5S Implementation & Hurricane Recovery at Space Shuttle Softgoods Shop

United Space Alliance (USA), LLC

Dave Tucker

Kurt Van Dyke

May 2005

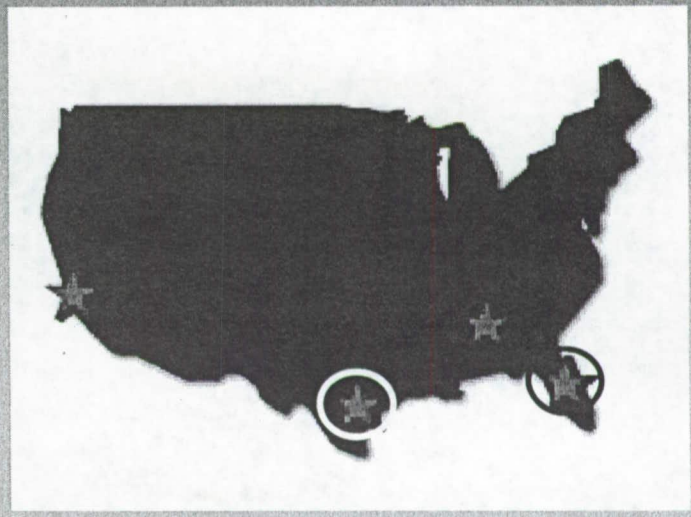
USA
United Space Alliance

L6S

United Space Alliance (USA)

Who are we?

- Prime Contractor to NASA for Space Flight Operations Contract
- Responsible for all Space Shuttle Fleet & International Space Station processing operations
- Two primary locations:
  - Johnson Space Center, TX
  - Kennedy Space Center, FL
- About 10,000 employees



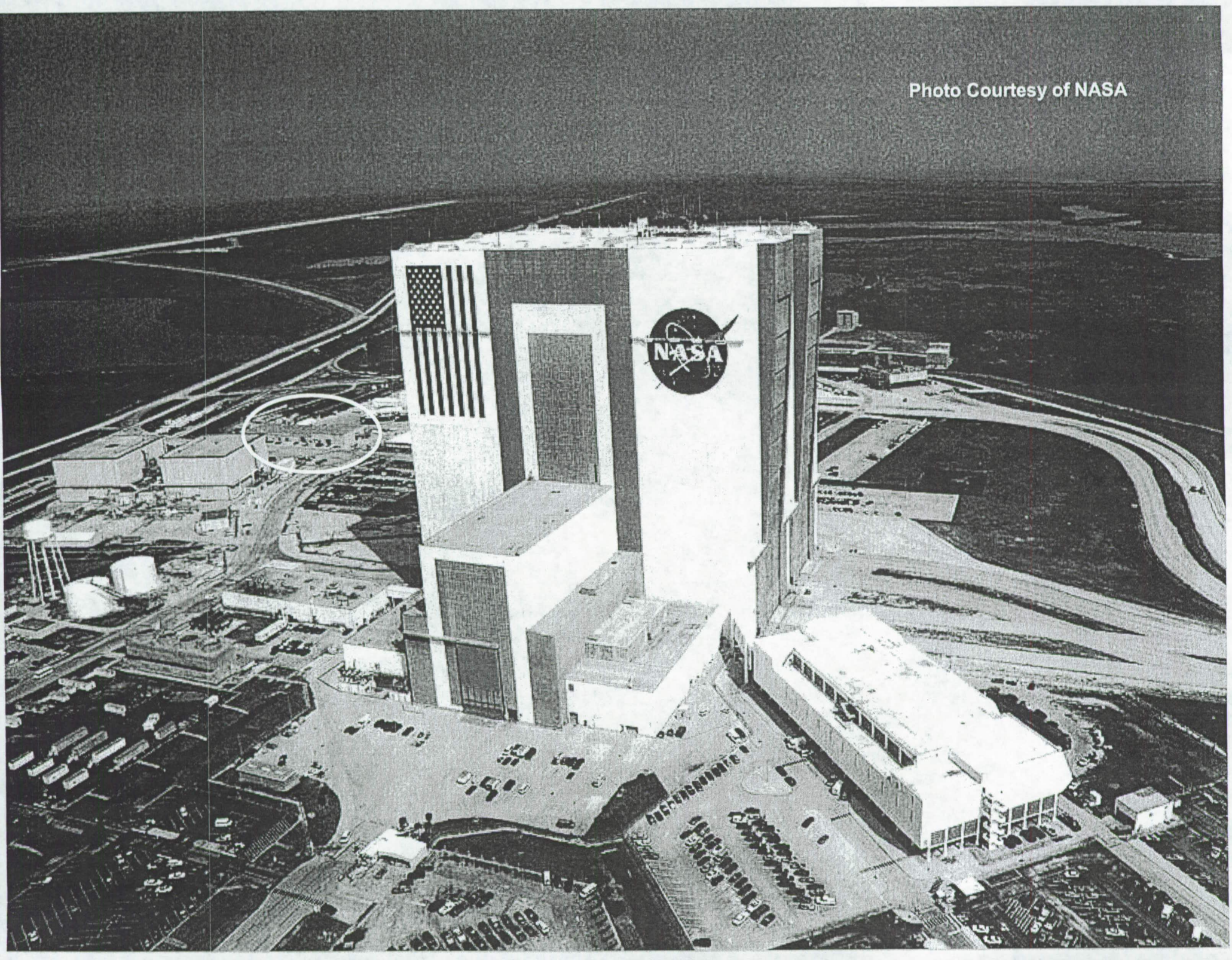


Photo Courtesy of NASA
NASA

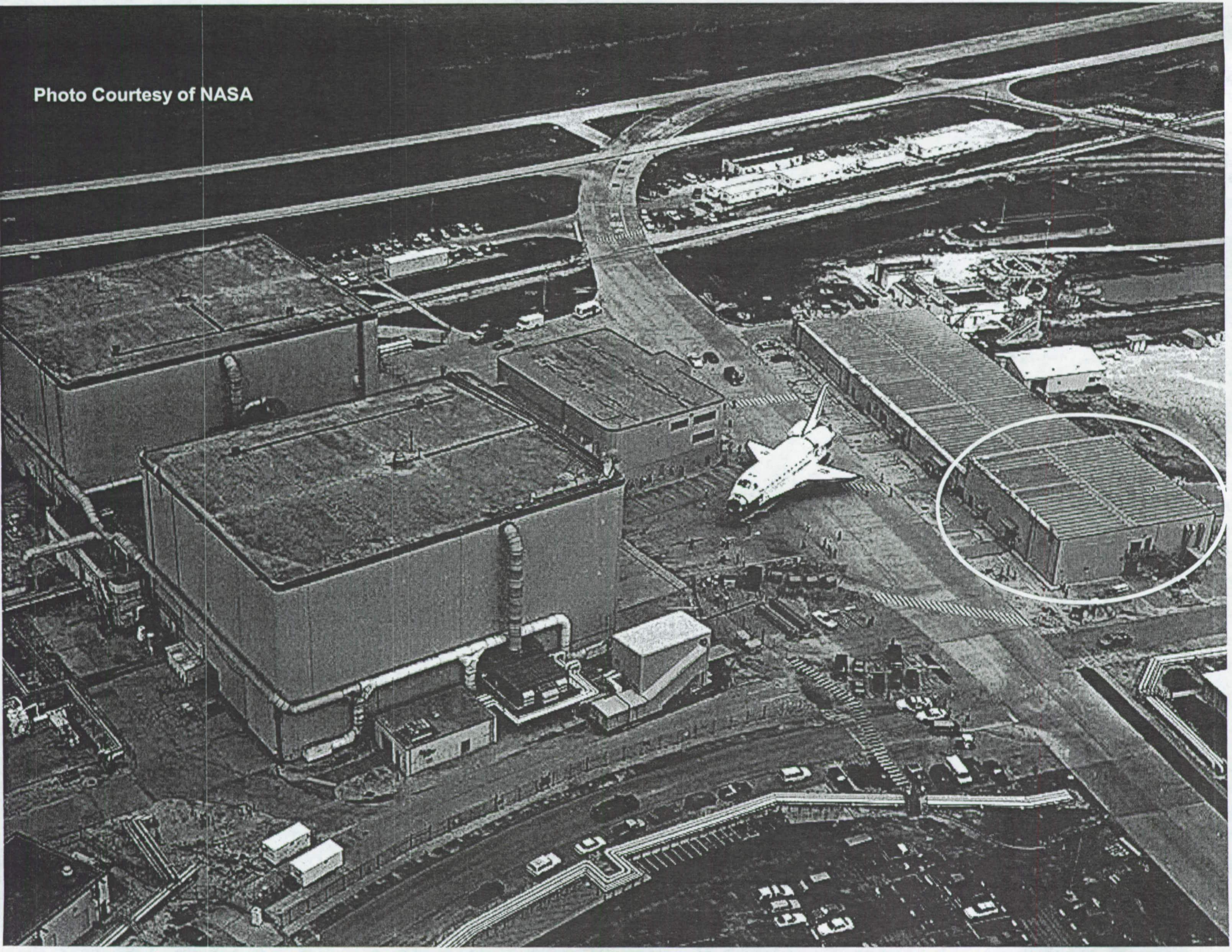
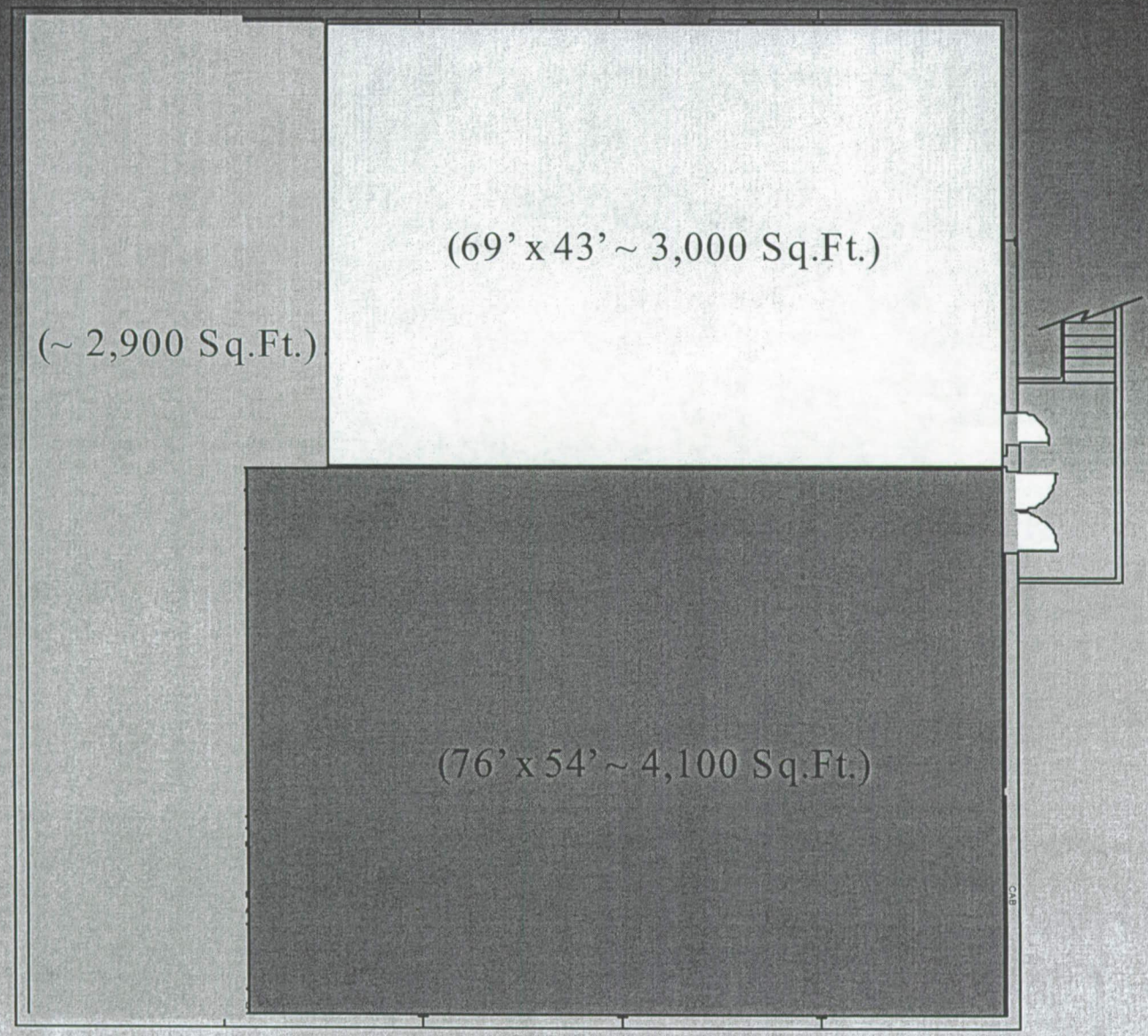


Photo Courtesy of NASA

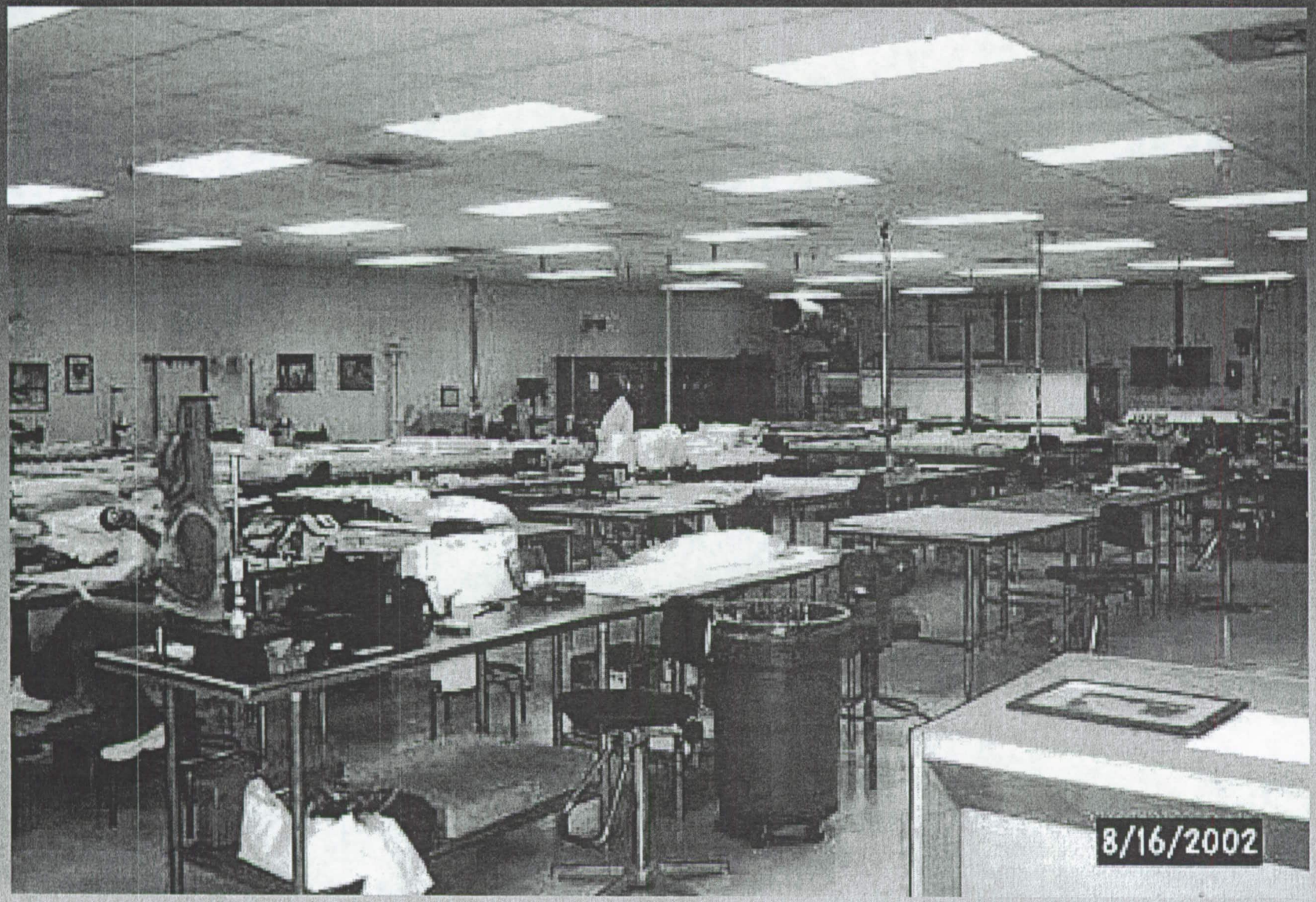
Thermal Protection Systems Facility (TPSF)

- TPSF produces over 90 different items related to shuttle thermal protection
- Tile Production - downstairs
- SoftGoods (SG) - upstairs
  - Items are hand stitched or sewn on machines
  - 4,100 square foot open main work room
  - Adjacent is a 3,000 square foot room used for SG production tooling and materials storage

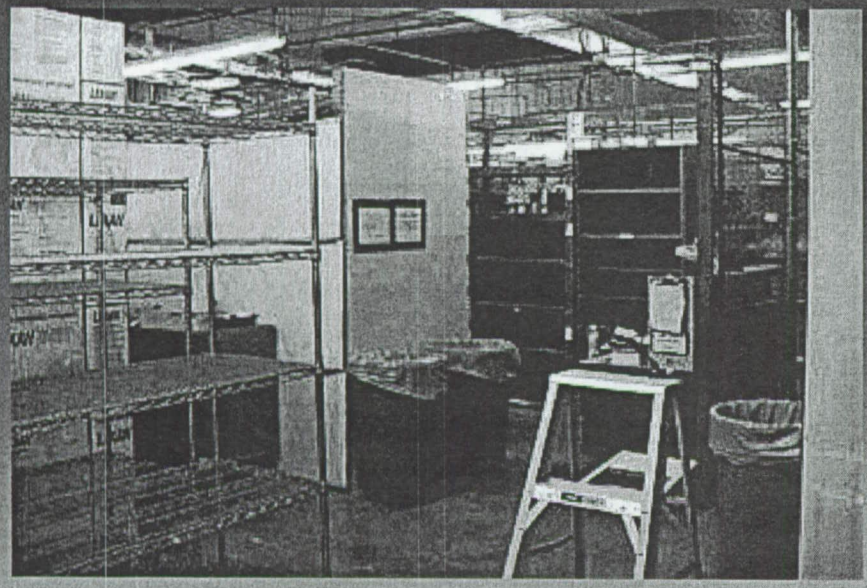
Team Challenge



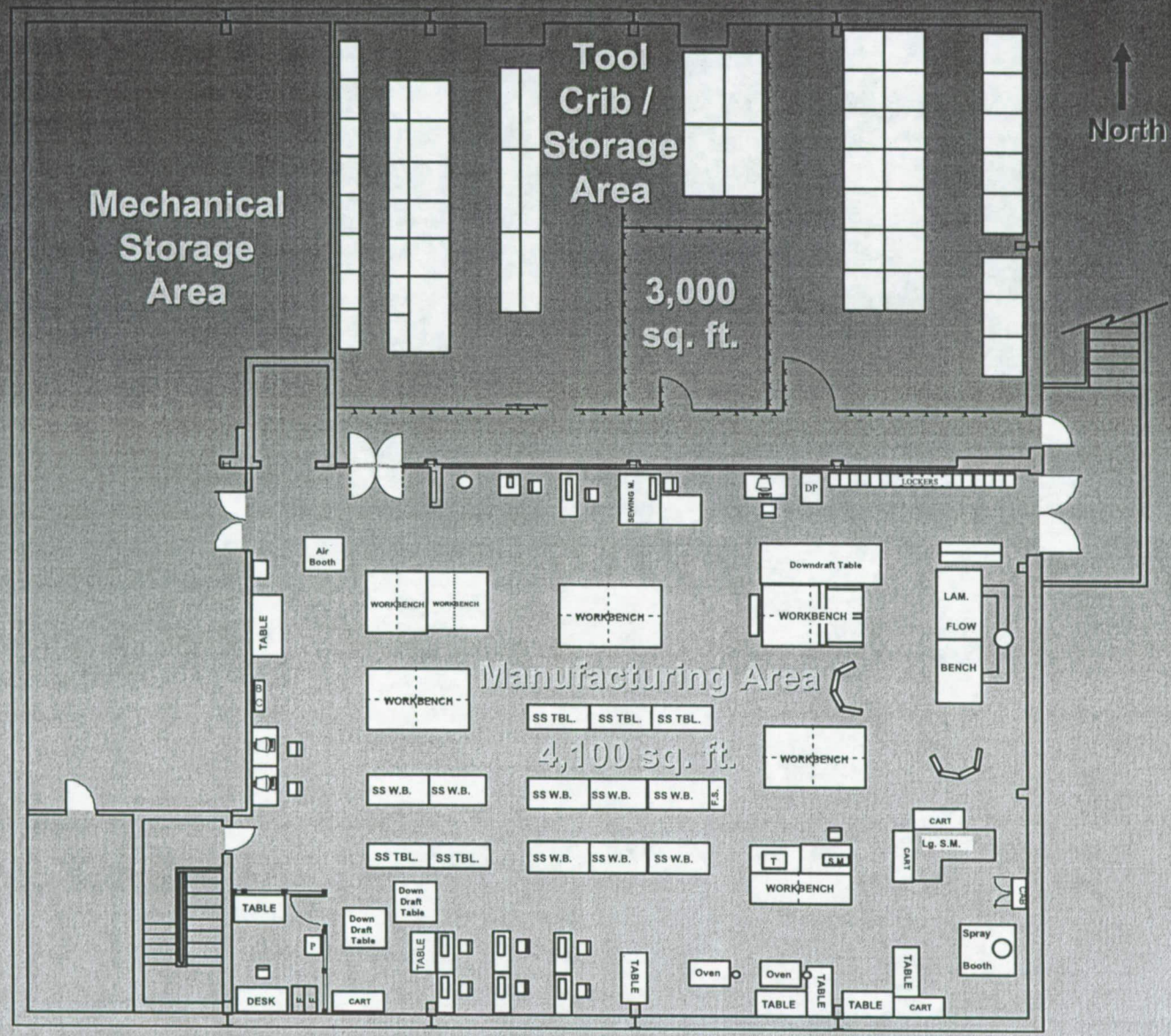
Soft Goods Main Work Area



Soft Goods Tool Crib Storage



SG Area Layout



Team Goals

- Review & improve the current physical layout of the soft goods manufacturing area including equipment, tools, parts staging areas, personal computers, and material supplies
- Create and optimize the processing of the four major product areas:
  - Thermal Control System
  - Non-Flight
  - SG: Thermal Barriers, Blankets & Seals
  - Gap Fillers

Kaizen / Process Improvement Team (PIT) Overview:

Kaizen/PIT is an intensive Continuous Improvement effort that assembles a dedicated cross-functional team for a short duration of time, who are empowered by management to seek solutions using Industrial Engineering Methodologies and rapidly implement the required changes.

Team Approach

- **Form Kaizen/PIT Team**
- **Understand the Current Process**
- **Identify Requirements**
- **Build a New, Improved Work Area**
  - Physical layout
  - Changes to the manufacturing work processes

Accomplish this in one week!

The overall goal of this effort is to implement the new process area* by the conclusion of the team event.

* To the greatest extent possible

5S Project Plan

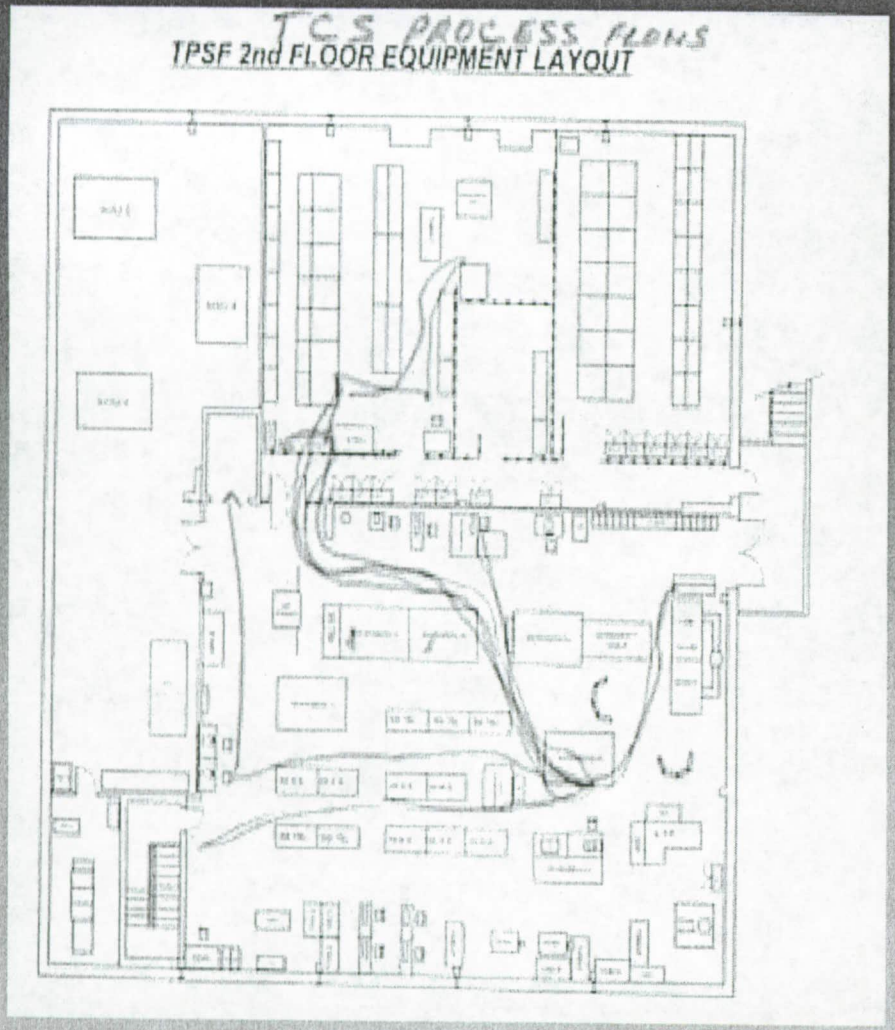
- **5S is a tool used to help create and maintain a clean, organized, high performance work place**
- **5S = Sort, Straighten, Shine, Standardize & Sustain**
- **The TPSF 5S Team:**
  - Members included SG Technicians, Quality, Engineers, Inspectors, Management, and outside facilitators
  - Received training, then worked 1 week performing a 5S exercise in the shop areas
  - Split into 3 sub-teams, each responsible for a portion of the Softgoods shop area and led by at least one facilitator

Team Activities

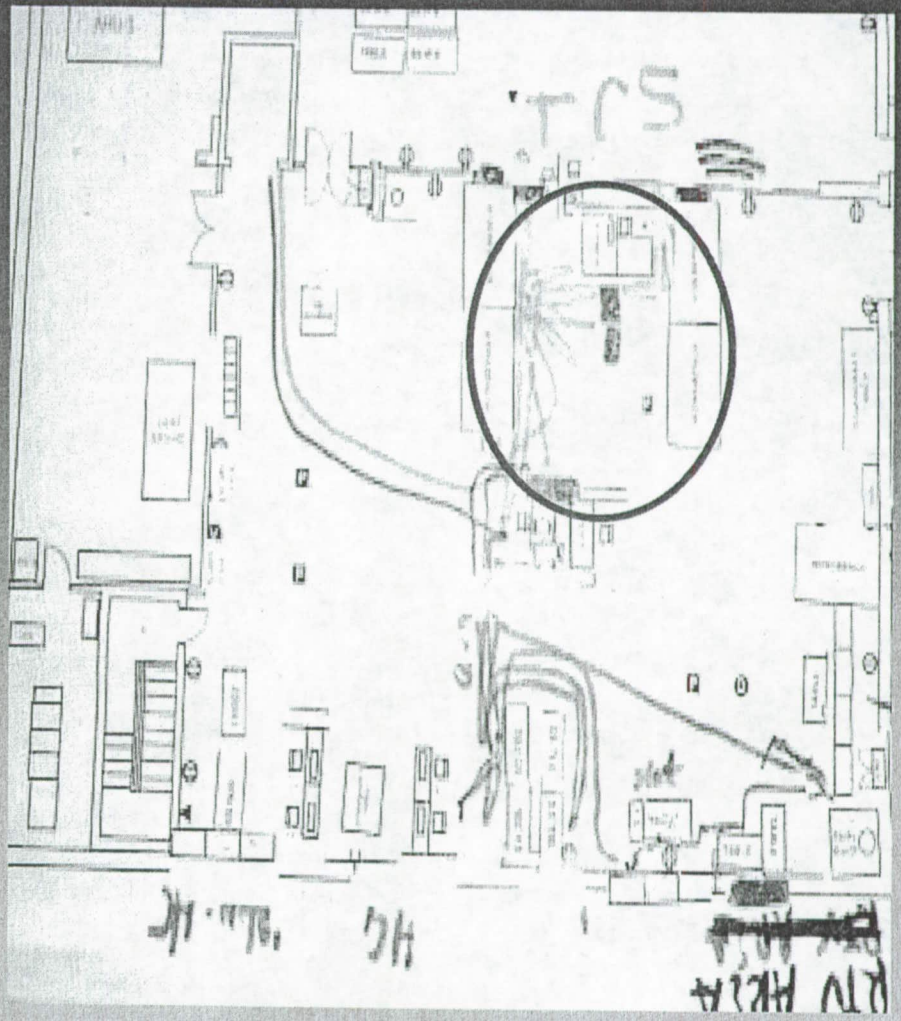
- **Apply Lean Manufacturing tools and IE Methodologies**
- **Optimize the work areas into product categories**
- **Team member duties included:**
  - Perform evaluation exercises using established criteria
  - Complete a "red tag" exercise to identify unneeded items
  - Remove unneeded items; relocate other items
  - Utilize layout drawings of shop areas to apply lean flow concepts at workstations
  - Organize workstations with materials & tools needed daily
  - Clean work areas, equipment, floors, cabinets, etc.
  - Utilize visual controls as appropriate

TCS - Work Travel

Before

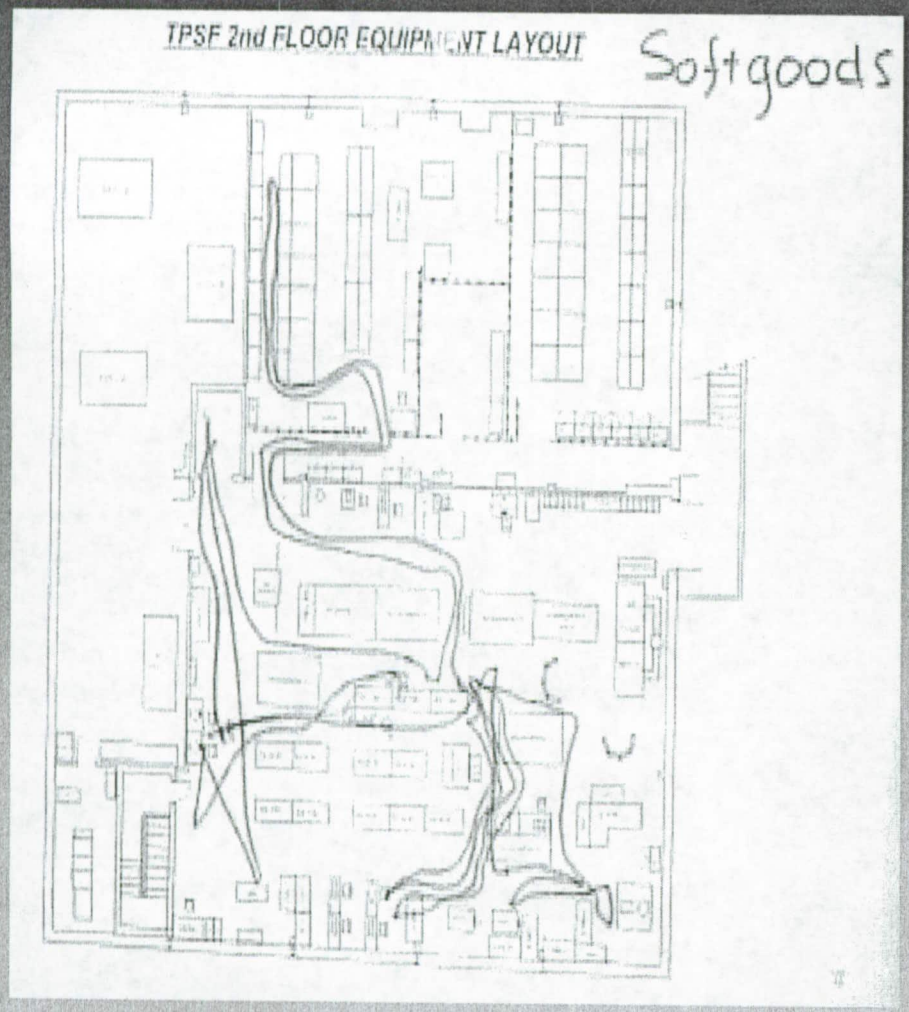


After

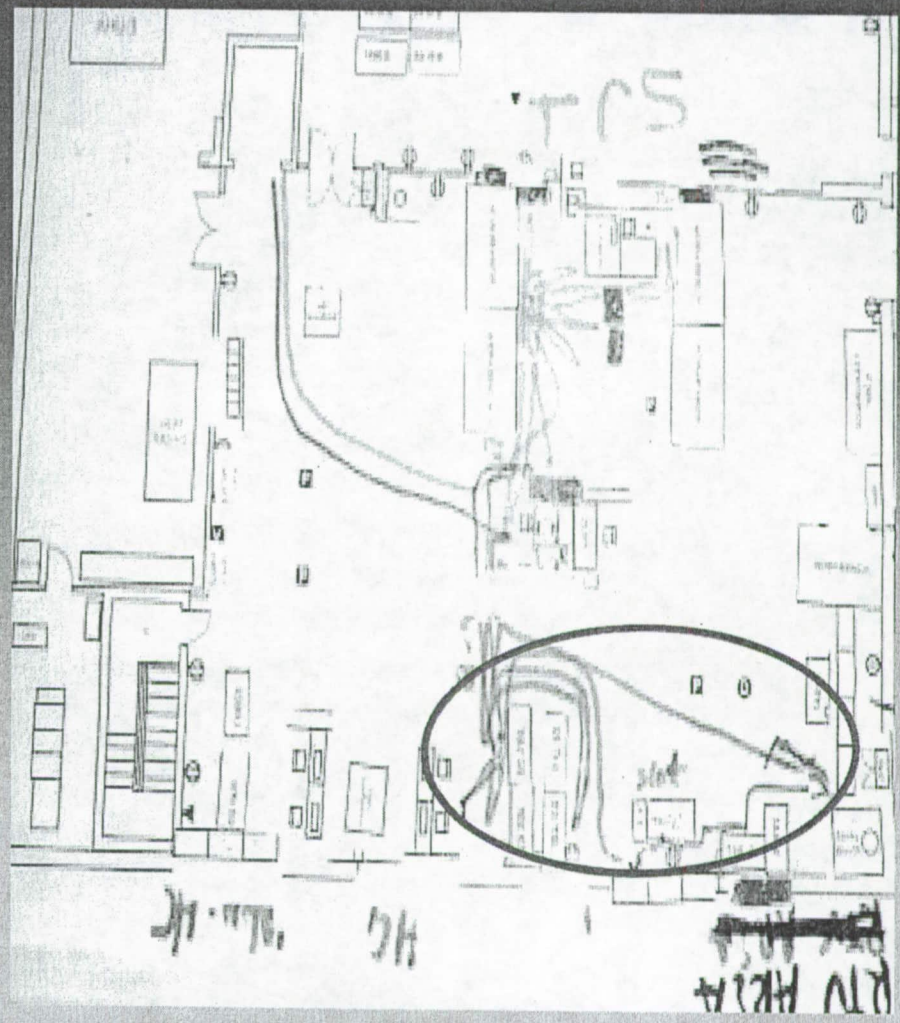


Softgoods - Work Travel

Before

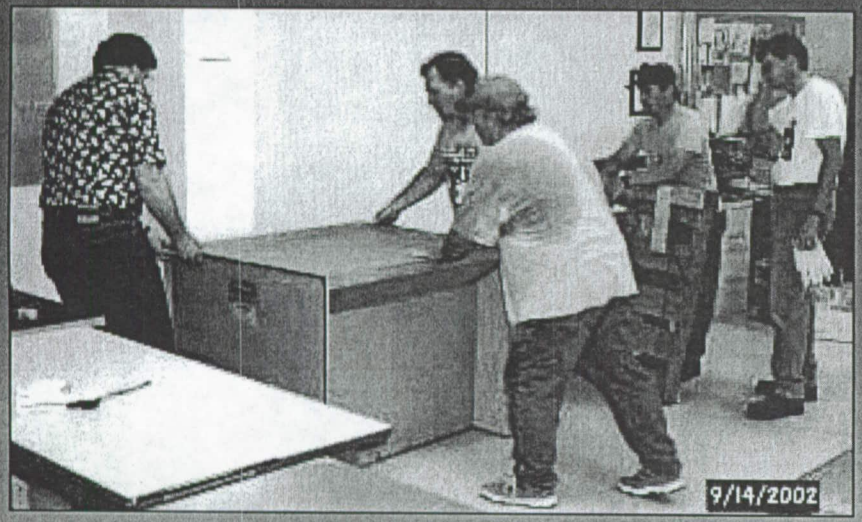


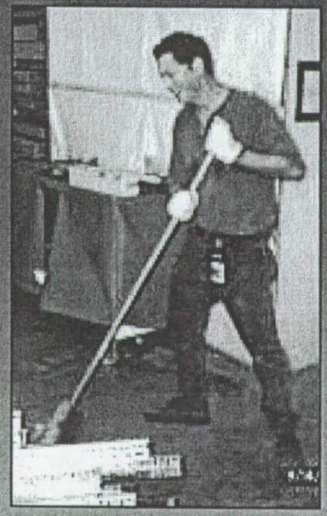
After

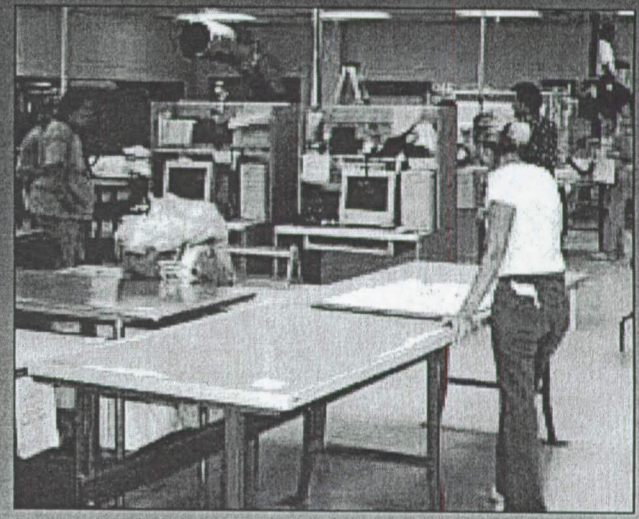


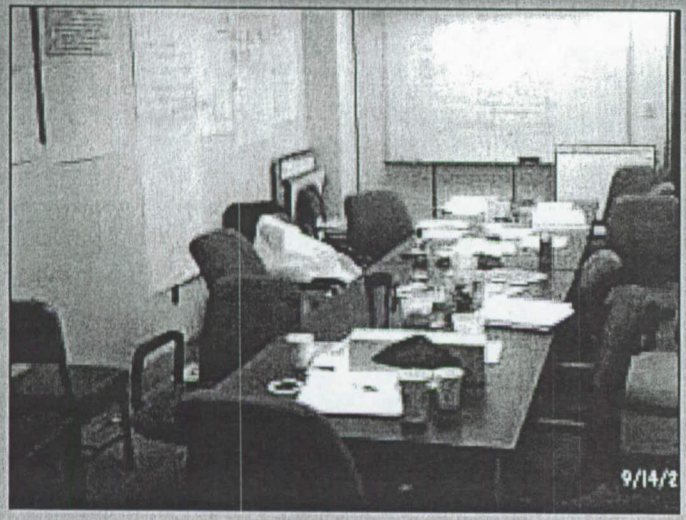
5S Team at Work

5S Works!









Major Changes

- Created six definitive production cells organized by equipment, bench space and raw materials required
- Developed a more organized and flexible work area
- Examined & reorganized the contents of tooling & materials storage area (tool crib)
- Cleared storage space to incorporate other Sew Shop Operations into the TPSF
- Removed excess equipment & unused materials

Results & Benefits

- **Increased work area by > 1,500 square feet**
  - Removed unneeded items: two large ovens, fume hoods, tables, carts of extra materials, shelving, etc.
  - Reduced storage area by 75%
- **Provided a Safer workplace**
  - Less congested areas for employees & flight hardware
  - Installed safety signs and created designated aisle markings
  - Removed minor potential safety problems:
    - Improved lighting in back room
    - Installed draft tables for highly fibrous materials

Results & Benefits

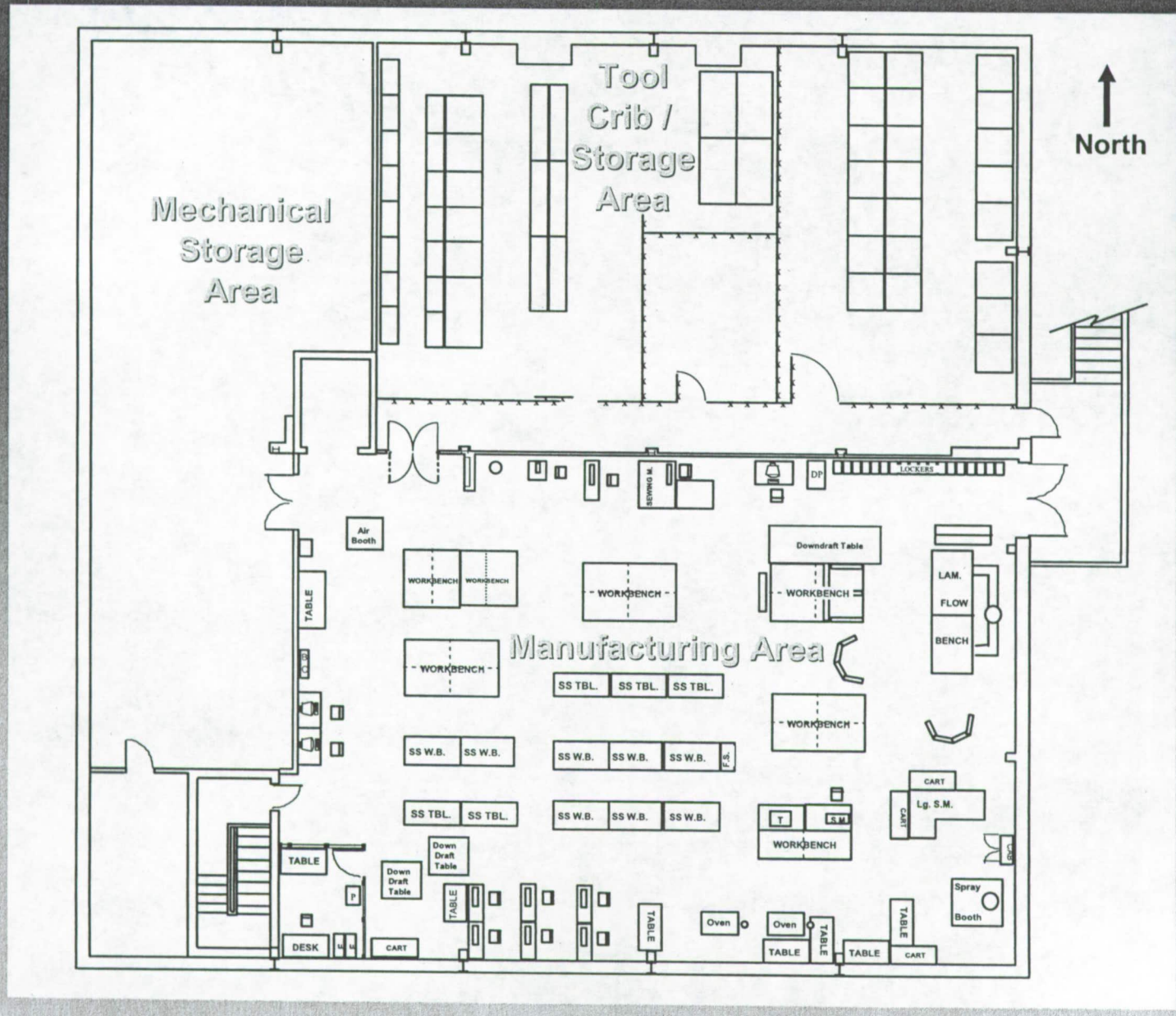
- **Created a clean, organized work area**
  - There is a place for everything and everything is in its place
  - Leads to quality improvements & increased efficiencies
  - Creates a positive image for our customers
  - Increases employee personal pride in the shop
- **Implemented Process Improvements**
  - Eliminated materials parts tag WIP validation
  - Eliminated the need to iron mylar templates
- **Enhanced SG Production Capability**

Results & Benefits

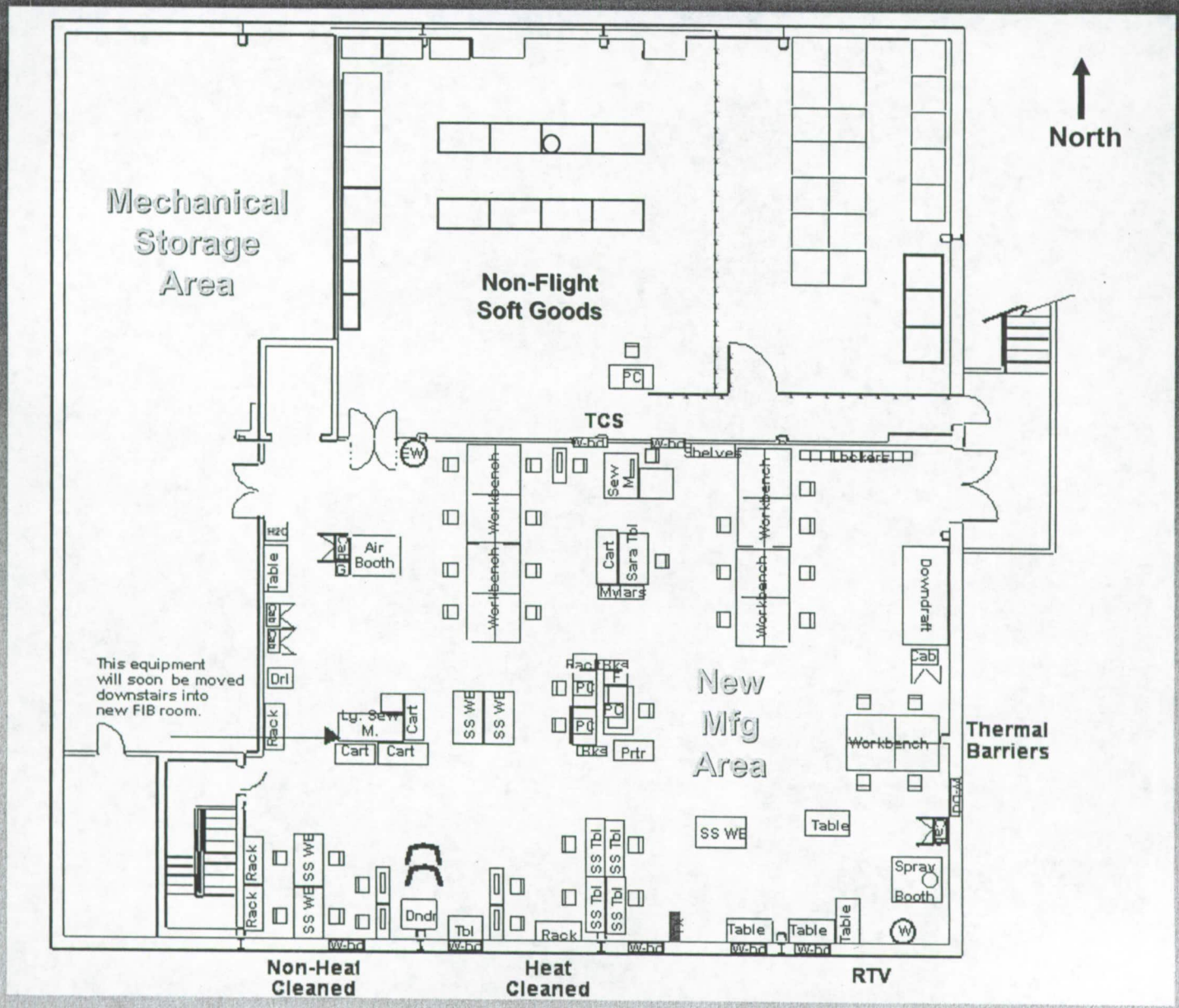
Reduced Employee & Part Travel distance by creating work cells

Location	Before	After	% Travel Distance Reduction
Soft Goods	1044 feet	372 feet	64 %
TCS	566 feet	311 feet	45 %
Non-Flight	155 feet	140 feet	10 %

Old SG Area Layout

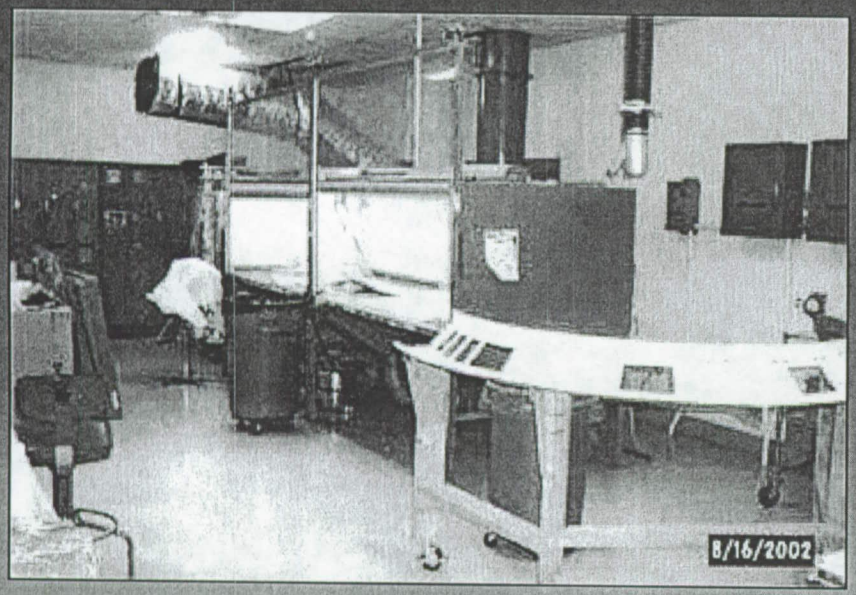


New SG Area Layout



SG Area Photos

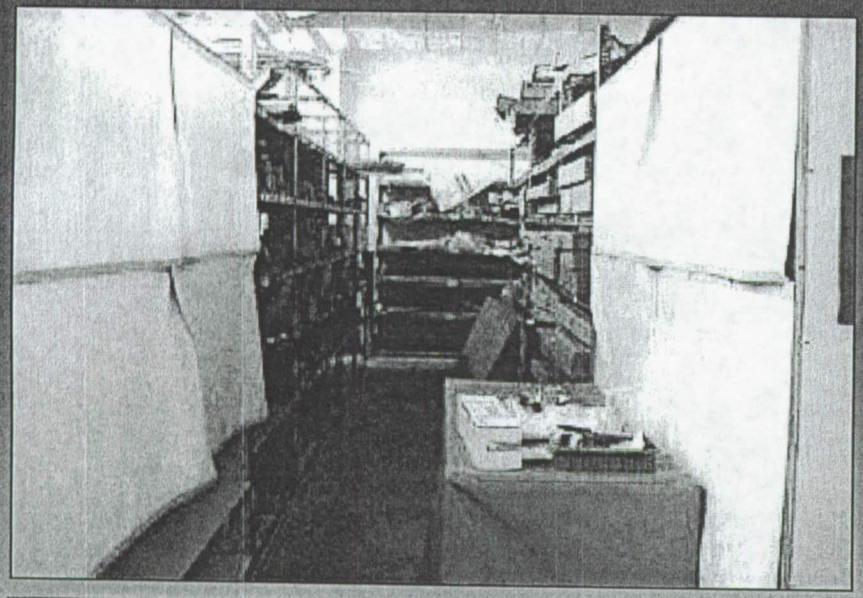
Before

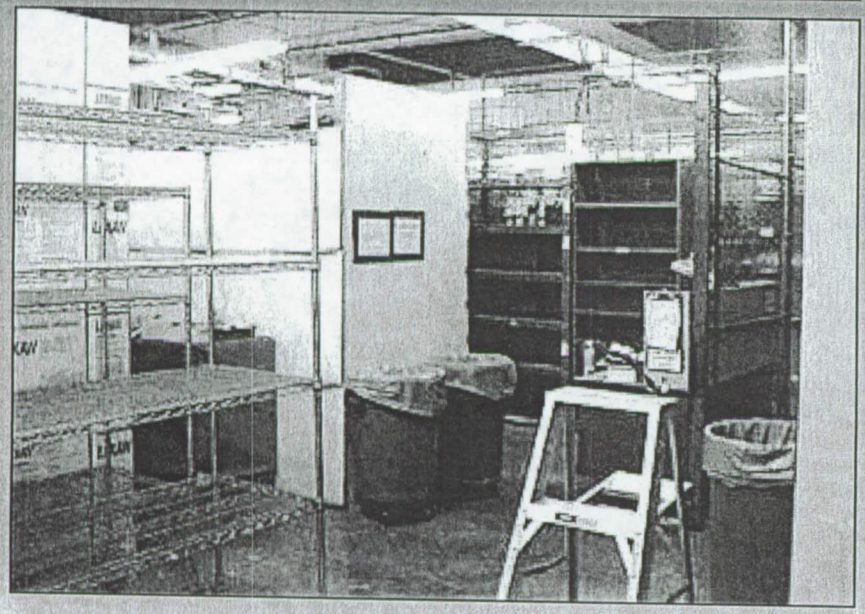


After

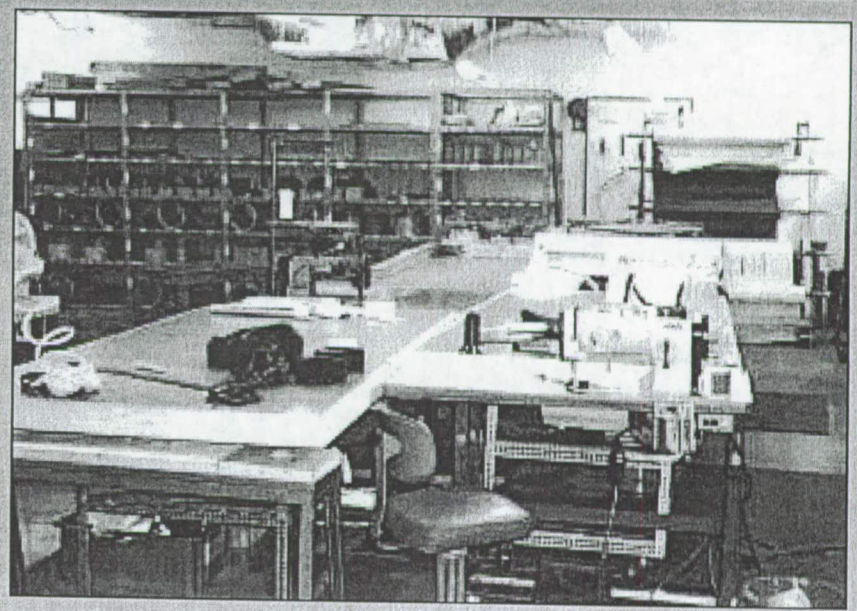
SG Area Photos

Before





After



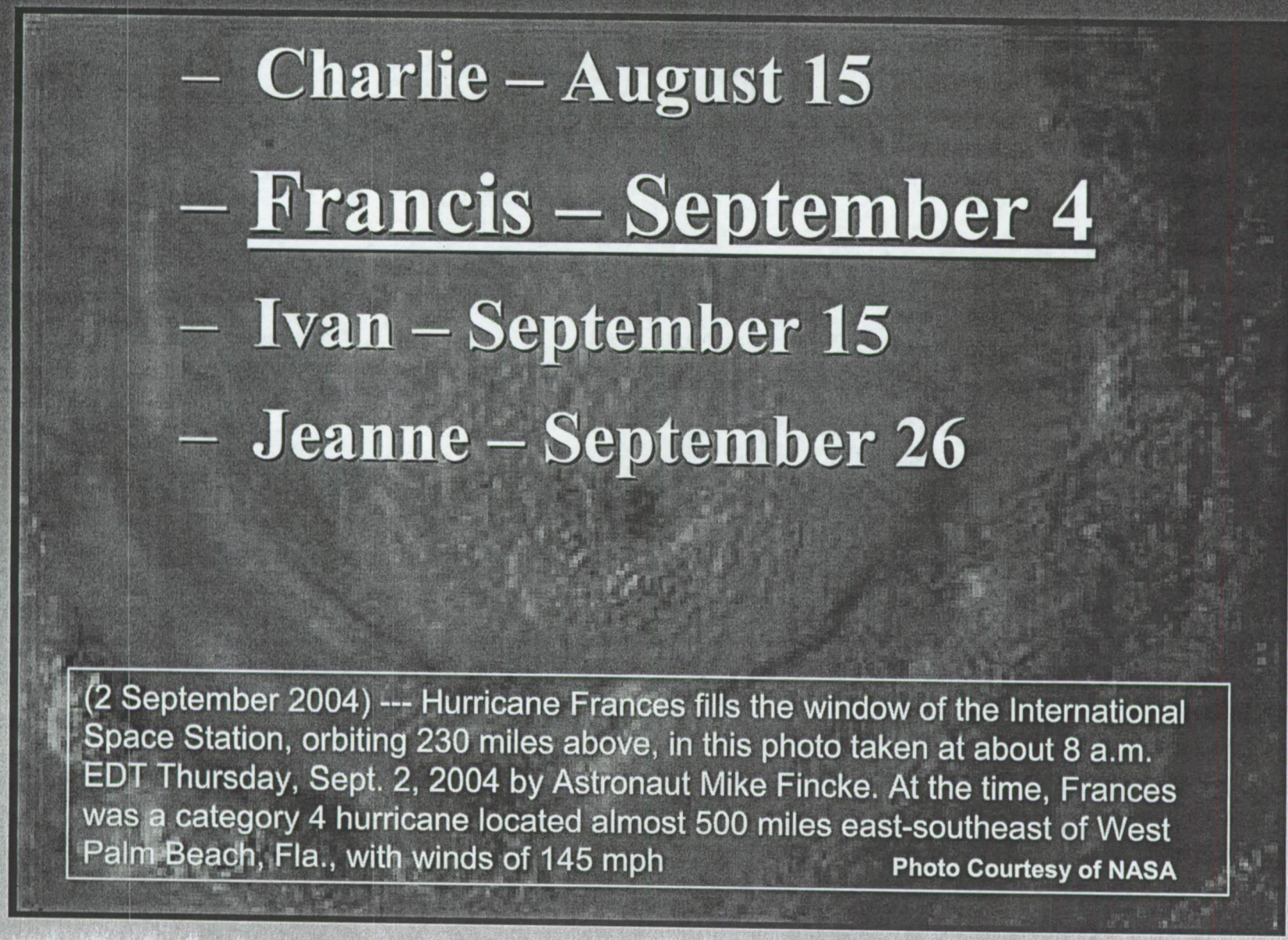
Next Steps

Maintain the Gains Achieved

- Technicians performed daily maintenance of the Shop areas
- Manager performed weekly walkthroughs and evaluations of affected areas
- Shop held regular meetings to maintain and improve 5S efforts

Hurricane Season 2004

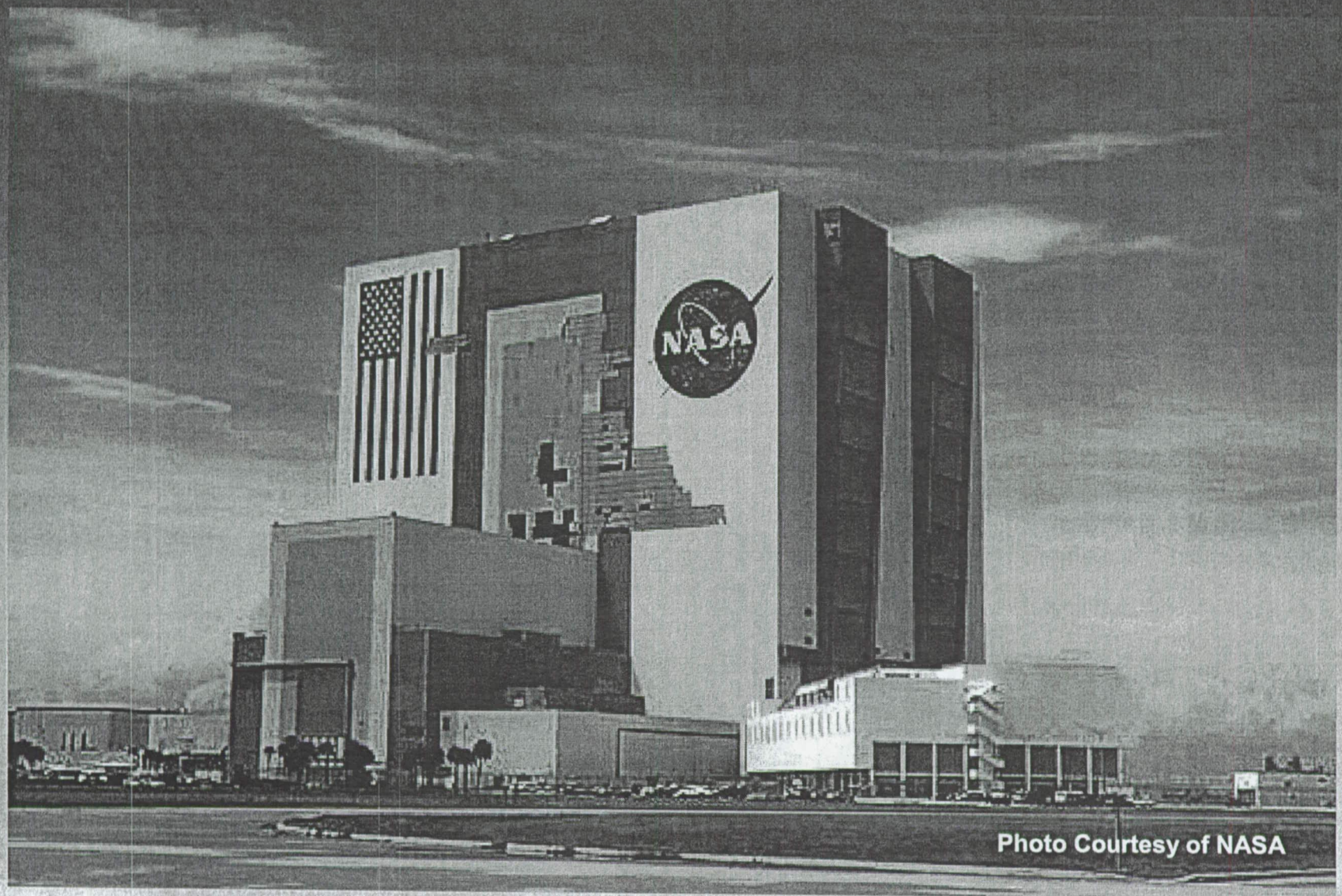
- Charlie – August 15
- **Francis – September 4**
- Ivan – September 15
- Jeanne – September 26



(2 September 2004) --- Hurricane Frances fills the window of the International Space Station, orbiting 230 miles above, in this photo taken at about 8 a.m. EDT Thursday, Sept. 2, 2004 by Astronaut Mike Fincke. At the time, Frances was a category 4 hurricane located almost 500 miles east-southeast of West Palm Beach, Fla., with winds of 145 mph

Photo Courtesy of NASA

Kennedy Space Center, FL



Kennedy Space Center, FL

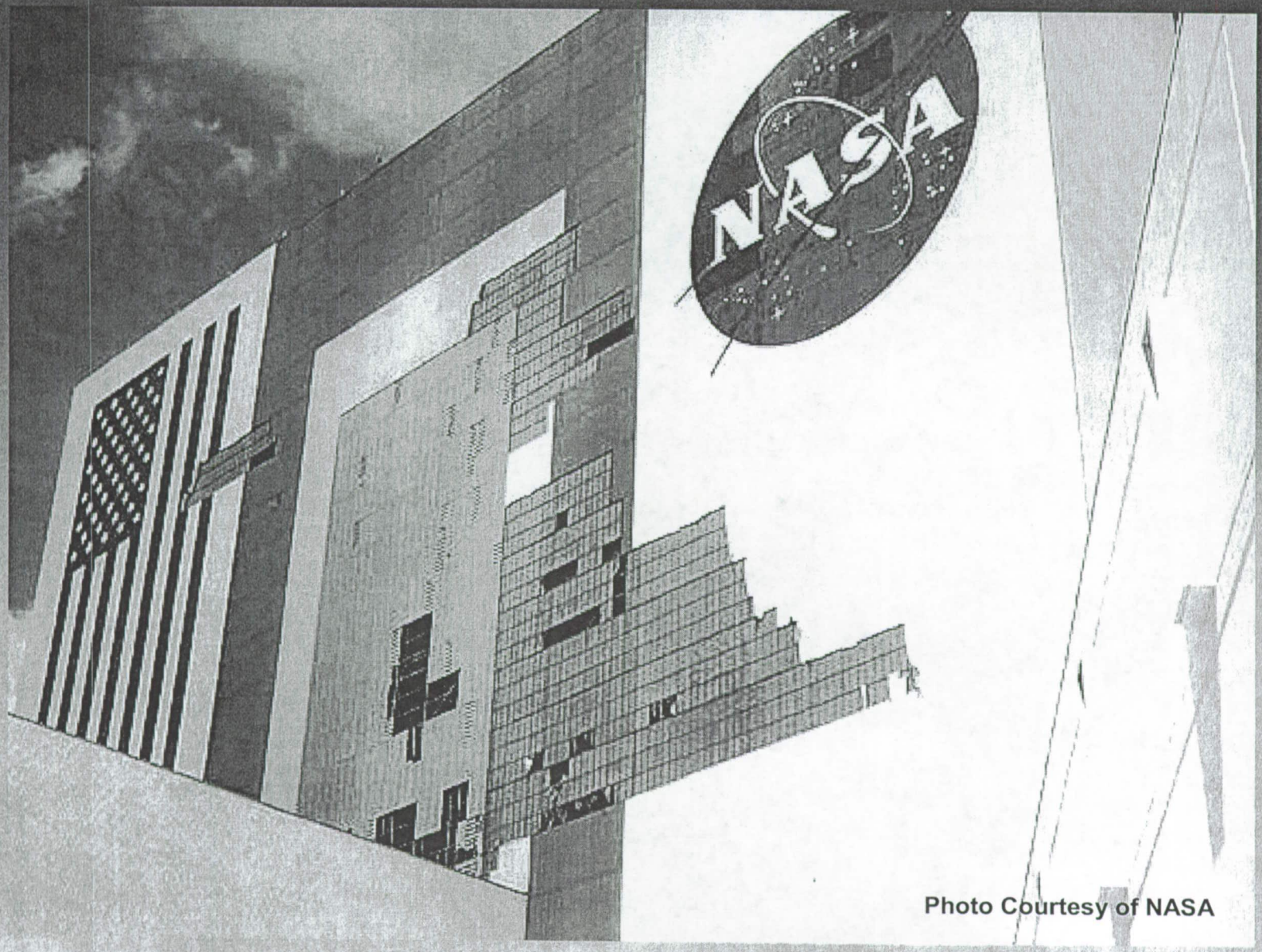
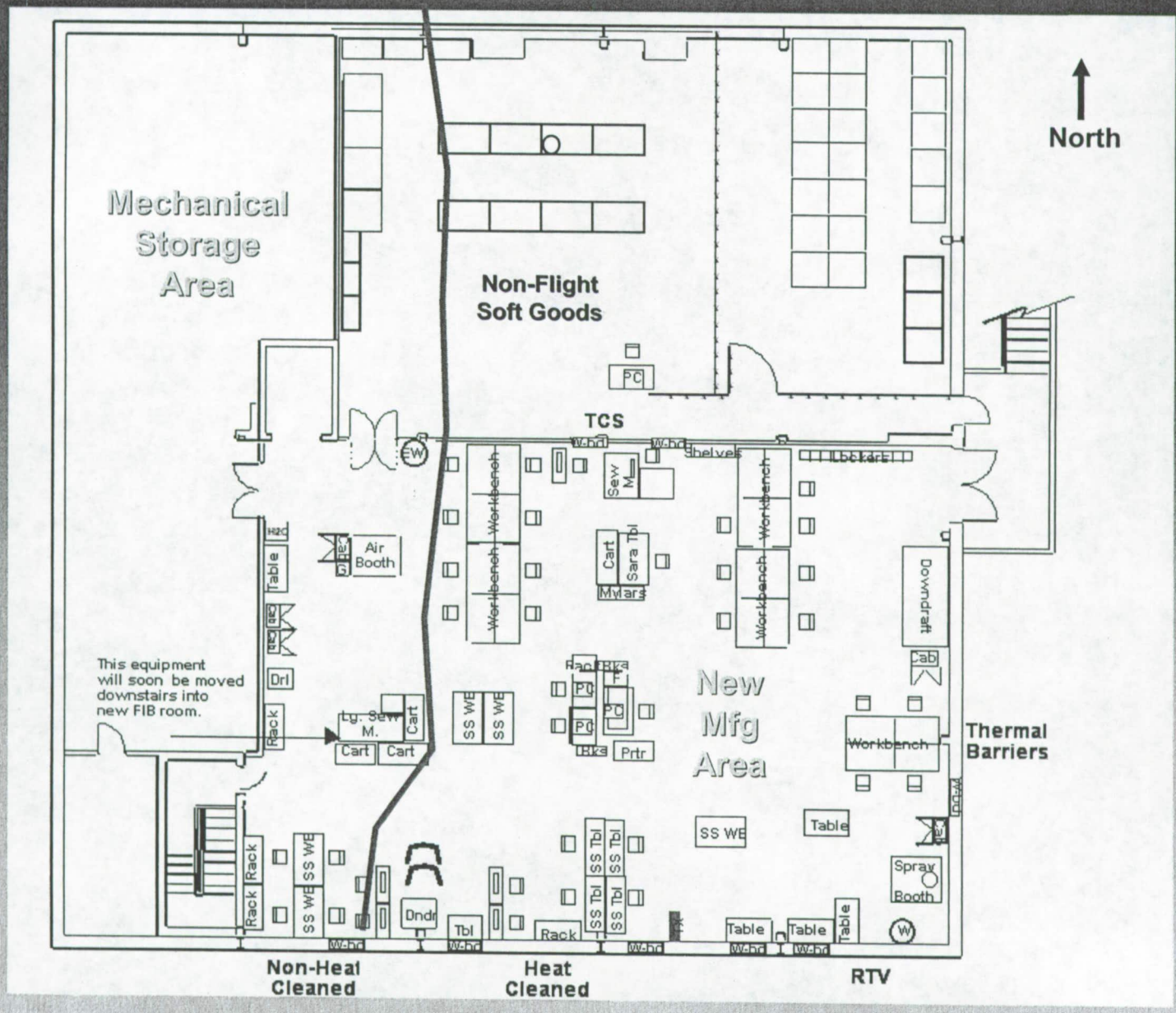


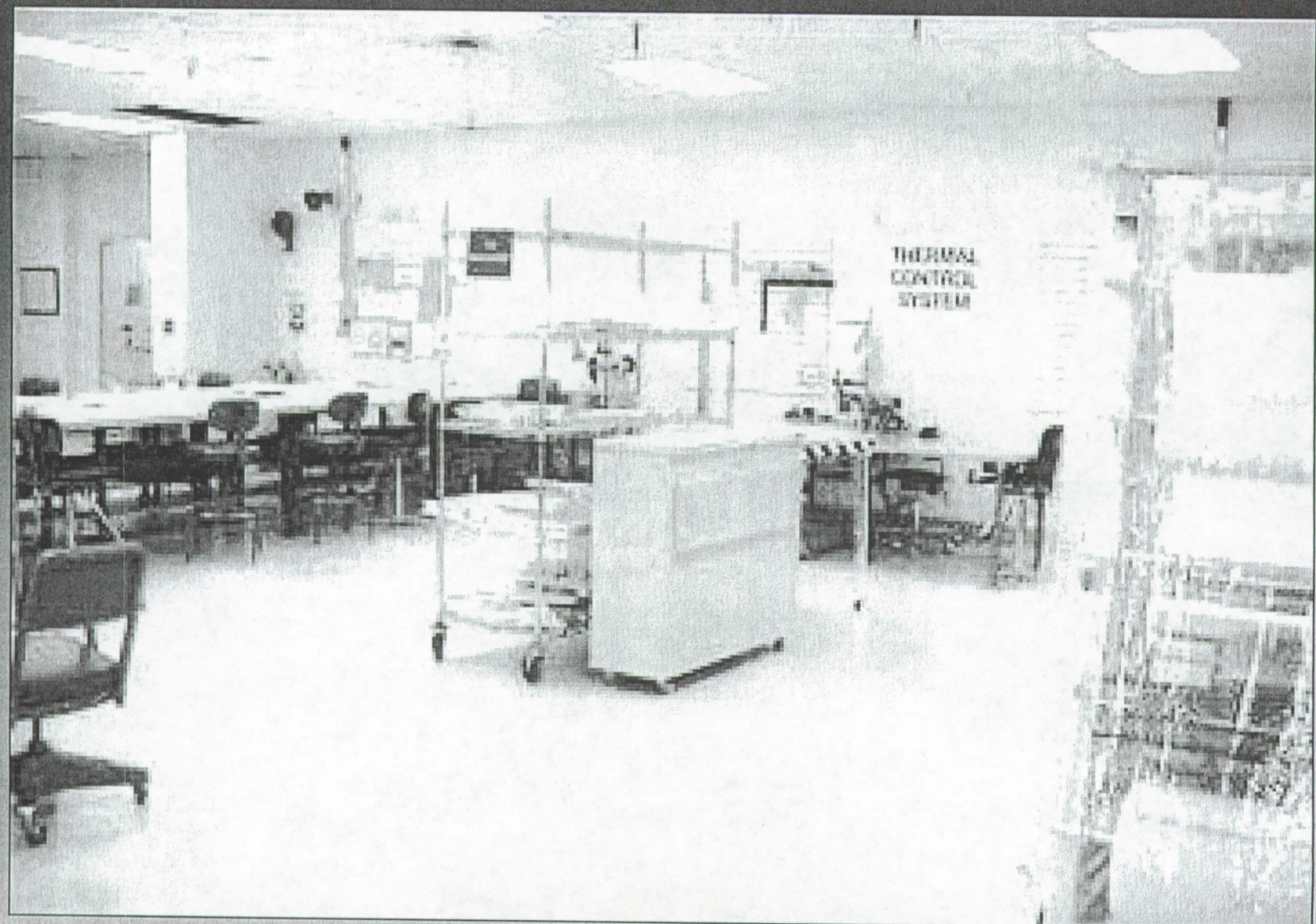
Photo Courtesy of NASA

TPSF Exterior Damage

SG Area Layout

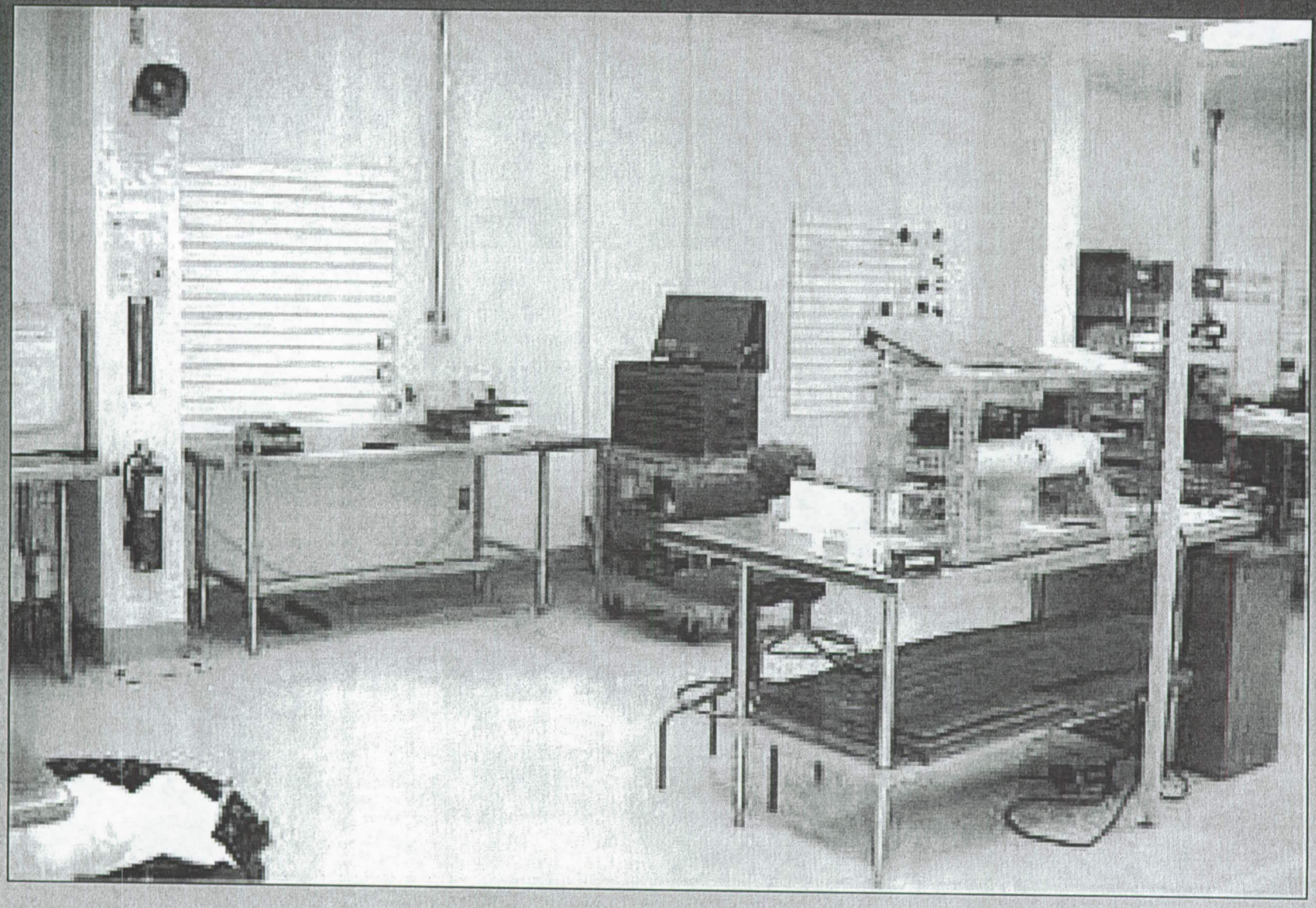


SG – TCS Area

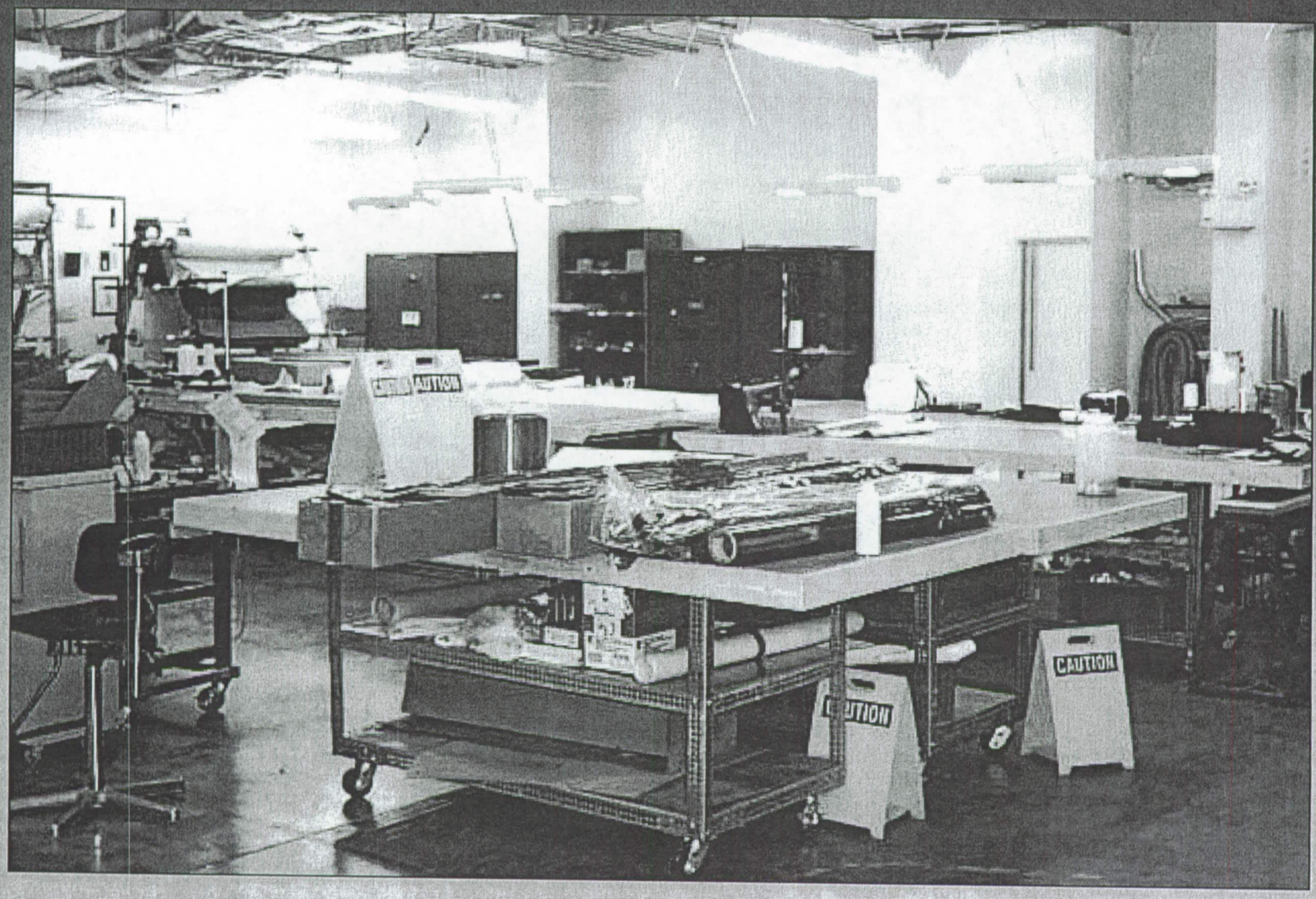


SG Thermal Barriers

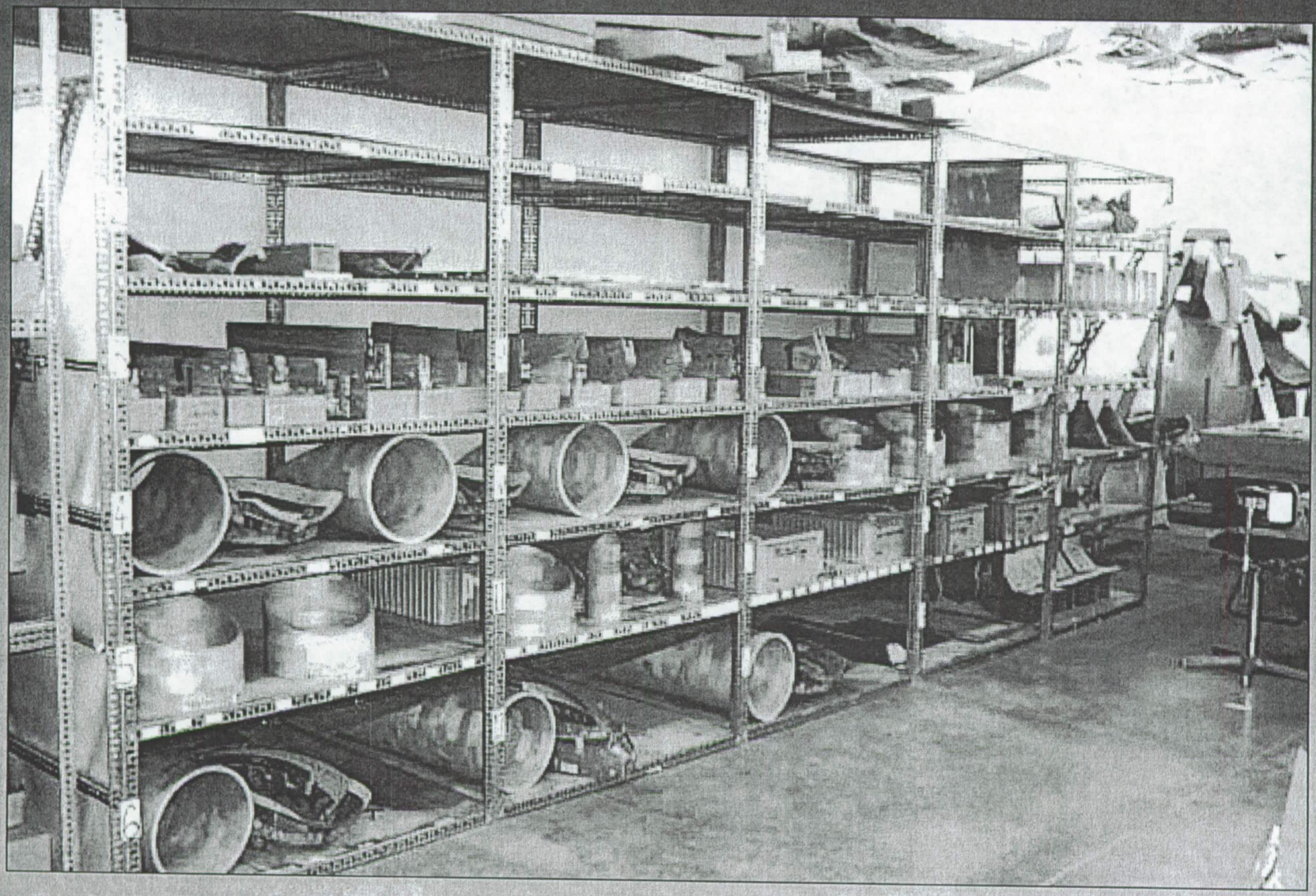
SG Gap Fillers Area



SG Non-Flight Area



SG Non-Flight Area

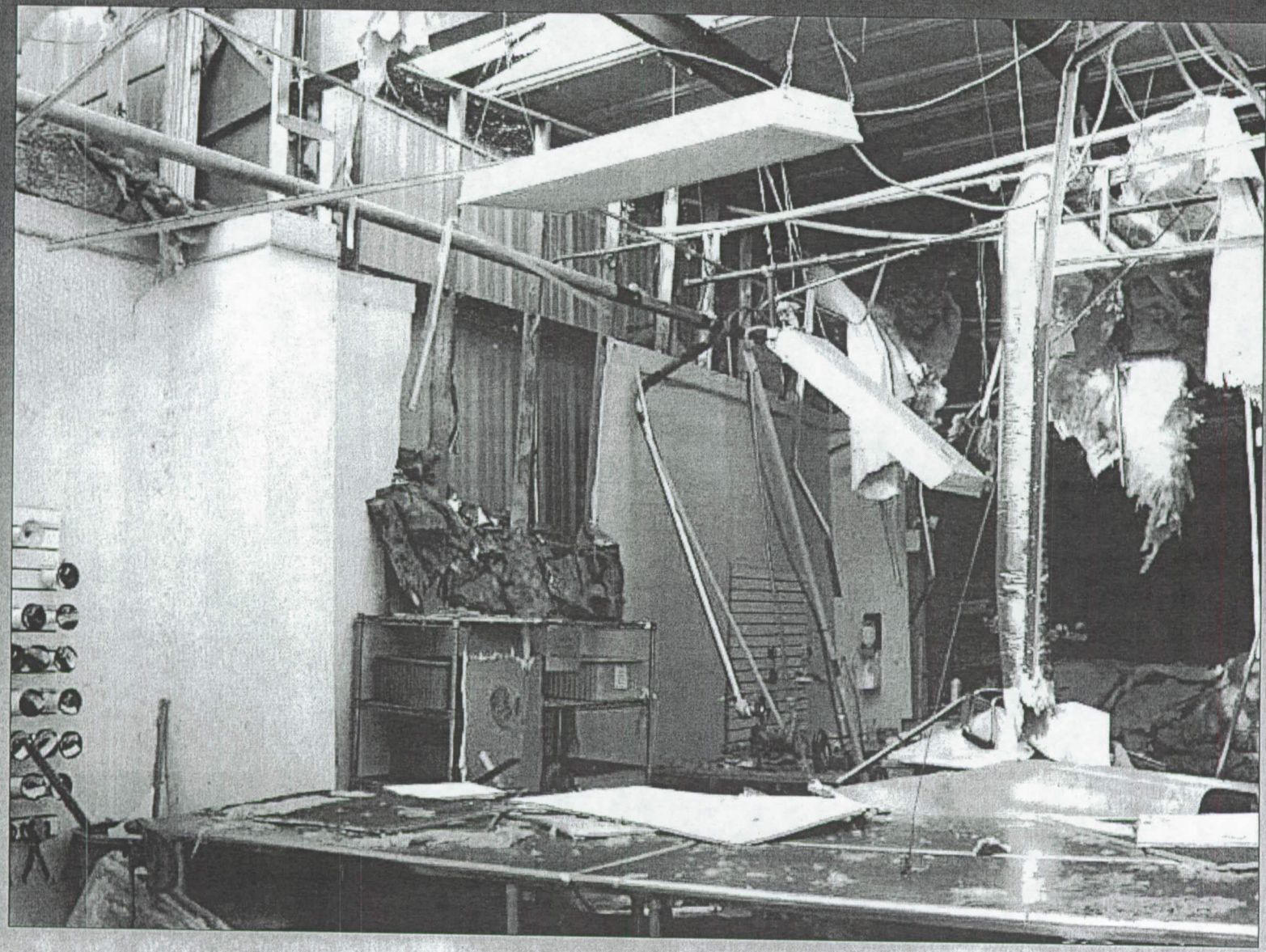


SG Main Room

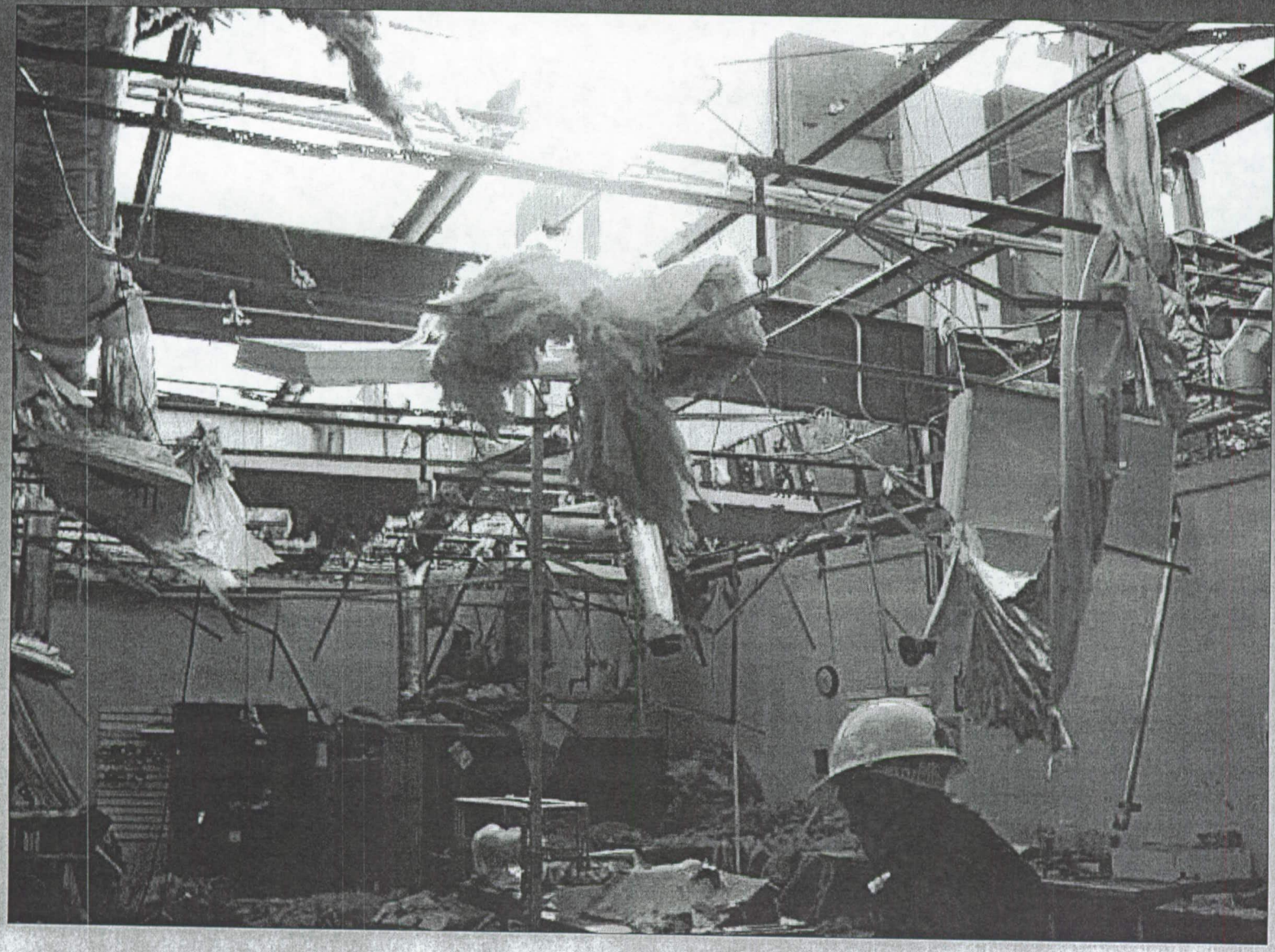
SG Main Room

SG Main Room

SG Main Room

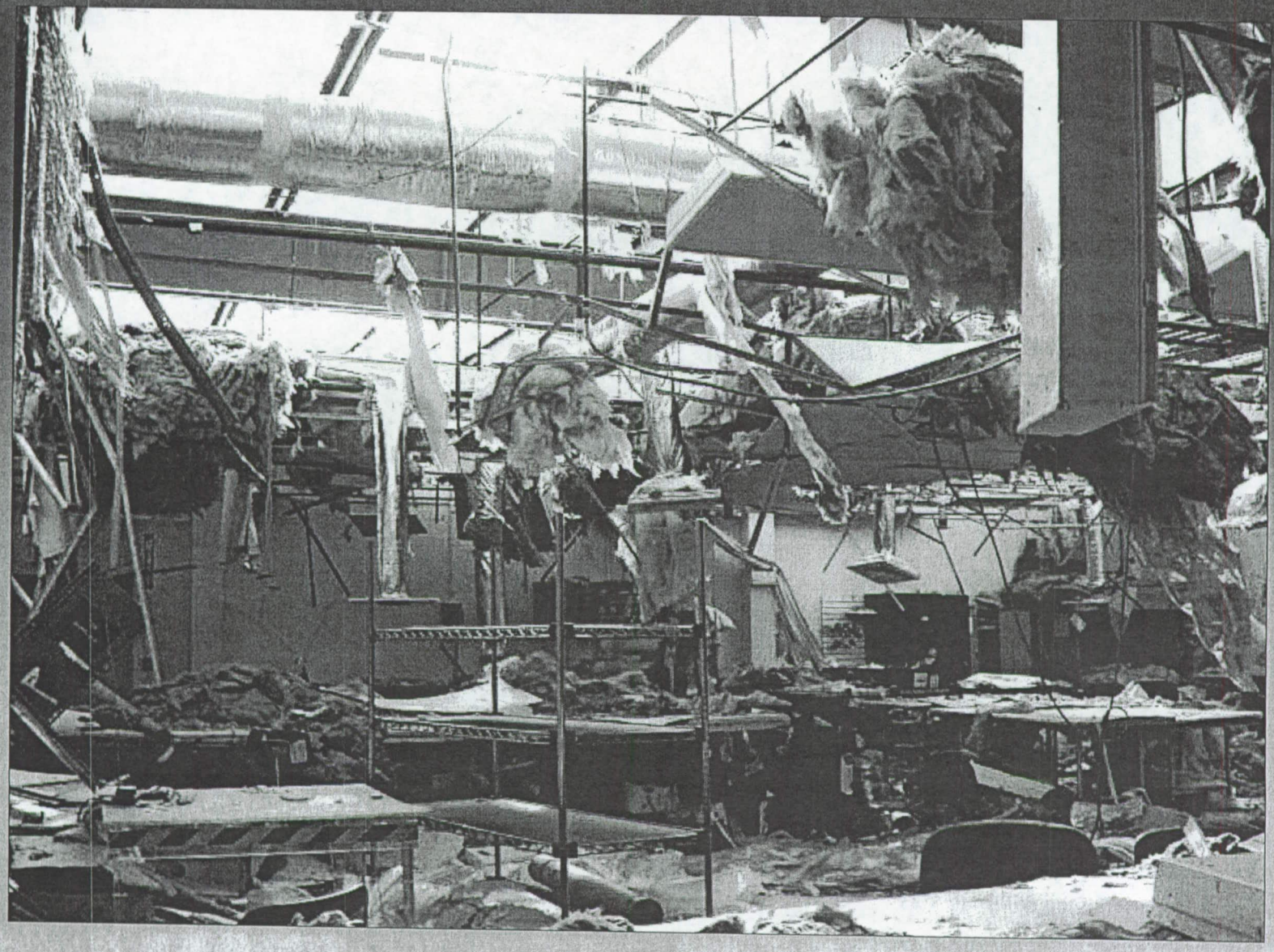


SG Main Room



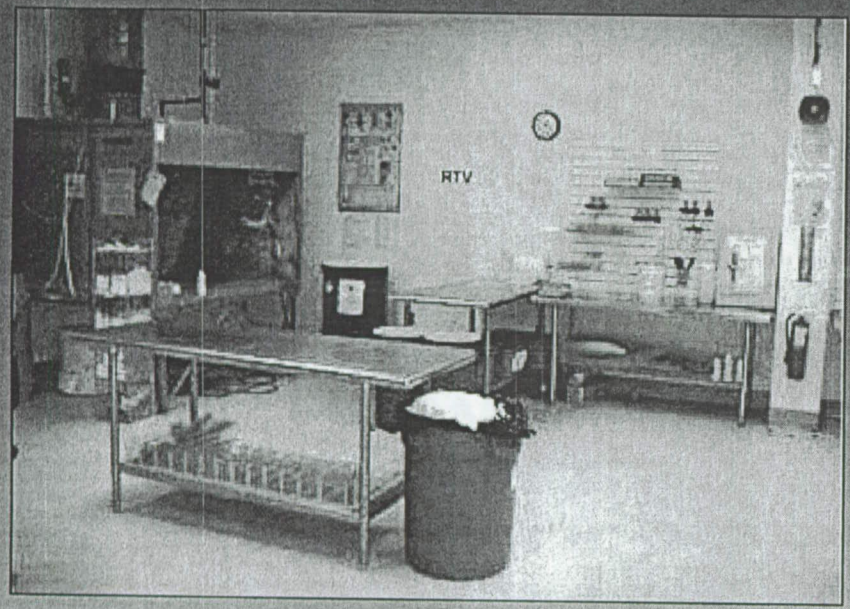
SG Main Room

SG Main Room

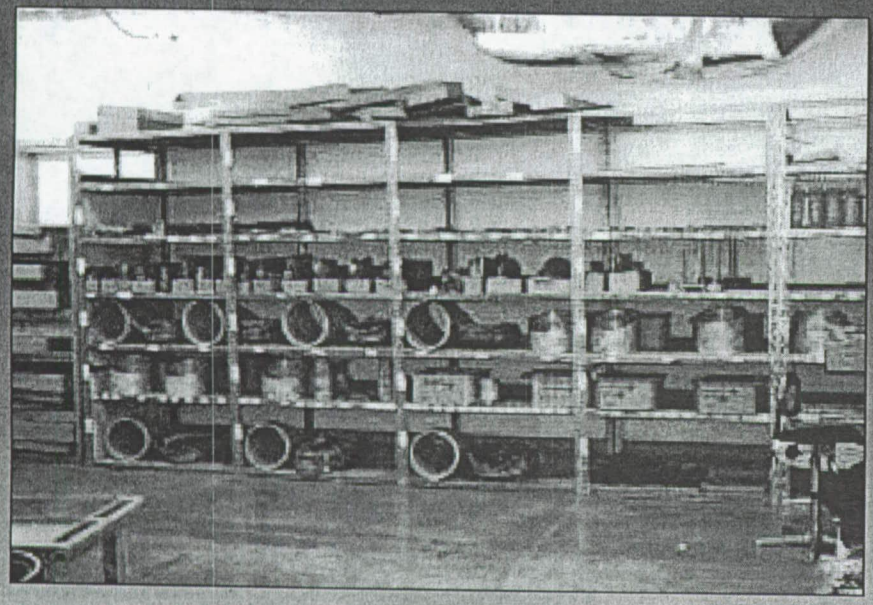


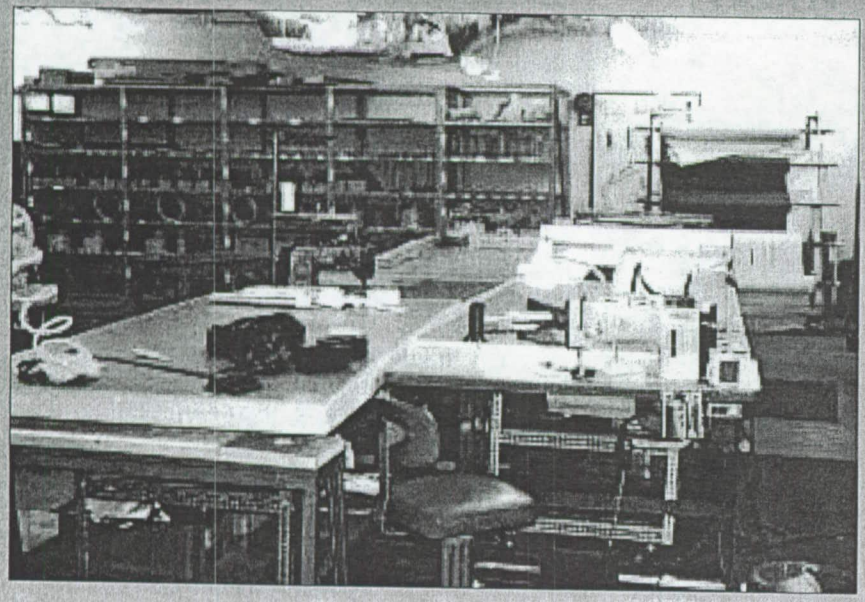
SG Main Room

SG Main Room



SG Non-Flight Room





Now What?

- Find a new facility immediately
- Salvage and relocate all useable equipment
- Sort
- Straighten / Sweep
- Shine
- Standardize
- Sustain

Shuttle Landing Facility Hangar

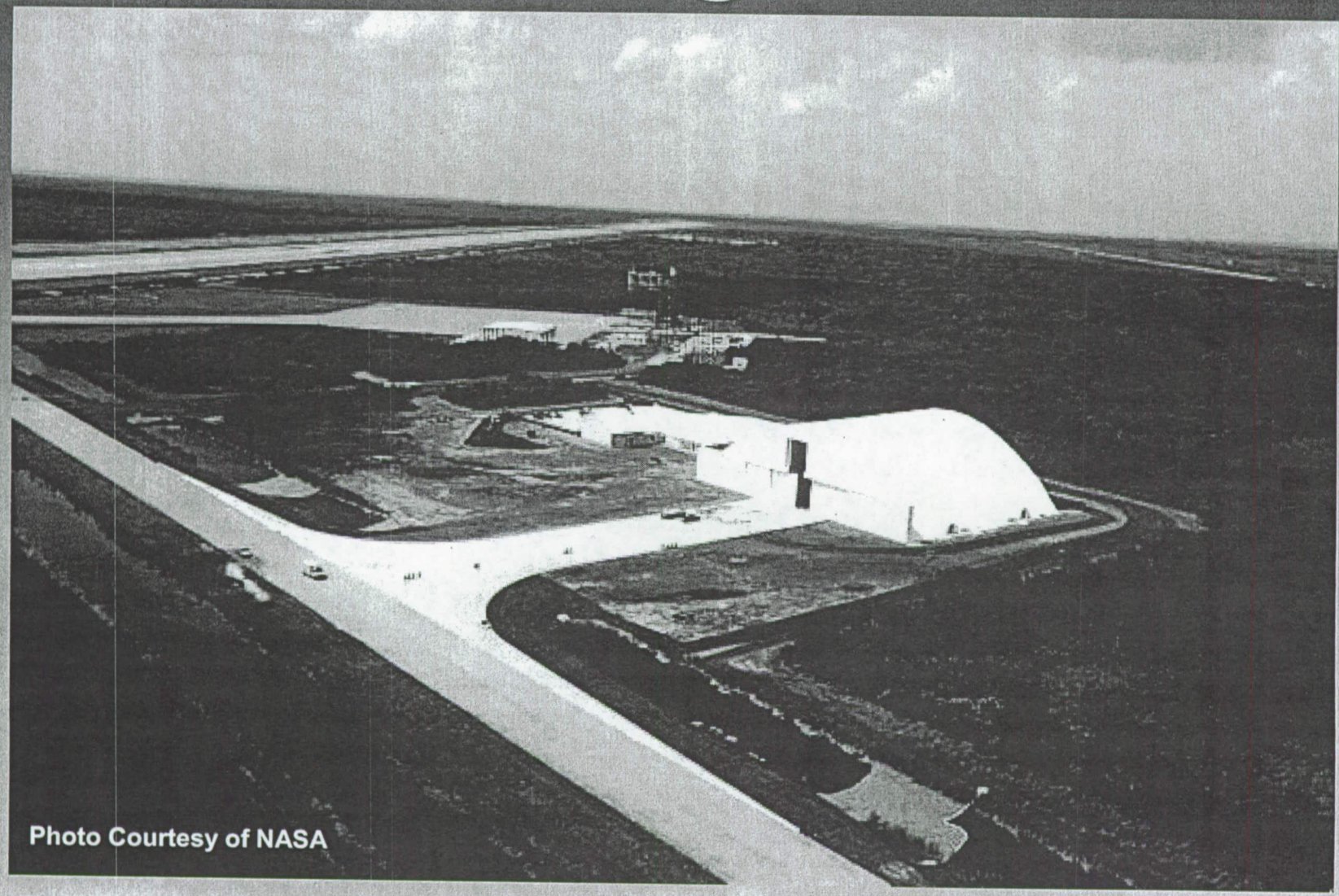
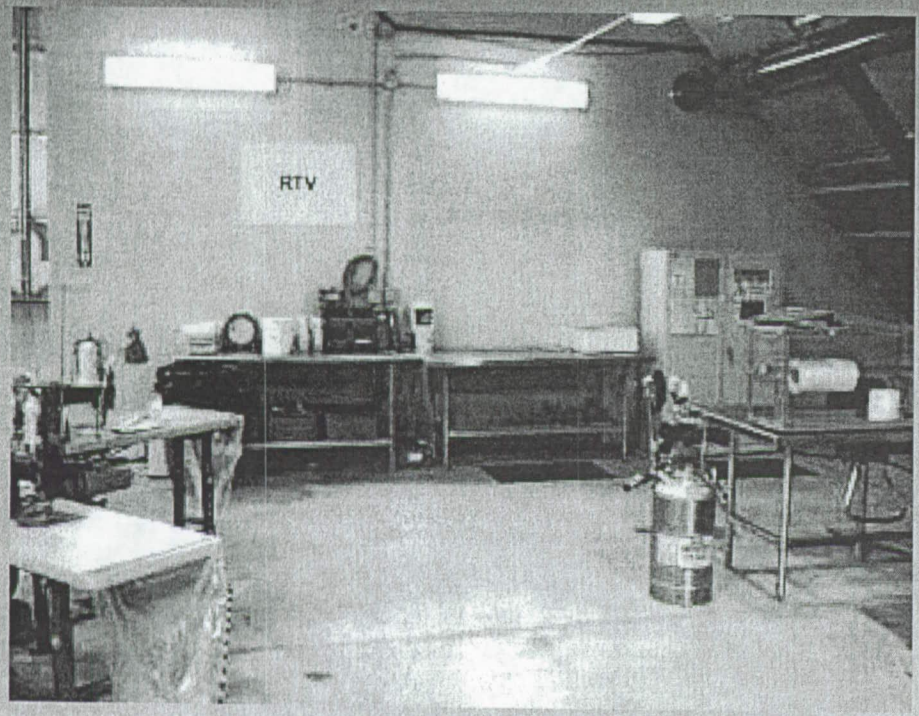
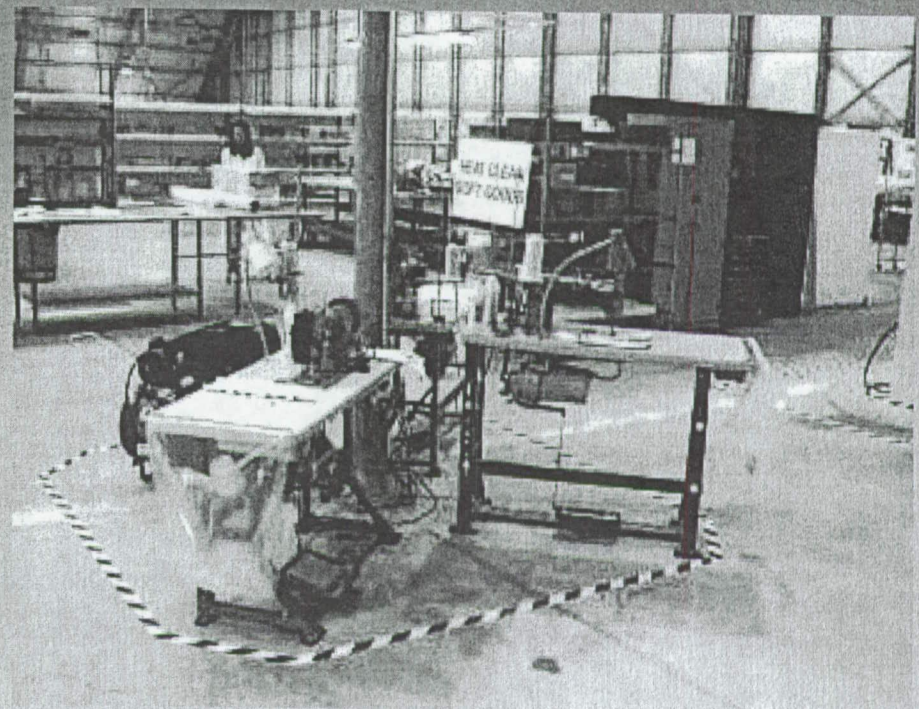


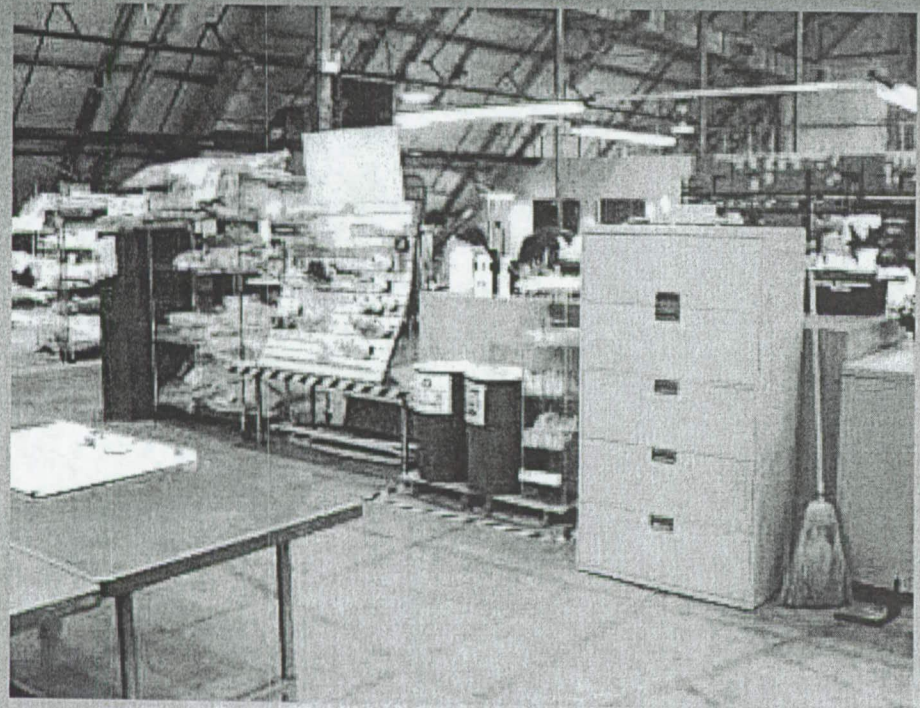
Photo Courtesy of NASA

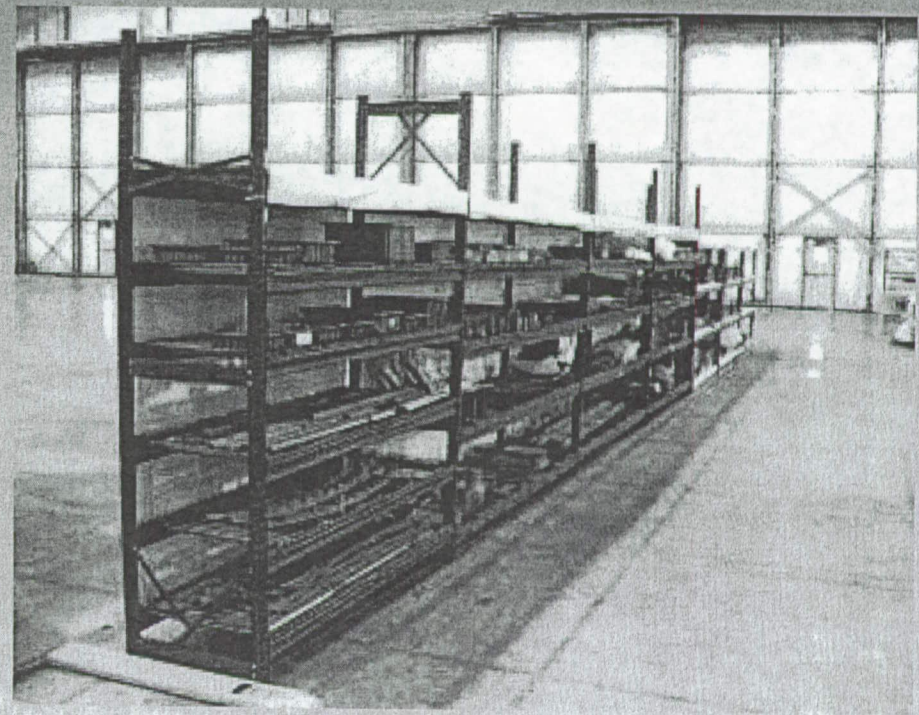
Less than three weeks after Francis


THERMAL
BARRIERS


RTV







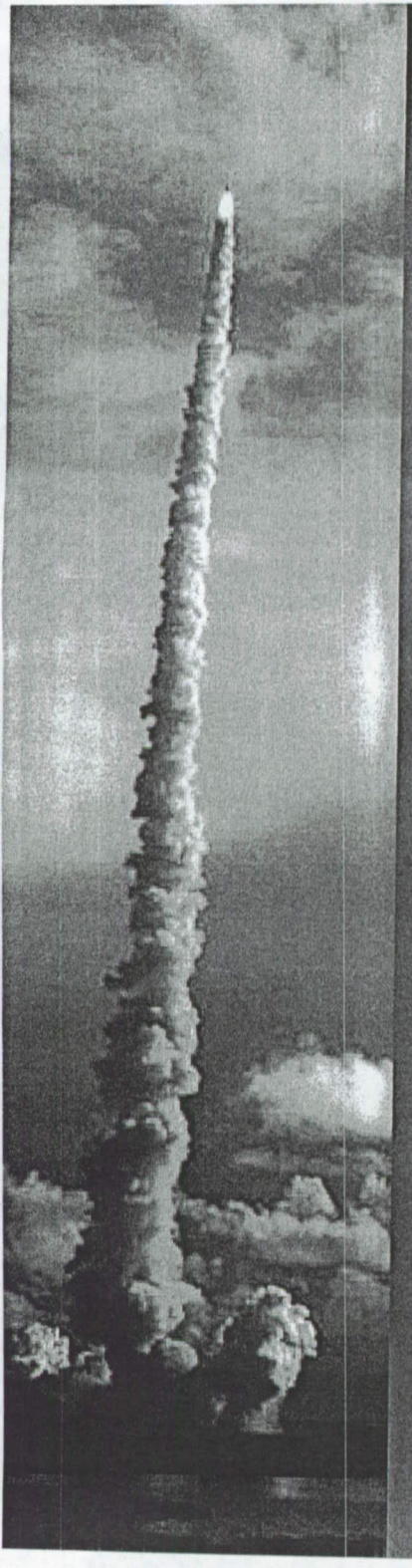
SoftGoods Shop Current Status

- Continuing to make SG items in preparation for Shuttle's Return to Flight
- Now planning re-re-re-design of the SoftGoods Shop for move back to TPSF!!
- Applying 5S principles once again
- Relocation back to the TPSF scheduled for August 2005

Lessons Learned

- Keep photos of the 5S process; you may need them later
- Teams can do amazing things when put to the test
- Your employees are your best recovery plan after a crisis
- Make sure you recognize deserving team efforts
  - TPSF Tile & SG Employees Awarded "USA 2005 Team of the Year"

Questions



USA®

United Space Alliance

Thank You