Cruise

During the cruise portion of the flight profile, enough thrust must be supplied to overcome aircraft drag at 50 mph.

$$D = 1/2\rho V^2 f_e = 1/2(0.00218)(74)^2(5)$$

$$= 29.5 \text{ lb (19.3 percent of full power)}$$

Time required at this thrust level is one hour.

A summary of the estimated engine run-time, power required, and fuel consumed at an SFC 1.0 may now be made.

CONDITION	RUN-TIME, HRS.	PERCENT POWER	FUEL USED, LB
Smooth Field T.O.	0.002	100.0	0.3
Climb	0.17	60.8	15.7
Rough Field T.O.	0.0047	100.0	0.7
Climb	0.17	60.8	15.7
Cruise	1.0	19.3	29.5
		Total Fuel Weight	61.9 lb

CONCLUSIONS

The valveless pulsejet engine suggested in this paper for auxiliary sailplane propulsion has many favorable qualities. It has no moving parts which simplifies maintenance and inspection, it can be formed into a variety of shapes and cowled to a low drag configuration, it can easily be restarted, and it requires a minimum of components for operation. This design has the capability of demonstrating a practical solution to the problems now associated with soaring flight.

EDITOR'S CORNER

A NASA-sponsored study (POTENTIAL STRUCTURAL MATERIALS AND DESIGN CONCEPTS FOR LIGHT AIRCRAFT, March 1969) available as NASA Report CR-1285, was carried out by San Diego Aircraft Engineering, Inc., and addressed the area of structural materials and design concepts. The primary objectives of that study were concisely stated in the introduction to CR-1285 and are quoted directly:

1. "To make a comparative evaluation of a wide variety of materials and structural concepts, presently and potentially available for application to light aircraft, by investigating the affect of design, manufacturing, operational, and material requirements on the cost of this class of aircraft."

2. "To apply the more promising materials and structural concepts to the conceptual design of light aircraft."

3. "To identify key problem areas where additional research may increase the potential of promising materials or concepts."

The scope of the report can be seen from the principal section headings listed below:

COST CONSIDERATIONS
- Dollar Value and Price Trends
- Cost as a Function of Speed and Empty Weight
- Cost by Component
- Cost Breakdown

POTENTIAL STRUCTURAL MATERIALS
- Material Costs
- Promising Candidate Materials
- Metallic Materials
- Non-Metallic Materials

EVALUATION OF PROMISING CANDIDATE MATERIALS
- Tension Members
- Simple Columns
- Compression Structure
- Shear Panels

(Editor's Corner continued on p. 35)

(References continued from p. 16)

3. Flight International, "Up to Date with Puffin II," pp. 757-760, November 3, 1966.

4. Flugsport, "Mitteilungen des Muskelflug-Institute," Nos. 1-6, 1936-37.

5. Haessler, Helmut, "Man-Powered Flight in 1935-37 and Today," Canadian Aeronautical Journal, pp. 89-104, March 1961.

6. McMasters, J. H., Cole, C. J. & Skinner, D. A., "Man-Powered Flight," AIAA Student Journal, April 1971.

7. McMasters, J. H., "The Optimization of Man-Powered Aircraft," AIAA Paper No. 71-798, July 1971.

8. Moulton, R. G., "Muscle-Power," Aeromodeler Annual, pp. 58-63+, 1964-65.

9. Moulton, R. G., "Man-Powered Flight," American Aircraft Modeler Annual, pp. 18-29+, 1968.

10. The Royal Aeronautical Society, "Man-Powered Flight-Regulations and Conditions for the £10,000 Kremer Competition," March 1, 1967.

11. Shenstone, B. S., "Man-Powered Flight: State of the Art," Flight International, pp. 325-327, February 27, 1964.

12. Shenstone, B. S., "Unconventional Flight," J. Royal Aeronautical Soc., Vol. 72, No. 692, pp. 655-660, August 1962.

13. Sherwin, K., Man-Powered Flight, Model & Allied Publications Ltd., 13/35 Bridge St., Hemel Hempstead, Herts., 1971.

14. Wilkinson, K. G., "The Design of Sailplanes for High Performance," Aircraft Engineering, pp. 263-271, September 1951.

15. Williams, David; Marsden, Anne; and Lassiere, Alan, "Southampton's Man-Powered Aircraft," Flight International, pp. 787-788, November 23, 1961.

16. Williams John and Butler, Sidney F. J., "Aerodynamic Aspects of Boundary Layer Control for High Lift at Low Speeds," J. Royal Aeronautical Soc., Vol. 67, No. 628, pp. 201-203, April 1963.

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(Editor's Corner continued from p. 34)

- Compression Flanges
- Installation Costs
- Material/Concept Feasibility

APPLICATION OF MATERIALS AND CONCEPTS
- Configuration Determination
- Material and Concept Selection
- Component Design
  - Vertical tail
  - Horizontal tail
  - Wing
  - Fuselage
- Component Cost and Manufacturing Considerations

FATIGUE CONSIDERATIONS
- Establishing a Fatigue Load Spectrum
- Estimation of Fatigue Life
- Pressurization Considerations
- Material Fatigue Properties

FASTENING DEVICES AND METHODS
- Riveting
- Electric welding
- Spotwelding
- Seam welding
- Butt welding
- Arc welding
- Strength of Weld Metal
- Welding Considerations
- Brazing
- Bonding

This study would be useful to designers of sailplanes as well as light aircraft.

The report is for sale ($3.00) by the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151.