Investigation Report on Flight Data Processor (FDP) Switchover and Momentary Flight Plan Dis-association on 29 November 2016

1. Observation

1.1 The Air Traffic Management System (ATMS) has commenced full operations since 14 November 2016 and Air Traffic Control (ATC) operation has been smooth in general. CAD reported an observation of FDP switchover from primary server to secondary server and momentary deferring and restoration of flight plan associations for aircraft targets on 29 November 2016 while running in Main System. Details of the abnormalities are given in the ensuing paragraphs. Given the undesirable impact on ATC operations, Raytheon's urgent investigation, by Raytheon's support on-site and factory personnel on the observation was engaged and relevant system logs and recorded data were immediately sent to Raytheon factory at Marlborough, USA.

1.2 Description of Occurrence

Date/Time: 29 November 2016/13:15 (Local Time)

Description: At 13:15, automatic switchover of FDP from the primary to the secondary server was indicated on the Control and Monitoring Display (CMD) due to activation of the auto-protection mechanism of the primary FDP server. External links with interfacing systems were not affected during the switchover. At 13:20, per standing procedures, the offline FDP server was manually restarted to restore fully hot-standby of server. During the restoration process, at 13:25, the screen refreshed with momentary flight plan dis-association for currently associated targets at all logged-on workstations. Display of information was affected for about 26 seconds.

2. Detailed Investigation and Findings

2.1 Raytheon was requested to promptly investigate into occurrence. There were two parts that were relevant to the occurrence:-

Part 1 – Switchover of FDP Server

Cause of the issue – after detailed analysis of the system log and fault signature, it was confirmed that switchover of the FDP server was triggered by an on-going Interactive Playback session. In serving the Interactive Playback session, the primary FDP had encountered a file access anomaly during the process of determining the availability of the network file system that maintains the automatically archived playback data. With the anomaly detected in the primary FDP and its associated data transferring modules, the system then activated an auto-protection mechanism to initiate an auto-switchover of FDP server to the secondary FDP while putting primary FDP offline, as per design. During the switchover, all the radar and flight information was displayed at all workstations in a continuous and seamless manner.

Part 2 – Momentary FPL Dis-association

Cause of the issue - the automatic FDP server switchover initiated and completed successfully. The offline FDP was then restored manually per procedures. Towards the end of the restoration process, auto flight information synchronization between the FDP servers took place at a high priority to ensure both the primary FDP and secondary FDP could be paired up to make ready hot-standby operation. During such time, the FDP processed traffic in parallel with a temporary data transfer for server-server synchronization and providing FPL association. The data synchronization process took priority over the FPL association process, resulting in the momentary FPL dis-association.

2.2 There had been no loss or corruption of flight plan data during the occurrence. The Surveillance Data Processor (SDP) and all other functions were also functioning normally.

Moreover, the Fallback system and the Ultimate Fallback System (UFS) were operating normally and available for selection at all times.

3. Permanent Fix being implemented and Available Workarounds

3.1 Part 1 - Switchover of FDP Server

Fix – the proposed mechanism for a change is already available and the strategy of the change would be the monitoring and management of Interactive Playback sessions such that the automatic switch-over mechanism would be optimized to allow for graceful ending of an anomalous playback session instead of triggering an automatic switch-over of FDP.

Workarounds – before the change is delivered, the following workarounds would be effective in preventing recurrence:

(a) Interactive Playback sessions to be conducted on the Fallback system without inducing any risk on the operational system or impacting Main system operation.

3.2 Part 2 - Momentary FPL Dis-association

Fix – the proposed mechanism for the optimization would be such that during the restoration of a previously off-line FDP server, the established associations between targets and flight plans would be protected, such that server-server synchronization could be handled in parallel with the other tasks that FDP server is processing, thus inhibiting recurrence of FPL dis-association event.

Workaround – before the change is delivered, the following workaround would be effective in preventing recurrence:

(a) to reduce the impact of data synchronization on flight plan associations, the restoration and maintenance work of an offline FDP server should be carried out during a period of low traffic.

4. Availability of Fix

The fix would be available in 2 weeks.

Raytheon Company

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