motor during its extended operation. He also kept his rockets on course by the use of a gyroscope. Today's liquid fuel rockets are in essence the same as his.

Goddard received very little attention at home, and it was in Germany that his work was perfected. With scientists such as Von Braun and his colleagues, Germany developed a rocket propelled plane which bettered 600 M.P.H. The V-2, a ballistic rocket, was so fast that it was unheard, usually unseen, and impossible to intercept.

World War II also employed many solid fuel rockets. Men using improved fuels and putting a spin on them in flight, made the rockets more accurate, and they did excellent work at short range. In peace they were useless, and after the War their development came to a stand-still.

With liquid fuel rockets this was really only the beginning. Von Braun and many of his colleagues came to America and joined with American scientists in making bigger and better rockets for launching into space.

The next development was in the original form of rockets, the solid fuel type. It was found that if solid fuels were mixed with rubber before casting the charge, it would not crack while burning. This was very important because cracks in a burning charge expose greater surface and cause parts of the charge to develop more thrust than others, thus causing an erratic flight. The solid fuel men immediately clamored for some U. S. defense contracts, since their rockets were more rugged, simpler and much cheaper than liquid fuel missiles. Furthermore, they did not require a long time to fuel and launch. They not only got contracts, but the first American satellite was launched by a composite rocket whose last stages were solid fueled.

While the U. S. were developing their rockets, the U.S.S.R. built and perfected even larger rockets. These rockets are thought to be the same as those used by the U.S., but are very much larger and accordingly more powerful. To counteract this the U.S. is developing a very high power fuel for use in conventional liquid fueled rockets. These fuels, known as exotics, are usually boron compounds, and, while very explosive are also very powerful, giving about 25% more thrust per pound than do the ordinary liquid fuels. It is in this field that the latest innovations in rocketry are being made. Those interested would do well to watch these developments.

Thus we may see that the rocket has progressed from festive to celestial fireworks. Most of this development has occured within the last fifty years—what will the next fifty bring?

—J. M. REDDIN '60

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