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AEROSPACE SESSIONS

WHAT MANAGEMENT HAS LEARNED

By JOHN R. WELTY
Ass't. Gen. Mgr., Semiconductor Products Div., Motorola, Inc., Phoenix, Ariz.

W. C. Moser, of the duPont Company, has described three separate considerations which make safety an important matter for the industrial manager: philosophical, economical, and organizational.

The first and most important consideration is philosophical. Safety is important because it is right. It is humane, ethical, and entirely consistent with our Judaeo-Christian heritage. We ask for, and expect, the loyalty and dedication of the individual employee. We can do no less than return to him a thoughtful concern for his safety and well-being. Paul Galvin, who founded Motorola, was a pioneer in the belief that the success of the corporation is based upon the success of many individuals in the organization. That the individual is important. That he will be considered and dealt with as an individual. Nowhere is this direct dealing concept more important than in our safety program. People are not thought of as a commodity, nor are they, in any sense, expendable.

Economically, safety programs are probably the best bargain on the American industrial scene. It is possible to demonstrate that modest investments in safety pay large dividends. As a matter of fact, safety is so profitable that I submit that its profitability is actually played down for fear that management's motives will be questioned. We would, at times, almost like to think that safety programs are very expensive, so that we could feel more altruistic about supporting them. I do not personally hold with this position. I believe safety programs are too important to gamble on their acceptance; and I want to use every form of justification available. Often, the full acceptance and whole-hearted cooperation of a particular individual or group in a safety program depends upon the answer to the selfish question, "What's in it for me?"

In what specific ways do safety programs save money? There is the direct savings in lost time and compensation payments to injured employees. There are the more subtle savings to be realized from improved morale, housekeeping, and productivity that are usually attendant to a comprehensive safety program.

The organizational considerations are, in many ways, the most significant. Peter Drucker, noted business writer, says that the only valid purpose of a business is to find a customer and to serve his needs. In order to adequately serve his needs, the organization must acquire discipline and responsibility. Each individual must accept his responsibility to serve the customer.

The plant safety program may be the first and best vehicle for promoting the kind of individual responsibility of which we speak. There are a large number of employee motivation programs extant in American industry today of the Pride, or Zero Defect, type. They suggest that it is possible to perform a series of very complex operations without making any mistakes, if the employee is motivated to think of perfect work as the normal standard of performance. Upon reflection, we must concede that this is a direct steal from the safety engineer, who has been insisting on this for years.

Feedback, or measurement of the efficiency of a particular organizational unit, is sometimes easier in the safety domain. Measurements of performance in the profit and loss statement is sometimes difficult because of the existence of direct and indirect costs for which the individual manager is not directly responsible. There are also continuing compromises between quality and cost. We say the production line must be able to produce a quality product, but always at what the customer considers a reasonable price. Even profit is a difficult criteria to apply to performance because a particular procedure may not improve profit for the short term, but may very well be the correct procedure for the longer term. We could all improve profits on the short term by

eliminating research and development, or cutting down on marketing, but none of us believe we could prosper in the future by following such a course of action. Only in the safety area is it possible to make uncompromising statements of purpose.

A president of duPont charged his managers as follows: "There is no consideration, however major, that can be permitted to outweigh personal injury, however minor." When he is charged in this way, a supervisor or manager can be measured directly by the accident rate. It is interesting to note that the steps he takes to reduce accidents are the same steps he takes to accomplish any other task in his area of responsibility. Thus, his department's safety record can be considered an accurate figure of merit of his managerial capability.

Another important aspect of a safety program is as a communications vehicle. Gellerman, in his book *Motivation and Productivity*, describes in some detail the breakthrough in human relations which occurred at the Hawthorne Works of the Western Electric Company in Chicago about 1927. It began with a set of fairly routine experiments to increase production by means of better illumination. Using standard experimental procedures, they varied the light level in several rooms, recording the output or productivity as a function of illumination level. In one room, they maintained a control where the illumination was not changed. The results were quite surprising. In every room production went up, whether the light was bright, dim, or constant. At this point, a group of researchers from the Harvard Graduate School of Business Administration under Mayo were called in to investigate the rise in productivity.

As they waded through the morass of factors that could have caused the rise, they soon left illumination behind. However, they used the same experimental method; this time using rest periods and the length of the work day as the variable. In an effort to eliminate the personal feelings of the employees or their motivation, all of the groups were briefed thoroughly on the experiments; specifically, the permission of the employees involved was obtained before the experiments began. Again, production soared, without any relation between rest periods or length of work day. Clearly, whatever was causing the spurt in production was not being held constant despite efforts to control everything but the length of the rest periods and the work day. In explanation, Gellerman writes: "By singling a few workers out from many to participate in an experiment, the Mayo Group had given them a sort of elite feeling among themselves; when this was compounded by giving them control (through assent) of their own work day morale soared, and production with it. The evidence was beginning to mount . . . in other words, in 'treating workers like human beings,' allowing them to coalesce into natural groups and relieving these groups of impersonal controls, motives were being harnessed which could improve production dramatically."

This is very powerful stuff. When the employee feels that he is being consulted and asked for his opinion on matters relating to the conduct of the business, he is powerfully motivated to identify himself strongly with the purpose of the enterprise. It is sometimes not feasible to consult with the individual line employee when complex technical procedures are involved. It is, however, true that the safety program offers a marvelous opportunity for cooperative discussion between the management and the employee aimed at solving common problems. Our experience is that the improvement in morale and motivation carries over into all aspects of the employee's relationship to the organization. Thus, the safety program, in addition to being an end in itself, also serves as a vehicle for accomplishing other desirable ends.

In spite of the foregoing, we still occasionally encounter the attitude that safety rules and safe procedures get in the way of efficient production. Why this attitude, and on what is it based?

It seems to me that the attitude almost always stems from a failure of the top management of the enterprise to make quite clear, as did the president of duPont, the exact position which the organization has taken on safety. Too many people give only lip service to safety. Safety programs are subordinated to other organizational activities. Too often, on a priority basis, we assume that safety and productivity are somehow at odds. We don't have to make a choice between safety and productivity because the most productive operations are,

in the final analysis, the safest operations. It is possible to have our cake, and eat it, too!

Much of the problem in attitudes toward safety stem from the nature of accidents themselves. With few exceptions, an accident results from some departure from normal procedure due to carelessness of an individual. It is so easy for us to mentally transfer the blame or the responsibility for the accident to this individual and to quickly relieve ourselves of a sense of responsibility for the accident. The safety man is the particular individual in the system who will not permit me to slough off my responsibility. He keeps reminding me that my inaction a month ago led to an accident yesterday. In a sense, he is the conscience of the organization. Did you ever encounter anyone who had a well-developed affection for his conscience? The ultimate solution to this general problem lies in developing a well thought out philosophy of safety and then implementing it throughout the organization. Nowhere is there as much hypocrisy at work as in our attitudes toward safety. We say, "Safety first," but we act as if we mean "Safety first—when convenient." If the employees do not believe us in our pronouncements on safety, they are not apt to believe any of our other pronouncements.

In summary, some of the things we have learned in the 'Sixties are:

1. That management has a very important responsibility to the safety organization.

2. That the safety organization must report at a high enough level in the organization to provide the visible evidence that management regards it as an important function.

3. A well-organized safety program actively supported by management will result in a definite production and profit increase.

4. Safety engineering should be more involved in the technical aspects of new experimental programs, new processes, new chemicals, new automated equipment, and new fail-safe devices.

5. The concept "remove the hazard rather than emphasize personnel protective equipment" provides permanent safety independent of employee error.

6. Safety engineering must assume "Murphy's Law"—"If it can happen, it *will* happen." Only with this attitude will the proper safeguards be designed into all processes.

7. Supervision must accept the responsibility for the safety and conduct of their subordinates.

It seems to me that at the heart of the problem is one word—"integrity." We must conduct ourselves with integrity when dealing with people—customers, competitors and, especially, other members of the production team.

ENLIGHTENED SAFETY MANAGEMENT IN THE SIXTIES

By J. E. GREER
Director, Chemical Propulsion Div., Hercules Inc., Wilmington, Del.

In the late 1950's, the Chemical Propulsion Division of Hercules Incorporated expanded its activities in the propulsion field at its Bacchus Works, Magna, Utah. A new plant was built, programs were defined, departments were staffed, and personnel began the task of designing, developing, and producing rocket motors with new propellant compositions of greater energy levels than previously used. The best talents within the company were assembled to accomplish this job. For the first two years, there was no doubt in minds of people who establish managerial and corporate policy that our plans included an outstanding safety program. This was substantiated by the safety statistics.

However, in 1962 two very serious and destructive mishaps occurred within sixty days at the Bacchus Works. These were two explosions within operating buildings. They occurred during the period when the plant was attempting to scale up research and development programs for production. The incidents raised a serious question of our capability of handling sensitive materials on a production basis and threatened to delay the entire program. Investigating teams, which included the Air Force, Navy, and Hercules personnel, studied both incidents in minute detail, documented their findings, and published their reports.

The company's concern about preventing such incidents in the future prompted an internal investigation effort whose scope and intensity went far beyond any known precedents. The Hercules investigation activity continued for quite a period of time after all other review teams had completed their work.

Their report showed that corrective action and redirection of effort was basic to strengthening safety practices in certain areas. The areas of concern were: management's effectiveness in the implementation of plant safety programs; engineering, with emphasis on safety in equipment design and equipment utilization; maintaining effective safety programs in production operations. As a result, a top management task force was put together to review and analyze these areas in minute detail and to establish procedures to correct the deficiencies. The task force identified four major needs or weaknesses in our system. These were a lack of: (1) a clear definition of a plant safety program; (2) a systems engineering approach to identify modes of failure in a process; (3) a Standards Program for Plant Operation; a program for auditing the plant against those standards.

Let's review each of these points.

1. A clear definition of a safety program, its organization, and its functions. One aspect of a management/safety organization relationship is often completely overlooked. This is the appreciable difference between setting up an organization and getting it to operate at maximum effectiveness. It requires no great amount of management skill to hire people and place these people into preconceived niches in an organization chart. It is quite another thing to get this group of people to function as an effective team and to effectively carry out a defined plant safety program while properly performing their other assigned duties. The definition of who or what department is responsible for carrying out a particular function, or a particular program, which represents even a tiny segment of that total safety program must be made. The manner in which this matrix is defined and put together within the plant is a key to being effective in any safety program. Then, take the same organization—forget about the bodies—and define what we want from each department within that organization in order to carry out the safety program. For each department or group you would spell out its responsibility for its segment of the overall safety program. Such a chart can graphically show the safety program, how it is organized, and how it functions. It identifies the safety responsibilities of each group or department.

When such programs are defined and reduced to writing, management and employees at all levels have the basis for an overall understanding of the program; a basis for program review and audit; and a capability to identify its weak and its strong points, as well as the costs involved.

2. A systems engineering approach to identification modes of failure in a process. This is sometimes called hazards analysis. Any piece of equipment which is used for the processing of sensitive and hazardous material must be designed with knowledge and thoroughness that go far beyond the conventional aspects of facilities engineering. Years of engineering experience is not sufficient justification for assuming an engineer can design this type of equipment safely.

The aspect of equipment design as it relates to sensitivity, stability, compatibility, and toxicity of sensitive ingredients must be thoroughly understood by the design engineer. A systematic method of evaluating process hazards has been developed by Hercules. It emphasizes the quantitative assessment of process conditions in engineering terms. In the past, the probable presence of hazards has been predicted on the basis of experience; that is, a new or modified material is compared to a standard material selected either arbitrarily or because it represents some experience in a given process. This method has obvious pitfalls.

Most of the materials to be processed can be hazardous in a given situation. The problem becomes one of: (1) defining the degree of hazard; (2) determining if the precautions to prevent initiation or explosion are sufficient; (3) determining whether the protection of personnel and facilities is adequate. All of these considerations then must be balanced against the original justification for introducing the material or process, whether for reasons of economy, quality, or performance.

Catastrophic incidents, unnecessary and costly precautions, or the rejection of a material or process because of a company's inability to properly assess suspected hazards, places a company in an untenable position. Hercules takes the position that these probabilities must and, in fact, can be determined through a systems engineering approach to identify potential modes of failure in a process.

3. The need to establish a standards program for plant operators. Good safety records can only be obtained through a constant vigilance of the total program and an awareness by all employees of the requirements for performing their unit of work. A comprehensive system of safety standards has been developed for the Chemical Propulsion Division. These standards cover all phases of propellant manufacture, handling, and storage. The system also contains minimum standards for training, facility and tooling design, scheduling, operating procedures, and personnel and explosive limits. These standards exceed normal requirements in establishing safety criteria or specifications and are designed to promote awareness, discipline, and self-evaluation at plant and worker level. They are published and are available at all plants. They can only be departed from after a careful review and evaluation of the possible results by a competent review team.

4. The need to provide a program for auditing the plant against those standards by a top management team. With the establishment of the standards, an intensive program for monitoring the standards and the overall safety program by the corporate office was also established. We recognize the time and the costs involved in development and maintenance of a standards program and we insist that this program be followed.

It is not uncommon to encounter personnel who consider the words "safety standards and audit" synonymous with "increase in cost." Often there are indications of overzealous "safety specialists" who create monstrous and expensive paper mills. However, a piece of paper that performs an essential function or provides needed information is an established and economical industrial tool fully accepted by management. The audit of these standards and their implementation by the plants at division level is considered essential to discipline and maintaining the program at a high quality level.

Two aspects of initiating a totally integrated standards program may have a disturbing influence on all departments within the plant. Such programs, no matter how skillfully presented as a staff or service function to assist other department managers in the safety aspects of their operation, may

arouse responses such as these: (1) safety is second guessing me, and is not creative. All they do is criticize us and try to publicize the lousy job they claim we are doing; (2) safety is continually looking over our shoulder and trying to tell us how to run our operation. These reactions, particularly from technical people, are going to exist whether openly expressed or secretly discussed in small closed group sessions. Be honest about the basic approach used in any standard, audit or management directive. Unless carefully and tactfully done, these can become destructive forces within the organization instead of a tool to discipline the program.

As a result of the safety program established at all of the Hercules Chemical Propulsion Plants, the division compiled a safety record that has been consistently superior to the overall corporate record for plants which produce or process materials usually regarded as being less hazardous. The frequency rate for 1969 at the explosives and chemical propulsion plants was .50, compared with 0.96 for all of Hercules Incorporated plants. The overall corporate record is far better than either the chemical or aerospace industry: 4.02 for the chemical industry; 2.44 for the aerospace industry; .96 for Hercules Incorporated; .50 for Explosives & Chemical Propulsion (.39 for C.P.). We are exceedingly and justifiably proud of the accident-free records achieved at our chemical propulsion plants.

In summary, I would like to say, yes, in the early 60's we recognized the need to explore and improve the effectiveness of the many facets of a total safety program. We were enlightened, and we demanded the cooperation of all employees.

This is important—let's talk about the human element. The human element is the most unpredictable factor with which any safety effort must contend. It is the knowledge in the heads of our people who perform any unit of work, moment by moment, which determines whether or not we are going to have a destructive mishap or a disaster.

An ill-advised decision on the part of just one person attempting to cope with a minor production problem can completely circumvent the best efforts of our most experienced engineers. A moment of inattention on the part of just one person at a critical point can result in a disaster, whether it is on the drawing board or in the process. The lack of proper safety knowledge in the heads of our people at any level is of critical importance in our pursuit of a totally successful safety program.

Electing to upgrade safety is not a safety department's prerogative. It calls for negotiation, first with those responsible for safety within the company, and then with the plant at top management level.

Specialization (whether it's in the science of safety, the science of quality, production, or engineering) does not set one department of a company against another. It is a means of assuring that pertinent viewpoints are considered as they work together for the best interests of the company.

In June of 1970 Governor Howard Pyle, President of the National Safety Council, said: "We are not a stagnant society. Our science and technology continue to make rigid progress. The organization that embarks on the "Zero In On Safety" campaign will motivate its management, supervision, and workers towards more safety progress. It will find that their heightened interest will direct attention to concrete and practical problems." When we "Zeroed In On Safety" in the 60's, we found this statement to be true and our concern for safety and well being of each employee heightened.

PROGRAM MANAGEMENT IN THE 70's AND BEYOND

By GORDON L. BOWEN
Regional Mgr., Gates-McDonald & Co., New York, N. Y.

We are, at the beginning of the 70's, on the threshold of a whole new world in all facets of social and business life. For industrial safety it will be so immense, and so much more than industry has ever known, that it reminds me of the old war story of the two G.I.'s leaning on the troop transport's rail as they're crossing the Pacific Ocean. Looking at the unbroken expanse of water, one says "Man, that sure is a lot of water." The other replies, "Yeah, and that's only the top of it!"

We are now witnessing the advent of state and national concern and legislation for safety—public, vehicular, product, environmental, and industrial. While we in industrial safety are a relatively small fraternity as a profession—and it is a profession—we are by and large a competent and dedicated one. We must then in this extremely important function insure its effectiveness in good legislation and its application. We—all Americans—must not allow emotion, self-interests, and politics to enter into the final production.

Our present statistical base, Z16.1 & Z16.2 is workable, although needful of some modifications. The method of gathering these statistics employed in the past and present by the U.S. Department of Labor is workable, too. Yes, I know, it must be required, and that will cost employers and all of us money. Employers must keep all sorts of other records now—payrolls, withholding, benefits deductions and accounting, hours of work, and now safety statistics. But it is the valid price of progress and essentially needed results.

Many opinions, including the U.S. Department of Labor's Gordon report, on U.S. accident statistics may be very misleading because of the past and current voluntary status of injury records-keeping. My own opinion is that great progress in injury (accident) prevention has been made and that serious and disabling injuries have steadily declined. Further, the compilation and evaluation of injury statistics must be done by those having special competence in the field. As an example, I quote from an article from the September 21, 1970 issue of the *N.Y. Times* on the Gordon report.

"Mr. Gordon and his associates found that disabling injuries ran eight per cent higher than the official figures showed. They further contended that serious injuries not causing a significant loss of time from the job might be as high as 25,000,000 a year, or about 10 times more than presently reported."

Further on, the article quotes the report ". . . information gathered in California 'revealed a ratio of 10 serious injuries for every disabling injury reported.'" Just how serious is an injury that is not disabling? I suspect too many commentators on injury statistics are prone, among other things, to "confuse" them with workmen's compensation claims statistics. One state routinely makes awards for disabling injuries which occasion no loss of time. A finger or hand laceration requiring three to four sutures, with a half-inch scar left, regularly brings a partial total award of two to five per cent loss of use of the member, and amounts to an award for permanency of anywhere from $100-$500. This, with no loss of time, only a "twinge in the scar when bending the digit or at weather changes" constitutes a disabling injury. How many of these get into the figures quoted over and above the official figures, and possibly as a serious injury?

Further on in the article, Mr. Gordon is quoted as saying that the survey was seriously restricted and impaired by several things, including widely varying definitions of what constitutes a serious injury. And this is the report that is loudly pointed to as proof of the need for the Williams-Daniels bill. I believe there is need for Federal standards, but realistic ones that will work and do good equally for all workers in all states of the Union—and hopefully of benefit to all countries. Representative James G. O'Hara, a proponent of the Williams-Daniels Bill, in a statement quoted in the *N.Y. Times* article says, "The Gordon report is important because it highlights the fact that the existing figures conceal a level of slaughter in the working place that is a national scandal." Oh, come now, slaughter no less! We need responsible facts and statements—not this. Proof or dis-proof of this statement should be easy to come by. The International Association of Industrial Accident Boards and Commissions can certainly tell us how many deaths there are each year on which workmen's compensation benefits are being paid under existing state and federal legislation, even though they would include many deaths from such controversial causally related incidents as heart attacks, cancer, emphysema, and other non-definitive causes such as "respiratory disease."

So, let's agree on the need for sound, workable legislation, cut out the histrionics, and get on with the job!

As to existing, and proposed state-level safety legislation, from what I've seen most of it is good, although not enough. Let's not throw it away and start over—let's use it. As examples, look at the standards in the states of New York, New Jersey, Ohio, and California, just to mention a few. All good.

Federal legislation, yes, but state administered, by all means. The Federal government's own record of safety and its enforcement is nothing to brag about, I am told. Proposed Federal legislation (Williams-Daniels) provides for the Secretary of Labor as standards setter, policeman, judge, and jury. Unconstitutional and non-democratic. Costs to the country, not just employers, would play havoc with the country's economy. We need something equal to or better than the Steiger substitute bill.

Now, as to the safety man himself. We will see, and are seeing, the start of true professionalism—we must. Safety is too complex and too all-encompassing to have it otherwise. We will and must see the professional safety manager, technician, specialist, et al, in ever increasing numbers as colleges, universities, and other institutions provide for this professional training as they do for engineers (ours is not just an engineering profession), lawyers, doctors, and business regimens. Witness the American Society of Safety Engineers new Board to designate "Certified Safety Professional of the Americas," and the National Safety Management Society concepts. Much legislation is pending, and no doubt will be passed soon, in state legislatures on safety professionalism. To be worthwhile, the standards must be realistic. But where are the qualified personnel coming from that will be demanded by the passing of a Federal Occupational Safety and Health bill? Who'll need them? Everybody; state and federal governments; industry, large, medium, and small. More and more we'll need the safety consulting and service firms and the local safety councils to provide professional safety services to companies of all sizes—economics dictates this. The majority of industrial firms today are not large enough to afford their own safety specialist, but they can't afford not to have effective safety, economically and legally.

Safety standards are all-important. We have much established by the states, as I've said before, much of it from industry and government supported consensus as epitomized by the American National Standards Institute. I believe this type of standards setting to be the most effective. It must be backed up by an adjunct function of research and development by a competent body representing all regimens directly concerned with new science and technology. These must be industry, labor, and government supported.

Safety programs of the 70's and beyond will be and must be a coagulation, a uniting of all of the past efforts and truths of safety into the true management concept. For years we have had the management team made up of specialists who, in addition to their individual technical expertise understand and are full partners in the total management function of their companies. We have the finance man, the personnel man, the legal man, the sales or marketing man, engineer, all part of the integrated management team. To this will be added the safety man, a pro among pros. This concept holds at the small unit level as well as at the corporate level. Time does not permit an in-depth exploration of this concept, but the best work I've seen on this subject is a thesis done by W. C. Pope, Chief, Division of Safety Management, and E. R. Nicolai, Senior Information Officer, of the U.S. Department of the Interior. It is entitled *Safety Aids Decision-Making*, and is available from the Director of Personnel, U.S. Department of the Interior, Office of the Secretary, Washington, D.C.

Their concept is that the safety member of the management team must do as other

team members must do: find errors or mistakes in operations involving incomplete decision-making, faulty judgements, administrative miscalculations, and just plain stupidity. Thus, the safety pro must become a systems evaluator, not just in the injury-prevention activity but in each specific area of accident loss-prevention to bring understanding and cooperation to each member of the management team of these matters of common interest. Understanding management, its functions and its cohesiveness, and that management and production are accomplished through people, will be paramount on the safety man's list for education and experience. The system's faults must be found and analyzed along with those of people; each is essential to problem solving. All interests of management, including safety, must be mutual.

The over-all development and administration of each element of the safety program is a staff function; technical knowledge and assistance is to be gained from those specialists on staff and line. Then, some day, all members of management and employees will be their own safety man. More and more companies will come to do as National Distillers and I.B.M., just to mention two—making the safety man's job one more management training and development position for the manager on his way up. How beautifully this gains respect for the responsibility and provides for subtle but lasting inculcation of safety in all members of line and staff.

Program development and on-going evaluation will use all of our past and current safety techniques, statistics with accident investigation and cause analysis. This, of course, is nothing more than application of proven production techniques of inspection, test, quality control, and waste control, but we'll increase their effectiveness by using the computer. More and more companies are developing these programs and are already reaping the benefits.

The basics of safety that we've learned and developed over the years will remain the mainstays of safety programs: management philosophy, employee responsibility (including supervisory), safety inspections and safety meetings, maintenance, evaluation and action coming out of accident investigations and cause analyses, use of specialists (industrial and public health, chemical, electrical, petroleum, etc.), especially for research and development, evaluation via measurement against performance standards ala techniques being pioneered by companies like Chas. Pfizer, Westinghouse, I.B.M., and my own company. And last, but most essential, will be the continuing use of all forms of training—on the job, classroom, home-study—for all employee levels. This, of course, I consider complementary to education and training from secondary school levels through graduate schools.

In essence, all that I have said here is that management will bring safety truly into the staff and line function as they have all other management functions, with true responsibility and accountability in contributing to the success of the total endeavor.

What are the incentives or the alternatives? Let's look at the incentives first. They are two: mankind's personal needs, and economics. The latter is really only an element or extension of the former. First, we are witnessing the actions and reactions of all segments of our society to many aspects of our daily lives, national and international. In the case of safety, it encompasses shoddy and dangerous products for both public and industrial use, vehicles, highways, pollution, food, drugs, and others. I consider that our industrial revolution and progress has brought our society a long way, even to the point that we are now being made aware that "That's great, but there's something big missing." What is so unusual about that? This is the way all real progress has been made. Yes, the profit motive has been overriding, and also missing a lot. Through understandable (to us) circumstances, we who are in safety and closest to the problems have come a long way, but not far enough. We now have spokesmen, adversaries in legal parlance, who are helping us get things done that must be done. Critics and supporters in public and private life. Some go to extremes, and it is necessary to then go back and forth and finally attain the optimum benefits. We in safety, now as never before, are becoming solidified and joined in our thinking, purpose, and action. As true management men and administrators, we must step forth, stand up, and make certain that objectivity and reason prevail, and then the needs will be fulfilled. We must get involved at all levels, including the legislative, and our employers and union officials must objectively encourage—not demand—

and support this. Now that a few outspoken crusaders have gotten the new ball game going, more and more people will be getting into the game. Just the other day I was reading the comic strips in our local newspaper. One caught my eye and my thoughts—*The Jackson Twins*, by Dick Brooks. This strip, among a few others, addresses itself to the current problems of our times. One of the twins says to her brother that cleaning up pollution costs money and she guesses a lot of people have friends in City Hall, so nothing's been done. She says kids can see the problem clearer than adults can because the concept is so new. The brother replies that they're more worried about what's going to happen to the earth. Jill, looking at her Dad sitting in his easy chair watching a football game on TV says, "And how quickly it is happening! While people just sit by." Are we going to just sit by? No! Thanks to catalysts now in the public eye, we have our chance to take the place we should—the lead. Let's not lose the opportunity and end up like puppets, perhaps living with bad law.

The second incentive is naturally economic. When applied to industry and business, profit is a nasty word, but when applied to the individual, not so. If it wasn't for business and industry, none of us would have the benefits we now know, with the hope for more for the presently deprived. The detractions we can and will get rid of. I constantly hear that industry can't afford the cost of safety, that profits will be lower (stockholders—all of us paradoxically), or costs will be higher (customers—all of us paradoxically), or both. "The public won't buy it." Nonsense!

The ingenuity and competitiveness of American industry and businessmen will overcome these costs and turn them to advantage. They'll learn how to do things they would come to sooner or later on their own, by being more efficient and productive and passing the savings and benefits on to us all. The worker, too, must do his share. If he says, "What's in it for me?" the answer must be made abundantly clear. Not "Hooray for me, the heck with you, I've got mine."

Costs—yes, a big incentive. What does $100 of workmen's compensation benefit represent in sales to produce the $100 at a five per cent net profit margin? Sales of $2,000. A $1,000 benefit cost? $20,000 of sales! If just the workmen's compensation cost of a company developing a premium of $100,000 per year were cut by 25 per cent through good safety, the savings, cash retention, and investment value would be over $170,000 at the end of five years and over $700,000 at the end of 10 years. Eight to ten years is usually the period through which most companies capitalize equipment. The intangible or uninsurable, but very real, costs would likely double these figures. Impressive, yes, but they are there to realize by this and other accident cost controls

In summary, I am certain that industrial safety has crossed the threshold of its rightful and necessary place in industry and public and private life and will continue to improve all of our lives. The old techniques will be bolstered and improved, with place for the safety manager and the technical man, or specialist, and for the teamwork—integration—with all other functions of management. Education and training will pace this and provide the manpower for safety—both the safety man and the worker.

The past is prologue, preparation; the future is ours to build on and sternly improve. We can and must decide so.

SAFETY TRAINING REQUIREMENTS AND TECHNIQUES FOR THE 70'S

By NICHOLAS ANTON
Training Manager, Caterpillar Tractor Co., Joliet, Illinois

In order to determine where we should be headed in the future, we should see where we have been in the past. Until now the emphasis and main thrust of safety training has been concentrated in the inspirational-motivational area designed to alter workers' attitudes. Presumably this will offset the effects of the mysterious urge within the individual to injure himself.

There is little evidence to indicate this type of training has had any significantly measurable effects on safety performance. Considering the time and money spent on safety training, it may be time to look for a new method.

Even more important is that training which could have prevented accidents or even fatalities, did not get done. Somewhere along the line, we have been sidetracked by an over-emphasis on the importance of teaching workers a proper or accepted set of attitudes without having any solid evidence that man's behavior is significantly correlated to his attitude set, although there are many indications to the contrary.

If management is going to get a fair return for their safety training dollar and, more importantly, if injuries and fatalities to workers are to be reduced, a new approach must be found. Safety training in the future that will produce results will probably be more performance oriented.

There will be greater emphasis on teaching specific behavior and less of the inspirational or motivational appeal. The emphasis will be on teaching workers what to do and what not to do as opposed to how they should feel about their work, the company, etc. The worker will be given skills and techniques to perform his work safely, not an endless stream of admonitions, cliches, slogans, and meaningless statistics.

Much of this training will utilize what has come to be called, "modern instructional technology." Until now, training people have been more concerned with what to teach, rather than how to teach it. Recent advances in the fields of psychology, education, and programmed instruction have demonstrated that great improvements in training effectiveness can be made.

Dr. Tom Gilbert, formerly of Harvard and now a consultant in training and education, has described how even a small bit of the right type of training can marke large differences in what people can do. Applied to our field of interest, we can see how a relatively small amount of truly effective training can make enormous differences in safety performance.

Modern instructional technology requires that prior to beginning a safety training program, we make an analysis in order to determine what kind of job performance is needed so that work may be performed safely. It is not enough to teach what people should not do—we must also teach what should be done.

The effectiveness of this training depends upon how well we have thought out what must be taught. Errors in performance lead to injuries. Before we can correct the error, we must know what kind of errors are being made. Generally there are two types of performance errors:

A. Those due to lack of knowledge

B. Those due to lack of execution

Type A errors are corrected by teaching the individual what must be done—"how to" —type training.

Type B errors are more complex. Again, Tom Gilbert sees Type B errors as being caused by:

1. Lack of Feedback: workers are not aware that what they are doing is hazardous.

2. Interference: other elements of the job get in the way of safe job performance. Safety equipment is difficult to obtain or use. Cluttered work environment.

3. Unpleasant Tasks: time consuming, detailed, repetitious aspects of the job.

4. Lack of Motivation: poor reward system, lack of recognition, unappreciative management.

Training can do much to reduce or eliminate Type A errors, but only little for Type B problems. These require change in organization, supervision, policies, assignments, etc.

Once we determine whether our performance errors are due to lack of knowledge, we may proceed with a plan for training:

1. Start at the end. Establish clear, attainable and measurable objectives. What do you want the person to be able to do upon completion of training?

2. Determine where you should start; what the people already can do.

3. Design the instructional sequence.

4. Test the program with a line pilot group.

5. Rewrite if necessary.

We can see from the above, the actual writing of the course does not occur until Step 3. Frequently though, this is the point at which many training programs begin. If we start with a set of clear, behavior-oriented objectives, we increase our chances of designing training programs that will have a better chance of changing on the job behavior and, consequently, improve safety performance.

AIR TRANSPORT SESSIONS

PREVENTING EMPLOYEE INJURIES—VITAL PART OF THE LOSS CONTROL PICTURE

By JOHN L. PICKENS
Secretary, Hartford Insurance Group, Hartford, Conn.

"Zero In"—a concentrated attack on high-priority hazards is the theme of the 1970 National Safety Congress. Howard Pyle has said, "What is called for is a total organizational commitment to the imperative that injury rates must come down."

To me this means examining where we are, what our problems really are, what we are doing to solve them, what progress we are making, what is on the horizon, and where we go from here. An honest, objective, self-examination of this type is not always comfortable or even pleasant, and we should be sure we really are prepared for what we find. Turning over rocks sometimes brings to light an unappetizing assortment of bugs and worms—which is why some people do it. I hope we are motivated by more than curiosity; are seeking a way to do our jobs better.

I plan to discuss employee injuries only as a part of the total loss control function, coordinated with and responsive to loss control efforts in other fields. I would like to suggest that we take a hard look at whether we are using a rubber yardstick to measure some of the less important aspects of our performance which are being conducted with less than maximum effectiveness because our objectives are not clear. Are we fighting the problem instead of working to solve it? Have we put blinders on our safety glasses, with the best of intentions, but with the result that we see everything from an unconsciously narrow viewpoint?

I have heard for many years complaints that "Management is not sold," and generally the inference is that something is wrong with management. I think we should look very carefully at what it is we are trying to sell, how we are trying to sell it, and how we arrived at the price tag.

What are some of our problems? How serious are they?

From recent financial reports, it appears that in 1970 the major domestic airlines will suffer their greatest single year loss ever, and the first year since 1961 that domestic trunk operations have not been profitable. Local service carriers appear likely to go in the hole, as they did in 1969. In 1961 the inauguration of jet service contributed heavily to the loss, whereas this year it is a combination of increased costs and decreased revenues. As of now, requests for increases in fares have been denied by CAB, along with proposals to restrict the number of seats available on certain major long-haul routes in order to reduce costs.

Although this discouraging report refers to the industry as a whole, and a few carriers will undoubtedly show a profit, the picture is certainly not a pleasant one. Emphasis on reducing costs is always affecting many of us, and the pressure will unquestionably increase to economize through eliminating non-essential services, deferring planned expenditures, and cutting essential services to the bone.

Will this include safety? And how well is the safety job going? The 1969 *Accident Facts* shows Air Transport with a frequency rate of 25.63, compared to all industry at 8.08. Air Transport is resting comfortably in fourth place—fourth from the *bottom*, better only than Meat Packing and the two Underground Mining categories, worse than Construction at 14.07. Incidentally, the National Safety Council's figure of 14.07 for Construction compares with an Associated General Contractor's figure of 30.46 and a BLS figure of around 25. Perhaps the Air Transport figure of 25.63 would really be higher if we had all the non-reporters included.

Yes, we have a problem if we base the record on frequency rates. It's not good enough, and in view of the industry's other problems we'd better find ways to improve it.

Another problem: Mr. Pyle implies that we may lack the coordination of effort required for a totally effective loss control performance. Could this be the fragmentation in organization that places in separate departments—reporting to different vice presidents—the responsibilities for employee safety, fire protection, aircraft damage, cargo losses, public safety, industrial hygiene, medical and first aid?

For example, one major corporation with which I am familiar has its safety department under Insurance, which reports to a top financial officer; employee training is under Personnel; supervisory training is in a separate unit in Industrial Relations; management development programs are somewhere else; fire protection and security are separate, although they do report to the same boss in manufacturing; first aid and medical, including visual and audiometric screening programs, report directly to executive management, to round out the confusion.

Nor is this piecemeal approach confined to internal operations. In one airline that we do not insure but with whom we have done some work operating personnel and safety personnel both complained that they were obliged to deal with a steady stream of insurance company representatives, each interested in some small facet of their insurance coverage—nine different companies, as I recall—and this, of course, did not include the state fire marshal, labor department staff from state and federal government, and many, many more in a seemingly endless succession. Think of the wasted time and repetitive efforts which result, without any assurance that the separate efforts ever fit together.

How can we "Zero In" on a problem, achieve the concentrated "organizational commitment" that Howard Pyle mentioned, with this kind of approach? How can we hit the bullseye with a well-directed slug when we are firing buckshot from a scattergun?

How many of us have the time, staff, facilities, and money to do the job we would like to do and think we could do if we only had more of these elusive items? Could we consider that this is one of our problems?

How many times in the last few months have you received unsolicited applications for positions in safety, perhaps observed first hand your friends or associates among them, from those who always seem to be among the first to go when cutbacks occur in production, budget, or profits—the safety man?

I think that all these pieces fit together. These are only symptoms of the real problem, which is that all too often management does not recognize the value of and place a proper price tag on our safety efforts. Proper by *our* standards, of course, because I am sure we all are convinced that our work is meaningful and valuable. Why doesn't management provide the needed money, why are our budgets among the first to feel the economy ax, why do we end up as organizational orphans?

Perhaps we should start with some of the reasons that management established its safety program in the first place. One of the reasons is that no one wants to see people get hurt. A sincere desire to protect employees against injury or death was the real reason that the safety movement was born. Concern for our fellow man and the desire to protect his well-being are among the highest and most noble virtues of man. Many managements today are motivated by this desire—but desire alone is not likely to result in action.

In other instances, management established the safety program because of pressure from its insurance carrier or, perhaps, the economics of a rating formula such as exists in California. In California, we have an antiquated procedure known as Schedule Rating, the only state that has not yet discarded the system. In California, eligible types of operations can receive a 10 per cent credit on their workmen's compensation rate by establishing a safety committee, having it meet once a month for not less than 30 minutes, and reporting such compliance through their insurance carrier to the California Inspection Rating Bureau. During the time I spent on the west coast, I soon found that only a very simple calculation was necessary to make the decision as to whether the safety program would or would not be set up. If the cost in time of the committee members for the necessary monthly activity was less than the 10 per cent savings on insurance, the committee was established. If the 10 per cent savings were not equal to or greater than the cost of the manpower required to hold the monthly meetings, the safety pro-

gram was not established. This may sound like a strong criticism of management, but I found many cases where this was true. The reason for a safety program had never been explained and sold to management, and they looked upon it simply as a means of saving some insurance premium. Insurance companies have over-emphasized premium savings, and have thereby been guilty of causing other and perhaps greater economic advantages to be overlooked.

In other instances, management established a safety program and safety procedures because of the threat, or at least the fear, of government action. They are motivated to take actions that they gave no evidence of having been willing to take, prior to the passage or discussion of new legislation in Congress. For example, from the early 1950's when noise was first generally recognized as a possible cause of hearing loss, we attempted to interest our clients in determining whether they might have a noise problem. We had the equipment to measure noise levels and men trained to use this equipment but, although we offered them these services at no cost, we found very few companies willing to even let us measure noise levels and determine whether or not there were potentially harmful noise levels in their plants. In the spring of 1969 the picture changed dramatically, because loss of hearing was specifically included in the Walsh-Healy regulations. Since that time we have been besieged by requests to come into some of the same plants we could not secure permission to get into before, and in spite of the fact that we have expanded our staff several times over, we continue to have a backlog of requests to conduct noise level surveys.

At this point I should make it clear that this criticism regarding noise does not apply to the airlines generally and certainly not to United Airlines specifically, whom we insure. Long before the first jet aircraft went into service, there had been extensive measurement of noise levels by engine manufacturers and the airlines. Employee exposures were recognized and precautionary steps taken, and such testing and evaluation continues. This relates to shop employees, ramp crews, and even engineering and clerical employees inside buildings near takeoff runways. We have assisted to the degree requested, but the majority of this work has been done by the airlines themselves. Insofar as study of noise levels affecting the general public near airports is concerned, I know of work going back into the 1940's, and each new generation of aircraft and engines right up to the SST has been preceded by exhaustive testing and evaluation. Noise, as a pollutant of the air, became the object of serious attention long before most other topics. Noise has one advantage, incidentally, over other forms of pollutants—it is 100 per cent degradable in a relatively short time!

Current interest in the quality of the environment has already made itself felt in requests for assistance in determining whether plant effluents are contaminating the air and water, the degree of seriousness as respects federal or state regulations, and what might be done to avoid possible prosecution for contamination. This is only the beginning of perhaps a decade of the greatest demands ever made on our industrial hygienists, chemical engineers, and related technical and safety consultants. I also predict that we will very soon see an increase in requests to consult with management on how to prevent product liability claims, a field in which the safety consultant has barely scratched the surface. Consumerism—with all that it implies in bringing the legal profession up to date, bringing both advisory and enforcement agencies into being, causing the insurance industry to tighten its underwriting and raise rates—will, to put it mildly, motivate many companies to take an interest in loss control in the product field that has never been demonstrated before.

I do not mean to imply that all management is hard-hearted, impersonal, or unconcerned about what they do to their employees, the public, or the environment. I am saying that in far too many cases they have not demonstrated their conviction by their willingness to allocate the money needed to control losses. Nor does the fault for this all lie at management's doorstep. Safety professionals as a group have failed miserably in providing the economic justification to do so.

Most of our so-called safety measurement methods are merely records of accidents, indicating lack of safety rather than measuring the level of safety performance, and they do little to help prevent accidents.

Peter Drucker has stated that "The measurement used determines what one pays attention to." ANSI Code Z16.1 is based on disabling injuries only and is subject to much criticism in regard to interpretations. Some feel that there is more preoccupation on the part of safety people with having the right numbers than with preventing accidents.

Since it is a national standard, however, Z16.1 will probably have to do until a better one can be developed and accepted. It is suggested that it could be more effective if more weight were given to severity as an indicator with not so much stress on frequency.

Too much time has been spent in explaining what frequency and severity rates mean, continuing to rely on them as evidence of results. In fact, I am not sure that reliance on frequency and severity measurements does not, in the long term, do more harm than good to our cause. It has helped create a communications barrier, because if we cannot agree on what Z16.1 means and how to use it, why do we expect it to be readily understood and accepted by management? Sometimes it seems that we are trying too hard to prove something with measurements that have no economic validity to our listener. Management wants to get down to the nitty gritty, the dollar impact of accidents and errors on production, time and material dollars wasted in scrap and rework, and profit dollars made through production of quality products at lower unit costs. What management wants to know is the contribution of loss control to the profit of the organization, and I don't think we have done an acceptable job in giving them answers. We have forgotten two of the basics of salesmanship and communication—consider the customer's interests and talk his language.

Profit minded management better understands safety performance which controls hazards and losses within acceptable or tolerable limits rather than seeking an unrealistic zero loss rate, which is another possible argument for concentrating on the causes of more severe injuries.

So, if you agree that our loss record needs improvement, and that our image with management needs improvement, let's now consider how we might go about finding some answers. What I am going to suggest is not so much an answer as a suggestion that we need to develop a new viewpoint on the problem. I am not sure that there is only one simple answer. I hope to stimulate some objective thinking from which may come some of the answers.

First of all, let's somehow forget for the moment all our accumulated concepts of the function of safety and the role we play as part of that function—eliminate our bias and start thinking objectively, not subjectively.

Let's start with the reason that a business exits: to provide goods or services at a profit. Someone has to run the business, and one definition says that the objective of management is "to maximize the productive efficiency of the enterprise." It does so by setting desirable goals and then achieving these goals in the face of obstacles, problems, and risks.

The taking of risk, meaning the possibility, the uncertainty, of loss, is part of the nature of business enterprise. Only by committing or risking assets in a business venture can there be the possibility of profit. In a sense, therefore, it is the job of the manager of a business to create risk. We mean here the speculative or business risk which can result in gain if all goes well—or loss if things do not go well, when sales, the market, or the general economic environment do not turn out as favorably as planned. This is the chance-taking inherent in all business, in the hope and expectation that gain or profit will result. I want to make it clear that I am not talking about this kind of risk.

There is another kind of risk, however, which is called pure risk or static risk. This involves no chance of gain, only a chance of loss or, at best, no loss. This includes losses from natural causes such as earthquake, flood, wind, lightning; from activities of man such as fire, explosion, collision, theft, embezzlement; the list is almost endless as man interacts with his environment, his products, and with other men. These losses can directly destroy company assets—property, people, or money—or can arise out of liability for damage to the property or personnel of others and can interrupt business operations or affect credit.

Man learned early that to survive he must learn to deal with risk by fleeing from wild animals, fighting with whatever weapon he could contrive, making protective clothing, or barricading himself in a cave. He survived

only if he recognized the peril soon enough, made the proper decision on how serious it was, and then took the proper protective action quickly enough. By thinking ahead, by planning these steps, he became the world's first risk manager.

The risk manager today functions as a part of management, helping to protect and preserve the corporate assets of property, plant, equipment, materials, personnel, cash, credit, and goodwill, not merely to prevent direct loss but to assure the continued availability of these assets for furthering the corporation's objective of making a profit—to help "maximize the productive efficiency of the enterprise."

To accomplish this requires five basic steps:

1. Risk analysis—discovering or recognizing the hazard of exposure which can possibly result in a loss.

2. Risk evaluation—estimating the probability and seriousness of the loss which might result from this hazard or exposure.

3. Risk abatement or loss control—eliminating or reducing the hazard.

4. Risk transfer—substituting known expense for uncertainty, usually through insurance.

5. Risk accounting—largely a procedural area.

Step 3, eliminating or reducing the hazard, is precisely the task of the loss control specialist; he is also uniquely qualified by training and experience to assist in steps 1 and 2, identifying and evaluating hazards. Loss control is thus not just one aspect of risk management; it is a vitally important, indispensable tool of the risk manager. It would seem that he needs the assistance and counsel of the loss control specialist at every step as he goes through his decision making process: what are the loss potentials, not only from natural perils, but from the thousands of new materials and new technological developments in industry today; how serious are they and how can they be eliminated or at least controlled within known limits; what is needed to implement the recommendations on programs for control?

One of the decisions to be made is whether to (1) retain a particular risk as part of the cost of doing business, with losses to be paid as an operating expense, to assume the risk without any insurance; or (2) to reduce the risk by setting up reserves or funds allocated to that purpose, as self insurance; or (3) to avoid the risk of transferring it to an insurance carrier for a price. It should be emphasized that no matter which of the alternatives is adopted, management will still pay the bill for losses. The only difference will be when the bill is presented and which pocket it will be paid from; the importance of preventing and controlling loss is always there.

Does this enable us to see loss control in a completely different light, in a greatly expanded role? Is it possible that top management might thus more readily recognize the value of loss control and its direct contribution to corporative objectives, might give more careful study as to where it fits into the organization?

This might also enable us to zero in on some other relationships involved in our job; for instance, our relationship to line supervision. Do we really feel that accidents are operating problems, whose control is a supervisory responsibility? We have long talked about the supervisor being the key man in safety, but let's take a look at what usually happens after an accident occurs:

1. The medical department treats the injured and prepares records.

2. The safety engineer appears on the scene to investigate the accident and prepare a report.

3. Various individuals begin to grind out records and statistics.

4. Sometimes a review of these statistics is the first notice to the supervisor that anyone in his department was injured.

5. A meeting is called to discuss safe practices, usually by the safety department.

6. Someone shows a film, discusses the record, and gives a pep talk.

7. Personnel, training or safety departments prepare a notice which appears on the bulletin board.

8. The safety or inspection committee inspects the department.

Let's quit kidding ourselves. If this is what happens, why should the supervisor have any interest in safety? Why should he feel that management wants him to accept any responsibility for safety, or is even letting him have any responsibility or interest in safety?

It appears that everyone and everything is conspiring to take away from him any feeling that he is responsible for safety in his department!

These comments about the supervisor are not new; in fact, I said the same thing in October, 1960. Apparently, I need to say it again, since it's questionable how many heard me the first time! We are failing to motivate supervision, to involve them in loss prevention to the degree necessary to do our most effective work.

Are we in loss control at least partly responsible for creating this contradiction? In some respects, loss control functions much like quality control, detecting deviations from an established performance standard. Injuries, accidents, near misses, and even observed hazards or poor practices—all are clues to something that caused or will cause a loss. Any one of them is evidence of a basic condition that can cause or is already causing losses of other types, some form of waste or damage. Any one of them, properly and thoroughly investigated, will reveal corrective actions which can eliminate many other losses before they happen. The injury which points to a lack of proper training may be a clue to errors which will produce poor quality work. The excessive scrap which results from lack of proper training is a clue to the potential injury from the same cause. And this investigation should be made by the line supervisor, trained to understand how and convinced that it is an important part of his job.

We are not talking about safety training or safety supervision. We are talking about good, effective supervision of operations which gets the job done in accordance with plans and specifications, meeting quality standards, on time, without the waste and damage of material and time, without the damage to people which we call injuries. How can we look at the injury problem except as an integral part of the total loss control picture? How can we hope to reduce injuries without going into basic supervisory and operating practices and procedures?

Although there is a need for the safety man as consultant in his own specialty, I believe this part of his job is much overworked. There is far too great a temptation to dictate to other departments, to "take-over" in making decisions, and to serve as policeman and traffic officer. I have heard it said with pride, many times, that a particular safety man could or had shut-down certain machines or operations. He may well have prevented an accident and injury by doing so, and I do not intend to minimize the value of this, if true, but I also wonder how many more accidents he caused or at least permitted by building barriers between himself and the supervisor he over-ruled. How soon will that supervisor, or any other in the plant, ask for help on a condition that he has observed? That safety man may well have become an adversary rather than an ally in the supervisor's efforts to get the job done without injuries, delays, or other losses.

If we believe that loss control is important and if we want management to think so too, we must start acting like part of the management team. We must see the big picture: management's vital concern over the managing of risk, whether they have formally established a position of risk manager or not. Only top management sets corporate objectives and decides how to organize the flow of information coming from below which is necessary for decision making. The reports from loss control specialists are a part of this information, but they must be couched in language management understands—dollars saved, dollars that could be saved, revenue dollars lost because of failure to act, dollars threatened by failure to act. Accident frequency and accident severity are not very meaningful, sometimes even serve to confuse the real issue.

Last month The National Safety Council sponsored a Symposium on Industrial Safety Performance Measurement. For those who were unable to attend, I recommend that you secure a copy of the September 1970 issue, Volume 2, Number 3, of the *Journal of Safety Research*. This special issue contains seven papers on the subject, plus an introduction which outlines the nature and characteristics of the safety performance measurement problem. In these papers you will find many different approaches to the problem, reference to a great many meaningful studies, and some very provocative suggestions but no real answers.

Among those comments which I was able to understand, several points stood out which seem to reinforce the theme I have been developing here.

It is emphasized more than once that the control of losses is only one of management's responsibilities, and the attention given to loss control and the success of the loss control effort will depend upon how clearly management outlines what it expects and how it will measure results.

Numerous studies tend to indicate that good loss control performance is a function of the general control climate, a result of overall effective management, which has tight control of operating costs in general. In other words, effective operations control produces effective loss control, not the reverse as some safety people might like to believe. And this seems to relate to all types of losses.

Much of this tends to support my premise that we must find ways to measure our results in dollars, emphasizing the hazards which threaten the success of the business mission and are responsible for the more serious, large dollar losses. It points to the possibility that embracing the concepts of risk management would improve both the image of loss control and its effectiveness.

I do not mean to suggest that all companies understand, or have adopted to the fullest, the concepts of risk management. It is a relatively new discipline, but it is beginning to assume an important place on the management team. Fortunately, transportation generally has been very progressive in this field and aviation, a relatively young industry, has developed some very aggressive and capable people. Regardless of title, which is usually associated with insurance, some of these men are our strongest supporters. It behooves those in loss control to learn more about risk management, because here is the big picture with a very substantial role for us to fill.

We will probably always need loss control consultants in the separate disciplines I mentioned earlier—fire protection, industrial hygiene, personnel safety—rather than expecting that everyone is an expert in all fields, but if they cannot be organizationally coordinated, at least there should be greater effort to cooperate, recognizing the common causes of most kinds of losses, the common basis for their efforts.

There should also be greater emphasis on cooperating with other specialized departments—employee training, supervisory training, industrial hygiene and medical, engineering—each of these departments providing the assistance and technical know-how required to solve particular problems we identify. We should not try to solve all the problems; we should identify them so they can be solved by the proper department. We must similarly help these other departments when they bring problems to us which are within the scope of our technical competence.

I mentioned earlier the rather discouraging predictions on airline profits in 1970. At the same time we learn that commercial jet transport orders through June totalled 679, for $9.9 billion. This compared to a backlog at the end of 1969 of 608 aircraft valued at $8.2 billion, an increase of 21 per cent. Foreign orders were up 27 per cent. Someone has faith in the future of the air transport industry, but you can be sure it is founded on a firm belief in the prospect of a bottom line profit—more money coming in than goes out.

What better time could there be than now to emphasize cost control through loss control, eliminating the waste and damage that increase costs and eat up profit? Never was the need or the opportunity greater to zero in on doing a better job in reducing injuries—working more effectively with our associates in other departments—broadening our mission from safety to loss control—measuring our results in terms that fit management's objectives rather than our own and thereby earning our place on the management team.

AIRCRAFT DAMAGE

By C. F. TURCOTT
Vice President, Line Maintenance, American Airlines, Tulsa, Okla.

Few will disagree that safety is a wonderful thing, and no airline should be without it. Also, we would never openly dispute the importance of it in our jobs, the personal welfare of ourselves and others, and the mounmental costs associated with its neglect. Beyond this point, we begin to encounter some obscurities or uncertainties. It seems that when we get down to the questions of who, when, where, how and how much, some confusion begins to enter the picture, and we may become too reliant on someone else. Even though we know our responsibility in leading others to the Promised Land, we don't know exactly which road to follow.

What has this to do with aircraft damage? In American Airlines we believe there is a way to maximize safety and accident prevention. We dig a little deeper in our investigations so that we can define our problems and understand them better. We increase our values on the importance of people and human behavior. We recognize the impedance of safety communication and add more power to the transmitters, clean up the resistance, and improve our receivers. We increase the frequency of our monitoring and improve its quality. We increase the administrative pressure on those who should be doing the job.

All of, which is another way of saying: We improve on our communication with our people; we dig deeper into accident causes; we try to make everyone aware of the cost of accidents; and we stress accident prevention and investigation.

First is the matter of communication. We all recognize that safety messages are not easy to get across due to the clouds of human impedance, or ohmic resistance. This is a fact that must be recognized for effective communication. One of the ways to overcome this resistance is to supply more whys in our communication. Sharing experiences is one of the most effective modes of communication.

If we recognize the pure and simple fact that safety is not an easy subject to communicate due to attitudes and lack of interest, then we will look for better ways to communicate. As an example, safety programs have historically been built around and feature the importance of communication, yet all too often they fall short of their mark. Therein lies a clue for us—a program is made up of many plans and profiles, generally has a climax and other integral parts, but above all it has a beginning and end. We think safety should have more survival and endurance, and be a way of life or, like marriage, an institution. Then, as in social codes and society, it will be related to and more influenced by expectations, and the rules will be more effective.

The interest and actions of higher echelons of management, from the foreman up to the vice president, communicate much more than most of us recognize. As an example, we made an analysis of one of our stations with an exemplary safety record. We found two things in line with what I've been talking about: (1) observable interest and actions of management setting the examples and the pace; (2) an incentive system using material awards for motivation. Both items together appeared to have successfully cleared many hurdles, giving the employees a more respectful understanding of management's sincerity. The intrinsic value of the awards was minute compared to the motivation produced by the message that enhanced the image of the company's position in the minds of the people. The communications' gap can be spanned. It is inexpensive, but does require a good working knowledge of people.

One final item on communication has to do with perception. People are communicating with one another all the time in many different ways, and if we are perceptive we will pick-up the signals. Nature has endowed the human body with sensors in the nervous system tied circuit-wise into the five special senses and the mind. It is possible to develop, time, adjust, or otherwise improve our sensors for optimum performance in many fields, including protection against damage or danger. Safety perception, unfortunately, is relatively undeveloped. Too many individuals have not kept pace with the technological progress of mankind in general. It can be said that an accident radiates its initial

influence long before the time of its occurrence, and this can be sensed and detected by early warnings—very often by prominent revelations well in advance of events that precipitate the action. Safety perception, therefore, is an excellent mode of safety communication ranking second in importance only to first-hand experience in the area of prevention capabilities. Once we learn the principal of perception, we can, through our special senses, detect a dividing line between go and no-go in many areas. Communication is a prerequisite for reaction..

Accident Causes

Research reveals that accidents are usually made long before they occur and depend only on the dreaded coupling of events or conditions to trigger them into some form of uncontrolled release of destructive energy that strikes an unsuspecting target. Some of the ingredients involved are: poor safety perception; attitudes; training; lack of interest; neglect; carelessness; day dreaming; and mental voids.

Some classic examples are:

1. High wind—gale. Wing damage by aircraft being blown into cabin service van. Probable causes: unpreparedness; poor appraisal/alertness; compliance failure (no brakes).

2. Aircraft towed into loading bridge. Windshield damage by boom. Probable causes: taking for granted different positions for makes of aircraft.

3. Aircraft struck lavatory cart. Probable causes: mental void or daydreaming.

Two things that cause accidents are the safety perception and value perception of people. Both are related to problems of communications. Safety perception, as I have indicated, is our sensors and mind at work in detecting pre-accident warnings. Value perception deals with our sense of values, that type of judgment, wherein we may take a very great risk for very little gain or save a few seconds and lose a life. This can be called the book value of safety.

There is an interesting story of how the New York Parkway Police caused a slowdown to get recognition for their labor negotiations. They were really on the ball with their super-enforcement—and what happened? An accident reduction of 500 per cent. In the first four days of operation, there were only six accidents as opposed to 35 normally for this period. They exposed themselves and the people and their regard for regulation and the writers of the so-called book who often throw many things in to look good but which sometimes are impractical or unworkable. Accidents don't happen; they are caused.

Cost

We collect our hard-earned dollars from the brains and sweat of many people, put them in the profit sack for well-planned distribution, then "whamo"—we tear into the sack by an accumulation of unsafe acts and neglect. Profit is lost. Who is to blame? To use the old Lindbergh pronoun for emphasis, "We"—management. If we are good professional managers (and that is what we get paid for) we should significantly reduce or eliminate this profit bleeding.

In our reference to values, we often turn to the so-called "book" as some sort of catalog for the economic worth of a commodity or product and generally label it simply, "the book value." There have been attempts to use the safety guide book for ulterior motives associated with economic gain. This has shown up in public prominence as strategic slow-downs designed to focus attention for sympathetic recognition. One example of this was the air traffic controllers' slowdown. Another was the Parkway police super-enforcement mentioned earlier, the affects of which were enlightening from a safety point of view. This experience actually exposed the sense of values of people on both sides of the fence. On the one hand, we have a human reaction for conformance; not for personal benefit of self protection or preservation, but simply for fear of material penalty. On the other hand, we demonstrate a delinquency of enforcement that obviously existed for some time, by another human peculiarity—tolerance or forgiveness of violation to project or enhance a "nice guy" image. We have a moral duty to abide by regulations designed to protect and an even greater moral duty to enforce them.

There are two very important managerial factors to consider here:

1. The book had better be right and workable so there is no impediment for progress

or safety in whatever optimization we determine. Then when we go by the book, as we should, it will be a gain, not a penalty.

2. Administration and enforcement is our undeniable responsibility. We cannot be too generous or forgiving of the many unsafe acts about us or unsafe working conditions within our power to correct.

Investigation

I believe that good investigations are the springboards for safety improvement. We have learned through some intensified investigation that some human behavior problems are the nucleus of personnel errors, and that they very often are the root of accident causes. When we conclude an investigation with human error, failure to use sufficient caution, carelessness, and other reasons of this type, we have failed to probe deep enough to really find out why.

If we don't, we may be dealing with an effect rather than a cause—of little value in preventing future incidents. In other words, we have not defined our problem very well and will not be too successful in solving it. This is not easy, and human behavior is the spawning ground for most of problems.

Let me give an example of what good investigation can do for you. This has to do with deceptions, a common booby trap that has given us trouble many times; in fact, if we considered all of our reports in this area we could come to the conclusion that people are stupid. Such is not the case. In one investigation we documented what we felt was the problem, and it deals with the deception phenomena. An excerpt from the analysis and conclusion of the report reads:

"If, in the investigation of this accident, the Board was totally confined to the facts in this case, it could be reasonably concluded that the accident was caused simply by a human error or failure to see and use sufficient caution while driving around an aircraft. Actually, this case and the problem are not that definitive or that easily dismissed, and the Board recognizes an obligation of greater depth in the investigation, fortified with the knowledge that too many accidents of this nature have accrued for it to be accidental. It is not until we relate or associate this call with others that a pattern is revealed. Afer some study an observation is made. The following is believed to be valid, but in no way should bias a responsibility for alertness and caution:

"1. There is a perceptive void or block on the part of a vehicle operator when making a turn around either with the tail or the nose of the aircraft and the wing is not seen until after it is too late.

2. The rotational path around the tail is more critical or deceptive than the turn around the nose, due to the wing sweep back.

3. Operators of various skill levels have been exposed and entrapped, and the vehicles involved in previous accidents run the gamut from small tractors to taxiing aircraft.

4. The deception is more critical at night when ramp light shadows exist and/or vision is obscured by a dirty windshield.

"It is the opinion of the Board that, unless recognition and heed is given to the phenomena, accidents of this nature will continue and are very serious. It is recommended that special emphasis be placed on this in the operator's indoctrination, coaching, and supervising and that all rotational paths around aircraft be forbidden."

The axiom can be simply stated: A vehicle operator working a rotational turn around one of the four protruding extremities of an aircraft is subject to a sight void with relation to the other protrusions and, depending on light condition, speed, and geometry of turn, fails to recognize proximity until often it is too late for evasive action or effective braking. Approach to wing trailing edge outlines are seemingly more critical and deceptive.

Solution: forbid all rotational arc turns around aircraft through media of training, supervision, and audits until the habit is broken. Substitute square turns. Establish this as a driving rule around ramp areas. Watch for and deal with offenders. Insist that people see the proverbial "hole in the screen door."

Conclusion

As I said at the beginning, "Few will disagree that safety is a wonderful thing and

no airline should be without it. . . . Even though we know our responsibility in leading others to the promised land, we don't know which road to follow." We think we are on the right road.

We dig a little deeper in our investigations.

We increase our values concerning people.

We recognize the importance of communication.

We increase the frequency of our monitoring.

We increase the administrative pressure on those who should be doing the job.

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