

S/TAR Solid State Recorders

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**Presented at the THIC Meeting at the Sheraton Barcelo
Annapolis MD 21401-3094**

May 8, 2001

THIC Inc.

The Premier Advanced Recording Technology Forum

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www.L-3Com.com/STAR

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May 9, 2001

S/TAR™

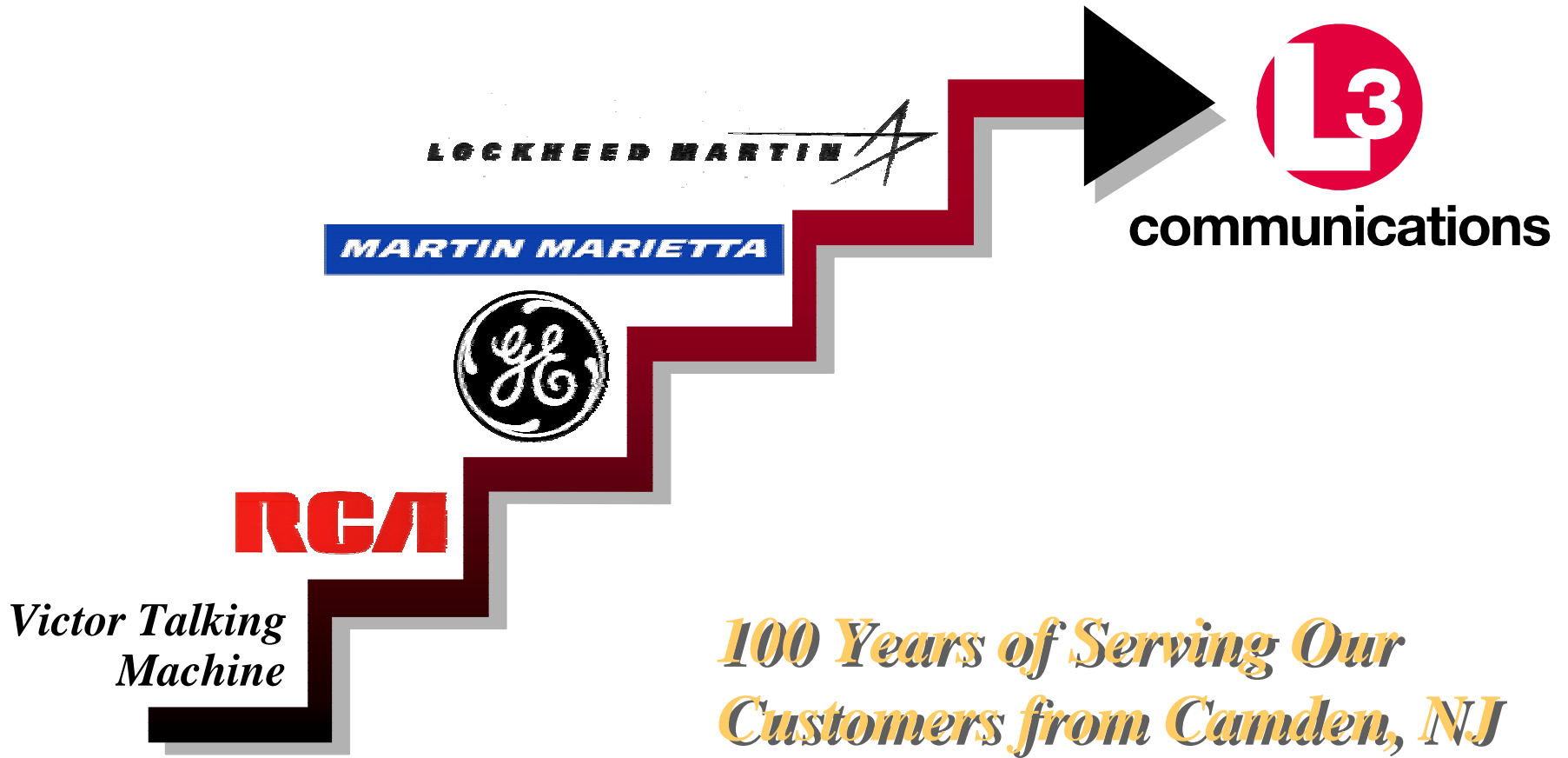
STRATEGIC / TACTICAL AIRBORNE RECORDER

High Performance Solid State Recording

L-3 Communication Systems-East

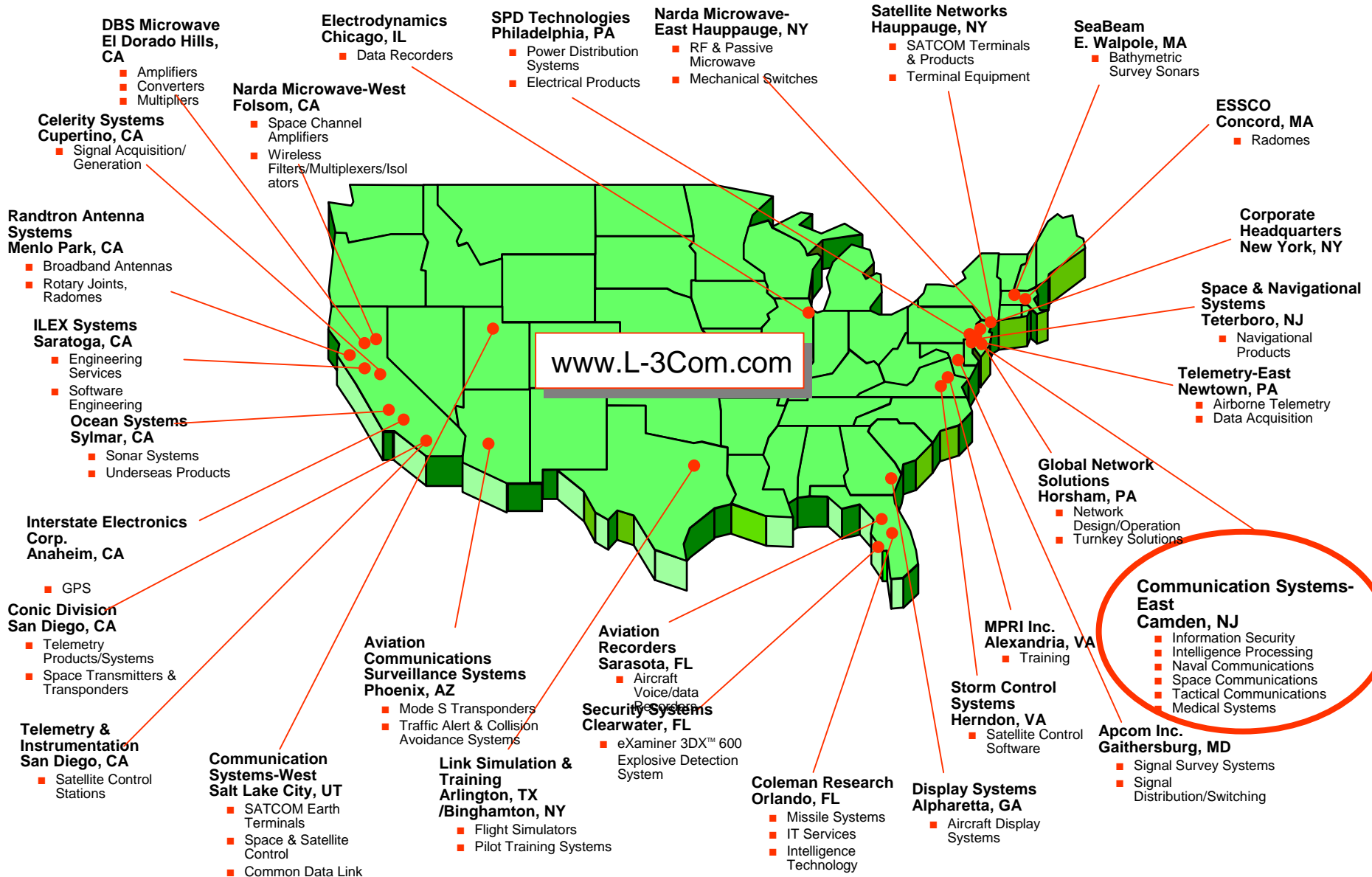


A PROUD HERITAGE



100 Years of Serving Our Customers from Camden, NJ

L-3 COMMUNICATIONS



L-3 CS-EAST



Naval Communications



INFOSEC



Solid State Recorder



Space Communications



Sensor Systems



Command Post Vehicles



Information Processing Systems

RECORDING SYSTEMS

Over 40 years providing High Performance Data Storage Systems



communications

DESIGN

High Data Rates
Advanced Packaging / Large Capacity
File Management Systems
Error Detection & Correction
High Reliability

TECHNOLOGY

Magnetic Tape
Laser Film
Optical Disk
Solid State

HERITAGE

> \$100 Million Technology Investment
> 4 M Hrs Space Recording Failure Free
> 300 Tactical Recce Tape Recorders sold
Experienced in all Recording Technologies
First to Qualify Commercial Memory for Space

Airborne Severe



AN/USH-17

Space



Landsat 7 SSR



EOS SSR

Surface / Subsurface



ID-1 RDR-400



TIROS SSR



Other Platforms with our Recorders include:

SR-71, A-6C, A-6E, RF-4, A-7, F-4, P-3C, RC-135V/WU, LANDSAT 4/5/7, NOAA, UARS, COBE, Tactical Shelters, Submarines, DSU, Skylab, ESSA, SAX, Classified Platforms, ATS, ITOS, SAGE, SMM, Nimbus, QSR

ADVANTAGES OF SOLID STATE VS OTHER MEDIA

ADVANTAGES OF SOLID STATE

Magnetic Tape

Magnetic Disk

ADVANTAGES OF SOLID STATE	Magnetic Tape	Magnetic Disk
Scalable, Sustainable High Data Rates	No	No
Multi Sensor Recording, Simultaneous Record / Play	No	Yes
Compatible with a Diverse Operating Environment	No	No
Low Power Consumption	No	No
Minimal Weight and Volume Requirements	No	Yes
Flexible, Scalable Architecture	No	No
Extremely High Reliability	No	No

Solid State Recorders are Required in the Severe, Demanding Airborne Environment

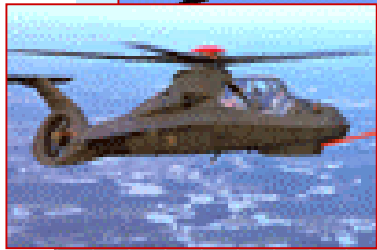
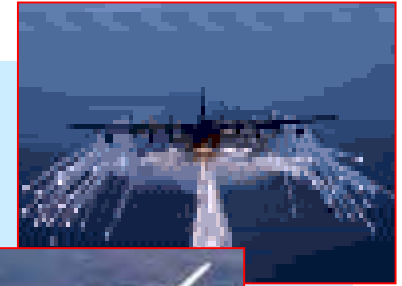
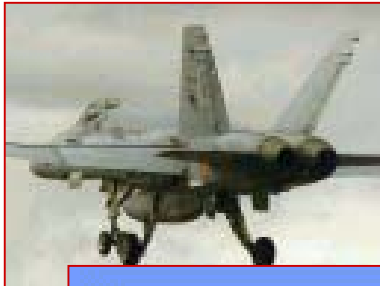
*Absence of Moving Parts Coupled with L-3's Custom Memory Packaging
Guarantees High Reliability and High Performance*

APPLICATIONS

The S/TAR™ Product Family is Designed to Support a Variety of Platforms & Applications

APPLICATIONS

- Reconnaissance Imagery (EO / IR)
- Radar Testing, Synthetic Aperture Radar
- SIGINT / ELINT / COMINT
- Electronic Warfare
- Anti-Submarine Warfare
- Instrumentation & Flight Test



**CURRENTLY USED ON
PROGRAMS AND PLATFORMS**

- F-18 E/ F Super Hornet
- F-15 Eagle
- Tactical Input Segment



- US Air National Guard
- AV-8B Harrier
- Classified Platforms

SHARP PROGRAM (SHARED Reconnaissance Pod)

KEY FEATURES

- Record Two Sensors Simultaneous; Data Rate 90 Mbytes per Channel
- Data Playback of Imagery to MFD or NRT Data Linking
- Supports Automated Event Marking
- Imagery must be Annotated with Mission Data
- Onboard formatting & editing
- STANAG 4575 Data Download Port
- Storage Capacity of 64 GB, Growth to 192 GB
- Secure Erasure / Sophisticated Built in Test
- Volume 6.8"(H) x 12.2" (W) x 17" (D) ; 25 lbs
- Power < 100 Watts; 115 VAC, 400Hz
- Pod Mounted, Severe Environment



“The Most Severe Environment... 35G’s Shock, 170db Acoustic Noise, Carrier Take Off / Landing”

**The SHARP Solid State Recorder is the
Most Advanced Airborne Recording System in the World**

***SHARP is the Largest Tactical Recce Program in
DOD in the current 10 year Period***



EMBEDDED PROGRAMS

KEY FEATURES

- Versatile VME 6U160 design permits shared recorder function in existing sensor / processor chassis
- Variety of data interfaces provided by I/O processor module
- Expandable memory capacity to from 8 Gbyte to 304 Gbyte
- Resultant system design is smaller size, less weight, lower power, and less cost than multi-box solutions
- Custom Application Program Interface (API) software for recorder control / status
- Complete set of software object libraries to support the API



LabSTAR

L-3 CS-E can supply the system engineering, software and hardware support to integrate the S/TAR functionality in existing, upgrade and new platform applications!

MODULAR PRODUCT LINE CONCEPT



RM - 8000



RM - 6000



VM-E001 **EMBED**



RM - 8000R



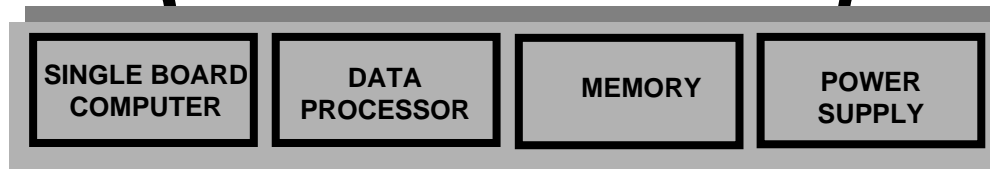
RM - 3000



LabSTAR



RM - 6000F **SHARP**



Common S/TAR™ Building Blocks

Pre-Planned Product Improvements (P3I)

- Future Generation Flash Memory
- Error Management Flexibility
- Modular Insertion of New Interfaces

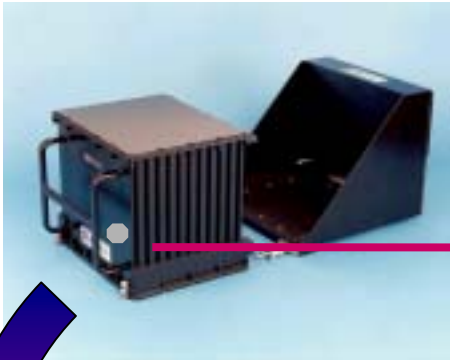
6U160mm VME 64 Modules

Pre-Planned Product Improvements (P3I)

- Programmable Logic Upgrades
- Compatible with RACE+
- Reserve MIPS for Software Upgrades

GROUND CONFIGURATIONS

AIRBORNE PLATFORM



S/TAR remains in platform, data download via cable from aircraft to ground station (ie. STANAG 4575)

GROUND STATION



GROUND RECEPTACLE



One man extraction and hand carry from platform to S/TAR Tray Assembly.

Playback data available via standard play port or optional high speed download port (ie. STANAG 4575)

MEMORY & ERROR MANAGEMENT

MEMORY Non-Volatile NAND Flash

- Commercial use in Digital Camera's, MP3 Players driving cost down
- Retains mission data without power, Erasable on command
- Good for > 1 Million write / erase cycles (> 100 years of Operation)
- Erasure of 50Gbytes is less than 2.5 minutes
- Next generation memory modules compatible with current generation

We Use the Highest Density Memory Packaging Technology in the World

ERROR MANAGEMENT

- Data error sources are a reality in Solid State Recorders
 - MTBF analysis indicates memory devices will fail over time
 - SSR's contain thousands of Flash memory devices
- Users are specifying a Bit Error Rate (BER) of 10^{-12} or better from SSR's

A single bit error in 100 Gbytes of mission data exceeds this requirement!!

ERROR MANAGEMENT

- S/TAR™'s Built in Reed-Solomon based Error Management System provides:
 - Error Free Mission Data, even with memory failures
 - Extended System Lifetime
 - Performance at High Altitude; Correction margin for SEU induced errors

COMPARISON OF ERROR MANAGEMENT SYSTEMS

Error Management System Requirement	Reed-Solomon Coding	Read-After-Write
Protects Mission Data Until Erased?	Yes	No
Correct for Failed Memory Devices?	Yes	Maybe
Component Level Fault Isolation?	Yes	No
Record / Playback Data Rate Bandwidth unaffected?	Yes	No

The error management system must be designed to provide error-free mission data when experiencing random memory failures

**ONLY ACHIEVED BY A REED-SOLOMON ERROR MANAGEMENT,
Not by a Read - After - Write System**

ENVIRONMENTAL SPECIFICATIONS

> 40 Years of Experience Producing High Performance, Severe Environment Recording Systems

QUALIFIED TO MIL-STD 810E, MIL 5400 AND STANAG 3518 LEVELS

<u>TEST</u>	<u>OPERATIONAL</u>	<u>NON - OPERATIONAL</u>
TEMPERATURE	-54C TO +71C	-57C TO +95C
TEMPERATURE SHOCK	-54C TO +71C	-57C TO +95C
HUMIDITY	95% +/- 5%	95% +/- 5%
ALTITUDE	50k Ft (No ECS required)	> 50k (ECS as reqd)
RAPID DECOMPRESSION	Mil-Std 810E	Mil-Std 810E
SHOCK	20G, 11mSec (Sawtooth)	30G, 18mSec (Half Sine)
CATAPULT / ARRESTED LANDING	Mil-Std 810E	Mil-Std 810E
RANDOM VIBRATION	10.0 Grms / 12.0 Grms	12.0 Grms / 14.0 Grms
BENCH HANDLING	Mil-Std 810E	Mil-Std 810E
SAND & DUST	RTCA DO	RTCA DO
BLOWING RAIN	Mil-Std 810E	Mil-Std 810E
CORROSIVE ATMOSPHERE	Mil-Std 810E	Mil-Std 810E
EMI	Mil Std 461B, C, D & E, STANAG 3516 (as applicable)	

Our Removable Memory Models

- Require No Special Mounting or Shock Isolation
- Are Conduction Cooled and Require No Forced Air Cooling

FLIGHT TEST RESULTS



L-3 CSE S/TAR™ Flight Test
Nov, 18, 1999 - Boron RADAR CA
400 knots, 5,000 feet

MOHAVE, CALIFORNIA, EO SENSOR , DCRsi MODE

SUMMARY

Why choose L-3 Communication Systems - East ?

- >40 years of Designing and Manufacturing Recording Systems
- Expertise in the Avionics Market. System Engineering to Customer Training
- Divisions with expertise in Data Links, Airborne Telemetry, Ground Systems
- Track Record. The only SSR in the Market with a Spacecraft SSR Heritage
- Strategic Partnership with Ampex
- Backing of a Large Corporation.
- Commitment to the Market, Participation and Influence in:
 - SAR/SLAR, NADS TST(STANAG 4575),RCC, SPIE, Conferences
 - S/TAR personnel resident in Europe & Middle East
 - Worldwide Sales Force, 24 hour Depot Operation
- Loaner Systems, Product integrations, Flight Tests, 120 day delivery

S/TAR™

The Most Advanced, Highest Reliability, Lowest Size, Weight and Power
Solid State Recorder on the Market.

Featuring a STANAG 4575 Compliant Intelligent Memory Cartridge Utilizing
Reed Solomon Error Detection and Correction