

## Automated Assistance for Designing Active Magnetic Bearings

Stennis Space Center, Mississippi

MagBear12 is a computer code (see figure) that assists in the design of radial, heteropolar active magnetic bearings (AMBs). MagBear12 was developed to help in designing the system described in "Advanced Active-Magnetic-Bearing Thrust-Measurement System" (SSC-00177-1), which appears in *NASA Tech Briefs*, Vol. 32, No. 9 (September 2008), p. 61.. (See the Mechanics/Machinery section in the accompanying issue of *NASA Tech Briefs*). Beyond this initial application, MagBear12 is expected to be useful for designing AMBs for a variety of rotating machinery. This program incorporates design rules and governing equations that are also implemented in other, proprietary design software used by AMB manufacturers. In addition, this program incorporates an advanced unpublished fringing-magnetic-field model that increases accuracy beyond that offered by the other AMB-design software.

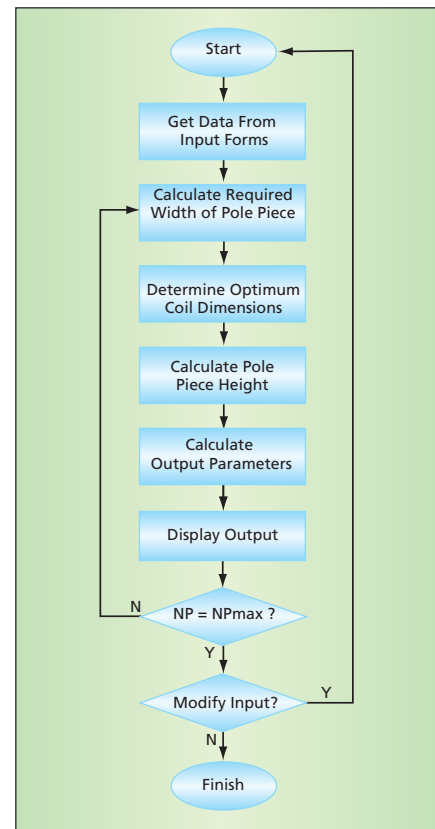
MagBear12 accepts input from the user in the form of parameters that specify the envelope, performance, and acceptable ranges of geometric features other than the envelope. The program then calculates optimized designs within those ranges. A series of designs are presented to the designer for review. The designer can accept one of the designs or can modify the input parameters to refine the designs. The program can also be used to analyze pre-existing AMB designs.

*This work was done by Joseph Imlach of Innovative Concepts In Engineering LLC for Stennis Space Center.*

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*Refer to SSC-00176-1, volume and number of this NASA Tech Briefs issue, and the page number.*



MagBear12 Flowchart

## Computational Simulation of a Water-Cooled Heat Pump

Lyndon B. Johnson Space Center, Houston, Texas

A Fortran-language computer program for simulating the operation of a water-cooled vapor-compression heat pump in any orientation with respect to gravity has been developed by modifying a prior general-purpose heat-pump design code used at Oak Ridge National Laboratory (ORNL). Although it is specific to the design of a high-temperature-lift heat pump for the International Space Station, this program could serve as a basis for development of general-purpose computational software for de-

signing and analyzing liquid-cooled heat-pumps. The ORNL program contained models of refrigerant-fluid-to-air heat exchangers; the main modification consisted in replacing those models with models of plate-type heat exchangers utilizing water as both the cooling and the heating source liquid.

The present program incorporates a Fortran implementation of the American Society of Mechanical Engineers water-properties tables. Semi-empirical models of the heat transfer coefficients

for these heat exchangers were developed from vendor and laboratory test data, inasmuch as applicable published correlations were not available. The program produces estimates of evaporator and condenser capacities, coefficients of performance, and operating temperatures over a range of compressor speeds.

*This work was done by Duane Bozarth of H and R Technical Associates for Johnson Space Center. Further information is contained in a TSP (see page 1). MSC-23375-1*

## Computational Model of Heat Transfer on the ISS

Lyndon B. Johnson Space Center, Houston, Texas

SCRAM Lite ("SCRAM" signifies "Station Compact Radiator Analysis Model") is a computer program for analyzing convective and radiative heat-transfer and heat-rejection performance of coolant loops and radiators, respectively, in the active thermal-control systems of

the International Space Station (ISS). SCRAM Lite is a derivative of prior versions of SCRAM but is more robust.

SCRAM Lite computes thermal operating characteristics of active heat-transport and heat-rejection subsystems for the major ISS configurations from Flight 5A

through completion of assembly. The program performs integrated analysis of both internal and external coolant loops of the various ISS modules and of an external active thermal control system, which includes radiators and the coolant loops that transfer heat to the radiators.