Three weeks before the launch, spacecraft commander Stafford and lunar module pilot Cernan had come down with influenza, but rest and comparatively reduced training schedules—"We've been able to cut back to an eight- or nine-hour day," said Head Astronaut Donald "Deke" Slayton—got them back well and on their feet.

The spacecraft and launch vehicle also seemed to be in a cooperative mood. Two days before the May 18 launch a minor problem with a fuel pressure regulator was easily corrected and later a blown fuse in a liquid oxygen pump was replaced without any delay in the final 28-hour countdown, thanks to the countdown's built-in delays or holds.

The only problem that threatened to affect the flight was a porous metal plate in the water evaporator used to help control the temperature of the crew's space suits. The plate, which needed to stay wet to keep the evaporative cooling process going, kept drying out. Finally, however, engineers satisfied themselves that the plate would remain wet, after it successfully passed three check tests in a row and with about 19 hours remaining until liftoff all systems were go.

The giant Saturn 5 booster lifted off more accurately than any earlier Apollo launch, 0.569 seconds off the scheduled 12:39 EDT mark on May 18.

One by one the Saturn booster's stages and adapter sections separated, or staged, and fell away as the spacecraft climbed into a parking orbit around the earth. ("Babe," said Cernan, as the booster's main section plummeted toward the Atlantic, "You ain't seen nothing till you've seen that S-1C stage.") Then, exactly as scheduled at 2 hours, 33 minutes and 26 seconds after liftoff, the engine of the still-attached third-booster stage was reignited to kick Apollo 10 out onto its course toward the moon.

As the flight progressed toward midweek, it continued to be a gem.

As on Apollo 9, the command and service modules (dubbed Charlie Brown by the astronauts) separated from the lunar module (Snoopy), turned around in space and returned to dock with the LM and pull it free of the booster. Linked together, they continued on their way in an almost trouble-free flight that progressed well for Wednesday's arrival in lunar orbit and Thursday's critical maneuvers of the LM.

"You can tell the world we have arrived," Young radioed jubilantly to earth after the spacecraft finished its first orbit around the moon Wednesday.

Periodically during the journey, spectacular color television presentations showed the earth, astronauts and spacecraft, all looking well, and all in all, by midweek the promise for a successful mission was golden. ◇

X-RAYS AND GAMMAS

Broad-band pulsar in the Crab

In making astronomical discoveries it always helps to know where to look. Radio pulsars were discovered more or less fortuitously (SN: 3/16/68, p. 255), but after several of these were identified, their locations became objects of intense search by observers using other portions of the electromagnetic spectrum.

Astronomers first concentrated on a search for pulsations in visible light. It took nearly a year from the announcement of the first radio pulsar to the confirmed and accepted discovery of an optical pulsar. When the optical identification came, it was for the fastest of the pulsars, NP-0532 in the Crab nebula (SN: 2/1, p. 111).

Finding an optical signal from a pulsar gave hope that they might also give off signals at yet shorter wavelengths, the X-ray and gamma-ray ranges.

At the time the optical pulsar was announced, X-ray astronomers from the Naval Research Laboratory were about to send up a rocket in an attempt to study the X-ray spectrum of the Crab nebula, which was known to be an X-ray source. "We had to make sure whether there was or was not a pulsating source," says NRL's Gilbert Fritz. So they added to their experiment equipment that would find pulsations if they were there.

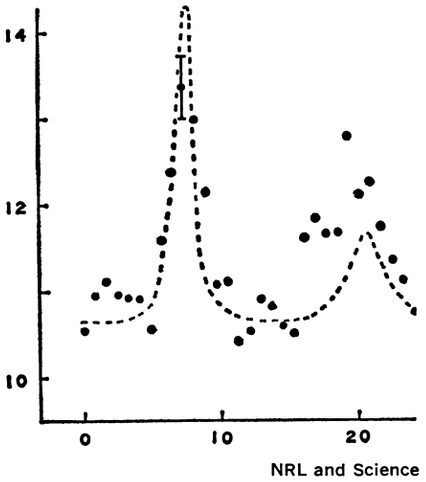
At the same time Dr. Robert C. Haymes of Rice University and two of his graduate students, Gerald J. Fishman and Frank Harnden Jr., were reminded of gamma-ray records of the Crab that they had from a balloon flight of June 4, 1967. "We didn't expect gamma-ray pulsars," says Harnden, "but as soon as we heard of the optical, we started to look."

Both efforts have been successful. The NRL group, which includes, besides Fritz, Drs. R. C. Henry, J. F. Meekins, T. A. Chubb and Herbert Friedman, flew their rocket on March 13 and found evidence of a pulsed X-ray signal coming from the direction of the Crab (SN: 5/10, p. 455). The signal came in at energies between 1 and 13 kilo-electron volts (keV).

The Rice group found a pulsed gamma signal at energies greater than 35 keV, the low-energy threshold of their detectors. This corresponds to wavelengths of less than about a third of an angstrom. (Some people call this range hard X-rays rather than gamma rays.)

In these parts of the spectrum, the pulsar accounts for something like 5 percent of the Crab's X-ray brightness.

The period of both signals is about



NRL and Science

NP-0532 light (dashes) X-ray (dots)

33 milliseconds, the same as that of the optical and radio pulses of NP-0532, and both groups identify their discoveries with it.

If these discoveries are confirmed, they mean that the one pulsar NP-0532 is emitting signals over a range of wavelengths from gamma rays at a fraction of an angstrom through X-rays (several angstroms), light (thousands of angstroms) to radio (10-millions to billions of angstroms), and all these signals are pulsed at an identical rate.

Given such a situation, the simplest possible way to explain it is to find one physical phenomenon that can produce all the radiation and ascribe the pulses to some mechanism, such as the rotation of an emitting body. Radiation produced by charged particles in a magnetic field, so-called synchrotron radiation, can appear in all these wavelengths and a plasma of such particles attached to a rotating neutron star has already been used in various ways to account for the radio (SN: 1/4, p. 9) and optical (SN: 3/1, p. 207) signals.

Prof. Thomas Gold of Cornell University, who has put forth a model of a pulsar as a rotating neutron star surrounded by a plasma trapped in a radial magnetic field, is quite pleased with the new discoveries. "Had the Crab not been an optical and X-ray pulsating device, it would have been a definite embarrassment to the theory," he says.

In Dr. Gold's theory the plasma particles are confined in sectors of the magnetic field as if they were between spokes of a wheel. The farther they get from the surface of the star the faster they go, until they approach the speed of light. At this point they break loose from the magnetic field and fly off into the rest of the nebula.

But the speed-of-light boundary will

be closer to the surface of the star the faster the star happens to be spinning. Particles close to the surface will be in a stronger magnetic field and will therefore radiate at higher frequencies than those at greater distances. On this basis, says Prof. Gold, "you can expect hard X-rays from the Crab pulsar. On the same calculation you can almost get visible light from the Vela pulsar (the next fastest) and nothing but radio for the other known pulsars."

Furthermore, he says, "If you see 100 keV X-rays, this implies that particles of energy necessary to make the rest of the Crab shine" are being expelled from the pulsar. Once they are loose, these particles could also be the source of cosmic-rays, he says.

Spectral analysis by the NRL scientists leads them to suggest that the radio emission could be synchrotron radiation produced by protons at distances from the neutron star surface where the magnetic field is about a few hundred gauss. The optical and X-ray emission, they say, could come from electrons operating in fields of comparable strength.

This does not mean the experimenters favor Dr. Gold's model, or any other. "Our orientation is experimental," says Fritz. "We want to avoid tying ourselves to any one model."

Higher energy is where the Rice scientists have made their observation, and, says Harnden, "We should have a better idea of the intensity of the high-energy pulsar when we complete our spectral analysis." Meanwhile they have calculated what they call a more accurate figure for the rate at which the pulsar's pulses are slowing down: They get 36.51 ± .02 billionths of a second per day.

At NRL analysis also continues. "We haven't milked this set of data dry," says Fritz. "We expect to find significant structure in the pulsations. The X-ray profile differs from the optical and the difference is not due to the equipment."

THE PANALBA CASE

FDA vs. the boss

High level political intervention in the affairs of the Food and Drug Administration poses a considerable threat to the agency's regulatory power, particularly as FDA moves into the sophisticated and revolutionary area of making fine distinctions about drug efficacy. Such a threat was posed recently when Health, Education and Welfare Secretary Robert H. Finch took the virtually unprecedented step of making a decision that would otherwise have been the sole responsibility of FDA Commissioner Herbert L. Ley Jr.

The Secretary's action raises questions about his future role in FDA affairs and about Ley's position as official watchdog over the powerful $3-billion drug industry.

The case involved an FDA decision to ban from the market a best-selling combination antibiotic called Panalba on grounds that it is neither effective nor safe (SN: 1/11, p. 33). In 1962, by order of a law pushed through the Congress by the late Sen. Estes Kefauver (D-Tenn.), FDA was charged with assuring that all drugs are not only safe but also effective. Only now is the agency ready to move on that mandate, which applies to drugs approved prior to the law's passage as well as since. In making that move, Ley is in for a bitter battle with industry.

Round one has just begun, and he had to take on Finch as well as the Upjohn Company of Kalamazoo, Mich., one of the country's largest drug houses.

From 1962 through 1966, FDA did little to evaluate drugs marketed prior to the passage of the Kefauver-Harris amendments. Then Dr. James F. Goddard took command of the agency, and asked the National Academy of Sciences to do the evaluating job for him. Ley took Goddard's position last September, just as the results of the NAS study were coming in.

In December, concurring with conclusions of the academy's panels on antibiotics, FDA announced its intentions of banning combination products. Commissioner Ley called them a shotgun approach where a rifle is called for. Drug houses had 30 days to file objections to the FDA maneuver.

FDA

Ley: Guarding the patient's health.

FDA

Finch: Intruding in FDA *business.*

Upjohn retorted that it needed more than 30 days to assemble convincing arguments in defense of Panalba, which had $16.8 million worth of sales last year, and Ley granted the company another 120 days and a hearing. Then the academy released more results of its drug scrutiny, this time challenging the safety of one of the components of the Upjohn product: Novobiocin. That drug, it said, has a high incidence of side effects, including rash, liver dysfunction and blood disorders. In view of the fact that other, safer drugs have come along since 1957 when the product was first approved, the FDA concurred that Novobiocin singly should be sold under new, strict labeling and decided that Panalba should be removed from pharmacy shelves and banned, by June 14, before any hearing was held.

Upjohn, aided by Kalamazoo's Rep. Garry E. Brown (R-Mich.), took its case directly to Finch, Ley's boss, and the Secretary intervened. He instructed the commissioner to hold off action until a hearing could be held. Ley objected and eventually won Finch to his side. Though the Secretary has refused to comment publicly on the situation, a spokesman suggests that he did not realize, at first, the threat to health Panalba might represent.

In another virtually unprecedented act of interference, Finch also kept the House Intergovernmental Relations subcommittee, which oversees FDA from obtaining agency files on Panalba until he personally approved their release. A spokesman for subcommittee chairman Rep. L. H. Fountain (D-N.C.) says, "We do not intend to go through this again. We have not had to ask the Secretary's permission to see FDA files in the past and do not plan to in the future." Finch had issued orders that all potentially explosives issues, such as this, be channeled through his office, an order which still stands.