

From Shanghai to Lima in 19 Hours

A Vision for Human-Autonomy Trust

AAAI Spring Symposium Series, March 21st, 2022

Putting AI in the Critical Loop: Assured Trust and Autonomy in Human-Machine Teams

Mauricio Castillo-Effen, Ph.D., Trustworthy AI & Autonomy
Lockheed Martin Advanced Technology Laboratories



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The Speaker

- Leads TAA @ LM ATL
- The **Trustworthy AI and Autonomy (TAA)** team at Lockheed Martin Advanced Technology Laboratories develops high assurance solutions (tools and methodology) supporting the entire lifecycle of Trustworthy AI and Autonomy.
- We help our customers deploy systems that incorporate complex decision-making (autonomy, AI/ML, + humans) with justified confidence that they are fit for purpose.



Mauricio Castillo-Effen

- > 15 Yrs in Aerospace with a focus on complex decision making, TEVV, and assurance.
- > 20 Yrs in robotics, autonomy, and controls.

Disclaimer

- The views and opinions presented in this presentation are solely the authors', and they do not represent the official policy or position of the Lockheed Martin Corporation or the Lockheed Martin Advanced Technology Laboratories.

Airbus Says Single Pilot Flight Crews Are the Long Term Future

Simple Flying, Sep. 27th, 2021

A350F Timeline in 'Right Place' for Single-Pilot Operations: Faury

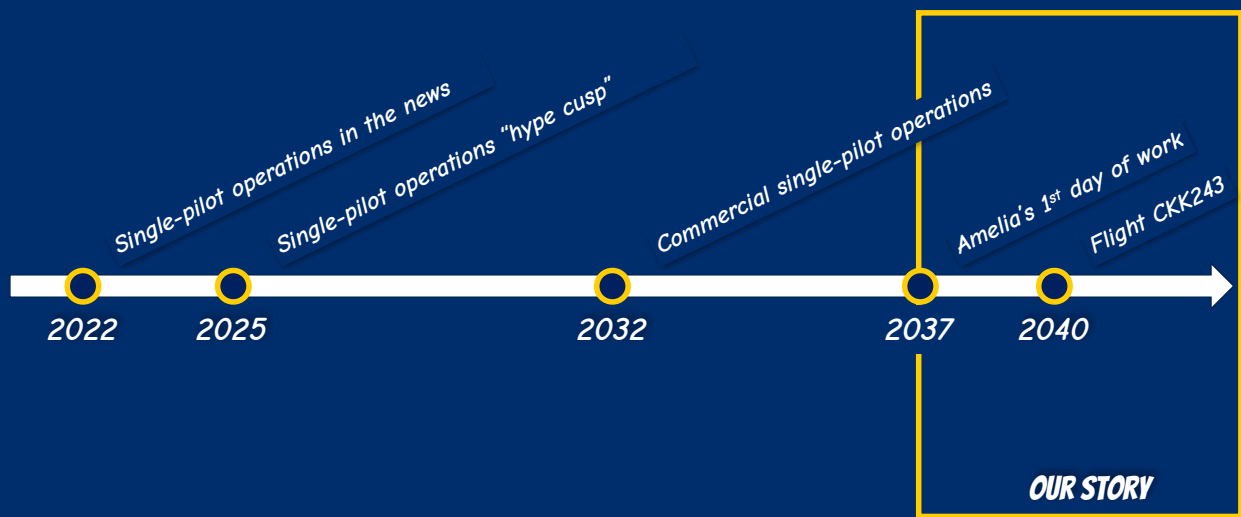
Flight Global, Nov. 15th, 2021

Your Packages May Soon Be Flown on a Massive Jet With Only One Pilot, and It's Only a Matter of Time Before You Could Be Too

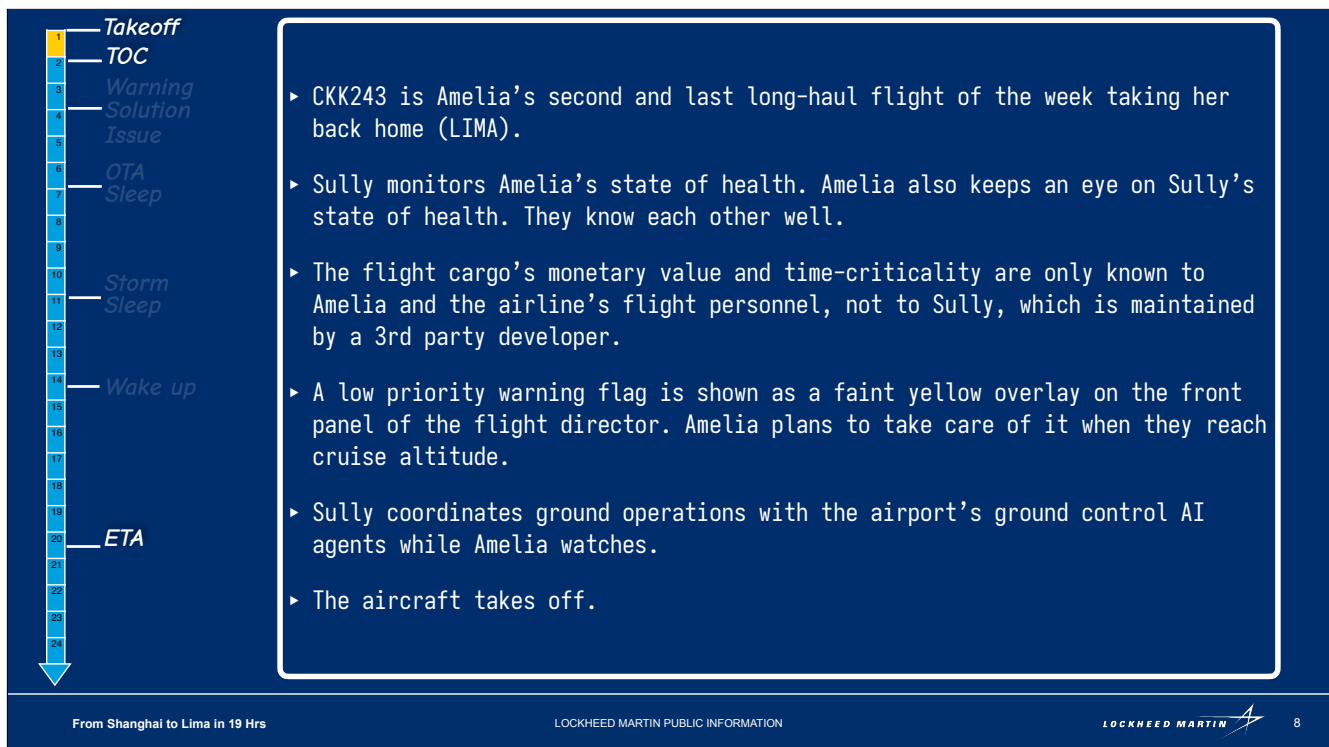
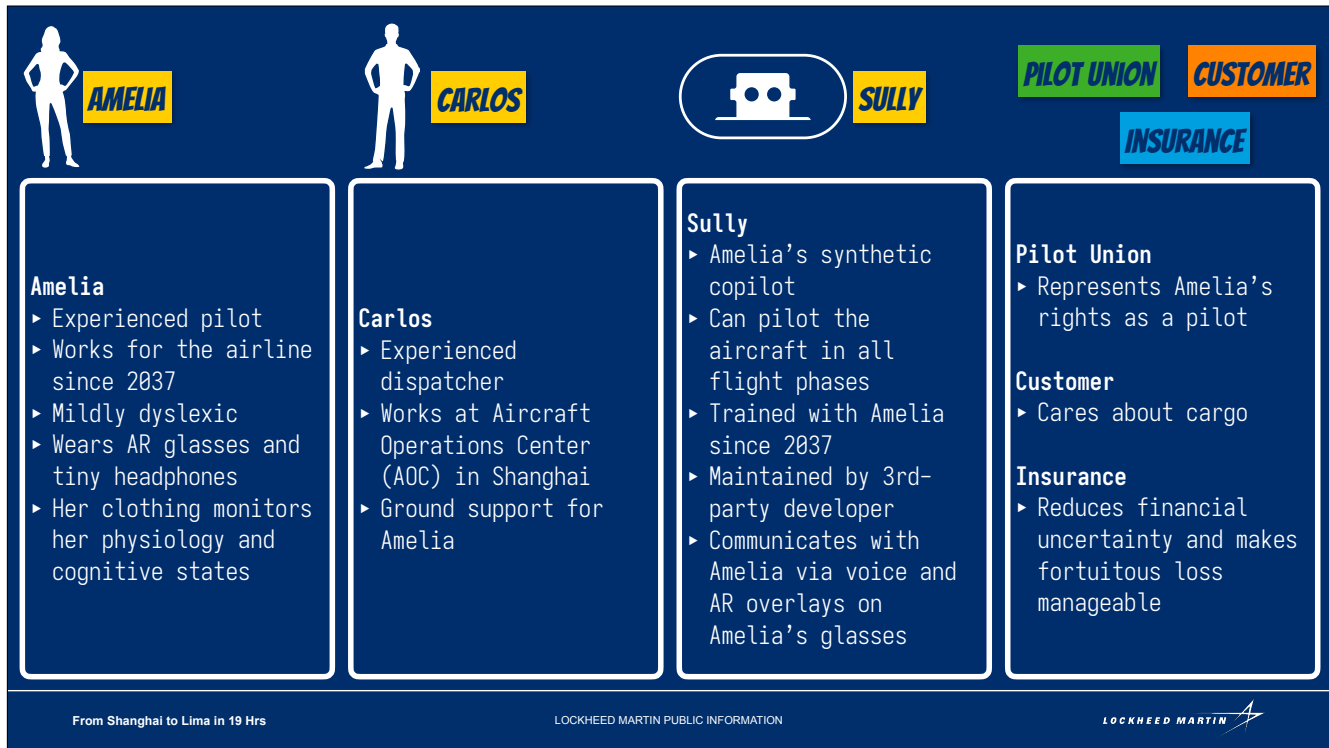
Business Insider, Dec. 5th, 2021

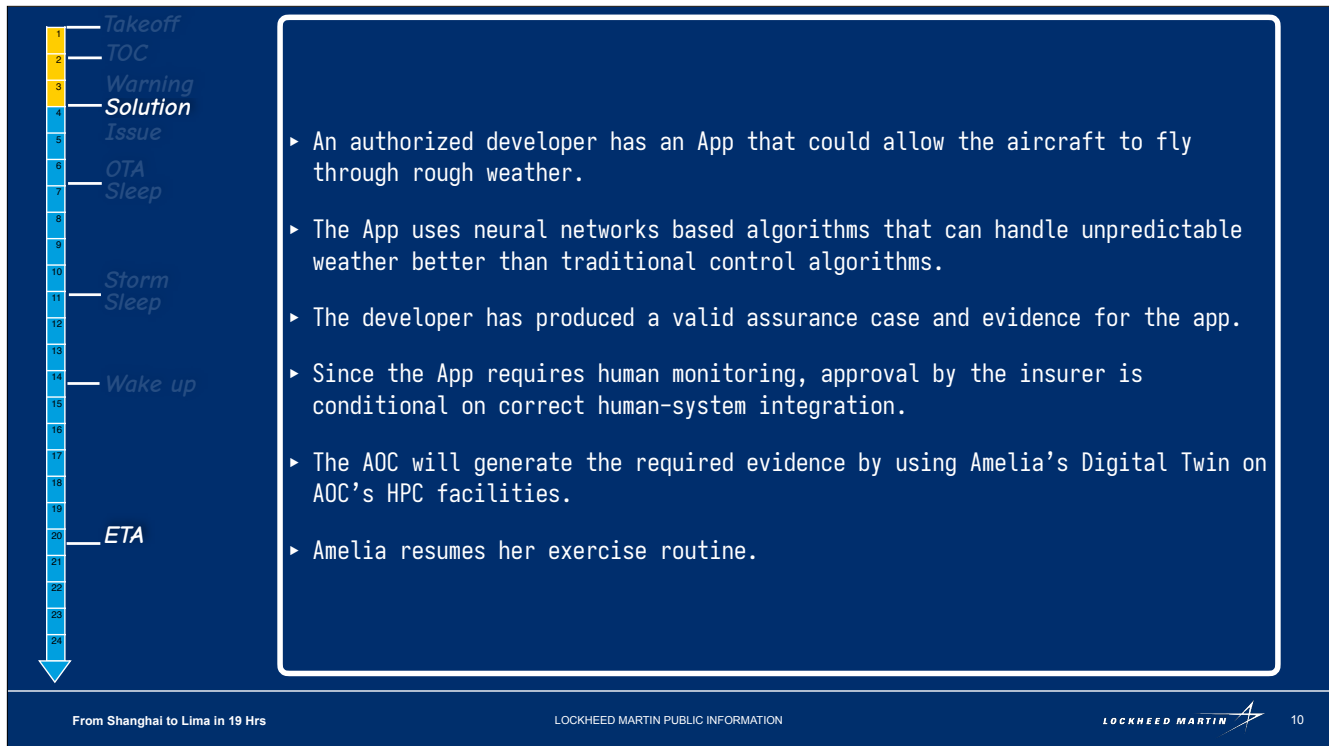
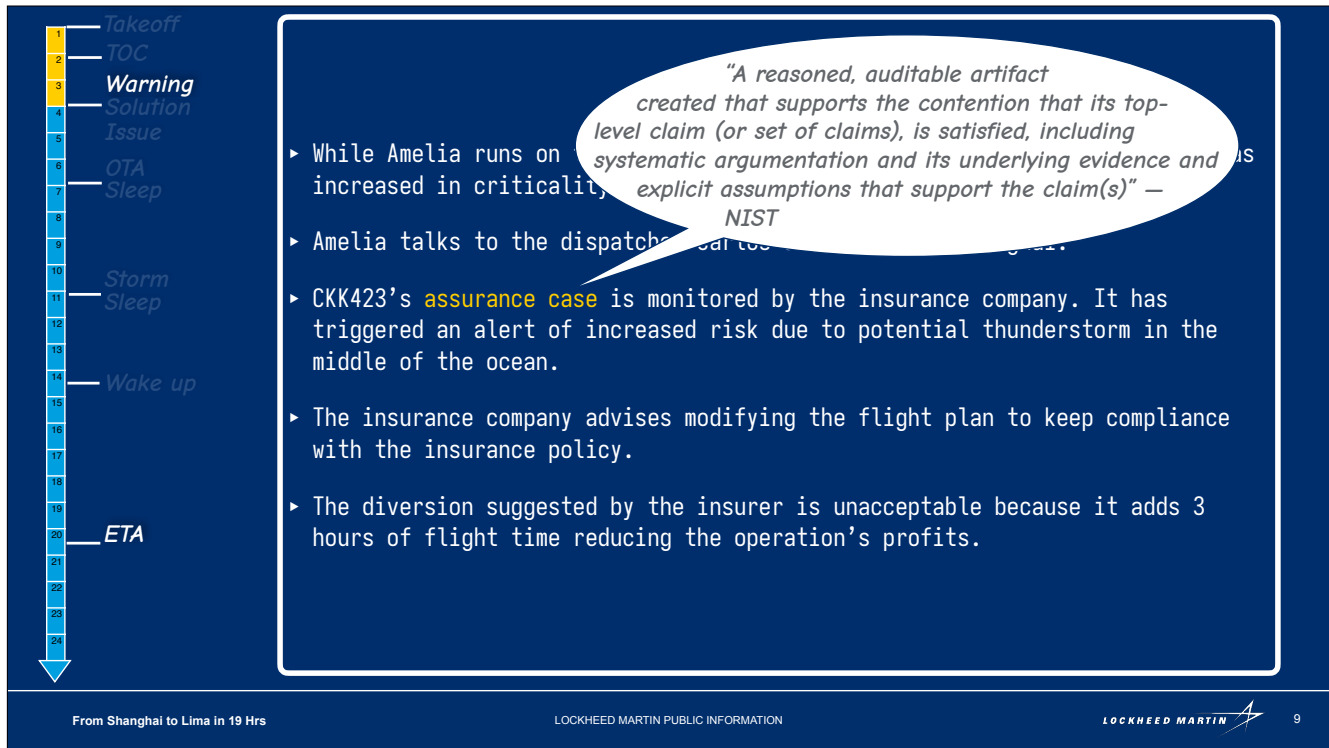
Why Airplanes Might Soon Have Just One Pilot

CNN, Jan. 13th, 2022



Flight:	CKK243
Dep. date:	9/21/2040
Origin:	Pudong (PVG)
Local dep. time:	04:15AM
	(UTC: 20:15)
Destination	Lima (LIM)
Local ETA:	10:45AM
	(UTC: 15:45)
Flight Duration:	19.5hrs
Distance:	9,279NM
Cargo Load:	158 tonnes
Cruise Alt.:	43,100ft







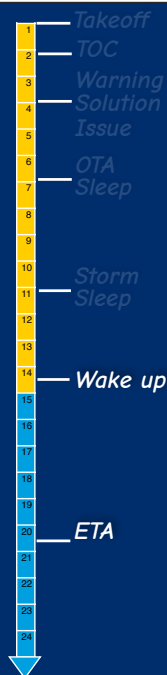
- ▶ Verification has been halted. Amelia's Digital Twin is missing an area of Amelia's cognitive profile protected by the Pilot Union. She knows its information related to her mild dyslexia.
- ▶ Amelia needs to pass tests proctored by the insurer and monitored by the Pilot Union.
- ▶ Amelia takes the tests in the aircraft's training room. This information can only be used for in situ verification. It cannot become part of her Digital Twin.
- ▶ The updated CKK243 assurance case is evaluated by the insurer.



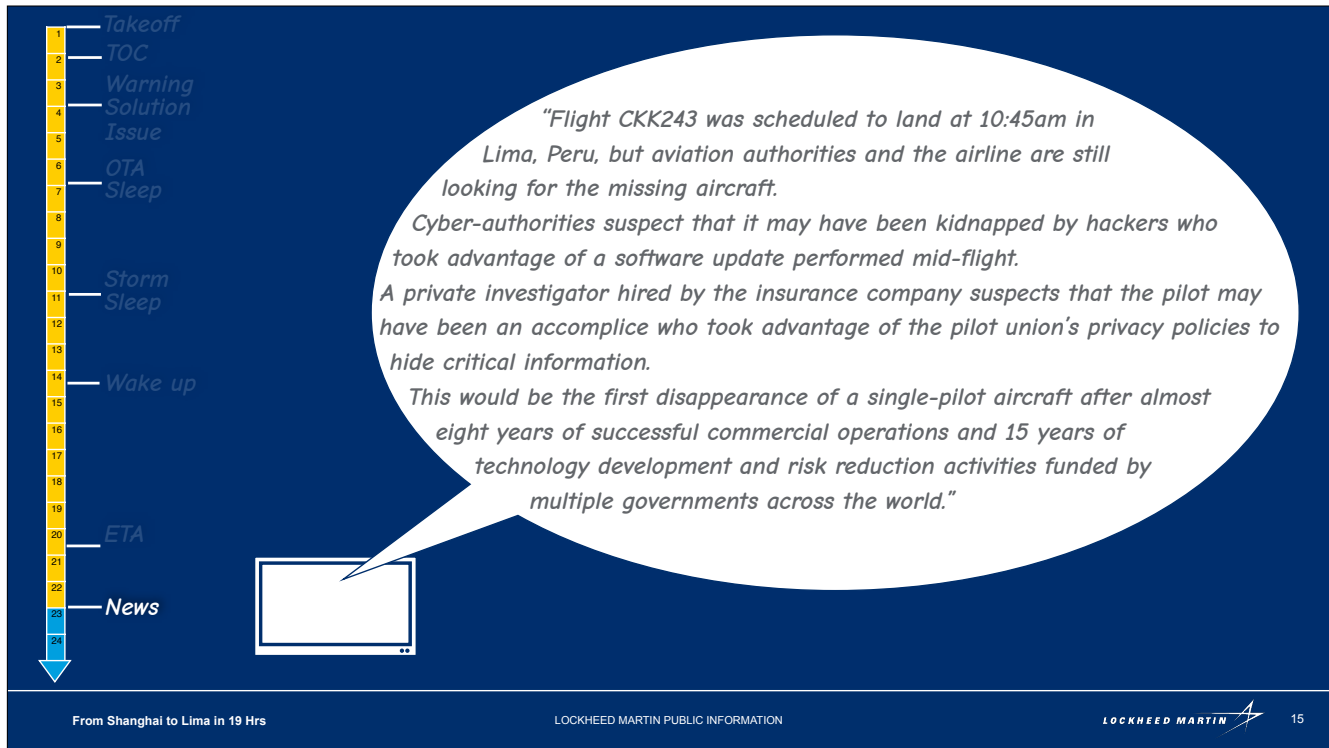
- ▶ Carlos lets Amelia know that the insurance company is fine with the suggested use of the App.
- ▶ AOC performs an Over-the-Air update.
- ▶ Since it affects Sully's core skills, it must remain inactive during the update.
- ▶ During the update Amelia flies the aircraft entirely manually.
- ▶ 15 minutes later, Sully is back.
- ▶ The AOC advises Amelia to take a rest. She will need to be fresh when they cross the storm.
- ▶ Amelia goes to sleep.



- Sully wakes Amelia.
- Amelia goes to the cabin.
- Sully flies the aircraft through the storm.
- While monitoring Sully, Amelia practices her flight skills on the aircraft's Digital Twin.
- Amelia goes back to sleep.



- Amelia goes to check the cargo area — one of her responsibilities. She turns off Sully's monitoring.
- She communicates updates to the AOC through dedicated communications channels.
- Carlos does not respond. Is he asleep?
- She tries to reach AOC personnel in Seattle. No response.
- She gets out of the cargo area and talks to Sully.
- Sully seems to be down.
- The procedure dictates that when Sully fails, the AOC alerts the pilot.
- Why is the AOC not responding?



Discussion

- There are many commercial incentives for making single-pilot operations a reality, exacerbated by a steadily dwindling workforce and supply chain challenges.
- Unifying human-machine interaction around a single machine agent is plausible and effective.
- Dynamic Assurance Cases represent a meaningful computational artifact for communicating and assessing risk.
- Assurance cases could be generated, updated, assessed, and summarized by machines working on behalf of the operator and the insurer.
- Digital Twins of humans could be used in the context of evidence generation activities
- Operations described in the story highlight intricacies of confidentiality and privacy.

Discussion

- We may be moving towards a future where open avionics platforms enable easy 3rd-party functionality integration.
- There are many developments in DevSecOps that will enable updates “at the speed of relevance.” Over-the-Air (OTA) updates help achieve the deployment step.
- Unpredictable weather will challenge the air transport industry in the coming decades.
- Neural networks offer advantages with respect to traditional algorithms, but also verification challenges.
- The asymmetric challenges of guaranteeing secure development and operation of increasingly interconnected cyber-physical systems and protecting them from malicious actors represents a major obstacle to this vision.

Corollary and Questions

- Trust can be multifaceted. It qualifies relationships between individuals, organizations, and machines. In some cases, machines are used as a trust vehicle for other forms of human trust.
- Performance, privacy, security and safety may be at odds, possibly raising ethical dilemmas.
- Humans remain the ultimate responsibility bearers and threats.
- Could this state of technology be achieved only with private investment? How much does de-risking do governments need to fund?
- What is the role of the government and regulators?
- In human-machine relationships, are trust and transparency always bidirectional?

