Very short example:
DC-10 engine out
Disclaimer

These exercises are not meant to represent a complete analysis, and they are not meant to exhaustively demonstrate STPA.

The exercises are only meant to introduce a few core concepts.
American Airlines 191: DC-10

- Left engine (#1) separates from aircraft on takeoff

- Pilot follows standard procedure for engine out. Raises nose to 14°, slows to takeoff safety airspeed \( (V_2) \) of 153 knots
  - This the specified speed at which the aircraft can safely climb after sustaining an engine failure

- Aircraft suddenly rolls left 120° (uncommanded), crashes

- Killed all 271 people on board. Deadliest aviation accident on US soil to this day.

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- Damaged hydraulic lines, left slats retracted
- Stall speed of left wing increased from 124 knots to 159 knots
- Cockpit indication incorrectly confirmed slats still in extended position (not visible from cockpit)
- Slat disagreement warning light inoperative (powered by #1 engine)
- Captain stick shaker inoperative (powered by #1 engine)
- First officer stick shaker never installed (offered as optional feature, not purchased by AA)
Using STPA to ask questions

**System Hazard:** Aircraft uncontrolled flight

**Question:** What Pilot control actions can cause aircraft to stall?

- **UCA:** Pilot decreases speed below stall speed

**Pilot**

- **Control algorithm**
- **Process Model (beliefs)**

**Control Actions**

**Feedback**

**Controlled Process**

**Question:** What Pilot beliefs would cause Pilot to decrease speed below stall speed?

- Incorrectly believes speed is higher than it is
- Incorrectly believes stall speed is lower than it is

**Question:** What Pilot inputs would cause Pilot to believe stall speed lower than it is?

- No stick shaker during stall
- No slat disagreement indication during slat retract

**Question:** What process behavior would cause slats to retract without slat disagreement indication?

- Loss #1 engine/power
- Hydraulic rupture near slats

John Thomas, 2019