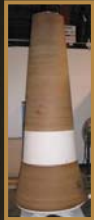


COLEMAN Aerospace

Theater Ballistic Missile Targets

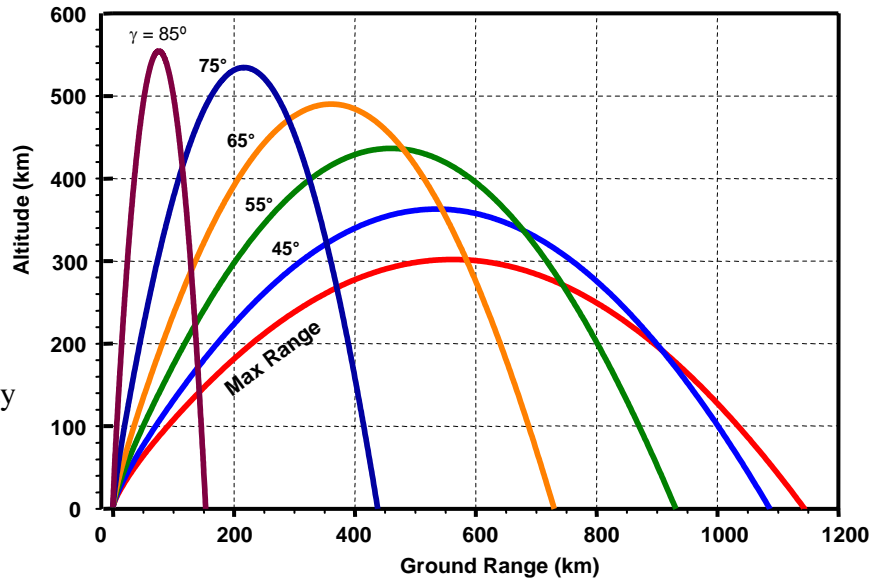


Launch Vehicles

Coleman Aerospace offers a family of theater ballistic missile (TBM) targets based on a common launch vehicle combined with a variety of reentry vehicles (RVs) and a suite of test and support equipment. Maximum commonality among the target family is maintained to provide flexible and economical operations, while subjecting the Ballistic Missile Defense System to sophisticated and complex test scenarios.

TBM targets can be configured to present a variety of target objects, including fully separating and unitary configurations. The design is modular to allow for tailoring of individual missions via software-selectable trajectories covering the spectrum of threat kinematics, available kits that match the infrared and radar signatures of typical threats, deployable countermeasures, and multiple modes of exoatmospheric attitude control.

Coleman Aerospace's target launch vehicles simulate the characteristics of existing and future TBM threats. Trajectories spanning a range of 100 to 1140 kilometers and velocities between 1.5 and 3.0 kilometers per second are provided using a standard launch vehicle configuration and tailoring flight path angle, mass properties, guidance schemes, and energy management maneuvers.




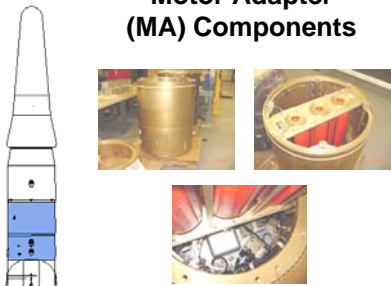
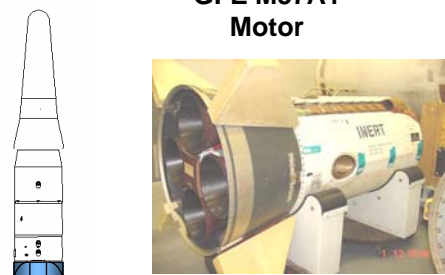
Coleman Aerospace launch vehicles provide a broad range of trajectory capability with varying flight path angles and ranges out to 1,140 km.






Coleman Aerospace Family of Theater Ballistic Missile Targets

Launch Vehicle Sections

Coleman Aerospace manufactures, assembles, and tests individual sections that are common to all TBM target launch vehicles. The TBM target system configuration includes a ballistic reentry vehicle (BRV) or matching ballistic reentry vehicle (MBRV) front end, guidance and control section (GCS), motor adapter (MA) section, M57 Stage 2 motor, interstage pile driver control section (PCS), SR19 Stage 1 motor, and aft skirt. Each missile section uses fully qualified components that have passed acceptance tests prior to section assembly. In addition, each section must pass its own acceptance test prior to integration into a launch vehicle.

<h3>Guidance Control Section (GCS)</h3>  <ul style="list-style-type: none"> • Structure • Components <ul style="list-style-type: none"> - Flight computer - Attitude Control System (ACS) - C-band system - Fan - Rate gyro assembly - G&C battery - Instrumentation: GCS air temp sensor - GPS/INS GNC system 	<h3>Motor Adapter (MA) Components</h3>  <ul style="list-style-type: none"> • Structure • Coast Control System (CCS) • Delta V system • Ballast (as needed) • C-band System • P92 assembly • NCU junction box • NCU battery • FTS system • S&A Rearm Module (SRM) • Arming plug 	<h3>GFE M57A1 Motor</h3>  <ul style="list-style-type: none"> • Government-furnished Equipment
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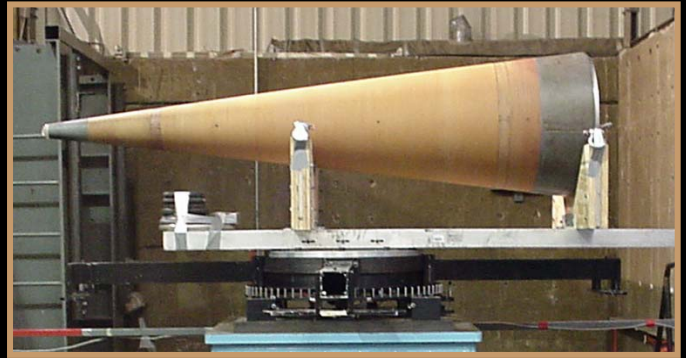
<h3>Pile Driver Control Section (PCS)</h3>  <ul style="list-style-type: none"> • Structure <ul style="list-style-type: none"> - Cut into two pieces via LSC • Forward section components <ul style="list-style-type: none"> - CCS thrusters(2) - Instrumentation - Thermocouples • Aft section components <ul style="list-style-type: none"> - Ballast (as needed) - FS separation A/D - PSS batteries(2) - FTM (2) - FTS (2) - Instrumentation 	<h3>GFE SR19 Motor</h3>  <ul style="list-style-type: none"> • Government-furnished Equipment 	<h3>Aft Skirt</h3>  <ul style="list-style-type: none"> • Structure • Components • Elevons • Actuators • Hot gas roll control system
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Reentry Vehicles

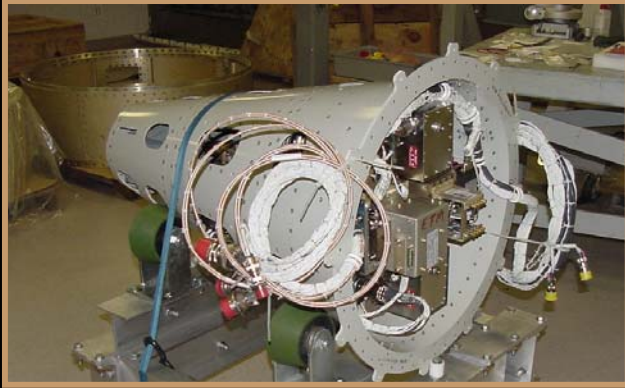
The BRV and MBRVs are non-maneuvering reentry vehicles (RVs) that fly a conventional ballistic trajectory after separation from the launch vehicle. The dynamics of the RV are adjusted by using varying amounts and position of ballast. The infrared (IR) and radar cross section (RCS) signatures of the BRV are adjusted by changing the nose tips, thermal protective systems, and RV skirts. The proper presentation of the RV in the electromagnetic spectra used by the missile defense system sensors and interceptors is essential to test success.



Ballistic Reentry Vehicle (BRV)



MBRV-1



MBRV-2 Avionics

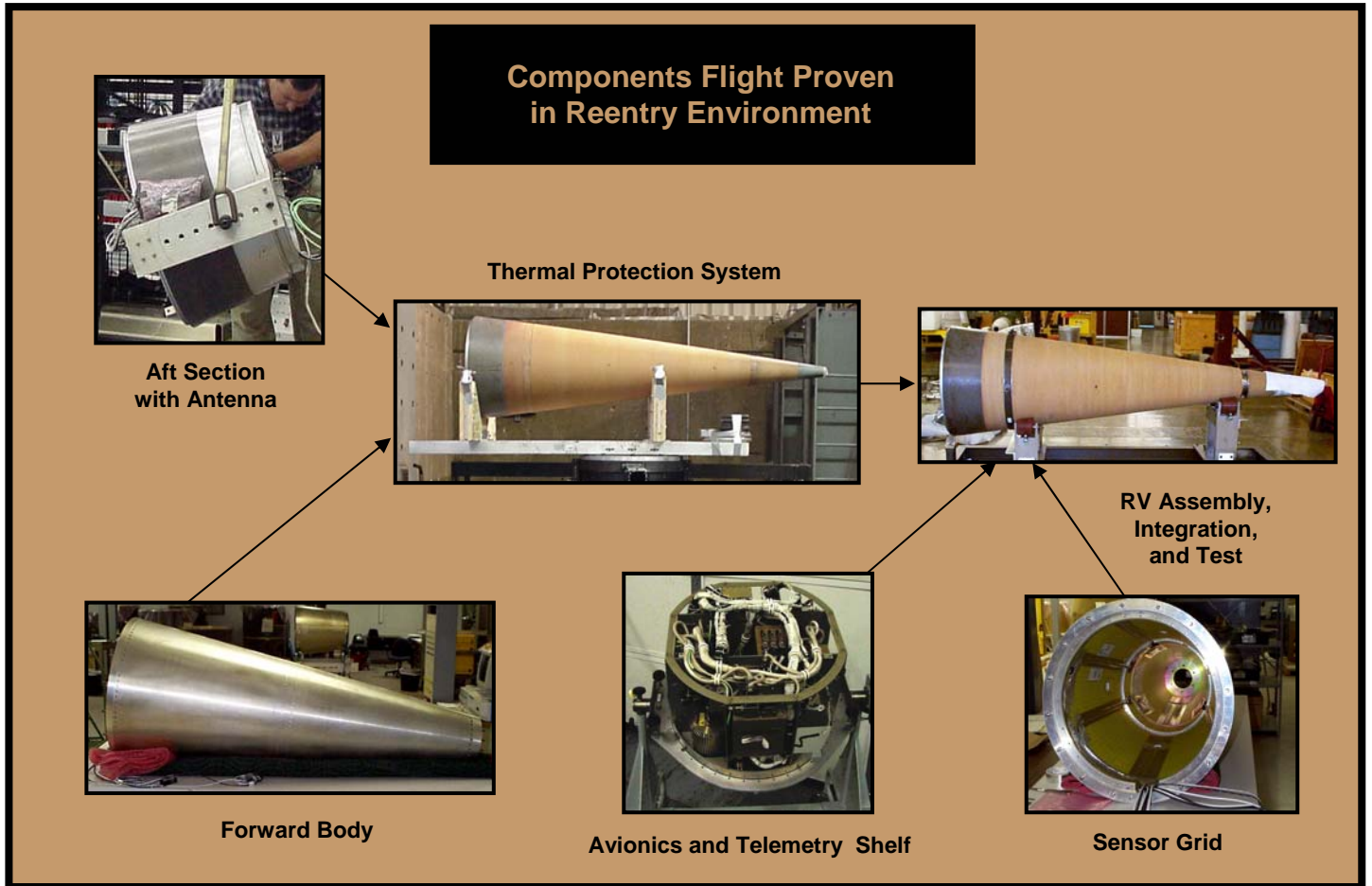


MBRV-3

The BRV has been precisely characterized and engineered to meet the required range of target signatures, having been used in 12 missions conducted by Coleman Aerospace. The MBRV-1 and MBRV-3 have been employed in a total of six missions, including risk reduction launches and intercept missions supporting PAC-3 interceptor testing. The Coleman reentry vehicles provide a full suite of instrumentation for test and evaluation missions, and can be configured with minimal instrumentation for training missions.

Telemetry, Instrumentation, and Range Safety

Coleman Aerospace supplies integrated flight avionics, telemetry, ordnance, and control systems for various applications. All components have been fully qualified to meet SR19 and M57 motor-induced flight environments, and can be qualified by analysis and/or a delta-qualification test program for other launch vehicle applications.



Avionics and Telemetry Components

Coleman Range Tracking Electronics

System Donner Digital Quartz IMU

Rockwell-Collins GNP-10

Hades Thermal Reference Unit

FSY Microwave Triplexer

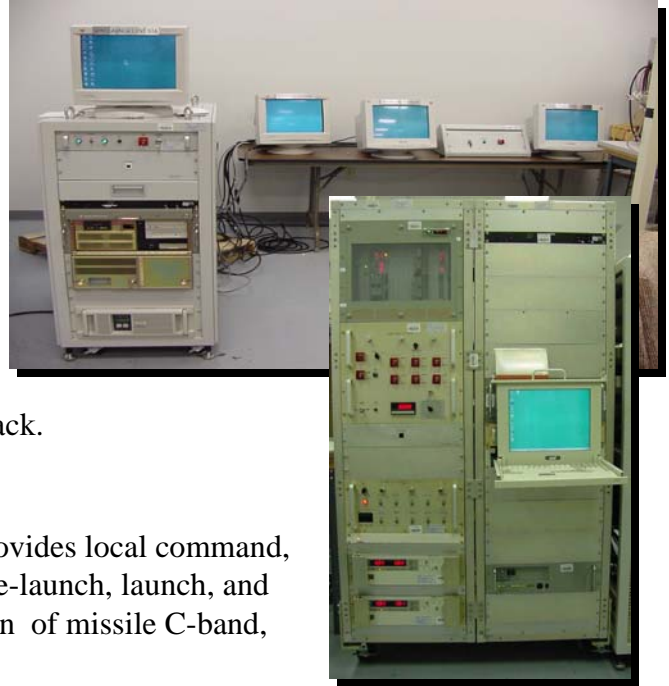
L-3 PCM Encoder

L-3 Telemetry Transmitter

Launch Equipment

Remote Launch Control Station (RLCS)

The RLCS provides a suite of control consoles for ground launch, and is connected via optical fiber to the portable launch station. The RLCS consists of an RLCS rack, a ground safety station (GSS), and a flight safety station (FSS). The RLCS rack controls all commands sent to the launch vehicle, including the final countdown sequence, emergency power-off (EPO), and software upload. The GSS and the FSS each provide separate touch screens through which the health and status of the vehicle is monitored. The GSS also has control over launch enable and EPO independent of the RLCS rack.



Portable Launch Station (PLS)

The PLS is used for both air and ground launch operations. It provides local command, control, power, and monitoring functions required to perform pre-launch, launch, and abort operations. The PLS also provides capability for reradiation of missile C-band, S-band, and L-band radio frequency (RF) signals.

Support Equipment

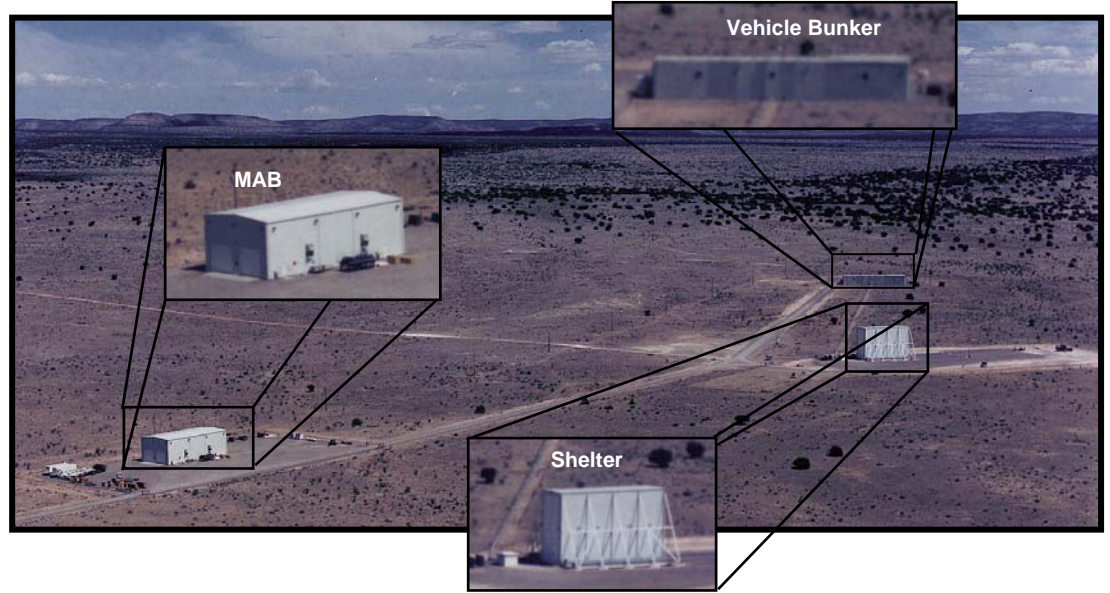
Support equipment includes all of the ancillary equipment used to support the testing and launch of the missile. This includes the following:



- **Telemetry Ground Station (TGS)** – Provides various telemetry control, power, and monitoring functions
- **Telemetry Van** – A mobile van that provides telemetry recording, processing and display stations for missile pre-launch checkouts
- **Launch Operations Trailer (LOT)** – A self-contained trailer that contains the equipment necessary to perform the missile countdown and launch
- **Launch Stool** – Supports the missile in the vertical position for launch, provides blast deflector shielding, and supports the umbilical cable mast
- **Transporter/Erector (T/E)** – A mechanical assembly platform for the missile, as well as the means to move the assembled missile from assembly area to launch area. The T/E incorporates a system of cradles and a hydraulic boom to allow the missile to be raised from horizontal to vertical and placed onto the launch stool.
- **Test Equipment (TE)** – Includes equipment to support various tests and field site buildup operations that are not explicitly used as a part of the actual launch countdown.

Launch Site Facilities and Services

Coleman Aerospace provides test range support services required to meet current and future test program needs. Coleman works with the customer and with the appropriate authorities at the designated test range to define support requirements and perform surveys of existing facilities.



Mobile Target Launch Platforms

Air Launch

Coleman Aerospace is the preeminent developer and supplier of air launched targets that simulate theater ballistic missiles. The successful flight of our Short Range Air Launch Target (SRALT) in 1999 marked the first time the United States had conducted a successful air launch mission of a ballistic missile target after being extracted from a C-130 cargo aircraft, igniting, and flying to a specified downrange aim-point.



Sea Launch

Mobile target launch systems permit flight tests to be conducted when there are no suitable ground-based launch sites located appropriately for the desired trajectory and aim point. They also provide the capability for multiple, simultaneous target launches from varying distances and azimuths to simulate real world threat scenarios under controlled test conditions.

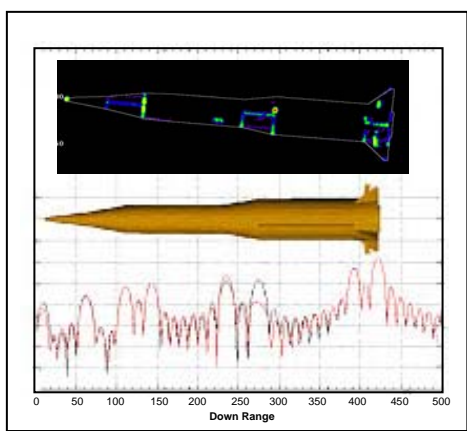
Coleman supplies the only proven launch support equipment for use onboard the Mobile Launch Platform (MLP). The MLP is the decommissioned USS Tripoli, the LPH-10 amphibious assault ship (helicopter), which has been converted by the Missile Defense Agency for use as a sea-based launch platform.



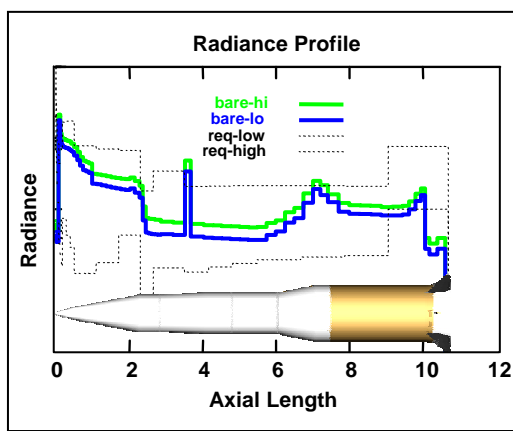
Engineering Design and Analysis

Coleman Aerospace has the engineering capabilities, analytical tools, and real-world experience to verify that each target configuration meets the threat description and user test requirements. We validate, through detailed analyses and ground-based testing prior to flight, that the target accurately represents the intended threat performance.

Radar Cross Section Correlation

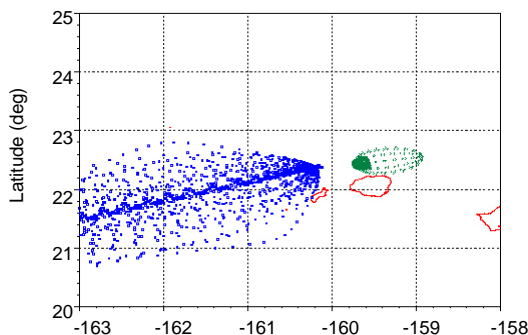


IR Signature Matching

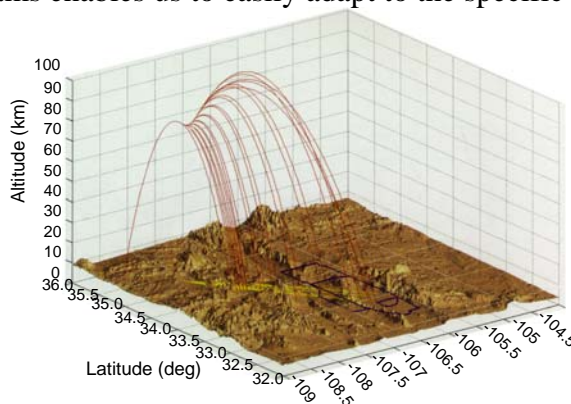


Coleman provides end-to-end test services that include preparing test support requirements, preparing documentation required by the test range, and performing flight safety analyses. Coleman has the tools and experience to provide trajectory shaping and debris footprint analyses to construct test scenarios that achieve test objectives and satisfy range safety constraints for missile launch operations. Our experience in planning and executing many successful missile test flight programs enables us to easily adapt to the specific needs of your test program.

Range Safety Analysis



Mission Planning



communications
Coleman Aerospace