Adapting Costing Methods to Aviation Safety:

Using Financial Tools to Show Value in Aviation Safety Processes

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1. Abstract

Safety is a fundamental and non-negotiable attribute of the airline industry equally desired and expected by the general public and operators. In this study a cost-base allocation methodology applied to airline operations is created and discussed. The focus of this new methodology is that in using cost accounting techniques and rationalizing airline operational and non-operational costs using epistemologically verified baselines aids airline safety officers in their efforts toward the acceptance of cost efficient safety programs. This in turn improves airline safety performance and the overall safety of the aviation industry as a whole.

2. Introduction

The safety performance of aviation as an industry has improved dramatically since its inception at the beginning of the 20th century due to a combination of technological improvements, as well as proactive and reactive safety programs. Technological improvements have to do with advances in aerodynamics and aircraft structures as well as in aircraft and aviation system electronics. Speed and efficiency of flight have been enhanced whereas electronics, navigation, aircraft positioning systems, as well as detection of malfunctions systems have evolved at a rapid pace assisting in the safety performance record of the industry.

A great revolution in aviation happened due to the introduction of the jet engine. Operational reliability, speed, and safety all improved with the introduction of passenger jet aircraft. First generation jets, while safer than their propeller predecessors, experienced some problems. Each subsequent generation of jetliner has been safer than the previous one. Generation by generation airliners evolved to the modern jetliners which are some of the safest vehicles ever operated by humans. Safety improvements were not exclusively due to technology advances, operational procedures, weather forecasting, pilot training, and the implementation of safety programs all contributed to the advances.

Airline operators utilize two types of safety programs vis-a-vis safety improvements, proactive and reactive. Typically, proactive safety programs refer to those that aviation operators themselves implement as a response to specific operational needs to maintain a high degree of reliability and safety. Proactive safety programs such as crew resource management and upset recovery training are attempts to mitigate risk before it becomes unacceptably high or an event (incident) occurs. Reactive safety programs such as improvements in aircraft wiring were due to problems experienced in service. Often, reactive safety programs come as a result of accidents and in many cases are legislated by civil aviation authorities. In combination utilizing reactive and proactive safety programs air travel has become one of the safest forms of transportation. The improvement is aviation safety has occurred while the average fare for passengers has declined. Airlines have proven that safety enhancements and cost efficiency can be complementary.

Our study develops a cost-base allocation methodology applied to airline operations that in using cost accounting techniques and rationalizing airline operational and non-operational costs using epistemologically verified baselines aids airline safety officers in their efforts toward the acceptance of cost efficient safety programs.

In this paper we focus on the internalization of safety costs in the core financial equation of airlines using activity based costing methodologies and arguing that through activity based costing techniques airlines can rationalize safety based programs and thus improve their operational and safety performance through improvements in business model consistency.

After a definitional discussion of airline safety and safety performance, we review our main methodological focus, that is, activity based costing methodology applied to safety programs. We conclude via a synthesis of our methodological discussion, its financial process implications and its link to safety management systems.

3. Defining Safety and Safety Performance

Attesting how safe airline travel is for US airlines is the recent release by the National Transportation Safety Board (NTSB) stating that in 2010 US airlines (14CFR Part 121) flew over 17 million hours with one major accident (NTSB 2011). There were no fatalities in scheduled airline operations in US or in Europe (EASA 2010). , However, even this strong level of safety can be improved, as traveling public's expectation of airline safety is greater than ever, and will continue to increase as the segment continues to mature and evolve. We should also never forget that, safety is a core focus and fundamental pre-condition for operations in the business rather than just a desired outcome.

In the past one of the important skills for the determination of safety improvements was forensic investigation. Aircraft incidents and accidents were studied in detail providing information which could be used to prevent a reoccurrence. When accidents occurred regularly this reactive method of safety improvement was effective. But the number of accidents has decreased as shown in figure 1. While this data is for the United States, it is representative of worldwide airline operations as the United States market and operational environment is very complex in a manner that parallels global system structure.

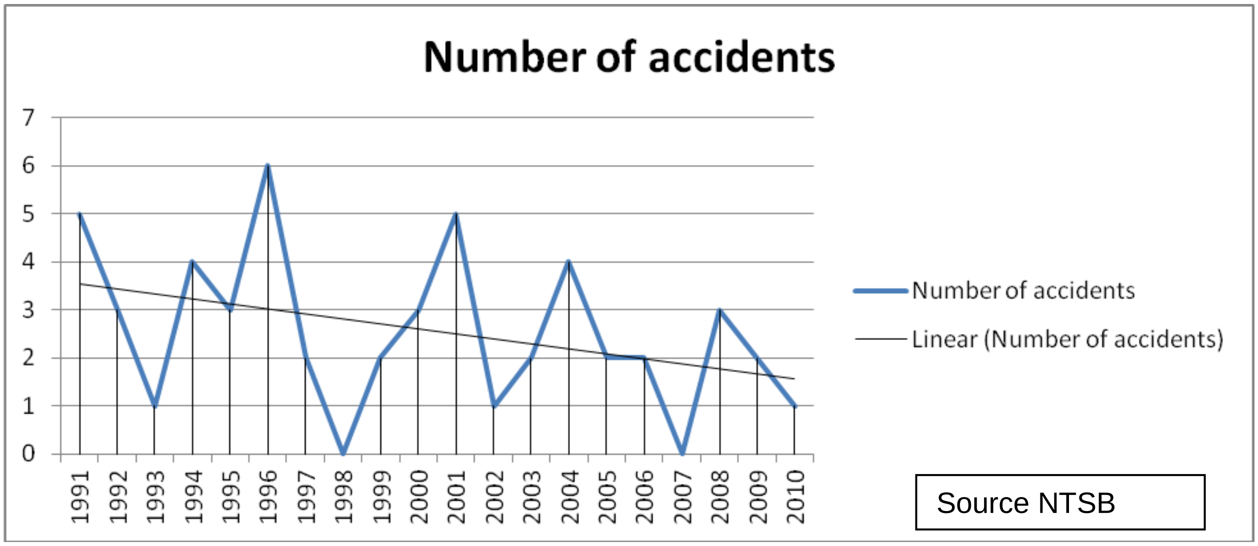

Figure 1. Number of Aircraft Accidents in United States

Consequently, proactive methods of risk identification, elimination and/or mitigation have become increasingly important. Rigorous processes such as Safety Management Systems (SMS) provide a carefully controlled methods of identifying risk that are specific to an operation, and tracking the effectiveness of mitigations. The NTSB described SMS in an accident report of July 2007 accident "It is generally agreed that a successful SMS program is one that incorporates proactive safety methods to evaluate a company's flight and maintenance operations to, at a minimum:

> Identify safety hazards;
>
> Ensure that remedial action necessary to maintain an acceptable level of safety is implemented;
>
> Provide for continuous monitoring and regular assessment of the safety level achieved; and
>
> Continuously improve the company's overall level of safety. (NTSB 2009)

Risk identification is the first element of SMS. A formal process of the documentation of potential hazards provides safety officers, and their managements, a quantifiable metric of threat. Once identified, the risks are evaluated for acceptability those found to be excessively high are either eliminated or mitigated to an acceptable level. It is important to recognize that risk acceptability can change due to societal pressures, political will, legislative actions, or management decisions.

Safety Management System implementation structures are usually tailored to an individual company and reflect the nature, likelihood and magnitude of risk faced by the company. Concepts and implementation regarding SMS are very limited in both quantity and context, especially in civil aviation business.

No two airlines will, or should, apply SMS in the same way. Companies and their SMS capabilities and needs differ dramatically by industry and size, and by culture and management philosophy. Thus, while all entities need each of the components to maintain control over their activities, one company's application of the SMS – including the tools and techniques employed and the assignment of roles and responsibilities for SMS – often will look very different from another's. For example, the Transport Canada Civil Aviation Risk Management process involves 7 steps, (by dividing the Q850 Step 6 into two steps (See Figure 2).

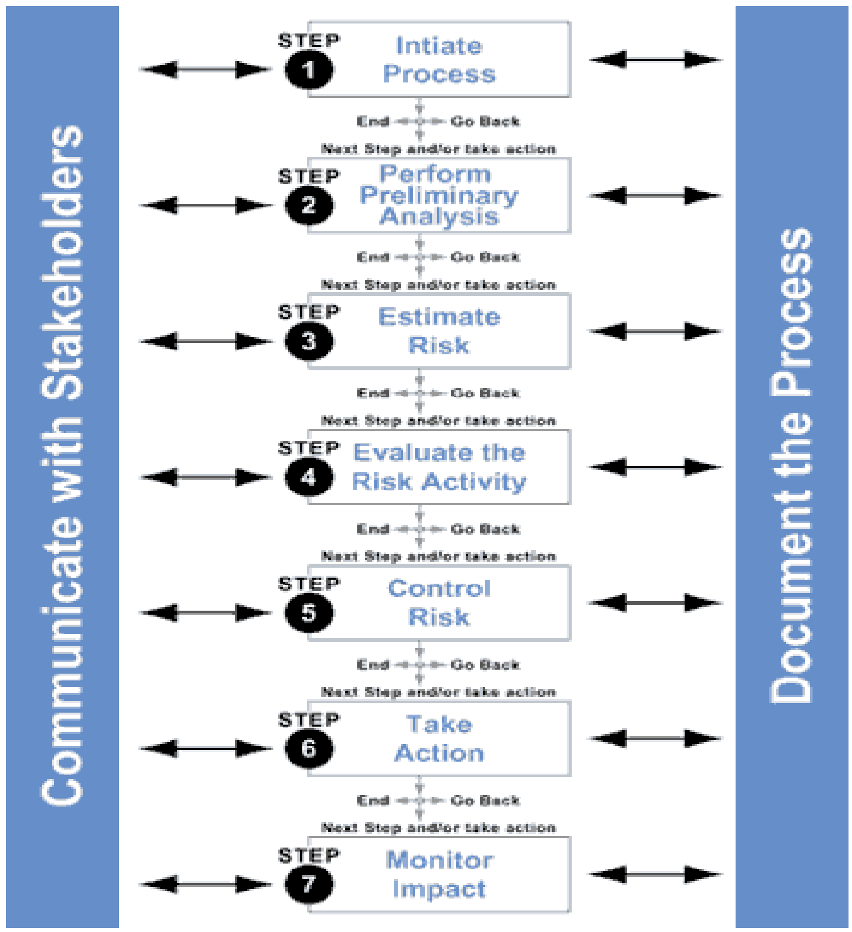

Figure 2. Transport Canada Risk Management Process, (Treasury Board of Canada Secretariat, 2001).

According the COSO Integrated Risk Management Framework, value is maximized when management sets strategy and objectives to strike an optimal balance between growth and return goals and related risks, and efficiently and effectively deploys resources in pursuit of the entity’s objectives.

As the public’s expectation of safety increased and the number of accident decreased only by being increasingly proactive could aviation continue to improve safety performance. This is due to the increased operational complexity as well as business activity in the industry. Figure 3 shows the rate of fatal US airline accidents.

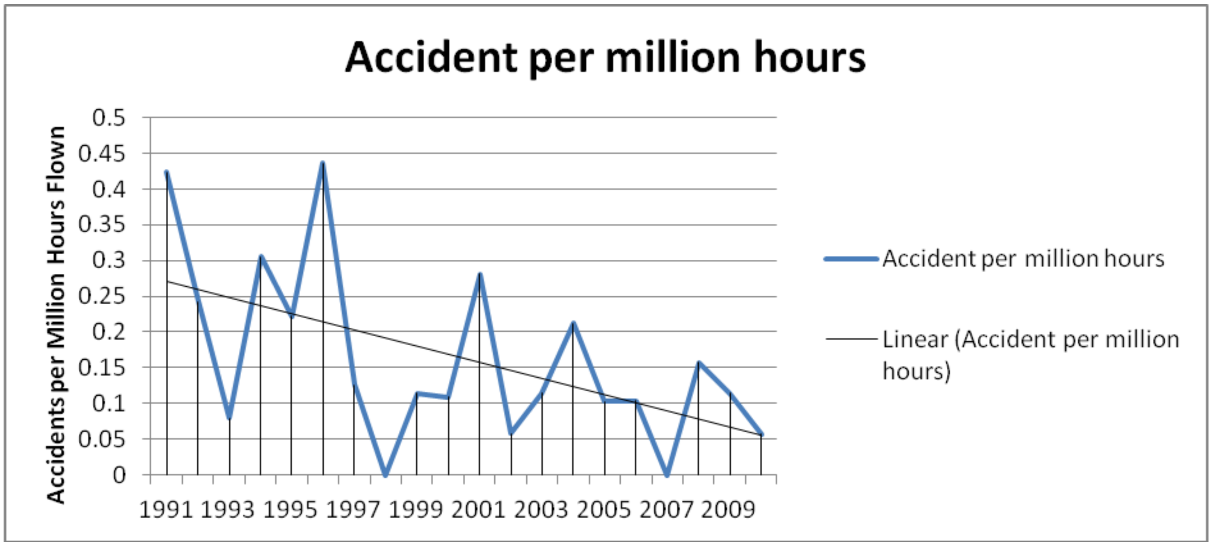

Figure 3: Rate of United States Fatal Accidents

As the rate of accidents declined Safety Officers found that promoting new proactive safety programs became more difficult. Technology provided many improvements which include:

> More reliable and more efficient jet engines – twin engine overwater operations (ETOPS) required the failure of an engine be a very rare event. ETOPS standards allows only one engine shutdown per 50,000 hours of operations or .02/1000 engine hours (DOT 2003). Engines for the first and second generation jets could not meet this rigorous requirement. The Boeing 757 and 767 series were early aircraft powered by engines reliable enough to be ETOPS certified.
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> Better weather radar– Accidents caused by air rushing from thunderstorms, known as windshear, were frequent in the 1960s, 1970s, and 1980s. Airborne weather radar began to incorporate color displays to better show pilots the heaviest precipitation.
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> Windshear detection – Radar was not the only technology used to detect windshear. Reactive windshear systems analyzed aircraft performance to provide pilots with an aural warning of windshear conditions. In the 1990s this technology incorporated special weather technology, known as Doppler radar, to predict windshear well before the aircraft encountered it. The number of windshear accidents has decreased as a result.
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> Terrain warning – Controlled Flight Into Terrain (CFIT) is the category of an accident when an normal airplane, usually without any malfunctions, unintentionally contact an object or the ground. This has been one of the leading causes of accidents for decades. Using GPS technology combined with three dimensional maps of the world terrain warning systems alerted pilots aurally and visually of potential threats from terrain. Since

the incorporation of terrain warning systems the number of CFIT accidents has decreased significantly.

Midair collision avoidance – Traffic Collision and Avoidance Systems (TCAS) is a technology that not only detects potential conflicting traffic but also provides guidance to each airplane to ensure vertical separation (TCAS II). TCAS was mandated by Congress in 1993 following the midair collision of an Aero Mexico DC-9 and a Piper. The number of midair collisions has decreased since TCAS has been required.

Whereas the technology and procedural improvements continued to be enhance dynamically and the desirable outcome achieved, that is safety performance improvement, the industry has experienced a so called safety paradox. Given the industry's strong safety record, how could a financial investment in additional safety programs be justified? In other words, when the risk of non-safety has been minimized, why invest further in safety?

The successes of the past now make future safety programs more difficult for senior management teams to justify. Safety Officers must adjust to the realization that safety is viewed as a business unit of the airline in addition to the abovementioned precondition for any operation. New safety programs now are evaluated on a value added basis. How can a safety program add value to the airline?

Reduction of risk certainly adds value, but when the risk is so low how much value can be added? Effective safety officers use other benefits, or added values, to promote safety programs. One example could be improving airline reliability, lowering costs, and improving safety by reducing diversions. However, to be effective the total cost should reflect the true cost to the airline as a whole and not limited to variable or direct costs only.

The accounting of costs should be similar to Activity Base Costing (ABC) which is a widely used accounting system that assigns costs based on activity (Horngren, Sundem, Stratton, Burstatahler, and Schatzberg 2008).

. ABC includes costs that traditional accounting does not; it is a bottom up view of costs that is more accurate but time consuming to produce. "ABC systems are more complex but promise more accurate costs that are more useful for decision making" (Horngren, et al. 2008)

4. Using Activity Based Costing methodology for Safety Programs

Determining the actual cost in advance of an event may not be possible. However, using past events as a baseline, development of an accurate model for predictive purposes is achievable. Assumptions have to be made in many categories, but these can be considered average values. Additionally, there must be the ability to customize the calculation for the substantial difference in event types. Using the diversion example again, a diversion may be a quick return to the departure airport by a regional jet, quickly fixed with little impact on the scheduled operation or it could be a diversion on an international wide-body flight on a polar route, with hundreds of passengers trapped in a small town for days. A comprehensive matrix is required to be effective. This matrix must allow the inclusion or exclusion of a cost category and often a selectable amount of the category. Once the matrix, or template, is completed a basic estimate of the cost can be calculated.

Traditional accounting methods only consider the variable costs. In the example of a diversion this may only include the direct operating costs (DOC) of the diverting airplane and the reserve airplane, if a reserve is utilized. Other costs are considered fixed costs and not included. An extreme example is operating a spare airplane to the airport where the diversion flight landed and then on to original destination but only considering the DOC. Traditionally, there would be no costs allocated to the diversion for the spare airplane. This can be significant for single aisle jets leases, conservatively, for $300,000 USD per month or $10,000 USD per day based on a 30 day month. This lease rate is below the average lease rate stated in ILFCs 2010 10-k report. The average ILFC lease returned over $422,000 per month, however, both wide body and single aisle aircraft were included in the average. (ILFC 2010) Using ABC the one day of use ($10,000) to replace the diversion flight would be included in the diversion cost calculation.

The more comprehensive the cost calculation matrix the more complete the calculation will be Items within the matrix become cost drivers to the total allocated cost.

Recognition by the operator's management of the costs charged to the activity being a true representation of the costs burden to the organization. Assets used by the activity (in our example a diversion) are assets that cannot be used at the same time for other work. This results in planned work being delayed or unfinished by the asset. If there is no disruption in the planned worked schedule by the sudden demand of an unanticipated activity, it is possible that there is an oversupply of assets. Better utilization of these assets provides a growth opportunity or reduction in asset costs (e.g. reduction in headcount) maybe possible.

The concept of overall costs to the organization has, in the past, proven challenging for some managers. When budgetary constraints are assigned by department consideration of overall costs is devalued. Safety Officers using ABC can show overall organizational costs thereby eliminating the requirement of providing costs incurred by each department. Success of using overall costs requires senior management involvement above the departmental management level. Some manufacturing organizations have incorporated ABC as a better representation of costing as shown in figure 4 below. There are examples of multiple cost pools in a single department. An example is a computer department that contains cost pools because multiple sub departments utilize the computer departments.

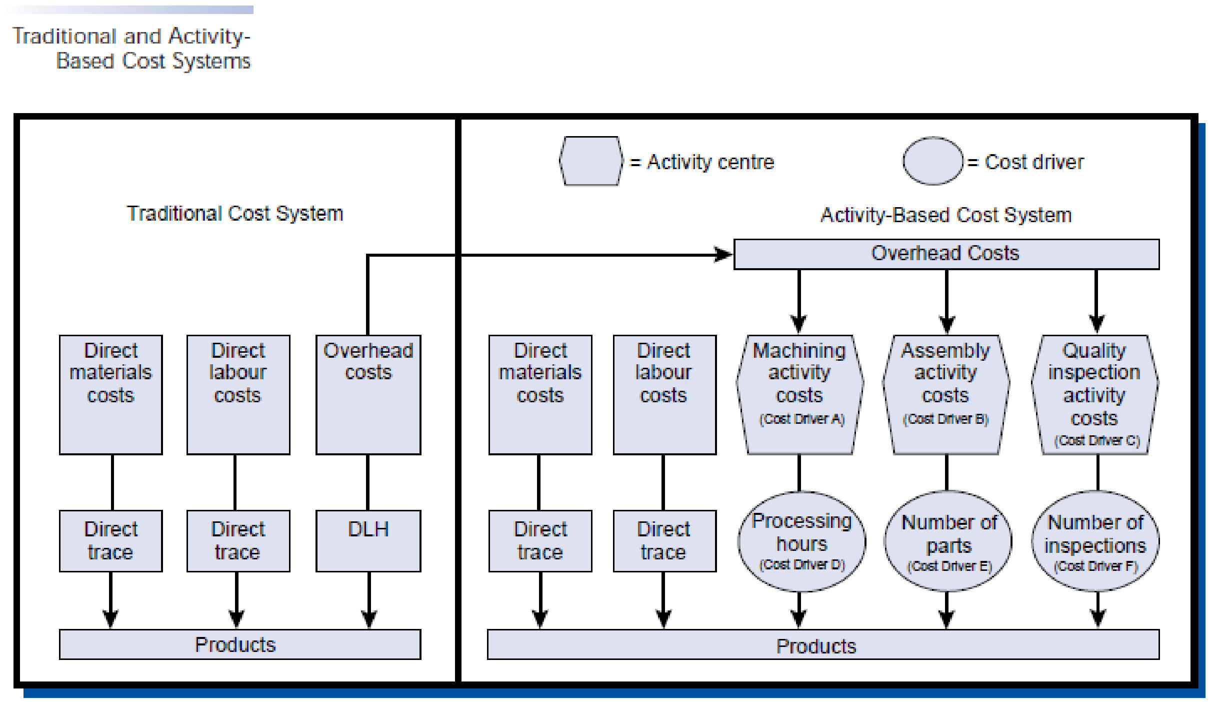

Figure 4: Cost Allocation and Activity-Based Costing Systems (Horngren et al. 2008)

More fully assigning costs centers provides opportunity for operational improvements. Overhead costs are now broken down into constituent parts allowing for better evaluation of cost and potential enhancements. (Advantages and disadvantages of activity base costing with reference to economic value addition, n.d.) While assigning costs to various activities can be challenging, there is an acceptable margin of error. The subsequent analysis is not affected by small errors in estimating parameters (Kaplan & Anderson 2004). ABC was created in the 1980s by Robert S. Kaplan (HBR Sept-Oct 1988]). It proved valuable to many companies such as Chrysler but there was resistance by some companies who retained traditional costing methods due to managerial inertia and lack of understanding of its potential benefits. Complexity and allocating the time required to determine cost drivers and cost pools were two of the reasons some companies did not adopt ABC. The these complexities included initial employee interviews, determining multifaceted aggregate cost drivers, overcoming difficulty in updating cost drivers, and other time consuming activities. It was easier, less disruptive, and required no change to remain with traditional costing methods. These factors overcame the increased accuracy of ABC. (Activity-Based Costing, June 2009)

Kaplan and Anderson realized that the benefits of ABC were overwhelmed by its complexity. In 2003 in their paper “Time-Driven Activity-Based Costing” they updated and simplified ABC by utilizing a time driven approach. ABC became Time Driven Activity Based Costing (TDABC). No longer were the inherent problems of ABC so overpowering, traditional companies (e.g. manufacturing, service, etc.) would choose not to adopt them. Key elements of TDABC is estimating the practical capacity of the committed resources and their costs, and second estimate the time necessary for performing transactional activities per unit. Airline operations are not traditional manufacturing companies, but there are applicable parts of TDABC. The improvements gained by TDABC further the realization that cost allocation can be “averaged” or incorporate estimated values while maintaining relevance.

Using the example of properly costing a diversion flight, now using the principles of TDABC the estimated cost per minute for the diversion for the each of the multiple cost drivers and cost pools are simplified where possible. Estimates are not expected to be exact, “Analysis not affected by small errors in estimating parameters” (Kaplan & Anderson 2004). Safety officers can use a template spreadsheet with estimated cost drivers to provide reasonably accurate calculations. An example spreadsheet is provided in Appendix 1. By providing the ability to change variables in costs and time the calculations can be customized as necessary.

<u>Proactive safety programs and technologies</u>

As stated above, Safety Management Systems is recognized by the aviation industry as an effective approach to formalize Standard Operating Procedures and establish methods that ensure adherence to them. It is generally agreed that a successful SMS program is one that incorporates proactive safety methods to evaluate a company’s flight and maintenance operations.

In its fundamental form, a Safety Management System program will have a process in which risks are identified. Following identification corrective actions are established to eliminate or mitigate the risk to an acceptable level. Like the movement from reactive to proactive safety programs, there is an ongoing need to eliminate more risks and mitigate fewer ones.

Not all risks can be eliminated, but some can be mitigated to a very low threat level. A celebrated example is the introduction of Terrain Awareness Warning Systems (TAWS) which has reduced the number, and rate, of Controlled Flight Into Terrain (CFIT) accidents. The Boeing Statistical Summary of Commercial Jet Airplane Accidents (Boeing 2010) shows a reduction in the number of CIFT accidents year over year since the introduction of TAWS. Why does TAWS work so well? The pilots are provided with threat identification before the threat occurs. Standard Ground Proximity Warning Systems (GPWS), the predecessor to TAWS, only provided threat awareness when the threat was already present. While it was an improvement in risk mitigation when compared to no warning system at all, the CFIT accident continued to occur. Furthermore, CFIT remained a leading cause of accidents long after the installation of GPWS. The risk mitigation was not sufficient. In 1996 technology became available that could predict the threat of a CFIT before it occurred, GPWS became predictive and proactive. This technology was installed into the fleet, consequently the number and rate of CFIT accident plummeted. In 2010 two aircraft with operational TAWS experienced accidents where CFIT is suspected (ASN n.d.) These two accidents are the only examples of CFIT accidents with operational TAWS. By being predictive and proactive the mitigation for CFIT improved to a satisfactory level.

Using technology, as it becomes available; to predict and mitigate threats before they become safety hazards by occurring is the necessary next step if aviation is to continue improving safety performance and thus reducing the overall accident rate. Of course, technology itself is not a panacea rather; it is a useful tool that if managed correctly it can contribute to the just mentioned safety benefits.

Safety is not an expense; it is a necessary and proactive investment

While safety is traditionally viewed as part of the Total Quality Management (TQM) process, it has evolved beyond that characterization. TQM is a well-tested and accepted the focus on quality with many key insights. Dr. W. Edwards Deming pioneered the concept of TQM, having great success in Japan and with Ford, the origin of the TQM included 14 points that provide organization improvement. These 14 points are

1. **Constancy of purpose**

   Create constancy of purpose for continual improvement of products and service to society, allocating resources to provide for long range needs rather than only short term profitability, with a plan to become competitive, to stay in business, and to provide jobs. Consistency in aviation is a necessary key toward safety outcomes as it eliminates operational as well as service errors thus improving performance.

2. **The new philosophy**

   Adopt the new philosophy. We can no longer live with commonly accepted levels of delays, mistakes, defective materials, and defective workmanship. Transformation of Western management style is necessary to halt the continued decline of business and industry. In aviation, implementation of SMS systems moving operations to a proactive world rather than one driven by reaction is evidence of the new philosophy.

3. **Cease dependence on mass inspection**

   Eliminate the need for mass inspection as the way of life to achieve quality by building quality into the product in the first place. Require statistical evidence of built in quality in both manufacturing and purchasing functions. Again, this is tied to the proactive mentality that SMS brings and an overall proactive and open minded mentality in how we think and operate.

4. **End lowest tender contracts**

   End the practice of awarding business solely on the basis of price tag. Instead require meaningful measures of quality along with price. Reduce the number of suppliers for the same item by eliminating those that do not qualify with statistical and other evidence of quality. The aim is to minimize total cost, not merely initial cost, by minimizing variation.

5. **Improve every process**

   Improve constantly and forever every process for planning, production, and service. Search continually for problems in order to improve every activity in the company, to improve quality and productivity, and thus to constantly decrease costs. Institute innovation and constant improvement of product, service, and process. This is aviation is a fundamental axiom given its complex and multidimensional nature.

6. **Institute training on the job**

   Institute modern methods of training on the job for all, including management, to make better use of every employee. New skills are required to keep up with changes in materials, methods, product and service design, machinery, techniques, and service. Aviation without training and retraining is hard to imagine and continual investment in it is a fundamental part of its operational safety and service performance.

7. **Institute leadership**

   Adopt and institute leadership aimed at helping people do a better job. The responsibility of managers and supervisors must be changed from sheer numbers to quality. Improvement of quality will automatically improve productivity. Management must ensure that immediate action is taken on reports of inherited defects, maintenance requirements, poor tools, fuzzy operational definitions, and all conditions detrimental to quality.

8. **Drive out fear**

   Encourage effective two way communication and other means to drive out fear throughout the organization so that everybody may work effectively and more productively for the company.

9. **Break down barriers**

   Break down barriers between departments and staff areas. People in different areas, such as Leasing, Maintenance, Administration, must work in teams to tackle problems that may be encountered with products or service.

10. **Eliminate exhortations**

Eliminate the use of slogans, posters and exhortations for the work force, demanding Zero Defects and new levels of productivity, without providing methods. Such exhortations only create adversarial relationships; the bulk of the causes of low quality and low productivity belong to the system, and thus lie beyond the power of the work force.

11. **Eliminate arbitrary numerical targets**

Eliminate work standards that prescribe quotas for the work force and numerical goals for people in management. Substitute aids and helpful leadership in order to achieve continual improvement of quality and productivity.

12. **Permit pride of workmanship**

Remove the barriers that rob hourly workers, and people in management, of their right to pride of workmanship. This implies, among other things, abolition of the annual merit rating (appraisal of performance) and of Management by Objective. Again, the responsibility of managers, supervisors must be changed from sheer numbers to quality.

13. **Encourage education**

Institute a vigorous program of education, and encourage self-improvement for everyone. What an organization needs is not just good people; it needs people that are improving with education. Advances in competitive position will have their roots in knowledge.

14. **Top management commitment and action**

Clearly define top management's permanent commitment to ever improving quality and productivity, and their obligation to implement all of these principles. Indeed, it is

> not enough that top management commit themselves for life to quality and productivity. They must know what it is that they are committed to—that is, what they must do. Create a structure in top management that will push every day on the preceding 13 Points, and take action in order to accomplish the transformation. Support is not enough: action is required! (Leadership Institute n.d.)

<u>SMS has its roots in TQM as a continuous process of improvement.</u>

Safety officers face an increasing difficult challenge to locate, promote, gain management acceptance, and implement safety programs and technologies. The risk of accidents is so low that just reducing accident risk is not enough. Successful safety officers must decrease the risk of accident while lowering costs, improving performance and/or improving operational efficiencies.

Success will directly result from careful, detailed, studies followed by precise proposals showing the overall benefits, financial and safety, to the organization. Pareto charts can be useful to establish the prioritization of risk elimination or mitigation. Once the risk priority is established a detailed study of how that those risks interact with the operation. An example would be a high number of unstable approaches resulting in go-arounds or balked landings. The risks of a CFIT or runway excursion are the safety threats; operationally flying time is increased which increases by the direct operating cost (fuel, maintenance allowance, flight crew) for each additional flying minute. Additionally gate availability or overtime (time beyond departure conflicting with next arrival) may be included. Other indirect costs may include agent time for any re-bookings, food vouchers required, or other passenger or freight costs. How can the indirect costs be brought in? Many airlines keep statistics on the different departure and arrival compared to the scheduled time. Additionally, they know the vouchers, hotel rooms or other costs for each flight. The cost of the average minute of delay is calculated based on these and other indirect costs. Adding the delay cost per minute, recognizing that there are quantum levels of time with a delay effect on airline operations. (e.g. <15 minute delay has little effect but > 1 hour delay at a hub results in the majority of passengers misconnecting has a significant financial impact) will help properly allocate the cost of the go-around or balked landing.

Determination of the variables allows for the use of the TDABC template and results in a more accurate cost to the airline as a whole. Once the aggregate cost is calculated it can be used as one component in the determination of the return on investment (ROI). The cost of the mitigation or elimination program divided by the frequency of occurrence and aggregate costs provides the ROI.

An important consideration in the use of the aggregate costs is that by allocating many of the costs to an activity will show unused capacity and/or unaccomplished work that traditional costing models fail to break out. For example, an average diversion requires 1500 minutes of agent time for rebooking 100 passengers. On average there are two diversions a month resulting in 3000 agent minutes per month are used for diversions. Eliminate these diversions and there is an additional capacity of 3000 agent minutes per month for no additional cost. When all the constituent costs of diversions are added together then multiplied by the average number of occurrences per month an average diversion cost per month is determined. All of these costs will be additional capacity if the number of diversions is reduced.

Financial Management

Consideration of revenue necessary to compensate for an activity requires calculations which include the annual profit margin (operating or net), and the cost (direct or inclusive) of the activity. Profit margin is the total revenue divided by the profit/loss; either operational or net profit/loss can be used. Once the margin is determined the cost of the activity is divided by the profit/loss margin to determine the amount of revenue needed. Using the diversion example for a large airline such as Delta Air Lines and using their 2010 Annual Financial Report an example would be:

Diversion cost $100,000

The 2010 net profit margin was 1.87%

The 2010 operating profit margin was 6.98%

Using the net profit margin: The diversion cost of $100,000 ÷ net margin 1.87% = revenue needed $5,354,975.

Using the operating profit margin: The diversion cost of 100,000 ÷ operating margin 6.98% = revenue needed $1,432,341. (Delta 2010)

Average revenue per 2010 passenger $337 (total revenue ÷ total passengers) note the total passengers is from the Bureau of Transportation Statistics (BTS n.d.) Passengers needed to produce needed revenue using net profit margin 15,890.

Passengers needed to produce needed revenue using operating profit margin 4,250.

The above basic function shows that safety considerations and continuous investments can have a direct positive impact on financial management. Holistic considerations of safety cannot ignore this fact as, investments that may be considered not necessary may help an airline improve its financial performance by avoiding risks such as the one shown here, which has to do with diversions.

5. Conclusion

Internalizing safety costs in the core financial equation of airlines using activity based costing methodologies is a fundamental next step that airlines must take toward operational and financial sustainability from an economic perspective. Their unwillingness to take this step could be viewed as equal to the unwillingness of a manufacturing company, for example, to internalize environmental costs in their primary business equation. In the current challenging economy and complex operational environment that we operate, something as fundamental to the airline operational and business model as safety must not continue to remain outside of airline companies basic financial equations.

In our paper we argued that through activity based costing techniques airlines can rationalize safety based programs and thus improve their operational and safety performance through improvements in business model consistency. To highlight our argument, we developed a cost-base allocation methodology applied to airline operations. In using cost accounting techniques and rationalizing airline operational and non-operational costs using epistemologically verified baselines we showed that airline safety officers are helped in their efforts toward the acceptance of cost efficient safety programs.

Further research and refinement of our ideas and model is needed in linking the internalization of cost base allocation to company sustainable advantage from a strategic management perspective by exploring theoretical strands such as they exist in strategic management theory. Furthermore, linking our concept with risk and risk management methodology will also be another needed theoretical work strand.

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