range, and depends only on the rudder angle and not on the speed. At high speeds, therefore, the turning advance is smaller than the stopping advance; as speeds falls, the two become identical, and at low speed stopping advance is the shorter of the two. (This takes no account of the tendency of the ship to behave irrationally when the rudder is hard over and the propellers reversing. Occasionally under these conditions ships make sharp turns, often to starboard, either because of the unbalancing effect of the right-handed screw propeller, or, in Dr Tani's opinion, because the course stability of the ship becomes extremely poor.)

What conclusions can the captain draw from these unexpectedly complicated considerations? At high speed, a full rudder turn is probably the best course, without reversing the engines. At lower speed, reversing the engines and putting the helm hard over may be best. If the object to be avoided is approaching—as, for example, in a collision situation—the important criterion is to reduce speed in as short a time as possible; in this case, although the ship may be travelling above the critical speed, a crash-back procedure with engines in reverse is recommended.

Saturn Aloft

from a Correspondent

LAST week's first Saturn V flight (called Apollo 4) may have helped NASA to catch up on the lagging timetable for landing two Americans on the Moon by 1970. By combining in one flight the first operational tests of several important components, time has been saved and many of the tactical obstacles to the first manned flight in the Apollo capsule cleared away. That flight is now fixed for autumn 1968, employing the less powerful Saturn I as booster for a low Earth orbit to check the capsule under "live" conditions. At least three further steps of graduated difficulty must follow before the lunar landing attempt.

There is no doubt of the technological achievement of the first Saturn V flight, however misplaced or outdated may now seem the goal of a manned Moon landing by 1970. The organization and co-ordination by themselves compare with an important military exercise—with far less margin for improvisation. That the launching took place to the minute—0700 hours local time, October 8—marks the planning efficiency and the soundness of the new Moonport Complex 39 at its first launching.

The chief engineering tasks to be met were these. The unflown first stage (*F1*), presumed the biggest booster ever to take off, used conventional fuel, but to concentrate a thrust building up to 8.5 million pounds within 150 seconds depended on the fine adjustment and balance of the supply of 28,000 pounds-per-second of propellant for simultaneous burning in five matched engines. The second stage, delivering one million pounds, had never flown before and used tricky liquid hydrogen as propellant in its five clustered (*J-2*) engines. To ensure smooth transfer of power between stages, eight solid fuel rockets used for stage separation also had to "settle" the super-cooled liquids in the bottom of their tanks to ensure instant feed under high vacuum and weightlessness. The third stage centred on a single liquid hydrogen *J-2* engine, with fourteen other rockets for ancillary purposes. The critical and pre-

viously untried test for this stage was to restart the main engine after two Earth orbits to push the vehicle out to a distance (9,300 nautical miles) whence it could start a simulated lunar return and re-entry to prove the Apollo capsule's heat shield. This involved accelerating it downward by means of further rocket burns and high precision onboard control only partly prompted from the ground to ensure correct attitude, angle and so on, to narrow margins for the high speed collision with the atmosphere. A glancing blow, 7.13° (to local horizontal), on the heat protected blunt forward end of the spacecraft was called for, and achieved.

More Action on Aldabra

CONVINCED that Aldabra Atoll should be preserved entire without the air staging post which the Ministry of Defence wants, the Royal Society has made a further approach to the Secretary of State for Defence. Since its last approach in May, the society has reappraised the case in the light of the results of the preliminary ecological survey of the atoll and of recent modifications to the defence proposals. These proposals would limit any development, if and when a decision is taken, to the eastern end of the south island, instead of involving all the islands of the atoll as originally planned.

The Royal Society has repeated that any development on Aldabra will upset the integral ecosystem, which is the great scientific interest of this, the last remaining ecosystem of its kind in the Indian Ocean. Confining the air staging post to one part of one island will not save the ecosystem. It would not be possible