Final Report

INTERNET BASED REMOTE OPERATIONS

Contract Number H-31226D
November 9, 1999
Report 99-1-484-007

Prepared for:

National Aeronautics and Space Administration
George C. Marshall Space Flight Center

Prepared by:

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1.0 INTRODUCTION

This is the Final Report for the Internet Based Remote Operations Contract, Contract No. H31226D. AZ Technology, Inc. (AZTek) has performed payload operations research support tasks under direction of the MSFC Ground Systems Department (GSD) from March 1999 through September 1999. These tasks support the GSD goal of developing a secure, inexpensive data, voice, and video mission communications capability between remote payload investigators and the NASA payload operations team in the International Space Station (ISS) era.

AZTek has provided feedback from the NASA payload community by utilizing its extensive payload development and operations experience to test and evaluate remote payload operations systems. AZTek has focused on use of the "public Internet" and inexpensive, Commercial-off-the-shelf (COTS) Internet-based tools that would most benefit "small" (e.g., $2 Million or less) payloads and small developers without permanent remote operations facilities. Such projects have limited budgets to support installation and development of high-speed dedicated communications links and high-end, custom ground support equipment and software.

The primary conclusions of the study are as follows:

1. The trend of using Internet technology for "live" collaborative applications such as telescience will continue. The GSD-developed data and voice capabilities continued to work well over the "public" Internet during this period. The demonstration mission voice system was reliable and provided good-quality voice communications throughout this period on all Internet connections provided in the AZTek testbed.

2. Transmitting multiple voice streams from a voiceconferencing server to a client PC to be mixed and played on the PC is feasible. A product which mixed four live voice streams and played them on a laptop sound card was demonstrated at Fall '99 VON by Multitude, Inc. (see Appendix A for contact info).

3. There are two classes of voice vendors in the market:
   - Large traditional phone equipment vendors pursuing integration of PSTN with Internet. Internet PBX, QoS protocols, , etc. Voiceconferencing is one minor, limited feature of large product line.
   - Small Internet phone startups. Provide custom systems taking advantage of PC, Internet for public "voice chat", e-commerce customer support, etc.

   The key to selecting a vendor will be to find a company sufficiently large and established to provide a base voiceconferencing software product line for the next several years. The vendor must also have the desire to provide custom features required by NASA (e.g., voice stream mixing) not found in commercial systems.

4. Discussions with other NASA centers - JSC (Mitch Macha/NASA) and KSC (Vic Colalula/USA) - indicate their similar need for Voice over IP systems to support mission operations. MSFC should continue to coordinate its efforts with those of other centers.

5. Telescience is not only useful to experimenters. Telescience is of great interest to NASA education and public outreach providers (E/PO) such as the MSFC Education Office (Jim Pruitt) and MSFC Science Directorate Communications Office (Dr. John Horack). Distance learning and "live" web site applications can utilize telescience data, voice, and video tools. Follow on proposals to these offices will develop prototype E/PO telescience applications in 2000. Both experimenters and educators will benefit from this dual use of telescience tools.

6. There was little test activity concerning TReK in this contract period. Test plans were developed for testing TReK-to-POIC Internet performance, but tests have been delayed into the fourth quarter of 1999.

2.0 TASK 1: DEVELOP HOSC REMOTE OPERATIONS TESTBED

The testbed utilizes the following Internet connection services:

- DirecPC direct broadcast satellite dedicated to one PC
- Interactive cable modem dedicated to one PC
- Dual-channel Integrated Services Digital Network (ISDN) on the corporate network to two PC's
- Dial-up modem to the DirecPC computer

No changes.

3.0 TASK 2. MAINTAIN AND OPERATE GFE TREK PC

NASA has provided one Government-Furnished Equipment (GFE) PC for use with TReK in the testbed. The GFE PC contains the DirecPC interface connected to a rooftop satellite dish. The GFE PC is the Pentium II 400 PC listed below. AZTek utilizes three corporate PC's in addition to the GFE PC to support TReK/voice/video testing. All three PC's have speakers/microphones to support voice tests.

CPU	Who/Loc	OS	HD	Mem	Internet	Notes
Pentium 400	Demo room	NT	5 GB	128 MB	DirecPC/dial-up modem	GFE PC
Pentium 333	Room 227	NT	8 GB	64 MB	ISDN gateway	AZTek-furnished PC.
Pentium 233	Room 222	NT	5 GB	64 MB	ISDN gateway	AZTek-furnished PC.
Pentium 166	Video room	NT	2 GB	64 MB	Cable modem	AZTek-furnished PC.

No changes.

4.0 TASK 3. SUPPORT TREK/VOICE/VIDEO DEMONSTRATIONS

AZTek supported the following TReK/voice/video meetings in this period:

- MSFC-JSC TIM at JSC concerning mission voice system.
- NEW teacher teleconferences.
- Fall '99 Voice Over Networks conference in Atlanta.
- Payload Control Board TIM.
- Demo to MSFC Science Directorate Communications Office (Dr. John Horack).

5.0 TASK 4. TEST INTERNET SERVICES PERFORMANCE & RELIABILITY

5.1 DirecPC Satellite

No change in this service.

5.2 Corporate LAN - Dual ISDN Gateway

No change in this service.

5.3 Cable Modem

No change in this service.

5.2 Phone Modem

No change in this service.

6.0 TASK 5. SUPPORT TREK, VOICE, AND VIDEO INTEGRATION TESTING

6.1 TReK System Tests

No formal TReK Beta testing activity.

6.2 NASA MSFC ISS Mission Voice/Videoconferencing Demonstration System

Supported an ISS OICB-related TIM at JSC concerning mission voice system. JSC is very interested in utilizing the MSFC approach in their voice system which will provide Space Station Engineering support.

At Fall '99 Voice Over Networks conference in Atlanta met several vendors interested in supporting IVoDS development. Met several times with VocalTec to encourage their participation in bidding on the operational system, but with little success. New companies showing interest included Nokia and White Pines. A vendor list is attached in Appendix A.

Continued task to define IVoDS system requirements, estimate costs, and identify potential voice vendors. An attached presentation in Appendix A summarizes potential voice vendor. Accomplishments included:

6.3 Payload Video System

Further activity on the payload video system is pending selection of a contractor for the operational system.

7.0 TASK 6. SUPPORT NEW "TREK IN THE CLASSROOM" TESTBED

Subtask 1: Develop test data collection program.

Previously completed.

Subtask 2: Develop the TReK prototype experiment displays.

Developed prototype displays for installation on NEW PC's. Contacted several early ISS experimenters utilizing TReK for possible participation in "TReK in the Classroom":

EXPERIMENT POINT-OF-CONTACT INFORMATION (TreK Users)					
EXPERIMENT	FLIGHT	CONTACT	PHONE	E-MAIL	LOCATION
ADVASC	7A.1	Shilo Halfen, Weijia Zhou, Paul Falk	608-262-5524, 608-262-5528	wzhou@facstaff.wisc.edu	Univ of WI
CPCG-H	7A.1	Dan Conner (Dan Sibley)	205-581-2912 (-2956)	dan_connor@msn.com (sibley@cmc.uab.edu)	UAB
PCG-STES	7A.1	Tim Allen/Amy Cardno	726-5072	tim.allen@pobox.tbe.com	MSFC TSC
PCS	7A.1	Bill Shiley	216-977-1153	William.Shiley@grc.nasa.gov	GRC, Harvard
SAMS II	7A.1	Dave Manner	216-977-1314	david.manner@grc.nasa.gov	GRC TSC
ADF	UF-1	Tom Stolarik	650-604-0139	tstolarik@mail.arc.nasa.gov	ARC TSC
BPS	UF-1	Tom Stolarik	650-604-0139	tstolarik@mail.arc.nasa.gov	ARC TSC
SpaceDRUMS	UF-1	Dr. James Stacey	709-895-3819	Jstacey@guigne.nf.ca	USOC-CO. Sch. Of Mines
ZCG	7A.1	Nurcan Bac	617-373-3769	Nbac@coe.neu.edu	USOC-NE Univ-INTEK
BTR	7A.1	Dan Magaw	281-461-2633	dmagaw@klsiems.jsc.nasa.gov	JSC TSC
MSG	UF-1	Larry Bauer	256-544-3055	larry.bauer@msfc.nasa.gov	MSFC TSC, Iowa State, ESTEC

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Subtask 3: Support test planning, test execution, and test results analysis.

Supported preparations to configure the NEW PC's.

8.0 PROBLEM AREAS

Request for quote from MSFC for IVoDS which was anticipated Sep. 1 was not received.

9.0 DELIVERABLES

The revised Voice Conferencing User Manual (Item 2) is included with COTR Bob Bradford's copy of this report. Twenty-eight copies of the manual have been provided to Mr. Bradford for inclusion in the NEW PC shipping boxes.

The deliverable Web software (Items 3, 4) has been delivered and is located on Voice Conferencing Servers QUARK and IVICS located in the HOSC Annex.. Server QUARK Web pages are located at D:\www\doc root directory. Server IVICS Web pages are located at D:\www\doc root directory. PC Anywhere is installed on the AZTek testbed Demo Room PC and Room 126 PC for remote access to the Voice Conferencing Servers for maintenance. Backups from Servers QUARK and IVICS are archived in S:\MOL\Voice\NASA Mission Voice Web Site Archives. Surf&Call Version 3.0 (Build 3), released in Fall, 1997 is used by the voice system. Several newer versions of the client software have been released but cannot be used unless the voice server software is upgraded.

10.0 COSTS

The current month cost is $14,170. The total contract cost is $85,000.

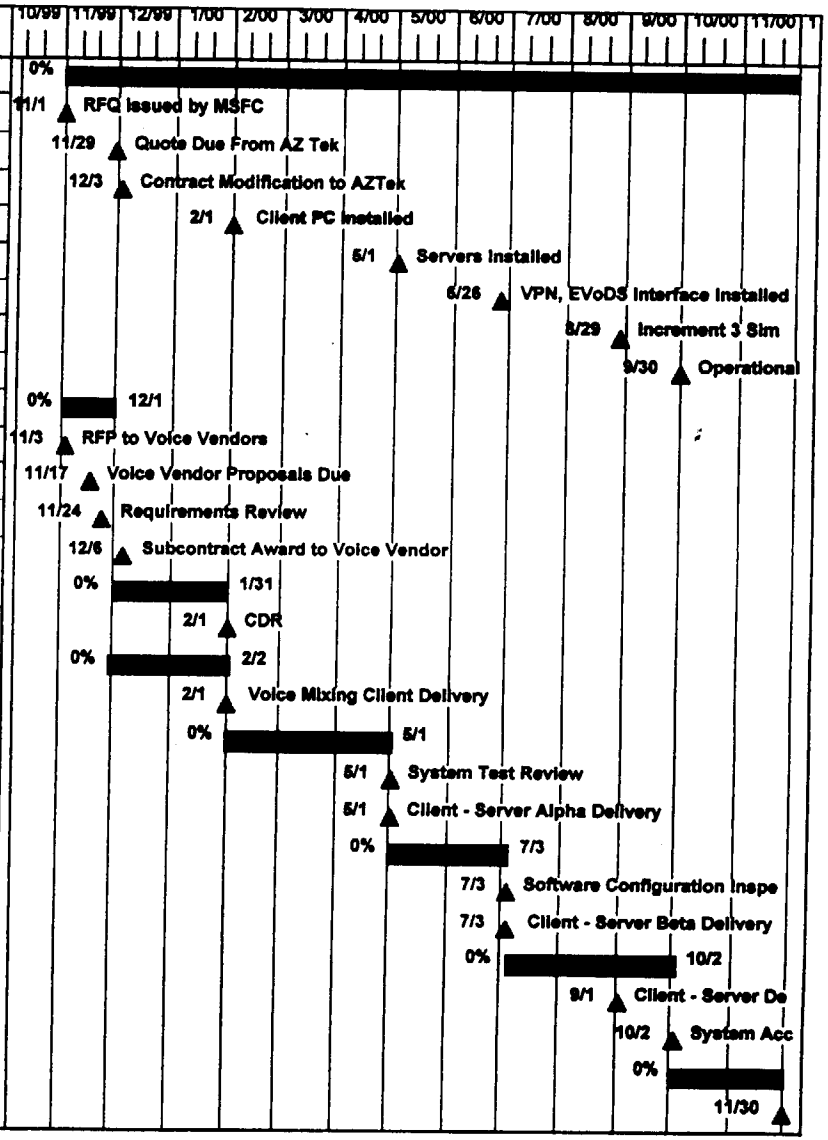
ATTACHMENT A. IVoDS Proposed Schedule and Vendor Lists

IVoDS Schedule - FY00

AZ Tek
AZ TECHNOLOGY

Start date moved from 9/1/99 to 11/1/99

ID	Task Name
1	**MSFC Contract Management & Integration**
2	RFQ Issued by MSFC
3	Quote Due From AZ Tek
4	Contract Modification to AZTek
5	Client PC Installed
6	Servers Installed
7	VPN, EVoDS Interface Installed
8	Increment 3 Sim
9	Operational Mission Date
10	**Requirements, Costing & Vendor Selection**
11	RFP to Voice Vendors
12	Voice Vendor Proposals Due
13	Requirements Review
14	Subcontract Award to Voice Vendor
15	**Design Phase**
16	CDR
17	**Prototype Client Voice Mixing Software**
18	Voice Mixing Client Delivery
19	**Implementation Phase, Alpha**
20	System Test Review
21	Client - Server Alpha Delivery
22	**Implementation Phase, Beta**
23	Software Configuration Inspection
24	Client - Server Beta Delivery
25	**System Integration & Acceptance Phase**
26	Client - Server Delivery
27	System Acceptance Review
28	**Operational Checkout with POIC Phase**
29	Operational Readiness Review



Vendor List

AZTek
AZ TECHNOLOGY

COMPANY/PRODUCT	NDA	RFI	Demo	NAME	POSITION	WEB	NOTES
8x8, Inc.	No	No		Dominique Pittloud			voice conferencing HW for ISP, not interested in selling HW
CISCO	No	No		B. Sedgley	Tech - talked to at VON		
CISCO	No	No		Darren Norris	SE		
CISCO	No	No		Dave Corley	Marketing		
Communities.com	**No**	**Yes**	**Yes**	**Duane Kuroda**	**Director of Bus. Dev.**	**www.communities.com www.onlive.com www.thepalace.com**	**Has server to demo, very responsive**
DSP Software Engineering, Inc.	**No**	**Yes**		**Peter D. Robinson**	**Sales Manager**	**www.dspse.com**	
Ericsson	**Yes**	**Yes**		**Dane Aderholt**	**Product Mgr**		
Fraunhofer Center for Research in Computer Graphics, Inc.	No	N/A		Daniel Gross	Senior Systems Engineer	www.crcg.edu	distance learning, VRML, animation,...
JSC - NASA	N/A	N/A		Mitchell Macha	DF consultant		
JSC - USA	N/A	N/A		Steve Weismuller?	ISP architect		
KSC - USA	N/A	N/A		Victor Colaluca			My equivalent at KSC
Multitude	**No**	**Want**		**Ned Lerner**	**VP**	**www.multitude.com**	**Client-side mixing demo worked well**
Nokia	**No**	**Want**		**Tom Parker**	**former White Pines...**		
RADCOM				Jacqueline McDonald		http://www.radcom-inc.com	Test equipment
Planet Telephonics	**Yes**	**Yes**	**Yes**	**Peter Hermsen**	**Consulting Partner**	**www.planettelephonics.com**	**Doing KSC system**
Telecom Computers	No	N/A		Daniel Berninger	CEO	www.telecomcomputers.com	
Telecom Computers	No	N/A		Darwin Vu		www.telecomcomputers.com	
Virtual Universe Corp.							
VirtualTalker	**No**	**Want**	**Yes**	**Mike Byrns**	**PM**	**http://www.vu.com**	
VocalTec	**No**	**No**	**Yes**	**Lior Haramaty**	**Vice President of Professional Services**		**Beringer's ex-boss**
VocalTec	No	No		Steven Shulkin	Director of Sales, ISPs		
White Pines	**No**	**Want**		**Gary McGuire**	**Federal Sales**		
White Pines	No	No		Scott Cavanaugh	Bus. Dev.	www.wpine.com	
WTS eMeeting.net	No	No		Larry Summers	President	www.eMeeting.net	study its design

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11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

This task requires the contractor to configure their facility as a HOSC Remote Operations facility and to support testing of voice, video, and telemetry data distribution capabilities.

14. SUBJECT TERMS
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