

International Civil Aviation Organization

WORKING PAPER

## SATELLITE DISTRIBUTION SYSTEM OPERATIONS GROUP (SADISOPSG)

## THIRTEENTH MEETING

Dakar, Senegal, 27 to 29 May 2008

#### Agenda Item 9: Any other business

## FUTURE SADIS SATELLITE BANDWIDTH REQUIREMENTS

(Presented by the SADIS Provider State)

## SUMMARY

This working paper outlines the existing arrangements for SADIS satellite bandwidth, and makes recommendations for the future requirement, based on operational needs, for years 2009 and beyond.

#### 1. **INTRODUCTION**

1.1 In accordance with SADISOPSG Conclusion 9/15, the SADIS 1G satellite broadcast will continue until 31 December 2008.

1.2 The details presented below outline the existing arrangements for SADIS satellite bandwidth, and makes recommendations for the future requirement, based operational needs, for years 2009 and beyond.

## 2. **DISCUSSION**

2.1 At the present time, the SADIS Provider State leases 1.5 MHz of satellite bandwidth on the Intelsat 904, of which 57% is dedicated to support the SADIS 1G and SADIS 2G satellite services (33% attributable to SADIS 1G and 24% attributable to SADIS 2G). The annual cost for utilising 57% of the total space segment in 2008 was £83,610 (£48,406 attributable to SADIS 1G and £35,204 attributable to SADIS 2G). A minimum data rate of 38.4 Kbps, up to a maximum of 64.0 Kbps, applies to both services.

2.2 At the end of this year, the SADIS 1G service is expected to come to an end. Opportunities and limitations exist following cessation of the SADIS 1G broadcast. The SADISOPSG, based on information provided by the SADIS Provider State and input from the SADISOPSG Technical

Development Team, will need to determine whether to relinquish or maintain the portion of satellite bandwidth currently occupied by SADIS 1G. This working paper is aimed at fulfilling much of this guidance.

#### 3. FUTURE WAFS PROVISION ON THE SADIS SATELLITE BROADCAST

3.1 The group may be aware of discussions within the World Area Forecast System Operations Group (WAFSOPSG) related to the development and future implementation of GRIB 2-coded WAFS forecasts. These forecasts are expected to replace the existing GRIB 1 code form WAFS forecasts in future years – and will include the existing upper-air forecasts for wind, temperature, humidity, as well as new automated SIGWX forecasts for icing, turbulence and cumulonimbus (CB) clouds.

3.2 The recent WAFSOPSG/4 meeting (February 2008) endorsed a detailed implementation plan for the transition from the GRIB 1 to the GRIB 2 code form within the WAFS. This plan included details of the development timescales proposed by the WAFC Provider States, and the introduction of GRIB 2 products into the operational environment. It was agreed that GRIB 2 forecasts (encompassing wind, temperature and humidity, as well as icing, turbulence and CB fields) should *only* be made available on the SADIS FTP server when available from the WAFCs (circa September 2009). It is possible, however, that the WAFSOPSG/5 meeting (September 2009) may endorse the dissemination of the GRIB 2 products over the satellite services *before the end of 2009*.

3.3 GRIB 2 WAFS datasets will be considerably larger that the GRIB 1 WAFS datasets they are designed to replace. Not only will the GRIB 2 data encompass the traditional wind, temperature and humidity data, but icing, turbulence and CB cloud fields will also be included. Furthermore, temporal and spatial resolutions changes mean that the GRIB 2 data will be of a higher resolution compared to preexisting GRIB 1 products. In fact, estimates suggest that the higher resolution grids will contain over 3 times as much data as the current products.

3.4 In terms of how this translates into GRIB data volumes, the WAFC Provider States have estimated that GRIB 2 WAFS data will be of the order 50-60 Mb *before* compression per model run. This compares with approximately 10 Mb data volume per run for the existing GRIB 1 products (excluding icing, turbulence and CB forecasts which are not disseminated on the satellite broadcasts). GRIB 2 does allow for data compression, through the use of an industry standard compression algorithm such as JPEG2000 – which could realise 2:1 compression for a WAFS grid. Therefore, GRIB 2 WAFS data sets, *after* compression, may be of the order 20-30 Mb.

3.5 To afford WAFS workstation vendors and flight planning companies adequate time to develop GRIB 2 decompression and decoding routines, as well as flight planning and visualisation suites, and for these changes to be rolled-out to WAFS users, the WAFSOPSG has endorsed a parallel running period of GRIB 1 and GRIB 2 forecasts. It is probable that provided the WAFC Provider States develop GRIB 2 WAFS data by the end of 2009, the GRIB 1 forecasts will continue until at least 2013. This will allow workstation providers and end-users at least 3 years of parallel GRIB 1 and GRIB 2 operation, to upgrade systems, before GRIB 1 is terminated.

3.6 At the present time, it takes approximately 20 to 30 minutes to disseminate an entire GRIB 1 WAFS data set (2352 bulletins totalling 10mb) across the SADIS 2G satellite broadcast. In future, with no changes to the configuration of SADIS 2G (i.e. bandwidth, data rate and transponder power remain the same), it is possible that a *compressed* GRIB 2 WAFS data set may take approximately

60 to 90 minutes to disseminate in its entirety. Such timescales will only be confirmed by way of a GRIB 2 data dissemination trial. However, should they be confirmed, these timescales may be unacceptable to the user community, and the SADIS 2G system may require modification to reduce the transmission times – such as an increase to the data transfer rate.

#### 4. FEASIBILITY OF RELINQUISHING OR MAINTAINING THE EXISTING SADIS SATELLITE BANDWIDTH

4.1 As outlined in 2.1 above, the SADIS Provider State currently leases 1.5 MHz of satellite bandwidth, of which 57% is used to support the SADIS 1G and SADIS 2G services (33% for SADIS 1G and 24% for SADIS 2G). There are a number of issues that require thorough deliberation if the group were considering relinquishing the satellite bandwidth portion allocated to SADIS 1G.

4.2 At the present time, SADIS 2G occupies the *upper end* of the allotted frequency range – uplink frequency for SADIS 2G is 6303.25 MHz, with the overall leased bandwidth between 6302.00 and 6303.50 MHz. SADIS 1G however, resides beneath SADIS 2G on the frequency range – uplink frequency at 6303.05 MHz.



4.3 The 1.5 MHz allocation is in one continuous block, and leased in segments of 0.1 MHz. Whilst carriers can be re-arranged within the total allocation, this would necessitate reconfiguration of all hub and end-user systems, and is *to be avoided where at all possible*.

4.4 Nevertheless, cessation of SADIS 1G at the end of 2008 could ultimately be to the benefit of the SADIS 2G system. Utilisation of the newly available bandwidth (previously supporting SADIS 1G) could *future-proof* SADIS 2G – i.e. the bandwidth allocation for SADIS 2G could, in future, be widened, with transponder power and data transfer rates increased. The SADIS Provider State believes that, given the scope and timescale of product developments taking place with in the WAFS (notably GRIB 2 and the discussions outlined in paragraph 3 above relating to potential data volumes and transfer times), it would be highly desirable, if not imperative, to maintain the pre-existing SADIS satellite bandwidth allocation even after the SADIS 1G service has been withdrawn.

4.5 By relinquishing the SADIS 1G allocation on 1 January 2009, the group would severely hamper any opportunity to regain that bandwidth for alternative future use – such as future WAFS products on the SADIS 2G broadcast.

4.6 Cable and Wireless, who lease satellite space segments on Intelsat 904 in support of SADIS and other services, has clearly stated to the Met Office that "current global satellite capacity is in short supply, and that if the SADIS 1G segment were to be relinquished back to Intelsat, they are likely to find another customer for it quite quickly, and it would be impossible to recover that bandwidth at later date if required."

4.7 If the SADIS 2G bandwidth were to eventually consume all or part of the SADIS 1G bandwidth, hardware configuration change would be necessary on end-user system – since users would need to access an alternative broadcast frequency, possibly close to the present allocation. However, it is important to realise that if the SADIS 1G bandwidth allocation was relinquished, users would *still require a hardware reconfiguration* at some stage in the future to accommodate any changes to the SADIS 2G service – i.e. data rates etc.

#### 5. CONCLUSIONS

5.1 Given the above discussion, it is important for the group to realise that by relinquishing the SADIS 1G satellite bandwidth allocation back to the satellite provider on 1 January 2009, they may severely hamper the future development and capabilities of the SADIS 2G service – particularly given the potential within the WAFS to request GRIB 2 code form forecasts on the SADIS satellite broadcast after WAFSOPSG/5 (September 2009), with a parallel running period alongside GRIB 1 of at least 3 years.

5.2 The group is invited to formulate the following draft decision and draft conclusion:

# Decision 13/.. — Future SADIS satellite bandwidth requirements

That, in view of future operational needs, the SADIS Provider State is invited to maintain the existing SADIS satellite bandwidth allocation into years 2009 and 2010.

*Note.* — *The bandwidth occupied by the SADIS 1G service is to be maintained after 31 December 2008.* 

# Conclusion 13/.. — Future utilisation of the SADIS satellite bandwidth

That, the SADIS Provider State, in co-ordination with the SADISOPSG Technical Development Team, be invited to:

- a) review SADIS satellite bandwidth allocation in respect of future WAFS provision (such as dissemination of GRIB 2coded WAFS forecasts); and
- b) report back the findings thereof to the SADISOPSG/15 meeting (2010).

Note 1.— It may not be possible to commence this work until after September 2009, in view of discussions at WAFSOPSG/5.

Note 2.— The report should assess the need to propose changes to the existing SADIS 2G hardware configuration.

## 6. **ACTION BY THE SADISOPSG**

- 6.1 The group is invited to:
  - a) note the information in this paper; and
  - b) decide on the draft decision and draft conclusion proposed for the group's consideration.

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