



## AIR TRAINING COMMAND

### DEPARTMENT OF MISSILE TRAINING

# INERTIAL GUIDANCE - COMMAND SIGNAL GENERATION

May 1961

Revised November 1961

COURSE OBR1821B/3121-3-III-8-P1  
TECHNICAL TRAINING

FOR INSTRUCTIONAL PURPOSES ONLY



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THE STUDENT STUDY GUIDE, contains the specific information required in the Unit of Instruction or it will refer to other publications which the student is required to read. It contains the necessary information which is not adaptable for student study in other available sources. The material included or referred to is normally studied either outside the classroom or during supervised study periods in the classroom. Also included are thought provoking questions which permit self-evaluation by the student and which will stimulate classroom discussion.

THE STUDENT WORKBOOK, contains specialized job procedures, important information about the job, questions to be answered, problems to be solved and/or work to be accomplished by the student during the classroom/laboratory, airplane/equipment activity. It serves as a job sheet, operations sheet, mission card, checklist, or exercise to be performed during classroom or laboratory periods. Also included are questions which will aid the student in summarizing the main points of the subject or Unit of Instruction.

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Missile Operations/Maintenance Officer  
Missile Fundamentals Branch  
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OBR1821B/3121-3-III-8-P1  
Student Workbook  
November 1961

DAY 46

INERTIAL GUIDANCE - COMMAND SIGNAL GENERATION

OBJECTIVE:

To develop an understanding of command signal generation in an inertial guidance system.

PROCEDURE:

1. Answer questions a through f.
  - a. Explain the effect of gravity on the output of an accelerometer.
  - b. What is the purpose of the built in float unbalance along the spin axis of the accelerometer?  
*ACC*
  - c. Explain why constant motion has no effect on the output of the accelerometer.
  - d. Why must a gyro nulling apparatus be incorporated into the accelerometer system?



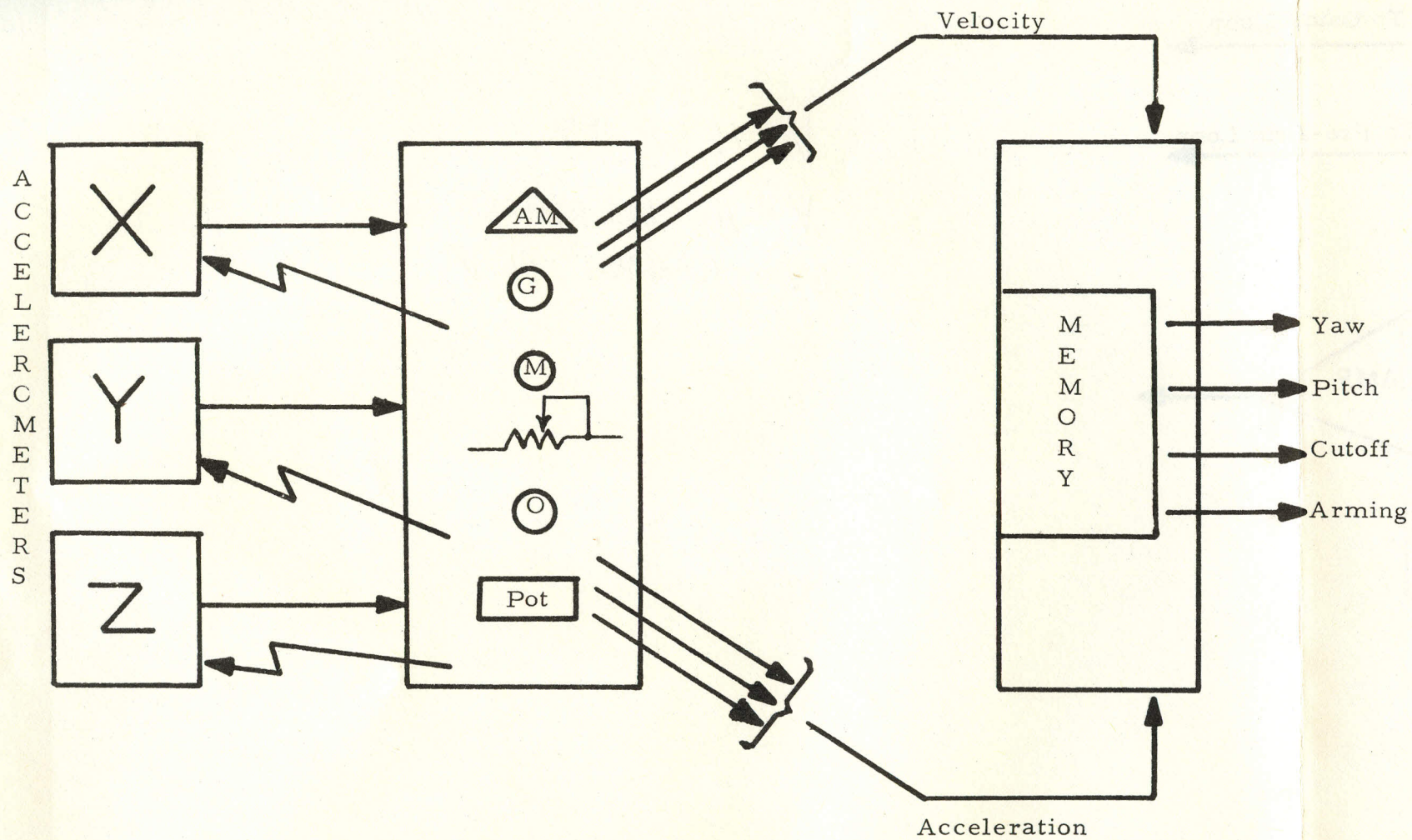
e. What is the purpose of the accelerometer drive motor in this system?

TO COMPENSATE TO NULL POSITION

f. What are three main differences between the stabilization gyro and the accelerometer gyro?

2. The instructor will supply the necessary extra information to complete Figures 1 through 7. Label the components and construct the data flow of each of the figures shown.





Command Signal Generation Data Flow

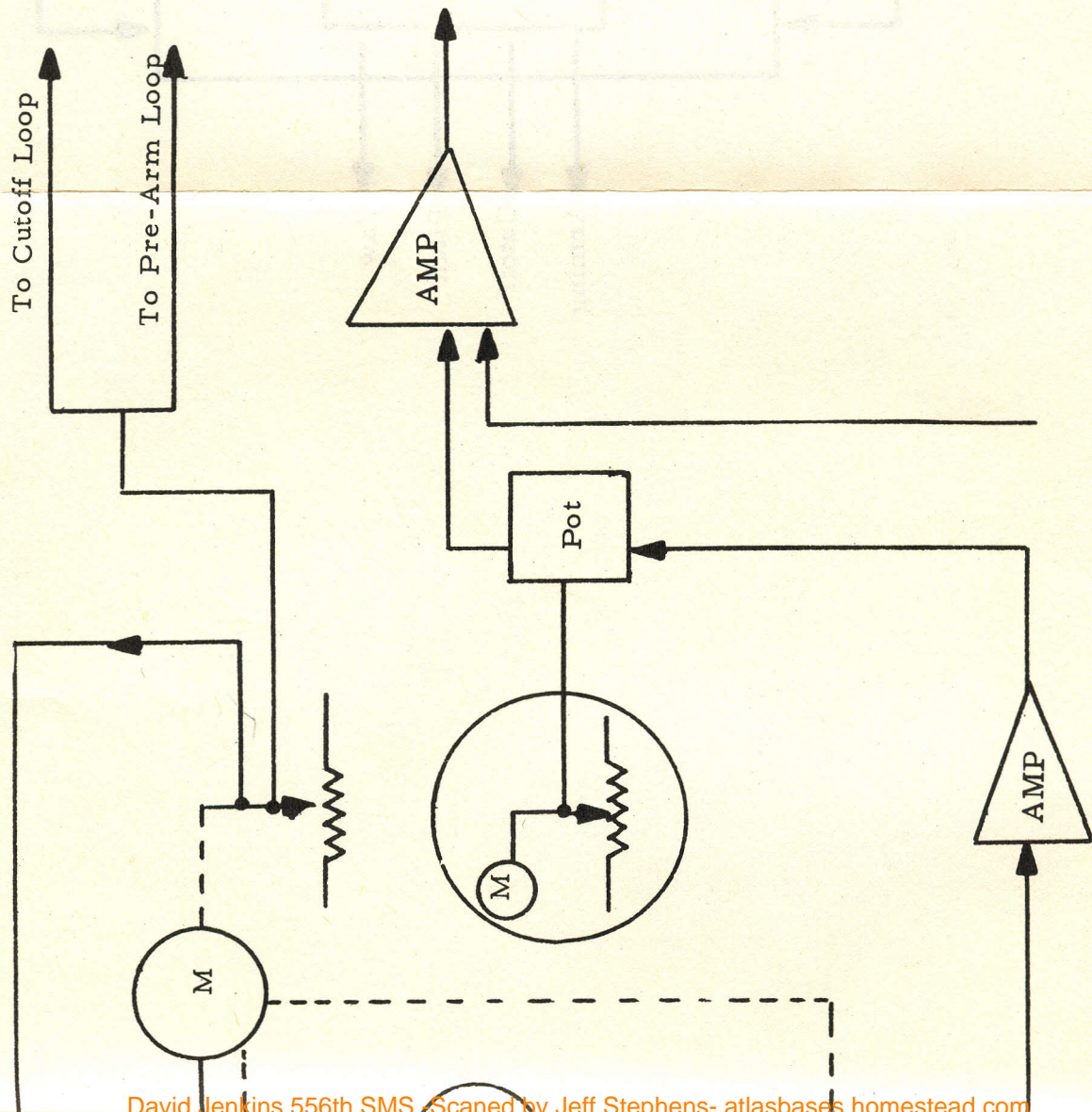
Figure 1



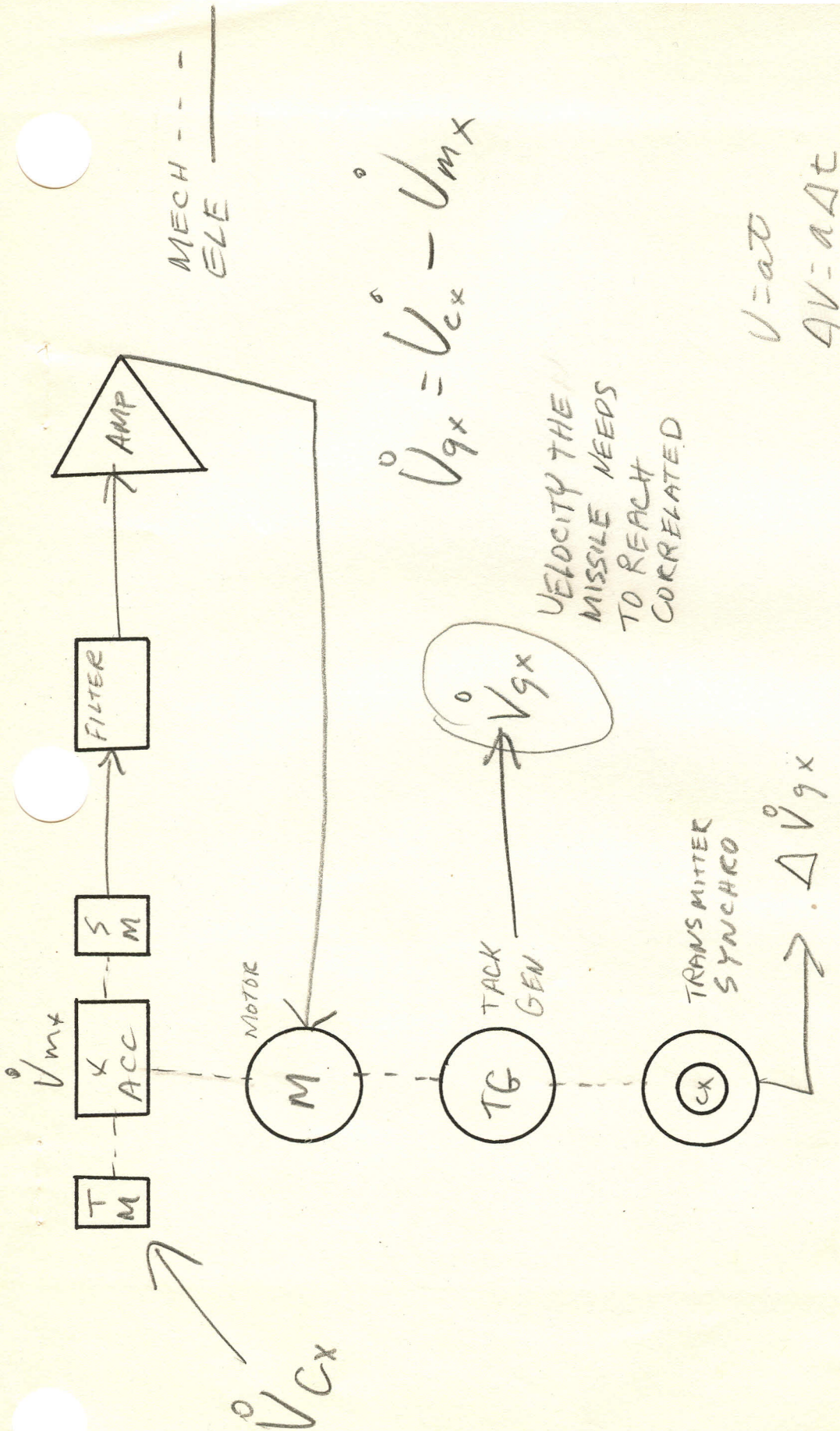




$V = \text{VELOCITY}$   
 $\dot{V} = \text{ACCELERATION}$   
 $\Delta V = \text{CHANGE OF } V$



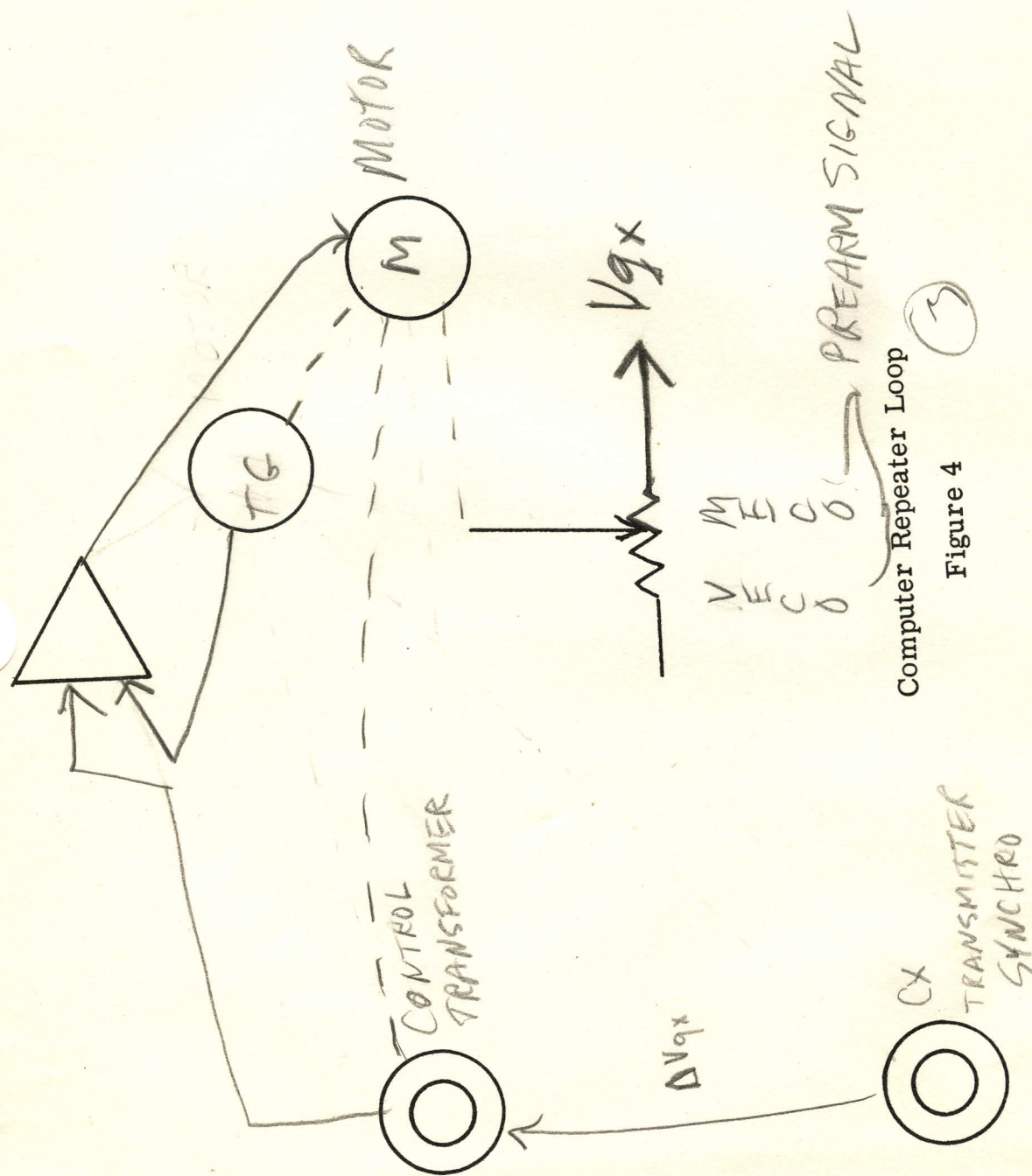




Accelerometer Drive Loop

Figure 3





Computer Repeater Loop

Figure 4



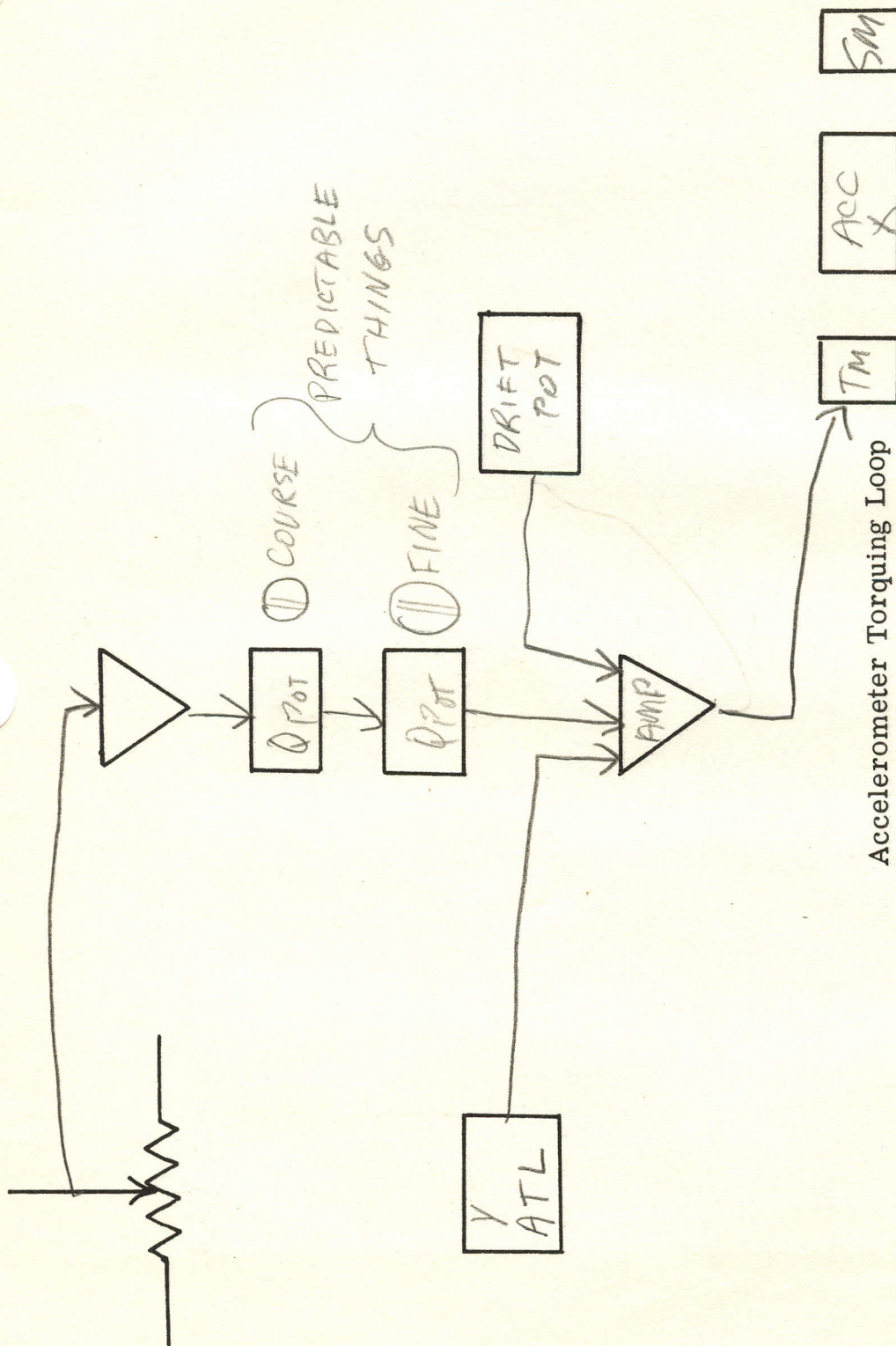


Figure 5

*ASTER*







## COMMAND SIGNAL GENERATION

### OBJECTIVE:

To develop an understanding of guidance system components.

### PROCEDURE:

Answer the following questions.

1. An inertial guidance system senses a missiles movement as an ACCELERATION quantity. This quantity is integrated to determine VELOCITY which is also integrated to determine DISTANCE.
2. What law of physics is the operation of an accelerometer based upon?  
NEWTON'S LAWS OF MOTION
3. Why is an accelerometer usually a single axis of freedom device?  
MORE ACCURATE
4. What effect will high velocities have on the operation of an accelerometer?  
NOTHING
5. What effect does gravity have on the operation of an accelerometer?  
VARRIES
6. Define velocity-to-be-gained.  
DIF BETWEEN MISSILE V + CORRELATED V



7. How does the magnitude of correlated velocity vary during the guided portion of flight?  
DECREASES
8. What two quantities are compared in order to determine steering signals?  
ACCELERATION + VELOCITY
9. Why is an intentional gyro wheel unbalance used in an accelerometer gyro?  
MAKE IT SENSITIVE TO ACCELERATION
10. Why must an accelerometer gyro be ~~continually~~ rotated about its input axis?  
MAINTAIN ROTOR IN THE NULL POSITION
11. What is the purpose of the signal microsyn as used on the accelerometer gyro?  
SENSE ROTATION ABOUT OUTPUT AXIS
12. Explain why it is necessary to maintain the accelerometer gyro at a null position during operation.  
MOST SENSITIVE AND ACCURATE POSITION
13. What is the major purpose of the following loops?
- Accelerometer drive.
  - Computer repeater.
  - Steering.



d. Accelerometer torquing.

14. Why is the main engine cutoff prior to the vernier engines?

1. THRUST DECAY
2. FINE ADJUSTMENT

15. What is thrust decay?

AFTER CUTOFF

16. What are the values of the following quantities at the instant of separation?

a. Velocity to be gained? = 0

b. Correlated velocity =  $V_m$

c. Missile velocity =  $V_c$

17. What is the purpose of pre-arming a re-entry vehicle?

SAFETY

18. Why is the guidance system used as the source of the pre-arm signal?

ONLY SYSTEM THAT KNOWS WHATS GOING ON