

SOCIETY OF AUTOMOTIVE ENGINEERS, Inc.

485 LEXINGTON AVENUE
NEW YORK 17, N.Y.

AERONAUTICAL INFORMATION REPORT

AIR 74

CONSIDERATIONS ON LIMITING PRESSURE SURGE DURING GROUND
PRESSURE REFUELING OF AIRCRAFT

Issued 3-1-60
Revised

CANCELLED
FOREWORD

Ground facilities for pressure refueling of commercial and military aircraft are being installed in many locations to provide rapid refueling of turbine powered aircraft. The advent of civil jet airliners in particular is requiring considerable expansion of such facilities at many major airports.

There is indication that the design of ground pressure refueling installations with regard to pressure surge, i.e. "water hammer", in some cases proceeded, or is proceeding, without well directed coordination with the airframe manufacturers and equipment suppliers who design and furnish the fuel systems and components within the aircraft which will be pressure refueled. Coordination is necessary because the intensity of pressure surge is dependent upon the interaction between the characteristics of the aircraft system and the characteristics of the ground pressure refueling system. Compatibility between the two systems is needed to hold pressure surges to levels which will avoid damage to equipment.

It appeared obvious to Society of Automotive Engineers Committee AE-5, Aircraft and Missile Fuel, Oil and Oxidizer Systems, that some agency should undertake the task of publicizing the importance of the inter-relationship between the aircraft system and the ground system in order that compatibility could be assured. Accordingly, a Surge Panel was established by Committee AE-5 and charged with the responsibility of determining whether surge rise during pressure refueling might present a problem with the new ground installations, and if so to recommend corrective measures.

The Surge Panel concluded that at present information on surge phenomena is widely scattered and somewhat inconclusive for use in the subject application; that authoritative information on this subject should be considered directly by those responsible for the design and installation of ground pressure refueling systems; that inter-relationship of the aircraft refueling system and the ground pressure refueling system must be considered if pressure surge magnitude is to be predicted; that to ignore or to misunderstand the importance of this relationship may result in serious consequences during pressure refueling operations; and that dissemination of information on surge phenomena in the subject application through the facilities of the SAE would be appropriate in the interests of promoting compatibility between aircraft and ground pressure refueling systems.

Accordingly, this Aeronautical Information Report has been prepared as a service to those concerned with the technical aspects of ground pressure refueling.

INTRODUCTION

It is desired to limit pressure surges developed during pressure refueling of aircraft lest they reach destructive values. Toward this end, certain considerations and recommended procedures are presented in this report. These are intended to apply only to ground pressure refueling, and to the pressure surge created by the shutting off of flow. Adherence to the recommendations contained herein would:

- A. Permit holding pressure surge to a predictable and desirable level during ground refueling of future aircraft;
- B. Cause reduction of the surge potential of long ground refueling systems to levels which are desirable for some existing aircraft models.

Other existing aircraft models may meet with pressure surges of greater severity than anticipated even when refueled by ground pressure refueling systems which adhere to the recommendations of this report. This is because the design of those aircraft models presumably was based on the use of very short ground refueling systems, or because the aircraft valve shutoff time may not have been related to the surge potential of ground pressure refueling systems. It would be possible, however, to determine the pressure surge magnitude to be encountered during ground refueling of those aircraft if the refueling system used adhered to the recommendations of this report.