

EXERCISE

## Day 3: At Risk Critical Infrastructure Effects

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## 2019 IAA Planetary Defense Conference

College Park, Maryland, USA  
April 29 - May 3, 2019

Bill Fogleman, GRIT – Mapping  
Mark Boslough, LANL – Blast Effect  
Lorien Wheeler/Dominic Mathias, NASA Ames – Probabilistic Effects  
Paul Chodas, JPL - Trajectory

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# Glasstone Dolan Damage Zone Descriptions\*

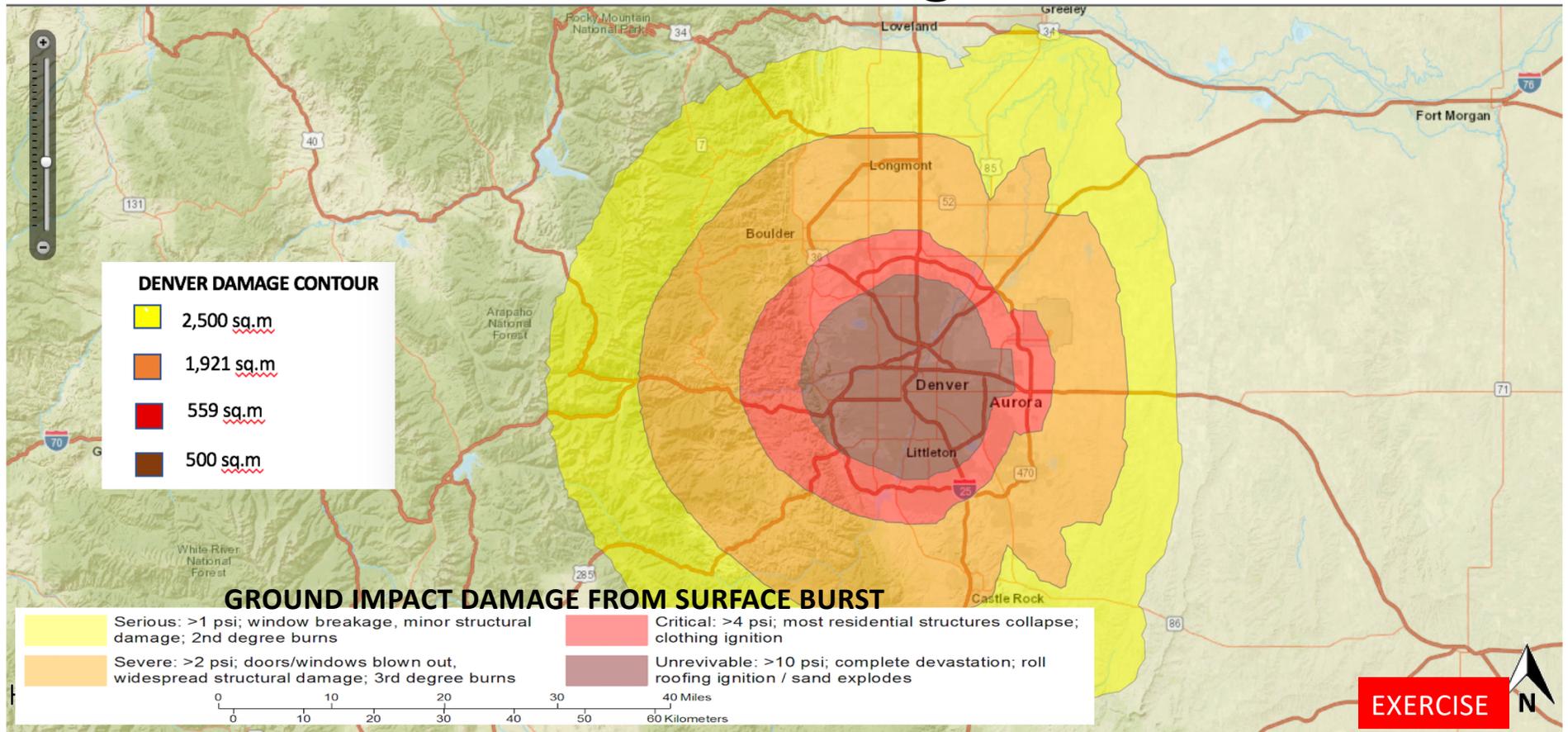
CATEGORY	EXPECTED DAMAGE BY PSI	THERMAL EXPOSURE
Serious	Overpressures >1 psi (window breakage, minor structural damage)	Thermal Exposure > 2 <sup>nd</sup> degree burns
Severe	Overpressures >2 psi (doors/windows blown out, widespread structural damage)	Thermal Exposure >3 <sup>rd</sup> degree burns
Critical	Overpressures > 4 psi (most residential structures collapse)	Thermal Exposure > clothing ignition
Unsurvivable	Overpressures > 10 psi (complete devastation; brick houses, commercial buildings destroyed)	Thermal Exposure > roll roofing ignition / sand explodes

\*Glasstone & Dolan, 1977. The Effects of Nuclear Weapons. Retrieved April 6, 2019. [https://www.dtra.mil/Portals/61/Documents/NTPR/4-Rad\\_Exp\\_Rpts/36\\_The\\_Effects\\_of\\_Nuclear\\_Weapons.pdf](https://www.dtra.mil/Portals/61/Documents/NTPR/4-Rad_Exp_Rpts/36_The_Effects_of_Nuclear_Weapons.pdf)

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# Impact Footprint Resulting from “2019 PDC”; 180 meter ~ 511 megaton PHA\*

\*Mark Boslough, LANL



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# Ground Zero; Denver, CO - At Risk Population

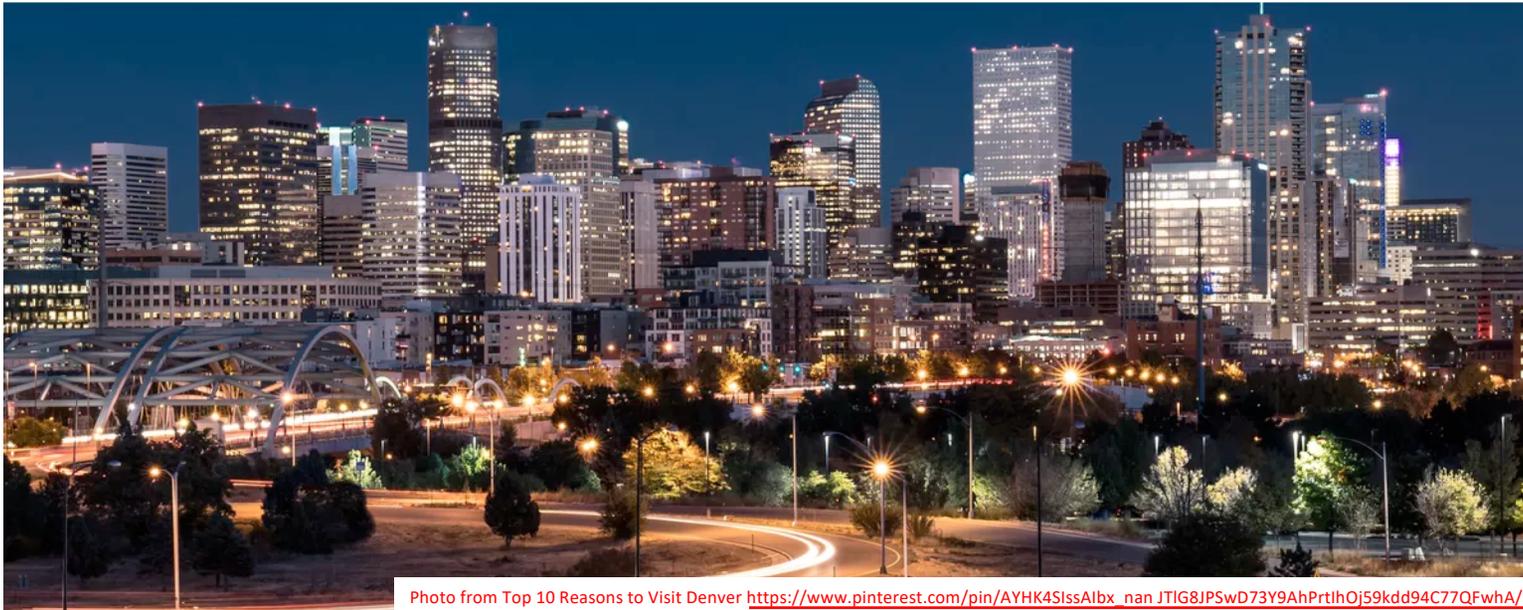


Photo from Top 10 Reasons to Visit Denver [https://www.pinterest.com/pin/AYHK4SissAlbx\\_nanJTIG8JPSwD73Y9AhPrthOj59kdd94C77QFwhA/](https://www.pinterest.com/pin/AYHK4SissAlbx_nanJTIG8JPSwD73Y9AhPrthOj59kdd94C77QFwhA/)

Damage Description	DAYTIME POPULATION	NIGHTTIME POPULATION
Serious > 1 psi	112,593	163,163
Severe > 2 psi	627,765	678,397
Critical > 4 psi	565,861	624,880
Unsurvivable > 10 psi	2,039,952	1,865,692
<b>Total Population</b>	<b>3,346,171</b>	<b>3,332,132</b>

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# Air and Train Passenger Traffic Through Denver

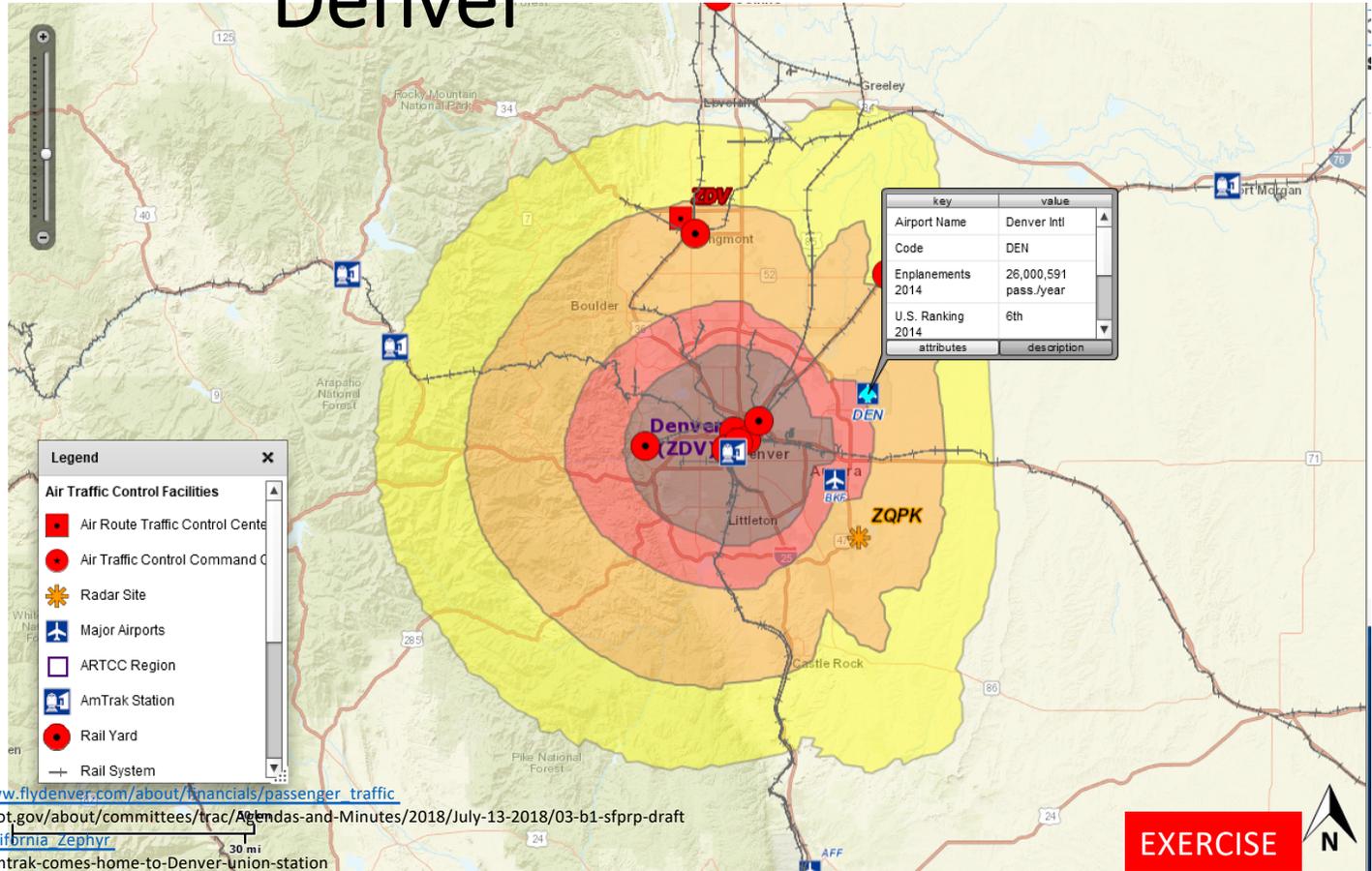
-64.5M Air Passengers in 2018\*

-1600 daily flights by 23 carriers\*

-29.2 M commuter light rail \*\*

-Ca Zephyr 417,322 in 2016\*\*\*

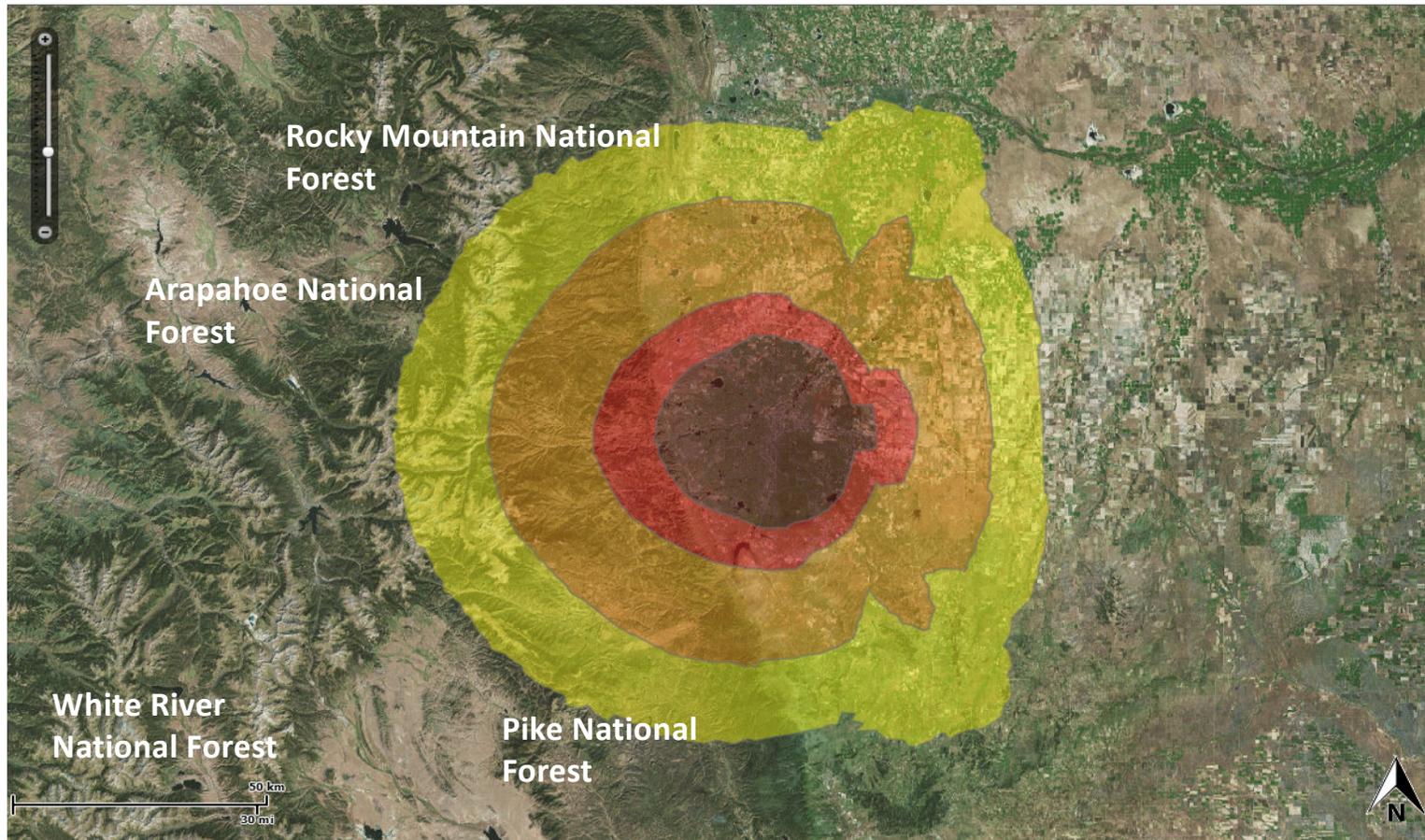
-AMTRAK 108,000 in 2014 \*\*\*\*



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\*Passenger Traffic Reports, Denver International Airport [https://www.flydenver.com/about/financials/passenger\\_traffic](https://www.flydenver.com/about/financials/passenger_traffic)  
\*\* Colorado State Freight and Passenger Rail Plan <https://www.codot.gov/about/committees/trac/Agendas-and-Minutes/2018/July-13-2018/03-b1-sfprp-draft>  
\*\*\* California Zepper, Wikipedia [https://en.Wikipedia.org/wiki/California\\_Zephyr](https://en.Wikipedia.org/wiki/California_Zephyr)  
\*\*\*\* AMTRAK Media Center <https://media.Amtrak.com/2-14/02/Amtrak-comes-home-to-Denver-union-station>

# Impact Aftermath; Forest Fires



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# GDP Economic Impact >100M per Month

State	Direct Impacts (\$M)	Indirect Impacts (\$M)	Total Impacts (\$M)
Colorado	\$8,073.2	\$12,283.7	\$20,356.9

Industry	Total Impacts	Industry	Total Impacts
Accommodation and food services	\$652.40	Information	\$1,627.60
Administrative and waste management services	\$707.20	Management of companies and enterprises	\$622.80
Arts, entertainment, and recreation	\$218.20	Mining	\$893.20
Chemical products	\$155.10	Miscellaneous manufacturing	\$136.40
Computer and electronic products	\$263.00	Other services, except government	\$529.90
Construction	\$916.80	Professional, scientific, and technical services	\$2,436.60
Fabricated metal products	\$107.70	Real estate and rental leasing	\$2,616.60
Federal Civilian	\$1,468.20	Retail trade	\$961.90
Finance and insurance	\$1,796.90	Transportation and warehousing	\$661.80
Food and beverage and tobacco products	\$283.70	Utilities	\$147.80
Health care and social assistance	\$1,216.00	Wholesale trade	\$1,359.80

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