3 Case Studies

This chapter describes related work performed for other Sandia departments over the past two years. The work has been predominately the animation of Pro/Engineer assemblies, through which we have been able to convert a large number of people to the visualization design center paradigm. Some projects have been one-time affairs, others are on-going and we are still heavily involved. All projects have been greatly enhanced by the use of the visualization design center equipment, software, and techniques.

3.1 Stronglinks

The first Sandia part chosen for proof-of-concept was the MC4438 Single Stronglink Assembly (SSA). This mechanism is one of two independent stronglinks used in the Pit Reuse for Enhanced Safety and Security, Cruise Missile applications (PRESS/CM). The stronglink is a rugged, mechanical device used to ensure the safety of nuclear weapons in both normal and abnormal environments. In the prototype environment that was built for

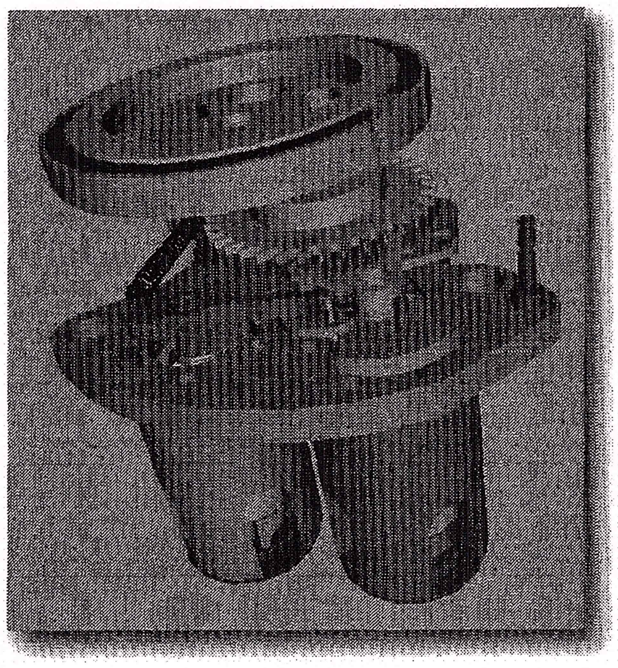

Figure 3-1 Stronglink Iterations

this project, the simulated design team was able to view and manipulate the stronglink assembly by using both the solid modeling application (Pro/Engineer) and the interactive engineering visualization/animation tools (VisMockup/VisLab). Additionally, a static VRML model of the assembly and a kinematic animation were generated for viewing with a World Wide Web (WWW) browser. For this application, just the first four steps of the stronglink device were animated.

2.2.3.3 Remote Control of Visualization Consoles

It is not enough to be able to view a remote computer's console locally. In order to perform the engineering design and analysis functions required the local user must be able to control the contents of the remote visualization computer's display. X-Windows provides the ability to display a window from the remote computer on the local display, but does not permit the control of the console itself. The technique we employ uses software provided on SGI workstations. The Networked Dual-head Software Daemon, ndsd, enables a machine with ndsd software, the "slave" machine, to accept keyboard and mouse input from another machine on the network. The slave machine appears as a virtual desktop to the left (or right) of the master machine's desktop. In the test configuration we employed, when the user moved the mouse past the right edge of the master display, the mouse and keyboard then controlled the slave computer. Using this software, in combination with the FORE AVA/ATV hardware, we are able to control the remote visualization console using the local keyboard and mouse, and display this on a local monitor or projector.

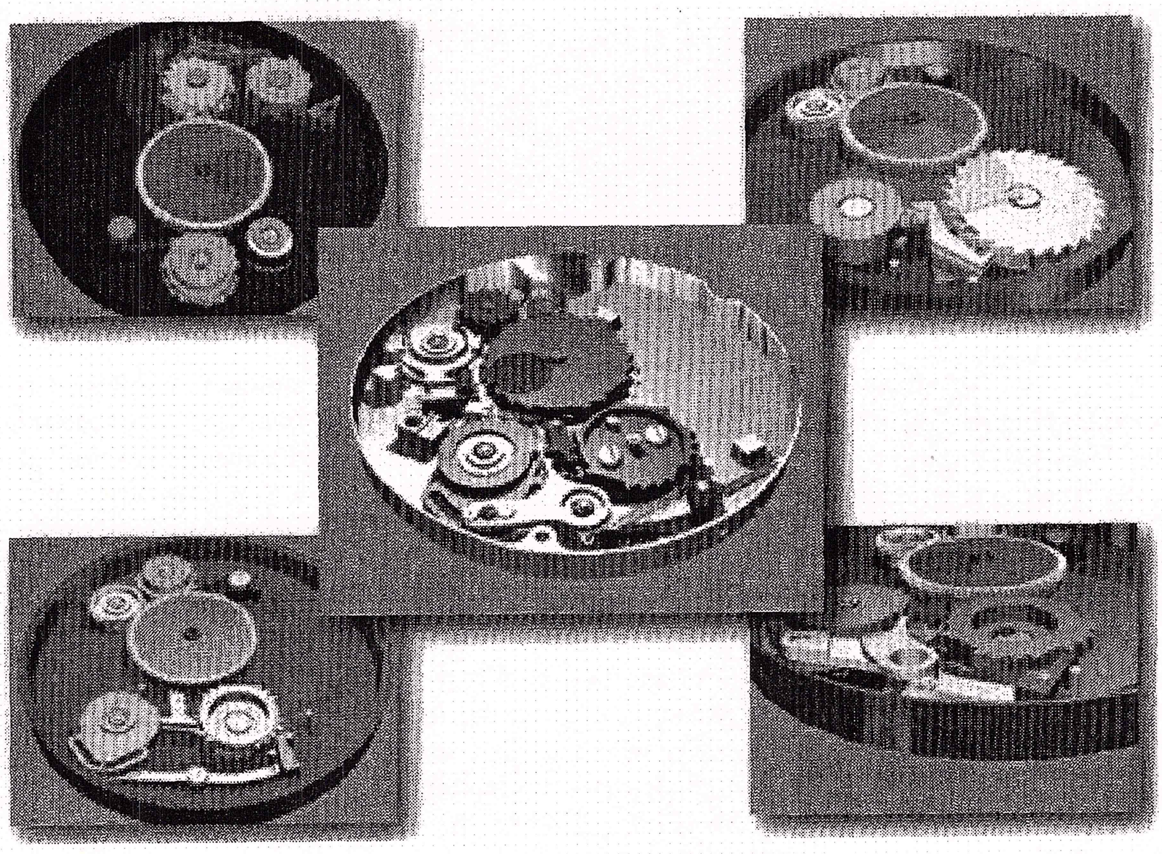

Figure 3-2 Five Versions of the CDSL

When shown the capabilities of the environment, the engineers and designers of the current generation stronglinks requested a simulation of the motion of their current Colocated Detonator Stronglinks (CDSL) safety system for SWPP/PR. Figure 3-2 shows pictures of five generations of stronglinks taken from video clips generated for their project. Figure 3-3 is a picture of a prototype stronglink being proposed for the W87. The last video clip produced was an animation showing, from different perspectives and with varying visible parts, how a lockup occurs when an incorrect sequence is entered.

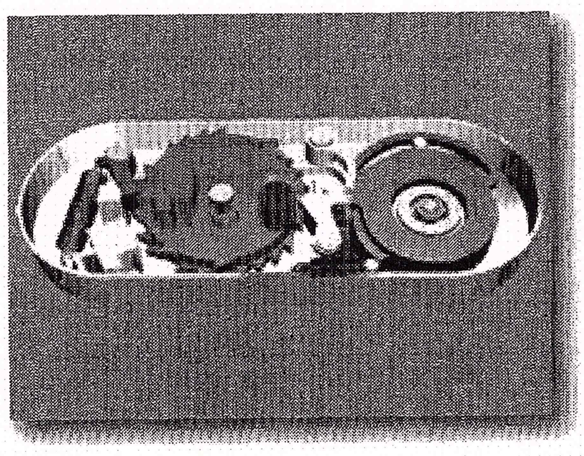

Figure 3-3 Prototype W76 Stronglink

These video clips have been used to show the interior workings of mechanisms before the part was actually built, detailing even the motions of coil and leaf springs in a manner that can be easily understood by both designers and engineers. They have been perceived as a great success for the visualization efforts at Sandia.

3.2 SWPP

The SLBM Warhead Protection Program (SWPP) is a joint DOD/DOE program to examine replacement options for the W88/Mk5 and W76/Mk4 systems. During the progress of the Pit Reuse Option, a prototype system is being assembled for a flight test in 2000. Multimedia assembly procedures are being developed to replace the traditional paper bound instruction procedures used in the past. The goal of these multimedia assembly procedures is to create a more thorough assembly procedure and record of assembly by incorporating various forms of media (pictures, video, and computer simulations) into a single database.

The following statements summarize some of the benefits of each type of media:

- Photos are much more descriptive than sketches and are the quickest information to incorporate into the multimedia procedures.
- Videos provide a realistic view of the time and complexity of a process by showing footage of actual assembly steps being completed.
- Computer simulations have some unique characteristics relative to the photos and filmed videos.

EAI's VisLab software was used to create the computer simulations used in the multimedia assembly procedures. The simulations were developed based on Pro/Engineer models of the system. These models were then modified to make certain components transparent providing a unique perspective of the assembly process that was previously not available. There are often assembly steps that are blind operations where the user can not see the internal interactions of parts. By showing transparent models of the system, the user can better understand the blind interactions of these internal components. Providing this additional information to the user creates a better understanding of the assembly, and ultimately helps to reduce errors during the assembly process. In a time critical project, errors in the assembly would be extremely detrimental to the on time and successful completion of flight-test unit assemblies. The use of very descriptive multimedia assembly procedures that utilize a combination of photos, video, and simulations will be integral to the successful completion of the SWPP Pit Reuse flight test assemblies.

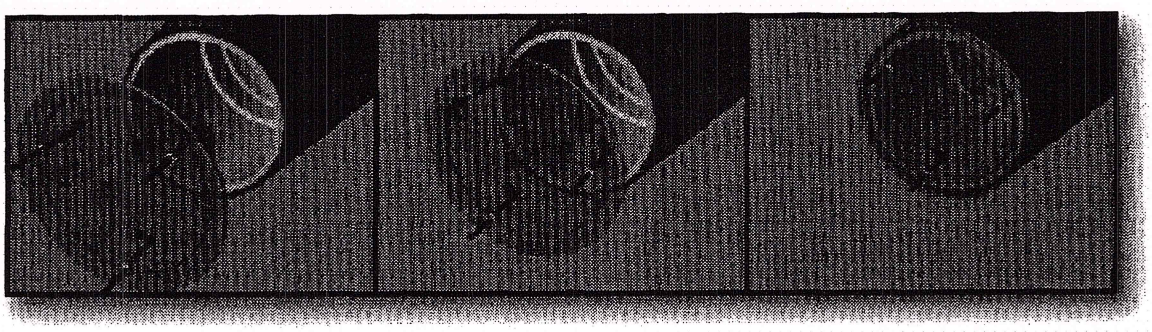

Figure 3-4 SWPP Animation Frames