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The five satellites of San Marco

On March 25, an American Scout rocket serviced by an Italian crew sent a satellite with a trinational package of scientific instruments into orbit from one of the world's most unusual launch pads. Built like a steel barge as wide as the distance from home plate to first base and the length of a football field, the San Marco platform stands on spidery metal legs in the Indian Ocean about 3 miles from the coast of Kenya.

Resembling an oversized example of an oil company's "Texas tower," the platform was leased to Italy in 1965 by the U.S. Army, which had formerly towed it by ship through various waters to use as a quick-docking facility. Since then it has been the point of departure for four satellites launched as part of the San Marco Project, a cooperative atmospheric-research program of the University of Rome's Aerospace Research Center and NASA.

The project was initially proposed to NASA by the Italian Space Commission in 1961. Its first satellite, called San Marco 1, was launched by NASA from Wallops Island, Va., on Dec. 15, 1964, and worked just fine. Officials with the fledgling and anything-but-wealthy Italian space effort suggested that placing a seaborne launch system off the Kenyan coast could eliminate the cost of the "dogleg" maneuver necessary to put payloads into equatorial orbits from higher latitudes. The San Marco facility stands only about 2.5° south of the equator.

The latest satellite in the series, San Marco D/L, was placed in an orbit that ranges in altitude from about 118 to 279 miles, circling the earth every 93 minutes. The roughly spherical device carries five scientific instruments: Italy's contribution is a Neutral Atmosphere Density or "drag balance" experiment, designed to measure drag forces on the satellite. From West Germany comes an Airglow Solar Spectrometer, a multipurpose device to measure solar radiation reflected from the earth's surface and clouds; radiation of solar, interplanetary and intergalactic origin that reaches the satellite directly; and the equatorial day and night airglow (observable light that originates in the high atmosphere and is associated with photochemical reactions of gases).

Three U.S. instruments complete the package: A Wind and Temperature Spectrometer is to measure the electromagnetically neutral winds and neutral particle temperatures around the satellite, as well as concentrations of selected gases. Another device will monitor the electric fields through which it passes. A third sensor will report on bulk ion velocities and ambient plasma concentrations, which bear on such fundamental matters as the nature of plasma turbulence and of the coupling between ionized- and neutral-gas motions.

Ground controllers are still checking out the satellite, but all its predecessors went on to meet their goals. If names can bring good luck, perhaps the project has associated itself with a fortuitous one: A few hundred feet away from the actual San Marco launch pad, named for the patron saint of navigators, is a smaller platform housing the facility's control center, which has never lost a Scout rocket (8 for 8). It is called Santa Rita – in honor, NASA notes, of "the patron saint of things impossible." *– J. Eberhart*

Hawks stoop with a group to increase hunting success

Tag team competition extends beyond the professional wrestling arena. Groups of Harris' hawks in New Mexico use a variety of cooperative hunting techniques, including a "relay attack," to capture rabbits and hares.

Cooperative hunting, in which many animals team up to capture and share one large prey, has long been observed in a small collection of mammalian species including lions, hyenas and wolves. But this is the first documented observation of such coordinated hunting behavior in birds, reports James Bednarz in the March 25 issue of SCIENCE. "There have been reports of pairs of falcons hunting together during mating season, but the pairs weren't very cooperative or successful," says Bednarz, who did the work while at the University of New Mexico in Albuquerque and is now a staff member of the Hawk Mountain Sanctuary Association in Kempton, Pa.

Harris' hawks are large hawks that normally survive by eating quail and other small birds. The hawks eat much better if they can capture rabbits or hares, but it is very difficult for a single hawk to do so because the speedy rabbits outweigh the hawks by as much as 3 to 1. Bednarz found that groups of four to six hawks increased their chances of capturing rabbits by employing group hunting techniques to seek out, then tire and confuse their prey.

The most common tactic was the "surprise pounce," in which many different hawks would dive at the rabbit from different directions, confusing it until one hawk could get a clean shot at the animal. In the "relay attack," the hawks chased the rabbit for several minutes; when the leader dived at the prey and missed, another assumed the lead position.

The "flush and ambush" strategy often was invoked if the rabbit found refuge in a bush or copse of trees. One hawk would land and walk into the cover, flushing out the prey and exposing it to the waiting hawks outside. The hawk on the ground has almost no chance of capturing the rabbit on its own, Bednarz explains, so it is acting to increase the group's chance of success rather than just its own.

The "flush and ambush" tactic is a strong example of how cooperative hunting differs from social hunting, Bednarz says. In social hunting, animals hunt in the same place because the presence of the others increases the individual's chance of success, he explains. Pelicans are hunting socially when they surround a school of fish to increase the individual's chance of catching one, Bednarz says.

The New Mexico Harris' hawks, on the other hand, work together to increase the group's success rather than the individual's. In most cases, Bednarz found, a hawk will dive at a rabbit even when there is no chance of catching the animal, just to cut off its escape. "For instance, a hawk will never catch a rabbit by coming at it head-on, but the hawk will come at the rabbit that way to turn it around and keep it in the field of play," Bednarz says.

Bednarz observed the hawks by using radio transmitters attached to the birds to follow them. Every 30 seconds he and his assistants marked the position and activity of the tagged bird and made notes about the activity of the group the bird was with. "I think we were able to observe this sort of behavior because we were maintaining constant surveillance of individual birds, which has not been done too often," Bednarz says.

The ability to hunt cooperatively is probably able to develop because the New Mexico population doesn't migrate and has a stable social structure, and because the rabbits can offer an important food source, in this case accounting for almost 90 percent of the hawks' energy needs. Individual hawks have almost no chance of getting those needed calories, because the adult rabbits' speed, size and powerful hind legs don't leave the furry creatures defenseless. "I have no doubt that a rabbit's kick could break a hawk's bones," Bednarz says, "and the hawks are very cautious when attacking." *– C. Vaughan*