Continued Airworthiness Assessment Methodology – 持续适航评估方法–

Using Data to manage Propulsion Safety
利用数据管理动力安全

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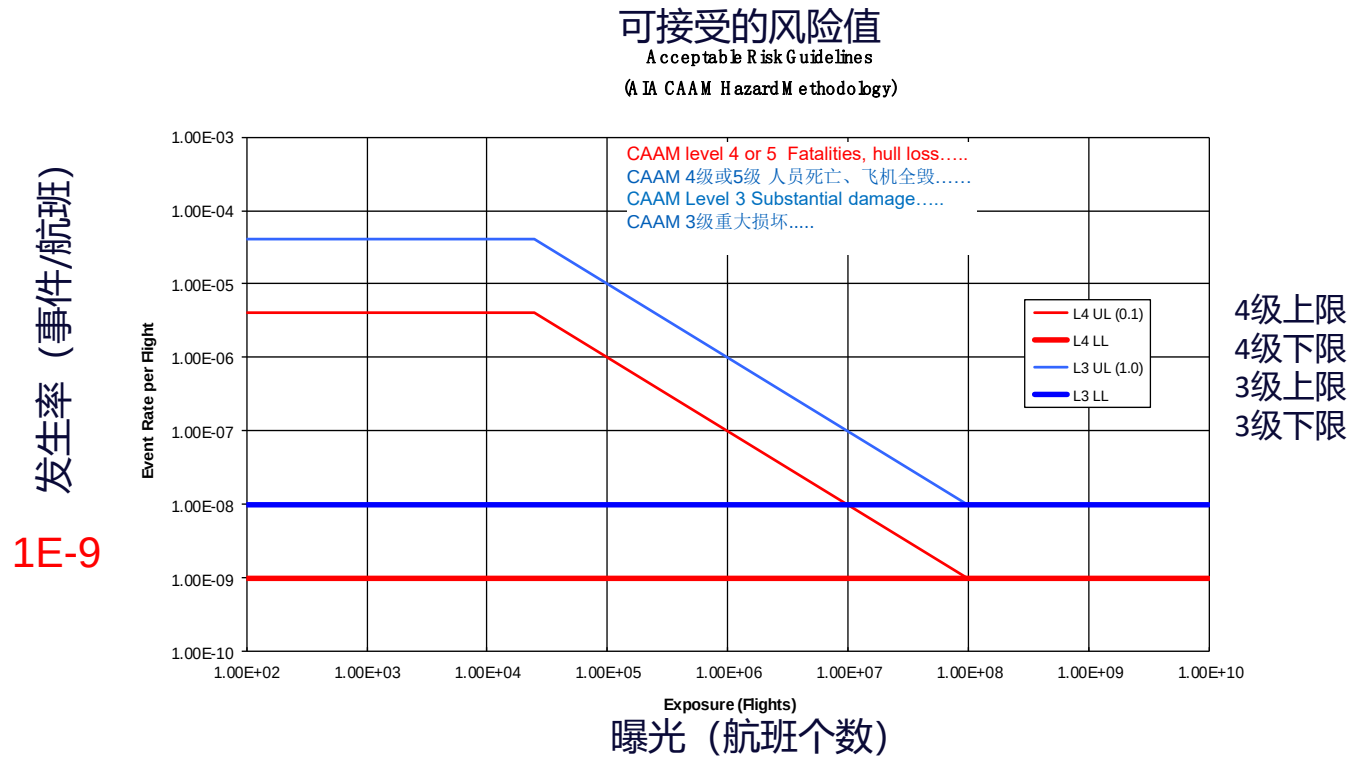
Dr. Sarah Knife
Sarah Knife博士
CAAM committee co-chair
持续适航评估方法（CAAM）委员会联席主席

Criteria
标准

Unsafe Condition – A condition which, if not corrected, is reasonably expected to result in one or more serious injuries AC39-8

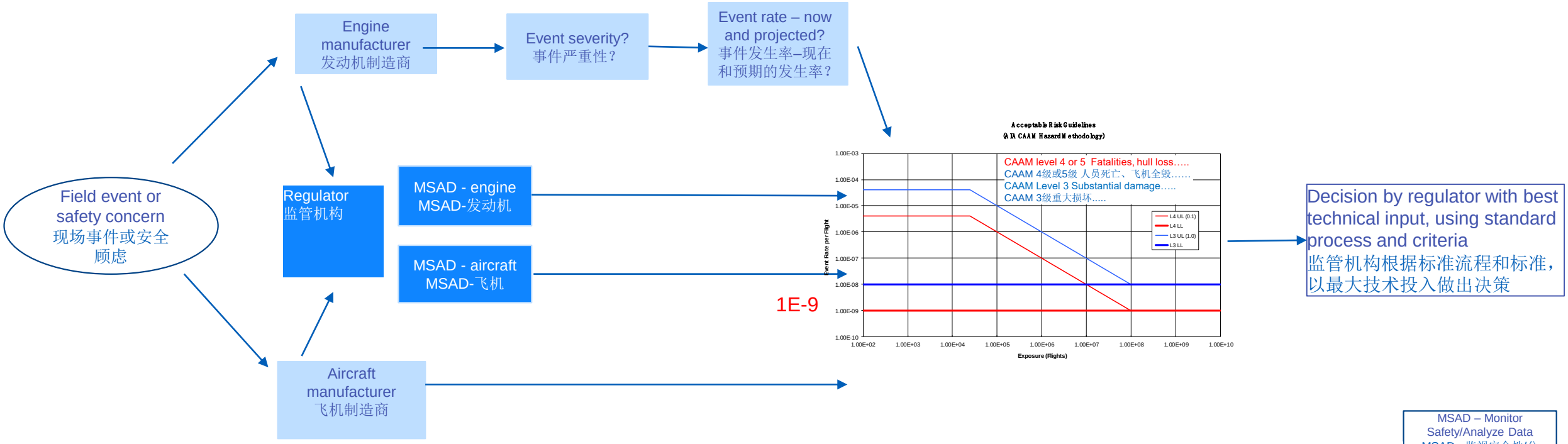
不安全状况–如果不加以纠正，可以合理预期会导致一人或多人重伤的状况AC39-8



Process
流程

FAA AC39-8 defines process to determine when an Airworthiness Directive is needed
FAA AC39-8详细说明了如何确定何时需要适航指令的流程

…….Return the product to the level of safety intended at certification
……使产品恢复到取证时所要求的安全水平



MSAD – Monitor Safety/Analyze Data
MSAD –监视安全性/分析数据

Data
数据

Report of component failure or finding
部件故障或检查发现的报告

Image event report
生成事件报告

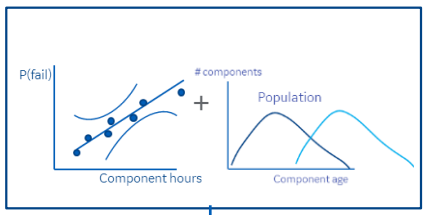
Field event or safety concern
现场事件或安全顾虑

Engine manufacturer
引擎制造商

Whole-industry data
整个行业的数据
- Hours, departures
  时数、起飞次数
- Safety-related events and outcomes
  安全相关的事件和结果
- Conditional probabilities
  条件概率
- Rates
  发生率

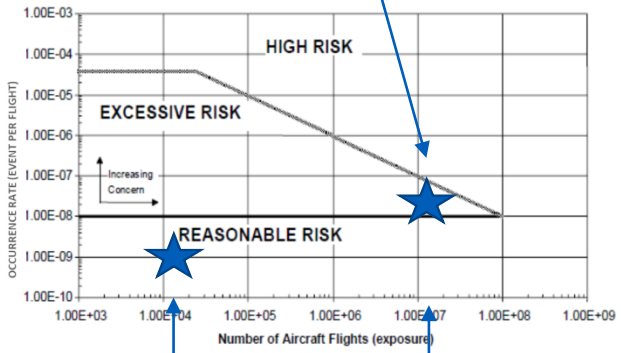
Event severity?
事件严重性？

Fleet hours + cycles
机队飞行时数+周期
Time on each component
每个部件的使用时间
Time of failure for each event
每个事件的时间



Event rate – now and projected?
事件发生率–现在和预期的发生率？

Decision by regulator with best technical input, using standard process and criteria:
监管机构根据标准流程和标准，以最佳技术支持做出决策：
REGULATOR ACTION NECESSARY
监管机构的必要行动



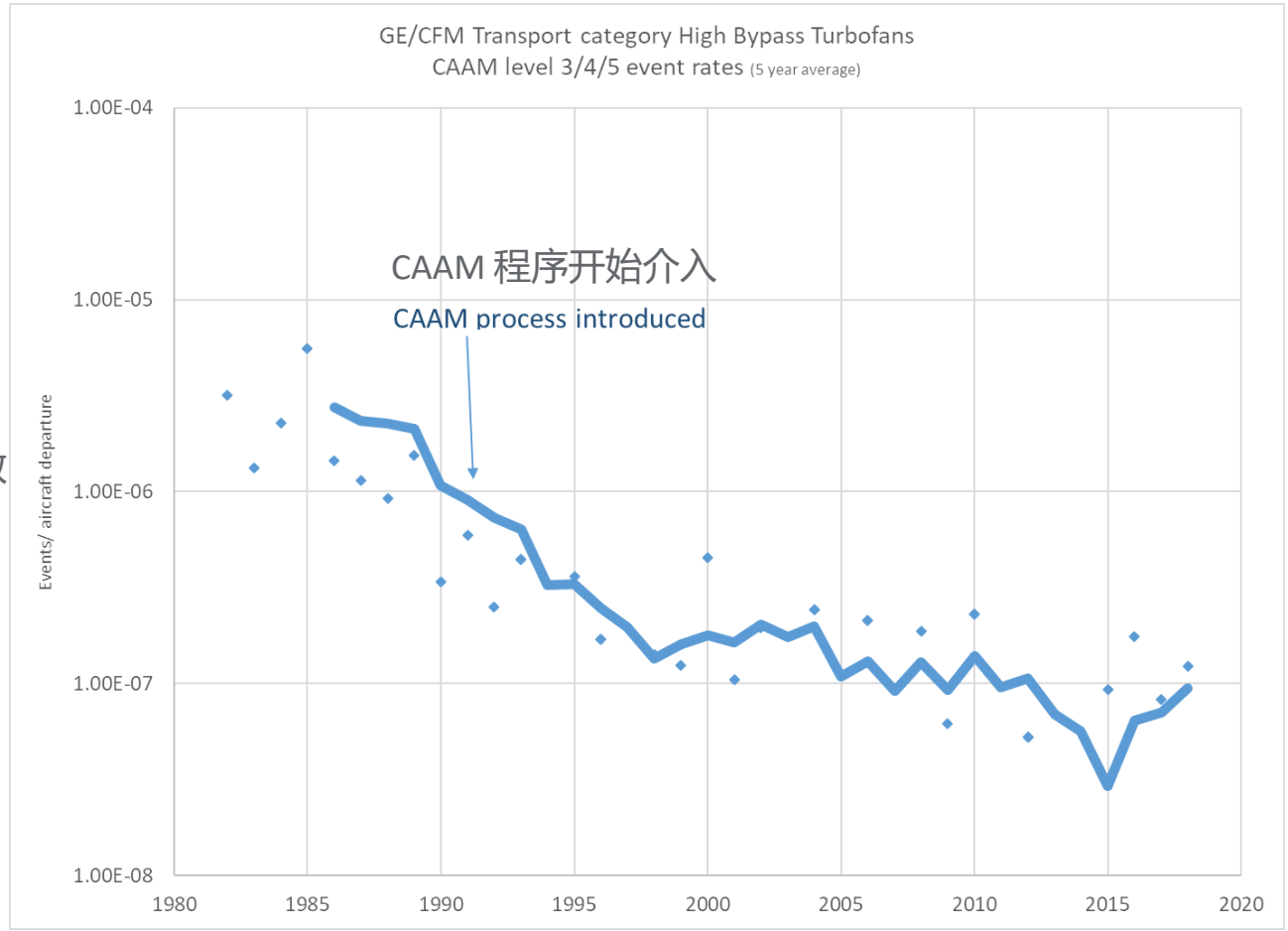
Today
现今

20 years from now
20年后

Results
结果

CAAM 三/四/五级事件发生率
（（五年平均值）

事件发生数/航班起飞数



Future work
未来的工作

- Refresh CAAM dataset with increased frequency (more continuous process)
  以更高的频率更新CAAM的数据集（更连续的过程）
- Expand stakeholder participation in process (+ operators, pilots)
  扩大相关方面对流程的参与（+运营商、飞行员）
- Analyze collected data for proactive use
  分析收集的数据以便主动使用
  - Share Safety Lessons Learned across manufacturers
    各制造商之间分享安全经验
  - Identify where new safety initiatives are needed
    确定哪里需要新的安全措施

Reference material
参考资料

U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: CONTINUED AIRWORTHINESS ASSESSMENTS OF POWERPLANT AND AUXILIARY POWER UNIT INSTALLATIONS OF TRANSPORT CATEGORY AIRPLANES

Date: 9/8/03 **AC No:** 39-8
Initiated By: AIR-100 **Change:**

1. PURPOSE.

a. This advisory circular (AC) describes the Continued Airworthiness Assessment Methodologies (CAAM). The Federal Aviation Administration (FAA) Engine and Propeller Directorate (EPD) and the Transport Airplane Directorate (TAD) may use CAAM to identify unsafe conditions and determine when an "unsafe condition is likely to exist or develop in other products of the same type design" before prescribing corrective action in accordance with Title 14 of the Code of Federal Regulations (14 CFR) part 39. CAAM is used for products associated with the Powerplant or Auxiliary Power Unit (APU) Installations on Transport Category Airplanes.

CAAM reports: https://www.faa.gov/aircraft/air_cert/design_approvals/engine_prop/engine_sp_topics/
CAAM报告：https://www.faa.gov/aircraft/air_cert/design_approvals/engine_prop/engine_sp_topics/

Continued Airworthiness Assessment Methodology (CAAM)
持续适航评估方法（CAAM）

LEVEL 3 - SERIOUS CONSEQUENCES
3级——严重后果

a. Substantial damage to the aircraft or second unrelated system
对飞机或其它无关系统的重大损坏
b. Uncontrolled fires – escape fire zone & impinge on wing or fuselage or act as ignition source
不可控的火灾——窜出火区域并影响机翼或机身或充当点火源
c. Rapid cabin depressurization
机舱快速减压
d. Permanent loss of thrust or power greater than one propulsion system
大于一套动力系统永久性失去推力或动力
e. Temporary or permanent inability to climb and fly 1,000 feet above terrain along intended route
暂时或长期无法沿预定路线爬升并在地面以上1000英尺高度飞行
f. Temporary or permanent impairment of aircraft controllability
对飞机可控性的暂时或永久性损害
g. Smoke or other fumes on the flight deck that result in a serious impairment
会导致严重损害的驾驶舱冒烟或有害气体

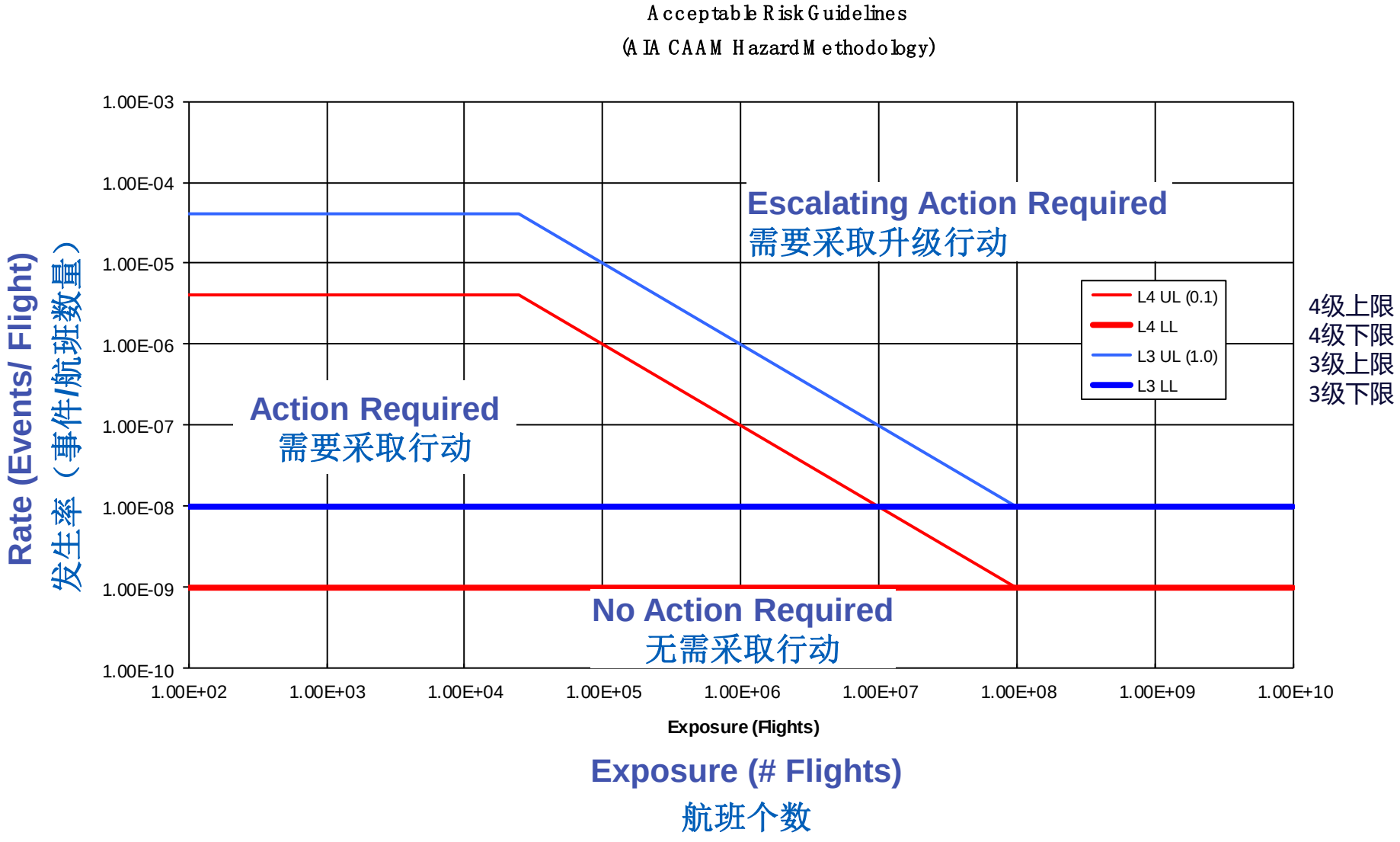
LEVEL 4 - SEVERE CONSEQUENCES
4级——严峻后果

a. Forced landing
迫降
b. Actual loss of aircraft while occupants were on board
飞机上有乘客时发生全毁
c. Serious injuries or fatalities
重伤或死亡

LEVEL 5 - CATASTROPHIC CONSEQUENCES
5级——灾难性后果

Catastrophic outcome - resulting in multiple fatalities, usually with the loss of the aircraft
灾难性后果——导致多人丧生以及飞机的损毁

FAA Acceptable Risk Limits
FAA可接受的风险值



Continued Airworthiness Assessment Methodology (CAAM)
持续适航评估方法（CAAM）

0. LEVEL 0 – CONSEQUENCES WITH NO SAFETY EFFECT

0级——不影响安全的后果

a. Simple IFSD above an altitude of 1,500 feet
海拔1500英尺以上的简单空中停车（IFSD）

b. Casing uncontained, nacelle contained
机匣非包容，短舱包容

c. Smoke and/or fumes with no effect on crew or passengers
不会影响机组人员或乘客的烟雾及有害气体

d. Rejected takeoff (RTO) with no runway excursion
起飞中断（RTO），未偏离跑道

e. Fuel leak with no operational effect beyond IFSD or of which the crew was unaware
燃油泄漏，除IFSD外没有运行影响，或者机组人员没有意识到

1. LEVEL 1 - MINOR CONSEQUENCES

1级——轻微后果

a. Uncontained - damage confined to affected nacelle area
非包容——损坏仅限于受影响的短舱区域

b. LOTC above V1 and below 1,500 feet (includes IFSD's below 1,500 feet)
高于V1且低于1500英尺（包括在低于1500英尺的高空发生IFSD）的推力控制损失（LOTC）

c. Temporary multiple propulsion system malfunctions (10% or greater thrust loss) including environmental induced events
暂时性多个动力系统故障（推力损失为10％以上），包括环境引起的事件

d. Separation of propeller, cowling, nacelle, or other which cause no other damage
螺旋桨、整流罩、短舱或其他部件分离，不会造成其他损坏

e. Uncommanded propeller feather
没有指令的情况下顺桨

f. Severe vibration caused by propulsion system malfunctions - exceeding 33.94 imbalance
动力系统故障引起剧烈振动——超过33.94条要求

g. RTO resulting in runway excursion or overrun with no airplane damage beyond brake overheat/tire burst.
中断起飞，导致偏离跑道或冲出跑道，除了刹车过热/轮胎爆裂外没有飞机损坏。

h. Fuel leak with noticeable imbalance but no operational effect beyond an IFSD.
燃油泄漏，明显失去平衡，除一次IFSD外没有运行影响。

i. Tailpipe fire of very short duration, or very small size, such as a candle flame at the centerbody.
持续时间很短或规模很小的排气管着火，例如中心主体处的微小像烛光的火焰。

Continued Airworthiness Assessment Methodology (CAAM)
持续适航评估方法（CAAM）

2. LEVEL 2 - SIGNIFICANT CONSEQUENCES

2级——重大后果

a. Nicks, dents and small penetrations in any aircraft principal structural element
任何飞机主要结构元件中存的缺口、凹痕和小穿孔

b. Slow depressurization
缓慢减压

c. Controlled fires (i.e., inside fire zones3) including tailpipe fires that do not require removal/replacement of airplane structure or control surfaces
可控火灾（如：在火区内），包括不需要拆除/更换飞机结构或控制面的排气管着火

d. (1) Flammable fluid leaks that present a fire concern
易燃液体泄漏造成火灾风险。

d. (2) Fuel leaks that present a range concern for the airplane. Crew is aware of the leak & manages operational aspects appropriately
影响飞机航程的燃油泄漏。机组发现了泄漏，正确处理了运行问题。

d. (3) Holes or punctures <2 sq.in. in low pressure fuel system or tank caused by uncontained or cowl loss events
因未包容或整流罩损失事件造成低压燃油系统或油箱中出现小于2平方英寸的孔洞。

e. Minor injuries
人员轻伤

f. Multiple propulsion system thrust loss of 10% or greater with 1 IFSD but flight 1,000 feet above terrain along the intended route is possible (see 3.e.)
多重动力系统推力损失达到10％以上，发生一次IFSD，但可以沿预定路线在地面上空1000英尺飞行（请参阅3.e.）

g. High-speed takeoff abort (100 knots or greater)
高速起飞中断（100节以上）

h. PFOOP without level 3
PFOOP，没有发生3级后果

i. Partial in-flight reverser deployment or propeller pitch change malfunction without level 3
部分飞行中反推打开或螺旋桨桨矩改变故障，没有发生3级后果

j. Smoke or toxic fumes that cause minor impairment or minor injuries to crew and/or passengers
对机组人员和/或乘客造成轻度损害或轻伤的烟或有毒烟雾