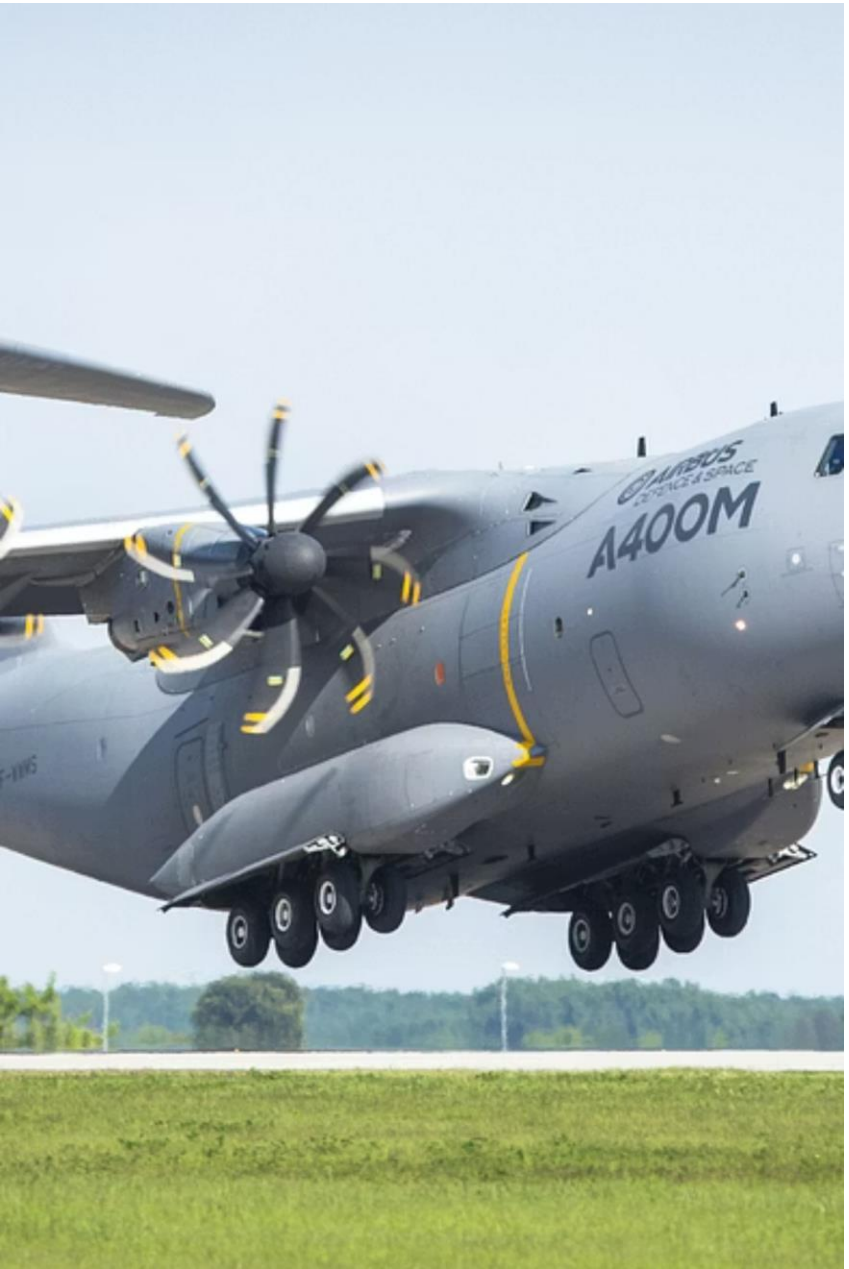
SOFEMA AVIATION SERVICES



Human Factors in Aircraft Maintenance: A400M Ground Power Power Unit Incident Case Study

An analysis of a serious incident involving incorrect ground power connection procedures that resulted in electrical system damage and significant safety implications for the A400M fleet.

Incident Overview and Context

Key Details

Aircraft: Airbus A400M Atlas

Date: March 2019

Classification: Serious Incident

Primary Issue: Incorrect external power connection connection causing electrical damage

Incident Summary

During routine pre-flight preparations, a ground engineer connected external ground power equipment to the aircraft with incorrect polarity settings. The reversed connection resulted in significant damage to the aircraft's electrical distribution system, including the emergency power supply unit and associated wiring looms.

Whilst no injuries occurred and the aircraft did not depart; the incident required required extensive electrical system repairs and prompted a fleet-wide safety safety review of ground handling procedures.

Sequence of Events Leading to the Error

1

06:45 - Task Assignment

Engineer received tasking to prepare aircraft for early morning departure. Ground power unit connection was amongst routine pre-flight duties assigned during shift handover briefing.

2

07:10 - Equipment Selection

Selected an unfamiliar ground power unit from the equipment pool. The unit was recently transferred from another station and had different control panel layout than standard equipment normally used at the base.

3

07:25 - Connection Procedure

Connected external power cable to aircraft without verifying polarity polarity settings on the ground power unit. Engineer assumed default default settings were correct based on previous experience with with familiar equipment.

4

07:28 - Power Application

Energised the ground power unit. Immediately observed unusual unusual electrical readings on aircraft systems, followed by circuit circuit breaker trips and visible arcing from electrical panel.

5

07:30 - Emergency Response

Shut down ground power unit and isolated aircraft electrical systems. systems. Reported incident to shift supervisor and commenced commenced emergency procedures for electrical system damage. damage.

Investigation Findings and Human Factors Analysis

Time Pressure

Engineer was working to tight schedule with aircraft departure planned within 90 minutes. minutes. Post-incident interview revealed feeling feeling rushed due to concurrent tasking requirements and perceived expectation to complete work quickly.

Procedural Non-Compliance

Engineer admitted to not following the written written procedure which explicitly required verification of ground power unit polarity settings settings before connection. Relied on habit and and assumption rather than checklist verification. verification.

Unfamiliarity with Equipment

First time using this particular ground power unit model. Control panel layout differed significantly from familiar equipment, but engineer did not seek guidance or consult equipment manual before use.

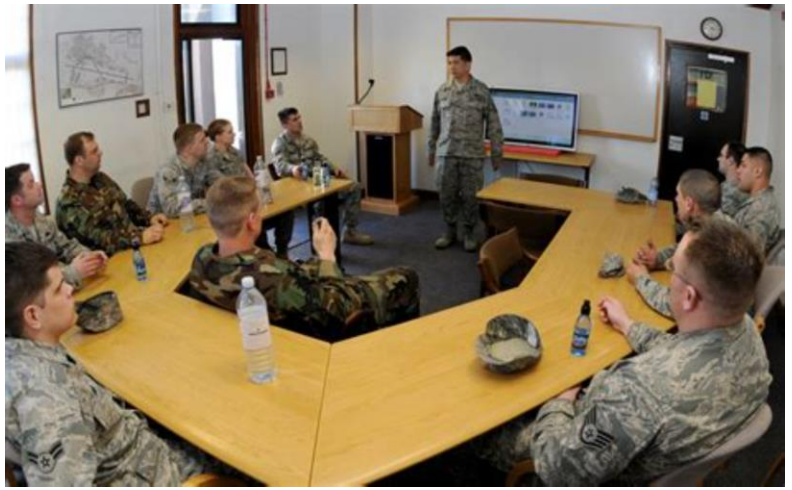
Expectation Bias

Engineer held strong expectation that all ground power units would be be configured identically. This expectation bias prevented recognition that that verification was necessary despite using unfamiliar equipment.

Knowledge Gap

Limited understanding of consequences of reversed polarity connection. Investigation revealed engineer was unaware of potential severity, viewing the task as routine and low-risk.

Organisational and Systemic Contributing Factors



Inadequate Training

Training programme did not include practical familiarisation with all ground power unit variants in use across the station. Engineers received generic training but lacked hands-on experience with equipment diversity.

Equipment Standardisation Failure

No organisational requirement for standardised control panel layouts across ground support equipment. Different units acquired from various suppliers over time created inconsistent human-machine interfaces.

Supervision Gaps

Shift supervisor was managing multiple simultaneous activities and did not verify engineer's competency with the specific equipment variant. No formal sign-off system for equipment familiarisation existed.

Workplace Culture Issues

Investigation identified an underlying culture, where asking questions or questions or admitting unfamiliarity was perceived as sign of weakness. weakness. Engineers felt pressure to demonstrate competence and and avoid appearing uncertain.

Procedural Accessibility

Written procedures were available but not easily accessible at point of work. Engineer would have needed to return to office to consult documentation, creating barrier to compliance under time pressure.

Key Lessons and Recommendations

1 Stop and Verify When Uncertain

Engineers must be empowered to pause work when encountering encountering unfamiliar equipment or situations. Organisational culture Organisational culture must actively encourage questioning and and verification rather than penalising perceived inefficiency.

2 Equipment Familiarisation Protocols

Implement mandatory familiarisation and competency sign-off before personnel use any equipment variant for the first time. Training records should track specific equipment types, not just generic categories.

3 Standardisation of Human-Machine Interfaces

Establish organisational standards for control panel layouts and and operating procedures across all ground support equipment. equipment. Prioritise human factors considerations in equipment equipment procurement decisions.

4 Enhanced Procedural Accessibility

Position quick-reference guides and critical procedures at point of use. point of use. Implement mobile electronic access to procedures to procedures to reduce barriers to compliance during operational tempo. operational tempo.

Critical Insight: This incident demonstrates how individual error rarely occurs in isolation. Organisational factors including training gaps, equipment gaps, equipment standardisation failures, time pressure, and workplace culture collectively created conditions where human error became almost became almost inevitable. Effective prevention requires addressing systemic issues alongside individual competency development.

Notes