THE RSL (RESERVE STATIC LINE)

SEPARATING FACT FROM FICTION

by USPA Director of Safety and Training Jim Crouch

There is probably no other piece of skydiving equipment more misunderstood than the reserve static line (RSL). If you want 10 different opinions on why you should or should not equip your container with one, simply ask 10 different skydivers. Unfortunately, most jumpers choose their positions and make their decisions based on raw opinion and contrived scenarios rather than facts. To separate fact from fiction and make a truly informed decision on whether to use an RSL, we need to look at a little history and actual data.

The reserve static line is a very simple device. A releasable snap shackle attaches to one main riser (or both main risers on

The lanyard of an RSL travels from the reserve ripcord to an attachment point on the main-canopy riser.

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the Parachute Labs [dba Jump Shack] Racer) on one end of a lanyard, and the other end connects to the reserve ripcord. The various manufacturers use different materials and designs to achieve this connection. The outcome of each design is the same: Once the jumper pulls the cutaway handle and the main risers release from the harness, the RSL immediately pulls the reserve ripcord as the jumper drops away from the main canopy. This initiates reserve deployment before the jumper physically pulls the reserve-ripcord handle. However, a jumper must still be prepared to pull both handles in the correct order after a main-canopy malfunction and only consider the RSL a backup device.

HISTORY

The RSL is certainly not new technology. According to "The Parachute Manual" by Dan Poynter, Perry Stevens developed the Stevens Cutaway System (what we now call the RSL) in the early 1960s while working for Security Parachute Company. The company incorporated the system into its Crossbow "piggyback" container, the first dual-canopy container system to have the reserve located above the main on the jumper's back. However, it would be another 10 years before companies adapted it for the front-mounted-reserve container systems that students (and most jumpers) commonly used at that time. Manufacturers developed this system primarily to simplify emergency procedures for students: Once a jumper jettisoned his main canopy, a lanyard pulled the reserve ripcord on the belly-mounted reserve, which launched a spring-loaded pilot chute to begin deployment of the reserve canopy. The lanyard was largely thought of as a backup safety device only for students, and many licensed jumpers chose not to use them even when designs improved and all manufacturers switched to selling back-mounted, dual-canopy containers. But USPA began requiring students to use RSLs until being cleared to solo freefall. (Once a student is cleared to solo freefall, an instructor may waive the requirement for an RSL for one jump or a series of jumps.)

Now, in addition to standard RSL designs, jumpers can choose main-assisted-reserve-deployment (MARD) devices such as the United Parachute Technologies

A jumper makes an intentional cutaway on a rig equipped with a United Parachute Technologies SkyHook.

SkyHook, which uses the cutaway main canopy to extract the reserve freebag from the container. The designs of these systems produce even faster reserve deployments than standard RSLs. They have grown in popularity over the last decade, and most manufacturers now offer some form of a MARD device for their containers. However, even with improvements over the years, many licensed skydivers still shun the use of RSLs or MARDs, even though jumpers continue to die from failing to pull their reserve ripcords after cutting away.

ENTANGLEMENTS

It is hard to say why jumpers continue to have concerns about using RSLs and MARDs. Although some jumpers say they are concerned with post-cutaway reserve entanglements caused by RSLs, the statistics certainly don't support this argument. Looking at the U.S. data from 1999 through 2013:

- 14 jumpers without RSLs died after cutting away their main canopies and manually deploying their reserves too low for full inflation.

- Five jumpers without RSLs died after cutting away main-canopy malfunctions and not pulling their reserve ripcords, resulting in no deployment of their reserve canopies.

- Five jumpers without RSLs entangled with their reserves after cutting away and deploying their reserves manually while tumbling and unstable.

- One jumper died after entangling with his reserve canopy, but the report contained no information about whether the RSL deployed his reserve or whether he deployed it manually.

A functioning RSL would have prevented a vast majority of the 25 fatalities listed above, although at least three of the cutaways were at such low altitudes that even had the jumpers immediately activated their reserves, they would likely not have inflated in time for survivable landings. The experience level of the 25 skydivers ranged from 28 jumps to 6,500 jumps.

During the same time period, how many jumpers who used RSLs died after cutting away their main canopies and entangling with their reserves? Four jumpers, each of whom had made fewer than 20 jumps. And of those four, two entangled with their main canopies before pulling their cutaway handles, which greatly increased the chances that they'd entangle with their reserves.

A tandem pair under its reserve flies away from a cutaway main canopy following an RSL-initiated reserve deployment on a Strong Enterprises tandem rig.

Additionally, there were two RSL/MARD-related incidents that are difficult to categorize, both involving tandems. In one, a tandem pair died after the instructor cut away the malfunctioning main parachute, which stayed attached to the container due to a misrouted RSL. The instructor did not deploy the reserve, and the pair landed hard under the spinning main canopy. In the other incident, a tandem pair died after a low main

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canopy deployment led to the automatic activation device cutting the reserve closing loop and initiating reserve deployment. Shortly after the reserve pilot chute launched, one main riser disconnected when the Collins Lanyard (which ran between the two risers as part of the MARD system) pulled the cutaway cable on one side while the main canopy remained attached by the other riser. The tandem instructor released the remaining riser at a low altitude, and the tandem pair struck the ground without an inflated reserve. Investigators were not able to determine the exact sequence of events leading up to the riser release.

Looking farther back, the statistics on entanglements remain consistent. An article in the November 2005 issue of *Parachutist* entitled "RSL: A Second Look" listed data from 1990-2005. In that time period, there were 30 fatalities involving jumpers cutting away main canopies but failing to deploy reserves in time compared to five jumpers who died after reserve entanglements following cutaways and RSL-initiated reserve deployments.

Jumper Bob Atkins, who was flying a Performance Designs Velocity 90 loaded at 2.5:1, cut away from a spinning malfunction. His rig was equipped with a United Parachute Technologies SkyHook MARD, which deployed his reserve, a Performance Designs PDR 113 loaded at 2:1.

Atkins said that many jumpers won't use an RSL because they fly heavily loaded, cross-braced canopies and remarked, "I was one of them." However, when he purchased a new rig, he had it equipped with a SkyHook. After this malfunction, he said, "I think everybody should have a SkyHook. By the time my arm is fully extended with my cutaway handle, I'm under my reserve. And besides that, reserves are built to fly flat and stable. I had no problem under my reserve; the line twists came out by themselves."

SPINNING MALFUNCTIONS

Some jumpers who are flying moderately to highly loaded canopies state that they are afraid of an RSL complicating reserve deployment following a spinning line-twist malfunction. However, the statistics don't support this fear: USPA has seen no documentation of a fatality attributed to an immediate reserve deployment after a cutaway from a quickly spinning main. In fact, cutting away from a rapidly spinning main canopy followed by immediate reserve deployment via an RSL or MARD system proves to work well, even under very highly loaded canopies. Most result in fast, clean reserve deployments. And although some jumpers have reported experiencing line twists on their reserve canopies, the reserves flew stably, and the jumpers were able to kick out of the twists and land uneventfully.

Jumpers under spinning canopies may actually have a greater need for an RSL. In high-speed spinning malfunctions, jumpers often discover that their harnesses are very distorted from the forces caused by spinning rapidly around the canopy. Emergency handles are nowhere near where they were when the jumpers were wearing the rigs on the ground. And even though most, if not all, jumpers were taught to look at their cutaway and reserve ripcord handles before grabbing and pulling them, some have found that during violent spins, the handles were difficult to see and locate. More than once, witnesses have observed jumpers groping for their reserve ripcords during the final seconds of freefall.

In "RSL: A Second Look," Derek Thomas, then co-owner of Sun Path, and Bill Booth, president of United Parachute Technologies, listed several reasons why jumpers—even those who moderately or highly load their canopies—should consider the use of an RSL or MARD:

▸ Violently spinning malfunctions rapidly draw blood away from the brain, affecting coordination and thinking ability, as well as slowing down reaction times.

▸ Spinning canopies lose altitude quickly, usually 100 feet or more per revolution at moderate wing loadings and several hundred feet per revolution at higher wing loadings.

▸ On average, a jumper takes six to eight seconds from the time he decides to initiate a cutaway to the time he actually releases the main canopy, losing a large amount of altitude.

▸ Test jumps have shown that once a jumper releases his main canopy, it takes an average of six seconds—or approximately 1,100 feet of altitude—to regain a stable, belly-to-earth body position (and this is when the test jumper was prepared for the cutaway before making the jump).

▸ Locating the cutaway and reserve ripcord handles while spinning rapidly is difficult during an actual emergency and nearly impossible to simulate on the ground for practice.

OTHER CONSIDERATIONS

Is the RSL a good idea for all jumpers? Not necessarily. For the canopy formation skydiving crowd, if a jumper becomes wrapped or entangled, the standard practice is to cut away and fall a short distance to get clear of the main and other jumpers before deploying the reserve. For jumpers who are not intentionally participating in canopy formation skydiving, an RSL can also add an extra step (disconnecting the RSL) to consider in the case of an inadvertent canopy collision.

Some camera flyers also worry about entanglements with their camera equipment if their reserves deploy via an RSL. However, cameras have gotten smaller and helmet designs have improved, so this is much less of an issue than it once was. Since 1999, when it began gathering data, USPA has not documented a single fatality due to an RSL- or MARD-initiated reserve-camera entanglement, although it has seen many documented cases of RSL- and MARD-initiated reserve deployments that occurred without entanglement even though the jumpers wore helmet-mounted cameras.

Some jumpers worry that if the riser equipped with the RSL breaks during deployment, it could pull the reserve ripcord while the main is still attached to the harness by the opposite riser and increase the chance of a main-reserve entanglement. However, riser design and manufacturing has improved to the point where failures are almost unheard of anymore. Worn or misassembled components caused the few recent incidents of riser-system failure, none of which resulted in a fatality. And some systems (including all MARDs) release both risers if one riser breaks. The last time a fatality occurred from an entanglement after riser failure was in 1997 (a tandem jump in which the instructor was killed and the student injured after landing hard under entangled main and reserve canopies).

Some jumpers mistakenly think that an automatic activation device is a suitable substitute for an RSL. Although AADs have saved some jumpers by re-arming and cutting reserve closing loops after the jumpers cut away from main malfunctions, they are not designed for this purpose. In order for an AAD to re-arm and activate after a cutaway, the jumper needs to be high enough to accelerate to at least 78 mph after dropping from the main canopy. And there still needs to be enough altitude remaining to allow the reserve to deploy and fully inflate. RSLs simply provide a different function and can be a valuable safety device whether or not you jump with an AAD. The important thing is to be sure you have a thorough understanding of your equipment so you can make an informed decision about its limitations and use.

RSLs have been quietly working in the background for decades, initiating countless successful reserve deployments. Whether you decide to use one or not, make sure you make an educated decision based on facts and data.