



Use of Towbarless Tractors at Airports—Best Practices

DETAILS

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AIRPORT COOPERATIVE RESEARCH PROGRAM

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Research Results Digest 15

USE OF TOWBARLESS TRACTORS AT AIRPORTS—BEST PRACTICES

This digest presents the results of ACRP Project 04-07A, “Best Practices for Managing the Use of Towbarless Tractors at Airports.” The study was conducted by a research team under the leadership of Ricondo & Associates, Inc., with Colleen Quinn acting as the Principal Investigator.

1 INTRODUCTION

1.1 Background

Towbarless tractors (TBLTs), also known as towbarless tow vehicles (TLTVs), are used to tow aircraft on the airport. TBLTs, as the name implies, do not use a towbar but instead use a pick-up device located in the center of the vehicle to cradle the nose gear tires in order to provide direct maneuvering of the aircraft. TBLT operations have increased in recent years due to the superior maneuverability provided by these vehicles and a renewed focus on energy and environmental conservation. The absence of towbars and the higher operating speeds mean that aircraft movements, pushbacks, gate-

to-gate towing, and maintenance towing can be carried out faster than with conventional towbar tractors, minimizing impacts to airport operations.

While some airports, airlines, and service providers have developed standards specific to their operation of TBLTs, no industry-wide guidance exists for this type of operation. Several incidents involving TBLTs have raised awareness of the need to establish “Best Practices” guidelines for TBLT operations.

1.2 Development of Best Practices

The use of TBLTs varies from airport to airport but is generally increasing. Although a TBLT represents a large up-front capital cost, it has several benefits over traditional towbar tractors, including the following:

- More secure control of the aircraft and greater responsiveness;
- Simplicity of use and reduced operator training;
- Allowance for operation in the entire airport environ, including movement areas, without impacting airport operations;
- Elimination of the need to maintain multiple towbars (for each aircraft type); and
- Energy and environmental conservation.

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Towbarless tractor after disengaging from an aircraft nosewheel.

The development of TBLT operations best practices started with identifying industry groups involved with TBLT operations. Once identified, the following groups were contacted to collect data and discuss TBLT considerations:

- Airlines that use TBLTs,
- Airports at which TBLTs are in use,
- Aircraft manufacturers,
- Aviation industry organizations, and
- Airport safety working groups involved with TBLT operations.

The information gathered from these groups was consolidated and common practices were identified as were unique practices that had application on a broader scale. Regulatory requirements pertinent to TBLT operations were also identified; these requirements generally apply to ground vehicles, which include TBLTs and their operators. The information was organized and presented as best practices aimed at providing broad guidance to airports and airlines for the enhancement of safety in TBLT operations.

1.3 Purpose

The purpose of this document is to provide practical planning guidance describing best practices for operating TBLTs at airports. This document introduces best practices to airports and operators that do not currently have guidelines and can be incorporated into or supplement existing documents and handbooks. The following objectives guided the development of this document:

- Develop the document as a reference that is useful to airports and aircraft operators,
- Provide practical guidance to assist airports and aircraft operators in developing training programs for the safe use of TBLTs, and
- Provide practical guidance to assist airports and aircraft operators in developing and implementing a standard set of guidelines for safe operation of TBLTs.

The purpose of this guidance is to assist airports and aircraft operators in gaining a basic understanding of the training and operational issues associated with TBLT operations. The guidance and information in this document is not intended to be a substitute for, nor in any case supersede, existing United

States Department of Transportation (DOT)/Federal Aviation Administration (FAA) rules and regulations, FAA advisory circulars (ACs), FAA orders, existing airport operating procedures, aircraft manufacturers' recommended practices, TBLT manufacturers' recommended practices, and equipment-specific training. Where appropriate, this document may, however, be used to supplement existing documentation, guidance, and information.

Each airport presents a unique combination of physical, operational, meteorological, and regulatory characteristics that must be evaluated as a whole when an effective TBLT operational and training program is being developed. This document is intended to serve as a starting point for airports and/or operators who are considering development of their own guidance on TBLT best practices. Communication and coordination within the local airport community is critical to ensure that the best practices ultimately implemented are clearly understood and agreed upon. It is important to recognize that the technical and operational landscapes surrounding aircraft towing are evolving, which may necessitate that this document be updated periodically to remain current and within existing and future regulatory requirements and guidelines.

2 DEFINITION OF TERMS

Air Traffic Control (ATC)—Personnel authorized to control aircraft and vehicles operating on the airport movement area and in the airspace. ATC issues specific instructions that approve or disapprove the movement of aircraft, vehicles, equipment, or personnel. For purposes of this document, ATC encompasses tower, ground, and ramp control.

Airport Traffic Control Tower (ATCT)—A terminal facility that uses air/ground communications, visual signaling, and other devices to provide ATC services to aircraft operating on and in the vicinity of the airport.

Airport Markings—Markings used on the runway and taxiway surfaces to identify a specific runway, a runway threshold, a centerline, a hold line, and the like.

Airport Operations Area (AOA)—The areas on the airport (generally inside airport fencing) that include aprons, ramps, aircraft parking areas, taxiways, and runways.

Airport Surface Detection Equipment (ASDE)—Surveillance equipment specifically designed to detect aircraft, vehicular traffic, and other objects on the surface of an airport, and to present the detected images on a tower display. ASDE is used to augment visual observation by tower personnel of aircraft and/or vehicular movements on runways and taxiways.

Apron (also referred to as Ramp)—A defined area, on a land aerodrome, intended to accommodate aircraft for purposes of loading or unloading passengers, mail or cargo; refueling; and parking or maintenance.

Automatic Terminal Information Service (ATIS)—The continuous broadcast of recorded non-control information in selected terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information.

Controller—A person authorized to provide ATC services.

Dispatch Towing—Towing of a fully loaded revenue airplane (passengers, cargo, fuel) from the terminal gate/remote parking area to a location near the departure runway. This type of towing can involve relatively high speeds and long distances with several starts, stops, and turns, and generally replaces typical pre-takeoff taxiing operations. (Formerly referred to as “high-speed towing” or “operational towing.”)

Empty—A tow tug (TBLT or conventional tug) that is operating without an aircraft in tow.

Escort—Airside operations vehicle leading, directing, and guiding a vehicle.

Flight Deck Observer—Personnel in the aircraft flight deck qualified and authorized to communicate with the ATC, assist the TBLT operator with situational awareness of taxi movements, and also to apply brakes only in case of an emergency.

Foreign Object Debris (FOD)—Any item located on the AOA that can be ingested or blown by an aircraft engine causing damage to property or personnel.

“Hold Short”—ATC communications term used to instruct vehicles or aircraft to hold short of a runway, traffic, or a specific point on the airfield such as localizer critical area, glideslope critical area, precision obstacle-free zone, and so forth.

Light Gun—A handheld directional light signaling device that emits a brilliant narrow beam of

white, green, or red light as selected by the tower controller. The color and type of light transmitted can be used when radio communication is not available for controlling traffic on the airport movement area.

Line of Sight (LOS)—An imaginary straight line from the observer’s eye to an object.

Lost Communications—Loss of the ability to communicate by radio.

Maintenance Towing—Towing of an airplane for maintenance/remote parking purposes (e.g., from the gate to a maintenance hangar). The airplane is typically unloaded (no passengers or cargo, reserve fuel only). This type of towing can involve relatively high speeds and long distances with several starts, stops, and turns.

Monitor—Listen on a specific frequency [e.g., ATC ground, ATC tower] and stand by for instructions. Under normal circumstances do not establish communications.

Movement Area—The airport runways, taxiways, and safety areas. The movement area does not include loading ramps or aircraft parking areas. Specific approval for entry onto the movement area must be obtained from ATC.

Night—The hours between the end of evening civil twilight and the beginning of morning civil twilight or such other period between sunset and sunrise as may be specified by the appropriate authority.

Non-movement Area—Taxi lanes, aprons/ramp and parking areas not under control of ATC.

Notices To Airmen (NOTAMs)—A notice containing information (not known sufficiently in advance to publicize by other means) concerning the establishment, condition, or change in any component (facilities, service, procedures, hazards) the timely knowledge of which is essential to personnel concerned with flight operations.

Oversteer—Exceedance of the maximum allowable steering angle or torsion load as defined by the airframe manufacturer for a specific airplane model or derivative.

Pushback Towing—Towing of a fully loaded revenue airplane (passengers, cargo, and fuel) from a parked position at the gate to the taxiway. Towing typically includes pushback with a turn, stop, and a short tow forward to align the airplane.

Runway Incursion—Any occurrence at an aerodrome involving the incorrect presence of an

aircraft, vehicle, or person on the protected area of a surface designated for the landing and take-off of aircraft.

Ramp Control—A ground communications facility that provides ATC services to aircraft operating on the ramp area.

Read Back—Upon receiving ATC instructions, a pilot repeats all, or specified parts, of the transmission.

Route—A defined path consisting of one or more courses that an aircraft can traverse on the airport.

Runway Visibility Range (RVR)—The maximum distance along the runway at which the runway lights are visible to a pilot after touchdown.

Situational Awareness—The ability to identify, process, and comprehend the critical elements of information about what is happening at a given point in time (i.e., knowing what is going on around you).

Super Tug—See Towbarless Tractor.

Tail Walker—Ground personnel assigned to accompany the aircraft to ensure sufficient clearance of aircraft tail to objects are maintained during pushback and/or towing in limited spaces.

Taxi—The movement of an airplane on the surface of an airport (ATC clearance required to taxi in movement areas).

Towbarless Tow Vehicle (TLTV)—See Towbarless Tractor.

Towbarless Tractor (TBLT)—An aircraft tow tractor that utilizes a pick-up device located in the center of the vehicle used to cradle the nose gear tire of an aircraft. The TBLT works without a towbar, thus enabling a quick, safe and economical handling of aircraft on the ground. The absence of towbars and the higher speeds mean that aircraft movements, pushbacks, gate-to-gate towing, and maintenance towing can be carried out faster than with conventional towbar tractors, minimizing impact to airport operations.

Visibility—The ability, as determined by atmospheric conditions and expressed in units of distance, to see and identify prominent unlighted objects by day and prominent lighted objects by night. Visibility is reported as statute miles, hundreds of feet, or meters.

Wing Walker—Ground personnel assigned to accompany the aircraft to ensure sufficient clearance of aircraft wingtips to objects is maintained during pushback and/or towing in limited spaces.

3 TBLT OPERATOR REQUIREMENTS

This section describes the specific minimum requirements for TBLT operators. These requirements include FAA guidance, airport operational requirements, airline operating manuals, and manufacturers' recommended procedures.

3.1 Credentials

In addition to demonstrating proper training and knowledge, TBLT operator licensing and badging must be obtained prior to operating a TBLT. Additionally, personnel must be able to show licensing documentation upon request. Airport operators typically require that TBLT operators obtain the following credentials prior to operating on the airport:

- Background checks and screening,
- Valid state-issued driver's license (*FAA AC 150/5210-20*),
- Valid airport security badge/identification, and
- Airport driving privileges (*FAA AC 150/5210-20*).

3.2 Training

Recommended minimum training requirements are listed below by training area. All areas should be covered during training and airport operators should provide a means of testing of the material.

Trainees should have on-the-job (OTJ) training prior to unescorted access and demonstrate sound situational awareness (*FAA AC 150/5210-20* and *FAA AC 00-65*). The TBLT owner should maintain training records (Federal Aviation Regulations (*FAR 139.329.f*)).

- General:
 - Minimum age requirement,
 - Physical qualifications,
 - Security background check, and
 - Appropriate level of knowledge of airport rules and regulations.
- Airport driver training (*FAR 139.329.e*):
 - An emphasis should be placed on initial and annual recurrent driver training for TBLT operators, specific to each TBLT model operated.
 - Many runway incursion factors include a lack of driver training. See *FAA AC 150/*

- 5210-20 Appendices A and B for specific driver training.
- Airport movement area training (*FAR 139.303.c*):
 - Initial training should be provided to the new employee or airport user that would enable the employee to demonstrate the ability to operate a vehicle safely on the AOA in accordance with established procedures.
 - Recurrent remedial training for personnel authorized to operate on movement areas should be provided at least yearly.
 - Airport movement area training course curriculum:
 - Airport familiarization, rules and regulations, diagram, aircraft operations (*FAR 139.303.c*) in all weather conditions;
 - Access to, and operation in, movement and safety areas (*FAR 139.303.c*);
 - Airport rules and regulations;
 - Movement area familiarization/situational awareness;
 - Airport communications (*FAR 139.303.c*);
 - Use of checklists (see *AC 00-65* for sample checklists);
 - Physical control/maneuvering of the vehicle;
 - Security on the AOA;
 - Airport signs/markings/lights (*FAR 139.303.c*);
 - Safety areas;
 - Low visibility;
 - Runway incursion prevention; and
 - Crew Resource Management (CRM).
 - TBLT manufacturer training specific to equipment. The TBLT operator should:
 - Perform a pre-tow TBLT safety inspection.
 - Be thoroughly familiar with the type of tow equipment and procedures to tow specific aircraft (*FAA AC 00-65*).
 - Understand restrictions/limitations on tow equipment (*FAA AC 00-65*):
 - Speed restrictions for both clear and cluttered ramp, and
 - Speed restrictions for contaminated pavement conditions.
 - Understand factors affecting the performance of TBLT equipment:
 - How speed affects control of the TBLT.
 - How aircraft weight affects the TBLT’s stopping distance.
 - How adverse conditions affect TBLT braking and turning (heavy snow, strong winds, etc.).
 - How exceeding the nose gear steering angle limits affects control of the TBLT.
 - Have a thorough knowledge of TBLT requirements, towed aircraft requirements, and towing procedures as outlined in Sections 4 through 10 of this document.
 - Receive training in handling emergency procedures.
 - Appropriate level of knowledge of airport rules and regulations (*FAA AC 150/5210-20*):
 - Proficient in communications with ATC,
 - Thoroughly familiar with airport layout,
 - Functional knowledge of the English language (*FAA AC 00-65*),
 - Functional knowledge of aviation terminology (*FAA AC 00-65*),
 - Familiar with aircraft operations on the airfield,
 - Understand light gun signals, and
 - Familiarity with airport signage

4 TBLT—VEHICLE REQUIREMENTS

This section describes the minimum requirements of a TBLT in order to conduct a safe and efficient towing operation.

4.1 Access Control

While operating on the movement area, TBLTs must adhere to procedures developed by the airport operator and ATC. TBLTs operating on the movement area should be limited to only these necessary to support operational activity.

4.2 Mechanical

A mechanically sound TBLT is required to ensure the safety of any towing operation. The TBLT operator is responsible for ensuring the equipment used meets safety requirements.

- The TBLT operator should perform an inspection of the TBLT before starting a tow operation. This inspection should include, as a minimum, the following verifications:
 - All equipment is serviceable and mechanically sound,

- All radio equipment is in working order, and
- All towing connections are secure

4.3 Communication

A means of communication between the aircraft flight deck and the TBLT cab is required. This is typically provided through the TBLT intercom system that is connected directly to the aircraft by wire. Additionally, the TBLT should be equipped with two permanently mounted, fully programmable, two-way radios, which will be the means of communication with ATC.

4.4 Lighting

Adequate lighting will increase visibility of the TBLT, especially at night or during periods of poor visibility. This is especially important when the TBLT operates away from a well-lit apron area.

The following lighting equipment is strongly recommended:

- Working headlights and brake lights;
- LED light bar on top of the operator’s cab and two amber strobe or beacon lights on the back;
- Lights should be mounted consistent with *FAA AC 150/5210-5*;
- The lights must be operational and turned on whenever the TBLT is in operation, whether or not it is in motion; and
- Additional lighting is encouraged because of the TBLT’s low profile and that the TBLT may be obscured by the aircraft in tow.

4.5 Painting

Adequate painting will increase visibility of the TBLT, especially at night or during periods of poor visibility. It is recommended that the TBLT be distinctly painted in international orange and that retro reflective tape be used to outline its shape, including rounded edges. Additionally, it is recommended that the TBLT be kept clean so its coloration is clearly visible.

4.6 Markings

Adequate markings will allow for prompt identification of the TBLT, especially at night or during periods of poor visibility. The following markings are strongly recommended:

- Unique identification number for each piece of equipment to enhance visibility, clearly displayed as described in *FAA AC 150/5210-5*;
- Guidance as provided in *FAA AC 150/5210-5* for all airport vehicles, regardless of the TBLT ownership and funding source; and
- Clear display of company logo.

4.7 External Elements Protection

It is recommended that the TBLT be equipped with a cab to keep its operator shielded against weather, external elements, and aircraft noise.

4.8 Equipment/Accessories

Several pieces of equipment and accessories are recommended to be available to the TBLT operator to increase the safety of the operation. It is recommended the TBLT be equipped with:

- ASDE-X transponder;
- Dual VHF radios;
- Seatbelt for each TBLT occupant;
- Windshield wipers and windshield defrost/defogging systems;
- Wheel chocks, complemented by sand bags in snow and ice conditions (*FAA AC 00-65*);
- Placard with the current airfield diagram (*FAA AC 150/5210-20*);
- Placard with ATC and other essential radio frequencies (*FAA AC 150/5210-20*);
- Placard listing essential 24/7 telephone contact numbers;
- Placard illustrating ATC light gun signals (*FAA AC 150/5210-20*); and
- Placard denoting airfield signage and markings (*FAA AC 150/5210-20*).

5 AIRCRAFT-UNDER-TOW REQUIREMENTS

This section describes the minimum requirements of an aircraft under tow in order to conduct a safe and efficient towing operation.

5.1 Safety—General

In anticipation of Safety Management System (SMS) requirements, all managers and supervisors should, identify, eliminate, control, and document hazards within the workplace to minimize risks associated with uncertainty in the decision-making process. (*FAA AC 00-65*)

5.2 Mechanical

The full aircraft braking system should be available for use at all times. An aircraft under tow should be mechanically sound and able to maintain minimum speeds that will preclude impeding airport operations. Additionally, the aircraft under tow must not exceed towing speeds as determined by the TBLT manufacturer, aircraft manufacturer, airport, or TBLT operator for the existing operating and airfield conditions.

5.3 Communication

The flight deck observer will be the primary communicator with ATC and the TBLT operator will be the secondary communicator. The aircraft's permanently mounted, fully programmable, two-way radio will be the primary means by which the flight deck will communicate with ATC. Communication between the flight deck and the TBLT cab is also required. This is typically provided through the TBLT intercom system that is connected directly to the aircraft by wire. The TBLT operator and flight deck observer must monitor all radio communications and are equally responsible for adhering to all ATC communications and instructions.

5.4 Lighting

To increase conspicuity the following aircraft lights may be turned on depending on operational conditions unless otherwise specified under written agreements and/or understandings between designated representatives of the airport, aircraft operators, and local ATC and FAA:

- Aircraft interior lights (night or reduced visibility operations),
- Navigation lights (day or night operations),
- Anti-collision lights (per the discretion of operator),
- Upper and lower rotating beacons (aircraft under tow), and
- Other supplemental lighting (requires FAA approval).

It should be noted that under certain conditions it is possible that an aircraft with lights turned on may incorrectly suggest to outside observers, including ATC, that the lighted aircraft is under its own power. The flight deck observer should ensure through direct communications that ATC clearly understands that the aircraft is under tow.

Although it is recommended that all of the aforementioned lights be turned on, only those specified in FAR Part 91.209 are mandatory. Aircraft anti-collision beacon lights should be turned on any time the aircraft engines are running. Furthermore, any supplemental lighting not specified in FAR Part 91.209 would require prior FAA approval.

5.5 Equipment/Accessories

It is recommended that the following be conspicuous inside the flight deck and TBLT cab to increase the safety of the operation:

- A current airfield map showing all non-movement and movement areas,
- All ATC and pertinent frequencies (ramp control, company, etc.), and
- Backup communications procedures (including phone numbers).

5.6 Personnel

A qualified flight deck observer is required on the aircraft flight deck to communicate with ATC and to apply aircraft brakes, which are only to be applied in case of emergency and communicated as such to the TBLT operator and/or ATC.

6 TOWBARLESS TRACTOR PROCEDURES

This section describes the recommended procedures to conduct a safe and efficient towing operation.

6.1 Before Start Procedures (Prior to Pushback and Towing)

The following procedures are recommended before the start of any tow operation. The TBLT operator and flight deck observer will be responsible for adhering to these recommendations:

- Review planned operating procedures with flight deck observer. (An aircraft towing operation by TBLT requires at least two qualified employees: one in the aircraft and one in the TBLT.)
- Review current airport/airfield conditions with the flight deck observer (NOTAMs, ATIS, ATC, airport layout and geometry, pavement conditions, etc.).
- Review planned route with the flight deck observer.

- Review contingency plans with the flight deck observer, including:
 - Weather,
 - Alternate tow routes,
 - Lost communications, and
 - Emergencies.
- Provide a visual check of overall condition of TBLT (*FAA AC 00-65*).
- Provide a visual check of overall condition of aircraft (cargo doors, latches, struts, tires, etc.).
- Close entrance doors, retract or remove ladders, install landing gear down locks (if required) (*FAA AC 00-65*).
- Test TBLT transponder (if applicable) and check proper working condition of minimum operating equipment (radios, lights, safety equipment, etc.).
- Verify the airport diagram (movement/non-movement) placard is available to both the TBLT operator and flight deck observers (review Surface Movement Guidance Control System (SMGCS) Plan/diagram if applicable).
- Check the pre-charged aircraft brake accumulator pressure before each tow, and do not use TBLT if aircraft brake pressure is below normal operating limits.
- Do not hang any equipment on the aircraft exterior (*FAA AC 00-65*).
- When connecting a tow vehicle, personnel should be extremely vigilant to any sudden movement of the tow vehicle or aircraft (*FAA AC 00-65*).
- Ensure all ground equipment and FOD is removed from the vicinity of the aircraft and pushback area.
- Ensure properly charged fire bottles/extinguishers are accessible.
- TBLT operators and flight deck observers must wear their seatbelts/safety belts prior to push back and at all times during the tow.

6.2 Aircraft Pushback Procedures

The following procedures are recommended for any aircraft pushback operation. The TBLT operator will be responsible for adhering to these recommendations:

- Wing walkers and tail walkers are recommended during pushback when other aircraft or objects are positioned in adjacent parking positions/gates.

- At the initiation of pushback, the TBLT should push the aircraft straight back until clear of all objects before proceeding with any turning maneuvers.
- The aircraft may be pushed back with engines operating if permitted by airport or company procedures.
- Engines may not be started during the pushback operation. If required, aircraft engines should be started before the pushback.
- Prior to starting the pushback:
 - The TBLT operator should be facing in the direction of pushback.
 - The TBLT operator should have thorough knowledge of the delineation of movement/non-movement areas.
 - ATC approval is required before entering the movement area.
 - TBLT operators must have a thorough understanding of airport right-of-way rules.

6.3 Aircraft Towing Procedures

The following procedures are recommended for aircraft towing operations beyond the pushback. The TBLT operator will be responsible for adhering to these recommendations:

- The tow team shall maintain contact with ATC through the proper ATC frequencies (ramp, ground, or tower).
- Proper phraseology shall be used while in radio contact with ATC.
- Prior to starting the tow:
 - The TBLT operator should be facing in the direction of tow.
 - ATC approval is required before entering the movement area (if applicable).
 - The TBLT operator should have thorough knowledge of the delineation of movement/non-movement areas.
 - TBLT operators must have a thorough understanding of airport right-of-way rules.
- TBLT operator must hold short of all mandatory instruction signs until cleared by ATC.
- TBLT operator should perform smooth starts/stops. (*FAA AC 00-65*); the aircraft should not be towed with engines operating. *Engines* may be operating if the TBLT is only used to push the aircraft away from the terminal gates (*FAA AC 00-65*).

- TBLT operator should maintain slow speeds and high turning radii during turning maneuvers. For example, Boeing recommends the maximum allowable steering angle be 80 percent of the conventional towbar limits. The conventional towbar limits were reduced for towbarless towing to provide a margin of safety for the absence of shear protection furnished by the towbar/tow lug connection.
- Aircraft brakes should not be used except in the case of an emergency.
- Maximum allowable towing speed should be determined by the operator based on the TBLT model and aircraft under tow. Recommendations for towing speeds in good weather conditions:
 - Towing speed in apron/ramp areas should be no faster than walking pace.
 - Towing speed in close quarters, turns and near gates should be restricted to less than 2 mph.
 - Towing speed limited to 6 to 8 mph on long hauls, straight portions not to exceed speeds as recommended by the TBLT or aircraft manufacturer.
- Reduce towing speeds according to aircraft weight and airfield conditions (snow, ice, wet pavement) (*FAA AC 00-65*).
- Towing personnel should not place themselves in the direct path of aircraft wheels nor ride on any external portion of an aircraft or tow vehicle (*FAA AC 00-65*).
- The TBLT operator should have knowledge of aircraft nose gear operating specifications to ensure the nose gear maximum allowable steering angle is not exceeded and the nose gear is not overstressed.
- Upon completion of the tow operation, the aircraft should be positioned such that the nose gear is aligned with the aircraft.
- Wing walkers should be used in congested areas such as the gate areas or non-movement areas having short separation distances from fixed or moveable objects.
- Tail walkers should be used during towing operations when the aircraft is turned in areas having short separation distances from fixed or moveable objects.
- Prior to disconnecting the TBLT from the aircraft, the aircraft parking brake should be set and/or chocks placed on the aircraft.

- Inspect aircraft for damage upon completion of the tow per manufacturer’s recommendations and report any damage.
- Prohibited operations:
 - Passing other vehicles or aircraft,
 - Leaving a TBLT unattended with the engine running, and
 - Driving a TBLT under an aircraft.

6.4 Towbarless Tractor Repositioning Procedures

TBLT repositioning consists of driving the TBLT without an aircraft in tow. It is sometimes referred to as “TBLT operating empty.” During repositioning, the following is recommended:

- Use service roads if the service road weight bearing capability and width are adequate (*FAA CertAlert 08-06*). When the use of service roads is not practical, the TBLT may use airport movement areas in accordance with rules, regulations, or agreements with the airport. While on airport movement areas, the TBLT operator must be in radio contact with ATC at all times.
- Driving under aircraft is prohibited.
- Driving under passenger boarding bridges is prohibited.

6.5 Dispatch Towing Procedures

6.5.1 Overview

Dispatch towing is the towing of a fully loaded revenue airplane (passengers, cargo, and fuel) from the terminal gate or remote parking position to a location near the departure runway made possible by the increased towing speeds achievable with a TBLT. Dispatch towing with a TBLT has been identified as a strategy to reduce aircraft taxi fuel burn and engine emissions.

6.5.2 Dispatch Towing Issues

Dispatch towing has been used at some airports in the U.S. However, a number of issues related to dispatch towing have been identified that limit widespread use. First, TBLT towing places heavy stress loads on the nose gear. Tests conducted by Virgin Atlantic and Boeing found that dispatch towing with TBLTs resulted in a reduced operational

life of aircraft nose gear because of the additional stress. Additionally, the TBLT must disconnect from the aircraft near the end of the runway and return to the terminal. This return trip represents an additional vehicle on the airfield with which ATC must maintain contact until such a point that the TBLT exits the movement area or can use a vehicle service road.

6.5.3 Procedures

For the reasons described above, TBLT dispatch towing is not a recommended practice. If dispatch towing is requested, the operation should be reviewed on a case-by-case basis. Airports and operators should apply the towing procedures outlined in Section 6.3 and monitor the operation to determine if additional regulations are necessary.

7 COMMUNICATION

Effective communication between airport users and ATC is a key to safe airport operations. This section describes communication requirements, responsibilities, and procedures during TBLT operations.

7.1 Requirements

- Towing operations require continuous contact with ATC via an aviation band transceiver while in the movement area, whether or not in motion.
- Proper aviation phraseology and phonetic alphabet should be used at all times.
- Satisfactory speech is required (radio communication should be made slowly and clearly).
- Communications will only be of a professional nature and necessary to ensure the safe and secure movement of aircraft.
- The TBLT operator and flight deck observer must always remain in communication with each other.
- The TBLT operator and the flight deck observer must have the capability to communicate directly with ATC at all times during towing operations.
- The tow team must be able to monitor the ATC frequency they are assigned to at all times regardless of the person who is in contact with ATC.

- ATC personnel should be provided familiarization of TBLT limitations.
- A means of communication with the TBLT operator's company should be provided.

7.2 Responsibility (See Section 5.3)

The flight deck observer will be the primary communicator with ATC while the TBLT operator will be the secondary communicator.

- The flight deck observer may authorize other personnel in the flight deck to communicate to ATC on their behalf; however, the flight deck observer is accountable to adhere to all ATC instructions.
- The TBLT operator will monitor appropriate radio frequencies, but will not, however, communicate directly with ATC unless directed by the flight deck observer who has communications responsibility during the tow operation.
- The TBLT operator will act as an extra set of "eyes and ears" and otherwise provide additional situational awareness to the flight deck observer. As such, the TBLT operator will maintain direct radio contact with the flight deck observer and communicate with him/her only as necessary.
- An alternate method of communication with ATC (when conditions restrict aircraft battery operation for instance), is through an escort vehicle in direct contact with the control tower and the TBLT operator. The escort vehicle would accompany the aircraft throughout the towing operation (*FAA AC 00-65*).

7.3 Procedures

- The flight deck observer must obtain clearance from ATC prior to operating on any movement area (*FAA AC 00-65*).
- The flight deck observer will read back ATC instructions when appropriate and/or required (e.g., "Hold Short of __," "Roger," "WILCO").
- The TBLT operator will acknowledge ATC instructions through read back procedures with the flight deck observer
- Identify TBLT operations to ATC as "Super-Tug {Equipment #}." TBLT operations using smaller equipment (e.g., TBLTs designed to

tow regional jets) can be identified as “MiniTug {Equipment #}.”

- Identify a TBLT repositioning to ATC as “Maintenance {Equipment #}.”

7.4 Contingencies

- The TBLT operator should use a headset if ambient noise is too loud.
- A backup form of communication with ATC should be provided.
- A communications plan should include contingencies in case of lost communications.

7.5 Emergencies

The TBLT operator and/or flight deck observer may communicate directly with ATC in case of an emergency.

8 OPERATOR RESPONSIBILITIES

This section sets forth the responsibilities of all parties involved in TBLT operations.

8.1 TBLT Owner

- When the TBLT owner is an aircraft operator under Title 14 CFR Parts 91, 91K, 121, 125, 129, and 135, it must establish guidance that clearly defines duties and responsibilities and employs the use of a checklist.
- The TBLT owner should submit procedures to the Certificate Holder District Office (CHDO), including at least (*FAA AC 00-65*):
 - Safety instructions,
 - Operating procedures (including day vs. night),
 - Initial and recurrent training,
 - Radio communication, and
 - Towing procedures checklist.
- The TBLT owner is required to maintain training records (*FAR 139*).

8.2 Flight Deck Observer

The flight deck observer has the following responsibilities:

- Check ATIS, NOTAMs, airport diagram, ATC frequencies, and so forth.

- Participate in “Before Start” briefing with TBLT operator and escort, if applicable.
- Act as primary communicator with ATC.
- Use proper aviation phraseology and phonetic alphabet at all times.
- Use satisfactory speech (slowly and clearly).
- Apply brakes in case of an emergency and when directed to do so by the TBLT operator
- Monitor aircraft brakes hydraulic pressure (*FAA AC 00-65*).

8.3 Towbarless Tractor Operator

The TBLT operator has the following responsibilities:

- Use a checklist (*FAA AC 00-65*).
- Acknowledge ATC instructions through read back procedures with the flight deck observer.
- Operate the TBLT in safe manner (*FAA AC 00-65*).
- Ensure placards specified in Section 4.8 are visible inside the cab, check for temporary placards (*FAA AC 00-65*).
- Ensure equipment is serviceable and functioning properly before starting tow.
- Provide a “Before Start” briefing to the tow team.
- Ensure compliance with aircraft lighting requirements (*FAR 91*).
- Ensure ATC clearance is obtained prior to entering the movement area.
- Ensure ATC clearance is clearly understood and acknowledged with flight deck observer.
- Perform pre-tow circle check:
 - Ensure all equipment and personnel are clear of the airplane prior to tow.
 - Check with flight deck observer that adequate hydraulic pressure has built up for aircraft brakes.
 - Check proper positioning of torque links if required.
 - Turn on all TBLT exterior lights (*FAR 91*).
 - Turn on position lights between sunset and sunrise (*FAR 91*).

Wear communication headset (except in limited cases where procedures dictate that the wing walker wears it for pushback).

- Remain in constant contact with flight deck observer.
- Stop TBLT upon losing communication with flight deck observer or ATC (*FAA AC 00-65*).

- Halt operation if direct LOS with wing walkers is lost.
- Perform a final visual check for damage when operation is complete.
- Obey emergency stop instructions given by any team member (*FAA AC 00-65*).
- Act as communications backup in case of communication failure between the flight deck observer and ATC.
- May be delegated responsibility of communicating with ATC by the flight deck observer.

8.4 Escorts

Escorts should be used in bad weather conditions, in case of an emergency, if the TBLT operator does not have the required credentials to operate on the movement area, when the flight deck observer cannot fulfill the requirements of the primary communicator with ATC, or at the discretion of airport management. When an escort is used, the escort vehicle operator is responsible for:

- The route to be used during the tow operation.
- The speed of the tow operation.
- Continuous monitoring of communications between the flight deck observer and ATC with the capability to contact the ATC if necessary.

8.5 Wing/Tail Walkers

The following applies to wing and tail walkers:

- Properly signal the TBLT operator as soon as it appears the aircraft is in danger of colliding with an obstruction (*FAA AC 00-65*).
- Use luminous wands at night (*FAA AC 00-65*).
- Use approved hand signals.
- Remain at least 10 feet from TBLT and aircraft nose wheel and main gear during movement.
- Do not occupy or transit the direct path of the aircraft wheels (*FAA AC 00-65*).
- Do not cross under aircraft during movement.
- Do not ride on any external portion of aircraft or TBLT.
- Remain in direct LOS contact with the TBLT operator.
- Wing and tail walkers are not required to:
 - Participate in annual proficiency checks, but should attend recurrent training, or
 - Be fully qualified in all towing procedures.

9 WEATHER

Weather conditions should be taken into consideration before starting towing operations. Below is a list of weather-related recommendations:

- Consider using an escort in poor weather conditions.
- Aircraft towing in low visibility (below 1200 RVR) is discouraged.
- If applicable, TBLT operator and flight deck observer must be familiar with the SMGCS plan.
- When ice, snow, slush, or water at near freezing temperatures is present, the TBLT may be fitted with tire chains, preferably on the axle closest to the aircraft.
- In poor weather conditions, speeds should be reduced as dictated by the airport/aircraft operator. The following speeds are recommended:
 - Close quarters, turns, near gates: < 1 mph.
 - Straight portions when about to stop: < 3 mph.
 - Long hauls, straight portions: < 6 mph.
- When lightning is present, the TBLT operator should not wear a headset connected to the aircraft. If the TBLT operator and flight deck observer are no longer in communication, lost communication procedures should be initiated.
- In strong wind conditions, TBLT operations should be restricted based on manufacturer's recommendations.

10 EMERGENCY/ABNORMAL PROCEDURES

This section provides some examples of recommended actions in the event of an emergency. These actions should be tailored to specific situations.

- Loss or failure of the aviation band transceiver during a reposition requires the immediate stoppage of the operation; the tow operation cannot proceed without proper ATC clearance.
- ATC may use light gun signals to direct the TBLT, although the safest method to proceed would be to contact airport operations for an escort out of the movement area.
- Aircraft under tow that become disabled may request mechanics for inspection and possible back-up tow to the ramp or maintenance area.
- All emergencies must be coordinated with airport operations for an escort to access the airfield. No unescorted direct access will be allowed.

- In the event the aircraft nose gear becomes disconnected from the TBLT during the tow and cannot be reconnected, or if the tow equipment has a mechanical problem and cannot continue the tow operation; the aircraft will need to be:
 - Towed by another TBLT, or
 - Taxied clear of the movement area, and
 - Positioned in a location that will not obstruct airport traffic flow.
- If oversteering occurs, perform an inspection of the aircraft in accordance with the aircraft maintenance manual and report any damage.
- When the tow is complete, make chocks immediately available to prevent the aircraft from rolling.
- In weather conditions that involve snow, ice and frost, use sand bags and chocks as necessary and appropriate.

11 FUTURE TOWBARLESS TRACTOR OPERATIONS

The use of TBLTs varies from airport to airport around the world, and the operational benefits indicate wider use of TBLTs in the future. Both technological improvements and new standards of use are to be expected in the coming years as TBLT equipment evolves.

11.1 Technology

A semi-robotic tractor is currently being tested to tow aircraft from the airport gate to the takeoff point or to the gate after landing. This type of towbarless system uses a “turret” to which the aircraft nose wheel is clamped and rotates as the pilot of the aircraft steers the nose wheel, allowing the pilot to steer the aircraft via the towbarless system and using the aircraft’s brakes. The towbarless system leaves the aircraft pilot in control of the taxiing and would not require any personnel inside the TBLT.

Under this concept, the towbarless system would be managed through a command and control communication center located in the ATC tower. The eventual goal of the program is to fully automate the taxiing process. The semi-robotic towbarless system has the potential to improve the air and noise quality, reduce fuel and engine costs as aircraft would not be under its own power. As such, this type of towbarless system has the potential to provide environmental and financial benefits.

11.2 Standards

Airports and operators that extensively use TBLTs may eventually be faced with new standards that will enhance operational safety. Some of these standards may address:

- Widening and/or strengthening of airport service roads to accommodate repositioning TBLTs,
- Additional guidance on TBLT painting and lighting,
- Additional guidance on lighting of aircraft under tow,
- TBLT operating performance limitations (creation of manufacturer’s operations manual),
- Radio equipment requirements,
- TBLT seat belt equipment requirements,
- Minimum TBLT operator training,
- TBLT operator simulator training, and
- Reporting of TBLT incidents and accidents.

12 REFERENCE MATERIAL

The following material was collected in the course of this project and is useful in understanding issues and challenges associated with ensuring safe TBLT operations at airports:

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