Project Plan for the

Network Backbone Architecture

of the

NCC98 LAN Upgrade

November 21, 1996

Updates:
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NASA Project Manager: John Donohue

1. OBJECTIVES

The fundamental objective of this project is to upgrade the current Network Control Center (NCC) Local Area Networks (LANs) to solve short term problems that exist with the current design while building a robust, scalable, highly efficient, easily managed, commercial off-the-shelf (COTS) based architecture for the foreseeable future. The following are specific goals to be achieved:

A. Simplify the current NCC LAN backbone architecture and design by developing a new LAN backbone architecture based on the latest *mature* (components should be "in the field" for no less than 1 year) COTS industry standard (IEEE, IETF, etc.) networking components

B. Replace the current NCC NACC switch with COTS networking hardware such as layer 2 switches which support virtual LAN segmentation techniques and advanced network management software

C. Allow for easy incorporation of any LAN hardware management software into the upcoming Network and Systems Management (NSM) suite of COTS software tools

D. Maximize LAN bandwidth utilization efficiency to relieve current bottlenecks

E. Meet recent revisions to the existing NCC security requirements

F. Minimize the transitional impact of the NCC LAN upgrade to the operations and development activities within the NCC

G. Design a flexible LAN architecture that is highly scalable relative to node number and bandwidth in order to meet current and future requirements

H. Provide an architecture that will support various current and future transport technologies such as Ethernet, Fast Ethernet, Gigabit Ethernet, FDDI, and ATM

I. Provide periodic progress reports/status as to the LAN design, network equipment on the market, and evaluation results to management and users of the current NCC LAN

2. BACKGROUND

In order to achieve the results and goals of the overall NCC98 LAN Upgrade, the network backbone must be upgraded as well. Current backbone architecture is based on multiple shared bandwidth (10 Mbps) subnets that are all centrally controlled through a NASA developed physical layer switch. Commercial off-the-shelf (COTS) shared bandwidth hubs are utilized within each subnet to group end-users together as well. This architecture will see its designed life cycle end within 1998. Additionally, heavy bandwidth requirements (primarily with the Development LAN) are currently stressing the existing network architecture past its capabilities resulting in extremely slow network access which leads to lower productivity among the users (not to mention the stress and frustration). These problems and issues prevent the current NCC LAN from operating efficiently, and in some cases, may prevent the NCC LAN from meeting its availability requirements.

An upgrade to the NCC LAN backbone is a necessary component of the overall NCC98 LAN Upgrade. Without it, bandwidth utilization becomes unacceptable within the Development environment (as has already been experienced thus far). These problems are highlighted by the recent network (Development LAN) performance analysis reports delivered by Booz, Allen & Hamilton in September and December 1996. Due to a high concentration of services on the SPSR1 server, users experience large periods of slow network performance when the capabilities of the server and the network are over-utilized (which is a frequent occurrence). The reports summarized the need for increased throughput, processing power, and memory for the server.

Additionally, due to an anticipated re-design of other network LAN components (Network Management System, Firewall, Host/LAN Interface Equipment Upgrade) under the proposed NCC98 architecture and due to the recent de-classification of the NCC, the LAN backbone can be made more robust and able to meet future requirements easily by adapting to industry standard COTS networking equipment. The NACC switch can be removed and replaced with COTS switches employing ethernet switching backbones supporting bandwidth measured in Gigabits per second as opposed to a theoretical 10 Megabits per second. These same COTS switches support various LAN transport technologies beyond ethernet such as FDDI, Fast Ethernet, and ATM thus providing the NCC with the flexibility to support whatever application that may be required (voice, video, imaging, etc.). Fault tolerance and redundancy are supported to the high levels that are expected in the NCC environment. Ease of maintenance and troubleshooting are switch features provided by their modular “plug-n-play” designs and by their support for network management tools. Each respective manufacturer uses the latest SNMP and RMON protocols that will easily integrate into the network management suite being developed by the NSM project.

Finally, a LAN backbone upgrade is consistent with the transition from synchronous serial circuits to an IP network via TCP/UDP that Nascom is currently implementing. NCC will now enter an era of seamless communication support for its customer base without delays or re-transmissions due to invalid/dropped frames or blocks due to layer 2, 3 or 4 (OSI layers) protocol conversions that were incurred between the serial circuits and the NCC’s ethernets.

3. APPROACH

A. Review the documents available on the NCC98 home page that summarize existing requirements and the planned NCC98 LAN Upgrade overall architecture (of which the network backbone is a component) in order to gain insight into what will be required of the networks' hardware capabilities. Develop requirements for replacing/upgrading the existing NCC LANs backbone for dissemination to respective network equipment vendors.

B. Initiate a Security Assessment of the current industry standard switching technologies that will be evaluated for potential use in the upgrade effort. This Security Assessment will also incorporate an evaluation of the use of virtual LAN technology which is typically a fundamental feature of current COTS based switches. The security assessment will be evaluated in light of the recent declassification of the NCC from a **Classified** environment to an **AIS Sensitive** environment and as a result will need to adhere to the revised *NCC Security Policy* and *Networks Division Information Technical Security Requirements* documents. Allied Signal (ATSC) will provide the lead (Bob Kannenberg and Jim Nangle) on the security risk assessment. The security assessment will also indicate the level of risk associated with a COTS based switching system, and verification procedures to determine the trustworthiness required of this system.

C. Research the current market for vendors of network switching equipment. Perform lab tests and analyses on the switching equipment and its associated software to check for full compliance to requirements and overall functionality. Vendors will be chosen from the list of contractors for network equipment listed in the SEWP when possible. If the list of manufacturers provided in the SEWP cannot meet the requisite design and security requirements, other manufacturers will be surveyed.

D. Examine and verify that the network equipment that will be used in the LAN design meets current NCC Security Requirements as defined by the *NCC Security Policy* document.

E. Design a LAN architecture that meets the current NCC reliability and redundancy requirements. Establish a list of hardware and software items necessary to complete the design, including spare parts and hardware maintenance schedules. Establish a contingency plan for minor design changes that must be made during system design.

F. Present a security analysis and network backbone design review to Code 530 and the Directorate DPI-ITSO for approval before initiating the procurement to implement the design. Risk Assessment and Approval will be performed by the appropriate Data Processing Installation - Information Technology Security Official (DPI-ITSO), who will provide formal (dis)approval of the completed backbone implementation per Chapter 18 of the *NASA Automated Information Security Handbook.*

G. Choose a vendor that meets the necessary security, architecture, management, and functional switching requirements. Procure all components necessary to meet on-line and sparing requirements of the network backbone design.

H. Develop a general outline for the *System Test Plan* and establish contingency plans that address problems that may interrupt the operations of the NCC. This will be used as a baseline for the *System Test Plan* document.

I. Develop informal documentation for the new LAN architecture. Specific documents required are the *Operations Concept, Implementation Plan, System Test Plan,* and *Training/User's Guide*.

J. Establish a multi-phase transition plan that produces minimal impact to normal operations of the NCC (as much of the network equipment as possible will be installed without establishing links with the current NCC equipment to maintain minimal transitional impact to NCC operations). Develop and provide installation instructions to NCC personnel for installing the communication equipment in the NCC. Develop the necessary configuration management documentation for equipment configuration and installation (engineering change requests, engineering changes, configuration change requests, etc.).

K. Implement the design. After installing all equipment necessary to make the transition, the formal transition will begin.

L. Establish a list of personnel who require training. Initiate a training course that instructs network managers on how to effectively manage and troubleshoot the new hardware/software which will be used in the backbone implementation. Additional training may be required off-site for certain vendor equipment.

M. Initiate system test and make the necessary design changes to provide a working system.

N. Assist the NCC Acceptance Test Team (NATT) in the development of a System Acceptance Test Plan. Provide support during the System Acceptance Test as requested by the NATT.

4. RELATIONSHIP TO OTHER ACTIVITIES

All activities performed under this project (as outlined by this Project Plan) make up a component of the overall NCC98 LAN Upgrade project which includes SPSR and CCS modifications, Network and System Management (NSM), NCC Security De-classification, NCC IP Address Transition, and the NCC Firewall (NFW) implementation and as such is being performed in coordination with these other components.

There are risks and uncertainties associated with upgrading the current NCC LAN, especially during the critical transition period that involves cut-over from the existing architecture to the new one. Implementation of the transition plan will strive to retain the maximum amount of redundancy that exists in the current LAN design in order not to impact the operations of the NCC. However, there may be some activities during the critical transition period that could impact normal and/or test operations of the NCC.

There also exists a potential conflict between NCC testing schedules during NCC98 testing and the NCC LAN transition which is currently scheduled during early July 1997 for the Development LAN portion and late July - early August 1997 for the Operational LAN portion.

5. MANAGEMENT

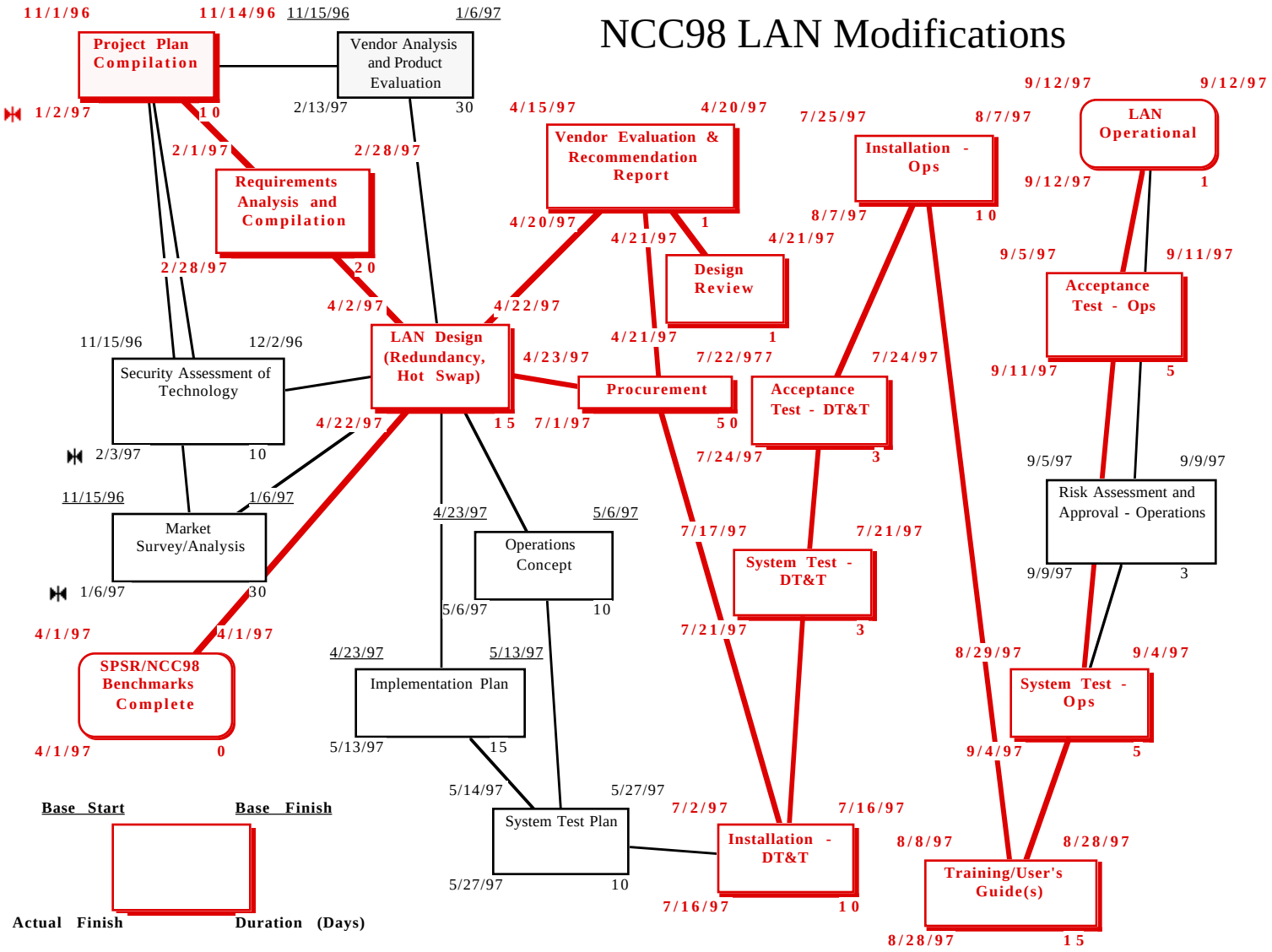
The NASA NCC Project Manager is John Donohue. The CNMOS contractor support team consists of Lockheed Martin Space Mission Systems and Services (LMSMSS) and Allied Signal Technical Services Corporation (ATSC) personnel. LMSMSS (Jeff Crowder) is responsible for the network backbone architecture design, market research and evaluation of networking equipment and vendors, establishing the transition, system test, contingency plans, design implementation, and assisting in system test and operational turnover. ATSC personnel (Robert Kannenberg, Jim Nangle) will provide security issue consultation on current NCC security requirements and technology assessment. ATSC (Kevin Willis) will provide assistance for the development of the required project documents (*Operations Concept*, *Implementation Plan*, *System Test Plan*, and *Training/User's Guide*) in addition to necessary installation documents such as Engineering Changes (ECs or ETNs). Additional ATSC personnel will perform installation of cabling, system test, and system installation (switches, hubs, etc.).

6. STAFF/BUDGET REQUIREMENTS (OBEs/$K)

Available upon request from the NCC Project Office. The anticipated expenditures on necessary equipment and software to upgrade the network backbone of the NCC are estimated as follows (figures for *Switches, Hubs, Spares, etc.* are preliminary and will be updated once a manufacturer is chosen):

Switches, Hubs, Spares, etc.	$ 250,000 - 350,000
Network Management software	$ 2,000 - 10,000
Training (Maintenance, System Administration)	$ 10,000 - 15,000

7. SCHEDULE


NCC98 LAN Modifications
11/1/96
11/14/96
11/15/96
1/6/97
Project Plan Compilation
Vendor Analysis and Product Evaluation
1/2/97
10
2/13/97
30
2/1/97
2/28/97
Requirements Analysis and Compilation
2/28/97
20
4/2/97
4/15/97
4/20/97
Vendor Evaluation & Recommendation Report
4/20/97
4/21/97
1
4/21/97
Design Review
4/22/97
LAN Design (Redundancy, Hot Swap)
4/21/97
1
11/15/96
12/2/96
Security Assessment of Technology
4/23/97
7/22/977
Procurement
7/25/97
8/7/97
Installation - Ops
8/7/97
10
9/12/97
9/12/97
LAN Operational
9/12/97
1
9/5/97
9/11/97
Acceptance Test - Ops
9/11/97
5
7/24/97
Acceptance Test - DT&T
7/24/97
3
4/22/97
15
7/1/97
50
2/3/97
10
11/15/96
1/6/97
Market Survey/Analysis
1/6/97
30
4/23/97
5/6/97
Operations Concept
5/6/97
10
7/17/97
7/21/97
System Test - DT&T
7/21/97
3
9/5/97
9/9/97
Risk Assessment and Approval - Operations
9/9/97
3
4/1/97
4/1/97
SPSR/NCC98 Benchmarks Complete
4/1/97
0
4/23/97
5/13/97
Implementation Plan
5/13/97
15
8/29/97
9/4/97
System Test - Ops
9/4/97
5
5/14/97
5/27/97
System Test Plan
5/27/97
10
7/2/97
7/16/97
Installation - DT&T
7/16/97
10
8/8/97
8/28/97
Training/User's Guide(s)
8/28/97
15
Base Start
Base Finish
Actual Finish
Duration (Days)