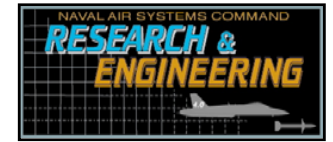




HCAT Hydraulic Actuator JTP Part II, Phase 1



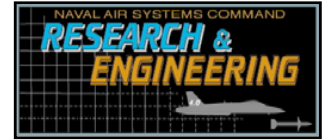
Jon L. Devereaux

AIR - 4.9.7.4

**NADEP Jacksonville
Materials Engineer**



HVOF as a Hard Chrome Replacement



HCAT Hydraulic Actuator

Joint Test Protocol

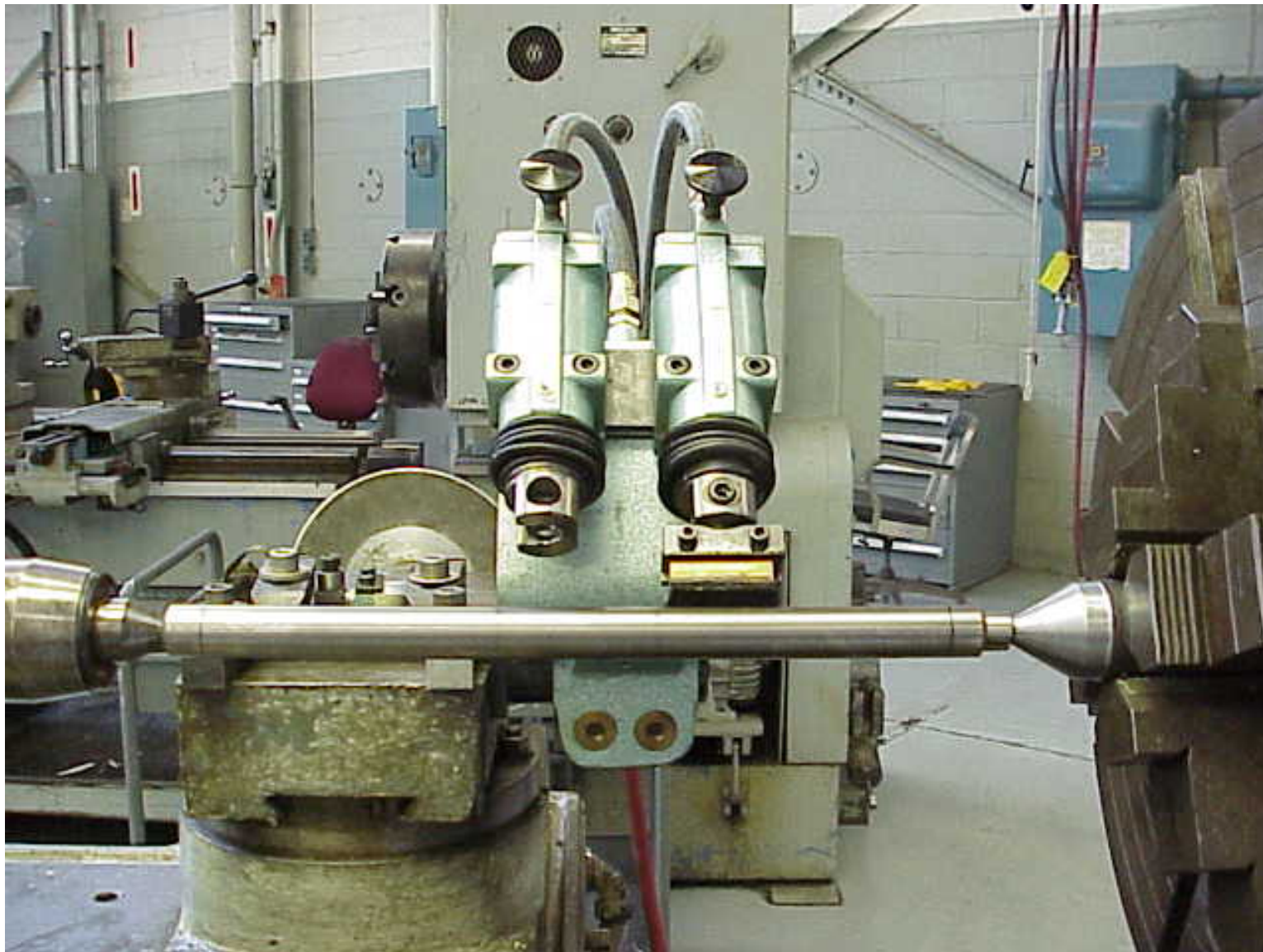
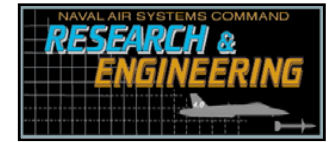
Part II, Phase 1

Functional Rod/Seal Testing

Before and After



HVOF as a Hard Chrome Replacement



**HCAT
Hydraulic
Actuator
JTP
Part II
Phase 1
1" dia.
Test rod**

**Superfinished
at
NADEP JAX**

HVOF as a Hard Chrome Replacement

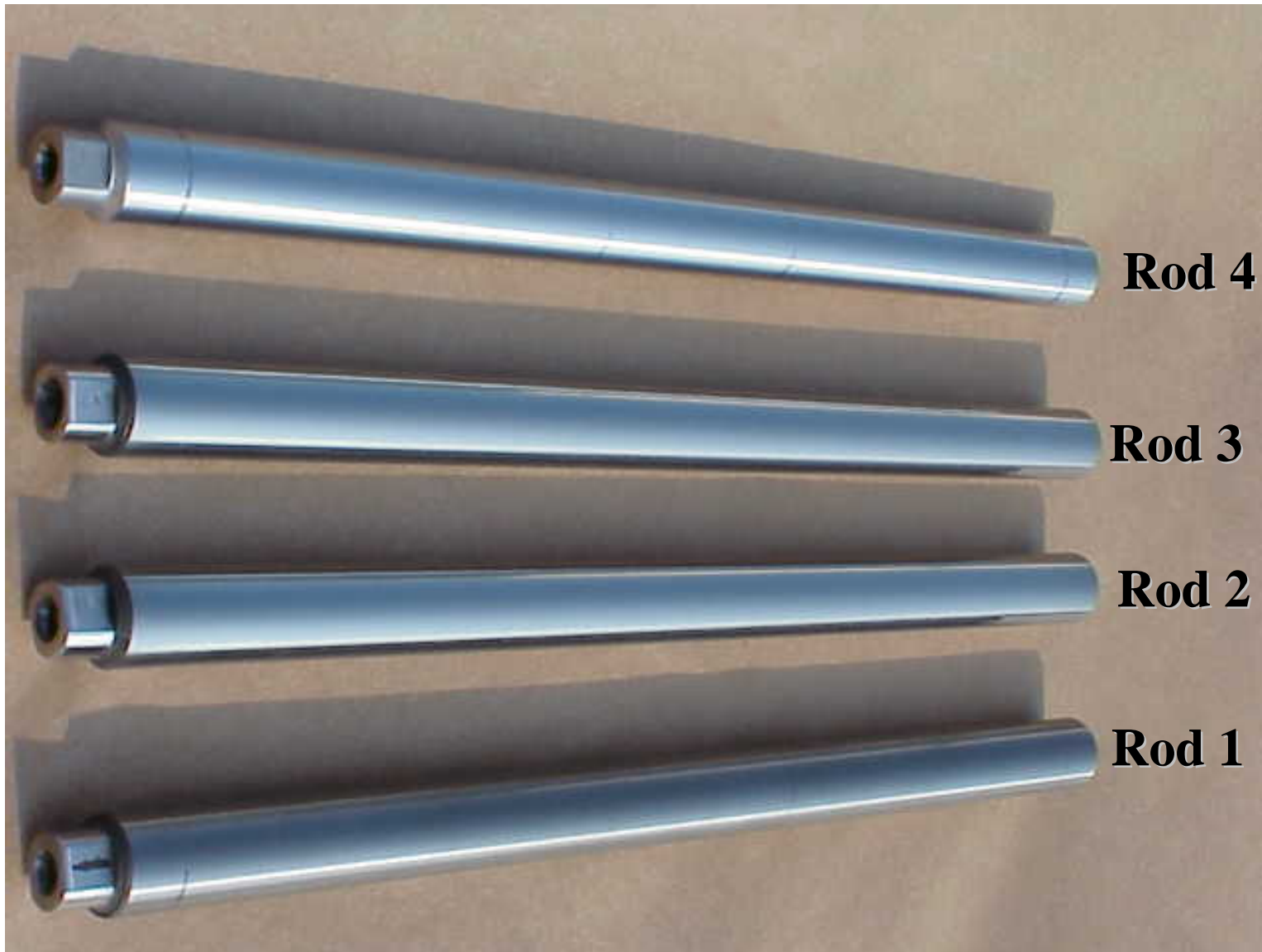
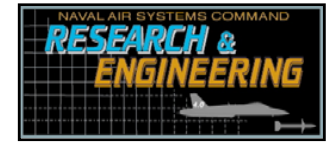


**HCAT
Hydraulic
Actuator
JTP
Part II
Phase 1
1" dia.
Test rod**

**Superfinished
at
NADEP JAX**



HVOF as a Hard Chrome Replacement

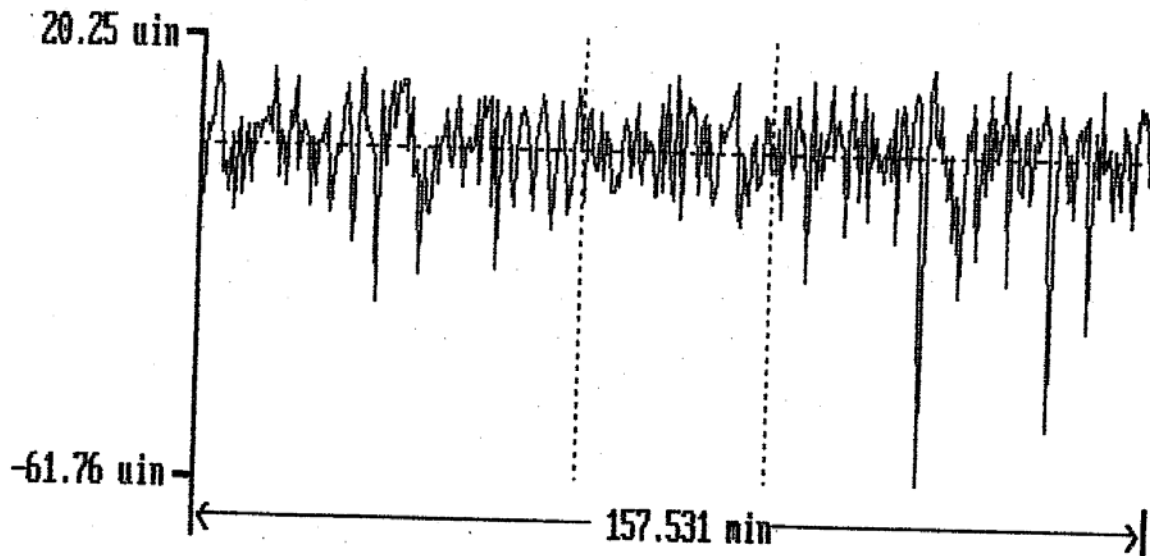
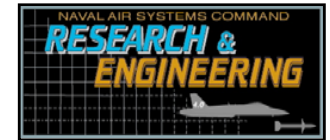


**HCAT
Hydraulic
Actuator
JTP
Part II
Phase 1
1" dia.
Test rod**

**Superfinished
at
NADEP JAX**



HVOF as a Hard Chrome Replacement



Peak To Valley = 82.01 uin

Rtn = 58.50 uin	Lo = 157.531 min	Ra = 6.46 uin
Rpm = 17.35 uin	Rp = 20.25 uin	Rq = 9.00 uin
Ry = 82.01 uin	Rv = 61.76 uin	Rsk = -1.9
Rt1 = 48.72 uin	Rt = 82.01 uin	Rku = 10.9
Rt2 = 49.00 uin		Delq = 2.65 Deg
Rt3 = 32.39 uin	SLOPE = .05 Deg	Lamq = 1.222 min
Rt4 = 82.01 uin		S = 633.54 uin
Rt5 = 80.39 uin		Sm = 1.200 min
		R3z = 37.86 uin
		R31 = 66.38 uin

Rod 1 - before

Measurements by
Bob Paterson
Supfina, Inc.

Taylor-Hobson

Cut Off – 0.030 In.

WC/Co/Cr 86/10/4

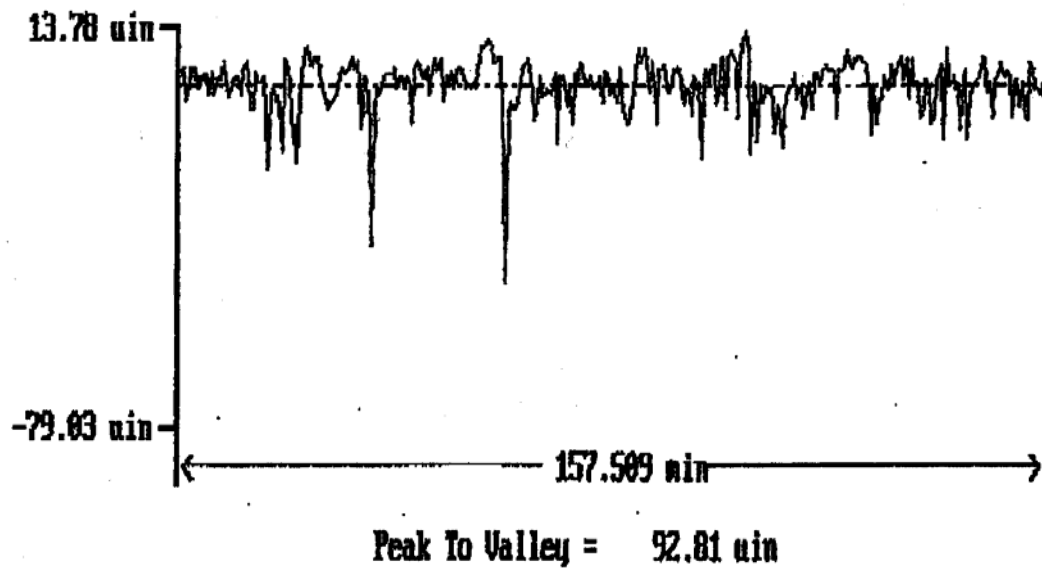
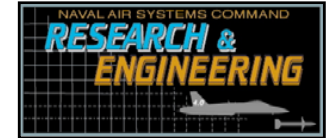
Ground to 4 – 6 Ra

320 grit diamond

As Ground



HVOF as a Hard Chrome Replacement



Rtn = 56.05 uin	Lo = 157.509 min	Ra = 4.32 uin
Rpm = 10.27 uin	Rp = 13.78 uin	Rq = 7.12 uin
Ry = 89.87 uin	Rv = 79.03 uin	Rsk = -3.9
Rt1 = 28.57 uin	Rt = 92.81 uin	Rku = 30.5
Rt2 = 89.87 uin		Delq = 1.05 Deg
Rt3 = 41.10 uin	SLOPE = .09 Deg	Lamq = 1.307 min
Rt4 = 54.92 uin		S = 1.037 min
Rt5 = 65.00 uin		Sm = 2.300 min
		R3z = 30.05 uin
		R3y = 45.52 uin

Rod 1 - after

**Measurements by
Bob Paterson
Supfina, Inc.**

Taylor-Hobson

Cut Off – 0.030 In.

WC/Co/Cr 86/10/4

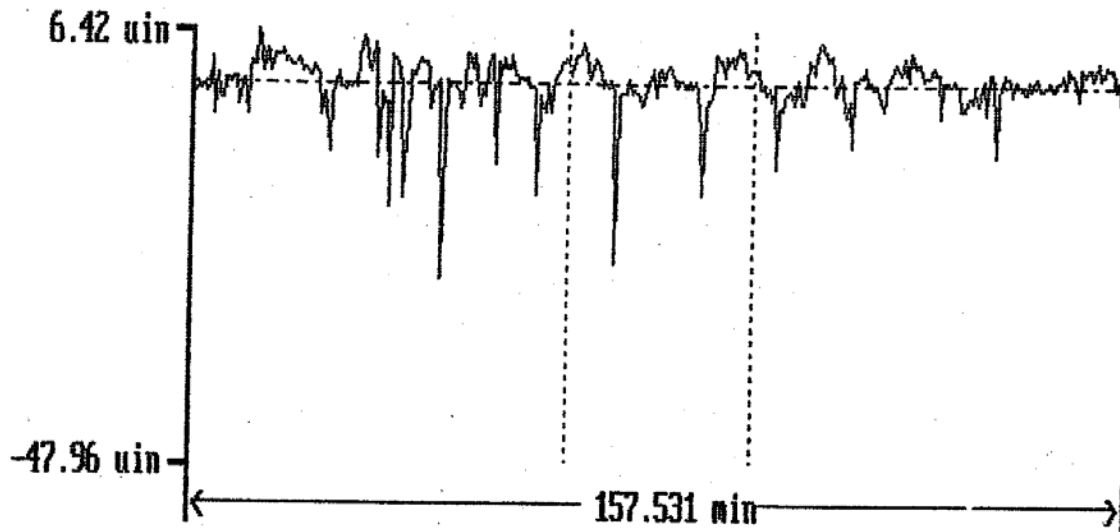
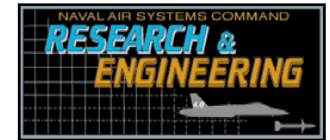
Ground to 4 – 6 Ra

320 grit diamond

**As Ground – after
testing**



HVOF as a Hard Chrome Replacement



Peak To Valley = 54.38 uin

Rod 2 - before

Measurements by
Bob Paterson
Supfina, Inc.

Taylor-Hobson

Cut Off – 0.030 In.

WC/Co/Cr 86/10/4

Ground to 20 – 22 Ra

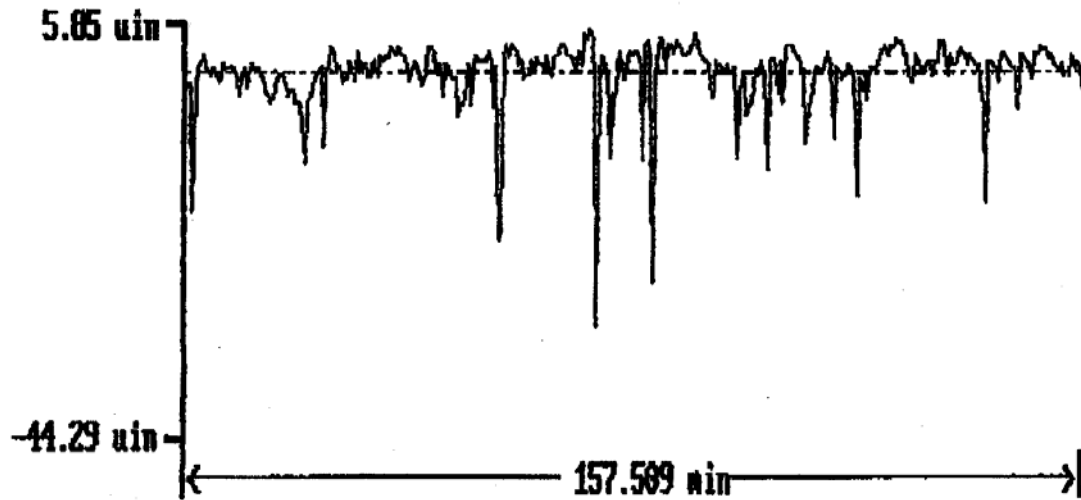
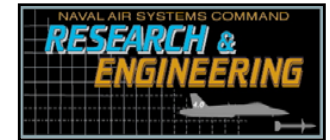
120 grit diamond

Superfinished at
NADEP JAX to 2 Ra

Rtm = 36.23 uin	Lo = 157.531 min	Ra = 2.31 uin
Rpm = 5.06 uin	Rp = 6.42 uin	Rq = 4.15 uin
Rq = 51.11 uin	Rv = 47.96 uin	Rsk = -4.7
Rt1 = 23.34 uin	Rt = 54.38 uin	Rku = 39.5
Rt2 = 46.67 uin		Delq = 1.22 Deg
Rt3 = 27.41 uin	SLOPE = .05 Deg	Lamq = 1.228 min
Rt4 = 32.62 uin		S = 915.11 uin
Rt5 = 51.11 uin		Sm = 2.346 min
		R3z = 15.36 uin
		R3y = 25.65 uin



HVOF as a Hard Chrome Replacement



Peak To Valley = 59.14 uin

Rtn = 36.59 uin	Lo = 157.589 min	Ba = 2.21 uin
Rpn = 4.12 uin	Rp = 5.85 uin	Rq = 4.85 uin
Rq = 48.57 uin	Rv = 44.29 uin	Rsk = -5.1
Rt1 = 24.00 uin	Rt = 59.14 uin	Rku = 41.8
Rt2 = 34.00 uin		Delq = 1.00 Deg
Rt3 = 48.57 uin	SLOPE = .09 Deg	Lang = 1.347 min
Rt4 = 28.15 uin		S = 1.001 min
Rt5 = 48.21 uin		Sm = 2.750 min
		R3z = 14.93 uin
		R3y = 19.64 uin

Rod 2 - after

**Measurements by
Bob Paterson
Supfina, Inc.**

Taylor-Hobson

Cut Off – 0.030 In.

WC/Co/Cr 86/10/4

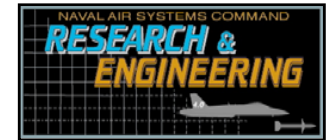
Ground to 20 – 22 Ra

120 grit diamond

**Superfinished at
NADEP JAX to 2 Ra**



HVOF as a Hard Chrome Replacement



Rod 3 - before

Measurements by
Bob Paterson
Supfina, Inc.

Taylor-Hobson

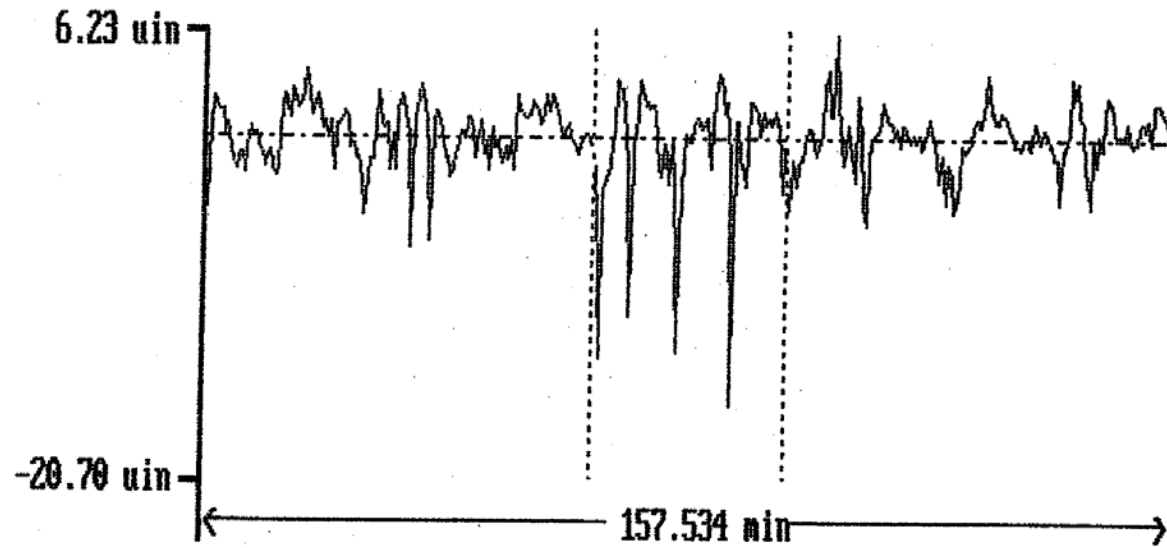
Cut Off – 0.030 In.

WC/Co/Cr 86/10/4

Ground to 8 – 10 Ra

220 grit diamond

Superfinished at
NADEP JAX to 2 Ra

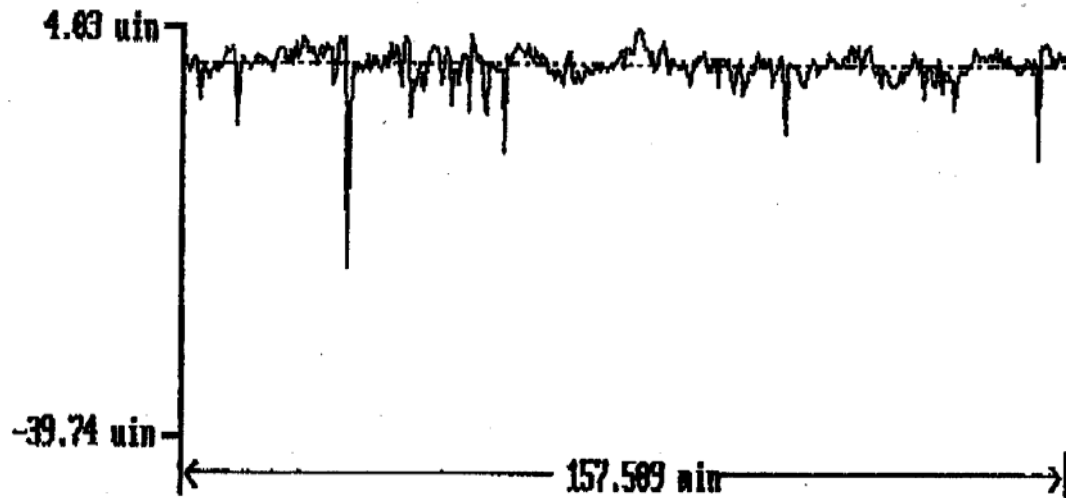


Peak To Valley = 26.92 uin

Rtn = 14.22 uin	Lo = 157.534 min	Ra = 1.49 uin
Rpm = 4.60 uin	Rp = 6.23 uin	Rq = 2.18 uin
Rj = 26.25 uin	Rv = 20.70 uin	Rsk = -2.2
Rt1 = 13.73 uin	Rt = 26.92 uin	Rku = 16.9
Rt2 = 9.85 uin		Delq = .51 Deg
Rt3 = 26.25 uin	SLOPE = .04 Deg	Lamq = 1.537 min
Rt4 = 12.67 uin		S = 877.46 uin
Rt5 = 8.60 uin		Sm = 2.320 min
		R3z = 9.44 uin
		R3u = 16.77 uin



HVOF as a Hard Chrome Replacement



Peak To Valley = 43.77 uin

Btm = 18.88 uin	Lo = 157.589 min	Ra = 1.28 uin
Rpm = 3.24 uin	Rp = 4.83 uin	Rq = 2.23 uin
Ry = 43.18 uin	Rv = 39.74 uin	Rsk = -7.1
Rt1 = 43.18 uin	Rt = 43.77 uin	Rku = 108.9
Rt2 = 15.68 uin		Delq = .67 Deg
Rt3 = 9.85 uin	SLOPE = .89 Deg	Lamq = 1.282 min
Rt4 = 9.75 uin		S = 959.36 uin
Rt5 = 12.53 uin		Sn = 2.533 min
		Rtz = 8.78 uin
		R3y = 13.81 uin

Rod 3 - after

**Measurements by
Bob Paterson
Supfina, Inc.**

Taylor-Hobson

Cut Off – 0.030 In.

WC/Co/Cr 86/10/4

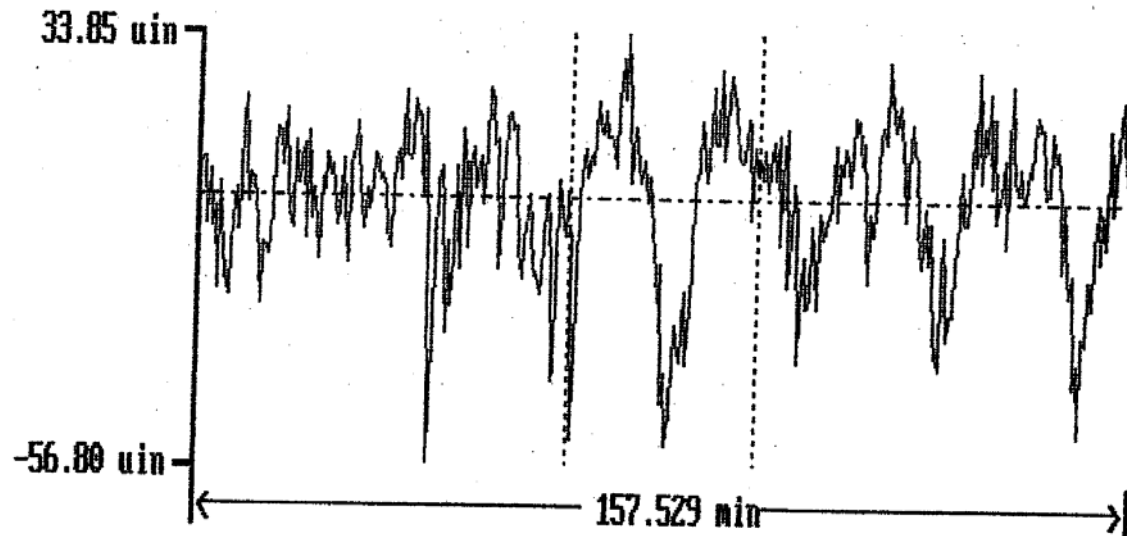
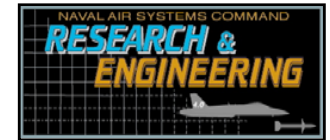
Ground to 8 – 10 Ra

220 grit diamond

**Superfinished at
NADEP JAX to 2 Ra**



HVOF as a Hard Chrome Replacement



Peak To Valley = 90.65 uin

Rtn = 75.29 uin	Lo = 157.529 min	Ra = 12.27 uin
Rpm = 28.12 uin	Rp = 33.85 uin	Rq = 15.75 uin
Rj = 90.32 uin	Rv = 56.80 uin	Rsk = -1.0
Rt1 = 53.29 uin	Rt = 90.65 uin	Rku = 3.8
Rt2 = 80.17 uin		Delq = 2.81 Deg
Rt3 = 90.32 uin	SLOPE = .05 Deg	Lamq = 2.013 min
Rt4 = 75.43 uin		S = 605.34 uin
Rt5 = 77.25 uin		Sn = 2.004 min
		R3z = 58.90 uin
		R3y = 82.51 uin

Rod 4 - before

Measurements by
Bob Paterson
Supfina, Inc.

Taylor-Hobson

Cut Off – 0.030 In.

Chrome plated at
NADEP JAX

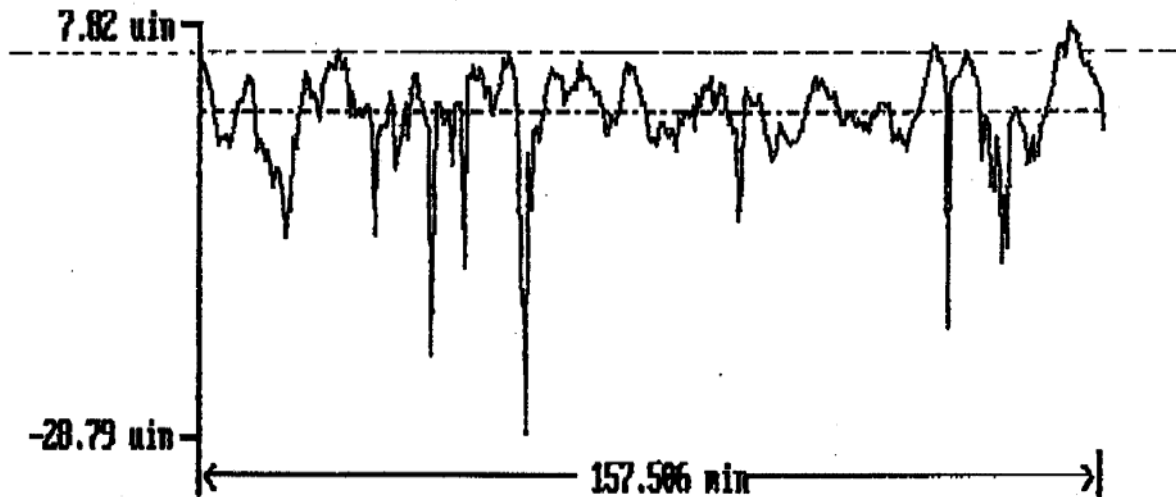
Ground to 12 – 15 Ra

60 grit Al₂O₃

As Ground



HVOF as a Hard Chrome Replacement



Peak To Valley = 36.61 uin

Rod 4 - after

**Measurements by
Bob Paterson
Supfina, Inc.**

Taylor-Hobson

Cut Off – 0.030 In.

**Chrome plated at
NADEP JAX**

Ground to 12 – 15 Ra

60 grit Al₂O₃

As Ground – after test

Rtn = 28.79 uin	Lo = 157.506 min	Ra = 2.88 uin
Rpm = 5.31 uin	Rp = 7.82 uin	Rq = 4.83 uin
Rj = 34.27 uin	Rv = 28.79 uin	Rsk = -2.0
Rt1 = 16.81 uin	Rt = 36.61 uin	Rku = 11.6
Rt2 = 34.27 uin		Delq = .67 Deg
Rt3 = 14.68 uin	SLOPE = .10 Deg	Lamq = 2.167 min
Rt4 = 10.18 uin		S = 1.292 min
Rt5 = 28.82 uin		Sn = 5.013 min
		Rz = 14.74 uin
		R3j = 25.93 uin