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507206



**TITLE**

GMAW POWER SOURCES FOR THE JOINING OF HIGH STRENGTH STEELS

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#507206 (3)

# **GMAW Power Sources for the Joining of High Strength Steels**

by

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and

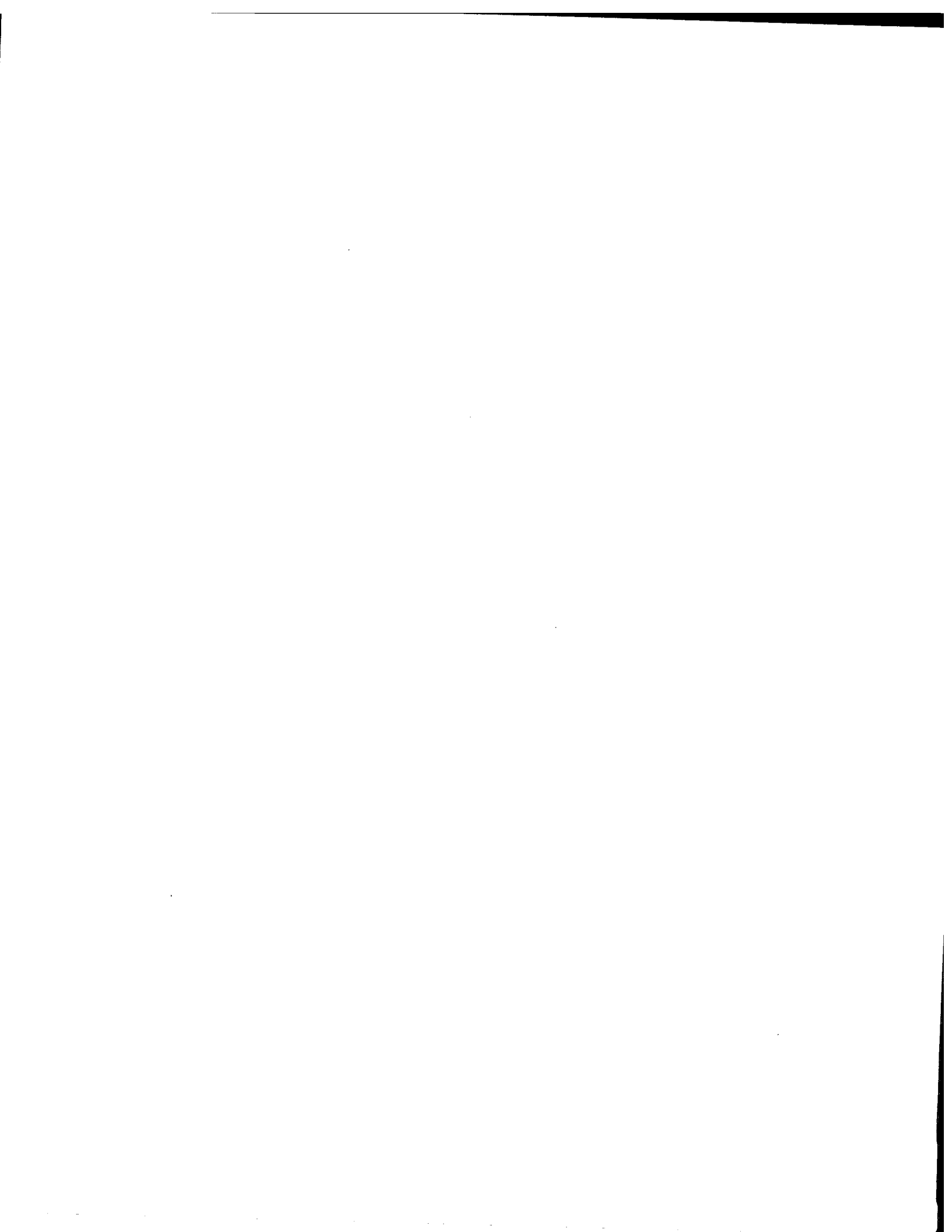
**James R Matthews  
Defence Research Establishment Atlantic**

## **ABSTRACT**

Commercially available Pulsed Gas Metal Arc Welding power sources were reviewed and evaluated, the main objective being to recommend the most applicable package for all position welding of high strength steels used in the construction of naval vessels.

Evaluation criteria included practical considerations such as size and usability, along with factors such as arc control methods and arc characteristics which relate directly to the suitability of any particular package for successful all position welding of high strength steels.

In addition, a literature review was conducted to determine if any new flux cored or metal cored arc welding consumables have recently been developed which provide adequate weld metal toughness in naval structural steel welds.



# **GMAW Power Sources For The Joining of High Strength Steels**



*by*

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*presented at*

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Materials Technology**

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# Objective



- The main objective was to recommend one or more P-GMAW power sources for use in the Dockyard environment
- A secondary objective was to investigate recently developed flux cored and metal cored consumables for joining high strength naval steels

# Approach



- Determine Current Practices in Shipyards in the US, UK, and Australia
- Review Technical Literature for Candidate Flux or Metal Cored Consumables
- Review Technical Literature Available from Power Source Manufacturers
- Conduct Limited Hands-on Trials with Candidate Power Sources

# Determine Current Practices



- Simulated Trials have been Successfully Completed in the UK with FCAW
- FCAW Consumable has been Approved for use in Australia
- Pulsed-GMAW is being Successfully Employed in the U.S.



## **Review of Consumables**



- **Lincoln Electric - Outershield E91T1-K2 reported as a replacement for the Murex Corofil B 65 used in UK trials**
- **ESAB/Alloy Rods - Dual Shield II series provides various FCAW consumables which may be suitable for the joining of QT-28, HY-80, and HY-100**
- **Lincoln Electric - MC 100 for MCAW**
- **GMAW Consumables Available from Lincoln, ESAB, and Soudor**

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# Power Sources Reviewed



## ■ Review of Technical Literature from Manufacturers Identified the Following Packages for Further Evaluation:

### Evaluation:

- Hobart Arcmaster 501 w/2410 wire feeder
- ESAB Digipulse 450 w/XRT feeder
- ESAB SVI 450 w/4HD wire feeder
- Miller Maxtron 450 w/64M wire feeder
- Lincoln Powerwave 450 w/Synergic 7 wire feeder

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# Power Source Criteria



## ■ Primary Evaluation Criteria:

- Arc Control Methods
- Arc Characteristics

## ■ Secondary Criteria:

- Ease of Use
- Size and Portability

# Arc Control Methods



- Adaptive
- Synergic
- Adaptive-Synergic

- In P-GMAW methods of arc control strongly influence how well any given machine can adjust to variations in electrical stickout (ESO). This ability is particularly important for all-position semi-automatic welding

# Arc Characteristics



Arc Characteristics are Generally Defined by:

- Pulse Parameters
- Dynamic Response

# Power Source Findings

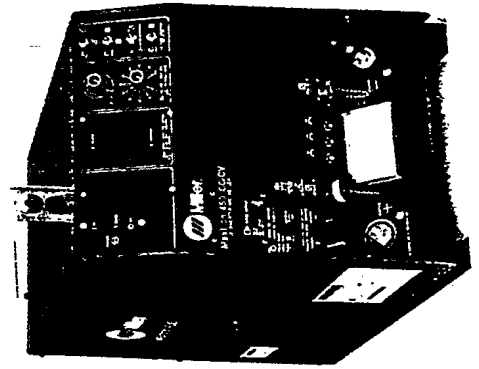
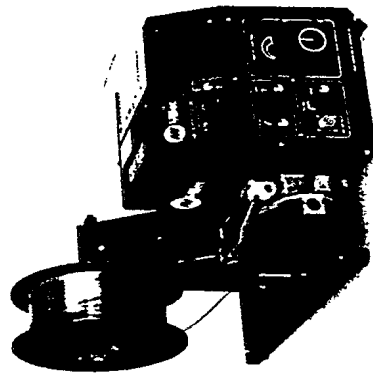


- All Five Packages are Suitable from the Standpoint of Size, Portability, and Ease of Use
- Two Packages, the Miller Maxtron 450 and Lincoln Powerwave 450 Provide the Most Favorable Arc Characteristics
- The Lincoln Powerwave 450 is the Preferred Package as a Result of Advanced Arc Control Methods and Low Alloy Steel Pulse Programs that Perform Well for All Position Welding

# Miller/BOC Canox



- Maxtron (BOC Invertron) 450 w/64M wire feeder:

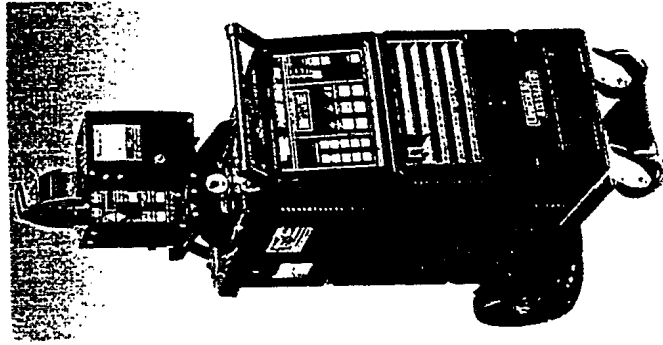


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# Lincoln Electric



■ Powerwave 450 w/Synergic 7 wire feeder



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# Conclusions



## ■ Developments in Power Source Technology and Consumable Formulation Present More Options Than Ever Before for the Joining of High Strength Steels Used in the Construction of Naval Vessels:

- The Lincoln Powerwave 450 has been judged to be the most suitable package for P-GMAW in the Dockyard application
- FCAW and MCAW consumables now demonstrate some promise as an eventual alternative to P-GMAW

