NFPA No. 402

Formerly NFPA
Aviation Bulletin No. 3

STANDARD OPERATING PROCEDURES, AIRCRAFT RESCUE AND FIRE FIGHTING

1951

Price: 35 cents*

NATIONAL FIRE PROTECTION ASSOCIATION
International
60 Batterymarch Street, Boston 10, Mass.

2M-5-51
F. P.

* Discount for Quantities

Printed in U.S.A.

National Fire Protection Association

INTERNATIONAL

Executive Office: 60 Batterymarch St., Boston 10, Mass.

The National Fire Protection Association was organized in 1896 to promote the science and improve the methods of fire protection and prevention, to obtain and circulate information on these subjects and to secure the cooperation of its members in establishing proper safeguards against loss of life and property by fire. Its membership includes over a hundred and seventy-five national and regional societies and associations and over thirteen thousand individuals, corporations, and organizations.

A large number of publications are sent to all members as published. These include monthly *Fire News*, the *Quarterly*, standards on fire prevention and fire protection, special reports and bulletins, the *Year Book*, and the *Proceedings* of the annual meetings.

Membership in the National Fire Protection Association is open to any society, corporation, firm or individual interested in the protection of life or property against loss by fire. The valuable engineering and popular literature issued by the Association is available, as issued, to every member. The Association is always glad to send samples of its publications to prospective members upon request.

NFPA Committee on Aviation and Airport Fire Protection

ONE OF 59 TECHNICAL COMMITTEES OF THE ASSOCIATION

This Committee was reorganized in 1946 to replace the NFPA Aviation Committee (organized 1928) and the NFPA Committee on Aircraft Fire Fighting (organized 1944). The present Committee is charged with the responsibility "to develop aeronautical fire protection, including the elimination of fire hazards in aircraft design and operation, the installation of fire protective equipment in aircraft, the control of fire hazards in aircraft maintenance and storage, fire protection for airports and aircraft rescue and fire fighting."

This publication, like its predecessor, is drafted as a "Suggested Good Practice" rather than a "Standard" since these recommendations cannot be strictly applied internationally because of varied conditions existing at airports where these suggestions apply. The recommendations given herein are, however, intended to apply internationally and may be considered as the best available, current data on the subject.

Committee on Aviation and Airport Fire Protection

Jerome Lederer, *Chairman,*
President, Flight Safety Foundation, 2 East 64th St., New York 21.

George H. Tryon, III,† *Secretary.*
National Fire Protection Association, 60 Batterymarch St., Boston 10.

EXECUTIVE DIVISION.

Harvey L. Hansberry, *Chairman,*
Civil Aeronautics Administration, Technical Development and Evaluation Center, P. O. Box 5767, Indianapolis 21.

Col. Edwin E. Aldrin,† Institute of Aeronautical Sciences. (ex-officio)

Ben W. Ashmead, Civil Aeronautics Board, Bureau of Safety Investigation.

Professor Frank K. Bentley, Daniel Guggenheim Aeronautical Laboratory, Massachusetts Institute of Technology.

Gifford T. Cook, Chief Fire and Crash Rescue, U. S. Air Force, Directorate of Installations, Office, Deputy Chief of Staff, Materiel.

Jack Curtis,* Safety Director, United Air Lines.

Allen W. Dallas, Chief Engineer, Air Transport Association.

J. Victor Dallin, Airport Operators Council.

Charles Froesch, Society of Automotive Engineers, Chief Engr., Eastern Air Lines.

F. W. Hancock,† International Civil Aviation Organization, Chief, AGA Section.

Jerome Lederer,† President, Flight Safety Foundation. (ex-officio.)

Harold L. Miner, N.F.P.A. Committee on Flammable Liquids.

John A. Neale, Chief Engineer, National Board of Fire Underwriters.

J. A. O'Donnell,* Supt., Industrial Safety, American Airlines.

Wilfred M. Post, Jr., American Association of Airport Executives.

Kenneth H. Ringrose, National Association of State Aviation Officials.

H. M. Robinson, Underwriters' Laboratories, Inc.

William H. Rodda, Transportation Insurance Rating Bureau.

Wing Cmdr. R. B. Whiting, Department of National Defence (DCEA), Ottawa.

TECHNICAL DIVISION.

J. C. Abbott,* Fire Protection Supt., British Overseas Airways Corporation.

Neill G. Bennett*, Chief Engineer, Graviner Works.

Major John Berry, U. S. Conference of Mayors, Cleveland Municipal Airport.

Harold J. Burke, Fire Extinguisher Manufacturers Association.

E. M. Butler, Airborne Equipment Division, Bureau of Aeronautics, Navy Department.

Joseph Chase,* Lumbermans Mutual Casualty Co.

George W. Clough,* Fire Marshal, Nassau County.

John W. Crowley, Jr.,† National Advisory Committee for Aeronautics.

L. C. Davies, Bureau of Aeronautics, Department of the Navy.

John A. Dickinson, National Bureau of Standards.

R. J. Douglas,* Oklahoma A. & M. College.

H. A. Earsy,* Fire Marshal, United Aircraft Corp.

W. E. Fairbanks,* Aviation Dept., North America Companies.

Milton M. Fischer,* Chief, Mitchel Air Base Fire Department.

D. D. Gordon-Carmichael,* Properties and Safety Assistant, Trans-Canada Air Lines.

Henry E. Halpin, Factory Mutual Engineering Division.

I. J. Hammill, Fire Extinguisher Manufacturers' Association.

J. B. Hartranft, Jr., Aircraft Owners and Pilots Association.

James W. Just, N.F.P.A. Committee on Firemen's Training.

H. A. Klein, Engineering Division, Hq., Air Materiel Command, Wright-Patterson Air Force Base.

W. E. Koneczny, Bureau of Safety Regulation, Civil Aeronautics Board.

Hervey F. Law,* Gen'l Supt. of Airports, The Port of New York Authority.

Dr. L. G. Lederer, Airlines Medical Directors Association.

E. T. Lee,* Safety Director, Eastern Air Lines.

E. E. Lothrop, Secretary, Aviation Technical Service Committee, American Petroleum Institute.

Daniel Mapes, Compressed Gas Association.

J. Brooks B. Parker,* Parker & Co. (Aviation Insurance).

Frank B. Quackenboss,* Rollins, Burdick, Hunter Co. (Aviation Insurance).

D. B. Rees, Chairman, Fire Prevention Committee, Civil Aviation Division, Dept. of Transport (Canada.)

J. P. Risque,* Associated Aviation Underwriters.

J. E. Ritchie, N.F.P.A. Fire Marshals' Section.

E. B. Rumble, National Automatic Sprinkler and Fire Control Association

Roussel G. Smith,* Chief Plant Security, Pan-American World Airways System, Pacific-Alaska Div.

William R. Smith,† Engineering Division, Air Materiel Command, Wright-Patterson Air Force Base.

E. J. C. Williams, Principal Fire Service Officer, Air Ministry, Royal Air Force.

Roger H. Wingate,* Liberty Mutual Fire Insurance Co.

Alternates.

T. S. Duke, National Automatic Sprinkler and Fire Control Association. (Alternate to E. B. Rumble.)

Edward B. Heyl, Civil Aeronautics Board, Bureau of Safety Investigation. (Alternate to Ben W. Ashmead.)

†Non-voting member.
*Serving in a personal capacity in accordance with Par. 11-b-2 of the Regulations on Technical Committee Procedure.

SUB-COMMITTEE ON AIRCRAFT RESCUE AND FIRE FIGHTING

The following Sub-Committee participated in the preparation of these recommendations which were subsequently acted upon by the full Committee:

George H. Tryon, III, Chairman
National Fire Protection Association
60 Batterymarch St., Boston 10, Mass.

J. C. Abbott, Fire Protection Supt., British Overseas Airways Corporation.

Gifford T. Cook, Chief Fire and Crash Rescue, Hq., U. S. Air Forces.

Jack Curtis, Safety Director, United Air Lines.

J. Victor Dallin, Airport Operators Council.

L. C. Davies, Bureau of Aeronautics, Navy Department.

H. A. Earsy, Fire Marshal, United Aircraft Corporation.

Chief Milton M. Fischer, Mitchel Air Force Base Fire Department.

F. W. Hancock, International Civil Aviation Organization.

Harvey L. Hansberry, Civil Aeronautics Administration (Ex-officio).

Chief James W. Just, NFPA Committee on Firemen's Training.

Hervey F. Law, The Port of New York Authority.

Jerome Lederer, Flight Safety Foundation (Ex-officio).

Daniel Mapes, Compressed Gas Association.

J. A. O'Donnell, Supt., Ind. Safety, American Airlines.

Wilfred M. Post, Jr., American Association of Airport Executives.

J. E. Ritchie, NFPA Fire Marshals' Section.

William R. Smith, Engineering Division, Air Materiel Command USAF.

E. J. C. Williams, Principal Fire Service Officer, Royal Air Force, Air Ministry.

Standard Operating Procedures, Aircraft Rescue and Fire Fighting.

Introduction

A. The basic premise upon which these Standard Operating Procedures are predicated is rescue of personnel involved in aircraft accidents. Extinguishment of fire incident to expeditious rescue is a necessary corollary but final extinction of fire is considered secondary to the rescue operations. Speed in response and rescue is the primary requisite.

B. The following breakdown of conditions liable to be encountered is adopted to aid in practical application of the Standards:

Condition A—On the Airport—On Land.

Situation 1: Anticipated accident at landing.

Situation 2: Potential accident during take-off.

Situation 3: Unexpected accidents and features common to all airport accidents.

Condition B—Off the Airport—On Land.

Situation 4: Normally within radius of one to five miles or within reasonably accessible distances.

Situation 5: Beyond radius described above (Situation 4).

Condition C—On or off the Airport—In the Water.

Additional Standard Operating Procedures are given to cover the following:

Local Public Fire Department Cooperation.

Aircraft Crew Training and Discipline.

Ambulance and Medical Services.

C. The following Standard Operating Procedures are predicated upon the provision of an aircraft rescue and fire fighting organization with adequate equipment (including radio facilities) and personnel, normally under the administrative control of the airport manager (see Appendix A). During an aircraft fire emergency the Chief of

Emergency Crew has absolute authority over operational phases of aircraft rescue and fire fighting.

D. It will be noted that no differentiation is made in these Standard Operating Procedures between the various types of aircraft liable to be involved in accidents although this obviously will have a marked effect upon the type and quantity of aircraft rescue and fire fighting equipment required to handle any fire which might result. (See Appendix B and pamphlet "Suggested Aircraft Rescue and Fire Fighting Equipment for Airports," NFPA No. 403.*)

E. Terminology used in this standard has been adapted for international use by employing, as far as possible, definitions interpreted from publications issued by the International Civil Aviation Organization. (See Appendix C.)

Condition A—Situation 1

On the Airport, On Land
Anticipated Accident at Landing

101. If, prior to landing, *any* abnormal condition existing on the aircraft is reported to Airport Control a report of this condition should be made to the Chief of Emergency Crew who may order a stand-by alert, either on the landing area (at predetermined locations judged most suitable for the type of emergency) or in the fire station, as conditions warrant.

102. The Airport Control Tower will give the Chief of Emergency Crew as much of the following information as possible. If this information is not volunteered by the Control Tower operators, the Chief will request the information from this or other reliable source.

a. Type of aircraft.
b. Number of occupants.
c. Nature of trouble.
d. Runway to be used.

The following additional information (as applicable) should be provided by Control Tower operators if time and conditions permit:

e. Position and injuries to occupants, or type of cargo.

* Available from the Association (50 cents per copy).

f. Amount of fuel aboard at time of emergency and location of tanks.

g. Presence or absence of fire in flight, time burning, action taken to combat fire, its apparent origin and smoke conditions.

h. Condition of landing gear, brakes, wing flaps, etc. which might affect landing runs.

i. Power available and engines affected.

j. Pilot's visibility for landing.

k. Anticipated ground contact point and estimated run.

l. Position of control switches at time of landing:

1. Ignition and battery switches.
2. Fuel and oil cut-off switches.
3. Throttle and propeller feathering controls.
4. Fire extinguisher control switches.

m. Anticipated use of hatches and emergency escapes:

1. Whether escapes are manned for immediate use.
2. Whether escapes are jammed or blocked.
3. Whether passengers are panicky.
4. Distribution of occupants at exits.

103. Airport Control will maintain facilities for continuous verbal or radio contact with the Chief of Emergency Crew for last-minute changes in the distressed aircraft's flight plan or emergency conditions existing. Mutual aid as may be needed to help fight any fire or accomplish rescue will be called by Airport Control according to prearrangements completed by the Chief of Emergency Crew. Where advisable, Airport Control will also notify the pilot of the distressed aircraft of the emergency action being taken to receive the aircraft.

104. The Chief of Emergency Crew will supervise placing aircraft rescue and fire fighting equipment in position to facilitate response.

a. Rescue and fire fighting equipment will be spaced so that the runs will be the minimum necessary but back of the anticipated ground contact point of the aircraft in distress. A safe distance will be maintained to avoid collision with the aircraft.

b. Rescue and fire fighting equipment will be dis-

tributed parallel to the runway or landing area to be used and grouped to afford maximum utilization.

105. The Chief of Emergency Crew will place equipment "on the roll" immediately as landing is accomplished and clearance given by Airport Control to enter the movement area even if no fire is visible and apparently a successful landing has been accomplished. The aircraft will be followed until it stops and fire prevention or fire-fighting operations will be conducted until the emergency is over. It is the Chief's duty to notify Airport Control when the fire emergency ends. Airport Control has no authority to recall rescue and fire-fighting equipment until the Chief of Emergency Crew pronounces the emergency terminated.

106. The possibility will not be overlooked that the aircraft might swerve suddenly because of faulty landing gear, improper brake action, tire failure, obscured vision of pilot, etc., or that the aircraft might overrun the landing area. Rescue and fire fighting equipment should not have to retract appreciably in any such contingency. This calls for long-range planning including analysis of topography, terrain conditions, fencing of the airport, mobility of equipment and mutual aid facilities.

107. Airport Control will be in charge of other field activities during the emergency and will be particularly alert for the possibility of simultaneous rescue or fire emegencies. Airport Control will keep the Chief of Emergency Crew fully advised by radio.

(See also Situation 3)

Condition A—Situation 2

On the Airport, on Land
Potential Accident During Take-off

201. Immediately upon notification or observance of potential take-off accident, the Chief of Emergency Crew will order aircraft rescue and fire fighting equipment placed "on the roll" toward the scene keeping in radio contact with Airport Control for clearance to enter movement area.

202. Great care will be exercised in this response to avoid going out of position until the accident location is defined to a given area. Remember that while the aircraft is airborne, unexpected attitudes might suddenly change the course of flight and consequently the final accident site.

(See also Situation 3)

Condition A—Situation 3

On the Airport, on Land
Unexpected Accidents and Features Common to all Airport Accidents

301. Constant observation will be maintained of flight activity from the Fire Station (advantageously located for this purpose) to supplement Airport Control personnel. This observation should be conducted by personnel familiar with aircraft, the airport operating regulations, normal air traffic patterns, and accepted principles of safe ground operation of aircraft. They should be provided with every possible visual aid including binoculars and should also have radio and telephone or loud speaker interphone communication facilities for prompt transmission of alarm and contact with Airport Control. Proper location of the Fire Station to afford maximum visibility of movement area is essential.

302. Emergency Crew personnel will take turns on alert duty during all hours of flight activity. Observation duties should include the following visual checks:

a. Clearance of movement area for arriving and departing aircraft.

b. Continuity of power in aircraft engines in the air and at time of take-off.

c. Clearance of structures, trees, and other obstructions.

d. Taxiing operations, ground operations of engines, security of landing gears, and aircraft maintenance operations on the flight line (including fuel servicing).

303. When approaching an aircraft fire, rescue and fire-fighting equipment will be placed so as to facilitate rescue. The following conditions will be particularly noted:

a. Wind direction.

b. Location of fire and its extent at time of arrival.

c. Location of fire relative to personnel involved.

d. Relation between wind, fire, personnel and fuel tanks.

e. Terrain conditions and exposures.

f. Flammable liquid spillages.

Proper training of drivers of the equipment is vital in this connection.

304. Emergency Crew personnel used for rescue work

will be protected with appropriate agents when entering any fire zone to accomplish rescue and will wear protective clothing. Protective clothing recommended includes:

a. Bunken suit with heat insulative interliners for coat and trousers to afford full arm, body and leg protection, outer garment to be water repellent and flame resistant.

b. Protective gloves of chrome leather with heat insulative interliner and gauntlet wrist protection.

c. Standard firemen boots with wool lining.

d. Firemen helmet with plastic full vision face shield, and front and neck protective aprons.*

305. All available lines will be charged for use on the fire after equipment is properly positioned irrespective of the extent of the fire at time of arrival. This will assure an immediate discharge available in case of a gasoline flash which would endanger emergency crews and equipment at the scene as well as occupants of the aircraft. If no fire is visible, all equipment will be placed in immediate readiness for service with lines laid but not charged.

306. All spills of flammable liquids will be neutralized or blanketed with foam as quickly as possible taking into consideration the water requirements for the primary rescue mission and the total supply available.

307. Since a continuous water supply is essential and usually not available at all points on an airport, pumpers will be immediately positioned at the time of alarm to relay water to the aircraft rescue and fire-fighting equipment and the lines charged upon direction of the Chief of Emergency Crew. In addition, general purpose vehicles will be available on prearranged schedules to bring additional supplies of extinguishing agents and equipment to the scene. (If the airport maintenance equipment includes a ladder truck or portable emergency lighting equipment, it is important that prearrangements include the automatic response of such mobile facilities.)

308. Rescue operations will be accomplished through regular doors and hatches wherever possible but emergency crews must be trained in forcible entry procedures and be provided with the necessary tools. Special items of accessory equipment desirable for such operations include:

* See NFPA No. 403, page 19 for photograph of typical protective clothing.

a. Manual Cutting, Opening and Access Tools:

Large and small axes specially designed for piercing metallic fuselage skin surfaces (non-wedging)
Bolt, bar and metal cutters
Metal and wood cross cut and hack saws
Rounded tip knives for cutting safety belts, parachute straps
Vise and electrical wire cutting pliers
Access ladders (height depending on aircraft utilizing airport)
Screwdrivers and fastener tools
Keys to aircraft compartments

b. Manual Shifting Tools:

Crow bar and claw tool
Grappling hook and cable (with tow hooks mounted on front and rear of mobile truck)
Long handled shovels
Pike pole
Sledge hammer
Plugs and crimping tools for flammable liquid lines and tanks

c. Electrical or Mechanical Tools (May be mounted on separate Auxiliary Unit*):

Electrical, circular metal cutting saw
Electrical, push-pull metal cutting saw
Electrical lighting plant with generator
Portable public address system with batteries
Power winch or crane

309. Rescue of personnel involved in aircraft accidents will proceed with the greatest possible speed. While care will be necessary in the evacuation of injured occupants so as not to aggravate such injuries, removal from the fire threatened area is the primary requirement. (See paragraphs 901-903.)

310. One member of the Emergency Crew will be detailed to disconnect the battery and to check the ignition, fuel, and fire extinguisher cockpit control switches and firewall shut-off valves to limit the extent of fire whenever such action is made possible by the fire condition existing.

* See NFPA No. 403, pages 25-28, for further details of Auxiliary Unit.

311. Broken fuel, hydraulic fluid (flammable type), alcohol and oil lines will be plugged or pinched to reduce the amount of spill and extent of fire.

312. If the source of heat cannot be removed and flames threaten, fuel tanks will be cooled by appropriate agents and vented to prevent explosion.

313. Where immediate rescue entrance cannot be achieved, bayonet type nozzles might be employed to distribute water spray ("water fog") in the interior of the aircraft to reduce the hazard to life of those occupants trapped inside.

314. Windows of aircraft may often be used for rescue or for ventilation. Some windows are designed as emergency exit hatches. On newer transport aircraft, these hatches are marked and have latch release facilities on the outside. Many emergency hatches open outward but some push inward. A knowledge of the design features of the exits on different aircraft is essential for the rescue crew. Plastic window panels are often heated above the "forming" temperature of the material (about 250°-300° F.) by a fire. They then become elastic and rubbery and are very difficult to shatter with an axe or sledge.*

315. Interior portions of the aircraft will be ventilated before removing the aircraft after rescues have been accomplished and the fire extinguished. Runway and ground surfaces will be thoroughly flushed of all flammable liquid spills before moving aircraft or permitting normal traffic to resume. Gasoline tanks will be drained (approved methods followed for fire safety) prior to removing aircraft if conditions necessitate and permit. One rescue and fire-fighting unit will be retained at the site while this work is performed. If the aircraft or parts must be removed prior to completion of full investigation and safetying, a record should be made of the accident locations of all parts and care exercised to preserve any evidence available that might help determine the cause of the accident.

316. Assure that the "No Smoking" rule is enforced at the scene of the accident and in the immediate vicinity.

317. Where the use of grappling hooks or tow chains

* Experiments have shown that cooling the panels to below the forming temperature with carbon dioxide to facilitate shattering is not practical.

must be used to expedite rescue or to assist in controlling fires, exercise discretion lest such a procedure result in strains which might release quantities of fuel from partially damaged tanks or cause greater injuries to entrapped personnel.

318. Burning magnesium parts should be covered with dirt, sand, or special powder extinguishing agents to prevent reflashes.

Condition B—Situation 4

Off the Airport, on Land Normally Within Radius of One to Five Miles or Within Reasonably Accessible Distances

(See also Situation 3 and Appendix D)

401. Despite any delay in transmission of alarm, predesignated aircraft rescue and fire-fighting equipment will be dispatched by the Chief of Emergency Crew to all accidents within the radius described or a similar radius where response is adjudged necessary because of factors surrounding the particular accident or life hazards presented.

402. Aircraft rescue and fire-fighting equipment held in reserve will be only auxiliaries capable of handling incipient fires. Airport control will be immediately advised of the substandard fire defense facilities available and will be in constant radio contact with the emergency units off the airport attending the accident.

403. All off-airport areas within the radius described will be plotted on a grid or azimuth map and the exact location of any accident will be spotted by coordinates as soon as established. Copies of this map will be mounted in every piece of aircraft rescue and fire-fighting equipment, in the Fire Station, and in the Airport Control Tower. It is recommended that this map also be circulated widely within the geographical vicinity of the airport with copies made available to such agencies as: local public fire departments and equipment, police stations and cruiser cars, hospitals and ambulance services, telephone exchanges, gasoline stations, and selected citizens. One or more local aircraft should also possess copies for possible use in spotting accident sites from the air. Prearrangements with all available fire protection agencies in the area are essential.

404. Response by aircraft rescue and fire-fighting equipment will be organized to avoid delays en route. Local police cooperation will be prearranged. Radio equipment will keep the major equipment, the Fire Station, and Airport Control within constant communication. Wherever possible, local fire departments will also be tied into this radio network.

405. The fastest and most mobile aircraft rescue and fire-fighting equipment will proceed independently of slower heavier units, but the former will direct the latter by radio, supplying route information wherever necessary.

406. Auxiliary water tank trucks and pumpers with auxiliary water tanks will be dispatched wherever there is an indication of their possible utilization and especially when the accident site is known to be beyond normal fire-protected zones (underground water mains and hydrants) or where water relays may be required.

407. Special aircraft rescue tools will be arranged in a kit for manual transportation to accident sites when circumstances prevent close approach by motorized units (i.e. marshy land, heavily wooded areas, high structures, etc.).

408. Judicious utilization of agents supplied is particularly important in unprotected off-airport locations and techniques of employment must be carefully selected to permit most advantageous use.

409. Prior surveys of off-airport terrain and traffic conditions will be made to prevent delays at time of emergency. Significant factors will be charted on the grid maps supplied to aircraft rescue and fire-fighting equipment.

410. Prearrangements with police agencies will be made to handle crowds, to enforce "No Smoking" regulations, and to preserve property and evidence useful in determining the cause of the accident.

411. Damaged aircraft will be tethered for protection against wind damage wherever possible and necessary to preserve evidence as investigations may be prolonged. Souvenir collection will be prohibited and firemen will be instructed in restricting unnecessary damage to the aircraft.

Condition B—Situation 5

Off the Airport, on Land Beyond Radius Described in Situation 4

(See also Situations 3 and 4)

501. Only one unit of aircraft rescue and fire-fighting equipment will *normally* respond to crashes over five miles from the airport. This unit will be the most mobile and self-contained available, possessing a combination of agents and equipment for employment as the individual situation warrants. The airport protection will not be unjustly jeopardized by prolonged absence of emergency equipment unless the airport can be closed to air traffic during the period of the emergency.

502. Response to these distant accidents will be in cognizance of the danger that, in some, ignition is a delayed result of impact, that only trained aircraft rescue and fire-fighting crews are capable of safetying damaged aircraft to eliminate potential fire hazards, and that removal of any trapped occupants from the danger zone may require special equipment.

503. Aimless wandering to fix exact location of the accident will be forestalled as much as possible by coordination of effort between local police, fire department, and spotter aircraft. Radio communication is essential in this regard.

Condition C—On or Off the Airport, In the Water

601. All available aircraft rescue and fire-fighting boats will be immediately dispatched, equipped with standard facilities and adequate crews.

602. Coast Guard, Naval, and municipal or similar fire and rescue units (as might be available) will be immediately notified and requested to assist in the emergency. This request will normally be made irrespective of the apparent seriousness of the accident and according to prearrangements.

603. Normally sweeping fire away from the aircraft with hose streams is the best practice in aircraft fires on water, but ample foam and water fog should be available for suppression purposes and rescue entry in case of extensive flammable liquid spills which might cover wide

areas. It should be appreciated that calm waters produce worse surface fires than rough seas. Rescue boats should approach from the windward side and the fire attacked off the quarter and from broadside as the rescue boat maneuvers. (It is very difficult to maintain a stationary position in this type of fire fighting and excellent maneuverability is the primary operating requirement of boats used for this service. Turrets should be capable of 360° rotation.) Land rescue and fire-fighting equipment will be mobilized to bring additional supplies of required agents to the nearest docking facilities.

604. Immediate attention must be given to occupants injured or trapped inside the aircraft particularly when fire is involved or the buoyancy of the damaged aircraft is in question. Those who have escaped unassisted and can swim in fire-free areas should be encouraged to help themselves until trapped persons and non-swimmers can be removed to safety by rescue forces. Life preservers should be standard equipment on rescue launches. Any apparent flammable liquid spills which have not been ignited should be swept away from the danger zone with hose streams as quickly as possible. The aircraft battery should be disconnected promptly. Ignition switches, fuel switches and firewall fluid shut-off valves should be closed. Motor launch backfires should be prevented.

Local Public Fire Department Cooperation

701. Local public fire departments will be periodically included in aircraft rescue and fire-fighting training activities conducted at the airport by participating in drills, tests, and aircraft familiarization programs. Such activities will be specifically pointed toward increasing the utility of local fire defense personnel in handling off-airport accidents and assisting in a mutual aid capacity for serious airport accidents. *(See Appendix D.)*

702. Confidence in handling aircraft fires can only result from actual aircraft fire experience or training in *realistic* simulated accidents. Local fire department crews which arrive at the scene of an aircraft fire first will be instructed to proceed with the rescue and fire suppression work. Upon arrival of specialized airport equipment, the Chief of the Airport Emergency Crew will consult with the public Fire Department Chief on what rescue efforts have

not been successfully completed and will direct the combined crews to assist in the furtherance of this aspect of the accident. After rescues are completed, both agencies will concentrate on final extinguishment, the division of responsibilities being a matter for individual determination by those in charge in accordance with previous arrangements.

703. Local public fire departments will be tied in closely with the airport emergency alarm service, preferably by radio or direct line telephone. They will be supplied with grid maps used for spotting accident locations. They will be encouraged to carry special equipment for aircraft rescue and fire suppression purposes (not uncommon to equipment which might be carried for gasoline tank truck or other flammable liquid fire-fighting work).

704. Local public fire departments will be offered schooling in aircraft fire hazards and physical structures of the types commonly operating out of the airport involved.

Aircraft Crew Training and Discipline

801. Since many emergency landings are caused by fires sustained in flight, it is vitally important that aircraft crews be well trained and disciplined in fire prevention and what to do in such an emergency. Knowledge of proper operation of installed fire protection systems in aircraft is the first essential. Important points for engine fires in multi-engine aircraft are:

a. Warn other aircraft crew members.

b. Place mixture control at idle cut-off.

c. Feather propeller, affected power plant.

d. Turn-off fuel to affected power plant.

e. Close firewall fluid shut-off valves (fuel, oil, hydraulic fluid) of affected power plant.

f. Switch-off ignition to affected power plant.

g. Check position of cowl flaps, affected power plant.

h. Select extinguisher position and operate system.

This procedure presupposes sufficient altitude to avoid ground collision from loss of power. Aircraft crews will also be familiar with hand fire extinguishers on board the aircraft and how they are properly operated. Cabin and cargo section fires must be promptly and effectively blan-

keted to avoid danger of asphyxiation of crew and passengers.

802. Aircraft crews will be instructed in the air flow configurations and methods which can be taken to prevent spread of fire and smoke throughout the aircraft. The dangers of opening doors and windows will be thoroughly understood.

803. Radio notification of emergency landings from the pilot will include information on:

a. Type of aircraft.

b. Number of occupants.

c. Nature of trouble.

d. Runway to be used.

{ *See paragraph 101 for possible supplementary information which might be volunteered if time and conditions permit.* }

804. The aircraft crew can also be of great assistance to the ground aircraft rescue and fire-fighting crews by taking as many of the following steps as possible to prevent or limit the amount of fire after landing:

a. Switch-off ignition and battery.

b. Stop flow of fuel and oil by operating cut-off switches.

c. Activate the installed fire protection systems at time of ground impact (if not done for control of fire in flight) even if no fire exists.

d. Open emergency hatches just before landing to prevent entrapment caused by jamming of escapes by impact stresses. (This is not recommended where an airborne fire is in progress affecting cabin or crew compartments or where flames might enter cabins from power-plant fires through such openings.)

e. In some cases, especially with wing fires, it is possible to shift the position of the aircraft after landing by braking in such a manner that the wind will carry flames away from the fuselage and main fuel cells.

f. When circumstances permit, bring aircraft to rest on paved surfaces to permit easy approach by aircraft rescue and fire-fighting equipment.

g. Maintain as much discipline as possible among passengers to prevent panic. Organize escape routes to prevent "bottlenecks" at certain exits. Enforce the use of safety belts during the landing.

h. Provide technical information to the Chief of Emergency Crew but do not attempt to direct the Emergency Crews in the performance of their duties.

Ambulance and Medical Services

901. Ambulance and medical services, like rescue and fire-fighting services, will be provided to administer aid to those involved and in need of medical assistance. Response of ambulances to the emergency will be automatic regardless of whether or not it is apparent that medical services are required.

902. Ambulance and medical services may be an integral part of the rescue and fire-fighting organization and this is recommended. A specialized attendant will be available during all operating periods to perform the dual function of ambulance driver and first-aid practitioner. Where operations are of such nature that a permanent ambulance service is not feasible, prearrangements with local, private or public services will result in prompt dispatch of a satisfactory assignment of ambulance and medical services. Where the latter arrangement is relied upon, it is of special importance that aircraft rescue and fire-fighting crews be well trained in first-aid practices.

903. Doctors will be on immediate call for all emergencies and will be notified of such emergencies by Airport Control according to prearranged schedules and procedures.

Table No. 1

Suggested Minimum Amounts of Extinguishing Agents and Minimum Personnel for Aircraft Rescue and Fire Fighting Operations Graded According to Aircraft Weight Categories

Aircraft by Gross Weight Categories (See Par. 201)	Minimum Quantities Extinguishing Agents (See Pars. 301–306)		Minimum Personnel on Duty (See Pars. 314–316)		Typical Civil Aircraft in Weight Category (See also Appendix "D")
	Water in U.S. Gals (For Foam Production)	Carbon Dioxide in Pounds	Full Time	Trained Auxiliaries	
Under 3,000 lbs.	300 gals.	and 300 lbs.	1	2	Piper Super Cub, Cessna 140, Beech Bonanza, Navion, etc.
3,000–8,500 lbs.	400 gals.	and 500 lbs.	1	2	Grumman Widgeon Cessna 190, deHavilland Beaver, etc.
8,500–15,000 lbs.	500 gals.	and 750 lbs.	1	4	Beech D-18S, Grumman Mallard, Short Sealand, etc.
15,000–26,000 lbs.	750 gals.	and 1,200 lbs.	3*	4	Douglas DC-3, Beech Model 34, Lockheed Lodestar, etc.
26,000–50,000 lbs.	1,500 gals.	and 2,000 lbs.	4*	4	Convair Liner, Martin 202, Douglas Super DC-3, etc.
50,000–90,000 lbs.	Either 2,500 gals.	and 4,000 lbs. or 3,500 gals. and 2,000 lbs.	4–5*	6	Douglas DC-4, "North Star" Handley-Page Hermes IV, etc.
Over 90,000 lbs.	Either 3,500 gals.	and 4,000 lbs. or 4,500 gals. and 2,000 lbs.	5–6*	6	Douglas DC-6, Lockheed Constellation, Boeing Stratocruiser, etc.

Paragraph references are to NFPA No. 403.

*Indicates at least one driver for each piece of apparatus plus a Chief of Emergency Crew. See paragraph 316 of NFPA No. 403 for further details.

Note 1; Maximum discharge period for dispensing the total amounts of both agents should not exceed 2½ minutes for each. See paragraph 302 of NFPA No. 403 for further details.

Note 2; As new mediums are developed consideration will be given to modification of this Table.

APPENDIX A

The following statement extracted from the NFPA "Suggested Aircraft Rescue and Fire Fighting Equipment for Airports" is presented as an Appendix to this Standard Operating Procedure as a matter of information and possible guidance.

"Aircraft rescue and fire fighting on the movement area of an airport should be under the administrative control of airport management, whether a governmental agency, a private corporation, or an individual and irrespective of how such activities are financed and/or organized. Airport management should also have administrative duties in connection with aircraft rescue and fire fighting within the reasonably accessible environs of the airport movement area where there is no conflict with the administrative jurisdiction of suitably organized and equipped public protective agencies. A prearranged high degree of mutual aid (joint defense measures) is desirable between airport rescue and fire fighting organizations and any public protective agencies serving the immediate vicinity. An "area emergency plan" should be established and airport management should provide educational instruction on the special problems and techniques associated with aircraft rescue and fire fighting to cooperating public agencies."

APPENDIX B

Table No. 1, page 20, provides recommendations for the minimum amounts of extinguishing agents and minimum personnel for aircraft rescue and fire fighting as extracted from the NFPA "Suggested Aircraft Rescue and Fire Fighting Equipment for Airports" (NFPA No. 403):

Notes Relative to Suggested Minimums Recommended in Table No. 1

1. The selection of carbon dioxide and foam (with option to "fog-foam" or water spray) is recommended as the most effective means currently available for aircraft rescue and fire fighting. This combination provides for rapid blanketing, effective cooling, and permanent extinguishment, assuming adequacy of agent supply and discharge facilities.

2. It is recommended that equipment dispensing these agents be so designed that the total amounts of water (dispensed as foam, "fog-foam" or water spray) and the total amount of carbon dioxide indicated in Table No. 1 be discharged within 2½ minutes maximum time so as to afford the desired rates of discharge considered essential to fire extinguishment or control.

3. The minimum agent quantities suggested in Table 1 presume the existence of additional water supply facilities (mobile or otherwise) and any special chemicals upon which dependence is placed for fire extinguishment to make possible continuing rescue and fire fighting operations for a reasonable period of time after the discharge of agents carried as the initial minimums.

4. It should not be assumed that the minimum agent capacities indicated in Table No. 1 should be carried on a single vehicle. In this connection, it should be noted that with the larger type aircraft (particularly aircraft weighing over 15,000 lbs. gross weight), it is desirable to have multiple units available to attack a fire from more than one point or quarter. In this respect, vehicle capacity and gross weight should be compatible with and without prejudice to its desired performance characteristics.

5. Sufficient trained aircraft rescue and fire fighting personnel (Emergency Crew) should be available during all periods of flight operations to bring into immediate employment at least one-third of the total extinguishing media specified or a minimum of one unit of equipment, whichever is the greater. This contemplates that the principal aircraft rescue and fire fighting unit can be fully manned with full-time and auxiliary personnel within 30 seconds of an alarm and that each additional unit of equipment has a full-time driver assigned. Other trained auxiliary personnel should be able to complete these additional vehicle manning requirements.

6. For further details see NFPA No. 403 "Suggested Aircraft Rescue and Fire Fighting Equipment for Airports."

APPENDIX C

The following is interpreted from the GLOSSARY OF DEFINITIONS by the International Civil Aviation Organization:

Aerodrome: A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure, movement and servicing of aircraft.

Aircraft: All air-supported vehicles.

Airport: Any aerodrome at which facilities available to the public are provided for the shelter, servicing or repair of aircraft and for receiving or discharging passengers or cargo.

Airport Control: A service established to provide air traffic control for airports.

Air Traffic: Aircraft in operation anywhere in the air-space and on the movement area of an airport.

Landing Area: The part of the movement area primarily intended for landing or take-off of aircraft.

Movement Area: The area at airport specially prepared for the movement of aircraft upon it (see landing area).

The following definitions are added to clarify the foregoing text. These definitions are promulgated by the NFPA Committee:

Aircraft Fire Fighting: The control or extinguishment of aircraft fires following ground accidents incident to aircraft rescue and thereafter. Aircraft fire fighting, as used in these recommendations, does not include the control or extinguishment of airborne fires in aircraft.

Aircraft Rescue: The removal of personnel from an aircraft which has sustained a ground accident. Rescue, as used in these recommendations, does not include search operations or medical services other than first aid treatments.

Airport Manager: The individual having managerial responsibility for the operation and safety of the airport whether he represents a governmental agency, a private corporation, or an individual. The airport manager properly should have administrative control over aircraft rescue and fire fighting services operating on the movement area of the airport. He should not have authority over operational matters at the time of emergency, said responsibility being that of a duly appointed chief of Emergency Crew.