AIR TRAFFIC SERVICES UNIT

AIRLINE OPERATIONAL CONTROL

Optimizing Critical Data Communications for Airbus Single Aisle and Long Range Operators

ATSU AOC

Honeywell

AIR TRAFFIC SERVICES UNIT AIRLINE OPERATIONAL CONTROL (ATSU AOC)

Optimizing Critical Data Communications for Airbus Single Aisle and Long Range Operators

The Air Traffic Services Unit (ATSU) provides the Datalink Host Platform, Router and Air Traffic Control applications used for Datalink communications on the Airbus A318, A319, A320, A321, A330 and A340 aircraft. The Honeywell ATSU Airline Operational Control (AOC) software and database support operational functions including:

- AOC uplinks and downlinks that enable efficient airline operations
- Out-off-on-in (OOOI) logic to define each flight phase
- AOC user interface to the flight crew
- Aircraft and operational data reporting—including engine, fuel, avionics and maintenance reports

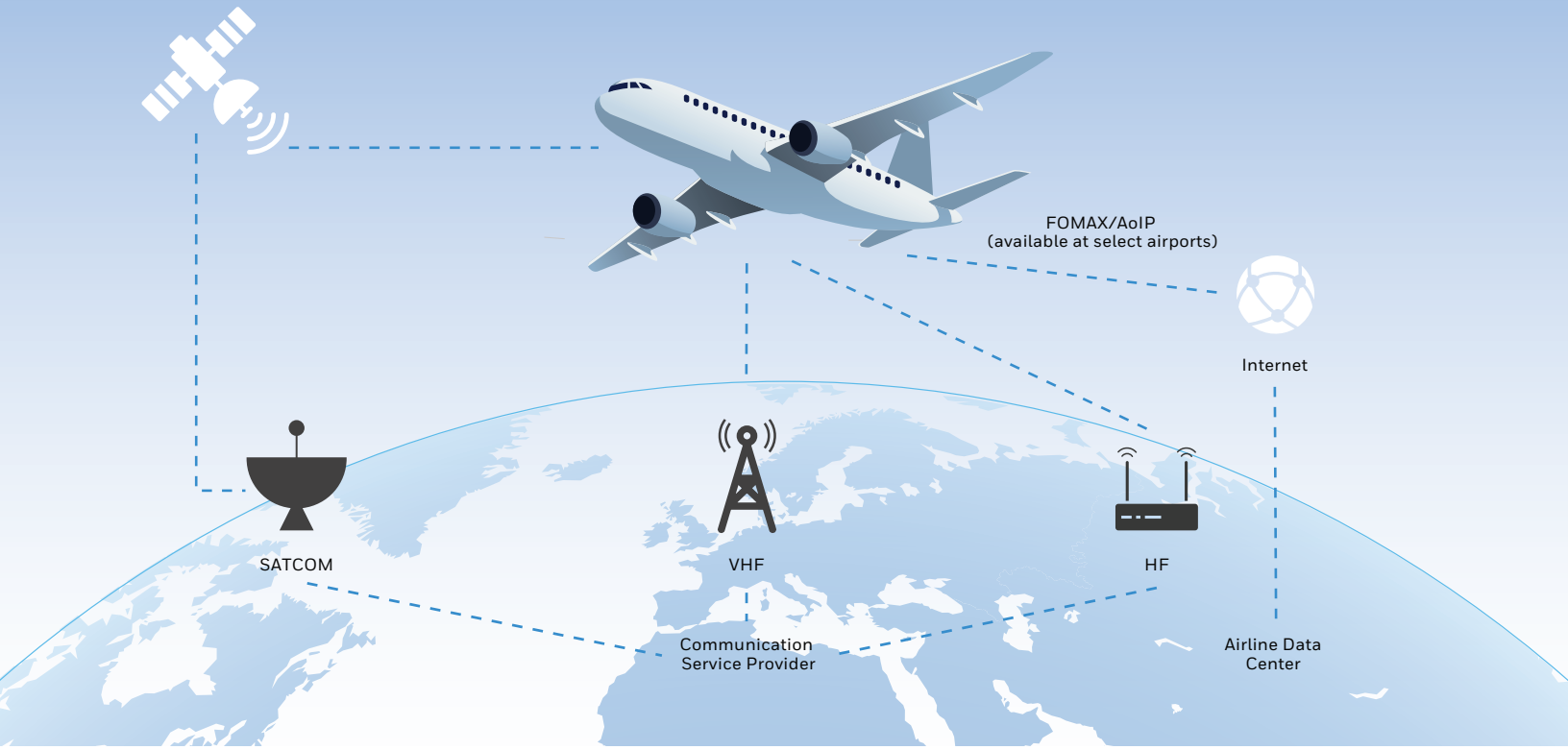
Honeywell's ATSU AOC software functionality is configured within a user-modifiable AOC Database. The AOC Database can be tailored directly by Honeywell customers using the ACARS Reconfiguration Tool or by the Honeywell Datalink Services team. AOC Databases are loadable on-wing and do not require aircraft certification (TC or STC). Three components make up the ATSU system:

- The ATSU Hardware on Airbus platforms – provided by Airbus
- The ATSU Aircraft Interface Software (including air/ground Router) and ATC Application - provided by Airbus
- The ATSU AOC software and AOC Database – provided by Honeywell

This brochure outlines the major functions provided in Honeywell ATSU AOC software, with particular emphasis on the AOC Enhancements introduced in the latest software version (part number 998-2459-513) that enable airline operational cost savings and facilitate schedule integrity. ATSU AOC -513 software became the standard version for forward-fit SA/LR aircraft deliveries in 2019. ATSU AOC -513 software is also available for retrofit.

ATSU AOC ENHANCEMENTS FOR REDUCED AIRLINE OPERATIONAL COSTS

The data fees an operator pays to communication service providers, such as ARINC, SITA, AVICOM, and ADCC can be substantial. The ATSU AOC provides options within its Airline Operational Control Database to minimize these data costs.



SET MESSAGE ROUTING PRIORITIES TO DESIGNATE MESSAGE TRANSMISSION ON THE LEAST EXPENSIVE NETWORK LINK.

Network routing choices now include:

- AOIP preferred
- VHF preferred
- SATCOM preferred
- HF preferred
- VHF only
- SATCOM only
- HF only

Priorities may be set for internal AOC Messages (e.g. OOOI, Free Text) and external AOC Messages (e.g. Maintenance Reports from CMC or Engine Reports from ACMS). The available data link with the lowest cost will be used for these non-safety messages.

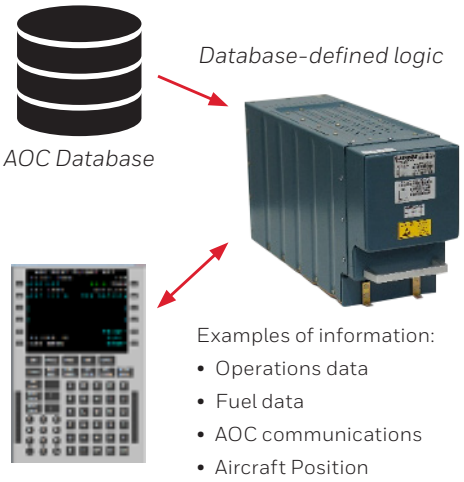
Aircraft equipped with the Airbus FOMAX AoIP capability can send AOC messages using ACARS over Internet Protocol (AoIP).

The lower cost AoIP link can be used for larger messages. More data can be cost-effectively sent to Airline Computing Systems for analytics.

1. HOW ATSU AOC ENABLES OPERATIONAL EFFICIENCY

Honeywell ATSU AOC provides enhanced ACARS customization via a user-modifiable Airline Operational Control (AOC) database that:

- Provides air-ground data reporting that is critical to big-fleet services and operational efficiency
- Defines the flight crew interface for ACARS, flight information, and metric reporting
- Enables collection of "big data" for offline analytics that can be used to understand and improve fuel efficiency, fleet operations, turn-around time, and aircraft maintenance



GATHER AIRCRAFT INFORMATION AND GENERATE AUTOMATIC REPORTS

- Precise time the passenger, cargo, and catering doors open or close
- Parking brake set/release times
- Engine start and stop times
- Movement times, including push-back, start of taxi, takeoff, landing and gate arrival
- Flight phase times, including top of climb, top of descent and start of approach
- Crew requests for ground services, including gate assignment, maintenance, connecting gate information and passenger services
- Turn-around times—after doors close how long before start of taxi; after taxi in how long before passenger doors open; after galley door opened how long for catering operation to complete; after cargo door opened how long for baggage loading to complete
- Aircraft position reports, including abnormal position reporting every minute, should an emergency situation occur
- Collect other data at each flight event; for example: engine power, fuel onboard, fuel burned, altitude, heading, air speed, ground speed and roll angle

OPTIMIZE FUEL EFFICIENCY AND ENABLE FURTHER FUEL-SAVING ANALYTICS

- Fuel on-board and fuel burned (calculated using fuel flow data). This data can be reported for flight segments like taxi out, takeoff hold, climb, cruise, diversion, descent, taxi in, hold for gate and at end of flight. Data supports analysis of fuel usage and identification of fuel saving opportunities
- APU start/shutdown events
- Refueling information, including fuel quantity before and after refueling, billing information and checks to ensure that adequate fuel has been loaded

PROVIDE THE FLIGHT CREW WITH THE RIGHT INFORMATION AT THE RIGHT TIME

- In-range reports, request for ground services, uplink gate assignments, uplink connecting gate information for passengers
- Remind crew to perform needed actions, including sending a ground request if not already sent
- Send Advisory Uplinks to the aircraft to notify the flight crew of an urgent message/task. The MCDU pages can be tailored to provide the flight crew with prompted response choices (Accept/Reject/Respond)

FLIGHT TRACKING TO MEET ICAO GADSS RECOMMENDATIONS FOR INITIAL PHASE

The ATSU AOC will monitor aircraft movement and operational parameters to determine an urgent or emergency situation, then automatically send aircraft position reports with 1-minute intervals with the relevant aircraft information to the airline operations center. The airline can then initiate secondary actions and respond to the situation. Criteria used to detect abnormal events are tailorable and can include:

- Altitude outside a safe range
- Ground/Air Speed outside a safe range
- Fuel on Board too low
- Vertical Speed for descent or climb is not safe
- Go around
- Loss of cabin pressure
- Engine power is too low

2. ATSU AOC -513 SOFTWARE OVERVIEW

Honeywell first introduced the ATSU AOC in 1999 and has made several software updates since. The most recent software version, designated "-513 software" and released in 2018, includes AOC Enhancements specifically requested by Honeywell airline customers. The AOC Enhancements enable operational cost savings, increase the tailorability of ACARS/AOC messages, and enable commonization of AOC functionality across CMU MKII+ and ATSU platforms for airlines with mixed Boeing and Airbus fleets.

AOC ENHANCEMENTS INTRODUCED IN ATSU AOC -513 SOFTWARE	
Added access to 1,000 new AOC parameters	Enables operating cost savings through intelligent use of aircraft data
Added ACARS Over IP support per Airbus Std 9 *	Enables non-safety messages to be sent over an Internet Protocol link
Added complex logic units, triggered actions, and enhanced parameter use	Enables if/then and event-based reporting, equalizes ATSU logic capability with CMU MKII+, copy right to left, multiply and divide, nested if/then functions, increased selection lists, increased print/display formats, increased table sizes
Added key-based complex logic	Enables MCDU keys to initiate nested and compound logic functions
Added option for multiplication and division	Increases math functions beyond addition and subtraction
Added routing preferences for peripheral avionics and AOC messages	Able to define routing preferences for all messages (except ATC/FANS). For example: specify HF or Satcom preferred. Enables retrofit with equipment on HF or SATCOM ports that uses IP for routing
Added bell character audio chime	Enables additional method to notify pilot of uplink message
Added option for pilot to confirm message deletion	Provides sanity check before deleting messages
Added OOOI support for A321-ACF passenger loading doors	Automatically detects passenger door configuration on Cabin Flex aircraft. Correct set of doors is used in the Out-Off-On-In logic
Added RESPOND action for uplinked reports	When received message is displayed, it can be defined to include a RESPOND prompt. The RESPOND key is defined to display any database defined page

HISTORICAL ATSU AOC SOFTWARE RELEASES			
	998-2459-505 (2001)	**998-2459-512 (2010)**	**998-2459-513 (2018)**
Configurable with AOC Database	X	X	X
Meteorological Weather Reporting – Version 2	X	X	X
Active Advisories		X	X
Conditional Logic (IF, ELSEIF, ELSE) for Line Select Keys		X	X
Logic Units with Complex and Compound Statements			X
Routing Policy for LRUs Defined in AOC Database		X	X
AOIP, HF, and SATCOM Preferred Routing Policies			X

3. ATSU AOC -513 SOFTWARE USE CASES AND EXAMPLES

ATSU AOC -513 software enables a much greater level of customization than previous ATSU AOC software versions. The customization capability for the ATSU AOC is now equivalent to that of the CMU MKII+ used on the Boeing 737 and other aircraft, which enables fleet commonization for airlines with both Airbus and Boeing aircraft. The structure of the AOC database is now very similar, including the number of parameters, table sizes and database logic functions. It is possible to convert CMU MKII+ databases into ATSU AOC v25.0 databases and vice versa. This enables airlines to easily maintain AOC Applications that are similar in functionality and their crew interface for both Airbus and Boeing aircraft.

3.1 INCREASED AOC DATABASE CAPACITY FOR RECONFIGURATION – ADDED 1000 PARAMETERS

ATSU AOC -513 software enables use of 1,000 new AOC parameters to relieve database size constraints for airlines with large, complex AOC databases. In addition, many AOC Database tables have been increased to enable definition of more downlinks, uplinks, screens and actions (logic). The new parameters and table entries can enable operational cost savings, by monitoring and collecting data, so it can be reported when certain conditions are met, or saved and sent in one summary message.

Parameters can be used to gather performance data and fuel usage. Additional usage examples include:

- Parameters can be used to capture APU start/shutdown events, engine start and stop times, detect when taxi is done using a single engine, store fuel-on-board at different flight phases, store fuel burned for different flight stages and collect refueling data. This information can be used by fuel efficiency systems (or other ground-based analytics) that help airlines achieve fuel cost savings.
- Parameters can be used to collect data to help identify opportunities for improvements to shorten turnaround times. For example, upon takeoff, store passenger door close time, cargo door close times, time until push-back, time during return to gate, time until start of taxi, time during taxi, time until take-off, when engines are running and delay information (time and reason). Upon landing, collect landing, taxi, parking brake, time airplane stops moving, engine shut down, time until passenger door opens and cargo door opening.
- Parameters can be used to collect snapshots of the aircraft and flight crew performance. For example, during takeoff rolling out and when ground speed is >80knots, report the Engine N2 power, or during approaching, report roll angle at multiple desired altitudes and CAS. The data can be stored for the flight crew to review immediately after landing or the data can be added to the AOC landing report.

3.2 ATSU AOC MESSAGES SENT OVER AOIP

ATSU AOC -513 software enables aircraft equipped with the Airbus FOMAX ACARS Over Internet Protocol (AoIP) capability to send ATSU AOC messages over the low-cost FOMAX AoIP system. The lower cost AoIP link can be used for larger messages, such as engine and maintenance reports that support ground-based analytics. In addition, selected ATSU AOC messages may also be designated to be sent over AoIP.

Contact your Airbus Customer Engineering Representative for details about FOMAX availability on SA/LR aircraft.

3.3 ATSU AOC DATABASE LOGIC UNITS AND TRIGGERED ACTIONS

ATSU AOC -513 software introduces logic units and triggered actions. Prior to -513, logic such as IF, ELSEIF, ELSE and triggered actions can be performed when an MCDU Line Select Key is pressed. For example, when a SEND prompt is pressed, a simple test of a condition can be done before actions are taken:

IF airplane is IN at the gate
  downlink the Post Flight Summary
ELSE
  display a message in the scratchpad "NOT ALLOWED UNTIL IN".
ENDIF

With -513, now it is possible to define compound and nested logic that will be performed when an MCDU Line Select Key is pressed (referred to as LSK Actions), when a predefined event occurs (Triggered Actions), and/or once per second (Logic Units).

The simple logic above can be extended to check for the IN state when Post Flight Summary SEND key is pressed. If not IN yet, set a flag, so when the airplane goes IN, the Post Flight Summary will be automatically sent. Example logic for SEND LSK:

IF airplane is IN at the gate
  downlink the Post Flight Summary
ELSE
  Copy '1' to the Send Post Flt flag
ENDIF
Triggered action assigned to IN trigger:
  IF Send Post Flt Flag = "1"
  downlink the Post Flight Summary
  Copy '0' to the Send Post Flt flag
ENDIF

Another example of logic unit use for the ON flight phase is provided here. After touchdown, detect when the airplane stops moving before the first door opens:

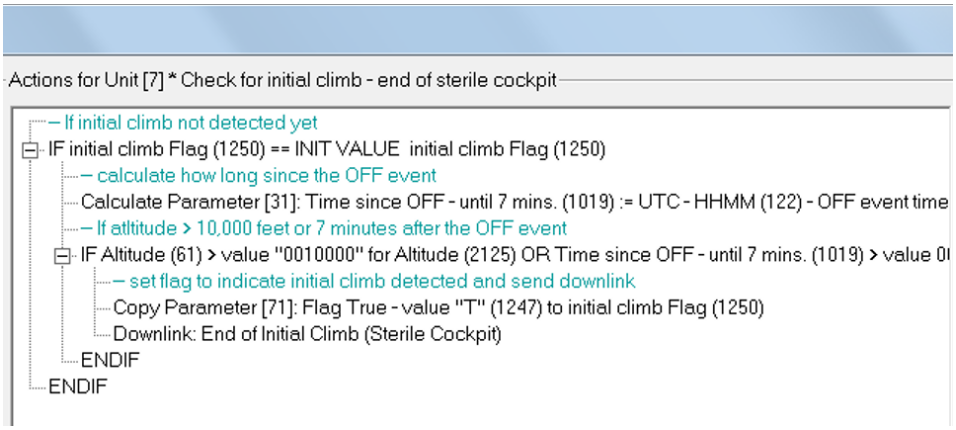
IF OOOI state is ON and ground speed is < 3 knots
  Save ground speed value and UTC every 10 seconds (expands to more logic)
  Compare the current ground speed to the values saved 10, 20 and 30 seconds earlier (expands to more logic)
  IF ground speed has changed less than .20 knots for the last 30 seconds
    Copy the UTC from 30 seconds ago to the parameter used to store the time the airplane stopped moving
ENDIF

Another example of logic unit use for Abnormal Position Reporting purposes is provided here. In this example, we want to detect if the aircraft altitude drops below 10,000 feet during the cruise phase (10 minutes after takeoff and 15 minutes before landing) and then kick off Abnormal Aircraft Position Reports with 1 minute intervals (per the ICAO GADSS recommendations).

Use a logic unit that will execute once per second.

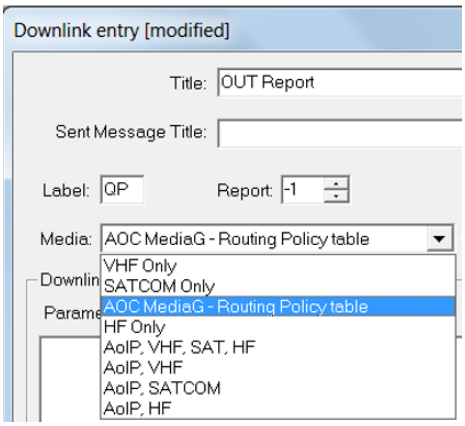
IF OOOI state is OFF
  Calculate time since OFF = Current UTC – OFF time
  Calculate time to destination = ETA – Current UTC
  IF time since OFF > 10 minutes AND time to destination > 15 minutes
    IF altitude < 10,000
      Copy 1 minute to position report interval
      Send position report and restart interval
    ENDIF
  ENDIF
ENDIF

This logic defined in the ATSU AOC database can be documented with comments to improve maintainability. See below for an example.

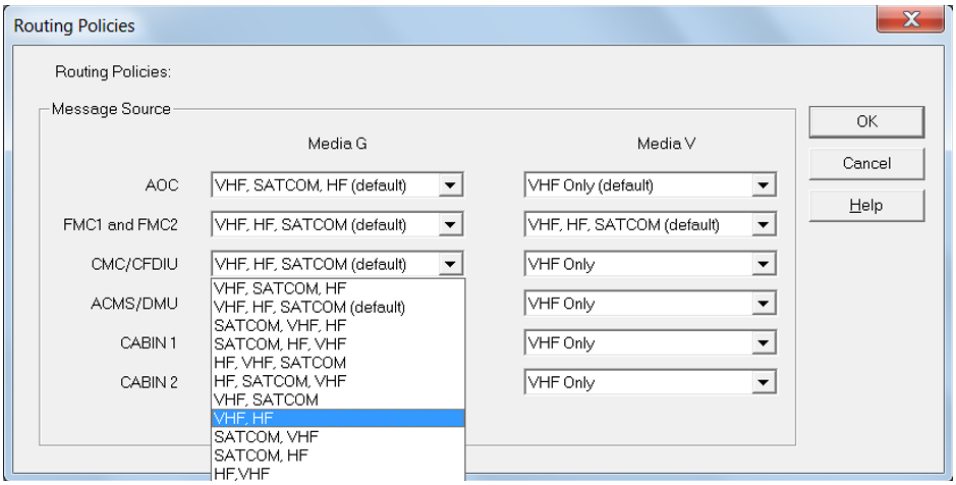


3.4 ATSU AOC MEDIA SELECTION AND ROUTING PREFERENCES

ATSU AOC -513 software enables the definition of Message Routing Preferences that allow airlines to send ACARS messages over the lowest cost link. There are two places in the ATSU AOC database where it is possible to select the media and routing preferences for AOC messages. Each AOC message defined in the AOC Database may be assigned the media that will be used. The choices include VHF only, SATCOM only, HF only, or Media 'G'. The default policy for 'G' is defined as VHF preferred. This is also where AoIP may be selected as the preferred media and will be used when the airplane is equipped with FOMAX.

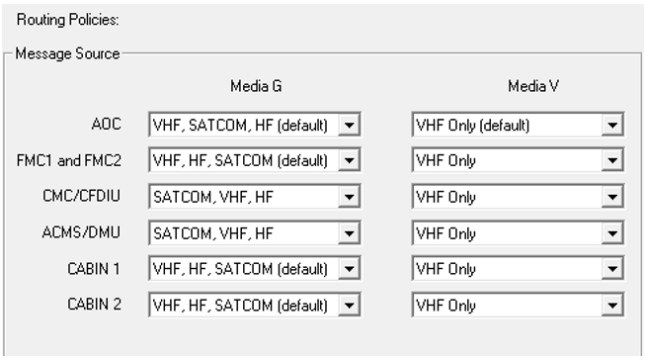


The routing policy for Media 'G' and VHF only (Media 'V') may be further customized in the Routing Policy Table of the database. This table allows the ATSU AOC database to specify the preferred routing media for internal ATSU AOC messages and for peripheral AOC messages generated by end-systems connected to the ATSU—including FMS, CFDIU, ACMS/DMU, and Cabin Terminals.

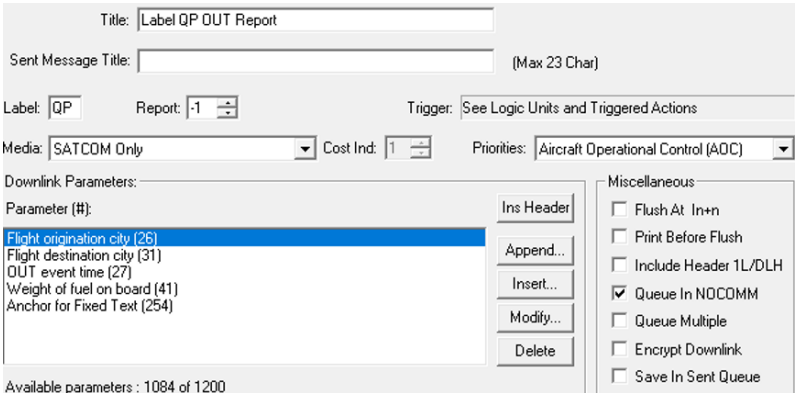


The use of this feature, when coupled with ACARS data link services through Chinese telecommunications company Avitech, has allowed Airlines in China to reduce their airline data costs for ACARS traffic by up to 90%. Chinese airlines pay Aviation Data Communication Corporation (ADCC) for ACARS traffic. A new China Telecom, called Avitech, now provides data link service via Iridium SATCOM and offers a competitive price for traditional ACARS traffic that can be 90% less costly than ADCC.

The downlink media preference can be set as Iridium preferred, while still allowing the ATSU to send downlinks via VHF or HF, when Iridium is in "No Communication" status. The routing preferences set in the ATSU AOC Database make the Media G field for the individual peripheral end-systems set to SATCOM Preferred. This will cause the Iridium SATCOM to be used as the primary choice. The setting shown below is done for CMC and ACMS messages.



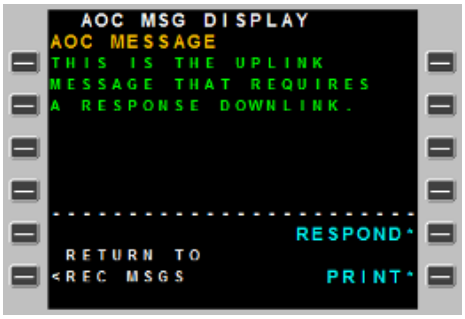
For ATSU AOC messages, it is necessary to keep the default routing policy for Media G as "VHF, SATCOM, HF". This is necessary to ensure that ARINC 623 messages (D-ATIS, OCX, and DCL) are sent via VHF. The A623 messages are defined to use the Media G media. For Chinese airlines that want the database defined ATSU AOC (non-safety) messages to be sent using the Iridium SATCOM, the Media field should be specified as SATCOM Only, so the Iridium SATCOM will be used to send the non-safety AOC Message.

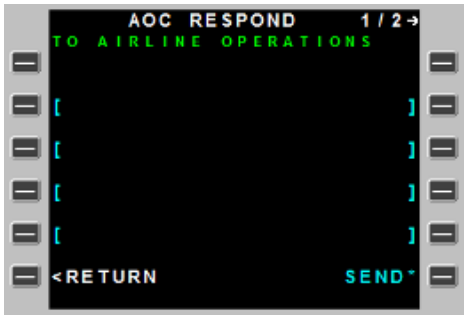


3.5 ACCESS TO RESPOND SCREENS FROM THE RECEIVED MESSAGE DISPLAY PAGE

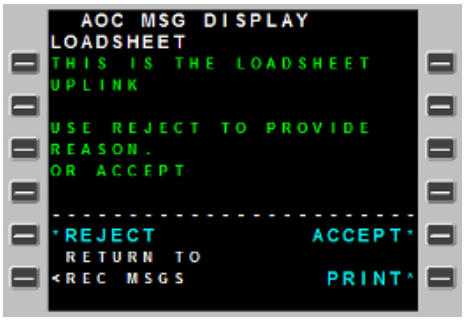
The -513 ATSU AOC adds the ability to define an uplinked Report so the flight crew can easily view and respond. A prompt can be defined to display any database-defined screen. The screen can be defined so the crew can enter data before sending a response to the uplink. This is useful for responding to free-text uplinks with a free-text downlink or for entering a reason for rejection. This simplifies the Crew Interface.

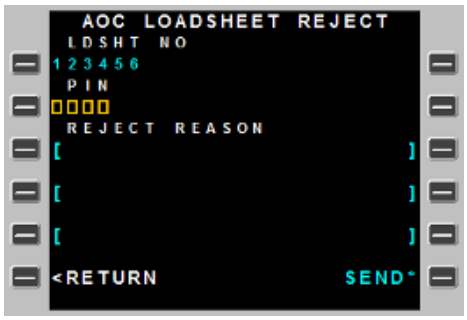
For example, when RESPOND is pressed, the AOC RESPOND page is displayed on the MCDU. Refer to below MCDU screen examples.





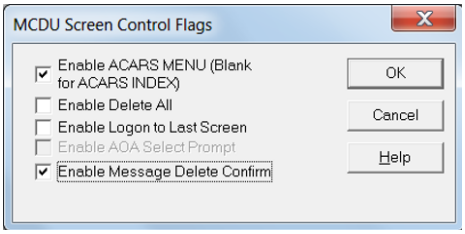
In this next example, the REJECT key will cause a screen to be displayed where the reason for rejection can be entered. The ACCEPT key can be defined to display a different screen, or to simply send the ACCEPT message.



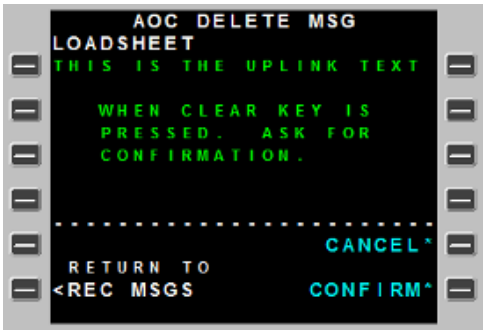


3.6 OPTION TO REQUIRE CONFIRMATION BEFORE DELETING UPLINKED MESSAGES

When the Enable Message Delete Confirm option is selected in ATSU AOC -513 software, it protects the crew from mistakenly deleting messages from the Received Messages list. This improves the flight crew interface.



When the Clear Key is pressed and then the key next to the message is pressed, the AOC DELETE MSG screen presents the choice to Cancel or Confirm the deletion. The CONFIRM key must be pressed before the message will be deleted.



4. ATSU AOC SOFTWARE AVAILABILITY AND ORDERING INFORMATION

ATSU AOC -513 software replaces all previous software versions. The software is additive—all functionality remains from previous versions. ATSU AOC -513 software has been tested and approved by Airbus and is available for retrofit and forward-fit applications today.

STSU AOC SOFTWARE		
Orderable Part Number	**Description**	**Service Information Letter**
998-2459-513	ATSU AOC -513 Software, Electronic Download – files for loading using A615-3 or A615-A Data Loading	D201810000039
69002375-513	ATSU AOC -513 Software, Electronic Download – files for loading using A665 Data Loading	D201810000039
SWM998-2459-513	ATSU AOC -513 Software, Floppy Diskette Installation Media – A615	D201810000039
SWM69002375-513	ATSU AOC -513 Software, CD-ROM Installation Media – A665	D201810000039

Electronic software download can be made available from https://ads.honeywell.com. Contact your Honeywell Sales Manager for electronic download ordering details and support.

ATSU AOC software can be installed on the ATSU using the ARINC 615-3 or ARINC 615-A method (when ordering specify part number 998-2459-513) or using the ARINC 665 method (when ordering specify part number 69002375-513). Software loading instructions are contained within the Service Information Letter.

5. DATALINK SERVICES

The Honeywell Datalink Services team is a core group of experts that collaborate directly with Honeywell customers to tailor ATSU AOC capabilities to your specific operational requirements. The Datalink Services team can take the complexity out of ACARS customization by listening to your operational needs, developing a custom AOC database suited to your specifications and finally simulating and testing the database functionality before the AOC database is deployed to your fleet. This is often a less-costly and more-conclusive test methodology than removing aircraft from revenue flights to verify new AOC database functionality. AOC database customization is accomplished using Honeywell proprietary ground-based support tools including the ACARS Reconfiguration Tool (ART®) and Airsim®. For further database customization support please contact DatalinkServices@Honeywell.com.

More information about Honeywell's ATSU AOC capabilities can be found online at:
aerospace.honeywell.com/en/learn/products/cockpit-systems-and-displays/atsu-airline-operational-communication

Further ATSU AOC -513 software ordering information is available from your Honeywell Sales Manager and at:
myaerospace.honeywell.com

For 24/7 technical support for all your Honeywell Aerospace products contact:
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THE FUTURE IS WHAT WE MAKE IT

Honeywell