Stars straightened out

by Russ Sampson

Everyone at one time or another must have gazed up into the night sky and wondered at the thousands of seemingly disorganized stars. Our ancient ancestors grouped these stars in constellations, each of which represent the shape of a living or mythological being, or an inanimate object.

One such constellation is Orion 'the Hunter' which is conveniently placed in the southern section of February's night sky. To find Orion just look for the three bright identical stars, equally spaced in a straight line. This group of stars form the belt of Orion and are given the names (from left to right) Alnitak, Alnilam, and Mintaka.

Once the belt has been found then the rest of the constellation can readily be traced. The two bright stars above the belt form his shoulders and the two bright stars below indicate his feet (see photo). In his right hand Orion wields a great club while his left holds out a huge shield.

The star which forms Orion's right shoulder is the famous red giant Betelgeux, more commonly referred to as 'Beetle-juice.'

Betelgeux has an estimated diameter of 250,000,000 miles which, if put in place of our sun, would extend past the planet Mars!

The Greek letters on the star chart indicate the star's brightness in relation to the other stars in the constellation. Therefore alpha Orionis (Betelgeux) is the brightest and Beta Orionis is second and so on. This sounds simple enough (if you know the Grecian alphabet), but for some unknown reason, Betelgeux is not the brightest but is second to Rigel (Beta Orionis). Well . . . I'll let you try and figure it out.

Rigel is the brilliant bluish-white star which forms Orion's left foot. It is estimated that Rigel's luminosity (its relative brightness) is over 50,000 times that of our own star, the sun.

Directly below Orion's belt is a group of stars forming his sword and in the midst of this grouping is a fuzzy object called M 42, a number given to it by Charles Messier who categorized many nebulous objects during the 1800's. This object is actually an immense cloud of rarified hydrogen gas which has been iluminated by a group of very young and very hot stars called the Trapezium. This is a very promising location for the birth of new stars and has attracted much interest in astronomical study.

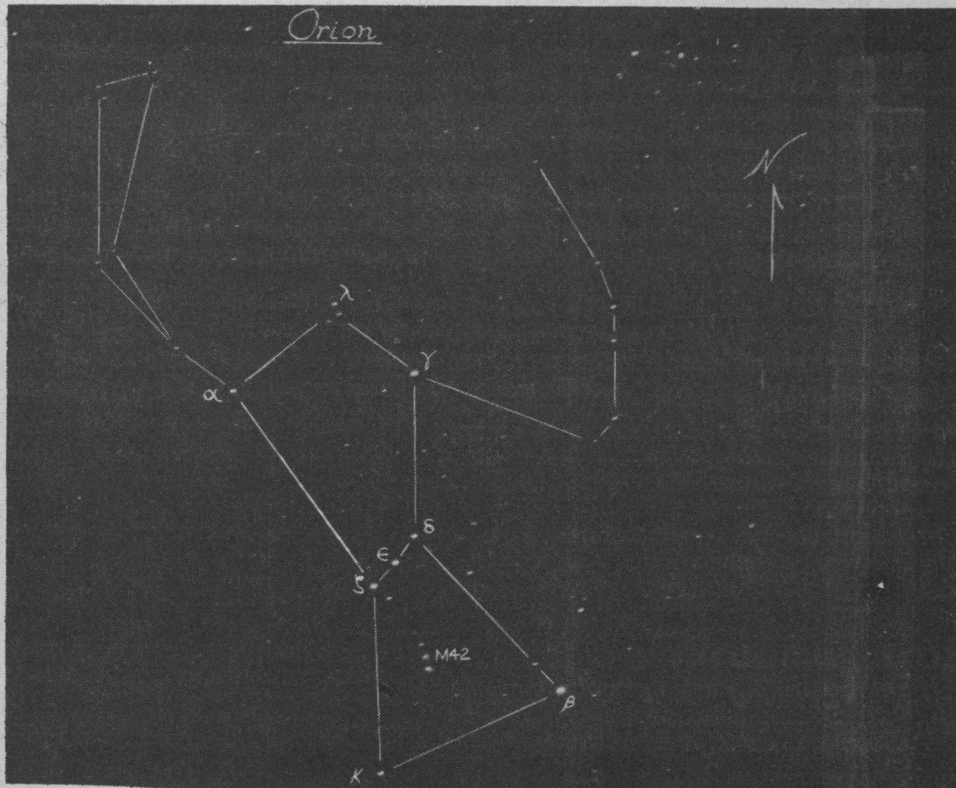


photo Russ Sampson

Orion is an easily recognizable and always fascinating winter constellation which shall provide a good stepping stone for next issue's constellation.

relativeperspectives

by W. Reid Glenn

Nuclear fired boilers can experience severe failures if heat removal from the core is not maintained. If conditions of flowing pressure and temperatures are not strictly preserved, melting of the heat transfer surface becomes a distinct possibility.

A nuclear boiler substitutes zirconium alloys for the iron and chrome mixtures used in standard fired vessels. A variety of reasons dictates this choice, the main being zirconium's resistance to nuclear flux and its small neutron cross-section. Zirconium has the tendancy, like magnesium, to burn violently with air or water at temperatures near its melting point. Thus, if the core's temperature is raised above 2000 ° F, the core begins to disintegrate.

The emergency core cooling systems come into play when normal flow conditions are lost. At the Three Mile Island (TMI) plant, this system didn't prevent a sizeable portion of the reactor cladding material from burning. The result of this core burn was the evolution of copious amounts of hydrogen as the oxygen in the water reacted with the zirconium to form zirconium oxide. The CANDU reactor has several backup systems to assure such cooling is maintained all the time while American and other designs are not equipped with such elaborate measures.

The design at Three Mile Island, advanced by Babcock and Wilcox U.S.A., had primary and secondary coolant loops linked by a pair of steam generators. The design of these heat exchangers limits the amount of coolant within the generator in order to achieve higher steam temperatures. This results in higher thermal efficiencies but lower allowable limits for error or malfunction.

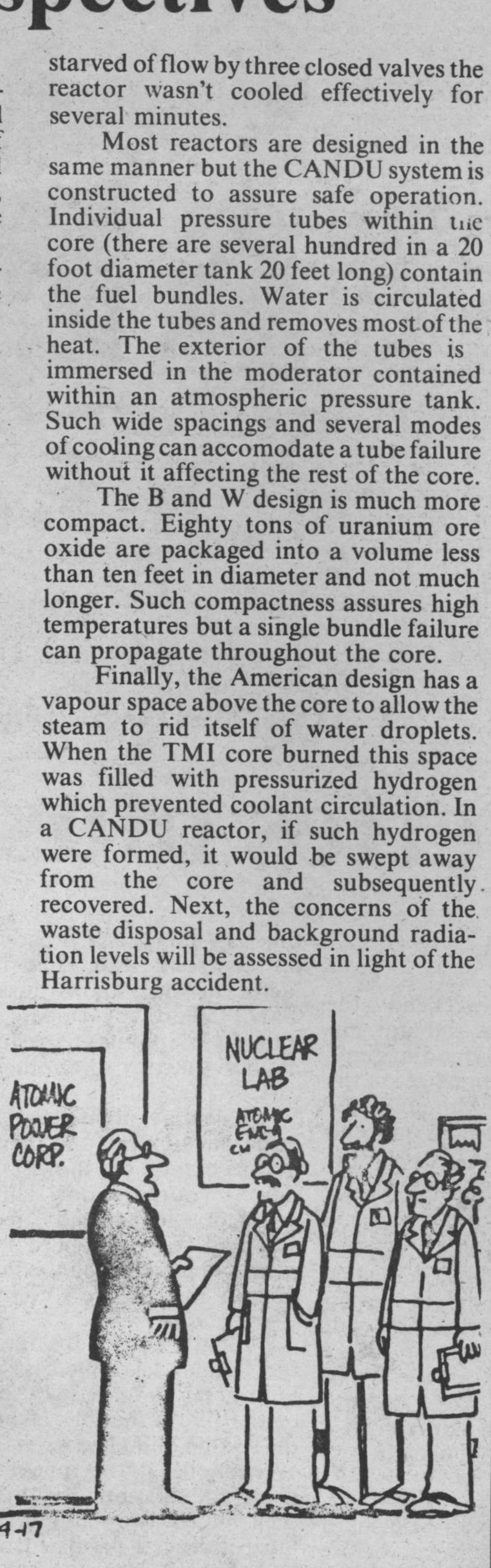
In the CANDU reactor, temperatures are lower and the generators are much larger (four are used). Their size and style (B and W Canada), accounts for considerable amounts of storage. Thus they can withstand coolant flow loss for half an hour while at TMI the secondary side of the heat exchanger boiled dry in about three minutes.

Time is required to allow operators to assess the situation and act upon it. One operator at TMI took eight minutes to open a pair of inadvertantly closed valves. Since the exchangers were starved of flow by three closed valves the reactor wasn't cooled effectively for several minutes.

Most reactors are designed in the same manner but the CANDU system is constructed to assure safe operation. Individual pressure tubes within the core (there are several hundred in a 20 foot diameter tank 20 feet long) contain the fuel bundles. Water is circulated inside the tubes and removes most of the heat. The exterior of the tubes is immersed in the moderator contained within an atmospheric pressure tank. Such wide spacings and several modes of cooling can accomodate a tube failure without it affecting the rest of the core.

The B and W design is much more compact. Eighty tons of uranium ore oxide are packaged into a volume less than ten feet in diameter and not much longer. Such compactness assures high temperatures but a single bundle failure can propagate throughout the core.

Finally, the American design has a vapour space above the core to allow the steam to rid itself of water droplets. When the TMI core burned this space was filled with pressurized hydrogen which prevented coolant circulation. In a CANDU reactor, if such hydrogen were formed, it would be swept away from the core and subsequently recovered. Next, the concerns of the waste disposal and background radiation levels will be assessed in light of the Harrisburg accident.



The public and press are demanding the truth... I want you to come up with three versions of it."

How will it effect the economy?

Energy tested

by Maggie Coates

Every group has its favorite solution to the energy crisis, raise the price of oil, cut back exports, encourage conservation or switch to solar power. But the implications of these different options for the Canadian economy are still unknown.

Dr. D. Quon of the Department of Chemical Engineering is determined to find out. In association with the Alberta Research Council and the provincial government's Department of Energy and Natural Resources, Quon is developing a comprehensive energy resource allocation model to test the effects of alternative energy policies.

Quon says we must reconcile ourselves in the long term to the high price of energy and the increased use of alternative energy sources. Given our energy resource base, the question is how to make the right allocative decisions in designing policies for the future, he says.

The implications of this question are so difficult and so important, it is necessary to use the best analytical tools available. Quon turned to the latest mathematical and computer techniques used to solve large systems problems. This is a standard approach in the U.S. which is now gaining popularity in Canada, he says.

The model includes 1200 equations and 6-7,000 variables — a staggering scale and number of parameters. But in principle, it is a long-run economics model which maximizes "household welfare."

The model attempts to reproduce the Canadian economy as realistically as possible. It incorporates population growth, employed labour force, labour productivity, and a limited concept of social welfare (for example, the cost of environmental programs).

The supply side estimates the cost and extent of Canadian reserves of coal, oil, gas and uranium, as well as important energy technologies. The demand side looks at the process of substitution among different inputs as relative prices change. In other words, what will happen to the demand for other inputs such as labour and capital when the price of oil or gas rises?

The data for Quon's research does add to the constant refinement of large systems analysis, this project is not primarily theoretical. It is a practical attempt to deal with an important problem.

"What we can estimate is the real cost of one policy option versus another. Now you have to weight those real costs against other social and political considerations," says Quon.

"For example, there may be a nationalist argument against exports. How much is that worth? I don't know. But I will be able to tell you how much foreign exchange you will forego by not exporting.

"I think the purpose of programs like this at the university is to try to at least turn out technically competent work so that you can raise the level of debate.

"What you want to do is make sure the choices you make are still valid in the technical sense."

Funding for project sought

Funding to build a proposed nuclear device for use in medical and physical sciences will be considered by the provincial government later this month.

Implementation of Phase II of the proposal, developing the engineering design studies, will be presented to the provincial government cabinet in a special meeting. Financing for this phase will cost $4 million over two years.

Members of the science advisory and steering committee of the project will present the government with the justification for moving the project into the second stage. The deans of Science, Medicine and Pharmacy, and the directors of UAH and the Cross Cancer Institute comprise that committee.

If built, the nuclear particle accelerator will be the only one of its kind in the world used largely for medical research. The next and final phase of the project is the actual building of the accelerator and its housing.