The Shadow is controlled by an automatic takeoff and landing system. It uses a rail compressed nitrogen gas powered catapult for launches directly into the prevailing wind. Navigation can be preprogrammed, programmed during flight or direct navigation by the vehicle operator. Recovery and landing is typically performed autonomously by the Tactical Automated Landing System (TALS), a process similar to an Instrument Landing System approach for manned aircraft. A tail hook/arresting cable system is used for rolling recoveries and primary and secondary arresting cables are utilized. In the rare event that Shadow does not catch on either arresting cable, an arresting net is preplaced to stop the aircraft aft of the arresting cables. The AO located in the Ground Control Station (GCS) controls the air vehicle, continually monitoring system status, and maneuvers the air vehicle as desired. Downlink data includes a display of health and status parameters such as attitude, magnetic heading, indicated airspeed, GPS position, barometric altitude, rate of climb, engine instrumentation, and warnings and cautions.

WIND LIMITS (TAKEOFF/ LANDING)

Landings may be continued to touchdown in up to 5 kts of tailwind. However, unless otherwise indicated by extremely low fuel level, autoland approaches shall not be initiated with any tailwind component, and approaches should be waved off by the AVO prior to decision point if substantial tailwind component is sensed by ground crew personnel.

Headwind component (maximum)................20 knots steady, gusting to 25 knots
Crosswind component (maximum) ....20 knots steady, gusting to 25 knots

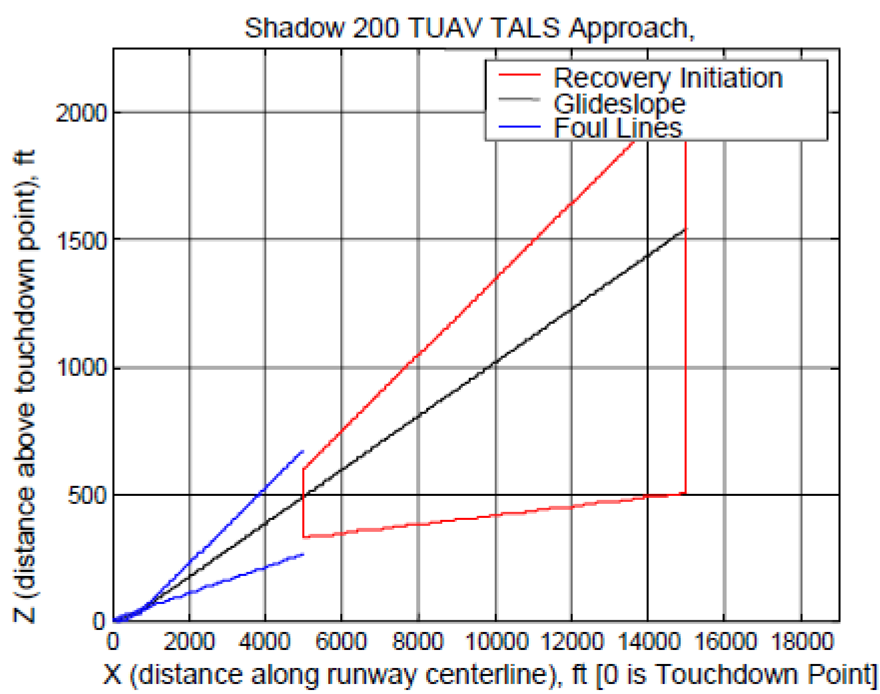
Launch: The using unit launches an RQ-7 Shadow Unmanned Aircraft (UA) from an optimal position on the runway depending on direction of the prevailing winds. The Shadow will climb at a rate of 500’ per minute, and proceed on-course to the designated mission area within the established waivered operating area while climbing to assigned altitude or fly direct to the designated TALS loiter location then turn on-course. Departures between 253° clockwise to 358° will begin turnout at 200’ AGL (.4 NM) to avoid departing designated airspace.

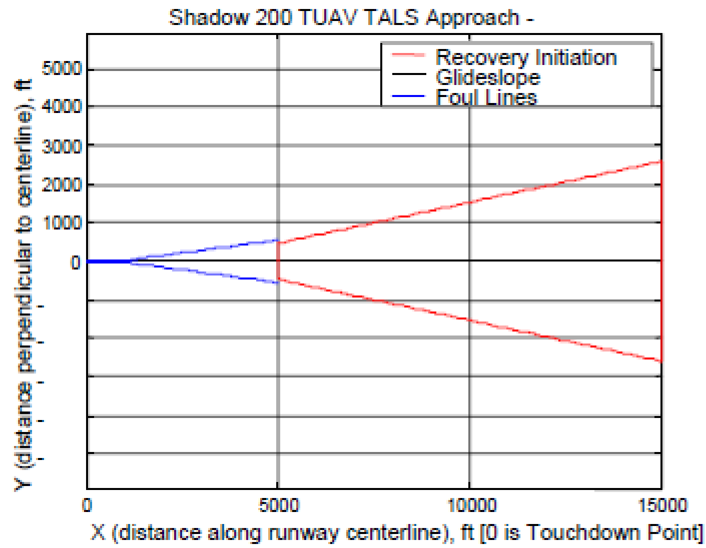
Recovery: The UAS will descend to 500’ AGL then proceed to the designated Tactical Automatic Landing System (TALS) loiter point or designated IP via the most direct route and fly straight-in. The selected TALS recovery point will be on the extended runway centerline approximately 6000’ (1828m) from the approach end of the runway of intended landing where the TALS will automatically land the UA.

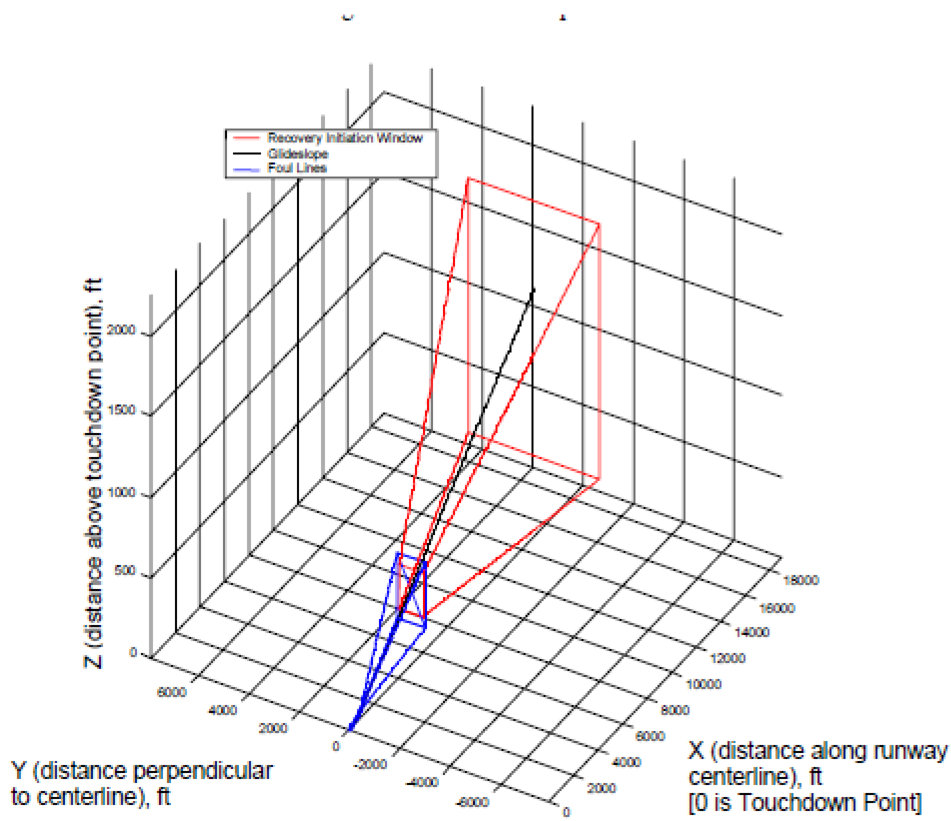
Tactical Automated Landing System (TALS): The TALS provides automatic landing guidance and control for the Shadow 200 TUAV System AV. The TALS is divided into two subsystems: the Airborne Subsystem (AS) and the Track Subsystem (TS) The AS is contained within the AV and consists of an AS Transponder and AS Antenna; the TS remains on the ground and consists of a Track Control Unit (TCU), an Interrogator unit, an Antenna/Radome and a Pedestal unit. The TCU contains software that flies the air vehicle during automatic recovery.

During a TALS recovery sequence the AVO normally uses the TALS loiter autopilot mode, which will automatically navigate the AV to the point, which has favorable geometry for starting the landing process. There are two relevant 'windows' for TALS landings. The acquisition window is a volume in space, relative to the physical location of the Track Subsystem (TS), in terms of azimuth and elevation and range, within which the TS can acquire and track an AS that is pointed towards the TS. It is a relatively large volume and the user can adjust the angles over which the TS will search to find the AS. In clear weather, the range for tracking between the TS and AS can be 8 nautical miles (14km) or more.

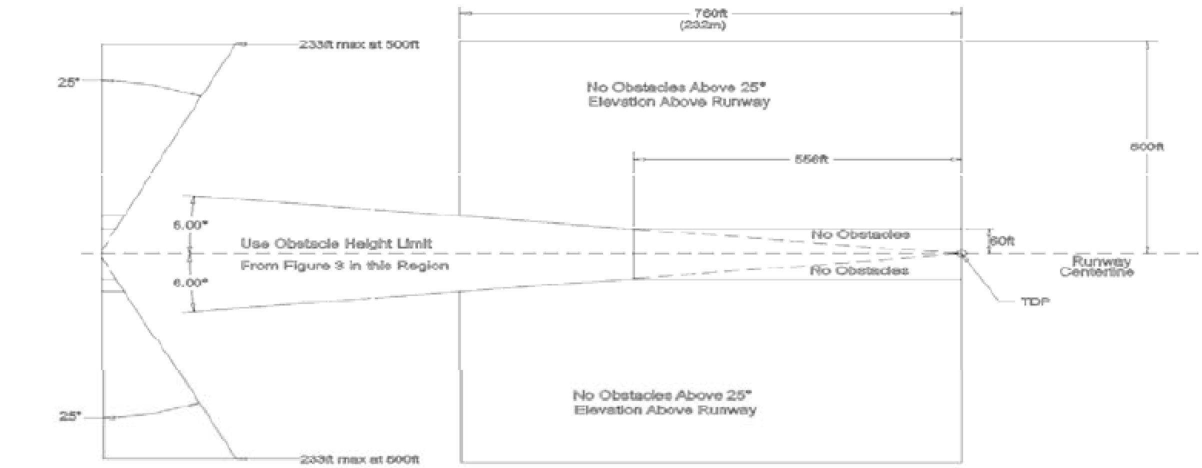
The Recovery Initiation Window (RIW) is a much smaller volume in space, from which the TALS can safely execute a landing, and when the TS has determine the AV to be in the RIW, then the Land AV button will be un-ghosted. The AV must be tracked by the TALS TS and determined to be in the RIW for the landing to proceed. Additionally, the AV must be between 60 and 75KIAS for the RIW conditions to be satisfied for landing. TALS will not land an AV when the engine is shutdown. TALS will not land an AV that has no downlink. The runway heading that is input during TALS setup adjusts the location of the TALS loiter location and the wave off course, but not the RIW. When TALS is actively controlling the AV's approach to landing in Land AV mode, the TS will constantly monitor the position of the AV relative to the centerline and glideslope. If the AV gets too far off of either centerline or glideslope, it will be considered to have contacted a 'foul line' and the TS will generate an automatic wave off, as long as the AV is outside of the 'Decision Point' (DP).







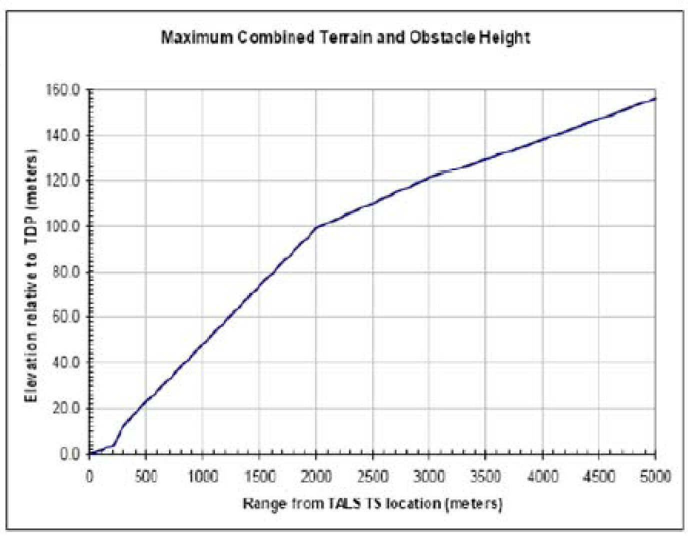
The TALS ES subsystem assists the ground crew in aligning the TALS TS pedestal during TALS emplacement, performs the TALS emplacement measurements, automatically transfers the measurements to the GCS/PGCS, assists the ground crew in determining if there are obstacles in the AV glideslope (within limitations), and detects if the TALS pedestal becomes misaligned after emplacement. The TALS ES can support the ground crew in determining if obstacles are in the AV glideslope. Once the TDP has been established through the TMU and TDP marker emplacement the TALS ES obstacle detection extends outward in a +/- 6 degree swath in both directions from the Touch Down Point (TDP) along the runway centerline. The maximum allowable combined terrain and obstacle height is shown in table above. TALS ES can help the ground crew determine the height of the obstacle to a range of 500 meters within these swaths through the use of the three cameras located in both TMUs. An embedded program within the TMU allows the MSD Laptop to connect via the Ethernet port, manipulate the cameras with a zoom in/out capability down range, and mark obstacles in the cameras view. Range and height of the marked obstacle is then displayed on the Glide Slope Graph. Range and elevation displayed in a red text box indicates the obstacle is inside the AV Glide Slope and must be removed. Obstructions identified below the Glide Slope appear in black text.



TALS OBSTACLE CLEARANCE
END VIEW

TALS OBSTACLE CLEARANCE - PLAN VIEW

Range from TS (feet)	Range from TS (meters)	Maximum Combined Terrain and Obstacle Height (meters)
0	0	0.0
100	30	0.5
200	61	1.1
300	91	1.6
400	122	2.1
500	152	2.7
600	183	3.2
700	213	3.7
800	244	6.7
984	300	12
	400	18
	500	23
	600	28
	700	33
	800	38
	900	43
	1000	48
	1500	74
	2000	99
	3000	121
	4000	138
	5000	156



In the event of a dual uplink failure when the AV is in TALS Autorecover mode, the AV will abort the TALS approach and proceed to the pre-programmed Return Home point, vice the preprogrammed Wave off waypoint. In the event of an automatic TALS abort, the AV will proceed to the reciprocal TALS recovery waypoint.

Attachment 1: TALS Recovery Points.