Inject 1

SAND2016-11271PE

Physical Effects Briefing

Oct. 24, 2016
TTX3

Mark Boslough
Sandia National Labs
Albuquerque, NM

Bill Fogleman, GRIT – Mapping

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company,
for the United States Department of Energy under contract DE-AC04-94AL85000.

This is what we know:

Entry speed: 13 ± 0.4 km/s (~29,000 mph)

Size: as large as 300 meters diameter

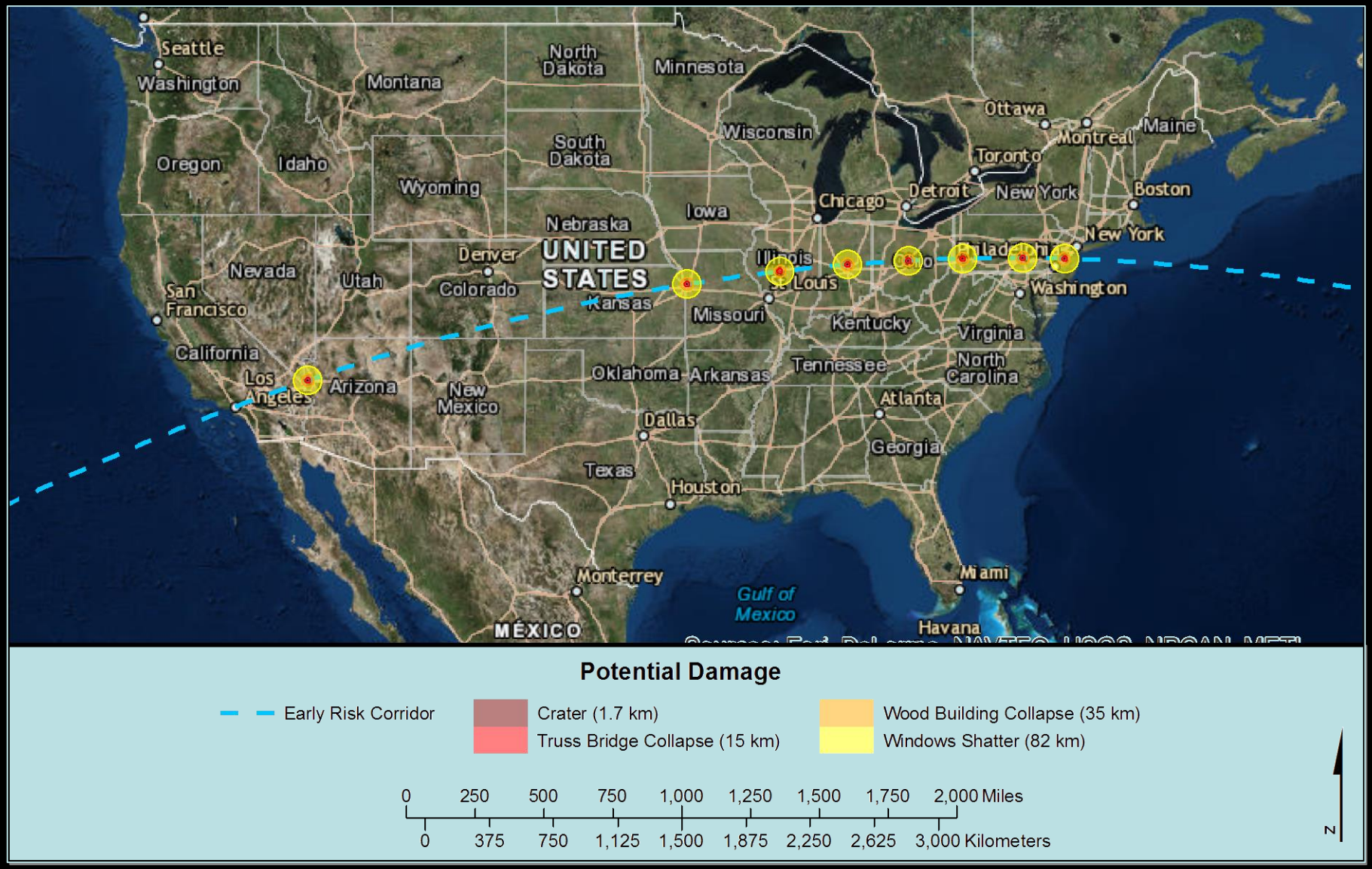
Composition: Stone, density as high as 1.5 g/cm^3

~450 Megaton impact cannot be ruled out

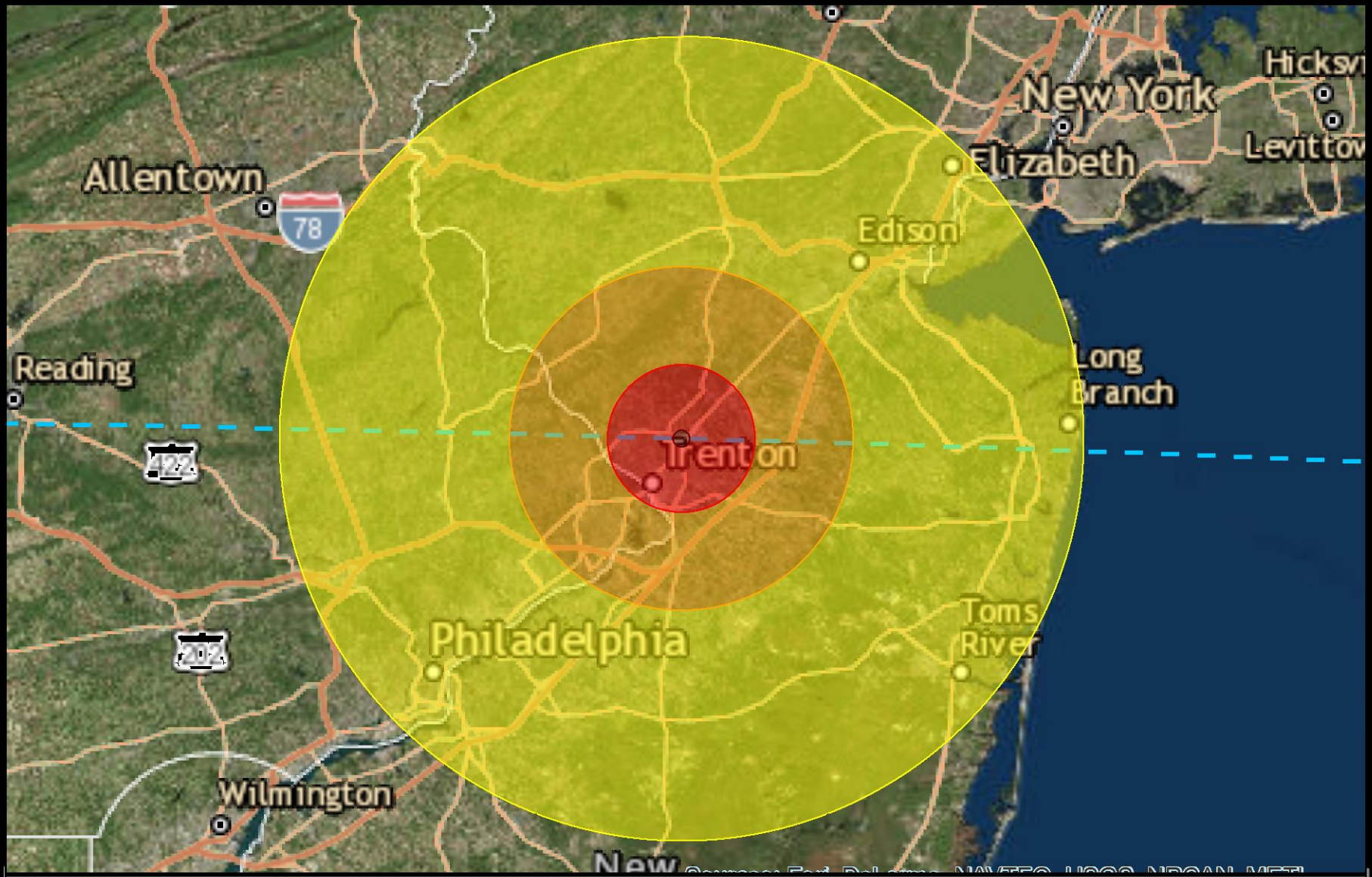
Probability of impact = 2%

Rapid estimate tool

Possible Impact Locations in CONUS



EXERCISE


New York
Elizabeth
Allentown
78
Edison
Reading
Long Branch
Trenton
Philadelphia
Toms River
Wilmington
Potential Damage (Trenton, New Jersey)
Early Risk Corridor
Crater (1.7 km)
Truss Bridge Collapse (15 km)
Wood Building Collapse (35 km)
Windows Shatter (82 km)
0 20 40 60 80 Miles
0 20 40 60 80 100 120 Kilometers
N

Physical Effects Briefing

Nov. 25, 2017
TTX3

Mark Boslough
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Bill Fogleman, GRIT – Mapping

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This is what we know:

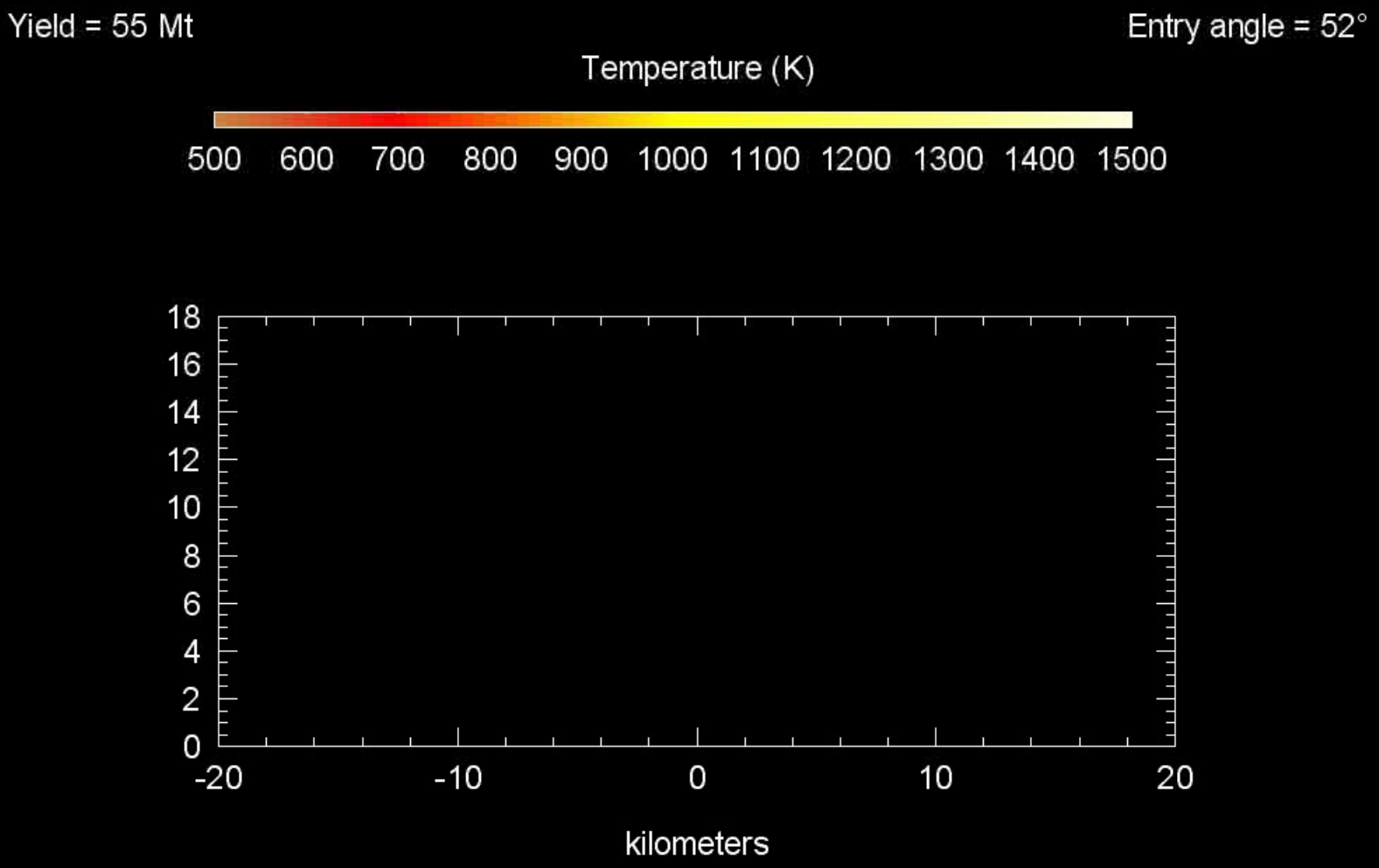
Entry speed: 13 ± 0.4 km/s (~29,000 mph)

Size: as large as 120 meters diameter

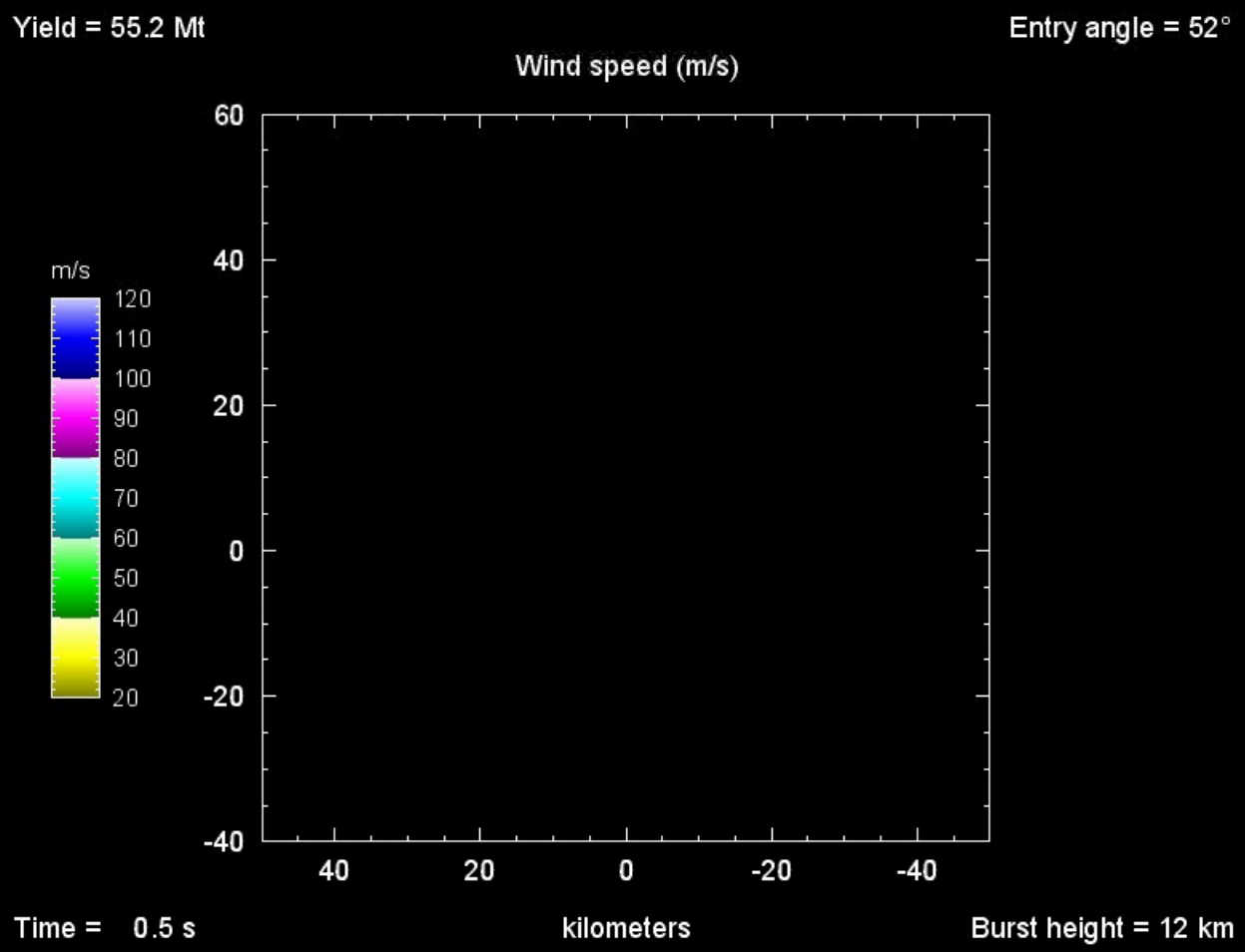
Composition: Stone, density as high as 2.9 g/cm^3

~55 Megaton impact cannot be ruled out

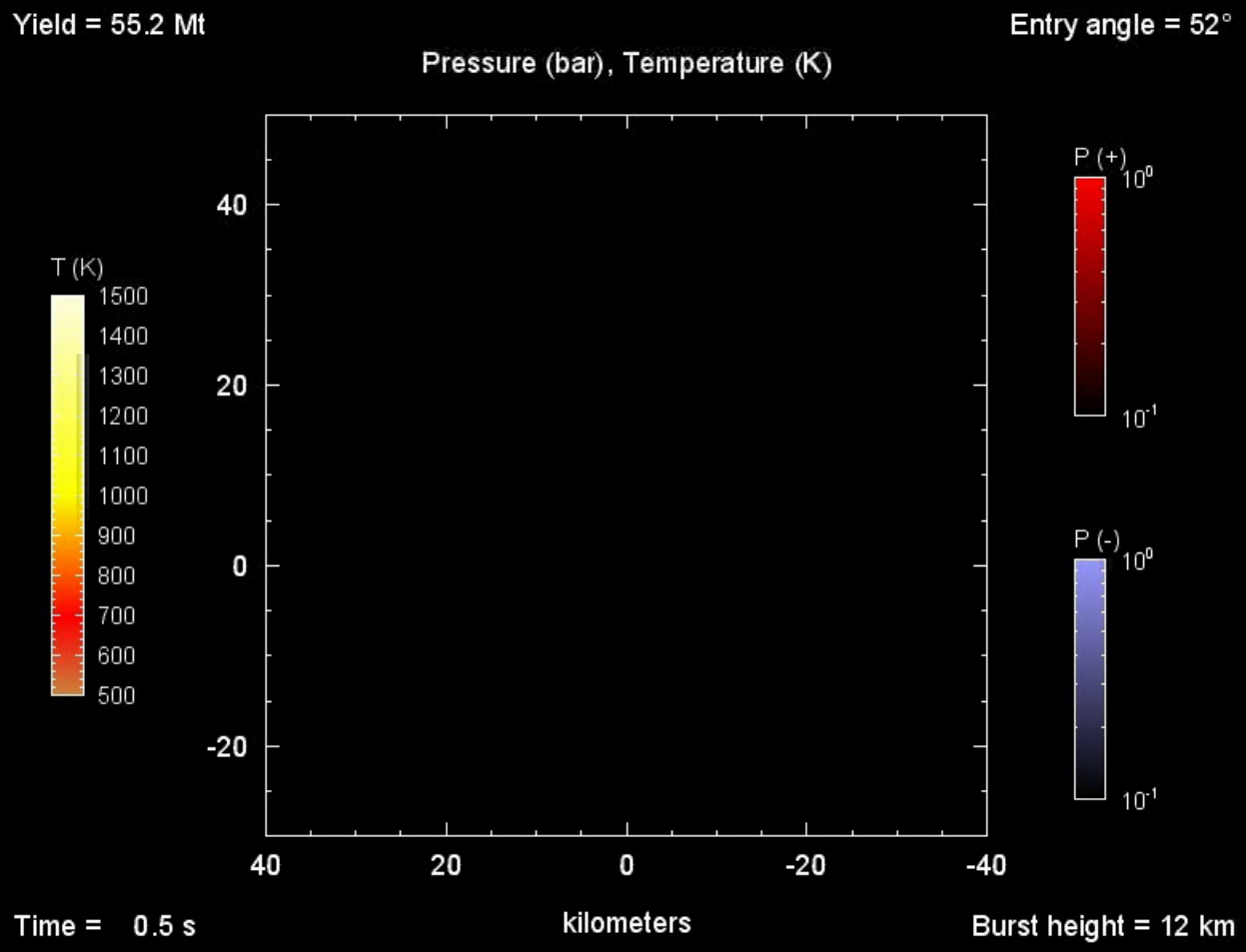
Probability of impact = 100%


Yield = 55 Mt
Entry angle = 52°
Temperature (K)
500 600 700 800 900 1000 1100 1200 1300 1400 1500
18
16
14
12
10
8
6
4
2
0
-20
-10
0
10
20
kilometers
Time = 0.0 s
Burst height = 12 km

EXERCISE

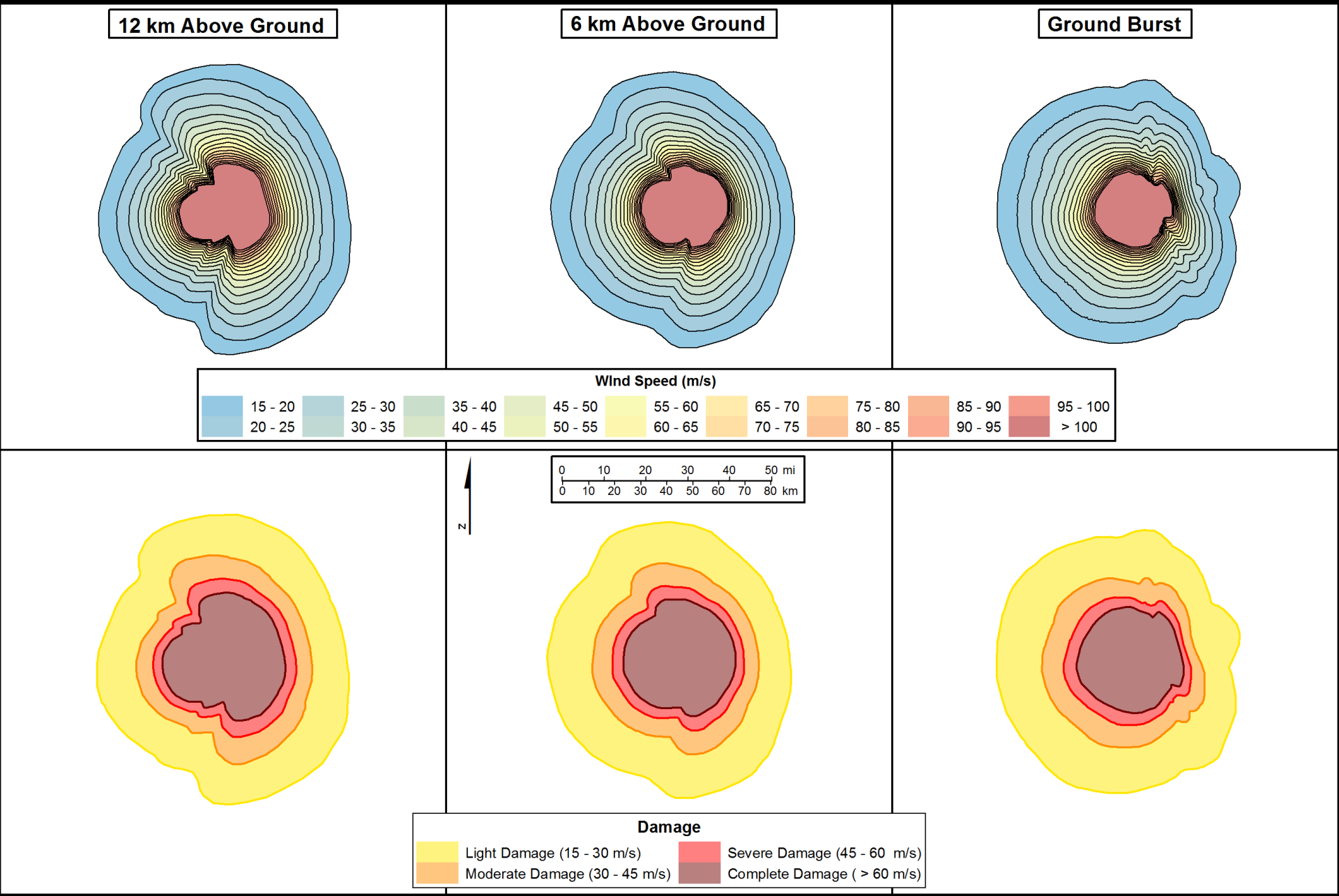

Yield = 55.2 Mt
Entry angle = 52°
Wind speed (m/s)
m/s
120
110
100
90
80
70
60
50
40
30
20
60
40
20
0
-20
-40
40
20
0
-20
-40
Time = 0.5 s
kilometers
Burst height = 12 km

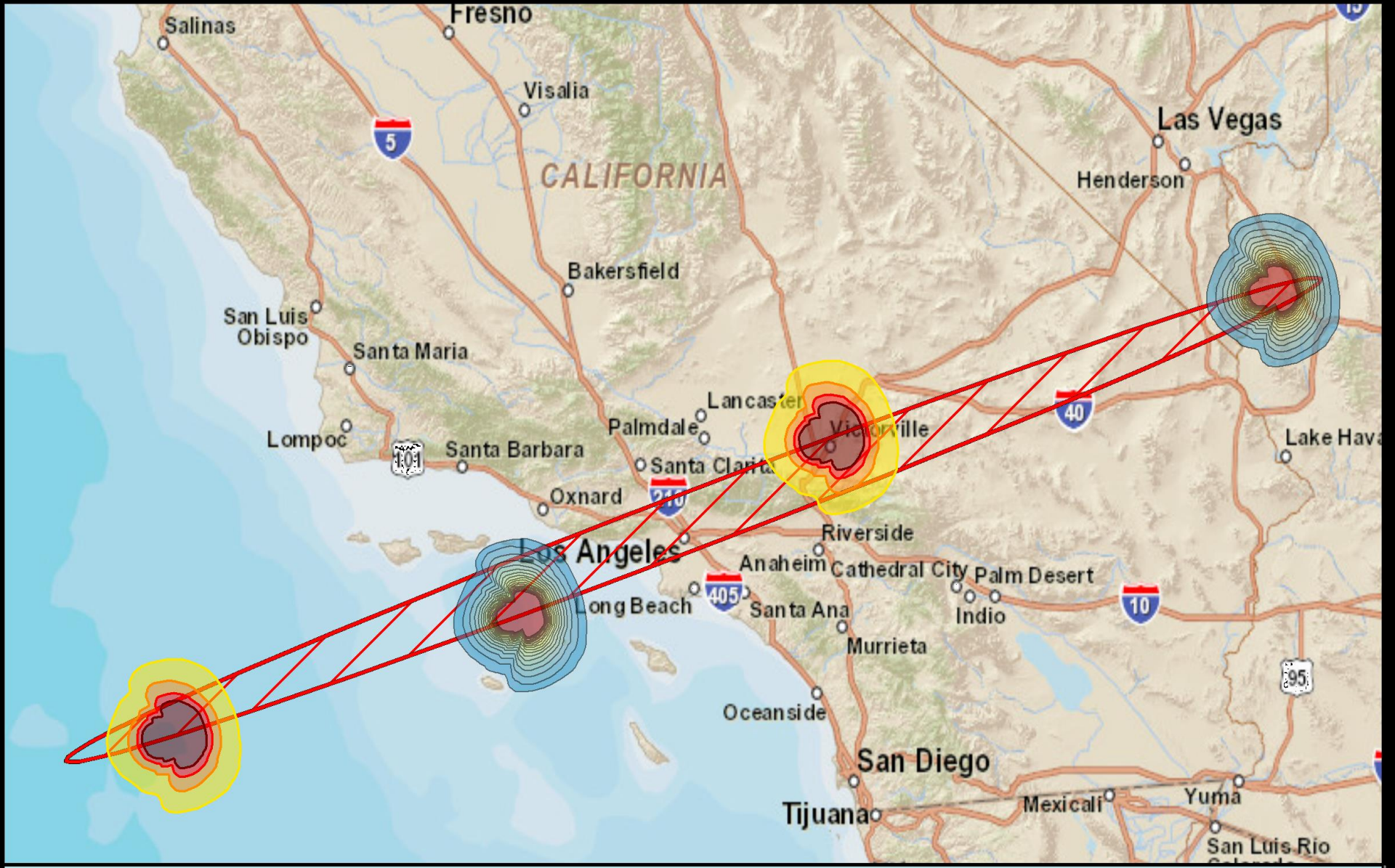
EXERCISE


Yield = 55.2 Mt
Entry angle = 52°
Pressure (bar), Temperature (K)
T (K)
1500
1400
1300
1200
1100
1000
900
800
700
600
500
40
20
0
-20
P (+)
10^0
10^{-1}
P (-)
10^0
10^{-1}
40
20
0
-20
-40
Time = 0.5 s
kilometers
Burst height = 12 km

EXERCISE

Comparison of damage vs. height of burst




Salinas
Fresno
Visalia
CALIFORNIA
Las Vegas
Henderson
Bakersfield
San Luis Obispo
Santa Maria
Lompoc
Santa Barbara
Lancaster
Palmdale
Victorville
Lake Hava
Santa Clarita
Oxnard
Riverside
Los Angeles
Anaheim
Cathedral City
Palm Desert
Long Beach
Santa Ana
Indio
Murrieta
Oceanside
San Diego
Tijuana
Mexicali
Yuma
San Luis Rio
5
40
10
405
95
Inject #2 - Possible Impact Locations
Impact Footprint
0
100 km
Light Damage (15 - 30 m/s)
Moderate Damage (30 - 45 m/s)
Severe Damage (45 - 60 m/s)
Complete Damage (> 60 m/s)
15 - 20
20 - 25
25 - 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
80 - 85
85 - 90
90 - 95
95 - 100
> 100
N

Physical Effects Briefing

March 21, 2019
TTX3

Mark Boslough
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Albuquerque, NM

Bill Fogleman, GRIT – Mapping

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This is what we know:

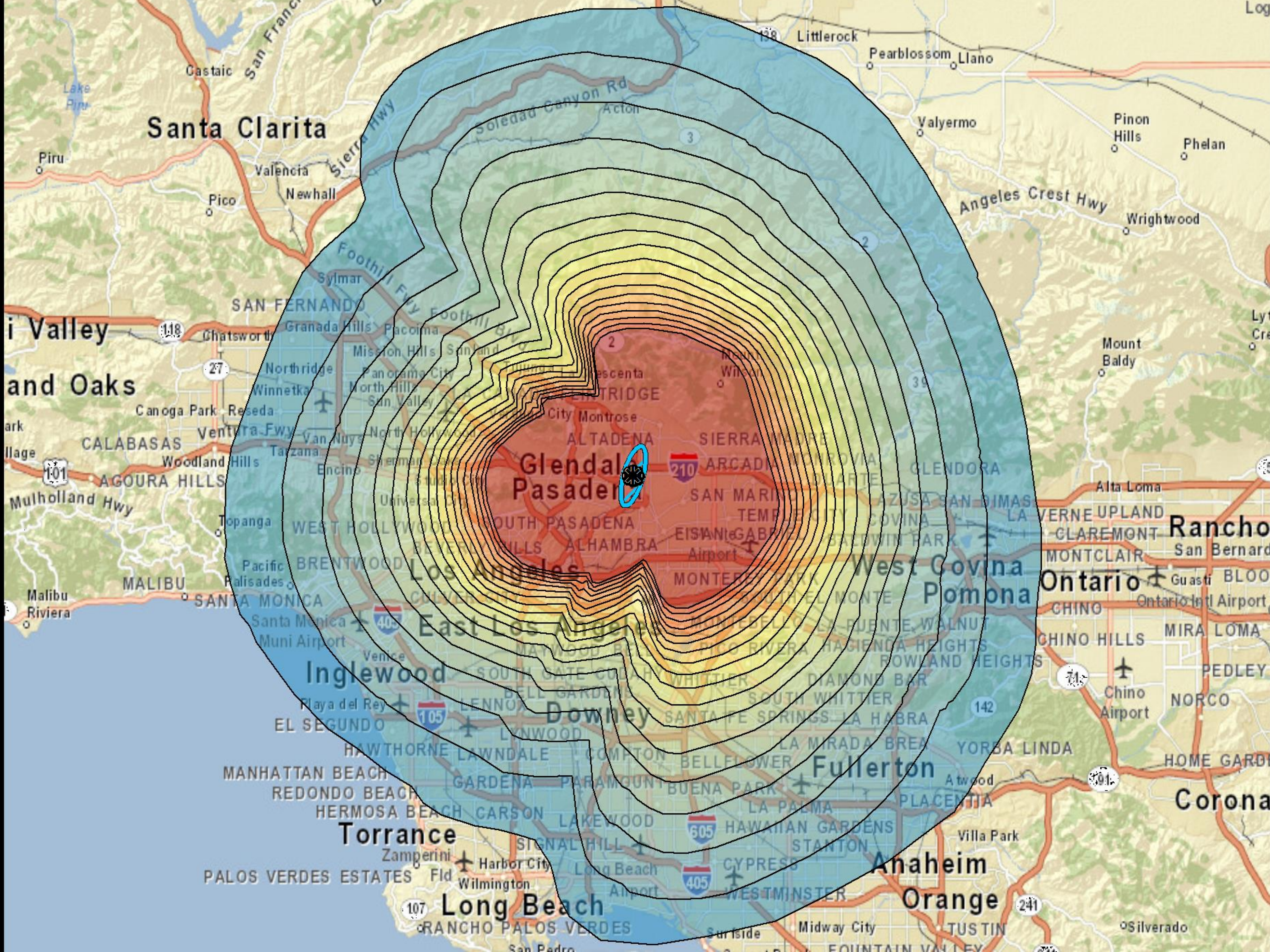
Entry speed: 13 ± 0.4 km/s (~29,000 mph)

Size: 120 meters diameter

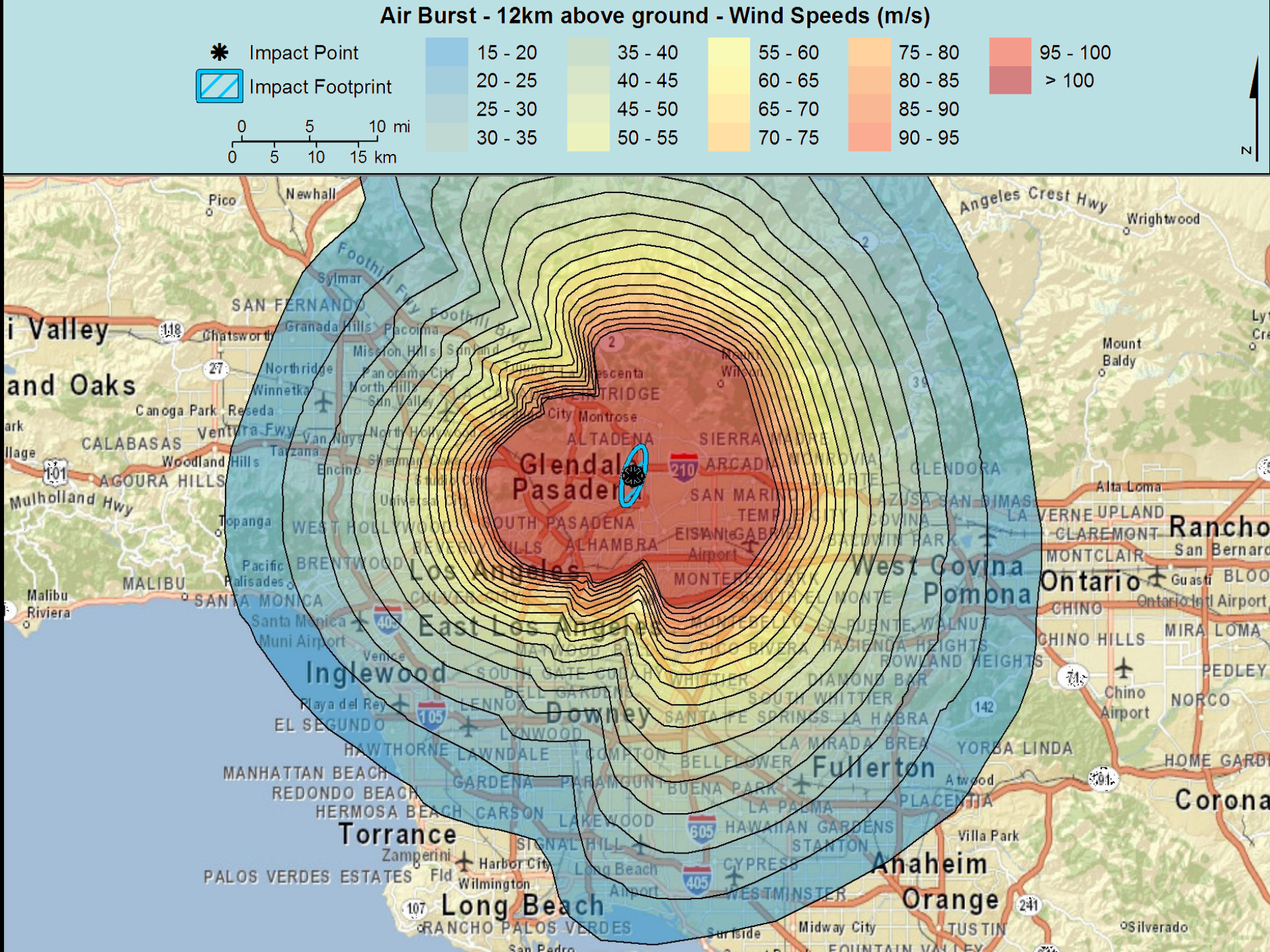
Composition: Stone, density = 2.9 g/cm^3

Magnitude: ~55 Megaton airburst or impact

Probability of impact = 100% in Pasadena, CA



Castaic
Santa Clarita
Piru
Valencia
Newhall
Pico
Soledad Canyon Rd
Acton
Littlerock
Pearblossom
Llano
Valyermo
Pinon Hills
Phelan
Angeles Crest Hwy
Wrightwood
Sierra Hwy
Foothill Fwy
Foothill Blvd
Sylmar
SAN FERNANDO
Granada Hills
Pacoima
Mission Hills
Sunland
Chatsworth
Northridge
Panorama City
North Hills
Sun Valley
Winnetka
Canoga Park
Reseda
Ventura Fwy
Van Nuys
North Hollywood
Tarzana
Encino
Sherman Oaks
Universal City
Woodland Hills
CALABASAS
AGOURA HILLS
Mulholland Hwy
Topanga
WEST HOLLYWOOD
BRENTWOOD
Pacific Palisades
MALIBU
Malibu Riviera
SANTA MONICA
Santa Monica Muni Airport
Venice
CULVER CITY
Los Angeles
East Los Angeles
La Crescenta
LA CANADA FLINTRIDGE
Montrose
ALTADENA
Mount Wilson
Glendale
Pasadena
SIERRA MADRE
ARCADIA
MONROVIA
DUARTE
GLENDORA
SAN MARINO
TEMPLE CITY
SOUTH PASADENA
ALHAMBRA
El Monte Airport
MONTEREY PARK
SOUTH EL MONTE
AZUSA
SAN DIMAS
COVINA
BALDWIN PARK
LA VERNE
CLAREMONT
UPLAND
Alta Loma
Mount Baldy
West Covina
Pomona
Ontario
Rancho
MONTCLAIR
CHINO
CHINO HILLS
Ontario Intl Airport
Guasti
MIRA LOMA
Chino Airport
NORCO
PEDLEY
MONTEBELLO
LA PUENTE
WALNUT
HACIENDA HEIGHTS
ROWLAND HEIGHTS
DIAMOND BAR
PICO RIVERA
WHITTIER
SOUTH WHITTIER
SANTA FE SPRINGS
LA HABRA
LA MIRADA
BREA
YORBA LINDA
Fullerton
BELLFLOWER
BUENA PARK
LA PALMA
PLACENTIA
Atwood
HOME GARDENS
Corona
Villa Park
HAWAIIAN GARDENS
STANTON
CYPRESS
Anaheim
Orange
WESTMINSTER
Midway City
TUSTIN
Silverado
FOUNTAIN VALLEY
Surfside
Inglewood
Playa del Rey
EL SEGUNDO
LENNOX
HAWTHORNE
LAWNDALE
Downey
LYNWOOD
SOUTH GATE
BELL GARDENS
COMPTON
GARDENA
PARAMOUNT
MANHATTAN BEACH
REDONDO BEACH
HERMOSA BEACH
CARSON
LAKEWOOD
SIGNAL HILL
Torrance
Zamperini Fld
Harbor City
Wilmington
Long Beach Airport
PALOS VERDES ESTATES
Long Beach
RANCHO PALOS VERDES
San Pedro


Air Burst - 12km above ground - Wind Speeds (m/s)
Impact Point
Impact Footprint
0 5 10 mi
0 5 10 15 km
15 - 20
20 - 25
25 - 30
30 - 35
35 - 40
40 - 45
45 - 50
50 - 55
55 - 60
60 - 65
65 - 70
70 - 75
75 - 80
80 - 85
85 - 90
90 - 95
95 - 100
> 100
N
Glendale
Pasadena
Los Angeles
West Covina
Pomona
Ontario
Rancho
Inglewood
Downey
Fullerton
Torrance
Long Beach
Anaheim
Orange
Corona
Pico
Newhall
Wrightwood
Mount Baldy
Malibu
Santa Monica
Burbank
Chatsworth
Northridge
Van Nuys
Encino
Topanga
Woodland Hills
Canoga Park
Reseda
Tarzana
Sylmar
Granada Hills
Pacoima
Altadena
Arcadia
Monrovia
Glendora
San Dimas
La Verne
Claremont
Montclair
Alta Loma
Chino
Chino Hills
Mira Loma
Pedley
Norco
Yorba Linda
Placentia
Villa Park
Atwood
Hawaiian Gardens
Stanton
Cypress
Westminster
Midway City
Tustin
Silverado
Rancho Palos Verdes
Palos Verdes Estates
Redondo Beach
Hermosa Beach
Manhattan Beach
El Segundo
Hawthorne
Lawndale
Gardena
Compton
Lakewood
Bellflower
Paramount
Buena Park
La Palma
Cerritos
Norwalk
Whittier
La Habra
Santa Fe Springs
Rowland Heights
Hacienda Heights
La Puente
Walnut
Diamond Bar
Pico Rivera
Montebello
Monterey Park
Alhambra
South Pasadena
San Marino
Temple City
Arcadia
Sierra Madre
Azusa
Irwindale
Duarte
Glendora
Claremont
Upland
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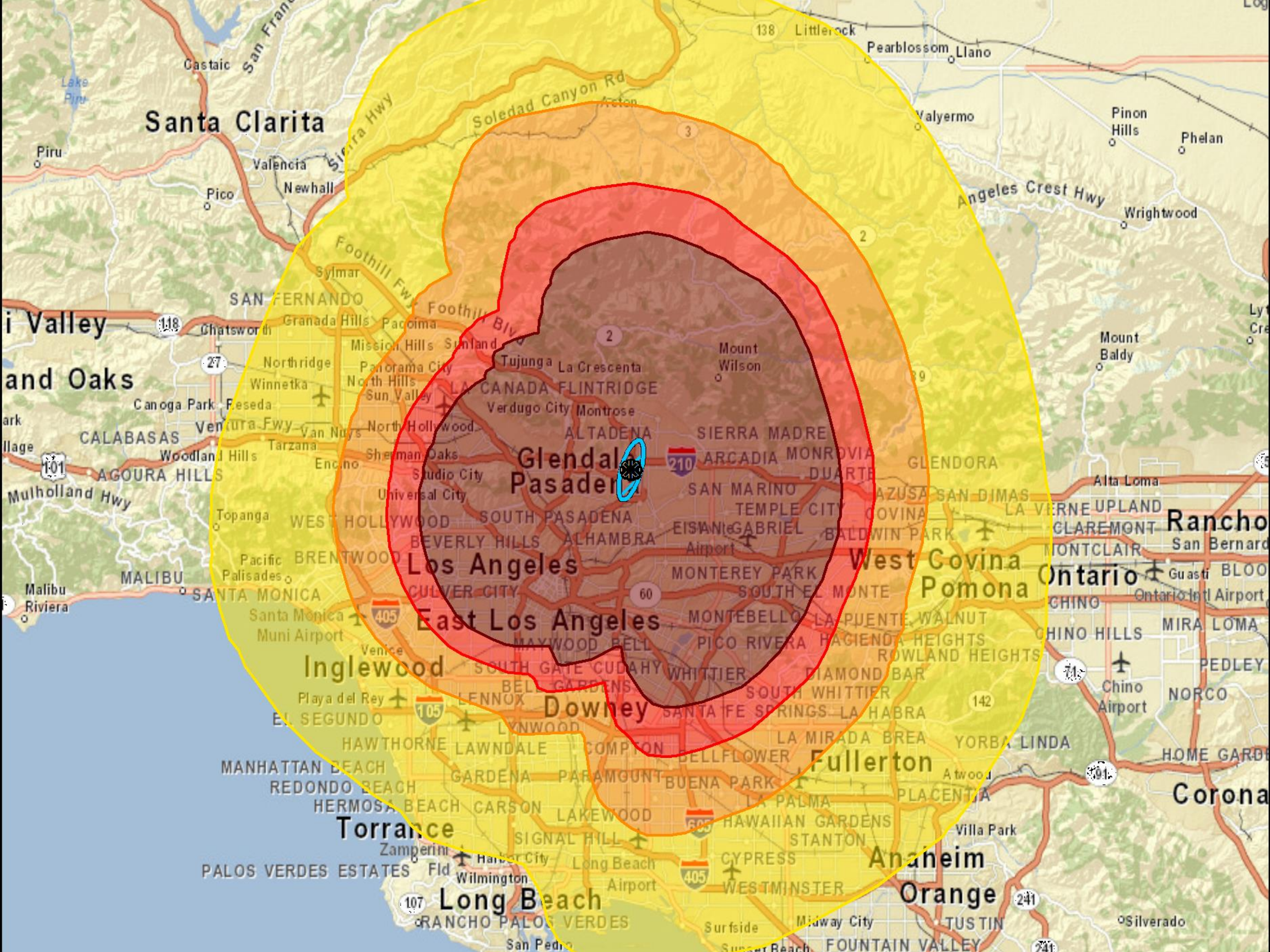
Hollywood
Los Feliz
Silver Lake
Echo Park
Eagle Rock
Glassell Park
Highland Park
South Gate
Bell Gardens
Lennox
Willowbrook
Florence-Graham
Athens
Gardena
Carson
Signal Hill
Long Beach
Surfside
San Pedro
Foothill Fwy
Ventura Fwy
Mulholland Hwy
Angeles Crest Hwy
Sepulveda Blvd
Foothill Blvd
Rosemead Blvd
Valley
Oaks
Village
Riviera
Muni Airport
Airport
Fld
Int'l Airport



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138
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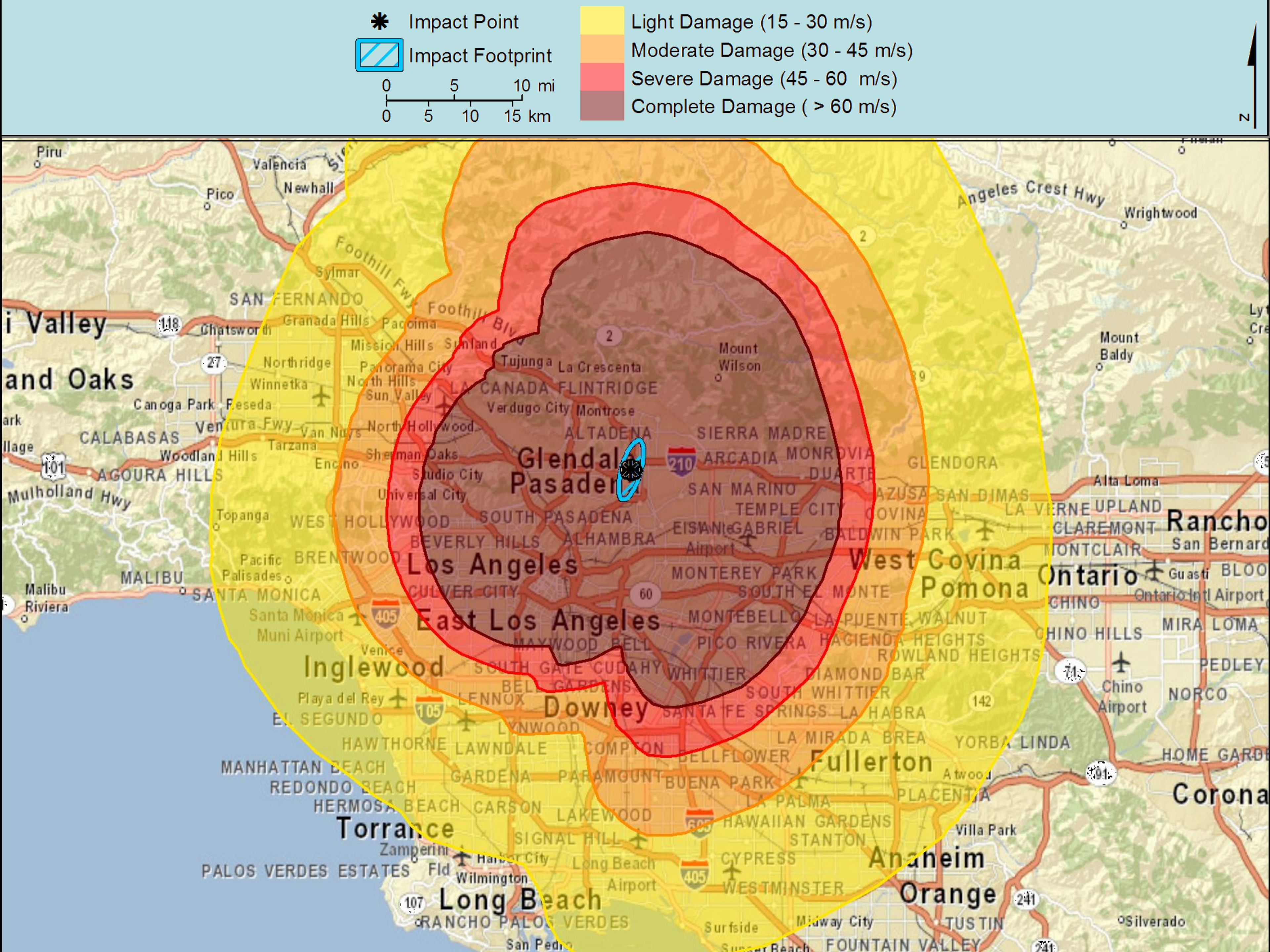
605
107
241
142
71
91


Impact Point
Impact Footprint
0 5 10 mi
0 5 10 15 km
Light Damage (15 - 30 m/s)
Moderate Damage (30 - 45 m/s)
Severe Damage (45 - 60 m/s)
Complete Damage (> 60 m/s)
N
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Newhall
Pico
Sylmar
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Pacoima
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ALHAMBRA
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LA VERNE
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CLAREMONT
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BALDWIN PARK
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HACIENDA HEIGHTS
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CHINO HILLS
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LA PALMA
PLACENTIA
Torrance
HAWAIIAN GARDENS
STANTON
Villa Park
SIGNAL HILL
Zamperini Fld
Harbor City
Long Beach Airport
CYPRESS
Anaheim
PALOS VERDES ESTATES
Wilmington
WESTMINSTER
Orange
Long Beach
RANCHO PALOS VERDES
Surfside
Midway City
TUSTIN
Silverado
San Pedro
FOUNTAIN VALLEY
Angeles Crest Hwy
Wrightwood
Mount Baldy
Alta Loma
Foothill Fwy
Foothill Blvd