ENGINEERING

River Basin Planning

➤ A NEW river-basin-planning technique is now being applied in the American development of hydroelectric power. It takes into consideration all the possible uses of the water in the basin, for domestic purposes, irrigation, navigation and recreation, as well as the need for flood-control.

This technique may be described as a new branch of engineering, combining hydraulic, civil and electrical engineering into "river-basin engineering," the UNSCCUR will be told at Lake Success this summer by Leland Olds of the American Federal Power Commission. UNSCCUR is short for the international group the full name of which is the United Nations Scientific Conference on the Conservation and Utilization of Resources.

The essential elements in the new program, he will explain, include viewing the entire river as a physical unit to be developed rather than limiting the planning to individual projects. The needs within the entire river basin for the various water uses are appraised in terms of their relation to and effect upon the development of power.

Various alternative plans for dams, reservoirs, waterways, and power plants are laid out upon a multiple-purpose water use basis, and analyzed physically and economically to determine the best plan for power consistent with the other water uses. The various plans are weighed in terms of the construction and operation of the river system upon existing improvements, and particularly upon the flooding of agricultural lands.

Cardinal to all plans studied is the adequate control of the stream through storage reservoirs. Because of the impact of inundations due to storage in the more highly developed areas, he will say, large reservoirs are generally found more practicable in the headwater and tributary streams, with developments only for pondage and power head on the main stem of the stream.

Analysis of the economic feasibility of hydroelectric developments is based on the most economic alternative source of power, which is generally steam-electric. These two sources of power, however, are not looked upon as competitive, but as having their own peculiar characteristics and values achieved through their complementary use.

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ENGINEERING

Ocean-Spanning Rockets

➤ OCEAN-SPANNING rockets, and even rockets that may circle around the earth and remain aloft for weeks, may be looked upon as probabilities, Dr. H. L. Johnston of the Ohio State University declared. He spoke as a guest of Watson Davis, director of Science Service, on Adventures in Science, heard over the Columbia network.

In order to cross the ocean a rocket would have to gain a speed of about 9,000 miles an hour shortly after takeoff, he said. To circle the earth like a miniature planet at, say, 1,000 miles altitude, a rocket speed of 22,000 miles an hour is necessary. With a little more speed, 25,000 miles per hour, the rocket could be sent to the moon or into outer space like a Buck Rogers space ship. The great essential in acquiring these speeds is proper fuel.

Only a fuel like hydrogen has the potentiality of giving a rocket the necessary acceleration to allow it to escape from the earth although some other fuels might be used, he asserted. Hydrogen itself would accomplish the job more easily if one or more "booster" rockets are employed to accelerate the main rocket before its own engine starts firing.

Dr. Johnston described experimental work of the past two years at Ohio State with rocket motors that use liquid hydrogen as a fuel and liquid oxygen to enable the hydrogen to burn. The rocket motor carries its own supply of oxygen. All other engines, including those not widely used in jet-propelled airplanes, depend upon surrounding air for oxygen. The rocket motor is the only type that can be employed in high altitude flight where the air is thin or non-existent.

Liquid hydrogen is ordinary hydrogen gas converted to a liquid by cooling it below its boiling point, which is a minus 423 degrees Fahrenheit, he explained. It looks like water but is only one-twelfth as heavy. It is completely non-combustible and non-explosive by itself but burns with intense heat in contact with liquid oxygen. The temperature in the combustion chamber of the motor may reach 6,000 degrees Fahrenheit, many hundreds of degrees above the melting point of the nozzle and of the chamber walls.

The exhaust from a liquid hydrogen-liquid oxygen rocket can obtain a speed in excess of 8,000 miles an hour, which is 50% greater than that obtainable by the use of alcohol as a fuel, as in the German V2 used to bomb London during the latter part of the war.

However, he added, it is possible to impart even greater speed to the rocket since it can be shown that the rocket obtains a speed higher than its exhaust when the weight of the propellant used for the rocket exceeds about 65% of the gross weight before takeoff. With a 90% propellant load the rocket can be accelerated to double the speed of the exhaust and with a 96% propellant load it can move at three times the exhaust speed.

In discussing the best fuels, he stated, "The maximum exhaust velocities will be provided by those propellant combinations that produce the most heat in burning and, at the same time, form the lightest gases in the combustion products. On both these counts the combination of liquid hydrogen and liquid oxygen ranks near the top."

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AERONAUTICS

Two Types of Jet Engines Power Flying Wing Bombers

See Front Cover

➤ BOTH turbojet and turbo-prop engines will be used for power in a new version of the Air Force's giant Flying Wing bomber, a product of Northrop Aircraft, Inc., Hawthorne, Calif., at whose plant the 100-ton piston-engined B-35 bombers are being converted to more modern propulsion.

Turbojets are the type of engines used in the ordinary jet-propulsion. The turbo-prop utilizes a somewhat similar gas turbine but the high-pressure gases formed are directed against vanes or buckets on a shaft, causing rapid revolution of the shaft which in turn operates conventional propellers.

The turbo-prop to be used is a product of Turbodyne Corporation, also located there, and it is said to be the world's most powerful aircraft engine. This new engine, until now unrevealed, has undergone an ardous testing program at the corporation's test cell and has now advanced to the flight test stage.

Three new versions of the Flying Wing will result from this modification program. Most unusual of the new versions will be a six-jet Flying Wing which will serve as a flying test bed for the new powerful Turbodyne engine. This airplane, designated the EB-35-B, in its first phase tests will be powered by six turbojet engines with the test Turbodyne mounted slightly to the left of the center of the plane, delivering its power through a large dual-rotation propeller.

All of the converted planes will be powered by new, improved Allison J-35 turbojet engines. The basic powerplant arrangement provides for four engines to be submerged in the wing in dual bays, and for two to be suspended in individual stream-lined pods, as shown in the artist's conception on this week's cover of the SCIENCE NEWS LETTER.

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