

October 15, 1997

Bunny White
Archivist – Lucent Technology
600 Mt. Avenue
Rm 3A-302
Murray Hill, NJ - 07974

Bunny,

Attached is a map showing the principal installations of the SAGE System (Semi-Automatic Ground Environment) a USAF/RCAF project that comprised much of NORAD's air defense of the US and southern Canada back in the late 50's through the early 80's. Interceptor air bases of the Air Force and Navy are not all shown.

The NIKE anti-aircraft systems, Ajax and Hercules, (the Army's systems designed and built by Bell Labs and Western Electric) was integrated with this system. NIKE locations are not shown. This system was significant in many ways:

1. It was the first big integrated communications network. High speed data ran at 1300 BPS on the 1A Digital Signaling System between the worlds largest vacuum tube computers (AN/FSQ 7s and 8s) which were duplexed for reliability at 23 direction centers (sectors). The sectors were fed radar data from apx. 250 radar sites, Texas Towers, picket ships, airborne radar, and weather stations. The 23 sectors fed summarized track data to seven regional combat centers, in turn to the NORAD center at Colorado Springs.
2. It gave the computer industry a big boost. The IBM 7090 was essentially a solid state version of the AN/FSQ 7/8 which was also converted. **Burroughs** also had a pre-processor at the radar sites.
3. The first ground control of interceptor aircraft was carried out by this system. Ground to air radio provided digital vectoring of the aircraft to the pilot via a fire control CRT on the aircraft. A wide variety of jet aircraft and air to air missiles were used.
4. Digital Display Technology was promoted. Light pens, random access digital display CRTs were developed by Hazeltine and IBM and used by the thousands in this system.
5. Simulation of hostile aircraft was developed by WE during the implementation of the system. This was done to cut down the use of large aircraft as targets during training exercises, and system integration testing of ground to air radio and interceptors. (Live aircraft were used in the final system tests but not actually shot down.)
6. The first in line microfilm fast processed 35 mm projection displays were incorporated. These preceded the printer plotters that followed in the 60s and 70s and were able to project a large screen display within 30 seconds of the computer generated display.
7. WE was able to obtain a large number of computer trained personnel. At a time when very few computer trained people existed, close to 500 engineers and technicians were trained at MIT's Lincoln Labs in digital techniques, computer programming and radar and other systems integration areas. These people often formed the cadres of computer personnel at many locations and other projects throughout the company when the SAGE implementation phase ended in the 1962-3 period.

Although the SAGE system design was led by the MITRE Corporation, Western Electric's Air Defense Engineering Service (ADES), headquartered on Church Street NYC, was awarded the systems integration contract to coordinate the installation, and perform the subsystems and

systems tests. (The good work on the DEW Line around the Arctic Circle helped getting the award.) It checked out hardware and software of many subcontractors (IBM, Borroughs, RAND/SDC, GE, Philco, Raytheon and others including AT&T)

WE hiring started in 1955 and hit full stride in 1957 with training started at Murphy Army Hospital in Boston and then moved to MIT Lincoln Labs, Lexington MA. Class groups of about 15 started about every three weeks. Training lasted nine months for the first three years, afterwards which, with trained people in the field, it was cut to six. Students were paid a base salary but not paid expenses until they went to the field and were expected to find their own housing with many going to boarding houses and apartments in Cambridge.

Upon graduation they were assigned to one of five field test teams that would move about every nine months if the sector tests went well. The first five sectors to be checked out were on the East Coast. Test teams were comprised of about 50 to 65 persons; half at the direction center, half at the radar and ground to air radio sites. At the end of a sector about ten persons were left behind to handle retrofit changes and upgrades. The others would be split into two groups with half matching up with half of another group at a new sector; the other half with another at another new location. Retrofit personnel losses were replaced with "rookies" just out of school. (The old men were those with two or three year's experience.) It made for close friendships between couples that shared the hardships of the road, moving and looking for a new place every nine months.. Essentially your company work mates and their spouses were your family. Those friendships lasted for many decades after the project winded down.

The first sector (New York Air Defense Sector) was cut over in late 1958. The entire 23 SAGE sector and 7 combat center job was completed in 1962 (on time) with smaller scale retrofits taking place for a few more years. A few of the experienced people went to Bell Labs Whippany where they worked on a series of very involved tests of SAGE and NIKE Hercules air defense effectiveness in 1961-62. An experimental SAGE system was maintained in Montgomery, AL for testing of new sub-systems through the 60's.

In the early 60's, some of the personnel of WE ADES were phased into Bell labs/WE projects such as MAR-I, NIKE X/Safeguard, Underwater Defense, and ESS. Some went to WE factory or service locations, Bell operating companies and AT&T. Many, longing to be closer to home, now with children, or seeking another venue went with NASA, Jet Propulsion Labs, or other companies.

SAGE was a great project for the country, the company, and most of the people who worked on it. For many it was a way of learning a new field, getting to see the country, and make a few dollars in the process, - a great adventure which led to many good things.

Robert F. Martina (Lucent ret.)
9870 Jennifer Lane
Shreveport, LA 71106

e-mail: rfjm9870@aol.com
phone: 318-797-5419