Ideal Safety System for Accident Prevention

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SESSION ONE

IDEAL SAFETY SYSTEM FOR ACCIDENT PREVENTION

By Jerome Lederer†

I. INTRODUCTION

This symposium sponsored by your School of Law, stems, I believe, from the influence of legal actions on loss prevention. The subject assigned me, the Ideal Safety System for Accident Prevention, would require an ideal world. But in an ideal world there would be no negligence and therefore little need for (tort) lawyers! This conference will probably uncover the extremes of care as the industry thinks of it; the extremes of negligence as the trial lawyers try to uncover it; the theoretical non-adversary intent of accident hearings of the NTSB in contrast to the actual adversary effects of these hearings; the dedication of investigators to uncover evidence and the dedication of vested interests also to uncover evidence but in self defense or to be revealed only as their legal advisers direct. (These vested interests may be government as well as industry).

II. PHILOSOPHICAL ASPECTS

The ideal safety system calls for a visionary freedom from danger,¹ or what is more basic, the prevention of an undesired event. This implies foreseeable dangers. Accidents, on the other hand, are by definition events without apparent cause. They result from dangers not foreseeable. Therefore, the title is redundant because it is difficult to prevent an unforeseeable accident.

But this is nitpicking. We are concerned with undesired events which can be foreseen as well as minimizing the effect of the unforeseeable event, the accident. This is mentioned because I suspect that subtle legal differences are implied by these definitions.

To go a step further, our concern is not only with the protection of the individual against harm, but also with risks of great magnitude involving protection of property and the preservation of corporate pride and national prestige.

Constraints of time and economic viability on safety are undeniable requisites in a practical world. It is difficult to find definitions of these constraints which are acceptable to the public or to the courts. For example, an immediate requirement for the elimination of all grade crossings would shut down most railroad and many highways; an immediate requirement for full crash fire protection at airports would close down most airports. Nevertheless, in an ideal system, industry aggressively tries to

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¹ The concise Oxford Dictionary.
meet these requirements or find ways to make them less necessary.

Practical ideals would demand that the inevitable safety trade-offs and compromises in design or operation would be fully rationalized and documented on the basis of trying to prevent the more probable undesired events. The less dangerous alternative risks are then accepted in the public interest. This seems like a contradiction in terms. However, the public would be deprived of the development of a necessary system of transportation if risks were not taken. The public might be unwilling to pay large sums for protection against very small risks or chances of rescue. The public might be unwilling to assume the inconvenience or discomfort that an ideal safety system would impose.

An informed public should be the final judge of safety. But safety is so complicated that the public has delegated this responsibility to regulatory agencies. An ideal safety system could mean the identification, evaluation, control and management of risks in such a manner that the public, the courts and juries would have only a peripheral interest in losses of whatever kind because there would be no negligence and there would be constant research and development to improve the state of the art.

### III. The Psychedelic Approach

An ideal is (by definition) a desirable goal rather than an objective which can be achieved. We might dream of several ideal actions which would do much to shorten this presentation if they were adopted. For example, the dream world would be one:

1. Where plaintiff lawyers would participate in the design of aircraft before the accident, not afterwards!
2. Where the time lapse which occurs before known preventive acts are taken would be an irreducible minimum.
3. Where designers and operators would be so far ahead of the regulations that they would not care whether the regulations ever caught up with them. They would comply with the spirit of the regulations as well as the “letter of the law.” (You may recall that in one aircraft design the emergency battery required by the regulations for use after an accident was located in the nose-wheel well where it was most subject to damage. Compliance with the letter of the law was not sufficient.)
4. Where every safety suggestion resulted in greater passenger appeal, less weight, and better economy.
5. Where engineers could conceive themselves not merely as designers but as design managers inviting other interested parties to participate in the design from conception: the human factors experts, the operational pilots, the test pilots, the mechanics, the inspectors, the airport managers, the accident investigators, the crash and fire experts, the cabin attendents, the airline engineers, even the FAA. This is part of systems safety engineering.
6. Where engineers could look upon the test pilot as friend not
foe, and reciprocally the test pilot would respect the restraints imposed on the engineer.

(7) Where the new ideas brought in from outside would be eagerly received, e.g., the NIH factor “not invented here” would be changed to the “now I hear.”

(8) Where familiarity with safety problems or costs of safety development would not close the mind to the possibility of solutions. There are many examples of this: the mid-air collision problem, the use of radar, the flight recorders are among them.

(9) Where safety devices would be accepted despite fear that they might create passenger apprehension.

(10) Where stylists of interiors would not take precedence over design for safety.

(11) Where time constraints would be ignored in design, production, scheduling and operation.

(12) Where assumptions would be based on experience instead of intuition (geniuses are excepted).

But the current safety system has turned out to be a fairly satisfactory one, judging by the public acceptance of air transportation. It can be improved. Negligence does occur else there would be little reason for this conference, assuming, of course, that juries are persuaded by facts and not only by the eloquence of the legal profession.

Negligence, then, is a key word in a conference such as this. Webster’s New World Dictionary defines negligence in law as “failure to use a reasonable amount of care when such failure results in injury to another.” Arguments over the significance of “reasonable” should make the legal profession a very profitable one for the foreseeable future.

People can be harmed and losses can occur when presumably no negligence exists. Unforeseen turbulence, for example, has resulted in injuries. This is an act of God with which the state of the art has not yet been able to cope. The influence of riots, politics (The Berlin Corridor), hijacking, sabotage, antagonistic personnel or organizational relations, will probably always cause accidents which cannot be prevented without stopping air transportation. So let us get on with the problem of a practical safety system, but from an idealistic viewpoint.

The elimination of negligence as a safety goal seems less demanding than attaining the “highest degree of safety in the public interest” required by section 601b of the Federal Aviation Act. How can this be achieved? There are several ways to structure a safety endeavor. I offer one which consists of a chain of five links or elements: attitudes, organizational systems, controls, research and development (advancing the state of the art), provision for contingencies or unforeseen events. These may overlap. Numerous subjects can be listed under each element.

IV. ATTITUDES

Attitudes are of enormous importance. Recall, for example, the example
of the location of the emergency battery mentioned before. It complied with the letter but not the spirit of the regulation. Attitudes are induced by example, by training, and by discipline, but more importantly, by acceptance of a basic philosophy. The British jurist, Lord Moulton, expressed the significance of attitudes in an article entitled, "Law and Manners," published in 1912. It follows:

I ask you to follow me in examining the three great domains of human action. First comes the domain of positive law, where our actions are prescribed by laws . . . which must be obeyed. Next comes the domain of free choice, which includes all those actions to which we claim and enjoy complete freedom.

But between these two there is a third large and important domain in which there rules neither positive law nor absolute freedom. In this domain there is no law which inexorably determines our course of action, and yet we feel that we are not free to choose as we would. This is the domain of obedience to the unenforceable, the obedience of a man to that which he cannot be forced to obey.

And to my mind, the real greatness of a nation, its true civilization, is measured by the extent of this law of obedience to the unenforceable. It measures the extent the nation trusts its citizens; and its existence and area testify to the way they behave in response to that trust . . . .

The true measure of a nation's greatness is the extent to which the individuals composing the nation can be trusted to obey self-imposed law.

Negligence results from attitudes—the most important single factor in reducing losses. Complacency, carelessness, incapacity, arbitrary rejection of suggestions because of pride, apprehension or suspicion, deliberate departure from accepted good practices (which occurs even in the face of excellent training), the nature of pressures exerted on management and by management in design and operation hinge on attitudes—attitudes of individuals, attitudes of society, attitudes of the government, of shareholders, or industry associations, of unions, and even of the man who sweeps the hangar floor.

Attitudes can be affected by definitive creeds. Engineers have their canons of ethics just as lawyers and doctors do. Engineers, however, have more problems in putting theirs into effect because they function more often as part of an organization, subject to organizational pressures, than doctors or lawyers who usually can act independently.

Over the years which I have been engaged in aviation, nothing has given me more gratification than acceptance by mechanics and many pilots of codes prepared for them. The Mechanics Creed is attached as Appendix I.

Management should not be exempt from a code of conduct. For example, suppose the airlines separately and jointly had a code which required them to stop operations into unsafe areas. There is one airport in the Middle East where several accidents might have been avoided by such a measure. This kind of action would have compelled the government to provide the necessary safe aids and facilities. Competitive pressures prevent adherence to such desirable codes of conduct in regard to safety,
though not for economics. The New York Times of 5 April 1968, reports
that, "Forty Airlines Balk at Heathrow Fee. . . . A spokesman for the
group said they had adopted the stand largely to protect passengers against
future fare increases." Codes of conduct written or unwritten are essential
to an ideal safety system.

By and large, the attitudes have been favorable toward risk control;
it is usually the anomalies that create an engineering or operating climate
conducive to hazardous situations, at least in airline type operations. It is
quite remarkable that a large airline can operate with one fatal accident
in 700,000 hours. Serious incidents are of course important, too, but often
special factors must have operated to prevent them from becoming tragedies. Foresight, alertness, structural integrity, training, redundancy, organi-
ization, are some of these factors.

V. IMPLEMENTATION

How can the chain of attitudes, systems, controls, research and con-
tingencies be used? Take a difficult objective: Obtaining the highest de-
gree of care in manufacture and assembly of a product, that is, "product integrity." The introduction of systems safety engineering as a new disci-
pline is a welcome step in securing product integrity. It happens to be
coincident with a trend imposed on industry by the pressure exerted by
legal liability for the design, manufacture and operation of products in
full compliance with the state of the art. It is part of the overall system.

Under systems, we would require criteria for selecting the employee—
his background, his mental, his psychological, and his physical require-
ments. This is followed by adequate training and recurrent training. The
man thus proves his competence and may be certified, a form of control.
During his training, his attitudes should have been orientated to give him
pride in what he is doing, to work with the highest degree of care and to
seek information to improve his trade or profession as long as he works
at it. The information system established to provide this should not be
inhibited by legal restraints, by loss of face or prestige, or by employee/
management restraints. In his attitude indoctrination, the employee should
be encouraged not only to work with care for his product, but also to
volunteer suggestions, call attention to problems, admit his errors, omissions or unsafe performance. These admissions should not be subject to
punitive action; quite the contrary, they should be well received. Attitude
should be supported by impartial discipline, by awareness and motivation
programs, by establishing a method for recognizing not only exceptional
work but also day to day dedication to just doing the job well. The sys-

tem should provide also for a method to relieve frustrations.

Then the system should require that the product be designed to mini-
mize the chance for making mistakes, such as incorrect electrical connec-
tions (Murphy's Law). It should also provide a working environment and
procedures which are psychologically and physically conducive to working
with care. This would include attention to the personal requirements of
the employee including fatigue as well as attention to possibility of personal injury.

Thus far we have touched two links in the chain to secure product integrity, attitudes and systems. Controls come next. Under this would come supervision, inspection, testing, quality assurance. The selection of supervisors would come under a similar program of attitude, organizational systems, controls, and contingency planning. Their technical knowledge should be coupled to an ability to obtain the confidence of their workers. Supervisors must enforce methods to preclude oversights made by changes in shifts, labor turnover, by rework, by changes in routine, by lapse in communications, and pay constant attention to interface problems between work units. No change would be made in the shop or field in design or configuration or procedures without an organized plan for approval preferably going back to the source of design. There is no time here to dwell further on the importance of the supervisor under the element of control, nor on other control factors except to mention the need for further research on human factors to improve the inspection process.4

The selection and certification of personnel, by attention to working environment and product design, inculcating attitudes and applying controls, is not sufficient to attain the ideal safety system and product integrity. The highest degree of care requires a research and development program to improve the product, the system, the attitudes and controls. Then provision must be made for the rare contingencies which may affect the product. For example, a change in top management can seriously affect product integrity for better or worse.5

The product must be economically viable lest the demand for it ceases to exist. This is probably part of the definition of the term “reasonable care” in defining negligence. It is also a function of how much risk the public is willing to assume for its comfort and convenience as well as cost. This varies as to whether they are sitting at home identifying themselves with a television picture of a crash or whether they are passengers anxious to go places with bulky packages, with matches in their luggage, with a bare minimum of seat or aisle space to secure lowest fare. With this ambiguity, lawyers have an assured future.

VI. Conclusion

Many of these points may be controversial. But on one we can probably all agree. An ideal system for accident prevention would eliminate human error whether it is caused individually or collectively. Except for acts of God and the state of the art, all losses can be traced to human error in design conception, regulation, design definition, manufacture, inspection, testing, operation and/or management philosophy.

The best that can be expected of an ideal safety system for accident

5 See NTSB file 1-0028.
prevention is a reduction in rejection or loss rates, and to make it more difficult for lawyers to uncover negligence. If perfection is beyond our grasp, we can at least strive to excel.

APPENDIX I

Mechanic's Creed

Upon my honor I swear that I shall hold in sacred trust the rights and privileges conferred upon me as a certified mechanic. Knowing full well that the safety and lives of others are dependent upon my skills and judgment, I shall never knowingly subject others to risks which I would not be willing to assume for myself, or for those dear to me.

In discharging this trust, I pledge myself never to undertake work or approve work which I feel to be beyond the limits of my knowledge; nor shall I allow any non-certificated superior to persuade me to approve aircraft or equipment as airworthy against my better judgment; nor shall I permit my judgment to be influenced by money or other personal gain; nor shall I pass as airworthy aircraft or equipment about which I am in doubt, either as a result of direct inspection or uncertainty regarding the ability of others who have worked on it to accomplish their work satisfactorily.

I realize the grave responsibility which is mine as a certified airman, to exercise my judgment on the airworthiness of aircraft and equipment. I, therefore, pledge unyielding adherence to these precepts for the advancement of aviation and for the dignity of my vocation.