更多安全保證

美國聯邦航空局(FAA)的跑道安全改進工作正按計劃進行，並初顯成效

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諸如開發出更好的航班追踪系統措施，雖能造成更多的頭條新聞，但美國聯邦航空局(FAA)已在進行一個長期而風險高的工作，以提高美國境內數百個機場跑道之安全，這些機場是被判定為，具有越限衝出跑道（overruns），和飛機進場未達預定點著陸（undershoots）等風險最高的機場。截至目前，美國聯邦航空局已悄然地取得了實質上的進展。

該局的計畫乃針對美國642個商用機場跑道安全區（Runway Safety Areas RSA）需要做重大安全改善者為目標，此計畫是在1999年6月美國航空公司MD-82在阿肯色州的小岩城衝離跑道意外事件之後推出。2014年底，美國聯邦航空局已經預留了30億美元，投入到該工程案中，來提升其中的603個機場，且該局有望順利完工或於今年2015完成剩餘的39項計畫，以達到美國國會議員要求的計畫完成期限。

其工作範圍從建造標準尺寸的跑道安全區（RSAs），到安裝人工墊層（artificial beds），用於飛航落地時，在無其他輔助措施且跑道空間過短的情形下能停住飛機。其中跑道安全區（RSAs）的大小乃基於各種因素不同而有所變化，包括跑道的長度和起降飛機的類型不同等等，但標準尺寸通常是1000英尺長到500英尺寬。

改善跑道安全區的案例，由安全數據可見一斑。美國聯邦航空局和美國國家運輸安全委員會指出：在美國“每年大約有10件不同嚴重程度的意外事件或失事事故”是肇因於越限衝出跑道，而美國聯邦航空局的研究發現，90%的越限衝出跑道案例，導致飛機會在跑道末端1000英尺內能夠煞停。波音公司的數據顯示，於2004-2014年間，在全球民用航空公司的致命事故中，於飛機著陸階段失事就占了18件，遠超過其他任何飛行階段。這些事故導致796人遇難，僅次於飛機失控和可控下飛行撞地之事故，是第三高，超過其後八項分類的總和。

圖一 跑道安全公司(Runway Safe)生產的攔阻墊層，主要是採取粉狀、可回收玻璃製成的矽膠泡沫，澆灌在土工格柵壁間，足以將材料固定在適當位置。

自從造成11人死亡的小岩城事故發生後，美國FAA前所未有的，執行了首次跑道安全區(RSA)調查之後，美國FAA的重點工作開始有所不同。在已完成的跑道安全區(RSA)計畫中，有一個是位於舊金山國際機場的28L跑道，該跑道於2013年7月6日韓亞航空214號班機，進場時未達預定點即降落著陸，導致波音777飛機尾部撕裂，並造成飛機滑落扭倒在跑道上。這起事故導致飛機損毀，並造成機上307名乘客和機組人員中有三人罹難，但美國FAA認為它是有可能會產生更嚴重的結果。

FAA在一份最近向國際民用航空組織（ICAO）報告中特別指出“幾百個生命獲救，因為…美國FAA推動的跑道安全區改進計畫中，為了預防未達預定點著陸的事故，業已增加了跑道安全區的標準距離。特別是通過延長跑道末端和舊金山灣之間的距離”，”如果沒有這方面的改善，該機很可能會在水中墜毀”。

在不足1000英尺或適當的額外道面空間情況下，裝置人工墊層，或工程材料攔阻系統（Engineered material arresting system EMAS），可創造出有效的跑道安全區。在62個美國機場中，有98個跑道安全區已安裝到位或預定要安裝EMAS系統。自1999年以來，EMAS墊層，成功攔阻了9次飛機衝出跑道的發生，其中包括在2005年紐約甘

迺迪國際機場的極地航空貨運747-200貨機和2008年芝加哥歐哈爾國際機場墨西哥航空公司載有145人的空中巴士A320。

跑道安全區的改進需求，有助於卓達宇航集團（ZODIAC Aerospace）旗下的ESCO公司推動該EMAS產品，於航空市場蓬勃發展。此產品是一些可壓碎的混凝土塊，排列結合建成一種有如砂坑般效果的墊層，它可以在不損壞飛機的情形下予以攔阻。在2012年4月，美國FAA批准了第二家供應商，跑道安全公司(Runway Safe)，該公司建立了綠色EMAS品牌的攔阻墊層，以重量輕，粉狀回收玻璃製成，具不溶性的矽膠泡沫為該產品之主要核心。

芝加哥中途島國際機場選擇更換掉ESCO的攔阻墊層，給予跑道安全公司(Runway Safe)安裝其新產品的首次工程機會。去年11月該公司的第一個攔阻墊層，245 X 170英尺，安裝在芝加哥中途島國際機場22L跑道的終點。“安然通過芝加哥嚴酷冬天氣候的考驗”，柯克· 馬爾尚，跑道安全公司的美國業務負責人如是說。 假設該型攔阻墊層持續符合預期之效益，也就是說即將安裝的儀器設備將會監測噴流的長期影響等結果，則2018年前跑道安全公司(Runway Safe)有可能獲得獨家供應合同，以更換三個中途島國際機場和兩個位於歐哈爾國際機場既有的攔阻墊層。

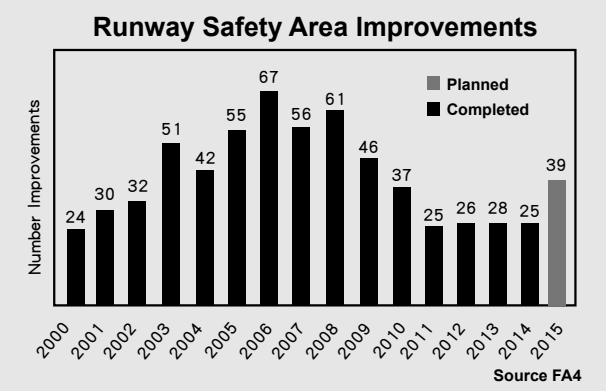
ESCO公司的先拔頭籌，和美國FAA的進展，意味著對在美國新安裝EMAS的市場佔有已呈飽和。不過，該項競爭，仍鼓勵著機場產業公司的主管們，因為美國仍有許多攔阻墊層需要更換，同時進軍國際的機會仍比比皆是。

美國FAA的RSA報告指出“第二個EMAS廠商的存在，預期可在世界各地創造一個有競爭力的EMAS市場，降低成本，並為機場提供多種不同的設計”。

ESCO公司目前的產品，Emasmax，是第四代產品，解決了一些早期的缺點，比如提供更有效的覆蓋材料，有助於防止水分損壞墊層塊。然而，其依賴預製的墊層塊，必須逐塊逐塊地個別覆蓋安裝或更換，這也限制了ESCO削減安裝，維修和維護等成本的能力。

跑道安全公司的設計，可以讓卡車載運原材料至機場跑道頭，現場澆灌在墊層上安裝並可作維修，同時它具有一體式無縫覆蓋層的特性。該公司表示，這些措施最大限度地減少了安裝時間，以及初期和後續經常性成本費用。

美國FAA的跑道安全區改進計畫是提高美國機場安全多階段性工作的一部分。該局下一個重大舉措，是改進滑行道的幾何形狀，以期減少跑道入侵（Runway Incursion）的風險。



圖二 跑道安全區域之改善
美國聯邦航空局FAA計劃在今年(2015)完成39件跑道安全區改進工作，那是自2009年以來完成最多件者。

圖三 建構跑道門檻增大的措施，是美國FAA的跑道安全區改善計劃的一部份，它有可能防止了韓亞航空公司214航班降落至舊金山灣中。

該FAA之15年專案計畫項目將分成三個步驟。首先，該局利用其在紐澤西州威廉· 休斯技術中心(William J. Hughes Technical Center)專家的數據編輯來鑒定“有幾何問題的”滑行道，並優先列入計劃。目標是在2015年第一季內完成管制清單。

第二步驟是將協調美國FAA各區域辦事處，並訂定執行該項工作的計畫。最後之步驟，則為預定於2016年起開展整替計畫工作。

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More Margin

The FAA's runway safety improvement effort is on schedule—and paying off

Sean Broderick

While initiatives such as better flight tracking generate more headlines, the FAA has quietly made substantial progress on a long-standing, high-stakes effort to improve runway safety at hundreds of airports identified as posing the highest risk to aircraft overruns and undershoots.

The agency's plan, launched after the June 1999 excursion of an American Airlines MD-82 at Little Rock, Arkansas, targeted 642 commercial airport runway safety areas (RSA) as needing significant safety improvements. At the end of 2014, the FAA had earmarked $3 billion into projects to upgrade 603 of them, and the agency is on track to wrap up work or finalize plans at the remaining 39 this year, meeting a deadline imposed by lawmakers.

The work has ranged from constructing standard-size RSAs—which vary based on factors including a runway's length and types of aircraft using it, but are typically 1,000 ft. long and up to 500 ft. wide—to installing artificial beds that stop aircraft in spaces too short for them do to so unaided.

The case for improving RSAS is evident in safety data. The FAA and the National Transportation Safety Board say that, in the U.S., overruns account for "approximately 10 incidents or accidents every year with varying degrees of severity," while an FAA study found that 90% of overruns result in an aircraft coming to rest within 1,000 ft. of the runway end. Boeing data show that landing-phase accidents accounted for 18 fatal commercial airline accidents globally in 2004-14, more than any other flight phase. Those accidents killed 796 people, third-most behind loss-of-control and controlled-flight-into-terrain mishaps, and more than the next eight categories combined.

Runway Safe's arrestor bed cores are made by taking silica foam made from powdered, recycled glass and pouring' it between geogrid walls that help keep the material in place.

The FAA's work, which began with its first-ever RSA survey after the 11-fatality Little Rock accident, has made a difference. Among the RSA projects completed was one for San Francisco International Airport's Runway 28L, which Asiana Airlines Flight 214 was approaching when it landed short on July 6, 2013, ripping open the Boeing 777's rear fuselage and sending it sliding and twisting down the runway. The accident destroyed the aircraft and killed three of the 307 passengers and crew onboard, but the FAA believes it could have been much worse.

"Several hundred lives were saved because . . . the FAA's RSA Improvement Program specifically increased the RSA to account for undershoots to the standard distance by lengthening the distance between the end of the runway and the San Francisco Bay," the FAA notes in a report recently presented to the International Civil Aviation Organization. "Without this improvement, the aircraft likely would have crashed into the water."

The artificial beds, or engineered material arresting systems (EMAS), create effective RSAS where there is not 1,000 ft. of suitable extra space. EMAS are in place or slated to be installed in 98 RSAs at 62 U.S. airports.

EMAS beds have stopped nine overrunning aircraft since 1999, including a Polar Air Cargo 747-200 freighter at New York John F. Kennedy International Airport in 2005 and a Mexicana Airlines Airbus A320 with 145 people onboard at Chicago O'Hare International in 2008.

The RSA improvement push helped Zodiac Aerospace's ESCO bring its EMAS product—which aligns crushable concrete blocks together to create a sand-pit-like effect that stops aircraft without damaging them—to market and thrive. In April 2012, the FAA approved a second vendor, Runway Safe, which builds its green EMAS-branded arrestor beds with a core of lightweight, insoluble silica foam made from powdered, recycled glass.

Runway Safes initial installation is at Chicago Midway International Airport, which opted to replace ESCO beds. The initial Runway Safe bed, a 245 X 170-it, installation at the end of Runway 22L, went into place last November and is "weathering well through the harsh Chicago winter," says Kirk Marchand, head of Runway Safe's U.S. operations. Assuming the bed continues to meet expectations—instrumentation will soon be installed to help monitor the long-term effects of jet blast, among other things—Runway Safe could be awarded a sole-source contract to replace three more Midway beds and two at O'Hara by 2018.

ESCO's head start and the FAA's progress means the market for new EMAS installations in the U.S. is all but filled. But airport industry executives are encouraged by the competition, as U.S. beds still can be replaced and international opportunities abound.

"The presence of a second EMAS vendor is expected to create a competitive market for EMAS throughout the world, lowering costs and offering a variety of designs for airports," the FAA's RSA report notes.

ESCO's current offering, Emasmax, is a fourth-generation product that addresses some early shortcomings, such as providing a more effective cover material that helps keep' moisture from damaging the blocks. However, its reliance on pre-cast blocks that must be installed or replaced on a b1ock-by-block basis and are covered individually limits ESCO's ability to cut

The FAA plans to wrap up work on 39 runway safety areas this year, its most since 2009.

An enlarged runway threshold built as part of the FAA's runway safety area improvement program likely kept Asiana Airlines Flight 214 from landing in San Francisco Bay.

installation, repair and maintenance costs.

Runway Safe's design allows the bed to be poured and repaired with raw material trucked onsite and features a seamless, one-piece cover. The company says these measures minimize installation time as well as initial and recurring costs.

The FAA's RSA improvement plan is part of a multiphase effort to boost U.S. airport safety. The agency's next major initiative is improving taxiway geometry to help reduce runway incursion risks.

The 15-year project will be broken into three steps. First, the agency-using data compiled by experts at its William J. Hughes Technical Center in New Jersey—plans to identify taxiways with "problematic geometry" and prioritize them for inclusion in the project. The goal is to have the list completed during the first quarter.

The second step will be coordinating with the FAA's regional offices-and setting up a plan to carry out the work. The final step—doing the work—is slated to begin in 2016.

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