 3.2. Orient Team A

*An asterisk denotes those steps which have been added or significantly modified in the restatement of the MGEEM.

APPENDIX F

- | | | |
|--|---|---|
| 7-3. | Average number shifts per individual shift worker per month (also forecaster, Wing Weather Officer, etc.) | Local Records,
Not Tabulated |
| 7-4. | Number personnel nominated for awards | Local Records,
Not Tabulated |
| KRA 8: Provide staff weather support to assist decision makers in completing their missions. | | |
| 8-1. | Inspector General inspection ratings | I.G. Report |
| 8-2. | Operational Readiness Inspection ratings | O.R.I. Report |
| KRA 9: Conduct job-related training. | | |
| 9-1. | Number fully trained in a category
<u>Number personnel to be trained in the category</u> | Unit Training Records
<u>Unit Training Records</u> |
| 9-2. | Number personnel upgraded on time
<u>Number personnel eligible for upgrading</u> | Unit Records, CBPO Data
<u>Unit Records, CBPO Data</u> |
| KRA 10: Provide the capability to support contingency operations. | | |
| 10-1. | Number discrepancies in local mobility exercise | Base Mobility Exercise Report |
| 10-2. | Evaluation of mobility capability during I.G. inspections | I.G. Report |

3-4.	<u>Number after the fact warnings issued</u>	<u>3rd W W Form 16</u>
	Total number warnings issued	3rd W W Form 16

3-5.	<u>Number compliance errors on AWS Form 39</u>	<u>AWS Form 80</u>
	Number possible errors	AWS Form 80

KRA 4: Issue metwatch forecast advisories.

4-1.	<u>Number metwatch forecasts verified</u>	<u>AWS Form 15</u>
	Number metwatch forecasts issued	AWS Form 15

4-2.	Number bust reviews for metwatch forecasts	AWS Form 15
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4-3.	<u>Number compliance errors in metwatch forecast advisories</u>	<u>AWS Form 80</u>
	Number possible errors	AWS Form 80

KRA 5: Prepare SAC alert packages.

5-1.	<u>Number compliance errors in SAC alert packages</u>	<u>AWS Form 80</u>
	Number possible errors	AWS Form 80

KRA 6: Provide routine and special weather briefings to aircrews and commanders to support operational missions.

6-1.	<u>Number compliance errors on 175-1, SAC 597-598</u>	<u>AWS Form 80</u>
	Number possible errors	AWS Form 80

6-2.	Total number of briefings (175-1, SAC 597-598, AWS 28)	M.I.S. Report to MAC HQ
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6-3.	<u>Number positive comments on SAC Form 352</u>	<u>SAC Form 352</u>
	Total number comments received on SAC Form 352	SAC Form 352

KRA 7: Meet the needs of operational requirements and unit personnel through good personnel management.

7-1.	Percent Officer Efficiency Reports, Airmen Performance Ratings submitted on time	Local Report
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7-2.	Number disciplinary actions (Letters of Reprimand, Article 15's, etc.)	Local Records, Not Tabulated
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Sample List

Weather Organization 5

Key Results Areas, Indicators and Data Sources

KRA 1: Issue accurate terminal area forecasts.

1-1.	<u>Number incorrect forecasts</u> Number incorrect forecasts allowed (Standard)	<u>Local Records</u> Air Weather Service Standard
1-2.	Number forecast amendments required	3rd W W Form 39A
1-3.	Number bust reviews required	Local Records, Not Tabulated
1-4.	<u>Number forecasts with discrepancies in forecast coding</u> Total number forecasts	<u>AWS Form 80</u> AWS Form 80
1-5.	Number forecasts not submitted or not submitted on time	3rd W W Form 1

KRA 2: Accurately and timely record and transmit weather
observations locally and by long-line.

2-1.	<u>Number discrepancies on AWS Form 10</u> Total number observations	<u>AWS Form 80 & AWS Form 1</u> AWS Form 80 & Form 1
2-2.	<u>Number electrowriter errors</u> Number observations	<u>AWS Form 80</u> AWS Form 80
2-3.	<u>Number late observations</u> Standard for late observations	<u>3rd W W Form 16</u> AWS Standard

KRA 3: Issue timely and accurate weather warnings

3-1.	<u>Number warnings issued that verify</u> Number warnings issued	<u>3rd W W Form 16</u> 3rd W W Form 16
3-2.	<u>Number warnings issued with desired lead time</u> Number warning that require lead time	<u>3rd W W Form 16</u> Local Records
3-3.	Number bust reviews for missed warnings (No Lead Time, etc.)	Local Records, Not Tabulated

APPENDIX E

3-2:	By type injury, $\frac{\text{Number of people injured on job}}{\text{Number assigned}}$	Safety office record
KRA 4: Full utilization of personnel and material resources.		
4-1.	By shift, by section, $\frac{\text{Number of hours on the job (Time x + 1)}}{\text{Number of hours on the job (Time x)}}$	AFTO Form 349
4-2.	$\frac{\text{Actual time to complete job}}{\text{Standard performance time}}$	Locally maintained record AFR 400-1
4-3.	$\frac{\text{Number hours test equipment in Precision Measuring Equipment Laboratory (PMEL) (Time x + 1)}}{\text{Number hours test equipment in Precision Measuring Equipment Laboratory (PMEL) (Time x)}}$	Locally maintained record
4-4.	$\frac{\text{Number of Material Deficiency Reports (MDRs) submitted to depot that receive proper response}}{\text{Number of MDRs to depot}}$	Locally maintained file Deficiency analysis
4-5.	$\frac{\text{By stock number, Number items cross-canned (Time x + 1)}}{\text{By stock number, Number items cross-canned (Time x)}}$	Monthly maintenance summary
KRA 5: Secondary equipment in highest state of readiness.		
5-1.	By item, $\frac{\text{Number out of commission}}{\text{Total number in inventory}}$	Locally maintained record
5-2.	$\frac{\text{Number hours required to keep equipment in state of readiness (Time x + 1)}}{\text{Number hours required to keep equipment in state of readiness (Time x)}}$	Monthly maintenance report
5-3.	Equipment breaking most frequently	Locally maintained record

Sample List

Propulsion Organization 6

Key Results Areas, Indicators and Data Sources

KRA 1: Quality power plants for assigned aircraft at right time and place.

- | | |
|---|---|
| 1-1. Number of spare engines available | Maintenance control - local record |
| 1-2. <u>By cause, Number of functional check flight (FCF) non-releases due to engine problems (Time x + 1)</u>
<u>By cause, Number of functional check flight (FCF) non-releases due to engine problems (Time x)</u> | Local daily status sheet |
| 1-3. <u>Flyable aircraft</u>
<u>Total inventory</u> | Local daily deviation sheet |
| 1-4. <u>Number of test cell rejects</u>
<u>Number of engines tested</u> | Test cell reject sheet |
| 1-5. <u>Number of repeat/recurring engine write-ups</u>
<u>Number of one-time engine write-ups</u> | Special "flightline" form for each engine |

KRA 2: An effective training program producing technically qualified personnel.

- | | |
|--|---|
| 2-1. <u>Number of 3-levels assigned</u>
<u>Number of qualified trainers</u> | Maintenance management information and control system (MMICS) |
| 2-2. End-of-course test scores | Training section record |

KRA 3: Safe operation.

- | | |
|---|--|
| 3-1. <u>Number of detected safety violations (DSV) (Time x + 1)</u>
<u>Number of DSVs (Time x)</u> | Quality Control report and maintenance standardization evaluation program (MSEP) reports |
|---|--|

APPENDIX D

- | | |
|--|--|
| 5-3. Number of Freedom of Information Act, Privacy Act, and AF Form 844 requests <u>processed incorrectly (Time x + 1)</u>
Number of Freedom of Information Act, Privacy Act, and AF Form 844 requests processed incorrectly (Time x) | Locally
maintained
record |
| 5-4. Number of reports/jobs reaccomplished due to improper procedures being used <u>by Administration Division personnel</u>
Total number of reports/jobs done | Not available

Locally
maintained
record |

KRA 3: Morale of administrative personnel.

- | | | |
|------|---|----------------------------|
| 3-1. | <u>Number of non-mission-related conflicting demands (Time x + 1)</u>
Number of non-mission-related conflicting demands (Time x) | Locally maintained records |
| 3-2. | <u>Number of monetary and non-monetary incentives awarded (Time x + 1)</u>
Number of monetary and non-monetary incentives awarded (Time x) | Locally maintained record |
| 3-3. | Average number of special military details outside of normal assigned duties | Locally maintained record |

KRA 4: Minimize the cost of supplies and equipment.

- | | | |
|------|---|--|
| 4-1. | <u>Number of times pouch mail is requested to be mailed out of pouch (Time x + 1)</u>
Number of times pouch mail is requested to be mailed out of pouch (Time x) | Locally maintained record |
| 4-2. | Number of reams of obsolete forms reused for public use | Locally maintained record |
| 4-3. | Number/quality of equipment/supplies not being used | Locally maintained record and supply records |
| 4-4. | <u>Quarterly cost of administrative supplies (Time x + 1)</u>
Quarterly cost of administrative supplies (Time x) | Base financial record |

KRA 5: Stay abreast of all current regulations and procedures.

- | | | |
|------|---|--|
| 5-1. | Number of Operational Readiness Inspection, self-assistance, and in-house write-ups | SAC Form 210 and locally maintained record |
| 5-2. | <u>Number of work request denials</u>
Number of authorized requests | Locally maintained record |

Sample List

Administration Organization 5

Key Results Areas, Indicators and Data Sources

KRA 1: Direction and leadership for base personnel on administrative matters.

- | | | |
|------|---|---------------------------|
| 1-1. | <u>Number of telephone inquiries received and honored regarding administrative procedures (Time x + 1)</u>
Number of telephone inquiries received and honored regarding administrative procedures (Time x) | Locally maintained record |
| 1-2. | Average time from inquiry to response | Locally maintained record |
| 1-3. | <u>Number of classes, films, etc. provided base personnel (Time x + 1)</u>
Number of classes, films, etc. provided base personnel (Time x) | Locally maintained record |
| 1-4. | <u>Number of unsolicited contacts with other base offices (other than staff assistance units) (Time x + 1)</u>
Number of unsolicited contacts with other base offices (other than staff assistance units) (Time x) | Locally maintained record |
| 1-5. | <u>Number of staff assistance visits requested by base personnel (Time x + 1)</u>
Number of staff assistance visits requested by base personnel (Time x) | |

KRA 2: Deliver administrative services to the customer.

- | | | |
|------|--|----------------------------|
| 2-1. | <u>Number of pieces of mail processed per week</u>
Number hours worked (Week x + 1)
<u>Number of pieces of mail processed per week</u>
Number hours worked (Week x) | Monthly log and time cards |
| 2-2. | Average turnaround time from date of work request to date of deliveries | AF Form 844 |
| 2-3. | Average time from date of work request to initiation of work | AF Form 844 |
| 2-4. | <u>Number of backlogged work orders</u>
Standard number of backlogged work orders | Locally maintained record |

APPENDIX C

19. As a result of participating in this process, how would you describe your current level of awareness of the meaning of productivity in Air Force organizations?

(Check one)

- 1. _____ Very Low
- 2. _____ Low
- 3. _____ Moderate
- 4. _____ High
- 5. _____ Very High

20. What other reactions do you have to the process, its results, or its utility for your organization?

*3.3. Use Nominal Group Technique (NGT) to define and prioritize KRAs

*3.3.1. Silent generation

*3.3.2. Round-robin listing

*3.3.3. Clarification

*3.3.4. Preliminary vote

*3.3.5. Discussion of voting patterns

3.3.6. Vote 2

3.3.7. Tally results of vote 2

*3.4. Sanity check of KRAs

3.5. Develop chart listing and describing KRAs

Phase 4: Development of Indicators

4.1. Form Team B

*4.2. Orient Team B

4.3. Generate productivity indices for KRAs

4.3.1. Silent generation

4.3.2. Round-robin listing

4.3.3. Clarification

4.3.4. Vote 1

4.3.5. Discussion of preliminary vote

4.3.6. Final vote

*4.3.7. Sanity check of indicators

4.4. Develop chart listing KRAs and indicators

*Phase 5: Review of Indicators and Data Sources

*5.1. Schedule meeting with target unit commander

*5.2. Review indicators and determine data sources

*5.3. Develop chart of KRAs, indicators and data sources

*5.4. Feedback of final results to participants

*Phase 6: Developing a Common Set of Indicators for
Research and Cross-Organizational Comparisons

- 6.1. Develop measurement plan
- 6.2. Select sample measurement locations
- 6.3. Develop plan for field work
- 6.4. Obtain clearance from appropriate headquarters
- 6.5. Finalize plans for field visits to measurement locations
- 6.6. Implementation of the methodology
- *6.7. Combine similar KRAs
- *6.8. Sort indicators into KRA categories
- *6.9. Refine the criterion modules
- *6.10. Develop an indicator matrix for each KRA

END

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