

Blog Entry © Tuesday, May 27, 2025, Translation of a Siacci's Method C# App to C/C++ by James Pate Williams, Jr., BA, BS, MSWE, PhD

Siacci's Method is a technique to solve the exterior ballistics problem for small elevation of the rifle's barrel. My original C# app was created in September of 2017. The equations used were from the textbook ***Exterior ballistics, 1935*** by Ernest Edward Herrmann. The Gauss-Legendre quadrature algorithm was utilized. The opening Windows input form is illustrated below. The angle of elevation should be less than approximately 12 degrees which is 0.2094395163 radians.

The screenshot shows a Windows application titled "Range Table Generator Siacci Method". The interface includes the following controls:

- Theta0 (Degrees):** 0.000
- Theta1 (Degrees):** 1.000
- Theta Steps:** 1000
- Time0 (Seconds):** 0
- Time1 (Seconds):** 120
- u Steps:** 10000
- Initial Velocity (FPS):** 2500
- Trunnion Height (Feet):** 0
- Target Height (Feet):** 0
- Density Air (SI Units):** 1.2034
- Coefficient of Form:** 0.500
- Vincenty:** ☐
- Curvature of Earth:** ☐
- Draw:** ☐
- Progress:** (empty progress bar)
- Runtime (Hrs:Min:Sec:MS):** (empty text box)
- Start:** (button)

The rifle chosen to model is a 16-inch 50 caliber naval artillery gun for the Iowa class of fast battleships (BB-61 Iowa, BB-62 New Jersey, BB-63 Missouri, and BB-64 Wisconsin). 50 caliber means that the rifled barrel is  $50 * 16$  inches in length = 800 inches = 66.667 feet. The following form is a comparison of the app's data with the range table found in Ordnance Pamphlet 770 © October 1941 by the Navy Department Bureau of Ordnance:

[OP-770 Page 1 Range Tables for 16"/50 caliber gun](#)

The word Comparison is misspelled in the two following Windows forms.

Range Table OP 770 Comparison for Siacchi's Method

Detailed Deviations from Ordnance Pamphlet 770							
Range	Start	Angle	Final	Angle	Time	V1	Y-Max
Yards	Degrees	Minutes	Degrees	Minutes	Sec	FPS	Feet
0	0	0.1	0	0	0.00	0	0
0	0	0.1	0	0	0.00	0	—
0	0	0.0	0	0	-0.01	1	—
0	0	0.0	0	0	0.00	0	—
0	0	0.0	0	-1	0.00	1	—
0	0	0.0	0	0	-0.01	0	0
0	0	0.1	0	0	0.00	1	—
0	0	0.0	0	0	0.00	1	—
0	0	0.0	0	-1	0.00	1	—
0	0	0.1	0	-1	0.00	1	—
0	0	0.1	0	-1	0.00	1	0
0	0	0.1	0	-1	0.00	1	—

Total 21  
Out of 87  
% Error 24.14

	Err	Cnt	Avg	Abs	Dev
Range	0			0.000	
Degrees	0			0.000	
Minutes	6			0.100	
Degrees	0			0.000	
Minutes	5			1.000	
Time	2			0.010	
V1	8			1.000	
Y-Max	0			0.000	

Range Table OP 770 Comparision for Siacci's Method

Range Yards	Start Degrees	Angle Minutes	Final Degrees	Angle Minutes	Time Sec	V1 FPS	Y-Max Feet
1000	0	26.8	0	27	1.21	2454	6
1100	0	29.5	0	30	1.33	2449	7
1200	0	32.3	0	33	1.46	2444	9
1300	0	35.0	0	36	1.58	2440	10
1400	0	37.7	0	39	1.70	2435	12
1500	0	40.5	0	41	1.83	2431	13
1600	0	43.2	0	44	1.95	2426	15
1700	0	46.1	0	47	2.07	2422	17
1800	0	48.9	0	50	2.20	2417	19
1900	0	51.6	0	53	2.32	2413	22
2000	0	54.4	0	56	2.45	2408	24
2100	0	57.2	0	59	2.57	2404	27

Ballistic coefficient 21.09375

Coefficient of form	0.5
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Density 1.2034

Diameter	16
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Weight 2700

V0	2500
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Theta0 0

Theta1	1
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Theta Steps	1000
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Time0 0

Time1	120
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TimeSteps	10000
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Hrs:Min:Sec.MS = 00:00:37.566

Single Firing Siacci's Method

Range	Start	Angle	Final	Angle	Time	V1	Y-Max
Yards	Degrees	Minutes	Degrees	Minutes	Sec	FPS	Feet
2199	1	0.0	-1	-2	2.69	2399	29


Approximate correction for curvature of the Earth:  
Correction in yards -19  
Corrected range 2180

One time Vincenty formula correction for curvature of the Earth:  
Correction in yards -19  
Corrected range 2180

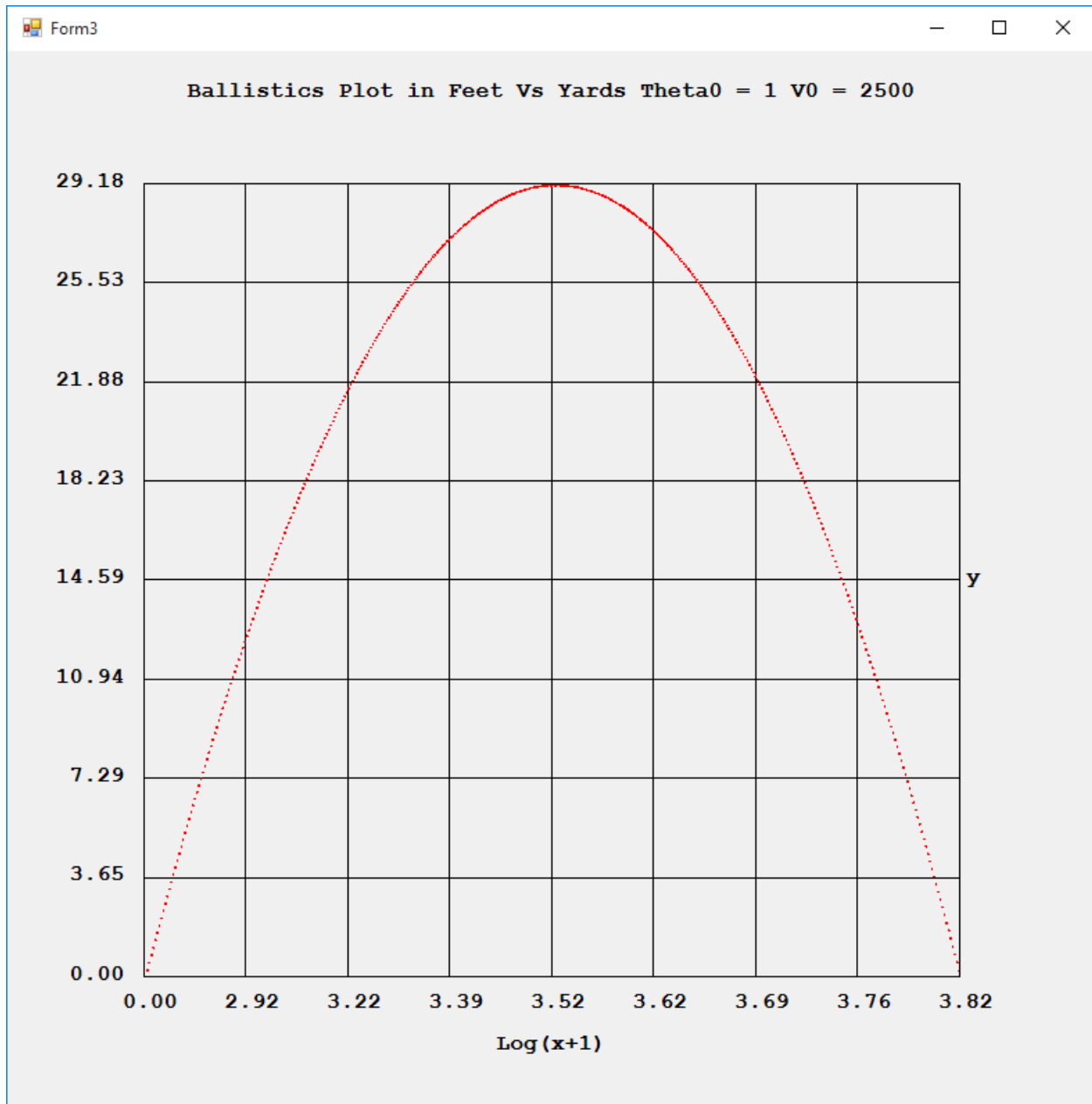
Ballistic coefficient 21.09375  
Coefficient of form 0.5  
Density 1.2034  
Diameter 16  
Weight 2700  
V0 2500

Theta0 1  
Theta1 1  
Theta Steps 1000  
Time0 0  
Time1 120  
TimeSteps 10000

Information

 Time of Flight (Seconds): 2.694  
Distance to Target (yards): 2198.96  
Distance to Target (mi): 1.2494  
Maximum Height (ft): 29.18  
Maximum Height (mi): 0.0055

OK



Next, we present some preliminary results found using the C/C++ translation of the C# app.

Siacci's Method Dialog

Input Data

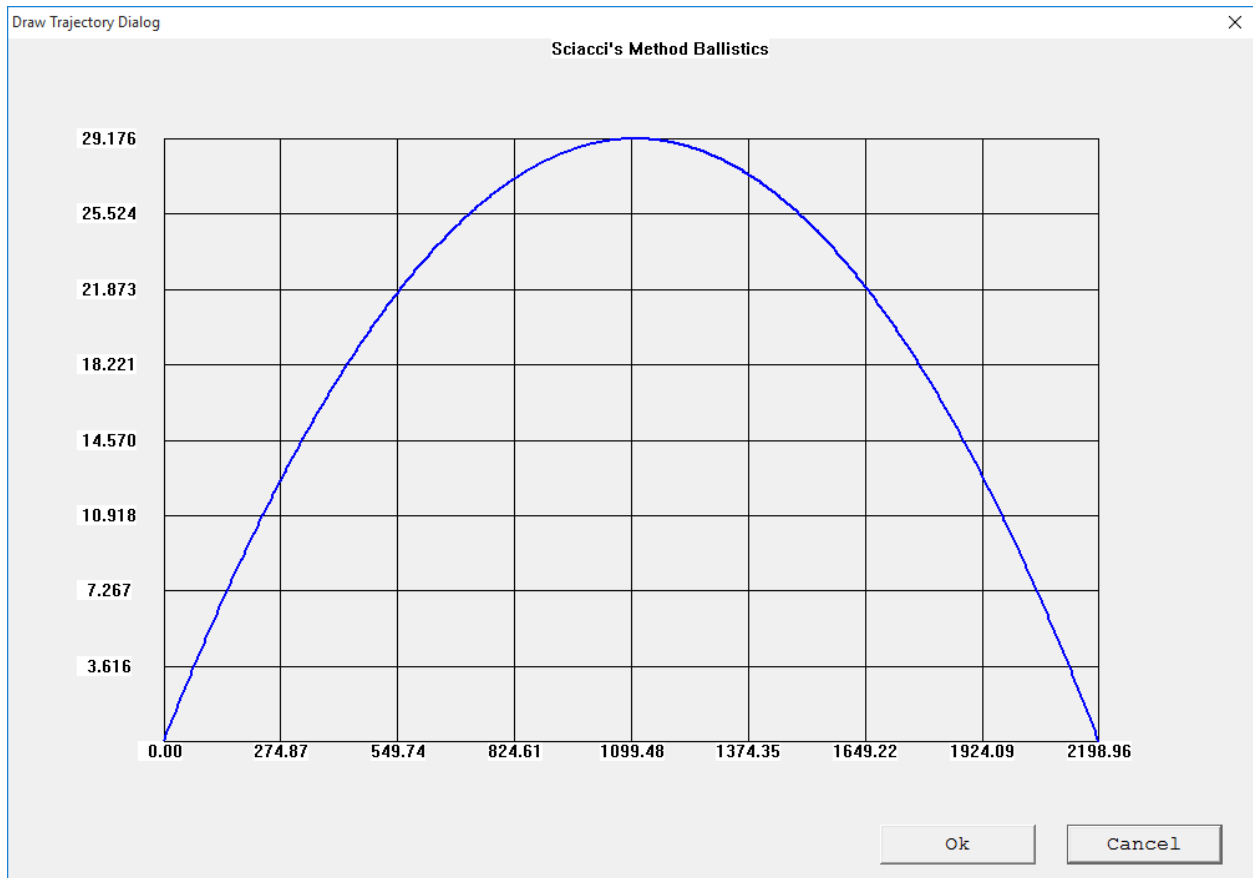
Theta0 (Degrees)	0.000000	Trunnion (Feet)	0.000000
Theta1 (Degrees)	1.000000	Target Height (Feet)	0.000000
Theta Steps	10.000000	Density Air SI	1.203400
Time0 (Seconds)	0.000000	Coefficient of Form	0.500000
Time1 (Seconds)	60.000000	Diameter (Inches)	16.000000
u Steps	20000.000000	Weight (Pounds)	2700.000000
V0 (Feet/Second)	2500.000000	Runtime (Seconds)	

Compare Draw Table Ok Cancel

Ballistic Table Data Dialog

Range Yards	Start Degrees	Angle Minutes	Final Degrees	Angle Minutes	Time Sec	V1 FPS	Y-Max Feet
1000	0	26.9	0	27.2	1.21	2454	6
1100	0	29.6	0	30.0	1.33	2449	7
1200	0	32.3	0	32.8	1.46	2444	9
1300	0	35.1	0	35.7	1.58	2440	10
1400	0	37.8	0	38.5	1.70	2435	12
1500	0	40.5	0	41.4	1.83	2431	13
1600	0	43.3	0	44.3	1.95	2426	15
1700	0	46.1	0	47.1	2.07	2422	17
1800	0	48.9	0	50.0	2.20	2417	19
1900	0	51.6	0	52.9	2.32	2413	22
2000	0	54.4	0	55.8	2.45	2408	24
2100	0	57.2	0	58.8	2.57	2404	27

Ok Cancel



Currently the pamphlet comparison for the C/C++ translation is buggy.