



NTIS/PS-78/0546

Hydrogen Storage
Part 1. Storage as a Gas or Liquid

A Bibliography with Abstracts

Search period covered

1974 - May 1978

NTIS

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
Springfield, Va. 22161

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16. Abstract: The bibliography references aspects of storing hydrogen as a liquid or a gas. Citations cover fuel storage, energy storage, and the construction of tanks used to store the material. Any type of storage that is related to batteries, fuel cells or solar cells unless the abstract states that its purpose is to store hydrogen are excluded. (This updated bibliography contains 112 abstracts, 16 of which are new entries to the previous edition.)			
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401 to 500 technical report summaries	200	250
More than 500 technical report summaries	Negotiated	

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SAMPLE ENTRY OF A CITATION FROM THE
NTIS DATA BASE

Title
Compilation of State Data for Eight Selected Toxic Substances. Volume I

Corporate Author
Mitre Corp., McLean, Va. *Environmental Protection Agency, Washington, D.C.
Office of Toxic Substances. (402 364)

Sponsoring Agency

Report Date
Final rept.

Pages in Report
165p*

NTIS Subject Categories

AUTHOR: Roberts, Elisabeth, Spewart, R., Stryker, S., Tracey, S.
C5945F4 FID: 06T, 06E, 57Y*, 57H, 68* USGRDR7606

REPT NO: MITRE-75-52-Vol-1

CONTRACT: EPA-68-01 2933

MONITOR: EPA/560/7-75/001-1

Paper copy also available in set of 5 reports: as PB-248 659-SET, PC\$36.00.

ABSTRACT: In June 1974, toxic substances data in the U.S. was collected and analyzed in 20 key states. This report describes that effort and discusses the amount, type and usefulness of the data and the toxic substances monitoring capabilities of the state agencies contacted.

DESCRIPTORS: *Environmental surveys, States (United States), Monitors, Toxicology, Arsenic, Beryllium, Cadmium, Cyanides, Lead(Metal); Mercury(Metal), Chlorine aromatic compounds, Data acquisition, Data processing, Water pollution, Air pollution, Chemical compounds

IDENTIFIERS: *Toxic agents, Biphenyl/chloro, State agencies, NTISEPAOTS

PB-248 660/3ST NTIS Prices: PC\$8.00/MF\$3.00

Paper Copy
Price

Microfiche
Price

Keywords

Order Number

NOTE: Prices are subject to change. See colored pages accompanying this search.

Evaluation of the Use of Hydrogen as a Supplement to Natural Gas

Ad Hoc Committee on the Use of Hydrogen for Natural Gas
Supplementation.*Energy Research and Development Administration. (9505254)

EC841K4 Fld: 21D, 97K GRAI7809

Jun 77 71p

Monitor: 18

Abstract: The potential for mid-term (1985-2000) commercial application of the use of hydrogen for blending into the present natural gas delivery system as an energy supplement was studied. Successful development of advanced electrolyzer technology and availability of low-cost "off-peak" and "spinning reserve" electric-generating capacity are basic to this concept. Because no source was found that would make such a concept economically viable in the near future, the Committee determined that a major, Federally funded R, D, and D program aimed at proving the technical feasibility is not justified within the next five years. In the considered opinion of the Committee, even a completely successful R, D, and D program within five years would not spur mid-term commercialization to: produce sufficient hydrogen to significantly alleviate the natural gas shortage on a national basis; produce hydrogen at a cost competitive with other supplemental gaseous fuels if present price projections hold true; provide the electric power industry with incentives to devote available generating capacity to this end in competition with various storage concepts, operating alternatives, and end uses under development. The Committee found no overriding environmental, safety, legal, code, or regulatory considerations that would preclude the hydrogen-natural gas supplementation concept. Fostering of long-term research activities for hydrogen production using water electrolysis is recommended in connection with other prospective end uses. A periodic review of R and D efforts that relate to commercialization of natural gas supplementation with hydrogen is also recommended. (EPA citation 03:010603)

Descriptors: *Hydrogen production, *Natural gas, Commercialization, Economics, Energy policy, Energy source development, Feasibility studies, Financial incentives, Fuel substitution, Hydrogen, Hydrogen-based economy, Implementation, Mixing, Off-peak energy storage

Identifiers: ERDA/295000, ERDA/080000, ERDA/294003, Synthetic fuels, Manufactured gas, NTISDE

TID-27747 NTIS Prices: PC A04/MF A01

Hydrogen-Fueled Railroad Motive Power Systems: A Feasibility Study

Escher Technology Associates, St. Johns, Mich.*Energy Research and Development Administration. (9501992)

AUTHCF: Foster, R. W.; Escher, W. J. D.

EC824K1 Fld: 21D, 97K, 85I GRAI7809

Sep 76 252p

Monitor: 18

Abstract: Under U.S. Energy Research and Development Administration sponsorship, and as part of its transportation energy conservation activity, a special assessment of prospects for railroad-system use of hydrogen fuel was conducted in the summer of 1976. Based on contacts with railroad organizations and individuals in government, industry, and research organizations, the feasibility and desirability of converting conventional diesel-electric locomotives to hydrogen operation were evaluated. Such a step is shown to be technically feasible and would provide another alternative--in addition to hydrocarbon synthetic fuels and railway electrification--for moving U.S. railroad systems away from today's near total dependency on petroleum. Environmental benefits would also accrue. The study report provides (1) the overall rationale for developing hydrogen railroad motive power systems, (2) an assessment of technical feasibility, and (3) a nominal development and demonstration program plan. (ERA citation 03:007076)

Descriptors: *Hydrogen fuels, *Trains, Demonstration programs, Feasibility studies, Hydrogen storage, Planning, Propulsion, Railways, Technology assessment, Uses

Identifiers: ERDA/330800, ERDA/295000, ERDA/080600, NTIS DE

CONS/47(7-1 NTIS Prices: PC A12/MF A01

Technological Data Bases for Energy Storage

California Univ., Livermore. Lawrence Livermore Lab.*Energy Research and Development Administration. (9500007)

AUTHOR: Quick, I. M

EC653A4 Fld: 10A, SE, 970, 88B GRAI7807

23 Sep 77 11p

Rept No: CCNF-770955-1

Contract: W-7405-ENG-48

Monitor: 18

ERDA-information exchange meeting for thermal energy storage program, Gatlinburg, Tennessee, USA, 29 Sep 1977.

Abstract: The Data Management Group at the Lawrence Livermore Laboratory is conducting research leading to the creation of data bases for energy storage systems. These data bases are computer-based and will contain bibliographic information, material properties data, and data on essential criteria for energy storage systems. Access to these central files will be from remote terminals over computer networks and by telephone dial-up, in addition to the more conventional means of computer-generated reporting, and dissemination on magnetic tape. To validate the material properties data, a working agreement has been established between the Lawrence Livermore Laboratory (LLL) and the National Bureau of Standards (NBS). The Office of Standard Reference Data at NBS coordinates and monitors data evaluations by recognized data evaluation centers. One data request, for molten salts and molten salts systems (battery and thermal energy storage materials), has been completed and the data are being entered into a thermal energy storage (TES) and molten salts data bank. Other data requests for selected properties of metals and metal alloys (flywheel materials), composite materials (flywheel materials), solid electrolyte materials (battery materials), and metallic hydrides (hydrogen storage materials) are currently being worked by several data evaluation centers. A bibliographic data base for flywheel energy storage has been created and is currently in the process of publication. In addition, a comprehensive bibliography for molten salts and TES materials is in preparation. Preliminary computer printouts which demonstrate interactive aspects of the molten salts/TES material properties data base are part of this report. (ERA citation 03:006821)

Descriptors: *Electric batteries, *Flywheel energy storage, *Heat storage, *Hydrogen storage, Computers, Information systems

Identifiers: ERDA/250600, ERDA/250500, ERDA/250900, ERDA/080201, ERDA/290700, *Information centers, *Data processing, Fused salts, Metals, Composite materials, Energy storage, *Materials, Data bases, NTISIF

UCRL-80115 NTIS Prices: PC A02/MF A01

have

Hydrogen--Halogen Energy Storage System for Electric Utility Applications

Brookhaven National Lab., Upton, N.Y.*General Electric Co.,
Wilmington, Mass.*Energy Development Associates, Madison Heights,
Mich.*Energy Research and Development Administration. (0936000
9504174)

AUTHOR: Beaufriere, A.; Yeo, R. S.; Srinivasan, S.; McElroy, J.; Hart,
G.

EO623A1 Fld: 10E, 970 GRAI7807
1977 5p

Rept No: CCNF-770804-7

Contract: EY-76-C-02-0016

Monitr: 18

12. intersociety energy conversion engineering conference, Washington,
District of Columbia, United States of America (USA), 28 Aug 1977.

Abstract: A techno-economic assessment is made for a hydrogen-chlorine energy storage system for electric utility load leveling and peak shaving applications. The proposed system consists of a GE Solid Polymer Electrolyte Cell, metal hydride hydrogen storage, and liquid chlorine/hydrochloric acid storage subsystems. The electrochemical cell operates under high pressure, which facilitates both hydrogen uptake by the metal hydride and production of chlorine as a liquid in the cell. The waste heat from the cell is used for decomposition of the hydride to release the stored hydrogen. Experiments carried out to date show that it should be possible to attain overall efficiencies (electric to electric) higher than 70% at high power densities (at least a factor of 5 higher than that for advanced batteries). Since the electrochemical process is reversible, the reactants for chemical and electrical generation are stored outside the cell, this system appears quite suitable for electric energy storage applications in both peaking and load leveling cycles. (ERA citation 03:001057)

Descriptors: *Hydrogen fuel cells, *Off-peak energy storage, Chlorine, Cost, Economics, Efficiency, Electric power, Electrolytic cells, Feasibility studies, Hydrides, Hydrochloric acid, Hydrogen storage, Regenerative fuel cells

Identifiers: ERDA/300501, ERDA/300504, ERDA/250800, ERDA/200107, Assessments, NTISIE

ENL-22820 NTIS Prices: PC A02/MF A01

Hydrogen in the Energy System of the Netherlands, a Possibility for the Future

Nijverheidsorganisatie TNO, Apeldoorn (Netherlands). (4692300)

EO453C2 Fld: 10A, 97 GRAI7805

Sep 75 23p

Monitor: 18

U.S. Sales Only.

Abstract: The consequences of the shift from fossil to other energy sources to the extent that other resources are dominant were investigated. A scenario is presented on the rate at which, during the transition period, hydrogen can be introduced into the Dutch economy. Production, storage, transmission and distribution, environment and safety, and utilization in stationary units and vehicles are considered. It could be concluded that there are no serious objections in connection with the transition to the use of hydrogen as fuel. (EPA citation 02:058577)

Descriptors: *Hydrogen-based economy, *Netherlands, Distribution, Electroclysis, Energy supplies, Environmental effects, Hydrogen fuels, Hydrogen production, Hydrogen storage, Safety, Transport, Uses

Identifiers: ERDA/080000, Scenarios, NTISEFDAP

NP-21230 NTIS Prices: PC A02/MF A01

Alternative Forms of Energy Transmission from OTEC Plants

Institute of Gas Technology, Chicago, Ill. *Energy Research and Development Administration. (9500656)

AUTHOR: Konopka, A.; Biederman, M.; Talib, A.; Yudow, B.

E026314 Pld: 10A, 97N GFAI7803

1977 12p

Contract: EX-76-C-01-2426

Monitor: 18

Ocean thermal energy conversion conference, New Orleans, Louisiana, United States of America (USA), 22 Mar. 1977.

Abstract: The transmission of OTEC-derived chemical and electrical energy is compared. The chemical energy-carriers considered are the following: gaseous and liquid hydrogen, liquid ammonia, methanol, gasoline, hydrazine hydrate, anhydrous hydrazine, unsymmetrical dimethylhydrazine (UDME), 1,7-Octadiyne, and tetrahydrodicyclopentadiene. The assessment assumes that each of the above energy carriers were transported by barge and/or pipeline. The delivered costs were then compared with transmission of electricity by submarine cables. Because chemical and electrical energy are not equivalent, however, their comparison can only be done after the outputs are converted to a common form. Thus, in addition to presenting the delivered cost and overall energy efficiency of the chemical energy-carriers, we have provided a discussion of the equipment, costs, and efficiencies of converting the hydrogen and ammonia delivered into electricity, and the electricity delivered into hydrogen and ammonia. A concise technical assessment and economic analysis of components associated with the conversion, storage, transportation, and shore-based receiving facilities for the conversion of OTEC mechanical energy to chemical energy is provided and compared to the conversion and transmission of electrical power. Results concerning the hydrogen and ammonia analysis were determined as part of the OTEC program at IGT from May 1975 through May 1976 under Contract No. NSF-C1008 (AFR-75-00033) with the National Science Foundation and ERDA. Information concerning carbonaceous fuels and high-energy fuels production was developed as part of the current IGT OTEC program under Contract No. E(49-18)-2426 with ERDA. (EFA citation 02:056089)

Descriptors: *Energy transport, *Ocean thermal power plants, Alkynes, Ammonia, Comparative evaluations, Cost, Dienes, Economics, Efficiency, Electric power, Feasibility studies, Gasoline, Hydrazine, Hydrogen, Hydrogen production, Hydrogen storage, Methanol, Power transmission lines

Identifiers: ERDA/140800, ERDA/200300, ERDA/090000, ERDA/080000, NTISERDA

CONF-770331-5 NTIS Prices: PC A02/MF A01

Overview of Surface Related Problems in the Nuclear Energy Field

California Univ., Livermore. Lawrence Livermore Lab.*Energy Research
and Development Administration. (9500007)

AUTHOR: Colmenares, C. A.

EO104E2 Fld: 18E, 77H, 97Q GRAI7801

25 May 77 65

Contract: W-7405-ENG-48

Monitor: 18

Abstract: An extended set of viewgraphs used in a talk on surface-related problems in the nuclear energy field is assembled in this report. Materials problems in the areas of fission reactors, hydrogen storage, catalysis, nuclear weapons, bullets, and nuclear waste disposal and fuel reprocessing are included. The viewgraphs are reasonably self-contained; there is no text. 15 figures, 36 tables. (EPA citation 02:052470)

Descriptors: *Nuclear energy, Catalysis, Hydrogen storage, Lectures, Materials, Nuclear engineering, Nuclear weapons, Radioactive waste disposal, Reactors, Reprocessing, Surfaces

Identifiers: ERDA/360000, NTISEEDA

UCID-17941 NTIS Prices: PC A04/MF A01

Utilization of off-Peak Power to Produce Industrial Hydrogen. Final Report

Institute of Gas Technology, Chicago, Ill. (9500656)

AUTHOR: Biederman, N.; Darrow, K. Jr; Konopka, A.

EC092I2 EId: 21D, 7A, 97K, 99B GRAI78C1

Aug 75 193p

Monitor: 18

Abstract: This study of the use of off-peak electricity to produce industrial hydrogen was conducted to provide an analytical methodology for determining the economic and technical feasibility of using off-peak power to generate hydrogen that can then be sold to industry as a fuel or commodity. Such a scheme might represent an attractive use of off-peak power and could provide the first step toward building a hydrogen-energy system. This report comprises three major sections: (1) Market, which discusses the current and projected uses of hydrogen along with the likely market price situations. This section also presents briefly the market opportunities for oxygen. (2) Economics of Hydrogen Production, Storage, and Transportation, which provides the baseline data required for utilities to calculate a cost of electrolytic hydrogen for a specific situation and to compare that with the cost of alternative hydrogen production. This section likewise briefly addresses oxygen storage and transportation costs. (3) Methodology, which describes, via several specific examples, the methodology for calculating a hydrogen production cost and matching that with a likely market price. This section recognizes the uniqueness of individual utility situations and the necessity of providing the individual utility with the ability to perform its own analyses. (EPA citation 02:052071)

Descriptors: *Electric power, *Hydrogen production, *Hydrogen-based economy, *Industrial plants, *Off-peak energy storage, Commodities, Economics, Electrolysis, Fuels, Hydrogen, Industry, Market, Planning, Storage, Transport, Uses

Identifiers: ERIA/295000, ERDA/296000, ERDA/080101, ERDA/200107, Feasibility, Cost analysis, NTISERDAP

EPRI-320-1 NTIS Prices: PC A09/MF A01

Hydrogen-Via-Electricity: A Candidate Transitional Transportation Energy System Concept. Eta Report Pt-67

Energy Research and Development Administration, Washington, D.C. Div. of Transportation Energy Conservation. (9501446)

AUTHOR: Escher, W. J. I.

D2994E3 Fld: 21D, 97 GRAI7718

Sep 76 154

Rept No: TFC-77/001

Monitor: 18

Abstract: There is an expressed need to move transportation off oil. However, the strategic alternatives for creating a non-petroleum energy base for transportation are all long-term, extremely costly systems (hydrocarbon synfuels, electricity, hydrogen energy), each having technical and socio-economic limitations and constraints which will govern their relative contributions. To "preserve the options" while conducting positive steps to obviate the possibility of energy shortfalls affecting transportation in the meanwhile, a "transitional transportation energy" systems approach may be needed. A candidate concept, "Hydrogen-via-Electricity" (HVE), is described in terms of criteria for such a system, and also related to each of the strategic alternatives to establish compatibility. If implemented, the HVE Concept has the near-term potential for supporting a certain fraction of the energy needs of the following transportation subsectors: railroads, intercity trucking, urban and intercity buses, and selected fleet vehicle systems. (ERA citation 02:029068)

Descriptors: *Hydrogen fuels, *Transportation systems, Automotive fuels, Electrolysis, Hydrogen production, Hydrogen storage, Load management, Public utilities, Usa, Vehicles

Identifiers: ERDA/C80600, ERDA/295000, NTISERDA

ERDA-77-13 NTIS Prices: PC A08/MF A01

Novel Energy Sources Based on Utilization of Catalysts in Atomic Energy. Progress Report, June 1, 1975--May 15, 1976 .

Princeton Univ., N.J.*Energy Research and Development Administration.
(5300000)

AUTHOR: Turkevich, J.

D2914J3 Fld: 21L, 7L, 97K, 99F GRAI7717

May 76 15p

Contract: E(11-1)-3029

Monitor: 18

Abstract: A program of conserving energy by more efficient use of catalysts and developing novel sources of energy consisted in the preparation for this purpose of monodisperse platinum, palladium, platinum-gold and platinum-palladium alloys in colloidal aqueous solution. These were characterized by optical absorption, ultracentrifugation, high-resolution electron microscopy and catalytic activity for hydrogen peroxide decomposition. The colloidal metal or alloy catalysts were mounted on plate like alumina and characterized by electron microscopy, electron diffraction, chemisorption of hydrogen, number of active sites in hydrogenation of ethylene as determined by poison titration and the activity per site for ethylene and benzene hydrogenations. It was shown that for particles down to 19A diameter the platinum had metallic character and all surface sites had equal catalytic activity. In the case of palladium the activity per site was four times that of platinum. Alloying of small amounts of gold increased the activity of the platinum or endowed catalytic activity to gold. Storage of hydrogen atoms (generated in the gas phase) in the fluoride lattice of calcium fluoride was investigated as a novel form of energy storage. (ERA citation 02:030371)

Descriptors: *Catalysts, *Hydrogen storage, Aqueous solutions, Calcium fluorides, Catalytic effects, Chemical preparation, Gold alloys, Palladium, Palladium alloys, Platinum, Platinum alloys, Research programs

Identifiers: ERDA/400201, ERDA/C80200, NTISERDA

COO-3029-15 NTIS Prices: PC A02/MF A01

Lean Combustion in Automotive Engines: An Assessment of the Addition of Hydrogen to Gasoline as Compared to Other Techniques

Aerospace Corp., El Segundo, Calif.*Energy Research and Development Administration. (0069000)
D2914A4 Pld: 21D, 21G, 97K, 81J GRAI7717
Feb 76 234p
Contract: E (C4-3) - 1101-PHA-3
Monitor: 18

Abstract: An examination was made of the feasibility, practicability, performance, fuel economy, and emissions of the concept of the addition of hydrogen to gasoline for use as an automobile fuel. The specific hydrogen addition concepts evaluated included onboard storage of hydrogen as a bottled gas, as a cryogenic liquid, and as a regenerable gas in a metal hydride storage system, and the onboard generation of hydrogen by the reformation of gasoline in a fuel reformer (or gas generator). Both partial oxidation and steam reforming fuel reformers were considered. For perspective, comparisons were made of the hydrogen addition concept with the conventional spark ignition engine baseline and other lean engine concepts, e.g., advanced lean carbureted engines and stratified charge engines. Hydrogen addition via fuel reformation was found to be a feasible method of achieving ultralean engine operation. (ERA citation 02:030202)

Descriptors: *Automobiles, *Automotive fuels, *Hydrogen fuels, Carbon monoxide, Combustion products, Comparative evaluations, Energy conservation, Feasibility studies, Fuel economy, Gasoline, Hydrocarbons, Hydrogen storage, Mixing, Nitrogen oxides, Performance testing, Spark ignition engines, Stratified charge engines, Uses

Identifiers: ERDA/330800, ERDA/080600, ERDA/330701, ERDA/330702, ERDA/330704, NTISERDA

CONS/1101-1 NTIS Prices: PC A11/MF A01

Hydrogen Energy. A Bibliography with Abstracts

New Mexico Univ., Albuquerque. Technology Application Center.

Quarterly repts.

E2875E4 Fld: 21D, 10A, 97K d7717

1975 4 issues

Monitor: 18

(PC A00)

Paper copy available on subscription, North American Continent price \$50.00/year; single copy price PC\$15.00, MF\$15.00; all others write for quote.

Abstract: The Hydrogen Energy Quarterly Update is a bibliographic series that contains citations and abstracts from over 7000 different sources devoted to hydrogen as a synthetic fuel or energy carrier. Foreign and domestic publications are cited, abstracted and indexed. The series provides current awareness to those interested in hydrogen energy. For easy reference the Hydrogen Energy Quarterly is divided into five sections: general, production, utilization, combustion, transmission, distribution and storage, and safety.

Descriptors: *Energy, *Hydrogen, *Bibliographies, Gas production, Utilization, Transportation, Distribution systems, Gas storage, Fire safety, Manufactured gas, Electrolysis, Photolysis, Photosynthesis, Dehydrogenation, Cryogenics, Embrittlement, Abstracts

Identifiers: NTISNHNCI

NTISOE/A/023 NTIS Prices: Subscription

Hydrogen Energy. A Bibliography with Abstracts

New Mexico Univ., Albuquerque. Technology Application Center.

Quarterly repts.

D2782E2 Fld: 21D, 97K* GRAI7716

1976 4 issues*

Monitor: 18

(PC ACC)

Paper copy available on subscription, North American Continent price \$50.00/year; single copy price PC\$15.00, MF\$15.00; all others write for quote.

Abstract: The Hydrogen Energy Quarterly Update is a bibliographic series that contains citations and abstracts from over 7000 different sources devoted to hydrogen as a synthetic fuel or energy carrier. Foreign and domestic publications are cited, abstracted and indexed. The series provides current awareness to those interested in hydrogen energy. For easy reference the Hydrogen Energy Quarterly is divided into five sections: general, production, utilization, combustion, transmission, distribution and storage, and safety. Author, corporate source, title and keyword indexes are included for easy access. A current and historic file of documents containing essentially all articles and publications referenced in the series is maintained at the Technology Application Center.

Descriptors: *Bibliographies, *Hydrogen, Hydrogen fuels, Hydrides, Production, Utilization, Transmission, Distribution, Fuel storage, Safety, Abstracts

Identifiers: NTISTAC

NTISUE/E/023 NTIS Prices: Subscription

Modification Techniques and Performance Characteristics of Hydrogen
(Powered IC Engines) State of the ART, 1975

Idaho National Engineering Lab., Idaho Falls.*Energy Research and
Development Administration. (9502158)

AUTHOR: Simpson, F. B.; Icfthouse, J. H.; Swope, D. R.; Woolley, E. L.
I2684E1 Fld: 21D, 21G, 97K, 81J GFAI7715

Sep 76 26p

Contract: E(10-1)-1375

Monitor: 18

Abstract: Over the past quarter of a century there has been a significant amount of work on modification of internal combustion (IC) engines to operate on hydrogen. However, comparisons are difficult because of large variation in designs, engine parameters, and test conditions. A comparative summary of the recent work on hydrogen-powered engines is presented under a unifying format. This summary includes material extracted from published reports and obtained by private communication. It is intended that this survey be of value to those beginning work in the field, and will provide some guidance in determining the direction of future research. Included are the following: engine parameters, modifications, operating conditions, running characteristics, performance, and related comments. More detailed discussion is included on the manpower and material costs associated with the modification of one of the engines listed. (EPA citation 02:022793)

Descriptors: *Hydrogen fuels, *Internal combustion engines, Cost, Design, Hydrogen storage, Modifications, Operation, Performance, Reviews, Technology assessment, Uses

Identifiers: ERDA/330800, ERDA/080600, NII SERDA

ANCR-1302 NII Prices: PC A03/MF A01

Desulfurization and Refining of Gasoline and Jet Fuel by Means of Surface-Active Agents in a Fluidized Bed

Foreign Technology Div Wright-Patterson AFB Ohio (141 600)

Edited translation

AUTHOR: Werner, K.

E2205C2 Fld: 21D d7712

30 Sep 66 15p

Rept No: FTD-TT-65-1343

Monitor: 18

Trans. of Academia Scientiarum Hungaricae, Acta Chimica v36 n1 p289-298.

Distribution limitation now removed.

Abstract: Investigations with regard to the simultaneous removal of S, O, and N compounds from low-boiling hydrocarbons by means of treatment with surface-active agents are reported on. It is shown that the application of fluidization techniques results in considerable advantages over other known processes. The experiments were carried out without the use of additional hydrogen at temperatures above the boiling temperatures of the feed fractions. A great variety of adsorbents and adsorbents mixtures was tested. It was found that the phenolic and basic components could be removed with considerably greater ease than in the known medium-pressure refining processes. Desulfurization amounted to approximately 80% in the experiments, which were conducted under normal pressure, the so-called aggressive sulfur compounds, in their turn, being removed almost quantitatively. In conclusion, a report is given on the development of a continuous pilot plant for about 20 kg feed/hour, which is operated according to the principles of fluidization both in its refining and regeneration sections. Experimental results from this plant are given. (Author)

Descriptors: (*Jet engine fuels, Purification), (*Purification, Fluidized bed processes), Surface active substances, Hydrocarbons, Sulfur compounds, Oxygen, Nitrogen, Corrosion, Storage, Stability, Hydrogen, Processing, Decomposition, Pyrolysis, Thermal stability, Gasoline, Adsorption, Cyclohexanes, Sulfides

Identifiers: Translations, NTISDCDXD

AD-803 832/5ST NTIS Prices: PC A02/MF A01

Assessment of Energy Storage Systems Suitable for Use by Electric Utilities. Final Report

Public Service Electric and Gas Co., Newark, N.J.*Energy Research and Development Administration. (5336000)

E2261J2 Fld: 10B, 97I GRAI7712

Jul 76 40p

Contract: E(11-1)-2501, EPRI-PRJ-225

Monitor: 18

Available from ERLA, P.O. Box 62, Oak Ridge, TN 37830, Attn: TIC.

Abstract: This is the final report of "An Assessment of Energy Storage Systems Suitable for Use by Electric Utilities." It is separated into three volumes: Vol. 1 contains the Executive Summary and Chapter 1, Overall Summary of Assessment; Vol. 2 contains Chapters 2 through 7 and associated appendices, the essential elements of the report; Vol. 3 is a separate topical report on hydro pumped storage. Selected material from Vol. 3 is included in Vol. 2. The systems include thermal, hydro pumped, compressed air, flywheel, electric batteries, hydrogen, and superconducting magnetic. (ERA citation 02:017390)

Descriptors: *Off-peak energy storage, *Public utilities, Electric batteries, Electric power, Feasibility studies, Flywheel energy storage, Heat storage, Hydrogen storage, Pumped storage, Superconducting magnets

Identifiers: ERDA/250000, ERDA/C80200, ERDA/200100, *Electric utilities, NTISEFDA

EPRI-EM-264 (V.1) NTIS Prices: Not available NTIS

Hydrogen- Jp-4 Dual Fuel Concept for the C-5A Aircraft

Air Force AERO Propulsion Lab Wright-Patterson AFB Ohio (011 570)

Technical rept.

Elrod, Charles W., Botteri, Benito P., Kelly, Larry G., Paulson, Allen M., Quinn, Gordon F.

D2044B1 Fld: 21D d7711

Sep 66 67p

Rept No: AFAPL-TR-66-54

Monitor: 18

Distribution limitation now removed.

Abstract: This volume limitation aspects of hydrogen have precluded its use in subsonic aircraft. The possible inclusion of the C-5A aircraft in the Air Force inventory has aroused new interest in the application of hydrogen to a normally hydrocarbon-fueled aircraft. This report presents an over-all evaluation of the safety, ground handling, tankage, and use aspects of the dual use of hydrogen and JP-4 fuel. The report shows that the possibility of the dual-fuel concept for this aircraft definitely exists; the potential payoff may be doubtful, but the feasibility exists. An increase in range is possible, but some problems exist with the use of hydrogen. Redesign and care in handling would resolve most problems. (Author)

Descriptors: (*Jet engine fuels, *Hydrogen), Safety, Ignition, Hydrocarbons, Flammability, Liquefied gases, Storage tanks, Isocyanate plastics, Handling, Aircraft, Heat of combustion, Subsonic characteristics

Identifiers: C-5a aircraft, Jp-4 fuel, NTISDODXD

AD-806 811/6ST NTIS Prices: PC A04/MF A01

Is Hydrogen Safe

National Bureau of Standards, Boulder, Colo. Cryogenics Div. (400 992)

Technical note

Hord, J.

D1644D1 Fld: 21D, 13L, 7A, 97K*, 99B*, 86V GRAI7708

Oct 76 42p*

Rept No: NBS-TN-690

Project: NBS-2750900

Monitor: 18

Abstract: The safety aspects of hydrogen are systematically examined and compared with those of methane and gasoline. Physical and chemical property data for all three fuels are compiled and used to provide a basis for comparing the various safety features of the three fuels. Each fuel is examined to evaluate its fire hazard, fire damage, explosive hazard and explosive damage characteristics. The fire characteristics of hydrogen, methane and gasoline, while different, do not largely favor the preferred use of any one of the three fuels; however, the threat of fuel-air explosions in confined spaces is greatest for hydrogen. Gasoline is believed to be the easiest and perhaps the safest fuel to store because of its lower volatility and narrower flammable and detonable limits. It is concluded that all three fuels can be safely stored and used; however, the level of safety risk for each fuel will vary from one application to another. Generalized safety comparisons are made herein but detailed safety analyses will be required to establish the relative safety of different fuels for each specific fuel application and stipulated accident. The technical data supplied in this paper will provide much of the framework for such analyses. Hydrogen safety guidelines, regulatory codes applicable to the distribution of hydrogen, and safety criteria for liquid hydrogen storage are compiled and presented.

Descriptors: *Liquid hydrogen, *Safety, Fuel storage, Methane, Gasoline, Comparisons, Physical properties, Chemical properties, Fire hazards, Flammability, Forecasting, Manufactured gas

Identifiers: Air fuel ratio, *Hydrogen fuels, Hydrogen storage, NTISCOMNBS

PB-262 551/5ST NTIS Prices: PC A03/MF A01

Liquid Hydrogen Storage Parameters for a Lunar Voyage

General Dynamics/Astronautics San Diego Calif (147 550)

Love, Charles C. Jr

D1601G4 Fld: 21I, 22A, 13D d7708

29 Aug 60 36p

Rept No: GDA-AE600848

Monitor: 18

Report on Symposium on Ballistic Missile and Space Technology (5th).
Distribution limitation now removed.

Abstract: A preliminary design analysis of the lunar voyage heat loads to a liquid hydrogen tank and of methods for minimizing hydrogen boil-off loss due to these heat loads is presented. The elements of space and lunar heating and the use of insulation for reduction of heat loads and extension of storage time are evaluated for typical hydrogen tanks. The derived data of boil-off and storage time are shown as a function of the insulation conduction parameter (k/l). Radical methods for negating boil-off losses including thermoelectric cooling and hydrogen solidification are also examined. (Author)

Descriptors: (*Cryogenic propellants, Storage), (*Lunar environment, Cryogenic propellants), Lunar probes, Liquefied gases, Hydrogen, Propellant tanks, Thermodynamics, Thermal insulation, Thermal conductivity, Solar radiation, Cooling, Thermoelectricity

Identifiers: Boiloff, NTISDODXD

AD-829 050/4ST NTIS Prices: PC A03/MF A01

Hydrogen Economy: Its Potential Promises and Problems

California Univ., Livermore Lawrence Livermore Lab. (9500007)

Sauter, G. D.

C7231D4 Fld: 21D, 7A, 97G, 97H, 99B ERA0100

31 Dec 75 10p

Rept No: CONF-760304-2

Contract: W-7405-Eng-48

Monitor: 18

World hydrogen energy conference, Miami Beach, Florida, United States of America (USA), 1 Mar 1976

Abstract: In recent years a number of new energy technologies have been proposed for development on a large, commercial scale. Among these are solar power, nuclear fission, nuclear fusion, geothermal power, and wind power. Hydrogen energy also has its proponents. It differs from the others mentioned inasmuch as the others represent primary sources of energy, while hydrogen represents a means for facilitating the transmission, storage, and utilization of energy which potentially can be coupled to a variety of primary sources. It is not clear what role, if any, these various technologies will play in the emerging energy scene. It is clear that no single technology will be "the" answer to the growing energy problem. For the foreseeable future, proponents of the hydrogen energy concept will be in competition for limited energy research and development funds with proponents of other energy technologies. To be successful in obtaining support, it will be necessary for them to carefully and completely develop and publicize a valid, rational, and even compelling case for the hydrogen energy concept, a case that clearly delineates not only those areas where hydrogen appears to have an advantage over competing technologies but also those for which hydrogen may not be the best answer. (ERA citation 01:010374).

Descriptors: *Hydrogen-based economy, Electrolysis, Environmental effects, Hydrogen production, Hydrogen storage, Partial oxidation processes, Pipelines, Safety, Steam reformer processes, Transport, Uses

Identifiers: ERDA/080000, ERDA/295000, NTISERDA

UCRL-76850 NTIS Prices: PC\$3.50/MF\$3.00

Hydrogen Fuels: A Bibliography

Energy Research and Development Administration, Oak Ridge, Tenn.
Technical Information Center. (9500788)
C7225G1 Fld: 21D, 7A, 97H*, 99B* ERA0100
Feb 76 484p*
Monitor: 18

Abstract: The bibliography comprises 4544 citations on the production, storage, transport, marketing and economics, safety, industrial and commercial use, and properties of hydrogen. (ERA citation 01:010375)

Descriptors: *Hydrogen fuels, *Hydrogen production, *Hydrogen storage, *Bibliographies, Economics, Market, Safety, Transport, Uses

Identifiers: ERDA/080100, ERDA/C80200, NTISERDA

TID-3358 NTIS Prices: PC\$12.50/MF\$3.00

Production and Utilization of Alternative Secondary Energy Carriers
Erzeugung und Nutzbarmachung von Alternativen Sekundaerenergietraegern

Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt,
Lampoldshausen (West Germany). Inst. fuer Chemische Paketantriebe.
Nitsch, J.

C7075D3 Fld: 21D, 10A STAR1415

24 Apr 75 34p

Rept No: DLR-IB-456-75/5

Monitor: 18

Language in German.

Abstract: Planned projects are outlined. Hydrogen, the most promising and most universal energy carrier, is used as an example. Primary activities considered are: investigation of combined thermochemical-electrolytical cycling processes, storage of hydrogen in low temperature absorbers and hydrogen-oxygen fed cycling process for energy storage and peak current generation. Supplementary activities are: the hydrogen aircraft, investigations of the liquid hydrogen tank/engine in an automobile, and safety investigations with hydrogen. Planned research in the fields of alcohols and mineral oil processing is mentioned.

Descriptors: *Alcohols, *Energy technology, *Hydrogen, *Mineral oils, Absorbers (Equipment), Aircraft fuels, Automobile fuels, Energy storage, Hydrogen peroxide, Production engineering, Project planning, Safety

Identifiers: Automotive fuels, West Germany, NTISNASAE

N76-24726/1ST NTIS Prices: PC\$4.00/MF\$2.25

Hydrogen as Energy Carrier. Future Possibilities in the Netherlands
Waterstof als Energiedrager, Toekomstige Mogelijkheden in Nederland

Organization for Industrial Research, TNO, The Hague (Netherlands).
C7075C4 Fld: 21D, 10A STAR1415
Sep 75 281p
Monitor: 18
Language in Dutch.

Abstract: The application of hydrogen as carrier for thermal energy, produced by new energy sources such as nuclear reactors and wind and solar energy generators, is discussed. Topics dealt with include production, storage, transport and distribution of hydrogen, aspects of location bound use, application in transport vehicles, environmental and safety aspects, and problems in introducing hydrogen. Conclusions and recommendations for each of these topics are given and, as a general conclusion, there are thought to be wide perspectives for the use of hydrogen as carrier in the energy supply in the Netherlands. The technological problems are considered surmountable.

Descriptors: *Energy transfer, *Hydrogen, Netherlands, Energy policy, Energy requirements, Energy storage, Environmental control, Production engineering, Safety factors, Transportation

Identifiers: Hydrogen production, Heat transfer, NTISNASAE

N76-24723/8ST NTIS Prices: PC\$9.25/MF\$2.25

Hydrogen as Energy Carrier. Future Possibilities in the Netherlands. A Summary Toekomstige Mogelijkheden van Waterstof als Energiedrager in Nederland. Beknopt Overzicht

Organization for Industrial Research, TNO, The Hague (Netherlands).

C7075C3 Fld: 21D, 10A STAR1415

Sep 75 41p

Monitor: 18

Language in Dutch.

Abstract: The application of hydrogen as carrier for thermal energy, as discussed in the full report is summarized, with emphasis on production, storage, transport, and distribution of hydrogen, location bound utilization, application in transport vehicles, environment, and safety.

Descriptors: *Energy transfer, *Hydrogen, Netherlands, Energy policy, Energy requirements, Energy storage, Environmental control, Production engineering, Safety factors, Transportation

Identifiers: Hydrogen production, Heat transfer, NTISNASAE

N76-24722/OST NTIS Prices: PC\$4.00/MF\$2.25

Recovery of Hydrogen Liquefaction Energy

National Bureau of Standards, Boulder, Colo. Cryogenics Div. (400 002)

Final rept.

Parrish, William R.

C6733G3 Fld: 21D, 97D, 86V GRAI7615

1975 6p

Project: NBS-2750154

Monitor: 18

Pub. in Proceedings of Conference on Intersociety Energy Conversion Engineering (10th), Newark, Delaware, Aug. 18-22, 1975, IECEC '75 Record, p1352-1355 1975.

Abstract: Liquid storage is an attractive means for storing the large quantities of synthetic hydrogen that will be needed in the future. However, the actual energy required for liquefaction is roughly 30 percent of hydrogen's lower heating value. This paper considers some ways of recovering part of the liquefaction energy. The emphasis is on utility applications. Results show that it is technically feasible to recover 25 to 50 percent of the actual liquefaction energy if a MHD generator is used; recovery factors of approximately 18 percent could be obtained with gas turbines and lower recovery factors of 8 to 20 percent are possible if fuel cells are used. This energy recovery has the net effect of lowering the required liquefaction energy which makes liquid a more attractive means of storage.

Descriptors: *Liquid hydrogen, Liquefaction, Storage, Energy storage, Electric power generation, Fuel cells, Materials recovery, Gas turbine power generation, Laboratory equipment, Liquefiers

Identifiers: *Hydrogen storage, Hydrogen fuels, Synthetic fuels, MHD generators, NTISCOMNBS

PB-252 393/4ST NTIS Prices: PC\$3.50/MF\$2.25

Atomic Hydrogen Storage Method and Apparatus

National Aeronautics and Space Administration. Lewis Research Center,
Cleveland, Ohio.

Patent Application.

Woolam, J. A.

C691111 Fld: 21D, 19A, 90B, 97H, 79A STAR1413

Filed 13 Apr 76 10p

Rept No: PAT-APPL-676 432, NASA-CASE-LEW-12081-1

Monitor: 18

This Government-owned invention available for U.S. licensing and,
possibly, for foreign licensing. Copy of application available NTIS.

Abstract: Atomic hydrogen, for use as a fuel or as an explosive, is stored in the presence of a strong magnetic field in exfoliated layered compounds such as molybdenum disulfide or an elemental layer material such as graphite. The compound is maintained at liquid helium temperatures and the atomic hydrogen is collected on the surfaces of the layered compound which are exposed during delamination (exfoliation). The strong magnetic field and the low temperature combine to prevent the atoms of hydrogen from recombining to form molecules.

Descriptors: *Hydrogen fuels, *Magnetic fields, *Storage stability,
*Patent applications, Graphite, Low temperature, Molybdenum disulfides

Identifiers: Hydrogen storage, Explosives, Cryogenics, NTISNASA

N76-22399/9ST NTIS Prices: PC\$3.50/MF\$2.25

Study of Automotive Storage of Hydrogen Using Recyclable Liquid
Chemical Carriers

Exxon Research and Engineering Co., Linden, N.J. Government Research
Lab. (9501227)

Sultan, O., Shaw, H.

C6621H3 Fld: 21D, 07D, 97H, 99 ERA0105

Jun 75 102p

Contract: 68-02-2135

Monitor: 18

Abstract: The catalytic dehydrogenation of naphthenes to their corresponding aromatic compounds was evaluated as a specific non-cryogenic approach for the on-board recovery of hydrogen for use as an automotive fuel. The dehydrogenation of methylcyclohexane (MCH) to toluene was used in this study as representative of the contemplated storage system. Although not evaluated in detail, it was assumed that by-product toluene would be recycled to a central hydrogenation facility to regenerate the MCH. Thus, in principle, MCH would not be consumed, but would act as a hydrogen storage medium. It was concluded, based on literature information, thermodynamic and kinetic analyses, engineering considerations, and cost estimates that this method of hydrogen storage does not compare favorably with gasoline fueled automobiles. Approximately 16 times more volume of MCH than gasoline would be needed for the same mileage range, thus severely curtailing the range of an automobile with a reasonably sized MCH tank. In addition, an unreasonable amount of time (in excess of 20 minutes) would be needed to bring the dehydrogenation catalyst to operating temperature (589 exp 0 K) from a cold start. Other factors that make the system appear unfavorable when compared to present automobiles are excessive system weight, high cost, and general inflexibility. No detailed comparisons were made of the MCH/hydrogen storage system with other automotive hydrogen storage systems or other automotive propulsion systems.

Descriptors: (*Automobiles, Hydrogen fuels), (*Hydrogen fuels, *Storage), (*Automotive fuels, Storage), (*Hydrogen storage, Feasibility studies), *Dehydrogenation, Comparative evaluations, Cost, Cycloalkanes, Engineering, Gasoline, Thermodynamics

Identifiers: ERDA/330800, Cyclohexane/methyl, NTISERDA

TEC-75/003 NTIS Prices: PC\$5.50/MF\$2.25

Energy Transfer and Energy Storage

Heinz, W.

C6611H1 Fld: 09A, 10C, 97E, 97D ERA0105

1974 21p

Monitor: 18

Translation of VDI--208.

Abstract: The increasing consumption of electrical energy together with the growing proportion of nuclear energy as a primary energy source require new concepts both with respect to energy transfer as well as energy storage. Research on the use of low temperature technology is reported. Other advanced transfer and storage systems are compared.

Descriptors: (*Power transmission, Cryogenic cables), (*Cryogenic cables, Cost), Comparative evaluations, Cooling, Design, Efficiency, Electric power, Energy storage, German federal republic, Hydrogen, Nuclear power plants, Performance, Power demand, Power generation, Power transmission lines, Pumped storage, Reliability, Superconducting cables, Superconductors, Transport

Identifiers: ERDA/250000, ERDA/200300, Translations, NTISERDA

ERDA-tr-83 NTIS Prices: PC\$3.50/MF\$2.25

United States Lppsd Technical Information Exchange Document No. 2. A
Summary Report of the Automotive Power Systems Contractors
Coordination Meeting, Ann Arbor, Michigan, May 13--16, 1974

Environmental Protection Agency, Ann Arbor, Mich. Alternative
Automotive Power Systems Div. (9501200)
C6044A2 Fld: 13F, 21G, 21D, 85B, 68A, 81J ERA7507
1974 371p
Monitor: 18

Abstract: In an effort to promote the maximum rate of technical progress toward clean air objectives, the Alternative Automotive Power Systems Division holds periodic coordination and progress meetings with all of its contractors, staff, consultants, prospective contractors, and selected guests. The meetings focus attention on the status of the programs and provides an opportunity for interaction between the participants on problem areas of mutual interest. The presentations and discussions at the seventh such meeting held on May 13-16, 1974, in Ann Arbor, Michigan are summarized, including: (1) the key issues under consideration in the AAPS Division; (2) the Gas Turbine Engine Program; (3) the Rankine Cycle Engine Programs; (4) the Diesel Engine Study, Alternative Fuel Investigations, Combustion Studies, Electric Vehicle Impact Study, and Hydrogen Storage Investigations. Wherever possible specific data, principle conclusions, and key illustrations are included. Additional supplementary material contained in the appendices include explanatory notes on the AAPS Division in the EPA organization (Appendix A), a list of attendees and representatives (Appendix B), a review of the background and evolution of the new EPA Highway Test Cycle (Appendix C), a final report on the health hazards of nickel oxide regenerator seal materials (Appendix D), and a bibliography of AAPSD reports released through May 1974 (Appendix E).

Descriptors: (*Automobiles, *Diesel engines), (*Environmental protection agency, *Research programs), Automotive fuels, Bibliographies, Combustion, Electric-powered vehicles, Exhaust gases, Federal driving cycle, Gas turbines, Health hazards, Hydrogen storage, Nickel compounds, Rankine cycle engines

Identifiers: ERDA/330102, ERDA/330103, ERDA/330202, ERDA/320203, ERDA/330300, NTISEPAG, NTISERDA

CONF-740543- NTIS Prices: PC\$10.50/MF\$2.25

Hydrogen Energy Economy

USAEC, Washington, D.C. (6549500)
A7241L1 Fld: 21D, 10A, 97G ERA7503
11 Nov 74 26p
Monitor: 18

Abstract: For abstract, see ERA 75 03, number 00338.

Descriptors: *Hydrogen fuels, *Hydrogen-based economy, Energy transmission, Hydrogen production, Hydrogen storage, Research programs

Identifiers: ERDA/080000, NTISEEDA

TID-26757 NTIS Prices: PC\$4.00/MF\$2.25

ABSTRACT:

Research and development programs related to the technologies required if hydrogen energy delivery systems were to be introduced into the United States energy economy are considered.

On the Trail of New Fuels: Alternative Fuels for Motor Vehicles
C6333E3 FLD: 21D, 07A, 97H, 99B NSA0101
1974 395p

MONITOR: 18

Translation of pp 1-282 from Neuen kraftstoffen auf der spur:
alternative kraftstoffe fuer kraftfahrzeuge.

ABSTRACT: A study is presented of motor vehicle alternate fuels which will alleviate the pollution and supply problems presented by the use of gasoline. Topics include: (1) an index of researchers; (2) properties of methanol and methyl fuel; (3) availability of the raw materials; (4) production of methanol; (5) ocean transport, storage, and inland distribution; (6) vehicle requirements and safety problems; (7) methanol operation of conventional vehicles; (8) methanol operation of other propulsion systems; (9) fuel cells and gas generators; and (10) a list of references. Likely prospects for alternate fuels are methanol in the short and intermediate term and hydrogen in the long term. For both these fuels, the manufacture does not depend on oil, combustion engines of known construction can be used, and these fuels can be substituted for gasoline in steps.

DESCRIPTORS: (*Automotive fuels, Comparative evaluations), *Hydrogen fuels, *Methanol, Automobiles, Engines, Exhaust gases, Fuel cells, Physical properties, Production, Resources, Safety, Storage, Transport, Vehicles

IDENTIFIERS: ERDA/330800, ERDA/080600, ERDA/090200, ERDA/300504,
NTISERDA

UCRL-Trans-10879 NTIS Prices: PC\$10.75/MF\$2.25

United States Lppsd Technical Information Exchange Document No. 2. A Summary Report of the Automotive Power Systems Contractors Coordination Meeting, Ann Arbor, Michigan, May 13--16, 1974

Environmental Protection Agency, Ann Arbor, Mich. Alternative Automotive Power Systems Div. (9501200)
C6044A2 FLD: 13F, 21G, 21D, 85B, 68A, 81J NSA7507
1974 371p
MONITOR: 18

ABSTRACT: In an effort to promote the maximum rate of technical progress toward clean air objectives, the Alternative Automotive Power Systems Division holds periodic coordination and progress meetings with all of its contractors, staff, consultants, prospective contractors, and selected guests. The meetings focus attention on the status of the programs and provides an opportunity for interaction between the participants on problem areas of mutual interest. The presentations and discussions at the seventh such meeting held on May 13-16, 1974, in Ann Arbor, Michigan are summarized, including: (1) the key issues under consideration in the AAPS Division; (2) the Gas Turbine Engine Program; (3) the Rankine Cycle Engine Programs; (4) the Diesel Engine Study, Alternative Fuel Investigations, Combustion Studies, Electric Vehicle Impact Study, and Hydrogen Storage Investigations. Wherever possible specific data, principle conclusions, and key illustrations are included. Additional supplementary material contained in the appendices include explanatory notes on the AAPS Division in the EPA organization (Appendix A), a list of attendees and representatives (Appendix B), a review of the background and evolution of the new EPA Highway Test Cycle (Appendix C), a final report on the health hazards of nickel oxide regenerator seal materials (Appendix D), and a bibliography of AAPSD reports released through May 1974 (Appendix E).

DESCRIPTORS: (*Automobiles, *Diesel engines), (*Environmental protection agency, *Research programs), Automotive fuels, Bibliographies, Combustion, Electric-powered vehicles, Exhaust gases, Federal driving cycle, Gas turbines, Health hazards, Hydrogen storage, Nickel compounds, Rankine cycle engines

IDENTIFIERS: ERDA/330102, ERDA/330103, ERDA/330202, ERDA/320203, ERDA/330300, NTISEPAG, NTISERDA

CONF-740543- NTIS Prices: PC\$10.50/MF\$2.25

Systems Study of Two Synthetic Transportation Fuel Options

Brookhaven National Lab., Upton, N.Y. (0936000)

AUTHOR: Sevian, W. A.

C6043J4 FLD: 21D, 97H, 97B, 85 NSA7507

1974 10p

REPT NO: CONF-741013-4

MONITOR: 18

ABSTRACT: The following fuel options are presented for detailed analyses of their potential resource, environmental, and economic impacts on the future development of the transportation sector of the nation's energy system: (a) hydrogen, generated with available off-peak electricity, or produced from coal; and (b) methane, produced from coal. For the purpose of evaluating the potential impact of these options on the energy system, attention was directed toward the year 2000. The extent to which hydrogen produced with off-peak power can be exploited is limited by the central station electric capacity forecast for the year 2000. The projected availability of off-peak electricity for hydrogen generation should be considered an optimistic upper bound for the actual availability. The amount of hydrogen and methane produced from coal is set at this same limit so that the two cases may be reasonably compared.

DESCRIPTORS: (*Methane, Production), (*Transportation systems, *Environmental effects), (*Hydrogen, *Demand factors), (*Synthetic fuels, Production), Economics, Flowsheets, Market, Off-peak energy storage, Storage, Systems analysis

IDENTIFIERS: ERDA/090100, ERDA/080600, ERDA/320200, ERDA/010500, *Manufactured gas, Forecasting, NTISERDA

BNL-20017 NTIS Prices: PC\$3.50/MP\$2.25

Cryogenics and the Energy Crisis

National Bureau of Standards, Washington, D.C. (240 800)

Final rept.

AUTHOR: Birmingham, B. W., Smith, C. N.

C5944C3 FLD: 10A, 86V USGRDR7606

Mar 75 4p

PROJECT: NBS-2700915

MONITOR: 18

Pub. in Cryogenics, v15 n3 p115-118 Mar 75.

ABSTRACT: This paper reviews some of the ways cryogenics can help solve the energy crisis. Five specific areas are covered: the use of LNG, the conversion of coal to fuel gas using oxygen from air separation plants, the use of superconductors in power plants and electrical transmission lines, superconducting instruments for geophysical exploration of new energy resources, and the hydrogen economy.

DESCRIPTORS: *Cryogenics, Energy shortages, Liquefied natural gas, Coal gasification, Superconductors, Superconductivity, Hydrogen based economy, Energy technology, Technology assessment, Reprint

IDENTIFIERS: *Energy crisis, Reprints, NTISCOMNBS

PB-248 560/5ST NTIS Prices: Not available NTIS

Utilization of Off-Peak Power to Produce Industrial Hydrogen

Institute of Gas Technology, Chicago, Ill.*Electric Power Research
Inst., Palo Alto, Calif. (181 350)

Final rept.

AUTHOR: Biederman, N., Darrow, K. Jr, Konopka, A.
C5802H4 FLD: 21D, 07A, 10A, 97H*, 99B* USGRDR7604
Aug 75 195p*
PROJECT: IGT-8793, EPRI-320
MONITOR: EPRI-320-1-FR

ABSTRACT: This study of the use of off-peak electricity to produce industrial hydrogen was conducted to provide an analytical methodology for determining the economic and technical feasibility of using off-peak power to generate hydrogen that can then be sold to industry as a fuel or commodity. Such a scheme might represent an attractive use of off-peak power and could provide the first step toward building a hydrogen-energy system. This report concentrates on those specialty markets that seem most susceptible to the use of off-peak-produced hydrogen, evaluates in more depth the economics of electrolytic hydrogen production, provides a techno-economic discussion of hydrogen storage and transportation, and demonstrates the methodology by which a utility can initially evaluate the possibilities of supplying a particular hydrogen user in its service area with hydrogen produced from off-peak electric power. As such, this report is a guide for electric utility companies in evaluating markets for off-peak-produced hydrogen.

DESCRIPTORS: *Hydrogen, *Market research, *Cost engineering,
*Electrolysis, *Manufactured gas, Fuel storage, Commercial
transportation, Electric utilities, Capitalized costs, Utilization,
Ammonolysis, Refineries, Methanols, Operating costs, Oxygen, Liquid
hydrogen, Availability, Comparisons, Water, Process charting

IDENTIFIERS: *Off peak energy use, NTISEPRI

PB-247 219/9ST NTIS Prices: PC\$7.50/MP\$2.25

Assessment of Fuels for Power Generation by Electric Utility Fuel Cells

Little (Arthur D.), Inc., Cambridge, Mass.*Electric Power Research Inst., Palo Alto, Calif.

Final rept.

AUTHOR: Stickles, R. P., Interest, E., Sweeney, G. C., Mawn, P. E., Parry, J. M.

C5802H3 FLD: 10B, 21B, 05C, 97D*, 97H, 96B USGRDR7604

Oct 75 320p*

PROJECT: EPRI-318

MONITOR: EPRI-318-FR

ABSTRACT: The relative cost of fuel supply options for the production and distribution of fuels suitable for fuel cells was assessed, including the supply alternatives of hydrogen, synthesis gas (hydrogen/carbon monoxide), SNG, methanol, and naphtha, and raw energy sources for conversion to product fuels--petroleum, natural gas, coal and municipal solid waste. Comparative economics of fuel cell power systems from raw of primary fuel to electricity were developed based on forecasted energy prices for 1978-1990. Alternative systems costs were developed for both dispersed and base load fuel cell systems in Hartford, Dallas, Columbus, and Los Angeles. Where appropriate, integration of on-site fuel conversion with the fuel cell power section was considered to utilize waste heat and water from the stack. For base load concepts, integration of coal gasifiers with fuel cell plants was investigated. In most cases second generation fuel cell heat rates and capital costs were assumed. Capital and operating costs for subsystems were prepared to establish module costs combined to obtain total system costs.

DESCRIPTORS: *Fuel cells, *Electric utilities, *Fuel cell power plants, *Raw materials, Supply (Economics), Economic analysis, Capitalized costs, Hydrogen, Synthesis gas, Methane, Carbinols, Carbon monoxide, Naphthas, Fuels, Operating costs, Cost estimates, Crude oil, Solid waste disposal, Liquefied petroleum gases, Byproducts, Reclamation, Energy management, Energy transport, Energy storage, Manufactured gas, Assessments, Electric power generation, Coal gasification

IDENTIFIERS: Fuel demand, NTISEPRI

PB-247 216/5ST NTIS Prices: PC\$9.75/MF\$2.25

An Economic Study of Electrical Peaking Alternatives *have*

National Bureau of Standards, Boulder, Colo. (240 750)

AUTHOR: Parrish, W. R.

C5742K1 FLD: 10A, 97C, 86V USGRDR7603

1975 20p

PROJECT: NBS-2750154

MONITOR: 18

Pub. in Proceedings of Conference on Hydrogen Economy Energy, Miami Beach, Fla. 18-20 Mar 74 Paper R889 p949-968 1975.

ABSTRACT: Results are given of a feasibility study of alternatives for producing peak power. Fuel cells, batteries, and superconducting magnetic storage are considered as well as gas turbines and pumped storage. The fuels considered are hydrogen, from coal or electrolysis, synthetic natural gas, and methanol. Fuel storage alternatives include liquid, compressed gas, and for hydrogen, metallic hydride.

DESCRIPTORS: *Electric power generation, Fuel cells, Electric batteries, Superconducting magnets, Gas turbines, Pumped storage, Hydrogen, Manufactured gas, Methyl alcohol, Fuel storage, Energy storage, Feasibility, Economics, Electric power demand

IDENTIFIERS: Off peak energy storage, Synthesis gas, Reprints, NTISCOMNBS

PB-246 779/3ST NTIS Prices: Not available NTIS

Quarterly Literature Review of Hydrogen Energy. A Bibliography with Abstracts

New Mexico Univ., Albuquerque. Technology Application Center.

Quarterly repts.

C5655F4 FLD: 21D, 97* USGRDR7602

1975 4 issues

MONITOR: 18

See also PB-236 367.

Paper copy available on subscription \$50.00/year domestic, \$60.00/year foreign, single copy PC\$17.50, MF\$17.50.

ABSTRACT: The report is a continuing bibliographic summary with abstracts of research and projections concerning hydrogen as a secondary fuel and as an energy carrier.

DESCRIPTORS: *Bibliographies, Hydrogen, Production, Utilization, Gas distribution, Storage, Safety, Abstracts

IDENTIFIERS: *Hydrogen fuels, NTISTAC, NTISNASA

NTISUB/A/023 NTIS Prices: PC-Subscription

Vacuum Jacket for Cryogenic Insulation, Volume 2

Boeing Aerospace Co., Seattle, Wash.

Final Contractor Report.

AUTHOR: Barclay, D. L., Bell, J. E., Brogren, E. W., Straayer, J. W.

C5623K4 FLD: 21I, 81C, 94G STAR1323

Apr 75 211p

REPT NO: NASA-CR-134760, D180-18476-2

CONTRACT: NAS3-15848

MONITOR: 18

ABSTRACT: The feasibility is demonstrated of producing a lightweight vacuum jacket using state-of-the-art technology and materials. Design and analytical studies were made on an orbital maneuvering system fuel tank. Preliminary design details were completed for the tank assembly which included an optimized vacuum jacket and multilayered insulation system. A half-scale LH2 test model was designed and fabricated and a force/stiffness proof test was conducted on the vacuum jacket. A vacuum leak rate of 0.00001 was measured, approximately 1500 hours of vacuum pressure was sustained, and 29 vacuum pressure cycles were experienced prior to failure. For vol. 1, see N75-26192. (Author)

DESCRIPTORS: *Cryogenic fluid storage, *Fuel tanks, *Thermal insulation, *Vacuum systems, Liquid hydrogen, Multilayer insulation, Space shuttle orbiters

IDENTIFIERS: NTISNASA

N75-32260/2ST NTIS Prices: PC\$7.75/MF\$2.25

Hydrogen Storage and Transfer

Stevens Inst of Tech Hoboken N J Dept of Mechanical Engineering*Office of Naval Research, Arlington, Va.*Advanced Research Projects Agency, Arlington, Va. (334580)

Semiannual technical rept. 1 Feb-31 Jul 75
AUTHOR: Cole, R. B., Magee, R. S., Hollenberg, J. W.
C5454F1 FLD: 21D, 7D, 99F*, 97H* USGRDR7525
25 Aug 75 89p
REPT NO: ME-RT-75008
CONTRACT: N00014-75-C-0220, ARPA Order-2615
MONITOR: 18
See also Semi-annual rept. dated 28 Feb 75, AD/A-006 984.

ABSTRACT: Various modes of hydrogen storage are considered: compressed gas, liquid and solid (Hydride). Preliminary analysis of energy-storage densities and costs dictated more detailed consideration of hydrogen storage as a cryogenic liquid or metal hydride for (1) small-scale mobile storage and (2) large-scale stationary storage. Concentration was on these two modes in gathering and evaluating sufficient quantitative information to allow assessment of engineering problems and overall practicality. Liquid-hydrogen liquefaction, transfer and storage, and safety were explored. Liquid-cryogen pumping technology is reviewed with particular concern for application to airborne pumping of liquid-hydrogen. Pump types and performance are examined and technical problems identified. An examination of the state-of-the-art of metallic-hydride hydrogen storage is examined.

DESCRIPTORS: *Hydrogen, *Fuels, Liquefied gases, Transfer, Storage, Pumping, Hydrides, Fire safety, Hazards, Pumps, Costs, Hydrogen embrittlement, Storage tanks, Cryogenics

IDENTIFIERS: *Fuel storage, Liquefaction, Design, Hazardous materials spills, Liquid hydrogen, NTISDODN

AD-AC16 256/OST NTIS Prices: PC\$4.75/MF\$2.25

NTIS 348 35000
McGee 420-5560
onside -5111
mailed 10/6/78

2

Proceedings of the Cornell International Symposium and Workshop on the Hydrogen Economy Held at Ithaca, N.Y. on August 20-22, 1973

Cornell Univ., Ithaca, N.Y.*National Science Foundation, Washington, D.C. Research Applied to National Needs. (098 550)

AUTHOR: Linke, Simpson

C5261F2 FLD: 21D, 07A, 97H, 99B USGRDR7522

Apr 75 443p

MONITOR: NSF/RA/N-75-062

ABSTRACT: This document contains the proceedings of a symposium on the hydrogen energy economy conducted at Cornell University in August, 1973. The participants included both advocates and skeptics, so that the principles in each camp would have direct intellectual contact in order to achieve a better understanding of the potential of the hydrogen economy, either pro or con. Both viewpoints are amply represented in these proceedings. Alternate proposals such as the all electric economy and the methanol economy are also included. The issue of hydrogen economics remains uncertain despite the attention given it during the conference, but the continuing high cost of fossil fuels will make hydrogen economically feasible sooner than any participant would have dared predict in 1973. Subjects covered here include the following: an overview of the hydrogen economy, hydrogen production and economics, energy transmission and storage, thermochemical means of producing hydrogen, electrochemical problems of the hydrogen economy, hydrogen in the marketplace, prospects for hydrogen utilization, and the impact of hydrogen on transportation.

DESCRIPTORS: *Fuels, *Meetings, Reviews, Hydrogen, Pipeline transportation, Fuel storage, Production, Electrolysis, Synthesis (Chemistry), Electric power generation, Economics, Methyl alcohol

IDENTIFIERS: *Hydrogen fuels, NTISNSFRA

PB-244 394/3ST NTIS Prices: PC\$11.25/MF\$2.25

Investigation of Hazards Associated with Using Hydrogen as a Military Fuel

Naval Ship Research and Development Center Annapolis Md (387691)

Research and development rept.

AUTHOR: Bowen, Thomas L.

C5212G3 FLD: 21I, 13L, 97H USGRDR7522

Aug 75 88p

REPT NO: NSRDC-4541

MONITOR: 18

ABSTRACT: This hazards investigation was undertaken as part of an overall exploratory Navy program intended to examine the logistic implications, the engineering problems, and the potential hazards associated with hydrogen as a military fuel. Existing literature which is relevant to the hazards associated with hydrogen was surveyed and summarized. The hazards of certain alternative fuels including hydrogen, ammonia, hydrazine, ethyl and methyl alcohol, and representative conventional fuels including diesel fuel marine, gasoline, JP-5, and methane, were compared. The comparison covered leakage, volatility, dissipation, ignition, flammability, deflagration, radiation, detonation, and health hazards.

DESCRIPTORS: *Liquid rocket fuels, *Liquid hydrogen, Hazards, Naval operations, Ammonia, Hydrazine, Alcohols, Diesel fuels, Gasoline, Methanes, Leakage (Fluid), Storage, Volatility, Ignition, Flammability, Deflagration, Detonations, Safety, Toxicity, Compatibility, Jet engine fuels, Comparison

IDENTIFIERS: Methyl alcohol, Ethyl alcohol, JP-5 fuels, *Hydrogen fuels, NTISDODXA, NTISDODN

AD-A014 127/5ST NTIS Prices: PC\$4.75/MF\$2.25

Hydrogen Safety Manual: Advisory Panel on Experimental Fluids and Gases, Lewis Research Center

National Aeronautics and Space Administration, Washington, D.C. (240 400)

Technical memo.

C5035J1 FLD: 21D, 07A, 13L, 99B, 97H USGRDR7519

1968 86p

REPT NO: NASA-TM-X-52454

MONITOR: 18

ABSTRACT: The 1968 manual is designed to cover most aspects of hydrogen handling and usage. Both personnel and equipment are concerned. It is the intent to present here acceptable hydrogen standards and practices for minimum safety requirements only. More extensive safety precautions should be employed when there is extra hazard, as in highly-congested areas or in operations with equipment that has little safety margin. The topics covered include: Nature of the hazard; design principles; elimination of ignition sources; protection of personnel and equipment; storage and test locations and blast effects; operating procedures; and emergency procedures.

DESCRIPTORS: *Manuals, *Hydrogen, *Liquefied gases, *Fuel storage, *Safety, Materials handling, Gas detectors, Ignition, Fire safety, Leakage, Design, Explosion proofing, Cryogenics

IDENTIFIERS: Hydrogen fuels, Hazardous materials, Protective equipment, Emergencies, NTISNASA

N75-72909/5ST NTIS Prices: PC\$4.75/MF\$2.25

Energy: A Continuing Bibliography with Indexes, February 1975

National Aeronautics and Space Administration, Washington, D.C.
C4993A4 FLD: 10A, 97 STAR1315
Feb 75 260p
REPT NO: NASA-SP-7043(03)
MONITOR: 18

ABSTRACT: Reports, articles, and other documents introduced into the NASA scientific and technical information system from July 1, 1974 through September 30, 1974 are cited. Regional, national, and international energy systems; research and development on fuels and other sources of energy; energy conversion, transport, transmission, distribution, and storage, with emphasis on the use of hydrogen and solar energy are included along with methods of locating or using new energy resources. Emphasis is placed on energy for heating, lighting, and powering aircraft, surface vehicles, or other machinery. (Author)

DESCRIPTORS: *Bibliographies, *Energy conversion, *Energy policy, *Solar energy, Energy storage, Hydrogen-based energy, Indexes (Documentation)

IDENTIFIERS: NTISNASA

N75-24094/5ST NTIS Price: PC\$4.00

Hydrogen-Future Fuel-A Bibliography (with Emphasis on Cryogenic Technology)

National Bureau of Standards, Boulder, Colo. Cryogenics Div. (400 992)

Technical note

AUTHOR: Olien, N. A., Schiffmacher, S. A.

C4443F1 FLD: 21D, 97H, 46, 86V USGRDR7510

Feb 75 134p

REPT NO: NBS-TN-664

PROJECT: NBS-2750123

MONITOR: 18

Paper copy also available from GPO as C13.46:664. Library of Congress Catalog Card No. 75-600002.

ABSTRACT: This NBS Technical Note is a compilation of references dealing directly and indirectly with the possible future use of hydrogen as a fuel. The references were selected using an automated information system operated by the Cryogenic Data Center. This bibliography of references emphasizes the use of cryogenic technology in the hydrogen field. Articles are indexed under 40 subject headings and an author index is included. Over 1600 references are included in this bibliography.

DESCRIPTORS: *Hydrogen, *Fuels, *Bibliographies, *Cryogenics, Separation, Heat transfer, Fluid dynamics, Physical properties, Fuel storage, Materials handling, Production, Gas generators, Coal gasification, Natural gas, Liquid hydrogen

IDENTIFIERS: NTISCOMNBS

COM-75-10289/7ST NTIS Prices: PC\$5.75/MF\$2.25

Materials Requirements for Advanced Energy Systems - New Fuels. Volume
3: Materials Research Needs in Advanced Energy Systems Using New Fuels

Stanford Research Inst Menlo Park Calif*Defense Supply Service,
Washington, D.C.*Advanced Research Projects Agency, Arlington, Va. (332500)

Final rept. 1 May 73-31 Jul 74

AUTHOR: Daniels, N. H. G., Syrett, B. C., Jones, R. L.

C4203C2 FLD: 21D, 97A USGRDR7507

Jul 74 111p

CONTRACT: DAHC15-73-C-0313, ARPA Order-2484

PROJECT: SRI-PYU-2580

MONITOR: 18

ABSTRACT: This program sought to identify materials-critical aspects of the use, production, transportation, and storage of new fuels derived from nonfossil sources. Hydrogen was the principal new fuel studied; hydrogen-derived fuels considered were ammonia, hydrazine, boranes, silanes, carbon monoxide, and methyl alcohol. The materials implications of the use of oxygen (produced as a by-product in hydrogen generation) as a fuel oxidizer and of the use of active metals in batteries were also examined. Volumes 1 and 2 are not available for public release.

DESCRIPTORS: *Fuels, *Hydrogen, Ammonia, Hydrazine, Boranes, Silanes, Carbon monoxide, Alcohols, Equipment, Production, Transport, Storage, Materials, Requirements, Manufacturing, Interactions, Planning, Research management, Oxidizers, Battery components, Metals

IDENTIFIERS: Methyl alcohol, Projects, Manufactured gas, NTISDODA

AD/A-004 550/OST NTIS Prices: PC\$5.25/MF\$2.25

Design, Fabrication, Assembly, and Test of a Liquid Hydrogen Acquisition Subsystem

McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

AUTHOR: Blackman, J. B.

C4004G1 FLD: 13G, 94F STAR1224

May 74 257p

REPT NO: NASA-CR-120447, MDC-G5360

CONTRACT: NAS8-27571

MONITOR: 18

ABSTRACT: The development of a cryogenic fluid system to supply liquid hydrogen to a turbopump at flowrates up to 7.5 pounds per second for a period of approximately 5 seconds before refill, is discussed. Refill is accomplished in less than 10 seconds, during which a constant flowrate can be maintained to the pumps. Diagrams are provided to show the configuration of the system. Subsystem acceptance and functional tests, including acquisition subsystem expulsion, pressurization, and refill were performed. The tests included: (1) thermodynamic vent system operation, (2) warm-gas pressurization effects, (3) hydraulic pressure surge effects, (4) screen device operational limitations, (5) feedline vapor control, and (6) two-phase refill. (Author)

DESCRIPTORS: *Cryogenic equipment, *Cryogenic fluid storage, *Fuel systems, *Liquid hydrogen, *Turbine pumps, Equipment specifications, Performance tests, Systems engineering

IDENTIFIERS: NTISNASA

N74-34874/9ST NTIS Prices: PC\$8.50/MF\$2.25

Hydrogen as a Navy Fuel

Naval Research Lab Washington D C (251950)

Special study

AUTHOR: Carhart, H. W., Affens, W. A., Boss, B. D., Hazlett, R. N.,
Schuldiner, S.

C3171G3 FLD: 21D, 15E, 97H*, 74E USGRDR7418

12 Jun 74 39p*

REPT NO: NRL-7754

MONITOR: 18

ABSTRACT: The report examines various factors relating to the possible use of hydrogen by the Navy as an alternate to conventional fuels. Properties, production, storage, hazards, handling, toxicity, and comparative costs of hydrogen in gaseous or liquid forms are discussed.

DESCRIPTORS: *Hydrogen, *Fuels, Air pollution, Production, Storage, Liquid hydrogen, Hazards, Handling, Transportation, Naval operations, Navy, Fuel cells, Costs, Marine propulsion, Ships

IDENTIFIERS: NTISDODN

AD-781 262/1 NTIS Prices: PC\$3.25/MF\$1.45

Comprehensive Bibliography of Literature on Noncryogenic Storage and Recovery of Hydrogen

Southwest Research Inst San Antonio Tex Army Fuels and Lubricants Research Lab (387339)

AUTHOR: Kuntz, P. A., Wimer, W. W., Weatherford, W. D. Jr, Quillian, R. D.

C3114D3 FLD: 21D, 7A, 97H*, 99B USGRDR7417

Sep 73 103p*

REPT NO: AFLRL-30

CONTRACT: DAAK02-73-C-0221

MONITOR: 18

ABSTRACT: The chronological annotated bibliography has been compiled from the scientific literature for the noncryogenic storage of hydrogen for use as a fuel in a mobile vehicle. The bibliography covers a period of sixty-eight years (1905-1973) and is organized into two separate chronological bibliographies, each arising from different sources. These two primary sources are Chemical Abstracts and the Defense Documentation Center at Alexandria, Virginia. Topics covered include generation via decomposition and reaction of hydrides, metals, and other organic and inorganic compounds, biochemical generation, and various other storage means. (Modified author abstract)

DESCRIPTORS: *Bibliographies, *Hydrogen, Hydrazine, Decomposition, Hydrides, Abstracts, Storage, Fuels, Chemisorption, Hydrocarbons, Ammonia, Gas generating systems, Metals, Biosynthesis, Production, Synthesis (Chemistry), Industrial production, Fuel cells

IDENTIFIERS: *Fuel storage, Manufactured gas, NTISDODA

AD-780 928/8 NTIS Prices: PC\$4.50/MF\$1.45

The Reduction of Heat Flux into Cryogenic Storage Vessels by Use of Vapour-Cooled Support Tubes

Rocket Propulsion Establishment, Westcott (England)..

AUTHOR: Horton, T. R.

C2835H2 FLD: 20M, 46 STAR1209

Sep 71 53p

REPT NO: RPE-TR-71/8, BR36745

MONITOR: 18

ABSTRACT: Methods of calculating the heat leak through a vapor cooled support tube of a cryogenic storage vessel were examined. A rigorous method of calculation was developed and its predictions were compared with limiting solutions and with experiments. The calculations performed for an existing high pressure liquid hydrogen storage vessel constructed of stainless steel lead to the conclusion that the heat leak through a vapor cooled support tube will probably be insignificant. Calculations for stainless steel and aluminum alloy vessels, containing the cryogens helium, hydrogen, nitrogen or oxygen, indicate that in a vessel constructed of an aluminum alloy the heat leak through the neck will be appreciable. (Author)

DESCRIPTORS: *Cryogenic fluid storage, *Energy dissipation, *Evaporative cooling, *Heat flux, Heat transfer, Leakage, Liquid hydrogen, Pipes (Tubes), Stainless steels

IDENTIFIERS: NASA

N74-18537/2 NTIS Prices: PC\$5.75/MF\$1.45

A Hydrogen Energy Carrier. Volume 2: Systems Analysis

Houston Univ., Tex.

AUTHOR: Savage, R. L., Blank, L., Cady, T., Cox, K., Murray, R.

C2254A1 FLD: 21D, 97A STAR1202

Sep 73 158p

REPT NO: NASA-CR-136007

CONTRACT: NGL-44-005-114

MONITOR: 18

DESCRIPTORS: *Energy requirements, *Energy sources, *Hydrogen, Costs, Energy storage, Fuel systems, Systems analysis

IDENTIFIERS: NASA

N74-11728/4 NTIS Prices: PC\$10.00/MF\$1.45

Reuseable Lightweight Modular Multi-Layer Insulation for Space Shuttle
Union Carbide Corp., Tonawanda, N.Y.

Final Report.

AUTHOR: Burr, K. F.

C1923H4 FLD: 22B, 84C STAR1121

Jul 73 152p

REPT NO: NASA-CR-121166

CONTRACT: NAS3-14366

MONITOR: 18

ABSTRACT: The adaptation of the Self Evacuating Multilayer Insulation System to the space shuttle orbiter liquid hydrogen tanks was investigated. Small scale material screening tests and subscale panel tests demonstrated the potential of the insulation to withstand the anticipated 100 flight cycles. The composition of the material and the process for producing the finished insulation are described. Results of the various tests to determine the durability of the material are presented. (Author)

DESCRIPTORS: *Cryogenic fluid storage, *Liquid hydrogen, *Multilayer insulation, *Space shuttle orbiters, Composite materials, Equipment specifications, Materials tests, Product development

IDENTIFIERS: NASA

N73-30883/5 NTIS Prices: PC\$9.75/MF\$1.45

Hydrogen and Other Synthetic Fuels. A Summary of the Work of the Synthetic Fuels Panel

Division of Reactor Development and Technology (AEC), Washington, D.C.
C1894K4 FLD: 21D, 81D, 97A* USGRDR7324

Sep 72 139p*

REPT NO: TID-26136

MONITOR: 18

Paper copy also available from GPO \$2.25 as Y3.AT7:22/TID 26136.

ABSTRACT: The specific purpose of this panel's work may be summarized as follows: To assess the potential of an energy system based on nonfossil synthetic fuels, mainly hydrogen; to give special attention to the use of synthetic fuels for the dispersed, stationary generation of electricity; to examine all segments of a synthetic fuel system and make recommendations for performing any required research and development. The report covers all aspects of an energy system based on nonfossil synthetic fuels and includes discussions on the production of the fuels; their storage, transmission, and end uses; and an overall systems analysis illustrating the role these fuels might assume in the future. A section on the use of coal to produce hydrogen and methanol is also included to help define the interim time period before our dependency on nonfossil fuels occurs.

DESCRIPTORS: (*Fuels, Reviews), (*Hydrogen, Fuels), Ammonia, Methyl alcohol, Hydrazine, Methane, Coal gasification, Cargo transportation, Fuel storage, Production, Utilization, Manufacted gas, Electric power generation

IDENTIFIERS: AEC

PB-224 482/0 NTIS Prices: PC\$4.75/MF\$1.45

Characteristics of a Gelled Liquid Hydrogen Polyphenylene Oxide (Ppo)
Foam Open-Cell Insulation System, Phase 1

General Dynamics/Convair, San Diego, Calif. Aerospace Div.

Final Report

C0794H1 FLD: 21I, 80C, 81G STAR1109

15 Feb 73 93p

REPT NO: NASA-CR-124114, GDCA-632-3-169

CONTRACT: NAS8-27203

MONITOR: 18

ABSTRACT: A large scale gel production and storage facility and a small scale facility, the latter used for detailed visual examination of the gel/PPO foam interface, were developed. A subcontract was given to investigate techniques for the production of gelled liquid hydrogen, develop a process design for scale-up to a 1.89e1 cu m (500 gallon) gel production and storage facility, determine gel transfer characteristics, determine the solubility rate of gaseous helium in the gel, and investigate the gross gel/PPO foam interfacial phenomena. An inside-tank process for scaled-up production of gelled liquid hydrogen was selected. No detectable gel structure degradation occurred during repeated shearing. The viscosity of gelled liquid hydrogen at shear rates of 300/sec and higher is 2 to 5-fold greater than that of neat liquid hydrogen. No clogging problems were encountered during the transfer of gelled liquid hydrogen through warmed transfer lines. The solubility rate of helium in liquid hydrogen was significantly reduced by the presence of gel structure. The boil-off rates from gelled liquid hydrogen were reduced from 25 to 50 percent compared to those observed for the neat liquid hydrogen under compatible conditions. The polyphenylene oxide (PPO) foam insulation was found to be compatible with liquid ethane. (Author)

DESCRIPTORS: *Foams, *Gels, *Insulation, *Liquid hydrogen, *Oxides, *Polyphenyls, Cryogenic fluid storage, Ethane, Helium, Production engineering

IDENTIFIERS: NASA

N73-18568 NTIS Prices: PC\$6.75/MF\$0.95

Low Gravity Reorientation in a Scale-Model Centaur Liquid-Hydrogen Tank

National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AUTHOR: Salzman, J. A., Masica, W. J., Lacovic, R. F.

C0653K3 FLD: 20D, 80F STAR1107

Feb 73 33p

REPT NO: NASA-TN-D-7168, E-7098

MONITOR: 18

ABSTRACT: An experiment was conducted to investigate the process of liquid reorientation from one end of a scale-model Centaur liquid-hydrogen tank to the other end by means of low-level accelerations. Prior to reorientation, the liquid was stabilized at the top of the tank at a Bond number of 15. Tanks both with and without ring baffles and with tank radii of 5.5 and 7.0 centimeters were used in the study. Reorientation acceleration values were varied to obtain Bond numbers of 200 and 450. Liquid fill levels of 20 and 70 percent were used. From the data in this study, relations were developed to estimate reorientation event times in unbaffled tanks through the point of final liquid clearing from the top of the tank. The insertion of ring baffles drastically changed the reorientation flow profiles but resulted in only minor differences in the times of tank-top uncovering and liquid collection. (Author)

DESCRIPTORS: *Centaur launch vehicle, *Cryogenic fluid storage, *Fluid dynamics, *Fuel tanks, *Liquid hydrogen, Baffles, Liquid filled shells, Liquid sloshing, Stabilization

IDENTIFIERS: NASA

N73-16252 NTIS Prices: PC\$3.00/MF\$0.95

Support of Energy Program Planning

Stanford Research Inst Menlo Park Calif (332500)

Final rept.

AUTHOR: Schmidt, Richard A.

C0423J3 FLD: 21D, 81D, 67B, 97A USGRDR7307

Sep 72 256p

REPT NO: SRI-1878-1

CONTRACT: N00014-72-C-0445, ARPA Order-2195

PROJECT: SRI-1878

MONITOR: 18

ABSTRACT: Principal energy problem areas of importance to the Department of Defense were identified and possible approaches to advanced research projects directed toward solutions of these problems were suggested to provide partial source material in support of ARPA's research program planning. Topics regarding sources and application of energy, energy transformation, storage, and distribution, and energy utilization were included. For each topic, information was organized according to statement of the problem, state of the art, present activities and organization, implications for the DoD, and recommendations for further studies. (Author)

DESCRIPTORS: (*Department of Defense, *Fuels), (*Energy management, Department of Defense), Management planning, Sources, Energy, Natural resources, Recovery, Energy conversion, Production, Transportation, Storage, Vulnerability, Fuel consumption, Distribution, Petroleum, Gases, Coal, Nuclear energy, Hydrogen, Heat, Mining engineering, Electric power production

IDENTIFIERS: Utilization, Conservation, Fossil fuels, Natural gas, Shale oil, Petrochemistry, Liquefied natural gas, Bituminous sands, Oil shale, Heat recovery, Chemical fuels

AD-755 222 NTIS Prices: PC\$3.00/MF\$0.95

Development of Advanced Materials Composites for Use as Insulations
for LH2 Tanks

McDonnell-douglas Astronautics Co., Huntington Beach, Calif.

Summary Report, 1 Jul. 1971 - 29 Apr. 1972
AUTHOR: Lemons, C. R., Watts, C. R., Salmassy, O. K.
C0294J1 FLD: 21H, 81C STAR1102
Jun 72 176p
REPT NO: NASA-CR-123928, MDC-G3677
CONTRACT: NAS8-25973
MONITOR: 18

ABSTRACT: A study of internal insulation materials and fabrication processes for space shuttle LH2 tanks is reported. Emphasis was placed on an insulation system capable of reentry and multiple reuse in the Shuttle environment. Results are given on the optimization and manufacturing process scale-up of a 3D fiberreinforced foam insulation, BX-251-3D, derived from the Saturn S-4B internal insulation. It is shown that BX-251-3D can be satisfactorily installed in large-scale tanks under conditions that will permit a significant cost saving over the existing S-4B technology. (Author)

DESCRIPTORS: *Cryogenic storage, *Fuel tanks, *Liquid hydrogen, *Space shuttles, *Thermal insulation, Composite materials, Materials tests, Product development, Thermodynamic properties

N73-11547 NTIS Prices: PC\$11.00/MF\$0.95

Compilation of Lasl n-1 Documents as of October 1963. Volume II

Aerojet-General Corp., Azusa, Calif. (0036000)
A7252G1 FLD: 18N, 77C NSA3302
Oct 63 217p
MONITOR: 18

ABSTRACT: For abstract, see NSA 33 02, number 04795.

DESCRIPTORS: (*Kiwi reactors, *Fuel elements), (*Hydrogen, *Corrosive effects), (*Graphite, *Chemical analysis), Coated fuel particles, Mechanical properties, Physical properties, Pyrolytic carbon, Research programs, Specifications, Storage, Testing, Thermal conductivity, Thermal expansion, Uranium carbides

IDENTIFIERS: NTISERDA

TID/SNA-3058 NTIS Prices: PC\$7.75/MF\$2.25

ABSTRACT:

Methods of fuel element testing and of chemical analysis used in the Research and Development Program for Pyro-Coated, Uranium Dicarbide-Loaded, Graphite Fuel Elements at LASL have been bound together in this document.

Hydrogen Energy Economy

USAEC, Washington, D.C. (6549500)
A7241L1 FLD: 21D, 10A, 97G NSA7503
11 Nov 74 26p
MONITOR: 18

ABSTRACT: For abstract, see ERA 75 03, number 00338.

DESCRIPTORS: *Hydrogen fuels, *Hydrogen-based economy, Energy transmission, Hydrogen production, Hydrogen storage, Research programs

IDENTIFIERS: ERDA/080000, NTISERDA

TID-26757 NTIS Prices: PC\$4.00/MP\$2.25

ABSTRACT:

Research and development programs related to the technologies required if hydrogen energy delivery systems were to be introduced into the United States energy economy are considered.

Government-Wide Report to Office on Management and Budget on Energy Storage R and D Program Strategies and Implementation Plans

USAEC Division of Applied Technology, Washington, D.C. (6553500)

A7241J3 FLD: 10A, 97G NSA7504

1 Jun 74 91p

MONITOR: 18

ABSTRACT: For abstract, see ERA 75 04, number 00620.

DESCRIPTORS: (*Energy storage, *Budgets), Electric batteries, Electric power, Flywheels, Fuel consumption, Fuels, Government policies, Hydroelectric power, Hydrogen, Management, Petroleum, Power plants, Power transmission, Public utilities, Research programs, Storage

IDENTIFIERS: ERDA/297500, ERDA/250000, ERDA/080200, NTISERDA

TID-26751 NTIS Prices: PC\$5.00/MF\$2.25

ABSTRACT:

A vigorous program to develop energy and fuel storage is proposed. Energy storage R and D has applications to electric utilities systems, transportation systems and commercial and industrial uses. This program includes major R and D efforts on battery development, hydrogen production, storage and reconversion, flywheels and magnetic energy storage. Smaller efforts on other storage techniques such as thermal, compressed air, underground pumped hydro and fuel storage are also important elements of this program.

Test Cell a Gas Storage Requirements

Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab. (6920000)

AUTHOR: Poindexter, A. M.

A7145K2 PLD: 18N, 77C NSA3205

29 Aug 62 2p

MONITOR: 18

ABSTRACT: For abstract, see NSA 32 05, number 13324.

DESCRIPTORS: (*Nerva reactor, *Test facilities), Helium, Hydrogen, Nitrogen, Specifications, Storage

IDENTIFIERS: NTISERDA

WANL-TME-111 NTIS Prices: PC\$4.00/MF\$2.25

NO ABSTRACT AVAILABLE

Facility Fluid Additions for Various Operating Times of Nrx Reactors
Up to 20 Minutes of Equivalent Full Power Operation

Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab. (6920000)

AUTHOR: Goldberg, S.

A7075L4 FLD: 18N, 77C NSA3112

25 May 64 11p

MONITOR: 18

ABSTRACT: For abstract, see NSA 31 12, number 35465.

DESCRIPTORS: (*Nerva reactor, *Test facilities), Helium, Hydrogen, Nitrogen, Storage, Testing

IDENTIFIERS: NTISERDA

WANL-TME-790 NTIS Prices: PC\$4.00/MF\$2.25

ABSTRACT:

The additional storage requirements of gaseous and liquid hydrogen needed for 20 minutes of NRX engine testing at test cell A are estimated. Existing storage capacities for gaseous helium and nitrogen at 500 R and of gaseous nitrogen at 200 R are adequate for 20 minutes of engine testing.

Cryogenics for Nuclear Rocket Application. A Course for Technical Personnel Concerned with the Nerva Program. Book 2. Course Notes

NERVA Test Operations, Jackass Flats, Nev. (9500447)
A7042B4 FLD: 21F, 81I NSA3111
15 Jun 62 174p
MONITOR: 18

ABSTRACT: For abstract, see NSA 31 11, number 29393.

DESCRIPTORS: (*Nerva reactor, Test facilities), (*Test facilities, Hydrogen), (*Hydrogen, *Storage), Education, Lasl, Liquids, Manuals, Materials handling, Personnel, Safety, Transport

IDENTIFIERS: NTISERDA

TID/SNA-1334 NTIS Prices: PC\$11.75/MF\$2.25

ABSTRACT:

A manual is presented for the safe handling and storage of liquid hydrogen at the Los Alamos Scientific Laboratory.

Instrumentation for Storage and Transfer of Hydrogen Slush

National Bureau of Standards, Boulder, Colo. (240 750)

Final rept.

AUTHOR: Weitzel, D. H., Cruz, J. E., Lowe, L. T., Richards, R. J.,
Mann, D. B.

A4433K3 FLD: 14B, 80C, 73D, 86V USGRDR7213

1970 11p

PROJECT: NBS-2750464

Proceedings 1970 Cryogenic Engineering Conference June 17-19, 1970,
Colorado Univ., Boulder, Colorado. Chapter in Advances in Cryogenic
Engineering, K. D. Timm Timmerhaus, Ed., v16, Paper No. F-1, p230-240.

ABSTRACT: A program for development and testing of density and flow
instrumentation for use in hydrogen liquid and liquid-solid mixtures
(slush) is reviewed. Performance criteria are indicated along with
experimental and analytical results which provide some basis for
choices among the various candidate systems. The density work is
nearing completion; the flow studies have not yet provided data beyond
the demonstration of feasibility. (Author)

DESCRIPTORS: (*Cryogenics, *Flowmeters), (*Slush, Flowmeters),
Density(Mass/volume), Liquid hydrogen, Solidified gases

IDENTIFIERS: Slush hydrogen

COM-72-50465 NTIS Prices: Not available NTIS

Hydrogen for Energy Transport and Storage in Solar Energy Systems

Brookhaven National Lab., Upton, N. Y.

AUTHOR: Hoffman, Kenneth C., Winsche, Warren E.

A4071K3 FLD: 10B, 67F NSA2605

1970 6p

REPT NO: CONF-711035-1

From 3. Conference On Large Scale Solar Energy Conversion For
Terrestrial Use- Newark, Del. (9 Oct 1971).

ABSTRACT: For abstract, see NSA 26 05, number 11432.

DESCRIPTORS: *Hydrogen,

BNL-16259 NTIS Prices: PC\$3.00/MF\$0.95

NO ABSTRACT AVAILABLE

Instrumentation for Storage and Transfer of Hydrogen Slush

National Bureau of Standards, Boulder, Colo. Cryogenics Div. (400 992)

AUTHOR: Weitzel, D. H., Cruz, J. E., Lowe, L. T., Richards, R. J., Mann, D. B.

A3785J2 FLD: 14B, 73D, 80C, 86V USGRDR7207

1971 12p

REPT NO: NBS-R-673

PROJECT: NBS-2750464

Proceedings of the Cryogenic Engineering Conference Boulder, Colo., 17-19 Jun 70.

Pub. in Advances in Cryogenic Engineering, v16 p230-240 1971.

ABSTRACT: A program for development and testing of density and flow instrumentation for use in hydrogen liquid and liquid-solid mixtures (slush) is reviewed. Performance criteria are indicated along with experimental and analytical results which provide some basis for choices among the various candidate systems. The density work is nearing completion; the flow studies have not yet provided data beyond the demonstration of feasibility. (Author)

DESCRIPTORS: (*Liquid hydrogen, Physical properties), (*Density measurement, *Cryogenics), (*Flowmeters, Cryogenics), Ultrasonic tests, Microwave equipment, Gamma ray spectroscopy, Acoustic velocity, Density(Mass/volume), Slush

IDENTIFIERS: Slush hydrogen

COM-72-10209 NTIS Prices: Reprint

Hydrogen Economy: A Utility Perspective

Brookhaven National Lab., Upton, N.Y. (0936000)

AUTHOR: Lotker, M., Fein, E., Salzano, P. J.

A6795J4 FLD: 07A, 97H NSA3103

1974 9p

REPT NO: CONF-740108-2

MONITOR: 18

ABSTRACT: For abstract, see NSA 31 03, number 07948.

DESCRIPTORS: (*Hydrogen, *Transport), Economics, Electrolysis, Hydrogen storage, Hydrogen-based economy, Market, Partial oxidation processes, Pipelines, Steam reformer processes, Thermochemical processes

IDENTIFIERS: NTISAEC

BNL-19267 NTIS Prices: PC\$4.00/MF\$2.25

ABSTRACT:

Presented is an overview of the "Hydrogen Economy," a concept in which sources of primary energy such as coal, uranium, deuterium, and sunlight, are used to make hydrogen, which serves as a synthetic fuel in many sectors of the energy consuming market. Specific techniques for the production, transmission, storage, and utilization of hydrogen are described. The impact on the entire energy economy in general and the utility industry specifically is discussed.

External Pressurization Systems for Cryogenic Storage Systems Design
Reference Manual

Airesearch Mfg. Co., Los Angeles, Calif.

AUTHOR: Wapato, P. G., Keeley, A. W., Jew, L. N., Young, C. F.

A3644I1 PLD: 13D, 81C STAR0924

10 Sep 71 224p

REPT NO: NASA-CR-115204, REPT-71-7535

CONTRACT: NAS9-10453

DESCRIPTORS: *Cost estimates, *Cryogenic storage, *Liquid hydrogen,
*Liquid nitrogen, *Liquid oxygen, *Pressurizing, *Weight analysis,
Circulation, Fluid flow, Systems analysis

N71-38021 NTIS Prices: PCS\$3.00/MF\$0.95

ABSTRACT:

The tools and techniques needed by system planners for estimation of the weight and cost of recirculation-type external pressurization systems for hydrogen, oxygen, and nitrogen storage are provided. Characterization information and design procedures are presented for all major system elements. These include energy addition devices, fluid-moving devices, transfer lines, and controls.

Lightweight Modular Multilayer Insulation Final Report

Union Carbide Corp., Tonawanda, N. Y. Linde Div.

AUTHOR: Nies, G. E.

A2541C3 FLD: 11G, 71M STAR0913

26 Feb 71 257p

REPT NO: NASA-CR-72856

CONTRACT: NAS3-12045

DESCRIPTORS: *Fuel tanks, *Insulation, *Liquid hydrogen, *Mylar (trademark), *Polyurethane foam, Aluminum, Cryogenic fluid storage, Dynamic tests, Flight simulation, Radiation shielding

N71-25447 NTIS Prices: PC\$3.00 MF\$0.95

ABSTRACT:

The design of a Self Evacuating Multilayer Insulation (SEMI) system for a 10 ft diameter by 20 ft long liquid hydrogen tank is described. The design, fabrication, and testing of a model system simulating the full size insulation system is also presented. Model system testing included both thermal and structural evaluations. Thermal tests, using liquid hydrogen and structural tests were performed. The SEMI system was subjected to a combined launch vacuum profile to simulate a typical launch profile. The system performed as designed.

Experimental Evaluation of a Purged Substrate Multilayer Insulation System for Liquid Hydrogen Tankage

National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AUTHOR: De Witt, R. L., Mellner, M. B.

A2533B2 FLD: 13D, 21I, 81C, 81G STAR0913

May 71 65p

REPT NO: NASA-TN-D-6331, E-6036

CONTRACT: 180-31

DESCRIPTORS: *Cryogenic fluid storage, *Heat shielding, *Liquid hydrogen, *Space storage, *Thermal cycling tests, *Thermal insulation, Conductive heat transfer, Nitrogen, Spherical tanks, Thermal degradation, Thermocouples, Vacuum chambers

N71-24822 NTIS Prices: PC\$3.00 MF\$0.95

ABSTRACT:

Seven space-hold and six ground-hold tests were conducted to determine the thermal performance of a GHe purged substrate multilayer blanket insulation system on a 7 ft (2.134 m) diam spherical LH2 tank. Space-hold tests were made using 30, 40, 50 and 60 insulation shields. No serious degradation of the space-hold thermal performance of the 30 layer system was observed over consecutive cyclic tests.

Reliability Tests Conducted on Five (5) Cryo-Formed Spheres

Ogden Technology Labs., Inc., Beaumont, Calif.
A2435H2 FLD: 21I, 81C STAR0912
Aug 69 36p
REPT NO: NASA-CR-61343, B-20415
CONTRACT: NAS8-30029

DESCRIPTORS: *Cryogenic fluid storage, *Environmental tests, *Helium,
*Pressure vessels, *Saturn s- 4b stage, Liquid hydrogen, Reliability
engineering, Spherical tanks, Titanium

IDENTIFIERS: NASA subject code 31

N71-24179 NTIS Prices: PC\$3.00 MF\$0.95

ABSTRACT:

A test program was carried out to verify the reliability of the manufacturing technology used in the production of the cyro-formed spheres, and to determine their suitability for use as replacements for the titanium Helium storage bottles currently installed in the liquid Hydrogen tanks in the S IV-B stage of the Saturn 1B vehicle. Each test is summarized and the results given at the end of the test write-up.

External Insulation Systems for Cryogenic Storage Systems Interim Study Report

Colspan, Inc., Boulder, Colo.

AUTHOR: Flynn, T. M., Kirgis, J. B., Wilson, J. R.

A19C4G1 FLD: 11G, 20M, 81C, 80P STAR0906

2 Nov 70 109p

REPT NO: NASA-CR-114827

CONTRACT: NAS9-10583

DESCRIPTORS: *Cryogenic fluid storage, *Fuel tanks, *Mathematical models, *Thermal insulation, Hydrogen oxygen engines, Liquefied gases, Surface layers

N71-16600 NTIS Prices: PC\$3.00 MF\$0.95

ABSTRACT:

Investigated were high performance external insulation systems for use on flight weight cryogenic gas storage systems. The fluids stored are hydrogen and oxygen. Preliminary thermal analysis, support analysis, producibility, operability and other factors were considered for five systems. Three systems, a shingle with substrate, fiberglass and blanket, were chosen for detailed analysis. Development work on mathematical models for the analyses is nearly completed, and summaries of the mathematical models and programming are presented.

DEVELOPMENT OF METHODS FOR APPLICATION OF POLYURETHANE SPRAY FOAM
INSULATION SYSTEMS TO LIQUID HYDROGEN TANKS

National Aeronautics and Space Administration. Marshall Space Flight
Center, Huntsville, Ala.

AUTHOR: Carter, J. M.

A1101B2 FLD: 13H, 69I STAR0820

12 Sep 69 62p

REPT NO: NASA-TM-X-53897, MSFC-IN-ME-69-3

DESCRIPTORS: *Liquid hydrogen, *Methodology, *Polyurethane foam,
*Spraying, *Storage tanks, Coatings, Equipment specifications,
Insulation, Materials tests

N70-37499 CFSTI Prices: HC\$3.00 MF\$0.65

ABSTRACT:

The methods are presented for insulation of a liquid hydrogen container with polyurethane spray foam. The spray foam equipment and its operation, the methods and techniques for application of spray foam to the surface of the tank, and the sealing of the external surface of the foam are described. Several test items which were insulated with polyurethane spray foam and general results of cryogenic testing of the insulation system are discussed.

IRRADIATIONS AT LOW TEMPERATURES. PART 1 - DEVICE DESIGNS

Commissariat A L Energie Atomique, Fontenay- Aux-roses (France).
Centre D'etudes Nucleaires.

les Irradiations Aux Basses Temperatures. Premiere Partie - Conception
des Dispositifs

AUTHOR: Conte, R. R.

7291A1 FLD: 13A, 13D, 18J, 939, 916 STAR0803

Oct 69 38p

REPT NO: CEA-R-3910

Lang- in French, English Summary

DESCRIPTORS: *Cryogenic fluid storage, *Cryogenics, *Irradiation,
*Reactor design, *Refrigerators, Cryostats, Electron irradiation,
Liquid helium, Liquid hydrogen, Liquid oxygen, Low temperature,
Neutron irradiation, Thermal conductivity

N70-13879 CFSTI Prices: HC\$6.00 MF\$0.95

NO ABSTRACT AVAILABLE

DETERMINATION OF PHYSICAL AND TECHNOLOGICAL PROPERTIES OF SUPERINSULATION

Boelkow G.M.B.H., Ottobrunn Bei Muenchen (West Germany). Space Dept.

Bestimmung Von Physikalischen Und Technologischen Eigenschaften Von Superisolierung

AUTHOR: Mueller, E.

7145L1 FLD: 20L, 934 STAR0801

Jul 69 40p

REPT NO: BMWF-FB-W-69-24

Lang- in German, English Summary Spon- Sponsored By Bundesmin. Fuer Wiss. Forsch.

DESCRIPTORS: *Aluminum compounds, *Cryogenic fluid storage, *Mylar (trademark), *Superconductivity, *Thermal insulation, Aerospace engineering, Liquid hydrogen, Liquid nitrogen, Product development, Spacecraft structures, Surface properties

N70-11236 CPSTI Prices: HC\$6.00 MF\$0.95

ABSTRACT:

Several properties of NRC-2 superinsulation, of interest for its use as insulation on cryogenic spacecraft tanks, were determined. The experiments were concerned with longitudinal and transversal heat conductivity, specific heats, surface properties, gas permeability, content of gases, humidity, and inflammability. The measurements were carried out at different temperatures. The cryogenic liquids used were liquid nitrogen and hydrogen.

STUDY OF LIQUID HYDROGEN AND LIQUID DEUTERIUM COLD NEUTRON SOURCES

Commissariat A L Energie Atomique, Grenoble (France). Centre
D'etudes Nucleaires.

Etude de Sources de Neutrons Froids A Hydrogene Et Deuterium Liquides

AUTHOR: Harig, H.-D.

6641L3 FLD: 2CH, 933 STAR0718

Jan 69 85p

REPT NO: CEA-R-3505

Lang- in French, English Summary

DESCRIPTORS: *Cold neutrons, *Cryogenic equipment, *Liquid hydrogen,
*Moderators, *Neutron sources, *Nuclear power reactors, Bibliographies
, Cryogenic fluid storage, Deuterium, Heavy water, Liquefied gases,
Neutron spectra, Reactor cores, Thermalization (energy absorption)

N69-32432 CPSTI Prices: HC\$6.00 MF\$0.95

NO ABSTRACT AVAILABLE

THE PRODUCTION OF LIQUID HYDROGEN

Foreign Technology Div Wright-Patterson AFB Ohio (141600)

AUTHOR: Rozhkov, I. V., Almazov, O. A., Ilinskii, A. A.

6612F1 FLD: 7A, 13H, 909, 916 USGRDR6921

9 Jul 69 162p*

REPT NO: FTD-HT-23-1291-68

Edited trans. of mono. Poluchenie Zhidkogo Vodoroda, Moscow, 1967
p1-198.

ABSTRACT: The production of liquid hydrogen, its liquefaction and its ortho-para-conversions, as well as specific features involved in the storage and transportation of this material are covered in detail in this report compiled from recent Soviet and other publications. The report deals specifically with the structural materials used in the fabrication of industrial installations, pumping and storage facilities. Cryogenic thermal insulation is covered, as are the rules of safety in connection with the handling of liquid hydrogen. A list of references, containing 170 entries, is provided. (Author)

DESCRIPTORS: (*Liquefied gases, Manufacturing methods), (*Hydrogen, Liquefied gases), (*Cryogenics, Chemical engineering), Handling, Storage, Thermal insulation, Transportation, Safety, USSR

IDENTIFIERS: *Liquid hydrogen, Translations

AD-693 480 CFSTI Prices: HC\$6.00 MF\$0.95

LOW-DENSITY FOAM FOR INSULATING LIQUID- HYDROGEN TANKS

National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AUTHOR: Summer, I. E.

6063L4 FLD: 11I STAR0710

Mar 69 52p

REPT NO: NASA-TN-D-5114

CONTRACT: 180-31-08-06-22

DESCRIPTORS: *Aerospace vehicles, *Liquid hydrogen, *Polyurethane foam, *Storage tanks, *Thermal insulation, Density (mass/volume), Performance tests, Systems engineering, Thermal stresses, Thermodynamic properties

N69-20790 CPSTI Prices: PC\$6.00 MF\$0.95

ABSTRACT:

A lightweight polyurethane form insulation for liquid hydrogen tanks of space vehicles was developed that (1) could be foamed in place, (2) did not crack when chilled to liquid hydrogen temperature, and (3) had a thermal conductivity of $0.0137 \text{ W}/(\text{m})(\text{K})$ ($0.0079 \text{ Btu}/(\text{hr})(\text{ft})(^{\circ}\text{R})$) at a mean temperature of 136 K (342 R). Thermophysical properties of the foam were determined and thermal stress profiles throughout a layer of insulation were calculated.

HYDROGEN GAS PRESSURE VESSEL PROBLEMS IN THE M-1 FACILITIES

Aerojet-general Corp., Sacramento, Calif.

AUTHOR: Frick, V. , Laws, J. S., Mc Connell, J.

6003A1 FLD: 13D STAR0709

Mar 69 65p

REPT NO: NASA-CR-1305, REPT-8800-67

CONTRACT: NAS3-2555

Coll- 65 P Refs

DESCRIPTORS: *M- 1 engine, *Storage tanks, *Structural failure,
Cryogenic equipment, High pressure, Hydrogen, Laminates, Metallurgy,
Stresses, Welded structures

N69-19831 CFSTI Prices: PC\$6.00 MF\$0.95

NO ABSTRACT AVAILABLE

DEVELOPMENT OF AN SPS/DPS HYDROGEN SHROUDED CRYOGENIC HELIUM STORAGE SYSTEM FINAL REPORT, JUL. 1967 - SEP. 1968

Bendix Corp., Davenport, Iowa. Instruments and Life Support Div.

AUTHOR: Bald, W. B.

5651D3 FLD: 21H STAR0704

9 Oct 68 135p

REPT NO: NASA-CR-92441, PUBL-4019-68

CONTRACT: NAS9-7337

DESCRIPTORS: *Cryogenic fluid storage, *Helium, *Liquid hydrogen, *Prelaunch tests, *Spherical tanks, Buckling, Cryogenic equipment, Lunar module, Space storage

N69-14774 CPSTI Prices: PC\$6.00 MF\$0.95

ABSTRACT:

The feasibility of using the concept whereby a primary cryogenic fluid is surrounded by a secondary refrigerant fluid was demonstrated earlier. The development of an SPS/DPS hydrogen shrouded cryogenic helium storage system is described which is sized to the approximate lunar module descent propulsion system requirements. Extensive testing performed on the completed system demonstrated its ability to meet the anticipated LM mission profile requirements. Methods for considerably extending the standby capabilities of a shrouded dewar are discussed.

STRUCTURAL PROSPECTS FOR HYPERSONIC AIR VEHICLES

National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AUTHOR: Heldenfels, R. R.

4922E4 FLD: 1C STAR0616

1966 46p

REPT NO: NASA-TM-X-59063

Conf- Presented At the 5th Congr. of the Intern. Council of the Aeron. Sci. (Icas), London, 12-16 Sep. 1966

DESCRIPTORS: *Air breathing engines, *Aircraft configurations, *Hypersonic aircraft, *Structural design, Air intakes, Aircraft design, Aircraft structures, Commercial aircraft, Cryogenic fluid storage, Heat shielding, Liquid hydrogen, Transport aircraft

N68-27447 CPSTI Prices: PC\$6.00 MF\$0.95

ABSTRACT:

Proposed missions, configurations, and design requirements of hypersonic air vehicles with air-breathing propulsion are reviewed to determine the important structural design problems. High external surface temperatures and internal storage of cryogenic fuel in a vehicle with a structural weight fraction comparable to current subsonic aircraft put stringent requirements on the selection of materials and structural configurations resulting from research on fuselage liquid hydrogen tankage, wings, heat shields, and air inlets are reviewed to indicate their applicability to a future hypersonic commercial air transport.

HYDROGEN SAFETY MANUAL

National Aeronautics and Space Administration. Lewis Research Center,
Cleveland, Ohio.

4865F2 FLD: 13L STAR0615

1968 84p

REPT NO: NASA-TM-X-52454

DESCRIPTORS: *Hazards, *Hydrogen, *Manuals, *Safety, Cryogenic storage
, Emergencies, Equipment specifications, Flammable gases, Gas mixtures
, Leakage, Liquid hydrogen, Materials handling, Personnel

N68-25704 CFSTI Prices: PC\$6.00 MF\$0.95

NO ABSTRACT AVAILABLE

FROM EARTH GAS TO SUN GAS

Technische Hogeschool, Eindhoven (Netherlands).

Van Aardgas Tot Zonnegas

AUTHOR: Gijsman, H. M.

3474F3 FLD: 7A STAR0513

11 Mar 66 16p

MONITOR: 18

in Dutch Presented At Eindhoven, Netherlands, 11 Mar. 1966

DESCRIPTORS: *Cryogenics, *Liquefaction, *Liquid gas, *Low temperature physics, Gas, Helium, History, Hydrogen, Liquid, Low temperature, Methane, Oxygen, Physical, Physics, Production, Property, Storage, Thermal, Transport, Utilization

N67-26111 CFSTI Prices: PC\$3.00 MF\$0.95

ABSTRACT:

The development, production, and utilization of liquefied gases and their role in cryogenics is presented in form of a lecture. Physical and thermal properties are given for methane, liquid helium, liquid hydrogen, and liquid oxygen. Transport and storage problems are briefly covered. Mentioned are the uses of liquefied gases in rocket propulsion, reactor technology, superconductivity, computer elements, cooling machinery, infrared detectors, and parametric amplifiers.

LOW-TEMPERATURE TECHNOLOGY. FACILITIES AND CONSTRUCTION MATERIALS FOR CONDUCTION, TRANSPORT AND STORAGE OF LIQUID HYDROGEN. LOW-TEMPERATURE PROPERTIES OF METALS, ALLOYS, AND NON-METALLIC MATERIALS - A BIBLIOGRAPHY

Kernforschungsanlage, Juelich (West Germany). Zentralbibliothek.

Tieftemperaturtechnik. Anlagen Und Bauelemente Fuer Leitung, Transport Und Lagerung, Speziell Von Fluessigem Wasserstoff, Sowie Tieftemperatureigenschaften Von Metallen, Legierungen Und Nichtmetallischen Werkstoffen. Eine Literaturzusammenstellung

AUTHOR: Freyschmidt, E. , Paul, E. , Wittenberg, M.

3313L1 FLD: 11G, 20M STAR0510

Sep 64 64p

REPT_NO: JUL-BIBL-4

MONITOR: 18

in German and English

DESCRIPTORS: *Cryogenic storage, *Liquid hydrogen, *Low temperature environment, Alloy, Cryogenic, Environment, Facility, Handling, Hydrogen, Liquid, Low temperature, Material, Metal, Nonmetallic, Storage, Structure, Transportation

N67-21096 CPSTI Prices: PC\$6.00 MF\$0.95

NO ABSTRACT AVAILABLE

Selected Topics on Hydrogen Fuel

National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards. (401 979)

Final rept.

AUTHOR: Parrish, W. R., Voth, R. O., Hust, J. G., Flynn, T. M., Hord, J.

C4774D2 FLD: 21D, 97A*, 97H, 86V USGRDR7515

May 75 215p*

REPT NO: NBS-SP-419

PROJECT: NBS-2750154

MONITOR: 18

Library of Congress Catalog Card no. 75-8798. Paper copy also available from GPO as C13.10:419.

ABSTRACT: This report is a summary report on selected hydrogen-fuel topics and was prepared to identify cost and technical barriers to the commercial use of hydrogen fuel and to generate reference data for policy-planning, decision-making and design. Cryogenic hydrogen fuel technology is emphasized in the economic and systems analyses. Research and development needs within selected areas of NBS competence are identified and future research plans are outlined.

DESCRIPTORS: *Hydrogen, *Fuels, *Reviews, Production, Cost analysis, Cost estimates, Research projects, Off-peak energy storage, Capitalized costs, Gas storage, Hydrogen embrittlement, Cryogenics

IDENTIFIERS: NTISCOMNBS

COM-75-10619/5ST NTIS Prices: PC\$7.25/MF\$2.25

Quarterly Literature Review of Hydrogen Energy. A Bibliography with Abstracts

New Mexico Univ., Albuquerque. Technology Application Center.

Quarterly repts.

C4043G4 FLD: 10B, 21D, 97A*, 99 USGRDR7504

1974 1p*

MONITOR: 18

Paper copy available on subscription only \$50.00/year domestic, \$60.00/year foreign.

ABSTRACT: Topic areas cover concepts, conferences, surveys, and reviews; production; applications; transmission, distribution, and storage; and safety.

DESCRIPTORS: *Energy, *Hydrogen, *Bibliographies, Abstracts, Gas production, Utilization, Transportation, Distribution systems, Gas storage, Fire safety, Manufactured gas, Electrolysis, Photolysis, Photosynthesis, Dehydrogenation, Cryogenics, Embrittlement

IDENTIFIERS: NTISTAC

PB-237 419/7ST NTIS Prices: PC-Subscription

Quarterly Literature Review of Hydrogen Energy. A Bibliography with Abstracts

New Mexico Univ., Albuquerque. Technology Application Center.

Quarterly repts.

C3865J1 FLD: 10B, 97A, 99 USGRDR7501

1974 4 issues

MONITOR: 18

Paper copy available on subscription only \$50.00/year domestic, \$60.00/year foreign.

ABSTRACT: HYDROGEN ENERGY is a continuing bibliographic summary with abstracts of research and projections on the subject of hydrogen as a secondary fuel and as an energy carrier.

DESCRIPTORS: *Energy, *Hydrogen, *Bibliographies, Abstracts, Production, Utilization, Fuel consumption, Distribution systems, Storage, Safe handling, Cryogenics, Hydrogen embrittlement, Electrolysis, Fuel cells, Hydrides, Combustion, Design, Fuels, Hydrocarbons, Catalysts, Ammonia

IDENTIFIERS: NTISTAC

PB-236 367/9ST NTIS Price: PC-Subscription

Hydrogen Energy. A Bibliography with Abstracts. First Quarter, 1974

New Mexico Univ., Albuquerque. Technology Application Center.

Quarterly update.

C3865I4 FLD: 10B USGRDR7501

31 Mar 74 139p

MONITOR: 18

Paper copy available on subscription only \$50.00/year domestic,
\$60.00/year foreign.

ABSTRACT: HYDROGEN ENERGY is a continuing bibliographic summary with abstracts of research and projections on the subject of hydrogen as a secondary fuel and as an energy carrier.

DESCRIPTORS: *Energy, *Hydrogen, *Bibliographies, Abstracts, Production, Utilization, Fuel consumption, Gas distribution, Storage, Safe handling, Hydrogen embrittlement, Cryogenics, Electorlysis, Distribution systems, Fuel cells, Hydrides, Combustion, Design

IDENTIFIERS: NTISTAC

PB-236 367-01/ST NTIS Price: PC-Subscription

TESTS FOR HYDROGEN EMBRITTLEMENT OF STEELS USED IN TANK FARM CYLINDERS

Los Alamos Scientific Lab., N. Mex. (211 350)

AUTHOR: Mills, R. L., Edeskuty, F. J.

3193B3 FLD: 11F, 13D NSA2106

Oct 66 15p

CONTRACT: W-7405-eng-36

MONITOR: 18

DESCRIPTORS: (*Hydrogen embrittlement, Steel), (*Storage tanks, Stresses), Failure(Mechanics), Gases

LA-3602-MS CPSTI Prices: PC\$3.00 MF\$0.95

NO ABSTRACT AVAILABLE

SLUSH HYDROGEN PRODUCTION, STORAGE, AND DISTRIBUTION STUDY PROGRAM
FINAL REPORT, 4 NOV. 1965 - 29 APR. 1966

Union Carbide Corp., Tonawanda, N. Y. Linde Div.
3082L1 FLD: 21I STAR0506
13 May 66 97p
REPT NO: NASA-CR-81185
CONTRACT: SNPC-41
MONITOR: 18

DESCRIPTORS: *Liquid hydrogen, *Nuclear propulsion, *Slush, Cost,
Cycle, Helium, Hydrogen, Liquid, Nerva, Nuclear, Plant, Propulsion,
Pump, Recirculation, Refrigeration, Storage, Vacuum, Vapor

N67-15455 CFSTI Prices: PC\$6.00 MF\$0.95

NO ABSTRACT AVAILABLE

LIQUID HYDROGEN TRANSFER TEST REPORT

Douglas Aircraft C Inc Santa Monica Calif (000000)
AUTHOR: Brincka, D. R.
1455E3 USGRDR
7 Jun 60 2p
REPT NO: sm-37500

ABSTRACT: The feasibility of transferring liquid hydrogen at high flow rates was verified. The transfer rate for this test was in the range of 2500-3000 G.P.M. into an ambient (temperature) pipe line and missile tank. Pipe line bow did not exceed six (6) inches at the beginning of transfer and returned to approximately the original position shortly afterwards. This bow compares favorably with our previous experience flowing liquid oxygen at rates up to 1500 GPM where the maximum bowing reached zero (0) to two (2) inches on the same type transfer system. Missile tank top pressure reached a peak of 24 PSIG approximately 6.5 seconds after transfer was initiated. It decayed thereafter to a minimum of 1 PSIG at termination of flow. The integrity of the WS-315A designed seals and joints were verified at liquid hydrogen temperatures and nominal pressures (not exceeding 40 PSIG). The standard ASA raised face (Serrated) flanges using Kel-F gaskets proved adequate as a sealing means on the pipe line configuration. The flexatallic seals used on the vent valves, emergency drain valve and the main lox tank exit cone all provided satisfactory sealing at liquid hydrogen temperatures. The applicability of cryogenic design practices in relation to valves was demonstrated.

DESCRIPTORS: (*FUELS, GUIDED MISSILES), (*LIQUID ROCKET FUELS, HANDLING), (*FLUID FLOW, LIQUID ROCKET FUELS), LIQUEFIED GASES, HYDROGEN, CRYOGENICS, STORAGE TANKS, FUEL TANKS, TANK VENTS, TEMPERATURE, SEALS (STOPPERS), THERMAL INSULATION, INSTRUMENTATION, TEST METHODS

IDENTIFIERS: TRANSFER RATES

AD-608 908 CFSTI Price: PC\$3.00

PERMEABILITY OF TITANIUM TO HYDROGEN

Defense Metals Information Center Columbus Ohio (000000)

Technical note

AUTHOR: Jackson, James D.

1441I4 USGRDR

29 Jul 64 2p

ABSTRACT: While titanium has proved to be a good material for containers for liquid hydrogen, calculations of the rates of diffusion of hydrogen through titanium indicate that there may be practical limits of temperature, pressure, and time that must be recognized in designing containers for hydrogen. These calculations are presented. On the basis of the reported data, it is not believed that titanium and its alloys can be recommended as a container material for hydrogen for long-term service much above 200 F. For short-term service, the permeation to hydrogen may be low up to temperatures near 500 F and at low pressures.

DESCRIPTORS: (*LIQUIFIED GASES, CONTAINERS), (*TITANIUM, PERMEABILITY), (*HYDROGEN, DIFFUSION), (*STORAGE TANKS, TITANIUM), TIME, PRESSURE, TEMPERATURE, TITANIUM ALLOYS

AD-609 339 CFSTI Price: PC\$3.00

OBJECTIVES OF USE OF INDIGENOUS RESOURCES FOR MANNED EXTRATERRESTRIAL BASES

Rand Corp Santa Monica Calif (000000)

AUTHOR: Steinhoff, E. A.

1203C1 USGRDR

Jun 62 2p

REPT NO: p-2604

Presented before the Working Group on 'Use of Indigenous Resources for Manned Extraterrestrial Bases,' held at The RAND Corp., 22 Jun 62.

ABSTRACT: An analysis of the support requirements for manned Mars missions is presented. Considered in the discussion are the costs and problems of life support which would be involved in the establishment of extraterrestrial bases.

DESCRIPTORS: (*MARS, EXTRATERRESTRIAL BASES), (*EXTRATERRESTRIAL BASES , LOGISTICS), (*CLOSED ECOLOGICAL SYSTEMS, EXTRATERRESTRIAL BASES), COSTS, LIFE SUPPORT, WATER, FOOD, OXYGEN, HYDROGEN, FUELS, NUTRITION, MANNED, TRANSPORTATION, STORAGE.

AD-604 820 CFSTI Price: PC\$3.00

THERMAL CHARACTERISTICS OF A STORAGE VESSEL ON THE MOON

National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

AUTHOR: Harrison, J. K.

1124C3 FLD: 20M STAR0505

Jan 67 54p

REPT NO: NASA-TN-D-3785

DESCRIPTORS: *Liquid hydrogen, *Lunar environment, *Radiation absorption, *Storage tank, *Thermoconductivity, Absorption, Analysis, Characteristics, Computer, Emission, Environment, Hydrogen, Insulation, Liquid, Lunar, Program, Radiation, Shadow, Shape, Size, Storage, Tank, Temperature, Thermal, Vessel

N67-14937 CPSTI Prices: PC\$6.00 MF\$0.95

NO ABSTRACT AVAILABLE

PRESSURIZATION SYSTEM FOR USE IN THE APOLLO SERVICE PROPULSION SYSTEM
INTERIM REPORT

Martin Co., Denver, Colo.
AUTHOR: Gorman, D. N., Page, G. R.
1005C2 FLD: 21H STAR0418
Jul 65 252p
REPT NO: NASA-CR-65314, CR-65-50
CONTRACT: NAS9-3521

DESCRIPTORS: *Apollo project, *Fuel tank pressurization system,
*Propulsion system, Cascade, Fuel, Gas, Helium, Hydrazine, Hydrogen,
Mass, Molecular, Pressurization, Propulsion, Reduction, Residual,
Storage, System, Tank, Temperature, Weight

N66-32114 CFSTI Prices: PC\$6.00 MF\$0.95

ABSTRACT:

In the development of an advanced, lightweight, fuel-tank pressurization system for use in the Apollo service propulsion system, three candidate systems were designed and analyzed; a single system was selected as a prototype for subsequent testing. Experimental results showed that gas molecular weight could be reduced from 4 to 2 by replacing helium with hydrogen. It was found that systems utilizing hydrazine monopropellant gas generator gases as fuel tank pressurants are very efficient from a weight standpoint.

ECONOMIC ANALYSIS OF PERLITE VERSUS SUPER INSULATION IN LIQUID
HYDROGEN STORAGE AND RUN VESSELS FOR THE M-1 PROGRAM

Aerojet-general Corp., Covina, Calif. Aetron Div.

AUTHOR: Commander, J. C., Rotter, L. L.

0843G2 FLD: 14A STAR0406

15 Oct 65 33p

REPT NO: NASA-CR-54720, AGC-8800-13

CONTRACT: NAS3-2555

DESCRIPTORS: *Cryogenic storage, *Dewar system, *Liquid hydrogen, *M-1 rocket engine, *Thermal insulation, Aluminum, Comparison, Cost, Cryogenic, Foil, Hydrogen, Insulation, Liquid, Multilayer, Powder, Reflectivity, Run, Storage, Thermal, Vessel

N66-15368 CFSTI Prices: PCS6.00 MF\$0.95

ABSTRACT:

This report is an evaluation, on a cost comparison basis, of the economic aspects of two possible insulation systems, powder type (Perlite) and multi-layer aluminum foil reflective type (Quilted Super Insulation). The analysis applies to 370000 and 575000 gallon liquid hydrogen storage dewars rated at 50 and 100 psig designed for the M-1 Engine Program.

SA-9 VEHICLE AND LAUNCH COMPLEX FUNCTIONAL DESCRIPTION. VOLUME III-
LIQUID HYDROGEN SYSTEM

Chrysler Corp., Huntsville, Ala. Space Div.

0684F2 STAR0311

May 64 61p

REPT NO: NASA-CR-62171, HEC-D042, VOL. III

CONTRACT: NAS8-4016

DESCRIPTORS: *Fuel system, *Liquid hydrogen, *Propulsion system,
*Saturn i (sa- 9) launch vehicle, Facility, Hydrogen, Interlock,
Liquid, Operation, Propulsion, Security, Storage, System

N65-21468 CFSTI Prices: PC\$6.00 MF\$0.95

ABSTRACT:

The liquid hydrogen fuel system that supplies the S-IV (second stage) propulsion system is described. The storage facility and its operation, the fill operations, flight requirements, liquid hydrogen drain, secure operations, and the liquid hydrogen system interlocks are discussed. A mechanical schematic drawing of the liquid hydrogen system is attached.

DESIGN STUDY OF A SOLAR HYDROGEN PROPULSION AND POWER SYSTEM QUARTERLY
REPORT, 17 MAY 1963 - 17 AUG. 1963

Electro-optical Systems, Inc., Pasadena, Calif.

AUTHOR: Mac Farlane, F.

0675K4 STAR0310

9 Sep 63 74p

REPT NO: NASA-CR-57743, EOS-4000-Q-1

CONTRACT: NAS7-231

DESCRIPTORS: *Cryogenic storage, *Solar power system, *Solar
propulsion, *Thrust, Analysis, Component, Concentrator, Cryogenic,
Distance, Level, Power, Propulsion, Solar, Storage, System

N65-20756 CFSTI Prices: PC\$6.00 MF\$0.95

NO ABSTRACT AVAILABLE

CHILLDOWN AND STORAGE LOSSES OF LARGE LIQUID HYDROGEN STORAGE DEWARS

Los Alamos Scientific Lab., Univ. of California, N. Mex.
AUTHOR: Liebenberg, D. N., Stokes, R. L., Edeskuty, F. J.,
0373D3 FLD: 2CM USGRDR6602

1965 14p

REPT NO: CONF-650802-3

CONTRACT: W-7405-eng-36

Presented at the Cryogenic Engineering Conference, Houston, Tex.
Distribution: No limitation.

DESCRIPTORS: (*Cryogenics, Storage tanks), (*Storage tanks, Cryogenics
).

LA-DC-7164 CFSTI Prices: PC\$6.00 MF\$0.50

NO ABSTRACT AVAILABLE

STORAGE, TRANSFER, AND SERVICING EQUIPMENT FOR LIQUID HYDROGEN

Little (Arthur D.), Inc., Cambridge, Mass. (208 850)

Final rept. for 1 May 58-31 Jul 59

AUTHOR: Bailey, B. M., Benedict, D. C., Byrnes, R. W., Campbell, C. R., Fowle, A. A.

0092H3 PLD: 10, 13, 18 USGRDR3923

Jul 59 780p

CONTRACT: AF33 616 5641

PROJECT: 6053

TASK: 60196

MONITOR: AD 231 635

ABSTRACT: The purpose of this study is to provide engineering data concerning the most adequate, safe, and economical procedures and equipment for liquid hydrogen storage, transfer, and ground servicing systems. Our investigations have centered on the requirements for (1) storage vessels, (2) transfer lines, (3) pumping systems, (4) valves, (5) instruments, and (6) recondensing systems. Results, conclusions and recommendations are reported in separate chapters classified in accordance with the above-listed hardware items. (Author)

DESCRIPTORS: (*Liquefied gases, Hydrogen), (*Hydrogen, Liquefied gases), (*Storage, Liquefied gases), (*Handling, Liquefied gases), Low-temperature alloys, Structural properties, Stainless steel, Aluminum, Mechanical properties, Phase studies, Thermal insulation, Materials, Thermal conductivity, Enthalpy, Entropy, Test methods, Test equipment, Pipes, Heat transfer, Costs, Storage tanks, Design, Pumps, High-vacuum valves, Vacuum seals, Vacuum pumps, Vacuum gages, Flowmeters, Liquid level gages, Refrigeration systems, Thermometers

PB-166 287 OTS Prices: HC \$10.80

Storage and Utilization of Liquid Hydrogen on Board the "Pegase"

CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). (1347000)

AUTHOR: Bertrand, G., Perroud, P., Rebiere, J.

A6582L4 FLD: 21D, 81D, 82G NSA3005

Oct 73 20p

REPT NO: CONF-731138-2

MONITOR: 18

In French. U.S. Sales Only.

ABSTRACT: For abstract, see NSA 30 05, number 14695.

DESCRIPTORS: (*Hydrogen storage, *Cryogenic tanks), (*Space vehicles, Hydrogen storage), Uses

IDENTIFIERS: NTISAEC

CEA-CONF-2562 NTIS Prices: PC\$4.00/MF\$2.25

NO ABSTRACT AVAILABLE

Cryogenics Safety in a Hydrogen Fuel Society

Los Alamos Scientific Lab., N.Mex. (Usa). (3820000)
AUTHOR: Reider, R., Edeskuty, F. J., Williamson, K. D. Jr.
A6515G4 FLD: 18B, 77B NSA2912
20p
REPT NO: CONF-740509-1
CONTRACT: W-7405-eng-36
MONITOR: 18

ABSTRACT: For abstract, see NSA 29 12, number 31464.

DESCRIPTORS: (*Hydrogen, *Safety), Cryogenics, Storage, Synthetic fuels

IDENTIFIERS: NTISAEC

LA-UR-74-340 NTIS Prices: PC\$3.00/MF\$1.45

ABSTRACT:

An inevitable world-wide shortage of fossil fuel and concern for environmental pollution have aroused interest in hydrogen as a synthetic clean fuel. The storage, shipment, and use of hydrogen in a cryogenic fluid have already been demonstrated to be feasible and safe. To make liquid hydrogen a universally attractive fuel requires only an extension of existing technology.

Operating Manual for the Pse and G Hydrogen Reservoir Containing Iron
Titanium Hydride

Brookhaven National Lab., Upton, N.Y. (Usa). (0936000)
AUTHOR: Strickland, G., Reilly, J. J.
A6504K1 FLD: 10C, 97D NSA2912
Feb 74 40p
MONITOR: 18

ABSTRACT: For abstract, see NSA 29 12, number 31449.

DESCRIPTORS: (*Hydrogen, *Storage), Electric power, Electrolysis,
Energy storage, Fuel cells, Heat exchangers, Impurities, Iron
compounds, Maintenance, Manuals, Operation, Safety, Titanium hydrides,
Water.

IDENTIFIERS: NTISAEC

BNL-18725 NTIS Prices: PC\$5.00/MF\$1.45

NO ABSTRACT AVAILABLE

Modeling Studies of Fixed-Bed Metal-Hydride Storage Systems

Brookhaven National Lab., Upton, N.Y. (USA). (0936000)

AUTHOR: Yu, W. S., Suuberg, E., Waide, C.

A6484J1 FLD: 21D, 97H, 97F NSA2911

1974 14p

REPT NO: CONF-740306-11

MONITOR: 18

ABSTRACT: For abstract, see NSA 29 11, number 28787.

DESCRIPTORS: (*Hydrogen, *Synthetic fuels), (*Power plants, *Fuels), (*Automobiles, Fuels), Energy conversion, Energy storage, Hydrides, Iron compounds, Magnesium hydrides, Mathematical models, Planning, Titanium compounds

IDENTIFIERS: NTISAEC

BNL-18720 NTIS Prices: PC\$4.00/MF\$1.45

NO ABSTRACT AVAILABLE

Electrochemical Aspects of the Hydrogen Economy

California Univ., Berkeley (Usa). Lawrence Berkeley Lab. (1112800)

AUTHOR: Muller, R. H.

A6393C2 FLD: 10A, 97A NSA2906

Nov 73 9p

REPT NO: CONF-730848-2

CONTRACT: W-7405-eng-48

MONITOR: 18

ABSTRACT: For abstract, see NSA 29 06, number 15023.

DESCRIPTORS: (*Hydrogen, *Energy storage), (*Synthetic fuels, Hydrogen), Economics, Electrochemistry, Electrolysis, Meetings

IDENTIFIERS: AEC

LBL-2232 NTIS Prices: PC\$3.00/MF\$1.45

NO ABSTRACT AVAILABLE

Sodium: Clean-Energy Storage Medium for Vehicular Power

Los Alamos Scientific Lab., N.Mex. (Usa). (3820000)

AUTHOR: Brown, W. K.

A6294J4 FLD: 10B, 97D NSA2901

Sep 73 10p

CONTRACT: W-7405-eng-36

MONITOR: 18

ABSTRACT: For abstract, see NSA 29 01, number 02310.

DESCRIPTORS: (*Sodium chlorides, *Electrolysis), (*Energy storage, *Sodium), (*Hydrogen, *Synthetic fuels), Chemical reactions, Efficiency, Energy, Motors, Nuclear power plants, Pollution, Transport, Vehicles

IDENTIFIERS: AEC

LA-5406-MS NTIS Prices: PCS4.00/MF\$1.45

NO ABSTRACT AVAILABLE

Hydrogen Economy

Brookhaven National Lab., Upton, N. Y. (1401000)

AUTHOR: Sailor, V. L.

A6225D2 FLD: 21D, 97A NSA2812

1973 23p

MONITOR: 18

ABSTRACT: For abstract, see NSA 28 12, number 32082.

DESCRIPTORS: (*Hydrogen, *Synthetic fuels), Economics, Efficiency, Energy consumption, Energy conversion, Energy conversion, Energy sources, Energy storage, Environment, Gases, Legal aspects, Liquid fuels, Natural gas, Petroleum, Transport

IDENTIFIERS: AEC

BNL-18224 NTIS Prices: PC\$3.25/MP\$1.45

NO ABSTRACT AVAILABLE

Storage and Transportation of Synthetic Fuels. A Report to the
Synthetic Fuels Panel

Oak Ridge National Lab., Tenn. (6171000)

AUTHOR: Johnson, J. E.

A6212G2 FLD: 21D, 97H, 99B NSA2810

Sep 72 20p

CONTRACT: W-7405-eng-26

MONITOR: 18

ABSTRACT: For abstract, see NSA 28 10, number 26787.

DESCRIPTORS: (*Synthetic fuels, *Storage), Ammonia, Energy
transmission, Hydrogen, Methanol, Transport

IDENTIFIERS: AEC

ORNL-TM-4307 NTIS Prices: PC\$3.00/MF\$1.45

NO ABSTRACT AVAILABLE

Logistics, Economics, and Safety of a Liquid Hydrogen System for
Automotive Transportation

Los Alamos Scientific Lab., N. Mex. (4808500)

AUTHOR: Stewart, W. F., Edeskuty, F. J.

A6152B4 FLD: 21D, 81D, 97H NSA2808

1973 31p

REPT NO: CONF-730917-1

CONTRACT: W-7405-eng-36

MONITOR: 18

ABSTRACT: For abstract, see NSA 28 08, number 20540.

DESCRIPTORS: (*Hydrogen, *Synthetic fuels), (*Engines, *Fuels),
Economics, Energy, Production, Safety, Storage, Transport

IDENTIFIERS: AEC

LA-UR-73-715 NTIS Prices: PC\$3.75/MF\$1.45

NO ABSTRACT AVAILABLE

Padre Sol and Chemical Fuel Production

Princeton Univ., N. J. (6801000)

AUTHOR: Axtmann, R. C.

A6135G2 FLD: 18J, 77I NSA2808

13p

REPT NO: CONF-730646-1

CONTRACT: AT(11-1)-3028

MONITOR: 18

ABSTRACT: For abstract, see NSA 28 08, number 20536.

DESCRIPTORS: (*Fuels, *Production), (*Hydrogen, Production), (*Methane, Production), (*Biological wastes, *Uses), Cost, Electric power, Energy storage, Fuel cells, Solar energy

IDENTIFIERS: AEC

COO-3028-6 NTIS Prices: PC\$3.00/MF\$1.45

NO ABSTRACT AVAILABLE

Hydrogen and Synthetic Fuels for the Future

Oak Ridge National Lab., Tenn. (6171000)

AUTHOR: Michel, J. W.

A6052K1 FLD: 21D, 81D, 97A NSA2806

1973 36p

MONITOR: 18

ABSTRACT: For abstract, see NSA 28 06, number 15019.

DESCRIPTORS: (*Hydrogen, *Synthetic fuels), (*Ammonia, Synthetic fuels), (*Hydrazine, Synthetic fuels), (*Methanol, Synthetic fuels), Electricity, Environment, Ethanol, Fossil fuels, Gasoline, Methane, Nuclear power, Pollution, Production, Solar energy, Storage, Transport

IDENTIFIERS: AEC

CONF-730807-3 NTIS Prices: PC\$4.00/MF\$1.45

NO ABSTRACT AVAILABLE

Experience in Handling, Transport and Storage of Liquid Hydrogen- the
Recyclable Fuel

Los Alamos Scientific Lab., N. Mex.

AUTHOR: Bartlit, J. R., Edeskuty, F. J., Williamson Jr, K. D.

A5593H1 FLD: 21D, 59B, 81D NSA2622

1971 13p

REPT NO: CONF-720925-1

MONITOR: 18

From 7. Intersociety Energy Conversion Engineering Conference- San
Diego, Ga. (25 Sep 1972).

ABSTRACT: For abstract, see NSA 26 22, number 55552.

DESCRIPTORS: *Hydrogen,

LA-DC-72-632 NTIS Prices: PC\$3.00/MF\$0.95

NO ABSTRACT AVAILABLE

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Originator (Give specific laboratory, or division and location.)		Personal Author
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