

# **SSES SUBMERGED STRUCTURE TESTS**

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**8004080667**

## OBJECTIVES

### PRIMARY

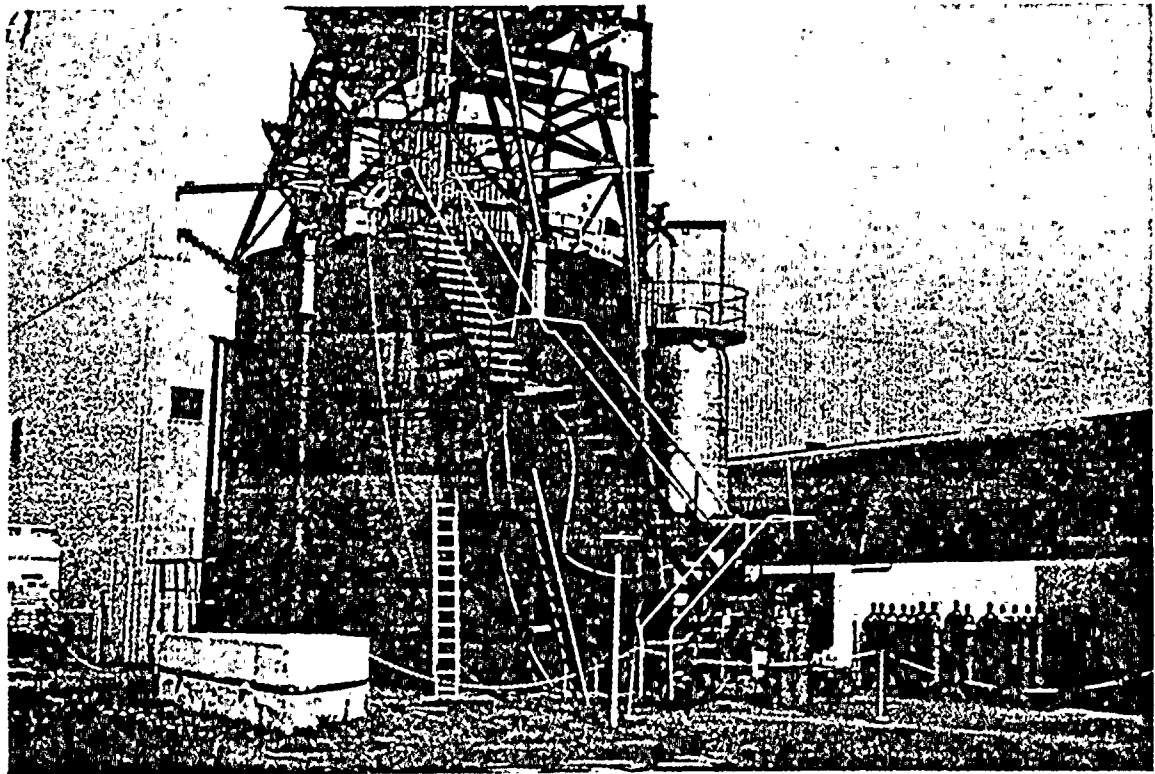
1. Measure Submerged Structure Loads and Response Under Simulated SRV Air Clearing.

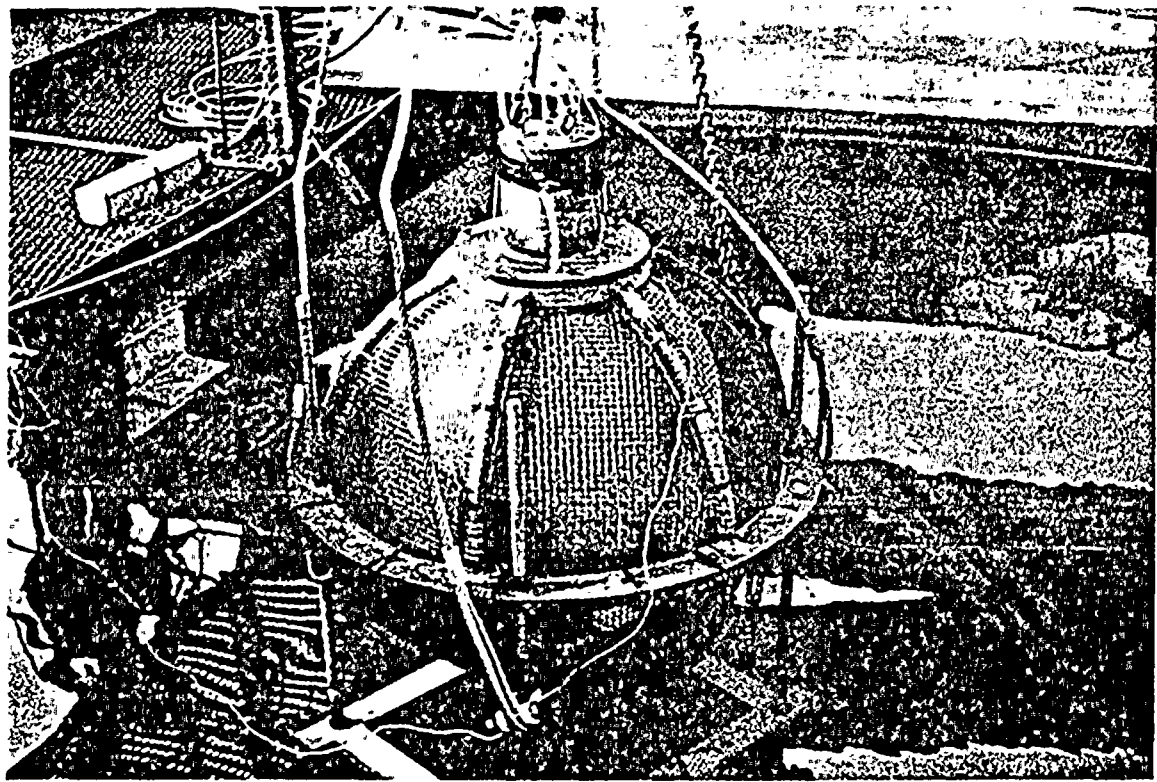
### SECONDARY

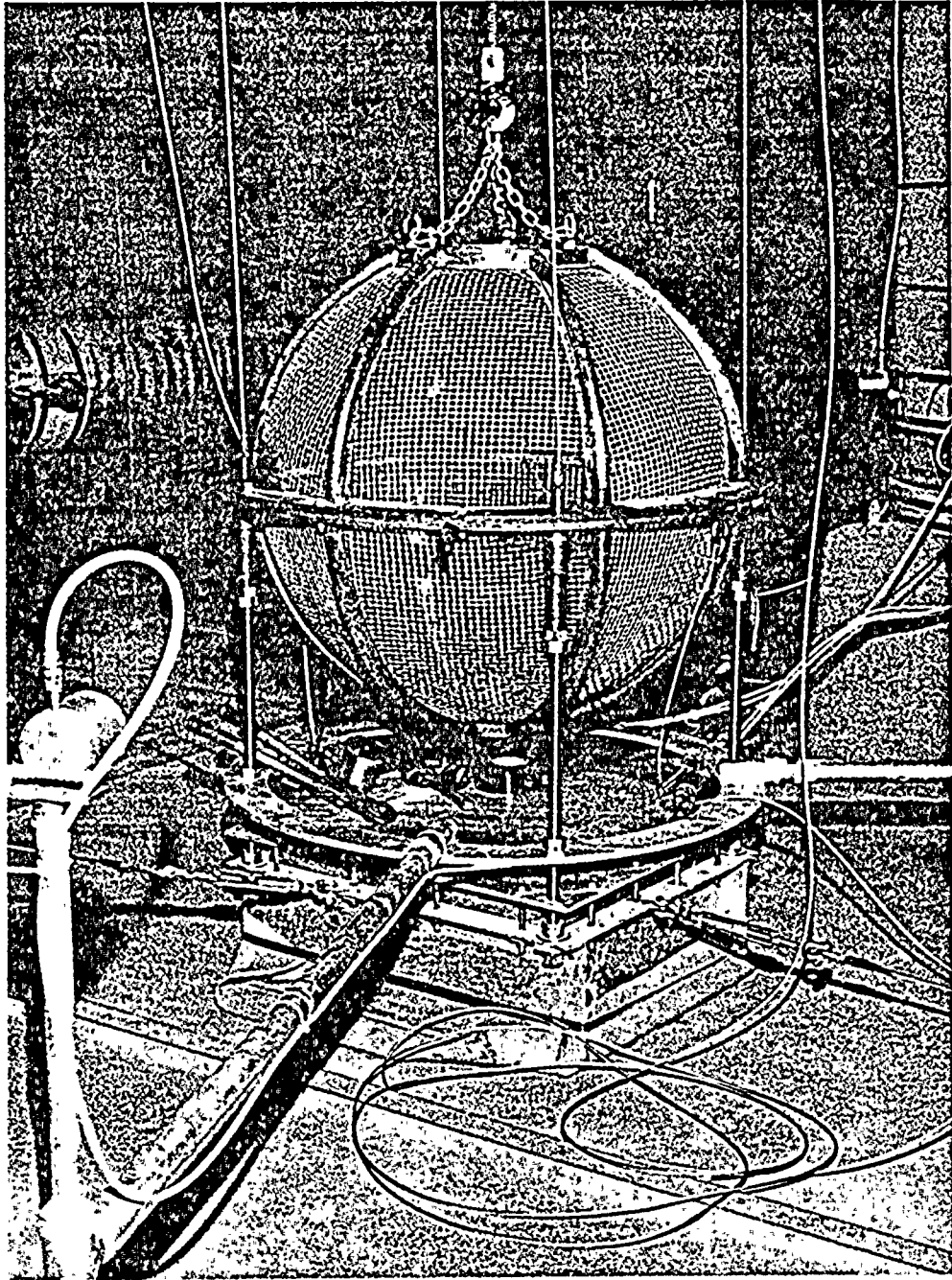
2. Verify Theoretical Transposition of Karlstein Air Clearing Loads to SSES.
3. Obtain Data with Two Interacting Bubbles for Comparison with Theory.

## OUTLINE

- **Characteristics of Air Clearing Bubbles in Karlstein Tests.**
- **Development of Bubble Source to Simulate SRV Air Clearing.**
- **Bubble Calibration Tests at Karlstein .**
- **SSES Tests. .**



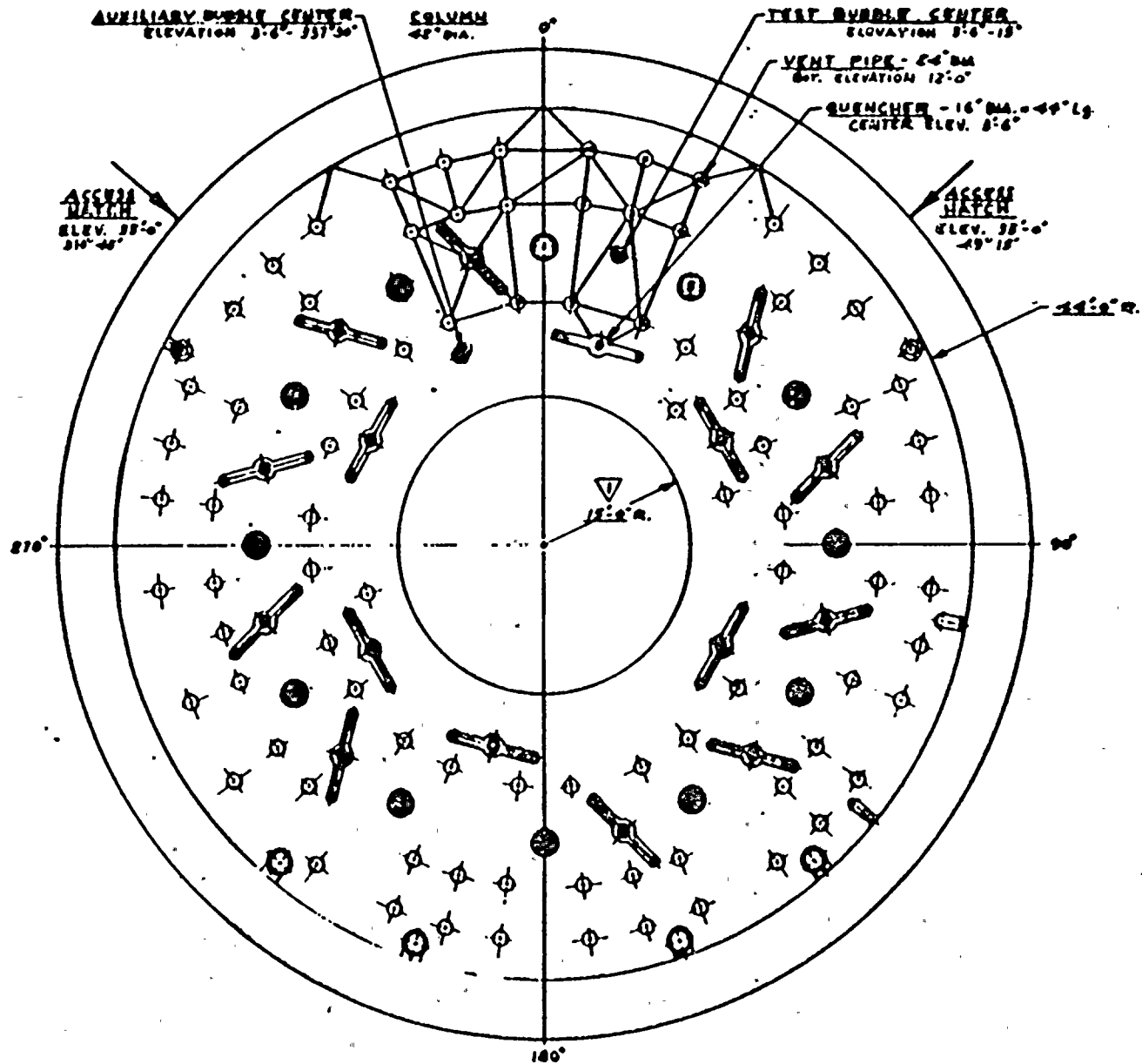




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## **SSES TESTS**

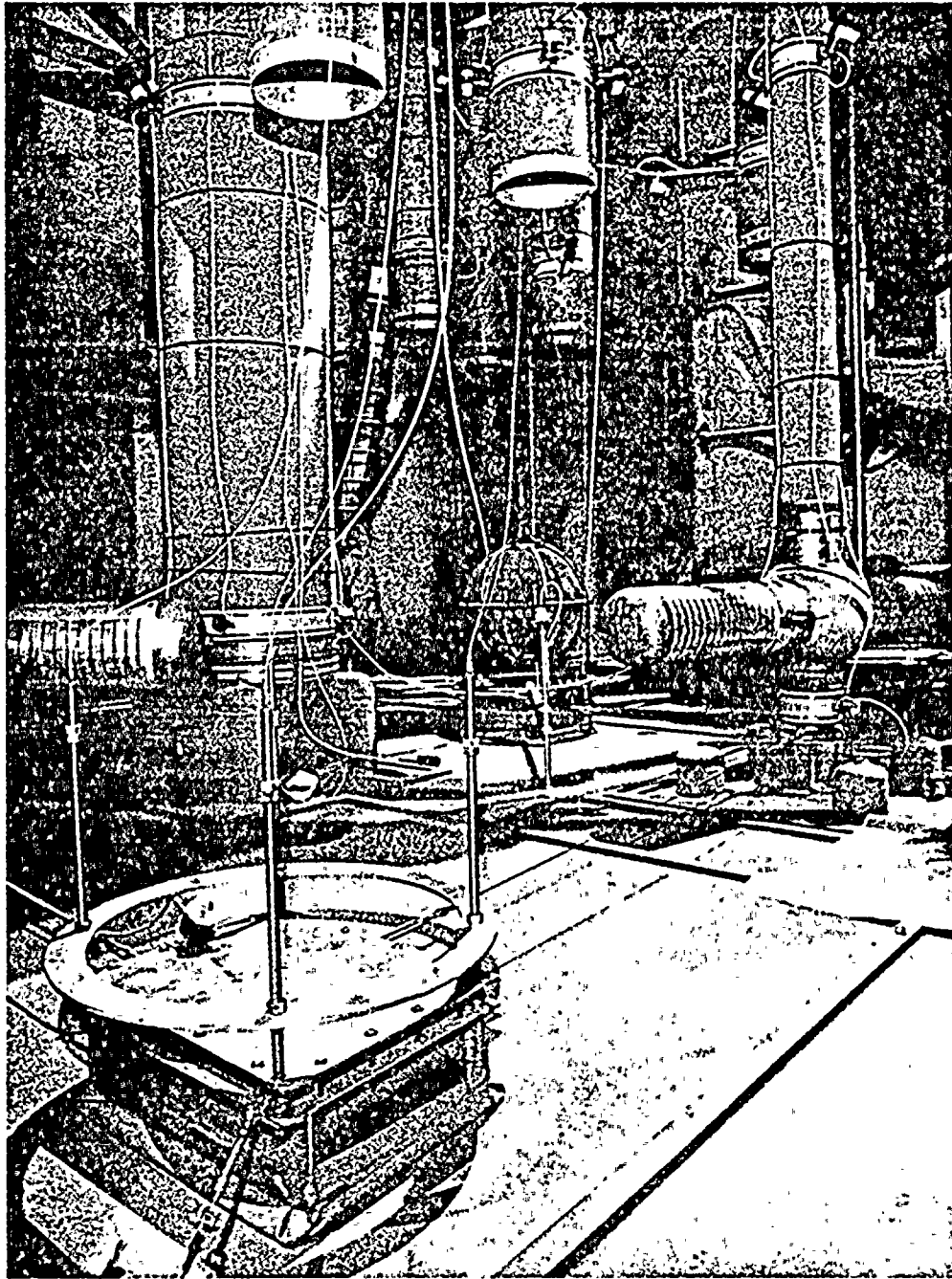
- **Bubble Locations**
- **Pool Instrumentation**
- **Single Bubble Tests**
- **Double Bubble Tests**



14'-0" DA  
 140"







MP-5881-108

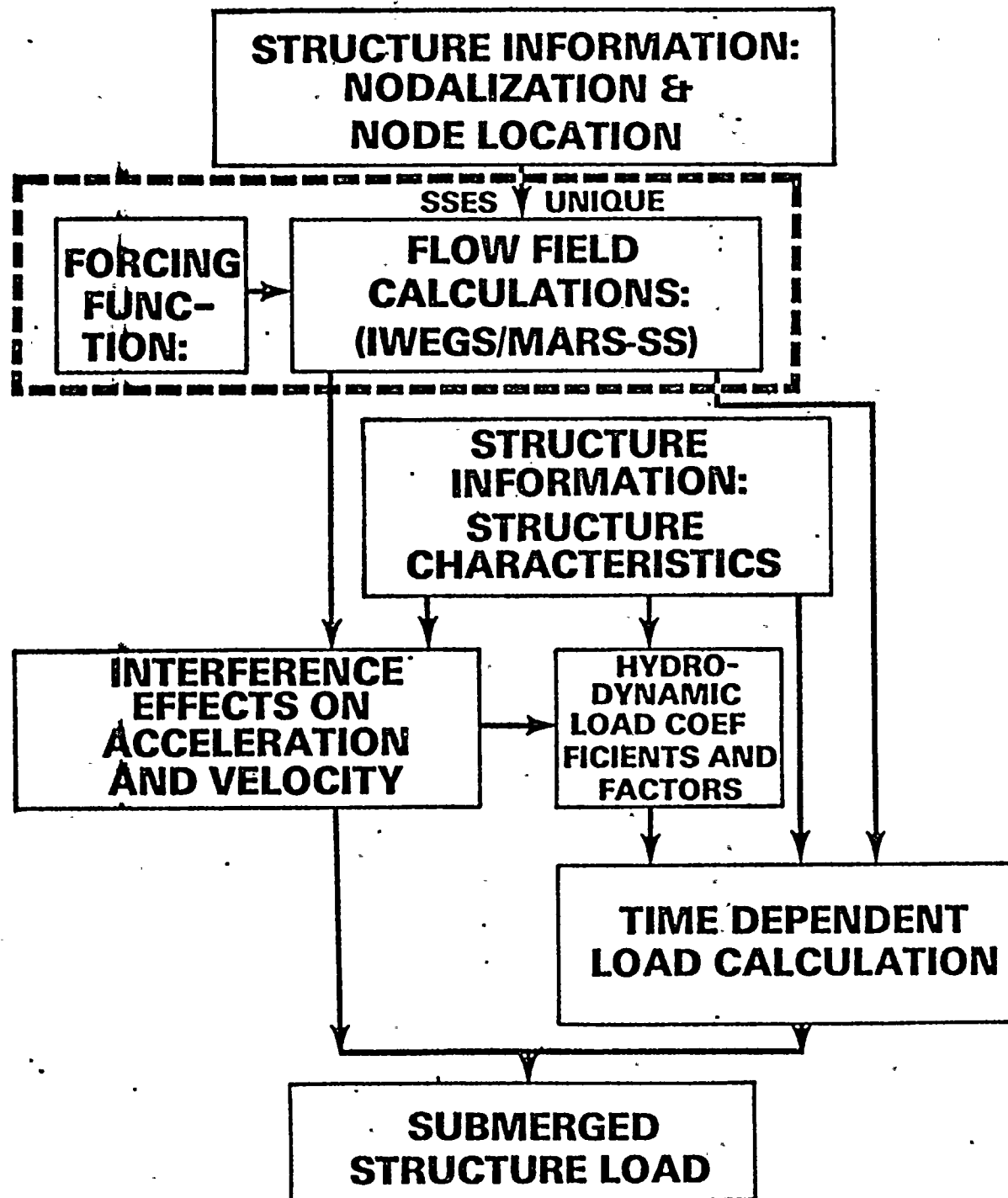
## LOCA SUBMERGED STRUCTURES LOADS

- FOR WATER CLEARING LOADS, WE ARE FOLLOWING LEAD PLANT APPROACH (LA SALLE DAR)
- WILL BE DISCUSSING BOTH LOCA AIR BUBBLE CHARGING LOADS AND STEAM CONDENSATION LOADS
- APPROACH USED FOR STEAM CONDENSATION LOADS WILL USE A SOURCE DEFINITION AS IN-PUT
- FINAL DEFINITION OF SOURCE STILL OPEN



## **PURPOSE:**

- 1. INDICATE THE SSES UNIQUE SUBMERGED STRUCTURE LOAD CALCULATION PROCEDURES**
- 2. SHOW THAT THE SSES UNIQUE PROCEDURES PROVIDE A METHOD CONSISTENT WITH OTHER MK II CALCULATION PROCEDURES**
- 3. DEMONSTRATE THE SIMILARITY OF THE OVERALL SSES CALCULATION PROCEDURES TO THE MK II SUBMERGED STRUCTURE PROGRAM**



# STEAM CONDENSATION LOADS

CHUGGING SOURCE  
MK II TASK A.16

C.O. SOURCE  
MK II TASK A.17

CHUGGING SOURCE

C.O. SOURCE

IWEGS/MARS  
(MK II TASK A.16)

ANALYTICAL & CODE  
MODIFICATIONS

IWEGS/MARS-SS

SUPPRESSION POOL  
BOUNDARY LOADS

SUPPRESSION POOL  
FLOW FIELDS

## **STRUCTURE INFORMATION:**

### **INPUT:**

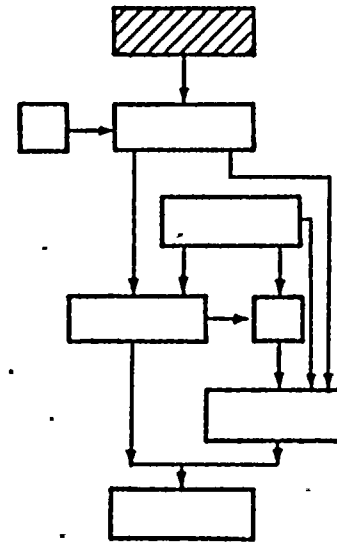
- 1. STRUCTURE DIAMETER**
- 2. STRUCTURE LOCATION**
- 3. STRUCTURE ORIENTATION**

### **OUTPUT:**

- 1. NODALIZATION OF THE STRUCTURE**
- 2. NODE LOCATIONS ARE 1 STRUCTURE DIAMETER APART**

### **REFERENCES:**

- 1. LEAD PLANT RESPONSE TO THE NRC CRITERIA (NUREG-0487)**
- 2. GENERIC RESPONSE TO THE NRC CRITERIA, TASK C.15**





## **FORCING FUNCTION (LOCA AIR BUBBLE):**

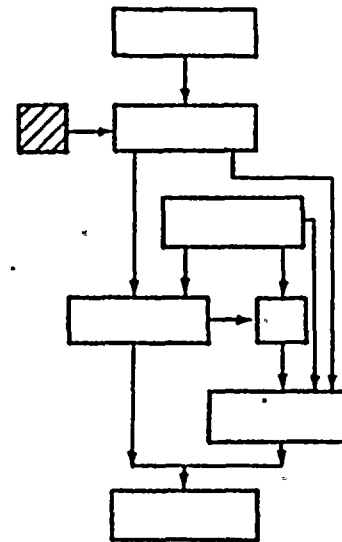
### **INPUT:**

#### **1. QUALITATIVE BASIS**

- a. CATTON, ET AL**
- b. SONIN, ET AL**
- c. 4T TEST DATA**
- d. EPRI 1/13.3 SCALE SINGLE CELL TESTS**
- e. EPRI 1/13.3 SCALE 3D-TESTS**

#### **2. QUANTITATIVE BASIS**

- a. 4T TEST DATA (INCLUDING RECENT 4TCO TESTS)**
- b. EPRI 1/13.3 SCALE SINGLE CELL TESTS**
- c. EPRI 1/13.3 SCALE 3D-TESTS**



## **FORCING FUNCTION (LOCA AIR BUBBLE) (Cont)**

### **OUTPUT:**

**LOCA AIR BUBBLE SOURCE, BOUNDING FOR THE PLANT PARAMETERS IN THE SSES CONTAINMENT (THE SOURCE IS GIVEN IN  $(L^3/T^2)$  FOR INPUT INTO IWECS/MARS-SS)**

### **REFERENCES:**

- 1. NEDE-13468P**
- 2. EPRI-SINGLE CELL TESTS (DRAFT REPORT)**
- 3. EPRI-NP-441**
- 4. SONIN, ET AL**
- 5. CATTON, ET AL**

## **FLOW FIELD CALCULATIONS:**

### **INPUT:**

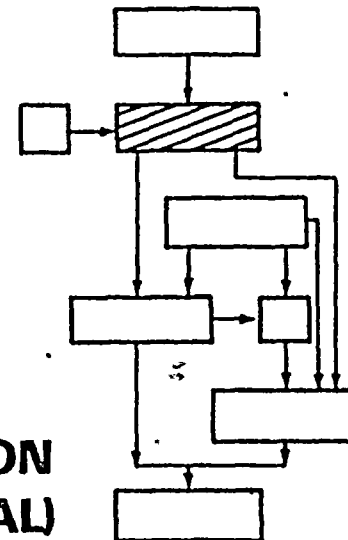
- 1. NODE LOCATION**
- 2. FORCING FUNCTION IN THE FORM OF A SOURCE.  
(DIFFERENT FOR EACH PHENOMENON)**

### **OUTPUT:**

- 1. TIME DEPENDENT COMPONENTS OF THE ACCELERATION AND VELOCITY VECTORS (RADIAL, AZIMUTHAL, & AXIAL) USING IWEGS/MARS-SS. (IWEGS/MARS-SS IS THE SAME CODE USED TO CALCULATE THE MARK-II CHUGGING, BOUNDARY LOADS; BUT MODIFIED TO CALCULATE THE FLOW FIELDS IN THE POOL INSTEAD OF BOUNDARY PRESSURES. THE ANALYTICAL SOLUTION REMAINS UNCHANGED)**
- 2. ALL SOURCES (87 VENTS) ARE APPLIED IN PHASE**

### **REFERENCES:**

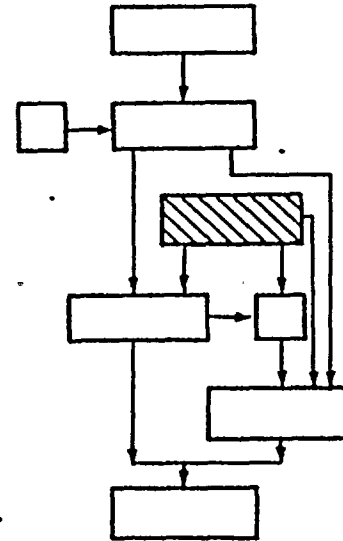
- 1. MARK-II CHUGGING PROGRAM (TASK A.16)**



## **STRUCTURE INFORMATION:**

### **OUTPUT:**

- 1. STRUCTURE DIAMETER**
- 2. STRUCTURE ORIENTATION**
- 3. STRUCTURE CROSS-SECTION (EG. CIRCULAR, BOX, I-BEAM)**
- 4. STRUCTURE (SEGMENT) LENGTH**
- 5. SURROUNDING STRUCTURES' LOCATION, SIZE, AND ORIENTATION**



FORCING FUNCTION (CHUGGING):

INPUT:

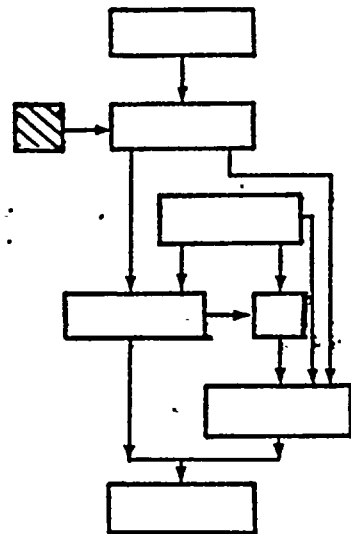
1. 4T TEST DATA
2. GKM-IIM (SSES PROPRIETARY) TEST DATA
3. 4TCO TEST DATA
4. GE BOUNDING CRITERIA

OUTPUT:

CHUGGING SOURCE, BOUNDING FOR SSES PARAMETERS (THE SOURCE IS GIVEN IN  $L^3/T^2$ ) FOR INPUT INTO IWECS/MARS-SS).

REFERENCE:

MARK II TASK A.16  
GKM-IIM REPORT



FORCING FUNCTION  
(CONDENSATION OSCILLATION):

INPUT:

1. 4T TEST DATA
2. 4T CQ TEST DATA
3. GKM-IIM (SSES PROPRIETARY) TEST DATA
4. GE BOUNDING CRITERIA

OUTPUT:

C.O. SOURCE, BOUNDING FOR SSES PARAMETERS (THE SOURCE IS GIVEN IN  $(L^3/T^2)$  FOR INPUT INTO IWECS/MARS-SS)

REFERENCE:

MARK II TASK A.17

GKM-IIM REPORT

