NASA Technical Memorandum 110442

DOT/FAA/AR-96/122

LOFT Debriefings: An Analysis of Instructor Techniques and Crew Participation

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March 1997

National Aeronautics and
Space Administration

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PREFACE

This study originated from requests from several airline training departments for help in analyzing the effectiveness of LOFT debriefings. Doug Daniel and Steve Gregorich helped identify crucial issues and ways to study these issues.

The study could not have been conducted without the generous willingness of instructors and line crews to allow us to observe their debriefings. We are impressed with their high standards of professionalism. Training department managers from each of the airlines that participated in the study provided a wealth of background information and made valuable suggestions on early drafts of this manuscript.

This study was funded by the FAA's Office of the Chief Scientist and Technical Advisor for Human Factors (AAR-100). Eleana Edens, the program manager, provided support, encouragement and helpful suggestions.

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LOFT DEBRIEFINGS: AN ANALYSIS OF INSTRUCTOR TECHNIQUES AND CREW PARTICIPATION

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SUMMARY

This study analyzes techniques instructors use to facilitate crew analysis and evaluation of their LOFT performance. A rating instrument called the Debriefing Assessment Battery (DAB) was developed which enables raters to reliably assess instructor facilitation techniques and characterize crew participation. Thirty-six debriefing sessions conducted at five U.S. airlines were analyzed to determine the nature of instructor facilitation and crew participation. Ratings obtained using the DAB corresponded closely with descriptive measures of instructor and crew performance. The data provide empirical evidence that facilitation can be an effective tool for increasing the depth of crew participation and self-analysis of CRM performance. Instructor facilitation skill varied dramatically, suggesting a need for more concrete hands-on training in facilitation techniques. Crews were responsive but fell short of actively leading their own debriefings. Ways to improve debriefing effectiveness are suggested.

1.0 OVERVIEW

How much crews learn in Line-Oriented Flight Training (LOFT) and take back to the line depends on the effectiveness of the debriefing that follows the LOFT. The Crew Resource Management (CRM) literature and the Federal Aviation Administration's (FAA) advisory circular (AC) 120-35C recommend that in the debriefing instructors should facilitate self-discovery and self-critique by the crew rather than lecture on what they did right and wrong. Self discovery by the crew is believed to provide deeper learning and better retention. Also, crews are more likely to enhance their performance of CRM in line operations if they develop their ability to analyze flight operations in terms of CRM and debrief themselves after line flights.

In this study 36 LOFT debriefings conducted at five major U.S. airlines were analyzed. Audiotape recordings of each session were made with the permission of instructors and crews. The recordings were subsequently deidentified, coded, and analyzed for more than 70 variables. The Debriefing Assessment Battery was developed to systematically characterize instructor effectiveness at facilitation and the nature of crew participation in debriefings. The data indicate that the Debriefing Assessment Battery is a reliable and valid instrument for assessing instructors' skill in facilitation and for analyzing crew participation. The battery was designed to be used by researchers, however a short form of the battery that can be used by training departments to evaluate debriefings in real time is currently being

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developed and evaluated.

Most instructors at all five airlines followed a similar general format for debriefing. However, within each airline both instructors and crews varied widely on many of the specific variables observed. There were also substantial differences among airlines on several variables for both instructors and crews, though most of these differences were not statistically significant due to the large variability within each airline.

The debriefings lasted an average of 31 minutes, with a range of 8 to 82 minutes. However, 31 minutes may not allow adequate time for crews to analyze their performance thoroughly or learn and practice the skills of self-debriefing. This study provides no data on the optimal length for debriefings, however an hour may be a useful rough target, with adjustments for the needs of individual crews. This suggestion must, of course, be considered in the context of other demands on instructors' time.

Most instructors appropriately emphasized crew performance in the LOFT and achieved a balance between CRM and technical issues, although the range of instructor scores on these variables was very large. Instructors typically emphasized the things crews did well, but said little about things done not so well and spent little time suggesting ways to improve. Likewise, crews' discussions of their performance tended to be factual descriptions of events and crew actions, with limited evaluation of performance or discussion of ways to improve.

The content of the debriefings was driven almost exclusively by the instructors; crew members rarely brought up topics on their own initiative. Also, discussions revolved around the instructor, even when the instructor succeeded in getting the crew to do most of the talking: there was little back-and-forth discussion directly between crew members. The data indicate that crews were responsive but not very proactive. This may be in part because few of the instructors explicitly told crews they should take a proactive role and perform their own analysis without depending on the instructor to lead them step by step. It may also be that instructors themselves either do not fully accept or understand the concept of crews taking initiative and responsibility for the content of the debriefing.

On average, instructors asked a large number of questions to elicit crew participation, directing their questions evenly among crew members. Participation by captains and first officers was quite similar. Participation by flight engineers (in three-person crews) was lower, but this difference was marginally significant.

Most instructors appeared to be highly competent and conscientious in the traditional roles of instructors, and most attempted to facilitate crew participation to some degree; however, their success in facilitation ranged from very good to poor. Instructors who were effective in facilitation tended to use a combination of techniques, such as careful phrasing of questions to encourage crew self-analysis, strategic silence, active listening, and follow-up on crew-initiated topics. Probably more important than the use of any particular technique is the instructor's underlying focus on encouraging the crew to analyze for themselves the situations that confronted them in the LOFT and how well they managed those situations.

Many instructors unwittingly did things counterproductive to their own attempts to facilitate crew participation. In addition to failing to explicitly state expectations for crew participation and allowing the discussions to revolve around themselves instead of encouraging crew interaction, some instructors failed to allow crew members enough time to formulate thoughtful responses to questions. Also, some instructors engaged in long monologues, gave their own evaluations before eliciting crew self-evaluation, failed to push the crew to go beyond superficial description of their actions, and/or failed to encourage crews to analyze why things went well when they did.

The wide range of instructor effectiveness in facilitation indicates that the airlines face an issue of standardization of this aspect of debriefing. The distribution of facilitation scores was distinctly

bimodal, with one group of instructors scoring in the *good* to *very good* range and another group of instructors scoring in the *marginal* range. Also, instructors who did well in one aspect of facilitation typically did well in all aspects (except stating expectations for crew participation), and those who did poorly in one aspect tended to do poorly in all aspects. These data suggest instructors' ability to use various techniques is determined at least in part at the conceptual level: Do they grasp the underlying concept of facilitation? Do they accept the concept? Is facilitation the type of approach for which they have ability?

The CRM literature states that debriefings should be led by the crews themselves, using the instructor as a resource. Our data suggest that this goal, although worthwhile, is rather idealistic. Instructors become discouraged when, after a brief and rather abstract course in facilitation, they attempt to facilitate debriefings and discover that crews often do not immediately respond. We suggest that it would be more effective to teach instructors that facilitation should be adapted to the level at which the particular crew is able to respond. Facilitation can be conducted at levels ranging from high, which approaches the ideal of the debriefing being led by the crew, to low, in which the instructor leads the crew substantially, but in all cases debriefings should emphasize as much self-discovery by the crew as possible.

Instructors are encouraged to attempt to facilitate at the highest level possible for a particular crew. Realistically, however, most crews do not yet have the skills and motivation needed to lead their own debriefings without substantial assistance from the instructor. It may be possible to change this situation over time if LOFT instructors consistently encourage crews to take a proactive role in debriefing their own training.

Instructors sometimes mistakenly assume that using facilitation requires giving up their role as teachers in the debriefing. On the contrary, good facilitation in no way precludes the instructor from adding his or her own perspective to the discussion or from teaching specific points about CRM and technical issues as appropriate. Effective facilitators can integrate their teaching points into a group discussion in which the crew members are full participants.

The study provides empirical evidence that facilitation can be used to substantially increase crew self-discovery and the depth of crew participation. Instructors, however, need additional training in facilitation. Facilitation training should emphasize hands-on practice in which instructors encounter the kinds of obstacles they are likely to face in actual debriefings. Initial training should be followed by mentoring by senior instructors who are themselves expert facilitators. A training manual that provides detailed suggestions for how to facilitate debriefings is forthcoming as a companion to this technical report.

2.0 INTRODUCTION

2.1 Background

Line Operational Simulation (LOS) is widely used to provide opportunities for crews to practice CRM concepts in realistic and challenging simulated flight situations. As indicated in the FAA's AC 120-35C (1995), LOS includes LOFT, Line Operational Evaluation (LOE), and Special Purpose Operational Training (SPOT). LOFT is the original "non-jeopardy" form of simulation training in which crews are not graded on their performance. Like LOFT, SPOT is used for training rather than evaluative purposes. In LOE crews are graded, which is required in those airlines that participate in the

FAA's Advanced Qualification Program (AQP). Both LOFT and LOE are full-mission simulations that include all phases of flight, whereas SPOT may be full-mission or only a segment of a flight tailored to focus on a particular training point.[3]

How much crews learn in LOFT and take back to the line depends on the effectiveness of the debriefing that follows the LOFT (Helmreich & Foushee, 1993). The simulation itself is a busy, intense experience, and thoughtful discussion afterward is necessary for the crew to sort out and interpret what happened and why. Instructors are expected to lead debriefings in a way that encourages crew members to analyze their LOFT performance for themselves. Rather than lecturing to the crew on what they did right and wrong, the instructor is expected to facilitate self-discovery and self-critique by the crew (Butler, 1993; Hawkins, 1987; Smith, 1994).

CRM and LOFT programs have developed considerably since their inception almost twenty years ago. The concepts and the value of CRM are now generally accepted by both airline managers and pilots. However, it is not clear whether crews consistently think about and practice CRM in line operations (see discussion in Helmreich & Foushee, 1993). AQP is bringing to fore the issue of how well crews are actually able to practice CRM, because poor CRM can cause crews to fail a LOE (Birnbach & Longridge, 1993; FAA, 1991). In order for LOE programs to be effective and accepted, pilots must believe they are being graded on performance dimensions they understand and by criteria that seem appropriate and achievable. The ability of crews to analyze and evaluate their own performance in LOFT may predict their acceptance of LOE grading.

2.2 What is Facilitation and Why Use It?

The FAA's AC 120-35C on Line Operational Simulations (1995) describes the general concept of facilitated debriefings:

> The facilitator should not handle the debrief in a "teacher tell" manner but, instead, operate as a resource to crew members by highlighting different portions of the LOS that may be suitable for review, critique, and discussion. The discussion should be led by the crew themselves, using the facilitator and the videotape as resources for use during their critique...Self-criticism and self-examination are almost always present in these situations, and in many cases they are much more effective than facilitator criticism...Thus, the facilitator should do everything possible to foster this sort of self-analysis, while at the same time keep the debrief at a constructive level. In the role of moderator, the facilitator can guide the discussion to areas that he or she has noted...However, unless absolutely necessary, the facilitator should avoid "lectures" about what is right and wrong.

The concept of facilitated debriefings appears to have been part of the early inception of LOFT (Lauber & Foushee, 1981). The origin of this concept is not clear, but it appears to have been derived from the use of facilitation in other business settings, such as retreats in which managers discuss their organizational goals and issues (e.g., Gibb, 1982; Mills & Roberts, 1981).

The primary rationale for facilitating rather than lecturing is that crews can learn and remember much more when they participate actively and make their own analyses than when they listen passively

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[3]This study examined only LOFT debriefings. Many of the findings, however, are also relevant to SPOT. At the time of this writing, LOE is just starting to come into use, and it is not clear whether airlines will consider LOE a tool for both training and evaluation or just for evaluation. Thus, the role of debriefings in LOE is not yet determined. This report addresses only the training objectives of LOS debriefings, not the evaluative aspect found in LOE. For consistency, LOFT is referred to in this report, although the findings are expected to genaralize to the training objectives of all forms of LOS.

to the instructor (Duvall & Wicklund, 1972; Smith, 1994). Another potential benefit of crew-centered LOFT debriefings is that they can help crews develop the habits of analyzing their own CRM performance on the line and conducting their own crew debriefings following line operations (Butler, 1993). In practice, crew debriefings on the line in civil operations are as yet rare, although military crews often debrief their missions. Thus, the LOFT debriefing is an important tool for showing crews how to debrief and for illustrating the benefits of self-debriefing.

Continental Airlines' (1992) handbook on LOFT facilitation techniques outlines a useful hierarchy of facilitation based on the concepts of discovery and ownership. According to this handbook, the goal of facilitation is to have crews recognize what they did well and what they need to improve (discovery), and to have crews make a commitment to continue or begin using desired behaviors and stop using undesirable ones (ownership). At the top of the hierarchy is "they see it, they say it." This is the ideal in which crews recognize and analyze their own performance. In the middle is "you help them see it, they say it." If crews are not able to recognize what they did well and what they can improve, the facilitator can lead them to self-analysis through questioning. Finally, at the bottom of the hierarchy is "you help them see it, you help them say it." When crews are unable to recognize or analyze their performance the facilitator must evaluate for them to ensure that they understand what went well or poorly, and why.

A literature search conducted as part of this study revealed no studies that analyzed the specific needs and issues of LOFT debriefings in order to adapt the general concept of facilitation to this specialized setting, which differs substantially from most business settings. The training departments of many airlines provide their instructors written guidelines; however, these guidelines tend to be rather sketchy and most do not provide a detailed exposition of how to use facilitation.

The general literature on facilitation in settings other than LOFT is also rather sketchy. This is a trade literature rather than a scientific literature, and very little empirical evidence is provided to support assertions, validate specific techniques, or qualify the range of settings in which advocated techniques may be effective. However, the general concept of facilitation has considerable face validity as a way to encourage self-discovery by crew members. Both the adult learning literature and the cognitive research literature suggest that self-discovery improves learning, retention, and the ability to apply knowledge in diverse settings.

According to the facilitation literature, adult learning is typically self-directed (Cornwell, 1979). In general, adults dislike long lectures, they learn best from discussions with peers, they need to integrate new knowledge with what they already know as professionals, they want to be told up front what is expected of them, and their self-esteem is directly affected by classroom discussion (Zemke & Zemke, 1981).

Active participation requires crew members to process information more deeply than listening passively to an instructor's critique does (see, for example, Slamecka & Graf, 1978). Deeper processing leads to elaboration of the information in memory and enables better retrieval from memory when it is needed (Baddeley, 1990).

Facilitation can help individuals develop problem solving and critical thinking skills (Gow & Kember, 1993). Research in several areas of expertise suggests that individuals are better at solving problems and applying their knowledge in diverse situations if they have a good metacognitive perspective of their technical skills (see Metcalfe & Shimamura, 1994). Metacognition refers to knowledge of one's own thought processes and the ability to keep track of what one is doing while analyzing problems and managing tasks. Debriefings that emphasize self-analysis and self-discovery help crews develop metacognitive skills for managing cockpit situations. One could argue that the concept of metacognition is implicit in the philosophy of CRM; for example, CRM teaches crews to

establish priorities and keep track of how they are managing their priorities during abnormal line situations.

2.3 Techniques for Facilitation

Most of the techniques for facilitating group participation that are suggested in the literature concern the use of introductions, active listening, questions, and silence. The use of video recordings to enhance discussion is also discussed.

2.3.1 Introductions. An explicit introduction is necessary to clarify the role of the facilitator and the nature of the participation expected of the group (Casey, Roberts, & Salaman, 1992; Nelson-Jones, 1992; Gibb, 1982). A good introduction can also motivate the group to participate by providing a rationale for the session.

2.3.2 Active listening. Good listening skills enable the facilitator to work with what the participants are saying and to encourage further participation. Active listening shows that the facilitator is attending to the speaker, understands what is being said, and wants to hear more. Active listening can range from a simple "uh-huh" or "okay" to echoing or reflecting in one's own words what a speaker is trying to communicate.

2.3.3 Questions. According to the Socratic method, learning is facilitated by questioning, encouraging exploration, and pushing for explanation; not by lecturing and telling the answers (Casey et al., 1992). "Can you give me a specific example?" "How did you and the other person actually behave?" and "What were your thoughts in the situation?" are examples of questions that can aid self-assessment (Nelson-Jones, 1992). Mills and Roberts (1981) assert that, ideally, questions should be brief; open (i.e., non-restrictive, don't imply opinion or judgment); and begin with who, where, and when for factual responses or what, how, and why for more in-depth and detailed answers.

The use of probing questions encourages active and in-depth participation. Probing questions that ask participants to explain and justify their responses have been reported to be particularly effective (Jacobsen, Eggen, & Kauchak, 1989). Mills and Roberts (1981) identified seven types of probes that encourage continued participation: non-verbal (e.g., a nod); short verbal ("Uh, huh?"); "W" words (especially what, how, and why); statements such as "Tell me more."; echoing of participant words; reflection of what the participant said with different words but the same meaning; and specialized reflections that imply more than stated by the participant. (Also, see Eitington, 1986.)

2.3.4 Silence. Sometimes group participants do not respond immediately to a leader's question. Most people find silence in a group setting uncomfortable, and leaders often allow no more than a one second pause before rephrasing a question or answering it for the group. However, one second may not be long enough for participants to formulate a thoughtful response. Studies show that waiting three to four seconds substantially improves both the number and quality of responses (Rowe, 1986; Jacobsen et al., 1989). The longer pause elicits longer, more confident responses from the group, as well as more numerous voluntary observations, participant interactions, and participant questions. Furthermore, responses from slower participants increase, speculative responses and evidence-inference statements increase, and failures to respond decline (Ornstein, 1990; Rowe, 1974).

2.3.5 Videos. Most airlines videotape the LOFT. Although the use of video is not a facilitation technique per se, it can aid facilitation. Instructors select segments of the videotape to show during the debriefing to help the crew observe and discuss their performance. The video can help the crew view their performance from a third-party perspective (FAA, 1995); it may also help the crew remember what happened.

The literature cited above provides examples of facilitation techniques and a rationale for using

them, but unfortunately provides little in the way of detailed, practical guidance for using these techniques in particular group settings and integrating the techniques into the overall management of a session. In order for these techniques to be used effectively in LOFT debriefings, they must be adapted to the particular characteristics and demands of these debriefings.

2.4 Research Questions

Although the concept of facilitated debriefings is widely espoused in the CRM literature, little empirical research has examined what actually happens in debriefings. This study attempts to answer five major questions:

1) To what extent do instructors attempt to facilitate crew participation and self-discovery in LOFT debriefings?
2) What techniques do instructors use to facilitate and how effective are these techniques?
3) Is facilitation a viable approach to encouraging crew participation and self-discovery?
4) What is the character of crew participation, especially in terms of analyzing and evaluating their own performance?
5) How much variation occurs among instructors and among airlines in the conduct of debriefings?

3.0 METHODS

3.1 Participants

Thirty-nine LOFT debriefings conducted at five major U.S. airlines between June 1994 and May 1995 were observed. All five airlines are large, well-established national companies; four are passenger airlines and one is a cargo company. At each of the airlines the first author observed four to eleven debriefings. (At the first company visited, a second research observer was also present at the debriefings and interviews.) The training department managers who arranged the observations were asked not to preselect which instructors and crews would be observed; rather, the selection was driven by the schedules of who was instructing during the three to five days each airline was visited. The observed debriefings represented all or most of the fleets operated by each airline, and at least one LOFT simulation of each scenario flown in each fleet was observed. Generally, one debriefing was observed per instructor and crew; however, four of the instructors were observed debriefing a second crew for the purpose of comparison.

Permission to attend the debriefing and to audio tape the session was obtained from each instructor and each crew member, and assurance was provided that all data collected would be completely deidentified to assure anonymity for all participants.

3.2 Procedures

Prior to observation of the debriefings, the written scenarios for each LOFT were reviewed and managers in the CRM departments were interviewed. After each debriefing the instructor was interviewed and asked to rate the crew's CRM performance and technical performance on separate five-point Likert scales ranging from poor (1) to exemplary (5). Instructors were also asked for comments about the debriefing process.

The audio recordings of 36 of the 39 debriefings were transcribed into text in their entirety and all references to individuals and organizations were deleted. (Two of the recordings were not sufficiently intelligible for transcribing and the tape recorder failed during another debriefing.) Of the 36 debriefings that were transcribed, 25 were from two-person crews, and eleven were from three-person crews (Table 1).

3.3 Measures

3.3.1 Descriptive measures. Each instructor and crew utterance was coded for nine factors and the coding was checked during data entry. (The factors and the coding rules are described in Appendix A.) From these nine factors 72 utterance variables were calculated (see Appendix B). Data were also extracted on the instructors' use of videotapes to illustrate the crews' performance in the LOFT, including the number of video segments played for crew discussion, the length of the segments played, and the extent to which the segments were discussed. The above data will be referred to as "descriptive" to distinguish them from the data generated using the Debriefing Assessment Battery described below.

3.3.2 Debriefing Assessment Battery. The Debriefing Assessment Battery was developed to systematically characterize instructor effectiveness at facilitation and the nature of crew participation in debriefings (Appendix C). This battery provides subjective rating scales on several dimensions, with appropriate anchoring (Appendix D), and can be used by raters who have experience in CRM. McDonnell (1995) provides a detailed description of the development and validation of the battery. The battery was based on the adult learning and facilitation literature, existing rating scales by M. M. Connors (1995) and R. H. Moos (1994), face valid assumptions of what constitutes good facilitation, and the airline industry's guidance to their instructors on how to facilitate LOFT debriefings. The battery incorporates a seven-point Likert scale ranging from *poor* (1) to *outstanding* (7).

The battery contains 28 items grouped into seven composite categories consisting of four items each. Five of the categories rate the instructor while the remaining two rate the crew. The five instructor categories are Introduction (letting the crew members know what is expected), Questions (to focus on topics and elicit crew participation), Encouragement (the degree to which the instructor encourages and enables the crew to participate actively and deeply), Focus on Crew Analysis & Evaluation[4] (getting the crew to analyze and evaluate their own performance), and Use of Videos (to remind the crew of what happened in the LOFT and provide a springboard for discussion). The video is not part of facilitation per se but its use is an important part of the overall structure of the debriefing. Items in the two crew categories—Crew Analysis & Evaluation and Depth of Crew Activity—were designed to correspond closely with items in the instructor categories.

Two of the authors independently rated the instructors and crews from each of the debriefing sessions after listening to each LOFT session audio tape while reading the verbatim transcript. For each of the first 10 debriefings, the ratings on the individual battery items were compared and discussed before rating the next debriefing. During each discussion, if either believed any ratings needed to be changed based on issues raised by the other, the scores were revised accordingly, although no effort was made to reach consensus on each item. For the remaining 26 debriefings, ratings were not systematically discussed.

Interrater reliability was determined by calculating Pearson correlation coefficients for the two raters' initial scores for each of the seven battery categories before discussion or any revision of

[4]This variable will be referred to as Focus throughout the rest of this report

scores. Pearson interrater reliability coefficients ranged from .73 to .91 for the seven categories of the battery (Table 2).

Aside from reliability coefficients, data from the battery are based on the average of the two raters' scores for each item. Composite scores for each of the five instructor and two crew categories were calculated by averaging the scores for the four items in each category.

3.4 Statistical Analyses

Differences among airlines were examined by one-way analysis of variance (ANOVA). In cases in which the ANOVA showed significant differences among the group of airlines, a Bonferroni post-hoc test was used to determine which airlines differed significantly from the others. Differences between two and three-person crews were examined by a t-test. Differences between crew members (captain, first officer, and flight engineer) were examined by a Wilcoxon matched-pairs test. Statistical calculations were based on the full set of 36 debriefings, unless otherwise stated in the tables. For all tests significance was computed by the two-tailed method, using an alpha of .05. Spearman rank-correlation coefficients were calculated for all pairs of variables. Correlation coefficients are referred to as "statistically significant" if $p < .05$. These findings should be interpreted cautiously, however, because a large number of correlations were run and five percent of these can be expected to represent type I error[5] at the .05 alpha level.

Four instructors conducted two debriefings; thus, each of these four instructors received two measurements for each of the variables associated with their performance. These two measurements were averaged to obtain a single data point ($n = 32$) for (i) calculation of means and standard deviations, and (ii) the analysis described below. The means with duplicate instructors' scores averaged ($n = 32$) are reported for scores on the Debriefing Assessment Battery. However, since differences between the two methods of calculating the means were minor for the descriptive variables, these means are reported for the full data set ($n = 36$).

Data from these four instructors were used to explore the question of whether the large variability observed among instructors reflected stable differences among the instructors. Five variables were selected for this analysis: session duration, percent of group words uttered by the instructor, percent of instructor words addressing CRM, percent of instructor words addressing crew performance, and instructor scores on a composite QEF variable created by combining the Questions, Encouragement, and Focus categories of the assessment battery. For each of these variables the difference between the values for the two debriefings given by the same instructors was obtained, providing a delta score. The average of the delta scores for these four instructors was compared to delta scores obtained by 448 random pairings among instructors who gave only one briefing.

4.0 RESULTS

4.1 General Observations

At all five airlines most debriefings were not conducted immediately after the LOFT. Instead, after a short break, the instructor and crew first returned to the simulator to conduct about two hours of

[5]Type I error represents the chance that differences will be assumed to be significant when they are not.

"batting practice" as rehearsal for the proficiency check that would follow the next day. A few instructors, apparently on their own initiative when scheduling allowed, reversed the order so they could debrief the LOFT before batting practice.

At all airlines most debriefings followed the same general format. The instructor would either give a very short introduction or no introduction at all, and then lead discussion of segments of the LOFT in the chronological order in which they occurred. Rarely did the instructor engage the crew in setting an agenda for discussion, although some instructors invited general comments on the LOFT before starting the discussion of specific segments. In the four airlines with video equipment, the instructor generally used a video segment to begin the discussion of related portions of the LOFT. A few instructors varied this general format; for example, one instructor systematically went through the CRM categories displayed on a wall poster, asking the crew to identify places in the LOFT in which they had employed each category.

For most variables large differences occurred among debriefings within each airline. For some variables substantial differences also occurred in the average values between airlines, although in most cases the within-airline variability prevented the differences between airlines from being statistically significant.

4.2 Descriptive Data

The average duration of the debriefings was 30.7 minutes (Table 3), with a range of 8 to 82 minutes. Duration was negatively correlated with instructors' ratings of crews' CRM performance ($r = -.49$, $p < .01$) and technical performance ($r = -.39$, $p < .05$) and positively correlated with the proportion of instructors' words directed to negative aspects of crew performance or ways to improve ($r = .51$, $p < .01$)[6]. This suggests that instructors spend somewhat more time with crews that had more problems.

Across airlines, instructors' ratings of crew performance averaged 3.6 (SD = .90) for CRM and 3.5 (SD = .89) for technical on a 1 to 5 scale in which 1 = poor, 3 = average, and 5 = exemplary. No statistically significant differences were found among airlines.

4.2.1 Participation. With two-person crews instructors (IPs) did an average of 61% of the talking, captains (CAs) 21%, and first officers (FOs) 18% (Table 4). Instructors participated significantly more than any of the crew members and the difference in participation between captains and first officers, though small, was also statistically significant. With three-person crews instructors did 49% of the talking, captains 20%, first officers 19%, and flight engineers (FEs) 13%. As with two-person crews, the amount of participation by instructors was significantly greater than any of the crew members. Though there were no significant differences in participation between captains and first officers in the three-person crews, the difference between first officers and flight engineers was statistically significant. While the percentage of participation was much higher for instructors than for crew members on average, the percentage of participation varied substantially among instructors; for example, the percentage of talking by instructors with two-person crews ranged from 35 to 85%.

The percentage of the talking done by instructors was negatively correlated ($p < .01$) with the percentage of the talking done by each category of crew member (CA: $r = -.62$; FO: $r = -.83$; FE: $r = -.77$). In contrast, the percentage of talking by captains was not significantly correlated with the percentage of talking by first officers or flight engineers, but the percentage of talking by first officers was positively correlated with the percentage of talking by flight engineers ($r = .68$, $p < .05$).

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[6]Appendix D lists all correlations we examined among variables, including those not shown in tables.

4.2.2 Content of discussion. The average percentage of words directed to CRM topics by instructors varied from 19 to 64 among the five airlines (Table 5). The percentage directed to CRM by crews varied from 25 to 68. The average percentage of crew discussion directed to CRM mirrored the percentage of instructor discussion directed to CRM at each airline. At most of the airlines, CRM topics occupied substantially more of the discussion than did technical topics.

On average, 41% of instructor words and 52% of crew words were directed to the performance of the crew in the LOFT (Table 6). Instructors emphasized positive aspects of crew performance (18%) over negative aspects (3%) and ways to improve performance (4%). Most of the crews' words concerning performance were neutral descriptions of what they did (33%), compared to positive aspects (8%), negative aspects (6%), and ways to improve (5%).

The content of the crews' remarks mirrored the content of the instructors' remarks. The percentages of crew words directed to discussion of CRM, technical, positive performance, negative performance, and ways to improve performance were all significantly positively correlated with the percentages of instructor words directed to these topics (Tables 7a and 7b).

4.2.3 Instructor questions. Most instructors asked a large number of questions, averaging 48 per hour among two-person crews (Table 8a). Among two-person crews, 60% of these questions were directed to specific crew members. Similar results were observed with three-person crews (Table 9a). No significant differences were found in either the proportion of questions directed to each crew member or in the proportion of non-directed questions answered by each crew member (Tables 8b & 9b), although the proportion answered by the flight engineer was substantially lower, falling just short of statistical significance ($p < .06$).

4.2.4 Interruptions. Instructors frequently interrupted crew comments. The average number of interruptions per hour by instructors was 26 (SD = 16). (Active listening interjections were not counted as interruptions. See Appendix A for coding rules.) Twenty-one percent (SD = 13%) of all crew utterances (excluding S statements, defined below) were interrupted by the instructors, and 12% (SD = 8.7%) of all crew utterances were interrupted and never completed. No statistically significant differences in these variables were found among the airlines. Neither variable—percent utterances interrupted nor percent utterances interrupted and not completed—was significantly correlated with descriptive measures of crew participation (percent crew participation, number of crew analyzing utterances per hour, number of crew words per response, and number of crew S1 words/hour) or crew variables measured by the Debriefing Assessment Battery.

4.2.5 Videos. On average, instructors showed 8.8 (SD = 5.0) video segments per hour, each averaging 150 (SD = 113) seconds in duration. No significant differences were found among airlines.

4.2.6 Crew participation. Crew utterances were categorized as questions (Q); responses to instructor or crew questions (R); statements that add content to the discussion (S1); or other statements (S), most of which were concerned with maintenance of discourse (e.g., "I see what you mean"). Responses accounted for 44% of all crew words and S1 statements accounted for 45% (Table 10). The distribution of the number of utterances among these four categories differed from the distribution of number of words because S statements were typically much shorter than the other three categories. The pattern of distributions among categories was similar among airlines.

On average, individual crew members asked about six questions per hour. To analyze the character of crew questions, the set of all crew questions from airlines Y and Z (n = 98) were divided into three categories. *Proactive* questions address the content of the debriefing, raising new issues or bringing new information into the discussion (e.g., Did you realize I had not finished the checklist?). *Reactive* questions respond to a prompt without adding new information, usually to disambiguate what was said or meant (e.g., Do you mean the taxi checklist or the predeparture checklist?). *Miscellaneous*

questions are generally extraneous (e.g., "Do I have time for a coke?") or meta-conversational (e.g., "You know what I mean?").

Thirty-five percent of crew questions were proactive, 34% were reactive, and 30% were miscellaneous (Table 11). Sixty percent of the proactive questions addressed CRM, technical, or mixed topics, but only 12% of the reactive questions, and 7% of the miscellaneous questions addressed CRM, technical, or mixed topics.

A few significant differences occurred among airlines in the number of proactive questions asked, but at all five airlines the number of proactive questions by crew members was small (Table 12). No significant differences were found in the number of proactive questions asked by captains, first officers, and flight engineers.

Three other measures of crew participation were also examined: the number of analyzing utterances per hour, the number of words per utterance, and the number of words per response to the instructor's questions (Table 13). Analyzing utterances were defined as those that go beyond simple description of events and actions to examine underlying factors and how those factors influenced the outcome (see coding rules in Appendix A). The number of analyzing utterances per hour averaged 6.2 (SD = 4.7), with no significant differences among airlines or among the three crew member positions. The number of words per utterance and the number of words per response averaged 22 (SD = 10) and 30 (SD = 17), respectively, with no significant differences among airlines or among the crew member positions.

In general, discussion in the debriefings revolved around the instructor, even when the instructor got the crew to do most of the talking. Direct back-and-forth discussion between crew members was infrequent. To explore this aspect quantitatively, sequences of utterances by crew members were examined (Figure 1). Debriefings were analyzed in terms of blocks of crew utterances, each block beginning with the first crew utterance after an instructor utterance and continuing until the instructor spoke again. These blocks were mostly very short; 80% of them consisted of only one utterance by a crew member before the instructor spoke again; thus, in these blocks there was no crew interaction at all. Only 5% of the blocks contained four or more utterances by crew members.

4.3 Debriefing Assessment Battery

4.3.1 Scores. Average scores for instructor Questions, Encouragement, Focus, and Use of Videos and for crew Analysis & Evaluation and Depth of Activity fell close to 4, or *adequate* (Table 14). Scores for instructor Introduction were much lower, averaging 1.6, which falls between *poor* and *marginal*. No significant differences were found among airlines in any category.

The instructors' battery scores on use of Questions, Encouragement, and Focus were distinctly bimodal, with one mode peaking around 2 (*marginal*) and the other between 5 (*good*) and 6 (*very good*). Table 15 and Figure 3 show this data for the five airlines combined. The separate data for four of the five airlines showed the same general bimodal pattern. In contrast, airline Y scores were all distributed around the higher mode and showed substantially less variance than did the scores of the other four airlines on these three variables. Scores for the two categories of crew participation at each airline also showed bimodal distributions similar to the distributions of instructor scores.

4.3.2 Correlations. Crew scores on Analysis & Evaluation and Depth of Activity were significantly positively correlated with instructor Questions, Encouragement, and Focus, with coefficients ranging from .51 to .78 (Table 16 and Figure 2). Instructor Introduction and Use of Videos were not significantly correlated with crew scores on the battery. However, the third item in the Introduction category was significantly positively correlated with Crew Analysis & Evaluation ($r = .45$, $p \leq .006$), and the third item in the Use of Videos category was significantly positively correlated

with Crew Analysis & Evaluation ($r = .45$, $p \leq .02$) and fell just short of significant positive correlation with Depth of Activity ($r = .38$, $p \leq .055$).

The five instructor categories were significantly positively intercorrelated with each other (Table 17). In particular, use of Questions, Encouragement, and Focus were highly intercorrelated. The two crew categories were also significantly positively intercorrelated ($r = .87$, $p \leq .01$).

4.3.3 Effect of introductions. The ten debriefings for which the instructor Introduction scores were 1.0 (the lowest possible score) and the nine debriefings for which the Introduction scores were the highest (ranging from 1.8 to 4.9) were analyzed further. Crew Analysis & Evaluation scores for the latter group were significantly higher than for the former group (Table 18). No significant difference between the two groups was found for Depth of Activity.

4.4 Correlations Between Battery and Descriptive Variables

4.4.1 Instructor battery with instructor descriptive. The correlations between the five instructor battery variables and seven instructor descriptive variables pertaining to how the instructor conducted the debriefing were examined (Table 19). The Introduction category was significantly positively correlated with number of directed questions, total number of questions, and percent of instructor words addressing CRM. The Questions category was significantly positively correlated with number of directed questions, total number of questions, and percent of instructor words addressing CRM and was significantly negatively correlated with percent participation by instructor and instructor words per utterance. Encouragement and Focus showed a pattern of correlation similar to that of Questions. Use of Videos was significantly positively correlated with percent of instructor words addressing CRM.

4.4.2 Instructor battery with crew descriptive. The correlations between the five instructor battery variables and seven crew descriptive variables involving the nature of crew participation were examined (Table 20). The Introduction category was significantly positively correlated with crew words per utterance, words per response, and percent CRM. Encouragement was significantly positively correlated with crew percent participation, words per utterance, words per response, self-initiated words, analyzing utterances, and percent CRM. Questions and Focus showed a pattern of correlations similar to that of Encouragement, except that the correlations with words per response and self-initiated words were smaller and not statistically significant. The Use of Videos category was significantly positively correlated with percent CRM only.

4.4.3 Crew battery with crew descriptive. Table 21 displays the correlations between the two crew battery categories and the seven crew descriptive variables. Both Analysis & Evaluation and Depth of Activity were significantly positively correlated with all seven descriptive variables except proactive questions.

4.4.4 Instructor descriptive with crew battery and descriptive. The correlations between six instructor descriptive variables and a number of crew descriptive and battery variables were examined (Table 22). The percent of all speakers' words uttered by the instructor (i.e., percent instructor participation) was significantly negatively correlated with the crew variables: percent participation[7], words per utterance, S1 statements, analyzing utterances, proactive questions, Depth of Activity, and Analysis & Evaluation. Instructor words per utterance showed the same pattern of negative correlations, except there was no significant correlation with crew words per utterance. Number of directed questions per hour was significantly positively correlated only with percent of

[7]Forced correlation; see discussion

crew words addressing performance, and number of non-directed questions was not significantly correlated with any of these crew variables. The percent of instructor words addressing performance was significantly positively correlated with percent of crew words addressing performance and significantly negatively correlated with crew proactive questions. The percent of instructor words addressing CRM was significantly positively correlated with crew words per utterance, words per response, percent of crew words addressing CRM, and Crew Analysis & Evaluation. For most variables with which a significant correlation occurred for the crew as a whole, significant correlations also occurred for each crew member position separately (Appendix E lists the intercorrelations among all variables).

4.5 Instructor Differences

The delta score is a measure of how much two debriefings differ on a given variable. The delta scores for the four instructors who gave two debriefings were not significantly different from the delta scores for randomly-paired instructors for duration, percent CRM, or percent performance (Table 23). Instructor scores on the battery's Questions, Encouragement, and Focus categories were combined to create a QEF variable. For the QEF variable, the delta score of instructors who gave two debriefings was 34% of the delta score of randomly-paired instructors ($t = -4.14$, $p \leq .005$).

5.0 DISCUSSION

The five companies studied appear to be representative of large, well-established U.S. airlines. Although some differences occur, debriefings at these five companies show many common patterns. These findings, however, may not be representative of smaller, regional, or newly-started airlines, some of which have not developed CRM and LOFT programs to the extent that major airlines have.

The large variability observed among instructors at each airline has important implications. For some variables the average values differed substantially among some of the airlines, although given the large variability, few of these differences were statistically significant. At airlines W and X, only four and five debriefings, respectively, were observed because not many LOFT sessions were run during our visits. With this small sample size and the variance observed, the standard errors for some of the mean values are large; thus, especially for these two airlines, the representativeness of these mean values is uncertain.

For the reasons discussed above, one cannot conclude from these data whether real differences exist among the airlines on most dimensions (one major exception is emphasis on CRM, discussed below). What is clear is that individual instructors at each airline differed enormously in their effectiveness as facilitators and in their emphasis on CRM topics and crew participation. This large variability within all five airlines overshadows any differences that might exist among the airlines. This finding reveals an urgent need for additional training and standardization within each airline (see section 5.4).

Some of the apparent variability among instructors may actually be within-instructor variability. For three descriptive variables that might seem characteristic of an instructor's approach—duration of debriefing, percent participation by instructor, and percent instructor words directed to CRM—as much variability was found between the two sessions given by the same instructor as between randomly-paired sessions given by different instructors. These results should be interpreted with great

caution because of the small sample size (only four instructors conducted two debriefings), but they suggest that individual instructors may vary on these dimensions as a function of crew performance, external constraints on time, or unidentified factors. In contrast to the descriptive variable results, a direct measure of facilitation (combined scores for Questions, Encouragement, and Focus) showed much less variability between sessions given by the same instructor. Thus facilitation effectiveness may be a fairly consistent characteristic of the individual instructor.

On several occasions crew members spontaneously volunteered that they had trouble remembering relevant aspects from the LOFT. The common practice of delaying the debriefing two hours or more until after the batting practice may have contributed to this memory difficulty. Performing the batting practice maneuvers, in the same cab as the LOFT and under similar conditions, is likely to interfere with the memory of the preceding LOFT. Unfortunately, we have no data addressing how much this practice interferes with the crews' memory, but we suspect it is not trivial and suggest that the issue be studied empirically.

No industry standards exist with which to compare our observations on descriptive variables such as duration of sessions, percent discussion devoted to CRM and crew performance, how much of the talking is done by the instructor, etc. However, we discuss these variables below in terms of our own subjective impressions of how consistent the observed values are with objectives stated in the airlines' internal publications and with guidelines such as AC 120-35C (Line Operational Simulations).

5.1 Descriptive Variables

5.1.1 Duration. Most debriefings were fairly short: 31 minutes on average, including time spent watching videos (typically about 1/3 of the total session was spent watching video segments). It was clear that a half-hour session allowed the group to discuss only a few examples of the crew's performance, and often did not provide adequate time for in-depth analysis. Given all that occurs in a typical LOFT lasting over two hours and the importance of deep analysis of what happened and how the crew managed the situations confronting them, it seems highly desirable to spend more than 31 minutes on debriefing. Although these data do not indicate what duration would be optimal, a thorough discussion was often accomplished in debriefings lasting about an hour. Instructors do need to vary the length of the session according to the training needs of the crew, but the 10-fold range of duration observed in this study is clearly problematic.

Instructors who rated the crews' LOFT performance as high tended to conduct shorter debriefings. During interviews with instructors after each debriefing, some instructors indicated that some of them feel there is less to discuss with a crew that has performed well, and these instructors wanted to avoid "nit-picking" good performance. We suspect this attitude may shortchange high performing crews. It is important for these crews to analyze why things went well in order to help them make explicit the factors and behaviors that led to success. These behaviors may have been intuitive and may have depended on the compatibility of the particular two or three crew members involved. In order to take the lessons learned back to the line and apply then in situations in which the crew may not be so compatible, it would be helpful for the crew members to explicitly discuss what makes certain behaviors effective. Also, even high-performing crews need a chance to practice the as yet infrequently used skill of self-debriefing.

5.1.2 Content. Substantial, statistically significant differences occurred among the airlines in the percent of discussion devoted to CRM, which may reflect differences in company training philosophy. At all but one of the five airlines, CRM topics occupied more of the discussion than technical topics. This emphasis is appropriate to the goals of LOFT. Very large differences also

occurred among instructors within each airline; at one airline, for example, CRM ranged from 6 to 75% of instructor words. It is not clear whether these differences reflect different attitudes among the instructors toward CRM or indicate that individual instructors spend more time on technical topics when they perceived a crew to be deficient in technical knowledge or skills. However, the fact that the instructors' relative emphasis on technical topics was not correlated with their ratings of the crews' technical performance argues against the latter interpretation, or at least suggests that it is not the dominant factor. Regardless, a debriefing in which CRM topics plus mixed (CRM and technical combined) topics occupy less than a third of the discussion seems inappropriate.

Discussion of the crews' LOFT performance was appropriately emphasized in the debriefings, accounting for roughly half of instructor and crew words, on average. This figure was fairly consistent across airlines. A good part of the instructors' comments on performance were positive, and this is consistent with the objective of reinforcing the crews with positive feedback. In contrast, only a very small percentage of the discussion by instructors and crews was directed to problematic aspects of crew performance or ways to improve performance, even though instructors tended to hold longer sessions for crews whose LOFT performance they rated as lower. This lack of emphasis seems inconsistent with the objectives of LOFT.

The content of the instructors' utterances and the content of the crews' utterances were highly correlated along most dimensions examined. Although correlation does not necessarily imply causality, our subjective impression is that the general content and emphasis of the debriefings was driven almost exclusively by the instructors. This impression is supported by the pattern of discourse, discussed below.

5.1.3 Instructor characteristics. Instructors generally talked substantially more than any of the crew members, averaging 61% of the words in debriefings of two-member crews and 49% of the words in debriefings of three-member crews. (However, the range of this variable was striking: among debriefings of three-member crews, one instructor did 17% of the talking and another instructor did 87% of the talking.) The total amount of talking by all crew members combined is, by definition, the amount not done by the instructor and thus the two variables are forced into perfect negative correlation. However, the fact that the amount of talking done by the instructor is also significantly negatively correlated with the amount done by each crew member separately suggests that too much talking by the instructor discourages participation by the crew members. Consistent with this inference, the amount of talking done by the instructors was significantly negatively correlated with other measures of crew participation: words per utterance, number of S1 statements, number of analyzing utterances, number of proactive questions, depth of crew activity, and extent of analysis and evaluation by the crew. (Number of S1 statements, number of analyzing utterances, and number of proactive questions contribute to the percent crew participation and thus inherently have some degree of correlation. These results should be interpreted cautiously.) The average length of utterances by the instructors showed a similar pattern of negative correlation with measures of crew participation, suggesting that long monologues by the instructor discourage crew participation.

One might wonder if the percent of participation by the instructor might be driven by the crew; an instructor might be forced to do more of the talking if he or she tried unsuccessfully to induce the crew to participate substantially. However, the data suggest otherwise: the battery variable Encouragement was strongly negatively correlated with percent instructor participation, which is not consistent with instructors resorting to lecturing only after seriously attempting to facilitate crew participation. Also, our subjective impression is that instructors seemed predisposed to whatever level of facilitation they used.

The large number of questions asked by most instructors suggests that they are attempting to elicit

crew participation. The number of questions asked by instructors was not significantly correlated with any measures of crew participation, but this might reflect a limitation of the across subjects design of this study. An instructor might increase the participation of a given crew by asking more questions, but this may be confounded by the possibility that instructors increase the number of questions they ask when they encounter a crew that participates inadequately. The crew prone to low participation may increase its activity in response to questions but still may remain below average.

The battery category Questions, which addresses the way in which instructors ask questions and takes into account the crew with which the instructor is confronted, appears to be a much more useful measure than the simple number of questions the instructors ask. Instructors' scores on the battery category were significantly positively correlated with several descriptive measures of crew participation and both battery categories of crew participation.

In all debriefings observed, the discussion revolved primarily around the instructor, even when the instructor encouraged the crew to do most of the talking. Direct back and forth discussion among crew members was rare; most of the time the pattern was instructor utterance, crew member utterance, instructor utterance.

Many instructors frequently interrupted crew utterances, and in many cases the crew members never completed their comment after the interruption. Surprisingly, the frequency of interruption was not correlated with any of the descriptive or battery measures of crew participation. Nevertheless, it is hard to believe that crew members find frequent interruptions encouraging.

5.1.4 Crew characteristics. Two important dimensions of crew participation are proactivity and analysis of LOFT performance. The descriptive variables do not directly measure these dimensions but do shed some light on them. One might expect a proactive participant to ask a lot of questions and to initiate topics and issues. However, crew members asked very few proactive questions. On the other hand, crew members' words were evenly divided among direct responses to the instructor and S1 statements (i.e., crew-initiated utterances that add substantively to the conversation). Upon further examination, though, it was found that even these S1 statements mainly address topics initially raised by the instructor. In general, most crew members were willing participants who responded readily to the instructor but showed little evidence of proactivity in the sense of taking responsibility for the direction of the debriefing.

On average, individual crew members made only about six utterances per hour that were characterized as "analyzing". For coding purposes the definition of "analyzing" was necessarily arbitrary, and other definitions might have yielded numbers substantially larger or smaller. Nevertheless, this rough characterization suggests substantial room for improvement toward one of the major goals of the debriefing.

Participation by captains and first officers was very similar, as measured by percent participation, number of non-directed questions answered, number of proactive questions asked, words per utterance, words per response, number of S1 words, and number of analyzing utterances. (However, among two-person crews the percent participation by captains was slightly but significantly greater than that by first officers.) On the same variables, flight engineers were generally lower than either captains or first officers, although the only difference that reached statistical significance was that between first officers and flight engineers on percent participation.

5.2 Debriefing Assessment Battery

5.2.1 Battery characteristics. The descriptive variables provide useful information about debriefings but are not by themselves adequate to characterize instructor use of facilitation or the nature

of crew participation. The Debriefing Assessment Battery was developed to provide a deeper characterization of instructor and crew performance. It is designed to be used by raters with a substantial background in CRM and a general understanding of the principles of facilitation. High interrater reliability was obtained on all categories of this battery with only a moderate amount of practice.

In contrast to reliability, it is difficult to establish the validity of the battery because no standard exists with which to compare it. However, the battery does have a certain amount of face validity in that the items address behaviors generally agreed upon as necessary for facilitation. Also, the items were worded explicitly in terms of the general objectives commonly stated for LOFT debriefings. The results discussed below suggest that, in general, the battery does measure what was intended.

5.2.2 Scores and correlations. Scores on three of the instructor categories—Questions, Encouragement, and Focus—were highly predictive of scores on the two categories of crew participation. The ability to explore the predictive power of the Introduction category was severely limited because of the small variation of instructor scores on this variable; most scores fell on the lowest value possible. However, crews scored significantly higher on Analysis & Evaluation in those few debriefings in which instructors gave at least a minimal introduction. Also, Introduction scores were significantly positively correlated with crew words per utterance, words per response, and percent CRM. These data plus the reasons discussed in the beginning of this paper suggest that a thorough and explicit introduction is likely to have a substantial effect, although this issue requires further study.

Properly speaking, the use of the video of the crews' LOFT performance is not technically a component of facilitation, but it is widely regarded as an important tool that can help the crews understand their performance. The nature of the data (transcribed audio tapes of the debriefing) limited the types of items that could be used to asses the instructors' Use of Videos. For example, what may be one of the most important aspects of the video clips, their content, could not be measured. The items in Use of Videos showed little predictive power for any aspect of crew performance except percent CRM, and this correlation may only reflect the fact that instructor scores on Use of Videos were fairly strongly correlated with instructor percent CRM. Thus we are inclined to delete this category from the battery.

Instructor scores on Questions, Encouragement, and Focus were moderately correlated with various descriptive measures of crew participation. Similarly, instructor scores on the battery were correlated with some descriptive measures of instructor behavior, and crew scores on the battery were correlated with most of the descriptive measures of crew behavior that seemed pertinent. The descriptive measures themselves provide at best a partial and largely indirect characterization of instructor and crew participation, so the most one could say is that the patterns of correlations are consistent with the battery measuring what is intended. For example, as would be expected, crew Depth of Activity was somewhat more strongly correlated with percent crew participation than Analysis & Evaluation was. Conversely, crew Analysis & Evaluation was more strongly correlated with percent crew CRM than Depth of Activity was.

The battery appears to provide a more meaningful appraisal of instructor facilitation and crew participation than most of the descriptive variables do. Also, the descriptive variables require a tedious amount of data reduction and can be measured only in a research setting. In contrast, the battery could, in principle, be used in real time to evaluate debriefings. We are currently developing a short form of the battery that can be used by airline training department personnel to rate instructors and crews during observations of their debriefings (McDonnell, Dismukes, & Jobe, in preparation).

Intercorrelations among Questions, Encouragement, and Focus were high, as was the

intercorrelation between crew Analysis & Evaluation and Depth of Activity, thus precluding a meaningful factor analysis. Also, the individual items within each category were highly intercorrelated. Two possibilities may account for these high intercorrelations: (i) individual items may overlap and/or entire categories may overlap substantially in what they measure, and (ii) in this particular data set the independent variables measured by the battery items and categories may covary. The latter might occur, for example, if instructors tended to either grasp and accept the fundamental concepts underlying facilitation or fail to grasp or accept those underlying concepts. Both possibilities may have been operating (see discussion of bimodality in section 5.4). In the short form of the battery mentioned above, the number of items will be reduced substantially: related items will be combined into one, and the content of separate items will be segregated more distinctly.

5.3 Facilitation Techniques and Common Mistakes

To facilitate debriefings, instructors used various specific techniques in the broad categories of *introductions*, *questions*, *active listening*, and *silence*. Many instructors showed considerable skill in using these techniques; other instructors were markedly less effective, or made little attempt to facilitate. Even effective instructors sometimes did things that undercut their efforts at facilitation.

The most common problem, failing to state explicitly the expectation for crew participation, is discussed above. Twenty-eight percent of instructors made no statement at all about expectations and only one instructor gave an explicit rationale for why the crew should take an active role. Other common mistakes included failing to pause when the crew did not respond immediately to questions, keeping the discussion centered on the instructor instead of encouraging the crew to interact with each other, making long soliloquies, evaluating crew performance before eliciting crew self-evaluation, failing to push beyond superficial description of events, and not getting the crew to analyze why things went well.

A companion to this report describes in detail specific techniques instructors used and suggests ways to integrate these techniques for effective facilitation (McDonnell, Jobe, & Dismukes, in press). This companion report, written as a training manual for instructors, also suggests ways to avoid common facilitation mistakes.

5.4 Implications for Training

The fact that instructors' scores on Introduction were uniformly low, much lower than on other categories of facilitation, indicates that this is an area in which instructors have not been adequately trained. It seems a matter of common sense that if one wants crews to participate in a certain way, particularly if that way differs substantially from traditional practice, it is necessary to tell crews explicitly what is expected of them. It may be that instructors are so accustomed to the idea that crews should be participating proactively that they overlook the fact that this expectation has not been stated explicitly to the crews. Alternately, some instructors may have reservations about the concept that it is preferable for the debriefing to revolve around the crew, and thus they do not explain this concept to the crews. Regardless, a good introduction is easy to provide once instructors recognize its importance; thus, training departments may be able to improve crew participation with relatively little effort by emphasizing this topic to instructors. Ideally, the introduction should describe how the debriefing will be conducted, explain how the crew is expected to participate and what the instructor's role is, and provide an explicit rationale for the benefits of crew-centered debriefings.

The fact that instructor scores on Questions, Encouragement, and Focus were distinctly bimodal

and highly intercorrelated suggests that the instructors either grasped the concept of facilitation and were able to put it into practice or did not grasp the concept and were therefore unable to practice it effectively. Alternately, the instructors who were not effective facilitators may not have "bought into" the concept of facilitation or might simply have lacked the ability for this type of approach.

These findings suggest that the airlines face an issue of standardization and quality control of debriefings. Although no attempt was made to measure these characteristics, it was clear that the great majority of instructors were highly competent technically, were conscientious, and displayed strong interpersonal skills. All seemed comfortable with and committed to the concepts of CRM. Thus, the variability may reflect inadequate training of instructors in the techniques of facilitation. When interviewed, several instructors spontaneously volunteered that they did not feel adequately trained to facilitate. To date, in most airlines with which we are familiar, training in facilitation is vague, consisting mainly of general concepts and adages (e.g., "Don't insist on closure"). However, facilitation, especially because it departs radically from the instructional techniques traditionally used in aviation, requires hands-on training in which instructors observe expert facilitators, practice facilitating, and receive feedback.

As this report is being written, several airlines are expanding their training in facilitation, and this can be expected to improve the conduct of debriefings. Currently, an industry group, the ATA AQP LOFT/Instructor Focus Group, is preparing a paper that will provide guidance on training instructors in facilitation, evaluation of crew performance, and related topics.

These findings also suggest that the concept of crews debriefing themselves using the instructor as a resource (a concept expressed frequently in the CRM literature and in AC 120-35C), though a worthwhile goal, is rather idealistic. Only one of the instructors observed attempted to have the crew lead their own debriefing. Though that debriefing was one of the better ones in terms of the level of crew participation, the crew only partially understood what constituted a good debriefing and needed considerable help. In order for crews to take greater responsibility for the debriefing they must first be told how to conduct one. It would also help if crews could observe another crew debriefing themselves effectively; this could be the subject of classroom training that precedes the LOFT. Crews may need to practice self-debriefing of several LOFTs before they become proficient.

At the current state of industry practice, instructors who attempt to encourage crews to self-debrief, or to at least take greater responsibility for the direction of the debriefing, will encounter widely varying levels of crew responsiveness. McDonnell et al. (in press), drawing upon a concept expressed by Continental Airlines (1992), suggest that facilitation can be conducted at a high, medium, or low level, depending on the level of initiative and the self-debriefing skill of the particular crew. In high-level facilitation the instructor approaches the ideal of assisting the crew in their own analysis. In low-level facilitation the instructor leads the debriefing, directs the crew's attention to critical issues, and may need to lecture to insure points are understood, but the instructor still attempts to foster as much self-discovery as possible.

Instructors are encouraged to attempt to facilitate at the highest level possible for each crew. Realistically, however, most crews do not yet have the skills and motivation needed to lead their own debriefings without substantial assistance from the instructor. It may be possible to change this situation over time if LOFT instructors consistently encourage crews to take a proactive role in debriefing their own training and to consider the benefits of debriefing line operations.

Instructors sometimes mistakenly assume that using facilitation requires giving up their role as teacher in the debriefing. On the contrary, good facilitation in no way precludes the instructor from adding his or her own perspective to the discussion or from teaching specific points about CRM and technical issues as appropriate. Effective facilitators can integrate their teaching points into a group

discussion in which the crew members are full participants.

With the exception of Introduction, instructors' scores on the facilitation categories averaged around 4 (adequate), as did crews' scores on Analysis & Evaluation and Depth of Activity. These values have little absolute meaning because they depend on the necessarily arbitrary anchoring of the scales. Each training department must establish its own standards for satisfactory performance and anchor their ratings accordingly. What the Debriefing Assessment Battery provides is a tool for evaluating the relative performance of instructors and of crews in LOFT debriefings.

It has been a matter of faith among training departments that facilitation is an effective tool to encourage crews to analyze their performance in LOFT along CRM dimensions in a way that will benefit them in line operations. This study provides empirical evidence that this faith is correct.

6.0 CONCLUSIONS AND RECOMMENDATIONS

These data provide a portrait of how debriefings were being conducted in major U.S. airlines during the period of mid 1994 to mid 1995. This sample seems representative of large U.S. carriers, although, as this report was being written many airlines were upgrading their training in facilitation and this can be expected to improve the effectiveness of debriefings. The following conclusions and recommendations reflect both the objective data and our subjective impressions:

1. Most instructors attempted to facilitate crew participation, but their success ranged from very good to poor. The bimodal distribution of instructors' battery scores suggests that at least half of the instructors grasped and utilized the concept of facilitation effectively, however a substantial minority of instructors were consistently ineffective in all measures of facilitation. Almost all instructors appeared to be highly competent and conscientious in the traditional role of instructors, thus this variability seems to reflect differences in how well instructors comprehend or buy in to the concept of facilitation.

2. Instructors effectively used a range of specific techniques to facilitate crew participation (described in detail in McDonnell et al, in press). Perhaps unwittingly, many instructors also did things that appeared to inhibit crew participation. The most striking shortcoming was that most instructors made little effort to convey to the crew that they should be proactive, and it is not clear whether instructors themselves grasped this concept. It appears that instructors could substantially improve crew participation by explicitly explaining the relative roles of the crew and the instructor at the beginning of the debriefing.

3. This study provides empirical evidence that facilitation, when used effectively, substantially increases the depth of crew participation and the quality of crew analysis and evaluation of their performance.

4. Crews were generally responsive but showed limited proactivity. Typically, instructors did most of the talking and the discussion invariably centered around the instructor's questions, comments, and choice of topics, even when the crew did most of the talking. Most, but not all, debriefings emphasized CRM and LOFT performance appropriately. Most debriefings would have been improved by greater depth of analysis and more attention to ways to improve performance.

5. Within each of the five airlines, instructors varied widely in their conduct of debriefings, especially in terms of emphasis on CRM, emphasis on crew participation, and effectiveness in facilitation. Not surprisingly, the character of crew participation varied similarly, and consequently it seems likely that how much the crews learned from the LOFT experience may also have varied considerably. This suggests a need for better standardization within companies. The great variability

within individual airlines obscured the statistical significance of differences observed among the airlines.

6. These findings suggest that instructors need better training in facilitation. One way to enhance training would be to emphasize hands-on practice and to follow up with mentoring by instructors who are themselves expert facilitators. The current literature on facilitation is rather idealistic, and instructors may become discouraged when they discover that crews sometimes do not immediately respond as desired. Instructor training should address obstacles to effective facilitation and should provide specific techniques to use when crews do not initially respond. Training should explain to instructors that facilitation can be conducted at different levels ranging from predominantly crew-led, with instructor assistance, to predominantly instructor-led, but still emphasizing self-discovery by the crew as much as possible. Instructors should adapt their level of facilitation in response to the skill and responsiveness of the particular crew.

7. The average session length of about 31 minutes appeared to limit the thoroughness and depth of the debriefings. Longer sessions would allow coverage of more issues and greater depth of discussion. We have no data on what duration would be optimal, but suggest that an hour might be a useful rough target, with adjustments for the needs of individual crews. However, this is a policy issue and each airline will have to make its own cost-benefit analysis.

8. Although we collected no data to assess the effect of the common practice of conducting maneuver practice between the LOFT and the debriefing, we suspect that it appreciably impairs the ability of the crew to remember and learn from what happened in the LOFT. We recommend that this issue should be investigated empirically.

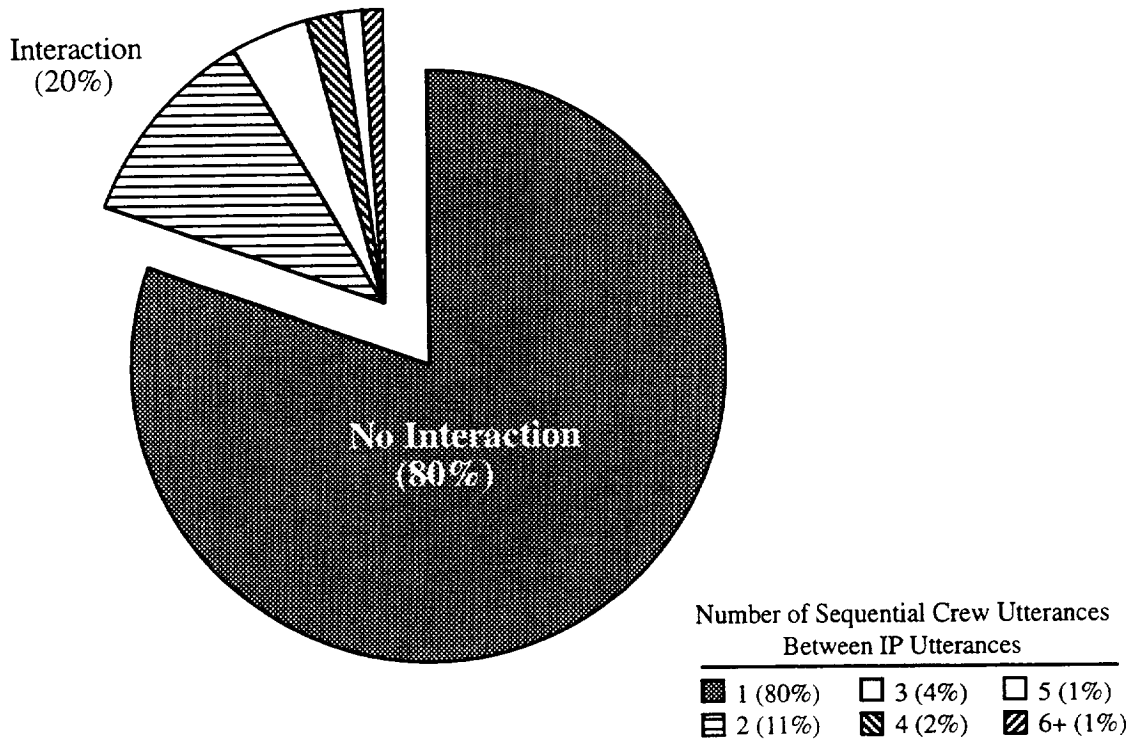


Figure 1. Crew interaction chart.

Note: Crew interaction is measured by counting the number of crew utterances between IP utterances. Two or more sequential crew utterances indicate interaction occurred, while single crew utterances indicate that there was no interaction.

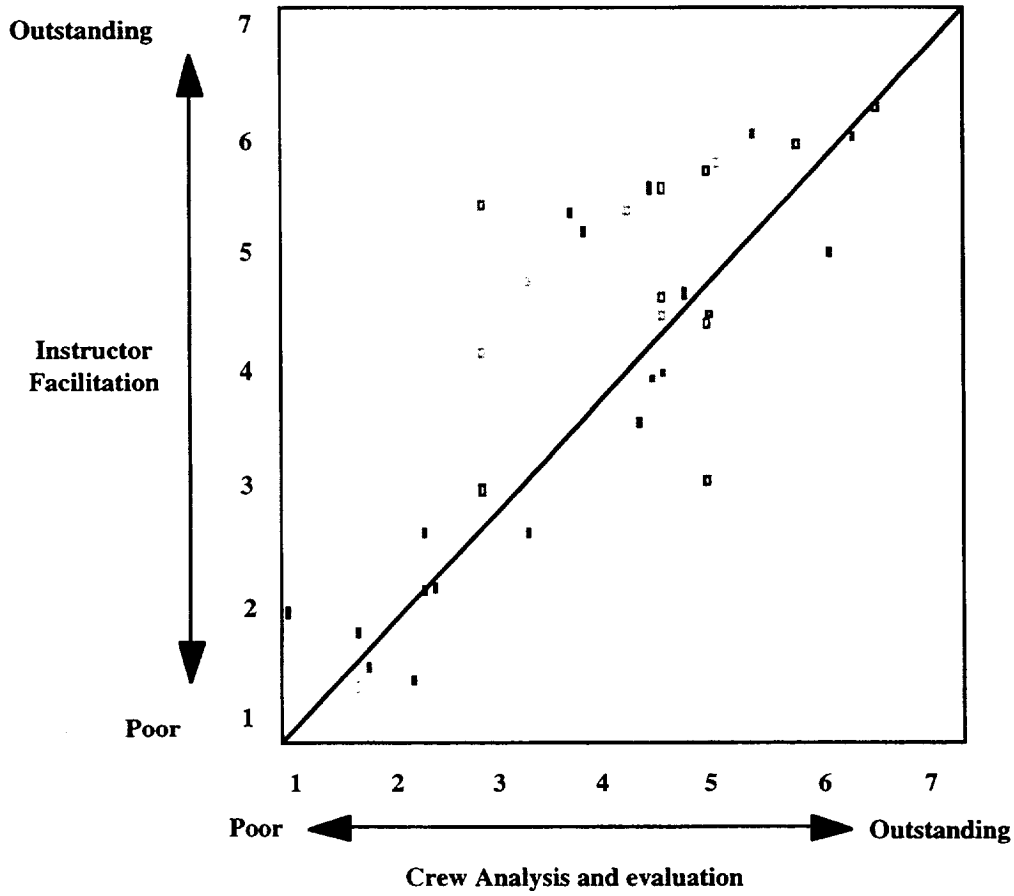
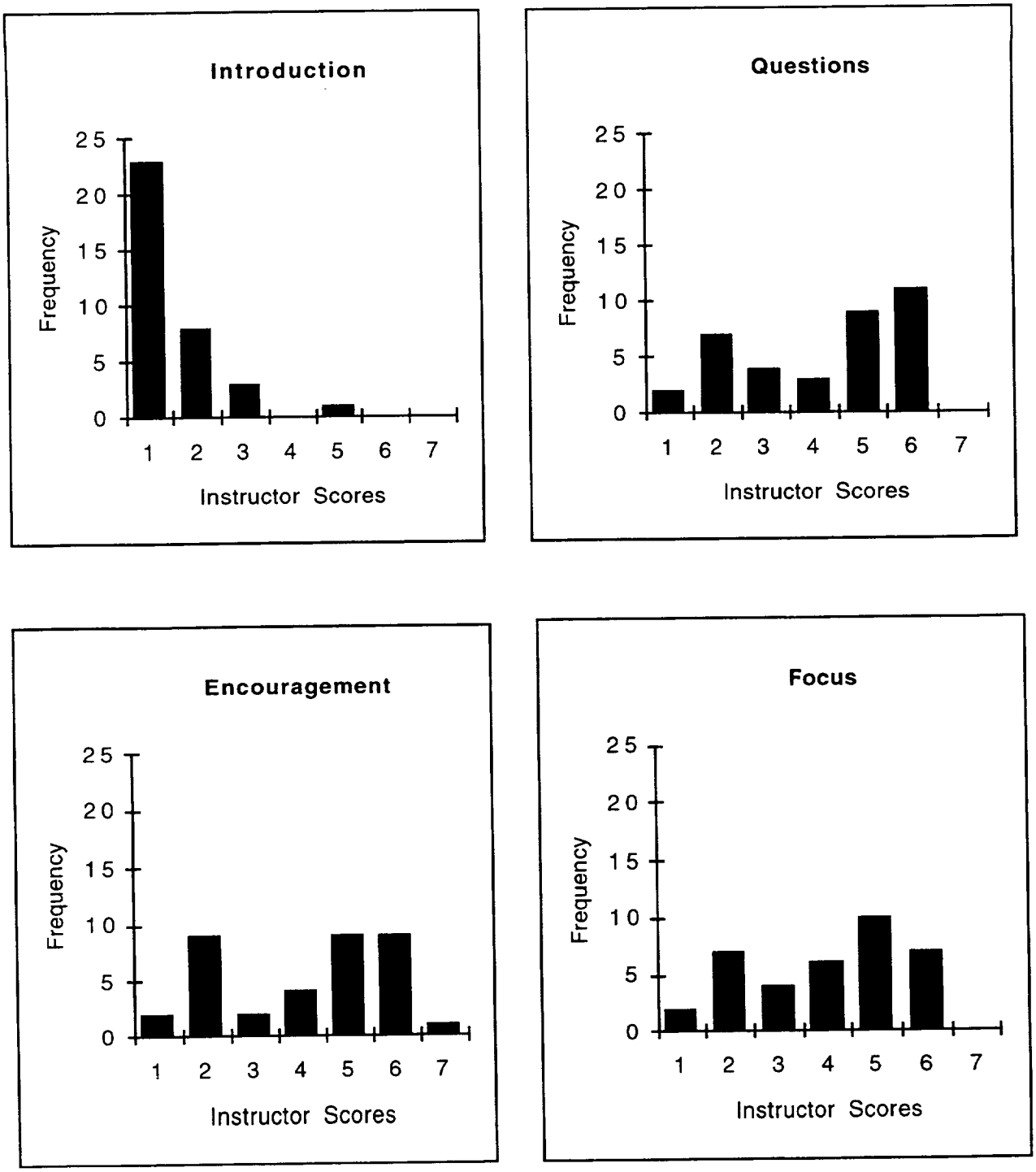


Figure 2. Effect of instructor facilitation on crew analysis and evaluation.

Note. Instructor Facilitation is a combined measure of Questions, Encouragement, and Focus



Instructor Scores

1 = Poor; 4 = Adequate; 7 = Outstanding

Figure 3. Distribution of instructor scores on the Debriefing Assessment Battery.

Table 1. Number of Debriefings Observed and Analyzed

	Airline V	Airline W	Airline X	Airline Y	Airline Z	Total
2-person	6	0	5	5	9	25
3-person	2	4	0	4	1	11

Table 2. Interrater Reliabilities for the Debriefing Assessment Battery

Battery variables	N	Pearson's r
IP		
Introduction	35[a]	.91
Questions	36	.78
Encouragement	36	.80
Focus	36	.84
Use of Videos[b]	18[c]	.77
Crew		
Analysis & Evaluation	36	.78
Depth of Activity	36	.73

[a] The audio recording began late for one session.
[b] Reported reliability for Videos is for crews Y and Z only. Reliability could not be calculated for all crews because one item was changed after scoring was completed, and that item was recoded by only one rater.
[c] The video equipment was not working for one of the 19 crews in Airlines Y and Z.

Table 3. Average Duration of Debriefings (minutes)

Mean (SD)

Airline V	Airline W	Airline X	Airline Y	Airline Z	Combined Airlines
28.1 (14.8)	29.2 (2.9)	40.3 (25.5)	36.9 (15.6)	23.1 (7.3)	30.7 (15.2)

Note. Differences among airlines were not statistically significant.

Table 4. Participation in Debriefings (percent of instructor and crew words)

Mean (SD)

	Airline V	Airline W	Airline X	Airline Y	Airline Z	Combined Airlines
Instructor:						
2-person crews	58(15)	--	61(18)	54(16)	67(14)	61(15)[a]
3-person crews	50(3.5)	58(27)	--	40(16)	41	49(20)[a]
Captain:						
2-person crews	19(6.9)	--	24(8.2)	22(8.1)	19(8.6)	21(7.8)[b]
3-person crews	23(17)	16 (8.9)	--	22(7.9)	21	20(9.4)
First Officer:						
2-person crews	23(9.4)	--	15(10)	23(13)	14(7.0)	18(9.7)
3-person crews	16(12)	13(9.2)	--	27(14)	23	19(13)[c]
Flight Engr:						
3-person crews	12(2.8)	14(11)	--	12(7.9)	15	13(7.8)

Note: Differences among airlines were not statistically significant. Significant differences among participants: [a] Instructor > captain, first officer, flight engineer ($p<.01$); [b] captain > first officer ($p<.01$); [c] first officer > flight engineer ($p<.03$).

Table 5. Content of Debriefings (percent of instructor and crew words)

Mean (SD)

	Airline V	Airline W	Airline X	Airline Y	Airline Z	Combined Airlines
Instructor						
CRM	32(25)	19(15)	27(13)	56(13)	64(17)	45(24)[a]
Technical	22(14)	13(11)	38(10)	8.1(8.7)	10(15)	16(15)[b]
Mixed	24(8.6)	33(13)	9.8(16)	5.6(5.3)	6.2(8.3)	14(14)[c]
Non-specific	22(11)	34(12)	26(7.6)	30(6.8)	20(10)	25(10)[d]
Crew						
CRM	25(12)	25(17)	36(20)	68(13)	68(19)	49(25)[e]
Technical	21(11)	10(4.2)	23(8.6)	5.6(5.3)	6.9(10)	12(11)[f]
Mixed	38(13)	46(12)	8.8(10)	11(10)	14(12)	21(18)[g]
Non-specific	16(11)	18(4.6)	32(14)	16(7.4)	12(13)	17(12)[h]

Note. Statistically significant differences were found among airlines: [a] Y>W; Z>V,W,X. [b] X>Y,Z. [c] V>Y,Z; W>X,Y,Z. [d] not statistically different. [e] Y>V,W,X; Z>V,W,X. [f] V>Y,Z; X>Y,Z. [g] V>X,Y,Z; W>X,Y,Z. [h] X>Z.

Table 6. Discussion of Crew Performance

Mean (SD)

	Airline V	Airline W	Airline X	Airline Y	Airline Z	Combined Airlines
Positive aspects						
% of IP words	19(11)	5.8(5.1)	15(9.3)	16(13)	24(12)	18(12)
% of crew words	6.5(7.3)	3.8(5.6)	7.4(13)	9.9(8.9)	9.5(12)	8.0(9.6)
Negative aspects						
% of IP words	3.8(2.7)	3.3(2.5)	9.4(13)	1.1(2.1)	1.6(2.6)	3.2(5.5)
% of crew words	6.6(4.1)	8.0(7.9)	9.8(12)	5.1(3.8)	3.4(7.2)	5.9(6.7)
Ways to improve						
% of IP words	5.0(4.4)	4.5(5.3)	6.8(6.7)	3.0(3.2)	2.7(4.4)	4.1(4.6)
% of crew words	3.6(4.3)	5.0(8.7)	5.6(4.0)	4.6(5.1)	5.6(8.6)	4.8(6.1)
Neutral description						
% of IP words	18(14)	17(9.6)	9.4(4.5)	21(7.0)	15(8.1)	17(9.5)
% of crew words	40(15)	36(15)	25(18)	28(15)	33(26)	33(19)
Performance total						
% of IP words	46(21)	30(14)	41(15)	41(13)	43(13)	41(15)
% of crew words	56(22)	53(19)	47(17)	48(21)	56(27)	52(21)

Note. Differences among airlines were not statistically significant.

Table 7a. Correlations Between Instructor and Crew Topics

	Instructor variables	
Crew Variables	% words CRM	% words technical
% words CRM	.76***	-.71***
% words technical	-.69***	.85***

*p ≤ .05. **p ≤ .01. ***p ≤ .001.

Table 7b. Correlations Between Instructor and Crew Emphasis on Aspects of Crew Performance

	Instructor variables		
Crew Variables	positive aspects	negative aspects	ways to improve
positive aspects	.35*	-.30	-.32
negative aspects	-.28	.61***	.53**
ways to improve	-.04	.35*	.67***

*p ≤ .05. **p ≤ .01. ***p ≤ .001.

Table 8a. Instructor Questions: Two-person Crews

Mean (SD)

	Airline V	Airline W	Airline X	Airline Y	Airline Z	Combined Airlines
Number of directed questions per hr:						
to CA	18(21)	--	21(7.6)	25(17)	9.3(12)	17(15)
to FO	8.6(6.6)	--	13(7.6)	20(10)	9.0(7.3)	12(8.5)
Number of non-directed questions per hr:						
	32(19)	--	12(17)	14(3.6)	19(12)	20(15)
Total number of questions per hr:						
	59(27)	--	46(26)	58(27)	37(14)	48(23)

Table 8b. Crew Responses to Non-directed Questions: Two-person Crews

Mean (SD)

	Airline V	Airline W	Airline X	Airline Y	Airline Z	Combined Airlines
Percent non-directed questions answered:						
by CA	63(32)	--	31(29)	77(15)	58(19)	58(27)
by FO	53(13)	--	35(32)	60(35)	51(21)	50(25)

Note. Significant differences were found among airlines in percent of non-directed questions answered by CA: Y>X.

Table 9a. Instructor Questions: Three-person Crews

Mean (SD)

	Airline V	Airline W	Airline X	Airline Y	Airline Z	Combined Airlines
Number of directed questions per hr:						
to CA	43(31)	4.5(6.4)	--	7.6(7.1)	9.3	13(20)[a]
to FO	20(11)	4.7(2.9)	--	6.6(5.8)	2.3	8.5(8.1)
to FE	27(2.1)	5.6(1.4)	--	6.4(9.2)	12	10(10)[b]
Number of non-directed questions per hr:						
	82(55)	12(5.2)	--	15(9.5)	16	27(35)
Total number of questions per hr:						
	171(70)	27(14)	--	35(22)	39	59(65)[c]

Note. Significant differences were found among airlines in [a] questions directed to CA: V>W; [b]questions directed to FE: V>WY; [c] total number of questions per hour: V>WY.

Table 9b. Crew Responses to Non-directed Questions: Three-person Crews

Mean (SD)

	Airline V	Airline W	Airline X	Airline Y	Airline Z	Combined Airlines
Percent non-directed questions answered:						
by CA	51(16)	68(28)	--	69(28)	14	65(25)
by FO	38(28)	35(47)	--	48(36)	43	41(36)
by FE	26(5.7)	18(21)	--	26(18)	14	23(17)

Note. Percent of non-directed questions answered by FE fell just short of being significantly lower than CA and FO answers ($p < 0.06$; Wilcoxan Matched-pairs test). Other differences among crew members were not significant.

Table 10. Percent of Total Crew Words & Utterances Coded R, S1, S & Q[1]

	Percent of total words				Percent of utterances			
Crew	R	S1	S	Q	R	S1	S	Q
V	41	48	7	4	35	28	30	7
W	35	51	8	6	23	32	36	10
X	39	48	9	4	26	30	37	7
Y	45	44	7	4	32	29	31	8
Z	54	38	5	3	40	32	22	6
All	44	45	7	4	33	30	30	7

[1]Response = first responsive utterance by each crew members following a Question. S1 = all self-initiated, substantive crew statements that raise issues. introduce topics, or add information to an existing topic. Statements = all utterances that do not fit the criteria for R, S1, or Q. Question = any utterance that explicitly asks a question.

Table 11. Distribution of Crew Questions (number per category)

	CRM	Technical	Mixed	Non-specific	Total
Proactive	7	11	3	14	35
Reactive	4	3	0	26	33
Miscellaneous	0	2	1	27	30
Total	11	16	4	67	98

Table 12. Average Number of Proactive Questions Per Hour

Mean (SD)

	Airline V	Airline W	Airline X	Airline Y	Airline Z	Combined Airlines
CA	4.9(3.6)	1.7(2.1)	7.5(8.5)	1.5(1.7)	1.2(1.7)	3.0(4.3)
FO	5.4(4.0)	3.8(3.2)	1.1(1.7)	2.5(3.2)	2.1(3.7)	3.0(3.5)
FE	8.1(2.0)	1.1(1.2)	--	1.3(1.4)	0	2.5(3.2)

Note. No statistically significant differences were observed between two and three person crews. Statistically significant differences found among airlines: CA: X>Z; FE: V>WY.

Table 13. Additional Measures of Crew Participation

Mean (SD)

	Captain	First Officer	Flight Engineer	Crew Average
Analyzing utterances per hour	7.0 (6.2)	6.4 (6.1)	3.4 (2.8)	6.2 (4.7)
Words per utterance	21 (10)	24 (13)	17 (9.2)	22 (10)
Words per response	29 (17)	35 (29)	21 (9.8)	30 (17)

Note. No statistically significant differences were found between airlines or crew positions.

Table 14. Debriefing Assessment Battery Scores

Mean(SD)

	Airline V	Airline W	Airline X	Airline Y	Airline Z	Combined Airlines
Instructor Profile:						
Introduction	1.5(.65)	1.4(.73)	1.1(.13)	2.1(1.3)	1.4(.42)	1.6(.83)
Questions	3.9(1.7)	3.1(1.9)	3.4(1.5)	5.0(.66)	4.2(2.0)	4.1(1.6)
Encouragement	3.8(1.7)	3.5(2.4)	3.3(1.7)	5.1(.66)	3.9(2.0)	4.1(1.7)
Focus	3.2(1.8)	2.9(1.0)	3.0(1.3)	5.0(.69)	4.0(1.7)	3.8(1.6)
Use of Videos	--	4.3(.85)	2.9(.62)	4.5(1.4)	5.1(1.0)	4.4(1.2)
Crew Profile:						
Analysis & Eval.	3.3(1.3)	3.4(1.2)	3.3(1.1)	4.8(.87)	4.2(1.8)	3.9(1.4)
Depth of Activity	4.0(1.0)	4.2(1.5)	4.0(1.5)	5.1(1.1)	4.4(1.9)	4.4(1.4)

Note: Numbers are average scores of two independent raters (except Video scores for airlines W & X, which were coded by only one rater) on a 7-point Likert scale: 1 = poor, 2 = marginal, 3 = needs improvement, 4 = adequate, 5 = good, 6 = very good, 7 = outstanding.
No differences between airline average scores were statistically significant.

Table 15. Frequencies of Rating Scores on the Debriefing Assessment Battery

Subjective variables	N	Rating Scores (Average of the two raters)						
		Poor	Marginal	Needs Improve	Adequate	Good	Very Good	Outstanding
IP								
Introduction	35	23	8	3	0	1	0	0
Questions	36	2	7	4	3	9	11	0
Encouragement	36	2	9	2	4	9	9	1
Focus	36	2	7	4	6	10	7	0
Use of Videos	26	0	3	4	6	5	6	2
Crew								
Analysis & Eval.	36	1	6	8	4	13	3	1
Depth of Activity	36	1	2	8	5	11	7	2

Table 16. Spearman Correlations Between IP and Crew Variables on the Debriefing Assessment Battery

	Instructor variables[a]				
Crew variables[a]	Introduction	Questions	Encourage	Focus	Videos
Analysis & Evaluation	.28	.75 ***	.78 ***	.75 ***	.33
Depth of Activity	.13	.59 ***	.78 ***	.51 ***	.26

[a] See Debriefing Assessment Battery (Appendix C)
*p ≤ .05. **p ≤ .01. ***p ≤ .001.

Table 17. Spearman Intercorrelations Among Instructor Variables: Debriefing Assessment Battery

Subscales	Questions	Encouragement	Focus	Use of Videos
Introduction	.55***	.44**	.49**	.29
Questions	--	.90***	.89***	.51**
Encouragement		--	.78***	.45*
Focus			--	.36
Use of Videos				--

*p ≤ .05. **p ≤ .01. ***p ≤ .001.

Table 18. Relationship of High and Low Introduction Scores to Crew Analysis & Evaluation and Depth of Activity

Mean (SD)

Introduction Scores	N	Analysis & Evaluation	Depth of Activity
1.0	10	3.2 (1.3)*	4.1 (1.4)
1.8 - 4.9	9	4.4 (.63)*	4.6 (1.0)

Note. The ten debriefings for which instructor Introduction scores were lowest were compared with the nine debriefings for which Introduction scores were highest.

*$p \leq .025$, t-test

Table 19. Correlations Between Instructor Battery[a] and Descriptive[b] Variables

	Descriptive variables						
Battery Variables	% total participation	Words per utterance	# directed questions	# non-directed questions	Total # questions	% words addressing performance	% words addressing CRM
Introduction	-.07	.12	.41*	-.20	.42*	.05	.35*
Questions	-.49**	-.38*	.56***	.10	.60***	.05	.35*
Encourage	-.75***	-.58***	.38*	.15	.43**	-.04	.25
Focus	-.40*	-.31	.50**	.08	.52***	.12	.45**
Use of Videos	-.06	.09	.24	.17	.38	.25	.69***

[a] See Debriefing Assessment Battery (Appendix C)
[b] See Appendix E
*p ≤ .05. **p ≤ .01. ***p ≤ .001.

Table 20. Correlations Between Instructor Battery Variables and Crew Descriptive Variables

Instructor Battery variables	Crew Descriptive variables						
	Percent participation	Words per utterance	Words per response	Self-initiated words	Analyzing utterances	Proactive questions	Percent CRM
Introduction	.07	.52***	.35 *	-.06	.12	-.08	.45**
Questions	.49**	.42*	.28	.18	.56***	-.07	.56***
Encourage	.74***	.50**	.34*	.47**	.70***	.10	.40*
Focus	.40*	.39*	.28	.09	.53**	-.16	.63***
Videos	.05	.31	.11	-.02	.14	-.21	.67***

*p ≤ .05. **p ≤ .01. ***p ≤ .001.

Table 21. Correlations Between Crew Battery and Descriptive Variables

	Descriptive variables						
Battery variables	Percent participation	Words per utterance	# of words per response	Self-initiated words	Analyzing utterances	Proactive questions	Percent CRM
Analysis & Evaluation	.67***	.58***	.50**	.51***	.80***	-.14	.56**
Depth of Activity	.84***	.57***	.45**	.76***	.80***	.10	.34*

*p ≤ .05. **p ≤ .01. ***p ≤ .001.

Table 22. Correlations Between Instructor Descriptive Variables and Crew Battery and Descriptive Variables

	Instructor variables					
Crew variables	% participation	Words per utterance	# of directed questions/hr	# of non-directed questions/hr	% words addressing performance	% words addressing CRM
% participation	-.99[a]	-.82***	.08	.23	-.06	-.05
Words per utterance	-.38*	.07	.07	-.16	.17	.39*
Words per response	-.19	.20	-.06	-.24	.14	.36*
S1 statements (# words per hour)	-.79***	-.62***	-.07	.20	-.07	-.06
# of analyzing utterances per hour	-.65***	-.35*	.19	.09	.08	.23
# of proactive questions per hour	-.31*	-.47**	.07	.24	-.41*	-.27
% words addressing CRM	-.04	.17	.17	-.28	.24	.76***
% words addressing performance	.08	.18	.37*	-.10	.41*	.08
Analysis & Evaluation	-.67***	-.39*	.23	.05	.12	.40*
Depth of Activity	-.84***	-.55**	-.001	.09	.02	.28

[a] Forced correlation; see discussion.

*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

Table 23. Variability Within and Across Instructors

Mean (SD)

Variables	Average value of variable	Delta scores		t-value	p-value
		same instructor (n=4)	different instructor (448 random pairings)		
Duration	30.7 (15.2)	18.2 (1.3)	13.7 (12)	0.67	n.s.
IP % CRM	45 (24)	22.8 (7.0)	26.9 (18)	-1.12	n.s.
IP % performance	41 (15)	21.8 (9.0)	18.1 (12)	0.84	n.s.
IP QEF	4.0 (1.6)	0.73 (0.48)	1.75 (1.3)	-4.14	< .005

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Appendix A. Coding

Utterance factors coded	
Utterance length:	number of words
Speaker:	Instructor (IP), 2nd Instructor in role of Flight Engineer (FEI). Captain (CA), First Officer (FO), or Flight Engineer (FE)
Interruptions/Interjections:	Completed (C), Unfinished (U), Interrupted (I), Interrupted and Unfinished (I/U), Active listening interjection (I/AL)
Utterance type:	Question, Command, Response, or Statement (Statements self-initiated by crew further coded as S1)
Target of Question (if clearly directed to a particular crew member):	Captain (CA), First Officer (FO), or Flight Engineer (FE)
Crew Proactive Questions:	"P" if crew question is proactive, "O" (Other) if it is a reactive or miscellaneous question
Topic type:	CRM, Technical, Mixed (CRM & Technical), or Non-Specific
Analysis:	"A" if crew analyzes situation/performance, "O" (Other) if not
Evaluation of crew performance:	Positive, Negative, Improve, or Neutral
Video factors coded	
ON ( ):	All video segments are coded by indicating segment number with duration in parentheses [e.g., ON #1 (:45)]
OFF:	Code end of video segments by indicating (OFF)
SEARCH ( ):	Time spent searching in silence [e.g., SEARCH (:30)]

CODING RULES

Utterance Length (LENGTH)

1. Fill in a word count for every utterance for which a speaker and content are identified. Do not count utterances in which speaker is identified but the words are unintelligible; or words are transcribed but speaker cannot be identified.

2. Count repeated words (i.e., stuttering) as one word only.

Speaker (SPKR)

Identify the speaker of each utterance using one of the following; IP, CA, FO, FE, or FEI.

Transcribing Utterances (UTTERANCE)

1. Transcribe the audiotape verbatim.

2. Record all pauses 3 seconds or longer in bold type.

3. Type titles in parentheses [e.g., (CA) or (FO)] in place of spoken names and type (XX) in place of spoken name of airline.

4. If an utterance is phrased as a statement but is intended to evoke a response, end the utterance with a "(?)" so it can be coded as a command.

5. If a speaker is interrupted (interjections of active listening or brief interruptions which do not change the flow of the original speaker's utterance) or is talked over but clearly continues on to complete the sentence or thought, transcribe and code the continuation(s) as part of the initial utterance with "(x)" where the interruption or interjection occurs, and type and code each interrupting utterance separately below ("I" in the INT column).

6. If speaker is interrupted by a substantial utterance and continues, but the topic or flow is slightly altered, code the initial utterance as unfinished ("U" in the INT column), and transcribe and code the continuation as a separate utterance after the interrupting utterance.

7. If a speaker makes a statement and then asks a question during a single speaker turn, break it into two separate utterances where the question begins.

8. If a speaker clearly changes topics in the middle of a single speaker turn, transcribe and code the topic change as a separate utterance.

9. Record length of video silent search time (no one speaks while IP tries to find a specific video segment) in bold type.

Interruptions / Interjections (INT)

1. Code all utterances that are not completed (whether the speaker is interrupted or trails off) as "U" and code all completed utterances as "C"

2. Code all utterances that interrupt or interject the preceding speaker as "I" (code as "I/U" if the interruption is not completed, either because the preceding speaker keeps talking or another speaker interrupts the interruption)

3. Code all active listening as "AL" (code interjections of active listening as "I/AL")

Utterance Type (TYPE)

Question = Any utterance that explicitly asks a question.

Command = Any IP utterance that commands a response but is not phrased in question form.

Response = First utterance by any or all crew members following a Question or Command, unless content of utterance makes it obvious that it is non-responsive.

S1 (crew) = All self-initiated, substantive crew statements that raise issues, introduce topics, or add information to an existing topic.

Statement = All utterances that do not fit the criteria for Q, C, R, or S1, unless content makes it obvious that the utterance is responsive (R) to the preceding Q or C (e.g., when separated by an intervening utterance).

Question Target (Q TRGT)

1. Code target of IP question if clearly directed to a particular crew member (e.g., "CA").

2. For non-directed IP questions, code the crew member(s) who respond in parentheses [e.g., "(CA)" or "(FO,CA)"] or code as "( )" if no one responds

Crew Proactive Questions (PAQ)

1. Record a "P" in the crew PAQ column if crew question is proactive, or an "O" (other) if the question is not proactive (i.e., reactive or misc.)

Proactive questions include clarification/verification questions used to raise new issues or bring new information into the conversation (e.g., "You wanted help?") and questions designed to gather information (e.g., "Did we have runway three?")

Topic Type (TYPE)

CRM = Pertains to the coordination and interaction of the crew and specifically relates to one or more CRM issues or topics.

Technical = Pertains to specific techniques of flying and navigating the airplane and/or managing the systems, without reference to coordination, planning, communication, judgment, or decision making among crew members.

Mixed = Has between 1/3 and 2/3 of both CRM and technical.

Non-Specific = Does not refer specifically to either CRM or technical topics. Includes undetermined, extraneous, procedural, and maintenance of discourse.

(ANALYSIS)

Code all utterances that indicate the speakers are Analyzing the situation &/or their performance in the LOFT by considering any of the following issues (both explicit and implicit) as A (Analyzes). Code all utterances which are not analytical as O (Other).

Generally, analyzing utterances are those that go beyond just describing what happened to discussing why it happened and identifying what factors contributed to the situation and/or how these factors influenced the outcome.

- explanations of why something was done and/or done a certain way, or what could have been done differently. Key words include *because, should have, could have* , and *might have* (e.g., "I think we *could have* performed faster in holding *because* we had to take a couple of turns in holding just to make sure we got set up." and "I felt a little disorganized pushing off and taxiing out and doing all of that and then having to de-ice; that breaks your flow *because* you don't put the flaps down")

- how & why factors influenced decisions, actions, and outcomes (e.g., "The reason this influenced my decision/actions was ..." and "I was thinking this, so I did this").

- contingencies (e.g., "It *might have* been a lot different *if* we had asked for more time before we took that turn. Maybe I *should have* asked for one more minute.")

(EVALUATION)

Code all utterances which indicate Evaluation of Crew Performance as follows:
Pos = positive evaluation of crew performance
Neg = negative evaluation of crew performance
Improve = suggestions for ways to improve
Neut = neutral evaluation of crew performance
Code all utterances which do not fit into the above categories as O (other)

(VIDEO)

Code all video segments by indicating segment number with duration in parentheses [e.g., ON #1 (:45)], when segment ends (OFF), and time spent searching in silence [e.g., SEARCH (:30)]

(COMMENTS)

1. Indicate any pauses IP uses to allow crew to formulate responses to questions, or pauses after crew statements which encourage crew to say more.

2. Indicate use of probing questions to encourage crew to analyze in more depth.

3. Indicate when IP follows up on topics initiated by crew.

4. Note any noticeably good or poor IP techniques.

5. Record any revelations and/or any specific references to video. Also indicate any difficulty using video equipment.

Appendix B.

Calculation of utterance variables	
# of words for IP, CA, FO, FE, Crew, total :	number of words spoken by each; add CA, FO, and FE totals together for crew total
% participation:	# of words per speaker ÷ total # of words for the debriefing
# of analyzing utterances per hour for CA, FO, FE, Crew:	(# of analyzing utterances ÷ duration) x 60
# of questions per hour for CA, FO, FE, Crew:	(# of questions ÷ duration) x 60
# of proactive questions per hour for CA, FO, FE, Crew:	(# of proactive questions ÷ duration) x 60
# S1 words per hour for CA, FO, FE, Crew:	(# of S1 words ÷ duration) x 60
# of words per response for CA, FO, FE, Crew:	# of response words ÷ # of responses
% crew words positive:	# of crew words positive ÷ total # of crew words
% crew words negative + improve:	# of crew words negative and improve ÷ total # of crew words
% crew words improve:	# of crew words improve ÷ total # of crew words
% crew words negative:	# of crew words negative ÷ total # of crew words
% crew words positive + negative + improve:	# of crew words positive, negative, and improve ÷ total # of crew words
% crew words neutral:	# of crew words neutral ÷ total # of crew words
% crew words performance:	# of crew words performance (positive, negative, improve, and neutral) ÷ total # of crew words
% IP words CRM:	# of IP words CRM ÷ total # of IP words
% IP words technical:	# of IP words technical ÷ total # of IP words
% IP words mixed:	# of IP words mixed ÷ total # of IP words
% IP words non-specific:	# of IP words non-specific ÷ total # of IP words
% IP words CRM + half of mixed:	# of IP words CRM + half of mixed ÷ total # of IP words

% IP words technical + half of mixed:	# of IP words technical + half of mixed ÷ total # of IP words
% IP words positive:	# of IP words positive ÷ total # of IP words
% IP words negative + improve:	# of IP negative and improve ÷ total # of IP words
% IP words improve:	# of IP words improve ÷ total # of IP words
% IP words negative:	# of IP words negative ÷ total # of IP words
% IP words positive + negative + improve:	# of IP words positive, negative, and improve ÷ total # of IP words
% IP words neutral:	# of IP words neutral ÷ total # of IP words
% crew words CRM:	# of crew words CRM ÷ total # of crew words
% crew words technical:	# of crew words technical ÷ total # of crew words
% crew words mixed:	# of crew words mixed ÷ total # of crew words
% crew words non-specific:	# of crew words non-specific ÷ total # of crew words
% of crew words CRM + half of mixed:	# of crew words CRM + half of mixed ÷ total # of crew words
% of crew words technical + half of mixed:	# of crew words technical + half of mixed ÷ total # of crew words
# of questions directed to CA, FO, FE per hour:	(# of questions directed to each ÷ duration) x 60
% of non-directed questions answered by CA, FO, FE, no one	# of non-directed questions answered by each ÷ total # of non-directed questions
# of directed questions per hour:	(# of directed questions ÷ duration) x 60
# of non-directed questions per hour:	(# of non-directed questions ÷ duration) x 60
total # of questions per hour	(total # of directed questions + total # of non-directed questions ÷ duration) x 60
number of video segments shown per hour:	(# of segments shown ÷ duration) x 60

average duration of video segments shown:	total duration of all segments shown ÷ # of segments shown
# of times IP interrupts crew per hour:	(total # of IP interruptions ÷ duration) x 60
% of crew utterances interrupted:	total # of crew utterances interrupted by IP ÷ total # of crew Q, R, and S1 utterances
% of crew utterances interrupted and unfinished:	# of crew utterances interrupted and unfinished ÷ total # of crew Q, R, and S1 utterances
% of crew utterances interrupted and completed:	# of crew utterances interrupted and completed ÷ total # of crew Q, R, and S1 utterances
# of crew (question, response, and S1) utterances per hour:	[# of crew (Q, R, and S1) utterances ÷ duration] x 60
# of words per utterance for IP, CA, FO, FE, crew:	total # of words for each ÷ total # of utterances for each

Appendix C.

DEBRIEFING ASSESSMENT BATTERY

INSTRUCTOR PROFILE

The Instructor Profile is a summary of the strategies and techniques IP's use to assist crews in conducting their own debriefings while giving direction and focus as necessary. The two main goals of the debriefing are to 1) get the crew to perform an in-depth analysis of the situation that confronted them, how they understood and managed the situation, the outcome, and ways to improve, and 2) get the crew to participate in a proactive, rather than reactive, manner in which they initiate discussion and elaborate beyond the minimal. These goals are based on the assumption that active participation by the crew will result in a higher level of learning and increased likelihood of transfer to the line.

Directions:

Use the scale below to rate the instructors on each of the following elements, then total the scores to get the overall rating for each category

Poor	Marginal	Needs Improvement	Adequate	Good	Very Good	Outstanding
1	2	3	4	5	6	7

Introduction

One purpose of the introduction is to let the crew know that participation and self-evaluation are expected of them, and why it is important.

_____Makes clear that his role is guide/facilitator and that crew should do most of the talking

_____Clearly conveys that crew should take an active role, initiating discussion rather than just responding to him

_____Clearly conveys that he wants crew to dig deep, critically analyzing the LOFT and their performance

_____Gives a persuasive rationale for the crew to participate actively and make their own analysis

_____**Overall rating of Introduction**

Questions

The purpose of asking questions is to get the crew to participate, focus the discussion on important topics, and enlist the crew in discussing the topics in depth.

_____Asks an appropriate number of questions to get crew talking & lead them to issues

_____Avoids answering for the crew when they do not respond immediately or correctly and uses a pattern of questioning that keeps the focus on the crew

_____Uses probing and follow-up questions to get crew to analyze in depth and to go beyond yes/no and brief factual answers

_____Uses questioning techniques to encourage interaction and sharing of perspectives among crew members

_____**Overall rating of Questions**

Encouragement

Encouragement refers to the degree to which the instructor encourages and enables the crew to actively and deeply participate in the debriefing.

_____Conveys sense of interest in crew views and works to get them to do most of the talking

_____Encourages continued discussion through active listening, strategic pauses, avoiding disruptive interruptions, and/or following up on crew-initiated topics

_____Encourages all members to participate fully, drawing out quiet members if necessary

_____Refrains from giving long soliloquies or giving his own analysis before crew has fully analyzed

_____**Overall rating of Encouragement**

Focus on Crew Analysis and Evaluation

The goal of the debriefing session is to get the crew to evaluate and analyze their own CRM performance so they will learn more deeply and can gain practice in debriefing themselves, a skill they can then begin to use on the line.

_____Encourages crew to analyze along CRM dimensions the situation that confronted them, what they did to manage the situation, and why they did it

_____Encourages crew to evaluate their performance and/or ways they might improve

_____Encourages crew to explore CRM issues and how they specifically affect LOFT performance and line operations

_____Encourages crew to analyze issues, factors, and outcomes in depth, going beyond simply describing what happened and what they did

_____**Overall rating of Focus on Crew Analysis & Evaluation**

Use of Videos

One stated purpose of showing videotaped segments of the LOFT is to enable the crew members to see how they performed from an objective viewpoint so they can better evaluate their performance. More realistically, perhaps, the video reminds the crew of the situation, aiding their memory and providing a focus for discussion.

_____Shows an appropriate number of videos of appropriate duration to illustrate/introduce topics

_____Uses video equipment efficiently: is able to find desired segment without wasting time and pauses the video if substantial talk begins while playing

_____Consistently discusses video segments, using them as a springboard for discussion of specific topics

_____Has a point to make and uses the video to make that point.

_____**Overall rating of Use of Videos**

CREW PROFILE

The crew profile measures the degree and depth of participation by the crew.

Directions:

Use the scale below to rate the crew on each of the following elements, then total the scores to get the overall rating for each category

Poor	Marginal	Needs Improvement	Adequate	Good	Very Good	Outstanding
1	2	3	4	5	6	7

Crew Analysis and Evaluation

Crew analysis and evaluation refers to the depth to which the crew members analyze the LOFT situation and evaluate their performance.

_____Analyze along CRM dimensions the situation that confronted them, what they did to manage the situation, and why they did it

_____Evaluate their performance and ways they might improve

_____Explore CRM issues and how they affect LOFT performance and line operations

_____Analyze issues, factors, and outcomes in depth, going beyond simply describing what happened and what they did

_____**Overall rating of Crew Analysis & Evaluation**

Depth of Crew Activity

Activity refers to how actively, versus passively, and deeply the crew participates in and initiates discussion.

_____Go beyond minimal responses to IP questions

_____Participate deeply and thoughtfully

_____Initiate dialogue rather than just responding to questions, and/or interact with each other rather than only with the IP

_____Behave in a predominantly proactive rather than reactive manner, being actively involved rather than just passing through the training

_____**Overall rating of Depth of Crew Activity**

Appendix D.

ANCHORING OF THE DEBRIEFING ASSESSMENT BATTERY

IP Introduction

Outstanding:

- Very specifically and thoroughly explains that his role is guide/facilitator and that crew should do most of the talking and lead the discussion
- Sets strong expectations for proactive crew participation, explicitly stating they should initiate discussion rather than just responding to IP questions
- Explicitly and emphatically states that crew should dig deep, critically analyzing the LOFT and their performance
- Gives a persuasive rationale for the crew to participate actively and make their own analysis and makes a strong case for why it is important to do it this way.

Very Good:

- Clearly conveys that his role is guide/facilitator and that crew should do most of the talking and lead the discussion
- Clearly conveys that crew should take an active role, initiating discussion rather than just responding to IP
- Clearly conveys that crew should dig deep, critically analyzing the LOFT and their performance
- Clearly conveys the general rationale for the crew to participate actively and make their own analysis

Good:

- Conveys that his role is guide/facilitator and that crew should do most of the talking, but not specifically that they should lead their own discussion.
- Conveys that crew should take an active role, initiating discussion rather than just responding to IP
- Conveys that crew should dig deep, critically analyzing the LOFT and their performance
- Makes a general statement of the rationale for the crew to participate actively and make their own analysis

Adequate:

- Conveys that his role is guide/facilitator and that crew should do most of the talking, but does not emphasize strongly
- Conveys that crew should take an active role and initiate discussion
- Conveys that crew should analyze the LOFT and their performance
- Gives a clear, though implicit rationale for the crew to participate actively and make their own analysis

Needs Improvement:

- Implies that his role is guide/facilitator and that crew should do most of the talking, but does not emphasize strongly
- Implies that crew should take an active role and initiate discussion
- Implies that crew should analyze the LOFT and their performance
- Gives a vague, implicit rationale for the crew to participate actively and make their own analysis

Marginal:

- Implies that his role is guide/facilitator and that the crew should talk, but does not emphasize
- Implies that crew should take an active role, but does not specify what they should do.
- Implies that crew should discuss the LOFT and their performance
- Gives vague impression of why crew should participate actively

Poor:

- Does not make clear that his role is guide/facilitator or that crew should do most of the talking
- Does not make clear that crew should take an active role or initiating discussion
- Does not make clear that crew should dig deep or critically analyze the LOFT and their performance
- Does not give rationale for the crew to participate actively and make their own analysis

IP Questions

Outstanding:

- Consistently asks questions as appropriate to get crew talking & lead them to issues
- Consistently rewords questions or otherwise avoids answering for the crew when they do not respond immediately or correctly, and consistently uses a pattern of questioning that keeps the focus on the crew
- Consistently uses probing and follow-up questions as a tool to evoke in-depth discussion and optimize crew self-discovery, while forcing crew to go beyond yes/no and brief factual answers
- Consistently uses questioning techniques to encourage substantial interaction and sharing of perspectives among crew members

Very Good:

- Frequently asks questions when appropriate to get crew talking & lead them to issues
- Predominantly rewords questions or otherwise avoids answering for the crew when they do not respond immediately or correctly and predominantly uses a pattern of questioning that keeps the focus on the crew
- Frequently uses probing and follow-up questions as a tool to evoke in-depth discussion and optimize crew self-discovery, pushing crew to go beyond yes/no and brief factual answers
- Frequently uses questioning techniques to encourage interaction and sharing of perspectives among crew members

Good:

- Generally asks questions as necessary to get crew talking & lead them to issues
- Generally rewords questions or otherwise avoids answering for the crew when they do not respond immediately or correctly and generally uses a pattern of questioning that keeps the focus on the crew
- Generally uses probing and follow-up questions to get crew to analyze in depth and to go beyond yes/no and brief factual answers but may steer crew to predetermined answers while emphasizing self-discovery.
- Generally uses questioning techniques to encourage interaction and sharing of perspectives among crew members

Adequate:

- About half of the time asks questions when necessary to get crew talking & lead them to issues
- Generally avoids answering for the crew when they do not respond immediately or correctly, but may not reword the questions. On average uses a pattern of questioning that keeps the focus on the crew
- On average uses probing and follow-up questions to get crew to analyze in depth and to go beyond yes/no and brief factual answers but steers crew to predetermined answers as much as emphasizes self-discovery.
- On average uses questioning techniques to encourage interaction among crew members

Needs Improvement:

- Sometimes asks questions when necessary to get crew talking & lead them to issues
- To some extent avoids answering for the crew when they do not respond immediately or correctly and uses a pattern of questioning that keeps the focus on the crew
- Sometimes uses probing and follow-up questions to get crew to analyze in depth and to go beyond yes/no and brief factual answers but steers crew to predetermined answers more than emphasizes self-discovery.
- Sometimes uses questioning techniques to encourage interaction among crew members

Marginal:

- Occasionally asks questions to get crew talking & lead them to issues
- Occasionally avoids answering for the crew when they do not respond immediately or correctly but generally answers for them rather than keeping focus on the crew.
- Occasionally uses probing and follow-up questions to get crew to analyze in depth but generally settles for yes/no and brief factual answers
- Occasionally uses questioning techniques to encourage interaction among crew members

Poor:

- Rarely asks questions to get crew talking or lead them to issues
- Usually answers for the crew when they do not respond immediately or correctly.
- Rarely uses probing and follow-up questions to get crew to analyze in depth. Usually settles for yes/no and brief factual answers
- Rarely uses questioning techniques to encourage interaction among crew members

IP Encouragement

Outstanding:

- Consistently communicates an interest in crew views and actively strives to get them to do most of the talking and lead their own discussion.
- Consistently uses active listening and pauses, avoids interrupting, and follows up on crew topics.
- Consistently encourages all members to participate and draws out quiet members as necessary.
- Consistently refrains from lecturing and giving own analysis before crew.

Very Good:

- Clearly communicates to the crew that their views are important and works to get them to do most of the talking and to lead their own discussion.
- Frequently uses techniques such as active listening and pauses, avoids interrupting, and follows up on crew topics to encourage continued discussion.
- Frequently encourages all members to participate and attempts to draw out quiet members as necessary.
- Usually refrains from lecturing and giving own analysis before crew.

Good:

- Shows a clear interest in crew views and attempts to get them to do most of the talking. Makes an effort to get crew to lead their own discussion.
- Often uses active listening and pauses, avoids interrupting, and follows up on crew topics.
- Generally encourages all members to participate, drawing out quiet members as necessary.
- Sometimes lectures, but generally gets crew to analyze situation before giving own analysis.

Adequate:

- On average demonstrates a desire to have crew participate and discuss their views.
- Uses some facilitation techniques to encourage crew discussion and generally avoids interrupting them. Acknowledges crew topics but may not follow up on them thoroughly.
- Attempts to get all crew members involved.
- On average gets the crew to analyze the situation themselves before evaluating and lecturing to them.

Needs Improvement:

- Shows interest in crew views but does not push them to do most of the talking.
- Sometimes uses active listening and pauses, and follows up on crew topics, but also sometimes interrupts.
- Expresses a desire for crew to participate but does not put a lot of effort into getting all members actively involved.
- Sometimes lectures rather than letting crew do the talking.

Marginal:

- Exhibits only modest interest in crew views.
- Only occasionally uses active listening, pauses, and/or follows up on crew topics, and often interrupts.
- Expresses a desire for crew to participate but puts minimal effort into actively encouraging them to do so.
- Tends to lecture and analyze for crew without encouraging them to discuss what happened themselves.

Poor:

- Gives the impression that crew views are not valued.
- Frequently hinders rather than encourages crew talk and does not follow up on topics initiated by crew.
- Makes little attempt to get crew members to participate.
- Frequently lectures to crew about what they did and how to improve.

IP Focus on Crew Analysis and Evaluation

Outstanding:

- Continually encourages and pushes crew to analyze along CRM dimensions the situation that confronted them, what they did to manage the situation, and why they did it.
- Consistently encourages and pushes crew to evaluate their performance and/or ways they might improve.
- Consistently encourages crew to explore CRM issues and how they specifically affect LOFT performance and line operations.
- Continually encourages crew to analyze issues, factors, and outcomes in depth, going beyond simply describing what happened and what they did.

Very Good:

- Frequently encourages and pushes crew to analyze along CRM dimensions the situation that confronted them, what they did to manage the situation, and why they did it.
- Frequently encourages crew to evaluate their performance and/or ways they might improve.
- Frequently encourages crew to explore CRM issues and how they specifically affect LOFT performance and line operations.
- Frequently encourages crew to analyze issues, factors, and outcomes in depth, going beyond simply describing what happened and what they did

Good:

- Generally encourages crew to analyze along CRM dimensions the situation that confronted them, what they did to manage the situation, and why they did what they did, but may settle for less than extensive discussion.
- Generally encourages crew to evaluate their performance and/or ways they might improve.
- Generally encourages crew to explore CRM issues, and attempts to get crew to discuss how they specifically affect LOFT performance and line operations.
- Generally encourages crew to analyze issues, factors, and outcomes in depth. Generally encourages crew to go beyond simply describing what happened and what they did.

Adequate:

- On average encourages crew to analyze along CRM dimensions the situation that confronted them and what they did to manage the situation. Encourages but does not push crew to analyze why they did what they did.
- Tends to encourage crew to evaluate their performance and/or ways they might improve, but may not pursue thoroughly.
- On average encourages crew to explore CRM issues but tends not to get crew to discuss how they specifically affect both LOFT performance and line operations.
- Generally encourages crew to analyze issues, factors, and outcomes, but settles for moderate depth, sometimes letting crew simply describe what happened and what they did.

Needs Improvement:

- Sometimes encourages crew to analyze along CRM dimensions the situation that confronted them and what they did to manage the situation but does not push crew to discuss why they did what they did.
- Verbally requests but does not pursue getting the crew to evaluate their performance and/or ways they might improve.
- Encourages crew to explore CRM issues but does not ask crew to discuss how they specifically affect LOFT performance and line operations.
- Tends not to push crew to analyze issues, factors, and outcomes in depth. Often settles for letting the crew simply describe what happened and what they did.

Marginal:

- Only minimally encourages crew to analyze along CRM dimensions the situation that confronted them and/or what they did to manage it. Does not push crew to discuss why they did what they did.
- Only occasionally encourages crew to evaluate their performance and/or ways they might improve.
- Occasionally encourages crew to explore CRM issues, and does not encourage crew to discuss how they affect LOFT performance or line operations.
- Only occasionally encourages crew to analyze issues, factors, and outcomes in depth. Content for crew to describe what happened and what they did.

Poor:

- Does not encourages crew to analyze along CRM dimensions the situation that confronted them, what they did to manage the situation, or why they did it.
- Rarely encourages crew to evaluate their performance or ways they might improve.
- Rarely encourages crew to explore CRM issues.
- Rarely encourages crew to analyze issues, factors, and outcomes in depth.

IP Use of Videos

Outstanding:

- Consistently shows an appropriate number of videos of appropriate duration to illustrate/introduce topics.
- Consistently uses video equipment efficiently: is able to find desired segment without wasting time and pauses the video if talk begins while playing.
- Actively evokes and consistently pursues thorough crew discussion of each video segment or topic.
- Consistently has a point to make and uses the video to make that point.

Very Good:

- Usually shows an appropriate number of videos of appropriate duration to illustrate/introduce topics.
- Usually uses video equipment efficiently: is able to find desired segment without wasting much time and pauses the video if substantial talk begins while playing.
- Works to get crew to discuss most of the video segments or topics in detail.
- Usually has a point to make and uses the video to make that point.

Good:

- Generally shows an appropriate number of videos of appropriate duration to illustrate/introduce topics.
- Tends to use video equipment efficiently: is generally able to find desired segment without wasting much time and generally pauses the video if substantial talk begins.
- Encourages crew to discuss most video segments or topics and refrains from lecturing to crew or hindering their discussion.
- Generally has a point to make and usually uses the video to make a point.

Adequate:

- On average shows an appropriate number of videos, usually of appropriate duration, to illustrate and introduce topics.
- On average uses video equipment somewhat efficiently, finding desired segment without wasting too much time and generally pausing the video if substantial talk begins while playing.
- Generally encourages crew to discuss video segments or topics, but may also lecture to crew, thereby somewhat discouraging thorough crew discussion.
- Generally has a point to make, but the point is not always clearly tied to the video.

Needs Improvement:

- Shows somewhat too few or too many videos. Sometimes shows very short and/or very long segments while trying to illustrate/introduce topics.
- Tends to use video equipment inefficiently: tends to waste some time trying to find desired segments and is slow to pause the video if substantial talk begins while playing.
- Sometimes encourages crew to discuss video segment or topic, but may lecture, interrupt crew discussion, and/or not consistently pursue crew discussion.
- Sometimes has a predetermined point to make, and sometimes uses the video to make a point.

Marginal:

- Clearly shows too few or too many videos, sometimes of much too long and/or short a duration. Many videos not used to illustrate/introduce topics.
- Uses video equipment inefficiently, wasting significant time trying to find desired segments while rarely pausing the video if substantial talk begins while playing.
- Tends not to discuss video segments, and when they are discussed tends to lecture to crew about what occurred, only minimally encouraging crew to participate in a discussion.
- Only occasionally has a point to make or uses the video to make a point.

Poor:

- Shows way too few or too many videos which are often much too long and/or short. Does not use videos to illustrate/introduce topics.
- Uses video equipment very inefficiently: wastes substantial time trying to find desired segments and fails to pause the video if substantial talk begins while playing.
- Usually does not discuss video segments, and when discussed usually lectures to crew without encouraging (and often hindering) crew participation.
- Rarely has a point to make or uses the video to make a point.

Crew Analysis and Evaluation

Outstanding:

- Consistently analyze along CRM dimensions the situation that confronted them, what they did to manage the situation, and why they did it.
- Consistently evaluate their performance and ways they might improve.
- Consistently explore CRM issues and how they affect LOFT performance and line operations.
- Consistently analyze issues, factors, and outcomes in depth, going beyond simply describing what happened and what they did.

Very Good:

- Frequently analyze along CRM dimensions the situation that confronted them, what they did to manage the situation, and why they did it.
- Frequently evaluate their performance and ways they might improve.
- Often explore CRM issues and how they affect LOFT performance and line operations.
- Frequently analyze issues, factors, and outcomes in depth, going beyond simply describing what happened and what they did.

Good:

- Generally analyze along CRM dimensions the situation that confronted them and what they did to manage the situation. Briefly discuss why they did what they did.
- Generally evaluate their performance and ways they might improve.
- Generally explore CRM issues and how they affect LOFT performance and/or line operations.
- Generally analyze issues, factors, and outcomes in moderate depth, usually going beyond simply describing what happened and what they did.

Adequate:

- On average analyze along CRM dimensions the situation that confronted them and what they did to manage the situation. Briefly discuss why they did what they did.
- On average evaluate their performance and/or ways they might improve.
- On average explore CRM issues and how they affect LOFT performance and/or line operations.
- Analyze some issues, factors, and outcomes in some depth, often going beyond simply describing what happened and what they did.

Needs Improvement:

- Only part of the time analyze along CRM dimensions the situation that confronted them, what they did to manage the situation, or why they did it.
- Only sometimes evaluate their performance and ways they might improve.
- Sometimes explore CRM issues but give little discussion of how they affect LOFT performance or line operations.
- Analyze only a few issues, factors, and outcomes in any depth, sometimes going beyond simply describing what happened and what they did.

Marginal:

- Occasionally analyze along CRM dimensions the situation that confronted them. Occasionally discuss what they did to manage the situation or why they did it.
- Only occasionally evaluate their performance and do not discuss ways they might improve.
- Only occasionally explore CRM issues and do not discuss how they affect LOFT performance and line operations.
- Analyze issues, factors, and outcomes in very little depth, rarely going beyond simply describing what happened and what they did.

Poor:

- Do little to analyze along CRM dimensions the situation that confronted them, what they did to manage the situation, or why they did it.
- Rarely evaluate their performance or ways they might improve.
- Rarely explore CRM issues and how they affect LOFT performance and line operations.
- Do not analyze issues, factors, and outcomes in depth; only briefly describe what happened.

Depth Of Crew Activity

Outstanding:

- Consistently go substantially beyond minimal responses to IP questions.
- Consistently participate deeply and thoughtfully.
- Continually initiate dialogue and pursue issues to completion rather than just responding to questions, and consistently interact with each other rather than only with the IP.
- Behave in a consistently proactive rather than reactive manner, being actively involved rather than just passing through the training.

Very Good:

- Frequently go substantially beyond minimal responses to IP questions.
- Usually participate deeply and thoughtfully.
- Frequently initiate dialogue rather than just responding to questions, and often interact with each other rather than only with the IP.
- Usually behave in a proactive rather than reactive manner, being actively involved rather than just passing through the training.

Good:

- Generally go well beyond minimal responses to IP questions.
- Generally participate deeply and thoughtfully.
- Tend to initiate dialogue rather than just responding to questions and generally interact with each other rather than only with the IP.
- Generally behave in a proactive rather than reactive manner, being actively involved rather than just passing through the training.

Adequate:

- On average go somewhat beyond minimal responses to IP questions.
- On average participate somewhat deeply and thoughtfully.
- On average initiate dialogue rather than just responding to questions and interact with each other rather than only with the IP.
- On average behave in a proactive rather than reactive manner, being actively involved rather than just passing through the training.

Needs Improvement:

- Tend to give slightly more than minimal responses to IP questions.
- Sometimes participate deeply and thoughtfully.
- Tend to just respond to questions rather than initiate dialogue. Tend to interact with the IP more than with each other.
- Sometimes behave in a more reactive than proactive manner.

Marginal:

- Frequently give only minimal responses to IP questions.
- Only occasionally participates deeply or thoughtfully.
- Tend to just respond to questions rather than initiate dialogue. Only occasionally interact with each other; tend to interact only with IP.
- Behave in a generally reactive rather than proactive manner.

Poor:

- Consistently gives only minimal responses to IP questions.
- Rarely participate deeply or thoughtfully.
- Rarely initiate dialogue; usually just respond to IP. Rarely interact with each other.
- Behave in a consistently reactive rather than proactive manner. Appear to just pass through the training rather than being actively involved.

Appendix E. Spearman Correlation Coefficients

* - Signif. LE .05 ** - Signif. LE .01 ***- Signif. LE .001 (2-tailed)

	DURATION	CRMPERF	TECHPERF	SI_INTRO	SI_QUEST	SI_ENCRG
CRMPERF	-.4881**					
TECHPERF	-.3875*	.5561**				
SI_INTRO	.0922	-.0319	.0368			
SI_QUEST	.1341	.2708	.1329	.5469**		
SI_ENCRG	.1491	.1784	-.0535	.4362**	.9043**	
SI_CONT	.2205	.1336	.1702	.4880**	.8861**	.7763**
SI_QEC	.1841	.1873	.0560	.5003**	.9667**	.9419**
SI_VIDEO	-.3847	.3863	.5632**	.3948	.5093**	.4529*
IPPART	-.2131	-.0360	.2846	-.0691	-.4929**	-.7481**
IPPOS	-.4259**	.3741*	.4785**	-.1384	-.0571	-.1429
IPNEGIMP	.5050**	-.4711**	-.3449	-.1584	-.1394	-.0209
IPNEG	.4006*	-.2601	-.3723*	-.1188	-.1359	-.0207
IPIMP	.4224*	-.4433*	-.1792	-.1607	-.0825	.0109
IPNEUT	-.0772	.2733	.4842**	.2620	.3599*	.2829
IPPERF	-.1579	.1401	.4721**	.0457	.0479	-.0364
IPCRM	-.1831	.1786	.4882**	.3525*	.3522*	.2478
IPTECH	.0413	-.0891	-.2728	-.3922*	-.4376**	-.3613*
IPMIXED	.0730	.0108	-.2949	-.2089	-.2899	-.1831
IPNS	.2524	-.1205	-.3642*	-.0455	.2627	.3428*
IPCRM2	-.1495	.2058	.4801**	.3883*	.3232	.2038
IPTECH2	.0794	-.1455	-.3799*	-.4225*	-.4994**	-.4055*
IPWPERUT	-.2826	-.0506	.2554	.1152	-.3839*	-.5794**
DIRQPHR	.1133	.0762	.0816	.4122*	.5555**	.3776*
IPDQ_CA	.1390	-.1000	-.0128	.3908*	.4512**	.3018
IPDQ_FO	.0935	.1192	.0872	.4221*	.6051**	.4546**
IPDQ_FE	.0182	.4846	.1014	.1161	.5182	.2278
NONDQPHR	.0612	.2254	.1162	-.1990	.1040	.1467
TOTQPHR	.1025	.1962	.1610	.4208*	.6005**	.4342**
INTERUPH	.0681	-.0535	-.1407	-.3407*	.0384	.1641
INTERRUP	-.0379	-.2019	.0242	-.2407	-.1315	-.2084
INTER_UN	.0452	-.1619	-.0012	-.1411	.1234	.0533
VSEGPERH	.2297	-.1332	-.0404	-.0243	-.0809	-.0413
AVSEGDUR	-.2558	.0209	.0703	-.3113	-.1606	-.1687
SC_ACTIV	.1616	-.0129	-.1347	.1338	.5926**	.7798**
SC_CONT	.2223	.0537	-.0501	.2776	.7509**	.7830**
CAPART	.1350	-.1540	-.3791*	.2469	.4096*	.5412**
FOPART	.1505	.0100	-.0899	.1221	.3557*	.5847**
FEPART	-.3636	.5224	-.1584	-.1639	.2091	.5467
CREWPART	.2198	.0269	-.2937	.0661	.4888**	.7443**
CREWPOS	-.0170	.3598*	.1648	.2579	.4267**	.3442*
CREWNEIM	.4817**	-.3829*	-.0423	-.1356	-.0482	.0567
CREWNEG	.4983**	-.3784*	-.1956	-.2538	-.1229	-.0079
CREWIMPR	.4069*	-.2460	.1401	-.0146	.0838	.1386
CREWNEUT	-.1443	.0758	.0513	.2106	.2612	.2205
CREWPERF	-.0674	.1056	.2349	.1543	.2847	.2063
CREWCRM	-.0390	.0998	.3983*	.4463**	.5629**	.4044*
CREWTECH	.1193	-.0381	-.3174	-.3605*	-.3820*	-.2782
CREWMIX	-.1820	.1848	-.1196	-.1849	-.1566	-.0765
CREWNS	.3989*	-.3928*	-.4842**	-.3296	-.3924*	-.2692
CREWCRM2	-.1646	.2015	.4667**	.4331**	.5778**	.4123*
CREWTEC2	-.0287	.0318	-.3552*	-.3900*	-.4374**	-.3043
CAWPERES	-.0144	.0045	-.1159	.3224	.3499*	.4077*
FOWPERES	-.0769	-.1506	.0587	.3114	.1115	.1377
FEWPERES	.1644	-.0884	-.0286	.3881	.2648	.2082
CREWPERE	.0098	-.0712	-.0620	.3501*	.2789	.3400*
CAWPERUT	-.0530	.0254	-.1600	.3890*	.3780*	.4511**
FOWPERUT	-.1424	-.0452	.0163	.4651**	.2832	.3569*
FEWPERUT	-.2466	-.1805	-.0382	.1609	.0046	.2151
CREWPERU	-.1298	.0552	-.0052	.5212**	.4160*	.4927**

CASIUTPH	.0427	-.1121	-.2770	-.1161	.1925	.3937*
FOSIUTPH	.0815	-.0038	-.1711	-.0087	.2200	.4783**
FESIUTPH	-.0909	.1636	-.3801	-.2868	.0727	.4510
CREWSIUT	.1095	-.0342	-.2893	-.1216	.2326	.5146**
CANALUTT	-.1476	.1638	-.0313	.1808	.4922**	.6006**
FOANALUT	-.0394	.0016	.1167	.0247	.3895*	.4894**
FEANALUT	.1777	.2336	-.2002	.1233	.3645	.3676
CREWANUT	-.0263	.1598	-.0224	.0699	.5590**	.7086**
CREWPAQP	.1906	-.1825	-.4826**	-.1131	-.0720	.1048
FOPAQPH	.3335*	-.1568	-.2807	.0997	-.0364	.1480
FEPAQPH	-.1864	.3065	-.0102	-.4594	.0621	.1126
CAPAQPH	.0735	-.2203	-.4341*	-.1646	-.1361	-.0379
NONDQ_CA	-.1144	.0641	.0003	-.0144	-.0658	.0390
NONDQ_FO	-.0939	-.0471	.0329	-.0577	.0513	.0876
NONDQ_FE	-.2023	.6371*	.0000	-.0721	.2575	.5023
NONDQ_NO	.3770*	.0467	-.0227	-.0299	.0828	.0491

	DURATION	CRMPERF	TECHPERF	SI_INTRO	SI_QUEST	SI_ENCRG
SI_QEC	.9164**					
SI_VIDEO	.3614	.4699*				
IPPART	-.4036*	-.5776**	-.0551			
IPPOS	.0401	-.0920	.1281	.1329		
IPNEGIMP	-.0948	-.0407	-.3417	-.1460	-.1979	
IPNEG	-.2323	-.0944	-.2766	-.1609	-.2192	.7942**
IPIMP	.0588	.0300	-.2193	-.1672	-.1198	.8565**
IPNEUT	.3165	.3478*	.5350**	-.1390	-.0179	-.1339
IPPERF	.1208	.0371	.2545	.0520	.7291**	.1576
IPCRM	.4533**	.3859*	.6864**	.0486	.2782	-.3150
IPTECH	-.5236**	-.4760**	-.6398**	.0637	-.1579	.2108
IPMIXED	-.3117	-.2663	-.1770	-.0544	.0230	.3470*
IPNS	.2112	.2538	-.1706	-.3976*	-.3283	-.0397
IPCRM2	.4469**	.3648*	.6551**	.0977	.2982	-.2635
IPTECH2	-.5883**	-.5246**	-.6997**	.0790	-.1677	.3398*
IPWPERUT	-.3072	-.4411**	.0853	.8200**	.2448	-.2443
DIRQPHR	.4956**	.4743**	.2442	-.0886	-.0663	.0767
IPDQ_CA	.4159*	.3781*	.0835	-.0231	-.0579	.1045
IPDQ_FO	.4971**	.5308**	.2816	-.1241	-.1704	.1013
IPDQ_FE	.2551	.5182	.9048**	.2785	.3455	.5577
NONDQPHR	.0848	.1064	.1720	-.2333	.0415	.0841
TOTQPHR	.5150**	.5120**	.3819	-.1382	-.0659	.0703
INTERUPH	-.0021	.0739	-.1735	-.4436**	-.0304	.4258**
INTERRUP	-.1414	-.1605	-.1458	.1207	.0092	.1507
INTER_UN	.1483	.1082	-.1044	-.1133	-.0534	.0781
VSEGPERH	-.0538	-.0498	-.0142	-.0713	-.1088	.1043
AVSEGDUR	-.2481	-.1864	.0560	.1889	-.1141	.0327
SC_ACTIV	.5137**	.6813**	.2614	-.8441**	-.0264	.1025
SC_CONT	.7487**	.8242**	.3279	-.6702**	.0565	.0264
CAPART	.3631*	.4907**	.1150	-.6180**	-.1737	.2339
FOPART	.2210	.3880*	.0499	-.8275**	-.0451	.0223
FEPART	-.0137	.2909	.0238	-.7671**	.2091	-.1521
CREWPART	.4007*	.5741**	.0457	-.9998**	-.1413	.1482
CREWPOS	.4954**	.4052*	.0876	-.1581	.3549*	-.3315*
CREWNEIM	.0430	.0597	-.2126	-.0520	-.1627	.7532**
CREWNEG	-.0717	-.0332	-.3366	-.0888	-.2845	.7322**
CREWIMPR	.2078	.1729	-.0315	-.1093	-.0441	.6022**
CREWNEUT	.1688	.2116	.2330	-.1397	.0418	-.0771

	SI_CONT	SI_QEC	SI_VIDEO	IPPART	IPPOS	IPNEGIMP

CREWPERF	.2539	.2632	.2464	.0800	.2325	.1183
CREWCRM	.6310**	.5550**	.6691**	-.0367	.2144	-.2777
CREWTECH	-.4985**	-.4228*	-.6131**	-.0084	-.1464	.3302*
CREWMIX	-.1967	-.1489	.2032	-.0925	-.0351	.0401
CREWNS	-.3631*	-.3257	-.7452**	-.0038	-.3572*	.3686*
CREWCRM2	.6446**	.5660**	.7317**	-.0260	.2643	-.3642*
CREWTEC2	-.5404**	-.4560**	-.4977**	-.0166	-.1219	.2831
CAWPERES	.3596*	.4064*	.1363	-.3094	.1671	-.1853
FOWPERES	.1587	.1353	.1428	.0188	.1993	-.2362
FEWPERES	-.0183	.0639	.2515	.0482	-.0274	-.3449
CREWPERE	.2876	.3270	.1069	-.1876	.1909	-.1563
CAWPERUT	.4171*	.4573**	.2877	-.3675*	.0824	-.1926
FOWPERUT	.2232	.2909	.3186	-.2833	.1362	-.2122
FEWPERUT	-.0297	.0000	.1205	-.2638	.2603	-.3079
CREWPERU	.3862*	.4503**	.3259	-.3764*	.1707	-.2239
CASIUTPH	.1348	.2854	.0654	-.6366**	-.1033	.3896*
FOSIUTPH	.0860	.2697	.0265	-.8281**	-.0040	.1751
FESIUTPH	.1412	.1909	-.2143	-.7808**	.0455	-.1106
CREWSIUT	.1510	.3278	.0383	-.8718**	-.1005	.3051
CANALUTT	.3916*	.5358**	.1723	-.5119**	.1219	.1005
FOANALUT	.4202*	.4424**	.1758	-.4703**	.1881	-.0955
FEANALUT	.1461	.2597	.2635	-.4531	-.2369	-.1478
CREWANUT	.5355**	.6371**	.1606	-.7068**	.1051	-.0047
CREWPAQP	-.1514	-.0290	-.1895	-.3358*	-.3882*	.4817**
FOPAQPH	-.0756	.0058	-.1203	-.2486	-.4140*	.3691*
FEPAQPH	.0240	.2198	.3546	.0576	.4062	.5645
CAPAQPH	-.1990	-.1045	-.2513	-.1733	-.2573	.4151*
NONDQ_CA	.0527	.0037	.2257	-.0877	-.0766	-.1307
NONDQ_FO	.0231	.0076	-.0214	-.1894	.0892	-.1900
NONDQ_FE	.1889	.3357	-.0976	-.8037**	.0736	-.2774
NONDQ_NO	.0259	.0592	-.2385	.0337	-.1362	.2710

	SI_CONT	SI_QEC	SI_VIDEO	IPPART	IPPOS	IPNEGIMP

IPIMP	.4395**					
IPNEUT	-.1263	-.0604				
IPPERF	.0732	.1660	.4550**			
IPCRM	-.3486*	-.1656	.2497	.1764		
IPTECH	.2897	.1049	-.3892*	-.1794	-.7359**	
IPMIXED	.4055*	.1320	-.0745	.1651	-.5774**	.2114
IPNS	-.1367	.0274	.0956	-.3378*	-.3054	-.0883
IPCRM2	-.2945	-.1405	.2466	.2199	.9621**	-.7851**
IPTECH2	.4272**	.1715	-.3803*	-.1254	-.8594**	.9402**
IPWPERUT	-.2118	-.3080	-.1835	.1260	.2371	-.1639
DIRQPHR	-.0880	.1356	.2457	.1434	-.0436	-.0249
IPDQ_CA	-.0630	.1456	.1282	.1504	-.1201	.0768
IPDQ_FO	-.0355	.1501	.1986	-.0379	.1637	-.1558
IPDQ_FE	.3506	.4360	.1187	.3736	-.0820	.0959
NONDQPHR	.1600	.1628	-.1312	-.0597	-.0942	.2405
TOTQPHR	-.0302	.1692	.1724	.1029	-.0537	.0841
INTERUPH	.3257	.4298**	-.1852	-.0743	-.2117	.2476
INTERRUP	.0506	.1151	-.2439	-.1019	-.0470	-.0046
INTER_UN	-.0074	.0921	-.1480	-.1501	-.0310	-.0788
VSEGPERH	.0507	.2162	.0905	-.0326	-.1260	.2894
AVSEGDUR	.1583	-.1726	-.0639	-.1172	-.0763	-.1026
SC_ACTIV	.0467	.1567	.1422	.0242	.2755	-.3878*
SC_CONT	-.0499	.0790	.2158	.1230	.4037*	-.5309**
CAPART	.1443	.2902	.0240	-.0362	.0443	-.0162
FOPART	.0592	.0677	.1382	.0076	-.0174	-.0313
FEPART	-.2618	-.1054	.1142	.0182	.1412	-.3379
CREWPART	.1645	.1670	.1349	-.0616	-.0522	-.0629
CREWPOS	-.2978	-.3226	.1063	.2957	.1132	-.2555
CREWNEIM	.5743**	.6183**	-.1603	.1062	-.0697	.1107
CREWNEG	.6063**	.5263**	-.1302	-.0311	-.2695	.1575
CREWIMPR	.3514*	.6740**	-.0301	.2173	.1116	.0363
CREWNEUT	.0030	-.0853	.2206	.1072	-.0032	-.2108
CREWPERF	.1291	.0171	.1861	.4086*	.0802	-.2408
CREWCRM	-.3434*	-.1837	.3301*	.2506	.7550**	-.7112**
CREWTECH	.4456**	.1990	-.4269**	-.2004	-.6894**	.8469**
CREWMIX	.1209	.0252	.1592	.0579	-.3808*	.0852
CREWNS	.2893	.2581	-.4427**	-.4304**	-.3637*	.4517**
CREWCRM2	-.4316**	-.2435	.4476**	.3158	.7509**	-.7826**
CREWTEC2	.3902*	.1923	-.2852	-.1345	-.7706**	.7046**
CAWPERES	-.1898	-.2329	.0284	.0914	.3749*	-.4673**
FOWPERES	-.2904	-.2100	.0190	.1654	.2522	-.3212
FEWPERES	-.1385	-.2792	-.0528	.0732	.0343	-.1147
CREWPERE	-.1736	-.2203	-.0144	.1294	.3556*	-.4511**
CAWPERUT	-.1825	-.2214	.1167	.0388	.4711**	-.5919**
FOWPERUT	-.1642	-.1838	.1196	.1408	.1950	-.3330*
FEWPERUT	-.1949	-.2479	.1858	.3158	.3959	-.6009
CREWPERU	-.1943	-.2226	.1757	.1725	.4020*	-.5442**
CASIUTPH	.3112	.4112*	-.0579	-.0578	.0304	.0227
FOSIUTPH	.1909	.1946	.0049	.0172	-.0755	.1043
FESIUTPH	-.2524	-.0240	.2466	-.0683	.1503	-.4566
CREWSIUT	.2899	.3056	.0082	-.0568	-.0630	.0079
CANALUTT	.1006	.0301	.0460	.1463	.1254	-.1739
FOANALUT	-.1163	-.0149	.0155	.0914	.3638*	-.4239**
FEANALUT	-.3655	.0528	.0938	-.1553	-.0868	-.0892
CREWANUT	-.0475	.0216	.0819	.0735	.2296	-.3679*
CREWPAQP	.5110**	.4420**	-.2524	-.4011*	-.2781	.2315
FOPAQPH	.4622**	.3138	-.0706	-.3189	-.2032	.0537
FEPAQPH	.1892	.4937	-.0216	.1868	-.0287	.0384
CAPAQPH	.4025*	.3833*	-.2920	-.3244	-.1971	.2943
NONDQ_CA	-.1721	-.0135	.2349	.0080	.0505	-.1806
NONDQ_FO	-.1098	-.0767	-.0011	-.0309	-.0619	.0266
NONDQ_FE	-.1702	-.3078	.1940	-.0714	.1083	-.1316
NONDQ_NO	.3704*	.0548	-.2307	-.0898	-.2099	.2261
	IPNEG	IPIMP	IPNEUT	IPPERF	IPCRM	IPTECH

IPNS	-.1320					
IPCRM2	-.3955*	-.4022*				
IPTECH2	.4839**	-.1150	-.8383**			
IPWPERUT	.0483	-.5308**	.3110	-.1053		
DIRQPHR	-.1527	.2048	-.0724	-.0789	-.1914	
IPDQ_CA	-.1337	.1482	-.1473	.0226	-.1217	.9393**
IPDQ_FO	-.3157	.2046	.0936	-.2262	-.1922	.8039**
IPDQ_FE	.2182	-.2182	.0364	.1636	-.0137	.8929**
NONDQPHR	.2117	-.2320	-.0490	.2333	-.3348*	-.0853
TOTQPHR	-.0651	.0085	-.0470	.0236	-.2784	.8323**
INTERUPH	.1828	.1166	-.2362	.2571	-.4455**	.1886
INTERRUP	.1444	-.1206	-.0039	.0826	.2730	-.0434
INTER_UN	.0721	.0834	.0104	-.0265	.0591	.0306
VSEGPERH	-.1160	.1997	-.2259	.1696	-.2053	-.0892
AVSEGDUR	.1682	-.1189	-.0347	.0438	.1527	-.2248
SC_ACTIV	-.0751	.2566	.2384	-.3834*	-.5495**	-.0005
SC_CONT	-.1208	.1880	.4032*	-.5208**	-.3985*	.2264
CAPART	-.0852	.1396	-.0011	-.0567	-.5008**	.2575
FOPART	.0128	.2593	-.0713	-.0540	-.6163**	.0007
FEPART	-.1182	.6455*	-.0455	-.1818	-.5890	-.4146
CREWPART	.0548	.4037*	-.1013	-.0775	-.8224**	.0844
CREWPOS	-.0097	.1653	.1335	-.2730	-.0214	.2161
CREWNEIM	.1506	-.1754	-.0361	.1650	-.0854	.0673
CREWNEG	.4016*	-.0005	-.2212	.2685	-.1441	.0793
CREWIMPR	-.1407	-.1784	.1138	.0098	-.1738	.1094
CREWNEUT	.1253	.0982	.0338	-.1251	-.0099	.3613*
CREWPERF	.1364	-.0906	.1282	-.1516	.1759	.3697*
CREWCRM	-.5138**	-.0223	.7012**	-.8040**	.1719	.1765
CREWTECH	.3043	-.0330	-.6964**	.8428**	-.2321	-.1464
CREWMIX	.6835**	-.0656	-.2421	.2794	-.1159	-.0233
CREWNS	-.0173	.2175	-.4008*	.4073*	-.1866	-.1524
CREWCRM2	-.4270**	-.0340	.7229**	-.8393**	.1910	.2341
CREWTEC2	.6020**	-.0504	-.6989**	.8218**	-.1901	-.1454
CAWPERES	-.0462	-.0077	.3974*	-.4277**	.0782	-.0207
FOWPERES	.1025	-.1842	.3211	-.2528	.3306*	-.0323
FEWPERES	.0776	-.0183	-.1005	-.1553	.6284*	-.0023
CREWPERE	.0866	-.1152	.4146*	-.3739*	.2045	-.0503
CAWPERUT	-.0023	-.0213	.5040**	-.5465**	.0549	-.0512
FOWPERUT	.1364	-.1145	.2585	-.2514	.1146	.1092
FEWPERUT	-.1279	.1370	.2420	-.5160	.2729	-.4005
CREWPERU	.1137	-.0985	.4534**	-.4710**	.0778	.0692
CASIUTPH	.0401	.1305	-.0304	.0098	-.5240**	.0266
FOSIUTPH	.0974	.1331	-.1201	.0841	-.6328**	-.0225
FESIUTPH	-.1273	.6182*	.0818	-.2909	-.6986*	-.4966
CREWSIUT	.1340	.2529	-.1110	.0185	-.6909**	-.0195
CANALUTT	.0683	.1104	.0992	-.1648	-.2805	.3096
FOANALUT	-.1979	.1203	.3227	-.4267**	-.1776	-.0723
FEANALUT	.0592	.2323	-.0820	-.0501	-.1602	-.1096
CREWANUT	-.0271	.2712	.1981	-.3562*	-.4140*	.1566
CREWPAQP	.1144	.2621	-.3015	.2486	-.4976**	.0693
FOPAQPH	.1815	.2507	-.1826	.0942	-.3522*	-.0899
FEPAQPH	.0621	.2246	-.0669	.1243	-.4465	.4599
CAPAQPH	.0439	.0596	-.2226	.2924	-.3005	.0843
NONDQ_CA	.1291	.0712	.0551	-.1368	.0440	-.0204
NONDQ_FO	-.2275	.3705*	-.1630	-.0709	-.2660	-.0180
NONDQ_FE	-.3357	.5977	-.0230	-.1241	-.8291**	-.4032
NONDQ_NO	.3969*	-.2624	-.0928	.3077	-.0043	-.0843

	IPMIXED	IPNS	IPCRM2	IPTECH2	IPWPERUT	DIRQPHR

IPDQ_FO	.6965**					
IPDQ_FE	.7000*	.6758*				
NONDQPHR	-.0822	-.0429	.5182			
TOTQPHR	.8065**	.7103**	.7882**	.4033*		
INTERUPH	.1526	.2137	.3326	.2721	.1747	
INTERRUP	-.0574	.0392	-.3158	-.1675	-.1740	.5489**
INTER_UN	-.0085	.0012	-.1545	-.1207	-.0769	.4477**
VSEGPERH	-.1754	-.0553	.1905	.0223	-.1664	-.0990
AVSEGDUR	-.1589	-.3120	-.4048	.0580	-.1140	-.0009
SC_ACTIV	-.0505	.1382	-.3052	.0945	.0226	.3627*
SC_CONT	.1390	.3184	.1327	.0543	.2088	.2207
CAPART	.2603	.2887	.2096	.0612	.2807	.3854*
FOPART	-.0130	.1481	-.3387	.2553	.1047	.3439*
FEPART	-.4091	-.3014	-.1000	-.1545	-.3554	-.2688
CREWPART	.0190	.1232	-.3098	.2332	.1337	.4461**
CREWPOS	.1835	.0875	.2870	-.0472	.2252	-.2244
CREWNEIM	.1062	.0649	.2648	.1392	.0643	.3196
CREWNEG	.1130	.0891	.0412	.1321	.0476	.5059**
CREWIMPR	.1148	.0868	.3494	.1930	.1586	.1754
CREWNEUT	.3054	.1948	.3273	-.1349	.1995	.1746
CREWPERF	.3569*	.1768	.5740	-.1032	.2523	-.0524
CREWCRM	.1049	.3269	-.3091	-.2851	.0848	-.3296*
CREWTECH	-.0692	-.1674	.2700	.3752*	.0605	.3402*
CREWMIX	-.0359	-.2937	.3059	.3474*	.0995	.1304
CREWNS	-.0874	-.1375	-.2597	-.1177	-.2723	.3067
CREWCRM2	.1440	.3307*	-.2091	-.2543	.1343	-.3424*
CREWTEC2	-.0868	-.3055	.3091	.4108*	.0484	.3145
CAWPERES	-.0904	.1120	-.2415	-.3855*	-.1958	.0102
FOWPERES	.0128	-.0950	-.2727	-.1095	-.1053	-.1297
FEWPERES	-.1096	-.0734	-.0548	-.3607	-.1190	-.3959
CREWPERE	-.0751	.0597	-.1913	-.2408	-.1703	-.0074
CAWPERUT	-.1298	.0889	-.2055	-.3247	-.1865	-.0418
FOWPERUT	.0859	.0815	-.2014	-.0636	.0695	.0593
FEWPERUT	-.4429	-.3991	-.2877	-.7078*	-.6110*	-.3730
CREWPERU	.0121	.1741	-.1868	-.1617	.0113	.0181
CASIUTPH	-.0330	.1082	.2273	.1537	.0264	.7105**
FOSIUTPH	-.0399	.0873	-.2455	.2911	.0864	.6107**
FESIUTPH	-.4273	-.2968	-.3818	-.2455	-.4510	-.1048
CREWSIUT	-.0781	.0410	-.3182	.2012	-.0106	.6982**
CANALUTT	.2972	.2892	.2364	-.0207	.2105	.4750**
FOANALUT	-.0647	.0747	-.5182	.0869	-.0507	.1089
FEANALUT	-.2642	-.1442	-.0410	-.1321	-.0799	-.6027*
CREWANUT	.1295	.1897	-.2460	.0678	.1004	.3381*
CREWPAQP	.0207	.1285	.3781	.2390	.1102	.5028**
FOPAQPH	-.0733	-.0120	.1535	.3106	.0572	.1058
FEPAQPH	.5592	.4441	.5879	.5448	.4551	.7712**
CAPAQPH	.0607	.1576	.3964	.0933	.0813	.6262**
NONDQ_CA	-.0318	-.0236	-.2460	-.0244	-.0816	-.0307
NONDQ_FO	.0554	-.0543	-.1150	.1036	.0222	.0410
NONDQ_FE	-.3265	-.0762	-.2437	.1058	-.1429	-.1313
NONDQ_NO	-.0608	-.1619	.1169	.3255	.1145	.1569

	IPDQ_CA	IPDQ_FO	IPDQ_FE	NONDQPHR	TOTQPHR	INTERUPH

INTER_UN	.8014**					
VSEGPERH	-.2676	-.1850				
AVSEGDUR	.2395	.2375	-.7074**			
SC_ACTIV	.1082	.2726	-.0797	-.0789		
SC_CONT	.0924	.2679	-.1552	-.1150	.8721**	
CAPART	-.0580	-.0335	-.0108	-.2827	.6260**	.5476**
FOPART	-.0394	.0800	.0895	-.2717	.7127**	.5029**
FEPART	-.6133*	-.4000	.3571	-.0476	.5923	.1785
CREWPART	-.1159	.1164	.0570	-.1767	.8434**	.6696**
CREWPOS	-.2554	-.1824	-.1432	-.1782	.1422	.3660*
CREWNEIM	.1363	.1139	-.0139	.1367	.1125	.1332
CREWNEG	.3070	.2169	-.1471	.2419	.0835	.0752
CREWIMPR	-.0601	.0180	.1798	-.0492	.1539	.1793
CREWNEUT	.1775	.2952	-.2334	.2762	.1257	.2030
CREWPERF	-.0168	.0460	-.1963	.2906	.0176	.2342
CREWCRM	-.0435	.0938	-.0303	-.1744	.3440*	.5645**
CREWTECH	-.0010	-.1514	.2469	-.0627	-.2718	-.4695**
CREWMIX	-.0572	.0134	-.3908*	.5376**	-.0786	-.1672
CREWNS	.2006	.0991	.0099	.0089	-.1148	-.2475
CREWCRM2	-.0612	.0874	-.1198	-.0889	.3181	.5539**
CREWTEC2	-.0070	-.1106	.0533	.1903	-.2868	-.4932**
CAWPERES	.2194	.2232	-.1251	-.3597	.5312**	.5860**
FOWPERES	.1552	.1904	.0432	-.1932	.1740	.2191
FEWPERES	.3218	.4703	.6946	-.5030	.3364	.2828
CREWPERE	.2365	.2198	-.0769	-.3119	.4472**	.5037**
CAWPERUT	.1056	.1748	-.1736	-.2671	.5783**	.5990**
FOWPERUT	.1680	.2622	-.1310	-.1743	.3940*	.3836*
FEWPERUT	.0115	.2466	.8796**	-.6506	.5904	.2276
CREWPERU	.1161	.1681	-.1923	-.2460	.5690**	.5787**
CASIUTPH	.2080	.1783	.0469	-.0321	.6359**	.4261**
FOSIUTPH	.1314	.1444	-.0409	-.1349	.6923**	.4471**
FESIUTPH	-.5584	-.5818	.3333	-.0476	.6560*	.3524
CREWSIUT	.1439	.1883	.0041	-.0496	.7628**	.5138**
CANALUTT	.1757	.1688	-.1895	.0407	.6313**	.6498**
FOANALUT	.0978	.3084	-.3010	.2060	.6382**	.5990**
FEANALUT	-.3601	-.1185	.4671	-.1198	.4886	.4060
CREWANUT	.0731	.2291	-.2420	.1195	.8035**	.8045**
CREWPAQP	-.0599	-.0245	.2674	-.1392	.1068	-.1192
FOPAQPH	-.3475*	-.1933	.3556	-.1745	.0619	-.1502
FEPAQPH	-.3032	-.3776	-.1909	-.0273	-.2922	-.1227
CAPAQPH	.2510	.1216	.0721	-.1327	.0326	-.1494
NONDQ_CA	-.1616	-.1305	.1983	-.3035	.0102	.0021
NONDQ_FO	-.1619	-.0294	-.0322	.0055	.0931	-.0482
NONDQ_FE	-.6644*	-.7587**	-.2684	.2684	.4263	.1528
NONDQ_NO	.2396	.2121	-.1900	.3059	.0276	.0508
	INTERRUP	INTER_UN	VSEGPERH	AVSEGDUR	SC_ACTIV	SC_CONT

FOPART	.3255					
FEPART	-.0228	.6819*				
CREWPART	.6175**	.8274**	.7563**			
CREWPOS	.1541	.0063	.1139	.1535		
CREWNEIM	.0034	.0062	-.7854**	.0529	-.2434	
CREWNEG	-.0284	.0652	-.4623	.0955	-.3064	.8433**
CREWIMPR	.0794	.0510	-.3632	.1046	-.1589	.8195**
CREWNEUT	-.1238	.1549	.2182	.1374	.0137	.0198
CREWPERF	-.2213	-.1263	-.0319	-.0871	.2930	.3932*
CREWCRM	.0976	.0121	.1091	.0323	.3686*	-.0665
CREWTECH	.0902	-.0127	-.2838	.0107	-.1637	.1391
CREWMIX	-.1222	.0279	.0913	.0919	-.1653	-.0859
CREWNS	.0341	-.0528	.0000	.0139	-.3955*	.2562
CREWCRM2	.0365	.0124	.2091	.0203	.3909*	-.1425
CREWTEC2	-.0055	-.0161	-.1455	.0179	-.2244	.0368
CAWPERES	.3525*	.2718	-.0228	.3074	.3896*	-.1088
FOWPERES	-.2118	.2142	-.1091	-.0232	.0705	.0747
FEWPERES	-.1465	.2046	.0274	-.0801	.0000	.0734
CREWPERE	.1102	.3000	-.0774	.1855	.2418	.0634
CAWPERUT	.4544**	.2247	.2146	.3662*	.3275	-.2040
FOWPERUT	.0939	.4415**	-.1236	.2793	.1550	-.0184
FEWPERUT	-.1281	.3793	.4429	.2265	-.0435	-.2890
CREWPERU	.3031	.4420**	.1230	.3730*	.3090	-.1214
CASIUTPH	.7339**	.3639*	-.0727	.6380**	-.1266	.2069
FOSIUTPH	.4726**	.8953**	.4000	.8284**	-.0610	.1006
FESIUTPH	.3007	.5401	.7909**	.7882**	.1503	-.6667*
CREWSIUT	.6350**	.6784**	.3545	.8730**	-.0416	.1731
CANALUTT	.5414**	.3437*	.1727	.5082**	.2672	.2190
FOANALUT	.0162	.5989**	.3182	.4700**	.0817	.1647
FEANALUT	.1826	.2156	.5421	.4384	.2283	-.3936
CREWANUT	.3919*	.5782**	.5148	.7048**	.3030	.1725
CREWPAQP	.3276	.1419	.2369	.3396*	-.3869*	.1669
FOPAQPH	.0912	.1993	.5397	.2512	-.2738	.2214
FEPAQPH	.0719	-.0048	.1434	-.0575	.0024	.1032
CAPAQPH	.3555*	.0349	-.2192	.1782	-.3845*	.0684
NONDQ_CA	.0156	.1164	.0182	.0824	.0364	-.0861
NONDQ_FO	-.0820	.3578*	.6069*	.1909	-.0781	-.2676
NONDQ_FE	.2742	.6412*	.6299*	.8341**	.3433	-.8430**
NONDQ_NO	-.0800	-.1155	-.2150	-.0312	.0158	.4074*

	CAPART	FOPART	FEPART	CREWPART	CREWPOS	CREWNEIM

CREWIMPR	.4525**					
CREWNEUT	.0920	-.0034				
CREWPERF	.2573	.3405*	.6928**			
CREWCRM	-.2761	.0930	.0133	.2389		
CREWTECH	.1986	.0660	-.2862	-.2879	-.7663**	
CREWMIX	.1354	-.1806	.3615*	.1431	-.5470**	.1328
CREWNS	.3938*	.0780	-.2160	-.3571*	-.5080**	.3962*
CREWCRM2	-.3159	.0181	.1339	.3166	.9637**	-.8524**
CREWTEC2	.1955	-.0665	-.0144	-.1558	-.9191**	.8407**
CAWPERES	-.1432	-.1435	-.0413	-.0362	.4524**	-.4058*
FOWPERES	.0000	-.0111	.2657	.2887	.2003	-.4171*
FEWPERES	-.1333	.0300	.6347*	.5606	.3196	-.2874
CREWPERE	.0296	-.0659	.1153	.1541	.3461*	-.4188*
CAWPERUT	-.1893	-.2439	.0172	-.0827	.5069**	-.5256**
FOWPERUT	-.0444	-.0855	.5080**	.3274	.2085	-.3552*
FEWPERUT	-.3034	-.1640	.4338	.2265	.4977	-.7655**
CREWPERU	-.0992	-.1938	.3139	.1777	.4087*	-.4951**
CASIUTPH	.2600	.1634	.1051	-.1070	-.0966	.1821
FOSIUTPH	.1781	.1182	.1292	-.1628	-.1221	.1704
FESIUTPH	-.3844	-.3265	.0091	-.1913	.2364	-.3341
CREWSIUT	.2564	.1454	.1904	-.0842	-.1183	.1497
CANALUTT	.2187	.1127	.4015*	.4444**	.1691	-.1179
FOANALUT	.0722	.2119	.2646	.2536	.3994*	-.4353**
FEANALUT	-.5138	.1613	.0911	.1963	.1913	-.0642
CREWANUT	.1444	.1754	.3957*	.3909*	.3037	-.3204
CREWPAQP	.2777	.0720	.0184	-.2349	-.4420**	.4059*
FOPAQPH	.2768	.1393	.0295	-.1080	-.3247	.2516
FEPAQPH	.2960	.0387	.0812	.1485	-.3393	.1059
CAPAQPH	.2531	-.0825	-.0182	-.3302*	-.4381**	.4343**
NONDQ_CA	-.0677	-.0230	-.1597	-.1131	.0859	-.2083
NONDQ_FO	-.1979	-.1318	-.0403	-.2170	-.0811	-.0183
NONDQ_FE	-.5116	-.4163	-.1333	-.4608	.0782	.1782
NONDQ_NO	.4496**	.2232	.0068	.1625	-.2793	.3743*

	CREWNEG	CREWIMPR	CREWNEUT	CREWPERF	CREWCRM	CREWTECH

CREWNS	-.1818					
CREWCRM2	-.3582*	-.6272**				
CREWTEC2	.6201**	.2307	-.8805**			
CAWPERES	-.3014	-.1795	.4477**	-.4447**		
FOWPERES	.0687	-.3072	.2841	-.2644	.4144*	
FEWPERES	-.3211	-.3227	.2329	-.3196	.3570	.7489**
CREWPERE	-.1563	-.2041	.3762*	-.3872*	.8480**	.7899**
CAWPERUT	-.1737	-.2041	.5203**	-.4900**	.8735**	.3000
FOWPERUT	.1697	-.4285**	.2988	-.1594	.5123**	.7613**
FEWPERUT	-.2523	-.4302	.5708	-.5525	.5881	.6210*
CREWPERU	.0220	-.4185*	.4775**	-.3633*	.7810**	.6157**
CASIUTPH	.0425	.1557	-.1445	.1454	.1370	-.1717
FOSIUTPH	.0749	.0789	-.1431	.1476	.2505	.0304
FESIUTPH	-.0411	-.1048	.3273	-.2000	.0683	-.2818
CREWSIUT	.1412	.1161	-.1404	.1646	.2152	-.0971
CANALUTT	.0204	-.1672	.1857	-.1102	.3701*	.2277
FOANALUT	-.0517	-.2862	.4288**	-.3829*	.3310*	.4301**
FEANALUT	-.0664	-.2557	.1822	-.1367	.0183	-.0410
CREWANUT	.0495	-.2219	.3398*	-.2571	.3776*	.2591
CREWPAQP	.1798	.3765*	-.4867**	.4156*	-.2774	-.3370*
FOPAQPH	.2110	.1988	-.3534*	.2961	-.3330*	-.1627
FEPAQPH	.3145	.1269	-.2246	.2915	-.4407	-.4588
CAPAQPH	.0559	.4428**	-.4932**	.3926*	-.1299	-.2885
NONDQ_CA	.1978	-.3828*	.1735	-.0355	.1863	.2070
NONDQ_FO	-.0074	.0982	-.0724	-.0115	-.1763	-.0918
NONDQ_FE	-.0901	.2097	.0782	-.0460	-.1244	-.5472
NONDQ_NO	.2194	.2285	-.3275	.3317*	-.0552	-.0090

	CREWMIX	CREWNS	CREWCRM2	CREWTEC2	CAWPERES	FOWPERES
CREWPERE	.7368**					
CAWPERUT	.4381	.7063**				
FOWPERUT	.7218*	.7192**	.4735**			
FEWPERUT	.6858*	.7643**	.6560*	.6345*		
CREWPERU	.6087*	.8377**	.8217**	.8458**	.7895**	
CASIUTPH	-.0594	.0372	.2816	.0924	-.0046	.2033
FOSIUTPH	-.0365	.1993	.2065	.3442*	.1096	.3530*
FESIUTPH	-.1872	-.1913	.2648	-.2746	.2831	.0501
CREWSIUT	-.0137	.1073	.3054	.2351	.2146	.3018
CANALUTT	.1187	.3895*	.3482*	.3942*	.1096	.4741**
FOANALUT	.2648	.4293**	.2822	.4693**	.4566	.4557**
FEANALUT	.3638	-.0753	.2449	-.1376	.2494	-.0365
CREWANUT	.2014	.3763*	.3896*	.4001*	.2700	.4802**
CREWPAQP	-.4348	-.2973	-.1309	-.1339	-.1190	-.1717
FOPAQPH	-.1122	-.2273	-.1310	-.0217	.2173	-.0631
FEPAQPH	-.5497	-.4527	-.4705	-.4692	-.3433	-.3736
CAPAQPH	-.5247	-.1877	-.0598	-.1218	-.3115	-.1341
NONDQ_CA	-.2769	.1373	.1553	.1743	.1808	.1770
NONDQ_FO	-.3995	-.2019	-.2266	-.1606	.0554	-.1739
NONDQ_FE	-.4411	-.4539	.0485	-.4074	-.1940	-.1797
NONDQ_NO	.3780	.0693	-.1094	-.0776	-.1385	-.0717

	FEWPERES	CREWPERE	CAWPERUT	FOWPERUT	FEWPERUT	CREWPERU

FOSIUTPH	.5963**					
FESIUTPH	.2455	.3545				
CREWSIUT	.8774**	.8464**	.7000*			
CANALUTT	.5834**	.4245**	.3727	.5705**		
FOANALUT	.1434	.4445**	.2000	.3451*	.3581*	
FEANALUT	-.0911	-.0456	.4875	.1777	.1458	.0319
CREWANUT	.4684**	.5389**	.6150*	.6349**	.8049**	.7468**
CREWPAQP	.5562**	.2674	.1822	.4825**	.0457	-.1936
FOPAQPH	.2074	.1205	.4001	.2401	-.0698	-.0980
FEPAQPH	.2820	.1051	.0526	-.0239	.2198	-.1816
CAPAQPH	.6022**	.2624	-.1772	.4296**	.0423	-.2631
NONDQ_CA	-.1254	.0434	.3645	.0161	-.0218	.1483
NONDQ_FO	-.1009	.2204	.3724	.0338	-.0807	.3146
NONDQ_FE	.1012	.6575*	.6851*	.5472	.1517	.1379
NONDQ_NO	.0208	-.0185	-.3693	.0053	.1047	-.1515

	CASIUTPH	FOSIUTPH	FESIUTPH	CREWSIUT	CANALUTT	FOANALUT
CREWANUT	.4429					
CREWPAQP	-.3881	-.0540				
FOPAQPH	-.0676	-.0662	.7407**			
FEPAQPH	-.4096	-.0862	.7329*	.4329		
CAPAQPH	-.7455**	-.1564	.8281**	.3531*	.7159*	
NONDQ_CA	-.1461	.1017	-.0536	.0445	.2251	-.1750
NONDQ_FO	-.0207	.0985	.1169	.1758	.4230	-.0020
NONDQ_FE	.2765	.4194	.1290	.2871	.1039	-.1297
NONDQ_NO	.3397	-.0197	-.0156	.0743	-.4866	.0003

	FEANALUT	CREWANUT	CREWPAQP	FOPAQPH	FEPAQPH	CAPAQPH
NONDQ_FO	.1322					
NONDQ_FE	-.1590	.4884				
NONDQ_NO	-.4557**	-.3257	-.2601			

	NONDQ_CA	NONDQ_FO	NONDQ_FE

* - Signif. LE .05 ** - Signif. LE .01 (2-tailed)

" . " is printed if a coefficient cannot be computed

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	March 1997	Technical Memorandum

4. TITLE AND SUBTITLE

LOFT Debriefings: An Analysis of Instructor Techniques and Crew Participation

5. FUNDING NUMBERS

505-64-13-48-01

6. AUTHOR(S)

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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Ames Research Center
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8. PERFORMING ORGANIZATION REPORT NUMBER

A-976212

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

National Aeronautics and Space Administration
Washington, DC 20546-0001

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

NASA TM-110442
DOT/FAA/AR-96/122

11. SUPPLEMENTARY NOTES

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12a. DISTRIBUTION/AVAILABILITY STATEMENT

Unclassified-Unlimited
Subject Category–03

12b. DISTRIBUTION CODE

13. ABSTRACT ***(Maximum 200 words)***

This study analyzes techniques instructors use to facilitate crew analysis and evaluation of their LOFT performance. A rating instrument called the Debriefing Assessment Battery (DAB) was developed which enables raters to reliably assess instructor facilitation techniques and characterize crew participation. Thirty-six debriefing sessions conducted at five U.S. airlines were analyzed to determine the nature of instructor facilitation and crew participation. Ratings obtained using the DAB corresponded closely with descriptive measures of instructor and crew performance. The data provide empirical evidence that facilitation can be an effective tool for increasing the depth of crew participation and self-analysis of CRM performance. Instructor facilitation skill varied dramatically, suggesting a need for more concrete hands-on training in facilitation techniques. Crews were responsive but fell short of actively leading their own debriefings. Ways to improve debriefing effectiveness are suggested.

14. SUBJECT TERMS	15. NUMBER OF PAGES
LOFT Debriefing, LOS, Facilitation, CRM, Training	92
	16. PRICE CODE: AFO

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified		