



Multiple Shift Test Operations for Long Endurance Unmanned Aircraft



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Triton at a Glance

- **Land Based Mission Control**
- **360 degree sensor field of regard**
- **Wingspan - 130.9ft**
- **Length - 47.6ft**
- **Height - 15.4ft**
- **GTOW - 32,250 lbs.**
- **EO/IR, Maritime, ESM, and AIS Payloads**





Background Info

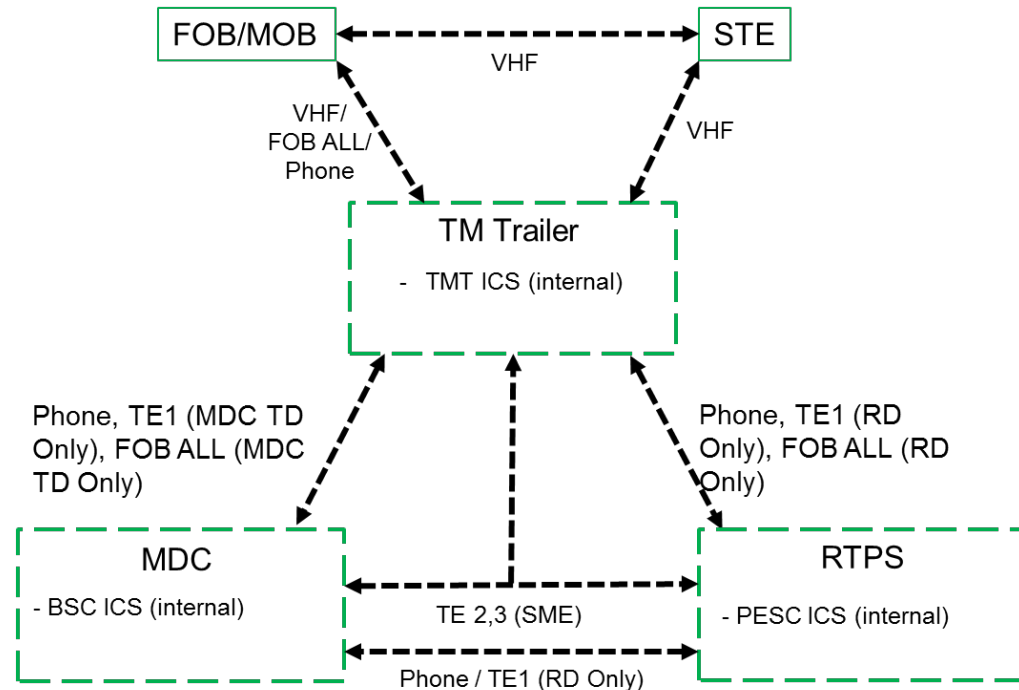
- Triton has an expected endurance in excess of 24 hours
- Testing across multiple weight bands requires 12 - 16 hour flights
- Brief, Setup, and Debrief times can add 4 hours to flight event
- Longer flights are well beyond single crew-day limits
- Requires multiple shifts





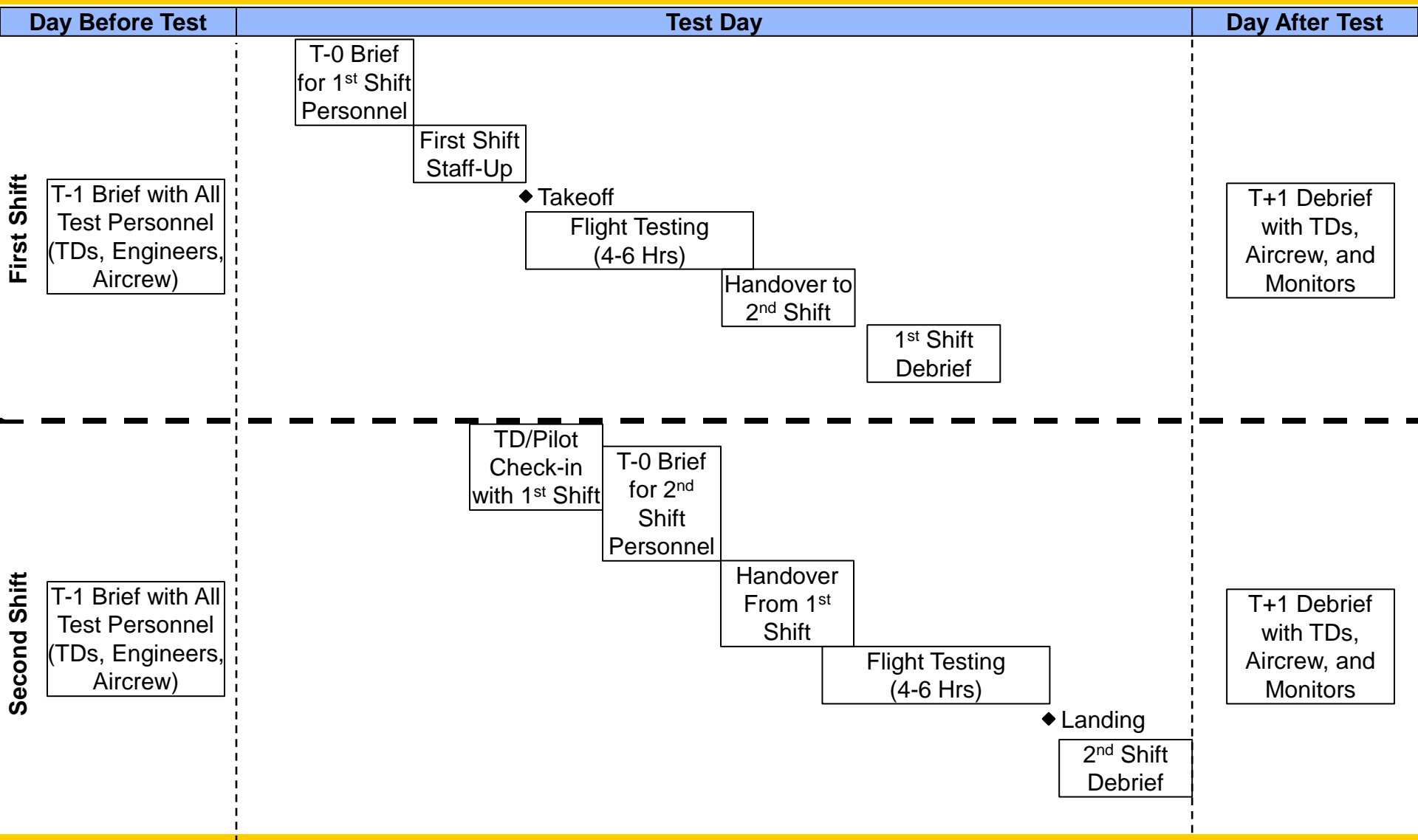
Communications Overview

- **ICS provides backbone of test coordination**
 - TD coordination channel (TD's only)
 - Internal room channel
 - Discipline specific sidebar channels
 - Test Coordination (TD/Pilot)
 - Control Station/UA Radio Monitors
- **Wall mounted radio in TM Trailer**
 - SA to TD for Mx crew activities and coordination with the range
 - Backup means of coordinating test
 - Set to pre-coordinated, mission specific frequency
- **Prepare for contingencies**
 - Classified conference lines available between sites
 - Support personnel on-site





Notional Two-Shift Flight Schedule





Staffing Concerns & Lessons Learned

- **Multiple shifts with multiple locations require more people**
 - 8 TD/TCs
 - 6 - 8 Aircrew
 - Limited number of backups for each position
- **Rescheduling flights**
 - Need to plan staffing ahead of time for backup flight dates
 - Try to keep the same people at the same location
 - Changing shifts can disrupt crew rest & working schedules
- **Mission rehearsal location versus test monitoring location**
 - Best to have everyone in the same location for mission rehearsal
 - Need to allow for travel time prior to crew rest



Handover Procedure

- **Handover based on experience with NASA Launch Control Room procedures**
 - **Brief expectations to test team during both T-1 and T-0 briefs**
 - **Stagger discipline arrivals by 10-15 minutes, no more than 3 disciplines at a time**
 - **Post the schedule in the briefing materials**
 - **Cover only test pertinent issues during handoff**
 - **Faults, troubleshooting steps/decisions, overall flow of test, things to keep an eye on, what's next**
 - **Treat discipline swap just like a break request**
 - **Approval from TD required prior to start and notify on completion**
 - **Maintain one set of log sheets per station**



Briefing Concerns & Lessons Learned

- **Loss of attention/participation due to number and length of briefs**
 - **Some repetition between T-1 and T-0 briefs (Hazards, go/no-go, weather, etc.)**
 - **Briefed hazards grow as you increase number of test plans/points being executed**
- **Limit call in participation to flight required personnel only**



Practice Makes Perfect

- **Mission rehearsals are essential part of team training**
 - **Emphasize comms etiquette early**
 - **Required for participation in test event (Aircrew, TDs, Engineers)**
 - **Simulated data from hot bench (no orange wire parameters)**
 - **Required to practice any new maneuvers prior to executing in flight**
- **New participants are in an observation role for first mission**
 - **Become active participant at discretion of discipline lead, TD, and team lead**
- **TDs and TCs go through review board, shadowing, and TD/TC under instruction (UI) roles prior to leading an event**
 - **2 days of lessons on system**
 - **Review of all policy documents**
 - **Open-book NATOPS exam**
 - **Minimum 4 events as TD UI (2 ground, 2 flight)**



- **Triton has completed initial envelope expansion with zero mishaps/incidents**
- **Assess each event for lessons learned and implement them**
- **Develop a communication plan that works for your system**
 - **Have a plan for how to communicate when that system fails**
 - **Evolve the system as program progresses**
- **Schedule the briefings, major events, shift handoff times**
 - **Leave some white space**
 - **Plan around crew rest**
- **Ensure personnel are available where you need them for all planned and backup days**
- **Brief shift handoff procedures and have the team practice it**
- **PRACTICE, PRACTICE, PRACTICE**



QUESTIONS?

