

System for Controlling a Hijacked Aircraft

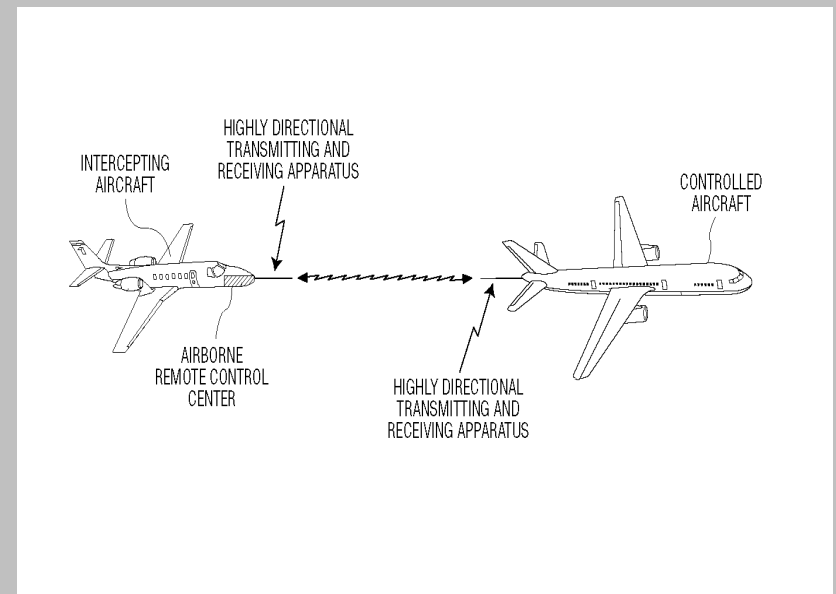
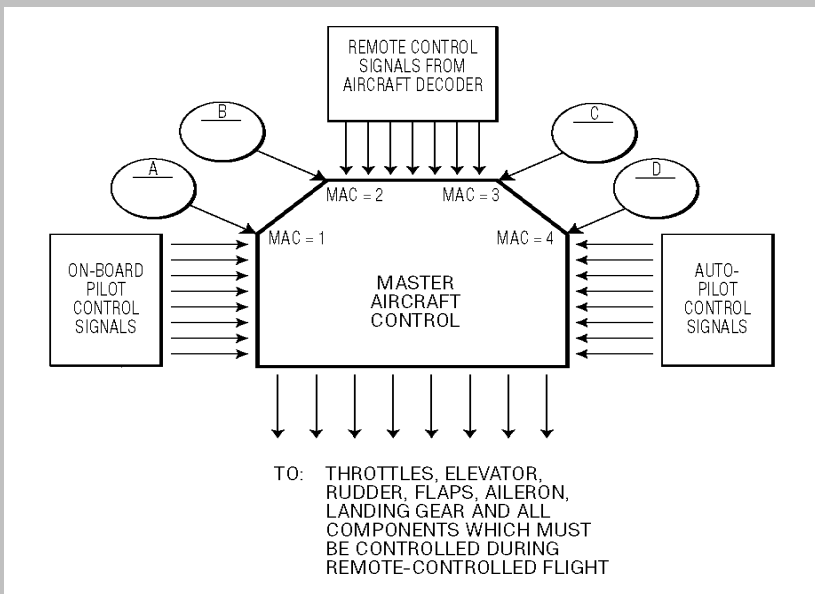
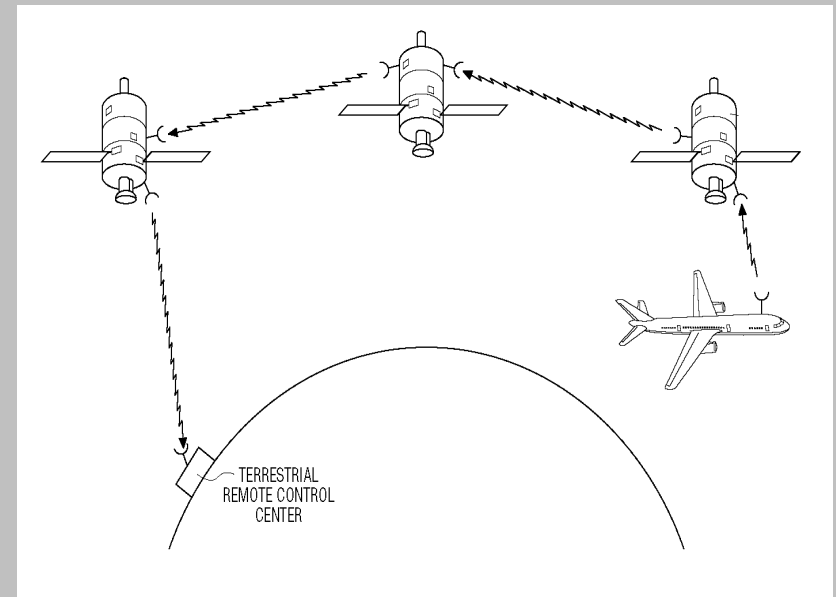
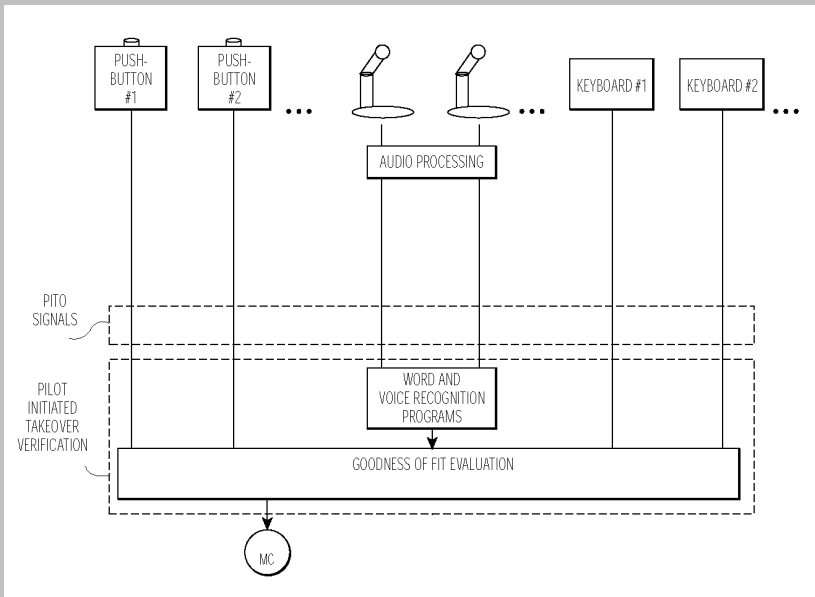
By Jeffrey A. Matos and Karl F. Milde, Jr.

Motivation for a Better System to Protect Against Aircraft Hijacking

- Given the current state of world affairs and of airport security, it seems unlikely that there will not be future attempts at air-terrorism.
- Given the current state of technology, we can do a far better job of protecting our passenger and commercial aircraft than simply reinforcing the cockpit door and giving the crew a gun.

Core Concept

- Thwarting of aircraft hijack attempt by:
 - taking control of the aircraft away from the on-board pilot, and
- Giving control to alternate pilot, viz.:
 - autopilot, and/or
 - human pilot aboard local interceptor aircraft, or
 - remotely situated human pilot
- The off-aircraft human pilot lands the hijacked aircraft.



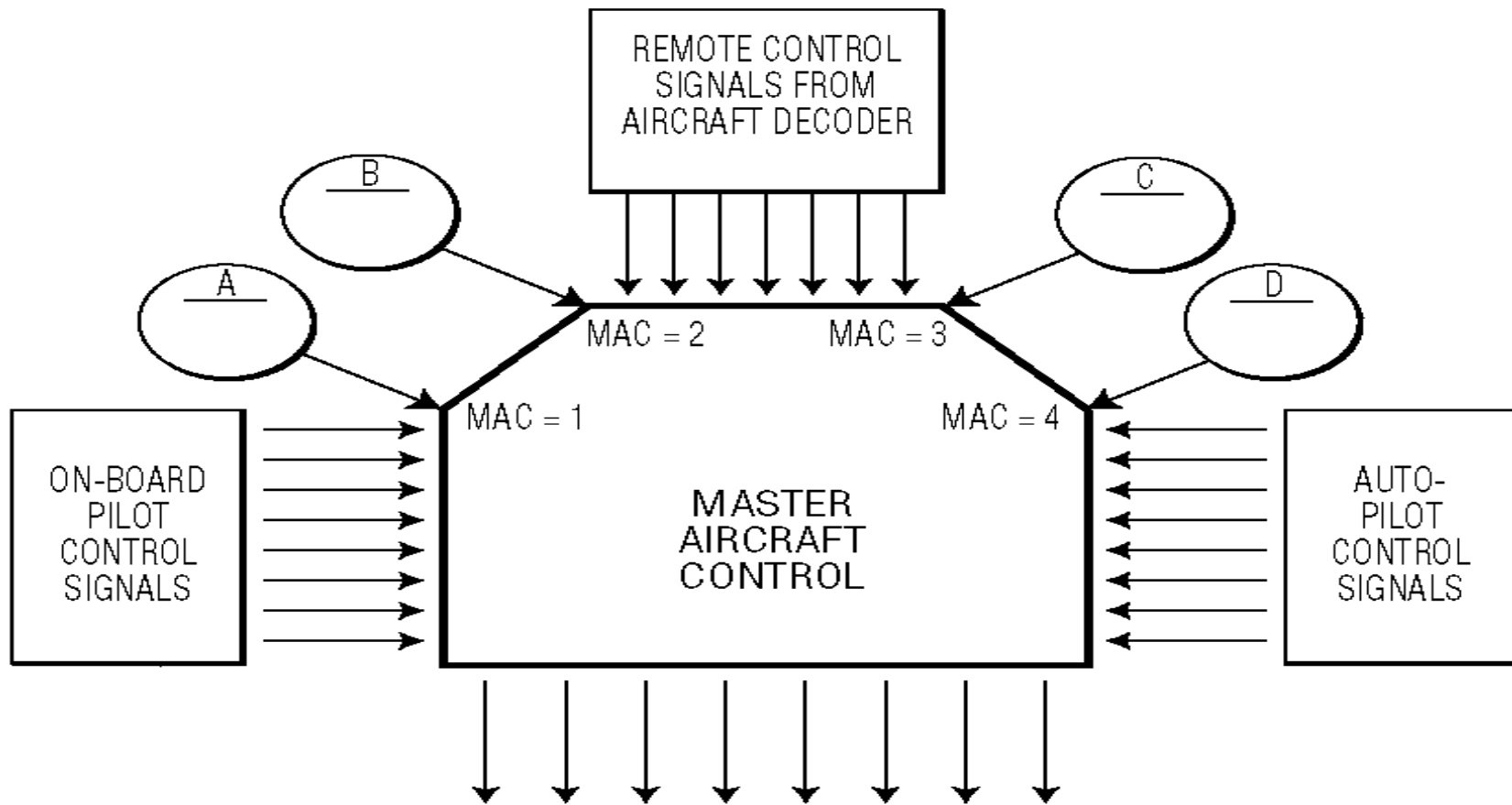
Three “Axioms”

- 1) Control of HAC (hijacked aircraft) taken from HAC pilot only if he requests.
- 2) Landing of HAC performed by off-HAC pilot, in visual contact with HAC
- 3) Render system “hack-proof” by excluding long distance remote control and allowing off-HAC pilot to communicate by line of sight/ highly directional system/ low sensitivity HAC receiver.

Method I

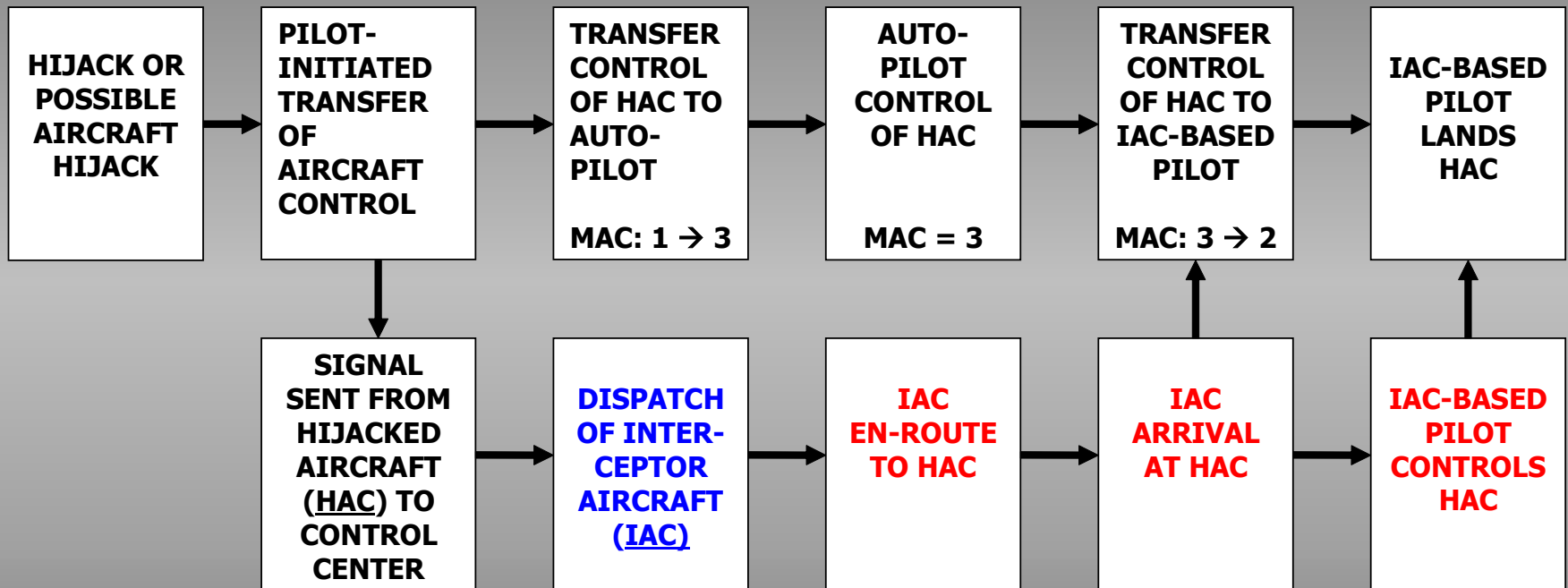
- 1) At HAC Pilot request, transfer control to Autopilot, and send signal to Control Center
- 2) Control Center dispatches IAC (Interceptor Aircraft)
- 3) On arrival of IAC at HAC, transfer control of HAC to IAC-based pilot
- 4) IAC-based pilot lands HAC

Master Aircraft Control

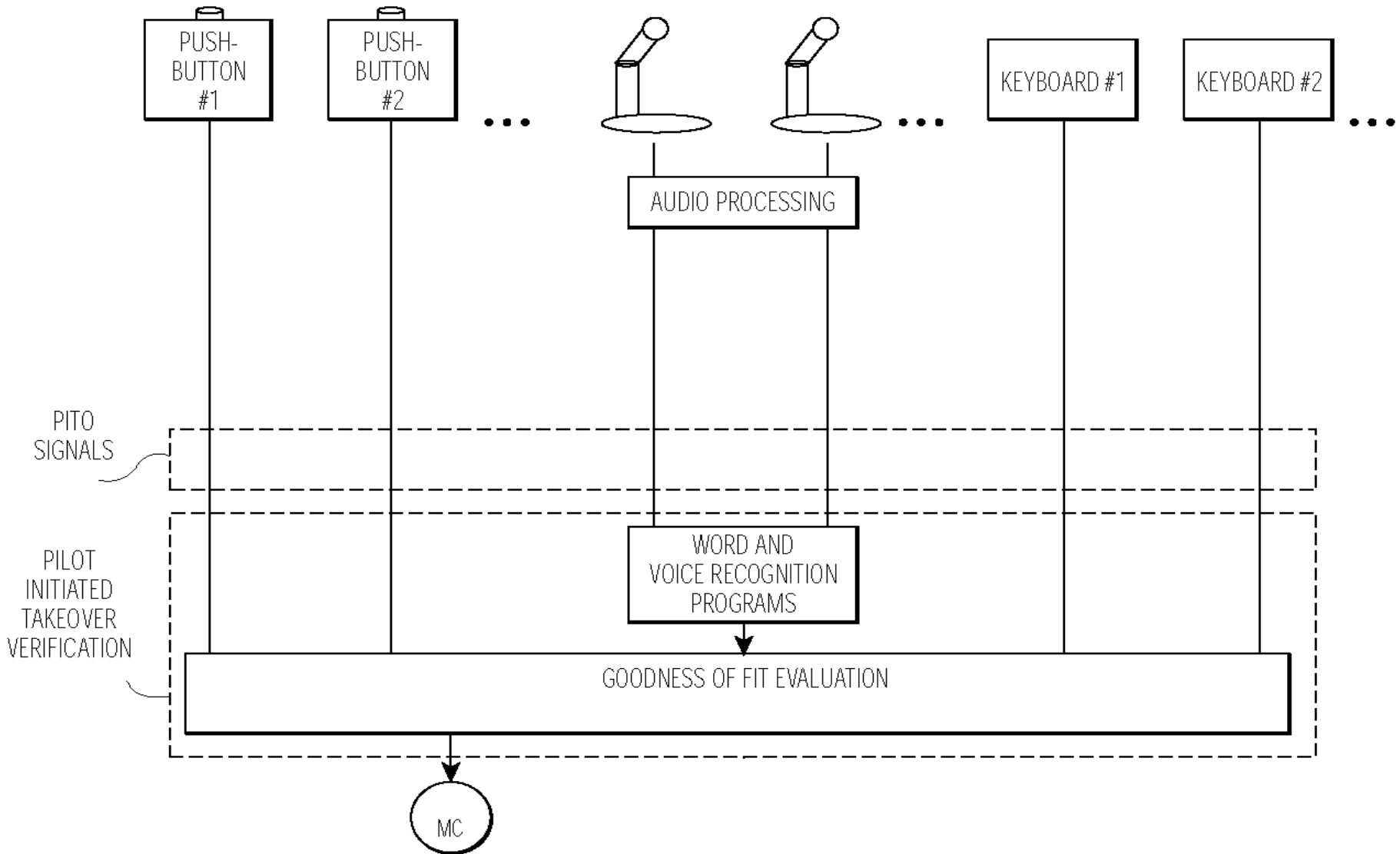


TO: THROTTLES, ELEVATOR,
RUDDER, FLAPS, AILERON,
LANDING GEAR AND ALL
COMPONENTS WHICH MUST
BE CONTROLLED DURING
REMOTE-CONTROLLED FLIGHT

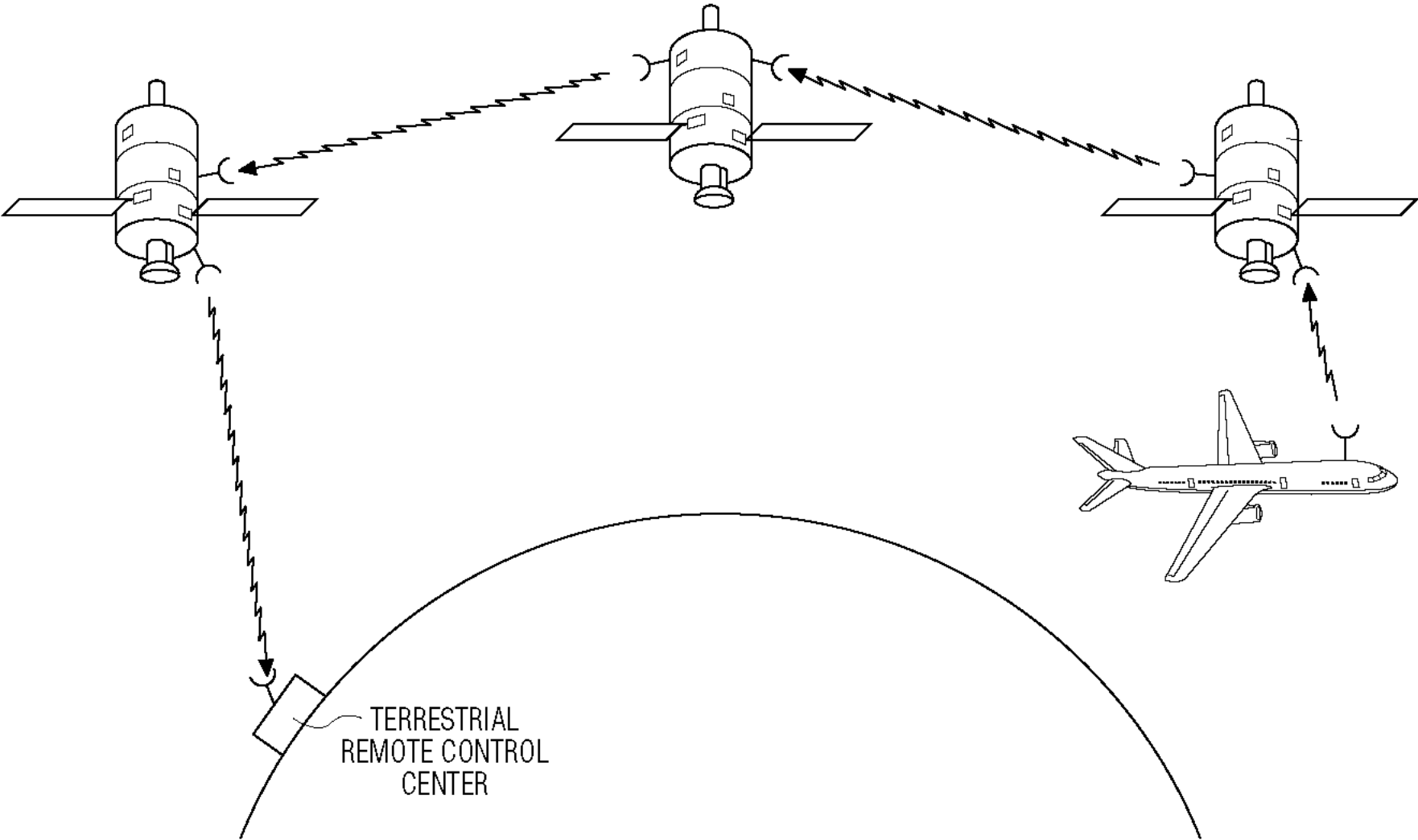
Method I



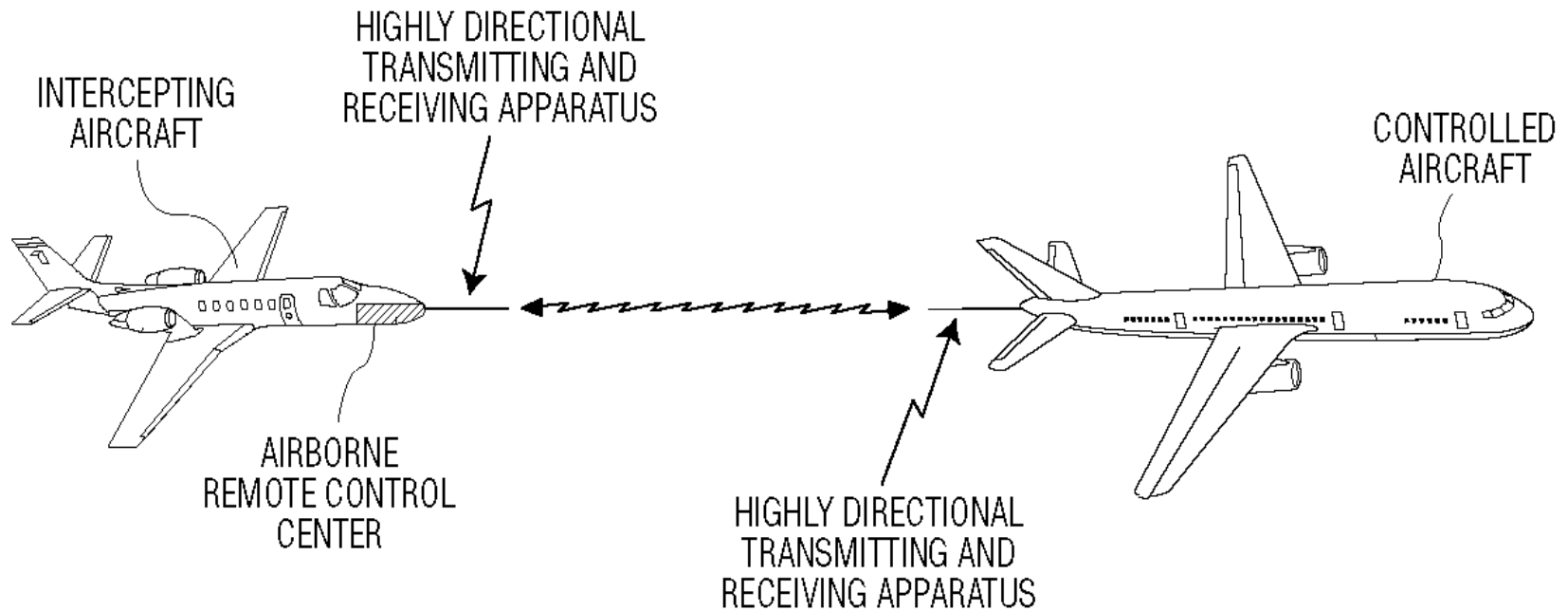
Pilot-Initiated Takeover



PITO Signal Relayed to Control Center



Interceptor Aircraft-Based Pilot Flies Hijacked Aircraft



Axiom Notation

(METHOD II USED AS EXAMPLE)

AXIOM NOTATIONAL

RULES:

- 1) Axioms which are “violated” are shown in large, white italic style. In the case of Method II, this obtains for Axiom (1).
- 2) Axioms which are left intact are shown in gray, with a smaller font size. In the case of Method II, this includes Axioms (2) and (3)

METHOD II AXIOMS

- 1) *Control of HAC (hijacked aircraft) taken from HAC pilot only if he requests.*
- 2) Landing of HAC performed by off-HAC pilot, in visual contact with HAC
- 3) Render system “hack-proof” by excluding remote control and allowing off-HAC pilot to communicate by line of sight/ highly directional system/ low sensitivity HAC receiver.

Method II: Axiom 1 Eliminated

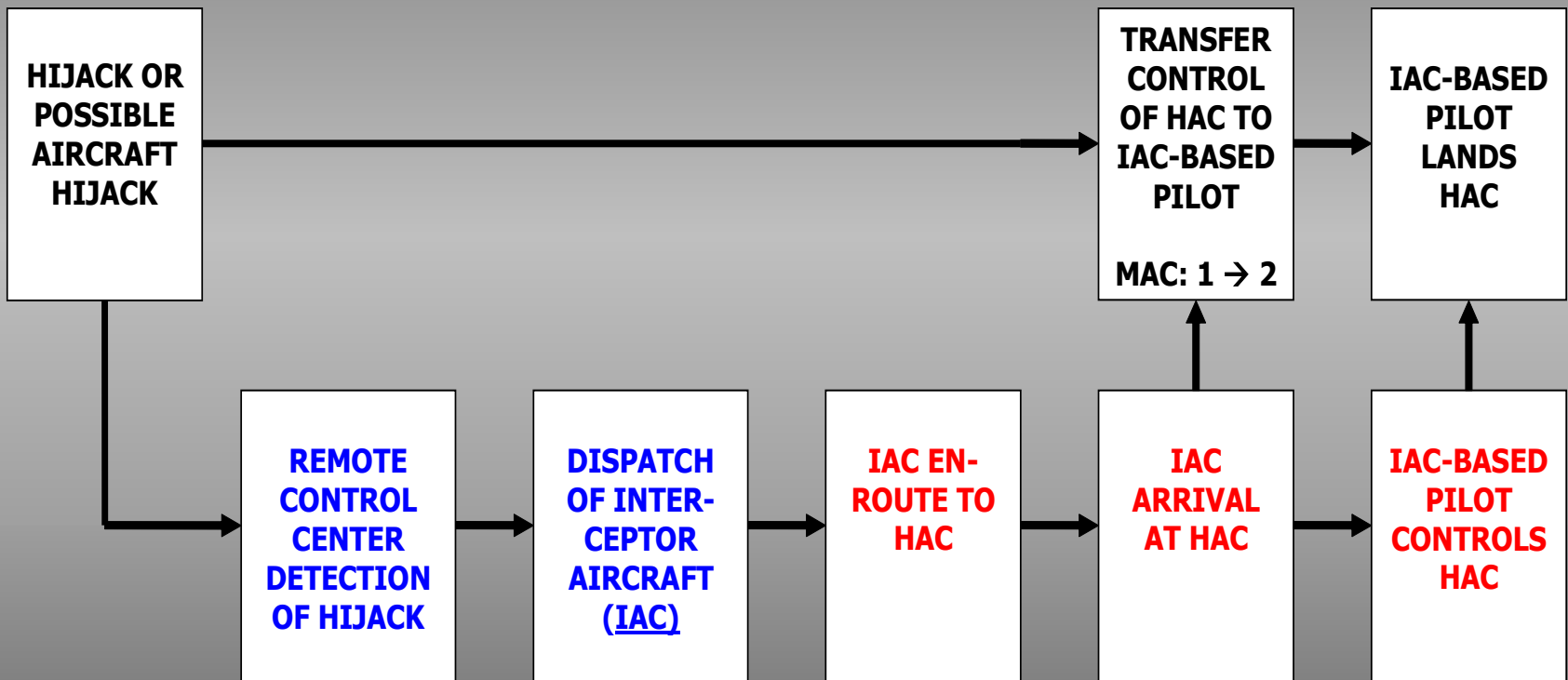
AXIOMS

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METHOD II

- 1) At off-HAC request, Control Center dispatches IAC (Interceptor Aircraft)
- 2) On arrival of IAC at HAC, transfer control of HAC to IAC-based pilot
- 3) IAC-based pilot lands HAC

Method II



Method III: Axiom 1 Eliminated and Axiom 3 Transiently Eliminated

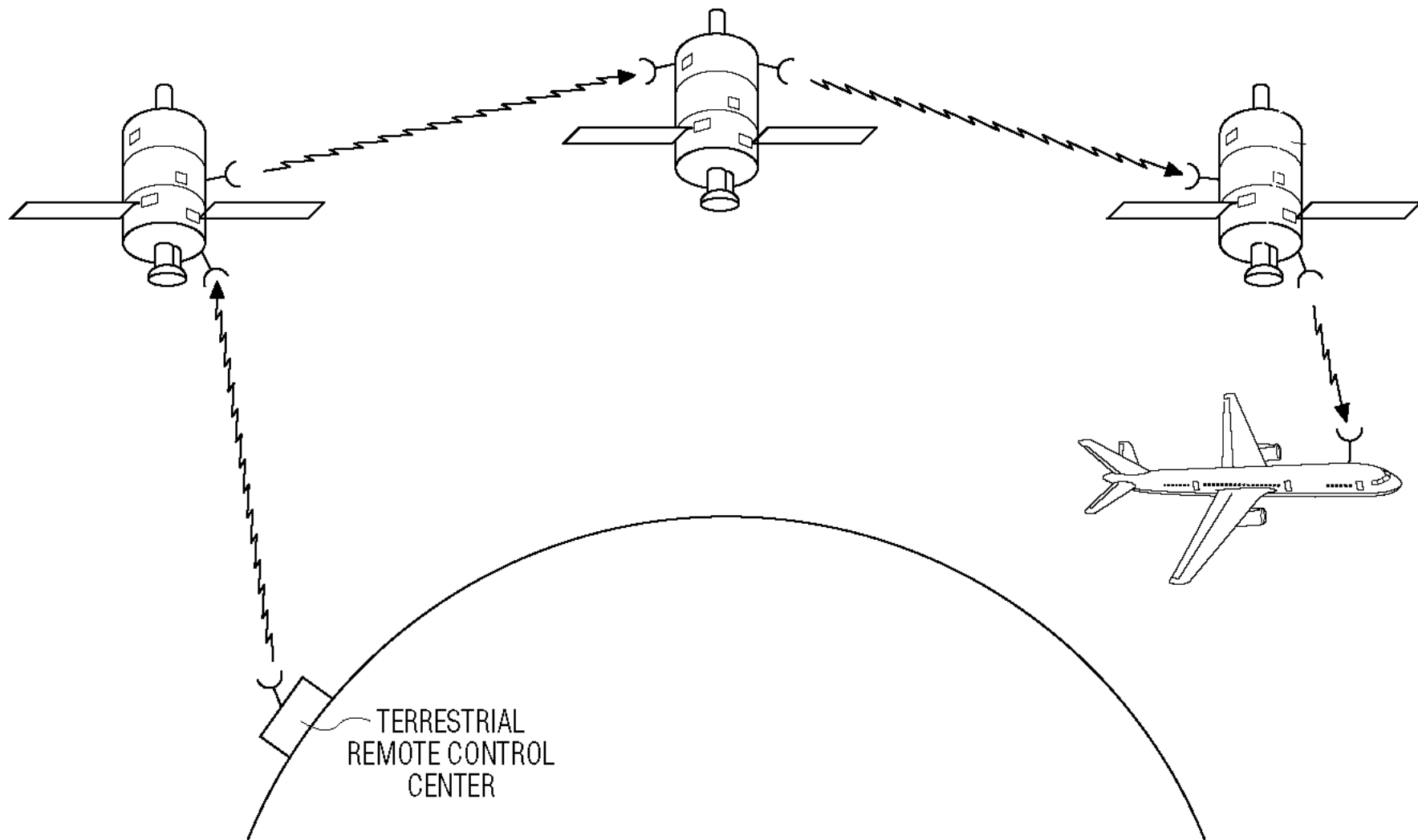
AXIOMS

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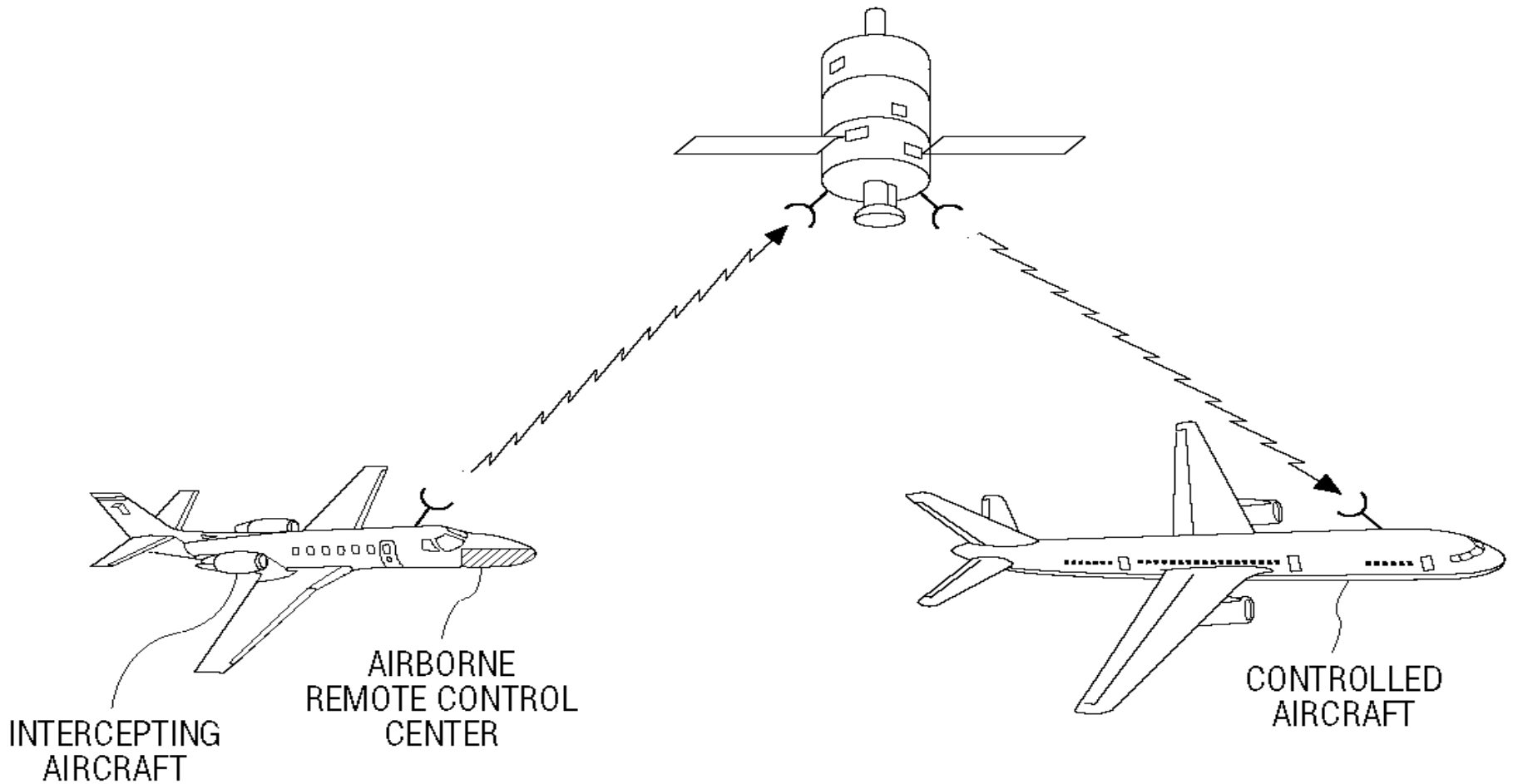
METHOD III

- 1) At off-HAC request, transfer control to Autopilot, and send signal to Control Center
- 2) Control Center dispatches Interceptor Aircraft (IAC)
- 3) On arrival of IAC at HAC, transfer control of HAC to IAC-based pilot
- 4) IAC-based pilot lands HAC

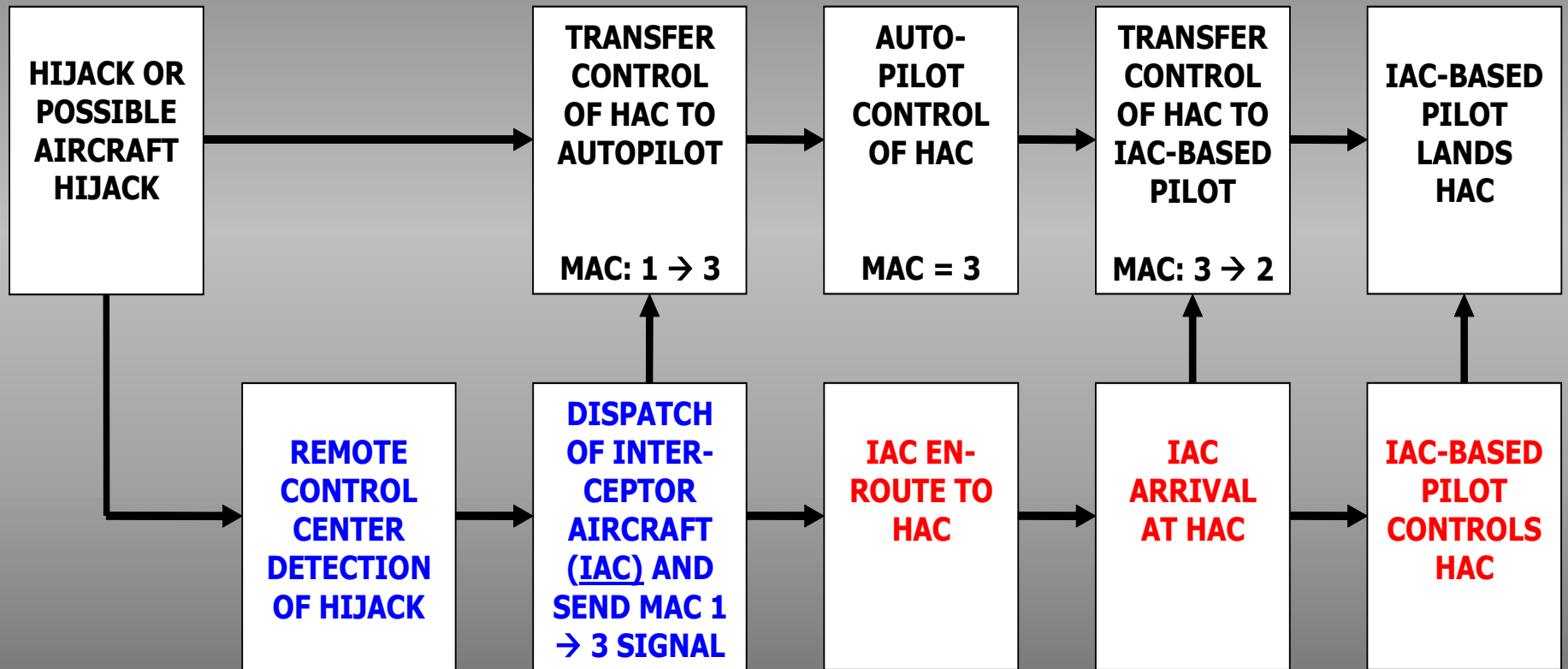
Takeover Signal Sent from Terrestrial Control Center



Takeover Signal Sent from Airborne Control Center



Method III



Method IV: Axiom 3 Eliminated

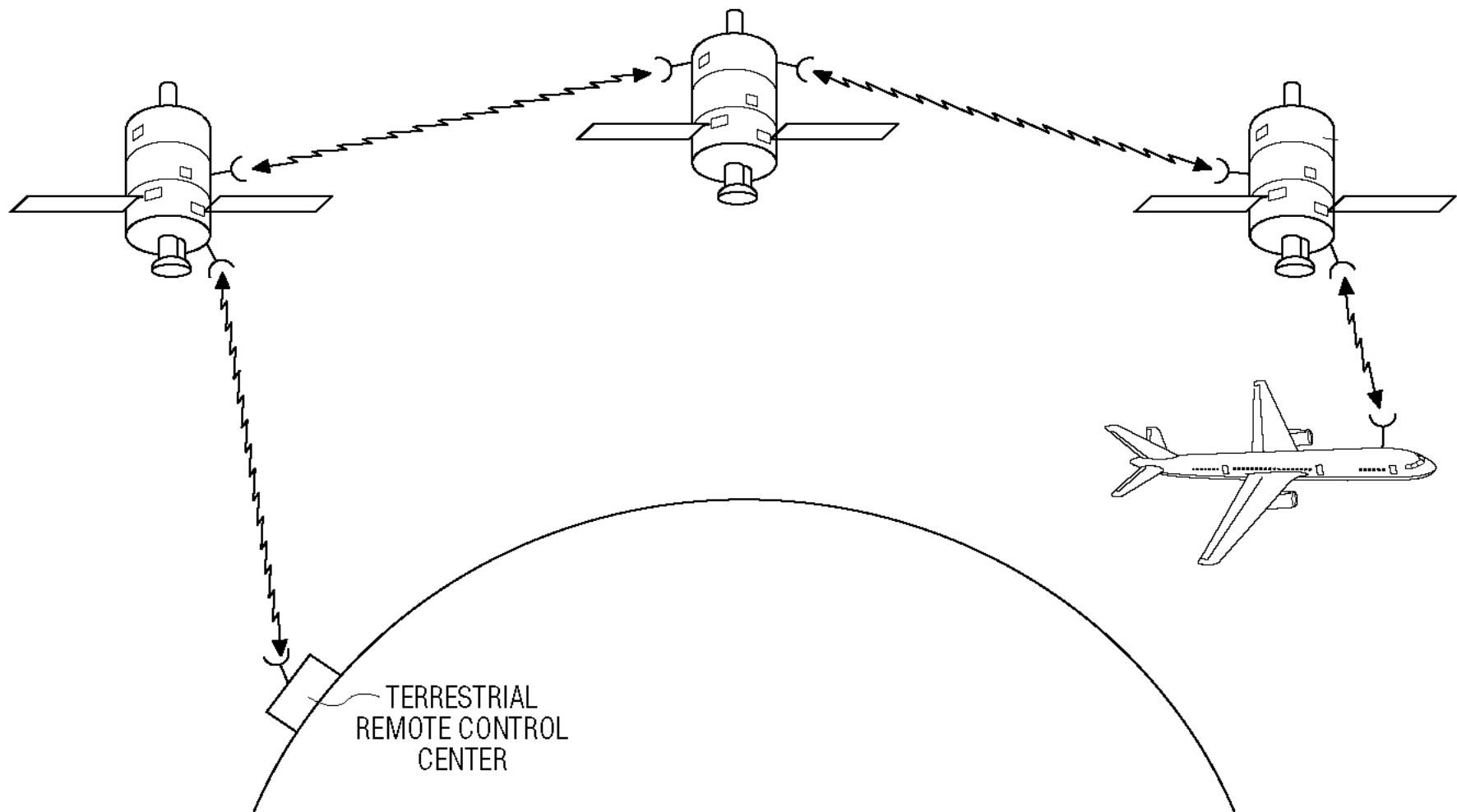
AXIOMS

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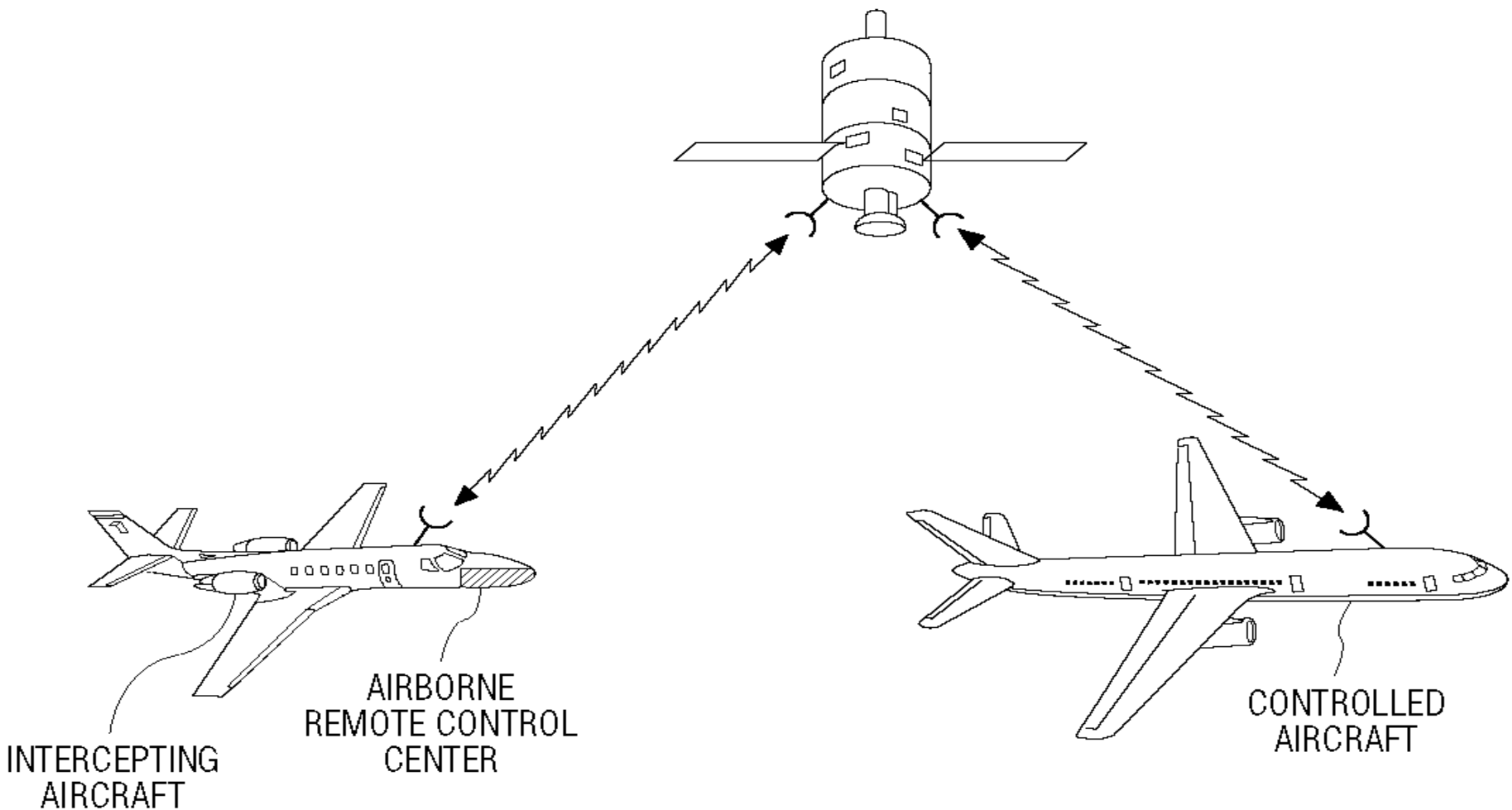
METHOD IV

- 1) At HAC pilot request, send signal to Control Center and transfer control to remote pilot
- 2) Control Center dispatches Interceptor Aircraft (IAC)
- 3) HAC Control by remote pilot until IAC arrives
- 4) On arrival of IAC at HAC, transfer control of HAC to IAC-based pilot
- 5) IAC-based pilot lands HAC

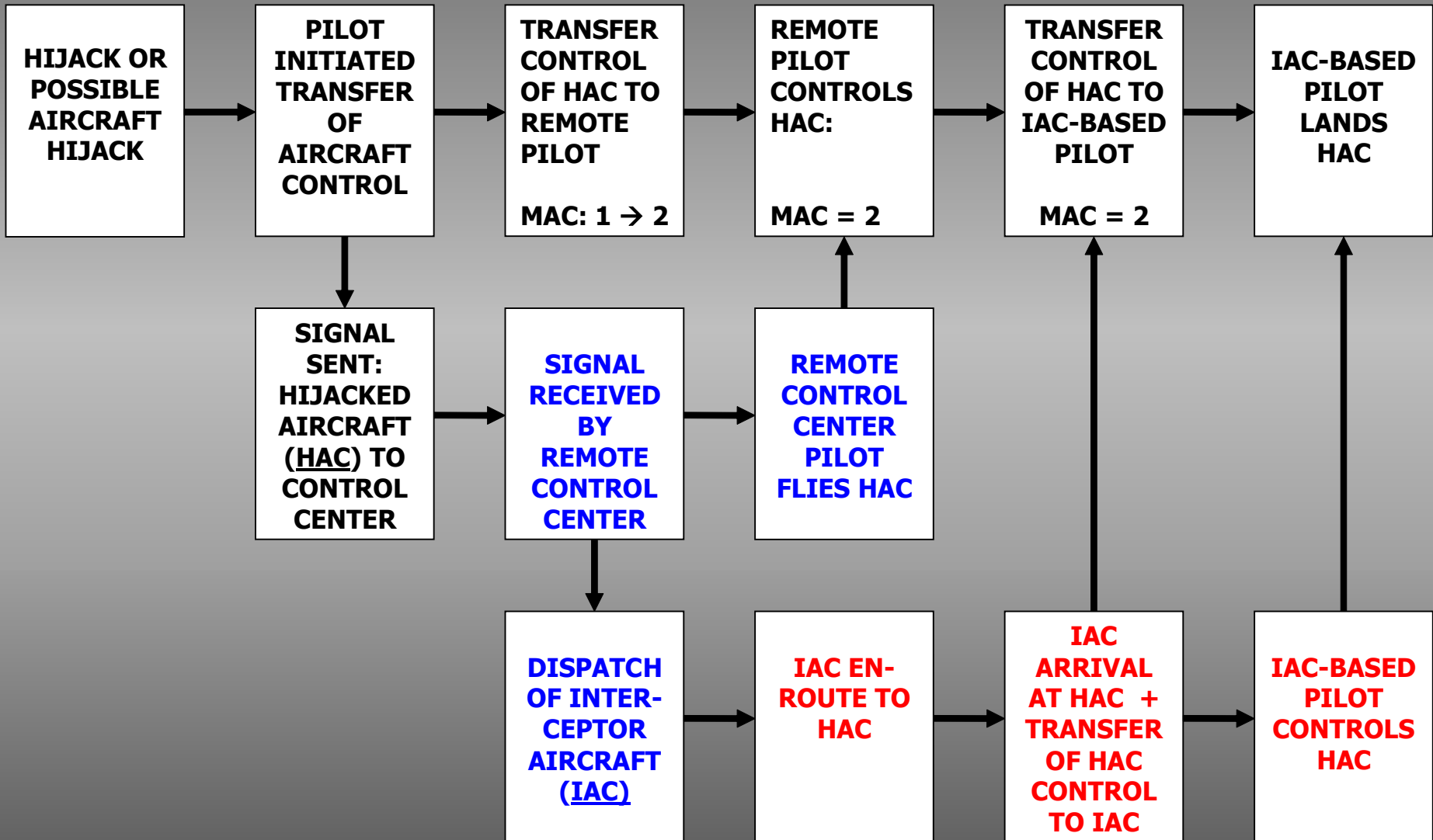
Hijacked Aircraft Piloted From Terrestrial Control Center



Hijacked Aircraft Piloted From Airborne Control Center



Method IV



Method V: Axioms I & III Eliminated

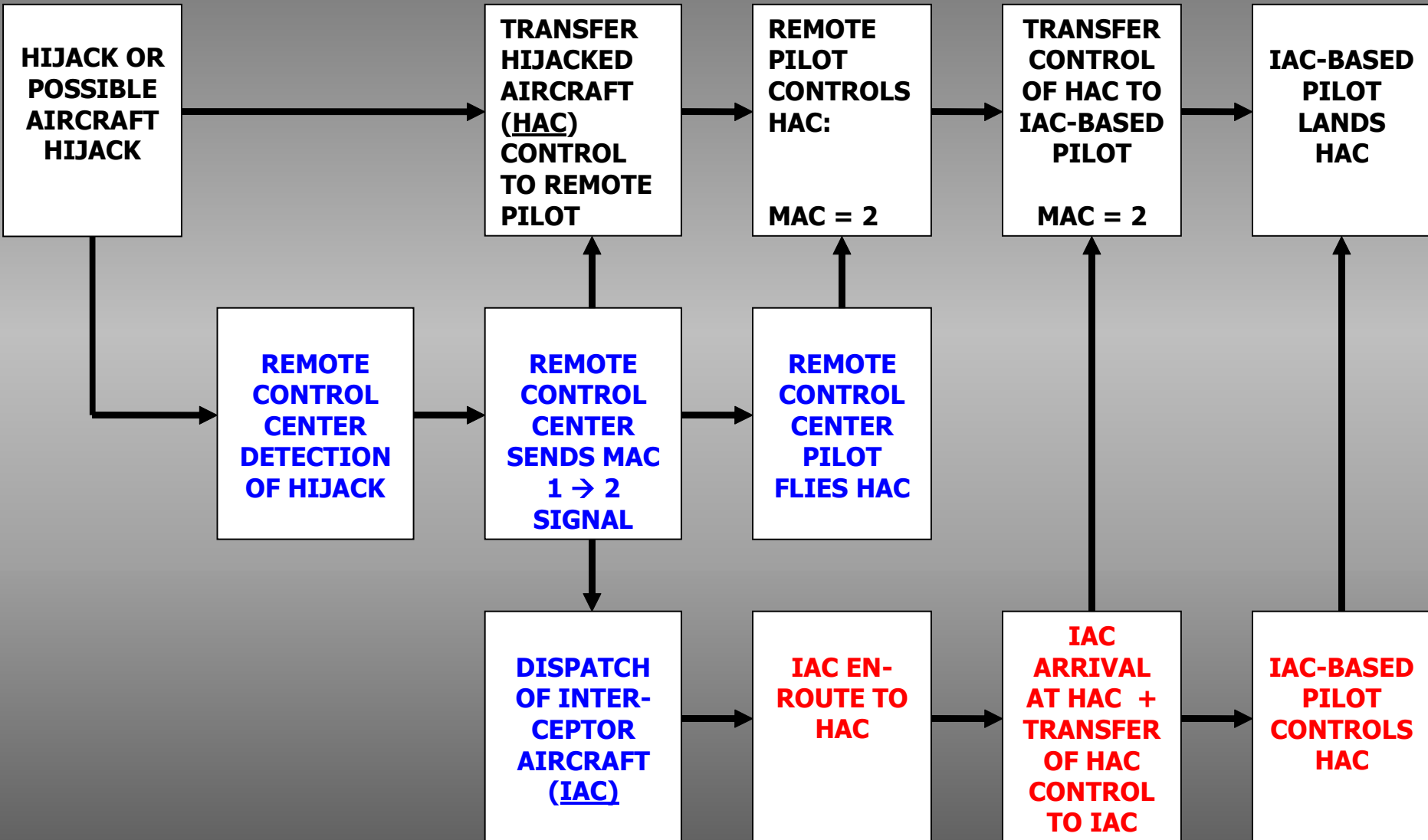
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METHOD V

- 1) At off-HAC request, transfer control to remote pilot
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- 3) HAC Control by remote pilot until IAC arrives
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- 5) IAC-based pilot lands HAC

Method V



Summary of Methods

<u>METHOD</u>	<u>AXIOM 1</u>	<u>AXIOM 3</u>	<u>PILOT PRE IAC</u>
I	+	+	AUTOPILOT
II	-	+	HAC PILOT
III	-	+/-	AUTOPILOT
IV	+	-	CONTROL CENTER
V	-	-	CONTROL CENTER

Axiom 1: + means that only hijacked pilot can initiate control transfer

Axiom 3: + means that post control transfer, only the autopilot and a local interceptor-based human pilot can control the hijacked aircraft

Hardware Requirements

- Protected Aircraft:
 - Communications Equipment
 - Autopilot Modifications
 - User Identification Coding Equipment
- Interceptor Aircraft:
 - Communications Equipment
 - Remote Pilot Console
- Terrestrial or Airborne Control Center

Dual Effect of System Implementation

- Direct Aircraft Protection
- Event Deterrence