蓄意違反規定

從LOSA的資料顯示，蓄意忽略檢查程序，或是不遵守下滑道的規定，會導致更大的問題。

邁德 譯

根據數千次航班的「線上飛航操作安全查核」(Line Operations Safety Audit，文後簡稱LOSA)所觀察到的資料，飛航組員蓄意違反駕駛艙的標準作業程序(Standard Operating Procedures, SOP)，相較於其他諸如：非蓄意而造成的疏失，或是對飛行安全的威脅管理不當等瑕疵，其發生次數高了2至3倍之多。

LOSA共同研究團隊執行長James Klinect先生，在2013年10月世界飛安基金會假華盛頓舉行的「第66屆國際航空安全高峰會議」(International Air Safety Summit, IASS)中表示，經常看到因蓄意違反規定而造成的疏失事件。

Klinect先生的研究團隊自1996年開始，在全球超過70家航空公司的LOSA觀察中，收集到超過20,000航班的資料(詳如圖一：LOSA觀察航班區域分佈圖)。LOSA觀察作業的特徵有10項，包括由訓練有素的觀察員坐在「觀察員座」(Jump seats)，執行例行航班中的觀察；飛航組員自願參與；資料收集採用匿名、保密及非懲罰等方式進行；以及研究結果回饋給線上飛行員等(請參閱「LOSA觀察作業特徵」)。【譯註：Jump seats通常設置在飛機駕駛艙或客艙之出入口旁，採用可摺疊式機動座椅以供非值勤組員使用；諸如：實習飛航組員、休班組員飛渡到另一個機場、飛航查核人員等；未使用時，應保持摺疊狀態，以確保走道，活動區之暢通。】

Klinect先生表示，經由這些觀察資料顯示，在飛航中蓄意違反規定的事件數量逐漸增加，至於發生威脅與疏失的管理不當，以及造成不預期的飛機狀態(Undesired Aircraft State, UAS)之事件數量，也同樣在增加中(詳如表一)。

根據LOSA觀察飛航所收集而設置的資料庫，不論是因蓄意違反規定而造成疏失的事件，或是因威脅而造成疏失的事件，其平均數量是相當的。但是，每班飛航中發生疏失的平均次數，非蓄意違反規定的疏失是2.1次、乙次蓄意違反規定的疏失是3.9次、兩次以上蓄意違反規定的疏失是7.5次。

Klinect先生在「第 66屆國際航空安全高峰會議」中表示，在LOSA研究團隊的資料庫中，觀察員的報告顯示，在49%的飛航中，至少發生乙次蓄意違反規定的疏失。

他強調真正的問題是，飛航組員面對蓄意違反規定而造成疏失的反應，經常是不正確地 — 也就是說，他們的反應實際上代表了面對疏失的管理不當 — 大約有20%的機會，「那麼會有20%蓄意違反規定的疏失，實際上是連結到其他方面的疏失。」

最常見蓄意違反規定的疏失，諸如：忽略了高度的呼叫、靠記憶執行檢查程序、未依強制規定執行重飛程序、操控飛行時由另一位飛行員更改飛航導引，以及飛機尚未脫離跑道卻認為是滑行的操控權責。

「這是非常簡單的情境，」Klinect先生說：「然而這些情境看起來，真的是細枝末節嗎？.....我會爭辯的說.....直到我們開始瞭解到，什麼才是蓄意違反規定.....當你從系統的角度來看，這是個需要處理的大問題.....甚至會發現到，違反規定會造成什麼樣的文化。」

他列舉LOSA觀察員參與波音777-300ER型機的飛航作業，進一步說明飛航組員因蓄意違反規定而造成的疏失事件。

飛機在2,800英呎的高度設定儀器落地系統以執行進場，飛航管制員(Air Traffic Control, ATC)通知飛航組員保持速度160浬/時。觀察員描述的替代情境是，機長告訴擔任操控飛行員(Pilot Flying, PF)的副機師：「你要忽略這項速度指示，飛機才能在1,500英呎的高度保持穩定進場。」飛航組員在操控面板上設置126浬/時的速度模式，並且選定襟翼伸放30度。雖然副機師「提議」設置在160浬/時，但機長「堅持不理會飛航管制員的指示。」觀察員強調的表示，當時機長已無多餘的時間，告訴飛航管制員他的企圖。

LOSA觀察員對此項疏失的分類是：「蓄意違反飛航管制員的速度指示/速度太低的偏差。」

程序偏差

Klinect先生表示，蓄意違反規定的事件是評估一個組織對執行程序發生偏差的方法之一，他的定義是：「如果你編寫設定一套程序.....然而，飛航組員卻對編寫的程序發生執行偏差。」

應該對每一家航空公司提出一個問題，他問道：「你能讓你的飛航組員偏差多遠？」

Klinect先生表示，LOSA觀察員在駕駛艙內聆聽及觀察飛航組員的言行舉止，據以評估程序發生執行偏差的程度。

舉一個例子來說，他以實例指證飛航組員犯同樣的疏失有數次之多，諸如在一個飛航階段中，就有4或5次在改平飛時沒有呼叫。這些沒有呼叫的疏失，整合在LOSA觀察的編碼為：飛航中乙次蓄意違反規定的疏失。

「我們無法當面問飛航組員：這是蓄意或是非蓄意的違反規定，」Klinect先生說：「我們企圖運用能夠觀察到的方法.....雖然這樣做並非完美無缺，但已接近我們的理想。」

再舉另一個例子，他說：「飛航組員公開討論，他們將會蓄意違反標準作業程序；而且，在觀察員實際的觀察時也發生了，」通常在這種案例中，飛行員相信他們是在節省時間 — 他補充的說：「靠記憶執行檢查程序是個傳統。」

管理疏失

Klinect先生表示，分析LOSA觀察資料，發現最好的飛航組員是，他們不僅是管理飛航時操控的複雜性，也同時能預見到威脅與疏失，並管理之。他們運用「威脅與疏失管理」(Threat and Error Management，文後簡稱TEM)的防禦機制，包括：政策與程序、監控/交互檢查、組員資源管理、檢查表、呼叫偏差、飛機硬體、飛行員素養等，以及「幸運」。

Klinect先生表示，TEM防禦機制的弱點在LOSA觀察中變得很明顯；舉例來說，LOSA資料庫中有26%的航班發生檢查表的疏失 — 大多數發生在飛機離場前的階段。

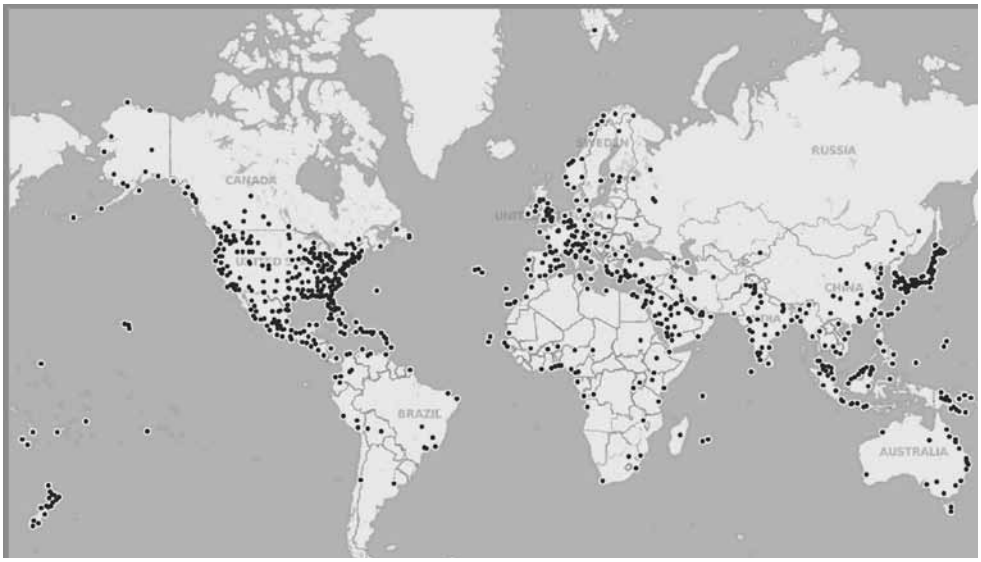
他同時指出LOSA觀察航班中的顯示，飛航組員在監控與交互檢查的技能上，已經瀕臨到缺乏/邊界的評估，相較於疏失的管理不當與發生不預期的飛機狀態，有超過2倍以上的觀察紀錄。

「這就是為什麼我們要關注監控/交互檢查，」Klinect先生說：「它的目的不是為了監控而監控.....威脅與疏失管理的企圖是.....我們想要關注的重點是 — 管理威脅、疏失，以及不預期的飛機狀態。」

經由20,000航班的觀察，幾乎在所有的航班中都發現，包括某些類別的飛航組員疏失，以及「不幸的是，並不是所有的飛航組員都能管理疏失。」他說：「事實上，我們看到約有35%的航班發生飛機偏差狀態，諸如：不穩定進場、速度偏差(LOSA的定義是：與航管許可或限制的速度相差超過正負10浬/時)、垂直偏差或橫向偏差等。」

EBT初步訓練

Klinect先生表示，LOSA資料支援以證據為基礎的訓練(Evidence-Based Training, EBT)，特別是針對飛行員的領域，可以在進一步的訓練中獲得助益。



圖一：LOSA觀察航班區域分佈圖。
LOSA = 線上飛航操作安全查核。
註：自1996年開始，觀察超過70家航空公司及超過20,000航班，指標代表觀察區域的分佈位置。
資料來源：James Klinect先生。

他表示，飛行員管理不當的主要項目，大都涉及操控飛機時發生速度偏差；依資料顯示，有81%的發生原因是管理不當。大多數發生在下降/進場階段，而問題出在監控飛行員(Pilot Monitoring, PM)很少呼叫；他強調的說：「程序就擺在那裡，但飛航組員為了某些原因，並沒有去執行它。」

根據資料顯示，他表示至少有兩個領域需要加強訓練，這涉及飛航組員與飛航管制員之間的互動 — 約有19%的管理不當，係飛航管制員使用無線電一次發出三個或更多的指令；約有13%的管理不當，係「挑戰」飛航管制員的許可速度；整體而言，有61%的管理不當，係涉及與飛航管制員有關的某種威脅。

其他較常出現的威脅是雷雨風暴天氣，約有12%的管理不當 — 典型的類別係涉及氣象雷達的運用，或是對雷雨風暴何時抵達，以及距離雷雨風暴影響區有多遠的不確定性。

Klinect先生表示，在其他方面則有16%的管理不當係因飛機故障，通常是發生在飛機離場前的階段，飛航組員喜歡走捷徑，諸如拉出斷電器以節省時間等。資料也顯示，有46%的管理不當係因檢查自動化系統時發生疏失，以及有35%的管理不當係在飛機離場前的階段中，對飛航管理系統(Flight Management System, FMS)輸入了錯誤資料。

不穩定進場

Klinect先生表示，根據LOSA飛航資料有4%涉及不穩定進場，LOSA對「穩定進場」(Stable Approach)的定義，其中之一是 — 機場海拔高度在儀器天氣情況1,000英呎、目視天氣情況500英呎以上，保持穩定進場 — 飛機指示空速不大於進場速度10浬/時、不小於進場速度5浬/時，下降率不超過1,000英呎/分，以及下滑道俯仰及方位導引之中心線，保持在一個指標內。

他表示，這些不穩定進場的事件中，有87%的飛航組員持續完成一次平穩的落地；有3%的飛航組員執行一次重飛程序；以及有10%的飛機持續降落在跑道上，但落地的位置距離正常落地區，不是太遠、就是太近、或是「明顯地偏離跑道的中心線」。

Klinect先生接著表示，LOSA飛航資料庫中的不穩定進場，有30%的威脅來自挑戰飛航管制員的許可，或是與天氣的問題有關。另外70%的威脅則沒有明確的相關因素，但替代的是飛航操控的技能不足。他指出，飛行員在監控飛行時，若發生不穩定進場，比較會說出涉及的威脅，而比較不會表示涉及飛航操控的技能不足。

他表示，LOSA觀察還發現有一些航空公司，其不穩定進場的發生率小於1%。典型地，這些航空公司都已實施穩定進場的標準，而最佳的策略是，飛機在機場海拔高度1,500英呎時就必須符合標準 — 給飛航組員更多的時間，

以確保飛機在落地前能調好正確的速度。這些航空公司同時具有的最佳策略是，召喚發生不穩定進場的飛行員來面談，俾共同找出發生該事件的相關因素與環節。

運用 LOSA 資料

許多航空公司把LOSA資料運用在飛航操控、飛航標準程序或人員的培訓上，特別是針對有些責任已經超負荷的人員，以及Klinect先生所說：「總是與最新危機進行奮戰的人員，」

造成的結果是，他們很少有時間去分析安全資料，進而專心從事預防性的事務處理。

他說：「這是一個問題，LOSA資料庫沒有與危機或緊急事件相關的預測資料，」他建議航空公司應建立獨立的LOSA審查委員會，主要的成員來自線上的飛行員，進行LOSA資料的審查以確認問題，以及向航空公司的管理階層提出解決方案。

最後，經由LOSA啟發而來的安全行動，必須有管理階層的支持，他強調的說：「就好像是Business Management 101管理顧問公司所說的，雖然聽起來有些老套，但卻是真的。」

LOSA觀察作業特徵

LOSA計畫始於1990年代，用來評估「組員資源管理」(Crew Resource Management, CRM)的成效(註一)。

LOSA計畫係美國德州大學奧斯丁(Austin)分校的「人為因素」(Human Factors, HF)專案研究團隊所開發，由訓練有素的觀察員坐在「觀察員座」，執行Delta航空公司480架次日常航班中的查核，據以評估該航空公司飛行員的CRM訓練，是否在實際的飛航線上落實執行。

其他的航空公司隨後效法執行之，並且擴大此理念，同時記錄飛航組員在面對威脅與疏失時的處理方式。

LOSA共同研究團隊執行長James Klinect先生明確指出，現今的LOSA觀察作業有10種特徵如后：

- 坐在觀察員座上，觀察日常的飛航操作；
- 資料收集採用匿名、保密及非懲罰等方式進行；
- 飛航組員自願參與；
- 觀察員訓練有素及值得信任；
- 整合性管理 — 飛行員協會贊助；

表一：

蓄意違反規定是侵蝕安全邊界的指標

TEM 指標	飛航中零次蓄意違反規定的疏失	飛航中乙次蓄意違反規定的疏失	飛航中兩次以上蓄意違反規定的疏失
觀察的百分比	51%	24%	25%
每班飛航發生威脅的平均次數	4.5	4.7	4.8
每班飛航發生疏失的平均次數	2.1	3.9	7.5
航班發生威脅管理不當的百分比	26%	40%	54%
航班發生疏失管理不當的百分比	29%	47%	67%
航班發生 UAS 的百分比	27%	43%	60%

TEM = 威脅與疏失管理；UAS = 不預期的飛機狀態。
註：飛航組員至少發生乙次蓄意違反規定的疏失，其機率是發生威脅與疏失管理不當的兩至三倍之多。
資料來源：James Klinect 先生。

- 基於威脅與疏失管理的系統性觀察方式；
- 安全儲存收集到的資料；
- 資料經審查委員會討論與驗證；
- 增強資料延伸的指標性；以及
- 研究結果回饋給線上飛行員。

註一：FSF Editorial Staff. "Line Operations Safety Audit (LOSA) Provides Data on Threats and Errors." *Flight Safety Digest* Volume 24 (February 2005): 1-18。

譯自AERO SAFETY WORLD, DECEMBER 2013 - JANUARY 2014

Intentionally Noncompliant

LOSA data show that purposely skipping a checklist or ducking under a glideslope can lead to bigger problems.

LINDA WERFELMAN

Flight crews that are *intentionally* noncompliant with cockpit standard operating procedures are two to three times more likely to commit other, *unintentional* errors or to mismanage threats to flight safety, according to data gathered during thousands of line operations safety audit (LOSA) observations.

Intentional noncompliance errors are common, James Klinect, chief executive officer of The LOSA Collaborative, said in a presentation to Flight Safety Foundation's 66th International Air Safety Summit (IASS), which was held in Washington in late October.

Klinect's organization has collected more than 20,000 LOSA observations at more than 70 airlines worldwide, beginning in 1996. LOSA observations are governed by 10 operating characteristics, including jumpseat observations by trained observers during regular operations; voluntary crew participation; anonymous, confidential and nonpunitive data collection; and feedback to line pilots.

Those observations show that, as the number of instances of intentional noncompliance increase on a flight, the number of mismanaged threats and errors and the number of instances of an undesired aircraft state also increase, Klinect said.

All flights in the LOSA archive, regardless of the number of intentional noncompliance errors, had about the same average number of threats, according to LOSA data. However, in flights without intentional noncompliance errors, an average of 2.1 unintentional errors occurred per flight, compared with averages of 3.9

unintentional errors in flights with one intentional noncompliance error and 7.5 unintentional errors in flights with two or more intentional noncompliance errors.

Klinect told the IASS that on 49 percent of the flights in his organization's LOSA archive, the observer reported at least one intentional compliance error.

The real problem, he added, is that flight crews often respond incorrectly to an intentional noncompliance error — that is, their response actually represents a mismanagement of the error — about 20 percent of the time, "so 20 percent of intentional noncompliance errors are actually linked to other errors."

The most common of the intentional noncompliance errors include omitted altitude callouts, checklists performed from memory, failure to execute a mandatory missed approach, a pilot making flight guidance changes while hand flying, and taxi duties that are performed while an airplane is still on the runway.

"Very simple things," Klinect said. "Don't these things seem really minor? … I would argue that … until

we start reading what the intentional noncompliance is. … It's a big deal when you take it from a system view … and [see] what a culture of noncompliance can create."

As an example, he cited a LOSA observer's description of the following intentional noncompliance error involving a flight crew on a Boeing 777-300ER.

With the airplane at 2,800 ft and established on an instrument landing system approach, air traffic control (ATC) told the crew to maintain 160 kt. Instead, the captain told the first officer (FO), who was the pilot flying, to "ignore it so that the aircraft could be stable by 1,500 [ft]," the description said. The mode control panel was set for 126 kt, and the crew selected 30 degrees of flaps. The FO "offered" to set the airspeed at 160 kt, but the captain "was adamant that [the ATC instruction] was to be ignored," the description said, adding that at no time did the captain tell ATC his intentions.

The LOSA observer classified the error as "intentional speed deviation without ATC clearance/ speed too low."

Procedural Drift

Klinect said that occurrences of intentional noncompliance are a way of measuring an organization's procedural drift, which he defined as, "if you have a set of procedures that are written … and flight crews drift away from how things are written."

One question that should be asked at every airline, he said, is "how far do you let your guys drift?" LOSA observers evaluate the extent of procedural drift by observing flight crew actions and listening to the comments they make in the cockpit, Klinect said.

As an example, he cited the instance of a flight crew that commits the same error several times, such as missing a level-off call four or five times during one phase of flight. Together, those missed calls are coded by LOSA observers as one intentional noncompliance error.

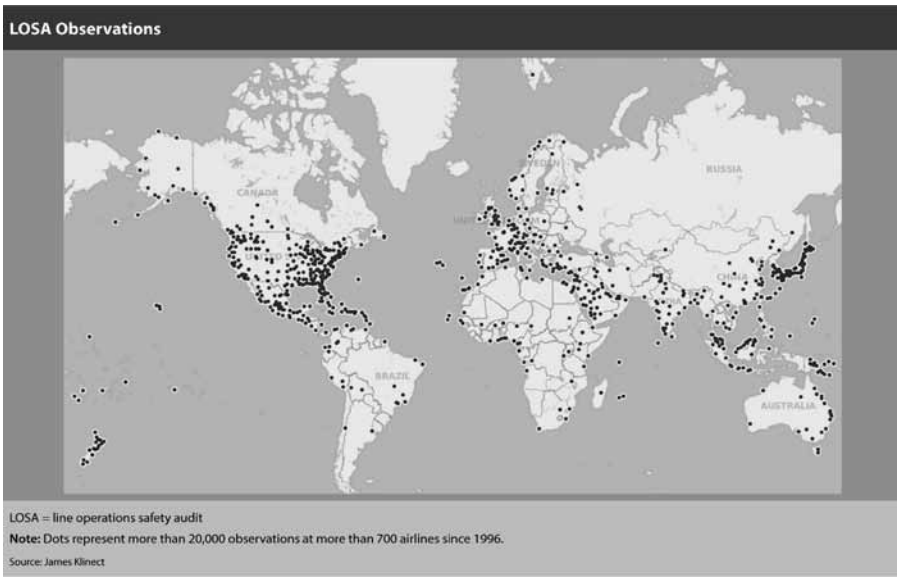
"We can't get in the guy's head to ask him whether it was intentional or unintentional," Klinect said. "We try to use observables…. It's not perfect, but it gets us close."

In other instances, the crew "openly discusses that they're going to break SOPs [standard operating procedures], and, yes, this happens in front of observers," he said. Often in these cases, the pilots believe that they are saving time — "performing a checklist from memory is a classic," he said.

Managing Errors

Analyses of LOSA observations have found that the best flight crews are those that not only manage the operational complexity of their flights but also anticipate threats and errors, and manage those, too, Klinect said.

They use threat and error management (TEM) defenses that include policies and procedures, monitoring/cross-checking, crew resource management, checklists, deviation callouts, aircraft hardware, airmanship and "luck."



Weaknesses in TEM defenses become obvious during LOSA observations, Klinect said, noting, as an example, that checklist errors occurred during 26 percent of LOSA archive flights — most of them during predeparture.

He also noted that flight

crews who are rated poor/marginal in their monitoring and cross-checking skills are two times more likely during LOSA flights to experience mismanaged errors and undesired aircraft states.

"That's why we focus on monitor/ cross-check," Klinect said. "It's not monitoring for the sake of monitoring. … Threat and error management tries to bring… the things that we want to focus on — managing threats, errors and undesired aircraft states."

Nearly all of the 20,000 flight observations include some type of crew error, and "unfortunately, not all flight crews manage errors," he said. "In fact, about 35 percent of the flights that we see get into aircraft deviations, unstable approaches, speed deviations [defined by LOSA as plus or minus 10 kt from an ATC speed clearance or ATC speed restriction], vertical deviations or lateral deviations."

EBT Initiative

LOSA data support evidence-based training (EBT), pointing to areas in which pilots would benefit from further training, Klinect said.

The primary pilot mismanagement issue involves speed deviations while hand flying an aircraft, he said, noting that data show that 81 percent of these occurrences are mismanaged. Most occur during descent/approach, and the problem is rarely called out by the pilot monitoring, he said, adding that "the procedures are there, but the guys don't do it, for some reason."

He said that at least two areas where data indicate a need for additional training involve crew interactions with ATC — coping with ATC radio transmissions that include three or more instructions, which are mismanaged about 19 percent of the time, and coping with "challenging" ATC speed clearances, which are mismanaged about 13 percent of the time. Overall, 61 percent of the archived observations involve some sort of threat related to ATC, he said.

Other frequent threats are thunderstorms, which are mismanaged about 12 percent of the time — typically because of issues involving weather radar usage or an uncertainty about when and how far to deviate around the storm.

Intentional Noncompliance Is an Indicator of Eroding Safety Margins

TEM Indicator	Flights with Zero Intentional Noncompliance Errors	Flights with One Intentional Noncompliance Error	Flights with Two or More Intentional Noncompliance Errors
% of observations	51%	24%	25%
Average number of threats per flight	4.5	4.7	4.8
Average number of errors per flight	2.1	3.9	7.5
% of flights with a mismanaged threat	26%	40%	54%
% of flights with a mismanaged error	29%	47%	67%
% of flights with a UAS	27%	43%	60%

TEM = threat and error management; UAS = undesired aircraft state

Note: Crews with at least one intentional noncompliance error are two to three times more likely to mismanage threats and errors.

Source: James Klinect

In other areas, pop-up aircraft malfunctions are mismanaged 16 percent of the time, often during predeparture, with crews using shortcuts, such as pulling a circuit breaker, to save time, Klinect said. Data also show 46 percent mismanagement of the detection of automation errors, and 35 percent mismanagement of flight management system entry errors during predeparture.

Unstable Approaches

Four percent of these LOSA flights had an unstable approach, Klinect said, noting the LOSA definition of a "stable approach" as one in which — during the last 1,000 ft above airport elevation in instrument meteorological conditions and the last 500 ft in visual meteorological conditions — the airspeed is between 5 kt below target speed and 10 kt above, with a sink rate no greater than 1,000 fpm, and within one dot of the glideslope and localizer centerlines.

In 87 percent of these flights, the crews continued to an uneventful landing; in 3 percent, the crews conducted a missed approach; and in 10 percent, the airplane continued to the runway and was landed long, short or "significantly off [runway] centerline," he said.

Of the unstable approaches among flights in the LOSA archive, 30 percent were associated with identified threats such as challenging clearances from ATC or weather problems. The remaining 70 percent had no clear association with a threat but were related instead to poor hand flying skills, Klinect said. He noted that pilots monitoring were more likely to speak up about the unstable approach in cases involving a threat than they were in cases involving poor hand flying.

The LOSA observations also revealed a number of airlines with unstable approach rates of less than 1 percent, he said. Those airlines typically have implemented best practices that call for aircraft to meet stabilized approach criteria 1,500 ft above airport elevation — to give the flight crew more time to ensure that the airplane is at the correct speed well before landing. Those airlines' best practices also call for conversations with pilots who have flown unstable approaches to discover the circumstances surrounding the events.

Using LOSA Data

At many airlines, LOSA data are turned over to flight operations, flight standards or training personnel who already are overloaded with other responsibilities and "always fighting the latest crisis," Klinect said.

As a result, they have little time to devote to proactively addressing the issues derived from analysis of safety data.

"There's no crisis or urgency associated with predictive data, and that's a problem," he said, recommending that airlines establish an independent LOSA review board, made up primarily of line pilots, to review LOSA data to identify problems and present solutions to airline management.

Finally, LOSA-inspired safety actions must have the support of management, he said, adding, "It sounds so cliché, so Business Management 101. But it's true."

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LOSA Operating Characteristics

The line operations safety audit (LOSA) had its roots in a program begun in the 1990s to evaluate the effectiveness of crew resource management (CRM).[1]

The program, developed by the Human Factors Research Project at the University of Texas at Austin, placed trained observers in the jump seats during 480 routine flights by Delta Air Lines to determine whether the CRM behaviors being taught to Delta pilots were actually put into practice on the line.

Other airlines followed suit, and the concept was expanded to also record flight crew methods of coping with threats and errors.

LOSA today involves 10 operating characteristics, identified by James Klinect, chief executive officer of The LOSA Collaborative, as:

- Jump seat observations during regular operations;
- Anonymous, confidential and nonpunitive data collection;
- Voluntary crew participation;
- Trusted and trained observers;
- Joint management–pilots association sponsorship;
- Systematic observation instrument based on threat and error management;
- Secure data collection repository;
- Data verification roundtables;
- Data-derived targets for enhancement; and,
- Feedback of results to line pilots.

— LW

Note

1. FSF Editorial Staff. "Line Operations Safety Audit (LOSA) Provides Data on Threats and Errors." *Flight Safety Digest* Volume 24 (February 2005): 1–18.