TMA Coupled Scheduling Authentication Testing Technology Integration Laboratory (TIL) Configuration Description

Draft Final

CENTER-TRACON AUTOMATION SYSTEM (CTAS)

BUILD 2

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1.0 Introduction

CSC has requested laboratory and support services from the Laboratory Future Development (AJP-7840) team under the direction of Terrence Moore of the William J Hughes Technical Center (WJHTC) to support man-in-the-loop requirements authentication testing of the Stage 1 TMA Coupled Scheduling (TCS) function. The purpose of this paper is to provide sufficient technical and logistics information to allow the AJP-7840 team to assess the technical feasibility of the contemplated tests and to estimate the resources required to fulfill CSC's request.

The purpose of the requirements authentication tests is to ensure that the Stage 1 TCS function performs as specified in the context of the operational environments that are experiencing problems the Stage 1 TCS function is intended to address. Additionally, this activity is intended to elicit potential additional requirements based on the feedback of the expert users participating in the tests.

2.0 Overarching Laboratory Requirements

The laboratory environment required for the man-in-the-loop tests is depicted in Exhibit 1 below.

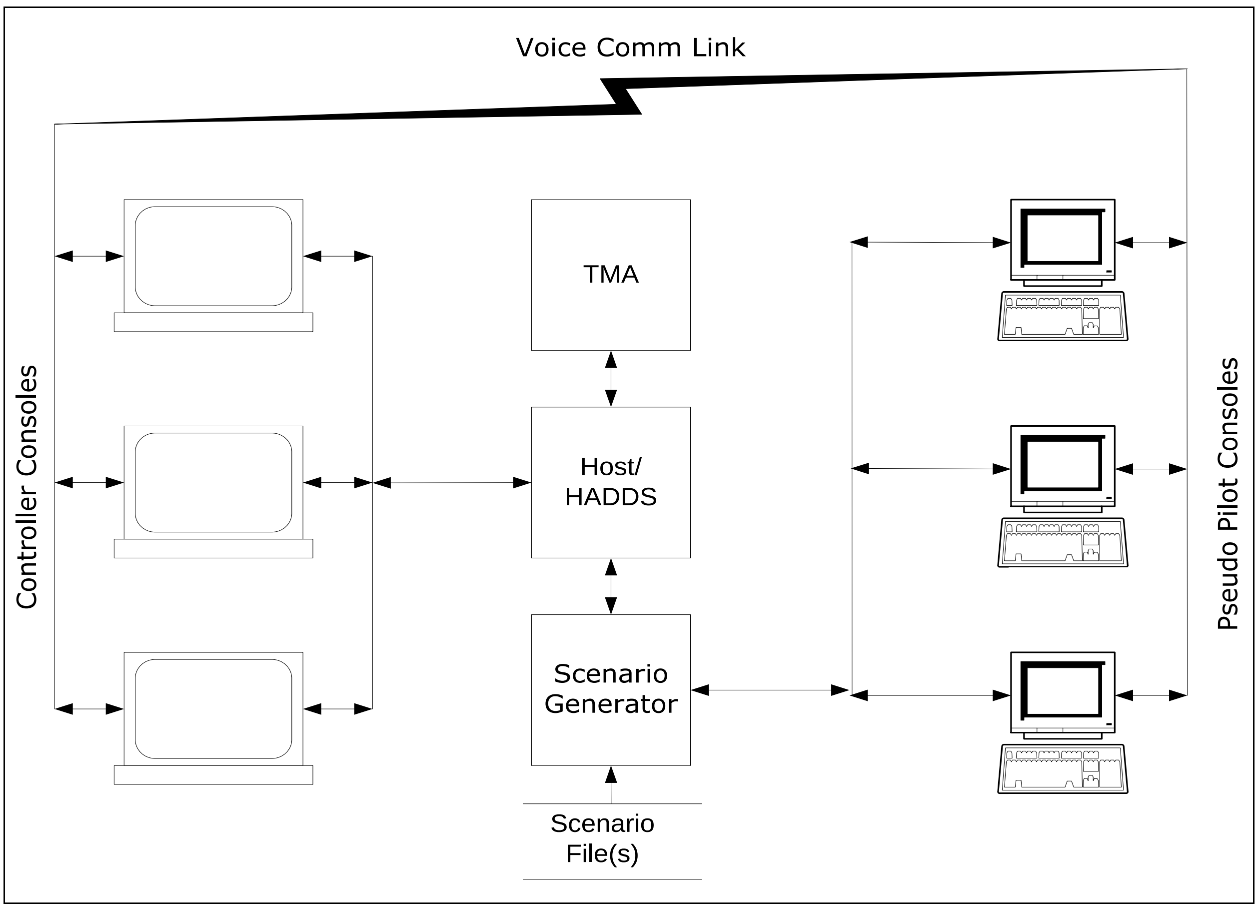

Exhibit 1: Notional Tech Center Lab Configuration – The essential elements of the needed lab configuration are shown. The specific laboratory configurations needed for the contemplated tests are provided below.

The laboratory is required to function in the following way:

1. A Scenario Generator[1] reads one or more scenario files that together define the scenario. The scenario files are expected to consist primarily of flight plans, flight plan amendments and track trajectory definitions corresponding to the defined flights, with associated time stamps. The scenarios are keyed to the specific airspace and metering configuration under investigation.
2. The Scenario Generator drives the Host/HADDS and the Pseudo Pilot Consoles with the flight plan and track data.
3. The Host/HADDS drives the Controller Consoles with sector configuration data, map displays, flight plan data and track data. The Host/HADDS also drives the TMA system with flight data and tracks.
4. The TMA processes the Host data according to a pre-defined metering scenario and generates meter lists that are sent to the Host. The meter lists are displayed on the Controller Consoles.
5. In response to the displayed meter lists, the ATC professionals manning the Controller Consoles issue commands to the pseudo pilots via the Voice Comm Link to maneuver the applicable flights to absorb any delay that resulted from the metering scenario.
6. The pseudo pilots enter the appropriate commands into the Pseudo Pilot Consoles to alter the trajectories of the affected flights.
7. The trajectory commands are processed by the Scenario Generator and corresponding track messages (or simulated radar hits) are then sent from the Scenario Generator to the HCS.
8. The HCS track messages to TMA reflect the altered trajectories.

3.0 Airspace Modeling Requirements

The requirements authentication tests involve two different metering designs in two different airspace situations. These differing scenarios are described below. In both scenarios it is necessary to have at least two arrival streams to the subject airport. One of the arrival streams is subject to a coupled scheduling arrangement and the other is not.

[1] The Scenario Generator may be integral to the HCS or not and may be a single system or several systems. It is shown here as being a single system outboard of the HCS.

3.1 Single Meter Point at the ZOB/ZNY Boundary Coupled to the PENSA Meter Arc

This scenario will consist of a meter point at the ZOB/ZNY boundary coupled to the PENSA meter arc that meters traffic into N90/EWR. The non-coupled flow will be via the southern approach in ZDC through sectors ZDC16 and ZDC12 directly into DYLIN. The overall metering geometry for this scenario is given in Exhibit 3.1 -1 below.

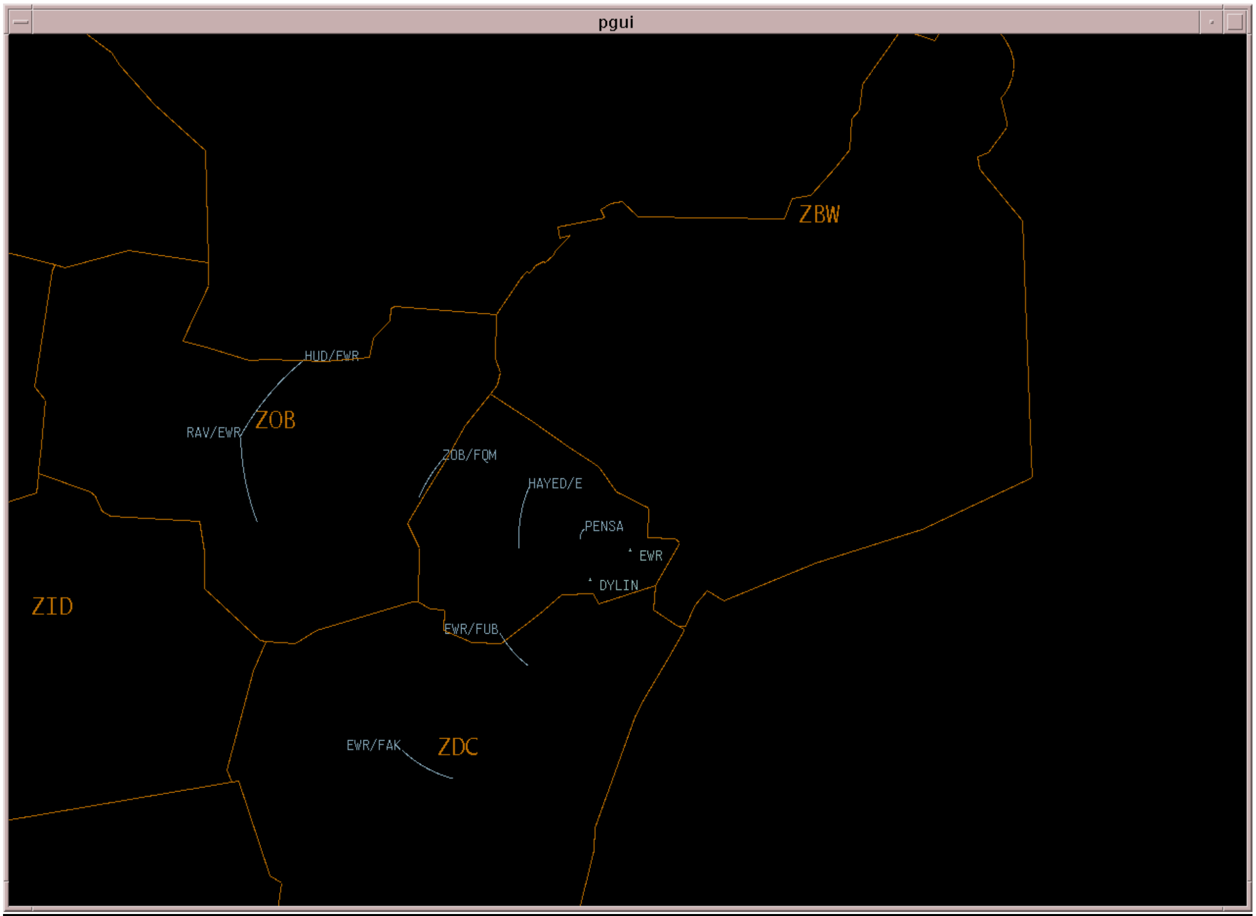

Exhibit 3.1 – 1 ZNY/ZOB/ZDC Scenario Metering Geometry

3.1.1 Western Approach (ZOB/ZNY)
Presently, the HUD/EWR and RAV/EWR outer3 arcs are situated at the eastern ends of ZOB26 and ZOB49 respectively. Traffic flows through these sectors into ZOB79. The ZOB/FQM outer-outer arc is situated at the eastern end of ZOB79 at the ZOB/ZNY boundary. Traffic flows from ZOB79 into ZNY75 where the HAYED/EWR outer arc is situated in the eastern half of ZNY75. Traffic flows through ZNY75 into ZNY74 where the PENSA meter arc is located near the ZNY74/N90 boundary. Altitude stratifications and relative distances for the western approach sectors are shown in Exhibit 3.1 – 2.

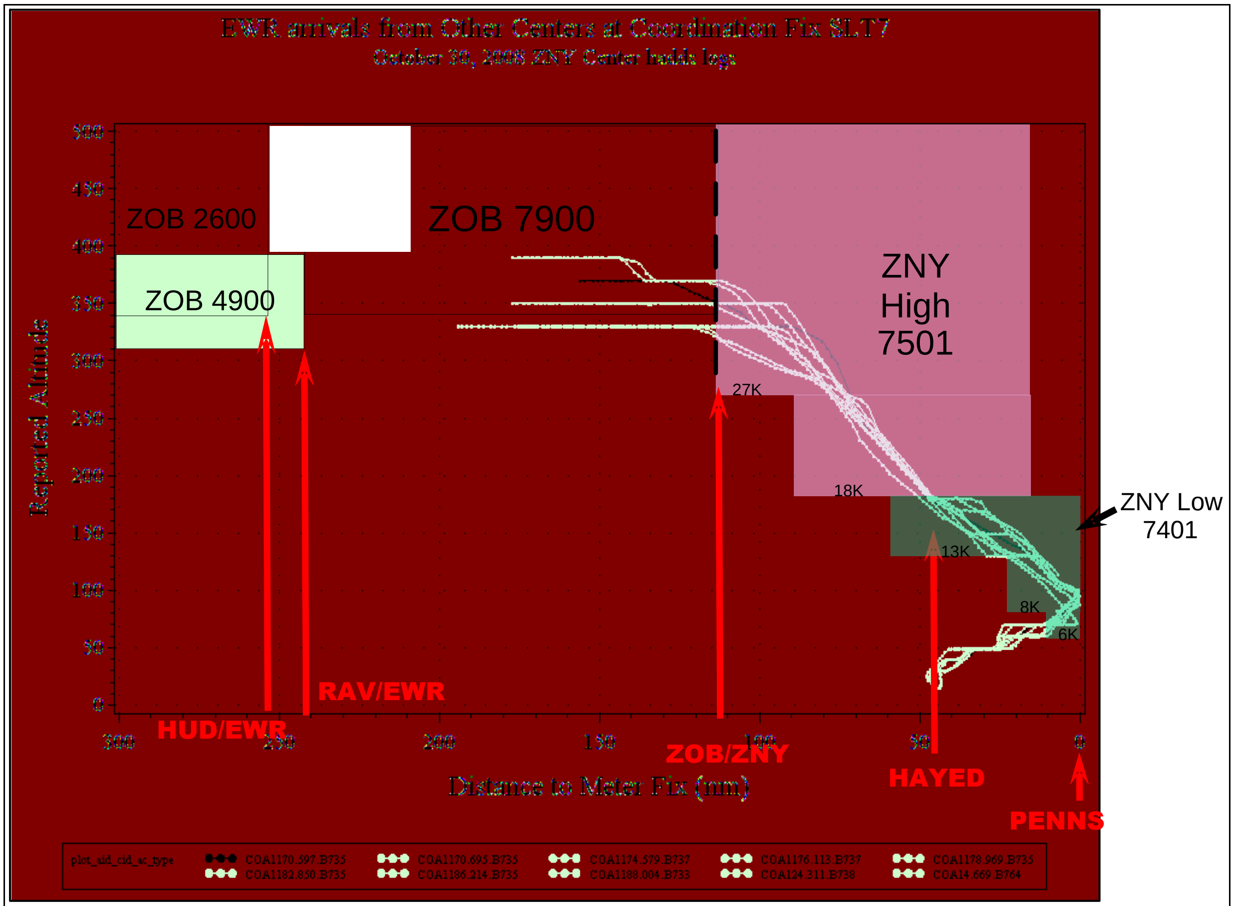

Exhibit 3.1 – 2: Western Approach Altitude Stratifications and Relative Distances

3.1.2 Southern Approach (ZDC)
Presently, the EWR/FAK outer-outer arc is situated at the northern end of ZDC16. Traffic flows through ZDC16 via EWR/FAK into ZDC12. The EWR/FUB outer arc is situated just north of the northern boundary of ZDC12. STAs are referenced to EWR/FUB but displayed at the ZDC12 sector position and EWR arrivals in ZDC12 are metered to the northern boundary using the EWR/FUB times. The DYLIN meter fix is at the northern end of ZDC18. Traffic flows into ZDC18 from ZDC12 where up to 1 minute of delay can be absorbed prior to crossing the DYLIN meter fix. ZDC18 hands off its traffic directly to N90.

3.1.3 Metering Design

The ZOB/FQM outer-outer arc will be replaced by the ZOB/FQM meter point[2] coupled to the PENSA meter arc. The HUD/EWR and RAV/EWR outer3 arcs will be replaced (or redefined as) ZOB/FQM outer arcs. The HAYED/EWR outer arc and PENSA meter arc will remain as they are. An AMDT value of one (1) minute is defined in the region between the HAYED outer arc and the PENSA meter arc however, for the purposes of this scenario, ZNY74 will not be staffed. The metering design for ZDC will remain as described above. However, for the purposes of this scenario, ZDC18 will not be staffed.

The following TRACON Buffer, AMDT, MPAD and Delay Dump specifications will be adapted initially:

1) EWR TRACON Buffer = 300s
2) AMDT = 2min between HUD/EWR and ZOB/FQM
3) AMDT = 2min between RAV/EWR and ZOB/FQM
4) MPAD = 4min between ZOB/FQM and HAYED/EWR
5) HAYED/EWR Delay Dump = "EOFD"
6) AMDT = 1min between HAYED/EWR and PENSA
7) AMDT = 0min between EWR/FAK and EWR/FUB
8) AMDT = 1min between EWR/FUB and DYLIN
9) Airport configuration, MiT and rates as per field defaults

3.1.4 Scenario Parameters and Laboratory Configuration

The following lists track loading, aircraft mix and identifies the involved sectors in each ARTCC.

3.1.4.1 ZOB/ZNY Sectors and Flows

80%/20% mix of large jets and RJs
ZOB26: 9 aircraft over 30 minutes into ZOB79 via HUD/EWR
ZOB49: 6 aircraft over 30 minutes into ZOB79 via RAV/EWR
ZOB79: 15 aircraft over 30 minutes (from ZOB26 & 49) into ZNY75 via ZOB/FQM
ZNY75: 15 aircraft over 30 minutes (from ZOB79) into ZNY74 (not staffed) via HAYED/EWR and then into N90 via PENSA.

3.1.4.2 ZDC Sectors and Flows

70%/30% mix of large jets and RJs
ZDC16: 15 aircraft over 30 minutes into ZDC12 via EWR/FAK
ZDC12: 15 aircraft over 30 minutes (from ZDC16) into ZDC18 via EWR/FUB
ZDC18: 15 aircraft over 30 minutes (from ZDC12) and then into N90 via DYLIN

3.1.4.3 Sector and Pseudo-Pilot Staffing

5 DSR sector positions: ZOB26, ZOB49, ZOB79, ZDC16, and ZDC12
1 ZNY PGUI sector position: ZNY75
6 pseudo pilot positions (1 to 1 with sector positions)

3.1.4.4 NAS Host/ARTCC Requirements

1 Host/DSR suite configured as "split NAS" for: ZOB ARTCC and ZDC ARTCC

3.1.4.5 Laboratory Configuration

The laboratory configuration corresponding to this test scenario is provided in Exhibit 3.1 - 3

[2] The conversion of the ZOB/FQM outer-outer arc to a meter point has been proposed by the field for metering into EWR.

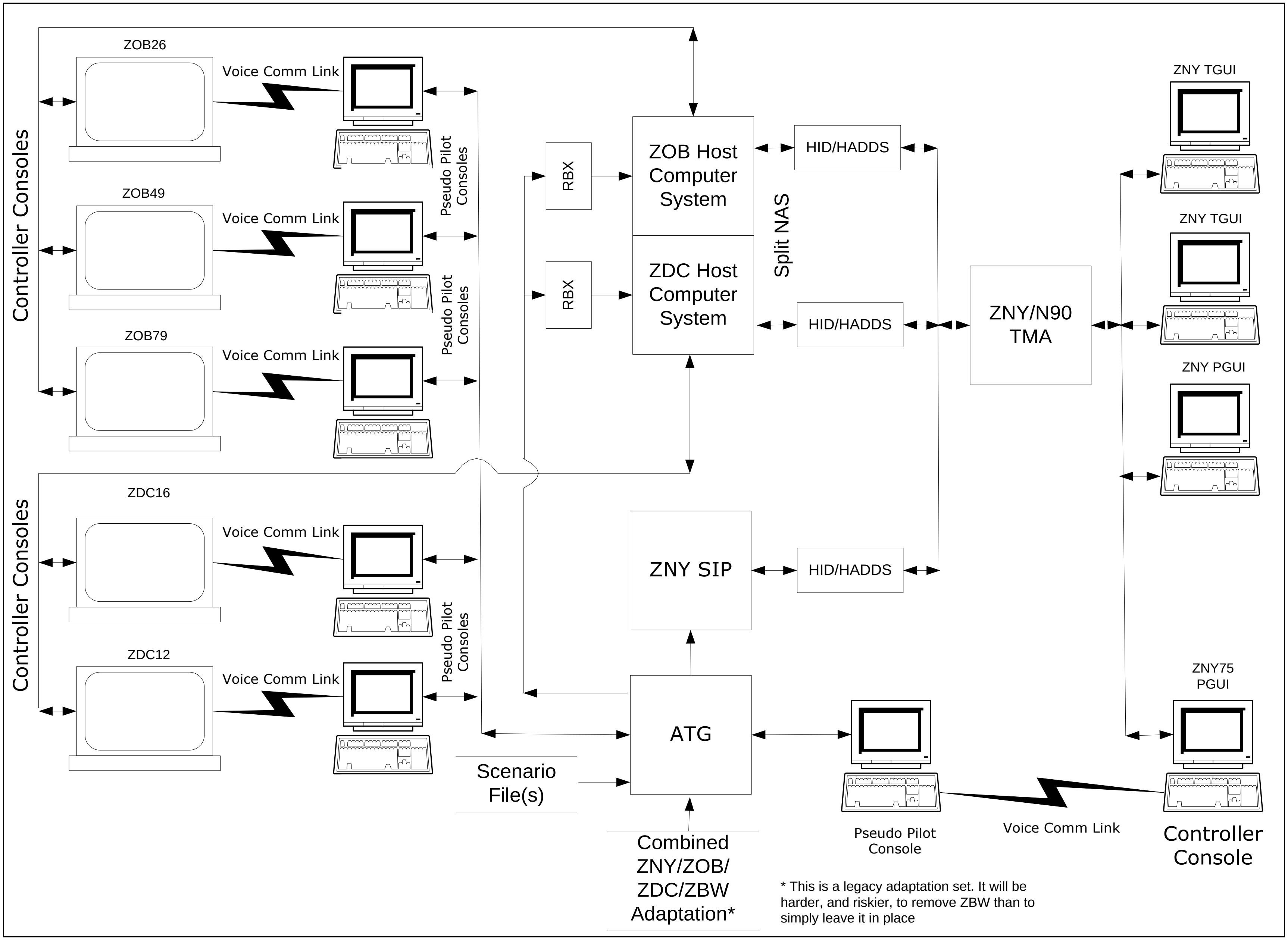

Exhibit 3.1 – 3 ZNY/ZOB/ZDC Scenario Lab Configuration

3.2 Three Meter Points in Two Adjacent Centers Coupled to a Single Meter Fix

This scenario will consist of two (2) meter points in different sectors in ZLC at the ZLC/ZLA boundary and one (1) meter point in ZDV similarly situated at the ZDV/ZLA boundary coupled to the LUXOR meter arc for LAS. The traffic out of ZLC enters ZLA from the north-northeast (Milford - MLF) and northeast (Bryce Canyon – BCE) and the traffic out of ZDV enters from the east-northeast (Dove Creek – DVC). Additionally, The southwestern approach into the CLARR meter arc will also be simulated, but without a coupled scheduling arrangement. The CLARR meter arc will be loaded with traffic volumes similar to the KADDY meter arc. The KADDY meter arc is to the southeast of LAS and services the traffic stream from ZAB. CLARR meter arc has been chosen instead of KADDY to eliminate the need to instantiate ZAB in the simulation. The metering geometry for this scenario is shown in Exhibit 3.2 – 1 below.

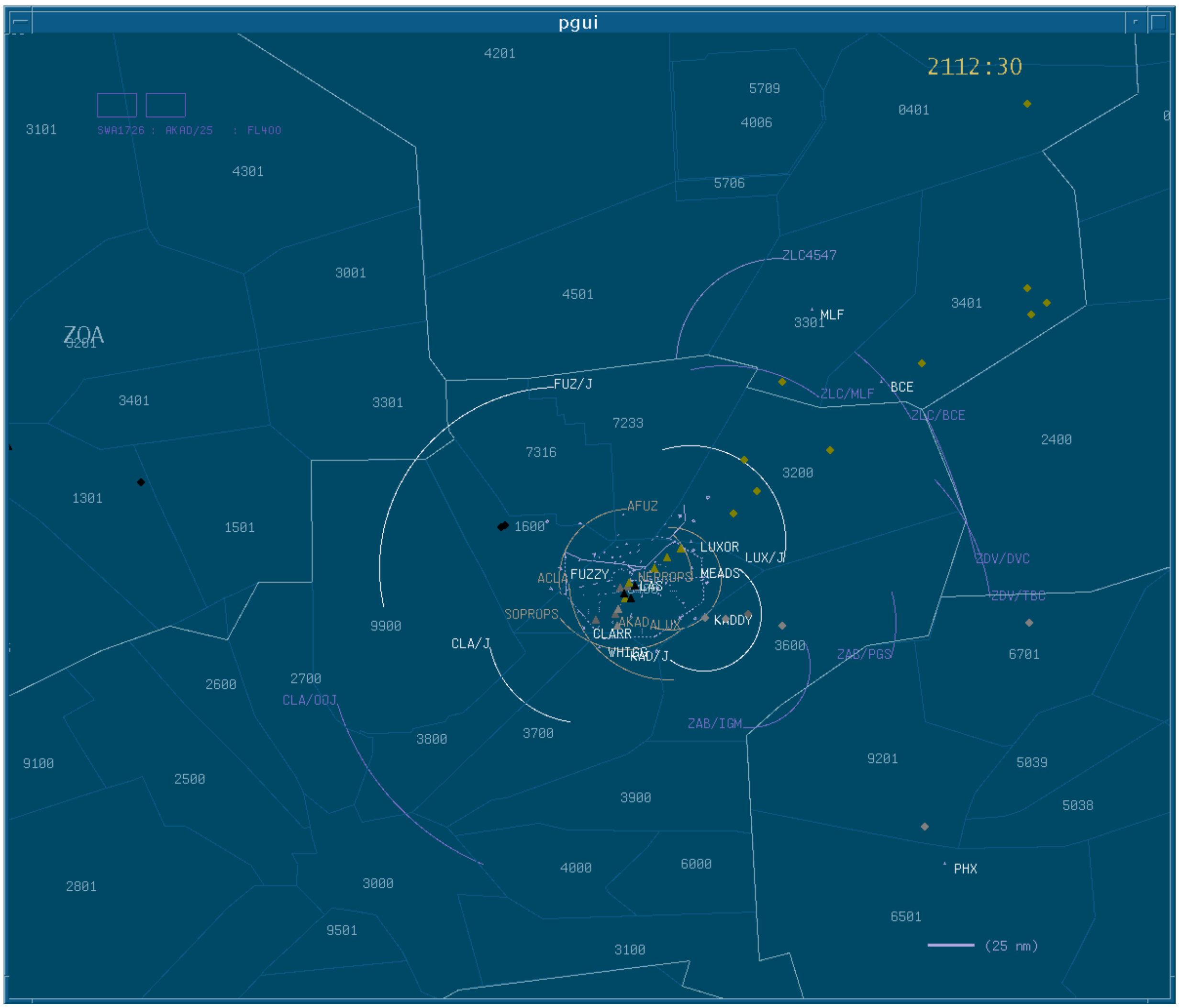

Exhibit 3.2 – 1: ZLA/ZLC/ZDV Scenario Metering Geometry

3.2.1 North-Northeast Approach (ZLC/ZLA via MLF)

Presently, the ZLC4547 outer3 arc is situated at the eastern end of ZLC45/ZLC47(4702 – high, and 4701 - low) and is adapted in such a way as to display metering data for all of the LAS arrival jet traffic that flows through any of those sectors. Traffic flows through ZLC45/47 into ZLC44. ZLC44 has the ZLC/MLF outer-outer arc situated at its southern end on the boundary with ZLA. Any delay in excess of one (1) minute at the ZLC/MLF outer-outer arc is distributed to the ZLC4547 outer3 arc. ZLC44 traffic flows into ZLA33 where the LUX/J outer arc is situated at the handoff point to ZLA07. There is zero (0) AMDT adapted between the LUX/J outer arc and the ZLC/MLF outer-outer arc. The LUXOR meter arc is located at the southwestern end of ZLA07. There is zero (0) AMDT adapted between the LUXOR meter arc (ALUX) and the LUX/J outer arc. LAS bound traffic through this portion of the LAS metering design is relatively light. The sector altitude stratifications and relative distances are shown in Exhibit 3.2 – 2 below.

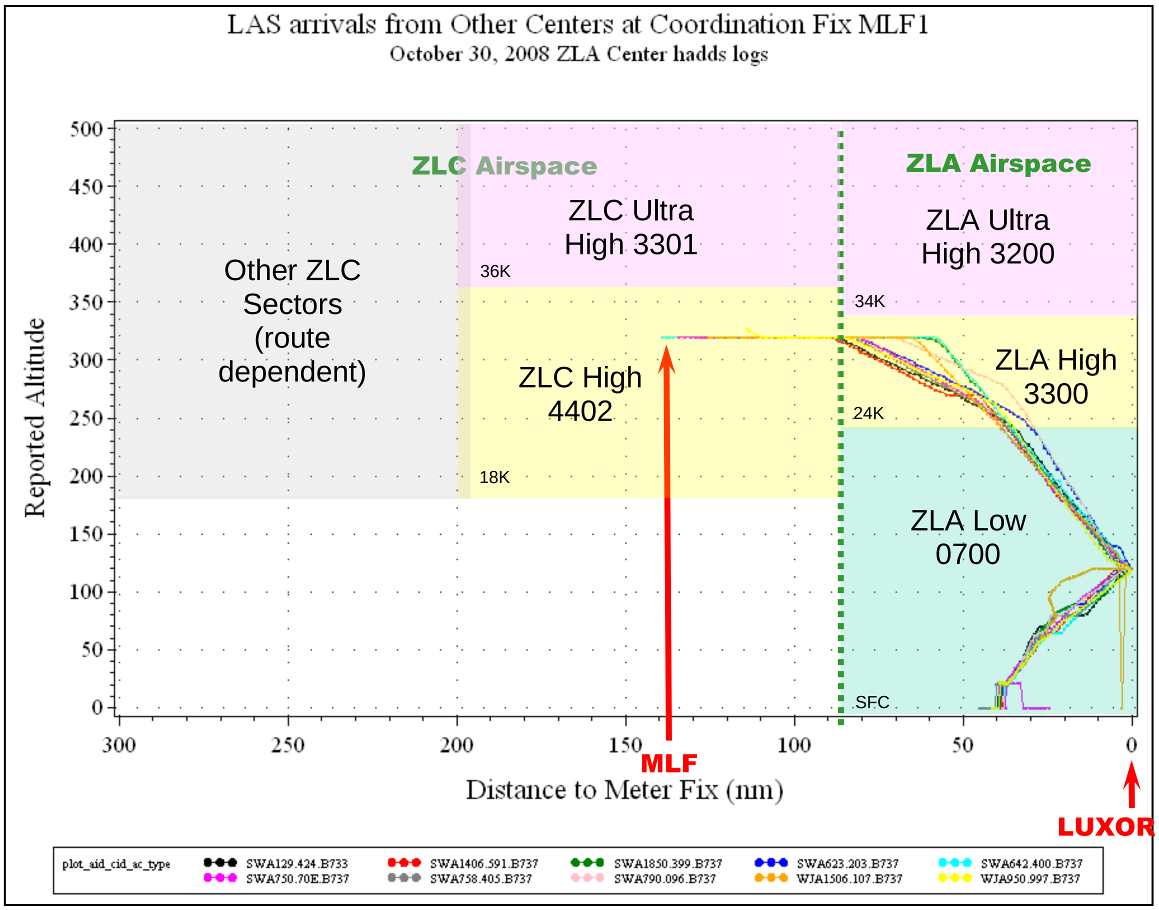

Exhibit 3.2 – 2: MLF Approach Sector Stratifications and Relative Distances

3.2.2 Northeast Approach (ZLC/ZLA via BCE)

Presently, the ZLC/BCE outer-outer arc is situated somewhat inside the southwestern ends of ZLC34 (ultra high) and ZLC46 (high) and is adapted in such a way as to display metering data for all of the LAS arrival jet traffic that flows through either of those sectors. Traffic flows through ZLC34/46 into ZLA33 where the LUX/J outer arc is situated at the handoff point to ZLA07. Any delay in excess of one (1) minute at the LUX/J outer arc is distributed to the ZLC/BCE outer-outer arc. The situation past the LUX/J outer arc is as described above in 3.2.1. Traffic through this portion of the LAS metering design is typically heavy and steady during rush periods. The sector altitude stratifications and relative distances are shown in Exhibit 3.2 – 3 below.

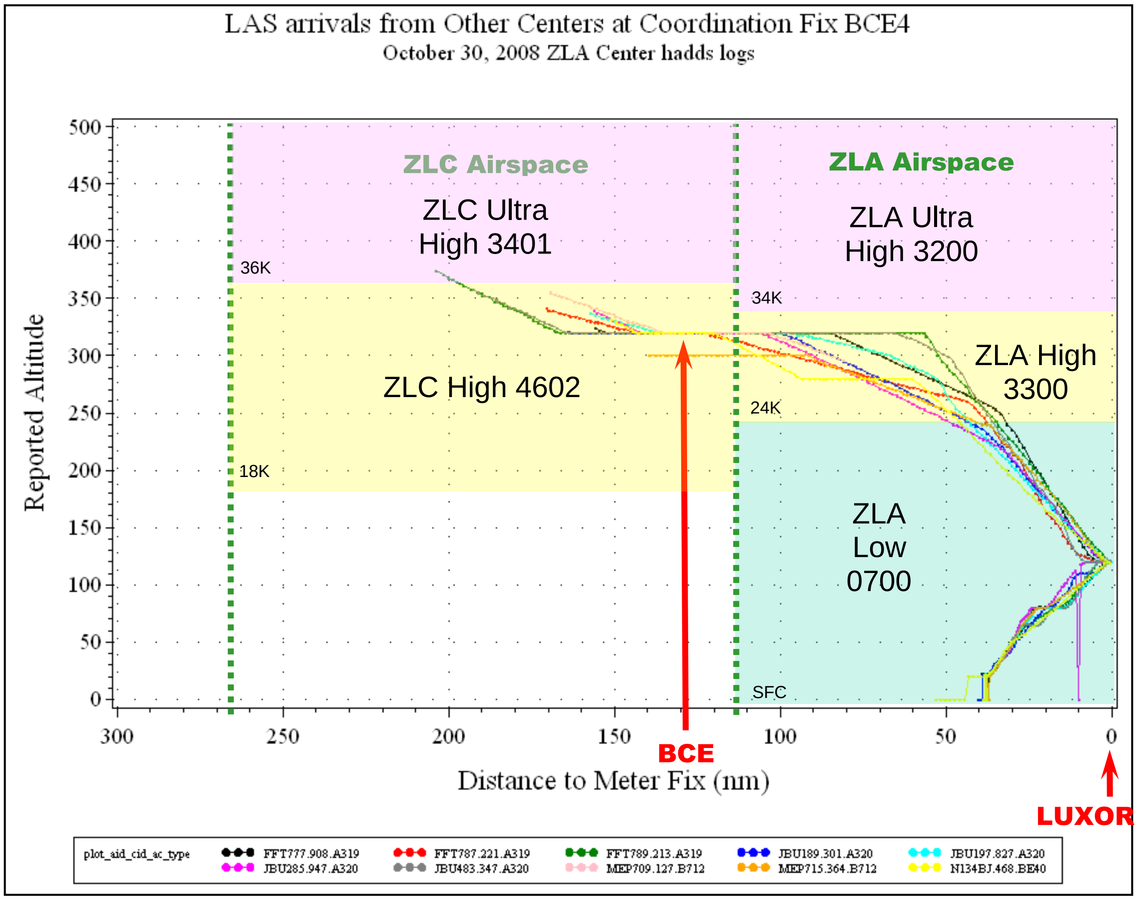

Exhibit 3.2 – 3: BCE Approach Sector Stratifications and Relative Distances

3.2.3 East-Northeast Approach (ZDV/ZLA via DVC)
Presently, the ZDV/DVC outer-outer arc is situated at the west-southwestern exit of ZDV24 (ultra high), ZDV23 (high) and ZDV26 (low) and is adapted in such a way as to display metering data for all of the LAS arrival jet traffic that flows through any of those sectors. Typically, traffic flows through ZDV23 into ZLA33 (and occasionally into ZLA32 before descending to ZLA33) where the LUX/J outer arc is situated at the handoff point to ZLA07. Any delay in excess of one (1) minute at the LUX/J outer arc is distributed to the ZDV/DVC outer-outer arc. The situation past the LUX/J outer arc is as described above in 3.2.1. Traffic through this portion of the LAS metering design is typically medium volume and arrives in bursts during rush periods. The sector altitude stratifications and relative distances are shown in Exhibit 3.2 – 4 below.

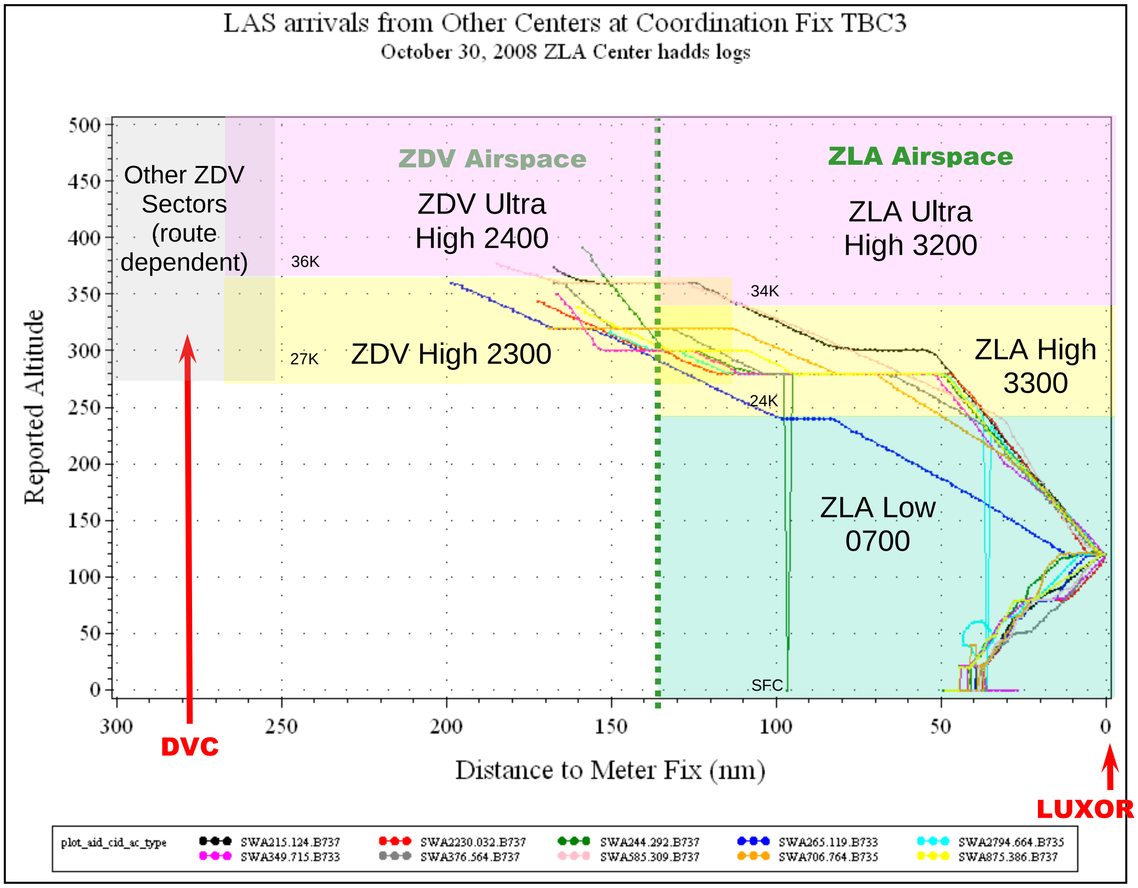

Exhibit 3.2 – 4: DVC Approach Sector Stratifications and Relative Distances

3.2.4 South-Southwest Approach (ZLA)
Presently, meter arc ACLA (CLARR meter fix) is located at the boundary between ZLA06 and LAS TRACON. Zero (0) AMDT values are adapted between ACLA and CLA/J outer arc and between CLA/J and CLA/OOJ outer-outer arc meaning that any delay in excess of what can be absorbed in the LAS TRACON would be distributed to the CLA/OOJ outer-outer arc. Traffic through this portion of the LAS metering design is light.

3.2.5 Metering Design
The ZLC/MLF outer-outer arc will be replaced by a coupled meter point named "LXMLFM1" with ZLC4547 as an associated outer meter arc. ZLC/BCE and ZDV/DVC will also be

replaced by coupled meter points "LXBCEM1" and "LXDVCM1" respectively. The AMDT values will be adapted as specified in the list below. ACLA will be loaded with traffic levels that are closer to the levels experienced by the KADDY meter arc (AKAD) and run as an SGFF operation.

The following TRACON Buffer, and AMDT specifications will be adapted initially:

1) LAS TRACON Buffer = 180s
2) AMDT = 1min between ZLC4547 and LXMLFM1
3) AMDT = 0min between LXMLFM1 and LUX/J
4) AMDT = 1min between LXBCEM1 and LUX/J
5) AMDT = 1min between LXDVCM1 and LUX/J
6) AMDT = 0min between LUX/J and ALUX
7) AMDT = 0min between CLA/OOJ and CLA/J
8) AMDT = 0min between CLA/J and ACLA
9) Airport configuration and all other MiT and rates as per field defaults

ACLA will be set and run as a SGFF operation, established at runtime.

3.2.6 Scenario Parameters and Laboratory Configuration

The following lists track loading, aircraft mix and identifies the involved sectors in each ARTCC.

3.2.6.1 ZLC Sectors and Flows

100% large jets
ZLC4702: 3 aircraft over 30 minutes into ZLC44 via ZLC4702 (47 high altitude sector)
ZLC44: 4 aircraft over 30 minutes (3 from ZLC4702 + 1) into ZLA33 via ZLC/MLF
ZLC46: 10 aircraft over 30 minutes into ZLA33 via ZLC/BCE

3.2.6.2 ZDV Sectors and Flows

100% large jets
ZDV23: 6 aircraft over 30 minutes into ZLA33 via ZDV/DVC

3.2.6.3 ZLA Sectors and Flows

ZLA33: 20 aircraft over 30 minutes into ZLA07 from ZLC and ZDV
ACLA: 20 aircraft over 30 minutes, SGFF

3.2.6.4 Sector and Pseudo-Pilot Staffing

4 DSR sector positions: ZLC4702, ZLC44, ZLC46, and ZDV23
1 ZLA PGUI sector position: ZLA33
4 pseudo pilot positions: 1 to 1 with sector positions except one pseudo pilot position for both ZLC4702 and ZLC44

3.2.6.5 NAS Host/ARTCC Requirements

1 Host/DSR suite configured as "split NAS" for: ZLC ARTCC and ZDV ARTCC

3.2.6.6 Laboratory Configuration

The laboratory configuration corresponding to this test scenario is provided in Exhibit 3.2 - 5

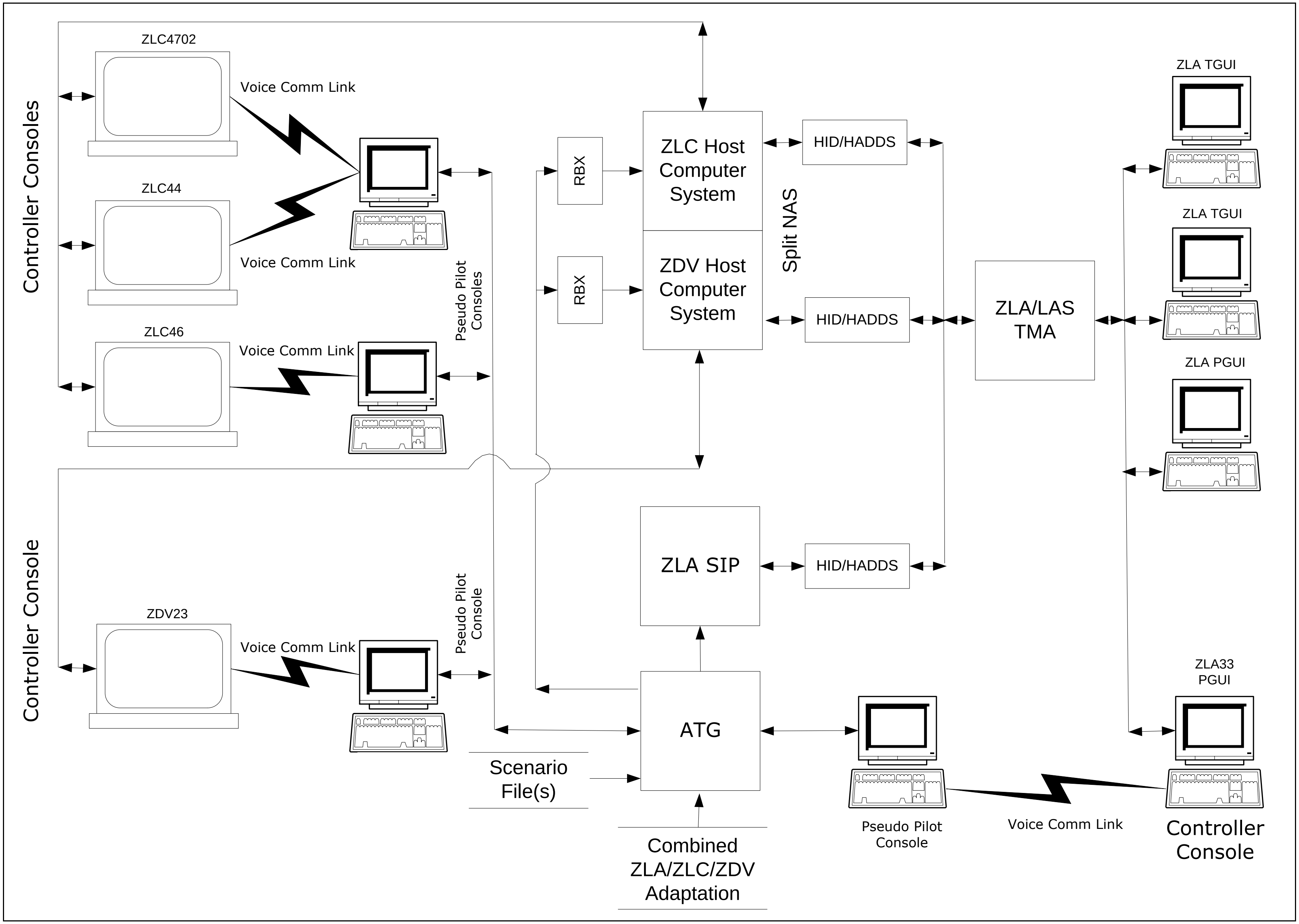

Exhibit 3.2 – 5: ZLA/ZLC/ZDV Scenario Lab Configuration

4.0 Software Requirements:

Identify TMA version: 3.9.0_SPUR1
Identify Aircraft Target Generator (ATG) version: 2.9.1

5.0 Adaptation Requirements:

TMA Adaptation versions: To be Determined.
Host Chart Change Update version: January 2009 CCU.