References:

1. NASA ARC/MSC Technical Memo, "Preliminary LSM Thermal Test Plan"
2. NASA ARC/MSC Technical Report/Communication, "Preliminary LSM/ALSEP Cable Study, " 4/26/66
3. NASA Letter EX32/L49-66-B50, "Thermal Study for Lunar Surface Magnetometer (LSM)," J. C. Church to J. Clayton, 6/12/66.
4. NASA ARC/MSC Technical Report/Communication, "LSM Thermal Control - Status of Secondary Heat Transfer Analysis," 4/13/66
5. BxA Drawing No. 2331191 - Junction-Adapter Magnetometer
6. BxA Drawing No. 2331192 - Cable, Ribbon Modified
7. BxA Drawing No. 2333503 - Cable Assy (W40) Magnetometer
8. LMSC/A852849, "Preliminary Analysis of ALSEP Cables," 2/2/67

## SUMMARY

The heat loss through the constantan section of the LSM cable has been analyzed by a closed analytical solution as developed in Reference 8. This solution includes the losses due to conduction and radiation. The effect of the radiation losses from the cable both internal and external to the EGFU package are also accounted for. The heat loss during lunar night was computed using boundary conditions consistent with the ALSEP environment, and found to be .25 watts.

## ANALYSIS

From Reference 8, the total heat loss is defined as:

$$Qe = KiAx \left\{ \frac{\frac{Asc(\sigma T_{sc}^4 - \sigma T_{sp}^4)}{KiAx}\left[\frac{Li}{2}\sqrt{\frac{Ase\,\sigma T_{se}^4}{Le\,T_{se}\,Ke\,Ax}} + \frac{Ki}{Ke}\right] + T_o\sqrt{\frac{Ase\,\sigma T_{se}^4}{Le\,T_{se}\,Ke\,Ax}}}{Li\sqrt{\frac{Ase\,\sigma T_{se}^4}{Le\,T_{se}\,Ke\,Ax}}} \right\}$$

where

Ki = conduction of the internal section of the cable

Ke = conduction of the external section of the cable

Li = length of cable internal to EGFU

Le = length of cable external to EGFU

Asi = area of cable internal to EGFU

Ase = area of cable external to EGFU

To = temperature of electronics

Tsp = temperature of internal surface of insulation surrounding EGFU

Tsi = temperature of cable internal to EGFU

Tse = temperature of cable external to EGFU

The following quantities were used assuming lunar night conditions:

$Ki = Ke = 13 \frac{BTU}{hr\ ^{o}F\ ft}$

Li = 1/6 ft

Le = 1/3 ft

Asi = .0225 $ft^2$

Ase = .045 $ft^2$

Ax = $9.3 \times 10^{-5}$ $ft^2$

To = $-22^{o}F$

Tsi = $-30^{o}F$

Tsp = $-40^{o}F$

Tse = $-200^{o}F$

Using these values, the heat loss was found to be 0.25 watts.

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# SCHEMATIC OF LSM CABLE HEAT LOSSES

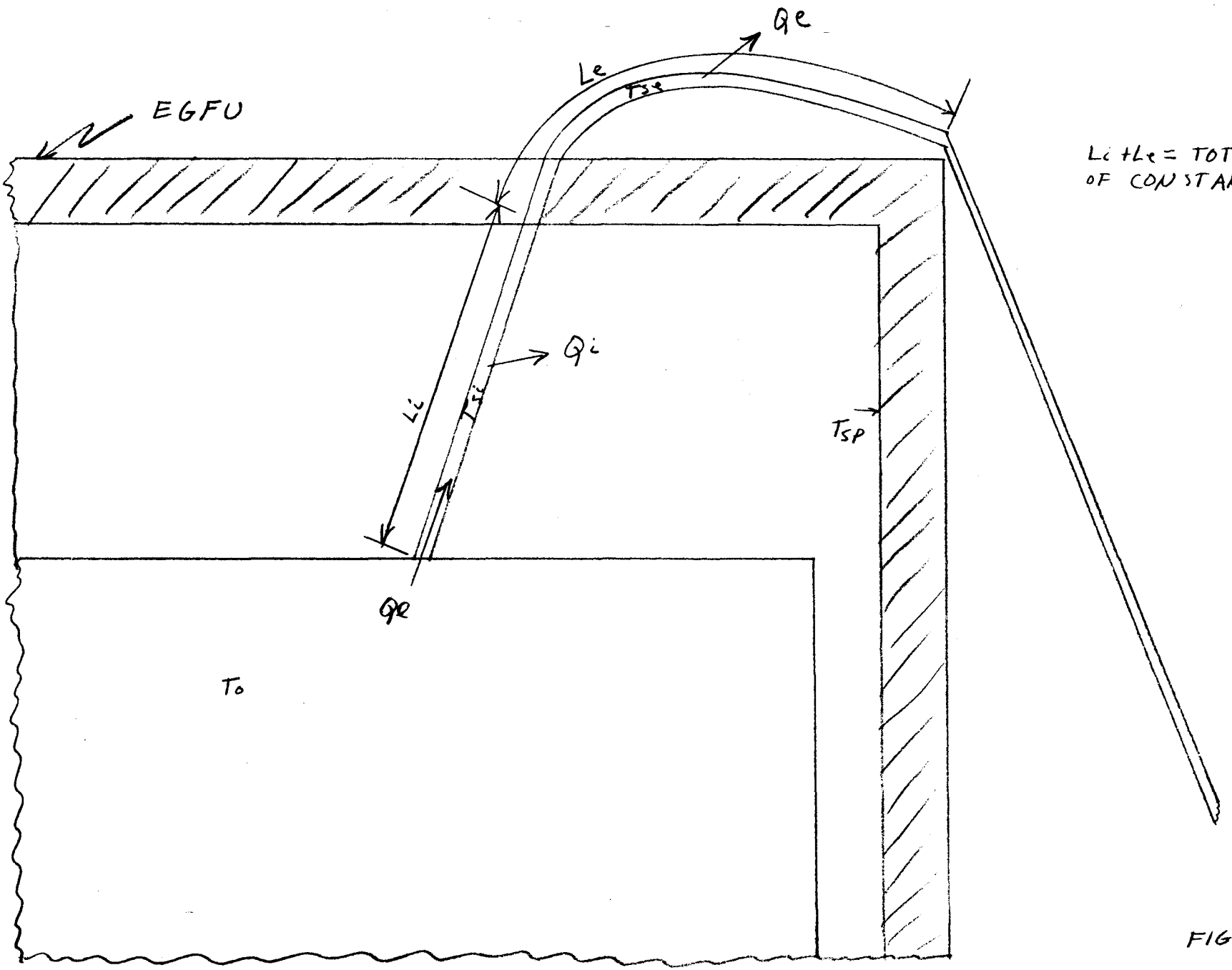


FIG. 1.