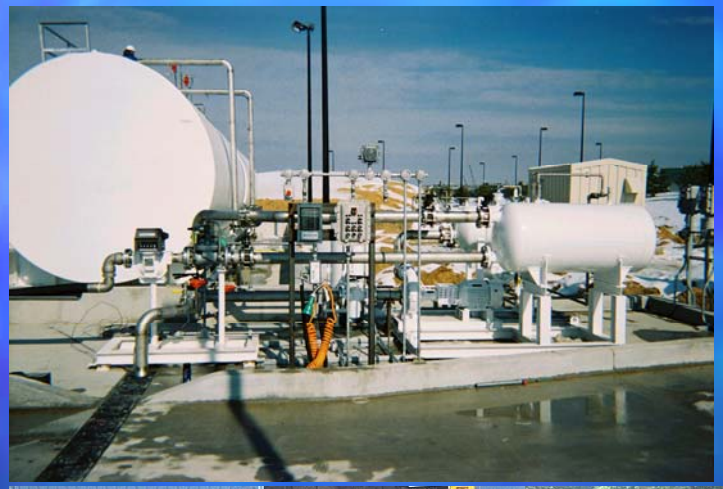
Millennium Systems International

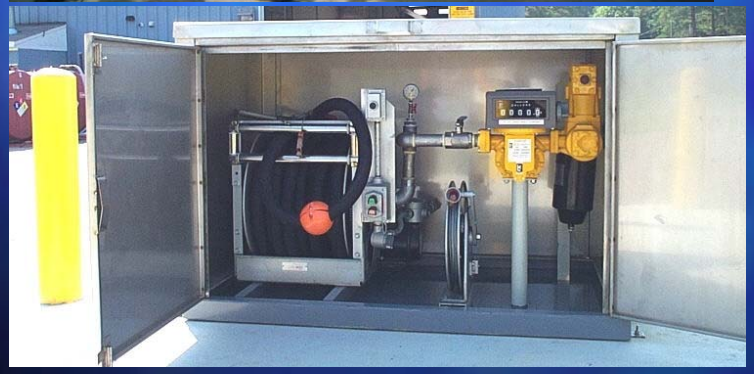
Aviation Fueling Engineering Seminar

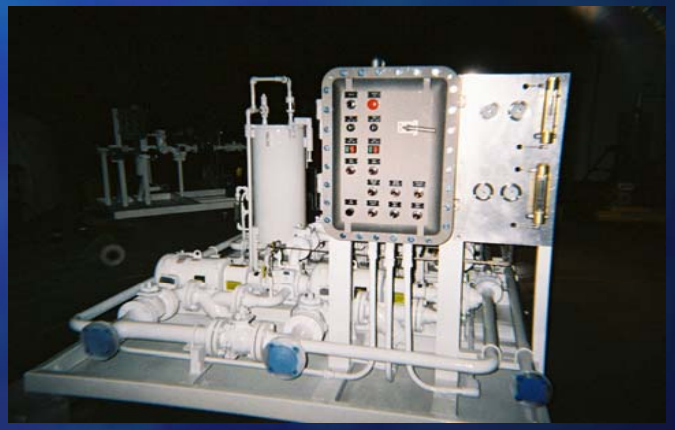
Aviation Fueling Systems

- System Safety as Design Priority
- Compliance with Standards/Regulations
- Specialized Fuel/Additive Requirements
- Specialized Aircraft Requirements
- Defining System Functionality
  - Offload into Storage/Recirculate thru Filter
  - Bottom Loading of Refueler Trucks
  - Direct-to-Plane Refueling
  - Combo Configurations
- Modular Approach to System Design

MSI Aviation Fueling System Installation Photos







Aviation Fueling Standards

- NFPA 407 (Fueling Safety & Fire)
- NFPA 30 & 30A (Fuel Storage Tanks)
- ATA 103 (Fuel Quality)
- FAA AC-150/5230-4 (Fueling Safety)
- API 1581 (Filter/Separators)
- API 1583 (Filter/Monitors)
- API 1529 (Fueling Hoses)
- MIL HNDBK 1022A (U.S. Military Fueling)

ATA 103 Requirements

- Never receive and dispense fuel from same tank simultaneously
- Fuel Testing (Clear/Bright, API Gravity, White Bucket Test, Color Membrane)
- Allow fuel to settle one hour per foot of product delivered before using
- Receipt & Issues Filtration
- Fuel Quality Documentation

NFPA 407 Requirements

- Materials of Construction
  - No Cast Iron Pipe or Valves
  - No Zinc or Red Metals
- Deadman Controls
- Fuel Relaxation (JP-8 excluded)
- Emergency Fuel Shutoff
- Bonding

MIL-HNDBK 1022A Requirements

- Guideline, not a requirement for U.S. Military Fuel Handling
- Truck Offloading:
  - Air/Fuel Mixture through Fuel Receipt Filter/Separators potentially hazardous
  - Air Elimination w/Rotoprime Pump
- Truck Loading & Aircraft Refueling:
  - Truck Fillstand Pantographs
  - Hot Refueling Pantographs

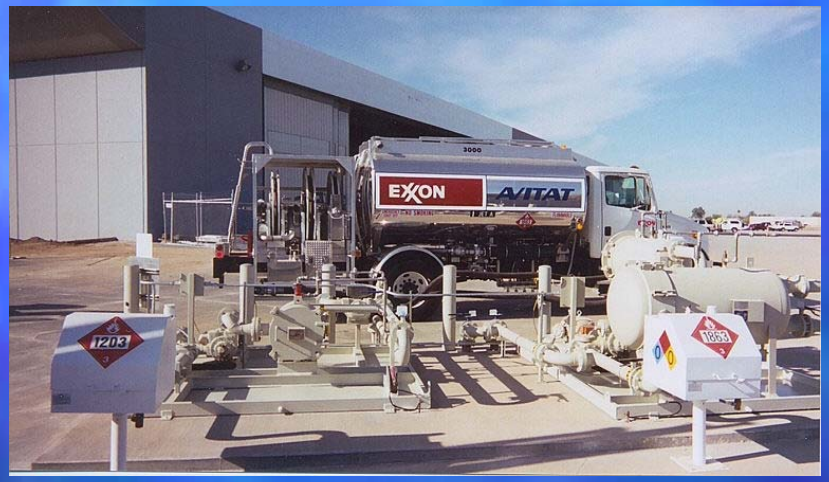
Aviation Fuels

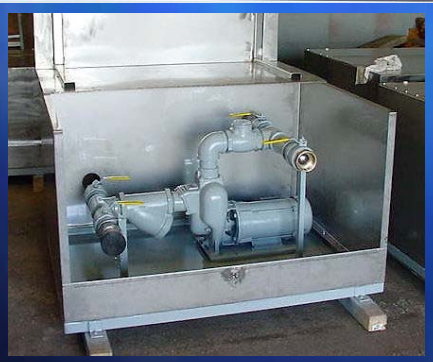
- AVGAS / F-18 (NATO)
- JET A-1 (Europe)-Commercial Fuel
- JET A (U.S.)-Commercial Fuel
- JET B (Canada) Cold Weather Fuel
- JP-4 / F-40 (NATO)-Obsolete
- JP-5 / F-44 (NATO)-U.S. Navy/U.S.C.G.
- JP-8 / F-34 (NATO)-All U.S. Forces

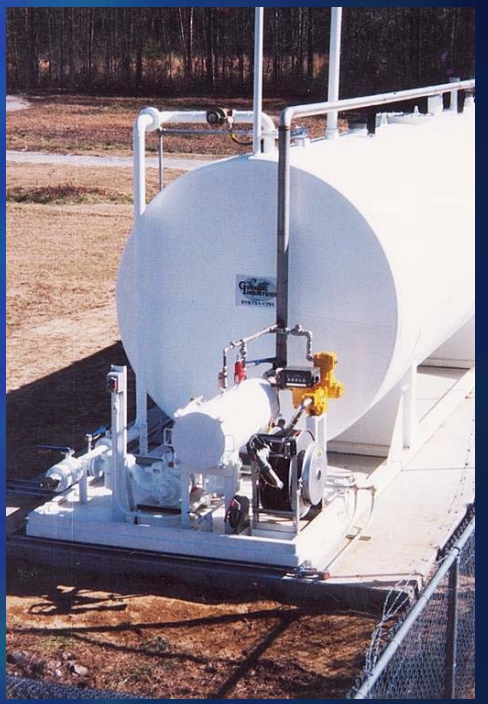
Aviation Fuel Additives

- FSII (Fuel System Icing Inhibitor)
- CI (Corrosion Inhibitor)
- SDA (Static Dissipating Agent)
- PLUS 100 (Raises Fuel Flashpoint)
- Biocides (Kills biologicals which grow at the water/fuel interface)

Millennium Systems International Fueling Module Installations







Aviation Fuel Pumps

- P.D. vs. Centrifugal vs. Vertical Turbine
- Submersible Turbine Pumps
- Suction/Cavitation/Pressure Drop
- Reading a Pump Curve
- Motors & Motor Control Systems
- Electrical Characteristics
- Enclosures

Aviation Fuel Filtration

- API 1581, 5th Edition (Filter/Separators)
  - Category C (Commercial)
  - Category M (Military)
  - Category M +100 (Military)
- Hydraulic/Electronic Water Defenses
- Filter/Monitors (API 1583/I.P. Specs)
  - Prohibited for use with fuels that are premixed with FSII
  - Suitable for Avgas (Aviaton Gasoline)

Static Electricity in Aviation Fueling

- Bonding: Equalize Electric Potential between aircraft & fueling equipment
- 30 Seconds of Residence (Relaxation) downstream of filter for Truck Loading
- Relaxation not required for aircraft refueling due to aircraft tank geometry
- Relaxation not required for JP-8 Fuel (due to presence of SDA additive)
- Reel, Skid & Tank Grounding

Aviation Fuel Flow Measurement

- Positive Displacement & Turbine Meters
- Materials of Construction
- Air Elimination/Truck Unload Systems
  - Air Block Valves
  - Rotoprime w/Air Release
- Electronic Temperature Compensation
- Electronic Preset Control

Aviation Fueling Control Valves

- Globe, Hydraulic, Pilot-Operated Valves
- Water Slug Pilot
- Rate-of-Flow Control Pilot
- Pressure Control Pilot w/Remote Venturi
- Surge Control Pilot
- Deadman Control Pilot
- Tank Overfill Control

Aviation Fueling Hose & Reels

- Spring, Electric & Air Rewind
- Electric, Air & Hydraulic Deadman Reels & Handles
- Static Reels
  - Plastic Coated Cable & Clips
- API 1529, Type C (softwall) Hose
  - 150 & 300 psig rated
  - Conductive

Aviation Nozzles

- Overwing (EBW, OPW, Emco Wheaton)
- Underwing (Whittaker, Carter & Cla-Val)
- Military Underwing (Single Point)
  - D-1 Aircraft Refueling; 45 degree elbow
  - D-2 Refueler Truck Bottom Loading; straight
  - D-3 Swivel to provide both D-1 & D-2 functions
  - -CCR (Closed Circuit Refueling); Helicopters only
- Hydrant Couplers
- Aircraft Adapters/Product Interference Rings

Aviation Fuel AST Accessories

- Tank Venting Equipment
- Floating Suctions
- AST Anti-Syphon Valve (XP Electric Solenoid)
- Fusible Link Valves (tank/loading hose)
- Water Scavenging Hand Pumps
- Overfill Control (Hydraulic/Electronic)
- Tank Monitoring & Inventory Control
- Sump Saver (Product Recovery)

Pantograph Systems

- Direct Aircraft Refueling Pantographs
  - Hose End & Solid State
  - Long Range & High Reach
- Truck Fill Stand Pantographs
- USAF/USN Elimination of Refueling Hoses as safety hazard
- NATO & USAFE –Approved Pantographs for “Hot Refueling” of Aircraft

MARS Modular Aircraft Refueling Systems

- Modular Solution for FBO Fuel Farms
- Fully Scalable Solution
- Standardized Module Designs
- Fully Compliant w/Industry Regulations
- Precision-engineered; built-to-last
- Premium, brand name components
- Wide range of Systems Options

MARS Family of Modules

- PFT (Pump & Filtration)
- DTP (Direct-to-Plane)
- RDS (Remote Dispensing)
- TLO (Truck Loading)
- PFT/DTP Combo
- PFT/TLO Combo
- PFT/DTP/TLO Combo
- RF/DTP Combo

Typical Module Flow Schematics

Aviation Refueling Applications

- FBOs (Fixed Base Operators)
- Corporate Jet Owners & Operators
- Emergency Medical Helicopter Services
- Commercial & General Aviation
- U.S. & Foreign Military
- Oil & Mineral Exploration & Production
- Airborne Law Enforcement

Millennium Systems Aviation Fueling Projects

- U.S. Navy, X-Craft Shipboard Fueling System
- Scottsdale Air Center, Scottsdale, AZ.
- Marathon Key Airport, FL.
- Prince Sultan Airbase, Saudi Arabia
- NASA (Langley, VA)
- U.S. Department of Energy (Mercury, NV)
- BWI Midfield Cargo Complex Fuel Farm
- Bombardier (Bridgeport, WV & Tucson, AZ)
- U.S. Coast Guard (San Diego)
- Fairfax County Hospital (Fairfax, VA)

Modular System Design Advantages

- Pre-Engineered, Packaged Modular Solution
  - Scalable Solution; add modules as needs expand
  - Combine Modules for multiple functions
- Standardized Module Design & Documentation
  - Easier to manufacture
  - Easier to service & support
- Improved Quality Control
  - Shop vs. Field Fabrication of Complex Modules
- Minimal Field Installation Work
  - Concrete Pad
  - Electrical Tie-in
  - Permits & Miscellaneous

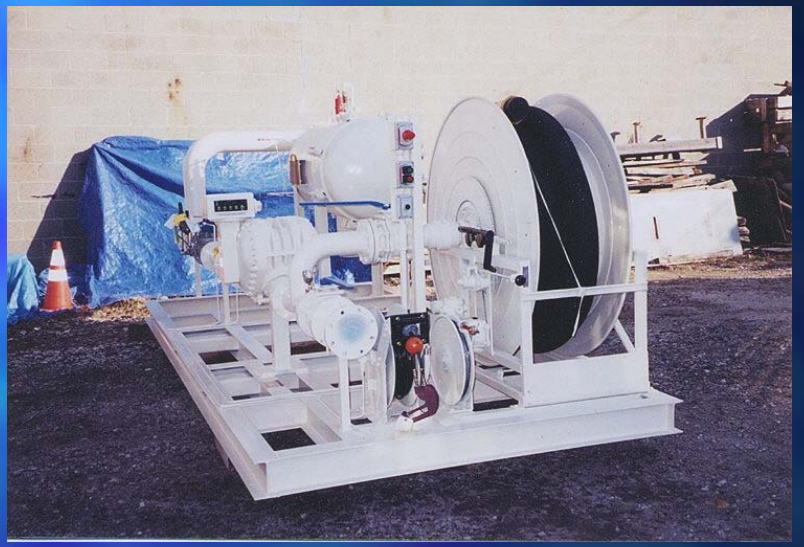
Workscope for Field Installation of MARS Modules

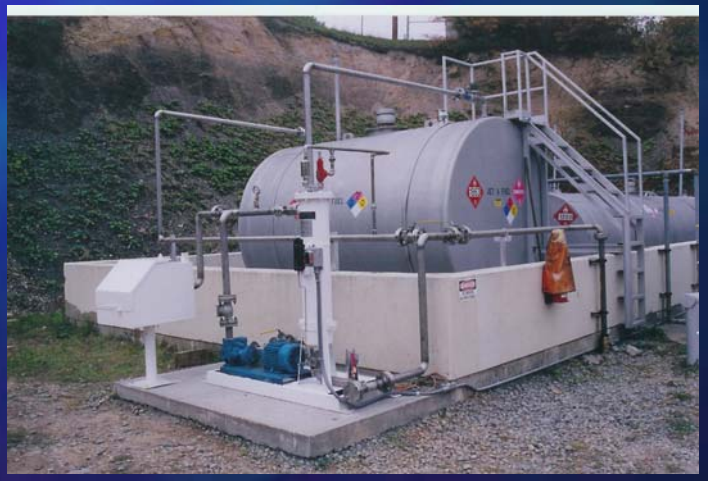
- Rig, Unload & Set Tank on concrete pad
- Install Tank Accessories
- Set MARS Module & interconnect piping (supply & return) to AST with 3” Sch. 40 Carbon Steel welded piping (SS optional)
- Start-Up & Commissioning
- On-Site Training
- After Sales Service & Support

Additional Service Offerings

- Consulting Engineering Services
- Value Engineering Services
- AUTOCAD Design & Drawing Services
- Fuel Quality Program Development
- Fuel Facility & Operations Evaluations
- Fuel System Safety Evaluations
- SPCC Plans
- Technical Training Services

Millennium Systems Aviation Refueling Systems





Thank You!

- Thank you for your Participation in today's Aviation Fueling Seminar.
- We invite you to contact us if we can be of assistance to you on future Aviation Fueling System requirements.
- Visit www.millenniumsystemsintl.com
- Phone us at 443-838-9550.