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WORKING PAPER

INTERNATIONAL CIVIL AVIATION ORGANIZATION

AERONAUTICAL MOBILE-SATELLITE SERVICE (AMSS) PANEL

Second meeting

Montreal, 28 March to 7 April 1989

Agenda Item 4: Development of SARPs and guidance material for AMSS

ATS MESSAGES CODING

INFORMATION PAPER*

(Presented by E. Esteban and prepared by D. Diez, Spain)

1. Introduction

Nowdays ATC transactions between ATC units and aircraft require that air traffic controllers: 1) perform voice communications to or from aircraft; and 2) manually update in accordance to those communications the flight plan data for the automated system.

In order to improve the efficiency of the controller and therefore the capacity of the ATC system, it is reqired to eliminate unnecessary work.

Upgrading the ATC system to permit the flight plan data updates mentioned in 2) above to be transmitted automatically to the aircraft concerned, will significally reduce controller/aircraft voice communications. Also it will be advantageous to permit pilots to directly interrogate MET, AIS, and flight plan data-bases. The introduction of expert systems capable of "making decisions", will progressively release controller from routine tasks, and allow him to be dedicated to specific problems.

In order to accomplish the above it is necessary to exchange ATS messages through a data link.

(6 pages)

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*Presented in the available languages--English and Spanish
Please note that the English is an unofficial translation.

2. Data link limitations

Both Mode S and satellite data links have some limitations that could importantly affect the capacity to exchange ATS messages in areas of high traffic density.

2.1. Mode S data link limitations

Mode S data link using a mechanically rotated antenna, eventhough it has a high data transfer rate, is restricted by the surveillance function performmed by its associated SSR. These restrictions are:

i) it has a very limited time per antenna revolution to transfer data since the mode of access is sequential and it does not permit variable dwell-time on chosen targets;

ii) it can not be used efficiently due to the fact that the SSR has to scan areas where sometimes there is no traffic nor ATS messages to exchange;

iii) priorities can not be handled properly due to the fact that the data link can not be pointed in any direction at will and stay at that point until a data transfer has been completed.

2.2. Satellite data link limitations

Satellite data link does not have the limitations of the conventional Mode S data link, but has a set of limitations of its own. As a consecuence of its wide beam and reduced frequency band available, if spot beam techniques or high transmition rate is not used, it can have significant capacity disadvantages.

3. Coding of messages

The number of transactions that can be done per time unit through a data link is conditioned both by the transmission rate of the link itself and by the length of messages related to them.

Fortunatly most of ATS transactions between ATC units and aircraft are performed by means of a very small number of messages. These ATS messages can be reduced in length by adopting a coding scheme which will shorten the time needed for its transmission, resolving or at least reducing the limitations described in paragraph 2 above.

The number of coded messages, which would not exceed 256, could be encoded in just one byte(8 bits). These codes could be used without reference to a given language, and would have its equivalence in each of the languages avaliable to the user. For this purpose, the corresponding code-phrase dictionaries should be developed- one for each language.

Selection of language could be done at each end of the data link, avoiding the need of having to use a language not well-known to the user. For example, a controller at Madrid ACC, when pressing a function key would generate a code of 8 bits which should be inmediatly decoded and displayed to him in the spanish language, and once transmited and received at the aircraft, this same code would be decoded and displayed to the pilot in the language selected by the latter, for example the english language.

The use of plain language will continue to be necessary to meet specific situations when code-phrase dictionaries can not be used.

Attachment 1 contains one example of a possible code-phrase english dictionary including some of the most common messages used in ATC, attachment 2 the spanish dictionary, and attachment 3 describes some practical examples of their use.

4. Conclusions

The coding of ATS messages:

i) could importantly increase data link capacity;

ii) could reduce time needed for a transaction;

iii) could avoid ambiguities;

iv) could reduce problems of language understanding;

v) should be common for both satellite based and Mode S data links.

5. Action required

This Panel is invited to discuss this WP, to accept its conclusions and to agree to a course of action for the development of SARPs establishing an ATS message coding method and code-phrase dictionaries,in co-ordination with other ICAO bodies, like SICASP, which are involved in data link matters.

ATTACHMENT 1

ATS MESSAGES CODING USING ONE BYTE

(english dictionary)

CODE	MESSAGE
Bit	
87654321	(X..is used for variables like time, level, fix,..)
00000000	CLIMB TO AND MAINTAIN FLIGHT LEVEL XXX
00000001	DESCEND TO AND MAINTAIN FLIGHT LEVEL XXX
00000010	REQUEST FLIGHT LEVEL XXX
00000011	REQUEST DESCENT CLEARANCE
00000100	HOLD OVER XXXX AT FLIGHT LEVEL XXX
00000101	EXPECT ONWARD CLEARANCE AT XXXX
00000110	REPORT LEAVING FLIGHT LEVEL XXX
00000111	REPORT REACHING FLIGHT LEVEL XXX
00001000	WE ARE NOW LEAVING FLIGHT LEVEL XXX
00001001	WE ARE NOW REACHING FLIGHT LEVEL XXX
00001010	WE ARE CRUISING AT FLIGHT LEVEL XXX
00001011	MAINTAIN FLIGHT LEVEL XXX
00001100	CONTACT XXXXX
00001101	CONTACT XXXX APPROACH CONTROL ON XXXXX
00001110	CHANGING OVER TO XXXXX
00001111	REPORT OVER XXXX
00010000	WE ARE OVER XXXX AT TIME XXXX ESTIMATING XXXX AT XXXX
00010001	CLEARED FOR ILS APPROACH RUNWAY XX
00010010	CLEARED TO LAND
00010011	TURN RIGTH HEADING XXX
00010100	TURN LEFT HEADING XXX
00010101	READY TO TAXI
00010110	TAXI TO RUNWAY XX
00010111	ROUTE CLEARANCE
00011000	GO AHEAD
00011001	CLEARED TO XXXX AIRPORT VIA FLIGHT PLAN ROUTE. MAINTAIN FLIGHT LEVEL XXX
00011011	CLEARANCE IS CORRECT
00011100	STAND SHORT OF RUNWAY
00011101	CLEARED FOR TAKE-OFF
00011110	MAINTAIN RUNWAY HEADING AFTER TAKE OFF
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ATTACHMENT 2

ATS MESSAGES CODING USING ONE BYTE

(spanish dictionary)

CODE	MESSAGE
Bit	
87654321	(X..is used for variables like time, level, fix,..)
00000000	ASCIENDA Y MANTENGA NIVEL DE VUELO XXX
00000001	DESCIENDA Y MANTENGA NIVEL DE VUELO XXX
00000010	SOLICITA NIVEL DE VUELO XXX
00000011	SOLICITA AUTORIZACION DESCENSO
00000100	ESPERE SOBRE XXXX A NIVEL DE VUELO XXX
00000101	ESPERE AUTORIZACION PARA ABANDONAR A LAS XXXX
00000110	NOTIFIQUE ABANDONANDO NIVEL DE VUELO XXX
00000111	NOTIFIQUE ALCANZANDO NIVEL DE VUELO XXX
00001000	ABANDONAMOS AHORA NIVEL DE VUELO XXX
00001001	ALCANZAMOS AHORA NIVEL DE VUELO XXX
00001010	MANTENEMOS NIVEL DE VUELO XXX
00001011	MANTENGA NIVEL DE VUELO XXX
00001100	COMUNIQUE XXXXX
00001101	COMUNIQUE XXXX CONTROL DE APROXIMACION EN XXXXX
00001110	CAMBIANDO A XXXXX
00001111	NOTIFIQUE SOBRE XXXX
00010000	ESTAMOS SOBRE XXXX HORA XXXX ESTIMANDO XXXX
	A LAS XXXX
00010001	AUTORIZADO A APROXIMACION ILS PISTA XX
00010010	AUTORIZADO A ATERRIZAR
00010011	VIRE A LA DERECHA A RUMBO XXX
00010100	VIRE A LA IZQUIERDA A RUMBO XXX
00010101	LISTO PARA RODAR
00010110	RUEDE A LA PISTA XX
00010111	AUTORIZACION DE RUTA
00011000	ADELANTE
00011001	AUTORIZADO A XXXX AEROPUERTO VIA RUTA PLAN
	DE VUELO. MANTENGA NIVEL DE VUELO XXX
00011011	AUTORIZACION CORRECTA
00011100	MANTENGASE PROXIMO A LA PISTA
00011101	AUTORIZADO A DESPEGAR
00011110	MANTENGA RUMBO DE PISTA DESPUES DEL DESPEGUE
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ATTACHMENT 3

PRACTICAL EXAMPLES

example 1

plain message:
CLIMB TO AND MAINTAIN FLIGHT LEVEL 310
length= 38 bytes

coded message: $310
length= 4 bytes
being $= 00000000 in binary

example 2

plain message:
HOLD OVER CJN AT FLIGHT LEVEL 290
length= 33 bytes

coded message: $ CJN290
length= 8 bytes
being $=00000100 in binary

example 3

plain message:
CLEARED FOR ILS APPROACH RUNWAY 33
length= 34 bytes

coded message: $33
length= 3 bytes
being $=00010001 in binary

example 4

plain message:
CLEARED TO LAND
length= 15 bytes

coded message: $
length= 1 byte
being $=00010010 in binary.

- END -