



Advances in Casing Centralization Using Spray Metal Technology

OTC Paper 21979 – May 3rd 2011

John Gammage

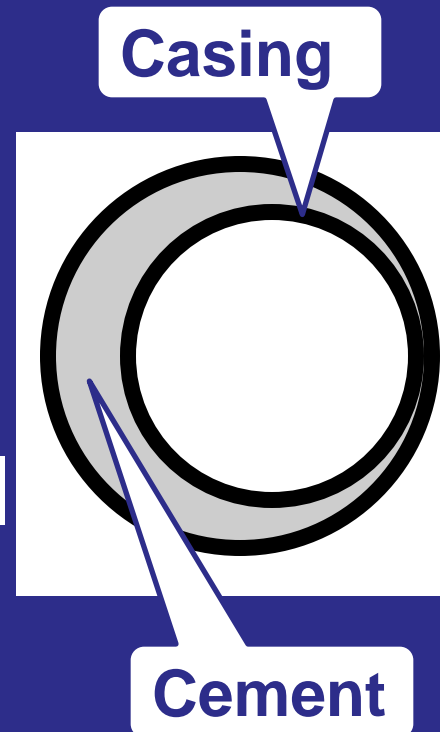
(a Driller, not a Welder)



Casing Centralization 101

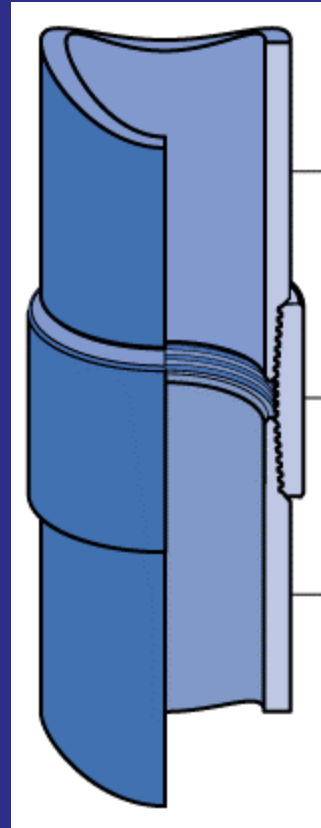
The Very Basics

- A hole is drilled
- Casing is run into the hole
- The casing is cemented in place to provide well control
- To ensure a good cement job the casing must be centralized in the hole



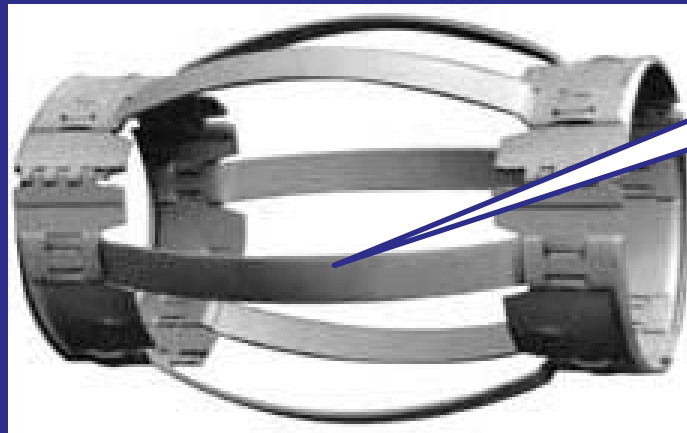
Casing Centralization 101

- Traditionally joints of casing are connected using threaded collars
- As annular tolerances get tighter the collar is replaced by a forged upset...
- ... until the casing is completely flush and the connecting threads are cut within the wall thickness of the casing itself³



Casing Centralization 101

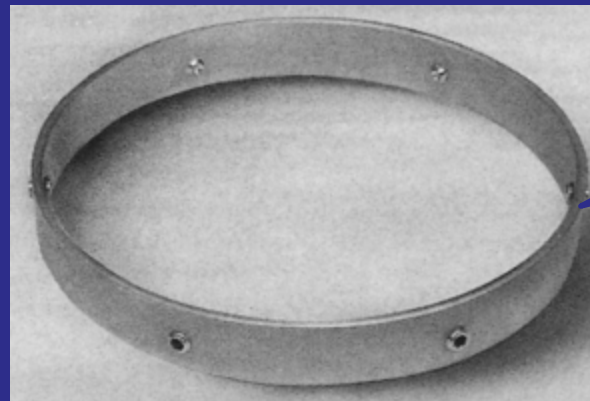
- Casing collars provide a very positive stop wherewith to locate centralizers
- The centralizer may be placed over the collar or above/below it



**Bowspring
Centralizer**

Casing Centralization 101

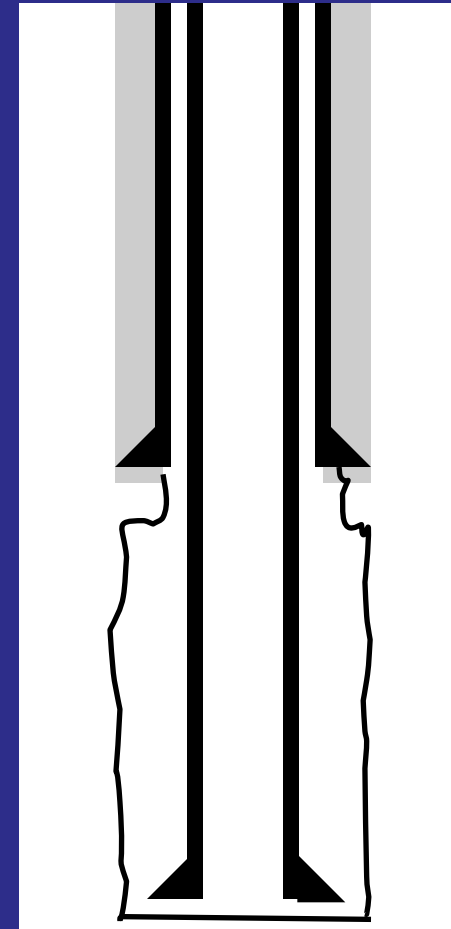
- With upset or flush connections the centralizer must be located with another device
- These have limited holding capacity especially with higher grade casing



**Set Screw
Stop Collar**

Casing Centralization 101

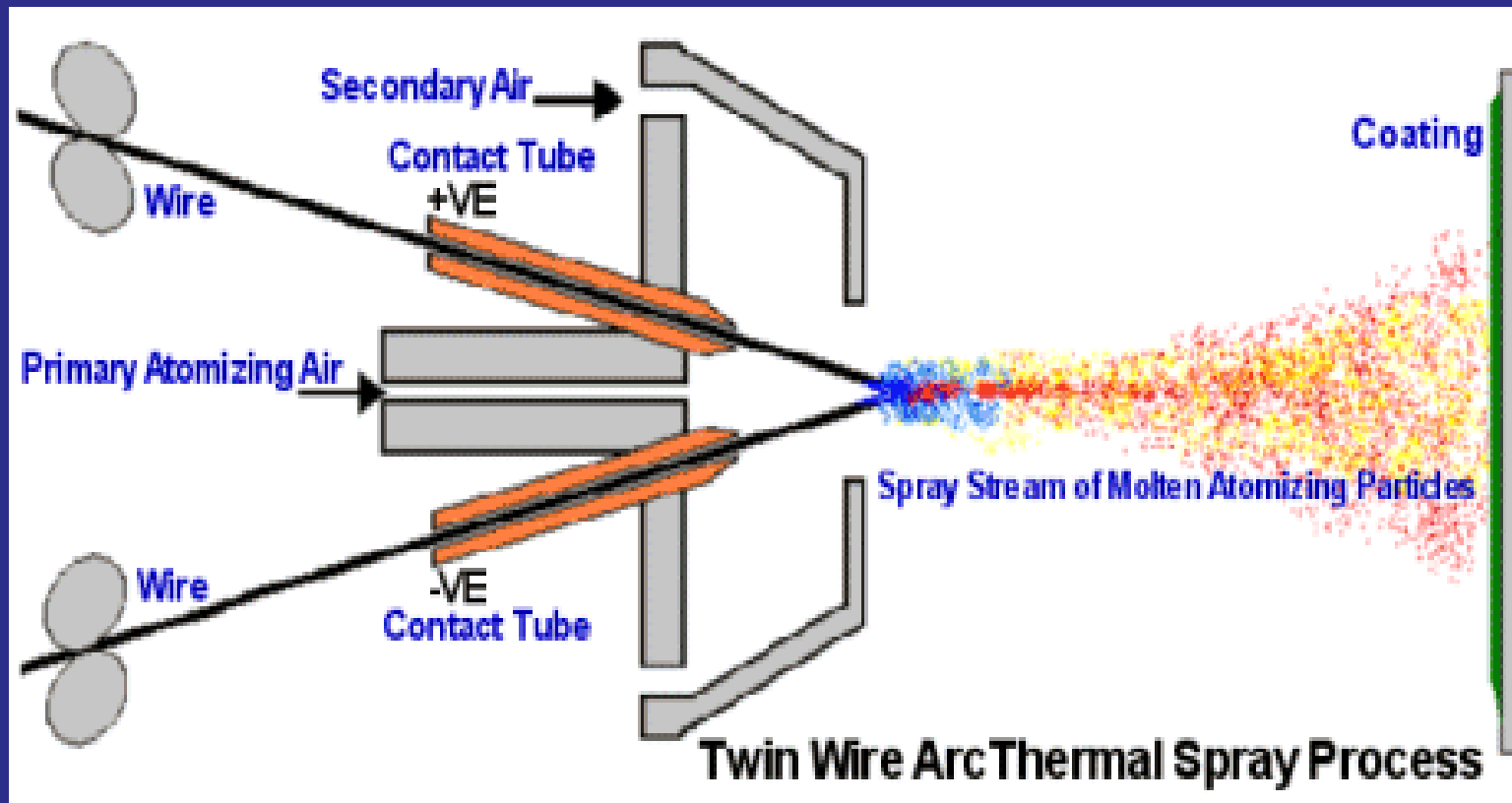
- The open hole beneath the last casing shoe is under-reamed to reduce circulating pressure while cementing and to ensure a good cement bond
- To be effective in this enlarged hole centralizers must be able to pass through the casing annulus and then open out some inches⁶



Casing Centralization 101

Casing OD"	Drift ID"	Annulus (r")	Notes
36	33	OH	
22	20	5.5	
18	16.5	1	
16	14.5	0.25	1/4"
13.625	12.25	0.4375	7/16"
11.875	10.5	0.1875	3/16"
9.875	8.5	0.3125	5/16"
7	6	0.75	

The Spray Metal Process



The Spray Metal Process

Two Wire Spools

Controls & Wire Drive

Power Supply

Spray Gun



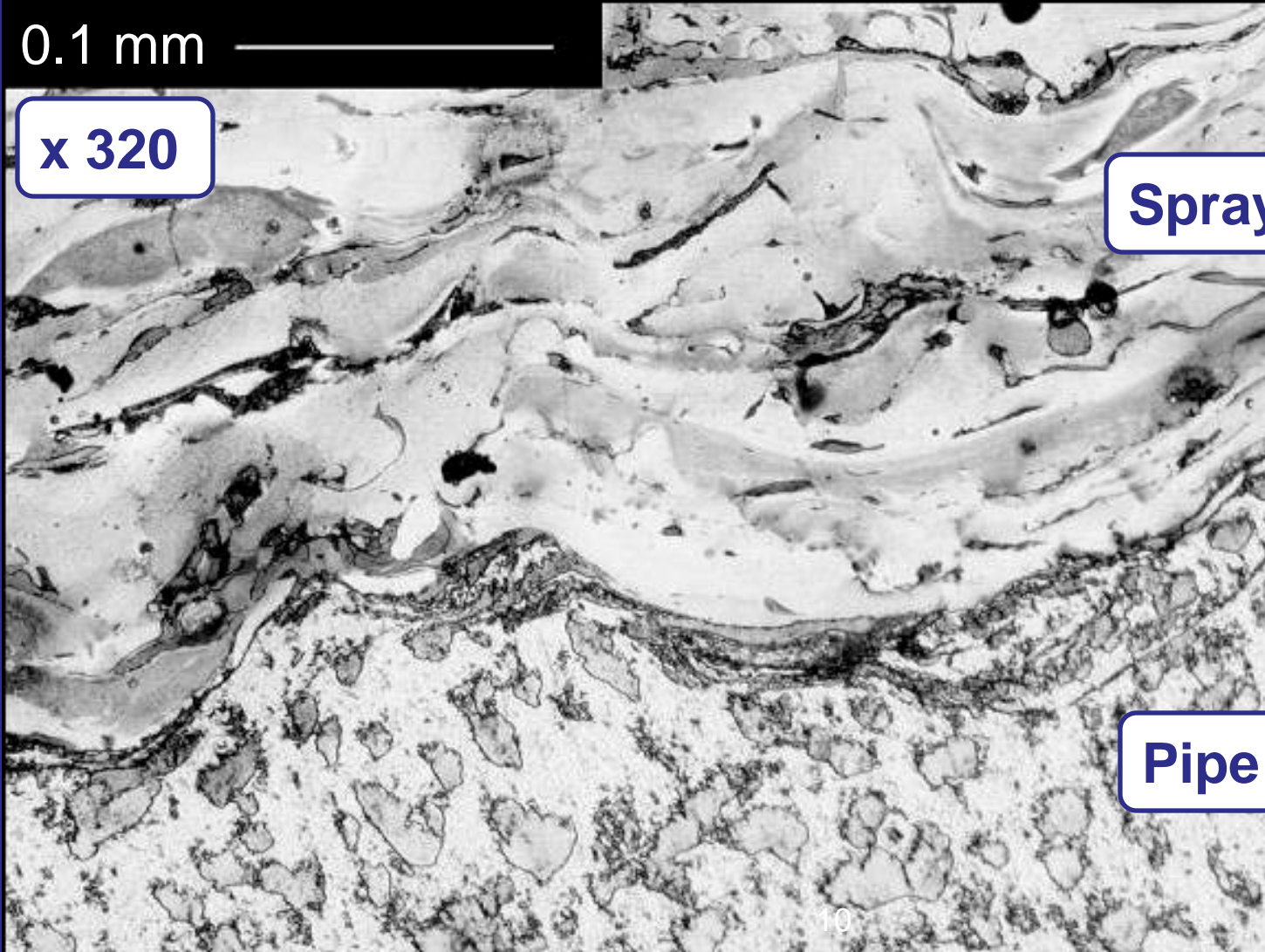
The Spray Metal Process

0.1 mm

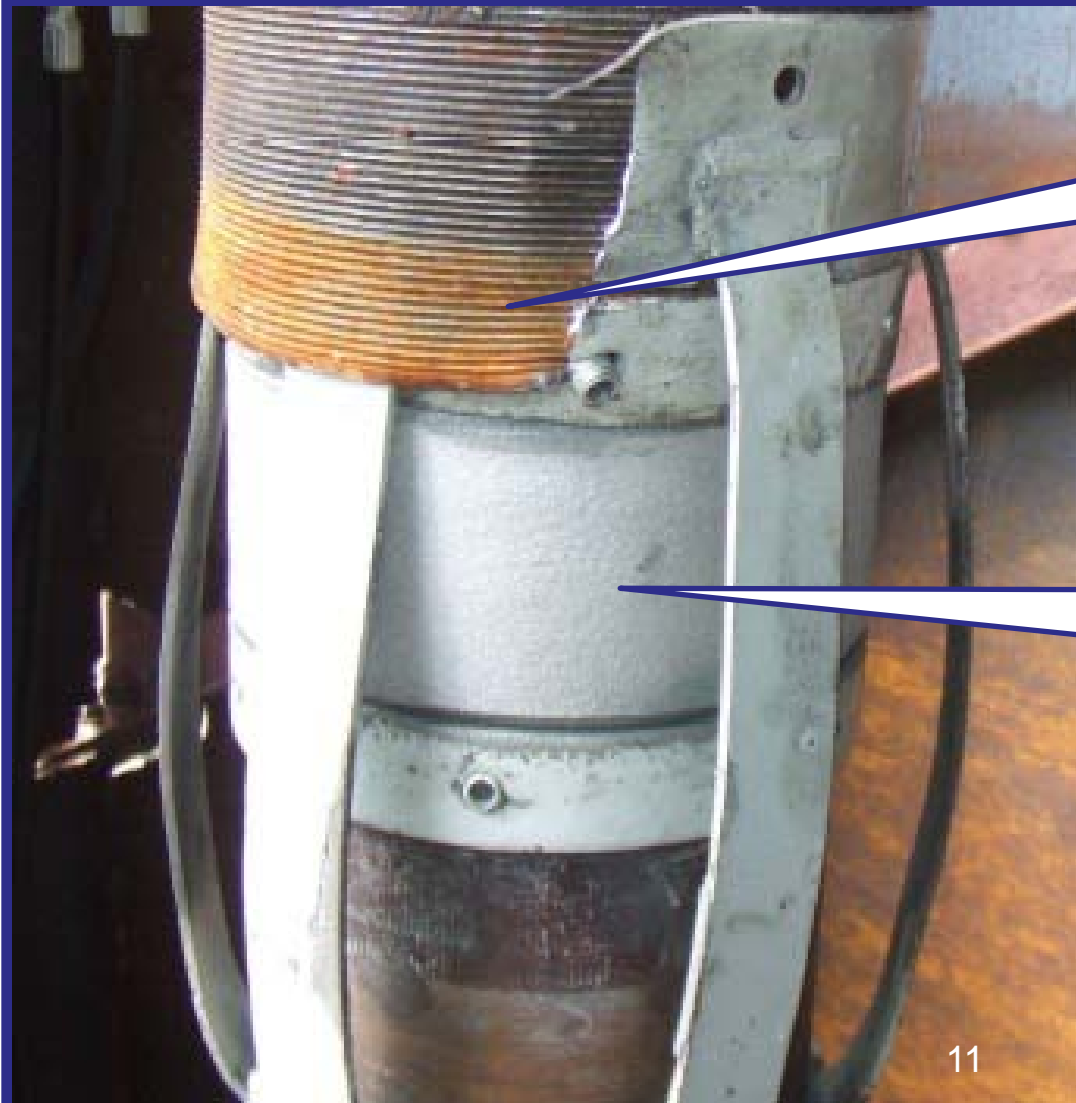
x 320

Spray Metal

Pipe Steel



The Spray Metal Process



**Push Pipe
@ 155 klbs**

**Spray Metal
Stop Ring
4" x 1/4"**

Centralizers using Spray Metal stops

13-5/8" Bowsprings to pass thru' 14.5"



Spray Metal
Stop Rings

Centralizers using Spray Metal stops

11-7/8" Unibody to pass thru' 12.25"



Flow channels
through 12.20"
stop rings to
reduce
circulating
pressure

Centralizers using Spray Metal stops

9-7/8" Unibody with Internal Anchors



Centralizers using Spray Metal stops



**Bowsprings
with internal
spray metal
stops.**

Allows rotation

Centralizers using Spray Metal stops



Use Solid
Bodies
where
clearances
allow

Centralizers built entirely of Spray Metal



The simplest designed centralizer has three straight blades.

Helical blades provide better stand-off.

Stabilizers built entirely of Spray Metal



For
Casing-
or Liner-
Drilling

Replacing
machined
IBS's

Conclusions

- **Spray Metal is proving to be an enabling technology in many downhole applications**
- **Its strength and durability are up to an order of magnitude better than alternatives**
- **Rather than starting with heavy-walled pipe and machining much of it away...**
- **... This process “grows” the required shapes directly onto the casing, as if it were a part of it, and without introducing additional potential failure points**



Advances in Casing Centralization Using Spray Metal Technology

Thank You

