NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

Office of Research and Engineering
Safety Studies and Statistical Analysis Division

January 2, 2008

Research Report

Research Report
Oversight of Air Carriers Experiencing Financial Difficulty

ACCIDENT INFORMATION

NTSB Accident Number:	DCA06MA010
Date of Accident:	December 19, 2005
Location of Accident:	Port of Miami, Florida
Investigator-in-Charge:	William English

SAFETY STUDIES AND STATISTICAL ANALYSIS DIVISION

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ACCIDENT SUMMARY

On December 19, 2005, about 1439 eastern standard time, a Grumman Turbo Mallard (G-73T) amphibious airplane, N2969, operated by Flying Boat, Inc., doing business as Chalk's Ocean Airways flight 101, crashed into a shipping channel adjacent to the Port of Miami, Florida, shortly after takeoff from the Miami Seaplane Base. All 20 people aboard the airplane were killed, and the airplane was destroyed by impact forces. Flight 101 was operating under the provisions of 14 *Code of Federal Regulations* (CFR) Part 121 on a regularly scheduled passenger flight to Bimini, Bahamas.

On May 30, 2007, the National Transportation Safety Board determined the probable cause of this accident to be the in-flight failure and separation of the right wing during normal flight, which resulted from (1) the failure of the Chalk's Ocean Airways maintenance program to identify and properly repair fatigue cracks in the right wing and (2) the failure of the Federal Aviation Administration (FAA) to detect and correct deficiencies in the company's maintenance program.[1]

PURPOSE OF THIS REPORT

In the Chalk's Ocean Airways accident investigation report, the Safety Board expressed its concern that "the FAA received cues from a number of sources that, when looked at in aggregate, served as indicators of potential safety deficiencies at Chalk's Ocean Airways" yet expressed no operational or maintenance concerns and did not modify Chalk's surveillance program. In response, the Board issued the following recommendation to the FAA:

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[1] *In-flight Separation of Right Wing Flying Boat, Inc. (doing business as Chalk's Ocean Airways), Flight 101, Grumman Turbo Mallard (G-73T), N2969, Port of Miami, Florida, December 19, 2005,* Aviation Accident Report NTSB/AAR-07/04 (Washington, DC: National Transportation Safety Board, 2007).

> Identify the systemic deficiencies in the maintenance program oversight procedures that led to this accident and modify those procedures to ensure that the maintenance program plans for commercial operators are adequate to ensure the continued airworthiness, both structural and otherwise, of the operator's fleet. (A-07-40)

Board Member deliberations during the meeting raised additional questions about the FAA's oversight of air carriers, particularly those experiencing financial distress. In light of those remaining questions, the Safety Board asked staff to gather additional information concerning FAA oversight of carriers experiencing financial difficulty.

This report provides information about air carrier financial and safety oversight programs. Additionally, it provides a short summary of research findings and an evaluation of the association between air carrier financial health and safety.

METHODOLOGY

To develop this report, staff met with representatives from the DOT Office of Aviation Analysis, Air Carrier Fitness Division, and representatives from the FAA, Flight Standards Service, Certification and Surveillance Division. Staff also reviewed associated regulatory documents and the associated economic and safety research literature.

AIR CARRIER AUTHORITY

Title 49 *United States Code* (U.S.C.) 41101 and 41102 requires air carriers to obtain authorization from the DOT before being eligible to provide transportation service. In practice that requirement includes two specific tasks, an economic authorization from the DOT and a safety authorization from the FAA. The first authorization is a certificate for passenger and/or cargo authority issued by the Secretary of Transportation through the DOT Office of Aviation Analysis, Air Carrier Fitness Division. The primary goal of economic authority is to promote

healthy competition within the industry and to protect the economic interests of the American public. The second authorization, addressed in 14 CFR Parts 119, 121, and/or 135, includes requirements for obtaining an air carrier certificate and operations specifications from the FAA. The primary goal of this authorization is to protect the public safety by ensuring the safety of air carrier operations.

ECONOMIC AUTHORITY

Before offering transportation services to the public, U.S. air carriers must be granted the authority to do so by the DOT. Economic authority[2] may be granted as either a certificate authority for passenger and/or cargo services operating large aircraft (mentioned above),[3] as commuter authority to operate small aircraft,[4] or as an exemption to operate as an air taxi.[5] To grant such authority, 49 U.S.C. 41101 requires the Secretary of Transportation to find a carrier to be "fit, willing, and able to provide the transportation to be authorized." Fitness includes a determination by the DOT Air Carrier Fitness Division that the carrier meets applicable standards for U.S. ownership and that it has sufficient financial resources and management competency to operate as an air carrier. For example, a new applicant must provide proof of sufficient funds to cover pre-operating expenses and one quarter of first-year operating expenses. At least two-thirds of the applicant carrier's key personnel—including the president, board of

[2] DOT issues several types of economic authorities: (1) section 401 certificate of public convenience and necessity for scheduled or charter operations, (2) section 418 domestic all cargo authority, (3) commuter air carrier authority, (4) air taxi operator authority, and (5) exemption authority.

[3] Companies that wish to engage in air transportation operations with aircraft having more than 60 passenger seats or 18,000 pounds payload ("large aircraft") are required to hold certificate authority. Companies operating smaller aircraft may also receive such authority, but are not required to do so.

[4] For the purposes of the DOT Office of Aviation Analysis, a commuter air carrier is defined as a company that operates aircraft designed to have no more than 60 passenger seats and that provides scheduled passenger service of five or more round-trip flights per week on at least one route according to published flight schedules.

[5] An air taxi operator is defined as a company that operates aircraft designed to have no more than 60 passenger seats or a cargo payload of 18,000 pounds and that carries cargo or mail on either a scheduled or charter basis, and/or that carries passengers on an on-demand basis only.

directors, and holding company, as applicable[6]—must be United States citizens. The individuals involved in managing the carrier (director of operations, for example) are also scrutinized to determine if they have sufficient experience and if their history of personal and/or professional behavior indicates a disposition for compliance. The Air Carrier Fitness Division may withhold economic authority or prohibit certain individuals from involvement with a carrier due to prior criminal history, outstanding judgments, or other patterns of behavior that suggest a potential threat to the economic interests of the carrier's customers. New applicants are typically granted a tentative finding with an order to show cause.[7] If no significant issues are identified, the applicant is granted a final order. After clearing any remaining requirements, such as liability insurance coverage, the applicant is granted effective economic authority.

Economic authority does not expire; the requirement to maintain economic fitness is ongoing. Title 49 U.S.C. 41110 requires that "an air carrier must continue to be fit, willing, and able to provide the transportation authorized by the certificate and to comply with this part and regulations of the Secretary." The statute further requires the Secretary of Transportation to modify, suspend, or revoke the certificate of a carrier that is subsequently found to be unfit, or that fails to report information required to determine fitness.[8] Limitations are placed on the economic authority of certificated carriers for the first 5 years after certification, during which time they are closely monitored by the DOT Air Carrier Fitness Division to ensure their compliance with all applicable economic regulations and limitations. During this time, certificated carriers must file formal requests to add aircraft, expand service, or change routes.

[6] The focus is on the certificate holder, but parent companies may also be considered if there are shared positions.
[7] In this case, a "show cause" finding indicates the DOT's intent to grant economic authority but provides an opportunity for comments from the industry, competing operators, and the public.
[8] Although they are not certificated, air taxis operating under exemption authority are also subject to an ongoing fitness requirement. The DOT does not conduct regular fitness reviews of carriers operating under exemption authority, but may review a carrier if it is informed of a potential problem.

After the 5-year probationary period has ended, the Air Carrier Fitness Division typically consults with the FAA before lifting the authority limitations. Thereafter, certificated carriers are informally assessed—typically every 3 to 4 years—or in response to significant proposed changes to their service, fleet, or management. The Air Carrier Fitness Office may impose limitations or other restrictions on a carrier at any time appropriate to address concerns. If a carrier requests additional authority at any time after the initial 5-year period—a carrier with commuter authority wishing to add large aircraft, for example—it must submit a new formal filing similar to that of a new applicant. In that case, the 5-year clock on limitations will be reset.

In carrying out its duties, the Air Carrier Fitness Division does not employ inspectors or field investigators to monitor carriers and collect data. They instead rely on other entities like the FAA, financial institutions, the Bureau of Transportation Statistics, and the carriers themselves to provide necessary information. A carrier's economic authority can be revoked in cases of significant noncompliance, but such an action would be coordinated with, or made at the request of, the FAA.

SAFETY AUTHORITY

Once an applicant receives DOT economic authority, it must be granted safety authority before commencing operations. Safety authority comes from the FAA in the form of an air carrier certificate and associated operations specifications. Title 14 CFR Part 119.39(a) states that an applicant may be issued an air carrier certificate or operating certificate if, after investigation, the administrator finds that the applicant meets the applicable requirements of Part 119; holds the economic authority issued by the DOT applicable to the kinds of operations to be conducted; is properly and adequately equipped; and is able to operate safely under the appropriate provisions of 14 CFR Part 121 or 135 and according to operations specifications

issued under 14 CFR Part 119. Title 14 CFR 119.51(a) states that the FAA may amend any operations specifications issued under Part 119 if the administrator determines that safety in air commerce and the public interest require the amendment or if the certificate holder applies for the amendment, and the administrator determines that safety in air commerce and the public interest allow the amendment.

Within the FAA, the Flight Standards Service (AFS) is responsible for setting certification standards for operators, agencies, and personnel. AFS is also responsible for setting federal regulations and conducting the oversight and enforcement necessary to implement those regulations. Within AFS, the Flight Standards Certification and Surveillance Division is responsible for implementing national certification and surveillance programs, policies, and procedures and for ensuring the standard application of those requirements in the field. To fulfill that responsibility, inspectors oversee the certification and surveillance of operators, agencies, aircraft, and personnel engaged in commercial air transportation.

FAA surveillance is a data collection process that is used to determine if a carrier is meeting its regulatory requirements and operating specifications. At the time of the Chalk's accident, three main systems were used for oversight of 14 CFR Part 121 carriers. The oldest of those systems, the FAA National Program Guidelines (NPG), was initiated in 1985. The NPG system was intended to ensure airline compliance with safety regulations, operating specifications, and FAA policy through a set of minimum inspection standards. Under the NPG system, program managers would specify a minimum set of required annual inspections. On the basis of their experience overseeing a particular carrier, inspectors would determine an additional set of planned annual inspections.

In response to critiques of the NPG system[9] and oversight failures like those identified in the 1996 in-flight fire and fatal crash of ValuJet Airlines Flight 592, the FAA established the Air Transportation Oversight System (ATOS)[10] in 1998. Rather than focusing strictly on compliance-based oversight, ATOS applies system safety principals to the oversight task by continuously identifying potential risks, evaluating the severity and probability of identified risks, and monitoring risk remediation. Rather than setting a minimum number of inspection activities, ATOS provides a methodology for directing oversight resources to areas of greatest need. Under ATOS, FAA inspectors use multiple data sources and analysis tools to monitor trends in a carrier's operations, maintenance, and workforce—or interactions between those elements—with the goal of identifying and minimizing risks.

ATOS was initially applied to 10 large legacy carriers, with the intention of eventually expanding to include all air carriers. However, the risk-based analyses in ATOS required more inspectors per certificate and resulted in a higher workload for inspectors than the compliance-based inspections of the NPG. Since resource limitations initially prevented the FAA from applying ATOS to all Part 121 carriers, the FAA established a third system. The Surveillance and Evaluation Program (SEP), was developed to apply some of the risk-based processes of ATOS to the oversight of non-ATOS carriers. The SEP, which was intended as an interim step toward fully implementing ATOS, used the risk assessment elements of ATOS to make more objective modifications to the required NPG inspections. As part of the SEP process, inspectors

[9] See for example, (a) General Accounting Office (GAO), *Aviation Safety: FAA's Safety Inspection Management System Lacks Adequate Oversight*, GAO/RCED-90-36 (Washington, DC: November 13, 1989); (b) GAO, *Aviation Safety: Problems Persist in FAA's Inspection Program*, GAO/RCED-92-14 (Washington, DC: November 20, 1991); (c) GAO, *Aviation Safety: FAA Needs to More Aggressively Manage Its Inspection Program*, GAO/T-RCED-92-25 (Washington, DC: February 6, 1992); (d) GAO, *Aviation Safety: Weaknesses in Inspection and Enforcement Limit FAA in Identifying and Responding to Risks*, GAO/RCED-98-6 (Washington, DC: February 27, 1998).

[10] For detailed descriptions of ATOS, see FAA Notice 8000.350, *Air Transportation Oversight System Version 1.1*, and FAA Notice 8900.11, *Air Transportation Oversight System Version 1.2*.

for each carrier used ATOS checklists and data analysis tools to periodically assess their findings and to modify the inspection plan to target areas identified as high risk.

In addition to specific ATOS and SEP/NPG program guidance, the FAA publishes Inspector's Handbooks[11] containing all FAA Flight Standards policy and guidance concerning aviation safety inspector job tasks, including surveillance. Field inspectors and managers of certificate-holding FAA district offices (CHDO) also have access to internal and external databases for monitoring carriers and planning oversight. To this end, both ATOS and SEP inspectors use the FAA's Safety Performance Analysis System (SPAS), an interface that provides access to multiple databases for evaluating operators, aircraft, and personnel. Oversight personnel use SPAS to search safety-related records like prior inspection data, enforcements, accidents/incidents, airworthiness directives, traffic reports,[12] and the VITALS database[13] of certificate holders. Inspectors are responsible for monitoring all SPAS data relevant to the certificates they oversee. The SPAS interface allows users to set "flags" to be notified of changes in the data that may be significant. When concerns are flagged in relevant data, inspectors are instructed[14] to determine what led to the flag and what action(s) may be necessary to address the concern. With regard to financial information, SPAS provides access to Experian Intelliscore[15] credit ratings, which use proprietary statistical models to predict and measure business risk.

[11] In September 2007, the FAA's Airworthiness, Air Transportation Operations, and General Aviation Operations Inspector's Handbooks (FAA Orders 8300.10, 8400.10, and 8700.1, respectively) were consolidated into FAA Order 8900.1, *Flight Standards Information Management System (FSIMS)*.

[12] DOT Bureau of Transportation Statistics Form 41, Schedule T–1 Traffic

[13] The VITALS database is maintained by the FAA Flight Standards Service and contains information on certificated operators and associated personnel.

[14] FAA Order 8900.1, *Flight Standards Information Management System (FSIMS)*, 1-69. CNG 0

[15] Experian Intelliscore results include a risk score from 0 to 100 (a high score indicates low risk), the variables contributing most significantly to the score, and any additional support data.

INTERACTION OF ECONOMIC AND SAFETY AUTHORITY OVERSIGHT

The DOT's assessment of air carrier fitness through the Air Carrier Fitness Division serves a distinctly different purpose than the regulatory and oversight functions conducted by the FAA. The Office of Aviation Analysis monitors air carrier traffic, fares, capacity, and financial status as well as general industry trends to fulfill the DOT responsibility for promoting a healthy and competitive airline industry while protecting public consumer interests. Analysts in the Air Carrier Fitness Division query FAA field inspectors about a carrier's accident, incident, and enforcement history as part of its economic fitness determinations. However, these safety-related details are considered only to determine a carrier's ability or willingness to provide the services authorized. Fitness Division analysts rely on FAA inspectors to determine a carrier's safety and compliance status. The certificate holder is also responsible for providing all appropriate information and notifications to maintain its economic fitness authority.

Effective communications are critical to the success of this process. An example of DOT communications with FAA was discussed in the Chalk's Ocean Airways accident report. These communications included a series of discussions between the DOT Air Carrier Fitness Division analyst and the FAA inspector responsible for Chalk's operating certificate oversight prior to the accident. During an informal periodic fitness review, the DOT analyst learned from the FAA that Chalk's had cancelled scheduled flights several times for maintenance and had rebooked passengers using contract services with a Part 135 carrier. The practice, known as sub-servicing, is prohibited[16] because it redirects passengers to an air carrier with a lower level of authority. Although their principal inspector was aware of cancellations, Chalk's had not informed the DOT of the instances of sub-servicing. The DOT informed Chalk's general manager about its

[16] Title 49 U.S.C. 41738 and 14 CFR 298.21

concern with the practice and contacted the FAA inspector about the carrier's safety and maintenance history to determine if the carrier had exhibited other signs that it might not be fit to provide the authorized transportation service. On the basis of the FAA inspector's response, and the possibility that Chalk's might soon be acquired by a third party, the DOT analyst deferred ruling on the fitness review and ordered Chalk's to report future cancellation events.

The FAA inspector handbook provides specific guidance for inspectors overseeing carriers experiencing significant change.[17] That guidance discusses detectable indicators of a potential imbalance between resources and operational requirements, and decision guides for determining when a carrier's oversight program may need to be modified in response to financial pressures. The guidance includes examples of potential stressors, as well as leading and lagging indicators of financial imbalance.

- Stressors are defined as internal or industry events—such as increased competition on key routes or a changing workforce—that may increase pressure on a carrier's operation or financial position.
- Leading indicators are those conditions or events—like personnel turnover or management restructuring—that may not be a problem but hint at a potential imbalance between a carrier's finances and operational demands.
- Leading indicators are not necessarily problematic but may warrant further targeted surveillance in order to address issues before they affect safety.

[17] At the time of the Chalk's accident that guidance was contained in FAA Orders 8300.10 and 8400.10, *Joint Flight Standards Handbook Bulletin for Airworthiness (HBAW)* and *Air Transportation (HBAT)*, bulletin numbers HBAW 98-21 and HBAT 98-36, Monitoring Operators During Periods of Growth or Major Change. As of September 2007, that guidance is contained in FAA Order 8900.1, *Flight Standards Information Management System (FSIMS)*.

- Lagging indicators include conditions or events that can be detected only after a financial imbalance condition has occurred. Like leading indicators, lagging indicators don't necessarily represent a safety risk but do point to the immediate possibility for problems. Lagging indicators include unpaid bills or bankruptcy.

FAA guidance instructs CHDO managers and field inspectors to evaluate stressors and leading/lagging indicators, and to work with carriers to address potential risks before they affect safety. Inspectors are instructed to use all available sources of information, both formal and informal, to identify potential stressors and indicators. Formal sources may include carrier requests to modify routes or operating specifications, notices of unpaid debt from banks or creditors, or bankruptcy filings. Informal sources include discussions with carrier personnel or trade publications. FAA Order 8900.1 also states that the CHDO manager and principal inspector are responsible for deciding how to anticipate or respond to air carrier risks and for identifying the information they need to make these decisions.

Just as the DOT relies on FAA inspectors, FAA managers and inspectors depend on DOT Air Carrier Fitness Division analysts for verifying a carrier's financial information. Fitness Division analysts stated that although they are not involved in safety assessments, they regularly contribute to FAA SEP reports[18] by answering questions like those below, which are designed to crosscheck economic authority records with inspection data.

1. What is the operator's current economic authority?
2. What is the number and type(s) of aircraft the carrier is authorized to operate?
3. Are you aware of any recent changes in ownership, type, or number of aircraft, or changes in management?

[18] DOT Air Carrier Fitness Division analysts currently do not receive ATOS reports or contribute to ATOS reports as with SEP.

4. Has there been a recent fitness review? If so, what was the result?
5. Are there any concerns or conditions imposed on the carrier?

OVERSIGHT PROCESS CHANGES

In a 2005 review of FAA safety oversight,[19] the DOT Inspector General (IG) stated that the FAA needed to strengthen its support functions to ensure that inspectors had sufficient data about the financial health of carriers. The IG found that the analyses supporting ATOS and SEP were not continually conducted, and that data were provided to inspectors only on request. The IG also found that few inspectors requested financial data and those who did made their requests only after the carrier began making changes in response to financial losses. As a result, changes in surveillance for financial reasons tended to be event-based, following significant events like bankruptcy. The report noted that in some cases the problem was compounded by inaccurate or old data. For example, one carrier's bankruptcy filing did not appear in SPAS for 6 months. Overall, inspector responses to carriers' financial distress or growth were found to be inconsistent.

The report also noted that the guidance[20] provided to inspectors at the time was partly to blame because it did not specify when or how surveillance should be adjusted. FAA guidance provided to safety inspectors at the time of the review included instructions for monitoring carriers experiencing financial distress, growth, or significant changes. In addition to safety, maintenance, and operations issues, the guidance instructed safety inspectors to be aware of any

[19] OIG Report Number AV-2005-062, "FAA Safety Oversight of an Air Carrier Industry in Transition," June 3, 2005.
[20] FAA Orders 8300.10 and 8400.10, *Joint Flight Standards Handbook Bulletin for Airworthiness (HBAW)* and *Air Transportation (HBAT)*, bulletin numbers HBAW 98-21 and HBAT 98-36, Monitoring Operators During Periods of Growth or Major Change.

limits placed on the carrier's economic authority by the DOT, and to inform the DOT of any indications that a carrier might be in conflict with those limitations. Inspectors were also given a general instruction to forward "any information regarding their air carrier's fitness, especially their financial fitness that may cast doubt on the air carrier's ability to operate or that may trigger a new fitness evaluation."

The FAA handbook also included items that inspectors should monitor as indicators of financial fitness. Among these items were questions attributed to an NTSB Corporate Culture Checklist,[21] comparing factors like wages, morale, and employee turnover to industry standards. As noted in the DOT IG report, however, the guidance did not clarify when inspectors should start monitoring those indicators and did not provide thresholds of change that would require surveillance to be modified. It should be noted that the guidance reviewed in the DOT IG's 2005 report was the same as that in use by inspectors at the time of the Chalk's accident.

In March 2006, the FAA published a change[22] to Order 8300.10, Chapter 125, "Evaluation of Air Carrier's Management of Significant Changes," which substantially modified the guidance to inspectors for adjusting surveillance in response to carriers' financial distress, growth or downsizing, and/or labor unrest. Changes included the addition of decision aids for determining the level of risk a carrier might be facing. As a result, CHDO managers and inspectors are now instructed to use the decision aids to compare a carriers' situation to a series of word pictures, scoring the presence and extent of various leading and lagging indicators. The word pictures address several dimensions of financial stability, safety, and workforce condition,

[21] The checklist referenced in the guidance is attributed only to the NTSB, with no further citation details. However, the citation is likely referring to an internal document developed by staff for use as an interview guide during human performance and operations investigations.
[22] Change 23, dated March 31, 2006.

with each resulting in a score. For example, the FAA guidance includes the following word picture and associated scoring as a measure of financial stability.

1) Deferment of discretionary spending (capital expenditure, training, advertising, etc.).

2) Sale of assets (spare parts, aircraft, lease back, etc.).

3) Loss of valuable suppliers.

SCORE	WORD PICTURE
1–2	The certificate holder is experiencing all three of the above financial stability issues.
3–5	The certificate holder is experiencing two of the three above financial stability issues.
6–7	The certificate holder is experiencing one of the three above financial stability issues.
8–9	The certificate holder is NOT experiencing any of the three above financial stability issues.
10	The certificate holder is financially stable.

Scores are added to produce a combined risk score from low to high that is then used to determine the need to modify a carrier's surveillance program. A high score indicates low risk, a sign that no surveillance changes are needed. Conversely, a low score indicates high risk, requiring inspectors to initiate a SEP or ATOS Risk Management Process. By adding a scoring tool and setting thresholds for required action, the revised guidance addresses the recommendation set forth in the IG's 2005 report, which asked the FAA to clarify and expand inspector guidance for evaluating a carrier's financial condition and growth.

Another recommendation in the IG's 2005 report was to provide inspectors with additional sources of financial information. In discussions with Safety Board staff, a representative of the FAA's Certification and Surveillance Division stated that part of the reason for a lack of financial data was that typical economic measures like debt ratio and credit scores were historically of little use to inspectors when making safety assessments. The FAA's current

approach to surveillance instead stresses that inspectors use all available sources of information—formal and informal, internal and external—along with their personal experience and knowledge of the carrier to adjust surveillance based on information needs. FAA's AFS Surveillance Office employs its own financial analyst to review economic data, but other than discrete events like a bankruptcy, there are few deterministic triggers for modifying surveillance. At one time, the FAA attempted to maintain a list of "distressed carriers," but found that they were unable to defend such ratings. The safety impact of financial stressors can vary greatly based on situational factors and carrier response. The assertion that financial databases are of limited usefulness to FAA inspectors is supported, at least in part, by research on the link between economics and safety, as described below.

EVIDENCE FOR FINANCIAL INDICATORS OF SAFETY

In its 1972 study of air taxi safety,[23] the Safety Board suggested that in contrast to the then-regulated 14 CFR Part 121 airlines, "the financial condition of air taxi/commuter air carriers is very closely related to the level of safety at which they operate." To date, however, analyses of the relationship between economic indicators and safety results have yielded conflicting results, and no measures have been identified as conclusive indicators of future safety problems. The issue of air carrier finances and safety performance generated academic interest following deregulation of the U.S. airline industry in 1978. Particularly in early research, the results were contradictory.

Using data from 11 large domestic airline operations from 1963 to 1970, Golbe[24] compared airline profits with safety outcomes and found no relationship between profitability

[23] *Air Taxi Safety Study* NTSB/AAS-72/09 (Washington, DC: National Transportation Safety Board, 1972).
[24] D.L. Golbe, "Safety and Profits in the Airline Industry," *The Journal of Industrial Economics*, 34(3) (1986) pp. 305-318.

and safety. In some cases, higher profits were even found to be associated with an increase in accidents. In later work using records from an expanded dataset of 35 carriers between 1957 and 1986, Rose[25] examined the relationship between accidents and a variety of operating and financial variables. The results indicated a small positive relationship between profitability and safety for small carriers. The relationship was not as strong for larger carriers; a finding that the author suggests may be due to FAA safety inspection and enforcement. In effect, the fact that the FAA scrutinizes failing carriers may weaken the relationship between a carrier's finances and safety. It could be argued that a central purpose of FAA oversight is to prevent the development of such relationships between safety stressors and negative safety outcomes.[26] Rose's results were also not uniform across operators, and some carriers exhibited the negative relationship identified by Golbe. In a 1997 study of Canadian operators, Dionne and others[27] found that for small carriers, increased profitability was associated with more accidents, directly contradicting Rose's early findings.

In a 2004 study, Noronha and Singal[28] used a slightly different approach, suggesting that the methodologies used by Dionne and Rose were not forward-looking. Instead of measuring profitability, the authors compared a carrier's bond ratings with accident and incident occurrences in subsequent months. Results showed that carriers with higher quality bond ratings were less likely to experience mishaps. On average, a letter grade difference in bond rating was

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[25](a) N.L. Rose, "Profitability and Product Quality: Economic Determinants of Airline Safety," The Journal of Political Economy, 98(5) (1990), pp. 944-964; (b) N.L. Rose, "Fear of Flying? Economic Analysis of Airline Safety," The Journal of Economic Perspectives, 6(2) (1992), pp. 75-94.

[26] GRA Inc., *Aviation Safety Data Accessibility Study: A Report On Issues Related To Public Interest In Aviation Safety Data*, prepared for FAA (January 20, 1997), available online at: http://www.faa.gov/library/reports/aviation/.

[27] G. Dionne and others, "Debt, Moral Hazard and Airline Safety: An Empirical Evidence," *Journal of Econometrics*, 79 (1997) pp. 379-402.

[28] G. Noronha and V. Singal, "Financial Health and Airline Safety," *Managerial and Decision Economics*, 25 (2004): pp. 1-16.

found to be associated with a 10-percent difference in accident/incident risk. However, bond ratings are of limited use for safety oversight because only the largest carriers issue bonds.

Profitability alone is not a useful indicator of safety risk because it is affected by many factors, all of which can affect safety in different ways. Higher volume, for example, may increase profits while increasing exposure to risk and the possibility of safety problems. In contrast, higher operating costs, which might decrease profits, could decrease the possibility of safety problems if the costs reflect more rigorous training or aircraft maintenance. When considered in this way, such factors represent possible measures of safety. For example, the previously discussed Dionne study showed that carriers that spent more on maintenance per departure had fewer accidents. Nevertheless, comparing maintenance and operating expenditures among carriers is difficult at best because of the carriers' intrinsic dissimilarities, including differing route structures, workforce demographics, and equipment age. Further, changes in expenditures within a particular carrier may indicate an emerging problem, but an increase in spending may not be a clear indicator of a problem because the increase may reveal an increased emphasis on maintenance or an attempt to deal with an ailing fleet rather than an effort to address safety issues.

Attempts to identify financial correlates to air carrier safety must control for the effects of regulatory changes, technological improvements, carrier size, and operating differences. Even comprehensive financial measures, like the credit bureau ratings available to inspectors, have shown little value for inspectors attempting to proactively identify potential safety problems. Profitability, debt, and credit rating data are rearward looking by nature—current indications of past performance. Downward movement in a credit rating suggests that the carrier has already felt the effects of financial difficulty and is no longer able to sustain its financial condition.

Downward movement in credit scores may also be limited since many carriers have low credit ratings to begin with due to the very small operating margins and high capital expenses typical of the industry. Since safety cannot be observed directly, and can only be measured through results like accidents and incidents, the choice of safety measure(s) will also affect analytical results. Air carrier accidents are rare events that yield limited statistical power, and a lack of accidents does not necessarily indicate a safe operation or low risk.

DISCUSSION

The Safety Board's investigation of the Chalk's accident identified maintenance problems that could have been identified and addressed by the operator, or through FAA operator surveillance, before they caused an accident. Further, FAA inspector guidance suggests that Chalk's surveillance program should have been modified before the accident to minimize risks related to the operator's financial position and personnel turnover. Nevertheless, Chalk's surveillance was not changed, even after the DOT's Air Carrier Fitness Division raised concerns about maintenance-related flight cancellations and subservicing during an informal economic fitness review. Surveillance issues included local oversight failures—such as the FAA principle maintenance inspector not acting on repeated indicators of problems with the accident airplane[29]—and systemic failures—like unclear guidance for when to modify surveillance.

However, FAA has made several changes in its surveillance programs for Part 121 carriers; one of the most notable is that all 121 carriers have been transitioned to ATOS.[30] Both

[29] See the NTSB report of the Chalk's accident investigation, page 45

[30] In January 2005, the FAA established the System Approach for Safety Oversight (SASO) to design, develop, and demonstrate standard system safety-based oversight for all part 121 air carriers. The SASO focused on the problems and challenges of transitioning all Part 121 carriers to ATOS by the end of 2007. Part of that effort included the development of ATOS revision 1.2. Guidance for ATOS 1.2 is provided in FAA Notice 8900.11, Air Transportation Oversight System Version 1.2. When last queried by NTSB staff in October 2007, fewer than 10 Part 121 carriers remained on the SEP/NPG system and those were on schedule for the end of the year transition deadline. In addition

the Government Accountability Office (GAO) and the DOT IG have reviewed ATOS and—in spite of some areas still needing improvement—find it superior to the SEP/NPG system it replaces. With regard to maintenance oversight in particular, GAO and the IG have found that the team tasks included in ATOS are more effective than those conducted by an individual inspector.[31] FAA has also updated its guidance for inspectors. Chapter 125 of FAA Order 8300.10, which addresses the evaluation of carriers experiencing significant changes in financial condition, size, or workforce, was substantially revised soon after the Chalk's accident, and has been incorporated in the new combined Flight Standards Information Management System (FSIMS).[32] The revised guidance includes decision tools, a scoring system, and action plans for identifying and responding to potential risks.

Despite these improvements, significant challenges remain. The FAA's recent expansion of ATOS is part of an overall effort to replace traditional oversight with safety management systems[33] that rely on data analyses and risk assessment tools.[34] The risk assessment tasks in ATOS typically require more personnel resources per certificate holder than the systems being replaced, and may therefore require more inspectors. Safety analyses and measurement tools are also only as useful as the data on which they are based. Current evidence suggests that although the link between finances and safety is intuitively plausible, there is a lack of data linking

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to moving all Part 121 carriers to ATOS, the SASO effort also developed a plan to move all Part 135 carriers to SEP. The FAA's recent expansion of ATOS is part of its shift toward safety management systems (SMS), which replaces traditional oversight programs that ensure compliance with applicable regulations and procedures through a process of hazard identification, risk analysis, hazards ranking, risk mitigation, and outcome assessment.

[31] (a) GAO, *Aviation Safety: FAA's New Inspection System Offers Promise, But Problems Need To Be Addressed*, GAO/RCED-99-183 (Washington, D.C.: June 28, 1999); (b) Statement of Todd J. Zinser, Acting Inspector General, U.S. Department of Transportation, before the Committee on Transportation and Infrastructure Subcommittee on Aviation, United States House of Representatives, Washington, D.C. September 20, 2006.

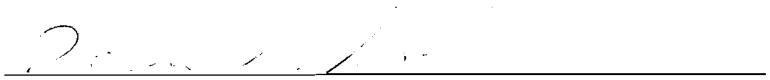
[32] FAA Order 8900.1, CHG 0, dated September 13, 2007.

[33] Acting FAA Administrator, Robert A. Sturgell, comments before the *4th Annual FAA International Safety Forum*, Washington, D.C., November 29, 2007

[34] Safety management analysis tasks include hazard identification, risk analysis, hazards ranking, risk mitigation, and outcome assessment.

financial indicators to safety risk. The FAA's new guidance and scoring tools provide inspectors with an improved methodology for oversight of financial issues but the identification of potential safety problems due to financial stress remains largely subjective. The FAA's safety oversight will therefore continue to depend upon the skill, experience, judgment, and diligence of the managers, inspectors, and operator personnel responsible for monitoring safety risks.

Submitted By:



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