AADs:
Their History, Evolution And Operation

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Introduction

: The history, development and technological advancements
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AADs are credited with saving lots of skydivers lives over the years.

With so many models, brands and makes on the market, CYPRES, Vigil, Argus, Kap 3, Astra, and the list goes on. How do you decide on something that, if needed, will save your life? Which one is the safest? Which won't fail?.

The aim of this thesis is to look at the history of AADs, milestones and the most notable technological advancements some operational comparisons and create a users guide for electromechanical AADs that are being used in Australia.

With so many options on the market, its not hard to understand the confusion a new jumper is faced with when it comes to deciding on which AAD to go with. Recommendations from other skydivers and which is used on the student gear they learnt on all come into the decision. The instructors opinions on equipment have and will continue to have the biggest impact for new skydivers in this area. In constructing this document, Australian CIs were surveyed to determine which AADs they used within their dropzone and why, the advantages and disadvantages. The knowledge and experience of these CIs is highly valued to students and experienced skydivers.

The author encountered some resistance from the manufactures when requesting information about future development the reason for this has to be an insecurity about industrial espionage. The amount of time,money and effort that goes into getting an AAD to market, plus the ongoing testing in that market place, it comes as no surprise that product information is so important. They collect any information that comes back to them via mandatory services and maintain the right to update their product without consulting

the customer who owns the device. Protecting information seems vital in this industry for manufactures. AADs are mandatory in Australia for all skydivers who have not yet gained there D certificate, minimum 200 jumps, the APF introduced this rule for a few different reasons, the history of inexperienced skydivers loosing height awareness played a major role in this decision.

History

Static lines were the first AADs to be used for parachuting.

First-generation AADs (e.g. Irvin Hite-Finder) were only used by military freefallers and they fired on every jump.These AADs pulled the closing pin of the main or reserve, we called this type a Pin Puller.

Second-generation AADs (e.g. FXC 8000) had two sensors to prevent them from activating if the skydiver opened his main at a reasonable altitude.

Third-generation AADs (e.g. Snyder's Sentinel) used electronic sensors to measure altitude more precisely.

First, second and third-generation AADs all open containers by pulling closing pins and are referred to as pin pullers.

Fourth-generation AADs (e.g.. Cypres, Astra, Argus, Vigil, etc.) use modern electronics to measure time and pressure more precisely. Fourth-generation AADs are the first to use a small explosive charge behind a blade to cut the closing loop, Therefor we refer to these AADs as loop cutters.

AADs were first introduced to the sport of skydiving after they'd successfully been primarily used to save unconscious military pilots at time of ejection from jets. They were also initially only used for military freefallers, and were fired with each and every jump. Second generation ADDs were the first which featured two sensors to prevent them from opening if the skydiver opened the

main at a reasonable altitude. This was more precise with the release of the third generation. Until the release of the forth generation, all AADs opened by pulling ripcord pins. The fourth generation saw the introduction of modern electronics to measure time and pressure more precisely, as well as the first 'loop cutters'. Newer models contain built-in computers, making better estimates of altitude and vertical speed, making the unit more reliable than previous generations

In April 1982, the USPA Board made an important distinction in the name of the devices. Where previously these devices had been referred to as "Automatic Opening Devices" (AOD), they were now to be referred to as "Automatic Activation Devices" (AAD). The "opening" characteristic was not found in the devices, they activated the opening sequence, and the name change was made so as to not be misleading.

In December 1992, an event took place which changed the AAD landscape forever. Tom Piras was a world-class skydiver based at DeLand, and jumping in Panama City. As a member of the US National 4-Way team, his equipment was fitted with a sponsored CYPRES. On this jump, it was not turned on. A funneled exit and a knee to the chin knocked him unconscious, resulting in a no-pull scenario. The lesson and the irony of the Tom Piras fatality – where an AAD may have saved his life yet was not turned on – was not lost on all who heard the story.

Tom Piras likely forgot to turn on his AAD, but the tale often told is an alleged quote; "they can make me wear one, but they can't make me turn it on", or "yeah, I've got one, can't work out how to turn it on". However, the death of such a highly experienced and seemingly "bullet proof" skydiver changed opinions about AADs, and a sharp spike in sales resulted.

Styles of AAD

Static line

Example: length of webbing with a locking snap fastener at one end and a deployment bag and closing pin at the other.

AADs that activate the deployment sequence by releasing the closing pin then pulling the deployment bag which is not connected to the parachute out of the container letting the skydiver freefall to line stretch before the parachute comes out of the bag is referred to as a static line. The parachute is packed into the deployment bag then closed into the container leaving the webbing and locking snap fastener exposed. The locking snap fastener is then connected to a strong point inside the aircraft. When the skydiver exits they freefall to the length of the webbing before activating the opening sequence.
A static line could also be used with just a closing pin but this practice was banned in Australia in 1980's.

Pin pullers

Examples: KAP3, Sentinel, FXC 12000, Hi Tek 8000

AADs that activate the opening sequence by pulling the pin are referred to as pin pullers. The head of the AAD has an opening which the pin is fed through and sit's between the loop and the bottom of the pin. Once the AAD decides to fire it retracts the cable which drags the closing pin with it. Some pin pullers are set on a time base system but most pin pullers are mechanical AADs They work off barometric pressure set to fire at a pre set height once a pre determined freefall speed has been reached. Some of them are wound up like a clock and locked in place with a safety pin others are spring loaded and need to be cocked by pulling the cable out till it clicks into place. All these need to pre set before each skydive and turned on. Any pin puller type of AAD such as the Kap 3 which has a locking pin the locking pin must be removed at altitude before exiting the aircraft.

Loop cutters

Examples: Cypres, Vigil, Argus, Astra, MPAAD

AADs that activate the opening sequence by cutting the closing loop are referred to as loop cutters. The cutting unit of the AAD has a hole through the middle where the loop is fed through, Inside the cutter of the AAD is a blade that sits right next to the loop and behind the blade is a small amount of propellent contained in a pressurised chamber. Once the AAD decides to fire the explosive charge is triggered forcing the blade across the chamber cutting the loop along the way and in turn releasing the tension from the spring loaded pilot chute allowing the spring to expand. All loop cutter type AADs are electronic computer based controlled. They measure air pressure up to twice a second to determine altitude and velocity, once the pre determined parameters have been met the AAD activates. Loop cutter AADs will only work if they are turned on and set to the right altitude above ground level. These AADs activate close to the ground, less that 5 seconds freefall time away from it, as a result if one of these AADs activate its considered a major incident and needs to be taken seriously.

Models of AADs

KAP-3

The first functional automatic activation device (AAD) for civilian skydiving is the KAP 3. Developed in the USSR in the 1930's the KAP 3 was the only sensible AAD for sport parachuting. An example of this is the military USAF high altitude bail out AAD hardwired to open at 14,000 ft ASL making it impractical for civilian skydiving. The KAP 3 is so reliable that all soviet manned space capsules and cosmonauts carried them. As a result of this by the 1970's most drop zones around the world had people using them, even now in 2010 here in Australia they are still used at some DZ's on student equipment. The KAP 3's reliability and long lifecycle means it doesn't time expire after a few years, The KAP 3 is a pin puller mechanical AAD installed on the main parachute and fire's on every jump at a preset altitude.

FXC 12,000

The FXC 12,000 is the result of over 20 years of research and development by the FXC corporation used widely in the military with well over 80,000 units sold to Armed Forces all over the world. Here in Australia the FXC 12,000 was embraced by the training dropzones because compared to the Kap 3 it is very user friendly and over time became the most familiar AAD on student equipment. The FXC is a mechanical pin puller type of AAD fitted to the main parachute. An instructor would use a 5 cent piece to set the activation height of the AAD depending on the planed opening height. Its working range is between 1,000ft to 4,000ft AGL and with the Safety Lockout Knob the instructor had control of whether or not the AAD would be turned on for the skydive or turned off for decent in an aircraft. The FXC 12,000 only fired if required to so it didn't need to be reset after every jump although the activation height needs to be set or checked to see if it is set for the right height before each jump.

Sentinel Mk 2000

The Sentinel MK 2000, Introduced in 1959 it consisted of a sensing unit wired to a power actuated ripcord handle for side pull, chest mounted reserves. The sensing unit sensed the rate of descent and altitude and the power actuated ripcord was the muscle of the unit. Once the sensing unit sensed it should fire it sent a signal to the power ripcord, via a cable, to tell the ripcord to flex it's muscles which would pull the reserve pin. The design of the Sentinel for sport skydiving was way ahead of it's time, this could be seen by the high number of skydivers pulling the cable connecting the sensing unit to the power actuated ripcord handle instead of the reserve handle, probably due to a lack of awareness or sensory overload, causing the wires inside the cable to break. The sensing unit's electronic signal would not reach the power ripcord as a result the Sentinel would not work. The sensing unit a black box was to be installed under the pack bands on the right hand side of the reserve which left the cable hanging to fix his problem some people would run the cable under the pack opening bands on top of the reserve preventing the top and right side flaps from opening, over the following years there were several incidents involving incorrect rigging and broken cable's. In 1974 Andre Smith manager of the Green Beret Sport Parachute Club set out to find a way to prevent this from happening, He made a channel from type 12 nylon webbing that was sewn to the reserve container. The channel prevents the cable from being accidentally pulled and prevented misrouting. This is know'n as the Smith Channel which was a recommended modification for all reserves with a Sentinel AAD fitted. In 1974 SSE the manufacture of the Sentinel recalled units with serial numbers 4491 to 4661 for a mandatory service inspection at no cost to their customers. This sequence of events, introduction, teething problems and solutions would be repeated over the years that followed.

CYPRES

CYPRES – an acronym for CYbernetic Parachute RElease System, made by Airtec in Germany – has become a generic name for AADs, proving to be the AAD of choice for many jumpers since its introduction in 1991. It has a processing unit, a control unit and a release unit (the "cutter"). Electronic AADs introduced to the market since have largely followed this design.

The CYPRES fires a line cutter designed to sever a pack closing loop. The loop itself must be impregnated with silicon. The cutter – an enclosed unit which generates no heat or smoke on activation – became the standard for reserve activation, and is also used in aerospace applications. Original designs reportedly also included "bugs", situated on the main riser locking loops; in the event of an AAD activation, the riser loops would also be cut, effectively cutting away any trailing main canopy. This feature was never deployed in the field.

CYPRES also included a special pouch which could be rigged into the reserve pack tray, keeping the unit concealed and out of harm's way. Manufacturers then began incorporating the pouch in their own harness designs, leading to the term "CYPRES Ready".

A later model, the CYPRES2, was introduced in 2003, offering a waterproof housing and eliminating the battery change previously required every two years with the original CYPRES.

Four versions of the CYPRES are currently readily available: Expert, Student, Tandem and Speed. The student CYPRES will fire at a lower rate of descent, and in fact can be fired by spiraling a student canopy through the activation window. Tandem activates at a higher altitude. The Speed CYPRES has a higher activation speed, a possible requirement for high performance canopies, and is covered in detail later in this document.

Other versions of CYPRES are available, such as:

Military CYPRES which caters for operation from pressurised aircraft;
Military Bundle CYPRES, attached to tethered bundles;
Air Crew CYPRES
These are not readily available to sports skydivers.

A specialised CYPRES was produced for George Bush Snr, former President of the USA, who performed AFF style skydives on his 75th and 80th birthdays.

The CYPRES was originally required to be serviced every two years. In 1994, following an
extensive history of servicing early units, this maintenance period was extended to four years on the proviso that batteries were changed every two years. Eventually, a service life of twelve years and six months for the unit was decided upon, and Airtec decided to warranty all repairs for maintained units to that extent.

Vigil

The Advance Aerospace Designs “Vigil” is the second competitor to CYPRES in the Electronic arena. The company is headquartered in Brussels, Belgium. Similar to CYPRES in design, it features a cutter and control unit which independently connects to the sensor/ battery unit. It is compatible with “CYPRES Ready” harnesses, and a curved case makes it slightly easier for packers. The Vigil was introduced in 2003, and the Vigil 2 in 2007.

Vigil is a “multi-mode” AAD, meaning it can be configured by the user for “Pro”, “Student” or “Tandem” modes. It can also be changed from metric to imperial measurements through the data display. Any of these changes are offered by Airtec (CYPRES) but require a trip to the servicing facility. Vigil have no specific “swoop” mode or “speed” version, and have been fired by swoopers on a number of occasions.

Data is recorded for 16 minutes or 16 jumps, whichever comes first, and an infra-red reader and software are available as an option.

A key difference between CYPRES and Vigil is in the activation window. Whilst they both open the activation at similar heights, a CYPRES ceases to operate at 130'; the Vigil remains active all the way to impact. In the event of a "save" – as distinct from an activation - the company will exchange a report for a new cutter.

The cutter is field replaceable, as are the batteries. Batteries are life'd at 10 years, 1500 jumps or when <<Bat Rpl>> is displayed. Although batteries are required to be changed at ten year intervals, it is recommended they are changed after five. Care must be taken to not leave the unit unpowered for any length of time as the "Pulses Plus" component – which delivers the charge to the cutter upon activation – demands continuous power.

Although the Vigil is cited as having a 20 year life, servicing is possible where required (such as an error on the display, or a recalibration).

Vigil have been the topic of a number of service bulletins, and their cutter is in its third incarnation following a number of issues. Public confrontation with the French Federation occurred in 2008, with the company alleging sponsorship issues masquerading as safety policy. A very public stoush followed the attempts by one NZ dropzone to return a number of early Vigils, resulting in the withdrawal of their "money back guarantee". However, unlike other manufacturers, they readily make admission of seven ground misfires and two more in-air.

Argus

The Aviacom Argus is the most recent entrant into the electronic AAD field. It is similar in appearance and specification to the CYPRES and Vigil, although appearing more robust with the solid aluminum case. Like the Vigil, it is “multi-mode”, meaning it can be switched from Standard to Novice or Tandem or Swoop by the end-user.

Standard, Novice and Tandem are similar in function to Expert, Student and Tandem as found on the CYPRES. However, the “Swoop” mode on the Argus is unique: the Argus stops monitoring and goes to standby after it detects an open parachute. This mode makes it unsuitable for wingsuit fliers, where the low rate of descent can fool the Argus into believing a high-performance parachute is open. For pond swoopers and other water landings, the Argus is water resistant to 1m for 30 minutes. A single-use goretex filter needs to be replaced after immersion.

Batteries in the Argus are easily-available CR123A, a lithium battery two-thirds the size of an “A” cell and commonly used in cameras. These are good for one year, 500 jumps, or when the Argus reports “BAT LOW” – whichever comes first. The reserve container must be opened in to facilitate this, and the clock reset afterwards.

The concept of being completely field-serviceable – by a rigger, or in Australia a Packer “A” – is also an Argus highlight. The Control unit, cutter and processing unit separate quickly and can be replaced easily. In the event of an activation, Aviacom will exchange a fired cutter for a new one if accompanied by an “Life Saving Report” available from their website.

Like the CYPRES, Aviacom have a mandatory four-year service program. Unlike the CYPRES, this is performed at a certified service centre; there are several within Australia. Data is recorded from the Argus and sent to Aviacom, and the Argus firmware can be updated if needed at the same time.

Argus are currently the subject of APF Technical Directive TD03/2010, where Students and Novices are not permitted to use the AAD. This is an endorsement of the Polish bulletin following a 2009 fatality, where an Argus AAD was activated in a no-pull scenario but failed to save the life of the student (18 jumps). The student's throwaway pilot chute was found in her hand, the freebag bridle was found twisted around the reserve lines, with the reserve parachute still in the freebag. Investigations continue into whether the closing loop was completely severed prior to the impact, and whether it was suitably impregnated with silicon as per the manufacturer's instructions.

An Aviacom service bulletin - SB AMMO050910/2, issued 5 Sep 2010 – recalls all Argus cutters manufactured August 2007 or prior.

Argus AADs are currently banned for use in Australia.
APF Technical Directive number
APF TD04/2010 Argus AAD issued 15/11/2010

ASTRA

The FXC Astra is a electromechanical AAD The Astra is a computer controlled electronic altimeter that determines the rate of descent and the altitude above ground level (AGL) and is whats called a loop cutter type AAD.The program stored in the micro controller reads the digital value from the analog-to-digital converter and determines the rate of descent and the altitude above ground level (AGL).
The ASTRA consists of three (3) major components:
The Altitude Control Assembly, the Power Pack, and the Cutter Assembly.

Altitude Control Assembly

The Altitude Control Assembly contains a micro controller circuit which has an EEPROM programmed with FXC's custom software.

The unit also contains a high resolution pressure transducer and circuits which convert ambient air pressure into an electronic signal. This signal is amplified, and then converted to a digital value by an analog-to-digital converter.

The micro controller reads the digital value from the analog-to-digital converter and determines the rate of descent and the altitude above ground level(AGL).

POWER PACK:

The Power Pack contains a Battery Pack and a back-up circuit which provide enough energy to fire the cutter until the battery is too weak (minimum of 150 hours of normal use).

CUTTER ASSEMBLY:

The Cutter Assembly contains a pyrotechnic cartridge which cuts a standard parachute locking-loop when the activation criteria is met.

The unit is battery operated and contains an absolute air pressure sensor, miniature computer, and electrically actuated pyrotechnic cutter. The computer averages 16 pressure readings each second and stores the initial average value (approximately 20 seconds after turn-on), the last average value, and the current average value. The difference between the initial value and the current value indicates altitude, and the difference between the current value and the last value indicates rate of change in altitude.
The proper functioning of the unit is verified by tests, in an altitude chamber, during manufacturing. The computer will fire the cutter only when the current altitude value is less than the calculated altitude limit and the current rate-of-descent value is greater than the calculated velocity limit.

Development Timeline

1936	KAP-3 developed in USSR
1959	Sentinel Mk 2000 introduced
1971	FXC Model 8000 developed
1973	FXC 12000 introduced
1983	FXC recall 1600 units, one-third of total production at the time.
1984	FXC advise that pull height should be 1500' above FXC12000 setting
1987	Sentinel Mk 2000 withdrawn after 10,000 sales and over 1,000 official saves
1991	CYPRES introduced
1992	Tom Piras fatality with CYPRES turned off
1993	First CYPRES Units returned for servicing
1994	CYPRES service requirement extended to four years
1994	CYPRES recall 1527 units from a total production of 7600
1995	FXC Astra (electronic) introduced
1996	FXC Astra optional swooping modification introduced
1997	CYPRES "silver sleeve" introduced
2002	Eight CYPRES units involved in train wreck, declared unairworthy and appear on eBay
2003	CYPRES2 introduced
2003	Vigil introduced
2004	AAD activation during swooping predicted
2005	Adrian Nicholas dies after AAD fires in a swoop
2005	"Speed CYPRES" for swooping becomes available

2006	Aviacom Argus introduced
2006	Swiss sensor factory advises their customers of a bad batch
2006	Vigil recall units affected by Swiss sensor factory
2007	First CYPRES2 units returned for servicing
2007	Vigil 2 introduced
2008	CYPRES recall of 798 CYPRES2 affected by Swiss sensor factory

Servicing

Maintaining skydiving equipment is so important it is often said that life depends on it. AADs are part of this and considering the nature of the AAD, just like an aircraft, the servicing schedule must be followed to ensure that the electronic and mechanical components of the AAD are in good working order. This gives the user piece of mind that the unit will work as expected. Each AAD must be serviced according to the manufactures specifications failure to do so will result in the warranty if any becoming void. The reason for the maintenance program from Airtec as given it the user guide states that there are 4 reasons for this, they are.

1. Deviations between nominal and actual values are corrected to ideal values. Every detail is observed. It is common that signs of wear and tear treatment is done.
2. The technical condition of each unit is analyzed. The fact that a very high percentage of units are returned for the periodic maintenance gives the ability to see statistical trends and to predict potential problems at a very early stage.The advantage: often it's possible to prevent situations by modifications during the maintenance procedures, rather than having to fix problems with downtime later.
3. Experience shows that during a period of 4 years, changes and improvements do happen. Applicable updates are performed during maintenance. Such updates may have the background of technical improvements, or enhancement of knowledge, or may result from environmental changes or changes in the sport (e.g. new disciplines), which Airtec is always researching and taking into consideration.
4. The most important part of the maintenance is the individual pre-adjustment of each unit for the next 4 years. A unit will not be returned before a high confidence level is reached regarding the prediction of the unit's proper function for the next 4 years.

The reason for maintenance and servicing seems fairly generic across all manufactures it is highly recommended that all AAD units be serviced not only for the ongoing development of the

industry and personal safety of the user but the safety of other skydivers. The APF requires a functional AAD to be used. An AAD that has not been serviced as required by the manufacture is not considered functional.

Technological advances

Barometric - aneroid

The introduction of an aneroid to the mechanical AAD gave the user the ability to set the activation of the AAD by altitude instead of being set by time. Just like an altimeter using barometric air pressure to know where ground level is it gave the user more freedom with exit height.With this new freedom skydivers could continue to climb the aircraft if needed without changing the opening height of their parachute. This had a profound effect on the mind set of skydivers that used them.

All of a sudden skydiving became easier with the introduction of a hard deck. The influence of a hard deck in skydiving influenced the opening height of the main parachute, the opening height had to be higher than the activation height of the AAD.This snowball effect continued on through more technological advances over the years. Without these advances we may not be using AAF as a teaching method now days.

Electromechanical/pyrotechnic

Cutter

The idea of severing a loop instead of pulling the ripcord pin is an idea Airtec had 20 + years ago. They started off by building a small guillotine driven by two springs in an aluminum case. That was a satisfying solution. But the reason to not use this guillotine but to look for another possibility to severe the loop happened because they feared that a mechanical guillotine would possibly not be that reliable as they need it to be.

The result of this search for a more reliable solution ended with a pyrotechnic cutter. Basically, every pyrotechnic cutter is constructed of a airtight cylinder design with a blade and propellant inside which should severe loop material that consists of a lot of small threads. Since then more then 19 years have gone by and Airtec have produced 200.000 + cutters – none of these has ever failed to activate properly.

The propellant used in these cutters is called Nitrocellulose. It is a film forming resin used in inks, paints and other solvent based coating products. It has good functionality, value for money and high standards of safety. Another name for the cutter is the Metron Actuator they are also know as Protractors, Retractors and Guillotines. They contain nitrocellulose as a propellant the cylinder and cutting blade are made of stainless steal. Most pyrotechnic cutters in use are commercially of the shelf available for – amongst others - the mining industry, the automotive industry, life support and life-saving devices. With minor modifications those can be modified as loop cutters for harness container systems. This is not a problem as long as the limitations of the use of cutters are known.

Advantages

1) High energy delivered per unit weight (power/weight ratio)
2) Small volume (compact) (power/volume ratio)
3) Long-term storability (20+ years)
4) Controllable initiation and energy delivery

Few sources of energy combine all four of these characteristics. Pyrotechnics contain the needed energy to accomplish a desired function within small volumes. The only external energy required is an initiation input.

Pyrotechnic cutters are solid compositions that are highly energetic and are known to be stable under extremes of both thermal and vacuum conditions.

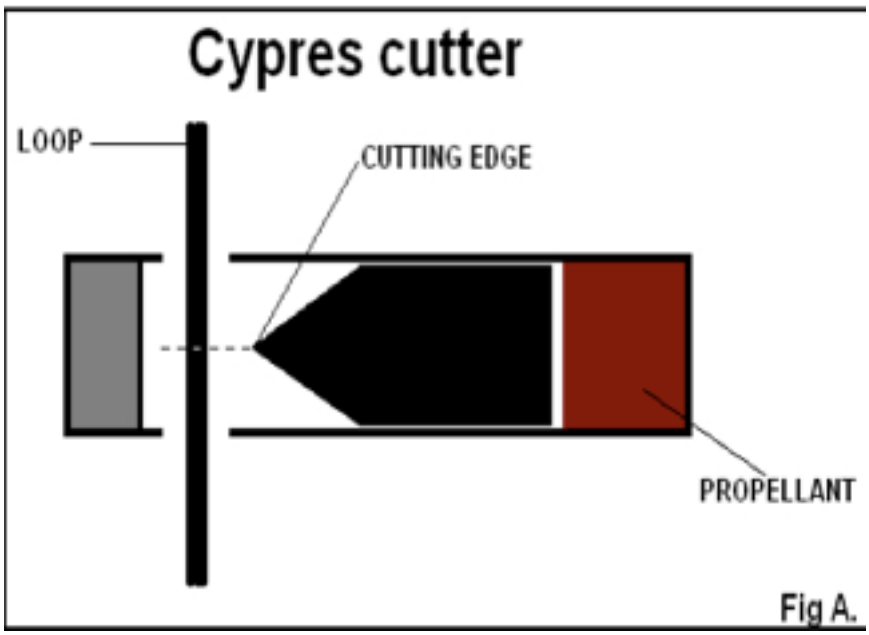
Disadvantages

- One way - Single activation
- Pyrotechnic cutters are used only once, since often internal structural deformation occurs during firing.
- Safety - Cannot be functionally checked (one way)
- Contain explosive materials
- Sensitive to unintended initiation by static electricity, electromagnetically induced energy or stray energy (short cuts)

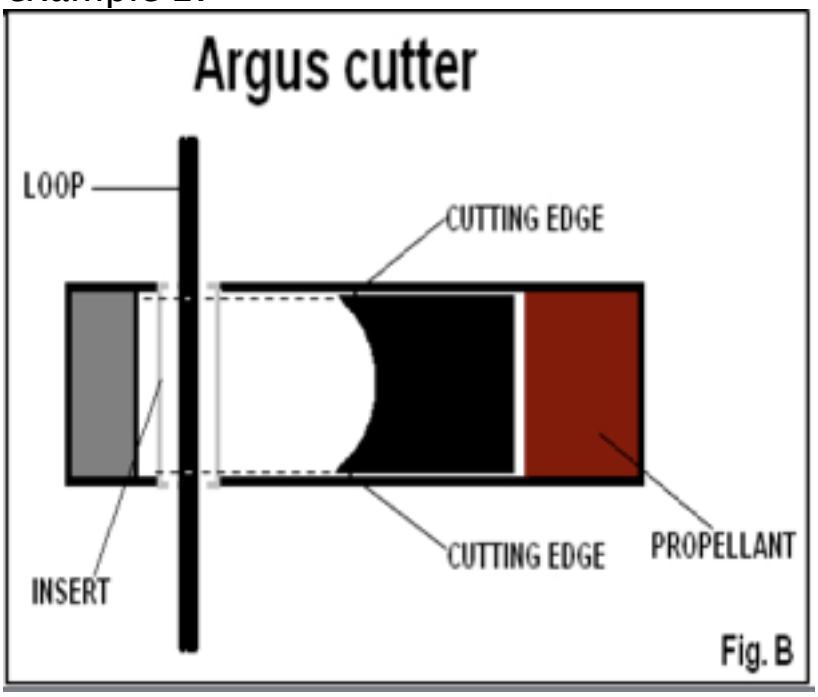
- These flow to the cutter by shielding, most of external influence via static electricity or EMC can be eliminated. However a 100% guarantee does not exist.
- Cutters cannot be functionally tested. The only test is measuring the current
- Engineering – Lack of standards and/or standard approaches,
- Lack of testing methods and logic to demonstrate functional margin.
- Lack of understanding of mechanical forces involved
- Poor resolution of failures (hard to trace)
- Few sources for information (reliance on manufacturers)

There are two types of blade they are a straight cut type (example 1) and a cylinder type blade (example 2)

example 1



example 2.



Conclusion

Pyrotechnic cutters cannot be functionally checked. In order to assure a acceptable level of quality and reliability. For assurance cutters are test activated per batch at random. A guarantee on a individual cutter can however never been given as it can not be tested on beforehand.
The minimum requirements to guarantee a successful cutting of the loop are critical and have to be obeyed at all times.

To be fully cut, a loop has to be near the cutter blade under a minimum tension of 5 kg (10 pounds). See the manufacturers' instructions and rigger manuals. To avoid loss of energy, free movement of the cutter has to be minimized. Cutters must be clean and free of any foreign objects (dirt, sand) as even the smallest amounts can seriously effect the functioning of the cutter.

Battery - power supply

The battery's used in AADs that require battery's must be in line with the manufactures recommendations. The battery's used in todays AADs are far superior than those used in the pass. Battery's have gone from lasting 6 months to now days 4 years. It is advised that any rigger or packer A installing or replacing batteries in AADs must ensure the batteries used are the type that the manufacture recommends. It is essential that the batteries be checked over for any defects or signs of wear before they are installed. All manufactures recommend battery's that have a proven track record of reliability and lifespan to ensure the user get the best product possible.

Data recording

Data recording is predominately done by the manufacture either at the time of service or at any time the unit is sent to them for whatever reason. Having a record of what each unit has gone through in its life gives the manufacture an invaluable wealth of knowledge about there product. This allows them to react to any situation that may arise, this is good for the skydiving community because it means that any problems that do arise can be communicated immediately. As a result of this no skydiver should ever have to jump from an aircraft with a defective unit on their back. The down side to this is that here in Australia, if an incident occurs involving an AAD and a fatality, we have to rely on the manufacturer to provide us with information. We sometimes need to prevent a situation from happening again, as we have seen from other times in the evolution of AADs this situation seems to be rectifying itself by the introduction of competition into the market forcing new manufactures to offer a little bit more than the last.

Applications

Sports skydivers

Any skydiver who has gained there B certificate is considered a sport skydiver some of these people do instructional jumps as well as fun jumps so there maybe a difference in the way some of these skydivers feel concerning the two. After gaining a B certificate the skydiving world opens up to you its at this point that you are allowed to now jump with other skydivers who aren't instructors or experienced enough for the DZSO to allow you are now looking after your self you jump with people who may not have much more experience than you so it is at this point that most skydivers realize that skydiving is full of potentials. The real risks of freefall collisions and loss of height awareness due to the fun factor are all to real. Surviving this sometimes intents learning curve can be a real issue for some and it has been said time and time again the longer you do this the more you will see the APF is aware of this fact which is why AADs are mandatory for B, C and D certificate skydivers after that the choice becomes yours although many CIs do have a mandatory AAD policy at there dropzone I have never heard any one at the DZ say they can't wait till they get there E certificate so they can stop jumping with an AAD.

Student skydivers

The Australian Parachute Federation implemented a mandatory directive that all student skydivers must have a functional automatic activation device on there equipment by 1996 this new operational regulation was extended to all skydivers who hold a B certificate holders then C and D certificate over the next two years to replace the now outdated RSL regulation. Having a AAD on student and novice equipment had a major effect on the industry first was the initial cost to the DZ operators and then to the new skydivers who in the last few years spent a considerable amount of money on there equipment were now forced to spend more on something they haven't needed in the pass, To ease this burden the APF implemented a strategy to help finance anyone who

needed help with this matter which was greatly appreciated by those who did need this help. Since this happened it has been proven how important this decision was not only by the student's saved but by the attitude of instructors who can't believe that students ever learnt to skydive without them.

Tandem

Tandem skydiving is considered student training by the Australian Parachute Federation, any tandem just like students must where a functional automatic activation device. The two main factors to think about here are the public perception of safety standards in the skydiving industry and the the tandem masters who before this implementation had no say wether or not they could use an AAD. This has been a great benefit to the tandem master of today not only for there own piece of mind but to ease there students fear as well.The upside of this is the tandem master knows if the AAD fires there will be repercussions, this keeps them form opening a bit lower at the end of the day to get to the bar quicker. In turn this has improved the over all safety of tandem skydiving in Australia.

Australian Community

The mandatory use of AADs for all skydivers up to E certificate in Australia means there are no dropzones in this country without an AAD being used. Most of these dropzones have a policy in place stating the use of an AAD was mandatory although that would be determined on a case-by-case basis if an experienced skydiver requested permission not to use one. The general feeling in the Australian skydiving community about AADs is that they are a backup device that could potentially save a life should the need arise so why wouldn't you want one.The fact that a skydiver has an AAD as a backup parachute activation devise gives them a felling of security that most skydivers wouldn't do without now days.

Tethered bundles

The Military Tandem Tethered Bundle (MTTB) System, now being used by governments around the world, is a parachute cargo delivery system that allows a parachutist to deliver a payload of between 200 and 400 pounds. The cargo may be delivered by landing with the parachutist or by being released into free-fall at a specified altitude (750 ft or greater) or the parachutist and opened by static line.The MTTB is a manually operated parachute cargo delivery system fitted with a 30-foot diameter canopy. The canopy is directly connected to the payload by a tether harness, with a swivel device incorporated to prevent twists. The cargo harness secures the payload with five lateral straps and two longitudinal straps. The straps can be quickly removed from the tether by a barrel harness quick-release box. Normal freefall parachute operational limitations apply with the MTTB. There are no altitude or speed restrictions, although opening altitudes are generally higher for additional safety.

Space

The space industry is renowned for reliability and performance so it is no surprise that the Warsaw Pac designed KAP 3 was used in every soviet capsule carrying cosmonauts. Although they were redundant they were an essential part of ever cosmonauts kit. These KAP 3 automatic activation devices are on display at the Smithsonian museum and the Boeing Air Museum in Seattle. The next AAD manufacture to have there automatic activation device in space was FXC through the NASA space program in that program the astronauts have FXCs on there parachute equipment as a back up devise. Airtec, the Cypres cutter component of there unit is now used in some satellites. They are used once in orbit for the precise opening of solar energy collectors. The Cypres cutter is used by the aerospace industry because of its proven track record of reliability.

Dual AAD usage

The first record of dual AADs are from the military for use on HALO jumps - With sport skydiving AADs were used primarily on the main parachute, With the introduction of loop cutter AADs they are now used primarily on the emergency parachute. While there is a transitional period where some dropzones were comfortable with the mechanical version of AADs but wanted to keep up with new technology. There was a number of dual systems at dropzones this situation has over time corrected itself although to this day even here in Australia there are dual AAD systems begin used for students. These system are all mechanical AADs on the main and electromechanical AADs on the emergency it is highly recommended that the altitude setting of both AADs are far enough apart that they don't interfere with each other. No manufactures recommend the use of duel AAD system skydiving equipment.

Mechanical plus Electronic

Imagine a student planing to open their parachute at 3,500ft the AAD on the main parachute should be set 1,500ft below the planed opening height the AAD on the emergence parachute for a student is set for 1,100ft that leaves 900ft difference between the two AADs which is less that desirable.

Static line plus electronic

Static line deployment of the main parachute is a great way of ensuring activation of the main parachute. Once the skydiver has left the aircraft the list of scenarios where a AAD on the reserve would be beneficial is worth considering. The use of dual AADs in this configuration has merit considering the control over the height of the main parachute activation and the chance of a two out situation caused by two AADs activating around the same time.

Restrictions by Discipline

CRW

FOR:

If you have a collision on exit that renders you unconscious. But the collision usually happens whilst your main canopy is deploying or is already deployed, so the AAD will probably not work anyway due to lack of airspeed. This will only really work if you knock yourself out on the way out before you deploy your parachute.

If you have a collision whilst turning points (docking) that renders you unconscious. But the collision happens after your main canopy is fully deployed, so the AAD will probably not work anyway due to lack of airspeed.

If you have a wrap / entanglement situation that renders you unconscious (knocked unconscious, blacked out due to G-Force turns, etc), and you are not capable of deploying or responding, then something out is better than nothing out.

AGAINST:

In most scenarios, you will have some fabric out. Deploying a second canopy into this is asking for trouble. Main / Reserve entanglement is a real risk.

This is almost an extension of the RSL principle in CRW – RSL's are disconnected to allow a CRW jumper to separate from any mess they are involved in prior to deploying a reserve. It is about control of when the reserve deploys.

At AAD firing time, you still have a little altitude remaining. The question here is, does something else fire something into something without any control, or do you take a few extra seconds to clear the situation a little more and fire lower into something that is cleaner.

AS A COMPETITOR

In most CRW / CF disciplines, you are allowed a 30 second time frame to build your first point. So you don't need to be deploying close to your team mates. This takes out the exit deployment collision factor (except for 8 way speed of course)

Although fast and furious, you are in a controlled team environment where the people you are jumping with are much more experienced than regular jumpers.
A quick look at some recent world meets revealed that the CRW community doesn't have a general agreement on this topic.

At the World Meet in France in 2003, AADs were mandatory, this is the only place where this has happened.

At the World Meet in Croatia in 2004 the Australian team didn't have AADs, but competitors had to wear a helmet.

At the World Record in Florida in 2007 it was optional.

AS A TUTOR

You tend to break off a little higher and the maneuvers you are performing are not as "robust" as competition CRW.

CRW students don't have the experience to deal with high stress / high pressure situations, so it may be better for them to have an AAD.

Accuracy

Without repeating scenarios just covered in the CRW section the introduction of swoop ponds led to the water proof / water resistant AADs. Even though these AADs allow for water jumps some considerations must be observed.

CYPRES 2 allows water jumps without removal of the unit. CYPRES 2 is waterproof for a duration of up to 24 hours down to a water depth of 5 feet (1.5 meters). This is achieved through a water resistant casing, sealed plug connections, a sealed cutter, a sealed control unit, and a special filter. The filter allows precise measurement of the air pressure and at the same time keeps water away from the inside of the unit. As long as there is no contact with water, the filter never needs to be replaced by the user. After water contact, the unit must be switched off and the filter must be replaced before next use.

The Vigil II has been designed to resist water immersion up till 0.5 meter for at most 30 minutes. The Vigil doesn't need any filter replacement, it has a built-in stainless steel air filter and after water contact no filter has to be changed. If your rig has been in contact with water. If the Vigil II has been in contact with clear water, you just need to dry the filter with a little water absorbent cloth. Put your Vigil II vertically on a cloth; filter down, to absorb any possible water behind the stainless steel filter. Never open your Vigil II's case unless it is completely dry on the outside.

The Argus allows water jumps without removal of the unit. It is water resistant up to a water depth of 3 feet (1 meter) for duration up to 30 minutes. This is achieved through a sealed cutter, a sealed control unit, sealed connectors and a special filter. The filter allows precise measurement of the air pressure and at the same time prevents water from entering the unit. As long as there is no contact with water, the filter never needs to be replaced by the user. If water does contact the filter, it must be removed and a new filter installed before the next use.

Swooping (Luke Oliver 2004)

AADs and UHP

It was reported in 1998 that UHP canopies could perform a vertical descent that may put them inside the window for Cypres activation, and I raised the issue formally at that time. Charlie Mullins was the most prominent pilot of the time, and reported to be diving his canopy at vertical speeds in excess of 100mph (161km/h) – well inside the 78mph parameter regarded as the touchstone for Cypres activation. Later in 1998 a study was conducted by Airtec to test the theory, with Mullins jumping a 58 square foot canopy, where it was found the vertical speed could not be sustained to a point where an expert Cypres would fire.

The study was repeated in 2000 with Luigi Cani jumping a 60 square foot canopy, well capable of exceeding and sustaining the 78mph activation speed of the Cypres through the threshold heights whilst still being able to land the canopy. However, during these tests, the Cypres did not fire as Cypres "does much more than trigger based on measured descent rate and altitude".

However, when downsizing to a 46sq ft canopy loaded at 3.6:1, Cani was able to sustain a dive and land a canopy inside the parameters required for Cypres activation. Results can be found on one of the Cypres website.

Troy Ketsdever conducted his own experiments, publishing in "Skydiving" issue #266. In addition to performing a pure test of the Cypres, he calibrated the Cypres for a +1,500' dropzone elevation. Performing aggressive maneuvers above 1,500', he was able to fire the device under an 86 square foot canopy loaded at 2.6:1

Whilst this may appear to have little relevance to the rank and file of Australian skydiving, it is worth noting that higher wing loadings have become acceptable with the advent of new technology: Most large dropzones will have jumpers regularly jumping canopies at a

wing loading in excess of 2.0, a number widely regarded as foolhardy just five short years ago.

Given a Student Cypres can be fired by overly aggressive maneuvers on a Student canopy, it is completely inappropriate to be coupled with a high performance canopy – let alone the UHP class.

Recommendation:

1. Maintain a watching brief on Cypres, Vigil and other AADs as canopies continue to evolve. Firing an AAD during a high performance swoop is not a probability, but is becoming a possibility.
2. Special attention should be paid to adjusting AADs for dropzones of differing elevations. Setting an AAD to fire high instead of low may well result in an activation and two-canopies-out scenario during aggressive canopy piloting.

This article was written in 2004, and the first fatality caused by an AAD activation in a swoop occurred in 2005.

APF Regulations

Operational Regulations

"AAD" means an automatic activation device.
"Incident" means:

(a) Any breach of these Regulations; or
(b) Any happening which, in the course of Operations, causes injury to any person, or damage to property; or
(c) Any unusual occurrence which it is reasonable to conclude might have caused injury to any person, or damage to property, or significantly increased the risk of a Descent; and Includes an off Drop Zone landing by a Student Parachutist, a tree or water landing, any equipment malfunction and the activation of a reserve parachute or an AAD.

8.8 AAD and RSL Requirements
All Freefall Descents made by Parachutists who hold a Certificate 'A', 'B' or 'C' must be made with equipment fitted with an operational AAD.

All Freefall Descents made by Parachutists who hold a Certificate 'D' must be made with equipment fitted with either:

(i) A functional RSL; or
(ii) An operational AAD.

(c) The ASO may authorise in writing an exception to this regulation for specified Descents.

13.1.9 Equipment for Student Parachutists
A Student Parachutists must be equipped with an AAD on all Freefall Descents so that:

Where the AAD is fitted to the main parachute, it will be set to activate no lower than 1000ft below the planned opening height; and/or where the AAD is fitted to the reserve parachute, the AAD must be approved by the manufacturer of the parachute harness.

13.1.10 Student Parachutist to have AAD on Freefall Descent

A Student Parachutist must be equipped with an AAD on all freefall Descents, so that:

Where the AAD is fitted to the main parachute, it will be set to activate no lower than 1000ft below the planned opening height; and/or where the AAD is fitted to the reserve parachute, the AAD must be approved by the manufacturer of the parachute harness.

13.2.6 Equipment to be fitted with AAD

A Tandem Descent must not be made unless the equipment is fitted with an operational AAD approved by the manufacturer of the equipment.

14.4.3 Where AAD Fitted

Where an AAD is fitted to activate the Reserve Parachute then the limits of its serviceability must be recorded on the packing record. This must include serial numbers, make and model, date of manufacture, service expiry date and required battery change date, as applicable.

14.4.4 Servicing or Replacing an AAD

A Packer 'A' may certify as airworthy a Reserve or Emergency parachute after opening and closing the container in order to service or replace an AAD provided that the said Packer 'A' is the same person that last signed the packing record required by Regulations 14.4.1 and 14.4.3.

A record of the work done is to be made on the Reserve packing record and in the Parachute Maintenance Log.

(c) Any work performed under this Regulation does not extend the period of Airworthiness under Regulation 14.4.2.

Operational comparisons

Feature matrix

Ceasing to operate

The Cypres 2 will cease to operate at approximately 130ft AGL.
The reason given for this by Airtec is.

Opening is no longer useful at this altitude so for this reason Cypres ceases operation below approximately 130ft AGL.

The Cypres 2 is the only AAD that does this.

Data logging

New generation AADs keep a log of flights done, freefall times freefall speeds, maintenance schedules and the list goes on. To access this information or to find out what data your AAD records refer to your user guide for your type of AAD.

Servicings

Mechanical AADs such as the KAP 3 and the FXC 12000 need to be field serviced every six months. This includes a pressure test in a pressure chamber. Factory servicing for the FXC revision A to G is annual and for revision J it is every two years.
Electromechanical AADs self test every start so no field servicing is required. The service schedule for these AADs are.

Cypres - every 4 years for the life span of the devise.
Argus - every 4 years for the life span of the devise .
Vigil - no service is required.

The FXC Astra electromechanical AAD is the only exception to this. During every repack of the reserve parachute a functional test is recommended on the Astra, using the Cutter-Test-Probe and the Portable Altitude Test Chamber.

Limitations and Issues

AAD in Pressurised aircraft

All manufacturers advise against transporting an active AAD in a pressurised aircraft. Given that one of the primary parameters for activation is governed by air pressure - via a sensor or aneroid - this makes sense.

An anecdote from Luke Oliver, describing a situation from the Formation Skydiving World Record in 2006, outlines the potential outcomes.

> "Wearing an AAD is compulsory on World Team, and every AAD manual will warn you of the dangers of using one in a pressurised aircraft. In spite of all the precautions, one of the Hercules did get pressurised for descent after a load was called down – the flight crew correctly assuming that their talking cargo required oxygen – but then rapidly depressurised as knowledgeable skydivers discussed this with the flight crew.
>
> As a result, four Vigil units promptly fired in the plane, and over thirty early model Cypres 1 units shut themselves down, demanding a trip to the factory to be checked for impossible pressure sensor readings. Airtec promptly dispatched a suitcase full of Cypres2 units with an engineer, and everyone with an AAD problem received the loan of a Cypres2 until the issue was resolved. The next night, some forty reserve containers were opened and closed in the hotel lobby and the problem put to rest."

The exception to the rule is a specific Military versions of the CYPRES. The Military CYPRES has a Green button, and the version for use in pressurised aircraft is labelled "Abs. adj." as well.

This version requires you to know the absolute pressure in the aircraft, and the absolute pressure at the dropzone. A wheel-style calculator is available to assist with calculations where absolute pressures are not available, with an associated warning about inaccuracies.

There are substantial other changes to the CYPRES for this specialised application, and these are outside the scope of this document.

Descending in aircraft

It is widely understood by pilots now about the importance of of descending the aircraft within the limitations of all AADs on board. If we take into account the fact that descending with a full load of skydivers isn't something that jump pilots do everyday so we must understand the extra pressure the pilot may be under at this time. Taking this into account it is up to the user of an AAD to remind the pilot of this situation or just turn your AAD off for descent. If you choose to turn your AAD off and the circumstance changes so now that your allowed to jump you must NEVER turn your AAD back on in the aircraft. You may skydive without an AAD but this depends on what certificate you hold and your local dropzone rules.

A student cypres will fire at 13ft per second this is 780ft per minute so as a general rule, on decent in an aircraft if the pilot slows the decent to 500ft per minute at 2000ft, we can stay within the limitations of all AADs.

Failures

No manufacturer has admitted that an AAD has failed to operate when it should have.

Travel on Aircraft

AADs on aircraft have been regarded with fear and uncertainty by airport staff. Use of the word “pyrotechnic” in electronic AADs has contributed to this in modern times. However, historically, the doubt arises from the use of “canisters” designed as ballistic recovery systems for Hang Gliders. These could contain solid fuel motors – smaller versions of the Space Shuttle booster rockets and represented a significant threat to aircraft.

The CYPRES cutter design develops no heat or smoke when it fires, and is a closed system designed to cut rather than penetrate material. In Australia, CASA have determined that a CYPRES AAD is not classed as "Dangerous Goods" within the ICAO definition for the carriage of items by air. It makes no sense to ship a rig with an active AAD by air, and it should be turned off if only to conserve battery life. However, given the firing parameters, inadvertently shipping an active AAD presents no additional risk to an aircraft or its occupants.

Most manufacturers offer downloadable documents from their website to cater for this situation, in addition to an inclusion showing x-rays of a typical rig in the shape of credit-card.

The US Department of Transport have a document on their website stating that parachutes with AADs can be taken on board as hand luggage or placed in the hold without special precautions, other than a comprehensive gear check before the owner jumps it if its been in the hold.

Very few problems have been reported with checking parachutes as hold luggage in recent times.

Your Personal Choice

For

- If for some reason, your main canopy is a tiny ball of mess and you are not “with it” (panic or not conscious or not aware of altitude), an AAD would be useful.
- Takes the stress out of having to deploy at lower altitudes yourself. More relevant for inexperienced jumpers or people who fear (hence panic) of lower altitude deployments.
- You’re in a high speed wrap and you can’t get your hands free.
- At AAD firing time, you don’t have a lot of altitude remaining.
- You cutaway and “forget” to deploy your reserve
- You cutaway and can’t find your reserve handle.
- You cutaway and then get hit and become unconscious.

Against

- The price of a AAD may seem quite excessive considering its something we never want to use unlike an emergence parachute the likelihood that any skydiver will use there AAD in a life saving situation is very minimal. The price extends from the amount of work that went into the design, testing and set up of manufacturing cost. Add to that the on going review, maintenance and up dates it must be said here that the company needs to make a profit as well. Over the life of a AAD there is the initial cost of buying the unit, shipping, taxes and installation after that there is a maintenance schedule and down time or time without a rig to jump. Looking at these factors it becomes apparent that an average price for a AAD ads up to a little bit more than a emergence parachute and these emergence parachutes have a longer lifespan so in comparison an AAD does seem expensive but in the mind of most skydivers who use them thinking about the chance of becoming unconscious while in freefall – the pros far out way the cons.

Unplanned firing

Over the years there has been documented cases of AADs activating in the wrong circumstances most notably descending in the aircraft. It is now widely understood by pilots the importance of slowing the rate of descent around 2,000ft AGL to prevent the unintentional firing of AADs. Other circumstances have been documented over the years such as a major pressure change, this can activate a AAD. Such as when a car boot closes as a result of theses circumstances all AAD manufactures recommend that there particular model be in the off mode while transporting. The other side of this is the dreaded miss fire some worst case scenarios of this are free flying because of the faster freefall speeds. Another scenario is activation while main deployment is happening creating a two out scenario. Nobody wants this to happen to them but mechanical and electronic devises do fail thankfully in the world of skydiving these are very isolated incidents and the manufactures are more than happy to rectify these incidents free of charge.

User Guide

Understanding the equipment your using for skydiving is important. AADs are part of your equipment so when you buy an AAD it is your responsibility to understand how it works and its limitations. The most important step toward understanding your AAD is to read the users manual. If you have any questions regarding your type of AAD ask your skydiving instructor. There is lots of information contained in these manuals and remembering all of it is almost impossible. To rectify this the manufactures include a quick guide or a road map to help you understand their product better.
Lets start at the beginning.

Choosing the right AAD for you
Tandem and student AADs as there names imply are only recommended for that particular type of skydiving. The choice an experienced skydiver has today is a electromechanical AAD set to activate the opening sequence of the reserve parachute at around 750ft when a vertical speed of 35m/s or faster is reached. This type of AAD is used by most experienced skydivers and works well with all disciplines of skydiving. The only other choice available is for high performance canopies, the activation height is the same but the activation speed is increased to about 43m/s to allow for the potentially faster air speed of these canopies.The choice between these two AADs should be well thought out. The 35m/s vertical speed required for an normal AAD to activate has not been reached under an open canopy by the entire skydiving community for decades. Even since the introduction of extreme radical canopies ranging below 100 square feet it took the worlds top class canopy pilots years to develop the handling skills to exceed this vertical rate of descent. Today it looks like the only chance to be that fast is to execute multiple 360's. Being at that vertical speed under a canopy below a thousand feet truly enhances your personal risk. This type of landing with these canopies should only be tried by highly experienced canopy pilots.The extra vertical speed needed to activate this type of AAD means that it may not activate under a

low speed malfunction or on a wing-suit jump, these situations and more need to be considered. Talk to your skydiving instructor before making your decision.

Choosing the make

The two main makes of AAD in use here in Australia are.
CYPRES and VIGIL
The main difference between Cypres and Vigil is the ability to change the Vigil from Pro, Student and Tandem by the user in the field. To do this with a Cypres the unit has to be returned to the manufacture. This may be great for a dropzone operator but for a skydiver this function is something they will probably never use. There are other makes available such as Argus and Astra. These AADs are not widely used in this country, to find out more about these AADs talk to your skydiving instructor.

Installing your AAD

All AADs must be installed by a packer A or a parachute rigger in Australia. It is recommended that you see how your AAD is installed in your parachute. Having seen what it looks like set up in your reserve pack tray improves your overall knowledge and understanding of your equipment.

Must do's

- **Turn your AAD on**.

All AADs must be turned on at the airfield you intend to take off from.When a AAD is turned on it will zero this means that whatever elevation the AAD is at when its turned on is ground level. Even a difference of 200ft means your AAD may activate at 550ft instead of 750ft.

- **Ensure the self check is complete**.

When you turn on a AAD it will count down during the self check. Make sure that you watch this count down to ensure that you end up at zero with an arrow pointing down.

- **Adjust the altitude reference if the airfield and dropzone are at different elevations.**

Adjusting the altitude reference is recommended for any elevation difference of 30ft or more. In the illustration below the airfield is 600ft higher than the dropzone therefor your AAD must read 600ft with the arrow pointing down.When your standing at the airfield think about weather you would walk up or down to your landing area. The direction of the arrow in this situation is very important it could mean the difference between a good skydive or a very bad one.

Servicing

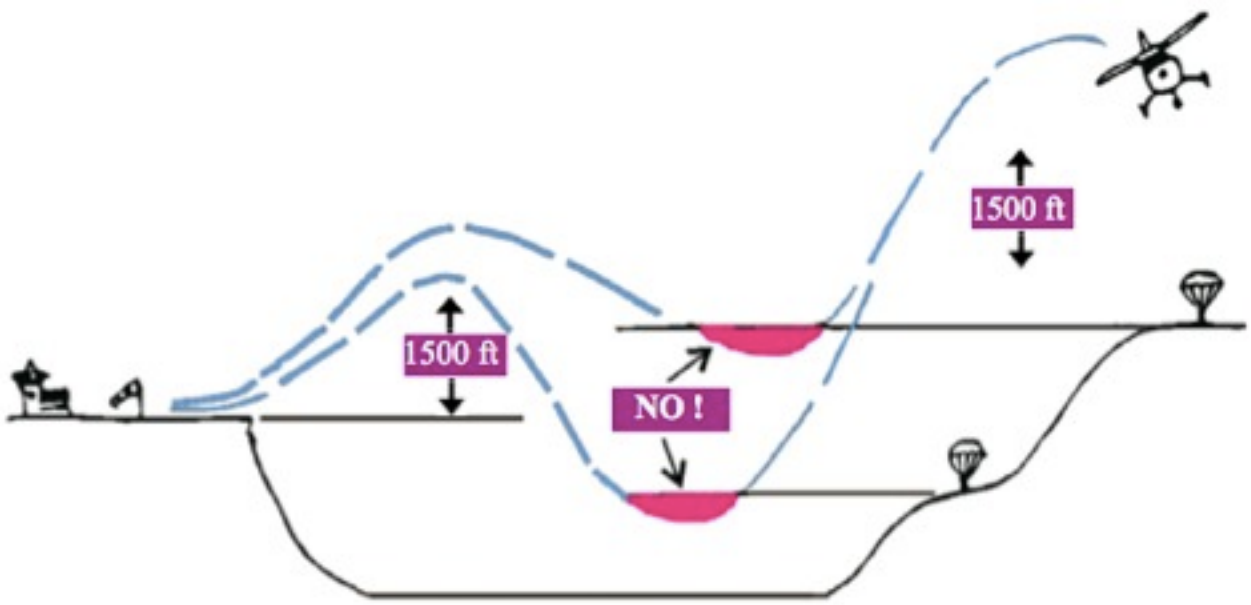
Like any electronic or mechanical devise they can break. Weather from a hard landing or even the way your rig is placed on the packing floor there is a chance that your AAD can become defective.Having an understanding of the components that make up your AAD will ensure your rig is treated with the respect it deserves. *You wouldn't drop your TV remote on the floor after each use*. Follow any service schedules set out by the manufactures to maintain reliable function of the unit and for your own piece of mind.

- **Stay within the limits**

Once the aircraft leaves the ground your AAD will arm its-self at a certain altitude. Your AAD will not work until this altitude has been reached.Once that altitude has been reached the aircraft must not descend below it then back up again.

Once the Aircraft takes off from the airfield it must not descend below ground level.

If the altitude reference has been adjusted never fly below the intended dropzone elevation



If your AAD arrives back at the dropzone by any means other than under an open canopy such as a car or by foot, then you should **turn your AAD off and back on again** to reset the AAD.
If your total flight time exceeds 1.5 hours then you should **turn your AAD off and back on again** to reset the AAD

Must not's
never transport your AAD in the on mode
never use your AAD if the self check did not complete
never use your AAD if it shuts down
never set and forget your AAD
never use your AAD as a primary means of deployment

A quote from the Cypres users guide

"The use of CYPRES does not automatically prevent injury or death. Risk can be reduced by assuring that each component has been installed in strict compliance with the manufactures instructions by

obtaining proper instruction in the use of this system, and by operating each component of the system in strict compliance with this users guide.
Automatic activation devices (AADs) sometimes fail to operate properly, and sometimes activate when they should not, even when properly installed and operated. Therefore the user risks serious injury or even death to themselves and others during each use."

A quote from the Vigil users manual

"AAD NV/SA intensively tests all Vigil® to assure their reliability. Each Vigil® has passed various documented technical inspections, calibration tests, quality control inspections and a final functional test (6 jumps in test chamber) before shipment. These are all documented and available to customers. However, AAD NV/SA cannot totally exclude the risk of a malfunction on electronic equipment. AAD NV/SA can not be held responsible in the event a faulty part escapes detection during the final testing phases. The AAD NV/SA warranty is exclusively limited to the replacement or rework of defective parts free of charge within one year from the date of purchase.

The use of a AAD is highly recommended just as the understanding of your personal skydiving equipment is.
stay smart, stay safe, stay jumping." Stuart Gough F 729

Summary

Actual Experience

In my time as a skydiver I have done almost all my skydives, 6,500 of them now, with an AAD in my equipment. When I started skydiving the student equipment I used was a Pigmee container with a X300 main and a PA260 reserve and had a FXC 12000 on the main and I remember a couple of times the AAD fired. Nothing was recorded in my logbook about a lack of height awareness it was said at the time they will fire + or - a 1,000ft from the preset altitude and the attitude of my instructors was that this was normal behavior for a pin puller type of AAD. After 18 skydives with this set up I had my first rig a Racer Elite with a PD 170 main and a PD 160 reserve there was no AAD installed on this set up so in order to jump my new rig I had to buy an AAD the APF had a bunch of Cypres 1's that were cheaper because the Australian Parachute Safety Counsel had covered the import tax. After agreeing to the terms and conditions and handing over about $1200 I found a rigger to install it into my rig at a cost of about $200 that was it off skydiving with no problems for the rest of the time I used that rig. Since then i've brought and sold a couple of rigs which always had Cypres 1's in them 3 years ago I brought my first new rig and didn't hesitate with my choice of a Cypres 2. I know there are other brands on the market but with my personal experience I thought it would be better to stick with what I know and there was a compatibility and piece of mind issue considering I use a Cypres 2 six days a week working as a tandem master.

Experienced CRW

My experience with CRW is limited to about 10 CRW jumps over 14 years. When I did these jumps AADs were not on my mind because of the nature of this type of skydive I was thinking about the instruction I was receiving at the time. I understand the pros and cons of using an AAD on these jumps because of the interaction i've had with experienced CRW jumpers so if I was going to do CRW jumps in the future I would consider myself a student of this discipline and listen to my instructors thoughts on this subject.

Swooping

In my experience with high speed landings I have watched the canopy's get faster and the pilots improve over time there for it was inevitable that one day a pilot would reach an air speed that could activate an AAD. Although this was talked about around the camp fire between my group of friends our thinking was " of course the manufactures are watching this" sadly as if history wasn't going to repeat itself over and over again something had to go wrong before this inevitable situation was rectified with the introduction of the speed mode on all electronic pyrotechnic AADs. although I currently fly a Katana 107 with a wing loading of 1.85 even with regular 270's and sometimes 360's i've never come close to meeting the requirements needed to activate my AAD set in the expert mode.

"Mad not to"

After gathering all the information I could find on AADs I have come to the conclusion that the pros far out way the cons.In other words you'd be "mad not to" have an AAD fitted to your rig. I would never say that I wouldn't jump without a functional AAD because in some circumstances I would. If this situation ever arose I would be aware of the fact that I don't have an AAD and would be more cautious about what I commit to in this circumstance. We can compere this argument with seat belts in cars over time general thinking changed and as a result most people want to wear one now days and lets face it you'd be "mad not to". Over the course of this process i've talk to many skydivers both inexperienced and very experienced and the attitude of all that I have spoken to is that AADs are a good thing to have although if I do a solo from a hot air balloon and i'm unsure wether we will go above 1,500ft and stay above this height until we jump or the landing area is 500ft higher than excepted then its great to be able to choose not to have to think about wether or not we can operate within the limitations of our AADs. I would choose not to, but this is my choice and not a recommendation or something I would advise other people to do. The most memorable conversation I had with a

skydiver on this subject was David McEvoy jnr when I asked him what he thought about AADs in general he said, “Stu your mad not to” and I agree with him on this. Todays generation of AADs are reliable, affordable and mandatory or at least highly recommended on all australian dropzones,so, you’d be mad not to have one as part of your skydiving equipment.

Appendix: Bibliography

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MPAAD

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thankyou

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