Target Generation Facility (TGF)
ACB-860 Simulation Group

Project Summary

Fiscal Year 2002

Dan Warburton

October 12, 2002

Table of Contents

TGF Project Summary
FY 2002

Executive Summary

The Target Generation Facility (TGF) completed another successful simulation year. All simulations were provided on-time and met or exceeded customer expectations.

TGF provided research and development (R&D) support to Domestic Reduced Vertical Separation Minimum (DRVSM) and Human Factors Laboratory (HFL) studies such as NexCom. TGF airspace redesign efforts included the Administrator's Chokepoint Study and HFL's NY Redesign. TGF has provided ongoing support for operational test and evaluation (OT&E) efforts such as STARS EDC, FS1 OT&E, and FS2/2+ OT&E. TGF is also providing ongoing support for STARS PHL. (STARS training has been identified by the Government Accounting Office (GAO) as a problem area for the Federal Aviation Administration (FAA)).

TGF began using a new simulation model program. Under development for several years, the new simulation dynamics represents a completely new design from first principles and is implemented in JAVA using object-oriented techniques. TGF has deployed this new simulator to the HFL and the Integration and Interoperability Facility (IIF). It is also driving the Display System Replacement (DSR) Labs in the main building.

On the international front, TGF maintained it relations with NAVCANADA, providing technical support for the micro-TGF in use there. TGF expanded its relations with Eurocontrol and plans for joint research in simulation methods and interfaces are under way.

Looking forward towards FY03, TGF appears to be booking quickly. A third DRVSM simulation, more MITRE Problem Analysis Resolution and Ranking (PARR) studies, Multi-Center Traffic Management Advisor (McTMA) testing, controller training for DCA, continued STARS test support, Interop and NexCom studies in the HFL are already scheduled.

Section 1 – Simulation Projects Supported

This section summarizes the simulation efforts supported by the Target Generation Facility during the fiscal year.

1.1 Simulation: New York TRACON Chokepoint Training (ARTS IIIE)

Simulation Dates: October 1, 2001 – October 25, 2001

Program Office: ATA-1

Contacts:	Thomas Zaccheo	NATCA N90
	Rusty Umbrell	NATCA N90

Simulation Summary

Once the Chokepoint studies were completed and the results accepted, the next hurdle was how to train 180 controllers between 9/01 and 12/27/01 when final implementation was to commence. It was evident that due to the massive scale of the training, the training labs at the individual facilities were not adequate for the task. The William J Hughes Technical Center (WJHTC) is not a training facility, but it had all the human capital, material assets and creativity to get the training done in the short time allowed. Therefore, the WJHTC (through the TGF) was tasked to put together a simulation that would be acceptable to allow the controllers to train to receive their required certification for the new airspace design. Working with NATCA representatives, the TGF simulation team was able to build six scenarios: chokepointEwrTrainingSW, chokepointEWRTrainingNE, chokepointTrainingSWMug, chokepointTrainingNEMug, chokepointTrainingNEArd and chokepointTrainingSWArd. The TGF staff, along with Ernie Heinz, scheduled and configured the ARTS3E lab in order to enable the controllers to receive their training.

The scenarios developed consisted of six (6) sectors from the N90 airspace:

Sector	Frequency
4A	120.150
2G	125.625
4P	128.550
5H	132.750
4U	127.600
4H	132.800

The scenarios ranged in size from 74 to 154 flight plans. Each one was designed to exercise a specific aspect of the chokepoint problem. These scenarios were all designed to last approximately 1 hour. The simulations required 11 simpilots to fly the 6 sectors. Each simulation had two ASR9 radars configured, EWR and JFK

1.2 Simulation: ZDC Chokepoint - (DSR)

Simulation Dates: October 29, 2001 – November 9, 2001

Program Office: ATA-1

Contacts: Kevin M. Aurandt NATCA ZDC
Michael Goodson NATCA ZDC

Simulation Summary

This simulation of the ZDC en route airspace was performed to train controllers in the new airspace configuration designed to reduce congestion in the northeast corridor. This simulation ran in parallel with the PHL chokepoint but since it was an en route simulation, it required different TGF resources. Since ZDC was a different part of the chokepoint problem a completely different set of simulation scenarios had to be developed by the TGF staff in order to provide acceptable training for the NATCA controllers to receive their required certification. There were eleven scenarios developed which were being revised and improved during the training: zdc01c1a, zdc01c2a, zdc01c2b, zdc01c3a, zdc01cp1, zdc0ccp2, zdc01cp3, zdc01c2c, zdc01c2d, zdc01c3b.

The scenarios developed consisted of seven sectors from the ZDC airspace:

Sector	Frequency
10	132.270
12	126.870
16	134.020
17	134.500
18	132.520
19	125.450
GHOST	123.450

The scenarios ranged in size from 123 to 371 flight plans. Each one was designed to exercise a specific aspect of the chokepoint problem. These scenarios were all designed to last approximately 1 hour. The simulations required 15 simpilots to fly the 7 sectors. Each simulation had 5 long-range radars configured: QBE, QVH, QPL, QBN and QIE.

1.3 Simulation: PHL Chokepoint Training (ARTS IIIA)

Simulation Dates:	October 22, 2001 – December 20, 2001 January 7 2002 – January 8 2002	
Program Office:	ATA-1	
Contacts:	Steve Nogar	NATCA PHL
	Kevin Bair	NATCA PHL

Simulation Summary

This simulation of the PHL airspace was performed to train controllers in the new airspace designed to reduce congestion in the northeast corridor. This simulation ran in parallel with the EWR chokepoint and required the same TGF staff to run both simulations. Since PHL was a different part of the chokepoint problem a completely different set of simulation scenarios had to be developed by the TGF staff in order to provide acceptable training for the NATCA controllers to receive their required certification. In all, there were eight scenarios developed but only four were utilized for the training: PHL_EASTSIM_18, PHL_EASTSIM_5, PHL_WESTSIM_18 and PHL_WESTSIM_5. The scenarios developed consisted of seven sectors from the PHL airspace:

Sector	Frequency
SD	119.750
SA	126.600
4P	125.120
ND	124.350
4U	126.070
Y	123.800
NA	128.400

The scenarios ranged in size from 157 to 174 flight plans. Each one was designed to exercise a specific aspect of the chokepoint problem. These scenarios were all designed to last approximately 1 hour. The simulations required 11 - 14 simpilots to fly the 7 sectors. Each simulation had the PHL ASR9 radar configured for it.

1.4 Simulation: DRVSM (ZOB) – Domestic Reduced Vertical Separation Minimum (DSR)

Simulation Dates	October 29, 2001 – October 30, 2001	
Program Office:	ATP-110 En Route Procedures	
Contacts:	Vince Lasewicz	ACB-330 HITL Simulation & Analysis Group
	Dianne Tyler	ATP-110 En Route Operations/ Procedures Branch

Simulation Summary

This simulation of Cleveland Center (ZOB) was performed to identify the impact of reduced vertical separation on an air traffic controller's workload. The study was designed to compare several alternative approaches toward implementing reduced vertical separation in the domestic airspace. Three bands of altitude were chosen for evaluation: FL290 – FL410, FL330 – FL390, and FL350 – FL390. Three en route sectors encompassed the airspace for the simulation: 57, 59, and 67. The procedure is scheduled for activation in late 2004 to early 2005 time frame and TGF provides an excellent environment in which the controller's workload can be evaluated.

1.5 Simulation: HAT Study aka HAD (High Altitude Demonstration) (IIF)

Simulation Dates:	October 22, 2001 – December 20, 2001 January 29, 2002 – January 31, 2002 February 1, 2002 – February 7, 2002	
Program Office:	ATA1 Air Traffic Airspace Management Program	
Contacts:	Jerry Hadley	ACB-330, 609-485-7920
	Sabra W. Kaulia	ATA-1 Program Director

Simulation Summary

This simulation of the Memphis Center was undertaken as part of the National Airspace Redesign Project. The purpose of the High Altitude Demonstration (HAD) was to compare several types of air traffic control procedures that are being evaluated for use in the redesigned National Airspace System (NAS). The following are the specific air traffic control procedures that were evaluated: RVSM parallel routes, RNAV routes, RVSM, and Grid navigation. All of these procedures were tested in conditions with and without weather.

In order to save valuable air traffic control resources and significant overtime pay, the study was conducted in the IIF laboratory with the DSR system split between two separate simulators running two separate simulations.

The adaptation was an en route environment using sectors 21 and 44 of ZME center. The following long-range radars were used: QRV, QYB, QPB, QRB, QXR, and TXK. A large number of flight plans representing the different type of air traffic control procedures were created. Their names were as follows: BASE.fp, MIXED.fp, RNAV1.fp, RVSM1.fp, baseMIX.fp, baseRNAV.fp, baseRVSM.fp, baseSUA.fp, baseWX.fp, direct1.fp, gridsua.fp, and gridwx1.fp

1.6 Simulation: STARS EDC (DCA)

Simulation Dates: October 10, 2001 – October 11, 2001

Program Office: ATB

Contacts: Jack McAuley ATB-230 (Acting) FS2/2+ Product Lead

Simulation Summary

The STARS Early Display Configuration (EDC) was a simulation of the Washington area airspace in order to validate the Computer Human Interface (CHI) of the EDC. It required TGF staff working in conjunction with DCA (Washington area) controllers to develop five scenarios so that the controllers could test and evaluate all the features of the EDC. These scenarios were named 11N60A, 11N_A, 11N_B, 20N_A and 20N_B. This simulation also ran in conjunction with the chokepoint studies, requiring TGF personnel to work double shifts. The TGF staff, along with Ernie Heinz, scheduled and configured the ARTS3E lab. These scenarios made use of seven sectors:

Sector	Frequency
West Departure	118.950
East Departure	125.650
Over Flights	128.350
East Arrival	124.200
West Arrival	119.850
E-Ghost	131.500
W-Ghost	135.400

The scenarios ranged in size from 403 to 478 flight plans. Each one was designed to exercise a specific aspect of the STARS system. These scenarios were all designed to last approximately 1 hour. The simulations required 11 simpilots to fly the 7 sectors. Each simulation had two ASR9 radars configured: DCA and ADW.

1.7 Simulation: STARS FS1 (PHL)

Simulation Dates: November 19 2001, November 20 2001,
January 28 2002 - January 31, 2002,
March 1 2002, March 13 2002, March 14 2002

Program Office: ATB

Contacts: Jack McAuley ATB-230 (Acting) FS2/2+ Product Lead

Simulation Summary

The STARS Full Service 1 (FS1) simulation was an operational test and evaluation (OT&E) of the STARS FS1 build. TGF staff, along with controllers, were tasked to build three new scenarios that would enable the test controllers to exercise the FS1 builds to their fullest capabilities. These scenarios were to be used in conjunction with previously built scenarios. The reused scenarios were called phl_cp, phl_cp1, phl_cp1_2735 and phl_cp_20_21z. The new scenario went through four revisions through the course of the FS1 testing. The final scenarios were acAv4, acBv4 and acCv4. As part of the testing there were numerous short notice simulations for the STARS team to check out Program Trouble Reports (PTR's) in support of the OT&E effort. These short notice simulations were critical to the STARS team being able to meet its deadlines. These scenarios made use of eight sectors:

Sector	Frequency
SA	126.600
FV	125.400
NA	128.400
W	127.350
Y	123.800
SD	119.750
ND	124.350
PHL Tower	118.500

The scenarios ranged in size from 39 to 179 flight plans. Each one was designed to exercise a specific aspect of the STARS FS1 system. These scenarios were all designed to last approximately 1 hour. The simulations required 11 – 14 simpilots to fly the 8 sectors. Each simulation had the PHL ASR9 radar configured.

1.8 Simulation: ZLA/ZOA/SCT (TATCA Study)

Simulation Dates: February 11, 2002 – February 14, 2002

Program Office: Free Flight

Contacts:	Chuck Romano	ACB-620 TMA Test Lead
	Terrence Moore	ACB-840 TFM Laboratory Manager

Simulation Summary

TGF provided radar data simulation for TATCA/TFM training of ZLA and SCT controllers in the DSR and ARTS labs.

1.9 Simulation: NexCom 1 – Human Factors Laboratory (HFL)

Simulation Dates: February 11, 2002 – February 14, 2002

Program Office: AND-360

Contacts:		
	Randy L. Sollenberger	ACB-220 NAS Human Factors Group
	James Eck	AND-360 PT Lead for Air/Ground Communications (Acting)
	Karol Kerns	

Simulation Summary

This study was conducted using the generic airspace, Genera, developed by the air traffic controllers within the Human Factors Laboratory. Intermediate Sector "18", arrival, departure and over-flight aircraft were included to maximize the use of communications in this voice communications study. Specifically, this study evaluated analog vs. digital communication equipment.

The TGF, as the provider for aircraft simulation in the Human Factors Laboratory, achieved an important step: the introduction of the new Java-based simulator. This simulator has upgraded aircraft performance dynamics to provide a high-fidelity simulation for air traffic controllers.

1.10 Simulation: NYRD 1 – Human Factors Laboratory (HFL)

Simulation Dates: April 8, 2002 – April 17, 2002

Program Office: ATB 1

Contact:	Todd R. Truitt	ACB-220 NAS Human Factors Group
	Bill Voss	Director of Terminal Business Service

Simulation Summary

This simulation was an arrival concept study where New York Center controllers worked along side New York TRACON controllers in one building with adjoining sectors. In this study, en route sectors (74 and 75) dealing directly with the associated TRACON arrival sectors were allowed to use reduced separation (three miles lateral in lieu of the standard five miles). The flow of traffic was from the west (Cleveland Area) into the New York Broadway area with the Newark and LaGuardia aircraft.

TGF supplied the aircraft simulation, reenacting three periods of actual traffic into Newark and LaGuardia during heavy periods of the day. In addition, TGF personnel assisted in the site development of the New York airspace into the TGF.

1.11 Simulation: DRVSM 2 (ZID)-Domestic Reduced Vertical Separation Minimum

Simulation Dates: April 22, 2002 – April 25, 2002
May 6, 2002 – May 9, 2002

Program Office: ATP110 En Route Procedures

Contacts:	Vince Lasewicz	ACB-330 HITL Simulation & Analysis Group
	Dianne Tyler	ATP-110 En Route Operations/Procedures Branch

Simulation Summary

This simulation of the Indianapolis Center is a continuation of the DRVSM 1 study. The major difference in this study is the decision to focus on the FL290 – FL410 altitude band to compare the various approaches to implementation. A further goal for this study was to determine the effect of non-RVSM equipped aircraft. This en route simulation involved four sectors of Indianapolis Center: 87, 88, 97, and 98. The DRVSM procedure is scheduled for activation in late 2004 to early 2005 time frame and TGF provides an excellent environment in which the controller's workload can be evaluated.

1.12 Simulation: NYRD 2 – Human Factors Laboratory (HFL)

Simulation Dates: May 17, 2002 – May 27, 2002

Program Office: ATB 1 TERMINAL BUSINESS SERVICE

Contact:	Todd R. Truitt	ACB-220 NAS Human Factors Group
	Bill Voss	Director of Terminal Business Service

Simulation Summary

This simulation was a departure concept study where New York Center controllers worked along side New York TRACON controllers in one building with adjoining sectors. In this study en route sectors (39 and 55) dealing directly with the associated TRACON Departure sectors were allowed to use reduced separation (three miles lateral in lieu of the standard five miles). The flow of traffic was Newark, LaGuardia, & Kennedy Airports to the west and southwest.

TGF supplied the aircraft simulation re-enacting three periods of actual traffic departing Newark, LaGuardia, and Kennedy Airports during heavy periods of the day.

1.13 Simulation: STARS FS2 (PHL)

Simulation Dates April 22 2002 – April 25 2002, May 16 2002, May 17 2002, May 29 2002, June 3 2002, June 4 2002, June 28 2002, July 2 2002 – July 11 2002

Program Office: ATB-230 STARS

Contacts: Jack McAuley ATB-230 (Acting) FS2/2+ Product Lead

Simulation Summary

The STARS Full Service 2 (FS2) simulation was an operational test and evaluation (OT&E) of the STARS FS2 build. TGF staff, along with controllers, were tasked to modify scenarios that would enable the test controllers to exercise the FS2 build to its fullest capabilities. The FS2 testing made use of the scenarios built for the FS1 testing and as such the names are the same. As in the FS1 simulations, there were numerous short notice simulations for the STARS team to check out Program Trouble Reports (PTR's) in support of the OT&E effort. These short notice simulations are critical to the STARS program's ability to test PTR's for incorporation into the next build in support of OT&E.

The scenarios contained the same eight sectors as FS1:

Sector	Frequency
SA	126.600
FV	125.400
NA	128.400
W	127.350
Y	123.800
SD	119.750
ND	124.350
PHL Tower	118.500

The scenarios ranged in size from 39 to 179 flight plans. Each one was designed to exercise a specific aspect of the STARS FS2 system. These scenarios were all designed to last approximately 1 hour. The simulations required 11 – 14 simpilots to fly the 8 sectors. Each simulation had the PHL ASR9 radar configured.

1.14 Simulation: Direct-To Tool

Simulation Dates:	April 23, 2002 – April 25, 2002, September 24, 2002 – September 26, 2002	
Program Office:	Free Flight Program	
Contacts:	Teri Lowe	ACB-100 Direct 2 Test Lead
	Terrence Moore	ACB-840 TFM Laboratory Manager

Simulation Summary

TGF provides radar data simulation for this PAS-based simulation effort.

D2 is being studied as part of Free Flight Phase 2. Rather than being able to fly the most efficient route to its destination, today's aircraft follow established airways that have inefficient components. Additionally, air traffic control user interfaces keep controllers from issuing user-preferred or more efficient routes, even under light traffic conditions. The goal of the Direct-To tool is to identify aircraft that can save at least one minute by flying directly to a downstream point on the flight route. A list on the controller's display shows eligible aircraft, the possible time-saved, the D2 points, and whether there is any danger of aircraft conflict. Acceptance of the D2 advisory automatically sends a flight plan amendment to a host computer.

1.15 Simulation: GOERS Preparation

Simulation Dates: Planned October 22, 2002 – November 15, 2002

Program Office: ATP110 En Route Procedures

Contacts: Vince Lasewicz ACB-330 HITL Simulation & Analysis Group
Charlyn Davis ATP-110 En Route Operations/Procedures Branch

Simulation Summary

This simulation of the Jacksonville Center is being conducted to understand the impact of a GPS outage on the workload of an air traffic controller. The study is divided into three observations of GPS signal outages: no outage, a partial outage, and a complete outage. These observations were repeated in an environment in which the available NAVAIDs have been depleted by 50%. This en route simulation involved sectors 14, 15, and 78 of the Jacksonville Center. TGF provides a flexible environment in which these observations can be simulated and evaluated.

1.16 Simulation: STARS FS2+ PHL Training

Simulation Dates: September 5 2002 – November 17 2002

Program Office: ACB-3, ATB, ATX-100, AEA-500, Philadelphia ATCT, NATCA

Contacts:	Jack McAuley	ATB-230 (Acting) FS2/2+ Product Lead
	Tom Norato	ATX-100

Simulation Summary

This simulation is for training the PHL air traffic controllers in the use of the STARS FS2+ system. It is being done by the TGF team at the WJHTC because there are not enough positions at the newly constructed air traffic tower at PHL and there would not be sufficient time to complete the training for over 106 controllers in order to implement STARS by 11/17/02. In addition, the labs and facilities at the WJHTC have a much greater fidelity, technical support and responsiveness for these particular circumstances. It should also be noted that the TGF team and the WJHTC is doing its part to aid in STARS training, an area that the GAO identified as being lacking. To accomplish this task, a simulation was specifically built for this training. Its name is phlStarsTraining and contains 195 flight plans. The same eight sectors from STARS FS1 and FS2 were used, namely:

Sector	Frequency
SA	126.600
FV	125.400
NA	128.400
W	127.350
Y	123.800
SD	119.750
ND	124.350
PHL Tower	118.500

This scenario was designed to last approximately 45 minutes. The training simulation requires 12 simpilots to fly the 8 sectors. Each simulation had the PHL ASR9 radar configured.

1.17 Simulation: Controller Pilot Data Link Communications (CPDLC)

Simulation Dates: Canceled

Program Office: Free Flight Phase 1

Contacts: Evan Darby

Simulation Summary

TGF worked closely with the HFL and Datalink software developers to produce an environment for prototyping Datalink concepts and procedures. This capability now exists in both the HFL and TGF Display Laboratories.

1.18 Simulation: MITRE URET PARR (Preparation) (IIF)

Simulation Dates: Planned for: November 19, 2002 – November 21, 2002

Program Office: Free Flight

Contacts:	Mary Cale	ACB-100
	Alfreda Gipson	MITRE 609-272-7542

Simulation Summary

Problem Analysis Resolution and Ranking (PARR) is envisioned as an enhancement to the User Request Evaluation Tool (URET) Free Flight Phase 1 (FFP1) capability and has been designated as priority research for the follow-on Free Flight Phase 2 (FFP2) effort. PARR is being developed as a series of incremental enhancements to URET, with the Initial PARR capabilities focusing on providing additional support to the Radar Associate (D) Controller for the resolution of aircraft-to-aircraft and aircraft-to-airspace problems.

This simulation of the Indianapolis Center involved four sectors of Indianapolis Center: 87, 88, 97, and 98.

TGF worked closely with the Mitre Corporation to develop a simulation in the IIF.

1.19 Simulation: McTMA (Non Interfere Demo)

Simulation Dates: May 2002

Program Office: Free Flight

Contacts:	Dominic R. Timoteo	ACB-100 Innovations Division
	Terrence Moore	ACB-840 TFM Laboratory Manager

Simulation Summary

TGF provided the NAS system build and simulation flight data upon which this direct simulation was based.

Section 2 – Technical Summary

This section summarizes the technical achievements of the TGF during the fiscal year.

2.1 JAVA-Based simulator Deployed

Departure manager, RbxControl, DRAT improvements

2.2 BARCO 2k x 2k Displays installed in the TGF Laboratory

This year, TGF replaced its Sony 2k x 2k CRTs with BARCO 2k x 2k flat-panel displays. TGF's Sony displays were reaching end of life. BARCO developed a new plug-compatible replacement. TGF was able to get four (4) displays from the initial production run and install them in the TGF Display Laboratory.

2.3 Sun Back-End Equipment refreshed

2.3 Cisco network infrastructure refreshed

TGF Acronyms and Abbreviations

ADAR	ARTS Data Acquisition & Router
AGW	ARTS GateWay
ARTS	Automated Radar Terminal System
ATCT	Air Traffic Control Tower
CAS	Controller Awareness Study
CTAS	Center TRACON Automation System
CHI	Computer Human Interface
CPDLS	Controller Pilot Data Link Communications
DFS	Deutsche Flugsicherung (German Simulation)
DIS	Distributed Interactive Simulation
DRVSM	Domestic Reduced Vertical Separation Minimum
DSR	Display System Replacement
EDC	Early Display Configuration
ETVS	Enhanced Terminal Voice Switch
FAST	Final Approach Spacing Tool
FFP	Free Flight Phase
FS1, 2/2+	Full Service 1, 2/2+
GAO	Government Accounting Office
GOERS	GPS Outage En route Simulation
GPS	Global Positioning System
HAD	High Altitude Demonstration
HAT	High Altitude Test
HFL	Human Factors Laboratory
HLA	High Level Architecture
IIF	Integration and Interoperability Facility
LAAEP	LA Arrival Enhancement Project
McTMA	Multi-Center Traffic Management Advisor
NAS	National Airspace System
NATCA	National Air Traffic Controllers Association

PARR	Problem Analysis Resolution and Ranking
PAS	Pseudo Aircraft System
PDU	Protocol Data Units
PTR	Program Trouble Reports
RDHFL	Research Development and Human Factors Laboratory
RNAV	Area Navigation
RVSM	Reduced Vertical Separation Minimum
STARS	Stand Alone Terminal ARTS Replacement System
TATCA	Terminal Air Traffic Control Automation
TFM	Traffic Flow Management
TGF	Target Generation Facility
TMA	Traffic Management Advisor
TRACON	Terminal Radar Approach CONtrol
URET	User Request Evaluation Tool
WJHTC	William J. Hughes Technical Center
XPVD	X-windows Planned View Display

TGF Airports and Centers

ADW	Andrews Air Force Base
DCA	Ronald Reagan International Airport
EWR	Newark International Airport
Genera	Generic airspace generated for HFL studies
JFK	John F. Kennedy International Airport
PHL	Philadelphia International Airport
ZDC	Washington Center
ZID	Indianapolis Center
ZJX	Jacksonville Center
ZNY	New York Center
ZOB	Cleveland Center