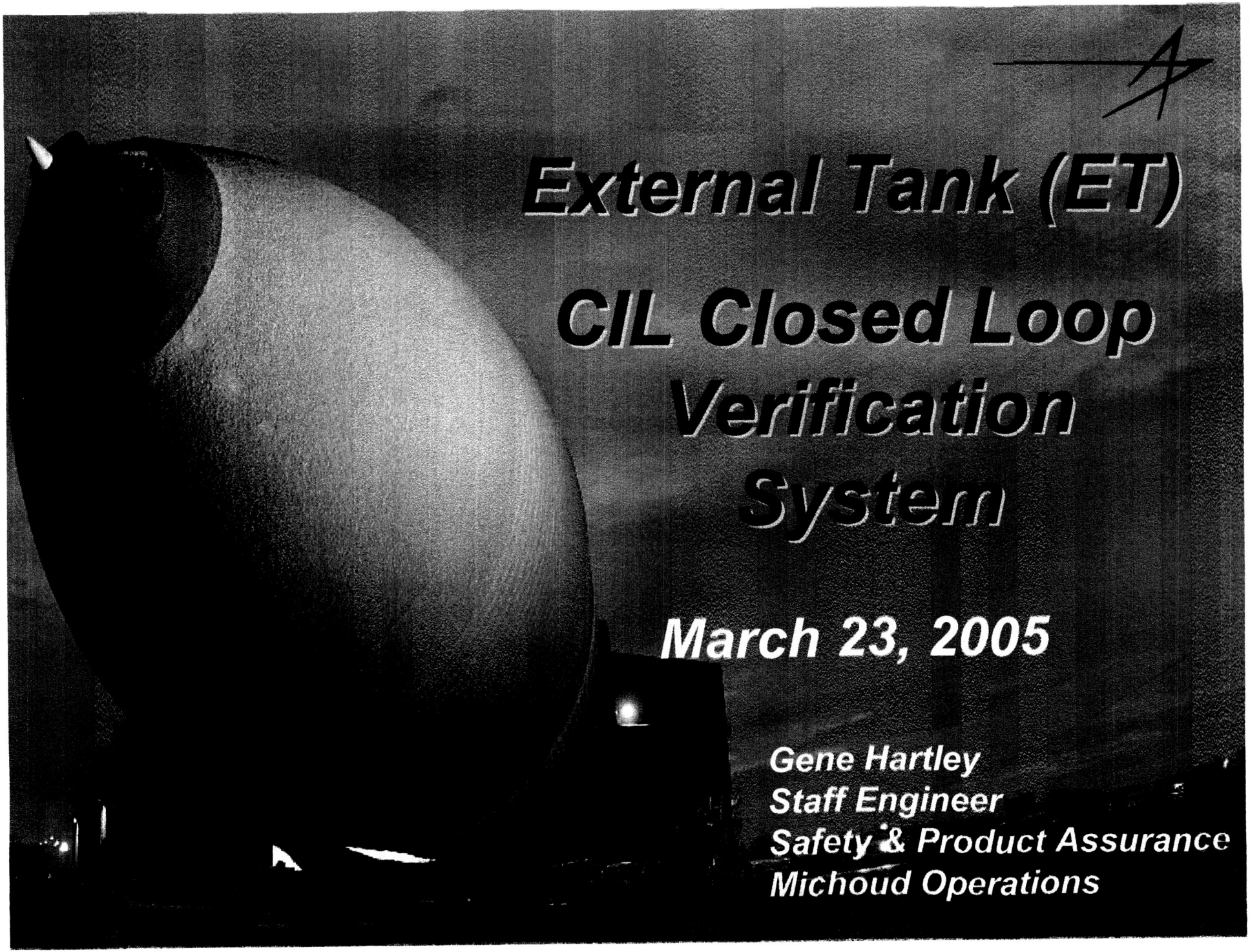
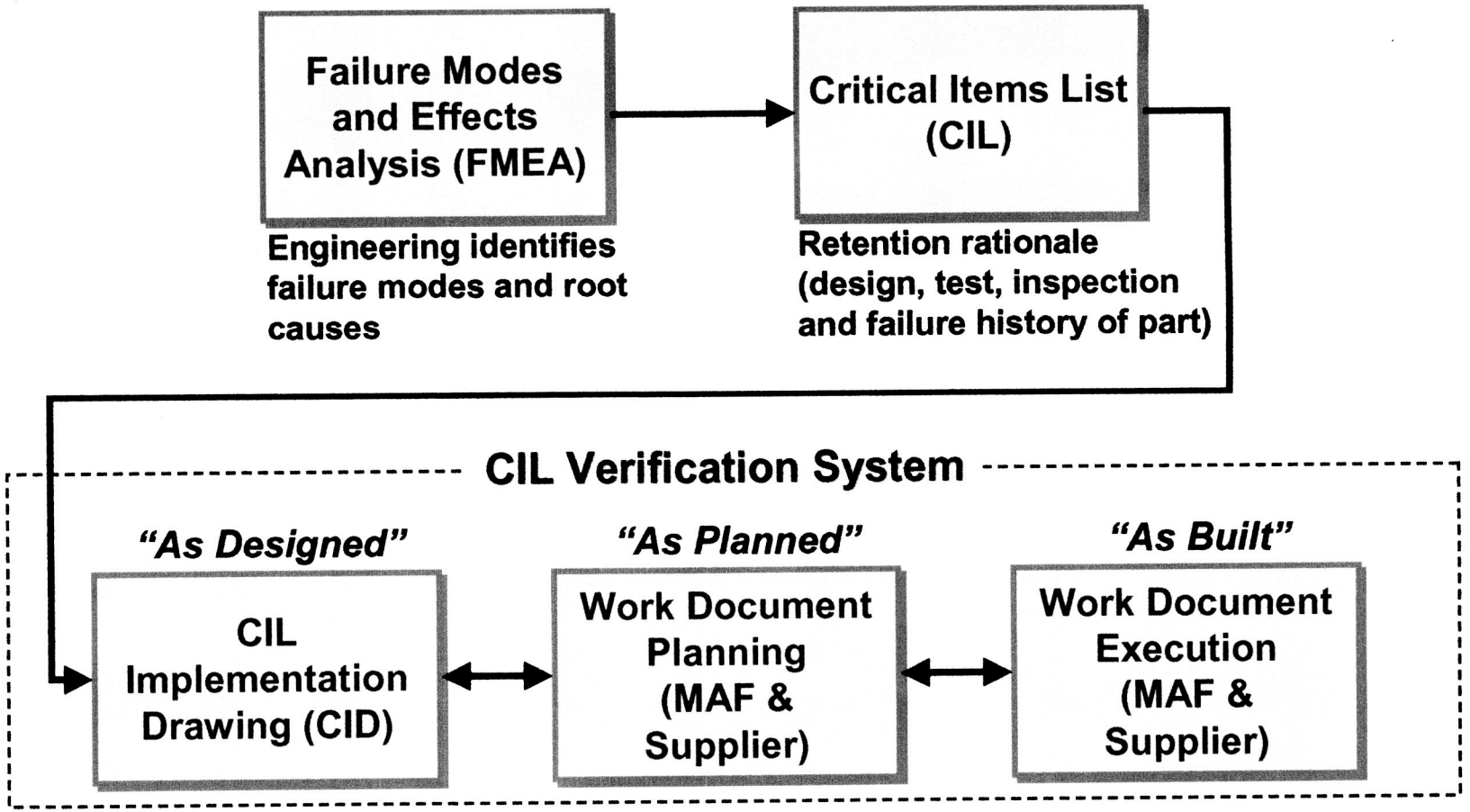

External Tank (ET)
CIL Closed Loop Verification System
March 23, 2005
Gene Hartley
Staff Engineer
Safety & Product Assurance
Michoud Operations

History
LM Closed Loop Verification Sys.

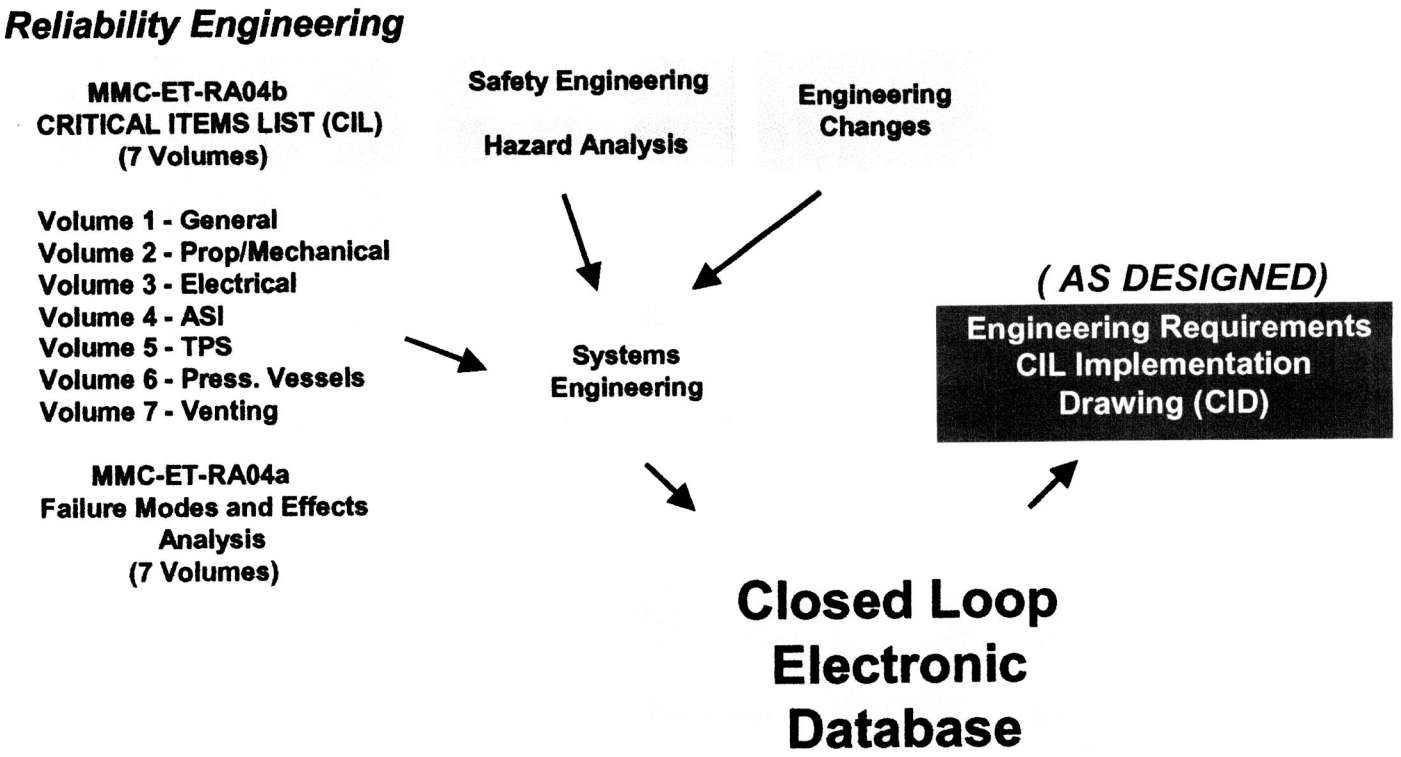
- Post 51L evaluation of the LM CIL system showed a need to establish an accurate accounting system to assure External Tanks had been accepted to the latest CIL retention rationale prior to flight. To provide this assurance, LM developed and implemented the Closed Loop CIL Verification System.
- The Closed Loop CIL Verification System provides value added in the following ways:
  - Instantaneous checks of compliance to CIL Requirements
  - Assures LM and NASA that the latest FMEA/CIL Retention Rationale has been verified at DD-250/CoFR
  - Assures planning errors do not result in unverified CIL Requirements
  - Facilitates cost effective and accurate CIL verification
  - Allows expeditious comparison of "As Designed" to "As Planned" and "As Built" CIL requirements at any level of tank build

Overview

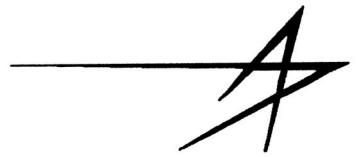


An automated "As Designed" to "As Planned" to "As Built" closed loop verification system that ensures all "CI" prefix tests/inspections in the CIL Implementation Drawing (CID) have been accomplished and satisfied

CIL Implementation Drawing (CID)



CID (cont'd)



- Establishes "Roadmap" for all test/inspections required in the Critical Items List (CIL)
- Provides a means of accountability through the FMEA/CIL database
- Each critical test/inspection is identified in the CIL Document is identified with an unique "Find Number" which is traceable back to the FMEA/CIL
- This document identifies the find number, part number, revision, retention rationale, location, and whether or not a receiving acceptance plan (RAP) is required

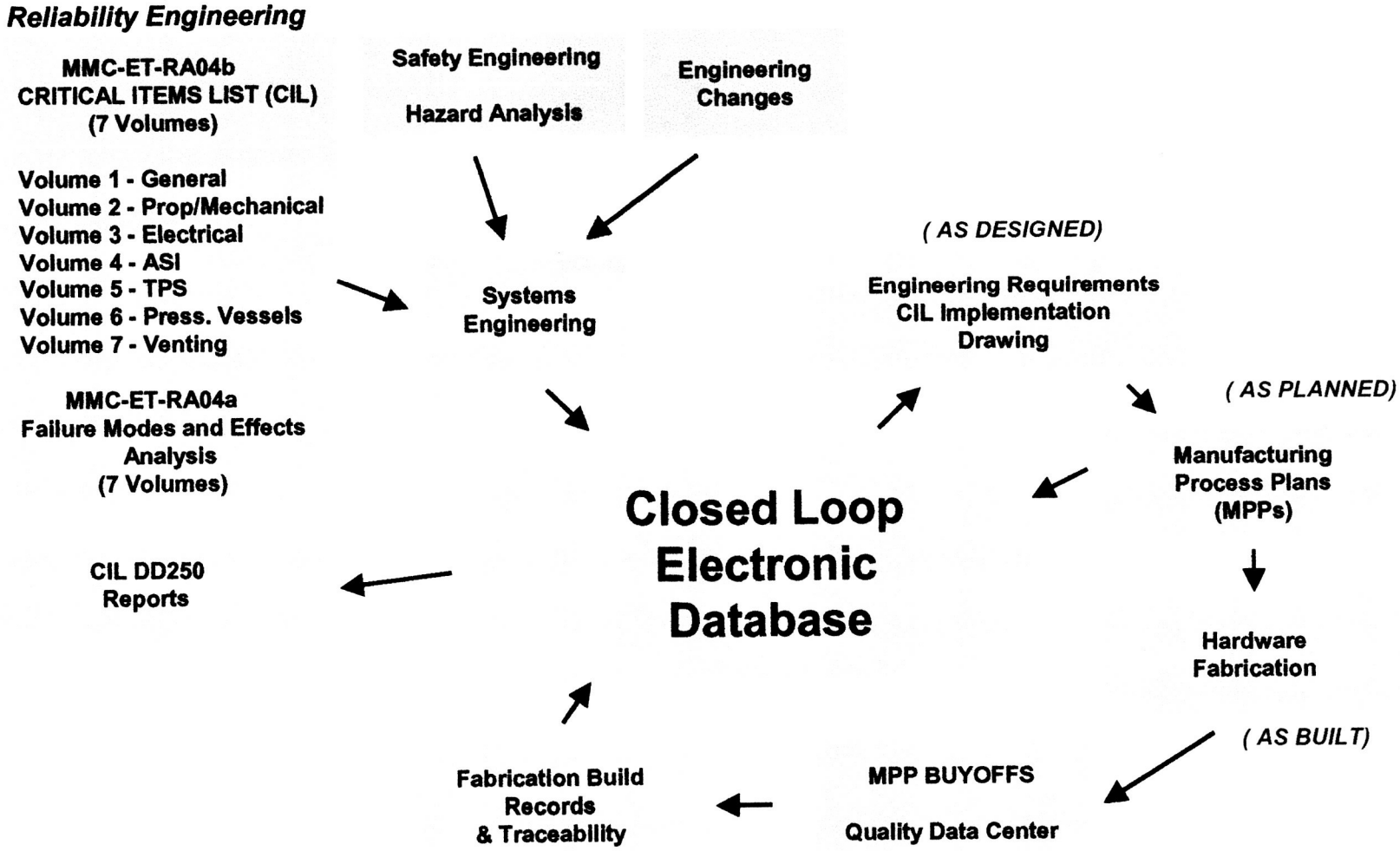
CID (cont'd)

Find Numbers:

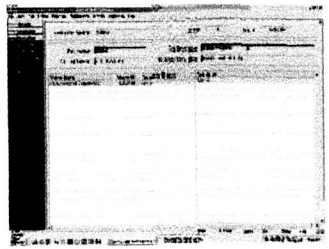
XX-X-XXXX.XXX.X

- **Inspection Identification Number**
- **System Identification Number**
  - **P** Propulsion
  - **E** Electrical
  - **A** ASI
  - **T** TPS
  - **S** Pressure Vessels
  - **V** Venting
  - **U** GUCA
  - **H** Safety Hazards
  - **G** Generic
- **Inspection Type**
  - "CI" – those tests/inspections identified in the CIL that cannot be validated by subsequent tests/inspections or that validate any previous tests/inspections
  - "MI" – all other tests/inspections identified in the CIL

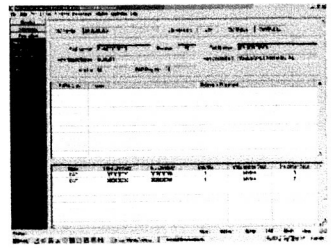
Michoud Assembly Facility (MAF) Process



MAF "As-Planned" & "As-Built" Process Flow



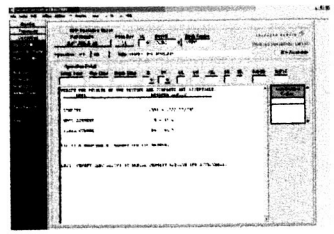
LM QE plans CIL insp. in Manf. Process Plans (MPP) via HMS CAPP



HMS CAPP module updates "As-planned" records CILVS module

As-Planned

LM QC inspectors verify & accept CIL inspections – SFM updates "As-Built" records CILVS module

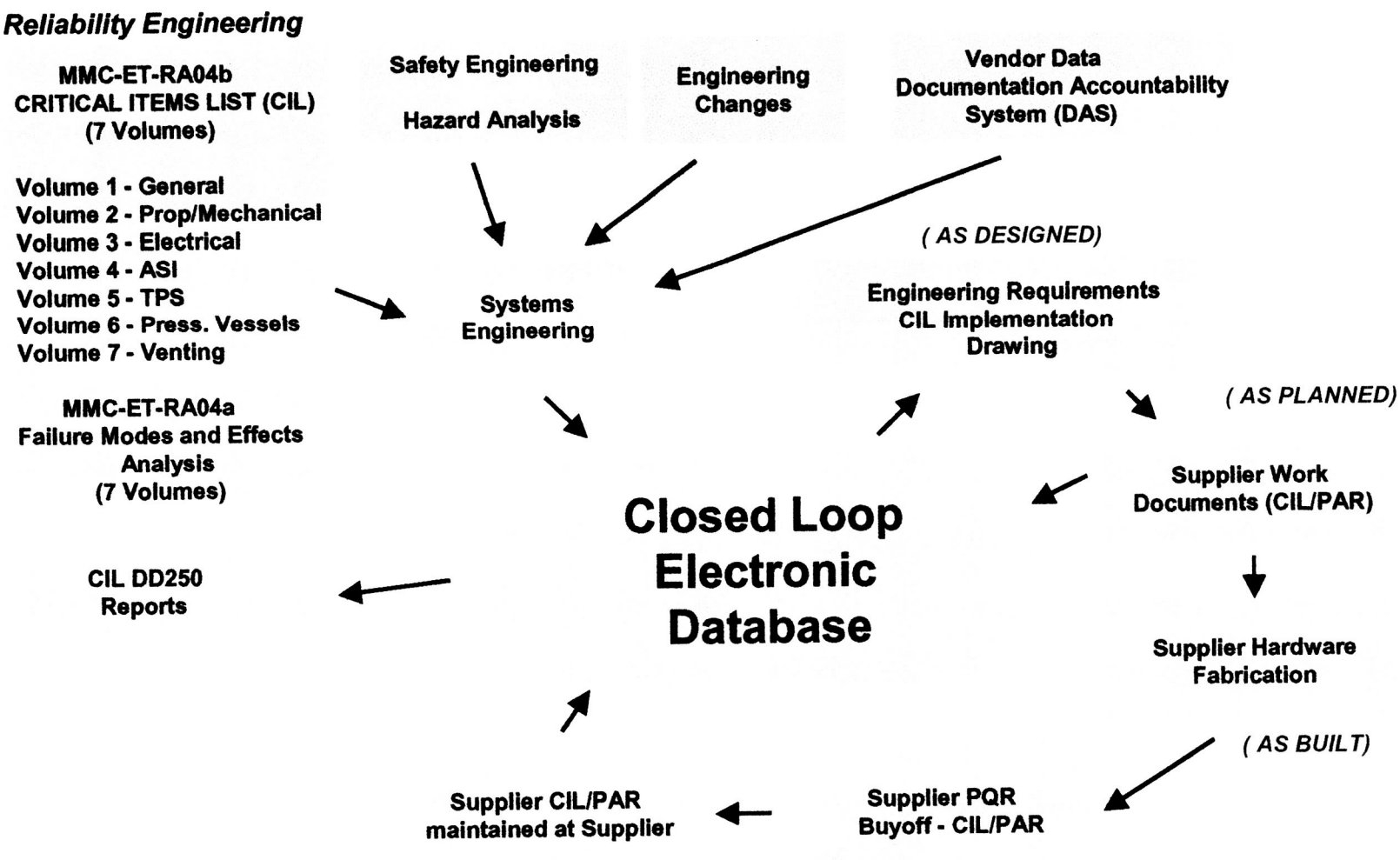


HMS SFM module provides Manf. Process Planning interface for shop/QC floor personnel

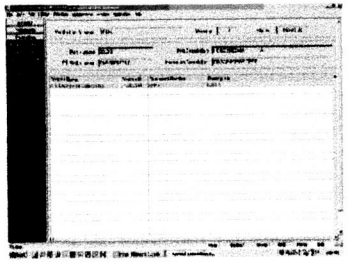
As-Built

CAPP = Computer Aided Process Planning *SFM = Shop Floor Manager*

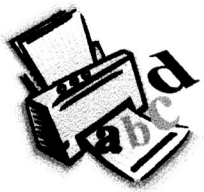
Supplier Process



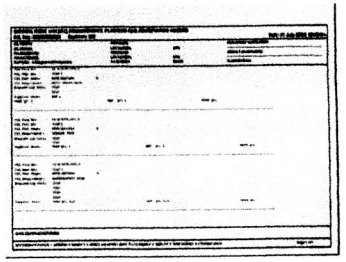
Supplier "As Planned" Process Flow



LM PQA plans Supplier CIL insp. in CILVS



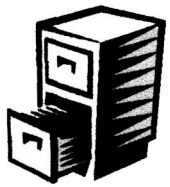
LM PQA prints CIL/PARs and forwards to Procurement (Materiel)



- Initial/latest CIL/PARs are incorporated into supplier contract(s)
- Supplier incorporates CIL inspections into work documents and updates/stamps CIL/PAR

LM PQA Rep. verifies CIL inspections are incorporated into work documents and stamps CIL/PAR

LM PQA Rep. updates CILVS planning information via Laptop



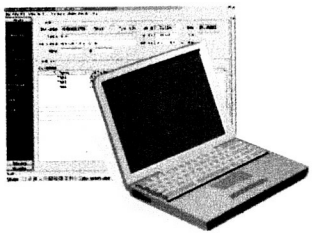
"As Planned" CIL/PAR filed at Supplier

CIL/PAR = Critical Items List Planning and Acceptance Record

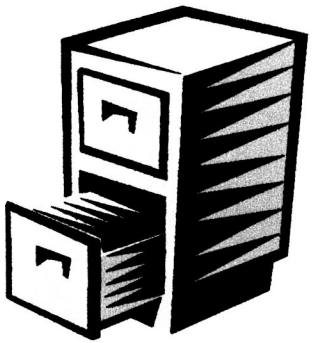
Supplier "As Built" Process Flow

Supplier builds and performs CIL insp. (Stamps CIL/PAR Form)

LM PQA Rep. performs CIL inspections and stamps CIL/PAR form



LM PQA Rep. accepts CIL inspections in CILVS via Laptop



CIL/PAR maintained on file at supplier

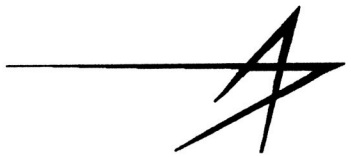
"As Planned" vs. "As Built" Comparison

- DD-250 Reconciliation Reports (by ET Effectivity)
  - Open Items
    - List "As Designed" records that are not planned
  - Measure of Performance
    - List all "As Planned" records
    - Provides evidence of "As Built" record matches
  - Proof of Performance
    - List records that need to be reconciled
      - Design without Build
      - Build without Design
      - Part Quantity Errors
  - ABHRS (As Built Hardware Reporting System)
    - Part Traceability
- Reviewed/Approved by DCMA and NASA

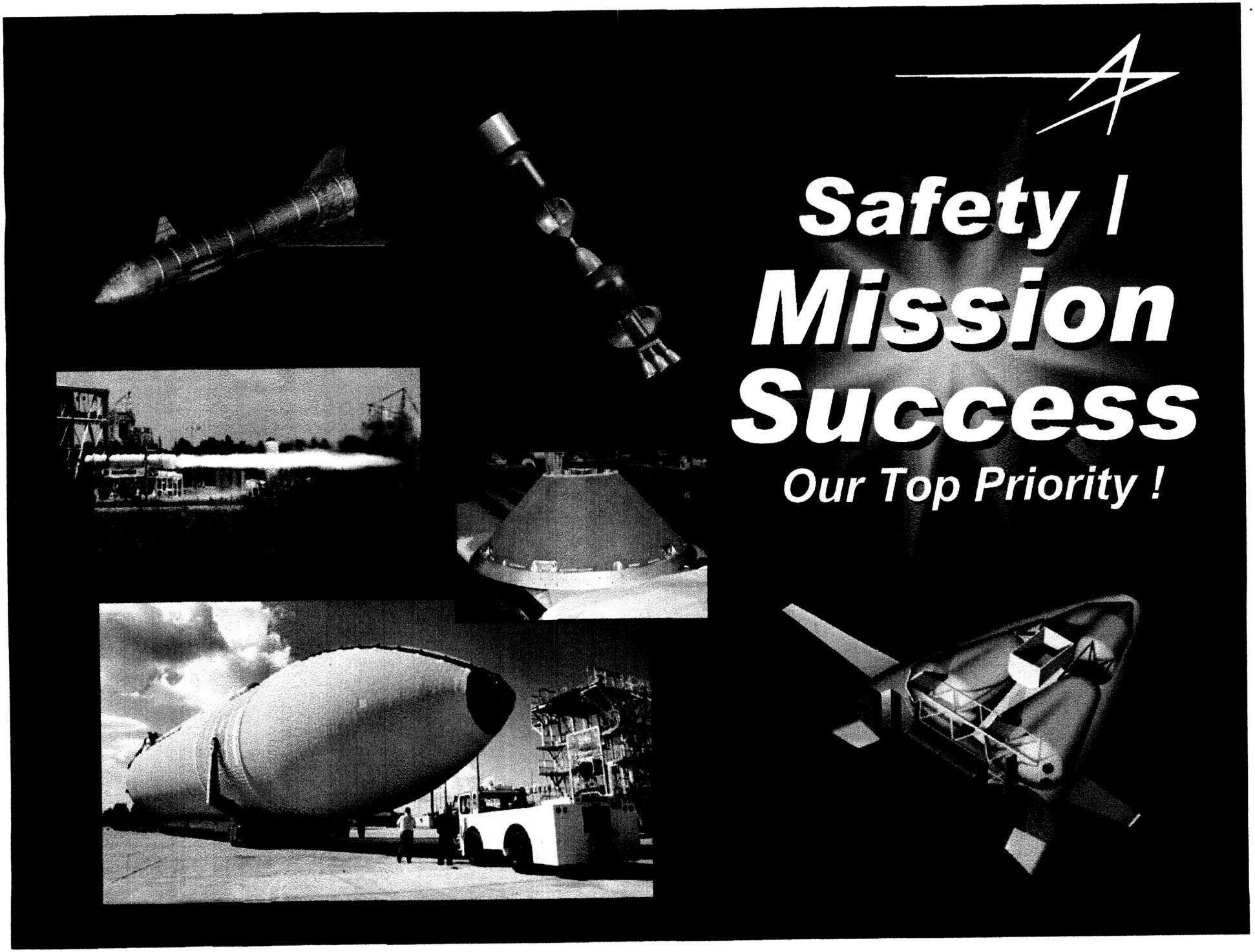
"MI" CIL Process

- "MI" CILs are currently planned into manufacturing and test documents per the CIL Implementation Drawing requirements
- At present, there is no Closed Loop process for "MI" CILs
- This may change, as our NASA Customer has requested Lockheed Martin to develop a method for closed loop accounting of "MI" CILs, and to provide an appropriate recommendation to contract requirements to accomplish this

Summary



- Lockheed Martin was requested to develop a closed loop CIL system following the Challenger accident
- The system that was developed has proven to be very robust with minimal problems since implementation, having zero escapes in last 7 yrs (27 External Tanks)
- We are currently investigating expansion of the CIL Closed Loop system to include "MI" CILs


Safety I
Mission
Success
Our Top Priority !